AHRI Standard 921 (SI)

2015 Standard for

Performance Rating of DX-Dedicated Outdoor Air System Units

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IMPORTANT

SAFETY DISCLAIMER

AHRI does not set safety standards and does not certify or guarantee the safety of any products, components or systems designed, tested, rated, installed or operated in accordance with this standard/guideline. It is strongly recommended that products be designed, constructed, assembled, installed and operated in accordance with nationally recognized safety standards and code requirements appropriate for products covered by this standard/guideline.

AHRI uses its best efforts to develop standards/guidelines employing state-of-the-art and accepted industry practices. AHRI does not certify or guarantee that any tests conducted under its standards/guidelines will be non-hazardous or free from risk.

Note:

This standard supersedes ANSI/AHRI Standard 920-2012.

For I-P ratings, see AHRI Standard 920 (I-P)-2015.

Foreword:

DX-Dedicated Outdoor Air Systems (DX-DOAS) condition outdoor ventilation air independently from the building HVAC system. This approach to handling ventilation air results in superior humidity control by limiting the primary source of humidity in most buildings – ambient humidity carried in by the ventilation air – directly at its source. When the DX-DOAS removes enough moisture from the ventilation air to match the building interior load, energy savings can be obtained by running the separate, sensible cooling only, interior cooling system at a higher evaporating temperature, thus improving the energy efficiency. Further energy savings may be realized by providing only the amount of ventilation air necessary and/or by using energy recovery from the building Exhaust Air to pre-treat the ventilation air. Alternate energy strategies may be employed to provide ventilation air at low or high dry-bulb temperatures to assist in building cooling and heating.

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PERFORMANCE RATING OF DX-DEDICATED OUTDOOR AIR SYSTEM UNITS

Section 1. Purpose

1.1 *Purpose*. The purpose of this standard is to establish for DX-Dedicated Outdoor Air System Units: definitions; classifications; test requirements; rating requirements; minimum data requirements for Published Ratings; operating requirements; marking and nameplate data; and conformance conditions.

1.1.1 *Intent.* This standard is intended for the guidance of the industry, including manufacturers, engineers, installers, contractors and users.

1.1.2 *Review and Amendment.* This standard is subject to review and amendment as technology advances.

Section 2. Scope

2.1 *Scope.* This standard applies to factory-assembled commercial or industrial DX-Dedicated Outdoor Air System Units as defined in Section 3.

2.1.1 *Energy Source.* This standard applies to electrically operated, vapor-compression refrigeration systems.

2.1.2 *Installation.* DX-Dedicated Outdoor Air System Units are intended for ducted or non-ducted installation with field or factory supplied grilles.

2.2 *Exclusions.* This standard shall not apply to products covered under ANSI/AHRI Standard 210/240, ANSI/AHRI Standard 340/360, and ANSI/AHRI/ASHRAE ISO Standard 13256-1. Direct conversion of values from testing performed under AHRI Standard 920 (I-P) shall not be used.

Section 3. Definitions

All terms in this document will follow the standard industry definitions in the *ASHRAE Terminology* website (https://www.ashrae.org/resources--publications/free-resources/ashrae-terminology) unless otherwise defined in this section.

3.1 *Coefficient of Performance.* A ratio of the heating capacity in watts to the power input values in watts at any given set of Rating Conditions expressed in W/W, including Supplementary Heat if required to provide room neutral supply air temperature as listed in Table 3.

3.1.1 *Standard Coefficient of Performance (COP).* A ratio of the capacity to power input obtained at Standard Rating Conditions, heating.

3.2 *Conditioned Space*. That part of a building that is humidified or dehumidified; heated or cooled, or both, for the comfort of occupants.

3.3 *DX-Dedicated Outdoor Air System Units (DX-DOAS Units).* A type of air-cooled, water-cooled, or water source factory assembled product which dehumidifies 100% Outdoor Air to a low dew point, and includes reheat that is capable of controlling the supply dry-bulb temperature of the dehumidified air to the designed supply air temperature. This conditioned outdoor air is then delivered directly or indirectly to the Conditioned Space(s). It may pre-condition Outdoor Air by containing an enthalpy wheel, sensible wheel, desiccant wheel, plate heat exchanger, heat pipes, or other heat or mass transfer apparatus.

Note: DX-DOAS Units can operate in combination with a separate sensible cooling system to satisfy the entire building humidity load. The system is sized to maintain a prescribed ventilation rate under any load condition. The ventilation rate can be constant or varied based on the building operation or occupancy schedule or in response to the actual occupancy. It may pre-condition Outdoor Air by incorporating an enthalpy wheel, sensible wheel, desiccant wheel, plate heat exchanger, heat pipes or other heat or mass transfer apparatus. It shall reheat the ventilation air by containing a reheat refrigerant circuit.

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sensible wheel, heat pipe, or other heat or mass transfer apparatus. Cooling components may include chilled water coils. Heating components are optional and may include electrical resistance, steam, hot water, or gas heat. In addition, it may provide for air cleaning.

3.4 *Exhaust Air*. Air removed from the Conditioned Space and discharged to the outdoor area of the building by means of mechanical or natural ventilation systems.

3.5 *Exhaust Air Transfer Ratio (EATR)*. A ratio of the tracer gas concentration difference between the Supply Airflow and the Outdoor Airflow and the tracer gas concentration difference between the Return Airflow and the Outdoor Airflow at the 100% rated airflows, expressed as a percentage.

3.5.1 *Outdoor Airflow (OA)*. The outdoor airflow before passing through the unit indicated in Figure 1 as station 1.

3.5.2 *Supply Airflow (SA)*. The outdoor airflow delivered after passing through the unit, indicated in Figure 1 as station 2.

3.5.3 *Return Airflow (RA)*. The exhaust airstream (indoor airflow) before passing through the unit, indicated in Figure 1 as station 3. This is only applicable on units with energy recovery exhaust.

3.5.4 *Exhaust Airflow (EA)*. The exhaust airflow (indoor airflow) after passing through the unit, indicated in Figure 1 as station 4. This is only applicable on units with energy recovery exhaust.

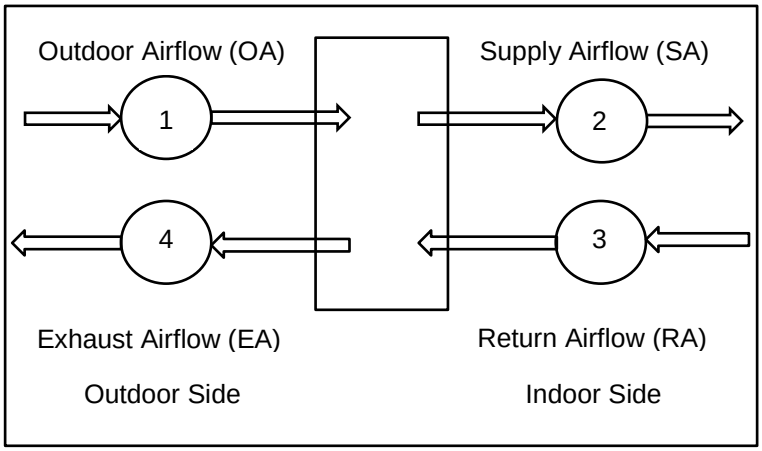


Figure 1. DX-DOAS Units Airflow Schematic

3.6 *Ground Source Closed-loop Heat Pump*. A heat pump that uses fluid circulated through a subsurface piping loop as a heat source/heat sink. The temperature of the fluid is related to climate and operating history conditions and usually varies from -4.0ºC to 38.0ºC.

3.7 *Ground Source Heat Pump*. A heat pump that uses water pumped from a well, lake or stream as a heat source/heat sink. The temperature of the water is related to climate conditions and usually ranges from 7.0ºC to 24.0ºC for deep wells.

3.8 *Hot Gas Reheat*. An air to refrigerant heat exchanger that uses energy from the cooling process to reheat cooled air.

3.9 *Integrated Seasonal Coefficient of Performance (ISCOP)*. This seasonal efficiency number is a combined value based on Equation 5 listed in Section 6.4 of the two (2) COP values for the heating season of a DX-DOAS Unit Water Source Heat Pump expressed in W/W.

3.10 *Integrated Seasonal Moisture Removal Efficiency (ISMRE)*. This seasonal efficiency number is a combined value based on Equation 6 listed in Section 6.5 of the four (4) dehumidification Moisture Removal Efficiency (MRE) ratings required in this standard for DX-DOAS Units expressed in kg of moisture/kWh.

3.11 *Moisture Removal Capacity (MRC)*. The amount of moisture removed from the Outdoor Air at the DX-DOAS Unit rated airflow rate expressed in kg of moisture/h.

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3.12 *Moisture Removal Efficiency (MRE).* A ratio of the Moisture Removal Capacity expressed in kg/h to the total power input in kW at any given set of Rating Conditions expressed in kg of moisture/kWh, including any additional auxiliary energy required to raise the temperature to the supply airflow design condition.

3.13 *Net Sensible Cooling Capacity*. The amount of sensible cooling remaining after the air has been cooled to remove moisture and that can contribute to the building sensible load with the reheat disabled and the conditioned space at 24ºC.

3.14 *Outdoor Air*. Ambient air that enters the DX-DOAS Unit.

3.15 *Published Rating*. A statement of the assigned values of those performance characteristics, under stated Rating Conditions, by which a unit may be chosen to fit its application. These values apply to all units of like nominal size and type (identification) produced by the same manufacturer. The term Published Rating includes the rating of all performance characteristics shown on the unit or published in specifications, advertising or other literature controlled by the manufacturer, at stated Rating Conditions.

3.15.1 *Application Rating*. A rating based on tests performed at application Rating Conditions (other than Standard Rating Conditions).

3.15.2 *Standard Rating*. A rating based on tests performed at Standard Rating Conditions as listed in Table 2.

3.16 *Rating Conditions.* Any set of operating conditions under which a single level of performance results and which causes only that level of performance to occur.

3.16.1 *Standard Rating Conditions.* Rating Conditions used as the basis of comparison for performance characteristics as listed in Table 2.

3.17 *"Shall" or "Should".* "Shall" or “should” shall be interpreted as follows:

3.17.1 *Shall.* Where "shall" or "shall not" is used for a provision specified, that provision is mandatory if compliance with the standard is claimed.

3.17.2 *Should.* "Should" is used to indicate provisions which are not mandatory but which are desirable as good practice.

3.18 *Standard Air*. Air weighing 1.2 kg/m^3, which is approximately dry air at 21°C and at a barometric pressure of 101.3 kPa.

3.19 *Supplementary Cooling*. A cooling source that is not part of the vapor compression cycle.

3.20 *Supplementary Heat Thermal Efficiency*. Heating output per heating input, %.

3.21 *Supplementary Heat.* A heating input value converted to watts that is not part of the vapor compression cycle, W.

3.22 *Total Cooling Capacity*. The capacity associated with the change in air enthalpy which includes latent cooling, sensible cooling and any effects of an energy recovery device, W.

3.23 *Tracer Gas Test*. The marking of air with a gas to monitor its presence, to monitor concentration, and to identify if any leaks are present in a system.

3.24 *Unit Total Heating Capacity*. Amount of heat the DX-DOAS Unit can input to the supply air in the heating mode, including the heat from the vapor compression cycle, air-to-air heat exchanger, and Supplementary Heat, kW.

3.25 *Unit Total Reheat Capacity*. Amount of heat the DX-DOAS Unit can input to the supply air in the dehumidification mode, including recovered heat from the vapor compression cycle and/or air-to-air heat exchanger or other heat or mass transfer apparatus, kW. This does not include Supplementary Heat.

3.26 *Water Source Heat Pump*. A heat pump that uses fluid circulated in a common piping loop as a heat source/heat sink. The temperature of the piping loop fluid is usually mechanically controlled within a moderate temperature range of 16.0ºC to 32.0ºC.

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