

DUAL EXHAUST SYSTEM WITH PURGE

Extended Outdoor Air System with Energy Recovery and Source Capture Exhaust

Every commercial pool requires the introduction of outdoor ventilation air during occupied times. The rate of introduction is dependent on the pool size, deck space, and occupancy. The introduction of this ventilation air helps to maintain air quality in the space. Refer to DESERT AIRE Technical Bulletin #5 for a detailed summary of the requirements in current standards.

DESERT AIRE offers its SelectAire™ Dual Exhaust system option to integrate ventilation air into the dehumidification package when the facility has two exhaust duct systems. The first exhaust captures the exhaust air at the low pool level and removes this air to outdoor the building without a chance for recirculation. The first exhaust blower is provided by others. The high return air is brought back to the dehumidifier where the remainder of the air is exhausted to meet the design intent of the facility. The dehumidifier blower will act as the ventilation fan and supply air blower to provide all of the required ventilation air for the pool room. The integral exhaust air blower is balanced to establish and maintain a negative pressure in the space.

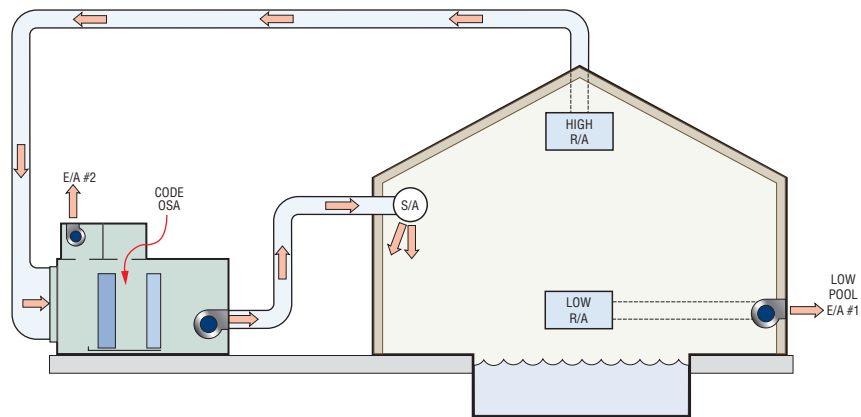


Figure 1 - SelectAire™ Dual Exhaust conceptual airflow diagram

The SelectAire™ control system simplifies air balancing while maintaining the correct proportions of return air, supply air, exhaust air and outdoor air. The system works by monitoring and controlling the static pressure difference at three areas: the outdoor air intake, evaporator coil, and the zone/ambient. The pressure difference at the specially designed orifice in the outdoor air flow path controls the outdoor airflow. Monitoring the pressure drop through the evaporator and controlling the evaporator bypass damper maintains the flow rate through the evaporator and optimizing the moisture removal. Monitoring the difference between the zone pressure and ambient pressure controls the exhaust fan and helps to guarantee the negative static pressure within the space so critical to the building envelope. The control system then modulates the respective damper in response to the pressure readings to achieve the desired airflow.

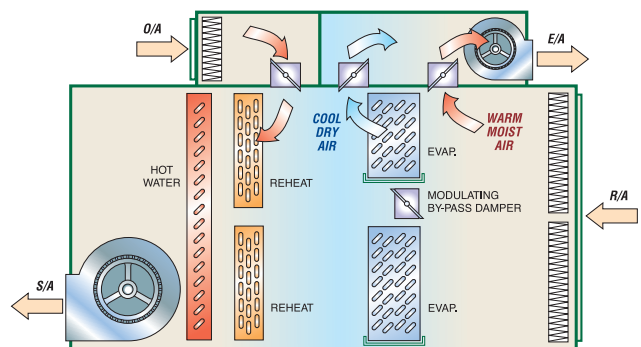


Figure 2 - Schematic for Outdoor Air

The DESERT AIRE SelectAire™ dehumidifier includes a modulating damper to divert a specific flow rate of air through the evaporator coil. This automatically provides a constant airflow and load for the evaporator coil and optimizes the moisture removal efficiency of the system. Similarly, even if outdoor air is preheated, it should always be introduced downstream of the evaporator coil. Cold and dry air introduced before the evaporator coil will lower the unit's dehumidification capacity.

In the SelectAire™ system outdoor air is filtered and a modulating motorized damper controls the introduction of outdoor air as follows:

Unoccupied Mode

Outdoor air volume is established in the field during startup at a level approximately equal to ½ of the ASHRAE recommended code. Exhaust air is removed by the source capture exhaust fan. Dehumidifier will be in recirculation mode. The dehumidifier exhaust air fan will be adjusted to maintain a small negative air balance in the pool room.

Occupied Mode

Outdoor air volume is established in the field during startup at a level equal to the ASHRAE recommended code. Exhaust air is removed by the source capture exhaust fan and the balance by the dehumidification system exhaust fan. The OA volume will be established between 0 and 50% of the supply air volume. Compressors are activated as required by the SelectAire™ standard sequence.

Event Mode

The event mode outdoor air volume is established in the field between 0 to 50% of supply air volume. This is a higher rate than the Occupied Mode setting and represents the required volume for pool plus spectators. Compressors are activated as required by the SelectAire™ standard sequence.

Alarm Mode

The alarm mode is initiated when the duct mounted VOC sensor detects a high level chloramine condition. This establishes an outdoor air rate that is two times higher than the ASHRAE 62 ventilation rate. Compressors are activated as required by the SelectAire™ standard sequence.

Purge Mode

A purge air is established at 50% of supply air volume. The auxiliary heater in this mode is controlled based on a leaving air temperature sensor located in the blower section, not on the zone sensors. Compressors are deactivated during purge mode and will remain off during the Purge Mode. Supply air temperature is heated as required to maintain a minimum temperature above the space dewpoint. This helps to prevent condensation on ducts and interior surfaces.

Heating Mode

For all integral heating elements the controller shall use a zone reset of supply air temperature sequence instead of an on/off method. The proportional plus integral loop will calculate a supply air temperature that maintains the pool air temperature in all modes defined above. The auxiliary heat must be sized for the maximum purge air volume at the local winter design condition.

Outdoor air is preheated as required to provide mixed air temperature at or above the space dewpoint. The pre-heater uses a feedback modulating control algorithm.

Energy Recovery

SelectAire™ systems have two exhaust air dampers. One is upstream of the evaporator coil and one is downstream while not impacting the unit's sensible cooling capacity. The special design of the SelectAire™ option allows the controller to follow basic thermodynamic principles:

- When the space requires heating, air is exhausted after the evaporator coil which recovers the energy contained in the exhaust air prior to its discharge.
Principle # 1: Exhaust air at its coldest point.
- In the cooling mode, air is exhausted before the evaporator coil which is warm and humid.
Principle # 2: Exhaust air at its warmest point.

The SelectAire™ system uses the principle of a heat pump to recover energy in the heating mode by operating one of the dual compressors in conjunction with exhaust air. Exhaust air consists of two energy components: sensible and latent. The cold evaporator coil absorbs both of these components and adds the heat of compression of the single compressor. This option provides high COP efficiency to the exhaust air recovery cycle.

The SelectAire™ is the most efficient method to recover the total energy of the exhaust air. Since the airflows and loads are maintained through the special airflow control sequence the amount of recovery can be optimized. Other systems that use passive heat exchangers cannot recover latent energy during the majority of the operation and the amount of sensible recovery is dependent on the outdoor temperature. Passive heat exchangers require additional fan energy and cannot take full advantage of free outdoor air cooling unless bypass dampers and controls are installed. The SelectAire™ has a constant rate of energy recovery when activated and is always controlled automatically based on the zone condition.

The following tables are examples of how the airflow could be established in the field if the ASHRAE 62 ventilation code volume was equal to 20% of the dehumidifier's supply air value.

Dehumidification/Cooling Example

	% of Supply Air				
	OSA	Cool Exh.	Warm Exh.	Compressor	Low Pool Exh.
Unoccupied	10%	0%	VFD maintaines a Neg. Pres. In all modes	Enabled as required	10%
Occupied	20%	0%		Enabled as required	10%
Event	30%	0%		Enabled as required	10%
Alarm	40%	0%		Enabled as required	20%
Purge	50%	0%		Locked out	20%

Energy Recovery Mode Example

	% of Supply Air				
	OSA	Cool Exh.	Warm Exh.	Compressor	Low Pool Exh.
Unoccupied	10%	0%	VFD maintaines a Neg. Pres. In all modes	Enabled as required	10%
Occupied	20%	10%		Enabled as required	10%
Event	30%	20%		Enabled as required	10%
Alarm	40%	20%		Enabled as required	20%
Purge	50%	20%		Locked out	20%

Additional design features of the SelectAire™ System with Extended Outdoor Air and Source Capture Exhaust:

- VFD for exhaust air
A room pressurization scheme maintains a negative pressure in the space. A unit mounted pressure transducer is provided by Desert Aire. 1/8" pressure tubing is run to the space and to the outdoor air by the installing contractor. Suitable terminations are provided by Desert Aire.
- Outdoor Air Balance Plate
Calibrated by Desert Aire to control outdoor air damper.
- Exhaust Air Balance Plate
Calibrated by Desert Aire, installed between the cold air and warm air dampers to maintain the proper ratio of exhaust air from these two locations to ensure a building negative pressure.
- Return air static pressures up to 1.5 inch WC and supply air static can be up to 2.0 inch WC

For a more detailed analysis, please refer to DESERT AIRE Technical Bulletin 6 - SelectAire™ Heat Recovery System.

Covered by Desert Aire United States Patent # 5,682,754

for more information: www.desert-air.com

