REFRIGERATION REVIEW

Air Units and Air Unit Pipeline Placement in Industrial Refrigeration Systems

The history of air units and pipeline placement has evolved literally over 100 years. Early on, traditional units were placed inside rooms on the floor and were provided surge drums which were fed with high pressure liquid in pipes back to the machinery room in what would have been assumed to have been a “dry suction.” These units were typically water defrost, and for the most part all ammonia. As refrigeration systems evolved, over time the hazards of surge drums manifested themselves in examples of broken pipelines, flood backs in compressors, and all the hazards associated with the eventual failing of surge drums, feed valves, etc. Surge drums are like geysers, so when a pool of liquid gets "heated," even in a cold room – keep in mind that ammonia gas has a volume ratio of 800 to 1 to its liquid state – like a coffee percolator, it will “fire off” and try to reach sonic velocity, forming liquid cannon balls.

In the early 1970s, when recirculating systems had started to employ reliable

ammonia pumps, dry suctions and surge drum air units were replaced with recirculated systems in process plants, distribution centers, and refrigerated warehouses. The industry went through a period of time when refrigerant pipes were placed inside the cold rooms as an expedient way to connect all the air units. Then it became obvious that pipes located inside the air units, particularly low-ceilinged rooms, were vulnerable to materials handling equipment, and this led to the placement of the pipelines above the roof, with ceiling mounted air units. Again, the maintenance and potential damage from fork truck equipment continued to be a challenge, and in the early '80s penthouses for individual air units were first widely used in distribution centers, milk plants, and in a wide variety of poultry and meat plants. The use of central penthouses was also started, which has its advantages and disadvantages. Both individual rooftop units and penthouse units permit placement of the air unit without having to concern oneself with the location of the condensate drain, which of course, in a freezer room would require it to be sloped and heated, and normally placed near an outside wall.

There have been several discussions on the merits of central penthouses versus individual penthouses for each air unit. The trade offs are: one location for air units which may or may not provide the best air distribution, and multiple locations for individual penthouse units which can provide the ideal air distribution pattern.

Generally, it is desirable to have all the air in a room going in the same direction. Multiple central penthouses will tend to create stagnant conditions in the air pattern. The construction of a separate steel system for central penthouses is a challenge in itself to maintain the vapor barrier in the penthouse structure. The individual

penthouses are generally better made and of individual construction and will provide a sealed enclosure for each air unit. This, in turn, facilitates in airing out and ventilating areas around individual air units, if and when an ammonia leak occurs, versus if a leak occurs in a central penthouse, and all the air units may be out of service. This causes the ammonia to spread to a larger area of the room.

Both methods facilitate the location of the pipelines, particularly for ammonia, above the roof.

The geometry of the roof system becomes an important factor for recirculated ammonia, in that recirculated pipelines need to have slope. While these lines are normally kept 2' off the roof, if the slope of the roof is opposite the required slope of the pipeline, the pipeline can rise substantially in a large processing facility or distribution center. The refrigeration designer needs to be an integral part of the design team that shapes the geometry of the building, particularly the roof slopes. Generally, we slope the roofs ¼" per foot, or 5" per 20 feet, which is more than what is needed for the industry standard pipeline slope of 1" in 40 feet.

While air units can still be ceiling hung with control groups above the roof, with the advent of CO_2 systems ceiling hung units can be employed. Again, placement is key in the distribution of the air pattern, which, with rooftop units, provides much more flexibility than ceiling hung units, which would need to have an outside wall for freezers to permit discharge of the condensate drain.

Another thing to be mindful of is how many fan motors are being used. While it may

be more “first cost” effective to use multiple fans, either propeller or axial, the same unit could use just one larger motor, which would give it a much longer life, can throw air farther, and, in some cases, be much quieter for work areas like docks and process rooms. I know of a freezer room years ago that had 69 small fan motors, and after a while, they were replacing two per month.

Room size and the height of the room will also play into the most cost-effective and risk-effective choice of air unit. Generally, taller rooms are better for good air distribution, and we recommend a minimum of 30” above product for good air flow; below, steel beams and framing are at a minimum.