

Selecting, Purchasing, Installing, and Using a Cheese Melter: A Guide for Food Manufacturers

The frozen foods, meals, and bakery market remains a staple at the grocery store. Growing whether in economic booms or busts, consumers turn to frozen products as both a cure to their hectic lifestyles and an affordable alternative to going out. In fact, the frozen foods market has experienced a resurgence in recent years, growing 2.6% to \$57 billion annually in 2018, according to the American Frozen Food Institute (AFFI) and Food Marketing Institute (FMI).

This growth has been driven largely by appetizers, sides, entrees, and breakfast foods, as frozen foods become increasingly popular as part of the “total meal solution” according to “The Power of Frozen” report.

Alison Bodor, president and CEO of AFFI, sees this as a renaissance of sorts, noting that “the frozen food aisle is in the midst of a strong comeback,” and that the resurgence has been driven by increasing quality, choice, and necessity of frozen foods.

However, as promises of quality and choice increase, consumer expectations from manufacturers increase as well. Meals and entrees need to appear fresh, sustainable, and attractive to consumers—especially as manufacturers innovate, focus on supply chain sustainability, and work to compete with meal prep kits or fresh alternatives.

Knowing this, for food manufacturers, there are few things more challenging than working with cheese. The ingredient that often holds a product together—whether it’s an appetizer, sandwich, quesadilla, entree or pizza—adding cheese to a frozen food often presents a challenge. Especially as consumers have begun to move toward “premium” frozen food products including organic and high quality ingredients, they expect the product to be attractive to match the price point.

From production to packaging to distribution to retail, your product will get bumped, dropped, thrown, stored sideways, and jostled before a consumer even sees the product. How can you keep everything in place? Cheese pre-melters have quickly become part of many frozen or refrigerated food manufacturers’ lines.

These unique products are a truly unsung hero, providing a food-safe way to hold ingredients in place and ensure that a customer’s expectations are met. In this guide, you will learn more about the role that these products play in food manufacturing and discover the buying process for this machinery.

Introduction: The Cheese Melter: The Quiet Hero

You often hear about unsung heroes in the sporting world. Often referring to a workhorse player or a specialist, these people clear the way for the superstars. The name recognition may not be there, but without them, the system is less effective.

For every Aaron Rodgers, there is an offensive line there to protect him. For every star linebacker, there is a defensive lineman there to harass the O-line and open holes. Every professional baseball team has its ace and a closer, but it’s the lefty specialist who often comes in when the game is on the line to get one out.

When it comes to food manufacturing, you rely on a wide variety of ingredients, products, and tools. From the ingredients to the machines that apply the ingredients to your conveyor system and freezers, every part of your system is well understood, each process is documented, and each supplier is sourced. However, it's the cheese pre-melter that plays an uncelebrated role, as documented by the "How It's Made" episode on making frozen pizzas.

However, many manufacturers do understand this product's role in delivering on customer expectations, gently fusing ingredients prior to the final freeze to ensure a product looks just as attractive as it does on the box.

How a Cheese Melter Works

Designed to protect ingredients, minimize waste, and improve product attractiveness, an infrared pre-melter emits a flash of heat (infrared energy) to the top of food products to gently fuse ingredients together. This has to be done quickly so as not to heat product into the temperature danger zone before the product is frozen.

Infrared Heating

Rather than using a convection heating process, a cheese pre-melter uses infrared heating. Infrared is a form of electromagnetic wave or radiation which lies just between visible light and microwaves/radio waves. The existence of infrared waves was discovered in 1800, and in the food processing and manufacturing industry, infrared heating has become a staple for drying, blanching, baking, thawing, and more.

The Rise of Infrared Heating in the Food Manufacturing Industry

The application of infrared radiation to food processing has gained momentum due to its inherent advantages over the conventional heating systems, including reduced heating time, uniform heating, reduced quality losses, absence of solute migration in food material.

Infrared heaters work by transmitting electromagnetic waves, generating heat from within the product. Operating efficiently, able to work within a very limited temperature range (+/- 1°C), and only penetrating the top layer of foods, more and more manufacturers have found infrared heating is perfect for food manufacturing.

Benefits of Infrared Heating in Food Processing and Manufacturing

As more and more manufacturers have embraced this method for a wide variety of applications, they have also reaped the benefits. Not only are these products extremely efficient and take up much less space than conventional heating, they are also more effective as they offer a targeted flash of heat and minimal penetration.

This makes infrared heating safer for food, provides increased uniformity, and decreases the heating time, ultimately resulting in minimal product quality loss, absence of solute migration in food materials.

Common Applications for Infrared Heating

There are many applications—both functional and aesthetic—for infrared heating. Manufacturers use this process for fusing chocolate, browning meat, caramelizing sugar on top of a baked good, drying beans or sheeted products, deactivating pathogens, and so much more. However, one area that fits both functional and aesthetic needs is cheese pre-melting.

Infrared Heating for Cheese Melting and More

For instance, frozen pizza manufacturers use pre-melters to gently fuse the cheese and additional toppings before entering a blast freezer. This pre-melting process prevents the ingredients — either fresh or frozen — from falling off during processing or becoming loose after packaging, during shipment or when vertically displayed for resale.

Cheese pre-melters go beyond pizzas, however. The infrared pre-melting process can and has been used for frozen cheese bread, quesadillas, prepared meals and many other food items.

Fusing Ingredients without Food Safety Concerns

One of the biggest reasons that infrared heating has become a major part of food manufacturing is that the short wavelengths generated by an infrared heater do not penetrate deeply into food. Due to limited penetration power, IR heating is regarded primarily as a technology for surface-heating applications.

In this, an infrared heater can provide a limited amount of melting without browning the cheese, cooking the toppings, or heating a product too much.

Benefits of Using a Cheese Melter

Manufacturers who use cheese pre-melters are able to fuse together ingredients without having to worry about food safety. This rapid flash of energy offers a wide range of benefits. While many were mentioned above, one of the leading reasons that companies opt to use this custom piece of equipment is to deliver on customer expectations.

Delivering on Customer Expectations

If you're a user of the social networking platform Reddit, it's likely you've heard of the community called "Expectation vs. Reality." For those not familiar, this community, or 'sub' as it's called on the platform, is a place where users post "comparison pictures" including failed cake designs, fast food failures, and other events in which a user expected something advertised to them, only to find the item provided was... different.

One of the top targets for these posts happens to be frozen foods. Despite being able to lock in freshness at the peak of production, frozen foods get a bad rap from consumers. Unfortunately, this makes the community a swarm of confirmation bias. When a customer gets a product that is falling apart or missing ingredients, they are more than willing to share the box next to the "reality," creating a branding blind spot for brands and a threat for manufacturers.

In fact, many consumers expect that a product, a frozen pizza for instance, is going to look worse than it actually turns out—making some of the most popular posts on this community times when a frozen item looks like it's supposed to.

Justifying a Premium Price Point

While the traditional frozen items were thought to be a cheap, fast meal, more consumers have looked towards "premium" meals. While many still buy the 4/\$10 frozen pizzas or the \$2 "TV Dinners," you can now find high-end products in the frozen food aisle. For the past decade, the Super Premium and Premium segments have seen strong growth across the board, driven by consumers' increasing culinary sophistication and diversity of palettes, as well as product innovation.

This premium market begets premium expectations—manufacturers are competing with similarly priced fresh meal prep kits or hot and fresh carryout. Knowing this, presentation is critical.

You can top a pizza with premium toppings, put organic, high-quality ingredients into your meals, and price your products as such, but you need premium presentation to match your premium price point. Infrared pre-melters can deliver on this, keeping everything together and improving presentation.

Safe and Affordable

As mentioned above, infrared heat does not penetrate as deeply as conventional heating, increasing food safety. Added to this, with a smaller footprint, you don't have to make significant changes to your floor layout to add this item (we can often build into your current processes with minimal change), and with a smaller footprint comes lower operating costs.

Selecting a Premelter

Now that you know the benefits of using a pre-melter for your frozen food manufacturing, it's now time to look at the selection, buying, and implementation process for such an important piece of equipment. Much like any piece of industrial equipment—especially process heating—everything from location to fuel source to product flow needs to be documented so that your manufacturer can deliver the product you expect and need.

Determine Your Needs: Considerations

Document Product Characteristics

The first thing you will need to look at is your product itself. A quesadilla will have different cheese and thickness than a pizza, which will in turn have different cheese than a sandwich. Added to this, some products may benefit from browning while others need to look as fresh as possible. Product ingredients will determine temperature, residence time, and more, which will often drive the conversation with your custom equipment manufacturer.

Fuel Source

Infrared heating applications can leverage natural gas or electricity as a fuel source. While the decision is often made on availability and fuel cost, both sources can deliver the necessary heat and energy to satisfy your needs. One of the more important decisions to be made when selecting a pre-melter, both electricity and natural gas have advantages and disadvantages.

Electric	Natural Gas
<i>Advantages</i>	<i>Advantages</i>
<ul style="list-style-type: none"> • Available: often easier to find an electric source. • Simpler: Fewer components. • Easy installation: Requires only wire connections, no ductwork or piping to get up and running. • No Purge or Exhaust Fans: Without natural gas, you don't need natural gas safety elements. 	<ul style="list-style-type: none"> • More Affordable: Lower cost per heating unit. • Faster Heat Up/Cool Down: Nearly instantaneous heat up and cool down. • Smaller Footprint: Can do the same job as an electric pre-melter in a shorter length of conveyor. • Longer Life Span: Natural gas-powered pre-melters last longer than their electric-powered counterparts.
<i>Disadvantages</i>	<i>Disadvantages</i>

<ul style="list-style-type: none"> • No Exhaust Fans: Creates risk for hot spots and burn hazards. • Larger Footprint: Electric pre-melters are longer than natural gas ones. • Longer Heat up and Cool Down: Compared to Natural Gas, these will require additional time to get up to temperature as well as cool down. • Shorter Life Span: While high quality machinery will provide years of service properly maintained, electric pre-melters do have a slightly shorter life span. • More Expensive per Heating Unit: • Wire Size and Amp Draw 	<ul style="list-style-type: none"> • Harder to Set Up (Sometimes): As with any natural gas-powered product, you need to run exhaust ductwork and plan for a fuel source. • More Components: Additional components needed to operate a natural gas-powered pre-melter. • Additional Safety Considerations: Natural gas requires ignition and flame-sensing components to operate safely.
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Often, this decision is dictated by space, current setup, and the availability of fuel sources within your facility. Both types of fuel have a reasonable range of heat output to adjust for varying product conditions. While there are many reasons to choose one fuel source over another, this decision will depend on the particular process, cost and availability of the fuel resources.

Dwell/Residence Time

Depending on the different ingredients in a product, thickness, or size, residence and dwell time for an infrared pre-melter may differ. While documenting your needs, prepare to discuss recipes and expectations to allow your pre-melter manufacturer design the solution for your needs.

Conveyor speeds and heat requirements necessary to provide an even melt are critical factors in determining the optimal treatment length. Using multiple heating elements allows more adaptability for varying product types while maintaining the proper melting time.

The heat source must be close enough to be effective but not so close that it overheats the product. A pre-melter with components that can be adjusted to specific requirements will ultimately generate a more consistent result.

Temperature

In addition to the speed of conveyors as the product flows through your pre-melter, you will also need to account for the temperature at which it will need to operate. Your pre-melter will need to blend time and temperature to provide safe partial melting without browning the product or causing damage. Temperature will dictate fuel costs and time in the heating zone.

Airflow?

Size and Floor Spacing Requirements

The overall footprint of the pre-melter needs to be factored in relatively early in the design process. After determining the line speed, residence time and conveyor width, the overall footprint of the pre-melter can be calculated. Because a pre-melter often is an addition to a current production line, the required space and implementation options must be considered carefully.

As mentioned above, electric-fueled pre-melters will require a larger footprint as the pre-melter will need to be longer to accomplish the same goals as a natural gas-fueled alternative. With these machines

being custom-designed, your pre-melter manufacturer can often design a product that requires minimal change to workflows or product lines.

Workflow: Where Product Comes From, Where it Goes

With the pre-melter often being one of the last processes before your product enters the blast freezer, understanding where this item will fit into your workflow will dictate the placement, sizing and floor space requirements, and fuel source availability.

Conveyor Systems

While you already have a system of conveyors that get your product from ingredient placement to the blast freezer and all the way to the packaging line, you will need to select a conveyor that can handle the pre-melting process without heating up too much and creating unwanted flaws. In this, you will need to decide on conveyor belts to feed your product into the pre-melter.

There are a wide variety of conveyor belt materials that can be used including metallic wire, wire rope, lamella, plastic and hybrids. An open metallic or wire-type belt is the most common style used in pre-melters.

Networking, PLC, and Control Systems

Depending on the complexity and automation of your product line, your pre-melter may range from a simple, push-button design to one that is fully networked and integrated into your production process. The manufacturer of your pre-melter can work with you to develop a product as simple or as complex as you need.

If the pre-melter does not need to be networked to other pieces of equipment, a simple approach may be the best solution. The control approach can be as straightforward as a series of relays and pushbuttons. This technique would be the most cost effective and potentially the most robust for high ambient room temperature conditions. The troubleshooting would involve just a voltmeter and a set of schematic drawings.

By contrast, if the process requires the pre-melter to relay information about production, a PLC may be necessary to gain remote connectivity. This would provide the ability to store recipes or to gather production statistics. A PLC also enables any changes or fine-tuning to be done while the pre-melter is in use, preventing downtime. Suitably chosen and applied controls can be maintained easily by support staff.

Designing for Safety: Three Key Considerations

In manufacturing and in food, safety means a variety of things. While we have discussed the value of infrared heating in food safety compared to that of a conventional heating element, your decision still needs to focus on delivering a wide range of safe operation, primarily focused on food safety, fire safety, and worker safety.

Food Safety

While a bad looking product might dent your reputation, contamination could derail it. Food safety is priority number one, especially when you are applying heat to an uncooked product. The goal of a pre-melter is to provide just enough heat to slightly melt cheese and fuse ingredients without raising the temperature to an unsafe level before rapidly sending it to a blast freezer. Additionally, you will need to implement food-safe materials and cleaning procedures to minimize contamination.

What to Look For

In designing for safety, it's important to work with a manufacturer of equipment who has been there before, and who has years of experience working with food manufacturers like you. An experienced food machinery manufacturer will follow good manufacturing practices concerning food-safety hygiene requirements in the design of its equipment.

Generally, equipment must be easy to clean, made of approved materials that are suitable for the operating environment, and compatible with the user's cleaning process and sanitizing procedures.

For a pre-melter, access is greatly enhanced when the conveyor and heat source areas can be separated easily during the cleaning process.

Additional Options

Additional options include a removable docking conveyor with a cantilevered heating section, a hinged heating section to ease access, or a heating section that automatically retracts above the conveyor. An integral belt-washing station or other clean-in-place (CIP) techniques can be incorporated according to the user's preferences.

Fire Prevention

Like any process heating equipment, fire prevention and safety is a necessity—both for worker and facility protection. Whether the risk exists in the product itself, the fuel supply, or combustible residues, pre-melters need to be designed with fire prevention in mind. Safety considerations begin with safe design and other administrative controls, with process-specific fire control or abatement controls in place.

Worker Safety

Infrared pre-melters operate at high temperatures, use fuel sources with risks like electrocution and fire, and contain moving parts. The manufacturer should follow good manufacturing practices and guidelines such as OSHA standards for machine guarding to provide for safe operation and the safety of all users of the equipment.

When inherent hazards such as rotating or moving parts, pinch points, wrap/entanglement points and hot areas cannot be completely designed out of the equipment, they should be minimized and then safely guarded in a sanitary manner. Additional safety measures may include emergency stop buttons, stop bars or pull cords as well as visual warning and marking systems.

Why a Custom Pre-melter is Better for Your Unique Needs

Infrared pre-melters may seem straightforward—melt cheese just enough to fuse materials—but there are many reasons that a custom pre-melter delivers improved reliability, better focus, and consistency. When you work with a custom machine manufacturer who specializes in heating applications for food manufacturing, you are able to get a tailored product ready for your unique ingredients and recipe.

Uniquely Designed for Your Ingredients and Product Considerations

Whether you are manufacturing different items on the same line or you need consistent and reliable solutions for your products, a custom infrared pre-melter can deliver improvements on multiple fronts. You have ingredients that make your product different from your competitor—whether it's the mix of cheese on your pizza, the supplier of meats and cheeses, different fat content of cheese, or more.

Knowing this, you can't afford to work with a provider of "generic" pre-melters. At The CMM Group, we deliver a custom solution built to handle your unique mix of products—focusing on the scientific realities of your ingredients.

The Selection and Consultation Process (NOTE—Modified from Oven/Dryer Guide)

Whether you are installing for the first time or replacing your current infrared melter, the consultation process may differ. Knowing this, the first call is often investigative, and could range from something as simple as "we need to duplicate a current production line and have all of the specs," to a more complex, bespoke project.

The Initial Call

With the above information documented, Have the following information available:

1. A description of the product.
2. A description of ingredients.
3. Maximum/minimum product width and expected line speed.
4. Maximum/minimum operating and/or product temperatures.
5. Anticipated length and number of temperature zones.
6. Materials of construction (stainless steel, carbon steel, etc.).
7. Specify a desired heat source (natural gas vs. electric)
8. Electrical power requirements (voltage, hertz, phase).
9. Installation supervision or complete turnkey installation requirements.
10. Physical installation area and/or site limitations.

The Site Visit

Following this discussion, your custom equipment manufacturer will send an engineer to complete a site visit, taking notes on the existing equipment, planned installation location, and more.

Engineering and Design Meetings

Following the on-site visit, in which much of the investigative work has been done, comes the engineering and design meetings. In these meetings, the engineering and design teams will get a chance to discuss the final notes, layouts, designs, and concepts with the end user before the build is completed.

Installing Your Cheese Pre-Melter

As with the installation of any process heating application, you have multiple options to install your product—ranging from start-up to turnkey.

Types of Installation

Depending on the complexity and scope of the implementation, there are different levels of support that take place.

Start-Up Installation

The most basic form of installation, in which your selected manufacturer will deliver your product, make necessary adjustments, and provide training. The customer is responsible for the unloading and placement, as well as the ductwork and gas/electric connections.

Supervised Installation

For simple projects, the installation process could be as easy as a supervised installation, in which your manufacturer will work with your internal team on an advisory level to ensure the oven is installed properly. The manufacturer will deliver the product and supervise the installation to ensure safety and proper installation, but the customer is responsible for the placement, as well as installation of ductwork, electric, and/or gas.

Turnkey Installation

More common for complex projects, this option is better for customers who don't have the labor available, or who want the security and peace of mind that comes from working with an experienced manufacturer and installer. In this, your manufacturer will assume responsibility for all of the labor, complete the installation and startup process.

Operating Your Melter: Ongoing Operations, Safety, and Cleaning

Maintenance

The best way to avoid a breakdown is to act proactively to prevent it. Preventive maintenance can help you avoid downtime, reduce the risk of breakdowns, and recognize any potential failures before they happen. Your oven or dryer manufacturer will advise you on maintenance procedures to ensure the oven or dryer continues to run smoothly, whether it's year one or year twenty.

For the design of electrical power and gas combustion systems, the manufacturer will closely adhere to regulatory agency design standards and guidelines.

Typically, maintenance is required due to contact of the processed material with the heating elements. Preventive steps can be taken during the design process to reduce the amount of contact that the product makes with the heat source, which will require less downtime during maintenance.

Safety

Process-monitoring devices are included to ensure safe operation of the equipment. Visual warning beacons and audible horns may be incorporated into a relay or PLC-based process control system, and a PLC-based system may display highly specific alarm information for successful troubleshooting.

Additionally, proper cleaning will reduce the risk of fire and ensure ongoing safe operation of your cheese pre-melter.

Cleaning and Food Safety

As mentioned above, your cheese pre-melter should be designed for easy, food-safe cleaning. In this, you should follow a cleaning schedule similar to any other item of food processing equipment. Develop a daily, weekly, and monthly cleaning schedule to minimize the likelihood of fire or contamination.

- Turn off and cool down pre-melter before beginning cleaning.
- Remove the conveyor belt and clean with a brush.
- Remove any other removable parts, clean with warm water and a non-toxic degreaser.
- Clear out the inside of the pre-melter, clean with the degreaser and rinse with warm water.
- Check all intake vents to ensure they are clear of any debris.
- Reassemble anything removed from the oven during cleaning.

Proper cleaning will extend the life of your product, improve food safety, and allow you to realize and fix problems before they cause downtime.

Conclusion

Infrared technology has become a more and more important part of the food manufacturing world in recent years, and while it provides many useful applications, there are few places it delivers more effectively and efficiently than in the world of frozen food. An infrared cheese pre-melter offers your food manufacturing business a reliable solution that ensures your products are consistent and meet or exceed customer expectations.

At The CMM Group, we have worked with many companies who have needed an infrared cheese pre-melter for their needs, and understand that whether it's pizza, paninis, quesadillas, cheese bread, or one of many other applications—if it has cheese, a pre-melter can deliver.

Get to know more about our work by reading our case study below.

Case Study: Custom Cheese Pre-Melter for One of Largest Pizza Manufacturers

When one of America's largest frozen pizza manufacturers decided it was time to replace their existing convection oven pre-melters; they selected The CMM Group, LLC to fulfill their needs.

The CMM Group custom engineered the equipment to allow the manufacturer the freedom to choose between multiple recipe options through the use of adjustable temperature and line speeds. The unit was tailored to fit precisely within the vacated footprint of their previous system.

An integrated removable conveyor, also designed by CMM, aids in the cleaning and sanitation process, while working in conjunction with the customer's full line spiral freezer.

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