Loss-in-Weight Feeder Equipment Eliminates Costly Waste, Reduces Production Time

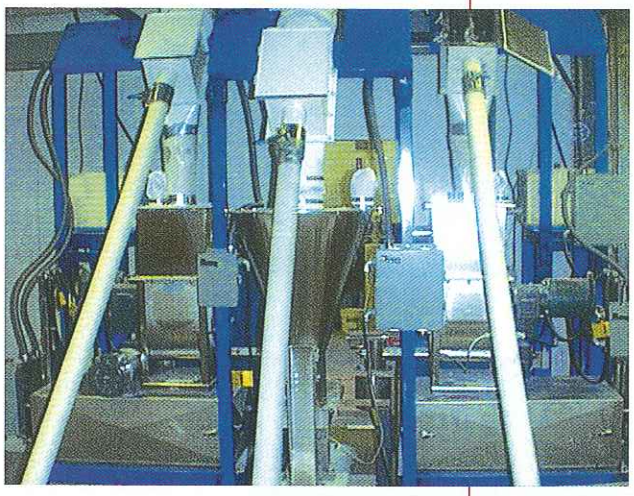
A careful investigation into quality-control problems led a manufacturer of sensors to a retooling that has dramatically reduced waste, sped up production and lowered production costs since the new system was installed.

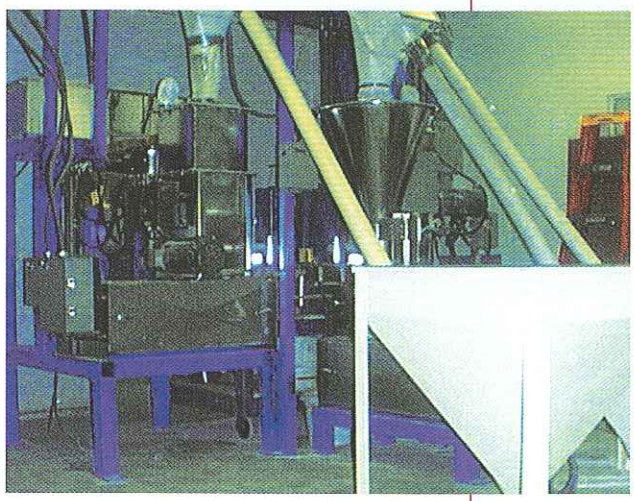
The company supplies foundries with heat sensors for analyzing molten steel and other alloys. These parts are replaceable tips for long wands wielded by metallurgists. Although they are disposable (after registering the temperature, they melt into the metal), their production is not a simple process. Each sensor's glass tubes are embedded in a socket mount and secured in place with a highly specialized, five-ingredient ceramic cement.

During production, each 50-pound batch of ceramic cement provides enough base material to assemble a tray of 1,000 sensors. If the five ingredients are not in precise proportion, the material will crack during the curing process, ruining 1,000 sensors. After loosing an exceptionally high number of batches each day, the company developed a plan to eliminate these unacceptable losses.

Management appointed a task force consisting of the project engineer, the project manager, the mechanical project engineer and the head of engineering. Embarking on a rigorous three-month evaluation, they quantified standards to ensure proper setting of the cement. They set accuracy tolerances for each ingredient-standards that had to provide leeway for slight, uncontrollable variations inherent to the processes, such as humidity and temperature cycling of the curing ovens. They also focused on their existing material handling and dosing system. Concurrently, they began to consult vendors, not only about the new equipment they offered but also about batching-weight targets and the handling characteristics of the ingredients.

A thorough evaluation of their existing process revealed that human error and their existing volumetric paddle wall screw feeders, installed on platform scales, were the cause of the problem. Some of the cement additive ingredients used in the process readily agglomerated and massed in the feeder, producing an unreliable discharge. In addition, the plant determined that the scaling system for the feeders did not provide sufficient resolution to accurately measure the material as it was being fed. The customer concluded that its existing dosing system was not capable of meeting their stringent demands for accuracy and reliability.





After consulting with application engineers from Thayer Scale, Hyer Industries Inc., the plant's task force arranged to test their ingredients in gravimetric dosing systems in Thayer's Material Test Center in Pembroke, Massachusetts.

To determine the equipment and instrumentation that would most effectively meet the task force's performance criteria, Thayer engineers analyzed the overall cement blending process as well as the specific handling characteristics of each ingredient. This entailed particle size screening, the determination of air indexes, bulk densities, angles of repose, and optimum hopper wall angles for mass flow. At the conclusion of a rigorous battery of tests, the task force chose five Thayer Scale loss-in-weight feeders.

For two of the ingredients, the company purchased two PF-18L-S Powder Feeders with screw discharge and patented dual chamber "U-trough" discharge hopper. This design ensured uniform material density and consistent filling of screw flights through a combination of an independently driven agitator above the screw and progressive confinement of the feed screw, tapered in the direction of material flow to relieve dynamic compres-

TABLE 1

Feeder	Material (#s)	Feed Tolerance (#s)	Inst. Resolution
1	00.165	+/- 0.0022	+/- 0.001
2	00.247	+/- 0.0022	+/- 0.001
3	22.500	+/- 0.1	+/- 0.1
4	14.300	+/- 0.1	+/- 0.01
5	04.100	+/- 0.022	+/- 0.01

sion forces as each screw flight advances towards the transition to the enclosed discharge tube.

For two other ingredients with extremely low flow rates, the company purchased two LWF-18L-V Vibratory Tray Feeders. For a fifth ingredient with difficult, cohesive handling characteristics as well as an extremely low flow rate, the company purchased a PF-8-V Powder Feeder with a vibratory tray. All three vibratory feeders include Thayer Spiralator™ vertical lift conditioning system that slowly rotates near the hopper wall to gently dilate and condition material, relieving the vibrating tray of the full weight of the material so that it can deliver a steady, uniform product stream.

Instrumentation for all five feeders is provided in a cabinet that houses a Thayer EZ-3200 double rack of communication and control modules, with an Allen Bradley PLC that provides an interface for supervisory recipe management and includes feeder start/stop and refill control. All feeders are equipped with a patented, Force Measurement Suspension System (FMSS). The FMSS functions as a force vector filter, allowing the load cell to respond only to changes in vertically directly forces (material weight) while blocking all other erroneous and destructive force vectors. The FMSS also permits counterbalancing of dead loads. This combination provides excellent weight measurement repeatability and resolution.

The task force conducted several more tests when the dosing system was installed. Five separate sample runs were executed and confirmed on a certified static scale. Table 1 shows the results, meeting or exceeding all test criteria set out by the team.

Not only did the Thayer system outperform the accuracy test, it also cut the process cycle time in batch preparation by a factor of five. This was possible of properly sized refill equipment and a comprehensive ingredient dosing system accommodates between-batch refills. What once took 10 minutes, now takes two - and with better results. Waste is eliminated because the system allows the customer to accurately produce smaller, repeatable consistent batches that are easier for the process to handle as larger batches tend to start to cure and harden before they can be used.

Since installation, the loss-in-weight system has been performing flawlessly. The compounded ceramic cement has been consistent and accurate. The plant has not had to reject a single tray. This upgrade has cut losses significantly due to failed parts, taking into account the costs of other sensor components as well as ingredient costs, lost production time and related disposal costs. The end result is increased productivity with reduced waste, a rapid projected return on investment and a positive net effect on the company's bottom line.

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