ENGINEERING WHITE PAPER

Internal use only

AirReps™

March 13, 2020

Fan Power Limitation

The energy code requires engineers to meet a minimum airflow rate per unit of fan power. There are two rules based on if the system is constant volume or variable volume. Each of these rules has two options for compliance: meeting a maximum motor nameplate horsepower, or meeting a maximum brake horsepower. The requirements are summarized in the table below.

Option	Limit	Constant Volume	Variable Volume
Option 1: Fan System Motor Nameplate HP	Allowable Nameplate Motor HP	HP = CFMS x 0.0011	HP = CFMS x 0.0015
Option 2: Fan System BHP	Allowable Fan System BHP	BHP = CFMS x 0.00094 + A	BHP = CFMS x 0.0013 + A

Where:

CFMS = The maximum design supply airflow rate to conditioned spaces served by the system.

HP = The maximum combined motor nameplate horsepower.

BHP = The maximum combined fan brake horsepower.

A = Sum of [PD × CFMD / 4131]

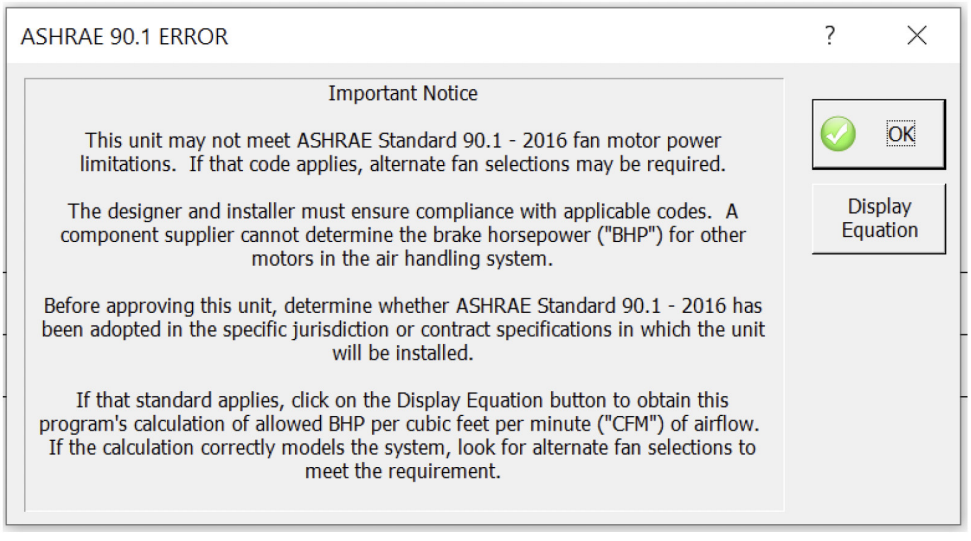
Where:

PD = Each applicable pressure drop adjustment from Table C403.8.1(2)[1] in. w.c.

CFMD = The design airflow through each applicable device from Table C403.8.1(2).

Table C403.8.1(2) lists pressure drop adjustments and is on page 3. In addition, there is an Excel spreadsheet in the H:\Engineering folder to automate this calculation.

The Vision and Skyline software in Daikin Tools does this calculation for you. With our other products, you'll need to use the spreadsheet to check compliance.



[1] *Table numbers are based on the 2018 WA State Energy Code*

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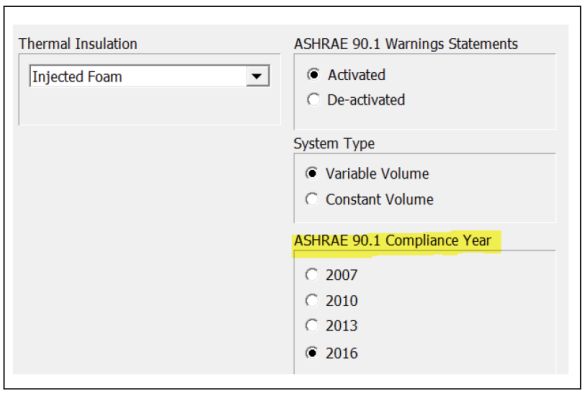
When using Daikin Tools, if your design doesn't comply, you'll get the error message below when saving the tag. You

can also check the calculation by using the "ASHRAE Calcs" button as shown below.

Please note that when you create a Daikin Vision or Skyline unit, the factory default may not be the most current 2016 ASHRAE code. Please be sure to set this to 2016, as some previous years aren't as generous with the allowances.



If your unit doesn't comply, there are some things you can try to get into compliance:

- Use clean filter pressure drops (but be sure to have enough motor for dirty filters)
- Select lower pressure drop coils
- Look for higher efficiency fan selections (be sure to check stability at part load)
- Increase the size of duct connections
- Increase the physical size of the unit to reduce the internal static pressure losses

If none of these work, or there is a physical space limitation, you'll need to talk with the engineer about reducing the external static pressure. That, afterall, is the point of this section of the energy code.

Any questions on this, please contact the Engineering Department.

Thanks,

Ken H

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TABLE C403.8.1(2) FAN POWER LIMITATION PRESSURE DROP ADJUSTMENT

Device	Adjustment
Credits	
Return air or exhaust system required by code or accreditation standards to be fully ducted, or systems required to maintain air pressure differentials between adjacent rooms	0.5 inch w.c. (2.15 inches w.c. for laboratory and vivarium systems)
Return and/or exhaust air flow control devices	0.5 inch w.c.
Exhaust filters, scrubbers, or other exhaust treatment	The pressure drop of device calculated at fan system design condition
Particulate filtration credit: MERV 9 –12	0.5 inch w.c.
Particulate filtration credit: MERV 13 – 15	0.9 inch w.c.
Particulate filtration credit: MERV 16 and greater and electronically enhanced filters	Pressure drop calculated at 2x clean filter pressure drop at fan system design condition
Carbon and other gas-phase air cleaners	Clean filter pressure drop at fan system design condition
Biosafety cabinet	Pressure drop of device at fan system design condition
Energy recovery device, other than coil runaround loop	For each airstream (2.2 × energy recovery effectiveness) – 0.5 inch w.c.)
Coil runaround loop	0.6 inch w.c. for each airstream
Evaporative humidifier/cooler in series with another cooling coil	Pressure drop of device at fan system design conditions
Sound attenuation section (fans serving spaces with design background noise goals below NC35) 0.15 inch w.c.	Exhaust system serving fume hoods 0.35 inch w.c.
Laboratory and vivarium exhaust systems in high-rise buildings	0.25 inch w.c./100 feet of vertical duct exceeding 75 feet
Deductions	
Systems without central cooling device	-0.6 inch w.c.
Systems without central heating device	-0.3 inch w.c.
Systems with central electric resistance heating	-0.2 inch w.c.

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