



## DEDICATED OUTSIDE AIR SYSTEMS OVERVIEW:

Ventilation requirements have become more stringent over the last few years. This has led to a rise in the demand for dedicated outside air systems. A dedicated outside air system (also referred to as 100% outside / outdoor air system) uses a separate unit to condition up to 100% of the entire outdoor air ventilation requirement for a particular application. It will then deliver the conditioned air to the occupied space or directly to the individual local units serving multiple spaces. There is no return air path on a dedicated outside air system. This system makes it easier to verify sufficient ventilation for the application, and helps maintain comfortable space conditions.

This document will focus on Lennox's solution for direct to space dedicated outside air applications. This application will use only Lennox equipment and controls. All Lennox dedicated outside air systems are *make-up air systems*, which means they are used to supply air to an area or space without contributing to the building HVAC load. These units supply *tempered* air that has been heated or cooled in moderation to nearly match the space temperature. The dedicated outside air unit has no return path and no exhaust provisions, so the air must be exhausted some other way.

## DIRECT TO SPACE DEDICATED OUTSIDE AIR SYSTEMS DEFINITION

In direct to space dedicated outside air systems, a separate rooftop unit is used to condition up to 100% of the outside air required to sufficiently ventilate the space(s). After the outside air is conditioned, it is then delivered directly to the space. Since the unit is sized to bring in exactly the amount of outside air needed, the system is assured to meet the ventilation requirements. Typically, the unit targets a neutral discharge air temperature; however the actual supply temperature will most likely fluctuate within a user-defined range. Setting this range is explained later in the document. Although it is possible for this unit to provide some cooling and heating benefits, it is important that the dedicated outside air unit only be sized to handle the ventilation requirements. This unit is a make-up air unit, and must not be counted on to handle any part of the building's latent or sensible load. Obviously the outside air unit will dehumidify and condition the outside air; however the local units must be sized to offset the entire building HVAC load.

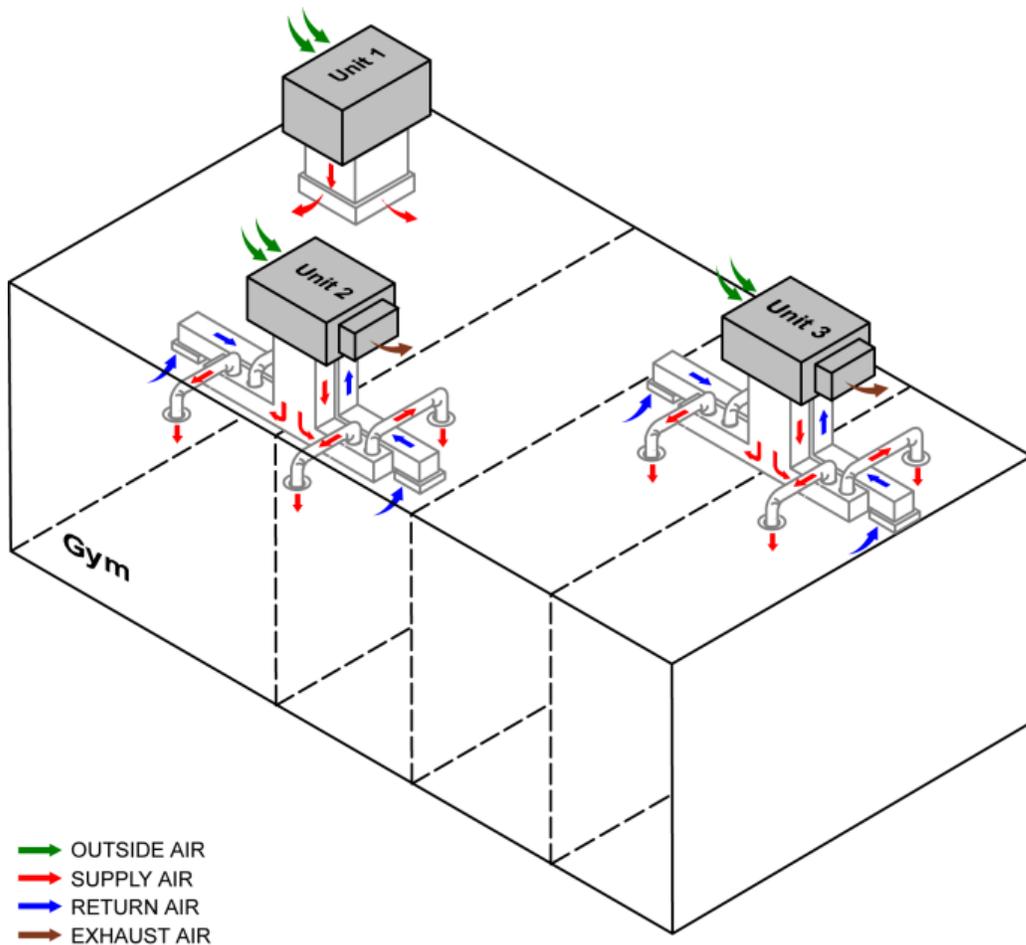


Figure 1: Direct to Space

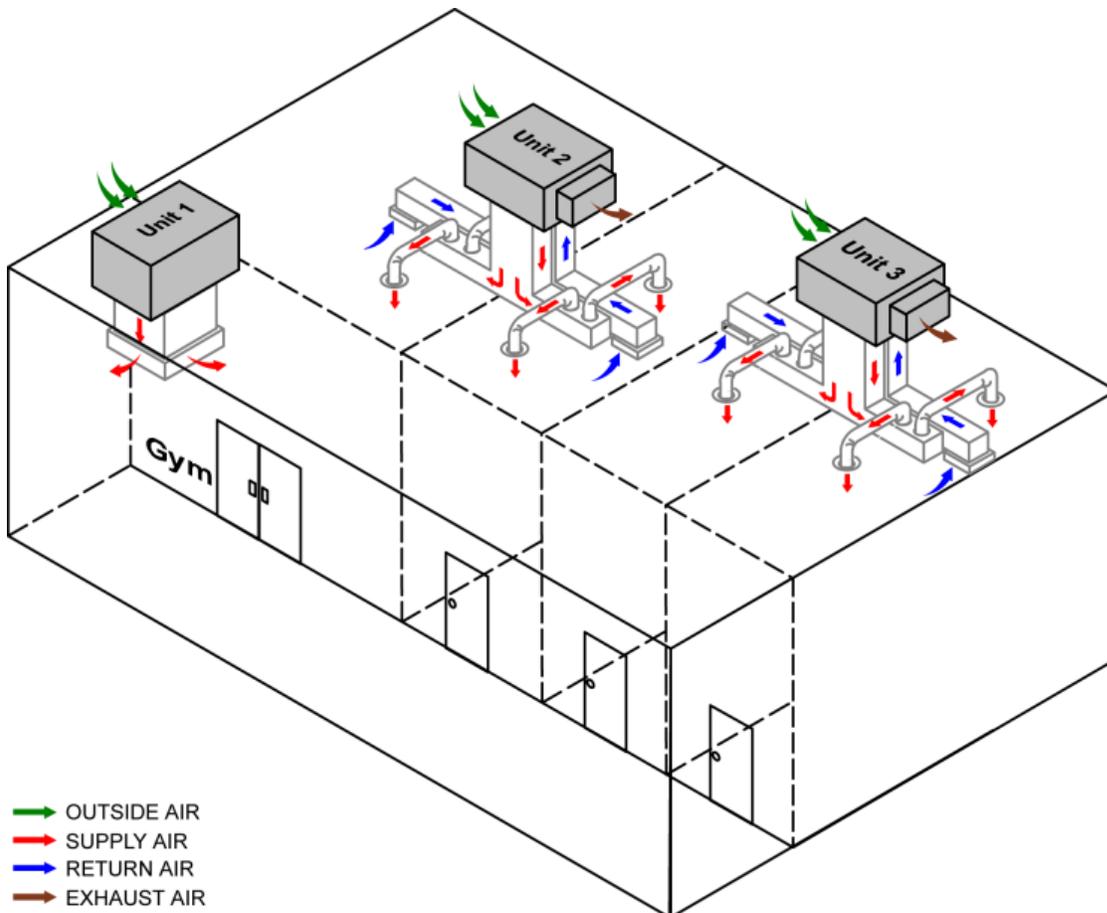


Figure 2: Direct to hallway

## UNIT SELECTION

For all dedicated outside air applications use only Emergence 3-50 ton packaged gas/electric or electric/electric rooftop units. Again, these units should be selected only to meet the ventilation load, and cannot be counted on to provide any cooling or heating benefit. A bypass curb must be included with the unit. Since the bypass curb controls air to the space, do not order units with a VFD or MSAV. The Humiditrol option must be selected to account for days that create a need for dehumidification but not conditioning. Units should also be selected with a stainless steel heat exchanger because of potential condensate buildup. Upon unit selection, it is important to verify there is enough airflow to meet the heating requirements. It is especially important for colder climates to select the highest amount of gas heat available.

## CONTROL

This system can be controlled using the Prodigy Controller with the Fresh Air Tempering (FAT) option along with a thermostat or Lennox zone sensor in the space. FAT set points must be set to control the discharge air temperature within a desired range. In the event of extreme ambient conditions, the discharge air temperature will remain close to the desired value. Please see the Prodigy Control Operation technical literature for Fresh Air Tempering (FAT) parameter setup instructions. A thermostat (or zone sensors) in the space will act as the secondary control for the outside air unit and will act as a safety precaution for the unit. If the space experiences an unusual temperature rise but Fresh Air Tempering does not sense the temperature increase in the supply duct, then the unit will heat or cool based on a call from the thermostat. Also, should Fresh Air Tempering fail, the unit will run off of the thermostat. The thermostat's set points should be adjusted to a value outside the Fresh Air Tempering dead band. A relative humidity sensor will measure the humidity and control the unit's Humiditrol system via the Prodigy Controller. The Humiditrol option will initiate the dehumidification cycle when the Prodigy Controller senses the room temperature is satisfactory, but the humidity level is above the desired set point, or if the Prodigy Controller receives a call for dehumidification from a relative humidity sensor. A call for cooling or heating will always take priority over the Humiditrol dehumidification option. The unit will continue to dehumidify the space even after the call for cooling or heating has been met. Refer to the Humiditrol option technical literature for a detailed sequence of operation.

## SENSOR / THERMOSTAT LOCATIONS

To use Fresh Air Tempering (FAT) control with the Prodigy Controller, the unit's standard discharge sensor must be relocated to the supply air duct. This will allow the Fresh Air Tempering to have the maximum amount of control, and will help to ease space temperature fluctuations. The thermostat (or zone sensors) should be placed in the space. The relative humidity sensor should be wall mounted in the space. Relocate the dedicated outside air unit's return air sensor to the space to act as a limiting device (high / low).

## TYPICAL SEQUENCE OF OPERATIONS

Fresh Air Tempering will handle the primary control of the dedicated outside air unit. When ambient temperatures are high, the discharge air temperature will begin to rise. As it passes the Fresh Air Tempering cooling set point, then Fresh Air Tempering control will switch the unit into cooling mode. If the ambient temperature is low, then the discharge air temperature will begin to fall. As the discharge air temperature falls below the Fresh Air Tempering heating set point, then Fresh Air Tempering control will switch the unit into heating mode. See the Prodigy Control manual for information on setting the Fresh Air Tempering (FAT) electronic configure to order (ECTO) parameters. The thermostat located in the space handles the secondary control of the dedicated outside air unit. This thermostat will only act as a backup for the Fresh Air Tempering control. It will only control the unit if the space experiences an out of the ordinary temperature change or Fresh Air Tempering fails. For days that have high humidity levels but are temperate and will not require a call for cooling or heating, the Humiditrol option is necessary to maintain humidity level set points. If the space thermostat is satisfied but the relative humidity sensor detects a humidity level above the set point, the outside air unit will initiate the Humiditrol option. The unit will run the Humiditrol option until the humidity level is reduced to the set point or there is a call for cooling or heating.

## Unoccupied Mode

During unoccupied mode, the damper for the dedicated outside air unit is driven closed. If the space were to meet the unoccupied set point, the unit would attempt to run with no provisions for airflow. All local units and/or exhaust fans must have the same occupied and unoccupied schedule as the dedicated outside air unit. Set local unit's unoccupied heating set point higher and cooling set point lower than dedicated outside air unit. For example, if your dedicated outside air unit's unoccupied set points are 84°F cooling and 56°F heating, set the local units unoccupied set points to 80°F cooling and 60°F heating.

## ADVANTAGES

This system has a few key advantages. Because the system is setup to discharge directly to the space, the customer knows how much outside air is being delivered and can be assured that the ventilation requirements are met. Because of a relatively simple setup, airflow measurement and balancing are simplified. There is a possibility to get some cooling / heating benefits, but these must be viewed as a “bonus” and cannot be counted on.

## SYSTEM DISADVANTAGES

Direct to space dedicated outside air systems can cause potential mixing problems because of the different air streams between the outside air unit and the local units / stratification. There can also be an increase in the price of ductwork because of the separate air distribution systems. If the Fresh Air Tempering sensor were to fail, the unit would run solely on the thermostat or zone sensor set points. This would cause additional temperature swings in the space.

## APPLICATIONS

The possible applications for direct to space dedicated outside air systems is somewhat limited. These systems should only be used to provide the necessary ventilation requirements for a given space. Large open areas such as gymnasiums, auditoriums, hallways, and kitchens that have large ventilation requirements are good applications. Direct to space dedicated outside air systems assure that each space is getting the required amount of outside air, which can be difficult for other systems to prove. Applications that have multiple spaces with equal ventilation requirements are not good candidates for these systems. Direct to units dedicated outside air systems are a more appropriate choice.

## LENNOX SOLUTION LIMITATIONS

There are a few limitations of Lennox’s solution to direct to space dedicated outside air systems. Because an outside air sensor does not control the system, it is possible to have fluctuations in the discharge air temperature. Fresh Air Tempering does not provide pinpoint control of the discharge air temperature, and always has a dead band of around 10 degrees where Fresh Air Tempering is not active. Although temperature sensors can help control the discharge air temperature in this dead band, the controls accuracy is limited. Customers should be informed of the potential temperature fluctuations in the space. Lennox’s L Connection<sup>®</sup> Network Control Panel cannot be used to control dedicated outside air systems, but it can still monitor them. Demand control ventilation is not available on dedicated outside air units. Single compressor units should be avoided as well. Without the ability to stage the compressors, they are more liable to overheat or overcool the space. The ability to stage compressors gives Lennox a distinct advantage in the larger units. Do not use heat pumps for dedicated outside air applications.