Fortrex HVAC 2025

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Sanitary (Hygienic) Design Modules

- Standards for Environmental Air Quality Requirements and the Associated Filtration Requirements must be based on Product Microbial Sensitivity should be developed and incorporated into Engineering Standards

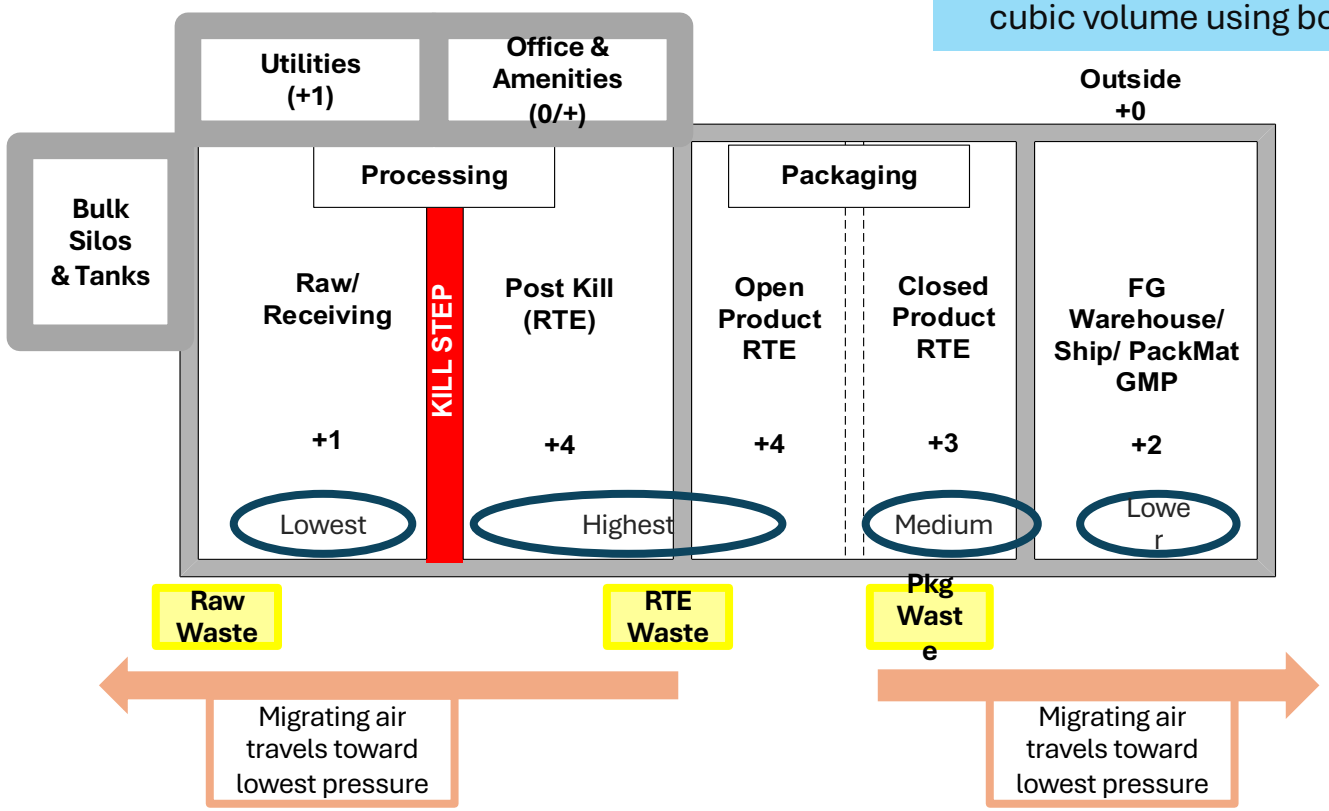
- 3-A has no standard

What HVAC Provides

- Pressurization
- Filtration
- Temperature Control
  - Heating
  - Cooling
- Dehumidification
  - Cooling
  - Desiccant
- Control of Heat and Vapors
  - Direct ventilation and collection equipment
- Process Users – dedicated systems for conditioning product

Proper Building Air Balance:

- Most expensive if we retrofit later
- Lower cost if designed and installed right up front.
- Lowest cost if controlled spaces are limited in cubic volume using box-in-box concept.



- 0.05 water column inches positive pressure from RTE to other areas
- Air exchanges in legacy facilities: 6-12

Air Exchanges Per Hour

- **Air exchange rates:**
- **General processing areas:** Aim for at least 4-6 air changes per hour (ACH).
- **Specific zones:** Requirements can be higher (e.g., 15 ACH or more) in areas with a higher concentration of airborne microbes or contaminants to help dilute and remove them.
- **Quality control areas:** Spaces dedicated to quality control and taste testing may require the highest levels of filtration, such as HEPA filters.

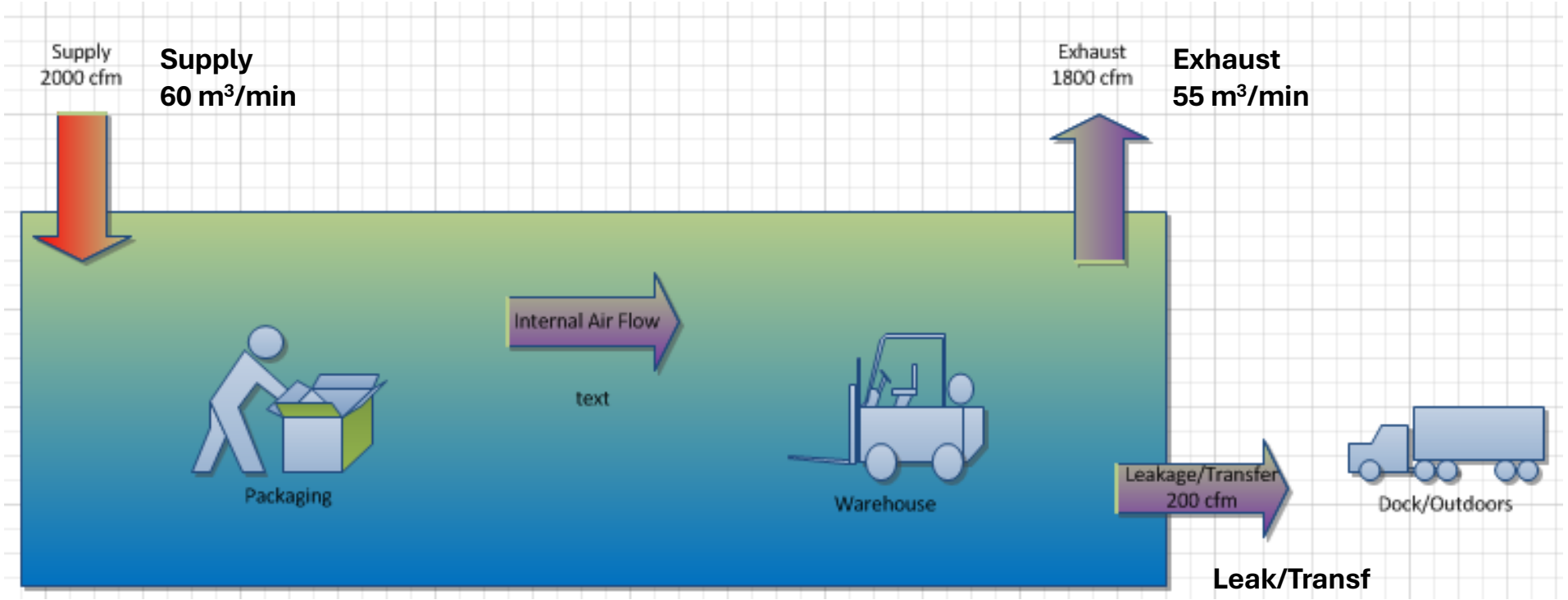
$$$ & Time Spent on Condensate Control

- Squeegee
- Fans
- Blowers
- Surface Heaters

Root Cause

- Temperature Variation
- Outdoor Weather Influences
- Water Control During Cleaning

Pressurization – Example #2



Scope of Environmental Air Standard

- Would apply to areas or rooms where food products are processed, packaged or stored
  - Ambient air
  - Heating, ventilating, and air conditioning units and ducts
  - Unit Heaters
  - Unit coolers

- Relative room pressures and filtration efficiencies must be maintained to minimize the potential for microbial cross-contamination (space pressurization)

- Practice should not apply to exhaust ducts, rotoclones, process ducts and related equipment

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Materials for Air Contact Surfaces

- Materials of air contact surfaces shall be metal or plastic … inert, non-porous, and non-toxic … not be coated or painted on air contact surfaces, except that Galvanizing is acceptable
- Rubber and rubber like materials for gaskets, seals, connectors, O-rings, being solid, non-foam
- Cotton flannel, wool flannel, expanded metal, carbon may be used for filter media… Chemical bonding materials shall be non-toxic, non-volatile and insoluble…
- Fiberglass for pre-filters when followed by a final filter

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Fabrication & Installation

- Air shall be taken from clean space passing through pre-filter before the fan
- Equipment shall be constructed so that air contact surfaces are accessible and cleanable of all dust, soil, and microbial contaminants
- In process areas insulation shall be sealed from ambient
  - Appropriate covering such as white PVC or similar, chemically sealed joints
  - Riveted coverings such as aluminum are not accepted
- Duct shall be insulated to prevent condensation
- Insulation on external surfaces only
- Duct socks

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Duct Socks

Fabrication & Installation

- Air contact surfaces shall be **smooth, free from flanges, sheet metal screws, rivets and similar protrusions**
- **Fabrication flanges shall be bent outward**
- **No sheet metal screws shall penetrate the air contact surfaces**

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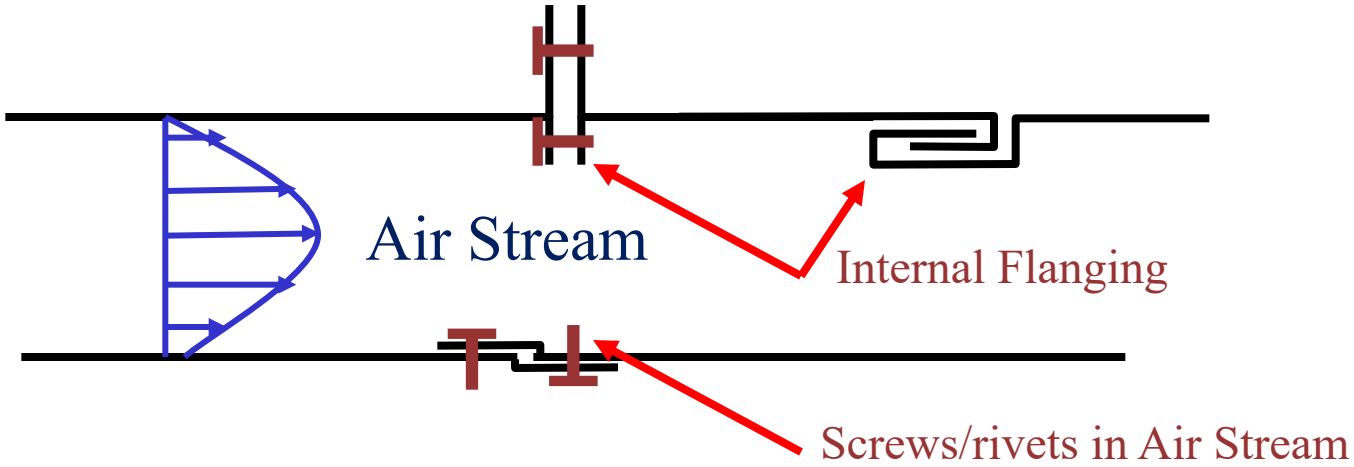
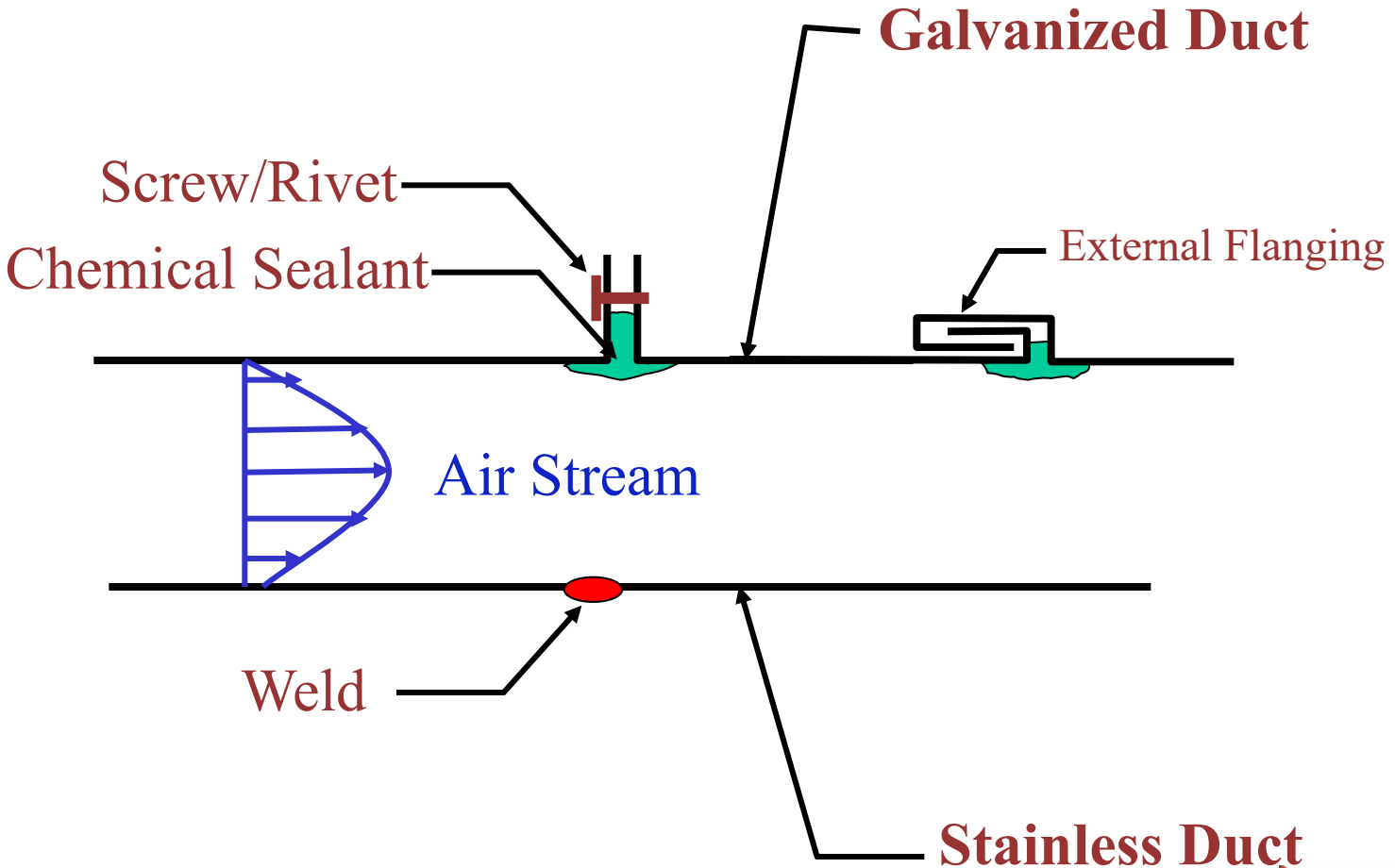
Ductwork Fabrication & Installation



NOT THIS!

Ductwork Fabrication & Installation



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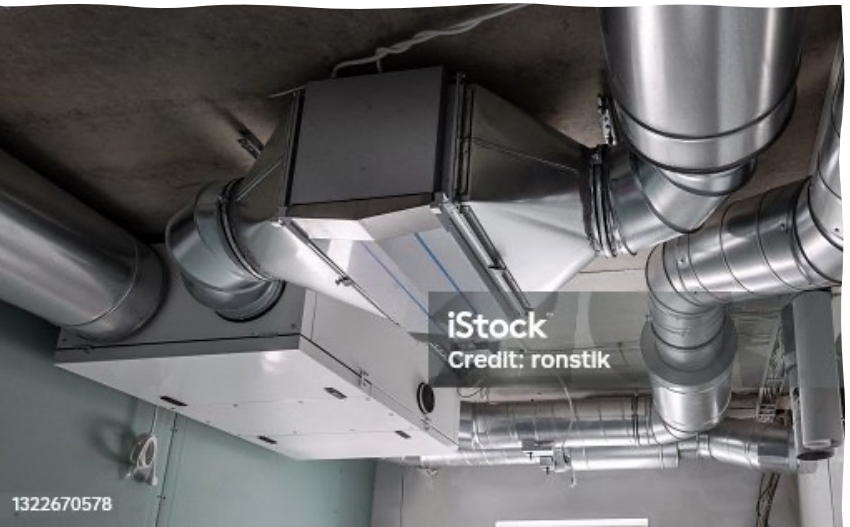

Sanitary Duct Work

Ductwork Fabrication & Installation

- When designing systems supply and return ductwork shall be minimized
- Provide access doors at least every 20 ft
- Doors may be hinged and sealed with rubber or rubber-like gaskets
  - No continuous or piano hinges
- No motors exposed to the air after the final filter

  Comments:
  - *Air flow should flow with the product (exposed product to packaged product)*
  - *Final filter should be at exit of air handler or at each diffuser*
  - *Air handler may need to be explosion proof depending upon service*

Insulating Duct Work

Environmental Air Standards

- Standards for air supplied to a room or area where food is processed, packaged, or stored should be development, but key pieces are:
  - Final Filter = Efficiency @ 1 micron
  - Room Conditions
    - Temperature
    - Relative Humidity
    - Room Relative Pressurization
  - Room Ventilation Requirements
    - Air Changes per Hour
    - % Outside Air Depends on Humidity and Temperature

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Environmental Air Quality

- Precautions shall be taken in construction to seal the space preventing entry of extraneous materials or pests
- Fans, grills or louvers fitted with screens and sealable self-closing louvers
- If more than one process in an area, the most stringent product space filtration requirement should apply
- Unit Heaters and Coolers must be appropriately selected, installed, and be cleanable
- Evaporative cooling in manufacturing areas should not be used

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MERV
Maximum Efficiency Removal Value

Standard 52.2 Minimum Efficiency Reporting Value (MERV)	Composite Average Particle Size Efficiency, % in Size Range, µm		
	E_1 Range 1 0.30 - 1.0	E_2 Range 2 1.0 - 3.0	E_3 Range 3 3.0 - 10.0
16	$95\% \le E_1$	$95\% \le E_2$	$95\% \le E_3$
15	$85\% \le E_1 < 95\%$	$90\% \le E_2$	$90\% \le E_3$
14	$75\% \le E_1 < 85\%$	$90\% \le E_2$	$90\% \le E_3$
13	$E_1 < 75\%$	$90\% \le E_2$	$90\% \le E_3$
12	n/a	$80\% \le E_2$	$90\% \le E_3$
11	n/a	$65\% \le E_2 < 80\%$	$85\% \le E_3$
10	n/a	$50\% \le E_2 < 65\%$	$85\% \le E_3$
9	n/a	$E_2 < 50\%$	$85\% \le E_3$
8	n/a	n/a	$70\% \le E_3$
7	n/a	n/a	$50\% \le E_3 < 70\%$
6	n/a	n/a	$35\% \le E_3 < 50\%$
5	n/a	n/a	$20\% \le E_3 < 35\%$

Kellogg's

MERV Filtration Ratings

MERV* Rating	Efficiency	Application
5-6	8-12% @ 1 micron	minimize extraneous material, debris and dust
8-9	25-35% @ 1 micron	minimize extraneous material, debris and dust
13-14	80-90% @ 1 micron	eliminate yeasts
15-16	90-95% @ 1 micron	eliminate molds and yeasts
17-20**	99.97% @ 0.3 micron	eliminate bacteria, molds and yeasts.

*** MERV: Minimum Efficiency Reporting Value**

**** High-Efficiency Particulate Arrester (HEPA) Filtration**

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Development of SSOP's for HVAC Inspection, Cleaning and Maintenance

- Filters- Intake, Pre-Filters, Final Filters, Housings
- Coils – Coil Depth, Fin Spacing, Drains, Housing
- UVC –Lights
- Intake Ductwork
- Exhaust Ductwork
- Dispersion Louvers
- HVAC Housing
- Idled HVAC Units
- Frequency – Inspection-Cleaning –Sanitizing
- Document – MCS, MSS as PIC, Maintenance Schedule .

PRINCIPLE #4 - ROOM AIR FLOW AND AIR QUALITY CONTROLLED
Criteria
All rooms have their pressure controlled to ensure the airflow will flow from more clean to less clean areas.
Critical process air is adequately filtered.
Outdoor makeup air is sufficient to maintain specified pressurization.
Air handling system components meet the 10 principles of Hygienic Facility Design.
Provision is made to capture high concentrations of heat, moisture and particulates at the source. (Condensate)
Heating, ventilation, and air conditioning (HVAC) refrigerations system components are located to avoid risks of product contamination.
Drain pans and distribution plenums are heated to prevent condensation on exposed surfaces.
HVAC/refrigeration systems are dedicated appropriately to specific control zones to prevent cross-contamination.

7 Sara Lee Deli Products

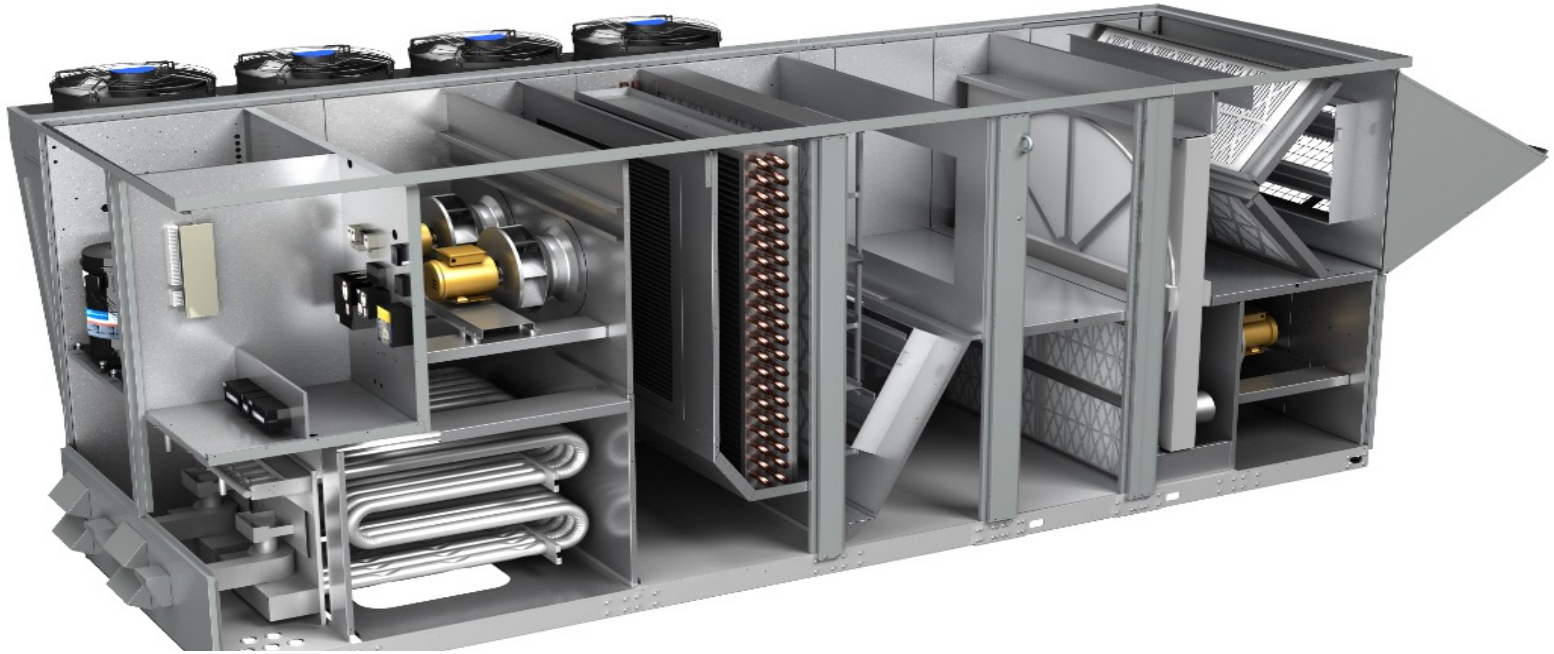
« PREV NEXT »

Sara Lee recalled deli products and hot dogs in 1998 when it was found that they were making people sick with listeria, a deadly disease.
AP PHOTO/AL BEHRMAN

In one of the largest meat recalls in history, Sara Lee Corp. recalled about 35 million pounds (almost 16,000 tons) of their deli products and hot dogs in December 1998 [source: Perl]. Cases of listeria had been linked to the meat from a Bil Mar Foods plant. Never heard of listeriosis? It's not as well known as E. coli and salmonella, but it happens to be more deadly. In this case, it's believed the outbreak contributed to 21 deaths and more than 100 cases of illness [source: New York Times].

Condensate drain pan under HVAC coil with improper drainage.

Facilities of the Future



HVAC

HVAC & Building Management

Air pressurization

Air filtration

UVC

HEATING COIL

COOLING COIL

New EVAPCO sanitary HVAC