

# information bulletin

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## **ASHRAE Advanced Energy Design Guide (AEDG) for Small Warehouses and Self-Storage Buildings**

### **Overview**

This 106-page document is intended as a guide for contractors and designers who build small warehouses up to 50,000 sq. ft. This is a set of guidelines and recommendations, not an official ASHRAE Standard. Application of the recommendations in the design guide should result in small warehouses with at least 30% energy savings when compared to the same warehouses designed and built to the minimum requirements of ASHRAE Standard 90.1-1999. Energy modeling analysis showed an average energy savings of 42%. Using the more recent ASHRAE 90.1-2004 as the baseline reduced the average energy savings to 33%.

The AEDG includes specific recommendations in the areas of: Building Envelope, Lighting, HVAC Equipment & Systems and Service Water Heating. Products included in the recommendations are available from multiple manufacturers. Recommendations are also categorized for the eight DOE climate zones in the U.S. and for climate zones in Canada and Mexico.

This 2008 design guide was developed and written by members of the following organizations:

ASHRAE (American Society of Heating & Air Conditioning Engineers)

AIA (The American Institute of Architects)

IESNA (Illuminating Engineering Society of North America)

MBMA (Metal Building Manufacturers Assoc.)

USGBC (U.S. Green Building Council)

DOE (U.S. Department of Energy)

## **Information Pertaining to Warehouse Heating Equipment**

The AEDG for small warehouses does not promote any specific type of heating system for all warehouse-heating applications. Four HVAC system types (options) are included in the guidelines for heating different parts of a non-refrigerated warehouse including both office and storage areas.

Option 1: Gas-fired air heaters (including gas-fired unit heaters and outside air units)

Option 2: Electric resistance heat

Option 3: Heat pump unit

Option 4: Radiant heater

The energy modeling referenced in the document is based on a 50,000 sq ft building that included a 34,000 sq ft bulk storage area using unit heaters and central exhaust fans to provide just 45°F heating for freeze protection.

Gas-fired unit heaters, air rotation units, radiant heaters and both indirect & direct gas-fired 100% outside air units are included in the guidelines. Direct gas-fired 80/20 recirculating heaters certified to ANSI Standard Z83.18 are not included as a heating option for use in warehouses.

Cambridge Air Solutions, S-Series Blow-Thru type space heaters are included in Chapter 5, the HVAC Section in sub-section HV2 on pages 73-74 and in sub-section HV7 on page 76.

**Page 73** – A diagram of an S-Series Heater is included in Figure 5-21, which is in the section that describes 4 different HVAC system types for warehouses. The diagram is titled “*Thru-Wall Mounted, Industrial –Type, Gas Direct-Fired Non-Recirculating Outside Air Unit (Blow-Thru)*” They also say “.... provided by Cambridge Air Solutions, Inc.” Cambridge is the only manufacturer mentioned by name in the entire HVAC section.

**Page 74** - The advantage of our 160°F high temperature rise Blow-Thru design is confirmed in the following statement “ *Ventilation requirements and heating flow requirements can be balanced by using a higher heating air supply temperature along with the appropriate air distribution strategies to avoid stratification*”

**Page 76** - The advantage of Blow-Thru heaters with high velocity air-throw diffusers to reduce stratification is covered as follows “ *Unit heaters in high bay spaces often result in significant stratification. Destratifying fans.....or higher velocity vertical-throw diffusers can increase air exchange between the upper and lower zones of the space, reducing the range of temperatures over the height of the space*”

Radiant heaters are included and recommended in the guidelines, but the AEDG also recognizes that radiant/infrared type heating systems can cause problems because they don’t provide any forced air movement or ventilation with outside air. This can lead to a lack of adequate ventilation, negative air and IAQ problems. These issues are addressed as follows:

**Page 74** - “ *Radiant heaters heat the surfaces at which they are directed through infrared radiation. ....They are usually supplemented by air systems*”

**Page 75** – “*Radiant systems must be supplemented by air systems for maintenance of appropriate ventilation rates, for pressure balance between the building and outside, and of overall desired air temperature*”

## Energy Efficiency

The AEDG uses the same terminology as Cambridge when it comes to heater energy efficiency.

$E_c$  = efficiency (combustion)

$E_t$  = efficiency (thermal)

Their energy efficiency recommendations for all types of gas heating equipment are shown below.

*Climate Zones 1 thru 4: Gas furnace (>225Kbtuh) = 80%  $E_c$*

*Climate Zones 5 thru 8: Gas furnace (>225Kbtuh) = 82%  $E_c$  or 81%  $E_t$*

Of course the rated efficiencies for Cambridge Blow-Thru Heaters are much higher:

$E_c$  = 100%

$E_t$  = 92%

## Use of Carbon Dioxide (CO<sub>2</sub>) Sensors in Warehouse Facilities

**Page 83** – The use of CO<sub>2</sub> sensors as a way to determine adequate ventilation in a warehouse is discouraged based on the following statement “*In warehouse or other areas which the occupant population is not the most important determinant of ventilation flow rate, demand-control ventilation using carbon dioxide sensors should not be used*”

**Page 83** - Guidelines are given for CO<sub>2</sub> sensors used in warehouses with direct gas-fired heaters. “*In warehouse areas that contain sources of CO<sub>2</sub> generation other than human occupancy (i.e., propane fork lift trucks, unvented gas-fired radiant heaters, direct gas-fired heaters, gas-powered scooters, etc.), sensor location should be carefully considered to reflect an average sample of the CO<sub>2</sub> concentration in the space.*”

## Summary

Genuine Cambridge<sup>®</sup> Blow-Thru Space Heaters are ASHRAE 90.1 compliant, are being used in LEED Green Building Warehouse Projects and are now included in the new ASHRAE Advanced Energy Design Guide (AEDG) for Small Warehouses. Properly applied Cambridge heaters can achieve 40 % to 70% energy savings versus all other warehouse heating systems for both small warehouse applications as covered in this AEDG and for larger warehouse facilities up to 3 million sq. ft. This has been documented in hundreds of building studies throughout the United States and Canada.

**A copy of this and other Advanced Energy Design Guidelines for different building types can be downloaded from [www.ashrae.org](http://www.ashrae.org)**

**For more information on Cambridge Heaters visit [www.cambridge-eng.com](http://www.cambridge-eng.com)**