ABB MEASUREMENT & ANALYTICS | APPLICATION NOTE

Precise air control during the spray drying process using continuous electrical control actuators from the Contrac range

Low operating costs thanks to maintenance-free, high-accuracy regulation of drying air during the powder production process

Contrac

Introduction

The process of spray drying is used to manufacture powder in a variety of sectors. Applications include the production of powdered milk, instant coffee or even detergents.
The process described here is for manufacturing detergent. This process begins with a paste-like mixture of raw materials known as slurry that is blended in line with a specified formula. The slurry is pumped through nozzles at up to 45 bar into a drying tower. Hot air is used to reduce the water content to 1 to 2 %. The resulting solids fall out of the drying tower as powder.
The temperature of the hot air added during this process must be regulated according to the water content and quantity of the slurry, and taking cooling caused by the evaporating water into consideration. Regulating the negative pressure in the drying tower is even more important than this temperature regulation process.

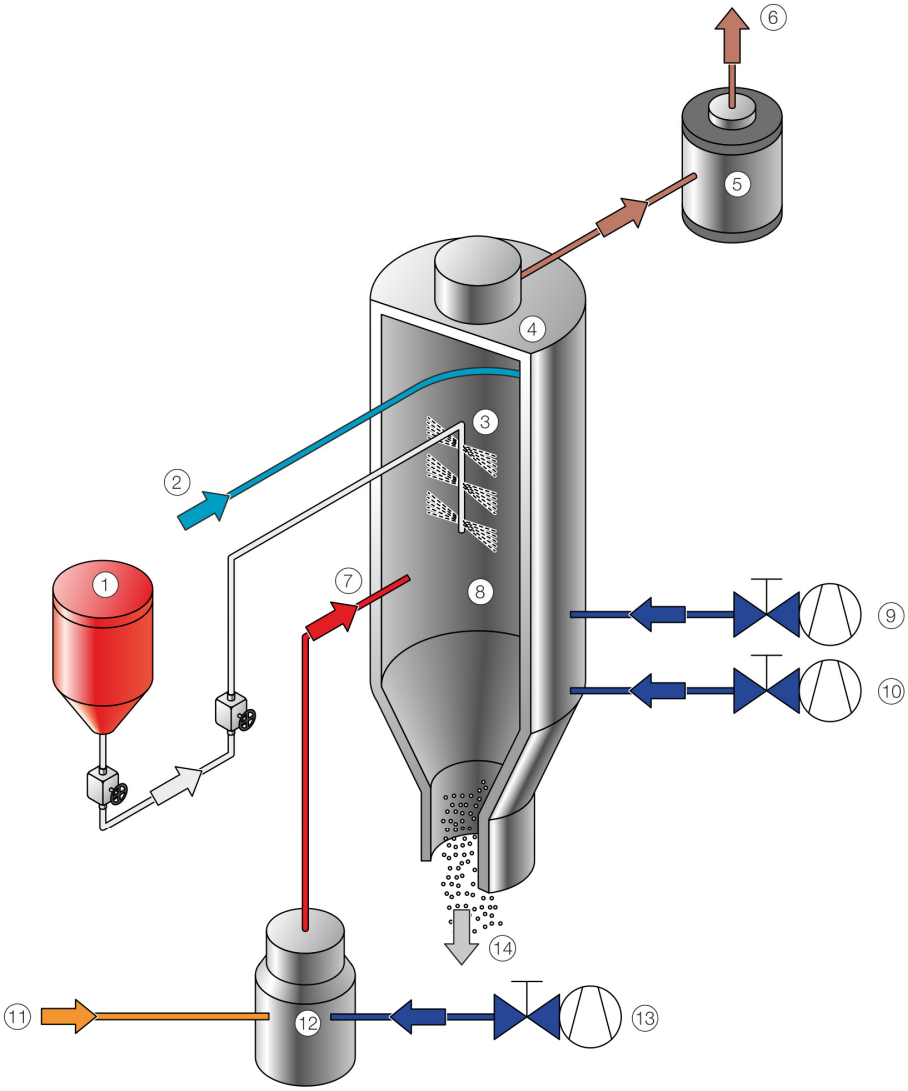
When starting up the drying tower after changing the formula, for instance, the hot air is started up first.
The exhaust fan is then started, which extracts the air saturated with water from the drying tower via a filter. The negative pressure must not down-scale −500 mbar for a safe start-up procedure. The negative pressure must be adjusted to −200 mbar once slurry injection has begun.

During this step, the pressure to be regulated is influenced by the following parameters:

- Quantity of slurry injected.
- Cooling of hot air due to water evaporating from the slurry during the drying process and due to the associated volume and pressure variations.
- Volume of finished powder extracted from the drying tower.

Diagram of spray drying

01 Diagram of spray drying



1. Raw material circulation (90° supply line for hot water)
2. Process air
3. Spray nozzle
4. Spray tower
5. Filter
6. Exhaust
7. Hot air
8. Drying chamber
9. Swirl air
10. Cooling air
11. Fuel
12. Burner
13. Process air
14. Extracted finished product

Fan with Contrac control actuator

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The problem

If an insufficient amount of air is blown in due to inaccurate regulation, the powder particle size will not correspond to product requirements. If too much air is blown in, the powder will be discharged from the process, which can lead to contamination of the entire system.

Furthermore, the pressure in the drying room has a significant impact on powder stability, which is critical for further processing of the powder. In the worst-case scenario, an instable powder cannot be further processed and leads to the loss of the entire batch.

This solution for enhancing the process and minimizing the likelihood of failure comprises an efficient drying process in which the drying air is regulated continually and with a high level of precision.

The solution

Continuous electrical control actuators from the Contrac range are the ideal solution for providing the required level of high-precision regulation for the drying air.
Contrac actuators can provide stepless, continuous movement of final control elements, regardless of whether pressure is regulated using throttle valves or swirl valves. This functionality enables the actuators to perform regulation with an unparalleled accuracy of ±0.05 % and actuating times of up to 10 s / 90 °.
The actuators enable S9 – 100 % duty cycle operation in accordance with IEC 60034-1 at ambient temperatures of up to 85°C.
The actuators also feature an oil-lubricated spur gear with drive shafts supported by ball bearings. In linear actuators, highly efficient ball screw spindles convert rotary motion into linear motion. Their robust design and IP rating of IP66 make them ideal for operation in harsh conditions.
In addition to the advantages previously mentioned, 10-year maintenance cycles also contribute to reduced operating costs.

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— 02 Control actuator on the process air supply
— 03 Control actuator on the swirl air and cooling air supply

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