AIRLESS DRYING TECHNOLOGY

Solves Problems for Protein and Co-Protein Process Industries

An airless dryer can address odor, environmental and product quality issues.

By Rob Horton,
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How often have you heard this all-too-familiar story?

"We want to be a good corporate neighbor, so when we built our co-protein processing facility, we built it in a rural area surrounded by forest and farms. But, over the years, as the surrounding land that buffered our facility has been sold and redeveloped into residential properties, people have begun to complain about the odor. The EPA has issued several warnings and fines and, despite our best efforts, our community relations and company reputation have suffered. And, as our plant has aged, we are constantly repairing steam leaks on our steam-heated dryers, and our boilers are aging and inefficient. Our product quality has also fallen behind those from competing companies with more modern facilities, and we are looking for ways to improve quality and increase our market share."

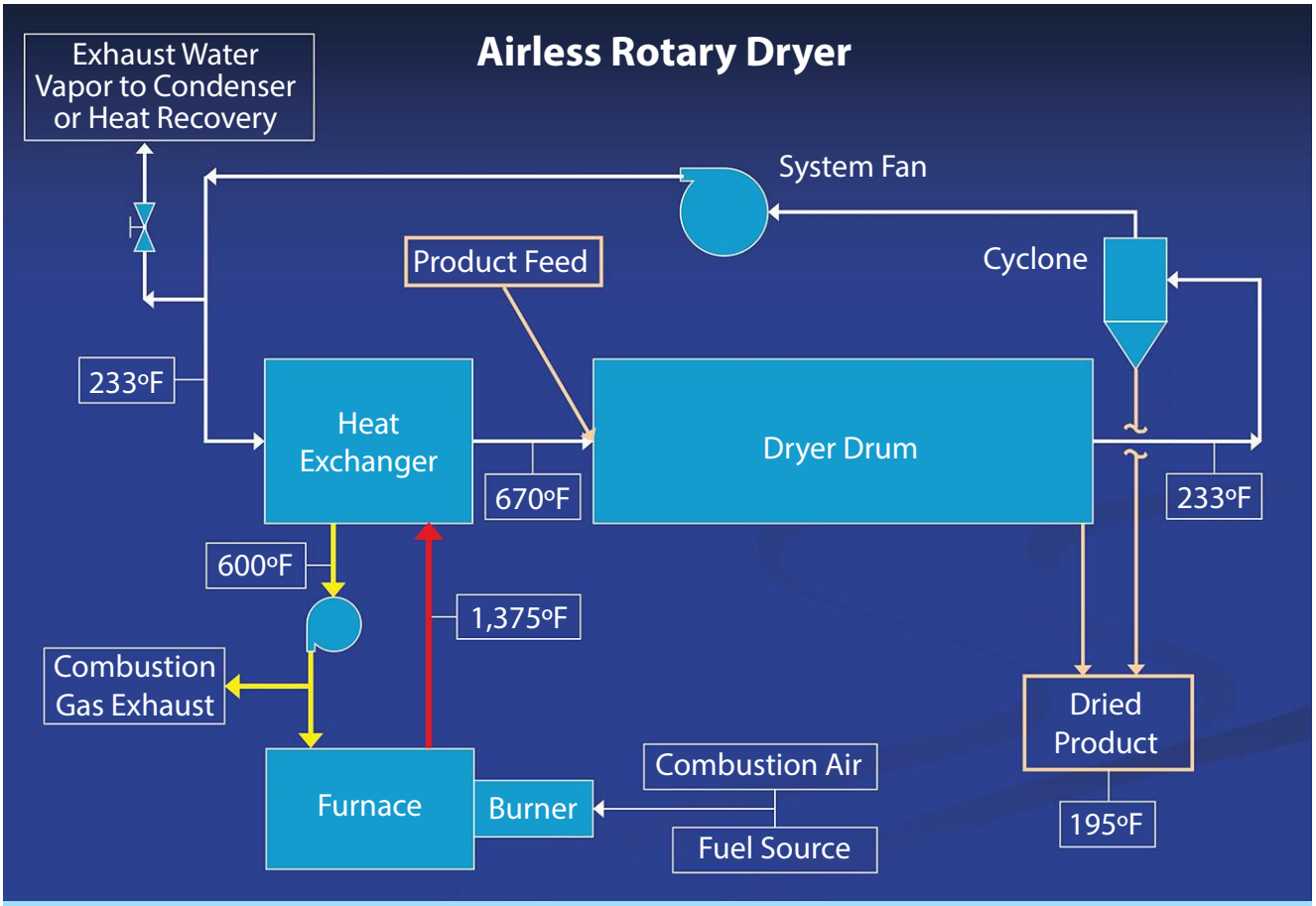

FIGURE 1. A rotary drum dryer with airless dryer technology uses atmospheric superheated water vapor evaporated from the product as the heating medium and does not require boiler steam.

While there are myriad solutions, one way is to upgrade the thermal processing equipment to an airless dryer system.

A rotary drum dryer with airless dryer technology uses atmospheric superheated water vapor – evaporated from the product – as the heating medium (figure 1). It does not require boiler steam. Here is how it works:

- Combustion gases from a conventional furnace provide heat to the heat exchanger, which transfers heat to the circulating water vapor. There is no direct contact between combustion gas and the product to be dried.
- The system fan circulates water vapor through the heat exchanger to the dryer drum. The superheated water vapor causes water to evaporate from the product in the dryer drum.
- Product and water vapor exit the dryer drum together. The product is separated from the water vapor dryer in the cyclone.
- Water vapor from the cyclone goes to the system fan, and excess water vapor is exhausted from the system through a control valve after the system fan.
- The dried product exits the system through a rotary airlock.
- The combustion gases from the furnace are circulated through the heat exchanger by

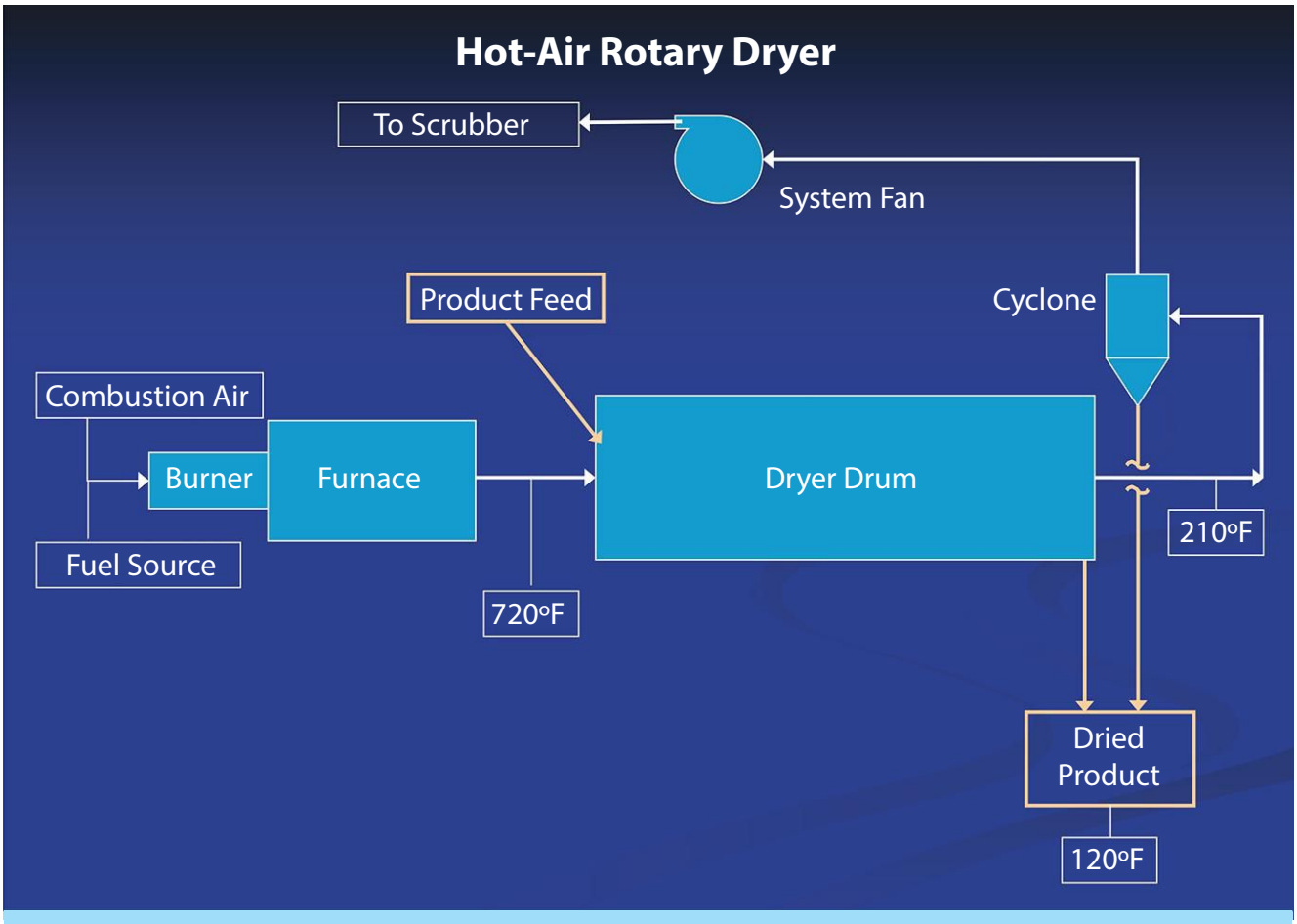

FIGURE 2. For comparison, a conventional hot air dryer operates differently than a modern airless dryer.

the combustion gas fan. Excess combustion gases are exhausted from the combustion gas loop to the atmosphere.

This is different than a conventional hot-air dryer (figure 2). The airless dryer system delivers multiple benefits, including:

- Improved safety.
- Improved product quality and consistency, which, in turn, improve revenue opportunities.
- Improved environmental and odor control, which improves community relations, helps ease the environmental permitting process and can reduce downstream processing capital equipment costs.
- Operational cost savings from increased thermal efficiency and design flexibility.

Let's take a closer look at each of the benefits.

Improved Safety. With very little oxygen (less than 2 percent) present in the drying system, coupled with offset hot-air introduction designs, there is minimal risk of fire in the dryer.

Improved Product Quality and Consistency. Because of the airless design, there is minimal risk of product degradation as a result of oxidation.

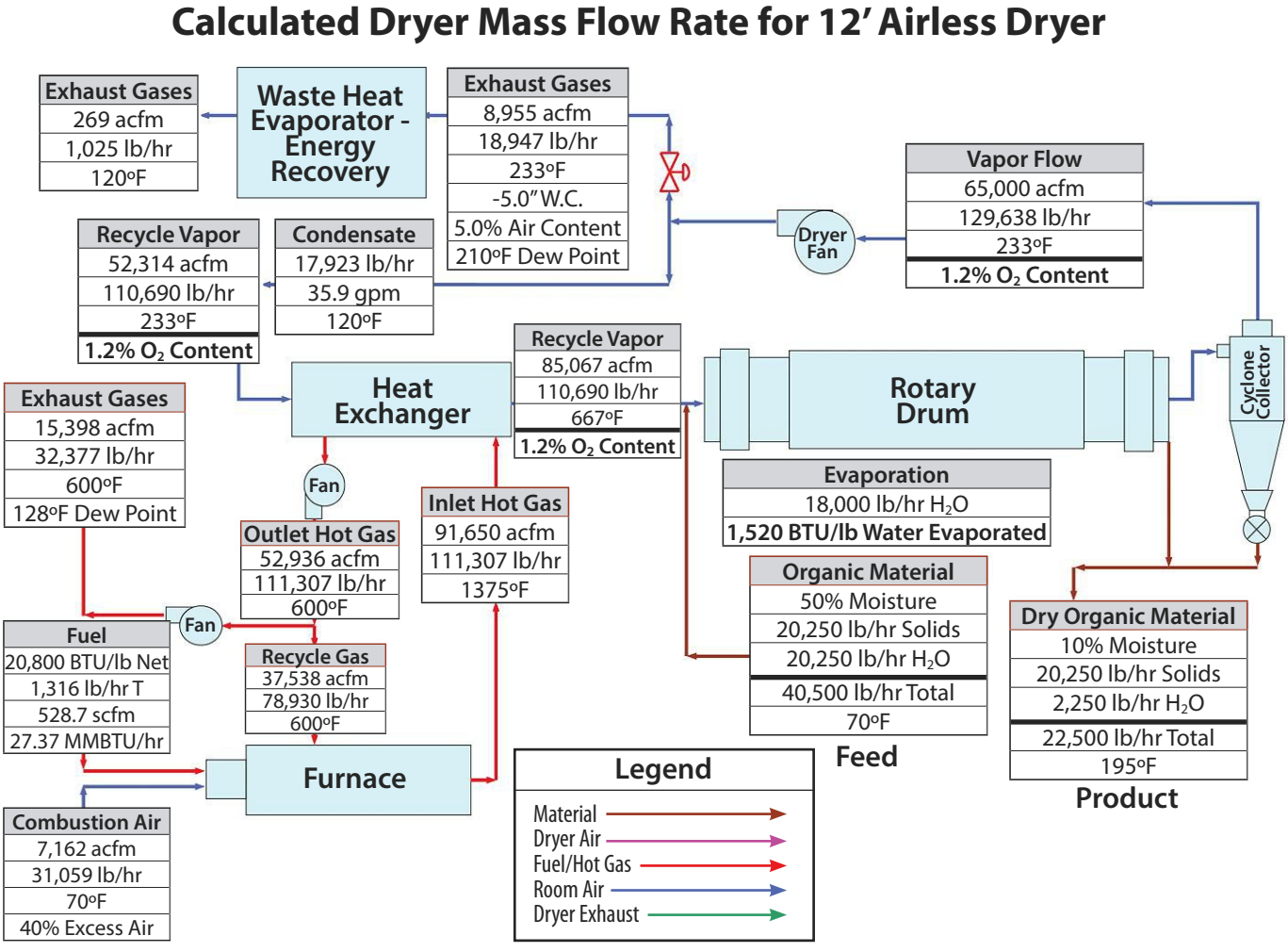

FIGURE 3. The volume of exhaust from the airless dryer is compared to hot-air dryers of similar capacity. For example, a 12' dia. airless dryer system processing 40,500 lb/hr of material and evaporating 18,000lb/hr of water will only exhaust 269 acfm.

In addition, the quality of the product produced with an airless dryer exceeds that produced by steam-tube dryers or steam-heated disc dryers, according to proprietary testing. Scorching and burning are virtually eliminated because the product does not stick to the hot tubes. On sensitive proteins like fishmeal, an airless dryer can improve digestibility figures by 1 to 2 percent compared to fishmeal dried in a conventional steam-heated disc dryer. High digestibility and improved product consistency help ensure that the producer can sell the product at a high unit price.

Improved Environmental and Odor Control. Improved environmental and odor control improves community relations, eases the environmental permitting process and reduces downstream processing capital equipment costs.

With the airless dryer, the volume of exhaust is virtually eliminated when compared to conventional hot air dryers of similar capacity. For example, a 12' dia. airless dryer system

Calculated Dryer Mass Flow Rate for 12' Rotary Hot-Air Dryer

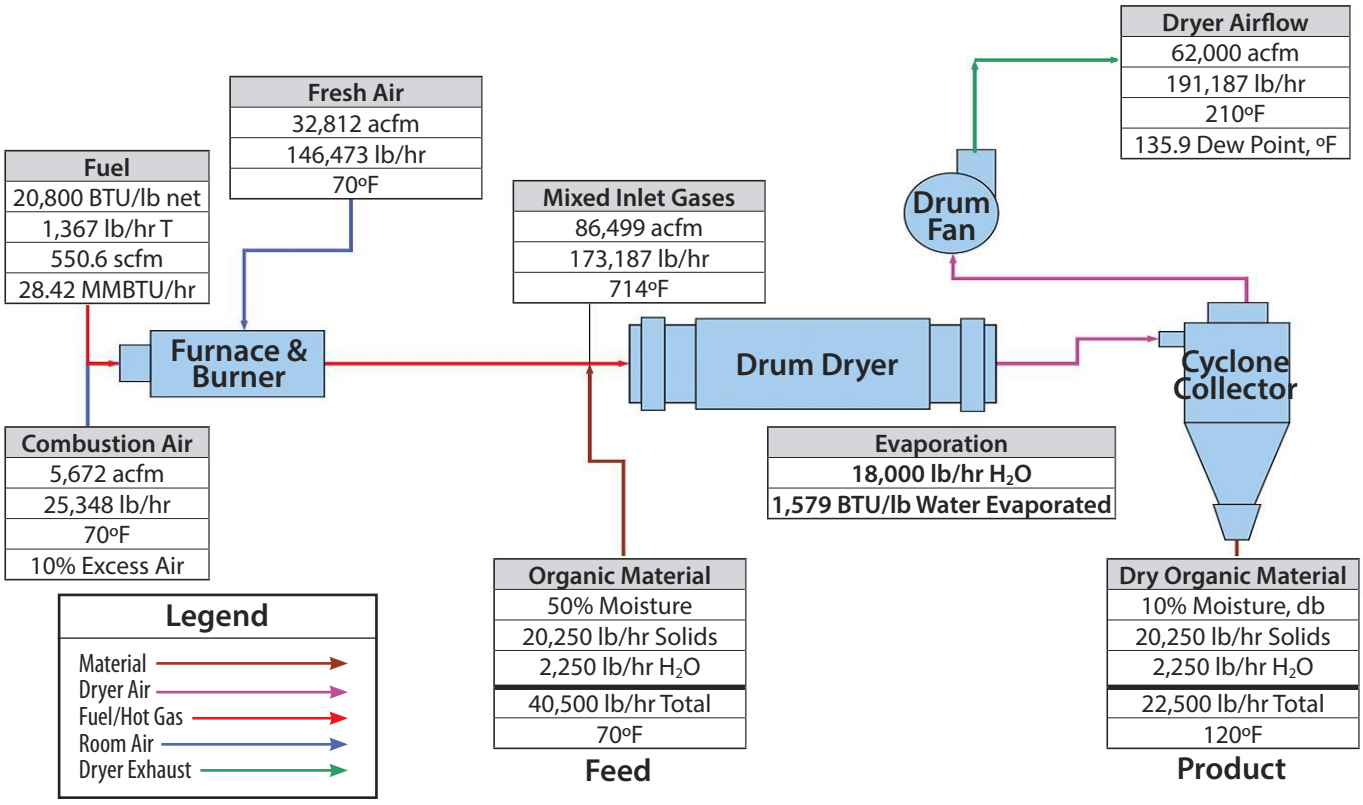

FIGURE 4. The volume of exhaust from the airless dryer is compared to hot-air dryers of similar capacity. A 12' dia. hot-air dryer processing 40,500 lb/hr of material and evaporating 18,000lb/hr of water exhausts 62,000 acfm.

processing 40,500 lb/hr of material and evaporating 18,000lb/hr of water will only exhaust 269 acfm (figure 3). By contrast, a conventional hot air dryer would exhaust 62,000 acfm (figure 4).

Because the airless dryer exhaust can be treated effectively in a conventional condensing system, odor control equipment is not required to treat the dryer effluent. In applications where a stand-alone scrubber is required to process the airless dryer exhaust because of local environmental requirements, it would cost less.

Other environmental benefits of the airless dryer include the absence of visible dryer exhaust plumes.

Increased Thermal Efficiency and Design Flexibility. Compared to the airless dryer, it would require two steam-heated disc dryers to handle the same capacity as one airless dryer and the exhaust of the disc dryers would be equal to or greater than an airless dryer (figure 5).

The thermal energy in the dryer exhaust vapor can be recovered for use in other parts of the process. For example, the exhaust of the airless dryer could be used in a waste heat evaporator.

The thermal efficiency of the airless dryer is better than a comparable conventional hot air dryer. The airless dryer requires less fossil fuel than a conventional hot air dryer or

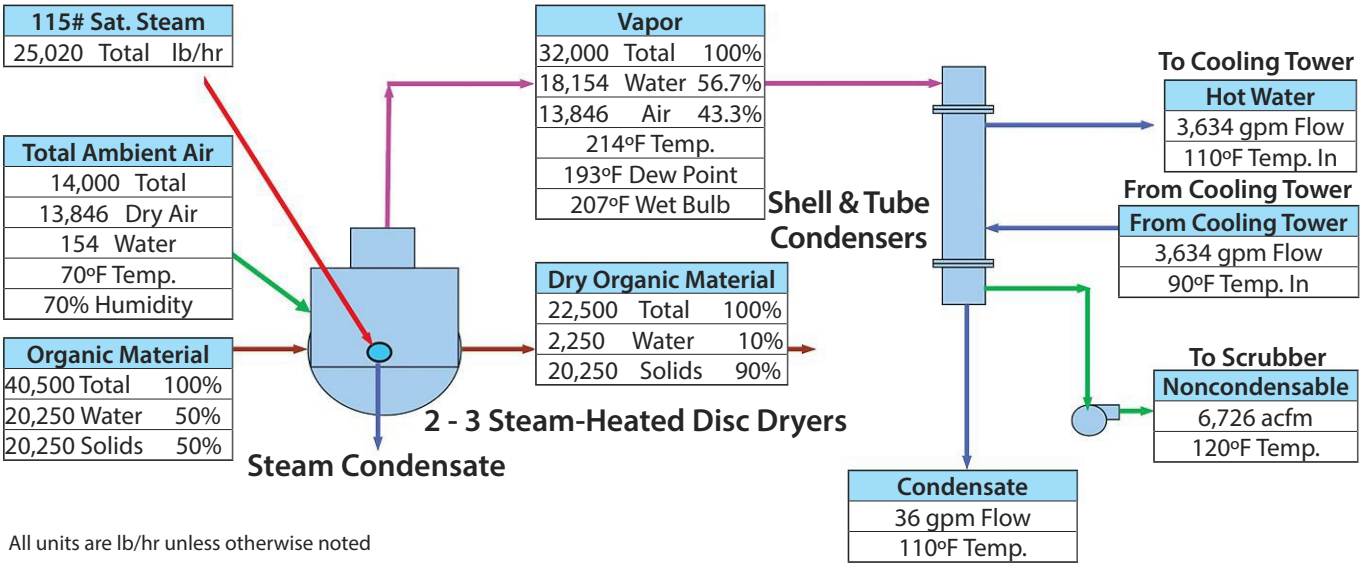

FIGURE 5. It would require two steam-heated disc dryers to handle the same capacity as one airless dryer, and the exhaust of the disc dryers would be equal to or greater than an airless dryer.

Natural Gas Usage Comparison

	Evaporation Rate	Natural Gas Required	Steam Required	Natural Gas Cost	Boiler Efficiency	Cost of Steam from Natural Gas	Natural Gas Usage Costs			
	lb/hr	MMBTU/hr	lb/hr	$/MMBTU	%	$/1000 lb-steam	$/hour	$/day	$/week	$/year (50 wks)
Airless Rotary Drum Dryer	18,000	27.37	N/A	$2.00	N/A	N/A	$54.73	$1,314	$9,195	$459,734
Rotary Hot-Air Drum Dryer	18,000	28.42	N/A	$2.00	N/A	N/A	$56.85	$1,364	$9,550	$477,519
Steam-Heated Disc Dryer	18,000	N/A	25,020	$2.00	85%	$2.4188	$60.52	$1,452	$10,167	$508,354

TABLE 1. The thermal efficiency of an airless dryer is compared to a rotary hot-air dryer. The airless dryer requires less fossil fuel than a hot-air dryer or steam-heated disc dryers processing the same amount of material. The table compares natural gas usage.

steam-heated disc dryers processing the same amount of material. Table 1 explains the natural gas usage comparison.

Because almost any fossil fuel can be used for a heat source, the processor can choose the most economical source for their locale.

So, when it comes time to modernize an existing facility or designing a new facility in an environmentally sensitive area, you may want to consider the multiple benefits of using airless drying technology. PH

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