AERCO Gas Fired KC 1000 Venting and Combustion Air Guide **GF-1050**

GENERAL

The AERCO KC1000 gas-fired module is a high efficiency forced draft hydronic/domestic water heating unit with unique venting capabilities. Venting options, such as horizontal and vertical discharges, direct vent, and manifolded vent breeching, typically exceed those of other combustion equipment. The KC1000 is designed to provide extremely high thermal efficiencies and optimum temperature control under widely varying conditions. The design of the flue gas vent and combustion air system must maintain these objectives.

The high efficiency is achieved through air/fuel modulation and the release of energy due to condensing of the moisture in the combustion products. Each KC unit is fitted with a condensate removal trap to discharge the condensate. Figure 1 indicates the air inlet, vent connection and the condensate connection. Condensation is possible in the exhaust vent system and it must be designed to accommodate the moisture.

This bulletin allows for broad design latitude while meeting the objectives of safety, longevity and optimum performance.

MATERIALS AND APPROVALS

The KC 1000 is a Category III and IV appliance and requires special attention to exhaust venting and combustion air details. The exhaust vent MUST be UL Listed for use with Category III and IV appliances: operating temperatures of up to 480°F, positive pressure, condensing flue gas service. Currently, UL Listed vents of AL29-4C stainless steel must be used with the KC 1000. Proper clearances to combustibles must be maintained per UL and the vent manufacturer.

UL and NFPA 54 (National Fuel Gas Code ANSI Z223.1) guidelines are often the basis for state and local codes. AERCO's recommendations follow the guidelines of these recognized agencies unless there are codes applicable to the installation site that are more stringent. The venting and combustion air systems must meet all applicable code requirements.

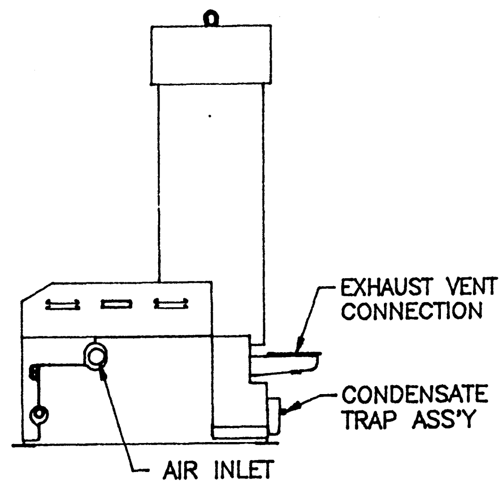

FIGURE 1

Code Required Vent Terminations:

The guidelines below should be followed to comply with AERCO, UL, and NFPA 54 (National Fuel Gas Code ANSI Z223.1) recommendations and regulations:

- Vent terminations should be at least 4 feet below, 1 foot above or 4 feet horizontally from any window, door or gravity air inlet of a building and should extend beyond the outside face of the wall by a minimum of 6 in. The bottom of the vent terminal should be at least 12 in. above both finished grade and any snow accumulation point.
- The vent termination should be least 3 feet above any forced air building inlet within 10 feet.
- Vents should not terminate over public walkways or over an area where condensate or vapor could create a nuisance or be detrimental to the operation of regulators, meters, or other equipment.
- Discharges should not be in wind blocked areas, corners or directly behind vegetation.
- Wall and roof penetrations should follow all applicable codes and the vent manufacturer's instructions. The vent should never be installed at less than the required clearances to combustible materials per UL, NFPA, and local codes. "Double-wall" or "thimble" assemblies are required when penetrating combustible walls and roofs.

- Vertical discharges should extend at least 2 feet above the roof through properly flashed penetrations and at least 2 feet above anything within a 10 foot horizontal diameter. Discharges that extend more than 2 feet above the roof must be laterally supported.
- Vertical and horizontal discharges should be designed to prevent rain from entering the vent. Large mesh screens can be applied to protect against the entry of foreign objects but the "free area" should be at least twice the flue cross-sectional area. Designs which minimize wind effects should also be used.
- If the vent system is to be connected to an existing stack, the stack must be UL Listed for Category III and IV appliances (capable of 480°F, positive pressure and condensing flue gas operation). Masonry stacks must be lined and the vent penetration must terminate flush with and be sealed to this liner. Vents may enter the stack through the bottom or side. All side connections must enter at a 45° connection in the direction of flow and must enter at different elevations, with the smallest vent connection at the highest elevation.
- KC 1000 vents must not be interconnected to those of other manufacturers' equipment.
- The exhaust vent must be pitched up toward the termination a minimum of 1/4 in. per foot of length. Condensate must flow back to the KC unit freely, without accumulating in the vent.

COMBUSTION AIR SUPPLY

Each KC 1000 requires 250 SCFM of combustion air when operated at full capacity. This flow must be accommodated. Air supply is a direct requirement of NFPA and local codes that should be consulted for correct design implementation.

In rooms with other air consuming equipment such as air compressors and other combustion equipment, the combustion air supply system must be designed to accommodate all users when all are operated at the same time and at maximum capacity.

Intakes should be located to prevent infiltration of chlorides, halogens or any other chemicals that are detrimental to the operation of combustion equipment. Whenever the environment contains these types of chemicals, the air *must* be supplied from the outdoors using direct vent/sealed combustion ductwork. Combustion air temperatures as low as -30°F can be utilized without affecting the integrity of the equipment, however the combustion settings may have to be adjusted to compensate for site conditions.

Combustion Air from Outside the Building

The room should have two permanent louvered openings to the outdoors. Each opening must have a minimum free area of 1 square inch for each 4000 Btuh of total input rating of all equipment in the space.

When the air is supplied to the room via ducts, two ducts must be used. Vertical ducts and openings must have a minimum free area of 1 square inch for each 4000 Btuh of total equipment input. Horizontal ducts and openings must have a minimum free area of 1 square inch for each 2000 Btuh of total input.

The free area of the openings must take into account restrictions from louvers and screens. The louver manufacturer should be consulted for the percentage of free area available. Consult NFPA 54 if the free area is not known. Louvers should be fixed in the open position or interlocked with the equipment so that they open automatically during equipment operation.

The combustion air openings, whether ducted or open directly to the outdoors, should be located on the same wall and positioned so that one is high in the room and one low to assure good ventilation. Openings should never be placed directly in front of piping or other equipment that might freeze during cold weather.

Combustion Air from Within the Building

Where combustion air is to be used from within the building, air must be provided into the equipment room via two permanent openings to an interior room. Each opening must have a minimum free area of 1 square inch for each 1000 Btuh of the total equipment input. The openings should be located on the same wall, one high and one low. There must be sufficient air infiltration into the building.

Direct Vent/Sealed Combustion

When room air is insufficient or not suitable for combustion, the KC 1000 is approved for direct vent installation, i.e. draw all combustion air from the outdoors via a metal or PVC duct connected between the KC unit(s) and the outdoors. An inlet air (sealed combustion) adapter is available as an accessory from AERCO. The minimum sealed combustion air duct size is 6 in. diameter for each KC unit. In many instances, the combustion air duct can be manifolded for multiple unit applications. The length and restriction of the sealed combustion duct has a direct effect on the size, length and restriction of the discharge venting. The direct vent air intake should be located at least 3 feet below any vent termination within 10 feet.

Exhaust Vent and Combustion Air Systems

The KC 1000 offers several venting and combustion air options, and although the application parameters may vary, there are some basic similarities for all systems. Tables 1 and 2 cover the pressure drop of most vent and duct fittings and sizes. The vent exit and air duct entrance losses are also included to allow for a correctly designed system. It should be noted that flow and vent or duct diameter have the most significant effect on overall system pressure drop. When using fittings or terminations not listed in the tables, consult the manufacturer for actual pressure drop values. If rectangular duct is to be used, consult Table 5 to select a round diameter duct that has the identical pressure drop per length of rectangular duct. The pressure drop values used in this bulletin are in equivalent feet of 6 in. dia. exhaust vent. Note that 1 eq. ft. of 6 in. dia. vent is equal to 0.00581 in. W.C.

Flue gases have a lower density (lighter) than air and will rise, creating "gross natural draft". Gross natural draft is created when the flue gases exit the vent at some elevation above the KC 1000. The amount of draft is dependent upon the height of the stack and the difference between the flue gas and the surrounding air temperatures (densities). Gross natural draft values for stacks of various heights for the KC unit are located in Table 3. The draft values are based on a sea level installation site. Adding the gross natural draft (negative) to the vent and air system pressure drop (positive) determines if the total system will be positive pressure or negative pressure ("net natural draft"). As with most combustion equipment, negative pressure (net natural draft) systems should be treated differently from positive pressure systems when the discharge vents are manifolded. Note that sidewall vent terminations, as well as some vertical terminations, are positive pressure systems.

Table 4 indicates correction factors that should be applied to installations that are above sea level. The correction factors must be applied to both natural draft and pressure drops of vent and air duct. The pressure *drop through vents and combustion air ducts will increase with higher elevations, while the natural draft will decrease.*

Although individual discharge vents are recommended, in many instances it may be more practical to manifold multiple units. When multiple units are connected via a manifolded vent, the operation of a given unit can be affected by the others if the venting or combustion air system is not designed properly. Properly designed common vent and air supply systems can be installed which will prevent "operational interaction" between units. The design parameters for manifolded vent systems will differ from those of individually vented systems. *Manifolded vent design must assure that all flue gases flow towards the vent termination at all firing rates by maintaining less pressure in the common vent than at the air inlets of the KC 1000s'.*

Exhaust Vent Systems

- *Positive Pressure -* Positive pressure in the vent at all firing rates. Side wall and vertical discharges at an elevation less than 30 feet above the AERCO's exhaust manifold typically fall into this category.
- *Natural Draft - Negative Pressure -* If the vent termination is 30 feet or more above the AERC0 exhaust manifold, a reasonable "natural draft" may be generated. The "natural draft" is dependent on the stack height, flue gas and ambient air temperatures, site elevation (atmospheric pressure) and the vent's resistance and exit loss.

Combustion Air Supply Systems

- *Room Air:* Air is supplied into the KC 1000 area via louvers or a make-up fan.
- *Sealed Combustion:* Sealed combustion air duct between the outdoors and the KC blower.
- *Forced Sealed Combustion:* A supplemental air supply fan installed in the sealed combustion duct. Select the fan to provide 250 SCFM per connected KC unit and maintain 17 to 43 equivalent feet (0.1 to 0.25 in. W.C.) of static pressure above the combined system pressure drop of all units when operated at their maximum capacity.

Individually Vented Systems:

Systems with individual vents may be used with any of the combustion air systems listed above and in Figure 2. The maximum combined pressure drop of the vent and combustion air system must not exceed 140 equivalent feet of length. Calculate the pressure drop for the exhaust vent separately from the combustion air duct pressure drop.

Divide the vent pressure drop by the altitude correction factor (CF), Table 5, to correct for installations above sea level. Determine the natural draft, if any, from Table 4 and multiply it by the altitude CF. Add the altitude corrected vent pressure drop (positive) and the draft (negative) to get the total vent pressure drop. Add the total vent pressure drop to the altitude corrected combustion air duct pressure drop. The total system pressure drop must not exceed 140 equivalent feet.

Example: Calculate max. pressure drop for an installation at 450 feet above sea level with a 6 in. dia. exhaust vent with 2-90° elbows, 2-45° elbows, 40 feet of horizontal run and 10 feet of vertical run and an 8 in. dia. sealed combustion air duct with 2-90° elbows and 50 feet of run.

<u>6 in. dia. exhaust vent pressure</u>

2-90° elbows:	2x15	=	30 ft
2-45° elbows:	2x8	=	16 ft
50 feet total run: (40 horiz. + 10 vert.)	50x1	=	50 ft
exit loss:	1 x 22.03	=	22.03 ft
vent drop subtotal:		=	118.03 ft
altitude correction:	118.03 / 0.982 CF	=	120.19 ft
natural draft-10 feet:	-4.68 ft		
altitude correction:	0.982 CF x (-4.68)	=	-4.60 ft
vent total drop:		=	**115.59 ft**

<u>8 in. dia. combo. air duct pressure</u>

2-90° elbows:	2x2.82	=	5.64 ft
50 feet total run:	50 x 0.14	=	7 ft
entrance loss:	1 x 3.06	=	3.06 ft
comb air drop subtotal:		=	15.7 ft
altitude correction:	15.7 / 0.982 CF	=	15.99 ft
comb. air total drop:			**15.99 ft**

<u>System total pressure drop</u> = vent drop+ air duct drop
= 115.56 + 15.99
= **131.55 ft**

System OK; less than 140 equivalent feet.

For systems utilizing manifolded sealed combustion ductwork, use the longest length of common duct and the individual branch to the furthest KC air inlet for calculating the pressure drop.

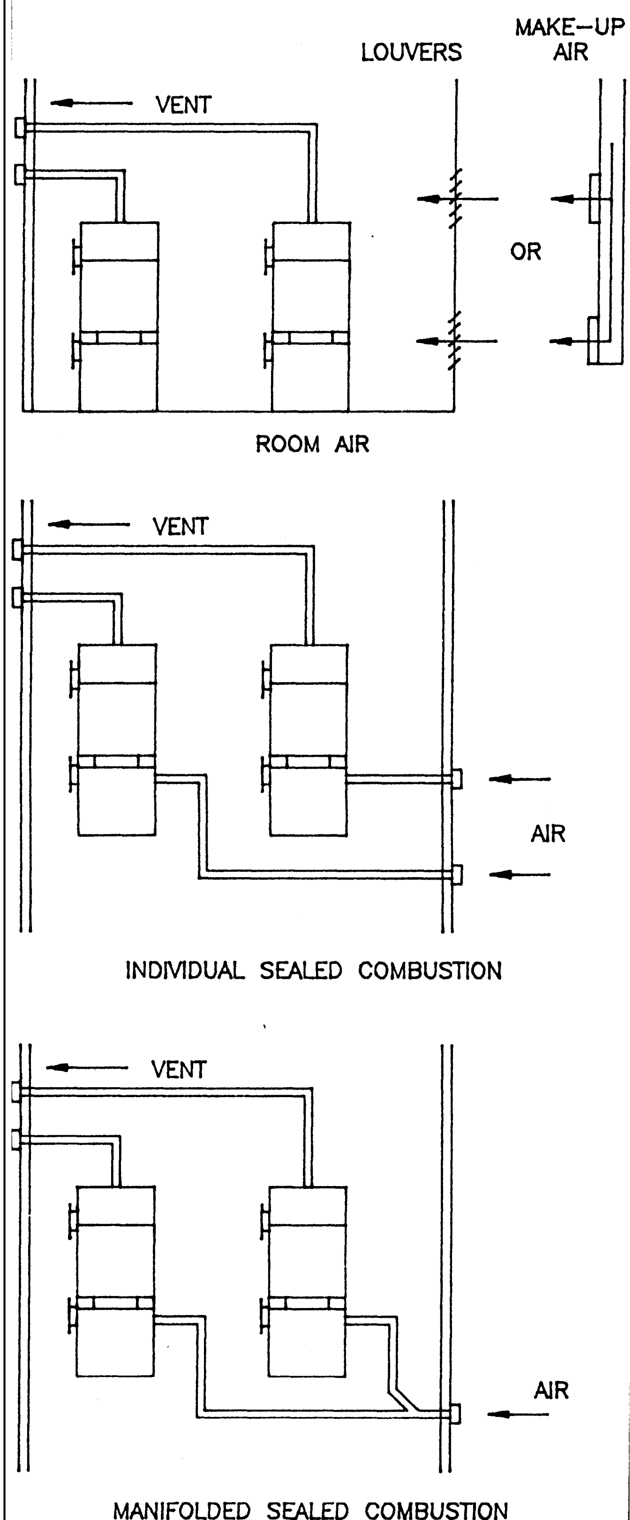

FIGURE 2
INDIVIDUAL VENTS

Common Vent Breeching (Manifolded) - Net Natural Draft

Vent and combustion air systems that have a combined system pressure that is negative or *neutral* fall into this category. Do not include the 6 in. dia. branches between the common vent and each KC 1000 if each branch is equal in pressure drop (same length and number of fittings). The maximum combined pressure of the vent and the air system must be in the range of 0.0 to negative (-) 43 equivalent feet (0.0 to -0.25 in. W.C.). Manifolded vent systems with pressures greater than 0.0 eq. feet must be treated as Positive Pressure systems. Net natural draft systems can use room air or sealed combustion (individual or manifolded) air supply systems. See Figure 3.

Add the vent pressure drop (altitude corrected), the combustion air pressure drop (altitude corrected) and the natural draft (altitude corrected). The total must be in the neutral to negative pressure range of 0.0 to -43 eq. feet.

Example: Calculate system pressure drop for an installation at 1000 feet above sea level. Two KC units are installed with a common 12 in. dia. vent breeching. The 12 in. dia. breeching runs 12 feet horizontally (includes distance between units), makes a 90° bend and runs vertically 37 feet to termination. 6 in. dia. vent, 6 feet long, connects into the 12 in. breeching above from each KC 1000. The KC units draw air from within the room.

12 in. dia. exhaust vent pressure drop:		
1-90° elbow:	1 x 3.75 =	3.75 ft
49 feet total run: (12 horiz. + 37 vert.)	49 x 0.12=	5.88 ft
exit loss:	=	5.51 ft
vent drop subtotal:	=	15.14 ft
altitude correction:	15.14 / 0.964 CF =	**15.71 ft**
6 in. dia. exhaust vent:		
same press. drop		**0 ft**
natural draft-12 in. vent-37 feet vert.	=	-16.85 ft.
altitude correction:	0.964x (-16.85) =	**–16.24 ft**
total vent pressure:	=	**–0.53 ft**
No combustion air drop.		
Total system pressure = vent drop +air duct drop	=	**–0.53 eq. feet**

System OK; less than 0 equivalent feet.

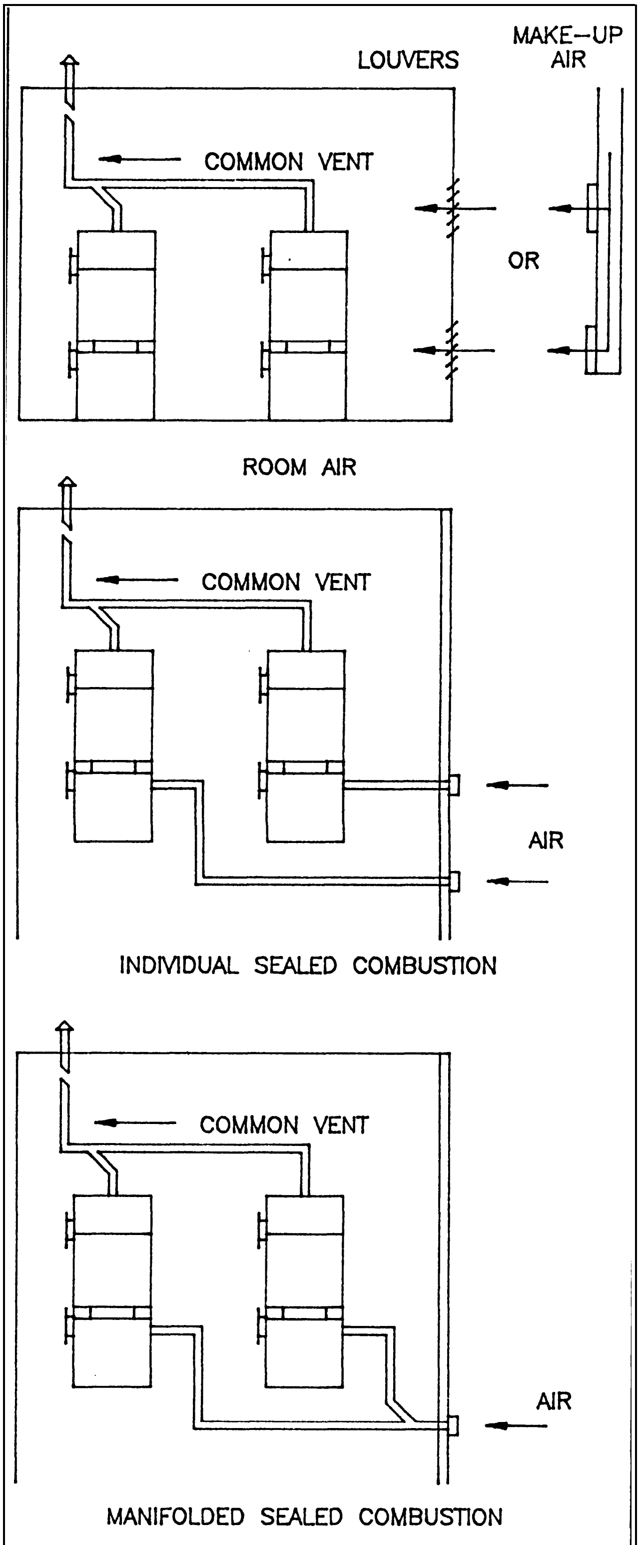

FIGURE 3
COMMON VENT–NATURAL DRAFT

Common Vent Breeching (Manifolded) Positive Pressure

When the common vent breeching is positive pressure, forced sealed combustion air ducting is necessary. The supplemental combustion air supply fan can draw air directly from the outdoors, or from within the room. See Figure 4. If room air is used, the louvers or make up air ducts to the outdoors must be sized, as described earlier. Add the altitude corrected pressure drops of the venting and combustion air system. If a supplemental air supply fan is required, it should deliver 250 SCFM per KC unit at 17 to 43 equivalent feet (0.1 to 0.25 in. W.C.) above the combined system pressure drop. The static pressure of the fan should not exceed 140 eq feet (0.81 in. W.C.). The combined pressure drop of the combustion air and venting system (without the fan) should not exceed 123 eq. feet (140 eq. ft.-17eq. ft.=123 eq. ft.).

Combustion Air Fan
Static Pressure Equivalents

static pressure (in. W.C.)	static pressure (eq. feet)
0.10	17.21
0.20	34.42
0.30	51.63
0.40	68.84
0.50	86.04
0.60	103.25
0.70	120.46
0.80	137.67

The combustion air supply fan should be operated at all times when any manifolded unit is firing. Installation of a "back draft" damper in parallel with the fan to assure that air would be available if the fan is inoperative.

Example: Site elevation is 1100 feet. Three KC units installed with a 12 in. dia. vent with 25 feet of horizontal run and 7 feet of vertical run and 3-90° elbows. A 6 in. dia. vent section rises 5 feet above the units and enters the breeching at a 45° angle. The combustion air duct is 10 in. dia. with 2-90° elbows and 25 feet of run. 6 in. duct, 8 feet long and 1-90° elbow connect the manifolded air duct with each unit. Calculate the required fan size.

12 in. dia. exhaust vent pressure drop:

3-90° elbow:	3x8.43 =	25.29 ft
32 feet total run: (25 horiz. + 7 vert.)	32 x 0.28=	8.96 ft
exit loss:		12.39 ft
vent drop subtotal:		46.64 ft
altitude correction:	46.64 / 0.964CF =	**48.38 ft**

6 in. dia. exhaust vent:

5 feet of run	5x1 =	**5 ft**

natural draft-12 in. and 6 in. vent-12 feet vert.	=	-5.61 ft
altitude correction:	0.964x (-5.61) =	**–5.41 ft**
total vent pressure drop:		**47.97 ft**

10 in. dia. combustion air duct pressure drop:

2-90° elbows:	2 x 10.72=	21.44 ft
25 feet total run:	25 x 0.43=	10.75 ft
entrance loss:		11.29 ft
vent drop subtotal:		43.48 ft
altitude correction:	43.48 / 0.964 CF	**45.10 ft**

6 in. dia. combustion air duct:

8 feet of run:	8x0.58 =	4.64ft
1-90° elbow:	1 x 8.67 =	8.67 ft
comb. air subtotal:	=	13.31 ft
altitude correction:	13.31 / 0.964 CF =	**13.81 ft**
total comb. air duct drop:	=	**58.91 ft**
Combined vent and air, duct drop:		**106.88 ft**

Determine fan static pressure required: = add 17 to 43 eq. ft. to 106.88. Do not exceed 140 equivalent feet.

= 123.88 to 140 eq. ft.
= 0.70 to 0.81 in. W.C.

Combustion air fan should deliver 750 SCFM at 0.70 to 0.81 in. WC.

Vent and Combustion Air System Design Requirements

- The *minimum* exhaust vent and combustion air duct size is 6 in. dia. The exhaust manifold connection is designed to accommodate a 6 in. vent. A 6 in. x 3 in. reducer, shown in Figure 5, is included with the inlet air adapter to connect to 6 in. dia. galvanized, aluminum or PVC sealed combustion air duct.

- A 1/2 in. dia. combustion test hole should be provided in each unit's vent starter section about 12 in. to 18 in. above the exhaust manifold connection. A 6 in. length of straight vent should be provided downstream of this hole. See Figure 6. A means to securely seal the hole should be provided to prevent leakage following any testing.

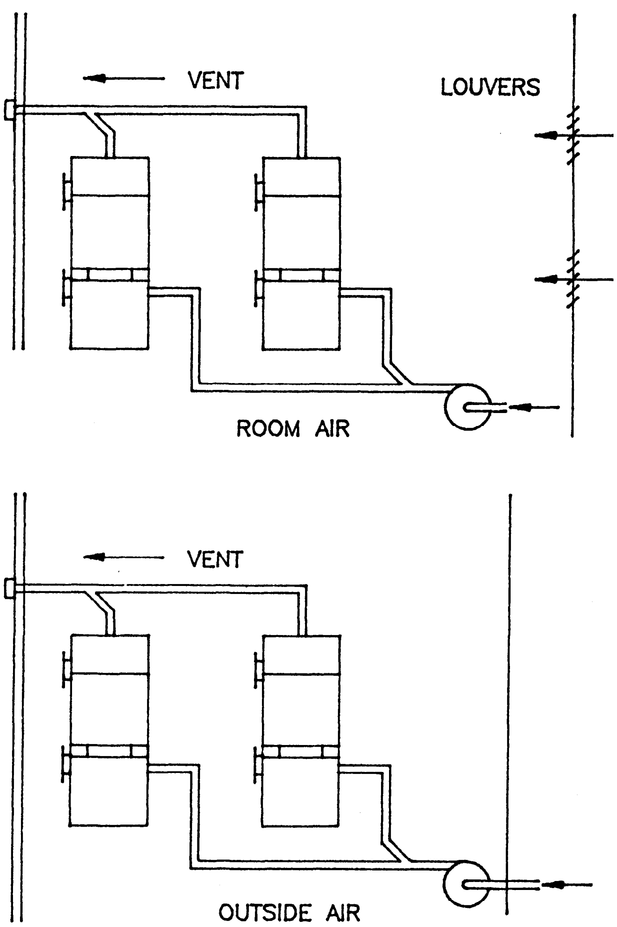

FIGURE 4
COMMON VENT–POSITIVE PRESSURE

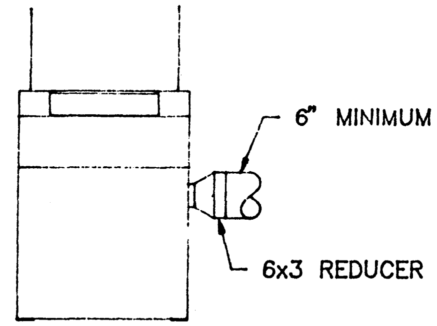

FIGURE 5
SEALED COMBUSTION AIR CONNECTION

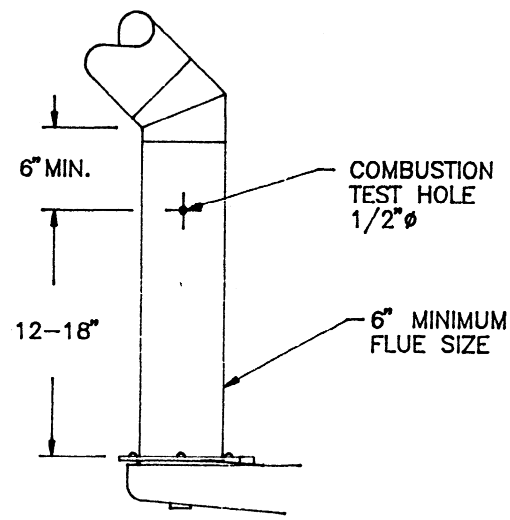

FIGURE 6
VENT STARTER SECTION

- Connections to common vent breeching or duct work must be accomplished with a 45° elbow in the direction of flow in the main breeching. "Tees" should not be used to accomplish these connections. See Figure 7.

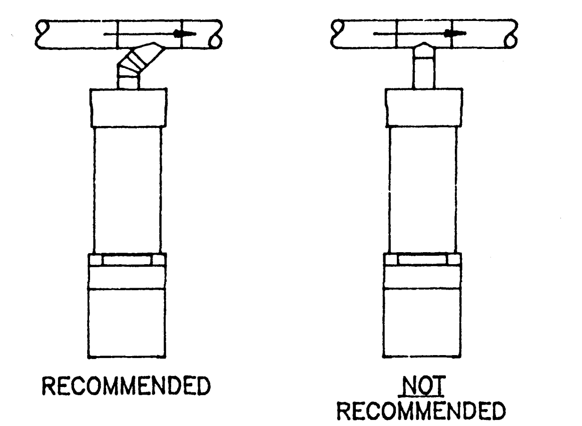

FIGURE 7

- Interconnection of groups of units must *never* be accomplished via a "tee". As shown in Figure 8, change the direction with one of the mains and then connect the second 3 diameters (common section diameter) from this turn via a 45° connection.

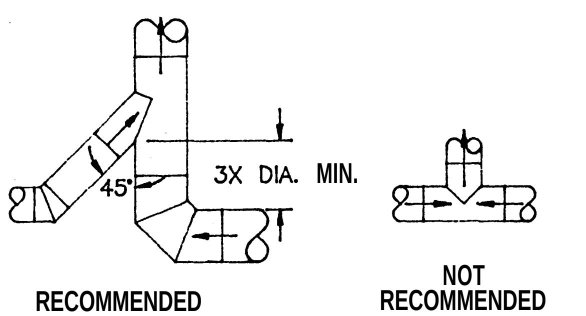

FIGURE 8

- Figure 9 illustrates the preferable "transition vent section" when making the 45° connection into a main. The main can also remain at one diameter, as long as it is sized for the total number of units vented, and the 45° branch connection is retained. Use of the *preferred* "transition" assembly will reduce the overall system pressure drop.

- The vent system should always be pitched up 1/4 inch per 1 foot of run towards the vent termination. This will allow condensate to drain back to the unit to be disposed of. Low spots in the vent must be avoided. Periodic inspection should be performed to assure for correct drainage. See Figure 10.

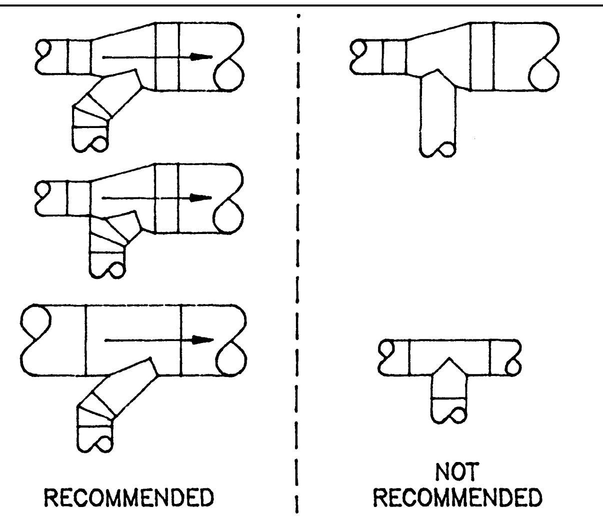

FIGURE 9

- As shown in Figure 10, an "inspection end cap" should be provided on the end of the vent or duct main.

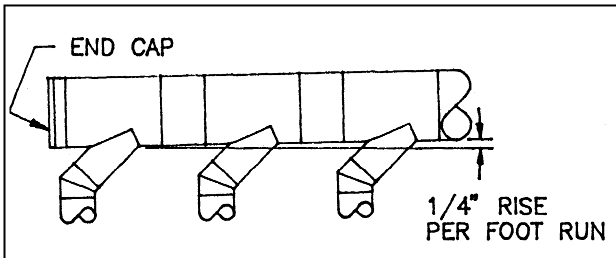

FIGURE 10

- KC 1000 vents should not be interconnected to those of other manufacturers' equipment.

- Horizontal vent and ductwork should be supported every six feet of length. Vertical vent and ductwork should be supported to prevent excessive weight on the horizontal runs. The exhaust manifold and inlet air adapter should never be utilized as a weight supporting element. The supports should be arranged and the overall layout designed to assure that stresses on the vent and combustion air connections are minimized.

- The vents and combustion air ducts may be insulated per the vent manufacturer's instructions and local codes.

CONDENSATE REMOVAL:

The exhaust vent system must be pitched up away from the KC unit towards the vent termination a minimum of 1/4 in. per foot of length. This will allow condensate to drain back to the unit to be disposed. Low spots in the venting where condensate may collect should be avoided. The condensate trap assembly is located directly below the exhaust manifold. Plastic hose should be connected to the trap assembly and run to drain. Care should be taken to avoid kinks and from raising the tube above the trap assembly. Condensate should flow freely to drain. Do not hard pipe the condensate to drain, as the trap assembly needs to be removed for maintenance and service.

If the condensate must be lifted above the trap assembly to a drain, it should be drained into a sump. From there a pump can lift the condensate away.

Table 1
Discharge Venting Pressure Drop

No. KC Units	Vent Dia. (In)	Straight Run/Ft. (eq. ft.)	90° Elbow (eq. ft.)	45° Elbow (eq. ft.)	Exit Loss (eq. ft.)
1	6	1	15	8	22.03
	8	.25	5.07	2.71	6.97
	10	.09	2.19	1.17	2.86
2	10	.35	8.75	4.67	11.42
	12	.12	3.75	2	5.51
	14	.06	2.09	1.12	2.97
	16	.03	1.27	.68	1.74
3	12	.28	8.43	4.5	12.39
	14	.13	4.71	2.51	6.69
	16	.07	2.85	1.52	3.92
	18	.04	1.66	.89	2.45
4	14	.24	8.38	4.47	11.89
	16	.13	5.07	2.7	6.97
	18	.07	2.96	1.58	4.35
	20	.04	1.99	1.06	2.86
5	16	.2	7.92	4.22	10.89
	18	.1	4.62	2.47	6.8
	20	.06	3.11	1.66	4.46
	22	.04	2.17	1.16	3.05
6	18	.15	6.66	3.55	9.79
	20	.09	4.48	2.39	6.43
	22	.06	3.12	1.67	4.39
	24	.04	2.11	1.12	3.1
7	20	.12	6.09	3.25	8.75
	22	.08	4.25	2.27	5.97
	24	.05	2.87	1.53	4.22
8	20	.16	7.96	4.24	11.42
	22	.1	5.55	2.96	7.8
	24	.06	3.75	2	5.51

Table 2
Sealed Combustion Air Duct Pressure Drop

No. KC Units	Duct Dia. (In)	Straight Run/Ft. (eq. ft.)	90° Elbow (eq. ft.)	45° Elbow (eq. ft.)	Ent. Loss (eq. ft.)
1	6	.58	8.67	4.62	9.68
	8	.14	2.82	1.5	3.06
	10	.05	1.19	.64	1.25
2	8	.56	11.28	6.01	12.25
	10	.19	4.77	2.54	5.02
	12	.07	2.07	1.1	2.42
	14	.03	1.14	.61	1.31
	16	.02	.68	.36	.77
3	10	.43	10.72	5.72	11.29
	12	.16	4.65	2.48	5.45
	14	.07	2.57	1.37	2.94
	16	.04	1.54	.82	1.72
4	12	.28	8.27	4.41	9.68
	14	.13	4.57	2.43	5.23
	16	.07	2.73	1.46	3.06
	18	.04	1.61	.86	1.91
5	14	.2	7.13	3.8	8.16
	16	.11	4.27	2.28	4.79
	18	.06	2.51	1.34	2.99
	20	.03	1.68	.89	1.96
6	16	.15	6.15	3.28	6.89
	18	.08	3.62	1.93	4.3
	20	.05	2.41	1.29	2.82
	22	.03	1.68	.89	1.93
	24	.02	1.13	.6	1.36
7	18	.11	4.92	2.62	5.86
	20	.07	3.28	1.75	3.84
	22	.04	2.28	1.22	2.62
	24	.03	1.54	.82	1.85
8	20	.09	4.29	2.29	5.02
	22	.05	2.98	1.59	3.43
	24	.03	2.02	1.07	2.42

Table 3
Gross Natural Draft

Stack Height (ft)	Draft (eq. ft.)		Stack Height (ft)	Draft (eq. ft.)
8	-3.73		44	-20.57
10	-4.68		46	-21.51
12	-5.61		48	-22.46
14	-6.56		50	-23.39
16	-7.49		55	-25.73
18	-8.42		60	-28.07
20	-9.36		65	-30.41
22	-10.29		70	-32.75
24	-11.22		75	-35.09
26	-12.17		80	-37.43
28	-13.10		85	-39.75
30	-14.03		90	-42.09
32	-14.96		95	-44.43
34	-15.9		100	-46.77
36	-16.85		105	-49.11
38	-17.18		110	-51.45
40	-18.71		115	-53.79
42	-19.64		120	-56.48

Table 4
Altitude Correction

Site Elevation (ft)	Altitude Correction Factor (CF)
0	1
500	0.982
1000	0.964
1500	0.947
2000	0.930
2500	0.913
3000	0.896
3500	0.880
4000	0.864
4500	0.848
5000	0.832
5500	0.817
6000	0.801
6500	0.787
7000	0.772
7500	0.758
8000	0.743
8500	0.729
9000	0.715
9500	0.701
10000	0.688

Table 5
Round Duct of Identical Pressure Drop to Rectangular Duct

Adjacent Side of Duct (in.)	Side of Rectangular Duct (in.)									
	6	8	10	12	14	16	18	20	22	24
6	6.6									
8	7.6	8.7								
10	8.4	9.8	10.9							
12	9.1	10.7	12	13.1						
14	9.8.4	11.5	12.9	14.2	15.3					
16	10.4	12.2	13.7	15.1	16.4	17.5				
18	11	12.9	14.5	16	17.3	18.5	19.7			
20	11.5	13.5	15.2	16.8	18.2	19.5	20.7	21.9		
22	12	14.1	15.9	17.6	19.1	20.4	21.7	22.9	24	
24	12.4	14.6	16.5	18.3	19.9	21.3	22.7	23.9	25.1	26.2

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