

# Make Up Air Fact Sheet

## Summary/Principles of Operation

Make-up air is outside air which has been introduced into a building to replace air which has been exhausted. It can be heated or not. The solution to the problem of removing undesirable elements from the building by exhaust is make-up air.

Outdoor make-up air units are the most common approach to relieving negative pressure inside commercial and industrial facilities replacing the exhausted air. Make-up air is outside air tempered and introduced into a building to eliminate negative pressure and provide a positive operating pressure within a facility. Fan and blowers used in spray booths, hoods, ovens, dust collectors, ventilators and other plant equipment exhaust air to the outside. Without a controlled introduction of “make-up” air an air-starved environment will result.

During the warm weather this air can enter freely through open doors and windows. But when the outside temperature drops below a comfortable level, an “air starvation” condition will result. During much of the year, tight, modern factory buildings are placed under suction by the exhaust systems. This immediately results in reduced volumes handled by the fans and inadequate removal of contaminants.

The most common fuel for heating make-up air is natural gas. This is because 100% of the energy goes into the air stream (92% sensible, 8% latent). Direct-firing eliminates the need for heat exchangers or combustion chambers that can corrode or leak. Natural gas is often the least expensive fuel<sup>1</sup>.

Make up air systems replace stale air exhausted from industrial and commercial buildings with fresh, heated outdoor air, maintaining a constant leaving-air temperature regardless of the incoming, outdoor-air temperature. Make-up air systems replenish equal amounts of fresh air for every cubic foot of air exhausted. Make-up air passes through the building only once. Make-up air temperatures are usually maintained at approximately 65 to 80 F, the same as the desired comfort level for the space heating system of the building.

Typical ratings are 1 CFH of gas for each 10 CFM of air; so a 10,000 CFM unit would have an input gas rating of about 1,000 CFH or 1,000,000 BTUs. (Max rating; will vary with air temperature and temperature rise setting). Most all manufacturers/ reps will desire elevated gas pressure as they will be able to get more heating capacity from a smaller unit and down size the gas train; however, standard pressure options are available on most units up to about 25,000 CFM (2,500,000 BTUs)<sup>2</sup>.

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<sup>1</sup> TRANE , Make-Up Air Units, Direct-Fired Outdoor Model DFOA, September 2000

<sup>2</sup> DTE Energy Technology Profiles

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### **Strengths/Opportunities**

- Reduces total fuel costs
- Provides a clean, clear indoor atmosphere
- Elimination of drafts and cold areas around doors and windows
- Reduction in load on present heating plant or elimination of central heating plant in certain cases
- Virtual elimination of maintenance cost
- Savings in space heating plant
- May be used year-round for air circulation

### **Weaknesses/Barriers**

- Direct-fired units cannot be used for sleeping quarters
- Insurance requirements for direct-fired units
- Lack of awareness of the equipment
- High capital cost of equipment

### **Market Niches**

- Restaurants
- Schools
- Factories
- Auto Body Shops
- Paint Spray Booths
- Manufacturing and Process Areas
- Warehouses
- Distribution Centers
- Steel Storage Facilities
- Foundries
- Food Processing Plants
- Bakeries
- Car Washes
- Locker Rooms

### **Competition**

- Electric
- Propane
- Oil

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### Typical Costs<sup>3</sup>

Typically a good rule of thumb is \$1.00 per cfm for direct-fired units and as high as \$10.00 per cfm for indirect-fired depending on the outside air quantities and stainless steel material requirements.

#### Direct MUA Unit

	<b>Clover</b>		<b>Cambridge</b>	
	<b>Equipment Cost</b>	<b>Unit Cost</b>	<b>Equipment Cost</b>	<b>Unit Cost</b>
<b>3000 Cfm</b>	\$5,400	\$1.80/Cfm	\$5,000	\$1.66/Cfm
<b>4000 Cfm</b>	\$5,900	\$1.50/Cfm	\$5,600	\$1.40/Cfm
<b>6000 Cfm</b>	\$7,200	\$1.20/Cfm	N/A	
<b>7500 Cfm</b>	N/A		\$6,500	\$0.87/Cfm
<b>10,000 Cfm</b>	N/A		\$8,000	\$0.80/Cfm
<b>16,000 Cfm</b>	N/A		\$9,500	\$0.59/Cfm
<b>26,000 Cfm</b>	N/A		\$12,000	\$0.46/Cfm
<b>38,000 Cfm</b>	N/A		\$15,500	\$0.41/Cfm
<b>50,000 Cfm</b>	N/A		\$17,000	\$0.34/Cfm

#### Indirect MUA Unit (Clover only)

	<b>Equipment Cost</b>	<b>Unit Cost</b>
<b>3000 Cfm</b>	\$5,300	\$1.75/Cfm
<b>4000 Cfm</b>	\$6,300	\$1.60/Cfm
<b>6000 Cfm</b>	\$8,300	\$1.40/Cfm

#### Questions to Ask

(General)

1. Are the doors hard to open to the outside?
2. Do standards require you to have a certain amount of make up air? i.e. Schools for IAQ issues (ASHRAE Standard 62)

(Restaurant Industry)

1. Do you have an exhaust hood for the kitchen?
2. Do you get complaints of cold feet?
3. Do kitchen odors pollute or enter the dining area?

<sup>3</sup> Clover Corporation & Cambridge Engineering Inc

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### (Manufacturing Sectors)

1. Do you have a lot of exhaust?
2. Do you have problems with heat exchangers of unit heaters rusting out?
3. Do you have high ventilation rates?
4. Do you have problems with pilots blowing out?
5. Are your vents rusting?
6. Do you have odor complaints?

### Manufacturers

The following is a very limited list of manufacturers of industrial make-up-air systems. MUA systems like other HVAC systems are sold nation wide by local distributors and installers. Systems should be selected based on the local distributor and dealer/installer support network.

Company	Representative	Phone Number	Website
Aerovent	Don Raymond	203-483-5555	<a href="http://www.aerovent.com/aerovent/index.asp">www.aerovent.com/aerovent/index.asp</a>
Cambridge	Frank Horstmann	888-296-8371	<a href="http://www.cambridge-eng.com/default.asp">www.cambridge-eng.com/default.asp</a>
Rupp	CaptiveAire-Tim Hill	888-594-8390	<a href="http://www.ruppams.com">www.ruppams.com</a>
Trane	Clover Corp	860-528-0081	<a href="http://www.trane.com/TraneHomePage.asp">http://www.trane.com/TraneHomePage.asp</a>
Reznor	Clover Corp	860-528-0081	<a href="http://www.rezspec.com">www.rezspec.com</a>
Carrier	Brian Dwyer		<a href="http://www.carrier.com">www.carrier.com</a>