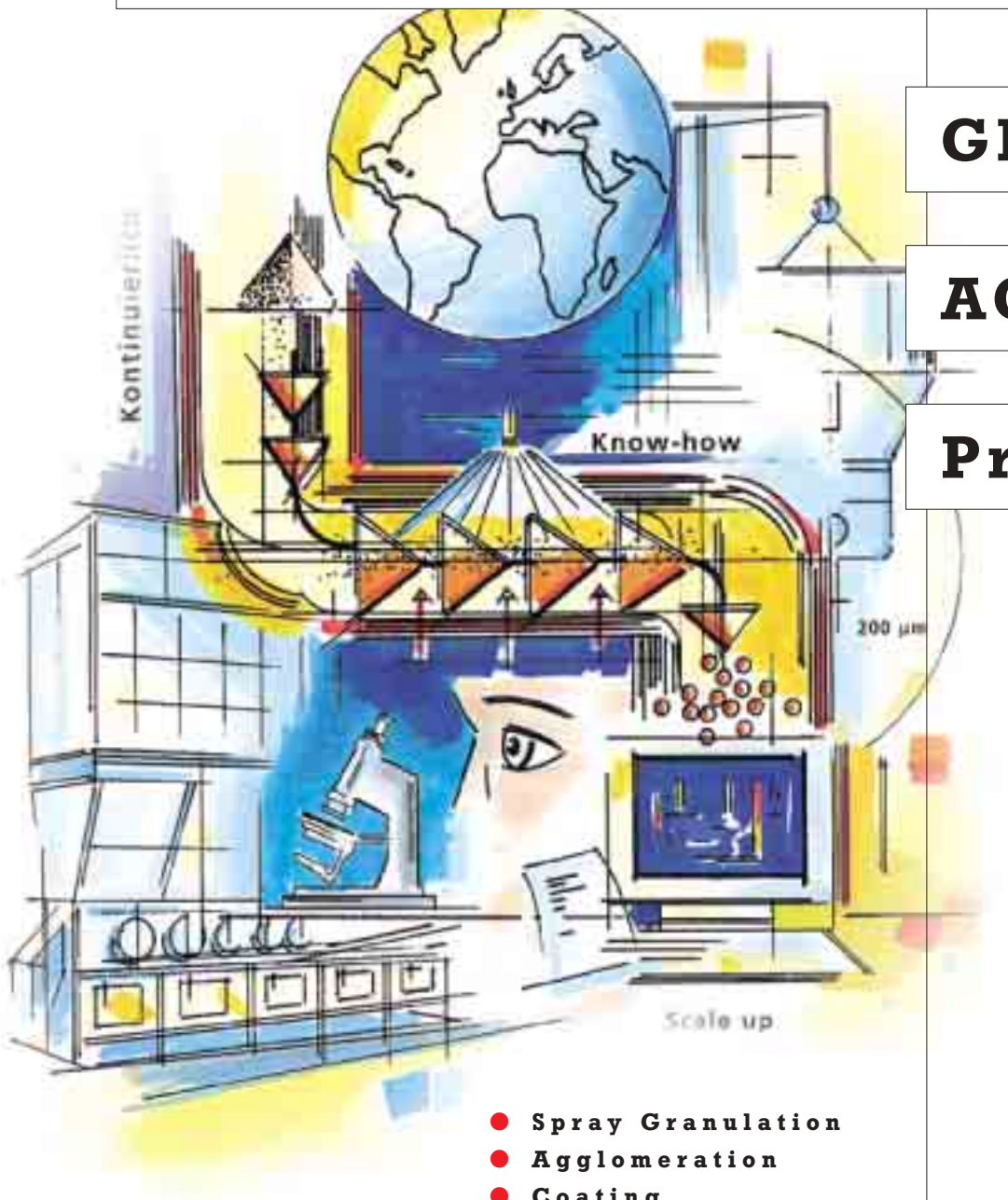
Continuous Technologies



GF

AGT

ProCell

- Spray Granulation
- Agglomeration
- Coating
- Instantiation
- Pelletizing
- Encapsulation
- Drying

Glatt®

We set the standard

Background

Glatt. Difficult processes managed by experience and know how.

What is now Glatt Ingenieurtechnik Weimar was founded in 1981 as innovation group "Continuous Fluid Bed Technology" within the research department of a large East German machine manufacturer. The task of the group was the introduction of the newly developed AGT technology in the industry. Already in 1983, the first production sized unit, an AGT for the granulation of potash solution was commercialized.

AGT 400, constructed in 1981

When the East German industry was privatized this group was taken over by the Glatt company and founded as Glatt Ingenieurtechnik in 1991. This was the start of a success story. The staff quadrupled within 10 years.

In 1996, Glatt developed the Glatt Fluid Bed (GF) in order to increase the flexibility of the continuous fluid bed processes. Originally used for drying and cooling of solids, today difficult agglomeration and coating processes can be accomplished with the GF technology.

The combination of 50 years experience with Glatt batch units in Binzen and 20 years continuous processing in Weimar results in a powerful know-how.

Besides equipment for the chemical industry, Glatt Ingenieurtechnik Weimar offers high quality equipment for the food industry. Designed according to GMP rules these units reach the well known quality of Glatt equipment and can be cleaned with WIP/CIP systems.

Contents

Glatt®

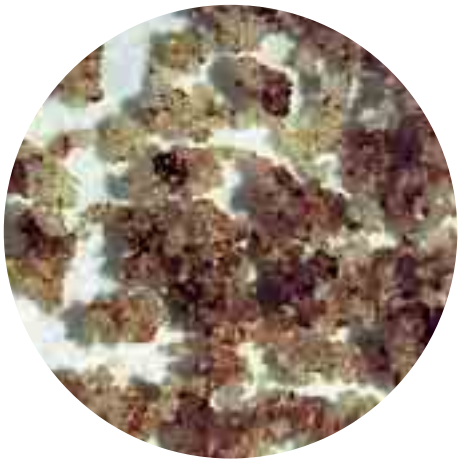
We set the standard

Product Advantages

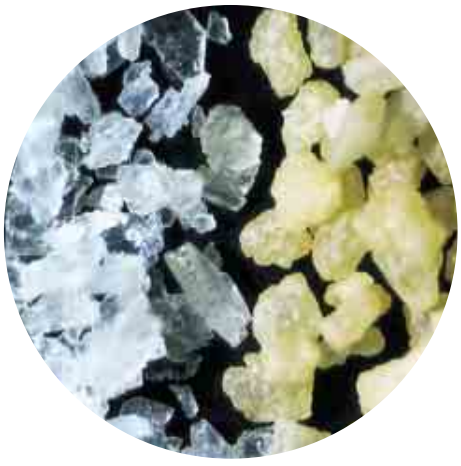
The plus points of continuous processes.

- constant product quality
- narrow grain size distribution
- dustfree and compact granules
- well dispersable and excellent soluble agglomerates
- easy to dose and to transport due to good free flowing properties
- constant filling weight and volume for packaging and pressing due to constant bulk density
- good storage properties due to a clear reduction of hygroscopicity
- no segregation of the components of a mixture

Granules



Agglomerates



Coated crystals

Continuous Fluid Bed - GF

Agglomeration. Spray granulation. Coating. One unit for all processes.

A fluid bed is formed when an upward flow of process air lifts small solid particles. As a result the small particles move rapidly within the fluid bed and ensure a very efficient heat and material exchange between the bed and the fluidizing air. The temperature in the fluid bed is constant across the whole height of the bed.

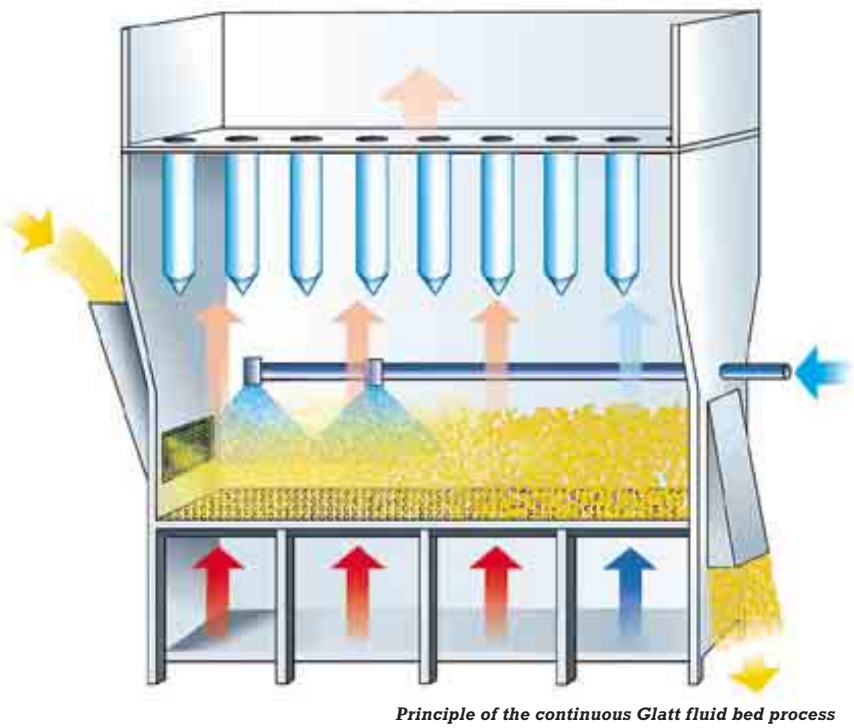
This ensures a gentle drying of temperature-sensitive products.

Besides simple drying and cooling processes fluid bed equipment is used to build particles from powder - agglomeration - or from liquids - granulation - and to coat particles - coating.

The continuous Glatt fluid bed GF can accomplish all these processes. Since the inlet air plenum is divided into multiple chambers it is possible to introduce air with different velocities and different temperatures into the processing chamber. By this means and by correct placement of the nozzles in the fluid bed, it is possible to set completely different conditions in different sections of the processing chamber.

In the process, shown in the principle picture, agglomerates are formed from powder above the first two inlet air chambers. The agglomerates are dried above the third inlet air chamber and are cooled above the forth before they are discharged as finished product.

Glatt fluid bed granulator GFG 1200



Principle of the continuous Glatt fluid bed process

Flexible Construction

Flexible processes and flexible design.

Glatt units offer significant process and construction flexibility.

The standard unit consists of structural components – processing chamber, internal filter, feeding device, discharge device and spraying system. These components can be changed independently to meet the demands of the process.

If necessary the internal filter is replaced by a lid and installed externally.

The design of the spraying system allows a change of the installation of the nozzles even after the commissioning of the plant. Hence the unit can be easily adjusted to new process demands and product properties.

Glatt fluid bed coater GFC 750

Depending on the quality requirements of the end product Glatt offers two versions:

- **Standard chemical plant design**
  For plants with only one product or plants were product change is possible without special hygienic requirements.

  Simple construction.
  For high inlet air temperatures and large throughputs.

- **Standard food plant design**
  For plants with high requirements on cleanability, demand for frequent product changes.

  High surface quality of product wetted parts to meet hygienic demands.
  Low inlet air temperatures for temperature sensitive products.

Glatt fluid bed granulator GFG 500, chemical plant design

ProCell 20, food plant design

Continuous Fluid Bed - AGT

The right mixture within the AGT.

The AGT (unit for continous granulation drying) has a round bottom screen. The entire fluid bed is always ideally mixed.

The product is discharged by means of a centrally arranged discharge pipe. The grain size of the product is determined by the velocity of the discharge air.

In most AGT processes a liquid raw material is dried while building up particle size. It is also possible to add continuously solid raw material. The fluid bed guarantees that all raw materials are mixed homogeneously in the final product.

The exhaust air is cleaned externally. All dust is recycled into the processing chamber were it is needed as seed material for the granulation process.

Principle of the AGT process

Processing chamber, AGT 400

Unit for granulation drying AGT 2700

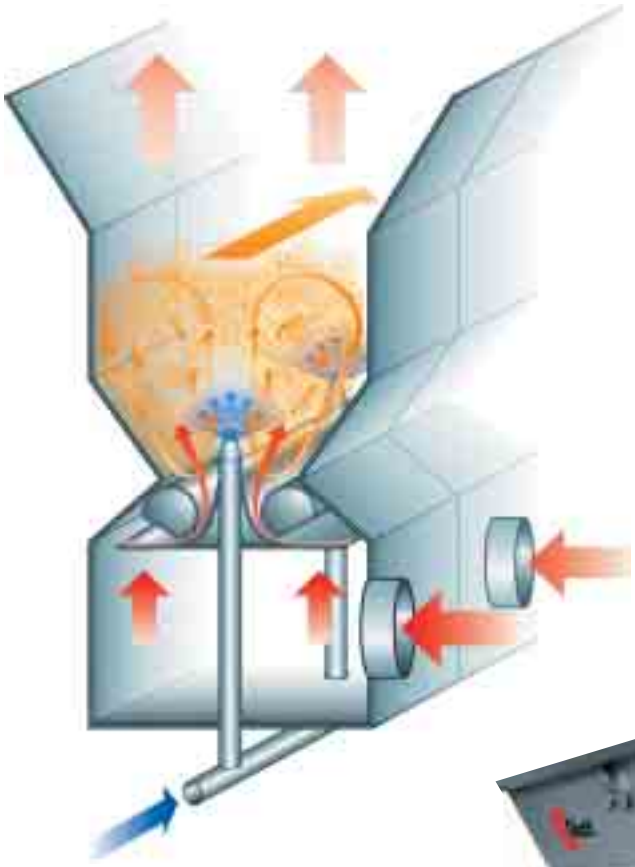
Continuous Spouted Bed - ProCell

Efficient processing of difficult fluidizable products

Particles in the Glatt Spouted Bed are fluidized by a flow of upwards streaming process air.
The process air enters the processing chamber through slots at the side and not through a bottom screen, like in fluid bed processes.

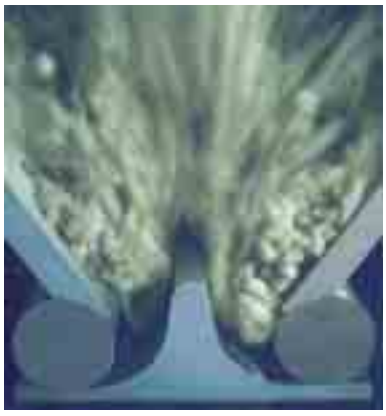
The cross section of the processing chamber is significantly increasing towards the top, resulting an a sharp decrease of the fluidizing velocity of the process air. This results in a controlled flow pattern of the particles in the processing chamber.

Nozzles in the processing chamber can be arranged in top spray or bottom spray position. Since they are arranged in the middle of the two slots they spray at the point of the highest energy input.



Principle of ProCell process

Pilot plant ProCell 20



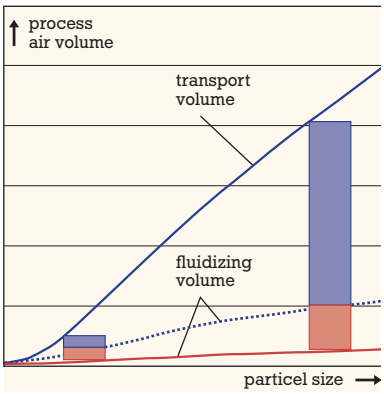
View into the processing chamber

Features of the ProCell

- no bottom screen
- highest process air velocity in the center of the spouted bed
- sharp decrease of the fluidizing velocity along the height of the processing chamber

Advantages of the ProCell

- fine particles can be fluidized
- large particles and irregularly formed particles can be fluidized
- gently drying of temperature-sensitive products
- process air volume can be adjusted to the energy demand of the process
- high process stability due to resistance against stickiness and lumps
- short processing times at high spray rates



Region of operation for fluidized bed (blue) and extended region of operation for ProCell (red)

Explosion Protection

Securing a safe solution.

Mixtures of dust and air do frequently provide an explosion risk. Glatt equipment can therefore be equipped with explosion protection measures.

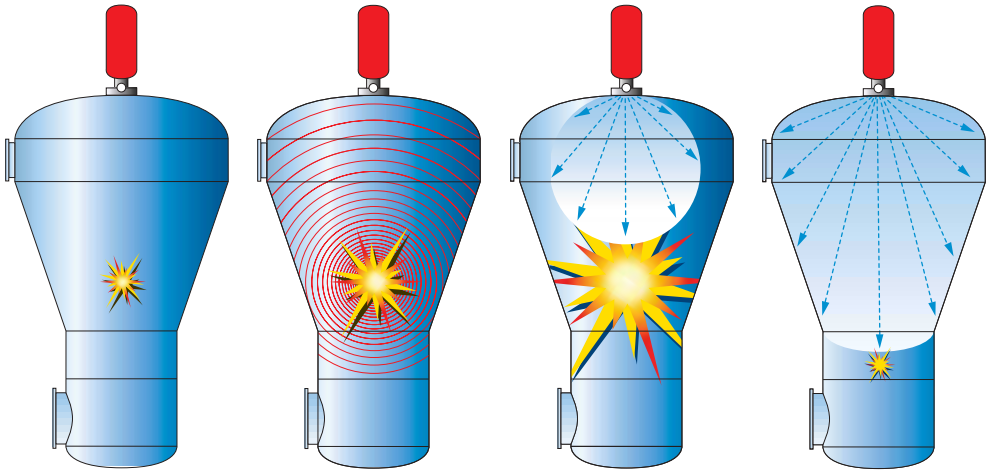
Continuous units usually offer explosion suppression systems. The pressure inside the unit is constantly monitored.

A developing explosion will cause a very fast pressure rise inside the processing chamber. If such a sharp pressure rise is monitored, pressurized vessels with extinguishing powder are emptied into the processing chamber. A developing explosion is by this means stopped in a matter of milliseconds. The fluid bed equipment needs to withstand only a pressure of less than 1 bar.

For equipment in the food industry the explosion protection system can also be equipped with hygienic flanges and food compatible powder.

Alternatively, Glatt equipment can be equipped with explosion venting devices.

AGT 400 with explosion protection system



1. ignition

time: 0 ms

2. sensors sense the pressure rise

time: 20 ms

3. extinguishing powder is discharged

time: 30 ms

4. the extinguishing powder extinguishes the explosion flame

time: 50 ms

Cleaning Systems

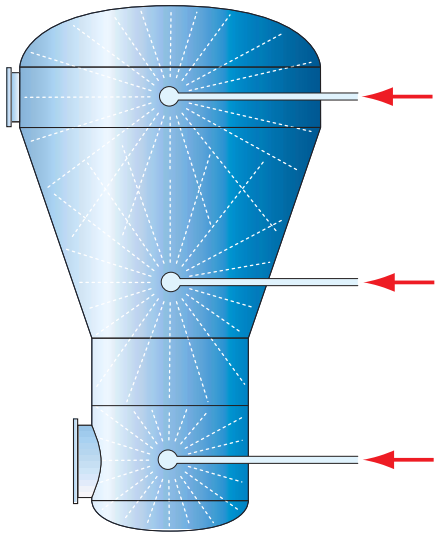
As clean as you like.

Simple cleaning is a cornerstone in the design of all Glatt equipment. Easy access to all parts of the machinery, correctly placed revision doors and cleaning water drains as well as the installation of cleaning nozzles are part of this philosophy.

Units for the food industry which have to be cleaned frequently for hygienic reasons are offered with comprehensive wash in place systems. Glatt has many years of experience with the design of WIP and CIP systems.

Many design criteria need to be addressed to ensure an automatic cleaning e.g.:

- high surface quality of all product contact parts
- easily detachable spray nozzles
- special flanges without gaps
- special sensors for process parameters
- correct arrangement of cleaning nozzles
- optimal drainage of cleaning water



Principle of automatic cleaning

WIP skid

In every unit the cleanability of the filter is decisive for the cleaning system. Glatt offers three designs to meet different demands:

- two sets of filters which are exchanged and cleaned outside
- sintered ceramic filters which can be cleaned in place but need to be checked afterwards

Glatt metal cartridge filter SC SuperClean®

- Glatt metal cartridge filters SC SuperClean® which can be cleaned in place and guarantee absolute cleanness

Flush mounted, hydraulically extending washing nozzle

Process Development

Long experience – Short process.

Process development is performed in Glatt laboratories where the experience of the customer with his product is combined with the process know how of the Glatt engineers.

First feasibility trials are carried out in small batch and continuous units with a throughput of 1-2 kg/h.

Further process development is done on pilot scale units with up to 50 kg/h throughput. Based on the determined parameters our engineers scale up and size the production equipment for the desired throughput. Fifty years experience and the process simulation program ChemCAD are the powerful tools used when scaling up.

After a thorough process development experience Glatt guarantees certain product and process parameters.

The laboratory units are mobile. Customers can rent the units for product development in their own laboratory.

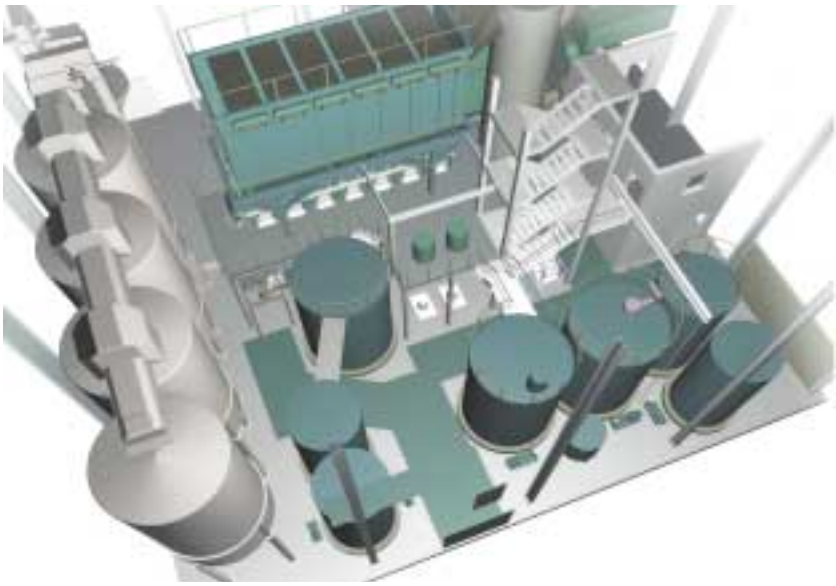
Laboratory unit ProCell 5 for spouted and fluid bed processes

Pilot plant ProCell 20

Analytical laboratory

Engineering

Service as requested, engineered success provided.



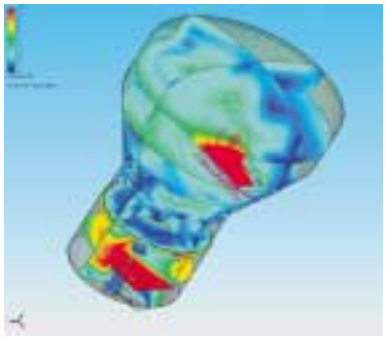
Besides the core unit GF or AGT, Glatt delivers all peripheral equipment necessary for the operation of the process, like fans, pumps and transport systems.

Further equipment needed for an optimal handling of the raw materials and the product can also be commissioned, like mixers, dosing devices and packaging machines.

Modern software tools, like CAD and FEM are used to provide an excellent service to the customer. For simulation of the process gas flow in our equipment we are using EFD.lab.

Glatt also works as a prime contractor, designing and commissioning entire plants, including the building.

Production plant, GFG 850



Simulation of the process gas flow with EFD.Lab

Control system as desired.

Standard Glatt equipment is controlled with a PLC by SIEMENS (Europe) or by ALLAN BRADLEY (USA).
On request different control systems can be used. Several other systems have successfully been installed, such as Mitsubishi and Freelance.
The process visualization is generally done using the desired program.

Installation, start up and training.

Glatt offers expertise in the installation and commissioning of the plant.
Glatt engineers start the plant up and train the customer staff.

Good technical support and a prompt spare part service provide long term customer satisfaction.

Technical Data

Continuous Fluid Bed – GF and Continuous Spouted Bed – ProCell

type		20	50	125	250	350	500
processing chamber	m^2	0.2	0.5	1.25	2.5	3.5	5.0
processes		spray granulation, agglomeration, coating, instantiation, pelletizing, drying,					
raw materials	liquid	solutions, suspensions, melts					
	solid	powder, granules, cristals, extrudates					
main dimensions							
width B [3]	mm	780	910	1200	1400	1600	1800
lenght L	mm	1000	1400	2300	3300	3900	5000
height H [3] [4]	mm	3300	3500	4800	5000	5200	5300
filter system		cartridge filter / bag filter / sinter plate filter					
agglomeration processes							
inlet air temperature [1]	°C	90					
water evaporation [2]	kg/h	15	40	100	195	275	385
spray granulation processes							
inlet air temperature [1]	°C	175					
water evaporation [2]	kg/h	30	80	200	400	560	800

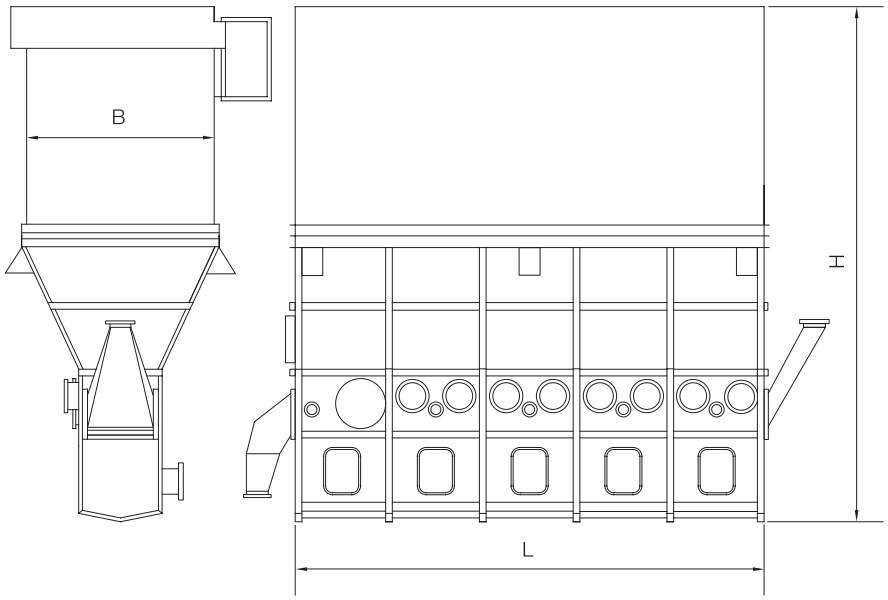
remarks:
[1] value for standard design
[2] estimated value for common air flow rates
[3] depending on product and process, normally smaller in case of agglomeration, higher in case of spay granulation
[4] depending on filter system, normally smaller in case of cartridge filter and sinter plate filter, higher in case of bag filter

Continuous Fluid Bed – AGT

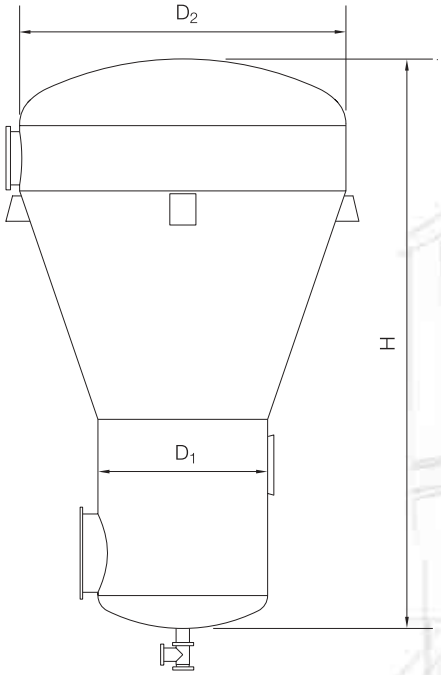
type		400	800	1200	1500	2200	2600
bottom screen area	m^2	0.1	0.5	1.1	1.8	3.8	5.3
processes		granulation, agglomeration					
raw materials	liquid	solutions, suspensions, melts					
	solid	powder, granules, crystals					
main dimensions							
diameter processing chamber D_1	mm	400	800	1200	1500	2200	2600
diameter expansion chamber D_2	mm	800	1500	2200	2700	3800	4500
height H	mm	3600	4300	5000	5500	6800	7800
spray granulation processes							
inlet air temperature [1]	°C	250					
water evaporation [2]	kg/h	60	240	540	840	1800	2500

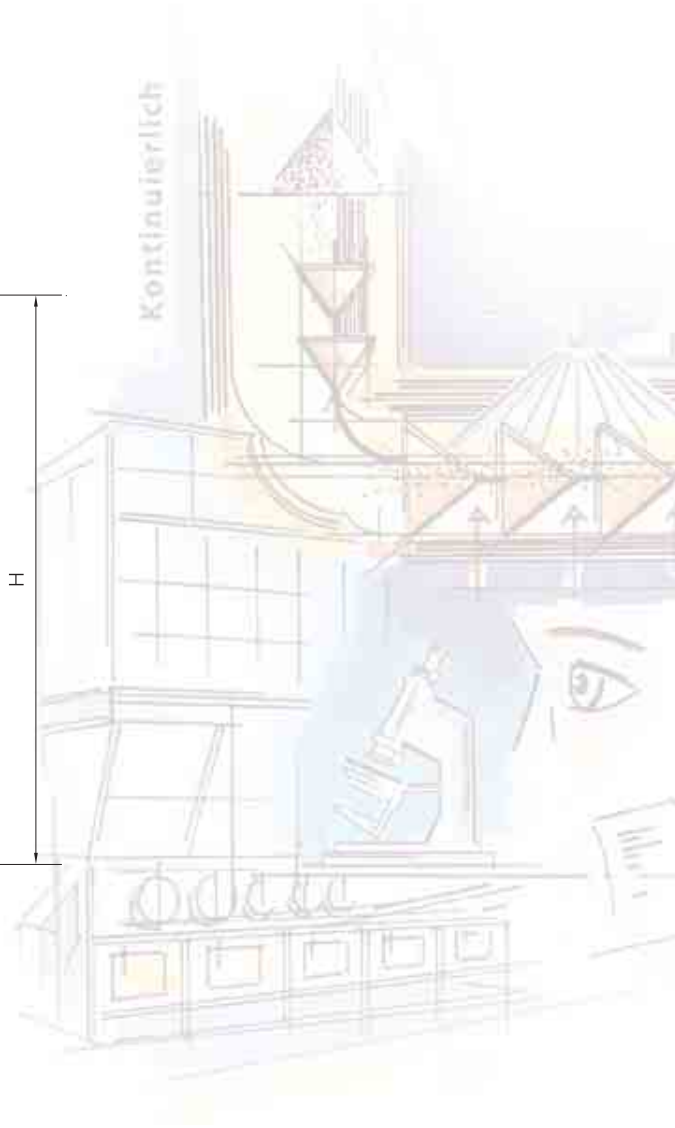
remarks:
[1] value for standard design
[2] estimated value for common air flow rates

750	**1000**	**2000**
7.5	10	20
cooling and combinations		
2100	2300	2800
6500	7700	12500
5500	5600	6300
580	770	1540
1200	1600	3200



3000
7.1
3000
5200
8500
3400





Product References

Experience with many products.

Continuous quality for:

Chemical industry
aluminum oxide
aluminum sulfate
antacid
copper hydroxide
detergent
detergent components
epoxide
hexamine
polymers
potash
potassium acetate
potassium benzoate
potassium formiate
potassium phosphate
potassium sulfate
silica
silica carbide
sodium acetate
sodium phosphate
surfactant
waterglass
xanthane
zeolithe
zirconium oxide

Food industry
baby food
chocolate drink
citric acid
coffee powder
cocoa powder
dextrose
dietary food
flavors
fructose
gelatine
glutamate
gravy
instant tea
lactose
malt extract
milk powder
soups
sweetener
whey powder
yeast

Ceramic industry
electrical ceramics
glaze-pigment
porcelain
special ceramics
catalysts

Agriculture
fertilizer
lysine
pesticides
yeast

Biotechnology
amino acids
antibiotics
choline chloride
enzymes
micro-organisms
proteins
vitamins

Glatt®

We set the standard

Glatt Service Program

Equipment, engineering and services, out of one source.

Glatt equipment

Batch fluid bed equipment
as dryer, with spraying system as granulator, with Wurster insert for coating, with rotor insert for powder layering.

Pan coater
for film coating of tablets.

Vertical granulator
for wet granulation of powders.

Pelletizer
for spheronization of extrudates.

Basket extruder
for extrusion of powder mixes.

Sieves
for reducing of oversized granules to a defined grain size.

Product handling
containers, container blenders, lifting systems, transport and pneumatic conveying systems, filling and discharging systems, docking systems, isolation flap systems, component weighing systems, dosing systems, washing systems, validation and documentation.

Engineering and service

Product development
development and optimization of your products in Glatt laboratories.

Engineering
Glatt engineers and commissions production lines up to turn key plants.

Qualification and validation
Glatt supplies all documents needed for a comprehensive qualification and validation of the equipment.

Toll manufacturing
Glatt also manufactures product with Glatt equipment. So you can considerably shorten your time to market.

Training
Glatt offers courses on specific subjects or organizes individual training programs.

Technology center, Binzen

Addresses

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