

APPLICATION MANUAL

For Central Air Conditioning
and Heating Systems



KWIK-WAY HEATING & AIR CONDITIONING SIZING SHEET

ITEM OF CONSTRUCTION	TOTAL STRUCTURE		ROOM:		ROOM:		ROOM:		ROOM:		ROOM:		ROOM:		ROOM:				
	AREA SQ FT	HEAT BTU	AREA SQ FT	HEAT BTU	AREA SQ FT	HEAT BTU	AREA SQ FT	HEAT BTU	AREA SQ FT	HEAT BTU	AREA SQ FT	HEAT BTU	AREA SQ FT	HEAT BTU	AREA SQ FT	HEAT BTU			
1 WINDOWS (cooling) (heating) (Glass Doors)																			
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																	
12 Sub-Total Lines 1 - 11																			
13 Sensible (Line 12 x Duct Factor (Fig. 1.6))																			
14 Heat Gain for Cooling Load (Line 13 x 1.3)																			
15 Equipment Selected (Fig. 1.7)																			
OUTDOOR UNIT :		INDOOR UNIT :														SUPPLEMENTAL HEAT :			
16 Adjusted Loads: LAF (Fig. 2.3) x Line 13 and Line 14		Line 13 Total Structure Heating =														Line 14 Total Structure Heating =			
17 Base Load Factors		RECOMMENDED NO. OF TERMINATORS =														RECOMMENDED NO. OF TERMINATORS =			
18 Recommended No. of Terminators (Line 16 ÷ 17)		BASE LOAD FACTOR HEATING =														BASE LOAD FACTOR COOLING =			
19 Selected No. of Terminators (Choose the larger number from Line 18)		Line 13 Total Structure Heating =														Line 14 Total Structure Heating =			
20 Orifices Required		RECOMMENDED NO. OF TERMINATORS =														RECOMMENDED NO. OF TERMINATORS =			
21 Adjustable Dampers Required		RECOMMENDED NO. OF TERMINATORS =														RECOMMENDED NO. OF TERMINATORS =			

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 SpacePak 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 second floor) is to be added to the first floor.

3. Ceiling height in each room.

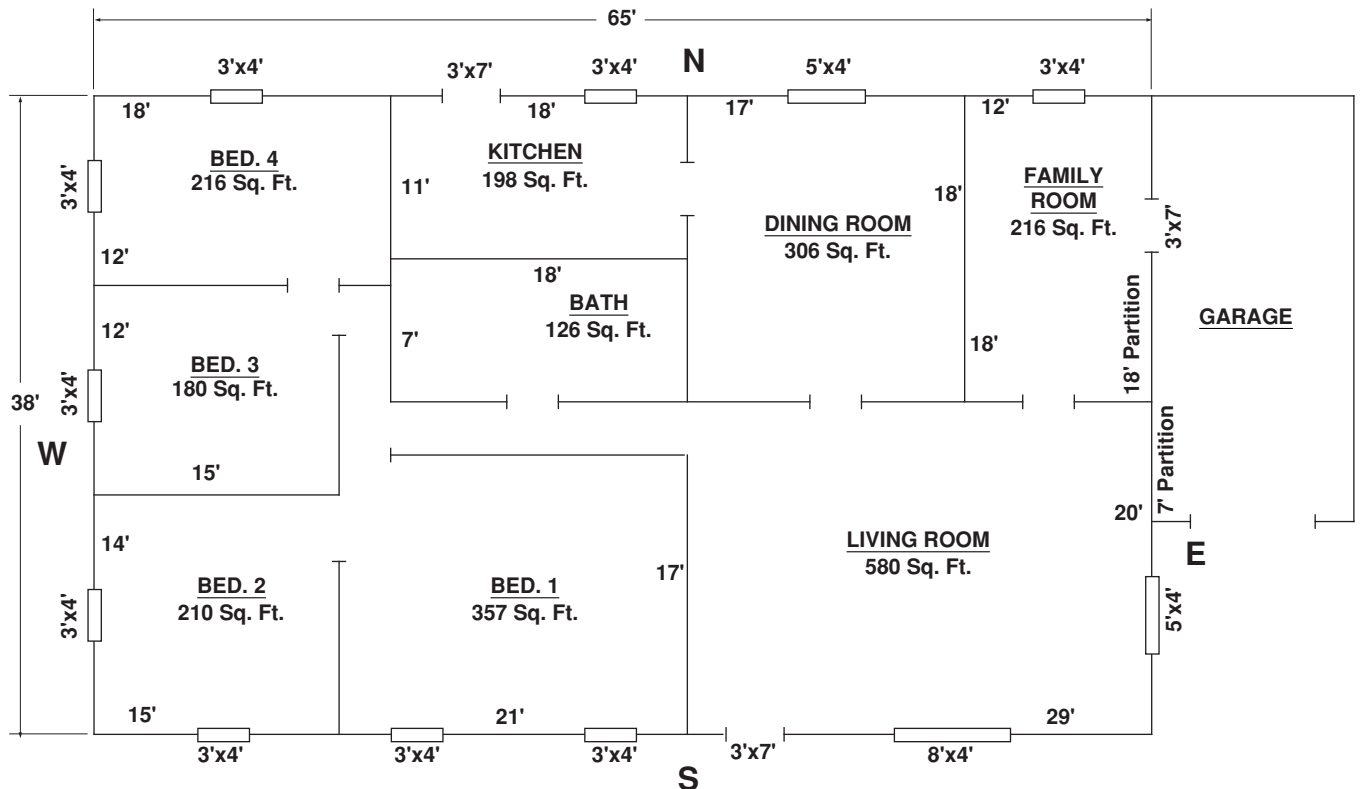


FIGURE 1.2: FLOOR PLAN EXAMPLE

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.

ITEM OF CONSTRUCTION	TOTAL STRUCTURE			ROOM:			ROOM:					
	FACTORS			AREA	HEAT	COOL	AREA	HEAT	COOL	AREA	HEAT	COOL
	Shade	Exposure	HEAT	SQ FT	BTU	BTU	SQ FT	BTU	BTU	SQ FT	BTU	BTU
Lg x Wd				X =			X =					
L ft exp wall	206											
Ceiling Ht	8											
Total Exp wall	1648											
1 WINDOWS (cooling) Including Glass Doors		N	20									
		NE & NW										
		E & W	50									
		SE & SW										
		S	25									
2 Glass Doors (heating)												
3 Windows (heating)												
4 Standard Doors (non-glass)			9									
5 Partitions (less doors & windows)			2.3									
6 Exposed Walls (less 1, 2, 3, 4 & 5)			2.0									
7 Ceiling/Roof			2.5									
8 Floor			.5									
9 Ventilation (Mechanical)/Infiltration			1.2									
10 People			300									
11 Appliances			1200									
12 Sub-Total Lines 1 - 11					HEAT	COOL		HEAT	COOL		HEAT	COOL
13 Sensible (Line 12 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 O/L		
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'

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)						
Jalousie (certified 1.5 CFM/FT)	Single	Double	Single & Storm Sash	Triple		
Double hung, horizontal on casement (normal)	135	---	80	---		
Double hung, horizontal on casement (certified .75 CFM/FT)	180	145	85	75		
Double hung, horizontal on casement (certified .5 CFM/FT)	105	70	60	49		
Fixed or picture	95	60	55	41		
Sliding glass doors (normal)	95	60	60	39		
Sliding glass doors (certified 1.0 CFM/FT)	175	140	---	---		
	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.						
C. Standard Doors						
	HEATING			COOLING		
	-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°
Masonry (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
Masonry (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.

ITEM OF CONSTRUCTION	FACTORS		TOTAL STRUCTURE			ROOM:			ROOM:			
	Shade	Exposure	HEAT	COOL	AREA SQ FT	HEAT BTU	COOL BTU	AREA SQ FT	HEAT BTU	COOL BTU	AREA SQ FT	
Lg x Wd			206			X =			X			
L ft exp wall			8									
Ceiling Ht			1648									
Total Exp wall												
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						
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 OL		
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 = 17 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	14
2 1/2	ESP-2430	18
3	ESP-3642	21
3 1/2	ESP-3642	25
4	ESP-4860	28
5	ESP-4860	35

* 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



KWIK-WAY HEATING & AIR CONDITIONING SIZING SHEET

ITEM OF CONSTRUCTION	ROOM: BED 1 21 x 17 = 375		ROOM: BED 2 14 x 15 = 210		ROOM: BED 3 12 x 15 = 180		ROOM: BED 4 12 x 18 = 216		ROOM: KITCHEN 11 x 18 = 198		ROOM: DINING 17 x 18 = 306		ROOM: FAMILY 12 x 18 = 216		ROOM: LIVING 20 x 29 = 580		
	AREA SQ.FT.	HEAT BTU	AREA SQ.FT.	HEAT BTU	AREA SQ.FT.	HEAT BTU	AREA SQ.FT.	HEAT BTU	AREA SQ.FT.	HEAT BTU	AREA SQ.FT.	HEAT BTU	AREA SQ.FT.	HEAT BTU	AREA SQ.FT.	HEAT BTU	
1 WINDOWS (Including Glass Doors)	56	1120	56	2800	56	2800	56	2800	56	2800	56	2800	56	2800	56	2800	
2 Glass Doors (heating)	68	1700	68	1700	68	1700	68	1700	68	1700	68	1700	68	1700	68	1700	
3 Windows (heating)	63	567	63	567	63	567	63	567	63	567	63	567	63	567	63	567	
4 Standard Doors (non-glass)	179	412	179	412	179	412	179	412	179	412	179	412	179	412	179	412	
5 Partitions (less doors & windows)	1226	2452	144	288	144	288	144	288	144	288	144	288	144	288	144	288	
6 Exposed Walls (less 1, 2, 3, 4 & 5)	2470	6175	357	893	210	525	180	450	198	495	306	765	216	540	580	1450	
7 Ceiling/Roof	2470	1235	357	179	210	105	180	90	198	99	306	153	216	108	580	290	
8 Floor	2470	1978	168	202	232	278	96	115	144	173	136	163	240	288	392	470	
9 Ventilation (Mechanical)/Infiltration	300	900	3	1200	3	1200	3	1200	3	1200	3	1200	3	1200	3	1200	
10 People	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	
11 Appliances	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	
12 Sub-Total Lines 1 - 11		20539		2162		2224		1423		2208		2013		2116		5154	
13 Sensible (Line 2 x Duct Factor (Fig. 1.6))		23620		2486		2558		1636		2539		2315		2433		5927	
14 Heat Gain for Cooling Load (Line 13 x 1.3)		30706		3232		3325		2127		3301		3010		3163		7705	
15 Equipment Selected (Fig. 1.7)																	
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																	
18 Recommended No. of Terminators (Line 16 + 17)		1.97	2.03	1.06	1.68	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
19 Selected No. of Terminators (Choose the larger number from Line 18)		1.97	2.03	1.06	1.68	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
20 Offices Required		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 16 by the cooling (heating) base load factor 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	.85	.88	.90	.94	1.0	1.1	1.25	1.50

FIGURE 2.3: LENGTH ADJUSTMENT FACTORS

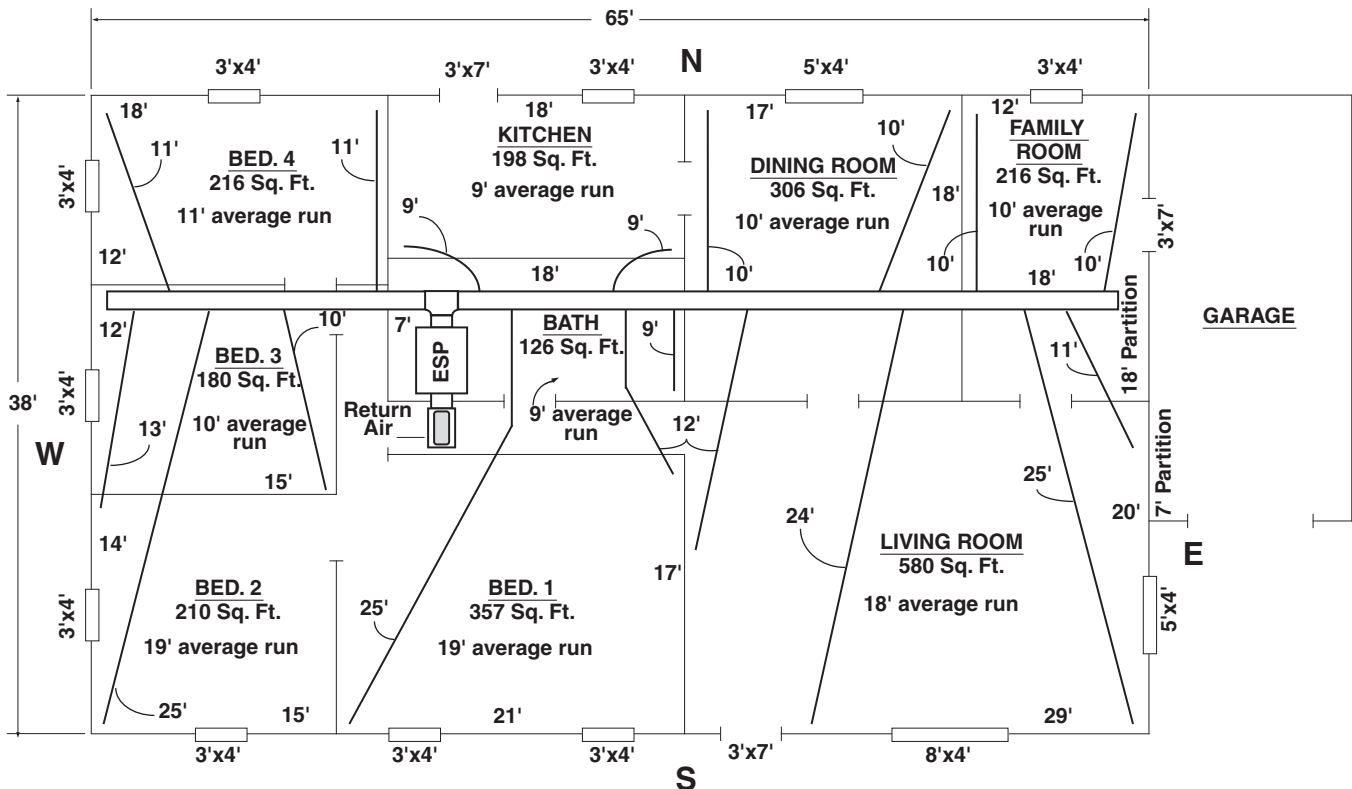


FIGURE 2.2: FLOOR PLAN EXAMPLE



KWIK-WAY HEATING & AIR CONDITIONING SIZING SHEET

ITEM OF CONSTRUCTION	TOTAL STRUCTURE		ROOM: BED 1 21 x 17 = 375		ROOM: BED 2 14 x 15 = 210		ROOM: BED 3 12 x 15 = 180		ROOM: BED 4 12 x 18 = 216		ROOM: KITCHEN 11 x 18 = 198		ROOM: DINING 17 x 18 = 306		ROOM: FAMILY 12 x 18 = 216		ROOM: LIVING 20 x 29 = 580						
	Shade Exposure	Area SQ FT	HEAT BTU	COOL BTU	Area SQ FT	HEAT BTU	COOL BTU	Area SQ FT	HEAT BTU	COOL BTU	Area SQ FT	HEAT BTU	COOL BTU	Area SQ FT	HEAT BTU	COOL BTU	Area SQ FT	HEAT BTU	COOL BTU				
1 WINDOWS (cooling) Glass Doors		56	1210		12	240	600	12	240	12	240	12	240	12	240	12	240	12	240	12			
2 Glass Doors (heating)		68	1700	24	12	300																	
3 Windows (heating)		63	567																				
4 Standard Doors (non-glass)		179	412																				
5 Partitions (less doors & windows)		144	288	208	416	64	168	84	432	111	222	116	232	84	168	263	56	129	526				
6 Exposed Walls (less 1, 2, 3, 4 & 5)		2470	6175	357	525	180	450	180	540	198	495	306	765	216	540	580	1450						
7 Ceiling/Roof		2470	1235	357	210	105	180	90	216	108	198	306	153	216	108	580	290						
8 Floor		1648	1978	168	202	278	96	115	240	288	144	173	136	163	240	288	392	470					
9 Ventilation (Mechanical)/infiltration		3	900																				
10 People		1200	1200																				
11 Appliances			20539	2162	2224	1423	1423	1423	2208	2208	2618	1200	1200	2013	2013	2116	5154						
12 Sub-Total Lines 1 - 11			23620	2486	2558	1636	1636	1636	2539	2539	3011	3011	2315	2433	2433	2433	5927						
13 Sensible (Line 12 x Duct Factor (Fig. 1.6))			30706	3232	3325	2127	2127	2127	3301	3301	3914	3914	3010	3163	3163	3163	7705						
14 Heat Gain for Cooling Load (Line 13 x 1.3)																							
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 =			BASE LOAD FACTOR COOLING =			Line 14 Total Structure Heating =			Recommended No. of Outlets =								
18 Recommended No. of Outlets (Line 16 + 17)			1.97			2.03			1.68			1.93			1.50			1.58			4.69		
19 Selected No. of Outlets (Choose the larger number from Line 18)			NONE			.15			.35			.50			NONE			.15			NONE		
20 Orifices Required			2			2			1			2			1			1			3		
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 unit is designed to operate with a total external static pressure of 1.5 inches of water column (minimum 1.2 — maximum 1.5). 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

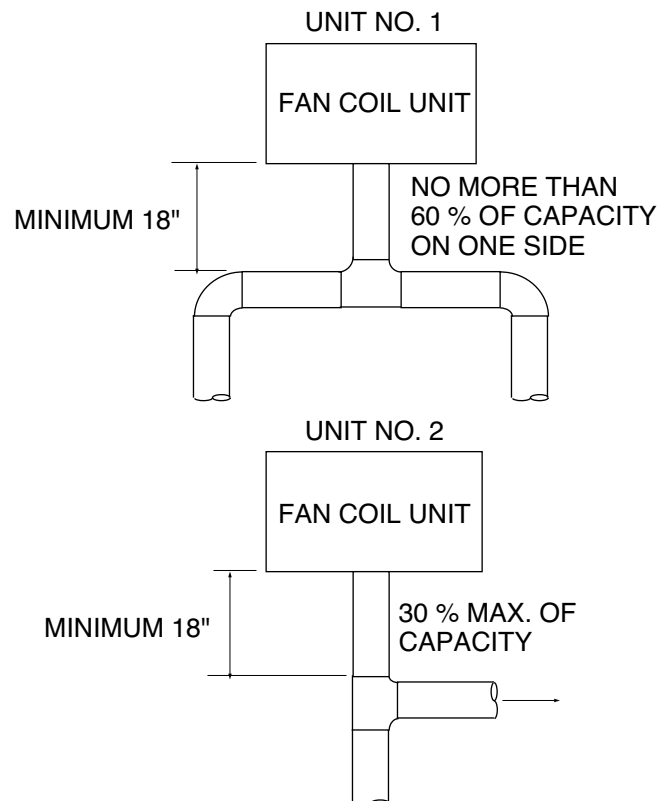


FIGURE 3.1: ESP-4860 INSTALLATION

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.

