REZNOR®

TECHNICAL TIPS

For installing, specifying or servicing Reznor HVAC equipment

The Hottest Name in HVAC for over 110 Years!

PRICE - $3.95

This handbook is furnished as a technical aid for those individuals who specify, install or service Reznor heating, ventilating, air conditioning or makeup air equipment.

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1 Symbols and Abbreviations

CFM	=	Cubic Feet of Air Per Minute (See Paragraph 3)
° F	=	Degrees Fahrenheit
° C	=	Degrees Celsius
Δ T	=	Temperature Difference
Δ P	=	Pressure Difference
BTU	=	British Thermal Units (Amount of heat needed to raise one pound of water one degree Fahrenheit)
BTUH	=	British Thermal Units Per Hour
WATTS	=	Measure of Work (Electrical)
OHMS	=	Measure of Resistance (Electrical)
HP	=	Horsepower
BHP	=	Brake Horsepower
RPM	=	Revolutions Per Minute
ESP	=	External Static Pressure (Duct and diffuser losses)
TESP	=	Total External Static Pressure (Includes ESP plus unit and accessory losses)
” W.C.	=	Inches Water Column (Pressure – See 12B and 12C)
” HG	=	Inches Mercury
KW	=	Kilowatts = 1,000 watts
KVA	=	1,000 Volt Amps (VA)
PF	=	Power Factor (Electrical

2 NEW YORK CITY APPROVALS

MODEL SERIES	MEA NUMBER
ADF/ADFH	251-93-E
B	55-89
BE	56-89
CAUA	333-98-E
DFAH/DFAV	287-96-E
EEDU/HEEDU	133-84-E
EEXL, CEEXL 125-400	135-81-E
EEXL, CEEXL 30-105	132-84-E
EEXLB/CEEXLB 30-105	42-85-E
EEXLB, CEEXLB 125-400	135-81-E
F	179-88
FE	180-88
FT 30-200	225-96-S
FT 250-300	273-97-E
OH/OB	169-93-E
OUH-OUB	66-75-E
PCCA/PCDA	228-00-E
RC/RCE/RCG	110-78-E
RG/CRG/HRG/HCRG	260-90-E
RDF	175-87
RIH	418-86-E
RIRH	57-87-E
RP/CRP/HRP/HCRP	259-90-E
RPV/HRPV	43-85-E
RTN	417-86-E
RX/CRX/HRX/HCRX	252-86
SC	109-78-E
SCA/SCB/SCE	44-85- E

2 NEW YORK CITY APPROVALS (cont'd)

SFT 45-300	273-97-E
TR	303-92-E
TRP	351-99-E
X/CX/HX/HCX	251-86-E
XL, CXL	105-78
XLB/CLXB 30-105	40-85-E
XLB/CXLB 125-400	41-85-E

A plate is available from Reznor to fasten to any of the above units that are installed under the jurisdiction of the New York City Dept. of Buildings. This plate includes the proper MEA number.

3 CFM DEFINED

CFM = (Cubic Feet Per Minute)

In convection heating the expression "CFM" is used to identify the amount of air in the circulating air stream or it may refer to the amount of air in the combustion process. All air quantities are given under standard air conditions of 70° F and one atmosphere (29.921"Hg). Change in either temperature or altitude causes the weight of the air to change but normally the volume remains constant. In Reznor convection equipment, the primary consideration is altitude. Increases in altitude cause the density (weight) of air to drop. This drop in density creates reduction in the amount of oxygen in the air. This affects combustion and also the lighter air causes an increase in the temperature rise across the heat exchanger. Therefore, the Reznor price sheet allows the specifier to select altitude for the specific installation location. When the altitude is selected, Reznor makes adjustments in the orifice sizing to accommodate for less dense air. The specifier takes into account the change in density and adjusts the specified air volume.

3A MEASURING RISE

The temperature rise through any convection heating unit can be measured but must be done in a specific manner to get meaningful results. If the rise is known, and the BTU output is known, then the CFM circulated airflow can be calculated and is more precise than most field measuring devices. Be certain that the unit has been supplied with prescribed gas pressures, oil pressures or voltage (depending on fuel to be used).

Once the furnace has been started and has been given time to reach level off temperatures, the input should be confirmed and the output calculated based on the unit thermal efficiency. (This information is usually provided on a rating plate attached to the appliance).

On gas fired equipment, the manifold pressure should be checked to make sure it is at the prescribed setting. A check of the gas flow at the meter can also be made, however you must be certain that all other gas burning equipment has been shut off.

Measure the time (T) in seconds for one cubic foot of gas flow - Then, using the following formula, determine the $BTUH_{INPUT}$.

$$\mathbf{BTUH_{INPUT} = 3600 \div T \times Heat\ Value\ (BTU)\ for\ 1\ ft^3\ gas}$$

Measure the inlet air temperature on a continuing basis, being sure to observe any fluctuations in this temperature.

Discharge temperatures should be measured at a distance from the heat exchanger that minimizes radiational effect on the measuring device. A distance of four feet should be adequate. Measure the discharge temperature by making at least ten measurements across the discharge duct. Be sure to pick up measurements top to bottom and side to side. Single measurements are not reliable due to temperature gradients in the discharge air.

Once the measurements are completed, the multiple discharge readings must be averaged. Then the temperature rise is determined by deducting the average inlet air temperature observed during the test.

CFM is then determined by the following formula.

$$\mathbf{CFM = BTUH_{INPUT} \times Efficiency \div 1.085 \div Temperature\ Rise}$$

> **NOTE:** Efficiency can be determined by referring to unit rating plate = (output ÷ input)

4 Clearances From Combustibles – Currently Manufactured Reznor Units

(Dimensions shown in inches)

Forced Air Heaters	TOP[A]	REAR	SIDE	CONTROL SIDE	BOTTOM	FRONT
Unit Heaters						
(Gas Fired)						
F25-125	2	24	18	-	12[H]	-
F165-400, FE, B, BE	6	24	18	-	12[H]	-
FT 30-75	1	18	1	18	1	-
FT 100-200	6	18	6	24	1	-
FT 250-300	6	24	6	24	1	-
SCA. SCB	6	24	6	W + 6"	6	-
SFT 45-75	1	18	1	20	1	-
SFT 100-200	6	18	6	24	1	-
SFT250-300	6	24	6	24	1	-
SHE	6	8	6	36-56	20	-
(Oil Fired)						
OB	6	6	18	18	6	48
OH	2	24	18	18	6	48
(Electric)						
AEUH	6	6	6	-	6	-
EUH	12	12	12	-	12	-
Duct Furnaces (Gas Fired)						
EEDU, HEEDU	6	29	6	-	12	-
RG/CRG/HRG/ HCRG	36	-	6[E]	W + 6", 10 Ft. Rad[C]	0[J]	-
RPV/HRPV	36[B]	-	6[E]	W + 6"	3	-
RP/HRP	36	-	6[E]	W + 6"	0[J]	-
RX/CRX/HRX/ HCRX	-	-	6[E]	W + 6", 10 Ft. Rad[C]	3	-
SC/HSC	6	-	6[E]	W + 6"	6	-
X/HX	6	-	6[E]	W + 6"	3	-
Packaged Units (Gas Fired)						
ADF, ADFH	0	-	0	Width of Unit	0	-
CAUA	1	0	Right Side - 0 Left Side - 0		0	3
DFBH/DFBV	0	-	0	As needed for service	0	-
DV	0	-	0	Width of Unit	0	-
PCCA Cabinet A	Open	120	36	50	0[J]	36
PCDA Cabinet B				60		
PGBL, SSCBL[D]	6	-	6[E]	56	6	-
RDF	3	-	3	Width of Unit	3	-
RGB/CRGB/HRGB/ HCRGB	-	-	-	W + 6", 10 Ft. Rad[C]	0[J]	-
RGBL, CRGBL[D]	-	-	6[E]	W + 6", 10 Ft. Rad[C]	0[J]	-
RPB/HRPB	36[B]	-	6[E]	W + 6"	0[J]	-
RPBL[D]	36[B]	-	6[E]	W + 6"	0[J]	-
SCE	6	-	6[E]	W + 6"	6	-
XE/HXE	6	-	6[E]	W + 6"	3	-

Infrared	TOP	BELOW	REAR	SIDES	FRONT[G]
(High Intensity)					
RIHVN 30, 60, RIHL 50	60	80 110[F]	30	30	80 110[F]
RIHVN 100, RIHVL 90	64	105 135[F]	30	36	105 135[F]
RIHVN 150, RIHVL 120	64	125 165[F]	33	46	125 165[F]
RIHVN 160	68	140 180[F]	33	48	140 180[F]
	TOP	**BELOW**	**BURNER END**	**OPPOSITE BURNER END**	**FRONT/ REAR**
(Low Intensity - Tubular)					
TR 50-100	12	66	24	24-36	30/30[K] 48/18[L]
TR 125-150	12	78	30	24-48	42/42[K] 66/32[L]
TR 175-200	12	84	30	24-48	54/54[K] 78/36[L]
	TOP	**BELOW**	**BURNER END**	**TURNING END**	**FRONT/ REAR**
TRP	6[M] 24[N]	72	24	18	24/24[K] 60/12[P]

[A] Cabinet and flue pipe where applicable

[B] Distance from overhangs to top of cabinet

[C] Radius from vent cap to nearest obstruction such as parapet, wall or buildings and other equipment

[D] From furnace

[E] Cabinet side opposite controls

[F] With optional parabolic reflector

[G] With RIH Models at 30 degree tilt

[H] When unit is equipped with discharge nozzle the bottom clearance is 42" - for service purposes, additional bottom clearance is recommended

[J] Unit is certified for installation on a combustible surface when equipped with standard heater mounting rails or curb cap

[K] Clearance to combustibles from the side of the heater when the reflector is set to 0° so heat radiates vertically downward

[L] When the reflector is angled, the FRONT indicates the side to which the heat radiates. The REAR indicates the side to the rear of the reflector.

[M] Vented units

[N] Unvented units

[P] When the unit is angled OR horizontal with a side shield, the FRONT indicates the side to which the heat radiates. The REAR indicates the side to the rear of the reflector.

W = width of unit at furnace (allows room to remove burner rack).

5 Gas Controls For Indirect Fired Units

The following gas controls are available with Reznor products. These are descriptions only of the various gas control systems. Certain gas controls are not suited for use with all Reznor heating equipment. The catalogs and price sheets identify where each control system may be used.

SINGLE STAGE (STANDARD) AG1

Each product will be equipped with single stage firing unless an optional control system is selected. Single stage units have either redundant valves (two safety valves in one body) or will be equipped with an ECO (energy cutoff) device. The ECO is a special limit control that is wired into the thermocouple on match lit systems. If for some reason, the standard limit fails to protect against excessive temperatures at the heat exchanger, the ECO will open the thermocouple circuit, allowing the safety pilot valve to drive closed, interrupting all gas flow. The ECO is not wired into the unit electrical supply, therefore it can act independent of the standard limit control. If for instance a foreign object should cause the main safety valve to stick in the open position, and the electrical supply has been interrupted, the standard limit control will be unable to shut down the burner. The ECO, however, will shut off the main burner and the pilot under these extreme conditions.

Optional Gas Controls For Indirect Fired Gas Furnaces

TWO STAGE - AG2

Two stage heating controls include single body halves having two stage capability built in. Low fire permits the unit to operate at 50% of the rated capacity. High fire drives the burner to full 100% firing of rated capacity. Two stage is controlled from a two stage room thermostat.

TWO STAGE WITH DUCTSTAT (MAKEUP AIR CONTROL) - AG3

The two stage valve described above is provided with a ductstat which is unit mounted and includes a capillary/bulb arrangement that is positioned to sense discharge air temperature. The ductstat has switching that controls the rate of firing as the temperature at the bulb rises or falls. The unit may be off, on low fire, or on high fire as the ductstat commands. The temperature adjustment for discharge air is at the ductstat and may be adjusted between 60° and 110° F as required for the particular application. For makeup air, the setting is generally adjusted to 65° or 70° F.

TWO-STAGE CONTROL WITH DUCTSTAT FOR MODELS RGBL, RPBL, PGBL AND SSCBL WITH TWO FURNACE SECTIONS (MAKEUP AIR) - AG4

A unit-mounted two-stage ductstat (60°-100°F) stages firing of the furnace sections. Each furnace section has a single-stage gas valve.

THREE-STAGE CONTROL WITH DUCTSTAT FOR MODELS RGBL, RPBL, PGBL, AND SSCBL WITH THREE FURNACE SECTIONS (MAKEUP AIR CONTROL) - AG5

Each furnace has a single-stage gas valve. Firing of the furnaces is controlled by two 2-stage ductstats (60°-100°F)

MECHANICAL MODULATION (MAKEUP AIR CONTROL) 50° - 100° F RANGE – AG6

The mechanical modulating valve has a capillary/bulb arrangement, the bulb drives the valve between 50% to 100% depending on the temperature at the bulb. If the temperature at the bulb drives up above the set point, the valve is designed to close. As the temperature at the bulbs drops, the valve opens at 50% flow and if further temperature drop occurs, the valve will drive towards the 100% setting. It may also modulate up and down between 50% and 100% flow.

MECHANICAL MODULATION WITH FULL FIRE BYPASS (MAKEUP AIR CONTROL)

50° - 100° F RANGE – AG13

Mechanical modulation with bypass has the same mechanical modulation control as above with the addition of a parallel single-stage valve. On call from a remote override thermostat, the single-stage gas valve cycles on at 100% fire.

ELECTRONIC MODULATION, 50%-100% FIRING RATE (HEATING) - AG7

Electronic modulation described here is used as a finite control of room temperature. The thermostat in this system is wall mounted and contains a thermistor to sense room temperature. The resistance of the thermistor varies with temperature. As the resistance changes, an amplifier at the unit picks up the signal and converts this information to a DC volt output that drives the modulating regulator between 50% to 100% of full fire. If the temperature at the thermistor drives above the set point (adjustable between 55° and 90° F), the amplifier acts to shut off the flow of gas by closing the safety valve. This system is particularly sensitive and provides room control within plus or minus 1°F. The amplifier, upon temperature fall at the thermistor, will open the safety valve and provide 10 seconds of high fire to assure good ignition of the main burner. After the ten second delay, the amplifier will drive to a position within the 50 to 100% modulating range.

ELECTRONIC MODULATION, 50%-100% FIRING RATE (MAKEUP AIR) AG8

Electronic modulation for makeup air operates similarly except that instead of a room thermistor thermostat, the unit is equipped with a discharge probe that contains a thermistor. The discharge air is monitored by the thermistor equipped probe and, as in the AG7 system, signals the amplifier which ultimately controls the flow of gas to the main burner. The discharge air can be adjusted between 55° and 90° F as dictated by the application but generally is set between 65° and 70° F. Adjustments of this setting are accomplished at the amplifier which is installed in the furnace.

ELECTRONIC MODULATION, 50%-100% FIRING RATE (MAKEUP AIR) REMOTE ADJ. AG9

The same system as AG8 but with the discharge temperature adjustment installed remote from the furnace. A potentiometer is shipped separately for installation by the contractor and can be located for convenience of the user. The potentiometer is calibrated for adjustment of the discharge air between 55° and 90°F.

ELECTRONIC TWO-STAGE CONTROL USING DUCTSTAT (50°-130°F) WITH REMOTE TEMPERATURE ADJUSTMENT - AG15

Same type of control as Option AG3, but the setpoint of the ductstat is adjustable from a remote temperature-selector. Includes factory-installed sensor and field-installed temperature-selector module with an adjustable stage-adder module.

ELECTRONIC TWO-STAGE CONTROL USING DUCTSTAT (50°-130°F) WITH REMOTE TEMPERATURE ADJUSTMENT AND TEMPERATURE DISPLAY - AG16

Same as Option AG15, plus a digital (liquid crystal) temperature-display module that provides selectable set point display and continuous display of sensor reading.

ELECTRONIC TWO-STAGE CONTROL FOR PGBL, SSCBL, RGBL AND RPBL WITH TWO FURNACE SECTIONS USING A DUCTSTAT (50°-130°F) WITH REMOTE TEMPERATURE ADJUSTMENT - AG17

Same type of control as Option AG4, but the ductstat has a remote temperature selector. Includes factory-installed sensor and field-installed remote temperature-selector module with an adjustable stage-adder module.

ELECTRONIC TWO-STAGE CONTROL FOR PGBL, SSCBL, RGBL AND RPBL WITH TWO FURNACE SECTIONS USING DUCTSTAT (50°-130°F) WITH REMOTE TEMPERATURE ADJUSTMENT AND TEMPERATURE DISPLAY - AG18

Same as Option AG17, plus a digital (liquid crystal) temperature-display module that provides selectable setpoint display and continuous display of sensor reading.

ELECTRONIC THREE-STAGE CONTROL FOR PGBL, SSCBL, RGBL AND RPBL WITH THREE FURNACE SECTIONS USING A DUCTSTAT (50°-130°F) WITH REMOTE TEMPERATURE ADJUSTMENT - AG19

Same type of control as Option AG5, but the ductstat has a remote temperature selector. Includes factory-installed sensor and field-installed remote temperature-selector module with two adjustable stage-adder modules.

ELECTRONIC THREE-STAGE CONTROL FOR PGBL, SSCBL, RGBL AND RPBL WITH THREE FURNACE SECTIONS USING A DUCTSTAT (50°-130°) WITH REMOTE TEMPERATURE ADJUSTMENT AND TEMPERATURE DISPLAY - AG20

Same as Option AG19, plus a digital (liquid crystal) temperature-display module that provides selectable setpoint display and continuous display of sensor reading.

ELECTRONIC MODULATION WITH DDC CONTROL - AG21

Used with customer-supplied 4-20MA or 0-10V input signal. Includes Maxitrol A200 signal conditioner and special modulating gas regulator.

ELECTRONIC FOUR-STAGE CONTROL WITH RPDBL WITH FOUR FURNACE SECTIONS USING DUCTSTAT (0°-130°F) WITH REMOTE TEMPERATURE ADJUSTMENT - AG23

Same type of control as Option AG5, but the ductstat has a remote temperature selector. Includes factory-installed sensor and field-installed remote temperature-selector module.

ELECTRONIC FOUR-STAGE CONTROL WITH RPDBL WITH FOUR FURNACE SECTIONS USING DUCTSTAT (0°-130°F) WITH REMOTE TEMPERATURE ADJUSTMENT AND TEMPERATURE DISPLAY - AG24

Same as Option AG23, plus a digital (liquid crystal) temperature-display module that provides selectable setpoint display and continuous display of sensor reading.

ELECTRONIC MODULATION BETWEEN 20% - 28% AND 100% FIRING RATE (U.S. PATENT NO. 6,109,255) FOR MODELS RP, RPB, SC, SCE; AND THE 400 SIZE OF MODELS RPBL AND SSCBL - AG39

Electronic modulation gas control that will provide precise control of discharge air temperature over an increased range of outside air conditions. This option allows the furnace input ratio to be fully modulated between 100% and 28 to 20%.

ELECTRONIC MODULATION BETWEEN 20% - 28% AND 100% FIRING RATE (U.S. PATENT NO. 6,109,255) WITH DDC CONTROLS FOR MODELS RP, RPB, SC, SCE; AND THE 400 SIZE OF MODELS RPBL AND SSCBL - AG40

Same as Option AG39, but includes signal conditioner for use with customer-supplied 4-20MA or 0-10V input signal.

ELECTRONIC MODULATION BETWEEN 20% - 28% AND 100% FIRING RATE FOR MODELS PCCA AND PCDA - AG41

Electronic modulation gas control that will provide precise control of discharge air temperature over an increased range of outside air conditions. This option allows the furnace input ratio to be fully modulated from 100% to 28/20% (depending on the unit).

This gas control can also be used on units with two furnace sections effectively lowering the modulation to 14%/10% (depending on the unit).

ELECTRONIC MODULATION BETWEEN 20% - 28% AND 100% FIRING RATE WITH DDC CONTROLS FOR MODELS PCCA AND PCDA - AG42

Same as Option AG41, but includes signal conditioner for use with customer-supplied 4-20MA or 0-10V input signal.

Optional Controls Available For Use With Direct Fired Units and Suitable for use With Either Natural Gas or Propane Gas

ELECTRONIC MODULATION (STD) AG30

The Maxitrol Series 14 system used on Direct Fired Makeup Air Units has an adjustment range of 55° to 90°F and includes a remote potentiometer. This system operates similarly to the AG9 system described above, however, the modulating control valve starts on low fire (low fire is 4% of the maximum burner rating.)

ELECTRONIC MODULATION WITH ROOM OVERRIDE AG31

This system is the same as AG30 except it includes a room override thermostat (T115). A rheostat located at the remote adjustment may be set between 0° and 40° F. When the room thermostat senses air temperature below set point, the discharge air temperature setting is adjusted upward, the same amount that has been selected at the rheostat. When the thermostat reverts back to the original setting that is between 55° and 90° F.

ELECTRONIC MODULATION - AG32

Same as Option AG30 except adjustment range is 80° to 120° F and may not have room override thermostat.

ELECTRONIC MODULATION CONTROLLED FROM ROOM SELECTRASTAT AG33

This system is a Maxitrol Series 44 which is capable of adjusting the discharge air temperature based on the temperature at the wall mounted Selectrastat. The discharge temperature may be set on the low end between 40° and 80° F, and on the high end between 80° and 120° F through the use of two separate adjustments at the amplifier. As the temperature at the Selectrastat changes, the discharge temperature changes to compensate for either heat gain or heat loss in the space.

ELECTRONIC MODULATION - AG35

Same as Option AG30 with discharge air temperature range of 120°-140°F.

ELECTRONIC MODULATION FOR PAINT BOOTH APPLICATIONS - AG36

Includes digital readout, two remote temperature selectors (Dry Selector either 80°-120°F or 80°-140°F; and Spray Selector 60°-90°F), Amplifier, two switches (dry/spray and summer/off/winter). All controls are mounted on a remote console.

ELECTRONIC MODULATION WITH DDC CONTROL - AG37

Used with customer-supplied 4-20MA or 0-10V input signal. Includes Maxitrol A200 signal conditioner and special modulating gas regulator.

6 Air Control (Damper) Systems

REZNOR	DAMPERS		DAMPER MOTOR		END	MIXED AIR CONTROL	OUTSIDE AIR CONTROL		MANUAL	PRESSURE
OPTION	O.A	R.A	2-POS	MOD*	SWITCH*	(SEE NOTE)	(SEE NOTE)	POTENTIOMETER	ADJUST	NULL SWITCH
AR8	X	-	X	-	1	-	-	-	-	-
AR9	X	-	-	X	-	-	-	1	-	-
AR10	X	-	-	X	-	-	-	2	-	-
AR11	X	X	-	-	-	-	-	-	X	-
AR12	X	X	-	X	-	X	-	-	X	-
AR13	X	X	-	X	-	X	-	1	-	-
AR14	X	X	X	-	1	-	X	-	-	-
AR15	X	X	-	X	-	X	X	1	-	-
AR16	X	X	-	X	-	X	X	-	-	-
AR17	X	X	X	-	1	-	-	-	-	-
AR18	X	X	-	X	-	-	-	1	-	X
AR23	X	X	-	X	-	-	-	-	-	X
AR27	X	X	-	X	-	-	-	-	-	X

* Modulating Damper Motor may have end switches (2) added by selecting option AT2 (not available on Direct Fired Damper Motors)

6 Air Control (Damper) Systems (cont'd)

DIRECT FIRED MODELS RDF, DV (Refer to catalog or price sheet for availability)

REZNOR	DAMPERS				DAMPER		PRESSURE	TOGGLE	COMPUTER	PHOTOHELIC PRESSURE
OPTION	DISCHARGE	BYPASS	RETURN	INLET	MOTOR	POTENTIOMETER	NULL SWITCH	SWITCH	CONTROL	SENSOR
AR19	X	X	-		Mod-Non Spring	X	-			
AR20	X	X	-		Mod-Non Spring	-	X			
AR22	-	X	X		Mod-Non Spring	X	-			
AR23	-	X	X		Mod-Non Spring	-	X			
AR32		X	X		2-Position			X		
AR33	X	X			Mod-Non Spring				X	
AR34		X	X		Mod-Non Spring				X	
AR35				X	2-Position					
AR36	X	X			Mod-Non Spring					X
AR37		X	X		Mod-Non Spring					X

Following is a description only of Air Control Systems. Some damper control arrangements are not available on all Reznor units. Please consult the specific product catalog, price sheet or your Reznor Representative to determine which arrangements can be used on specific equipment.

Recommended application of above air control systems.

Indirect Fired Models

AR8 Use when makeup air unit is to be turned on and off.

AR9 Use when makeup air must be two step. Minimum flow adjusted at potentiometer.

AR10 Use when makeup air will be three step. Minimum and intermediate flow adj. at two separate potentiometers.

AR11 Use for manual (fixed) adjustment of return air (R.A.) and outside air (O.A.)

AR12 Use when atmospheric cooling is required. Mixed air control provides mix temperature adjustment.

AR13 Same as AR12 except minimum outside air percent can be fixed by potentiometer adjustment.

AR14 Use when night cycle is 100% return air, and day cycle is 100% outside air for makeup air duty. O.A. controller used for warm up air return air from night setback.

AR15 Same as AR13 except O.A. controller used for warm up of return air from night setback.

AR16 Same as AR12 except O.A. controller used for warm up of return air from night setback.

AR17 Use when night cycle is 100% return air and day cycle is 100% outside air for makeup air duty.

AR18 Use for varying amounts of ventilation air that is adjusted from remote potentiometer.

AR23 (Indirect Fired) Use for varying amounts of ventilation air that is adjusted automatically by a pressure null switch.

AR24 Cabinet with both horizontal and vertical opening to be used with field-supplied damper system.

AR25 Modulating outside return air dampers with DDC interface.

AR26 100% outside air and 100% return air dampers with modulating motor (0-100% outside air - no controls)

AR27 Use for varying amounts of ventilation air that is adjusted automatically by a pressure null switch.

AR30 Vertical cabinet with screened intake stand open on 4 sides. **Model ACB only.**

AR31 Vertical cabinet with screened intake stand open on 3 sides. **Model ACB only.**

AR38 Duct flange (in lieu of screened opening).

AR46 Screened inlet, 2 sides - no damper. **Model PCB - horizontal units only.**

AR50 100% Outside Air with dampers, no motor.

Indirect Fired Models (cont'd)

AR51 30-50% Horizontal Return Air/Horizontal Outside Air Inlet.

AR52 30-50% Upflow Return Air/Horizontal Outside Air Inlet.

Direct Fired Units

AR19 Use on DIRECT FIRED for variable air flow – controlled from remote potentiometer (allows 25 to 100% of CFM to enter building)

AR20 Same as AR19 except air volume is controlled from remote pressure null switch.

AR22 Use with DIRECT FIRED for air recirculation – controlled from remote potentiometer. (allows up to 75% of CFM to be recirculated from space.)

AR23 (Direct Fired) Same as AR22 except recirculated air volume is controlled from remote pressure null switch.

AR32 Two-position outside and return air system. Outside, bypass and return air dampers with two-position actuator. Change between 100% outside air to 20% outside/80% return air. Control is with an SPDT toggle switch mounted on a 4x4 box.

AR33 100% Outside air with variable supply air volume (minimum 20% rated air supply). Discharge and bypass dampers with modulating actuators. Control of discharge damper from a field-supplied 0-10 VDU or 40-20 milliamp signal (computer control).

AR34 Combination outside makeup and bypass return air (maximum 80% return air). Outside air, bypass and return air dampers with modulating actuators. Control of return air damper from a field-supplied 0-10 VDC or 40-20 milliamp signal (computer control).

AR35 Two-position (open/closed) inlet shutoff damper.

AR36 100% outside air with variable supply air volume (minimum 20% rated air supply). Discharge and bypass dampers with modulating actuators. Control of discharge damper from a remotely located photohelic pressure sensor.

AR37 Combination outside makeup and bypass return air (maximum 80% return air). Outside air, bypass and return air dampers with modulating actuators. Control of return air damper from a remotely located photohelic pressure sensor.

AR40 100% outside air with variable supply air volume. Same as AR19 with space pressure control from a remotely located solid state panel (panel shipped separately) - up to 4 units can be controlled from one panel. **Model DFB only.**

AR41 100% outside air with variable supply air volume. Same as AR19 with Autocycle control with two exhaust fan interlocks. **Model DFB only.**

AR42 100% outside air with variable supply air volume. Same as AR19 with Autocycle control with three exhaust fan interlocks. **Model DFB only.**

AR43 Combination outside makeup air and recirculation heat system. Same as AR22 with space pressure control from remotely controlled solid state panel (panel shipped separately) - up to 4 units can be controlled from one panel. **Model DFB only.**

NOTE: Outside air (O.A.) controller may be used to sense outside air temperature or may be used in the return air duct to monitor return air temperature. Adjustment is 0° to 100° F.

6A Damper Motors

Used On Reznor Indirect Fired Packages

TWO POSITION

White Rodgers #3405-21 or #3402-9 both have single end switch.

MODULATING

Minneapolis Honeywell #M965A 1007 or 9175 1015 less end switches

Minneapolis Honeywell #M975B 1030 or 9175 C1008 with two end switches.

Used on Reznor Direct Fired Models RDF, ADF, DV

TWO POSITION

RDF1	Minneapolis Honeywell #M6414A 1007 or M8415A 1004
RDF2 & 3	White Rodgers #3402-9
ADFH	Horizontal discharge - Minneapolis Honeywell #ML6474A1008
	Vertical discharge - Minneapolis Honeywell #ML6161A1001
DV	#JC M 9216-BGC-2

MODULATING

RDF1	Minneapolis Honeywell M6414A 1007 or Minneapolis Honeywell M6414A 1009
RDF2 & 3	Minneapolis Honeywell M644E 1012 or M9175A1015 Minneapolis Honeywell M6414A 1007 or M6194B1011
DV	J/C #M9108-AGA-2, #M9216-JCCG-2 or #M9116-ACG-2

There are no end switches available on the direct fired damper motors.

6B General Description for Direct Digital Control Systems Control Packages - Models RGB and RPB Only

Option D1 Strategy

Option D1 is programmed to automatically control a dual damper arrangement to maintain a mix of outside and return air to meet the mixed air temperature setting of the control. The UNT controller continually monitors the outside air, discharge air, and zone sensors and modulates the dampers to provide economizer temperature control. If the actual zone temperature continues to separate from the zone setpoint the controller will automatically raise the discharge air setpoint until the zone temperature is reached.

Option package D1 also maintains a minimum factory default setting of 15% outdoor air as a percentage of total air through the system.

Zone temperature as selected by the building management system is maintained through an electronic gas modulating control. (The factory default setting is 72°F).

Option D2 Strategy

Option D2 is programmed to automatically provide intermittent makeup air through control of a two-position, 100% outside air damper arrangement. The UNT controller continually monitors the field installed outside air, discharge air and zone sensors to maintain a constant discharge air temperature. If the actual zone temperature continues to separate from the zone setpoint, the controller will automatically adjust the discharge air setpoint until the zone temperature setpoint is reached.

Zone temperature as selected by the building management system is maintained through an electronic gas modulating control. (The factory default setting is 72°F).

Option D3 Strategy

Option D3 is programmed to automatically control a dual damper arrangement to maintain a mix of outside and return air to meet the mixed air temperature setting of the control. The UNT controller continually monitors the field installed outside air, discharge air and zone sensors and modulates the dampers to provide economizer temperature control. If the actual zone temperature continues to separate from the zone set point the controller will automatically raise the discharge air setpoint until the zone temperature is reached.

Option package D3 also maintains a minimum factory default setting of 15% outdoor air as a percentage of total air through the system.

Zone temperatures as selected by the building management system is maintained through a 2-stage gas control. (The factory default setting is 72°F)

Option D4 Strategy

Option D4 is programmed to automatically provide intermittent makeup air through control of a two-position, 100% outside air damper arrangement. The UNT controller continually monitors the field installed outside air, discharge air and zone sensors to maintain a constant discharge air temperature. If the actual zone temperature continues to separate from the zone setpoint, the controller will automatically adjust the discharge air setpoint until the zone temperature setpoint is reached.

Zone temperature as selected by the building management system is maintained through a 2-stage gas control. (The factory default setting is 72°F)

7 Derating of Gas Fired Units

All gas fired units may be down-rated from their listed input by as much as 20%. Derating may be done by installer or service technician (by orifice sizing). For correct orifice sizes, the factory should be contacted. You must have the unit model number and the type of gas for proper orifice sizing to be computed.

8 Reznor Duct Furnaces Used in Drying Applications

Please read the following recommended steps for sizing and specifying drying systems. After reading, you may elect to set up your own specifications, but we suggest that you contact Reznor Application Engineering to confirm your selections and performance criteria.

Reznor indoor duct furnaces are used frequently in drying applications where air in motion transports the heat to the space where the drying is usually done at elevated temperatures.

In most drying applications, a certain amount of ventilation and exhaust is utilized in order to carry away the moisture that is driven from the material being dried. Practice has shown that approximately 10% of the air volume should be used to ventilate the drying space.

Sizing of the heat source is important in order to obtain efficient and timely drying. The heat loss of the drying space needs to be calculated. Then the BTU necessary to dry the material must also be calculated (*) and added to the heat loss of the drying space. Also, allowance must be made in the air flow volume to provide ventilation, and BTU's added to accommodate the added air that is needed. In order to do this, the total BTU's (oven losses + drying losses) must be multiplied by 1.3. This will provide approximately 10% ventilation rate to evacuate moisture. Once these calculations have been completed, the total is the BTUH required to complete the drying process in one hour. An example shown below outlines the procedures for converting these numbers to accommodate other than one hour drying time.

(*) Most drying applications are designed to eliminate water – One

8 Reznor Duct Furnaces Used in Drying Applications (cont'd)

pound of water requires the addition of 970 BTU's for complete evaporation. For other liquids refer to the ASHRAE Handbook of Fundamentals. Do not forget to add the BTU's required to raise the temperature of the material being dried. You will need to know the specific heat (BTU's required to raise one pound of the material one degree Fahrenheit). Then multiply the weight in pounds X specific heat X temperature rise. By adding the evaporation load and the specific heat requirements, the total BTU requirements for drying the material will be known.

EXAMPLE: Drying oven radiational losses = 25, 000 BTU

BTU required to dry contents = 140, 000 BTU

Total BTUH losses = 165, 000 BTUH

Multiplier to add ventilation (165,000 x 1.3) = 214,500 BTUH

BUTH required to provide ventilation = 49,500

To determine BTUH required to dry contents in ½ hour:

BTU required to dry contents = 140,000

BTU required to offset oven losses = 25,000 X .5 = 12,500

BTU required to offset ventilation = 49,500 X .5 = 24,750

Total BTU's for ½ hour drying time = 177,250

Since gas fired units are rated in BTU per hour, we have to size the equipment so that the required BTU's are available in the ½ hour time frame desired. Therefore, the equipment required is determined by dividing the total above by .5 (177,250/.5) = 354,500 BTUH. This answer must be divided by the efficiency of the unit in use (354,500/.77) = 460,389 BTUH input.

Since the 460,389 BTU is greater than our largest duct furnace, we logically will need two furnaces. By dividing 460,389 by two, we find that we need two furnaces that have inputs of at least 230,194 BTUH. Our selection would be two X250 duct furnaces.

The furnaces must be installed in tandem (series).

Furnace and blower assembly must not be installed in the oven space.

The maximum rise through a given unit should not exceed 70° F.

Therefore, by dividing the unit output (385,000 BTUH) by 1.085 and then dividing the answer by 140 (70 x two units) we can determine the airflow that is required. The answer is 2534 CFM. This is the minimum amount of air to be directed through the system.

Part of the total air volume should be fresh air with an exhaust system in the drying space to evacuate moisture. We recommend approximately 10% of the total airflow to be ventilation air for this purpose. The balance of the air volume will be recirculated from the oven.

The X series of duct furnaces is recommended since they are gravity vented appliances. (Power vented furnaces should never be used for drying ovens).

Due to the high temperature normally used in drying processes, the controls in the X furnace must be relocated outside of the cabinet. It will be necessary to re-pipe the gas controls and move all electrical accessories to the outside of the cabinet. If this is not done, the controls and electrical accessories will become too hot and fail prematurely.

IMPORTANT: Never operate unit without having the outer panels (doors) in place.

The standard limit control in these appliances will not function properly in this application, therefore another limit control will be needed and should be of the adjustable variety so it can be adjusted to a setting about 50 degrees higher than the oven control temperature. One that can be considered is the White Rodgers Model 1002-6 with 72" capillary. This control has an adjustment range of 100° to 500° F. The bulb should be located in the air stream, immediately downstream from the furnace heat exchanger.

Maximum oven temperatures are suggested as follows:

Units with aluminized steel heat exchanger

MAX OVEN TEMP = 180°

Units with 409 stainless steel heat exchanger

MAX OVEN TEMP = 250°

Units with 321 stainless steel heat exchanger

MAX OVEN TEMP = 400°

The Reznor RBHA blower assembly may be used since it is designed to handle elevated return air temperatures. The motor, drive and bearings are all located outside of the air stream. This blower, however, is limited to about 6000 CFM. If the system requires greater air volumes, another blower having these same characteristics must be used.

SPECIAL NOTE: If starters or contactors are used, be sure they are adequately protected from radiant heat. Starters having overload devices, if exposed to excessive ambients, will tend to trip prematurely and may require higher rated overload devices and in some cases, larger size starters.

NOTE: Reznor duct furnaces have not been certified for use in systems where the final control temperature exceeds 104° F. Therefore, when units are used in drying applications, the C.S.A. seal becomes void, and the warranty of the product is no longer valid. However if the proceeding recommendations are followed, the equipment should perform reliably and provide continued drying or baking.

8A Pull Through Duct Furnaces

Duct furnaces must always be installed downstream from the air mover. National standards do not permit duct furnaces to be installed upstream from air movers. The rationale is that if the heat exchanger or gasket should fail, the negative pressure will pull products from the combustion zone and deposit them into the circulating airstream.

8B Maximum Static Pressure For Duct Furnaces

Furnaces are tested under ANSI standards at 2 inches water column external pressure. The maximum total pressure that may be imposed against the heat exchanger of a duct furnace is 3.9 inches water column.

9 Seasonal Efficiencies of Various Heating Systems

Following may be used as a guide in determining fuel consumption for various heating systems.

SYSTEMS	SEASONAL EFFICIENCY
Gas Fired Gravity Vent Unit Heater	64%
Energy Efficient Unit Heater	80%
Ultra High Efficiency Unit Heater	92%
Electric Resistance Heating	100%
Steam Boiler with Steam Unit Heaters	65-80%
Hot Water Boiler with Hydronic Unit Heaters	65-80%
Oil Fired Unit Heaters	78%
Municipal Steam System	66%
Infrared (High Intensity)	85%
Infrared (Low Intensity)	87%
Direct Fired Gas Makeup Air	94%
Improvement with Power Venter added to Gas Fired Gravity Vent Unit Heater	4%
Improvement with Spark Pilot added to Gas Fired Gravity Vent Unit Heater	1/2-3%
Improvement with Automatic Flue Damper and Spark Pilot added to Gravity Vent Unit Heater	8%

10 Flue Gas Characteristics

Models	Approximate Volume (CFM/100,000 BTUH Input)	Maximum Gross Temperature under normal operating conditions
X, F, B, SFT, FT, CAUA	50	400 degrees F
RG, RX, SC, RPV, RP, FE, BE, EEDU	35	425 degrees F

EFFLUENTS	**NATURAL GAS**	**PROPANE GAS**
Carbon Monoxide	.0009 Lbs/100,000 BTUH Input	.0008 Lbs/100,000 BTUH Input
Carbon Dioxide	11.25 Lbs/100,000 BTUH Input	13.8 Lbs/100,000 BTUH Input
Water Vapor	9.21 Lbs/100,000 BTUH Input	7.6 Lbs/100,000 BTUH Input

NOX (Nitrous Oxide) will not exceed 110 PPM on any of the Indirect Fired Reznor Units. (Tests on separated combustion units used for above NOX levels)

10A U.S. Public Health Information

The following was taken from the Occupational Safety and Health Administration web site at:

www.osha-slc.gov/OshStd_toc/OSHA_Std_toc_1910.html.

OSHA Regulations (Standards - 29 CFR)

Air contaminants. - 1910.1000

OSHA Regulations (Standards - 29 CFR) - Table of Contents

Standard Number: 1910.1000

Standard Title: Air contaminants.

SubPart Number: Z

SubPart Title: Toxic and Hazardous Substances

An employee's exposure to any substance listed in Tables Z-1 of this section shall be limited in accordance with the requirements of the following paragraphs of this section.

(a)

"Table Z-1."

(a)(2)

"Other substances" - "8-hour Time Weighted Averages." An employee's exposure to any substance in Table Z-1, shall not exceed the 8-hour Time Weighted Average given for that substance any 8-hour work shift of a 40-hour work week.

[The following are Particulate Emission Levels (PELs) for selected substances from Table Z-1 of the above referenced document.]

Substance	**PEL**
Carbon dioxide	5000 ppm
Carbon monoxide	50 ppm

PEL is the Particulate Emission Level measured in parts per million (ppm). The PELs are 8-hour Timed Weighted Average (TWAs) unless otherwise noted. They are to be determined from breathing-zone air samples.

ppm - Parts of vapor or gas per million parts of contaminated air by volume at 25°C.

Carbon Monoxide (CO) - Product of incomplete combustion

Carbon Dioxide (CO_2) - Product of complete combustion

Nitrogen Oxides (NOx) - Product of normal combustion

INDIRECT FIRED UNITS that are properly installed do not release CO, CO_2 and NOx to the indoor air.

DIRECT FIRED UNITS, HIGH INTENSITY RADIANT HEATERS and UNVENTED LOW INTENSITY HEATERS release CO, CO_2 and NOx to the indoor air. When these heaters are installed and operated with the recommended outside air ventilation as listed in the appropriate installation instructions, the concentration of CO, CO_2 and NOx will not exceed the OSHA limits.

For more information on occupational safety and health standards visit the Occupational Safety & Health Administration web site at: www.osha.gov.

11 Formulas

Find CFM	BTUH Output ÷ 1.085 ÷ ΔT
Find BTUH	CFM x 1.085 x ΔT
Find Temperature Rise (ΔT)	BTUH Output ÷ 1.085 ÷ CFM
Find BTUH Input	BTUH Output/Unit Thermal Efficiency
Weight of Water	One Gallon = 8.347 Pounds.

11A Electrical Formulas

E = Volts

I = Amps

% EFF = Percent Efficiency

PF = Power Factor

To Find:	For Single Phase	For Three Phase
Kilowatts (KW)	$\frac{I \times E \times PF}{1000}$	$\frac{I \times E \times 1.73 \times PF}{1000}$
KVA	$\frac{I \times E}{1000}$	$\frac{I \times E \times 1.73}{1000}$
Horse power (HP)	$\frac{I \times E \times \%EFF \times PF}{746}$	$\frac{I \times E \times \%EFF \times 1.73 \times PF}{746}$
Amps from KVA	$\frac{KVA \times 1000}{E}$	$\frac{KVA \times 1000}{1.73 \times E}$
Amps from KW	$\frac{KW \times 1000}{E \times PF}$	$\frac{KW \times 1000}{1.73 \times E \times PF}$
Amps from HP	$\frac{HP \times 746}{E \times \%EFF \times PF}$	$\frac{HP \times 746}{1.73 \times E \times \%EFF \times PF}$

12 Fuel Comparisons

This provides equivalent BTU Data for Various Fuels

Natural Gas	1,000,000 BTU = 10 Therms or
	1,000,000 BTU = (1000 Cu. Ft.)
Propane Gas	1,000,000 BTU = 46 Lb. Or
	1,000,000 BTU = 10.88 Gallon
No. 2 Fuel Oil	1,000,000 BTU = 7.14 Gallon
Electric Resistance	1,000,000 BTU = 293 KW (Kilowatts)
Municipal Steam	1,000,000 BTU = 1000 Lbs. Condensate
LP/ Air Gas	1,000,000 BTU = 46 Lb. Propane or
	1,000,000 BTU = 10.88 Gallon Propane or
	1,000,000 BTU = 690 Cu. Ft. Gas/Air Mix

12A Fuel Gas Characteristics

Natural Gas - 925 to 1125 BTU/ft^3	.6 to .66 Specific Gravity
Propane Gas - 2550 BTU/ft^3	1.52 Specific Gravity
* LP/Air Mix - 1425 BTU/ft^3	1.29 Specific Gravity

* Before attempting to operate units on these fuels, contact factory.

12B Gas Pressures

Reznor gas INDIRECT FIRED products have been tested, certified and assembled with controls that are not to be operated against an inlet pressure above ½ lb. (14 inches W.C.) pressure. Gas pressures in excess of ½ lb. can damage the gas controls, and can create hazardous conditions. If gas pressures in the inlet gas supply line exceed ½ lb., another regulator must be installed in the supply line ahead of the unit regulator, and it is mandatory that the high pressure regulator be of the lock up type. In some cases, local codes may require venting to outside depending on pressure and capacity.

Following are the typical gas **inlet supply pressures**. For actual required pressures, refer to the rating plate information.

FOR INDIRECT FIRED UNITS

Natural Gas – Max-14” w.c.; Min-5” w.c.

Propane Gas – Max-14” w.c.; Min-10” w.c.

MANIFOLD PRESSURES

Full Rated Input	– Natural Gas = 3.5" W.C.*
	- Propane Gas = 10" W.C.
Low Fire Input	- Natural Gas = .9" W.C.
	- Propane Gas = 2.5" W.C.

*5.0” W.C. on Model TR size 175 and 200

FOR DIRECT-FIRED UNIT GAS PRESSURES,

REFER TO THE UNIT RATING PLATE.

12C Pressures

NOTE: Supply gas pressure should always be checked on the rating plate for safety.

Inches Water	= Ounces/ .5781
	Pounds / .03613
	Inches Hg (Mercury) / .07355
One Pound	= 16 Ounces
	27.67 Inches Water
	2.036 Inches Hg (Mercury)

Maximum Inlet Pressure at Unit Controls

(INDIRECT FIRED UNITS)

Natural Gas	14 Inches Water
	8 Ounces
	1.017 Inches Hg (Mercury)
Propane Gas	14 Inches Water
	8 Ounces
	1.017 Inches Hg (Mercury)

DIRECT FIRED units may be supplied with either 14 inches w.c. maximum or 5 P.S.I.G. - check unit rating plate.

If pressure exceeds ANY of the above limits, an additional regulator must be incorporated to reduce inlet pressure. Reznor requires that the auxiliary regulator be a lock up type to preclude pressure leak-through during down cycles which can cause malfunction and damage to the unit gas controls.

13 Fan Controls

The fan controls used on duct furnaces (except EEDU) and packaged products (except CAUA) is a Bi-Metal disc type having a heat generating resistor located adjacent to the Bi-Metal disc. This resistor is wired to the control system so that when the thermostat calls for heat, the resistor is energized in parallel with the main operating valve. The resistor emanates artificial heat which supplements the heat that the disc picks up from the heat exchanger. This accelerates the fan on time so the fan will be energized within about 60 seconds after the main burner is energized. Also, after the heat cycle, the added heat causes the fan to run for up to 5 minutes to purge the heat from the heat exchanger.

13 Fan Controls (cont'd)

Should the resistor fail, an erratic operation of burner and fan will occur. The burner will come on in response to the thermostat. The burner will fire and generate heat at the heat exchanger. Since the resistor is not functioning, the fan control will delay because it has no added heat. About the time the fan control closes to bring on the fan, the limit control may shut down the burner. This kind of cycle will repeat throughout the burner on cycle. The fan control must be replaced in order to resume normal ON/OFF fan operation.

14 RP (Power Vent) vs RG (Gravity-Vent)

NOTE: Power venting should always be used when continuous high winds are existing. Units on buildings over three stories high should also be considered for power venting.

Selection of power vent vs gravity vent on outdoor units very often is not carefully thought out.

RG (gravity vented) units may be installed on roofs or at grade, providing the flue terminal cap is at least 10 feet radius from any obstructions such as walls, parapets, or other equipment. If in the engineering stage, this rule cannot be met, it is wise to select the power vent furnace because it is designed to operate normally under all sorts of wind and pressure conditions. We have found that within the 10 foot radius expressed above, wind conditions often prevail that may be pressure packs, down drafts or up drafts. The power vent furnace experiences no trouble in operating under such conditions.

15 Halogenated Hydrocarbons

Halogenated hydrocarbons, particularly chlorine, can be detrimental to a gas fired heating unit.

When chlorine vapors are directed through the flame of gas fired systems, the chlorine will build up on the interior of the heat exchanger. Any subsequent appearance of condensation in the same location creates strong acids by the mere fact that the chlorine goes into solution with the condensate. The acid formed is hydrochloric which can and does attack the metals in the heat exchanger. (Glass is the only common material that resists the attack of hydrochloric acid).

Condensation within the heat exchanger is a normal occurrence that happens during almost every heat cycle. Condensation becomes more intense as the temperature of the heat exchanger lowers. Lowering of the heat exchanger temperature occurs during ON/OFF cycles, when the ambient of the space is below normal room temperatures (68°F), when the rise through the furnace is 40°F or lower or when the entering air is below 40°F as in makeup air units. Reznor does not warrant their equipment when it can be proven that chlorides or other halogenated hydrocarbons are present in the combustion process.

Chlorine can be found in the following compounds:

- Trichlorethylene
- Perchloroethylene
- Carbon Tetrachloride
- Methylene Chloride
- Methyl Chloroform
- Refrigerants 12, 114, 11, and 21 (All Freon Gases)

Common sources for Chlorides are:

- Aerosol Cans
- Degreasing Compounds
- Dyes
- Road Salt (Car Wash Areas)
- Swimming Pools
- Plant where plastics are in process (Modulating, Shredding, Gluing, Etc.)

16 Horsepower Ratings For Two Speed Motors

PRIME HP	1800/900	1800/1200
1	1/.25	1/.44
1-1/2	1.5/.37	1.5/.68
2	2/.5	2/.88
3	3/.75	3/1.3
5	5/1.2	5/2.2
7-1/2	7.5/1.9	
10	10/2.5	

17 Hazardous Areas

Hazardous areas are classified due to the presence of flammable or explosive contaminates in the air. Hazardous areas generally are classified by the local authority having jurisdiction or by the Nat. Elec. Code-NFPA70. Many times, this responsibility is in the hands of the fire marshal. Before installing gas fired equipment in a building that houses possible hazardous materials, you must check with the local authority having jurisdiction on such matters to make certain that the application is acceptable. Reznor gas fired products are not designed for use in any hazardous areas. Reznor hydronic unit heaters when equipped with explosion proof motors may satisfy some of the restrictions surrounding such areas.

NOTE: The National Fuel Gas Code and the National Electric Code offer some guidance on the matter of hazardous locations.

18 Makeup Air Sizing

Makeup air is outside air that is forced into a building to replace air within the building that is being drawn off through exhausters. Reznor makeup air units heat the outside air before it is introduced to the building so that the general comfort of the space is not diminished and also so that the general welfare of the building is not endangered by freezing temperatures. Makeup air requirement is sized to admit just the right amount of outside air to either pressurize the building or to create a slight vacuum within the space, depending on the conditions and the use of the building.

Building exhausters are in place to evacuate unwanted contaminates. Examples are; paint, cleaners, degreasers, odors, chemical vapors, and even, as in restaurants, the effluents of cooking. When the exhauster draws these contaminates from the building, a large amount of the air within the space is also evacuated. If makeup air is not introduced, the evacuated air is replaced through infiltration which occurs where the buildings tend to leak. Such leaks are found in window joints, cracks around doors and through the building where joints were not adequately sealed during construction. When outside air enters the building through these avenues, uncomfortable conditions result.

There are two considerations when sizing for makeup air – whether the building should be placed into a positive or a negative pressure condition and whether supplemental heating through makeup air should be used.

Your decision generally is based on the contaminates involved and the end use of the space.

If for instance the building is heated by a separate heat source and includes a single exhaust, and this exhaust is evacuating contaminates that for one reason or another should be permitted to migrate to other parts of the building, then the makeup air should be calculated to provide approximately 90% of the exhausted air volume. This would assure that the contaminates are being evacuated and not spilling into the surrounding space. An exhauster in a restaurant kitchen is a good example for the 90% method. Cooking odors in a kitchen should not be allowed to migrate into the dining area.

On the other hand, the building may be equipped with a number of exhausters that are utilized to evacuate various contaminates, none of which are necessarily threatening to the occupants. Under these conditions, the makeup air volume should be sized to provide a slight pressurization of the building. In addition to replacing the air being exhausted, the makeup air volume should be sufficient to create slight exfiltration. When sizing for pressurization, the total exhaust CFM should be multiplied by 110%. This will guarantee adequate replacement air and can also reduce infiltration losses.

Full building heating through the use of makeup air can be accomplished by multiplying the building infiltration rate by 150% (CFH/60 X 1.5 = CFM). By adding the heat loss of the building (less infiltration losses) to the BTU's necessary to heat the makeup air (CFM X 1.085 X TEMP DIFF), the total BTUH output is determined. Infiltration losses may be excluded from the building heat loss calculation. The building will be pressurized, eliminating all infiltration losses.

In order to obtain the most efficient makeup air system, the exhaust CFM's must be carefully determined so that the makeup air volume can be accurately identified and incorporated into the makeup air equipment. Along with establishing the CFM, all duct and diffuser losses must be determined for the purpose of selecting horsepower and RPM specifications.

CFM quantities for kitchen exhausters may be estimated by the following rules of thumb:

Island Type Canopy Hood - CFM = 150 FPM x Square Foot Face Area of Hood.

Wall Hung Canopy – CFM = 100 FPM x Square Foot Face Area of Hood

Exhaust Ventilator Wall Hood – CFM = 250 FPM x Front Width (Ft)

It is best however to obtain the airflow information from the exhauster rating or from the manufacturers specifications.

Paint booth exhausts may be sized by using 100 to 200 feet per minute velocity across the face of the booth. Example: A booth having an opening of 10 ft by 10 ft (100 ft sq.) would require from 10000 cfm to 20000 cfm for proper capture velocity. (100 sq. ft. x100 fpm or 200 fpm).

Corridor ventilation may be calculated based on the square foot area of the corridor. A minimum of .75 CFM to a maximum of 1.5 CFM per square foot is the range within which the sizing usually occurs. For more accurate CFM ratings, you may have to check with the state or local codes that apply.

Swimming pool areas may be ventilated by supplying from 5 to 10 air changes per hour, based on building volume. A safe minimum would be 2 CFM for each square foot of pool area. ASHRAE recommends a minimum of 15 CFM per occupant to a maximum of 25 CFM per occupant.

Determining BTUH Output: CFM x 1.085 x Temp. Diff.

Determining BTUH Input: BTUH Output/Unit Thermal Efficiency (Indirect Fired Only)

INDIRECT FIRED

MAXITROL MODULATING SYSTEMS FOR SINGLE FURNACE PACKAGES

REZNOR OPTION NO.	MAXITROL SERIES #	AMPLIFIER NO.	SENSING DEVICE - *	REMOTE ADJUST	THERMOSTAT ROOM	THERMOSTAT OVERRIDE	MODULATING VALVE
AG7	20AH	A1010B	In Stat	At Stat	T120		MR410, 510
AG8	21H	A1010F	TS121			T115**	MR410, 510
AG9	21HR	A1010B	TS121	TD121		T115**	MR410, 510
AG21		A200	A200 SIGNAL CONDITIONER				MR410, 510
AG39	92	A1092	TS194	TD92		T115**	M420, M520
AG40			A200 SIGNAL CONDITIONER				M420, M520

* All discharge air sensing devices include an averaging tube MT 1-12, in which the sensing device listed above is installed. The averaging tube is installed in the discharge of the unit to monitor discharge air temperature.

** The T115 override thermostat senses room temperature and adjusts burner output to bring the space to the thermostat setting. A T115 used with AG8 and AG9 brings the burner to full fire. A T115 when used with AG39 causes the discharge temperature to rise based on adjustment of the remote potentiometer (0 to 40 degrees F) located on top of TD-92 selector.

19 Maxitrol Modulating Systems (cont'd)

INDIRECT FIRED

MAXITROL MODULATING SYSTEMS FOR MULTI-FURNACE PACKAGES

REZNOR OPTION NO.	MAXITROL SERIES #	AMPLIFIER NO.	SENSING DEVICE - *	REMOTE ADJUST	THERMOSTAT ROOM	THERMOSTAT OVERRIDE	MODULATING VALVE	1st/2nd FURNACE
AG7	30AH	A1011B	In Stat	At Stat	T120		MR410, 510	AG7/AG7
AG8	31H	A1011F	TS121			T115**	MR410, 510	AG8/AG8
AG9	31HR	A1011B	TS121	TD121		T115**	MR410, 510	AG9/AG9
AG21		A200	A200 SIGNAL CONDITIONER				MR410, 510	AG21/AG21
AG41	92	A1092	TS194	TD92		T115**	M420, M520	AG39/AG2***
AG42			A200 SIGNAL CONDITIONER				M420, M520	AG40/AG2***
AG44		A200	A200 SGNL COND				MR410, 510	AG1/AG21

* All discharge air sensing devices include an averaging tube MT 1-12, in which the sensing device listed above is installed. The averaging tube is installed in the discharge of the unit to monitor discharge air temperature.

** The T115 override thermostat senses room temperature and adjusts burner output to bring the space to the thermostat setting. A T115 used with AG8 and AG9 brings the burner to full fire. A T115 when used with AG41 causes the discharge temperature to rise based on adjustment of the remote potentiometer (0 to 40 degrees F) located on top of TD-92 selector.

*** Includes quantity of two (2) BN2 outside air thermostat controls (0-100°F setting) for control of 2-stage AG2 option on 2nd furnace.

19 Maxitrol Modulating Systems (cont'd)

DIRECT FIRED

REZNOR OPTION NO.	MAXITROL SERIES #	AMPLIFIER NO.	SENSING DEVICE - *	REMOTE ADJUST	THERMOSTAT ROOM	THERMOSTAT OVERRIDE	MODULATING VALVE
AG30	14	A1014	TS114	TD114			MR212, M611
AG31	14	A1014	TS114	TD114		T115**	MR212, M611
AG32	14	A1014	TS114A	TD114A			MR212, M611
AG33	44	A1044E	TS144E & Stat	At Stat	T244		MR212, M611
AG35	14B	A1014	TS-114B	TD-114B			MR212, M611
AG36	94	A1494	TS-194	TD294E			MR212, M611
AG37	A200	A200 SIGNAL CONDITIONER					MR212, M611

* All discharge air sensing devices include an averaging tube MT 1-12, in which the sensing device listed above is installed. The averaging tube is installed in the discharge of the unit to monitor discharge air temperature.

** A T115 when used with AG32 causes the discharge temperature to rise based on adjustment of the remote potentiometer (0 to 40 degrees F) located on top of TD-114 selector.

All Maxitrol accessories listed below are clearly marked with the identifying numbers.

Maxitrol literature provides troubleshooting guides for above systems.

INDIRECT FIRED - MR410 and MR510 are modulating regulators that decrease gas flow as the DC volts increase.

0 Volts = Maximum flow.

17 Volts = Minimum flow.

DIRECT FIRED - M611 and M212 modulating valve increases flow as the DC volts increase. (For NATURAL OR PROPANE Gas)

0 to 5 volts = low-fire.

5 to 15 volts = modulating

15 to 20 volts = high-fire.

DC VOLTS ARE MEASURED AT THE MODULATING REGULATOR OR AMPLIFIER.

20 Composition of Metal Used in Reznor Heat Exchangers

TYPE 1, ALUMINIZED STEEL (STANDARD HEAT EXCHANGER MATERIAL)

Made of drawing quality steel with a coating of aluminum applied by a continuous hot-dip method which provides approximately one ounce of aluminum per square foot of steel. The finished product has an aluminum thickness of .002". At 800° F the material has ten times the strength of aluminum. Additionally, the aluminum coating provides extremely high resistance to corrosion.

409 STAINLESS STEEL

(OPTIONAL HEAT EXCHANGER MATERIAL)

409 Stainless Steel used in Reznor heat exchangers includes the following:

Carbon	.05%
Manganese	.67%
Phosphorus	.6%
Sulfur	.02%
Chromium	11%
Titanium	.5%

409 Stainless is recommended for use when the inlet air to the furnace is at or below 40°F. This recommendation is due to the high rate of condensation that can be expected under these conditions. Such condensation can be detrimental to aluminized steel heat exchangers, depending on the amount of sulfur in the fuel.

20 Composition of Metal Used in Reznor Heat Exchangers (cont'd)

It should be noted that in checking for the presence of 409 stainless steel, the material will attract a magnet the same as carbon steel or aluminized steel. Therefore, this test will not work. The only way to check for the presence of 409 is by scientific analysis.

321 STAINLESS STEEL

(OPTION HEAT EXCHANGER MATERIAL)

321 Stainless steel used in Reznor heat exchangers includes the following:

Nickel	8%
Carbon	.08%
Manganese	2%
Phosphorus	.04%
Sulfur	.03%
Silicon	1%
Chromium	17-19%

409 stainless steel will provide maximum protection against most adverse conditions such as corrosion and temperature. However, some specifiers do require that the heat exchanger be constructed of a high grade of stainless steel. If so, then 321 certainly meets this need.

321 Stainless may be confirmed by using a magnet. The magnet WILL NOT attract 300 grade stainless.

NOTE: None of the heat exchanger materials shown above will withstand attack resulting from hydrochloric acid. (See paragraph 15)

21 Typical Load Currents For Blower Motors (Open, Dripproof)

	SINGLE PHASE (FRACTIONAL)				THREE PHASE			
HP	RPM	115V	208V	230V	208V	230V	460V	575V
1/6	1800	8.8	4.8	4.4	-	-	-	-
1/4	1800	5.1	2.1	2.3	1.1	1.4	0.75	-
1/3	1800	5.5	3.2	2.8	1.4	1.6	0.8	-
1/2	1800	8.8	5.1	4.4	3	2.5	1.0	0.8
3/4	1800	11.0	6.3	6.5	2.9	2.6	1.3	1.1
1	1800	13.0	7.5	7.5	3.7	3.2	1.6	1.1
1 1/2	1800	15.0	8.3	10.2	5.6	5.0	2.7	1.6
2	1800	20.4	10.0	12.4	7.0	6.6	3.5	2.1
3	3600	-	14.0	26.0	9.0	8.6	4.3	3.6
5	3600	-	28.0	28.0	13.4	13.2	6.6	5.4
7 1/2	1800		35.0	32.0	22.5	19.4	9.7	7.8
10	1800		42.0	38.0	30.0	26.0	13.0	10.4
15	1800				43.1	39.0	19.5	16.0
20	1800				58.7	53.0	26.5	21.2
25	1800				69.8	60.6	30.3	24.3
30	1800				78.0	75.0	37.5	30.0

These amperes are typical. For exact full load AMPS, please refer to motor rating plate.

22 Obsolete Reznor Models

MODEL	TYPE	LAST MFD. (YEAR)	PARTS AVAILABLE	CURRENT MODEL
ABB	Air Turnover Unit			ACB
AFA	Room Heater	1945	None	None
ARB	Air Turnover Unit			ACB
(H) CRP	Duct Furnace	1996	Yes	(H) RP
(H) CRPV	Duct Furnace	1996	Yes	(H) RPV
(H) CX	Duct Furnace	1996	Yes	(H) X
(H) CXE	Pkgd. Heating/MUA	1996	Yes	(H) XE
D	Duct Furnace	1956	None	X,EEDU
DBF	Residential Furnace	1956	None	None
DFA	Direct Fired Heater			DFB
DFAH	Hi-Bay Unit	1975	Limited	None
DFT	Duct Furnace	1977	See Note	See Note
DS-LDS	Duct Furnace	1964	None	X,EEDU
DU	Duct Furnace	1952	None	X,EEDU
EE	Elec Furnace	1980	Limited	None
(C) EEXL	Unit Heater	1988	Yes	FE
(C) EEXLB	Unit Heater	1988	Yes	BE
EJ	Elec M.U.A.	1980	Limited	None
ERBC	Elec Furnace/ Evap CLG	1980	Limited	None
ERBJ	Elec M.U.A.	1980	Limited	None

22 Obsolete Reznor Models (cont'd)

MODEL	TYPE	LAST MFD. (YEAR)	PARTS AVAILABLE	CURRENT MODEL
ERC	Elec W/Evap CLG	1980	Limited	None
ERE	Elec Furnace	1980	Limited	None
ERJ	Elec M.U.A.	1980	Limited	None
FM	Room Heater	1962	None	None
HC	Hydronic Cabinet Heater	1999	Yes	None
HH	Hydronic Unit Heater	1999	Yes	WS
HR	Heat Recovery	1981	Yes	None
HRA	Heat Recovery	1981	Yes	None
HRB	Heat Recovery	1981	Yes	None
HV	Hydronic Unit Heater	1999	Yes	WS
IR	Infared	1964	None	RIH
IR-IP	Infared	1959	None	RIH
LUSF	Unit Heater	1964	Limited	F,FE
LUSB	Unit Heater	1964	Limited	B, BE
OUD	Oil Duct Furnace	1978	Limited	None
OUE	Oil, F.A.F	1978	Limited	None
OUH/OUB 95, 140, 185	Oil Fired	1992	Limited	OH/OB
OUH/OUB 250-300	Oil Fired	1988	Limited	None
PAK, CPAK, DPAK	Pkgd. Heating/MUA	1997	Yes	PGBL
PAB				PCB

22 Obsolete Reznor Models (cont'd)

MODEL	TYPE	LAST MFD. (YEAR)	PARTS AVAILABLE	CURRENT MODEL
PAC				PCB
PBB				PCB
PBC				PCB
PV	Sep Comb Duct Furnace	1973	Yes	SC
PVA	Sep Comb Unit Heater	1973	Yes	SCA
PVB	Sep Comb Unit Heater	1973	Yes	SCB
PVC	Sep Comb Unit Heater	1973	Yes	SCE
PVD	Sep Comb Hi-Bay Unit	1973	Yes	None
PVE	Sep Comb F.A.F.	1973	Yes	SCE
RAM	Evaporative Cooling	1990	Limited	REC
RC	DX CLG Only	1980	Limited	None
RCE	Heat W/DX CLG	1980	Limited	None
RCG	Heat W/DX CLG	1980	Limited	None
RDE	Gas/ Elec Heat	1975	Limited	None
(H)-REB, CREB	Pkgd. Heating/MUA	1990	Yes	RGB
REBC	Heat W/Evap CLG	1978	Yes	RGB *
RHD	Sep Comb Unit Heater	1975	None	SC Series
ROUE	Oil F.A.F	1978	Yes	None
ROUD	Oil Duct Furnace	1978	Yes	None
RPAK, CRPAK	Pkgd. Heating/MUA	1990	Yes	RGBL

22 Obsolete Reznor Models (cont'd)

MODEL	TYPE	LAST MFD. (YEAR)	PARTS AVAILABLE	CURRENT MODEL
RPBC	Heat W/Evap CLG	1978	Yes	RPBE *
(H)-RPBE, CRPBE	Pkgd. Heating/MUA	1990	Yes	RPB
RPVAK, CRPVAK	Pkgd. Heating/MUA	1990	Yes	RPBL
RPVC	M.U.A/Evap CLG	1976	Yes	RPB *
(H)-RPVE, CRPVE	Pkgd. Heating/MUA	1990	Yes	RPB *
RPVG	Heat W/DX CLG	1979	Limited	None
RPVJ	M.U.A	1978	Yes	RPB *
RTN/RTL	Infrared	1992	Limited	TR
RXC	M.U.A/Evap CLG	1976	Yes	RGB *
(H)-RXE, CRXE	Pkgd. Heating/MUA	1990	Yes	RGB *
RXG	Heat W/DX CLG	1979	Limited	None
RXJ	Heat W/DX CLG	1976	Yes	RGB *
RXR	Duct Furn/ Rear Access	1975	Limited	None
SCFD	Greenhouse Heater	1981	Limited	BE
UA	Unit Heater	1975	Limited	F
US, US-B	Unit Heater	1945	None	F,B
USA	Unit Heater	1947	None	F
USF	Unit Heater	1961	None	F
XA	Unit Heater	1973	Yes	F
XB	Unit Heater	1973	Yes	B

22 Obsolete Reznor Models (cont'd)

MODEL	TYPE	LAST MFD. (YEAR)	PARTS AVAILABLE	CURRENT MODEL
XC	Unit Heater	1973	Yes	XE, CXE
XD	Hi Bay Unit	1973	Yes	None
(C)-XL	Unit Heater	1988	Yes	F
(C)-XLB	Unit Heater	1988	Yes	B
XR	Duct Furn/ Rear Access	1975	Limited	X,EEDU
XFD	Greenhouse Heater	1981	Limited	BE
XG	Heat W/DX CLG	1979	Limited	None
XJ	M.U.A	1979	Yes	XE *

* These models will require optional accessories to equal the obsolete model shown in first column

NOTE: DFT Furnace service is being handled by:

C.N.I.
3569 Bristol Pike
Building 1, Suite 103
Bensalem, PA 19020
215-244-9650

23 Paddle Fans

Most unit heaters are designed to drive the air down from fairly great heights. However, even with the addition of downturn nozzles, the air may not strike the floor from exceedingly great heights. (Check the catalog for limited throw data). When the units are unable to drive the air to the floor level, we recommend the use of ceiling fans or paddle fans as they are more popularly called. These paddle fans can drive air from heights of 50 to 80 feet, and in doing so, will reduce the temperature gradient from floor to ceiling. This, in effect, will reduce the heat loss in the building by lowering the temperature at the ceiling. Reznor energy efficient units may be mounted at any height when ceiling fans are in use. These units and fans can together reduce fuel consumption by as much as 30% and create a more comfortable space.

NOTE: Care must be exercised in placement of paddle fans so they do not interfere with the performance of the draft hood of gravity vented units.

24 Predicting Static Losses In A Duct System

The following rules are helpful in anticipating losses in a duct system. This information is necessary to select horsepower and drive configuration.

Duct Velocities	Pressure Loss/100 Equivalent Ft.
Low – Up to 1200 FPM	.1" W.C.
Medium – 1200 to 2400 FPM	.3" W.C.
High – 2400 to 6000 FPM	.6" W.C.

90 Degree Elbow = 15 Equivalent Feet

45 Degree Elbow = 8 Equivalent Feet

Losses caused by diffusers or directional louvers must be obtained from the manufacturer's data and added to the duct losses shown above.

24A Measuring Static Loss In A Duct System

If it becomes necessary to determine the exact static losses within a duct system, a measurement can be made by using a slope gauge. The slope gauge must be suited to the anticipated pressure range to be measured. If the pressure will exceed the range of the slope gauge, then a manometer or "U" gauge may be used. On a slope gauge, connections for positive pressure readings must be made at the top of the incline. Negative readings are connected at the tap leading to the bottom of the incline. If both inlet and discharge pressures are desired, connect tubing as above to both sides of the gauge. The final reading includes all external losses in the duct system. Manometer or "U" gauge is available with the scale arrangement on one of two models. One type of scale is movable where the "ZERO" must be aligned with the lowest column after

24A Measuring Static Loss In A Duct System (cont'd)

pressure equilibrium has been reached. The final reading is then made at the peak of the opposite column. The other "U" gauge has the zero at the center of both columns. Each side must be read, and the total of the two sides added to obtain the appropriate pressure reading.

It is suggested that all pressure readings be multiple point and that an attempt be made to avoid locating the sensing device in a position where it is facing the air flow, as this will tend to give you false readings due to air velocity pressures. Use of a pitot static tube is recommended to eliminate such errors. The pitot tube must be positioned so that the pointed end containing the velocity port is facing the airstream.

25 Unit Heaters Installed In Low Ambient Application (Models with temperature sensitive fan control)

F, FE, B, BE, SCA, SCB

Gas equipment for indoor use has been tested in ambients of approximately 70° F. Therefore, when such equipment is installed in ambients that are below this temperature, unusual performance and physical abuse will sometimes occur. Normally, ambients down to 60° F create no noticeable difference in performance, but when the ambient drops below 60° F, the first problem may surface in fan switch performance. The fan switch will tend to cycle the fan during heat cycles. This is because the low entering air temperature cools the Bi-Metal disc, causing it to snap open momentarily. Once the fan stops, the heat at the Bi-Metal disc becomes warm again and snaps to turn the fan on again. This abnormal operation will persist until the ambient rises above 60° F.

Another situation arises when the ambient is controlled below 60° F. Condensation occurs within the heat exchanger, generally at the top of the heat exchanger tubes, nearest the fan. The result is a mild acid which is formed from the products of combustion. This acid will eventually corrode the heat exchanger and very often will open holes in the tube wall, rendering the unit unsafe.

In some instances, particularly when the unit is shut down during unoccupied periods, the pilot on automatic spark systems will hesitate to light. We believe that with the cold ambient/cold stack combination, a downdraft occurs over the burner and in particular around the pilot. This creates adequate disturbance to interfere with pilot ignition. Also, after extended shutdowns the gas sometimes migrates from the pilot tubing. If the ignitor is the lockout type, the ignition system may go into lockout before the air can be bled from the pilot tubing. New lockout systems will have longer timing that should preclude this from happening. Minimum required timing is 30 seconds, however newer systems include timers of 120 seconds duration.

There are very few remedies for the aforementioned problems. However, it is suggested that if you know in advance that a low room temperature (Ambient) will be required, you should first insist on 409 grade stainless in the heat exchanger, and you may have to specify a thermostat that has a manual fan switch to ensure that the fan will operate on a continuous basis. (Time delay relays may be utilized to activate the fan. Such relays are available and would be wired in parallel with the fan control).

Or, select a unit heater with an electronic circuit board that controls the fan, such as Model FT.

26 Up Rate Of Gas Fired Units

Gas fired units may not be uprated from their listed inputs. These units have been tested at the input shown on the rating plate and have only a small margin of safety to handle any pressure surges. If the unit would be uprated, there would be no margin for pressure fluctuations. Uprating of units can result in personal injury, property damage or even death.

27 Multiple Venting

When more than one gas fired unit is installed in a single heat zone, very often the installer desires to vent two or more units to a single final vent.

FOR UNITS WITH DRAFT HOODS (GRAVITY VENT)

If the units are gravity vented, multiple venting can be done. The National Fuel Gas Code (ANSI Z228.1/NFPA54) states that when more than one gas fired gravity vented appliance is connected to a common flue, the total cross sectional area of the first flue must be calculated. To this you must add 50% of the area of each subsequent flue to be attached to the common final vent. The sum of these areas is then calculated into a new required flue size. The formula that is used to calculate the final flue diameter is as follows:

Sq. root of (sum of all vents (100% of first + 50% of all subsequent) / 3.1416) multiplied by 2, provides the new diameter for the final flue run dimension.

POWER VENTED UNITS (INTEGRAL EXHAUSTERS)

Multiple power vented units (SC, SCE, SCA, SCB, SFT, FT*, CAUA, FE, BE, EEDU, PGBL) should never be connected to a single final vent pipe. There is an inherent danger in doing this. Flue products may be evacuated from one unit and forced into the space through the second or subsequent units connected to a common flue.

***NOTE**: Model FT with Optional AV6 may be installed with a common vent. Special venting instructions apply.

27A Vent Damper

Automatic vent dampers are used to close the vent during off cycles of gravity vented gas fired appliances. This is to prevent the flow of room air to atmosphere, thus reducing off cycle losses. While the addition of such dampers tends to reduce the seasonal losses, the on cycle losses are unaffected. Savings of annual fuel costs may be as much as 8% when the automatic vent damper is used. Reznor gravity vented indoor units may be equipped with vent dampers. However, Reznor suggests that the damper system designed and marketed by Johnson Controls be considered since this is the only damper that has been tested with Reznor units, and has met with the approval of Reznor Engineering. Reznor does not carry approval agency listing of any vent dampers in conjunction with their products, however, vent dampers have separate listings and may be used with most gravity vented units. Please be advised that when such dampers are used, a standing pilot cannot be used. A spark ignited, intermittent pilot must be used in conjunction with vent dampers.

28 Suggested Air Change Rates (Taken From ASHRAE Data)

Values shown on are for minutes per air change for air turnover in a building.

For sizing makeup air equipment, refer to section in this manual covering makeup air sizing.

TYPE OF SPACE	MINUTES
Assembly Halls	5 to 10
Auditoriums	5 to 10
Bakeries	3 to 5
Boiler Rooms	1 to 4
Box Annealing	2 to 5
Breweries	2 to 8
Dry Cleaning Plants	1 to 6
Dye Plants	2 to 4
Electric Sub Stations	8 to 12
Engine Rooms	1 to 2
Factories (No Contamination)	5 to 10
Factories (Contamination)	1 to 5
Forge Shops	1 to 3
Foundries	1 to 3
Furnace Bldgs.	1 to 3
Galvanizing Plants	1 to 3
Garages	3 to 5
Generator Rooms	2 to 5
Glass Plants	1 to 2
Gymnasiums	2 to 10
Heat Treating Buildings	1/2 to 1
Kitchens	1 to 3
Laboratories	3 to 10
Laundries	2 to 5
Machine Shops	3 to 6
Offices	4 to 8
Packing Plants	2 to 5
Paint Shops	1 to 3
Paper Mills	2 to 3
Pickling Plants	2 to 3
Plating Shops	1 to 4
Pump Rooms	8 to 12
Railroad Round House	1 to 3
Recreation Rooms	2 to 8
Restaurants	5 to 8
Shops (Gen. Fabrication)	5 to 10
Steel Mills	1 to 5
Textile Mills	5 to 12
Toilets	2 to 5
Transformer Rooms	1 to 5
Turbine Rooms	2 to 6
Warehouses	10 to 30
Wood Shops	3 to 6

29 Allowable Ampacities of Insulated Conductors – Copper Wire

(Refer to National Electric Code for more specific information)

SIZE	60°C	75°C	85°C	90°C
	TYPE	TYPE	TYPE	TYPE
		FEPW	V	TA, TBS
		RH		SA, AVB
	TW	RHW		SIS
	UF	RUH		FEP
		THW		FEPB
		THWN		RHH
		XHHW		THHN
		USE, ZW		XHHW
AWG MCM				
18				14
16			18	18
14	20	20	25	25
12	25	25	30	30
10	30	35	40	40
8	40	50	55	55
6	55	65	70	75
4	70	85	95	95
3	85	100	110	110
2	95	115	125	130
1	110	130	145	150
0	125	150	165	170
00	145	175	190	195
000	165	200	215	225
0000	195	230	250	260

29A Wiring Diagram Locations

All Reznor units have wiring diagrams either affixed to the unit or accompanying the unit in a separate envelope. Many times the wiring information that is shipped in the separate envelope is lost or destroyed. For such occasions, the wiring diagram number is needed to acquire a replacement copy. Due to the complexity of many of these units, the exact wiring diagram must be used. For this reason, Reznor has attached a plate on the outer jacket of the blower section. This plate contains model, electrical data, horsepower, CFM, ESP and the wiring diagram number which has the prefix letters "WD". If you need a replacement diagram, this number is paramount in obtaining the correct wiring information. Without this number, you should be prepared to describe the unit in total including model number, gas controls, voltage, damper information and sequencing. Very important also is the serial number from the rating plate. However, with the "WD" number, you can be assured that the proper wiring diagram will be supplied.

To acquire a replacement wiring diagram, contact your Reznor Representative. Wiring diagrams are also available on the Reznor web site at www.ReznorOnLine.com.

30 Fan and Limit Control Temperature Settings

Model	Size	Applies To	Fan Control	Replaces	Limit Control	Replaces
US-F, LUS-F[A]	25 - 200	1950-56 only[A]	1472 (350 deg. F)	892	1473 (555 deg. F)	893
AFA[A]	All except 4660	1950-51[A]				
FM[A]	All	1952-3/55 only[A]				
PAC, D, DBF[A]	All	Mfgd prior to 1995			[C]	8027, 5177
DS, LDS[A]	All	All			7256[D]	2753
UA; UB; RCG 7-1/2 and 10 Ton	All	Mfgd prior to 1994	10357 (125 deg. F)[E]		50417 (125 deg. F)	11305, 12936, 26303
RCG	75	All	Combination fan and limit	Cemco CTC-105-1A200FCD, P/N 49411		
	100, 125, 150	All		Cemco CTC-100-1A200FCD, P/N 43815		

Footnotes are listed at the end of this section.

30 Fan and Limit Control Temperature Settings (cont'd)

Model	Size	Applies To	Fan Control	Replaces	Limit Control	Replaces
XA, XB, XC, XD, XJ, XR, DFAH; PV[B], PVA, PVB, PVE, PDFAH; X, XE, RX, REB[F], RXE, RXJ, RXG, RXR, RPV, RPBE, RPVE, RPVJ prior to Series 6 (except (H)-CRPV-5); SC prior to Series 3; SCA, SCB, SCD, SCE, HSC Also applies to above models with prefix letter "C", "H" or "HC" (except where specifically noted)	All	All with exceptions indicated in Model column	10357 (125 deg. F)[E]		50418 (145 deg.F)	11305, 18183
(H)-X, CX, XE, CXE, RX, CRX, REB, CREB, RPV, CRPV, RPVE , RPBE Series 6 and 7; (H)-CRPV Series 5 and 6; SC Series 3, 5, and 6; (H)-RG, CRG, RP, CRP, RGB, CRGB, RPB, CRPB	All	As indicated in Model column	10357 (125 deg. F)[E]		50417 (125 deg. F)	

Footnotes are listed at the end of this section.

30 Fan and Limit Control Temperature Settings (cont'd)

Model	Size	Applies To	Fan Control	Replaces	Limit Control	Replaces
ECO Limit Control for (H) - X, CX, XE, CXE	All	Starting 4/83; Standing Pilot and Spark Prior to 12/99 Serial No. Code AID			131450 (306 deg. F)	82414
ECO Limit Control for SC, SCA, SCB, SCE Series 6	All	Series 6 prior to 12/99			82414 (306 deg. F)	
(C)-PAK, RPAK, RPVAK[F] prior to Series 6	1	As indicated in Model column	10357 (125 deg. F)[E]		50418 (145 deg. F)	11305, 15183
(C)-PAK, RPAK, RPVAK[F] Series 6	1				50417 (125 deg. F)	
(C)-RGBL, RPBL mfgd prior to 12/96[F]	400					
(C)-PAK, RPAK, RPVAK[F]	2	As indicated in Model column	10357 (125 deg. F)[E]		50417 (125 deg. F)[H]	11305, 12936, 26303
(C)-RGBL, RPBL mfgd prior to 12/96[F]	500 - 800				57953 (170 deg. F)[J]	12937
(C)-PAK, RPAK, RPVAK[F]	3	As indicated in Model column	10357 (125 deg. F)[E]		50417 (125 deg. F)[H]	11305, 12936, 26303
(C)-RGBL, RPBL mfgd prior to 12/96[F]	1050, 1200				19080 (155 deg. F)[J]	57952
					57953 (170 deg. F)[K]	12937

Footnotes are listed at the end of this section.

30 Fan and Limit Control Temperature Settings (cont'd)

Model	Size	Applies To	Fan Control	Replaces	Limit Control	Replaces
(C)-RGBL, RPBL, PGBL and SSCBL mfgd beginning 12/96	400	As indicated in Model column	10357 (125 deg. F)[E]		50418 (145 deg. F)	None
					148588 (270 deg. F)	
	500 - 800				50418 (145 deg. F)[H]	50417 (125 deg. F)[H]
					57953 (170 deg. F)[J]	
					148588 (270 deg. F)[J]	
	1050, 1200				50417 (125 deg. F)[H]	
					50418 (145 deg. F)[J]	
					57953 (170 deg. F)[K]	
					148588 (270 deg. F)[J]	
(H)EEDU	All	All	147611[L]		45602 (180 deg. F)	

Footnotes are listed at the end of this section.

30 Fan and Limit Control Temperature Settings (cont'd)

Model	Size	Applies To	Fan Control	Replaces	Limit Control	Replaces
XL, EEXL	30-400	All	147676 (135 deg. F)[M]	48706 (150 deg. F) 63555[N] (150 deg. F) 93629[G] (150 deg. F)	45602 (180 deg. F)	
CXL	140-400					
CEEXL	30, 200-250					
XLB	30, 45	All	147677 (150 deg. F)[M]		45602 (180 deg. F)	
CXLB	30-105					
EEXLB	30, 45, 125-400					
CEEXLB	30-105, 300-400					
CXL	30-105	All	147676 (135 deg. F)[M]		85449 (200 deg. F)	
CEEXL	45-170, 300-400					

Footnotes are listed at the end of this section.

30 Fan and Limit Control Temperature Settings (cont'd)

Model	Size	Applies To	Fan Control	Replaces	Limit Control	Replaces
XLB	60-105, 300-400	All	147677 (150 deg. F)[M]	93629 (150 deg. F)	82091 (160 deg. F)	
EEXLB	60-105					
CXLB	300-400					
XLB, CXLB	200-225	All	147677 (150 deg. F)[M]	93631 (170 deg. F)	45602 (180 deg. F)	
XLB, CXLB	125-170				85449 (200 deg. F)	
CEEXLB	125-250					
XLB, CXLB	250				82091 (160 deg. F)	
ECO Limit Control for XL, CXL, XLB, CXLB	All Standing Pilot only	Starting 4/83; Serial No. AID			82414 (306 deg. F)	
F	25	All	123974 (135 deg. F)	96387	85449 (200 deg. F)	82091[P]
	50, 75[R], 100[R]		123976 (135 deg. F)	114009, 96387	85449 (200 deg. F)	
	125		123976 (135 deg. F)		45602 (180 deg. F)	
	130, 165		123976 (135 deg. F)		82091 (160 deg. F)	
	200		123974 (135 deg. F)	96387	85449 (200 deg. F)	
	250, 300, 400		123974 (135 deg. F)		45602 (180 deg. F)	

Footnotes are listed at the end of this section.

30 Fan and Limit Control Temperature Settings (cont'd)

Model	Size	Applies To	Fan Control	Replaces	Limit Control	Replaces
FE	25	All	123974 (135 deg. F)	96387	85449 (200 deg. F)	
	50		123976 (135 deg. F)	114009, 96387	85449 (200 deg. F)	
	75, 100, 125		123976 (135 deg. F)		45602 (180 deg. F)	
	130, 165		123976 (135 deg. F)		82091 (160 deg. F)	
	200		123974 (135 deg. F)	96387	85449 (200 deg. F)	
	250, 300, 400		123974 (135 deg. F)		45602 (180 deg. F)	
ECO Limit Control for F and FE	25-50	All (Spark Pilot prior to 9/99 only)			131449 (228 deg. F)	96513 (228 deg. F)
	75-400				82414 (306 deg. F)	
B	25	All	123975 (150 deg. F)	100857 (170 deg. F)	45602 (180 deg. F)	
	50[R], 75[R], 100[R]				85449 (200 deg. F)	
	125-400				100799 (150 deg. F)	
BE	25-100	All	123975 (150 deg. F)	100857 (170 deg. F)	45602 (180 deg. F)	
	125-400				100799 (150 deg. F)	
ECO Limit Control for B, BE	25-50	All (Spark Pilot prior to 9/99 only)			131449 (228 deg. F)	96513 (228 deg. F)
	75-400				131450 (306 deg. F)	82414 (306 deg. F)

Footnotes are listed at the end of this section.

30 Fan and Limit Control Temperature Settings (cont'd)

Model	Size	Applies To	Fan Control	Replaces	Limit Control	Replaces
RDF	All Sizes	All			86979 (135 deg. F) Auto Limit 82610 (150 deg. F) Manual Limit 82414 (306 deg. F) Flame Safety Limit	
ADF	All Sizes	All			122856 (130 deg. F) Auto Limit 122858 (135 deg. F) Manual Limit 82414 (306 deg. F) ECO Device	
ADFH	All Sizes	All			19080 (155 deg. F) Auto Limit 122990 (175 deg. F) M anual Limit 82414 (306 deg. F) ECO Device	
DV	109-122	All			161437 (190 deg. F) M anual Limit	
	125				161433 (205 deg. F) M anual Limit	
	All Sizes				82414 (306 deg. F) ECO Device	
DFAH/DFAV	All Sizes	All			(2)163133 (180 deg. F) M anual Limit 121275 (275 deg. F) ECO Device	
EUH	All	All	Time Delay Relay P/N 40994		50417 (125 deg. F) 35-60 KW require 2	

Footnotes are listed at the end of this section.

30 Fan and Limit Control Temperature Settings (cont'd)

Model	Size	Applies To	Fan Control	Replaces	Limit Control	Replaces
AEUH	3 KW	All	Time Delay Relay, P/N 46382, for 120 volt only; P/N 46386 for all other voltages		45534 (120 deg. F)	
	5KW				45535 (140 deg. F)	
	7 KW				45536 (170 deg. F)	
	10 KW				45537 (210 deg. F)	
	12 KW				45538 (230 deg. F)	
OUD, OUE	140, 200	All			Cemco #TC108A-250, P/N 50186	
OUH, OUB, OUE, ROUE	95, 140, 185, 200	All	Combination Fan & Limit, M /H #L4064-1592-4, P/N 36559			
OH, OB	95	All	Fan and Limit Control Assy, P/N 123977			120679
	140, 190		Fan and Limit Control Assy, P/N 123973			104437

Footnotes are listed at the end of this section.

30 Fan and Limit Control Temperature Settings (cont'd)

Model	Size	Applies To	Fan Control	Limit Control	Replaces
FT	30	All	On these models, fan control is a function of the ignition control module.	Flame Rollout Limit, P/N 121275, (275 deg. F)	
				High Limit, 45602 (180 deg. F)	
	45			Flame Rollout Limit, P/N 112752, (225 deg. F)	
				*Flame Rollout Limit, P/N 121275 (275 deg. F)	
				High Limit, 45602 (180 deg. F)	
	60			Flame Rollout Limit, P/N 121275, (275 deg. F)	
				High Limit, 45602 (180 deg. F)	
	75			High Limit, 45602 (180 deg. F)	
	100-200			High Limit, 155764 (220 deg. F)	96512 (220 deg. F)
	250-300			Fan Back Limit, P/N 100799 (150 deg. F)	
				High Limit, 155765 (200 deg. F)	85449 (200 deg. F)

* Model FT45 with Option AL2B (San Diego School unit)

Other footnotes are listed at the end of this section.

30 Fan and Limit Control Temperature Settings (cont'd)

Model	Size	Applies To	Fan Control	Limit Control	Replaces
SFT	45-75	All	On these models, fan control is a function of the ignition control module.	High Limit, 45602 (180 deg. F)	
				Flame Rollout Limit, P/N 157282 (180 deg. F)	
	100-200			High Limit, 155764 (220 deg. F)	96512 (220 deg. F)
	250-300			High Limit, 155765 (200 deg. F)	85449 (200 deg. F)
CAUA	150, 200	All		148588 (270 deg. F) w/60" capillary	
				Flame Rollout Limit, P/N 112752, (225 deg. F)	
	250, 300			164792 (300 deg. F) w/54" capillary	
				Flame Rollout Limit, P/N 121275, (275 deg. F)	
	350, 400			148588 (270 deg. F) w/60" capillary	
				Flame Rollout Limit, P/N 112752, (225 deg. F)	

Footnotes are listed on next page.

30 Fan and Limit Control Temperature Settings (cont'd)

[A] Replacement parts will be discontinued when stock is depleted.
Important: "Applies To" column indicates dates of manufacture. Do not rely solely on manufacture date code. Always verify temperature setting of original controls.

[B] PV Series also used a post purge relay P/N 11896.

[C] WR 5A75-10 combination fan and limit is no longer available from Reznor

[D] WR 484-14 adjustable limit, 0-350 deg. F.

[E] For operation and wiring of replacement fan control P/N 10357, see Parts Form RGM-713.

[F] Manual reset limit, P/N 82610 (replaces P/N 20140), is located in the blower compartment of Models REB, RXG, RXE, RXJ, RPBE, RPVE, RPBE, RPAK-1,2,3, RPVAK-1,2,3. Effective 1/3/1990, manual reset limit in the blower cabinet was replaced by auto reset limit, P/N 103323, is used on Models RGB, RPB, RBL and RPBL. Also applies to any of the above listed Models with prefix "C", "H", or "HC".

[G] Spring loaded fan control assembly.

[H] Furnace next to the blower.

[J] Second furnace from the blower.

[K] Third furnace from the blower.

[L] Effective June 1996, control is Honeywell L4064A1347 which will functionally replace previous control.

[M] Replacement kit with spring-loaded fan control assembly. To install follow instruction in Parts From RGM-713.

[N] If you have P/N 63555 in stock, it can be used on XL Series units manufactured through January 1987. Serial No. Code AMA.

[P] P/N 82091 is not obsolete; limit control standardized with Model FE25, effective April 1993.

[R] These units manufactured prior to 9/96, use limit P/N 45602 (180°F)

31 Separated Combustion- Defined

The Reznor Models SC, SFT and CAUA are certified as separated combustion systems, and is suggested for use in atmospheres that are highly contaminated with airborne dust or particulate. Such contamination, if allowed to enter the combustion zone, can plug burners and pilots and even flue passageways. Obviously, these problems would create requirements for frequent cleaning. The separated combustion unit actually separates the combustion process from the atmosphere in which the unit is installed, taking all of its air for combustion from outside the building and disburses the products of combustion to the outside. The routing of the combustion air and flue products is through parallel pipes that connect at a concentric adapter just inside the outer wall. From that point on the piping becomes concentric with the flue gas vents inside the fresh air pipe. The concentric arrangement terminates outside the building and is designed to separate the flue products and combustion air under all sorts of wind and pressure conditions.

The separated combustion system is derived in part from the sealed combustion requirements which allow a certain level of leakage at the unit to occur. This means that some of the contaminated air from within the space may enter the combustion process. For this reason the separated combustion units are not recommended for use where chlorine contamination is present.

Further to this, as stated in Paragraph 17, Reznor gas fired units are not acceptable in areas that have been declared hazardous, thus further limiting the use of separated combustion units to spaces which are contaminated with nonexplosive dust or particulate and which do not contain chlorines at any level of contamination. (The heat exchanger temperature during operating cycles is normally in excess of 500° F. This temperature can kindle most explosive vapors or combustible particulate.)

Separated combustion furnaces may be used in spaces where positive or negative pressure ambients exist. Maximum ambient pressures should not exceed .15" W.C. and the unit must never be operated with the panels removed.

32 Short Cut Method For Determining Heat Loss

The following system is intended to permit quick estimates of heat requirements in a building based on the cu. ft. volume of the building and design conditions that exist. It is not for final BTUH loss computation. Such finite figures can only be determined through the use of an ASHRAE heat loss study.

A heat loss calculation program on CD is available from your Reznor Representative.

32 Short Cut Method For Determining Heat Loss (cont'd)

SHORT CUT METHOD

	Masonry Wall			Insulated Steel Wall (RB Insulation)		
	Indoor Temp (degF)					
	60	65	70	60	65	70
	BTU/Cubic Ft			BTU/Cubic Ft		
Single Story 4 Walls Exposed	3.4	3.7	4.0	2.2	2.4	2.6
Single Story One Heated Wall	2.9	3.1	3.4	1.9	2.0	2.2
Single Floor One Heated Wall Heated Space Above	1.9	2.0	2.2	1.3	1.4	1.5
Single Floor Two Heated Walls Heated Space Above	1.4	1.5	1.6	0.9	1.0	1.1
Single Floor Two Heated Walls	2.4	2.6	2.8	1.6	1.7	1.8
Multi Story – 2 Story	2.9	3.1	3.4	1.9	2.1	2.2
Multi Story – 3 Story	2.8	3.0	3.2	1.8	2.0	2.1
Multi Story – 4 Story	2.7	2.9	3.1	-	-	-
Multi Story – 5 Story	2.6	2.8	3.0	-	-	-

The above values are expressed in BTU for each cubic foot of building volume. Once the volume in cubic feet has been determined, multiply the cubic volume by one of the factors listed above. Having done this, the following correction factors must be used and multiplied against that answer.

Corrections For Outdoor Design Temperature	Multiplier	Corrections For "R" Factor (Steel Wall) "R" Factor	Multiplier
+50	.23	8	0.0
+40	.36	10	.97
+30	.53	12	.95
+20	.69	14	.93
+10	.84	16	.92
+0	1.0	19	.91
-10	1.15		
-20	1.2		
-30	1.46		

Considerations Used For Above Values:

1 0° F Outdoor Design (See Corrections)

2 Slab Construction – If basement is involved, multiply final BTUH by 1.7

3 Flat Roof

4 Window Area is 5% of Wall Area

5 ½ Air Change per hour

When exhausters are to be included, the total exhaust CFM must be added and the results multiplied X 1.085 X (Design T). This must be added to the final corrected BTUH found above. It is suggested that if exhausters are in use, correctly sized makeup air units be considered for use – see Para. 18.

This short cut method should be used only for preliminary estimates and should not be used for final sizing of any heating equipment. Failure to use the long form method or computer heat loss program may result in improperly sized heating equipment.

33 Grounding Electric Circuits

All electrical circuits must be positively grounded. The neutral wire must be connected to ground, as a safety measure but also in most spark ignition systems, the spark and electronic flame sensing are totally dependant on such grounding to complete the electrical circuit. You should carefully check the applicable wiring diagram to determine exact grounding procedures.

34 Safety Pilots

Safety pilots are devices which are able to detect the presence of flame at the pilot. If the pilot flame is adequate for smooth ignition of the main burner, a sensing device advises either a magnetic valve or a safety relay circuit that the pilot is ready for main burner ignition.

The most popular sensing device is a thermocouple. This device is positioned so that its tip is heated by the flame from the pilot.

34 Safety Pilots (cont'd)

When the tip is heated adequately, an electrical signal is generated at the cold junction of the thermocouple. And this current is directed to an electromagnet. The electromagnet creates a magnetic field which may activate a relay, or it may provide a means of holding a manually activated plunger in place. The plunger, when held by the magnet, allows gas to flow through a valve connected to the plunger. If the flame is lost, the plunger releases and closes the valve, shutting off all gas flow to both the main burner and the pilot.

Currently, many pilot systems use a flame rectification capability that is tied into spark ignition systems (IID). In this system a probe at the pilot is used to detect flame. An electrical circuit is poised to flow through the flame as soon as flame appears. The same electrical circuit will not travel through air or the gas/air mix from the pilot. Therefore, there is no signal until flame appears. This signal is then transmitted to the flame detection apparatus which then will provide a "GO" command to the main burner. This system does not rely on temperature. It relies only on the electrical path between the pilot burner and the sensing rod. The signal generated in the circuit is measured in Micro-AMPS. A minimum reading of .2 µA is generally required to provide the "GO" signal. Response time is less than .8 seconds for "STOP" or "GO" command. Therefore, if the pilot flame should fail, the main burner will be shut down within .8 seconds.

Definitions: RECYCLING PILOT – Safety pilot that is supplied gas only when ignition system is energized by call for heat from a thermostat. Recycling pilots are used with natural gas. (Natural gas is lighter than air.)

LOCKOUT – Safety pilot that is supplied gas only when the mechanism is manually overridden, during trial periods for automatic spark ignition system, or when the pilot flame is established so that it holds the safety device in the run mode. Lockout pilot systems are generally used with propane gas or any gas that is heavier than air. If the pilot flame should fail and is not reignited, or if the gas/ air mix at the pilot should fail to light, the safety pilot mechanism will shut off the flow of gas to the pilot. Either mechanical or electrical reset of the safety pilot will be required in order to initiate a new trial for ignition of the pilot.

NOTE: Reznor units certified to ANSI Standards (U.S.) require lockout pilot system on indoor propane units. Canadian approved units require lockout pilot system on all propane units.

MULTIPLE-TRY, DSI, LOCKOUT: Direct spark ignition system that will make three successive ignition attempts and purge cycles in an attempt to ignite the main burners. (Each ignition and purge cycle is approximately 60 seconds) If ignition fails to occur in the three cycles, the control board will go into a "soft" lockout mode. The control board will remain in "soft" lockout for approximately one hour. At the end of one hour the control board will repeat another three-ignition attempt cycle. If ignition does not occur in the second sequence, the control board will go into a "hard" lockout. No more ignition attempts will be made. The control board may be taken out of "soft" or "hard" lockout at any time by lowering the thermostat setting below the room ambient or by interrupting the electrical power to the unit.

35 Typical Sound Pressure Levels

(Extracted From ASHRAE Handbook of Fundamentals)

dB	NOISE SOURCE AND DISTANCE
130	Jet Plane at Full Power From 200 Feet
120	Police Siren at 50 Feet
110	Pneumatic Hammer at 50 Feet
100	Millworking Machines at 50 Feet
90	Manufacturing Plants, (Average)
80	Symphony Orchestra, (Fortissimo)
70	Vacuum Cleaner at 10 Feet
60	Business Machine Areas
50	Normal Business Office
40	Quiet Residential Area at Night
30	Normal Speech at 3 Feet
20	Soft Whisper at 3 Feet

NOTES:

1 Doubling of the sound pressure from a single source results in a 3 dB rise in sound pressure level.

2 Doubling of the distance from the source of sound to the receiver will reduce its level by 6 dB.

3 A 10 dB rise in sound level indicates the sound perceived by the ear will be twice as loud as the original sound.

4 Most blower and fan type heating equipment will emit sounds at between 30 and 55 dB sound pressure. At equivalent air flows, the propeller fan will produce sounds at 5 to 15% higher levels than centrifugal blowers with forward curved blades.

Ducted packages that are installed remote from the area which they are treating have the added advantage of both distance and the muffling effect of the duct system. As a result, sounds on these systems normally range within the 20 to 25 dB sound pressure level within the space being treated.

36 Definitions

AMBIENT – Surrounding temperature.

AMPACITIES – Total amperes expected at maximum load X 1.25

A.N.S.I. – American National Standards Institute

ASHRAE – American Society of Heating Refrigeration and Air Conditioning Engineers.

36 Definitions (cont'd)

ATMOSPHERE – (as used) 29.9 inches Mercury (HG).

AUXILIARY CONTACT – Extra switches added to magnetic contactors or starters that operate simultaneously with the load contacts (switches). Such switches are used to energize secondary circuits such as signal lights or exhausters that may be used in conjunction with makeup air equipment.

CLEARANCE TO COMBUSTIBLES - The minimum distance from the heater to a surface or object that is necessary to ensure that a surface temperature of 90°F above the surrounding ambient temperature is not exceeded.

COMBUSTIBLES – Materials that will ignite and burn or char.

CONDENSATION – When vapors are chilled adequately, they are converted into liquid.

CONDUCTION - Heat transmitted by contact between two elements of different temperatures.

CONDUCTIVE LOSSES – Heat loss from a building through contact with the ground or with other unheated buildings or appurtenances.

CONVECTION – Heat is transmitted to the space by air currents.

CONVECTIVE LOSSES – Heat loss from a building by contact with outside air or heat loss by leakage and by infiltration.

DEGREE DAYS – (Annual degree days) The total number of outdoor degrees F below the indoor design temperature (65° F) using the average deviation for each day over a 365 day period.

DIRECT FIRED - Air being heated by direct contact with the flame.

DUCT FURNACE - Convection unit requiring circulated air under power. Air is forced through the furnace by the use of ducts and distributed to the space through ducts.

EFFICIENCY – Useful output after conductive, radiant and combustion losses have been deducted.

F.L.A. – Full load AMPS –AMP draw of electrical device at full rated working load.

FLUE GAS – Mixture of air and bi-products of combustion.

GRAVITY VENT FURNACE - Furnace that depend on convection to draw the hot flue gases to the outdoors.

INDIRECT FIRED – Combustion is confined to chamber which in turn transmits heat by convection or radiation to the space.

MANIFOLD - Pipe or tubular fitting into which the orifice is fastened. The pipe or tube directs the gas from the controls to the orifice.

MAGNETIC CONTACTOR – Multiple switch (2 or 3) assembly that includes an electromagnet which, when energized, closes all switches in unison. Magnetic contractors are used with single and three phase motors that have overload devices built into their windings.

MAGNETIC STARTER – Multiple switch (3 or 4) assembly that includes overload devices. An electromagnet is included to activate the switches in unison. If the overload devices sense an overload condition at the motor, they will open the circuit to the electromagnet, opening all the switches to stop the motor. Magnetic starters include a reset button to reinstate motor after it has been shut down by the overloads. **Note:** If overloads shut down motor, check to find out what created the overloaded condition before restarting the motor.

MANUAL STARTER – Switch that is operated manually and which is used to start single phase motors. The switch includes an overload device that will disengage the electrical circuit to the motor in the event the motor becomes overloaded.

MODULATION – Where the flow of gas to the main burner is varied between maximum and minimum input.

ORIFICE – Fitting that controls the flow of liquid or gas based on a given pressure.

OVERLOAD HEATER – Electrical device used in motor starters that will shut off if the motor load exceeds acceptable Amperes.

PACKAGED UNITS - Heating system that includes burner, controls, air mover, and other accessories to provide complete performance as desired by the building designer.

POTENTIOMETER – A device designed to vary the resistance in an electrical circuit. Resistance is measured in OHMS.

POWER FACTOR – An expression of work capability based on the amount of power producing current developed in a motor design.

POWER VENT FURNACE – Furnace with integral means of venting products of combustion using a motor powered exhauster.

PRESSURE-NULL SWITCH – A pressure sensing device with SPDT switching. The switch is activated by a diaphragm which senses pressure differential. The SPDT switch has a floating contact which may be positioned against either pole or can be positioned for no circuit at all. Used with non-spring return damper motors.

P.S.I. – Pounds per square inch (Pressure).

RADIATION – Transmission of heat by line of sight heat waves. (The sun is the best example of radiant heat).

RADIANT LOSSES – Heat lost from a building through radiation from the walls.

36 Definitions (cont'd)

RATED INPUT – Acceptable input to furnace based on compliance with ANSI standards. (The input is shown on the rating plate that is affixed to each appliance).

REGULATOR – A device used in the gas supply that controls the gas pressure at a specified setting for proper operation of the burner and pilot systems.

RESISTOR – Electrical device that is designed to create resistance to electrical flow thereby creating heat and reducing power potential in the complete electrical circuit.

RISE – The measured difference between the entering air temperature and the leaving air temperature (expressed by the symbol ΔT).

SEASONAL EFFICIENCY – The consummate efficiency of a heating system over a 12 month period considering flue losses, electrical consumption, warm-up and cool down cycles, pilot losses and fuel consumption, when compared to the design loss of the building and the annual degree day value for the geographical areas of the building being studied.

SPECIFIC GRAVITY – Weight of gas when compared to the weight of air (air considered at a value of 1.0).

STATIC PRESSURE – The pressure exerted against the walls of an airway that is created by the resistance of the walls of the airway. Also can be created when air is turned or strikes a surface which may block its path. (Referred to as impact loss.)

ZONE – Specific area to be heated or cooled at a specific temperature. Zones within a building may require different indoor design temperatures based on their ultimate use.

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