



Hygienic Air Handling for Food Processing

From the Center for Disease Control:

"To better quantify the impact of foodborne diseases on health in the United States, we compiled and analyzed information from multiple surveillance systems and other sources. We estimate that foodborne diseases cause approximately 76 million illnesses, 325,000 hospitalizations, and 5,000 deaths in the United States each year. Known pathogens account for an estimated 14 million illnesses, 60,000 hospitalizations, and 1,800 deaths. Three pathogens, *Salmonella*, *Listeria*, and *Toxoplasma*, are responsible for 1,500 deaths each year, more than 75% of those caused by known pathogens, while unknown agents account for the remaining 62 million illnesses, 265,000 hospitalizations, and 3,200 deaths..."

Pathogen prevention at the plant level cannot be inspected into any product but be part of the process.

The US government, in order to address the public's concern on food safety, put in place the HACCP program starting with larger meat processing plants. In short, the government required processor to identify the key processes in which contamination can occur and what processes are in place to prevent the contamination from happening.

Every process room has one item that is common: the air. Air touches every piece of product and equipment in every room. From the USDA website..."*Listeria monocytogenes* is universally present and can be found in airborne dust particles." The control of the air as a critical control point is very important in maintaining a pathogen free process area.

Webster defines air conditioning as "to equip (as a building) with an apparatus for washing air and controlling its humidity and temperature;" and refrigeration as, "to make or keep cold or cool;". Hygienic food process air conditioning is a combination of both of these.

In room evaporators will provide refrigeration "to make or keep cold" efficiently and inexpensively. However, they do not provide anything else and can actually increase the pathogen load in a process room.

A properly designed hygienic food process air conditioning system will provide both refrigeration and air conditioning to a process space. There are five specific areas of concern that will be addressed:

Filtration The only effective way to remove microscopic airborne pathogens is through filtration. Passing the air in a space over filters designed to remove pathogens frequently will help ensure clean air. A typical unit will have a minimum of two sets of filters. The first set is a rough filter, used to remove larger (> 5 microns) particles of dust, dirt, bugs and such. These should be located at the inlet of the unit and be easy to change.

Final filters, located at the end of the unit, need to be selected to remove pathogens that are the concern of the process. Most bacteria, yeasts, molds are, alone, between 0.5 to 1.5 microns in size. Very few bacteria are found free floating; most combine with dust or other bacteria and the aggregate size ends up being about 2- 5 microns. Commercially available 95% ASHRAE filters will capture 100% of particles larger than 1.5 microns.

For the ultimate in clean air, HEPA (High Efficiency Particulate Air) filter can be used. A HEPA filter will remove 99.97% of particles 0.3 microns and larger, providing essentially "sterile" air. The downside of using HEPA filters are the cost of the filters (5 - 6 times the cost of a 95% filter), the increase operating costs due to higher pressure drops and the reduced airflow per filter, requiring more filters per CFM than a 95% filter.

Pressurization Keeping airborne contamination and moisture out of process area is very important. On a typical summer day, 1,000 cubic feet per minute entering a plant unconditioned will bring into the space 2-3 *billion* particles and about 70 pounds of moisture. Keeping a process area under a pressure of 0.005" to 0.01" wg will prevent uncontrolled infiltration.

Refrigeration With the cooling coil located outside of the conditioned space, the moisture being removed from the air will be drained outside of the space, reducing the total moisture in the space. Outside of the space, coils can be maintained and cleaned much easier without disrupting production.

Condensation With the USDA taking a "Zero Tolerance" approach to process room condensation, ensuring a dry process area is critical. A properly designed system will provide relatively dry air strategically in the space to provide an envelope of air between the walls, ceiling and the space. The air will absorb any moisture generated in the space before it has a chance to condense and drip.

Sanitation A properly designed system will have the ability to provide heated fresh air into the space during the sanitation mode in the space. The unit will also need to provide exhaust to remove the moisture-laden air from the space. This cycle will keep the room fog free, aiding the cleaning process and the removal of the moisture during the process will allow the room to get dry and down to temperature and production much faster.

Equipment Considerations

Equipment designed to provide the above must be designed for the hygienic demands of a food processing plant. Some key elements:

- Double wall, insulated, full wash down construction.
- Full access to all sections through large doors.
- Coils designed for cleaning
- Drain pans, preferably stainless steel, in every section
- High efficiency filtration located in the proper place in the unit.
- Ability to handle clean-up / sanitation
- Industrial controls to handle the various cycles and communicate with the plants' central control system.
- Designed to minimize interior flat surfaces and "catch" points.

Summary

To create an environment that is conducive to processing a safe food product, air conditioning needs to be addressed in the broad sense of the word. A properly designed system will provide the following:

- Pressurization to control infiltration.
- Refrigeration to provide cooling to maintain required temperatures
- Filtration to remove airborne particles that are potentially harmful or can affect quality.
- Condensation control for a dry process room.
- Sanitation for better clean-up and shorter dry times.
- Equipment designed specifically for hygienic food processing.