BATCH PROCESSING SOLUTIONS.

Granulation.

GEA Engineering for a better world.

GEA.com

Batch Processing Solutions: High-Shear Granulation.

With both top and bottom drive granulators available, GEA can help you to select the technology that is most suitable for your project.

Offering small capacity systems designed for R&D as well as industrial-size plant for the batch and continuous production of pharmaceutical compounds under cGMP conditions, GEA high shear mixer and granulators — PMA and UltimaGral — are multipurpose processors that are equally suitable for the high-speed dispersion of dry powders, aqueous or solvent granulations, effervescent products and melt pelletization applications.

The design of both the Gral and the PMA allows for different ways to setup a standalone machine in a GMP-compliant manner. And, whether your installation is standalone or fully integrated, several features are available to ensure completely contained processing, such as GEA high containment split butterfly valves, isolator boxes and vacuum transfer systems.

Contained processing also requires that the equipment can be cleaned without human intervention. Our high-shear granulators can be equipped with a full CIP system that ensures cleaning-in-place of the product feed, product filter, bowl, lid and discharge valve. Even downstream equipment such as a mill can be incorporated in the CIP system.

Having established a credible pedigree of expert know-how in the pharmaceutical manufacturing industry, GEA provides optimal solutions for your applications: no other supplier offers such a complete range of granulation and drying equipment.

Integrated High-Shear Granulation
This is the most common configuration used on an industrial scale for the production of pharmaceutical granules. This system allows full integration with upstream and downstream equipment, and even includes a wet mill between the granulator and dryer

With modern control systems, it is easy to load, mix and granulate a second batch in the high shear granulator whilst drying the previous batch in the fluid bed prior to discharge. All equipment can be cleaned in place in a single automatic process.

Batch Processing Solutions: Fluid-Bed Processing.

Fluid bed operations such as drying, granulation or particle coating are often major process steps in the production of solid dosage forms.

And, even though fluid beds have been in use by pharmaceutical companies for more decades, GEA continues to enhance existing designs, introduce new technologies to optimize performance and improve process understanding.

GEA offers a series of fluid bed processors that are suitable for the formulation, development and production of clinical material through to full-scale manufacture; this includes small capacity systems designed for R&D as well as industrial-size plant for the batch production of pharmaceutical compounds under cGMP conditions.

The philosophy behind our approach is that a combination of standardised modules can be combined to meet specific requirements. As such, dryers of equal capacity may be completely different with respect to design, configuration and physical size.

For maximum process flexibility, GEA can supply a single fluid bed unit or the patented FlexStream. Using proven GEA technology to achieve fluid bed granulation, drying and pellet coating (or tablet coating) in a single module, FlexStream is a multipurpose processor that addresses the current shortfalls of traditional fluid bed processing, including linear scale-up, fully contained loading and unloading, and superior product homogeneity for both LOD and PSD.

FlexStream
Requiring only one product container for all unit operations, the FlexStream reduces your build envelope (both height and footprint) and provides PAT-compatible inline particle growth measurement. The FlexStream concept has the additional advantage that no mechanical adjustment is necessary to switch between using the equipment as a dryer, a granulator or a coater. And, impressive test data prove that, in addition to these commercial benefits, FlexStream gives superior product quality when compared with conventional top spray granulation or Wurster coating.

Using recognized standard components, GEA makes plant design both simple and flexible. User-selected process modules, filters, control systems and air preparation units can be combined in a system that meets your process requirements exactly. This modular approach ensures that qualification and validation procedures are kept to a minimum.

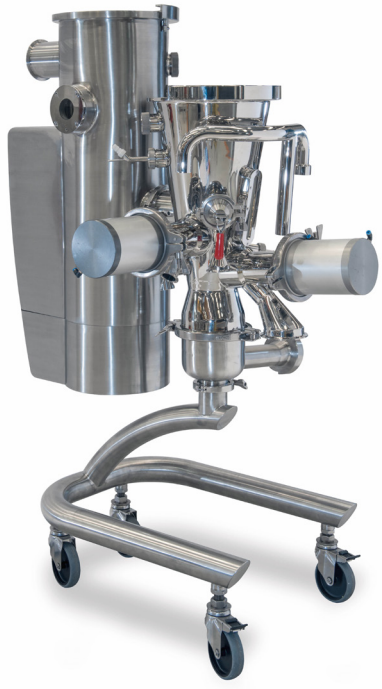
Batch Processing Solutions: AirConnect.

The multipurpose AirConnect from GEA delivers a range of fluid bed processing solutions for small-scale applications.

A service unit provides the main air treatment and control facilities with exchangeable modules delivering an array of processing options, including fluid bed drying, granulation and both pellet and tablet coating.

The AirConnect has been developed by GEA to meet the pharmaceutical industry's requirements for unit operation flexibility and is based on the proven principle that a single core component can be used for numerous processes by interchanging a range of application-specific modules.

The ultimate fluid bed processor for small-scale research and production applications (from 100 g up to more than 10 kg), the AirConnect accelerates and optimizes product development by minimizing the amount of scale-up required to move from R&D-level batch processing to full-scale production systems.



Batch Processing Solutions: Single-Pot Processing.

With high-shear granulation technology at its core, single-pot processing relies on the application of a vacuum within the bowl to dry the wet mass. This technique allows pharmaceutical compounds to be dried at very low temperatures and, even if organic solvents are used during the granulation process, an efficient solvent recovery system means that environmental exhaust levels are minimal.

Single-pot processing is a very compact and flexible technology, achieved by incorporating several manufacturing steps into one machine. This reduces the capital cost of the equipment and, by reducing the cGMP and technical space required for granule production, the overall project cost.

The swinging bowl option enhances this flexibility even further by being able to process older formulations to a high-quality standard. Quick product changeover is simple and efficient, and the equipment is clean-in-place (CIP)-compatible.

In addition, because of its very nature, a single-pot process is contained. No transfers are required between process steps, except to load the raw materials and unload the dry granules. This not only protects the operators from potent actives, it also prevents product being exposed to external influences such as heat, light or moisture.

A range of process control systems is available that offer maximum flexibility and functionality for process visualization, automation and data recording.

And, by combining process monitoring using online, PAT-compatible analyzers with solid process engineering principles and advanced process modeling techniques, we enable processes to be actively controlled to compensate for minor input variations (such as raw materials), so that the specifications for the final product will be closer to the ideal target.

Batch Processing Solutions: PharmaConnect.

A complete range of technologies for R&D.

This innovative plug-and-play system provides a unique benefit to the pharmaceutical development industry and enables a diverse range of process modules to be integrated with a single control unit.

Based on GEA's PMA and Gral granulation technologies, the PharmaConnect can process batch sizes of 25 kg or more, all from a single control system. However, the PharmaConnect is not just limited to granulation; the unique design of the control unit allows any number of process technologies to be operated from the single operator interface, including high-shear granulation, IBC blending and high shear blending.

Typically ranging from 1 to 60 L, standard capacities are available for each set of modules, with each unit being geometrically scalable.

In addition to the typical high-shear granulation process, GEA also supplies PharmaConnect modules for its NICA extrusion and spheronization pelletizing system and for its TRV (Turbo Rapid Variable) high speed blender.

Through-the-Wall or Mobile Control Unit
Two versions of the control unit are available: a through-the-wall option and a mobile module. The unit also features a touchscreen user interface, a module drive motor and GEA's Module Recognition System (MRS), which automatically detects the type and capacity of the connected module, seamlessly displaying an image of the process on-screen and both enabling and defining the correct operational set points and parameters.

PharmaConnect is a truly PAT-compatible, cGMP-compliant, plug-and-play solution for the busy formulation scientist.

Designed for specific applications, our R&D range covers every aspect of oral solid dosage production: from high shear mixers, fluid bed dryers and single pot systems to extruders and spheronizers, blenders and containment solutions, right through to tablet compression.

Bottom-Driven High Shear Granulation: Offering a wide range of processing capacities, standard module sizes for the bottom-driven PMA are set at 1, 3, 5, 10, 15, 20, 30 and 60 L, with each unit being geometrically scalable. Critically, each of these modules features its own impeller drive motor, maintaining a consistent energy input per unit volume and enabling true scale-up data to be generated, even at the 1 L level, for commercial expansion.

Top-Driven High Shear Granulation: The Gral top-driven granulation system is renowned worldwide for its high quality, robust design and scalability. The UltimaGral comes with a 10 L bowl and can be scaled-up to provide 25 and 75 L capacities, facilitating the move to production-scale equipment. Furthermore, integration with the PharmaConnect control unit provides complete process flexibility.

Extrusion and Spheronization: Designed specifically as a pelletization system for the pharmaceutical industry and able to pelletize small batches (50 g) using the operating principles of larger pilot-scale and production machines, the NICA IPS-5 extruder and spheronizer is the perfect development partner for the PharmaConnect.

IBC Blending Systems: Featuring the unique, removable Blending Prism and designed to handle a complete range of laboratory sized IBCs (3–75 L) using a single process module, NIR technology can also be applied to provide online blend homogeneity detection. The Prism adds low shear mixing to the rotating IBC, adding to the turbulence of the tumbling product and reducing the blend time.

Inhalable Fine Powder Processing: Inhalation is often the preferred drug delivery method for lung diseases, offering a number of advantages for both patients and medical professionals for the administration of vaccines and other biological drugs.

As well as a wide range of high quality homogenization equipment, GEA also offers production-scale mixing, blending, spray drying and micronization solutions for the manufacture of inhalable products (dry powders and suspensions), plus an unparalleled level of expertise in the design and layout of suitable plant: from vessel size dimensions to valves and 3D P&IDs, and from R&D to full-scale production.

The TRV is a high-speed blending unit that features a single, bottom-driven impeller drive. It is particularly suitable for the rapid batch blending of small quantities of APIs and excipients for inhalable products.

The modular design enables batches from as little as 200 g to be processed. And, with a range of bowl capacities up to 60 L — plus standalone systems integrated with isolators — the PharmaConnect system provides the ability to perform 1:10 scale-up procedures that are completely compliant with current regulatory requirements. Integrating GEA's BUCK® containment valve technologies further enhances the system's capabilities.

Batch Processing Solutions: PharmaConnect-PLUS.

GEA has expanded its popular Pharma-Connect system with the introduction of PharmaConnect-PLUS, extending the unit's high shear granulation capacity to encompass batch sizes of up to 60 kg.

Designed for small-scale granulation and research and development applications, particularly with potent actives, the PharmaConnect-PLUS — based on the established combination of a single control unit with a diverse range of process modules — further benefits from both physical and control integration with GEA's fluidized bed processors: the MP2-Advanced and MP3-Advanced.

The modular design provides the opportunity to process batches from as little as 5 kg. With the new, increased maximum capacity, one integrated system now provides the ability to perform 1:10 scale-up procedures that are completely compliant with current regulatory requirements.

Both the BUCK® MC valve and the disposable Hicoflex® system can be used to deliver OEB 4 containment levels, facilitating the safe loading of raw materials and the collection of finished granulated product.

The high shear granulator discharges through an integrated wet mill with granules being conveyed directly into a fluid bed processor. After drying, the end product handling system utilizes GEA's lean phase conveying technology to ensure the rapid, contained transfer of product through the dry mill and into the finished product IBC.

Batch Processing Solutions: Pelletization.

Pharmaceutical pellets for optimized release characteristics.

Flexible, efficient and easy to formulate multiparticulate drug delivery systems.

Using our breakthrough technology and the experience gained during many successful installations, GEA provides seamlessly integrated pellet production plant. Our history of working with integrated systems is second to none and we continue to provide the highest quality and support for each of our core technologies.

For example, the unique, modular concept of the NICA Pelletizing Plant enables us to meet your process requirements exactly, whereas mixer/granulator, extruder and spheronizer modules can be combined to create a completely integrated pellet production plant, or selected individually to suit specific requirements.

For maximum flexibility, the modules can be operated in either batch or continuous mode, and can be used as standalone products or integrated with other up- or downstream equipment (such as a fluid bed processor). Ideal for both product development and full-scale production applications, scale-up is easy; it's simply a factor of processing time.

With the advantage of being a single source of supply, GEA can supply a single fluid bed unit, such as an MP-Classic or MP-Advanced, or a FlexStream fluid bed processor that enables granulation, drying and pellet coating in one single unit.

The Benefits of Pellets

- Enhanced drug dissolution
- Ease of coating and improved aesthetic appearance
- Desirable release characteristics (sustained, controlled, delayed, site-specific or pulsatile delivery)
- Uniform packing
- Ease of capsule filling (improved flow properties)
- Even distribution in the GI tract and less irritation
- Flexible formulation development and manufacture
- Chemically incompatible products can be formulated into pellets and delivered in a single dosage form.

Capacities

PharmaConnect PMA									
Size		**1**	**3**	**5**	**10**	**15**	**20**	**30**	**60**
Standard Capacity Range	Litres	0.4-0.8	1.2-2.4	2.0-4.0	4.0-8.0	6.0-12.0	8.0-16.0	12.0-24.0	24.0-48.0
Typical Batch Weight	kg	0.33	1.0	1.65	3.3	5.0	6.5	10	20

PharmaConnect-PLUS PMA								
Size		**15**	**20**	**30**	**60**	**90**	**120**	**150**
Standard Capacity Range	Litres	6.0-12.0	8.0-16.0	12-24	24-48	36-72	48-96	60-120
Typical Batch Weight	kg	5.0	6.5	10	20	30	40	50

PMA								
Size		**150**	**300**	**400**	**600**	**800**	**1200**	**1800**
Standard Capacity Range	Litres	60-120	120-240	160-320	240-480	320-720	480-960	720-1440
Typical Batch Weight	kg	50	100	150	200	300	400	600

Gral / UltimaGral										
Size		**10**	**25**	**75**	**150**	**300**	**400**	**600**	**900**	**1200**
Standard Capacity Range	Litres	3.0-7.0	7.5-17.5	22.5-52.5	45-105	90-210	120-280	180-420	210-630	360-840
Typical Batch Weight	kg	3	11	30	60	120	160	240	350	480

UltimaPro										
Size		**10**	**25**	**75**	**150**	**300**	**400**	**600**	**900**	**1200**
Standard Capacity Range	Litres	3.0-7.0	7.5-17.5	22.5-52.5	45-105	90-210	120-280	180-420	210-630	360-840
Typical Batch Weight	kg	3	11	30	60	120	160	240	350	480

MP-Classic									
Size		**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Standard Capacity Range	Litres	20-55	50-124	30-280	60-450	90-765	120-1060	180-1525	240-2135
Typical Batch Weight	kg	25	50	100	200	300	400	600	800

MP-Advanced									
Size		**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Standard Capacity Range	Litres	10-80	18-160	30-225	60-450	90-600	120-900	180-1500	240-1920
Typical Batch Weight	kg	30	60	100	200	300	400	600	800

For more information
GEA Pharma & Healthcare
pharma@gea.com
gea.com/contact