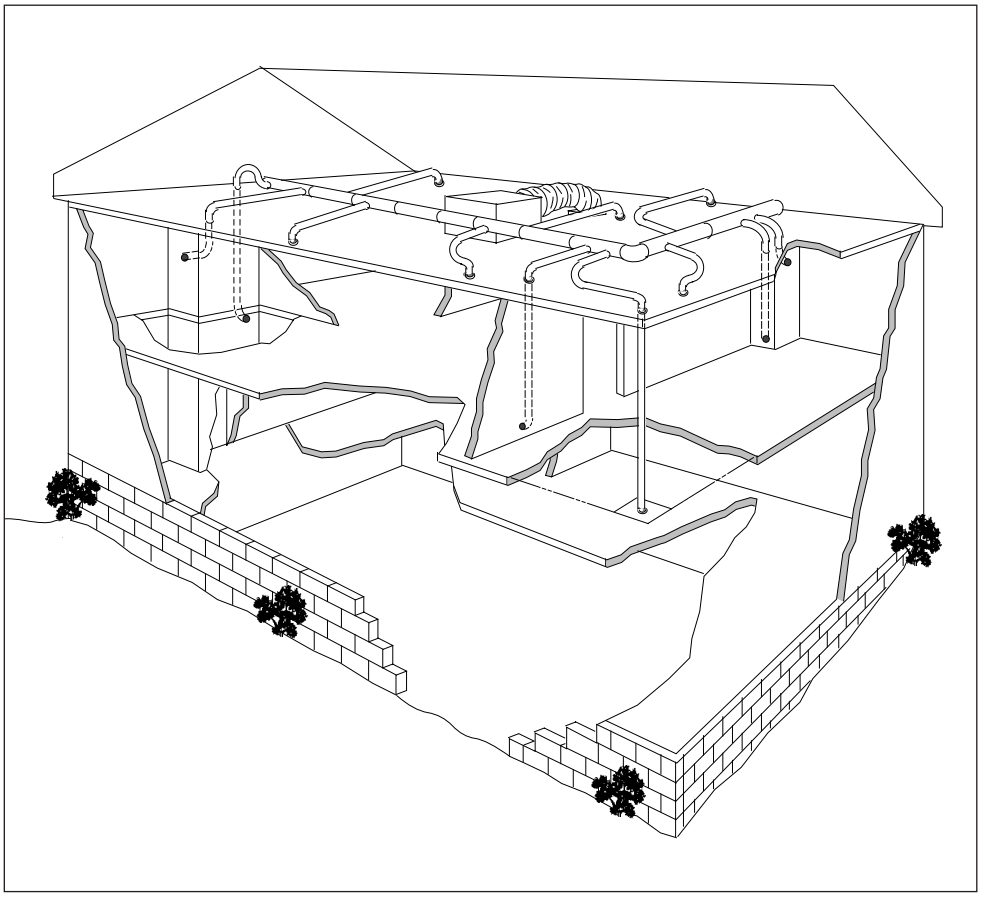
SP9-1118

SPACE PAK



APPLICATION MANUAL

For Central Air Conditioning and Heating Systems

KWIK-WAY HEATING & AIR CONDITIONING SIZING SHEET

ITEM OF CONSTRUCTION	Shade	Exposure	FACTORS HEAT	FACTORS COOL	TOTAL STRUCTURE AREA SQ FT	TOTAL STRUCTURE HEAT BTU	TOTAL STRUCTURE COOL BTU	ROOM: AREA SQ FT	ROOM: HEAT BTU	ROOM: COOL BTU	ROOM: AREA SQ FT	ROOM: HEAT BTU	ROOM: COOL BTU	ROOM: AREA SQ FT	ROOM: HEAT BTU	ROOM: COOL BTU	ROOM: AREA SQ FT	ROOM: HEAT BTU	ROOM: COOL BTU	ROOM: AREA SQ FT	ROOM: HEAT BTU	ROOM: COOL BTU	ROOM: AREA SQ FT	ROOM: HEAT BTU	ROOM: COOL BTU	ROOM: AREA SQ FT	ROOM: HEAT BTU	ROOM: COOL BTU
		Lg x Wd				X =			X =			X =			X =			X =			X =			X =			X =		
		L ft exp wall																										
		Ceiling Ht																										
		Total Exp wall																										
1 WINDOWS (cooling) Including Glass Doors		N																										
		NE & NW																										
		E & W																										
		SE & SW																										
		S																										
2 Glass Doors (heating)																												
3 Windows (heating)																												
4 Standard Doors (non-glass)																												
5 Partitions (less doors & windows)																												
6 Exposed Walls (less 1, 2, 3, 4 & 5)																												
7 Ceiling/Roof																												
8 Floor																												
9 Ventilation (Mechanical)/Infiltration																												
10 People				300																								
11 Appliances				1200																								
						HEAT	COOL		HEAT	COOL		HEAT	COOL		HEAT	COOL		HEAT	COOL		HEAT	COOL		HEAT	COOL		HEAT	COOL
12 Sub-Total Lines 1 - 11																												
13 Sensible {Line12 x Duct Factor (Fig.1.6)}																												
14 Heat Gain for Cooling Load (Line 13 x 1.3)				1.3																								
15 Equipment Selected (Fig.1.7)			OUTDOOR UNIT :					INDOOR UNIT :						RECOMMENDED NO. OF TERMINATORS:						SUPPLEMENTAL HEAT:								
16 Adjusted Loads: LAF (Fig. 2.3) x Line 13 and Line 14																												
17 Base Load Factors			BASE LOAD FACTOR HEATING = Line 13 Total Structure Heating / Recommended No. of Terminators =											BASE LOAD FACTOR COOLING = Lline 14 Total Structure Heating / Recommended No. of Terminators =														
18 Recommended No. of Terminators (Line 16 ÷ 17)																												
19 Selected No. of Terminators (Choose the larger number from Line 18)																												
20 Orifices Required			NONE .15 .35 .50					NONE .15 .35 .50			NONE .15 .35 .50			NONE .15 .35 .50			NONE .15 .35 .50			NONE .15 .35 .50			NONE .15 .35 .50			NONE .15 .35 .50		
21 Adjustable Dampers Required																												

FIGURE 1.1: KWIK-WAY HEATING AND AIR CONDITIONING SIZING CHART

SpacePak provides the Kwik-Way Heating & Air Conditioning sizing sheet (see Figure 1.1) to help dealers calculate the heat gain and/or heat loss of a structure to assure maximum comfort for the occupants. The form is easy to use; provides an accurate analysis; and is essential for sizing the structure and selecting the appropriate SpacePak equipment.

The Kwik-Way form also provides a room-by-room analysis for selecting the appropriate number of air outlets and balancing orifices for each room. Proper system balancing is the key to proper system operation.

The small amount of time that is spent in designing the SpacePak system will result in a satisfied customer every time. We have provided a number of extremely important guidelines in this application manual involving the air distribution system design, such as static pressures, plenum duct and supply tubing runs, and location of room outlets.

We recommend reviewing these guidelines carefully, as they are intended to save time on the job, help obtain the best possible installation, and provide continuous, trouble-free operation.

SECTION 1: EQUIPMENT SELECTION JOB ESTIMATING & SYSTEM DESIGN

Before equipment can be selected for an installation, it is imperative that the heat gain (for cooling) and/or the heat loss (for heating) be calculated for the home or business in which the Space Pak system will be installed to assure maximum comfort for the occupants.

Prior to performing your calculations, complete a floor plan of the structure, such as the one shown in Figure 1.2, which contains the following measurements (all of which can be rounded off to the nearest foot):

1. Square footage (length x width) of each room.

2. Linear feet of exposed (outside) wall in each room. If more than one exposed wall in each room, add the lengths together. If the wall has two different kinds of construction (part brick, part frame), measure each section as though it were a separate wall. If the wall is partially above grade and more than 3-feet below grade, measure each section as though it were a separate wall. If there is an open stairway alongside an exposed wall, the entire wall area (all the way to the ceiling of the sec-ond floor) is to be added to the first floor.

3. Ceiling height in each room.

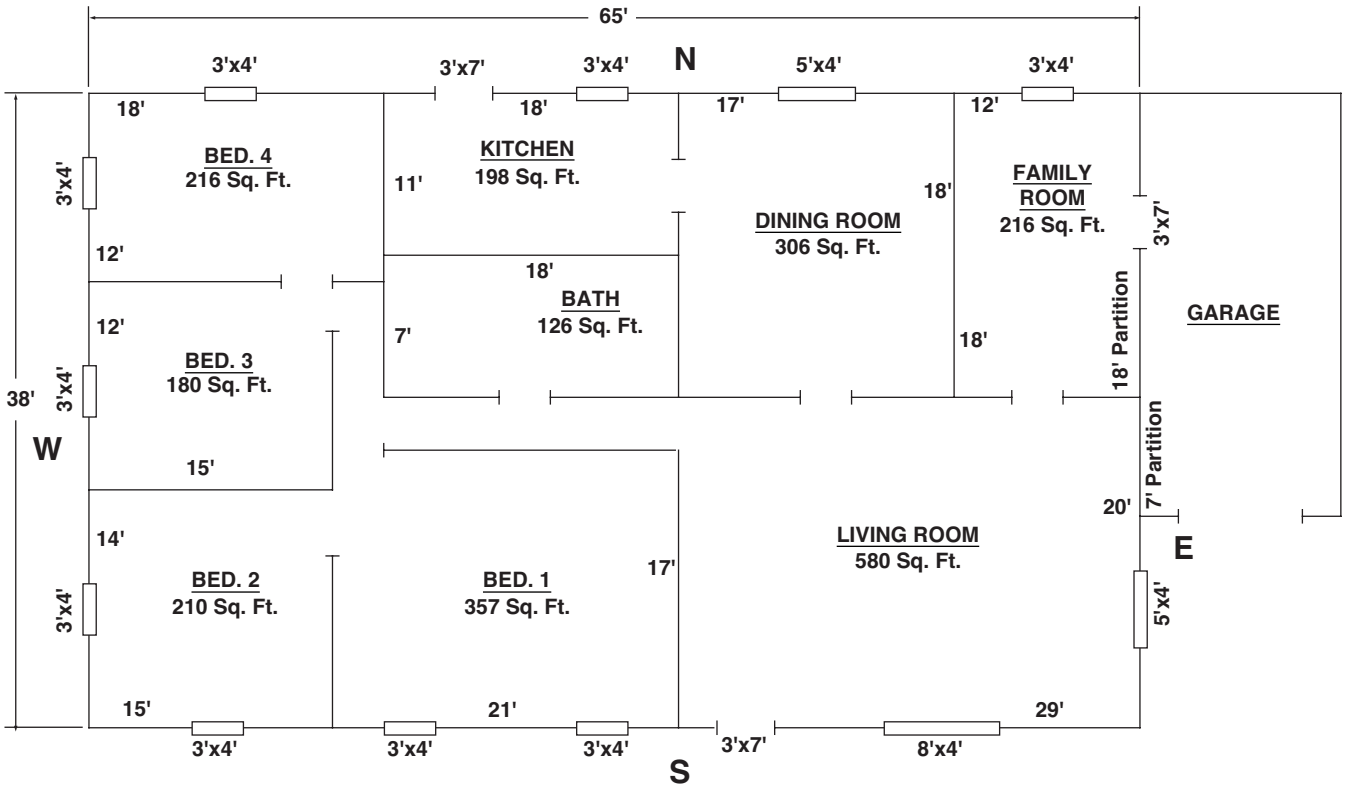


FIGURE 1.2: FLOOR PLAN EXAMPLE

4. Square footage of partitions — the walls between a conditioned and unconditioned area (such as a living room and attached garage).

5. Square footage of all exposed doors and windows.

6. Square footage of all exposed sliding glass doors. These are considered “windows” for cooling and “doors” for heating.

7. Square footage of exposed ceiling in each room. All rooms in a one-story structure have exposed ceilings. All second floor rooms in a two-story structure have exposed ceilings.

8. Square footage of exposed floors or floors over an unconditioned area in each room.

9. Indicate North-South and East-West directions.

Now, you’re ready to perform the heat gain/lost calculations using the SpacePak Kwik-Way Heating & Air Conditioning Sizing Sheet (Form PR108).

KWIK-WAY EXAMPLE

For our Kwik-Way example, we will use the floor plan and measurements as shown in Figure 1.2. This will be a cooling-only installation with the indoor fan coil unit to be located in a vented attic. Construction consists of one-story frame over a basement (R-11 insulation between floor and basement); 3-1/2-inch insulation in the walls and ceiling; 8-foot ceiling height; double-hung windows with blinds; storm doors; masonry partition with no insulation; and infiltration (no mechanical ventilation).

There are three occupants, the house faces South and the summer outdoor temperature is 90°F.

TOTAL STRUCTURE HEAT GAIN (LOSS)

To determine an accurate whole-house heat gain (loss) for the structure for estimating purposes, you can complete the **TOTAL STRUCTURE** column first on the Kwik-Way sheet. However, this does not preclude performing a final room-by-room analysis.

L ft exp wall: At the top of the Kwik-Way sheet, on this line, fill in the total linear feet of exposed wall for the structure (see Figure 1.3).

Ceiling Ht: On this line, fill in the ceiling height of the structure (see Figure 1.3). NOTE: If a room(s) has a different height than the others, such as one with a cathedral-type ceiling, then you will have to factor in the room’s height and linear exposed feet separately.

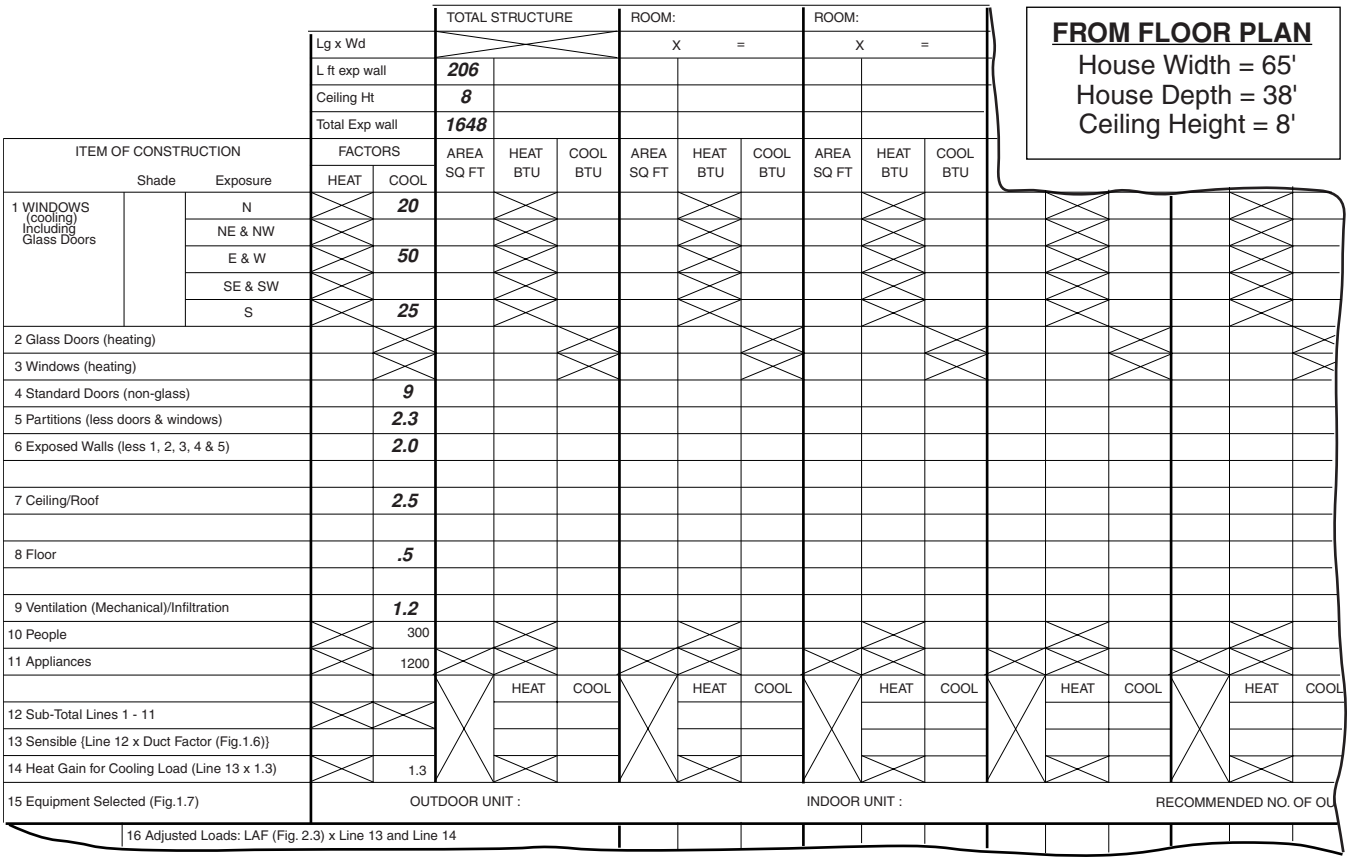


FIGURE 1.3: TOTAL STRUCTURE COOLING EXAMPLE

Total Exp wall: On this line, fill in the total square footage of exposed wall. Simply multiply linear feet of exposed wall by ceiling height in each room.

FACTORS: For this column, select and enter the applicable factors, as shown in Figure 1.4, which correspond to the construction of the structure and the application: cooling-only or heating (see Figure 1.3). These factors are also available in Table 1 on the back of the Kwik-Way sheet.

For cooling-only installation, select factors for Lines 1, 4, 5, 6, 7, 8 and 9. For heating installations, select factors for Lines 2, 3, 4, 5, 6, 7, 8 and 9.

Example (cooling-only): Based on example house construction, the following factors would be selected:

DESCRIPTION	FACTORS
Double-Hung Windows With Blinds	
North	20
East & West	50
South	25
Storm Doors (at 90°F)	9
Masonry Partition w/o Insulation (at 90°F)	2.3
Frame Walls w/3-1/2" Insulation (at 90°F)	2.0
Ceiling w/3-1/2" Insulation (at 90°F)	2.5
Floors Over Basement, R-11 (at 90°F)	5
Infiltration (at 90°F)	1.2

HEAT GAIN & LOSS FACTORS

A. Heating (Windows/Glass Doors)	Single	Double	Single & Storm Sash	Triple
Jalousie (certified 1.5 CFM/FT)	135	---	80	---
Double hung, horizontal on casement (normal)	180	145	85	75
Double hung, horizontal on casement (certified .75 CFM/FT)	105	70	60	49
Double hung, horizontal on casement (certified .5 CFM/FT)	95	60	55	41
Fixed or picture	95	60	60	39
Sliding glass doors (normal)	175	140	---	---
Sliding glass doors (certified) 1.0 CFM/FT)	115	90	---	---

B. Cooling (Windows/Glass Doors)	N	NE & NW	E & W	SE & SW	S
Single-no shade	30	65	90	80	50
Single-draperies or venetian blinds	25	40	55	50	30
Single-roller shades	25	50	70	60	40
Single-shaded	30	30	30	30	30
Double-no shade	25	50	75	65	40
Double-draperies or venetian blinds	20	35	50	40	25
Double-roller shades	20	45	60	50	35
Double-shaded	20	20	20	20	20
Triple-no shade	18	40	58	51	29
Triple-draperies or venetian blinds	14	26	38	32	20
Triple-roller shades	15	32	47	41	24
Triple-shaded	19	19	19	19	19

For tinted or reflective glass, see manufacturer's data.

	HEATING			COOLING		
C. Standard Doors	-10°	0°	+10°	85°	90°	95°
No Weather strip or storm	360	315	270	7.5	10	13
Weather strip or storm	195	170	145	7	9	12
Weather strip and storm	105	90	80	6	8	11
Insulated core	328	287	246	3.0	4.3	5.5
Insulated-weather strip or storm	180	158	135	2.8	4.0	5.0
Insulated-weather strip and storm	92	81	69	2.3	3.3	4.2
D. Walls						
Partition-frame-no insulation	25	22	19	2.5	4.5	6.0
Partition-masonry-no insulation	18	16	14	1.5	2.3	4.5
Wood frame w/sheathing & siding						
No insulation	20	18	15	4.0	5.5	7.0
R-5 polystyrene sheathing	9	8	7	2.5	3.5	4.5
R-7 (2" to 2-3/4" batt.)	8	7	6	2.0	3.0	3.5
R-11 (3" to 3-1/2" batt.)	6	5	4	1.5	2.5	3.0
R-13 (3-1/2" to 3-5/8" batt.)	5	4	4	1.5	2.0	3.0
6" Framing with R-19	3.2	2.8	2.6	.9	1.5	2.1
Polystyrene plus R-13 batt.	4	3.5	3	1.4	2.0	2.7

	HEATING			COOLING		
	-10°	0°	+10°	85°	90°	95°
Masonary (Above Ground)						
Plain	36	32	27	7.0	9.5	12.0
Furred with R-5 insulation	11.2	9.8	8.4	2.5	3.5	4.5
R-13 batt.	5.6	4.9	4.2	1.1	1.8	2.6
Masonary (Below Ground)						
Plain	5	4	4	0	0	0
R-5 (3/4" Poly.) below	3.4	3.0	2.6	0	0	0
R-13 batt.	1.9	1.7	1.5	0	0	0
E. Ceiling & Roofs-Vented Attic						
No insulation	48	42	36	8.0	9.0	10.0
R-5.6 (1-1/2")	14	12	11	3.5	3.9	4.4
R-11 (3" to 3-1/2")	6	6	5	2.0	2.5	3.0
R-22 (6" to 7")	3	3	2	1.0	1.5	1.5
R-30	2.6	2.2	1.9	1.0	1.1	1.3
R-38	2.0	1.8	1.5	.8	.9	1.1
F. Built-Up Roof/Ceiling Combinations						
No insulation	25	22	19	10	11.5	13.0
R-11 (3" to 3-1/2")	6	5	4	2.5	2.5	3.0
R-22 (6" to 7")	3	3	2	1.5	1.5	1.5
R-30	2.4	2.1	1.8	1.0	1.2	1.4
Ceiling under unconditioned room	24	21	18	2.5	3.5	3.5
G. Floors						
Over unconditioned room	11	10	8	1.5	2.5	3.5
Over open or vented space - no insulation	22	20	17	1.5	3.5	5.0
Over open or vented space - R-11	6	5	4	.5	.5	1.0
Over open or vented space - R-19	4	3	3	.5	.5	1.0
Over open or vented space - R-22	3.3	2.9	2.5	.5	.5	1.0
Basement floor	3	2	2	0	0	0
Slab - no insulation - BTUH per foot of perimeter	60	55	50	0	0	0
Slab - 1" insulation - BTUH per foot of perimeter	50	45	40	0	0	0
Slab - 2" insulation - BTUH per foot of perimeter	40	35	30	0	0	0
H. Make-up Air						
Mechanical Ventilation BTUH/CFM	85	75	65	11	16	22
Infiltration BTUH/SQ.FT. Exposed Wall	10	9	8	1.1	1.2	1.3

FIGURE 1.4: HEAT GAIN (LOSS) FACTORS

Line 1 Windows (cooling): In the column AREA SQ FT, fill in the total square footage of all exposed windows and glass doors, based on the direction they are facing. Multiply the square footages by the appropriate factors and enter results in the column COOL BTU (see Figure 1.5).

Line 2 Glass Doors (heating): For heating installations, in the column AREA SQ FT, fill in the total square footage of all exposed glass doors. Multiply the square footage by the factor and enter result in the column HEAT BTU.

Line 3 Windows (heating): For heating installations, in the column AREA SQ FT, fill in the total square footage of all exposed windows. Multiply the square footage by the factor and enter result in the column HEAT BTU.

Line 4 Standard Doors: In the column AREA SQ FT, fill in the total square footage of all exposed standard doors (non-glass). Multiply the square footage by the factor and enter result in the column COOL BTU(HEAT BTU).

Line 5 Partitions: In the column AREA SQ FT, fill in the total square footage of all partitions (less doors and windows). Multiply the square footage by the factor and enter result in the column COOL BTU (HEAT BTU).

Line 6 Exposed Wall: In the column AREA SQ FT, subtract the square footages in lines 1, 2, 3, 4, & 5 from the total exposed wall square footage and enter the result. Multiply the square footage by the factor and enter result in the column COOL BTU(HEAT BTU).

Line 7 Ceiling/Roof and Line 8 Floor: In the column AREA SQ FT, fill in the total square footage of the ceilings and floors. Multiply the square footage by the factors and enter the results in the column COOL BTU (HEAT BTU).

Line 9 Ventilation/Infiltration: Incoming outside air, from either mechanical ventilation or infiltration, must be accounted for:

A. For infiltration (no mechanical ventilation available, as in our example), in the column AREA SQ FT, fill in the square footage of the total exposed walls. Multiply the square footage by the factor and enter result in the column COOL BTU (HEAT BTU).

B. If mechanical ventilation is available, select the appropriate factor from Table 1 (Kwik-Way sheet). Multiply the factor by the CFM of the mechanical ventilation and enter result in the column COOL BTU (HEAT BTU).

Line 10 People: In the column AREA SQ FT, fill in the total number of people living in the home. Multiply the number by the factor of 300 (constant) and enter result in the column COOL BTU.

					TOTAL STRUCTURE			ROOM:			ROOM:								
				Lg x Wd				X	=		X								
				L ft exp wall	206														
				Ceiling Ht	8														
				Total Exp wall	1648														
ITEM OF CONSTRUCTION			FACTORS		AREA SQ FT	HEAT BTU	COOL BTU	AREA SQ FT	HEAT BTU	COOL BTU	AREA SQ FT								
	Shade	Exposure	HEAT	COOL															
1 WINDOWS (cooling) Including Glass Doors		N		20	56		1120												
		NE & NW																	
		E & W		50	56		2800												
		SE & SW																	
		S		25	68		1700												
2 Glass Doors (heating)																			
3 Windows (heating)																			
4 Standard Doors (non-glass)				9	63		567												
5 Partitions (less doors & windows)				2.3	179		412												
6 Exposed Walls (less 1, 2, 3, 4 & 5)				2.0	1226		2452												
7 Ceiling/Roof				2.5	2470		6175												
8 Floor				.5	2470		1235												
9 Ventilation (Mechanical)/Infiltration				1.2	1648		1978												
10 People				300	3		900												
11 Appliances				1200			1200												
						HEAT	COOL		HEAT	COOL		HEAT	COOL		HEAT	COOL		HEAT	COOL
12 Sub-Total Lines 1 - 11							20539												
13 Sensible {Line 12 x Duct Factor (Fig.1.6)}				1.15			23620												
14 Heat Gain for Cooling Load (Line 13 x 1.3)				1.3			30706												
15 Equipment Selected (Fig.1.7)			OUTDOOR UNIT : 3-Ton								INDOOR UNIT : ESP-3642						RECOMMENDED NO. OF OU		
16 Adjusted Loads: LAF (Fig. 2.3) x Line 13 and Line 14																			

FROM FLOOR PLAN

House Width = 65'
House Depth = 38'
Ceiling Height = 8'
Windows-N = 3 (3' x 4') = 36'
Windows-N = 1 (4' x 5') = 20'
Windows-W =3 (3' x 4') = 36'
Windows-E = 1 (4' x 5') = 20'
Windows-S = 3 (3' x 4') = 36'
Windows-S = 1 (4' x 8') = 32'
Doors = 3 (3' x 7') = 63'
Partitions = 1 (8' x 25' - 21') = 179'
People = 3

FIGURE 1.5: TOTAL STRUCTURE COOLING EXAMPLE (CONTINUED)

Line 11 Appliances: For appliances, the factor is a constant 1200. Enter this in the column COOL BTU. NOTE: For the room-by-room analysis, this 1200 factor would be included in the kitchen heat gain.

Line 12 Sub-Total: In the column COOL BTU (HEAT BTU), enter the subtotal of Lines 1 through 11.

Line 13 Total Sensible: In the FACTORS column, enter a factor for Duct Gain Cooling, based on where the plenum duct will be run, such as through an attic or basement (see Figure 1.6). Multiply the subtotal on Line 12 by the factor and enter result in the column COOL BTU on Line 13. These duct factors are also available in Table 2 on the back of the Kwik-Way sheet.

Line 14 Heat Gain For Cooling Load: Multiply the COOL BTU on Line 13 by the factor of 1.3 and enter result in the column COOL BTU on Line 14. This calculation accounts for the moisture introduced into the dwelling by people, cooling or bathing. Experience has shown this latent heat load is an additional 30% of the total sensible load.

EQUIPMENT SELECTION

Line 15 Equipment Selection: Based on the heat gain in Line 14 (and/or heat loss in Line 13), select the appropriate cooling-only Model "ESP" system from the applicable product specification sheet and enter the information on Line 15.

Example: For our 30,706 heat gain, you would select a Model ESP- 3642 (3-ton) system, as it has the closest cooling capacity to the 2.6 ton overall Heat Gain.

ROOM TERMINATORS (OUTLETS)

Line 15 Equipment Selection: Based on the equipment selected, determine the recommended number fully open outlets from Figure 1.7 and enter the information on Line 15. This information is also available in Table 3 on the back of the Kwik-Way sheet.

Example: 3-ton system = 18 terminators (fully open)

However, this is for estimating purposes only and does not preclude performing a room-by-room analysis which is completely necessary to assure a balanced system Considering each room outlet (fully open or partially orificed) requires a terminator/sound attenuating tubing installation kit, we recommend completing the room-by-room analysis before pricing the job.

LOCATION	DUCT FACTOR	
	COOLING	HEATING
Basement	1.00	1.10
Crawl Space (Vented)	1.05	1.15
Attic Vented	1.15	1.15
Attic Unvented	1.15	1.15

FIGURE 1.6: DUCT GAIN (LOSS) FACTORS

NOMINAL TONNAGE	MINIMUM RECOMMENDED NUMBER OF FULLY OPEN OUTLETS *	
	MODEL	RECOMMENDED
2	ESP-2430	12
2 1/2	ESP-2430	15
3	ESP-3642	18
3 1/2	ESP-3642	21
4	ESP-4860	24
5	ESP-4860	30

* The minimum or recommended number of outlets means fully open outlets. Any outlet having an orifice would be only a percentage of an outlet.

FIGURE 1.7: TERMINATOR SELECTION

SPACE PAK CENTRAL AIR ANYWHERE ®

KWIK-WAY HEATING & AIR CONDITIONING SIZING SHEET

ITEM OF CONSTRUCTION	Shade	Exposure	FACTORS HEAT	FACTORS COOL	TOTAL STRUCTURE AREA SQ FT	TOTAL STRUCTURE HEAT BTU	TOTAL STRUCTURE COOL BTU	ROOM: BED 1 AREA SQ FT	ROOM: BED 1 HEAT BTU	ROOM: BED 1 COOL BTU	ROOM: BED 2 AREA SQ FT	ROOM: BED 2 HEAT BTU	ROOM: BED 2 COOL BTU	ROOM: BED 3 AREA SQ FT	ROOM: BED 3 HEAT BTU	ROOM: BED 3 COOL BTU	ROOM: BED 4 AREA SQ FT	ROOM: BED 4 HEAT BTU	ROOM: BED 4 COOL BTU	ROOM: KITCHEN AREA SQ FT	ROOM: KITCHEN HEAT BTU	ROOM: KITCHEN COOL BTU	ROOM: DINING AREA SQ FT	ROOM: DINING HEAT BTU	ROOM: DINING COOL BTU	ROOM: FAMILY AREA SQ FT	ROOM: FAMILY HEAT BTU	ROOM: FAMILY COOL BTU	ROOM: LIVING AREA SQ FT	ROOM: LIVING HEAT BTU	ROOM: LIVING COOL BTU
		Lg x Wd						21 x 17 = 375			14 x 15 = 210			12 x 15 = 180			12 x 18 = 216			11 x 18 = 198			17 x 18 = 306			12 x 18 = 216			20 x 29 = 580		
		L ft exp wall			206			21			29			12			30			18			17			30			49		
		Ceiling Ht			8			8			8			8			8			8			8			8			8		
		Total Exp wall			1648			168			232			96			240			144			136			240			392		
1 WINDOWS (cooling) Including Glass Doors		N		20	56		1120										12		240	12		240	20		400	12		240			
		NE & NW																													
		E & W		50	56		2800				12		600	12		600	12		600									20		1000
		SE & SW																													
		S		25	68		1700	24		600	12		300															32		800
2 Glass Doors (heating)																															
3 Windows (heating)																															
4 Standard Doors (non-glass)				9	63		567													21		189				21		189	21		189
5 Partitions (less doors & windows)				2.3	179		412																			123		283	56		129
6 Exposed Walls (less 1, 2, 3, 4 & 5)				2.0	1226		2452	144		288	208		416	84		168	216		432	111		222	116		232	84		168	263		526
7 Ceiling/Roof				2.5	2470		6175	357		893	210		525	180		450	216		540	198		495	306		765	216		540	580		1450
8 Floor				.5	2470		1235	357		179	210		105	180		90	216		108	198		99	306		153	216		108	580		290
9 Ventilation (Mechanical)/Infiltration				1.2	1648		1978	168		202	232		278	96		115	240		288	144		173	136		163	240		288	392		470
10 People				300	3		900																1		300	1		300	1		300
11 Appliances				1200			1200															1200									
						HEAT	COOL		HEAT	COOL		HEAT	COOL		HEAT	COOL		HEAT	COOL		HEAT	COOL		HEAT	COOL		HEAT	COOL		HEAT	COOL		HEAT	COOL
12 Sub-Total Lines 1 - 11							20539			2162			2224			1423			2208			2618			2013			2116			5154
13 Sensible {Line12 x Duct Factor (Fig.1.6)}				1.15			23620			2486			2558			1636			2539			3011			2315			2433			5927
14 Heat Gain for Cooling Load (Line 13 x 1.3)				1.3			30706			3232			3325			2127			3301			3914			3010			3163			7705
15 Equipment Selected (Fig.1.7)			OUTDOOR UNIT : 3 - Ton					INDOOR UNIT : ESP-3642															RECOMMENDED NO. OF TERMINATORS: 17						SUPPLEMENTAL HEAT:					
16 Adjusted Loads: LAF (Fig. 2.3) x Line 13 and Line 14							3555	1.1		3658	0.90		1914	0.92		3037	0.89		3483	0.90		2709	0.90		2847	1.1		8476			
17 Base Load Factors			BASE LOAD FACTOR HEATING = Lline 13 Total Structure Heating / Recommended No. of Terminators =																	BASE LOAD FACTOR COOLING = Lline 14 Total Structure Heating / Recommended No. of Terminators			= 1806									
18 Recommended No. of Terminators (Line 16 ÷ 17)							1.97			2.03			1.06			1.68			1.93			1.50			1.58			4.69		
19 Selected No. of Terminators (Choose the larger number from Line 18)							1.97			2.03			1.06			1.68			1.93			1.50			1.58			4.69		
20 Orifices Required			NONE	.15	.35	.50	NONE	.15	.35	.50	NONE	.15	.35	.50	NONE	.15	.35	.50	NONE	.15	.35	.50	NONE	.15	.35	.50	NONE	.15	.35	.50	NONE	.15	.35	.50
21 Adjustable Dampers Required																																

FIGURE 2.1: KWIK-WAY HEATING AND AIR CONDITIONING SIZING SHEET

SECTION 2: ROOM-BY-ROOM ANALYSIS

Complete the heat gain (heat loss) for each room on the Kwik-Way sheet (see Figure 2.1), following the same procedures you used for calculating the Total Structure Heat Gain (Loss). Complete each appropriate calculation through Line 14.

To assure proper balancing of the SpacePak system, room by room, the next concern is providing each room in the house with the proper number of air outlets or room terminators.

On your floor plan, now "rough in" the location of the indoor fan coil unit and the plenum duct run. The plenum duct is normally located in the attic or basement (see Figure 2.2). Then, estimate the average length (per room) of supply tubing runs to the outside corners of each room on your floor plan (see Figure 2.2).

Line 16 Adjusted Loads: Based on the average supply tubing run for each room, select the appropriate "Length Adjustment Factor" from Figure 2.3 and enter the factors in the AREA SQ FT columns for each room. This information is also available in Table 4 on the back of the Kwik-Way sheet. Multiply COOL BTU on Line 14 (HEAT BTU on Line 13) by the factors and enter results in column COOL BTU (HEAT BTU) on Line 16 for each room.

Line 17 Base Load Factors: To obtain the base load factors, divide the Total Structure COOL BTU on Line (HEAT BTU on Line 13) by the recommended number terminators on Line 15 and enter result on Line 17.

Line 18 Recommended No. of Terminators (Outlets): Divide the COOL BTU (HEAT BTU) for each room or Line 16 by the cooling (heating) base load factor on Line 17 and enter results on Line 18 for each room. **DO NOT ROUND OFF TO THE NEAREST WHOLE NUMBER** - if less or more than a whole number, leave the fraction.

Line 19 Selected No. of Terminators (Outlets): For heating installations, select the larger of the two numbers on Line 18 for each room and enter the results or Line 19 for each room.

2" SUPPLY TUBING LENGTH ADJUSTMENT FACTOR CHART								
RUN	6'	8'	10'	12'	15'	20'	25'	30'
FACTOR	1.18	1.14	1.11	1.06	1.0	.9	.8	.66

FIGURE 2.3: LENGTH ADJUSTMENT FACTORS

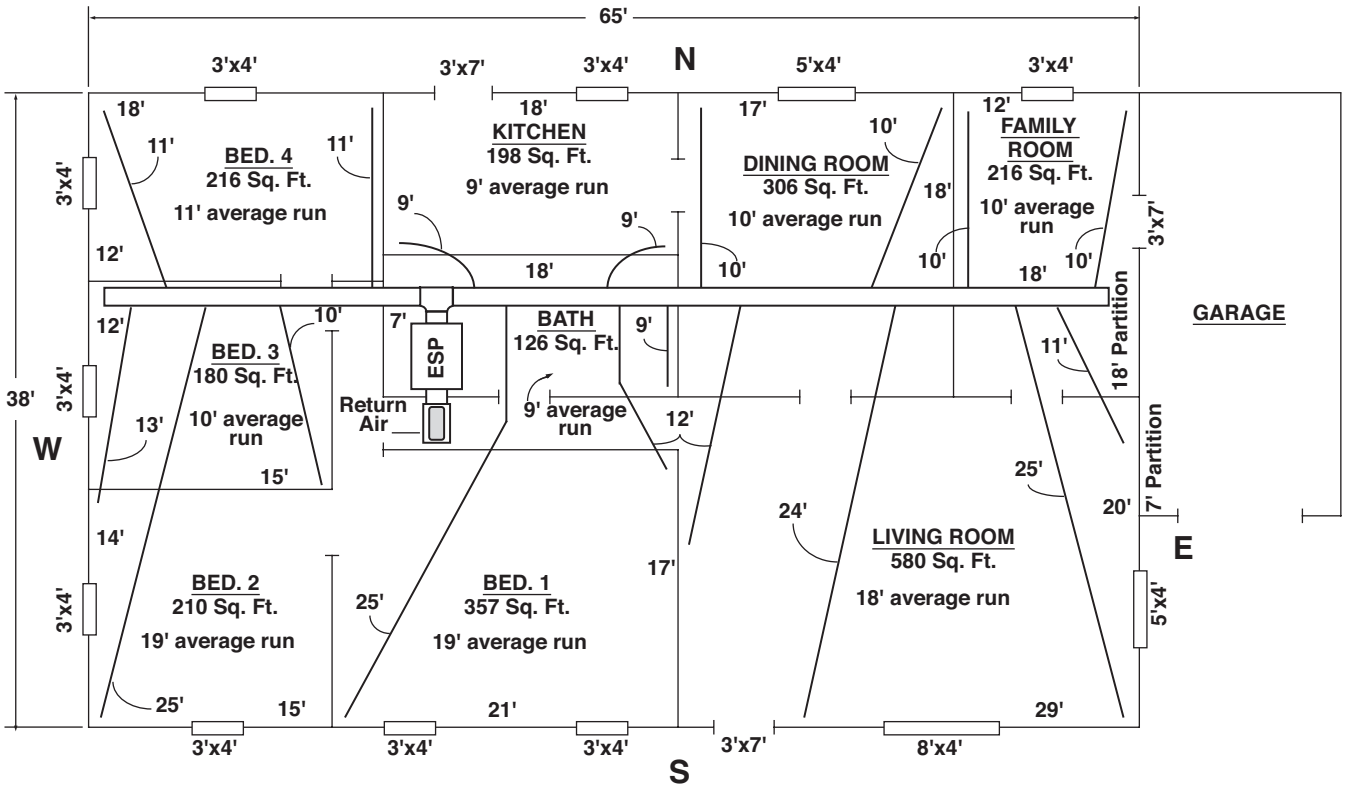


FIGURE 2.2: FLOOR PLAN EXAMPLE

SPACE PAK CENTRAL AIR ANYWHERE ®

KWIK-WAY HEATING & AIR CONDITIONING SIZING SHEET

ITEM OF CONSTRUCTION	Shade	Exposure	FACTORS HEAT	FACTORS COOL	TOTAL STRUCTURE AREA SQ FT	TOTAL STRUCTURE HEAT BTU	TOTAL STRUCTURE COOL BTU	ROOM: BED 1 AREA SQ FT	ROOM: BED 1 HEAT BTU	ROOM: BED 1 COOL BTU	ROOM: BED 2 AREA SQ FT	ROOM: BED 2 HEAT BTU	ROOM: BED 2 COOL BTU	ROOM: BED 3 AREA SQ FT	ROOM: BED 3 HEAT BTU	ROOM: BED 3 COOL BTU	ROOM: BED 4 AREA SQ FT	ROOM: BED 4 HEAT BTU	ROOM: BED 4 COOL BTU	ROOM: KITCHEN AREA SQ FT	ROOM: KITCHEN HEAT BTU	ROOM: KITCHEN COOL BTU	ROOM: DINING AREA SQ FT	ROOM: DINING HEAT BTU	ROOM: DINING COOL BTU	ROOM: FAMILY AREA SQ FT	ROOM: FAMILY HEAT BTU	ROOM: FAMILY COOL BTU	ROOM: LIVING AREA SQ FT	ROOM: LIVING HEAT BTU	ROOM: LIVING COOL BTU
		Lg x Wd						21 x 17 = 375			14 x 15 = 210			12 x 15 = 180			12 x 18 = 216			11 x 18 = 198			17 x 18 = 306			12 x 18 = 216			20 x 29 = 580		
		L ft exp wall			206			21			29			12			30			18			17			30			49		
		Ceiling Ht			8			8			8			8			8			8			8			8			8		
		Total Exp wall			1648			168			232			96			240			144			136			240			392		
1 WINDOWS (cooling) Including Glass Doors		N		20	56		1210										12		240	12		240	20		400	12		240			
		NE & NW																													
		E & W		50	56		2800				12		600	12		600	12		600									20		1000
		SE & SW																													
		S		25	68		1700	24		600	12		300															32		800
2 Glass Doors (heating)																															
3 Windows (heating)																															
4 Standard Doors (non-glass)				9	63		567													21		189				21		189	21		189
5 Partitions (less doors & windows)				2.3	179		412																			123		283	56		129
6 Exposed Walls (less 1, 2, 3, 4 & 5)				2.0	1226		2452	144		288	208		416	84		168	216		432	111		222	116		232	84		168	263		526
7 Ceiling/Roof				2.5	2470		6175	357		893	210		525	180		450	216		540	198		495	306		765	216		540	580		1450
8 Floor				.5	2470		1235	357		179	210		105	180		90	216		108	198		99	306		153	216		108	580		290
9 Ventilation (Mechanical)/Infiltration				1.2	1648		1978	168		202	232		278	96		115	240		288	144		173	136		163	240		288	392		470
10 People				300	3		900																1		300	1		300	1		300
11 Appliances				1200			1200															1200									
						HEAT	COOL		HEAT	COOL		HEAT	COOL		HEAT	COOL		HEAT	COOL		HEAT	COOL		HEAT	COOL		HEAT	COOL		HEAT	COOL
12 Sub-Total Lines 1 - 11							20539			2162			2224			1423			2208			2618			2013			2116			5154
13 Sensible {Line12 x Duct Factor (Fig.1.6)}				1.15			23620			2486			2558			1636			2539			3011			2315			2433			5927
14 Heat Gain for Cooling Load (Line 13 x 1.3)				1.3			30706			3232			3325			2127			3301			3914			3010			3163			7705
15 Equipment Selected (Fig.1.7)			OUTDOOR UNIT : 3 - Ton					INDOOR UNIT : ESP-3642															RECOMMENDED NO. OF OUTLETS: 17						SUPPLEMENTAL HEAT:					
16 Adjusted Loads: LAF (Fig. 2.3) x Line 13 and Line 14								1.1		3555	1.1		3658	0.90		1914	0.92		3037	0.89		3483	0.90		2709	0.90		2847	1.1		8476
17 Base Load Factors								BASE LOAD FACTOR HEATING = Line 13 Total Structure Heating / Recommended No. of Outlets =														BASE LOAD FACTOR COOLING = Line 14 Total Structure Heating / Recommended No. of Outlets								= 1806		
18 Recommended No. of Outlets (Line 16 ÷ 17)										1.97			2.03			1.06			1.68			1.93			1.50			1.58			4.69
19 Selected No. of Outlets (Choose the larger number from Line 18)										1.97			2.03			1.06			1.68			1.93			1.50			1.58			4.69
20 Orifices Required								NONE	.15	.35	.50	NONE	.15	.35	.50	NONE	.15	.35	.50	NONE	.15	.35	.50	NONE	.15	.35	.50	NONE	.15	.35	.50	NONE	.15	.35	.50
								2				2				1				1		1		2					1	1		1		1		3	2		
21 Adjustable Dampers Required																																			

FIGURE 2.4: KWIK-WAY HEATING AND AIR CONDITIONING SIZING SHEET

Line 20 Orifices Required: You must select the terminal-orifice combination from Figure 2.5 which produces close to the number of terminators required on Line 19 for each room. This information is also available in Table 5 on the back of the Kwik-Way sheet.

Example (see Figure 2.4): Bedroom 4 requires 1.68 terminators, which is equal to 168% capacity. To assure equal air distribution, we selected the combination of two room terminators, one fully open and one with a 35% orifice.

Line 21 Adjustable Dampers Required: For heating installations, if there is a significant difference between the number of cooling and heating terminators on Line 18, then adjustable dampers will have to be used to change the air flow from the cooling season to the heating season. Enter the number of adjustable dampers required for each room.

DESIRED NUMBER OF TERMINALS *	TERMINAL - ORIFICE COMBINATION
.5	(1) .5
.65	(1) .35
.85	(1) .15
1.00	(1)
1.15	(1) .5 + (1) .35
1.30	(2) .35
1.50	(1) .35 + (1) .15 or (1) + (1) .5 or (3) .5
1.65	(1) + (1) .35 or (2) .5 + (1) .35
1.70	(2) .15
1.80	(2) .35 + (1) .5
1.85	(1) + (1) .15
1.95	(3) .35
2.00	(2)

* For a room with more than two (2) terminals, combinations of the above may be used to achieve the desired fractional number.

FIGURE 2.5: TERMINAL-ORIFICE COMBINATION

SECTION 3: SYSTEM DESIGN CONSIDERATIONS

PLENUM DUCT

The plenum duct can be run in practically any location accessible for the attachment of the supply tubing. The plenum is normally located in the attic or basement, and it is usually more economical to run the plenum where it will appreciably shorten the lengths of two or more supply runs. In some two-story split level homes, it may be advantageous to go from one level to another with the plenum duct. Whenever necessary, either between floors or along the ceiling, the small size of the plenum makes it easy to box in.

The fan coil coil unit is designed to operate with a total external static pressure of 1.2 inches of water column. Excessive static pressure increases the air flow in individual runs and may cause some or all terminators to be noisy.

For systems with a tee installed as on Unit No. 1 (Figure 3.1), the best results are obtained if not more than 60% of the total number of system outlets are attached to any one branch of the tee. For systems with a tee installed as on Unit No. 2 (Figure 3.1), not more than 30% of the total number of system outlets should be attached to the perpendicular branch of the tee.

The larger system capacities (ESP-4860) are affected more by higher system static pressure than the smaller

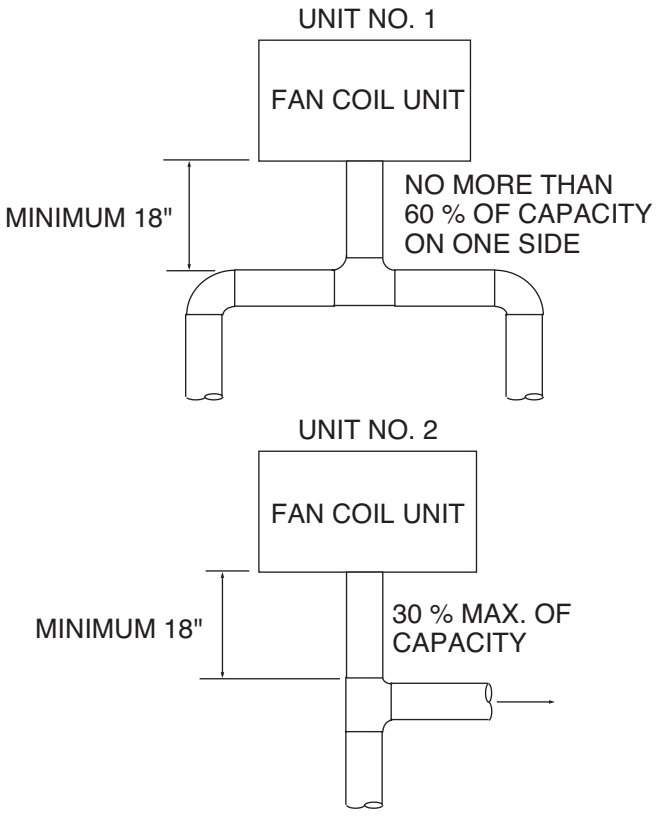


FIGURE 3.1: ESP-4860 INSTALLATION

systems. The four and five ton system should be considered and handled as two separate smaller units. This necessitates the installation of the plenum tee a minimum of 18" from the unit (see Figure 3.1). No supply runs should be installed between unit outlet and tee.

All tees and elbows must be a minimum of 18" from the fan coil unit or any other tee or elbow. Keep all tees and elbows to a minimum.

SUPPLY TUBING

In the case of two-story or split-level applications, supply tubing may run from one story to another. It is small enough to go in stud spaces, but this is often difficult in older homes because of hidden obstructions in stud spaces. It is more common to run the supply tubing from the attic down through second story closets to the first story terminators. Supply tubing runs in the corners of the second story rooms can be boxed in and are hardly noticeable since overall diameter is only 3-1/4".

At the plenum, all supply tubing connections must be a minimum of 18" from any plenum tee, plenum elbow or the fan coil unit.

Individual supply tubing runs must be a minimum of 6 feet, even if the distance between the sound attenuating tubing and plenum is less than 6 feet.

ROOM TERMINATORS

Terminators should be located in the ceiling or floor for vertical discharge. However, ceiling locations are not recommended for heating where ceiling height is 10 feet or more due to possible stratification and short circuiting of air flow.

Horizontal discharge is acceptable for cooling-only systems, but is sometimes more difficult to install. Two excellent spots for horizontal discharge are in the soffit area above kitchen cabinets and in the top portion of closets. Horizontal discharge is not recommended for heating systems, as it will not maintain a proper floor-to-ceiling temperature difference.

Terminators should always be out of normal traffic patterns to prevent discharge air from blowing directly on occupants. And they should not be located directly above shelves or large pieces of furniture. Outside wall or corner locations are recommended if the room has more than one outside wall. Locating terminators away from interior doors prevents short cycling of air to the return air box.

NOTE:

The Kwik-Way method is appropriate for calculating the cooling loads of most buildings or normal structures but it might not be appropriate when calculating loads for sun rooms and buildings that do not comply with data and factors in this application manual and Kwik-Way form. If in doubt, calculate the actual cooling load using the long form manual “J”.

Some factors may vary state to state and your design temps may be greater. SpacePak assumes no liability for incorrect interpretation of this manual.

SPACE PAK ® CENTRAL AIR ANYWHERE

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