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Subject: Supplying Outside Air to Ducted Units
Models: AC0**MNHDCH/AA, AC0**KNZDCH/AA, AC0**JNHDCH/AA, AC0**KNLDCH/AA, AM0**MN*DCH/AA, AM0**JNMDCH/AA, AM0**JNHDCH/AA, AM0**FNLDCH/AA, AM0**FNHDCH/AA, AM0**JNZDCH/AA

Supplying Outside Air to Ducted Units

Introduction

This Application Note provides a design guide related to outside air being supplied to system.

Heat Load Calculation

Outdoor air introduced into an indoor unit constitutes a large part of the total load, which is the reason to limit air exchange rates into the indoor unit, as this will increase the load on the selected indoor unit.

Incoming air must be heated or cooled from the outdoor air temperature to the indoor temperature. This sensible heating or cooling load is given by

$$q_S = 60 Q \rho c_P \Delta t$$

where

q_s = sensible heat load (Btu/h)
Q = airflow rate (CFM)
ρ = air density (lb/ft^3)
c_p = specific heat of air, Btu/lb · ° F (≒0.24)
Δt = temperature difference between indoors and outdoors, ° F

This equation is commonly presented as follow

$$q_s = 1.1 Q \Delta t$$

HVAC designers typically assume sea-level air pressure for locations with altitudes of 2000 feet or lower.

Air exchange also modifies the moisture content of the air. The rate of energy consumption associated with these latent loads is given by

$$q_l = 60 Q \rho \Delta W (1075 + 0.444 t)$$

where

q_l = latent heat load, Btu/h
ΔW = humidity ratio difference between indoors and outdoors
t = average of indoor and outdoor temperatures, °F

Example

If an indoor unit is supply with 200 CFM of outdoor air for a building and the air is to be delivered directly to the indoor unit, how much sensible and latent heat will be added to the indoor unit coil load by the outside air at summer/winter design conditions provide below.

Load (Btu/h)	Total	Sensible Cooling	Sensible Heating
Zone (no OA)	30,000	19,500	22,000

Air condition	Summer (°F DB)	Summer (°F WB)	Winter (°F DB)
Outdoor air	95	75	23
Return air	80	67	70

Solution

Air flow rate (Q): 200 CFM

Air density (ρ): 0.07648 lbm/ft^3
(1atm, Dry bulb 59°F, Relative humidity 0%)

Return air temperature (Winter): 70°F DB
Return air temperature (Summer): 80°F DB / 67°F WB

Design temperature (Winter): 23DB°F
Design temperature (Summer): 95°F DB / 75°F WB

Humidity ratio (Summer, Outdoor air): 0.01406
Humidity ratio (Summer, Return air): 0.01116

Sensible heat (Winter): 10,340 Btu/h

$$q_s = 1.1 Q \Delta T = 1.1 \times 200 \times (70 - 23) = 10{,}340 \text{ Btu/h}$$

Sensible heat (Summer): 3,300 Btu/h

$$q_s = 1.1 Q \Delta T = 1.1 \times 200 \times (95 - 80) = 3{,}300 \text{ Btu/h}$$

Latent heat (Summer:) 2,966 Btu/h

$$q_l = 60 Q \rho \Delta W (1075 + 0.444 t)$$
$$= 60 \times 200 \times 0.0765 \times (0.01406 - 0.01116) \times (1075 + 0.444 \times 95) = 2{,}966 \text{ Btu/h}$$

Conclusion

Load (Btu/h)	Cooling		Heating	
	q_s	q_l	q_s	q_l
Zone(no OA)	19,500	0	22,000	0
Additional	3,300	2,966	10,340	0
Sub total	**22,800**	**2,966**	**32,340**	**0**
Total	**25,766**		**32,340**	

Capacity (Btu/h)		Cooling		Heating	
		q_s	q_l	q_s	q_l
AM030FNLDCH		23,000	7,000	27,800	-
	Total	30,000		27,800	
AM036FNLDCH		27,500	8,500	32,500	-
	Total	36,000		32,500	

→ AM036FNLDCH should be selected instead of the AM030FNLDCH.