Food Processing Plants

General Design and Application Considerations:

Providing appropriate working environments and preventing food contamination hazards are the primary goals of the HVAC and refrigeration systems in a food processing plant. Engineering directly affects the safety and stability of the food supply in design of cleanable equipment and facilities, as well as maintenance of environmental conditions that inhibit microbial growth.[1,2]

Plant equipment tested under UL standards includes thermal processing (heating and refrigeration) equipment, as well as conveyors, grinders, mixers, etc.[2] Proper selection and capacities of the heating and refrigeration equipment will ensure the proper environmental conditions are maintained. The proper dehumidification system will prevent condensation, reduce washdown recovery times, prevent process shutdowns and production delays, and eliminate (or at least greatly reduce) defrost cycles on the plants evaporator coils, stop ice build-ups on conveyors and doors, and maintain dry floors.

Environmental Standards or Requirements:

The specific space conditions will vary from plant to plant, and even among the process areas within each of the plants. Selection of dehumidification equipment (including its airflow, supply air temperature, dehumidification capacity and requirement for food-grade construction) will be determined only after each specific site is evaluated. Each evaluation should include an in-depth interview with the plant engineer and/or plant manager. Because of the numerous variables involved (e.g., environment's temperature, number of shifts, number and length of process area washdowns, length of recovery time between shifts, etc.), it is not possible to state specific design criteria. However, some of the rules of thumb used within the industry and/or comments might be beneficial as a starting point in these evaluations. You will find them on the reverse side.

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Environmental Considerations

For refrigerated process areas:

- Consider two Air Changes per Hour (ACH), as a minimum, for the cut and/or process areas (unless the building is very loosely constructed. In that case consider a minimum of three ACH).
- Ask for recovery time expectations as this may indicate a requirement for a much larger volume of dry air to be recirculated within the area.
- In carcass coolers (beef, hog, etc.), ask if the plant personnel pre-sprays with chilled water to lower the carcass temperatures from the normal 103-104° F to less than 38° F (USDA requirement).
- The more rapidly the rooms can be cooled, the better the meat will appear.
- Target a 3-4° F differential between the meat temperature and the dewpoint temperature of the surrounding air. If the differential is too great, the meat will dry too quickly and this toughens the meat, making it harder to cut.

For freezer areas:

- For spiral freezers, try to maintain a velocity of approximately 800 fpm on the conveyor belt, unless the food product is too light in weight for this velocity.
- Minimize the open areas where the conveyors enter and exit the spiral freezer.

For loading docks:

- For -10° to -20° freezers deliver 3,000 cfm per access door into the freezer.
- Deliver about 2,000 cfm per truck bay door.
- After comparing the difference between the two above points, use the larger figure or use best judgment.
- Always use the selected unit's maximum airflow and dehumidification capacity.

Reference Sources:

1. Code of Federal Regulations, 21CFR110: Current Good Manufacturing Practice in Manufacturing, packing, or holding human food – Government Printing Office, Washington, DC. (Specifically Section 110.80 Processes and Controls, Page 222)

2. Underwriters Laboratories Inc. (UL) / American National Standard for Meat and Poultry Plant Equipment, ANSI/UL 2128 (1st Edition), Northbrook, IL

Other resources of importance:
- 2006 ASHRAE Handbook of Refrigeration, Food Microbiology and Refrigeration, Chapter 12
- Engineering for Food Safety and Sanitation (Hardcover), Thomas J. Imholte (Author), 1999, Technical Institute for Food Safety, Woodinville, WA
- FDA 2005, Food Code, U.S. Food and Drug Administration, Washington, D.C.

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