

Simple, Safe, More Uniform Frying

Private-label food manufacturer uses thermal frying and a nontoxic heat transfer fluid to enhance product quality and improve plant safety.

Like any food processor, D.C. Foods needs process equipment that is flexible yet reliable. At its manufacturing plant in Ontario, four production lines marinate, form, batter dip, coat, bread, par-fry, flash freeze and package vegetables, pizza nuggets, meats, poultry and cheese products. This dynamic processing environment requires equipment that can quickly adjust to changing process demands. D.C. Foods found that two online fryers, each heated by its own closed-loop thermal fluid heater, can do the job best.

A custom private label manufacturer, D.C. Foods has used closed-loop thermal fluid heaters since its Waterloo, ON, facility opened in 1992. While a single thermal fluid circuit can serve multiple processing lines operating at varying temperatures, D.C. Foods operates a separate thermal system for each of its fryers to ensure that production is not halted if the system requires servicing.

D.C. Foods operates two thermal systems to heat two 600/4000TH fryers manufactured by Meyn Food Equipment Inc., Kettleby, ON. Both fryers have tempura capabilities for puff-batter frying. One fryer, located 60' from the mechanical room, is heated by a 800,000 BTU thermal fluid heater. The other fryer, positioned 200' from the furnace, is heated by a 1.2 million thermal heater located in a refrigerated plant where the air temperature is kept below 50°F (10°C). Both thermal fluid heaters are manufactured by [Fulton Thermal Corp.](#), Pulaski, NY. They circulate NF nonfouling food-grade heat transfer fluid manufactured by [Paratherm Corp.](#), Conshohocken, PA.

For Ron Curik, vice president and co-owner of D.C. Foods, the thermal fluid systems offer many advantages over direct heating methods: The heat can be applied more evenly, the temperature can be controlled more precisely, quality and output of processed items are increased, and waste is reduced. Additional benefits to food processors include increased cooking oil life, elimination of products of combustion in the kitchen, reduced noise and reduced risk of fire.

For D.C. Foods, the advantages of closed-loop thermal frying over direct heat technologies such as gas, electric or steam process heating are many. "It's simpler, safer and provides uniform frying," Curik said. "The system is completely self-monitoring. It's programmed to maintain a consistent temperature throughout the day. The NF fluid we're using in the thermal heater then maintains the frying oil's temperature within 11°C."

The system operator sets the thermal fluid heater temperature between 550 and 600°F (260 and 316°C). The temperature controller is kept in a locked room to ensure that the setting will not be changed accidentally during a production run. The thermal fluid is piped through insulated piping to the thermal fluid booster pump on the fryer, where the desired temperature for the frying oils is dialed into the PLC controller. When the frying oil is cold, the valve is wide open, allowing the thermal fluid to flood the heat exchanger fryer coils. As the temperature approaches setpoint, the controller responds and begins closing the valve (going into bypass mode) so that no more thermal fluid circulates through the heat exchanger. As the volume, temperature and weight of the product being processed changes, the thermal fluid booster sensor automatically adjusts the amount of thermal fluid going through the heat exchanger before the temperature of the oil can deviate from setpoint.



At D.C. Foods, uncooked breaded chicken strips are placed on flat, nonstick bars that carry the product through the Meyn fryer for processing. The fryer is heated by a Fulton thermal fluid heater filled with Paratherm NF heat transfer fluid.

Curik has found that the system is able to maintain a consistent temperature at the fryers no matter how the process changes. "Say I'm running frozen product, and I set my frying oil at 375°F [191°C]. If it's a high volume of a larger, heavier product like turkey schnitzel or breaded chicken breasts, the controller on the heat exchanger senses this and tells the booster to open wide, allowing more heat transfer fluid to heat the fryer," Curik said. "If less product or a smaller size product starts coming down the line, the sensors will close the valve before the temperature of the frying oil rises beyond the setpoint." According to Curik, this ensures uniform cooking, improved product consistency and less product waste.

"At any given spot in the fryer, the cooking oil is the same temperature, whereas with direct heat you get hot spots," Curik noted. "Electric fryers are hotter at the element, gas fryers are hotter at the rods. You get a lot of burned product with these other methods."

Rated to 600°F, and the NF fluid maintains its viscosity well, which allows D.C. Foods to maintain temperature and flow even when the system operates at high temperatures. Its quick heatup time also saves production time and energy costs.

According to Curik, the system is ready only 15 min after startup, and short production breaks are not a problem either. "When there is no cold product entering the fryers - during coffee breaks or lunch, for example - the thermal heater keeps circulating the heat transfer fluid to maintain the temperature, so you're not heating up from zero," Curik said. "And, since you're not going from cold to hot or on to off between breaks, there's less temperature shock to the metal, so the system requires less maintenance and the equipment lasts longer."

Safe Operation

Curik also believes that thermal systems are much safer to operate than direct heating systems.

"With electric fryers, if you mistakenly open the valve, your cooking oil leaves the fryer. It's then exposed to the hot heating elements, which can ignite the cooking oil residue. Though electric fryers have safety features to prevent such a thing from happening, it's easy to bypass the system if your production is running late and you don't want your sanitation crew to wait the two-hour lock-down period before cleaning.

"With gas, you're dealing with an open flame and lots of hydraulic equipment nearby," Curik continued. "A few years ago, several people were killed in a gas-fired explosion when a hydraulic hose broke. In a plant I was managing, someone thought they were closing a valve but actually opened it. The hot elements ignited the remaining oil. We were able to evacuate everyone, but the smoke got into the chimney, which was in the second story ceiling, and caught fire, all within 15 minutes."



A quality control inspector at D.C. Foods examines parfried breaded chicken strips as they leave the Meyn fryer. During frying, the cooking oil's temperature is maintained within 11°C.

Curik noted that chances of having a fire with a thermal fluid system are much lower because the cooking oil never comes in contact with the open flame or exposed heating elements. "The worst that can happen with a closed-loop thermal system is that if a thermal pipe breaks, the fluid can get into your fryers. If that happens, the problem can be repaired and the system flushed." Production staff is less likely to bypass safety features when a thermal fluid heating system is used because only a 5 min lock down is required after production before the cleaning crew can begin. With only a short delay, processors are less tempted to bypass the safety

feature to start cleaning.

The main reason D.C. Foods chose Paratherm's NF fluid is its nonfouling, nontoxic formulation, according to Curik. The NF fluid has a comparatively low level of thermal expansion, which allows for the installation of a smaller expansion tank and reduces air exchange in the tank. The NF fluid is certified by the Food and Drug Administration (FDA), United States Department of Agriculture (USDA), Canadian Food Inspection Agency (CFIA) and Canadian Health and Welfare, among other government agencies. It also carries the USDA's H-1 incidental food contact rating and is certified kosher by the Orthodox Union (OU).

Quality Assurance

Another key benefit of the NF fluid is the versatility it offers when processing different kinds of foods according to the required temperature. Maintaining those temperatures is essential to product quality and consistency. Curik says, "One day we may be running chicken nuggets for a customer who requires an 18 to 20 sec fry time at 350°F (177°C), and the next day we might be frying cheese at 310°F (154°C) with a 15 sec par-fry. If you're off by even a degree or two, it really affects how the coating system turns out. The NF fluid performs well at any given temperature." D.C. Foods also uses the NF fluid to heat water to 210°F (99°C) for cleaning the fryers following production.



Paratherm NF heat transfer fluid can process different kinds of foods according to the required temperature, including par-fried, breaded chicken strips.

As a result of the company's ability to maintain quality while processing a range of prepared foods, it recently underwent a 50/50 merger with Inter-national Menu Solutions Inc., a sales and marketing company for the home meal replacement trade. D.C. Foods is gearing up to fulfill the concept of home meal replacement. According to Curik, the new freezing and packaging technologies are better able to capture and maintain food freshness. Fresh and frozen foods can be bundled together at the next stage of processing or by the retailer. For D.C. Foods, this means adding another 40,000 ft² to its current 25,000 ft² facility and doubling its production lines.

As a first step, in January 2000, D.C. Foods replaced one of its Meyn fryers with a Meyn 600/4000TH tempura fryer, allowing the addition of another puff-batter frying line. Puff-batters require that the product enters these fryers on flat, nonstick bars instead of a wire belt. While retrofitting the system, D.C. Foods drained the NF fluid from the thermal system for the first time since it was filled in 1992. Curik reports that after eight years of running the NF fluid for 10 to 16 hr a day, at or close to its maximum temperature, inspection of the system's piping showed no corrosion or carbon deposits.

Unlike conventional heat transfer fluids, the NF fluid will not cause hard carbon formation on surfaces heated at extremely high temperatures - an essential feature in systems such as D.C. Foods. Curik explains that once carbon is cooked on the system, it is nearly impossible to remove. And, if pieces of the carbon deposit should break off while the system is in operation, it can foul up the system and possibly cause significant damage.