ABOUT

Since 1951, FEECO has been engineering and supplying custom agglomeration equipment and systems for industries around the world. Whether you’re looking for a single piece of equipment, or a complete system, we can offer you a customized solution, tailored to your processing needs. Advantages of FEECO agglomeration equipment and systems include:

RUGGED, YET REFINED
You can rest assured when you purchase FEECO agglomeration equipment, that you’re getting equipment that was engineered around the material to be processed, and built with longevity in mind. Our engineers work closely with our in-house fabricators to ensure everything is crafted just right. We use only the best materials to provide you with a dependable solution that will work reliably for years to come.

CUSTOM SOLUTIONS
What sets FEECO systems apart from our competitors is not just the quality of craftsmanship, but the customized solutions we offer. We look at our customers’ unique needs, from material characteristics, to process goals, in order to design a system that operates at optimal efficiency, and accomplishes exactly what you’re looking for. Our familiarity with hundreds of materials allows us to provide you with the best solution possible.

WHO WE WORK WITH
FEECO’s expertise has been sought by everyone from start-ups to Fortune 100 companies seeking innovative solutions in process design, engineering, and manufacturing for a variety of industries. Some of these companies include:

COMMON MATERIALS:
- Aggregates
- Animal Feeds
- Biomass Products
- Clinker
- Coal
- Copper Ore
- Fertilizer Products
- Frac Sand
- Grain
- Gypsum
- Inorganic Chemicals
- Iron Ore
- Lignite
- Limestone
- Nickel
- Organic Chemicals
- Petroleum Coke
- Potash
- Pulp & Paper Products
- Sulfur
- Woodchips
From problem to solution

“...What’s unique about our process is that we can zero in on the precise particle characteristics that a customer is looking for. Our familiarity with a wide variety of materials and how they function in a process is second to none. This allows us to help our customers in all their particle size enlargement endeavors.

- Ron Eichhorn
FEECO Agglomeration Expert

Copper Hydroxide micro pellets created in the FEECO Innovation Center
WHY AGGLOMERATE?

Agglomeration is the process of particle size enlargement. Most commonly, it refers to the upgrading of material fines into larger particles, such as pellets or granules, but it can also be used to turn sludge-like materials into a dry, granular product.

In general, agglomerating a material offers a variety of benefits:

- Improved handling & transportation
- Improved end product characteristics
- More complete utilization of raw or waste materials
- Significant dust reduction

More specifically, agglomeration offers a variety of multi-dimensional benefits to everything from the raw material, to the process, end product, and even from an environmental and economic perspective, as can be seen below:

**PRODUCTS**
- Improve physical appearance
- Simplify handling and application processes
- Prevent segregation
- Create precise formulations

**PROCESSES**
- Eliminate dust and fines
- Increase flowability
- Streamline process and post-process material handling
- Reduce recycle

**ECONOMIC**
- Convert waste to saleable product
- Reduce transportation costs
- Reduce material handling costs

**RAW MATERIALS**
- Simplify transport and shipment
- Prevent dust loss
- Increase porosity, density and meltability

**ENVIRONMENT**
- Can eliminate need for landfill
- Improve characteristics for cost-efficient recycling
- Make waste to fuel processes possible
- Improve cost efficiency of waste disposal

Tungsten Oxide pellets created in the FEECO Innovation Center

Sulfur granules created in the FEECO Innovation Center
INDUSTRIES & MATERIALS

With so many advantages, the use of agglomeration to solve material problems and improve product characteristics is constantly growing. Agglomeration has spread from use in a few key industries to include a multitude of industries and materials, with new applications being discovered all the time. Common applications include:

**Ag Chemicals:** fertilizers, gypsum, pesticides, herbicides, insecticides, soil conditioners, aglime, dolomite

**Cement/Lime:** raw meal, kiln dust

**Ceramics:** alumina, catalysts, tile mix, press feed, frits, color

**Chemicals:** soda ash, sodium sulfate, detergents, cleaners, zinc oxide, pigments, dyes, industrial carbons, carbon black

**Copper:** concentrates, smelter dust, precipitates

**Ferralloy:** silicon, ferrosilicon, ferromanganese, ferrochrome

**Glass:** glass raw mix, glass powder, glass batch

**Gold/Silver Recovery:** heap leaching, mine tailings

**Steel:** EAF baghouse dust, coke fines, raw materials, iron ore pellets, process dust

**Utilities:** ash, coal, dust, FGD sludge

EQUIPMENT

A variety of agglomeration equipment is available, with each falling into one of two main categories: non-pressure (tumble growth) or pressure. Non-pressure agglomeration processes material fines in the presence of a binder to form agglomerates. Pressure agglomeration relies on the principle that some materials, when put under extreme pressure, will adhere to themselves. Not all materials behave this way, so this method is not always an option. Each method and corresponding pieces of equipment offer their own unique advantages. The choice of which method and type of equipment will best suit the process is based on product goals, and the characteristics of the material to be processed. For this reason, feasibility testing is often necessary in order to determine which type of equipment, or combination of equipment, will produce the desired results. The chart below summarizes the various processes that can be carried out by each type of equipment.

<table>
<thead>
<tr>
<th>Process</th>
<th>Non-Pressure Agglomeration</th>
<th>Pressure Agglomeration</th>
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<td>Pelletizing</td>
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<td>Compaction Granulation</td>
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<td>Micro Pelletizing</td>
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AGGLOMERATION DRUMS

Agglomeration drums offer a reliable solution for high capacity processing in a variety of agglomeration applications. Agglomeration drums are open-ended, rotating cylinders, which impart a tumbling and growth action to form granules (often spherical) in the presence of a liquid binder. These drums produce a wider range of granules and are often operated with screening and recycle. They are a good option when a chemical reaction is combined with agglomeration, or when a long residence time is needed.

Agglomeration drums are especially robust and offer uniform results in demanding settings.
**FEATURES**
- Efficient bed turning/flight designs
- Robust design and construction
- Various material options

**CAPACITY** | 500 lb/hr - 3500+ TPH

**CHAIN & SPROCKET DRIVE**
Chain and sprocket drive assemblies are reserved for smaller drums, running up to 75 horsepower (55kW). This type of arrangement is typically not suitable for larger drums running above 75 horsepower, but is ideal for smaller jobs, as it is cost-effective and easy to run.

**GEAR & PINION DRIVE**
(Shown) The gear and pinion drive assembly is best for heavy-duty applications running above 75 horsepower (55kW). While this type is more costly, it operates better in demanding applications and requires less maintenance.

**FRICITION DRIVE**
Friction drive assemblies are reserved for small applications requiring low horsepower. This is commonly seen with drums around 6’ (1.8m) and under. With a friction drive, two of the four trunnion wheels are connected by one shaft and driven by a shaft-mounted reducer and motor arrangement.

**DIRECT DRIVE**
*Direct drive assemblies are also available.*

**UNITIZED DRIVE BASE**
All FEECO agglomeration drums utilize our unitized drive base. The drive system is mounted on an adjustable, one-piece drive base, which is bolted down to a sole plate resting on custom-leveled mounting pads. Adjustment screws are included to easily adjust the entire drive base, avoiding the hassle of having to realign each component separately. This results in quicker installation, savings in labor, and increased gear/sprocket life.

**SIZE** | Drum diameters from 36” - 15’ (1 - 4.6m)

**OPTIONAL COMPONENTS**
- Spray Systems
- Various Liner Options
- Machined Bases
- Screw Conveyor Feeder
- Automatic Gear Lubrication System
- Variable Speed
- Variable Slope
- Variable Frequency Drive (VFD)
The disc pelletizer can be used for a variety of materials, and is often chosen for its ability to fine-tune a pellet product. Material is fed onto the disc, where it is taken up by the rotation. Both material feedstock and a binder are continuously fed onto the pelletizer, making this a continuous process. The binder causes the fines to be tacky, which allows them to pick up more fines as they tumble on the disc. This results in an effect similar to rolling a snowball, referred to as coalescence. Several variables can be adjusted during operation to tweak end product characteristics in order to meet exact product specifications.

Disc pelletizers create a refined, round pellet product ideal for use in many applications. They are especially popular in the soil amendment industry, because they create a premium product that can withstand handling and transportation, but still break down easily upon application.

The diagram above illustrates a typical disc pelletizing system with a preconditioning step. The preconditioning step in the mixer helps to make the process more efficient and more effective by pre-mixing the material and binder in a pin mixer or pug mill.
FEATURES
- 6’ (1.8m) and larger discs are lined with expanded metal to reduce abrasive wear.
- A hand-wheel operated jacking screw allows for easy adjustment of disc angle.
- The base and plow support members provide maximum rigidity, while simultaneously allowing rapid disc angle adjustment, without the need for separate plow adjustment.
- Individually mounted vane-type plows easily control and maintain the product layer over the disc’s entire surface.
- The pivot base is mounted on heavy-duty, anti-friction bearings. Automatic lubrication is featured on larger discs.

CAPACITY | 100 lb/hr - 100 TPH

OPTIONAL COMPONENTS
- Reciprocating Scraper
- Partial Hood
- Full Hood
- Stainless Steel Construction
- Variable Frequency Drive (VFD)

SIZE | 24” - 25’ (0.6 - 7.5m)

*Testing and rental options available
Pin mixers are industrial mixers that are ideal for micro pelleting and de-dusting applications. Pin mixers are particularly adept at processing ultra fine materials in the presence of a binder, and can be used as a stand-alone agglomeration unit, or combined with a disc pelletizer or agglomeration drum to produce a premium pelletized product. Pin mixers use a high-speed spinning action to both mix and agglomerate materials in the presence of a binder. A single shaft affixed with rods (pins) rotates at a constant speed, creating a densified product through the use of motion.

**FEATURES**

- Full sweep pin design
- Polished stainless steel liner to improve machine operation
- Available custom configuration
- Accurate feed ratios of powder to liquid for precise quality control
- Accurate production rates
- Custom designed control panel for housing controls

**SIZE**

| 10" - 50" (254 - 1,270mm) |

**CAPACITY**

| 200 lb/hr - 70 TPH |

**OPTIONAL COMPONENTS**

- Zero Speed Switches
- Raising Cover Assembly
- Abrasion-Resistant Pin Coatings
- Two Screw Feeders
- Various Pin Arrangements
- Variable Frequency Drive (VFD)

*Testing and rental options available*
PUG MILLS

Pug mills, also known as paddle mixers, are industrial mixers reserved for especially heavy-duty processing applications, such as those found in the mining industry. These industrial mixers are highly adept at processing materials in the presence of a binder, to provide thorough mixing of both a liquid and solid feed. Pug mills utilize dual shafts with pitched paddles to create a kneading and folding over motion inside the mixer, resulting in an intimate mixture of materials. Pug mills can be used as a stand-alone agglomeration device, or as a precursor to a disc pelletizing or agglomeration drum setup.

FEATURES
- Double shaft design for thorough mixing of materials
- Heavy-duty construction for years of reliable operation
- Binder spray system to accommodate a liquid feed
- Options in paddle facings to help prevent wear
- Reversible paddles for modifying mixing pattern

SIZE | 14" - 78" (356 - 1,981mm)
CAPACITY | 500 lb/hr - 250 TPH
OPTIONAL COMPONENTS
- Zero Speed Switches
- Mid-Height Cover w/ Spray Assembly
- High Cover w/ Spray Assembly
- Electronic Shock Relay
- Stainless Steel Wetted Parts
- Bottom Doors Open for Cleanout
- Direct Drive

*Testing and rental options available
BRIQUETTERS

Briquetters produce large, pillow-shaped briquettes. Briquetters use mechanical force to press material fines into a desired shape, and are typically reserved for instances where larger agglomerates are desired, such as in the making of water softener or charcoal briquettes. Material fines are fed between two counter-rotating rolls. Each roll has one half of the desired “pillow” shape, and as the rolls come together, the halves unite, pressing the material into one complete pillow form. Briquetters typically require a binder if the cohesive forces between the particles are low.

**FEATURES**

- Double-output gear box and internal gear couplings for preventing misalignment caused by traveling roll movement
- Optional hinged frame for ease of maintenance
- Optimized feed system
- Heavy-duty frame constructed to withstand high pressure operation

**CAPACITY**

| 100 lb/hr - 100 TPH | (.5 kg/hr - 91 MTPH) |

*Testing options available*
COMPACTORS

Compactors produce dense, jagged granules. Because pressure is utilized to form agglomerates, typically no binder is needed, though sometimes a binder is desirable. Compactors are often used to process fertilizers, pigments, catalysts, detergents, and other types of chemicals. Compactors use mechanical force to press material fines into a compacted sheet, which is then broken up into granules.

FEATURES

- Double-output gear box and internal gear couplings for preventing misalignment caused by traveling roll movement
- Optional drive systems for specialty applications (high torque, etc.)
- Optimized feed system
- Various options for material of roll construction

CAPACITY | 100 lb/hr - 50 TPH (.5 kg/hr - 45 MTPH)

*Testing options available
CUSTOMIZED TESTING SOLUTIONS

Testing in the FEECO Innovation Center offers a host of invaluable information, allowing you to gain critical data on your material, work out process variables, and develop a recipe for process scale-up.

Capable of testing both non-pressure and pressure agglomeration methods, the Innovation Center is well equipped to suit small batch tests on a single piece of equipment, as well as a continuous process loop with multiple pieces of equipment, including drying, particle sizing, and product recycle capabilities. We can record operating data to assist in process scale-up and design a full-scale production plant.

The Innovation Center can convert dusts, bulk powders, and sludges into free-flowing pellets for dust-free handling, or to improve product characteristics. Our process experts can work with you to develop a customized testing program around the answers you’re looking for. Depending on your needs, we offer testing services in four categories:

1. Feasibility/Proof of Concept - An initial, non-witnessed batch testing phase in which the possibility of creating a product is explored.

2. Proof of Product - A more in-depth batch testing phase in which more time is spent determining whether a product can be made to desired specifications.

3. Proof of Process - A continuous testing phase that aims to establish the equipment setup and parameters required for continuous production of your specific material.

4. Process/Product Optimization - An in-depth study to optimize your specific material’s characteristics and/or production parameters in an industrial setting.

PARTICLE CHARACTERISTICS
There are a variety of particle characteristics that can be measured and adjusted during processing to achieve a product with ideal characteristics. The following properties can be measured and fine-tuned:

- Attrition
- Bulk Density
- Compression
- Crush Strength
- Flowability
- Green/Wet Strength
- Moisture Content
- Physical Characteristics
- Particle Size Analysis
- Solubility
- Temperature

WE CAN TEST THE FOLLOWING METHODS OF AGGLOMERATION:

Non-Pressure
- Pelletizing (Disc)
- Pelletizing (Rotary Drum)
- Conditioning
- Mixing
- Coating
- Micro-Pelletizing

Pressure
- Briquetting
- Compaction
Granulation

Questions That Can Be Answered Through Agglomeration Testing:

- Will my material agglomerate?
- Can agglomeration solve my material problem?
- Which method of agglomeration will best suit my material?
- What equipment configuration will be required to produce the results I’m looking for?
- What binder, if any, will work best for my material?
- Can my product be improved?
- How can I optimize my existing process?

Fly ash pellets created in the FEECO Innovation Center
SERVICE
We are an extension of your maintenance department. From start-up and installation support, to emergency services and preventative maintenance, FEECO offers a variety of services to help keep your equipment running at its best for years to come, whether your equipment is FEECO brand or otherwise. We offer the following services:

- Installation & Start-up Support
- Spare Parts
- Field Services
  - Tire & Trunnion Wheel Grinding
  - Drum Trunnion Training
  - Alignments
  - Gear Replacement
  - Spare Parts Installation
  - Laser Alignment
  - Inspections
  - Equipment Audits
- Training Programs
- Process Optimization Engineering
- 24-Hour Emergency Service

AUTOMATION AT ITS BEST

FEECO is a Rockwell Automation partner, providing integrated process control solutions, both as a service in the Innovation Center, and as part of a system purchase. FEECO and Rockwell Automation process control solutions are provided with current technology, motor control centers, programmable logic controllers, and data collection systems with advanced technologies for reporting. The FEECO Innovation Center features a Rockwell Automation PLC/MCC system, which utilizes current technologies for optimizing testing operations.

DATA IN REAL-TIME
Our system allows you to monitor, trend, and adjust various data points in real-time, all from a single interface or mobile device. This includes:
- Current (Amps)
- Feed Rate
- Flow Rates/Product Flow
- Fuel Usage
- Gas Sampling & Analysis
- Horsepower
- Speed
- System Pressure
- Temperature
- Torque

UNPARALLELED REPORTING CAPABILITIES
A control system from Rockwell Automation provides state-of-the-art data collection and reporting capabilities. Our system allows you to select only the variables you want to report on, from the exact time frame you’re looking for. This is especially beneficial in the Innovation Center, allowing returning customers to pick up exactly where they left off.

FEECO can integrate third party equipment into your control system, giving you complete process tracking and visualization.

Secure remote access to the system unparalleled troubleshooting capabilities.
THE FEECO COMMITMENT TO QUALITY

FEECO International, Inc. was founded in 1951 as an engineering and equipment manufacturer. FEECO is recognized globally as an expert in providing industry-leading process design, a range of engineering capabilities, including everything from process development and sample generation, feasibility studies, to detailed plant engineering, as well as manufacturing to a variety of industries, including fertilizer and agriculture, mining and minerals, power/utility, paper, chemical processing, forest products and more. As the leading manufacturer of processing and handling equipment in North America, no company in the world can move or enhance a concept from process development to production like FEECO International, Inc.

The choice to work with FEECO means a well-rounded commitment to quality. From initial feasibility testing, to engineering, manufacturing, and aftermarket services, we bring our passion for quality into everything we do. FEECO International follows ISO 9001:2015 standards and procedures.