APPLICATION BULLETIN
FORM NO. **RGM-T-WHV**

WAREHOUSE HEATING AND VENTILATING

OVERVIEW

Warehouses usually are simple in shape. Most warehouses have very few partitions resulting in large open spaces for storage. These buildings may have few, if any, windows and sometimes include areas that are used as permanent work stations.

Because warehouses contain items of endless description, the requirements for heat and ventilation are varied. There is almost always a need for fire protection. Water distributed through an overhead sprinkler system is normally utilized and must be protected against freezing. A minimum amount of heat (40°F) is therefore needed for freeze protection. Also, the heat requirements could be greater if the wares stored in the facility need to be maintained at a temperature above 40°F. Ventilation is also a consideration, depending on items in storage and processes occurring inside the space. Often, material movement is achieved using gasoline or propane powered vehicles that exhaust harmful carbon monoxide (CO). Ventilation may also be required because of the material that is in storage. Unless some kind of mechanical cooling is used, summer time ventilation may be needed to minimize temperature buildup that could affect the material being stored.

Most warehouses include people, only when materials need to be moved in or out. Often, though, warehouse managers are housed within the building in separate offices and material handlers spend their entire work day within the facility. Also, packaging and preparation of material for shipment could be part of the work day. This means that comfort heating and ventilation may be necessary.

Sometimes warehouses are used to store foodstuffs needing mechanical cooling. When such equipment is needed, cooling may be provided through the use of evaporative cooling, direct expansion (DX) or chilled water coils. Consult with the Reznor Factory Representative to select the proper system.

EQUIPMENT SELECTION FACTORS

Before a selection of heating equipment can be made, a heat loss of the facility is needed A heat loss study based on ASHRAE recommendations will be required. Reznor can provide a computer printout of the building hourly losses if all pertinent dimensional, constructional and design condition data is supplied. The Reznor factory representative and many Reznor distributors are prepared to compute this information for you using a specially designed Reznor computer program.

In addition, the following specifics must be known.

1. Types of materials to be stored
2. Fire protection requirements
3. Minimum and maximum temperatures
4. People occupancy
5. Ventilation requirements, air change rate
6. Infiltration rates, especially through large doorways

TYPES OF MATERIALS STORED

Because of the endless possibilities, a good understanding of the wares to be stored is needed. Is exposure to heat, cold or humidity a concern? If so, what are the tolerable limits?

FIRE PROTECTION

Sprinkler systems are generally in use. That means that at least 40°F temperature will be required to prevent freezing of the water in the pipes.

MINIMUM TEMPERATURE

The material being stored could required a minimum storage temperature that must be known before that heat loss study for the structure is conducted.

MAXIMUM TEMPERATURE

Some materials may be sensitive to elevated temperatures. Either evaporative cooling or mechanical cooling may be necessary. Summertime ventilation may be all that is needed. A consultation with the owner or end user would be in order to make these determinations.

PEOPLE

Some warehouses are used only intermittently but many are in constant use with personnel for moving, loading, unloading or packaging. When people are involved, the heat requirements may change and the ventilation requirements may be dictated by code.

VENTILATION

Many warehouse materials are moved using gas or propane powered lift trucks. Since these vehicles give off carbon monoxide, adequate ventilation of the area is in order. Also, the materials that are stored may give off harmful fumes, requiring continuing air changes. In addition, building codes may require at least minimum ventilation that must be implemented as part of, or in addition to, the heating equipment. ASHRAE states that the ventilation rate of outside air for a warehouse should be 0.15 CFM per square foot of floor area.

CONTENTS

In addition to the above considerations, there is the possibility that the wares being moved into the building may contribute to the heating or cooling and ventilation requirements. Materials that enter the building at low (winter) temperatures will add to the heating load. Conversely, summertime heat may add to the cooling or ventilation load when wares are brought in at elevated temperatures. Considerations to offset these added loads would only prevail if the warehouse is to controlled to a specified temperature and if the materials being brought in are adequate in volume to actually affect the space temperature.

SPECIFIC HEAT

Every material, whether gas, liquid or solid, may be heated or cooled. Each degree Fahrenheit of change involves a measure of heat (BTU) to be introduced or withdrawn for each pound of the material. This value is the "specific heat."

Four your information, Table 1 lists some specific heat values that you may encounter when planning environmental control for warehouses.

Since every material possesses a specific heat value, this table represents only a small sampling. We offer this short list to demonstrate how specific heat can vary from one material to the next. It should be obvious how large quantities of materials can create a need for heating or cooling as demonstrated in the following example.

Example:

A warehouse used for storing a variety of materials, must be maintained at a minimum of 60°F due to special paint storage requirements. When a weekly shipment of steel arrives during the winter months, it is unloaded and placed in the warehouse. In this example, the steel will be at 30°F temperature. The specific heat of steel is 0.12 BTU/LB/°F. Since the weight of the steel for each shipment approximate 20 tons (40,000 lbs.), we find that, in order to elevate the steel to 60°F, we must add 144,000 BTU to the steel as shown:

0.12 BTU/LB/°F 40,000 lbs. x 30°F = 144,000 BTU

If you want the steel to reach 60°F in one hour, then the heat requirement will be 144,000 BTUH. For a two hour process, the heat requirement will be 72,000 BTUH. As the acceptable time lengthens, the BTU requirements for each hour are lessened.

In the summer, this same shipment of steel, if delivered at 95°F, will add 168,000 BTU to the hourly cooling load as shown:

0.12 BTU/LB/°F x 40,000 lbs. X 35°F = 168,000 BTU

In some cases (heating or cooling) there may be no concern for these added loads but you should be aware of the impact that hot and cold materials will have on the space temperature of the building. If it is important to bring these temperatures in line with the specified space temperature and to do it in a short time, the needed BTU must be added to the heating or cooling equipment capabilities.

TABLE 1

MATERIAL	SPECIFIC HEAT (BTU/LB/DEGREE F)
Ammonia	0.520
Bromine	0.107
Cement	0.186
Ethylene	0.334
Felt	0.198
Gasoline	0.500
Helium	1.240
Indi Rubber	0.481
Iron	0.101
Lead	0.030
Methyl Chloride	0.189
Olive Oil	0.471
Paper	0.324
Rubber Goods	0.480
Steel	0.120
Sulfuric Acid	0.344
Wood - Oak	0.570
Wood - Pine	0.670

LOCATION OF HEATING EQUIPMENT

In most warehouses, materials are stacked or shelved close to the ceiling or roof; therefore, it is difficult to place the heating apparatus in its most advantageous location. The stacks and shelves often cut off the flow of heated air or block the radiated waves from infrared heaters. If there is an opportunity to influence the storage pattern of the facility at the design stage, location of such equipment becomes much easier. However, many times the storage pattern has been determined in advance of the heat design or on some occasions, the heating must be added because of changes in material storage or the addition of work stations after the warehouse has been put into service. Such situations pose the greatest challenge. The following suggestions and recommendations may be helpful in arranging the equipment to the best advantage.

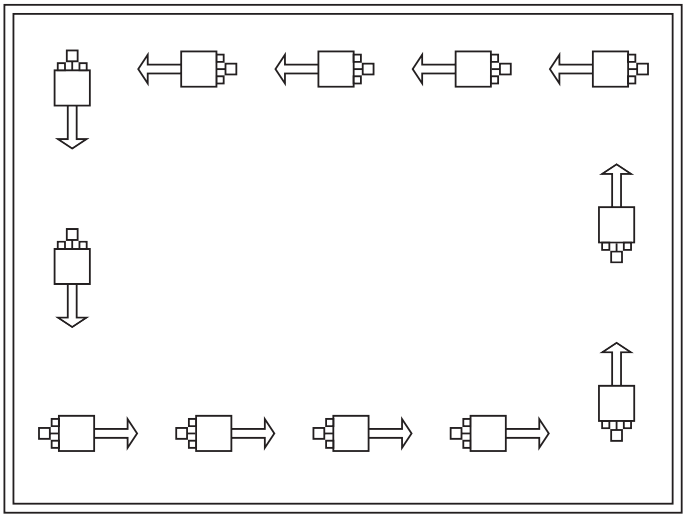
UNIT HEATERS

Figure 1 illustrates a perimeter hanging pattern for unit heaters. This technique has the greatest merit for several reasons:

1. The circular air flow pattern around the perimeter of the building is created when each unit heater fan supports the next
2. Access for service is maximized
3. Gas supply network is simplified
4. There is less chance of interference with the ehat flow from high stacked materials
5. Heat is concentrated along the walls where the greatest losses and the most infiltration occurs
6. Stacking of wares against outside wall is usually avoided, leaving a space for traffic and for unit heater location and operation

Distributing the heat to floor level is important and can be implemented

FIGURE 1



UNIT HEATERS are suspended overhead and in warehouse, are very often located around the perimeter as shown. Mounting heights are variable with unit size. Downturn nozzles are available to increase standard mounting height. Unit heaters may be used to circulate air in the summer months.

by the addition of downflow nozzles that are available from Reznor as optional accessories. Depending on unit size, air may be driven to floor level from as high as 36 feet. An air circulation rate for warehouses of 1 to 4 changes per hour is recommended by ASHRAE. By following these recommendations, temperature stratification should be kept to a minimum.

NOTE: When considering gas fired UNIT HEATERS for use in spaces that will be controlled at low temperatures (less than 60°F), we recommend the use of stainless steel heat exchangers and double wall vent pipe. Unless these steps are taken, early failure can occur due to corrosion from flue product acids.

INFRARED UNITS

Infrared units may also be installed around the perimeter of the building. However, when heating with infrared, the radiant heat rays must NOT be allowed to contact the exterior walls. Infrared heating is unique to the extent that the heating rays should all be direct at floor or objects that can re-radiate the heat. If the walls are heated, they simply lose the heat to the outdoors.

For this reason, infrared may not be suitable if it cannot be focused properly due to materials or shelving that block the heat rays. Infrared can be ideal in warehouses that store materials with low silhouettes or low stacking heights and are especially effective when the material in storage can re-radiate the infrared energies. Figure 2 illustrates a layout for low intensity infrared units and Figure 3 illustrates a somewhat different layout for high intensity infrared units.

FIGURE 2

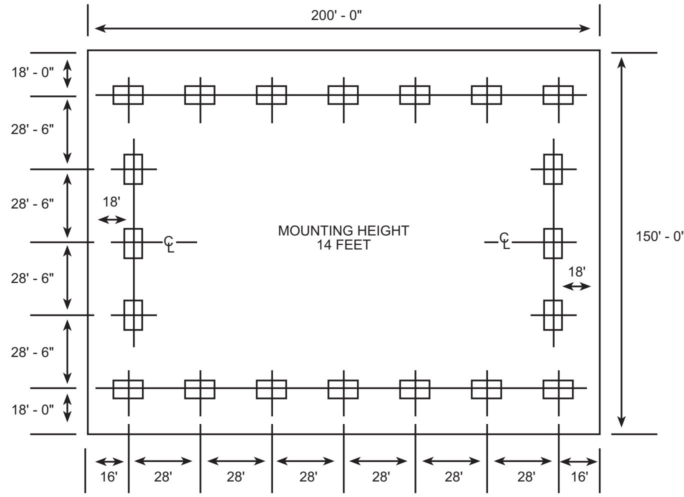
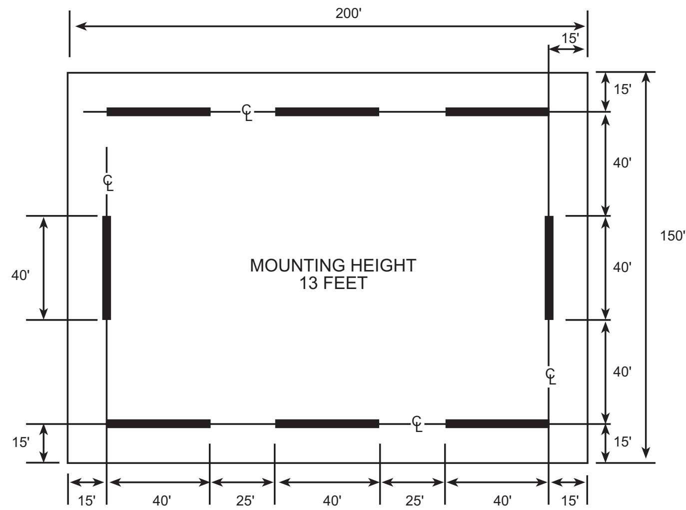


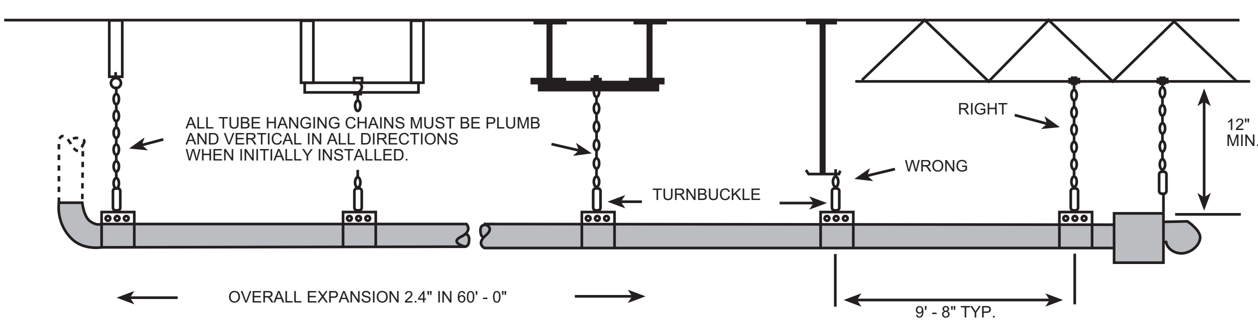
FIGURE 3



Infrared is especially effective in providing heat for people who are working in large open spaces, commonly found in warehouses. Where people are working around dock doors, infrared can be the most efficient method of heating. Since infrared does not heat the air, heat loss to the outdoors is minimized.

Infrared units are suspended overhead (see Figure 4). Installation is simple because they are easily hung in place using chains or metal rods. High intensity infrared units require clearances that cannot be overlooked if the materials in storage are combustible (fire hazard clearance are noted in the sales literature and in the installation manuals). The heat radiated from these units is absorbed by everything visible to the hot surface. Therefore, care must be exercised when materials in storage have tem-

FIGURE 4



perature limitations. Infrared units may be operated without vents; however, the space must be adequately ventilated to rid the environment of both harmful flue products and vapors. SPOT HEATING with infrared may be considered when the warehouse requires only minimal heat n where people are positioned in one place for on gong chores such as packaging, sorting or assembling.

An Infrared Handbook that illustrates spot heating is available from Reznor.

PACKAGED UNITS

CONVENTIONAL HEATING METHODS

Ducted air or "free blow" arrangements can be accomplished using larger, higher capacity units. The most common units cover ranges from 2,000 to 30,000 CFM and up to 3 million BTUH. High capacity units are offered by Reznor as duct furnaces or package units with integrated blower sections. Either indoor or outdoor units can be used depending on building construction, indoor space allocation or airflow optimization. The disadvantage of ductwork is in the space required for the ductwork and the cost of installation. Rooftop outdoor units often have an advantage in that valuable storage space is not used by the units. Rooftop units also have the advantage of high discharge placement that usually allows for good air distribution.

Large "package" units are available from Reznor as indirect fired or direct fired. Each has its own advantages and should be selected according to the particular building application. Indirect is especially good for applications where 100% recirculation is needed all of the time or just part of the time. Direct fired units are advantageous in applications where some outside air is necessary or beneficial during normal operation. Direct fired units have the advantage of efficiency. All of the sensible heat produced goes into the space resulting in 95% to 100% efficiency.

Another important advantage of larger package units is that they can be used in dual purpose roles for both space heating and ventilation. With the proper air damper selection and controls (regulating to space temperature or pressure), one unit can be used to provide heated outside air to replace exhausted air and can be used to control space temperature with recirculation. Many applications use indirect fired units to provide makeup air for exhaust during working hours and provide 100% recirculated heat during nighttime or off hours. Direct fired units can recirculate up to 75% of the total air capacity.

PRESSURIZED BUILDING HEAT AND AIR TURNOVER

This concept of pressurized building heating has recently gained a lot of popularity. Simply stated, a unit, usually direct fired, is used to provide heated air to the space. This is 100%, or at least a large percentage, outside air. The introduction of a significant amount of outside air into the space creates a positive pressure in the space. This pressure will naturally seek relief through openings in the building structure. In doing so, the heat is carried evenly throughout the space. The result is reduced stratification and reduced hot and cold spots. Ductwork and complex nozzle arrangements are not necessary. This method is especially suited for high ceiling buildings and areas divided by high shelving and other obstructions. Infiltration is reduced to a minimum or eliminated.

Direct fired equipment is often the unit of choice for two reasons. The first is efficiency. All of the available heat output from the burner is used, resulting in a 95% to 100% efficiency. The second reason is that the direct fired unit depends on significant outside air in order to dilute the by-products of gas combustion and provide for proper combustion. Since the pressurization requires a significant amount of outdoor air, both tasks are accomplished.

Recirculating units will produce discharge temperatures of 50° to 75° above room temperature. The advantage with pressurized building heat is that typical discharge air temperatures are within 5° to 10° above room temperature. This promotes less swing in space temperature. Most applications set up in this way will experience only 2° to 4° temperature difference between floor and ceiling.

Air turnover is used to heat a building by completely cycling the volume of air in the space, usually several times in a short period of time. This essentially does the same job of eliminate the stratification of temperatures from floor to ceiling. Higher air volumes are sometimes necessary to produce an acceptable air changeover rate. It is practical to think that while an air change rate of two per hour may relate to a 10° temperature difference from floor to ceiling, a higher air change rate of 4 per hour may relate to just 2° difference from floor to ceiling. It depends on the building heat loss and the ceiling height.

It has been found; however, that rates as low as one air change per hour can produce the desired conditions in the space when using pressurized methods. The disadvantage of using air turnover is that it may require more air changes, and it will potentially cause more swing in temperature. Modulation of the burner can of course offset much of the swing effect. On indoor installations, vertical configuration units are well suited. It will occupy floor space; however, and performance can be effected by obstructions to airflow.

To make the correct decision, one must determine what degree of stratification or temperature variance is allowable and what physical application constraints exist. The concepts of air turnover and pressurization can be used to great advantage in heating system design.

DETERMINING BTUH AND CFM REQUIREMENTS

When the heat loss/gain study has been completed, it will be noted that two BTUH loss loads are given. One covers BTU's that are lost to the outdoors through the walls, floor and roof (radiation losses). The other relates to the amount of cold air that is expected to leak into the building through cracks and crevices (infiltration losses). In wintertime, this infiltration adds to the heating load (BTU's) because the cold air must be warmed to the indoor design temperature. Infiltration also can be a conveyor of dust and dirt and therefore is a greater reason for the application of pressurized heating, especially when the health of the workers is at risk or when the quality of the work in process is threatened.

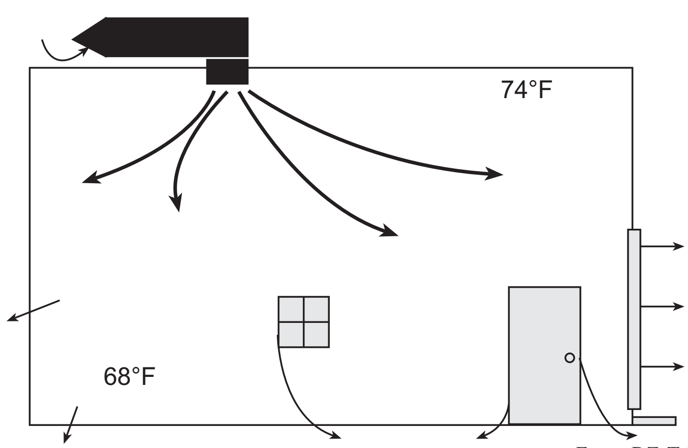
In many older buildings, the infiltration load is an unusually large part of the total hourly loss. In the newer buildings, infiltration loss is usually smaller, but will always exist because conventional construction has not reached the state where air tight buildings are expected.

When considering pressurized heating, there are three air flow volumes (CFM) that must be known:

1. Infiltration
2. Exhaust
3. Doorway in-rush

The infiltration rate is the most difficult to determine. ASHRAE standards are available for determining leakage around doors, windows, building joints and construction designs. Leakage is based on natural convec-

FIGURE 5



tion and the added force of wind pressure. Experience has shown that factories will have an infiltration rate between 10% and 100% of the building volume each hour. Because of such wide possibilities, we recommend that the ASHRAE guidelines be utilized to develop infiltration rates. This load should not be taken lightly since it is always a large part of the total building heat losses.

Powered exhaust may be used but is not prevalent in warehouse and storage buildings. Each exhauster includes the CFM and pressure information , either on the exhauster or in the technical literature that is normally shipped with each exhauster. To determine the amount of heat that is needed to replace the heat that is lost, simply use the following formula:

$$\mathbf{BTUH_{EXHAUST} = CFM_{EXHAUST} \times 1.085 \times DT}$$

Where:

$BTUH_{EXHAUST}$ is the BTUH lost through exhausters

$CFM_{EXHAUST}$ is the Total Exhaust

DT is the difference in the inside design temperature minus the outdoor design temperature

Doorways, when opened, permit cold outside air to enter, usually with a boost from the wind. The amount of heat that is needed to offset this intrusion can be easily computed. Use 15 MPH winds as a criterion converted to feet per minute (FPM).

15 MPH x 5280 feet per mile ÷ 60 minutes per hour = 1,320 FPM

Then apply the following formulas:

$$\mathbf{CFM_{DOOR} = 1320\ FPM \times AREA_{DOOR}}$$

$$\mathbf{BTUH_{DOOR} = CFM_{DOOR} \times 1.085 \times DT}$$

Where:

$AREA_{DOOR}$ is the door area measured in square feet

CFM_{DOOR} is the volume of air lost through the open door in cubic feet per minute

$BTUH_{DOOR}$ is the BTUH lost through the open door

DT is the difference in the inside design temperature minus the outdoor design temperature

If you feel that wind speed should be greater than 15 MPH, then make the adjustment before computing your final BTUH losses. Do not use less than 15 MPH wind velocity.

Another consideration is the amount of time the doors are open. This can significantly effect the final performance. Also, when *pressurized heating methods* are used, the doorway infiltration CFM may be reduced up to 50%. Over pressurization is not good since excess heat will be lost through the open door. In this type situation, a space pressure sensor can be used to control the heating/makeup air unit and insure that the unit is not causing heating to be lost to the outdoors.

After having determined the radiation losses, infiltration losses, exhaust losses and doorway losses, the heating requirements may be tabulated. This is the heating capability that will be needed for the winter design conditions.

CFM REQUIREMENTS FOR BUILDING PRESSURIZATION

In order to determine the amount of air flow that will be required for pressurization, the infiltration rte, exhaust CFM and the open door CFM must be totaled. This will be the amount of pressurized outside air that is needed to attain a theoretical neutral pressure within the building. As each door is closed and as each exhauster is turned off, the internal pressure will rise. If you desire to maintain a positive pressure inside the building during peak conditions (all doors open and all exhausters energized), the CFM will have to be increased. To do this we recommend that you double the open door CFM (bee sure to recalculate the BTUH losses for open doorways and revise the total heating capability before proceeding).

MAINTAINING PRE-SET BUILDING PRESSURE

Variable air flow damper systems can be provided to adjust to changing conditions within the building. Pressure sensing devices are available that monitor building pressure. These devices signal the damper system on the makeup air package to modulate to a new position, as the pressure conditions vary. By using this control, the amount of outside air being introduced will be adjusted to maintain the pre-set internal building pressure, usually within a range of 0.01 to 0.2 inches water column.

DIRECT FIRED OR INDIRECT FIRED PACKAGES

To assist you in deciding which burner *design* may be best for your particular application, here are a few differences of which you should be aware. First, each has its own burner characteristic. The DIRECT FIRED burner will modulate between 4% and 100% of the rated input and will operate within this input range while energized in the winter position. The INDIRECT FIRED burner will modulate between 50% and 100% of the rated input and will turn completely off during a normal cyclic pattern. In multiple furnace indirect fired units, staging may allow operation in increments of 15%, 25% or 50% of full input.

Secondly, the seasonal efficiencies vary between the two. The DIRECT FIRED package can exhibit up to 95% seasonal efficiency while the INDIRECT FIRED package will provide up to 80% seasonal efficiency.

Finally, the DIRECT FIRED package must have at least 25% of its total air flow volume introduced as outside air at all times. This is to support proper combustion and dilution of combustion by-products going into the space. Conversely, the INDIRECT FIRED unit can operate with 0% outside air, providing total recirculation of room air during nighttime or shutdown periods.

COMBINATIONS

The primary heating may be done with either unit heaters or with infrared. Then when ventilation, cooling or makeup air is needed an appropriate package unit can be specified. Most warehouse applications are best served by using a combination of heating and ventilation units to address specific but different problems in the building.

TABLE 2: REZNOR PRODUCTS FOR WAREHOUSE USE

TYPE	MODEL	FUEL TYPE	TYPE OF BURNER	TYPE OF VENT	NUMBER OF SIZES	MBH INPUT RANGE	MBH MECHANICAL COOLING RANGE	CFM RANGE	INSTALLATION TYPE	
									INDOOR	OUTDOOR
UNIT HEATER	F	Natural or Propane	Indirect Fired	Gravity Vent	20	25 - 400	N/A	245 - 6500	Ceiling Suspended	-
	B	Natural or Propane	Indirect Fired	Gravity Vent	20	25 - 400	N/A	245 - 6500	Ceiling Suspended or Base Mounted	-
	FE	Natural or Propane	Indirect Fired	Power Vent	20	25 - 400	N/A	245 - 6580	Ceiling Suspended	-
	BE	Natural or Propane	Indirect Fired	Power Vent	20	25 - 400	N/A	245- 6580	Ceiling Suspended or Base Mounted	-
	FT	Natural or Propane	Indirect Fired	Power Vent			N/A		Ceiling Suspended	-
	SFT	Natural or Propane	Indirect Fired	Separated Combustion			N/A		Ceiling Suspended	-
	SHE	Natural or Propane	Indirect Fired	Separated Combustion			N/A		Ceiling Suspended	-
	SCA, SCB	Natural or Propane	Indirect Fired	Separated Combustion	19	100 - 400	N/A	1230 - 4930	Ceiling Suspended	-
	OH, OB	Oil	Forced Exhaust	Power Burner	6	119 - 230	N/A	2000 - 3200	Ceiling Suspended or Base Mounted	-
	EGE, EGH, EXU	Electricity	N/A	N/A			N/A			-
	WS	Steam or Hot Water	N/A	N/A			N/A			-
INFRARED	RIH (H)	Natural or Propane		N/A	8	30 - 160	N/A	N/A	Ceiling Suspended	-
	TR (L)	Natural or Propane		Power Vent	18	50 - 200	N/A	N/A	Ceiling Suspended	-
	TRP (L)	Natural or Propane		Power Vent		30 - 100	N/A	N/A	Ceiling Suspended	Ceiling Suspended
	ERIC, ERC, ERHC	Electricity	N/A	N/A				N/A	Ceiling Suspended	-
	ERIE, ERE	Electricity	N/A	N/A				N/A	Ceiling Suspended	-
	ERIR, ERHR	Electricity	N/A	N/A				N/A	Ceiling Suspended	-
	ERIQT, ERQT, ERHQT	Electricity	N/A	N/A				N/A	Ceiling Suspended	-
	ERIQL, ERQL	Electricity	N/A	N/A				N/A	Ceiling Suspended	-
	ERIH	Electricity	N/A	N/A				N/A	Ceiling Suspended	-
INDIRECT FIRED PACKAGED SYSTEMS	SCE	Natural or Propane	Indirect Fired	Separated Combustion	9	125 - 400		990 - 5700	Ceiling Suspended or Base Mounted	-
	XE/CXE	Natural or Propane	Indirect Fired	Gravity Vent	2	975 - 400		615 - 5835	Ceiling Suspended or Base Mounted	-
	PGBL	Natural or Propane	Indirect Fired	Power Vent	6	360 - 1200		4000 - 12000	Ceiling Suspended or Base Mounted	-
	RGB/CRGB (C) (E)	Natural or Propane	Indirect Fired	Gravity Vent	20	75 -400		585 - 6635	Ceiling Suspended or Base Mounted	-
	RPB/CRPB (C) (E)	Natural or Propane	Indirect Fired	Power Vent	14	112 - 400		965 - 7100	-	Roof Curb or Base Mounted
	RGBL/CRGBL (C) (E)	Natural or Propane	Indirect Fired	Gravity Vent	14	360 - 1200		4000 - 14000	-	Roof Curb or Base Mounted
	SSCBL	Natural or Propane	Indirect Fired	Separated Combustion		400 - 1200		3100 - 13500	Ceiling Suspended or Base Mounted	-
	ACB		Indirect Fired			240 - 2500		4500 - 65000	Base Mounted	-
	PCB									
	CAUA (C)	Natural or Propane	Indirect Fired	Power Vent or Optional Separated Combustion		150 - 400	60 - 180	1600 - 6500	Base Mounted	-
	PCCA/PCDA	Natural or Propane	Indirect Fired	Power Vent		125 - 700	60 - 360	1200 - 7100	-	Roof Curb or Base Mounted
DIRECT FIRED PACKAGED SYSTEMS	ADF/ADFH (E)	Natural or Propane	Direct Fired	N/A	4	30 - 1250		2000 - 15500	Ceiling Suspended or Base Mounted	Roof Curb or Base Mounted
	RDF (E)	Natural or Propane	Direct Fired	N/A	8	750 - 3000		1000 - 28000	Ceiling Suspended or Base Mounted	Roof Curb or Base Mounted
	DFB	Natural or Propane	Direct Fired	N/A		70 - 8000		9000 - 75000	Ceiling Suspended or Base Mounted	Roof Curb or Base Mounted
	DV	Natural or Propane	Direct Fired	N/A		250 - 3000		750 - 22000	Base Mounted	Base Mounted

The unit heaters and infrared units listed in Table 2 are for heating only.
The package units are for both heating and ventilation.
Indirect fired package models with a prefix "C", direct fired packages, unit heaters and infrared units are approved for use in California.
(H) indicates high intensity infrared unit (2000°F radiant surface temperature).
(L) indicates low intensity infrared unit (700°F radiant surface temperature).
(E) indicates unit can be equipped with evaporative cooling.
(C) indicates unit can be equipped with cooling coils for chilled water or direct expansion (DX) cooling.
Models PCCA/PCDA are self-contained heating/cooling/makeup air units with on board compressors.

NOTICE

This bulletin is intended for general information only. In all cases, local and national mechanical and electrical codes must be followed. Also refer to and abide by the manufacturer's specific installation, operation and maintenance instructions for all equipment. Installation and service of equipment should be by licensed, qualified professionals only.

IMPORTANT

Read manufacturer's installation, operation and maintenance manuals thoroughly regarding all INSTRUCTIONS, CAUTIONS, WARNINGS and NOTICE STATEMENTS before specifying, installing, operating or servicing equipment.

WARNING

Improper specification, installation, operation or maintenance of equipment may cause:

- Severe personal injury or death and/or
- Conditions that may result in property damage.

The following precautions MUST be observed:

- Proper venting, gas and electrical supply according to national and local codes.
- Proper supply of combustion air for all gas and oil appliances.
- Proper application, setup and operation of all direct-fired heating equipment to eliminate buildup of CO (carbon monoxide) or other combustion gases in the conditioned space.
- Proper venting of indirect-fired heating equipment to exhaust all flue products to the outside atmosphere.
- Proper installation to prevent harmful gases in the discharged air caused by entrained liquid vapors (such as chlorinated or halogenated hydrocarbons) drawn across burner flames or hot surfaces.
- Proper environment/atmosphere or application to avoid fire or explosion from hazardous atmospheres containing flammable vapors or combustible dust.
- Avoiding the use, storage, containment and handling of gasoline or other flammable vapors and liquids in the vicinity of heating equipment.
- Specification of the proper equipment for the particular application.

SUMMARY

When evaluating a warehouse for heating, cooling, or ventilation, you can rely on the Reznor sales force to assist you in many ways. Contact your local Reznor factory representative or distributor sales representative and make use of their vast experience in the heating and ventilating field.

You may also wish to refer to these other Reznor Technical Application Bulletins

- SEPARATED COMBUSTION HEATING EQUIPMENT
- HEATING INDUSTRIAL AND COMMERCIAL BUILDINGS
- MAKEUP AIR AND VENTILATION FOR COMMERCIAL KITCHENS AND RESTAURANTS
- HEATING AND VENTILATING INDOOR SWIMMING POOLS
- VENTILATION FOR INDUSTRIAL BUILDINGS
- VENTILATION AND MAKEUP AIR FOR COMMERCIAL BUILDINGS
- WAREHOUSE HEATING AND VENTILATING
- MAKEUP AIR FOR PAINT BOOTHS
- GREENHOUSE HEATING AND VENTILATING
- INFRARED FLUX DENSITY (HEATING) CHARTS
- AIR TURNOVER: THE AIR MOVEMENT CONCEPT

MANUFACTURER OF GAS, OIL, ELECTRIC HEATING AND VENTILATING SYSTEMS
YL POD 9/01 Form RZ-T-WHV (Version .1)