



## **APPLICATION SPOTLIGHT**

Mass Meters Optimize Marshmallow Candy Production



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Preparation tank



Mixing and aeration tanks where the product is mixed with air

### APPLICATION:

The confectionary industry often uses marshmallow as the basis for producing jelly candy, hard sugar toffee, licorice and chewing gum. The production process includes mixing sweeteners such as corn syrup, sugar and dextrose with emulsifying agents, water and gelatin to give marshmallow a puffy texture.

In addition to ingredients, air serves an important role in the texture and quality of marshmallow. Too much air can create bubbles that form substandard marshmallow. To produce high-quality marshmallow, the process must control air flow, taking into consideration the amount of marshmallow produced in different cycles. In addition, the process must accurately measure the liquid form of the marshmallow after the process tank to ensure consistent quality to the final end product.

### PRODUCT SUPPLIED:

- Vogtlin Thermal Mass Flow Controller
- TRICOR TCM 028K Coriolis Mass Flow Meter

### CHALLENGES:

Marshmallow production differs from most candies as its density is significantly reduced by the introduction of air. Marshmallow comes in two varieties: "non-grained" or "grained." Non-grained marshmallow keeps all the sugars in the solution to produce a chewy texture. In the production of grained marshmallow, part of the

sugar is deliberately crystallized to create a short texture. In both varieties, a controlled proportion of clean air is mandatory to get the right results. Too much or too little air during the production process will change the texture and appearance of the marshmallow as well as its physical volume. As a result, air must be closely monitored during production.

Once the marshmallow mixture leaves the tanks, the process must accurately measure its mass flow to ensure consistent production to the final product. High viscosity, high temperature and pressure drop can result in crystallized particles reaching a ratio of 2 to 3% during the mixing process.

### SOLUTIONS:

#### I. Monitoring Air Flow into Marshmallow Mixture

**Fluid:** Clean air

**Flow rate:** Depends on capacity of production line. For our application, max value is around 2.5 CF (70 NLPM)

**Feeding Pressure:** 150 psi

**Inlet pressure:** 120 psi

**Outlet Pressure:** 100 psi

**Temperature:** 70-80°F (20-30°C)



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Previously, electronic meters monitored air flow into the marshmallow production process that did not provide enough precise feedback. Vogtlin Thermal Mass Flow Controllers offer greater precision and faster response in controlling the amount of air for marshmallow production cycles. While the application requires at least 1% accuracy for clean air feeding for each measurement cycle, the Vogtlin MEMS sensor technology offered 0.5% accuracy with fast response time. While flow rate of the clean air depended on the capacity of the production, the maximum value was approximately 2.5-3.0 ft<sup>3</sup> /min (70 NLPM).

### II. Measuring Marshmallow Mass Flow

**Media:** Marshmallow

**Flow Rate:** depends on capacity of production line. For our application, max value is reached at 2000 lbs/min (1000kg/min) and min value is around 3.0 lbs/min (400 kg/h)

**Pump Pressure:** 75 psi (5 bar)

**Temperature:** up to 210°F (100°C)

**Density:** .09-1.0 lbs/ft<sup>3</sup> (1.3-1.4 kg/m<sup>3</sup>)

**Viscosity:** around 200-2000 Cp at 175°F

In addition to monitoring air flow during the production, another important issue is accurately measuring mass flow of the marshmallow after formulation in the process tank. For this application mass flow meters must be placed near and below process tanks to reduce temperature effects.

When monitoring flow at long distances, temperature loss becomes larger, directly affecting product viscosity. Pressure drop, expected maximum and minimum flow rate, and mass flow accuracy directly depend on the temperature.

As a medium-sized marshmallow production line produces around 20-25 tons/day final products at a 24/7 production schedule, flow meters also must accurately measure the amount of fluffy mixture. If a mass flow meter is not accurate enough, the process cannot ensure an accurate amount of the final product.

Installed on the mixing-aeration tanks that feed the air for fluffy forming, the TRICOR Coriolis Mass Flow Meter provides an accurate measurement of marshmallow viscosity at approximately 0.3-0.4% for each cycle, without depending on mounting position or straight pipe length. With accurate flow measurement, operators can check the amount of the final product just at the end of a process before the packing with a weighing system. Without using a Coriolis Mass Flow Meter, the manufacturer previously used at least three weighing systems prior to packing.

As the pump and globe valve on the line is controlled by a PLC using the 4-20 mA output from the Mass Flow Meter, operators can easily change flow rate depending on production. Operators can also quickly reference the total amount in each production cycle to determine the total amount of clean air.

In addition, providing greater response than previous instrumentation with greater production accuracy, the Coriolis Mass Flow Meters reduced the cost of production line design and maintenance costs.

