JAG PROCESS PLANTS AUTOMATION ROBOTICS

Powder Processing Solutions

The Finest in Powder Handling.

Process technology for complex bulk material production.

Plant construction and process automation for 3D-printing powder production. A reference for JAG Jakob Ltd Process Technology.

PROCESS PLANTS
AUTOMATION
ROBOTICS

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Fine, finer, finest.

Highly automated process technology for 3D-printing powder.

This project required not only technological knowledge and capability, but also the human strengths of our team: empathy, passionate engagement and the persevering pursuit of perfection.

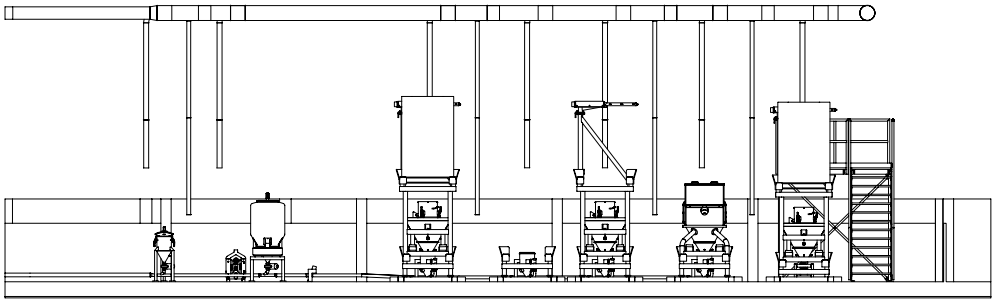
The project started out harmlessly. It was just simple relocation planning. All we needed to do was dismantle a powder mixing plant, move and then rebuild it. But the ink on the proposal paper had barely had a chance to dry before the requirements started to change.

The stages of the tender

Why settle for a simple move when it would be the perfect opportunity to improve? The first set of changes affected various plant optimisations. So we wrote up a second proposal. This in turn inspired a desire to increase the size of the plant. So we reworked the proposal. At this point the client started reconsidering, deciding to abandon the current plant and replace it with a new one. This change in direction brought about yet another new situation. By engaging with the client and reviewing all aspects of their current powder handling capacity, and following detailed discussions, we presented them new solutions and design variations. Following a few additional modifications, we were able to offer them a solution for an optimum processing facility, which ultimately landed us the contract.

The specific advantages of the plant

- Minimal personnel requirement
- No downtime
- Maximum flexibility with packaging, dosing and recipes
- Automatic emptying of octabins
- Highly automated



The essentials in brief

The main purpose of the process plant is to facilitate powder mixing in batches under laboratory surveillance. The raw materials arrive in various containers and are then dispensed via multiple docking stations to the powder containers. The goods are subsequently added to mixers in batch-sized doses. The mixed product is then forwarded on to intermediary powder containers before the final packages are filled. Working on three-shift non-stop operation, the plant requires only two operators at a time.

Our services at a glance

Planning

- Conception
- Basic engineering
- Detailed engineering
- Software engineering

Construction

- Pre-assembly and assembly of the process plant
- Programming of the automation software
- Electrical installation
- Systems integration
- Simulation and testing
- Commissioning

Operation

- Customer training
- Maintenance
- Support and consultation

Multiple challenges.

The requirement for flexibility, productivity and minimal personnel.

Industry insiders predict a big future for 3D-printing. Therefore, most importantly for the client, flexibility was essential, encompassing the need to adapt the powder mixing plant in line with future 3D-printing developments.

As in many other industries, the shape and size of the preferred final delivery packaging are subject to trends. Sacks and octabins (cardboard containers with plastic inliners) currently dominate the industry, but these could be replaced in the future with Big Bags, IBC or other types of container.

Complete container compatibility

The option for retrofitting to suit potential future packaging changes was a primary requirement. This was followed by the logical secondary requirement of being able to freely select the appropriate packaging for the end product, i.e. the ability to fill containers of various shapes and sizes.

Variable dosing and mixing

A third requirement was the need for a freely selectable sequence for the dosing of the raw materials. And the fourth requirement was that the plant was able to process all conceivable recipes. In short the client demanded:

- flexible selection of packaging for raw and end materials
- flexible dosing sequencing
- flexible recipe selection

Production and personnel

A further important requirement concerned optimal plant utilization in order to achieve a production capacity of at least 3 tonnes per shift. Additionally the batch changeover and cleaning needed to be as simple as possible, with minimal dust exposure for the personnel during operation and cleaning. And finally, the process plant was to be operated by only two persons per shift.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Four-handed powder handling.
A super-flexible solution.

Essentially, our solution encompasses four docking stations that enable maximum flexible operation in terms of packaging, dosing and recipe variation. All docking stations have been designed for easy retrofitting to Big Bag, IBC, etc. and the buffer/mixer unit offers maximum capacity.

At the docking stations, the packaging is automatically emptied into a funnel by means of compressed air (instead of the conventional suction spout). This enables the integrated weighing cells to dose the raw materials to a precision of 0.1%. The outputs from the four docking stations can, if required, be directed to a single conveyor pipe by means of a diverter valve. Between this valve and the buffer container it is also possible to add small amounts of additional materials to the mixture.

Interaction between the buffer container and the mixer

Batch control demands production in batch operation. Once all of the raw materials for a batch have been delivered to the buffer container and the mixer is ready, the buffer container empties into the mixer. And while this is mixing, the system is already dispensing the raw materials for the next scheduled batch into the buffer container. This interaction between the buffer and the mixer allows the continuous, uninterrupted production of successive batches. Furthermore, this clever process technology eliminates downtime.

Monitoring and filling

After the raw materials have been mixed, a sample is taken for control purposes – if the laboratory gives the green light then filling can commence. The final product is delivered to a buffer container via a rotary feeder followed by control screening. From here, filling and dosing is performed by a JAG PAD (Powder Discharge and Dosing Device) with the appropriate adapter for the final product container.

Two people, no masks

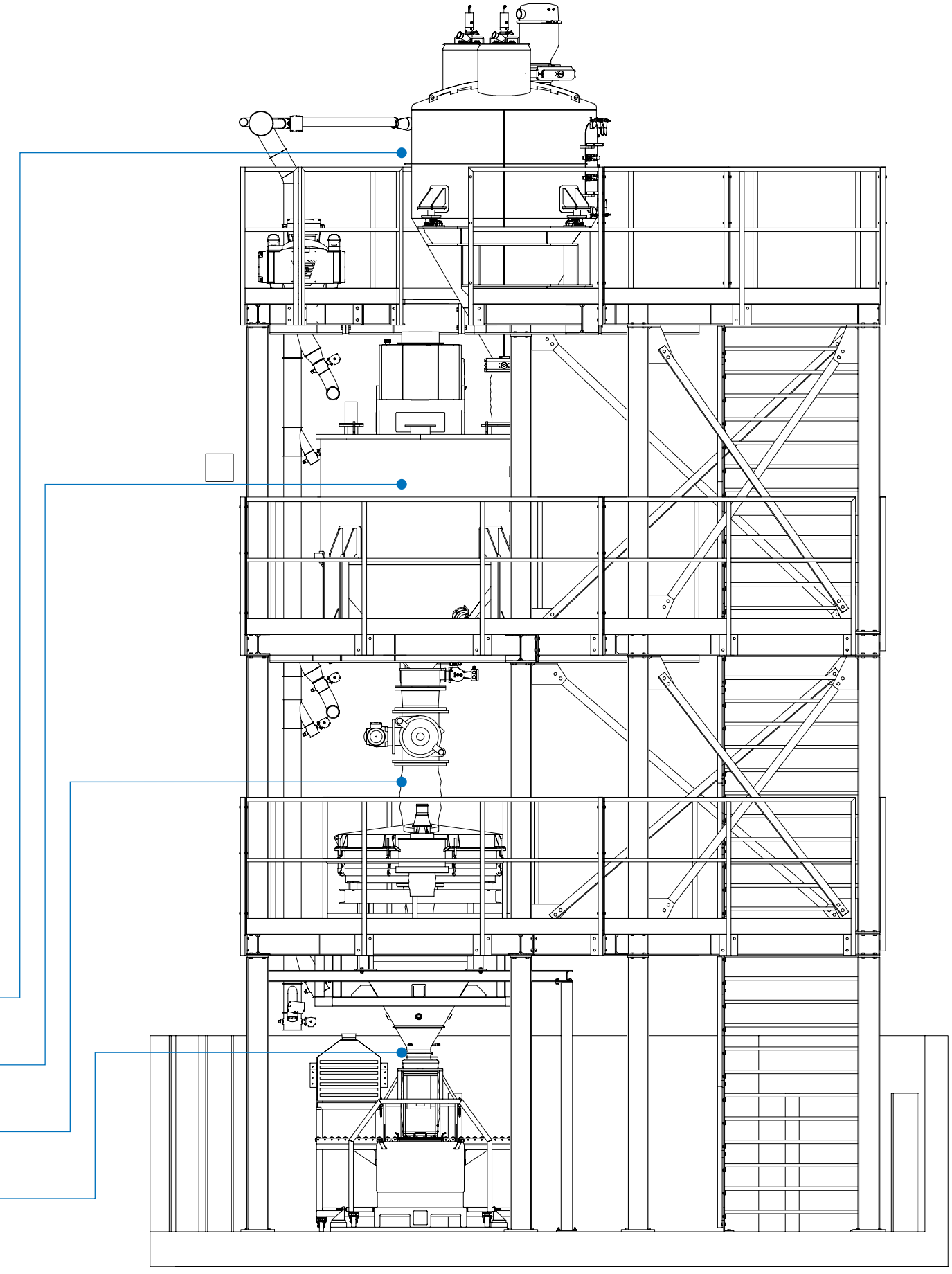
Powder in motion inevitably releases dust particles. In order to reduce dust levels, the plant automatically sucks in escaping powder. This efficient dust removal system means that the two operators can work hazard-free without dust masks.

Buffer container

Mixer

Rotary feeder and control screen

Powder discharge and dosing device



From stainless steel to software.

An overview of the components, hardware and software.

The following components, developed internally at JAG, were used: a JAG PAD for dosing; a JAG Fluidising Nozzle for delivery; a JAG Diverter Valve to direct product to the conveyor pipe; and a JAG PSC Powder Separator on the buffer container. The remaining components were sourced from external suppliers.

JAG PAD
Powder Discharge & Dosing Device

Discharge, dosing, shut off: the JAG PAD unifies these three functions. A pneumatic drive lifts the cone to allow the powder to flow through the annular gap. The repeated raising and lowering of the cone means flaky and bulky materials can be easily delivered. The upward and downward movements of the cone are controlled by specialised dosing software; positive and negative weighting ensures high dosing accuracy.

JAG SW
Diverter Valve

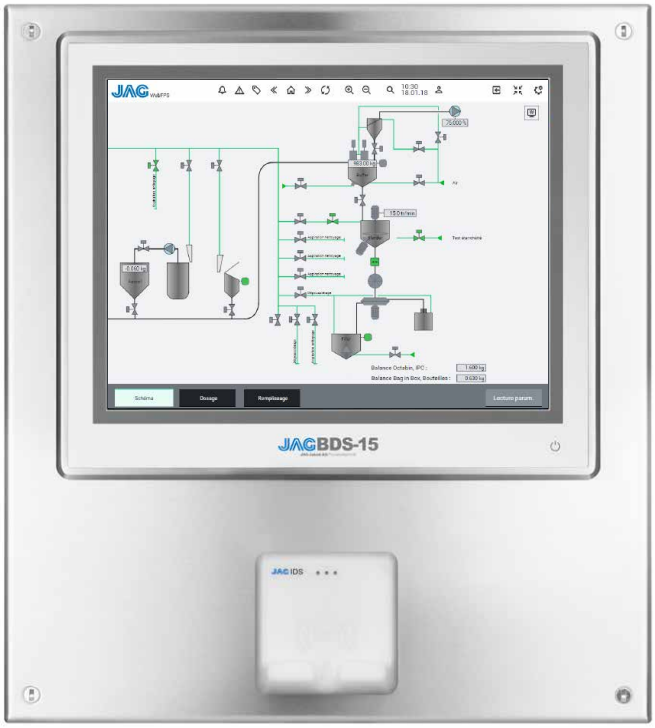
Specially developed for pneumatic transport systems, the JAG Diverter Valve ensures a reliable connection. It is ideal for use in sterile rooms. Its extremely compact construction allows it to be installed in the tightest of spaces.

JAG FLD 32
Fluidising Nozzle

Temperature and humidity affect the flowability of powdery materials. In order to ensure continuous discharge, the JAG Fluidising Nozzle improves the flow behaviour of powder by disrupting the bridging and coagulation tendencies of powder. To achieve this, the fluidising nozzle blows compressed air impulses along the inside of the container. Existing process plants can easily be retrofitted with this device.

JAG PSC
Powder Separator

No suction and pressure reliability without an efficient powder separator! The JAG PSC works without a filter, with the double advantage that between batches no filter replacement is necessary and so the environment is not contaminated. A further advantage comes in the simple and safe cleaning of the JAG PSC; and if required, a connected CIP system can provide thorough cleaning in place.



JAG WebFPS

The JAG WebFPS process management system is the recommended web-based all-in-one solution, providing a modular, extendable system and easy operation via web browser on PCs, tablets and smartphones.

JAG BDS-15

The JAG BDS-15 Touch-Panel-PC with Intel Celeron Quad Core technology and a Windows 7 operating system is used for commanding, controlling and visualising the automated process. The JAG BDS series units were specially developed for demanding applications and can be installed in both control cabinets and stand-alone operator interfaces on site, in sterile rooms or elsewhere on the process line.

JAG PdiCS+

The centrepiece of this automated process is the JAG PdiCS+ XPM Master Module. Its powerful processor accomplishes complex control and communication tasks with ease. With four ARCNET interfaces per XPM Master Module, up to 1000 input and output peripherals can be controlled via PdiCS+ I/O Modules.

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