Small Duct High Velocity Installation Training

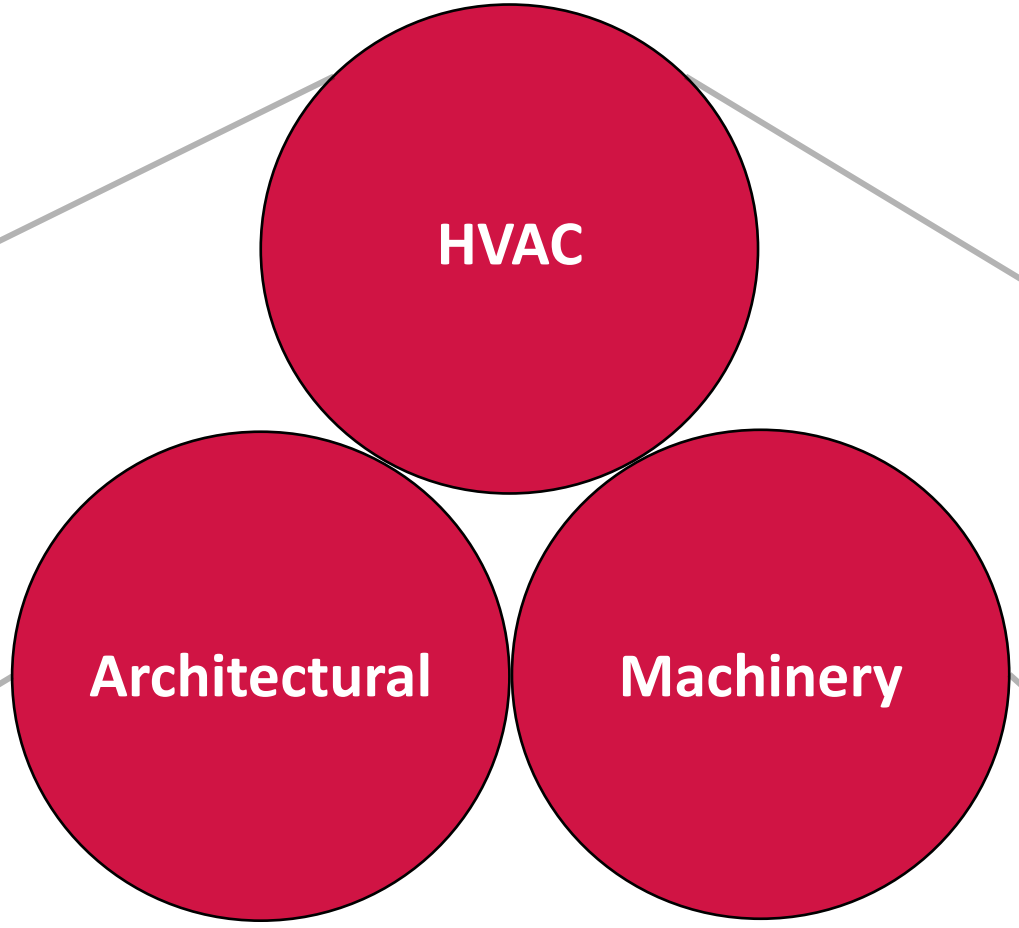
June 27th, 2024

Mestek, Inc

- Established 1946 in Westfield, MA
- Privately owned
- Over 45 companies involved in the HVAC, Architectural, & Metal Forming Machinery & fabrication industries
- Began with founder John Reed and original Fin Tube Radiation in 1946 as Sterling Radiator Company
- 1975 Reed National
- 1986 merger becomes Mestek
- SpacePak joins Mestek family in 1991

Mestek Today

Residential
- Hydronic baseboard
- Hydronic heating fan coils
- Hydronic & gas-fired unit heaters
- Small duct high velocity
- Air to water heat pumps
- Equipment Controls
- Radiant tubing



Commercial
- High-efficiency boilers & water heaters
- Air source and water source heat pumps
- CO2 heat pump water heaters
- Hydronic chilled beams
- Rooftop and makeup air units
- Hydronic baseboard & convectors
- Hydronic & gas-fired unit heaters
- Portable air conditioners

- Monumental glass skylights
- Panel systems
- Ornamental metal products
- Sunshades
- Louvers
- Vision/sunscreens
- Architectural grilles

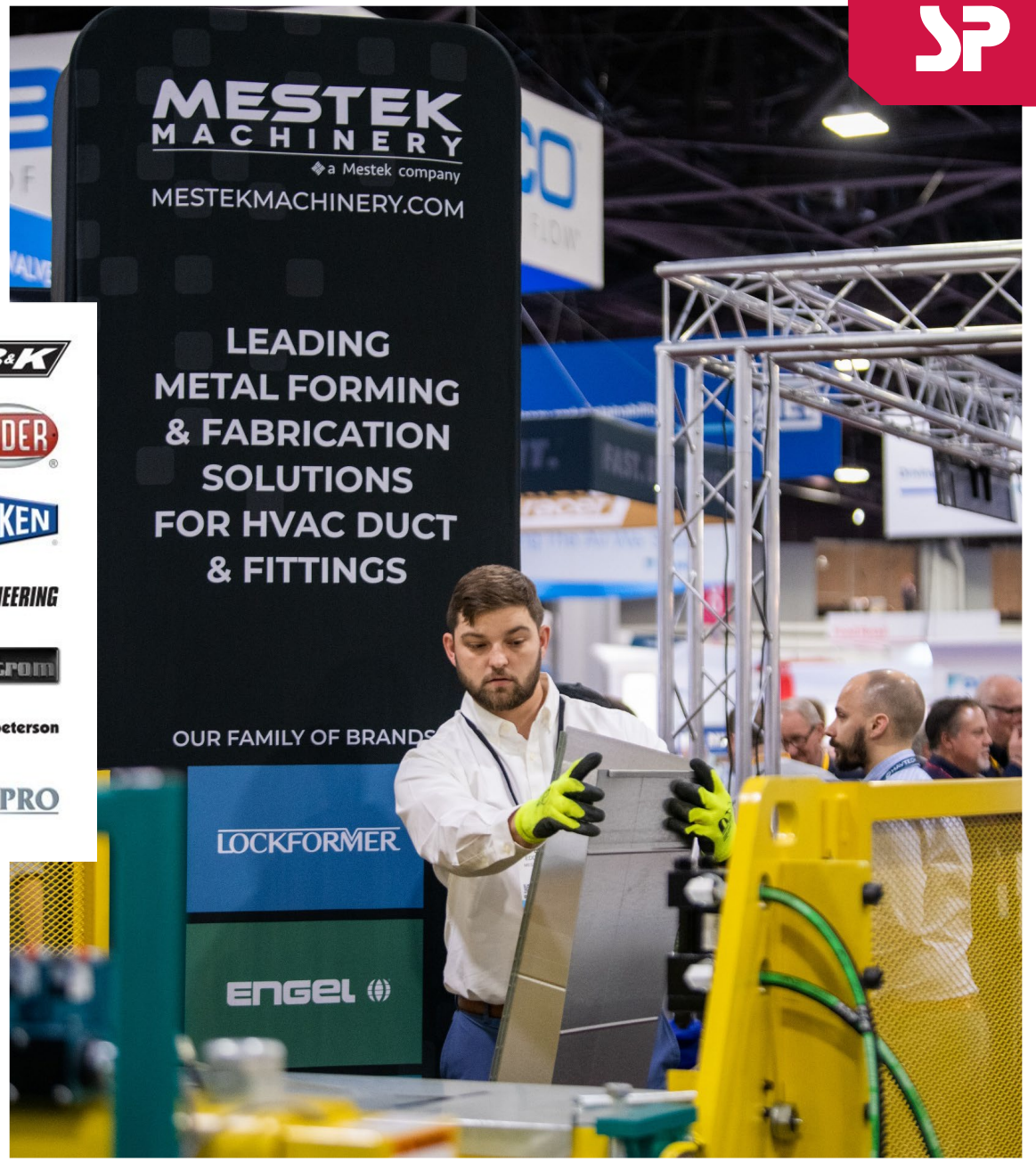
- Sheet metal forming
- Sheet metal cutting
- Coil material handling
- Duct fabrication
- Spiral fitting & tube forming
- Hydraulic sheet metal bending

Architectural

- Monumental glass skylights
- Panel systems
- Ornamental metal products
- Sunshades
- Louvers
- Vision/sunscreens
- Architectural grilles

Machinery

- Sheet metal forming
- Sheet metal cutting
- Coil material handling
- Duct fabrication
- Spiral fitting & tube forming
- Hydraulic sheet metal bending

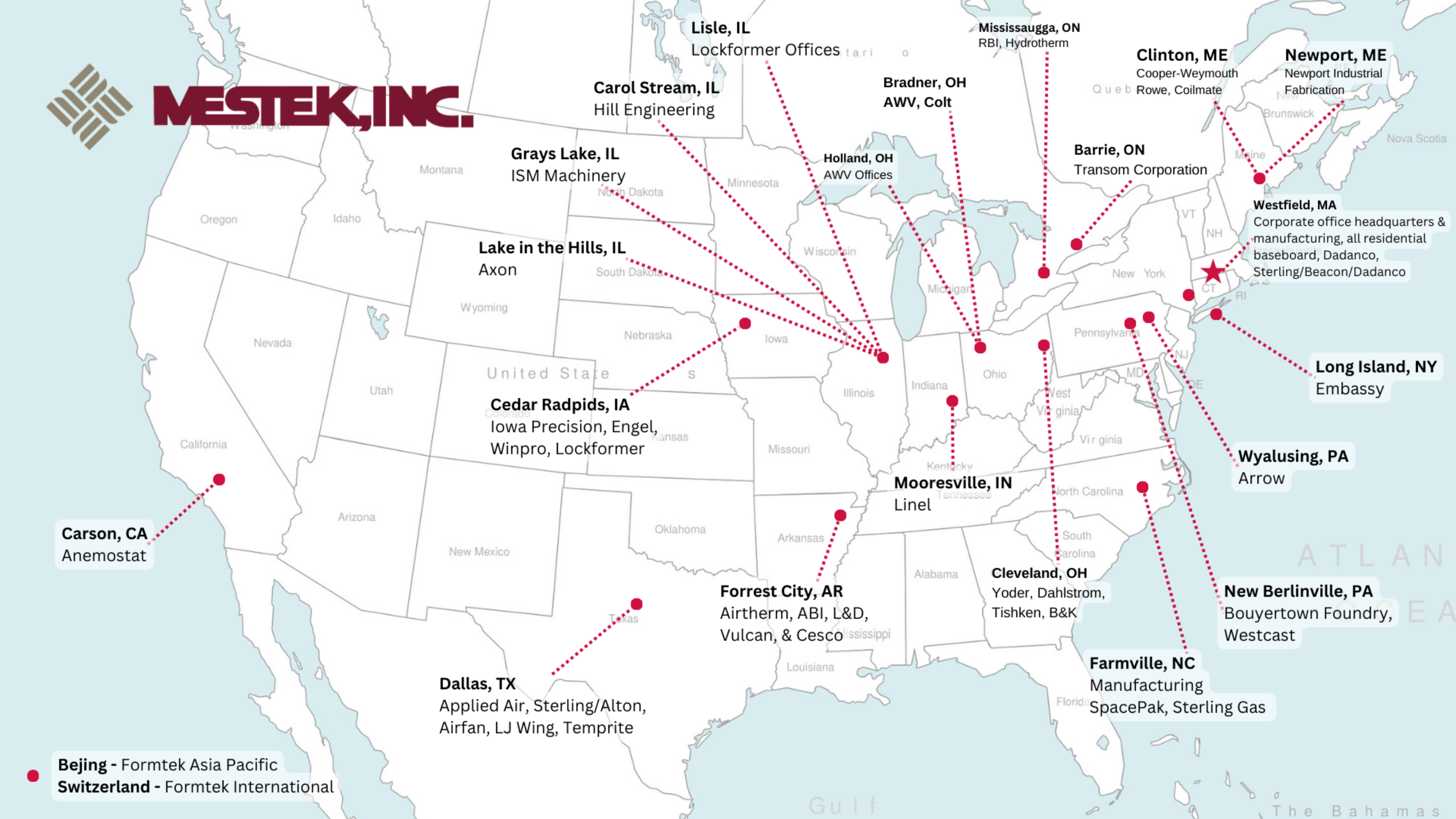


HVAC (Residential & Commercial)

- Hydronic fin-tub baseboard & convectors
- High-efficiency commercial boilers & water heaters
- Hydronic & gas-fired unit heaters
- Air source and water source heat pumps
- CO2 heat pump water heaters
- Hydronic chilled beams
- Rooftop and makeup air units
- Portable air conditioners
- System control technology


FLEXCORE
RBI
FUTERA
RBI


STERLING


MESTEK, INC.
Lisle, IL
Lockformer Offices
Mississaugga, ON
RBI, Hydrotherm
Clinton, ME
Cooper-Weymouth
Rowe, Coilmate
Newport, ME
Newport Industrial
Fabrication
Carol Stream, IL
Hill Engineering
Bradner, OH
AWV, Colt
Holland, OH
AWV Offices
Barrie, ON
Transom Corporation
Grays Lake, IL
ISM Machinery
Westfield, MA
Corporate office headquarters &
manufacturing, all residential
baseboard, Dadanco,
Sterling/Beacon/Dadanco
Lake in the Hills, IL
Axon
Long Island, NY
Embassy
Cedar Radpids, IA
Iowa Precision, Engel,
Winpro, Lockformer
Wyalusing, PA
Arrow
Mooresville, IN
Linel
Carson, CA
Anemostat
Forrest City, AR
Airtherm, ABI, L&D,
Vulcan, & Cesco
Cleveland, OH
Yoder, Dahlstrom,
Tishken, B&K
New Berlinville, PA
Bouyertown Foundry,
Westcast
Farmville, NC
Manufacturing
SpacePak, Sterling Gas
Dallas, TX
Applied Air, Sterling/Alton,
Airfan, LJ Wing, Temprite
Bejing - Formtek Asia Pacific
Switzerland - Formtek International

Westfield, MA - Mestek Home Base

CORPORATE HEADQUARTER OFFICES

- Product & Engineering
- Sales & Marketing
- Executive Level Management
- Customer & Technical Service
- Accounting & Finance
- Human Resources & Legal
- IT & Technology

RESEARCH & DEVELOPMENT LAB

- New product development
- Product testing
- Performance testing

MANUFACTURING

- All residential baseboard lines
- Beacon Morris unit kickspace heaters
- Sterling Commercial
- Dadanco
- Vulcan
- MTI Controls

TRAINING CENTER & LIVE-FIRE SHOWROOM

- SpacePak
- Commercial Boilers
- Commercial Heat Pumps
- Show room

Jim Bashford

SpacePak National Sales & Training Manager

Jim has been with SpacePak for over 7 years. In addition to his role as National Sales and Training Manager, Jim has used his extensive knowledge of all SpacePak products to continually expand his role within the company, taking on greater responsibility with the training side of the business including instructing our SpacePak Systems and Applications seminars.

Before joining the SpacePak team, Jim was a manufacturer's representative for three years working with a variety of HVAC products. He has over 23 years of experience in the HVAC industry which includes experience as a contractor and business owner where he spent many years selling and installing SpacePak products.

Meet the Team

Jared Stearns
Product Manager, P.E.

Allyson Moauro
Product Management Assistant

Eric Rainey
Application Engineer / Inside Sales

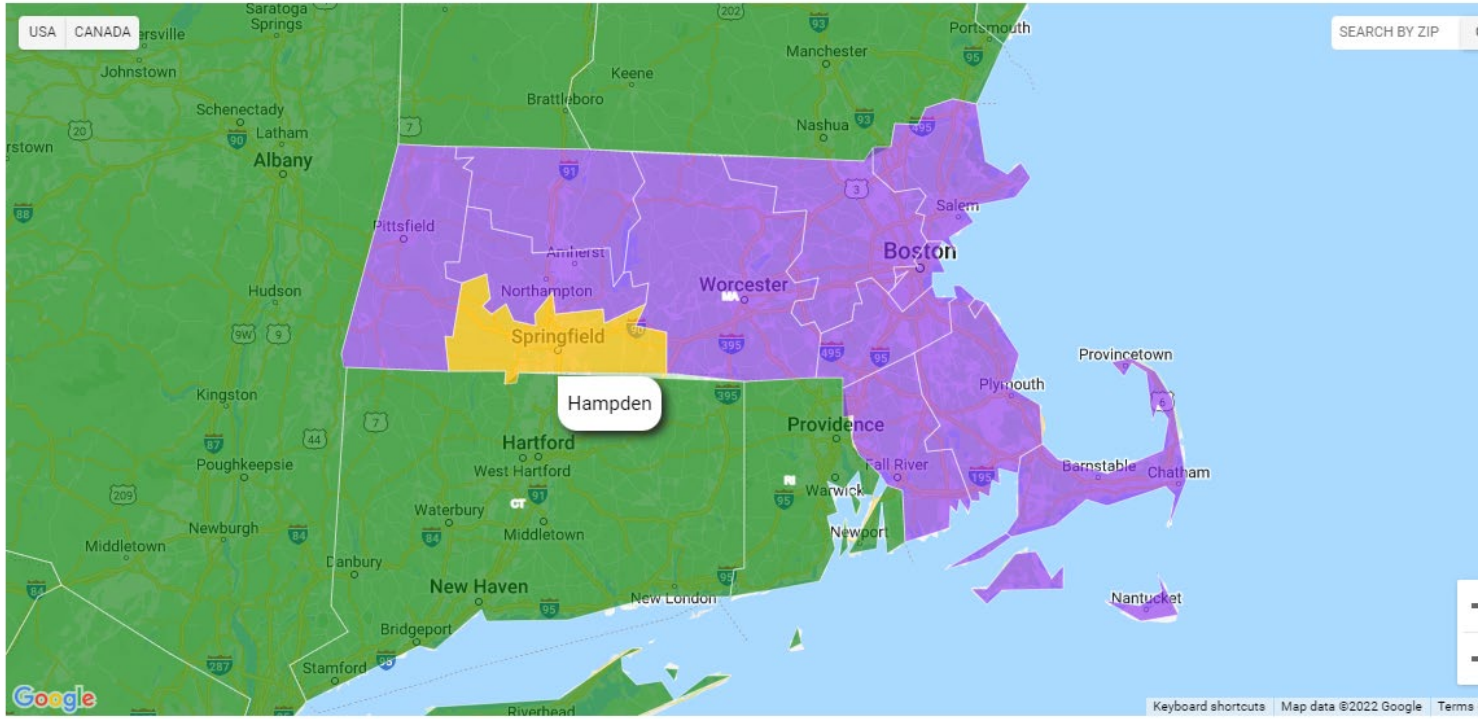
Meagan Harrington
Marketing Manager

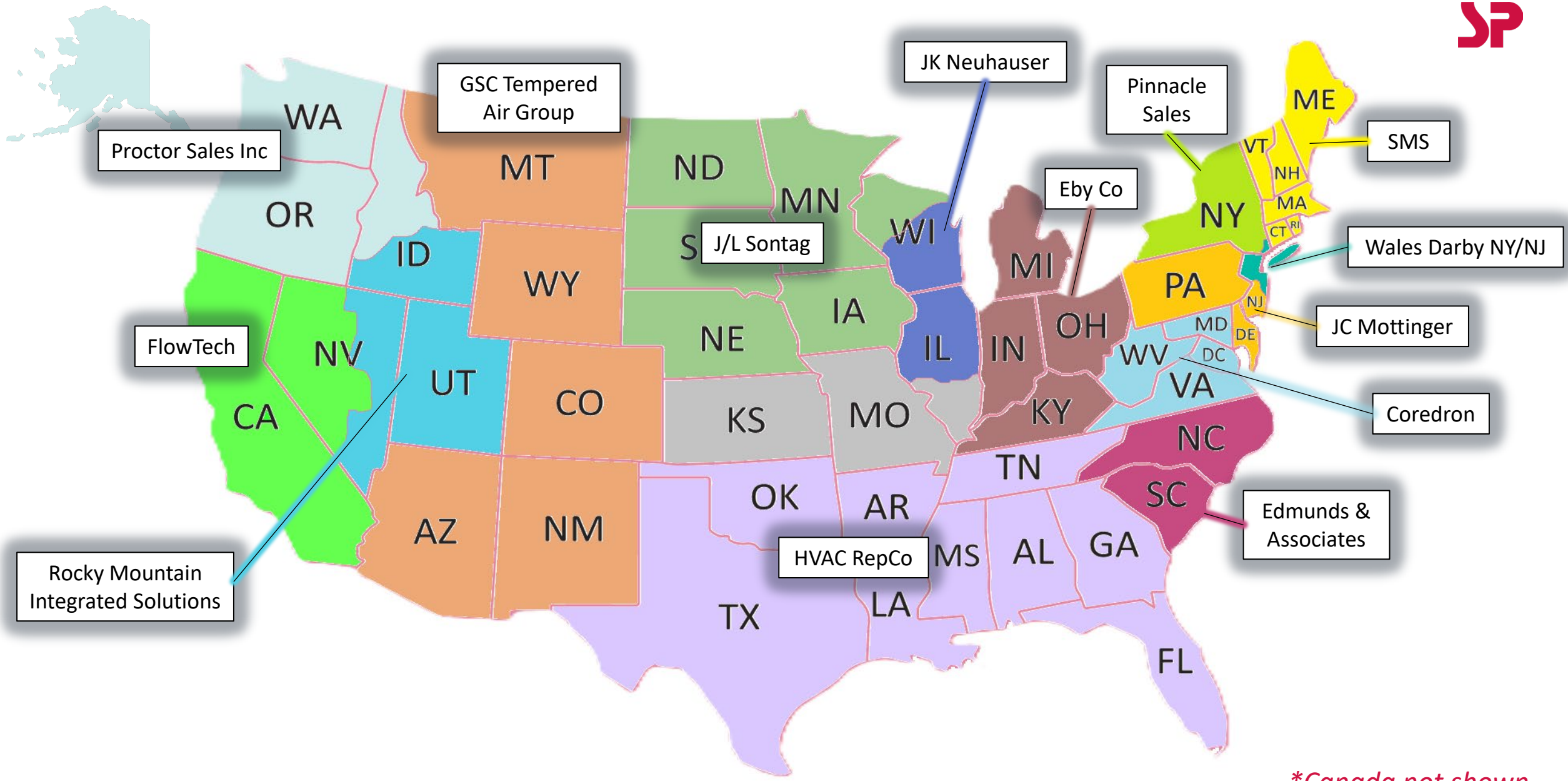
MESTEK

MESTEK: Manufacturing in Farmville, NC

Local Representative Support

For all local field support, including **pricing, availability, and project questions**, please contact your local SpacePak Representative. For contact information visit: www.spacepak.com/RepLocator





**Canada not shown*

US Manufacturer Representative Network

Pre-Sale Application Support Team

PreSaleSupport@SpacePak.com

Available to Representatives, Wholesalers and Contractors

- System application support
- Equipment selection
- Load calculation and rough material list

Any questions regarding equipment already shipped should be directed to

TechnicalService@SpacePak.com (413) 564 - 5530

Warranty Policy

Small duct high velocity, hydronic fan coils, & associated equipment

Standard Warranty

- 1-year parts

Extended Warranty

- 5-year parts*

*Extended Warranty Requirements

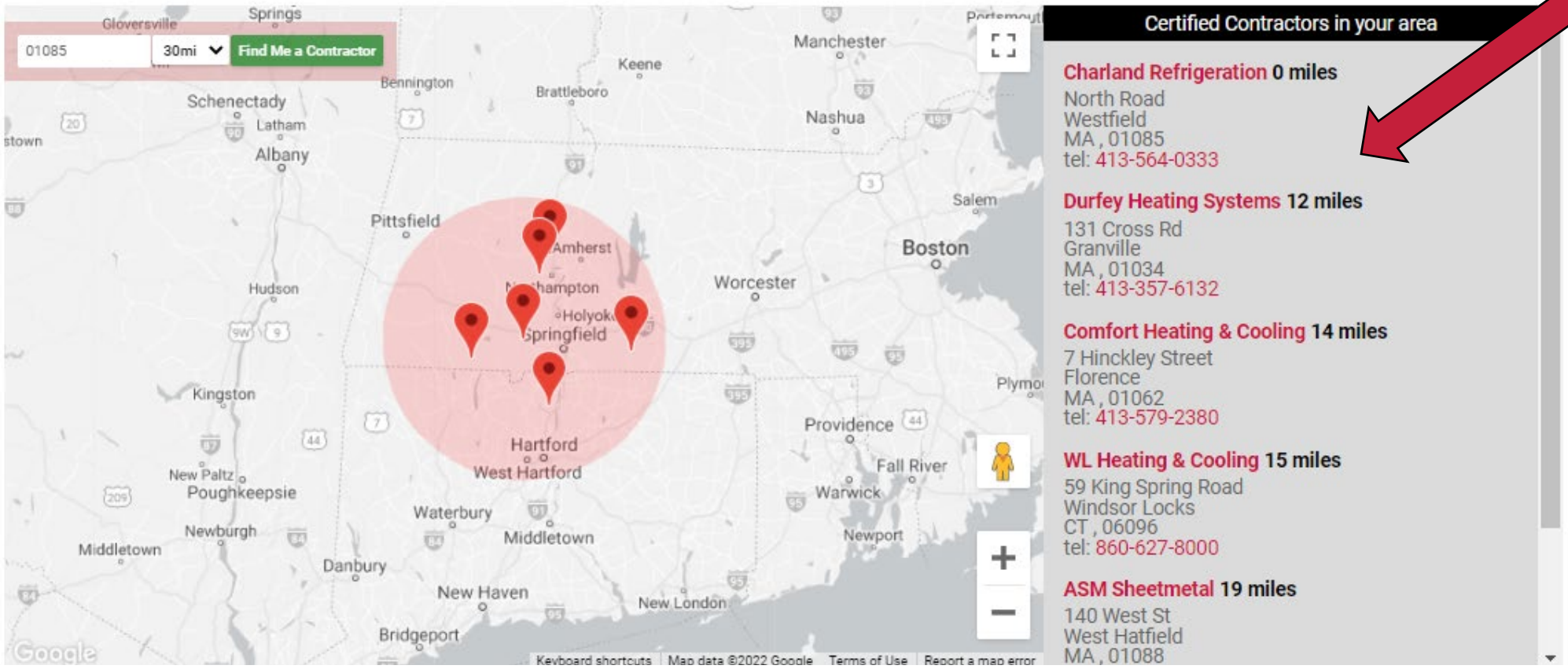
- Must be listed as a SpacePak Certified Contractor at time of installation
- Must register project/equipment via the website
- MUST FOLLOW WARRANTY PROCESS WHICH INCLUDES CALLING TECHNICAL SUPPORT TO VERIFY PROPER DIAGNOSES

Certified Contractor Program

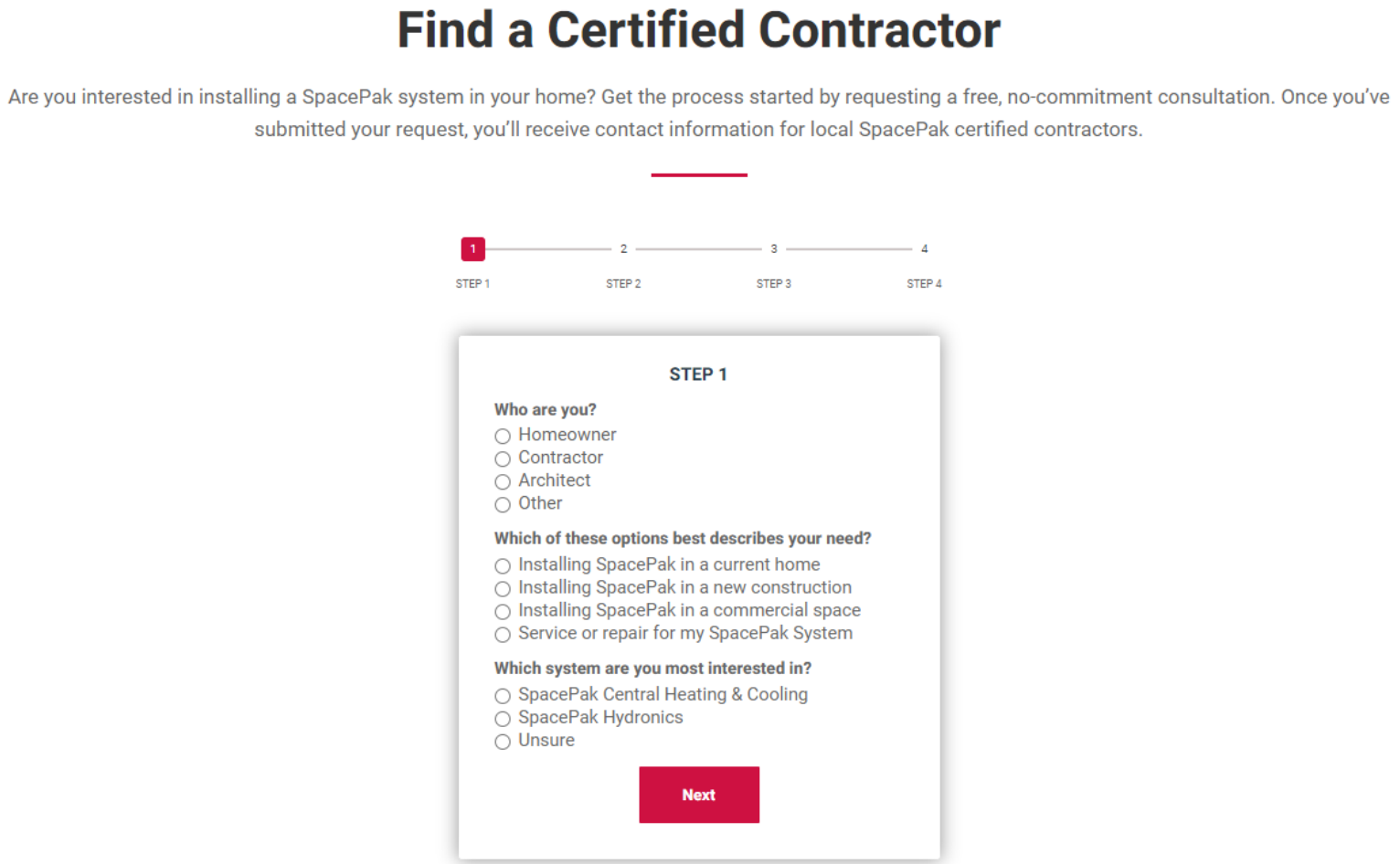
- Extended warranty*
- Listed on website
- Homeowner leads
- Pre-sale support
- Marketing support – co-op dollars

**with project registration*

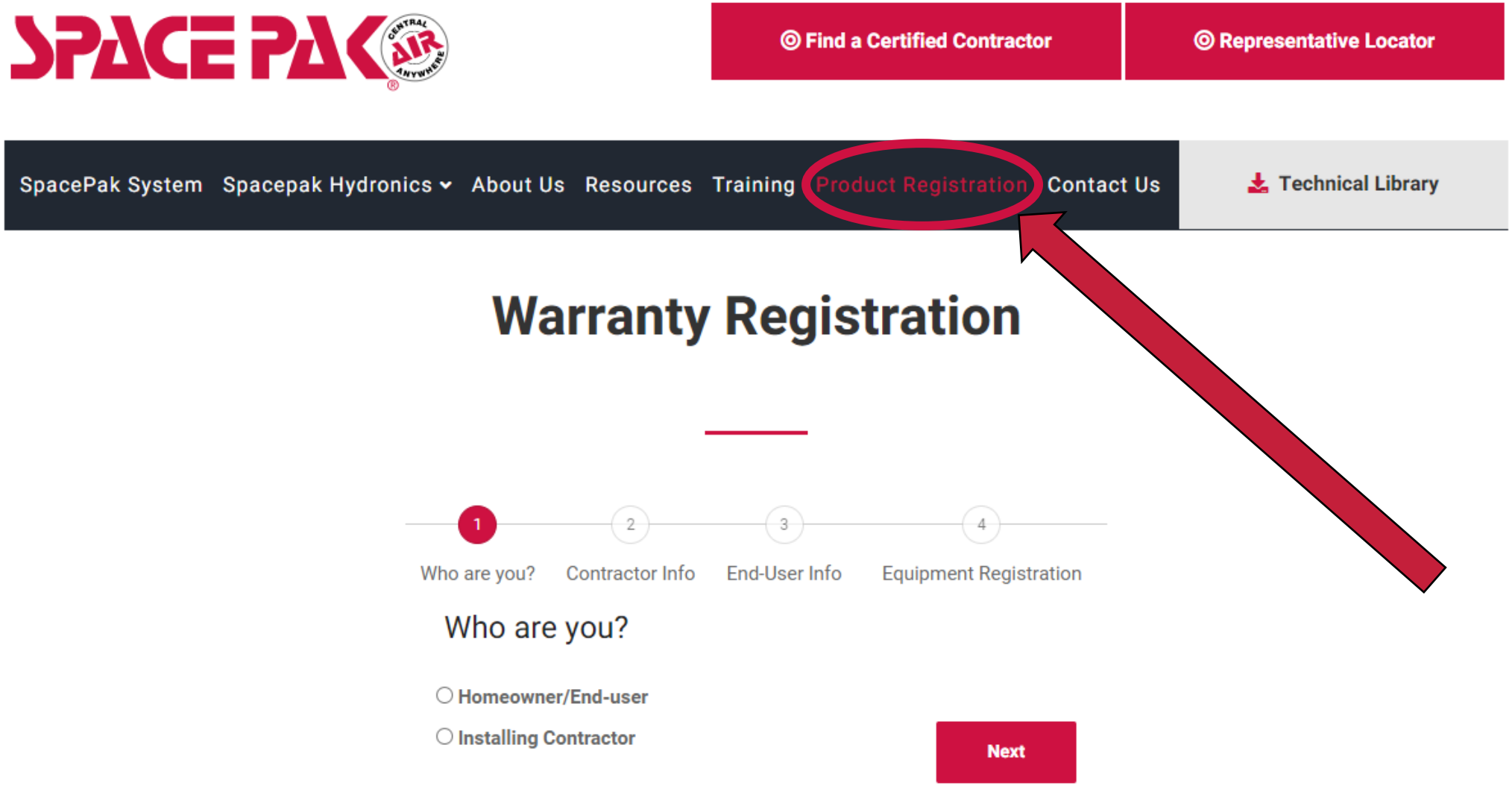
Contractor Locator Map & Lead Generation



Homeowner Leads Emailed Directly to you



NOTE: Extensive form guarantees only serious inquiries.


Find a Certified Contractor
Representative Locator
SpacePak System
Spacepak Hydronics
About Us
Resources
Training
Product Registration
Contact Us
Technical Library
Warranty Registration
1
2
3
4
Who are you?
Contractor Info
End-User Info
Equipment Registration
Who are you?
Homeowner/End-user
Installing Contractor
Next

Small Duct High Velocity (SDHV) Heating & Cooling

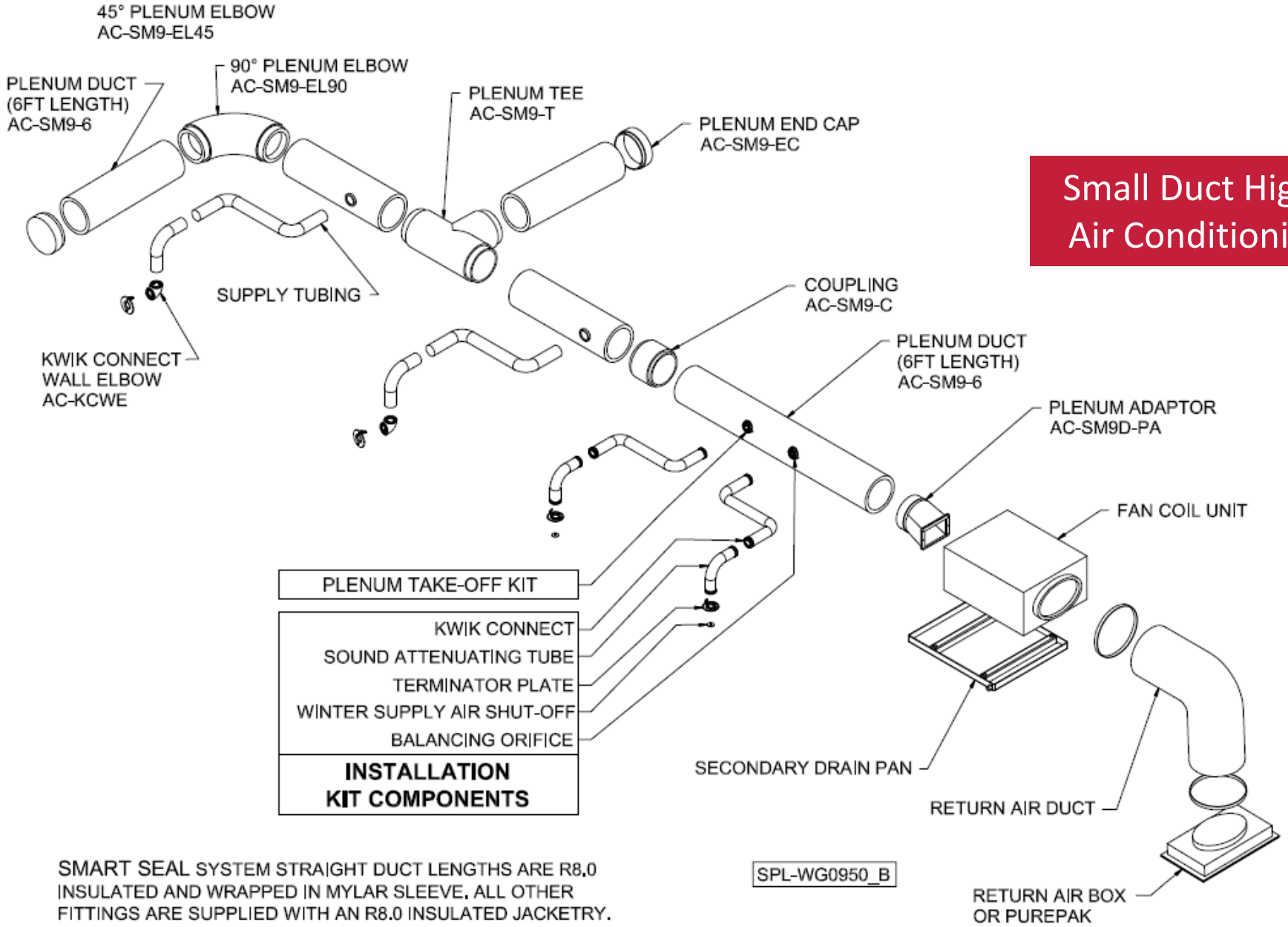
- SpacePak delivers uniform, year-round comfort, with fewer of the unwanted challenges common to other central heating and air-conditioning systems. Making sure there are:
  - **No** Major Renovations
  - **No** Loss of Usable Floor Space
  - **No** High Energy Bills
  - **No** Unsightly Components

- Simply quiet, cost-effective comfort for virtually any home or building, regardless of the structure's design, age, size, or construction type.

- SpacePak is an air distribution system which uses a principle known as aspiration - as the air stream enters the room, it creates a gentle mixing of air in the room to provide thorough, comfortable draft-free air circulation.

- SpacePak eliminates stratification with a minimum floor-to-ceiling temperature difference.

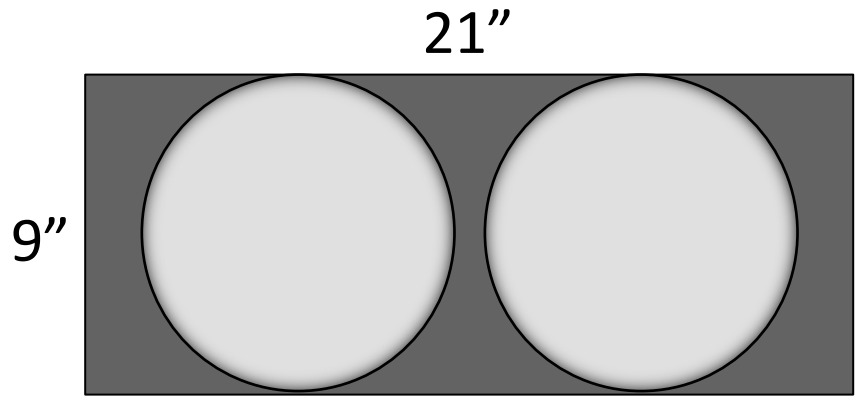
Small Duct High Velocity Heating and Air Conditioning Distribution System



SMART SEAL SYSTEM STRAIGHT DUCT LENGTHS ARE R8.0 INSULATED AND WRAPPED IN MYLAR SLEEVE. ALL OTHER FITTINGS ARE SUPPLIED WITH AN R8.0 INSULATED JACKETRY. DUCT COMPONENTS SHOWN WITHOUT FACTORY SUPPLIED R8.0 INSULATED JACKETRY.

Comparing Conventional Duct Space Vs. Small Duct Space

When space and efficiency counts

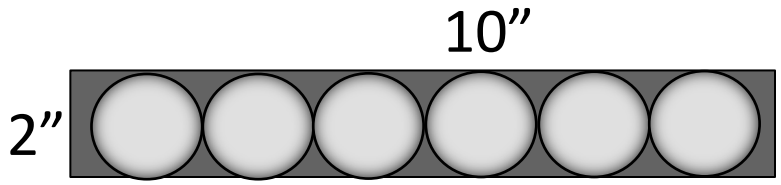


1 CONVENTIONAL TRUNK
60,000 Btu Cooling
90-120,000 Btu Heating

=

2 SDHV MAIN TRUNK SIZE
120,000 Btu

SAME SPACE. MORE BTU’s.



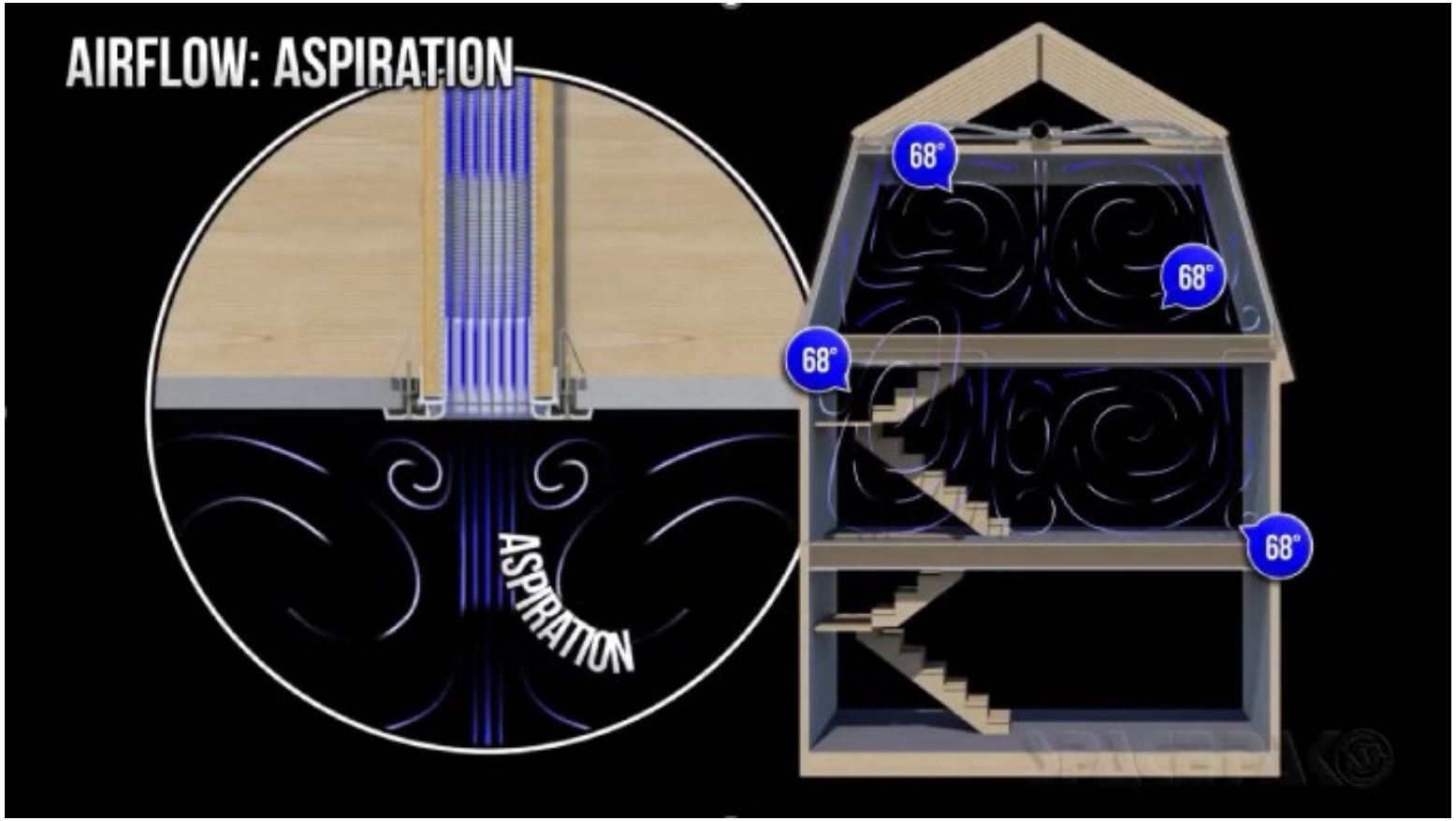
1 CONVENTIONAL DUCT
2,000 Btu cooling
3,000+ Btu Heating

=

6 SDHV DUCTS
12,000 Btu

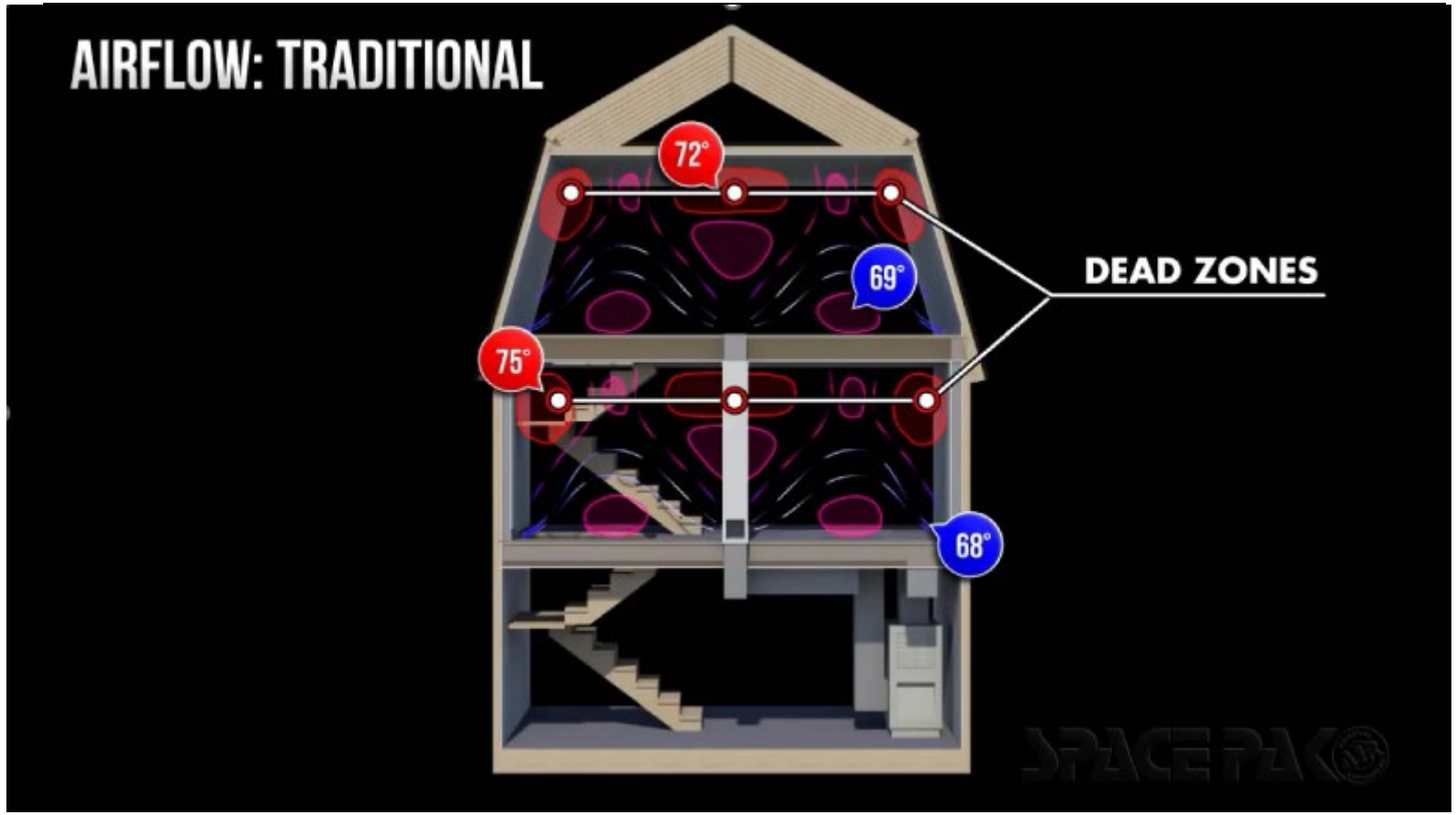
Uniform, Draft-Free Comfort

- The SDHV air distribution system utilizes a principle known as **aspiration.**
- As the air stream enters the room, it gently and continuously mixes air to provide uniform, draft-free air circulation.
- Eliminates stratification with a less than 2°F floor-to-ceiling temperature differential.

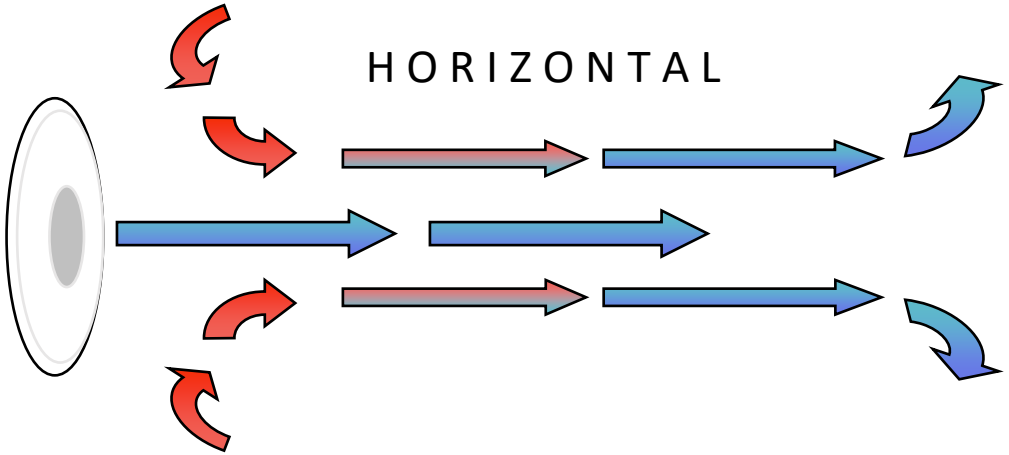


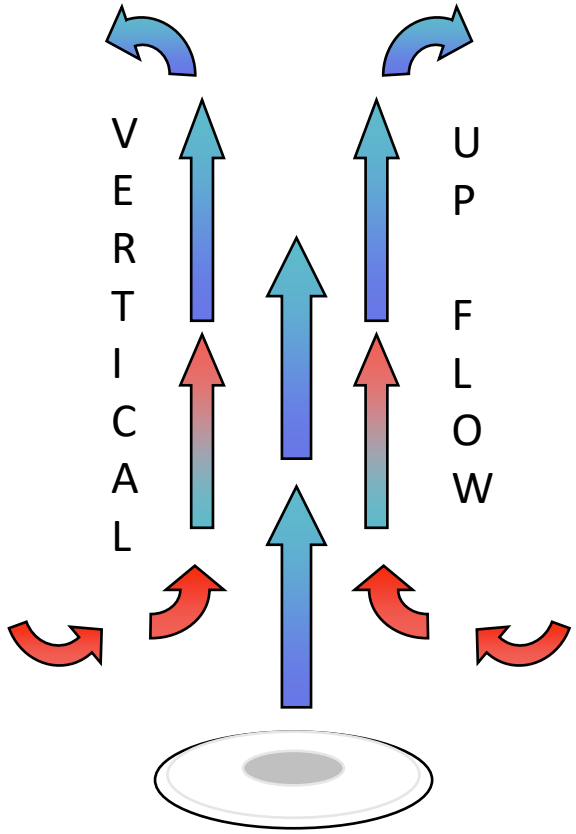
Conventional Air Distribution

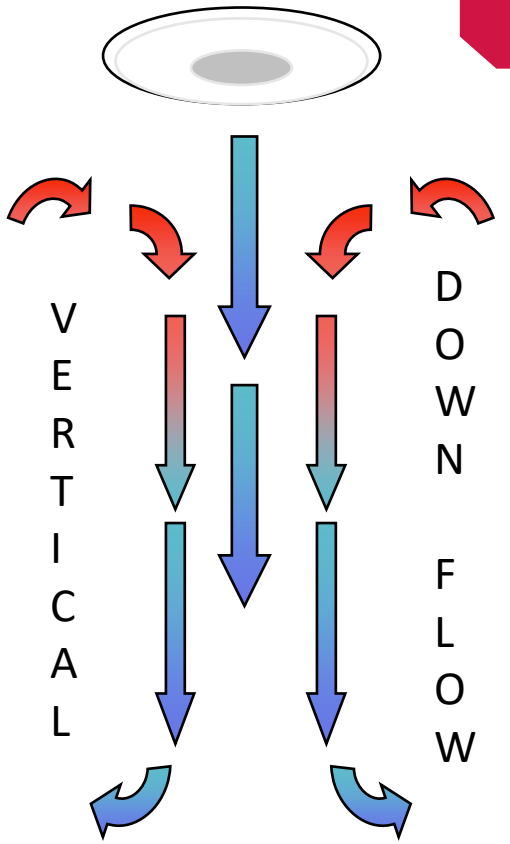
- Diffusion, throw, & return
- Conventional units generally need individual returns for every room
- Needs complete air change
- Works for and is generally designed for heating or cooling applications. NOT BOTH.



Outlet Orientation



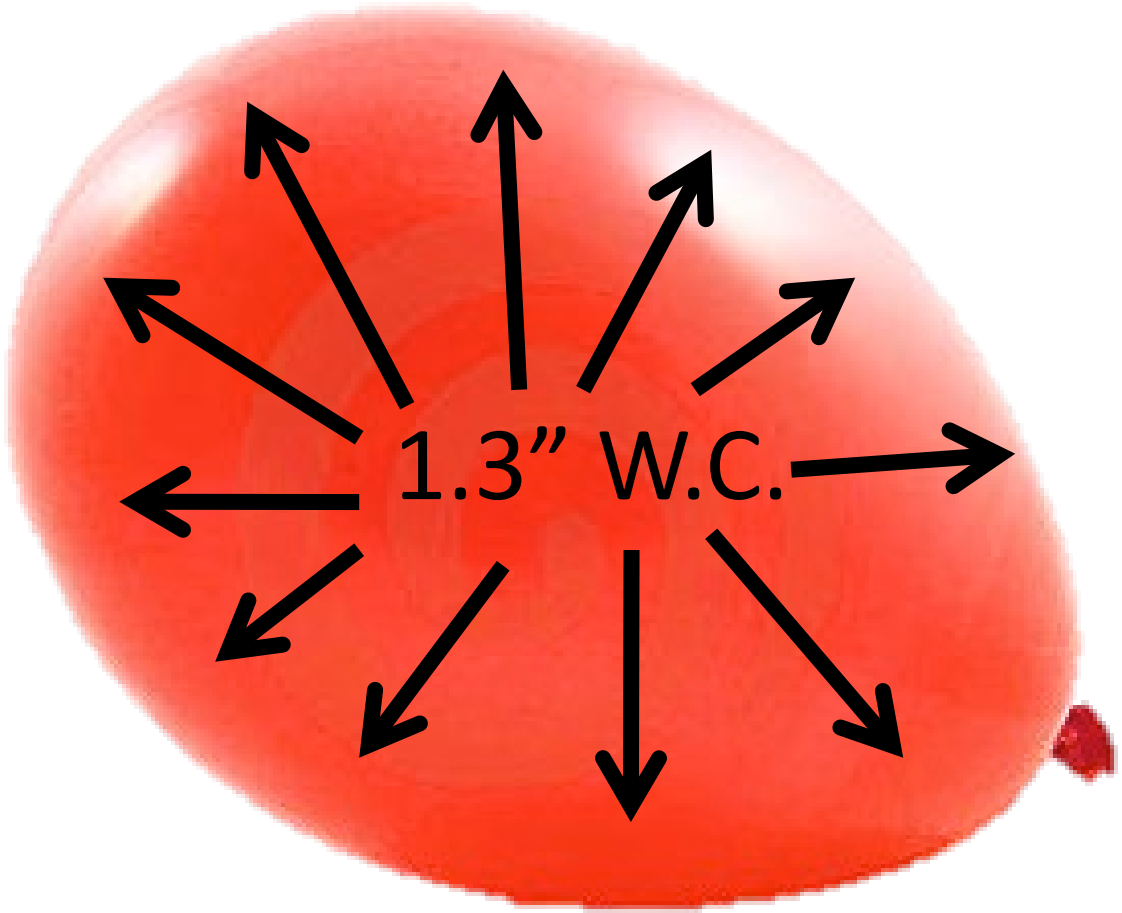




Motor & Blower

SPACEPAK	CONVENTIONAL
1.2 - 1.8 + INCHES WC STATIC PRESSURE	**.5 INCHES** WC STATIC PRESSURE
220 TO 250 CFM PER NOMINAL TON	**350 TO 400 CFM** PER NOMINAL TON

STATIC = EQUAL PRESSURE ON ALL INSIDE SURFACES

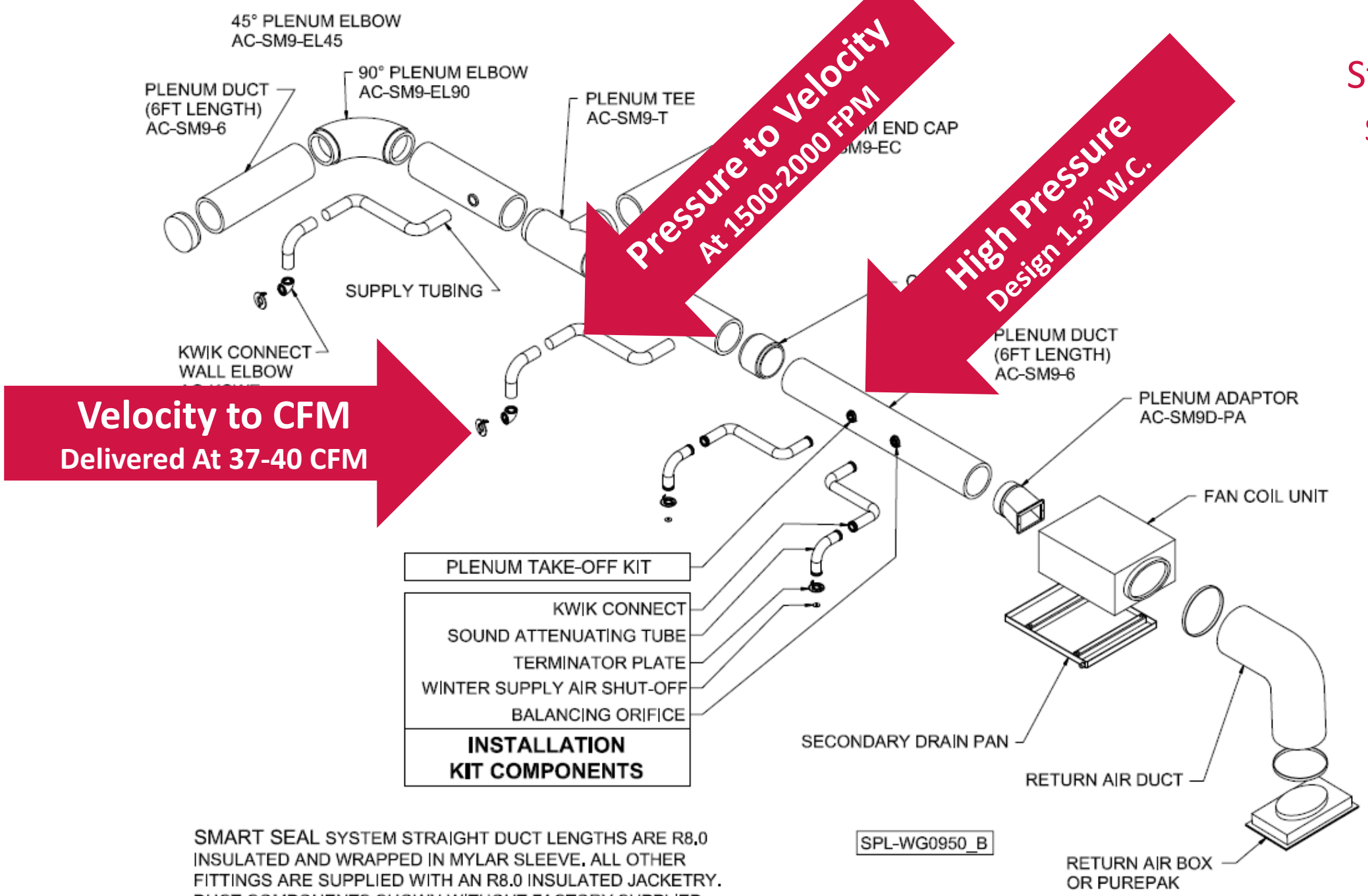


The Process of Static Regain (Its about the pressure)

MAIN PLENUM

Static Regain

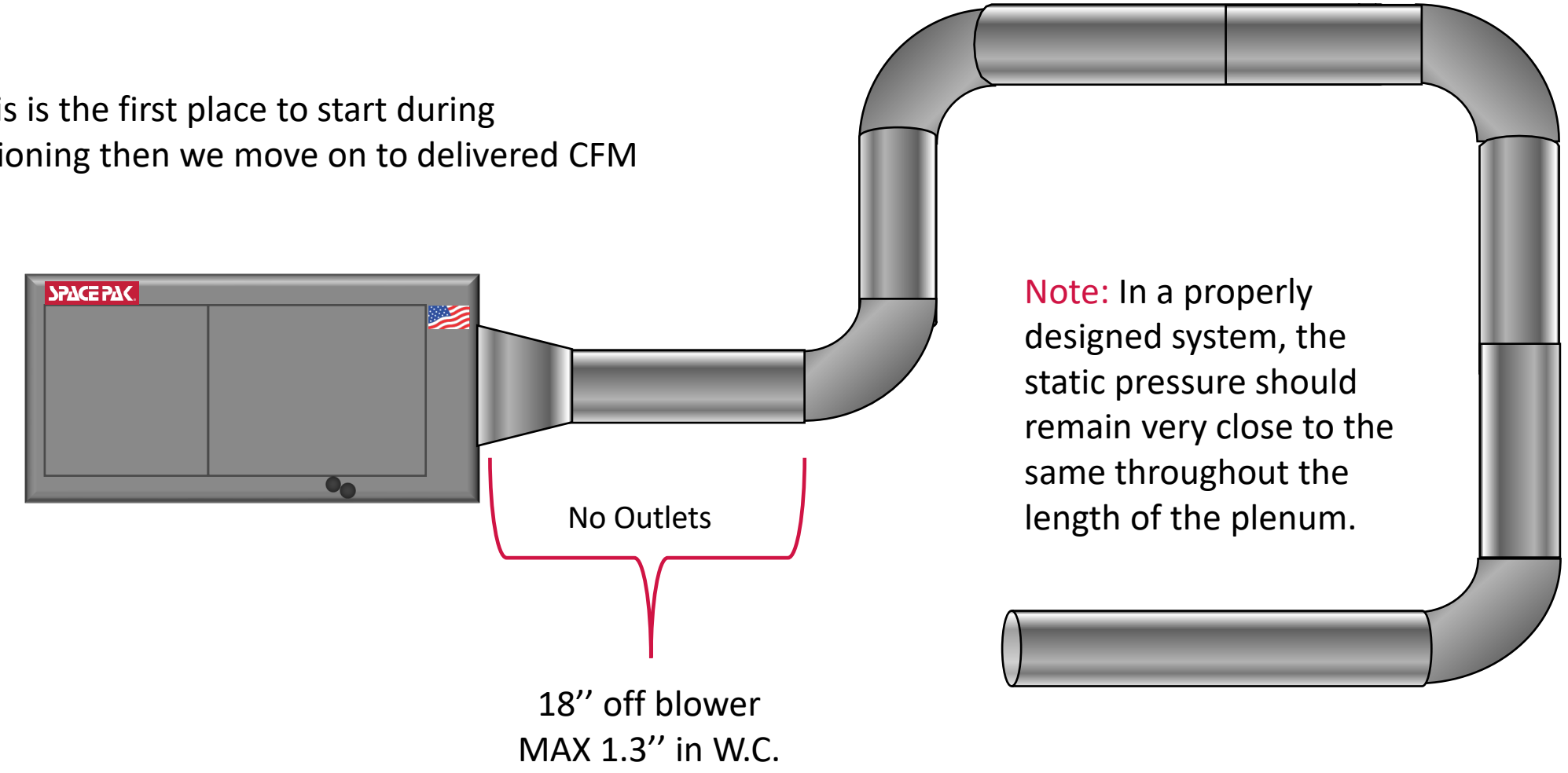
System layout and target pressures



SMART SEAL SYSTEM STRAIGHT DUCT LENGTHS ARE R8.0 INSULATED AND WRAPPED IN MYLAR SLEEVE. ALL OTHER FITTINGS ARE SUPPLIED WITH AN R8.0 INSULATED JACKETRY. DUCT COMPONENTS SHOWN WITHOUT FACTORY SUPPLIED R8.0 INSULATED JACKETRY.

Static Pressure Check

Note: This is the first place to start during commissioning then we move on to delivered CFM

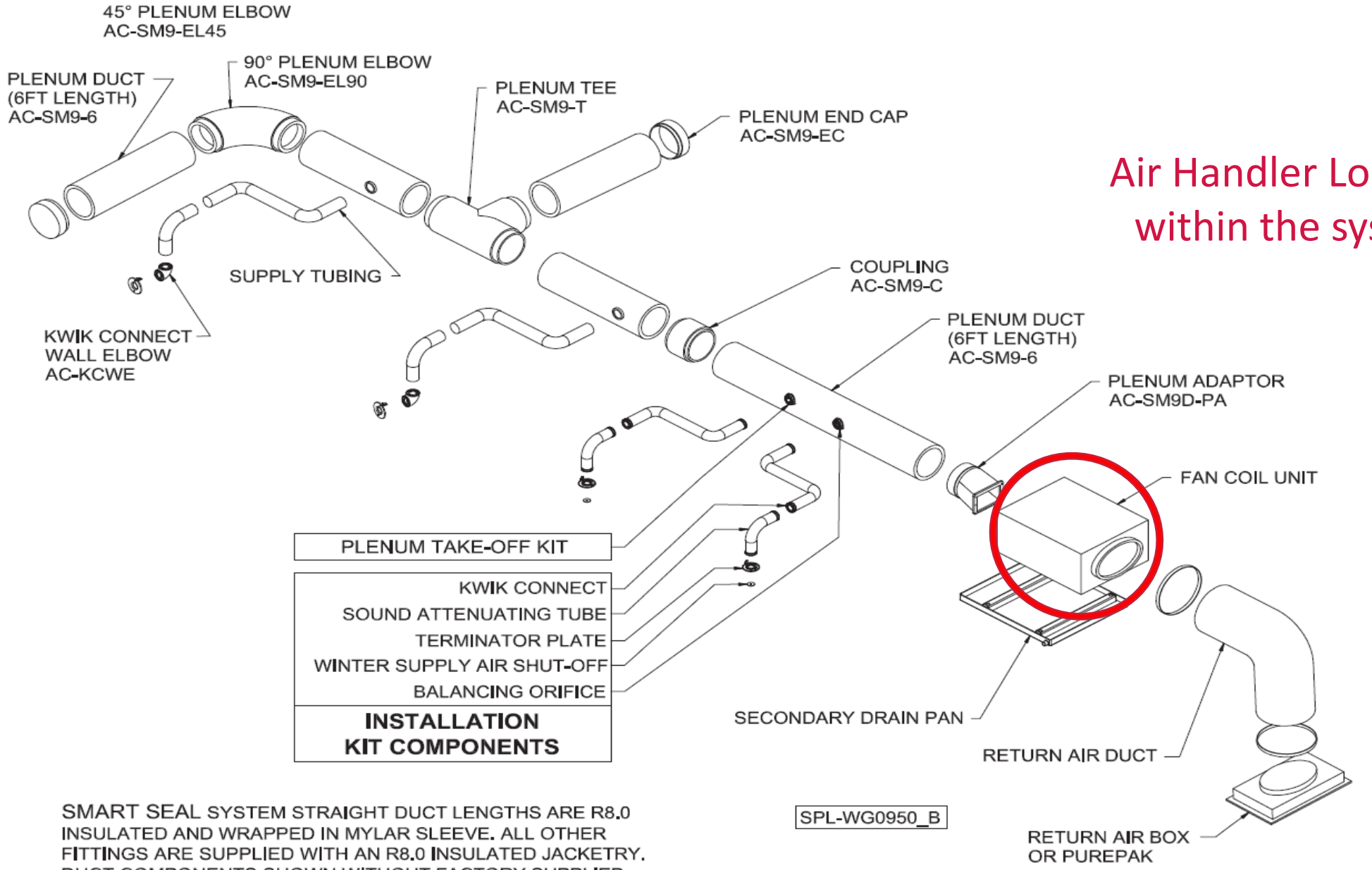


Questions

Air Handler

J Series Air Handler

Air Handler Location within the system



SMART SEAL SYSTEM STRAIGHT DUCT LENGTHS ARE R8.0 INSULATED AND WRAPPED IN MYLAR SLEEVE. ALL OTHER FITTINGS ARE SUPPLIED WITH AN R8.0 INSULATED JACKETRY. DUCT COMPONENTS SHOWN WITHOUT FACTORY SUPPLIED R8.0 INSULATED JACKETRY.

J Series

ESP Model
(DX Coil)

ESP-J
DX Horizontal

ESP-JV
DX Vertical

WCSP Model
(Water Coil)

WCSP-J
Hydronic Horizontal

WCSP-JV
Hydronic Vertical

Available in 3 sizes

2430 - 24,000 to 30,000 BTU/Hr. (2-2½ tons)
3642 - 36,000 to 42,000 BTU/Hr. (3-3½ tons)
4860 - 48,000 to 60,000 BTU/Hr. (4-5 tons)

Note: Units are not field convertible

ESP-J Specifications

FIGURE 2.1: MODEL ESP-J SPECIFICATIONS

Model	System capacity (Nom. Tons)	Electrical Characteristics*	Connections				Recommended Condensing Unit	
			Suction Line (O.D.)	Liquid Line (O.D.)	Cond. Drain (FPT)	Return Inlet (Dia.)	Nominal Capacity (MBH)	Min SEER
ESP-2430J-V	2 - 2-1/2	230/60/1	7/8"	3/8"	3/4"	15"	24 to 30	13+
ESP-3642J-V	3 - 3-1/2	230/60/1	7/8"	3/8"	3/4"	19"	36 to 42	13+
ESP-4860J-V	4 - 5	230/60/1	7/8"	3/8"	3/4"	24"	48 to 60	13+

*Unit includes optional conversion kit to 115V.

Model	System capacity (Nom. Tons)	Blower				Coil		Ship. Wt. (lbs)	
		Std. CFM @ 1.2" W.C.	Wheel Dia. and Width	Motor HP	115V/230V F.L. Amps*	No. of Rows Deep	Flow Control Device	J	JV
ESP-2430J-V	2 - 2-1/2	440, 550	10" x 6"	3/4	5.6/2.8	6	TXV	105	135
ESP-3642J-V	3 - 3-1/2	660, 850	10" x 6"	3/4	7.6/4	6	TXV	123	170
ESP-4860J-V	4 - 5	880, 1150	10" x 6"	3/4	10.6/5.4	6	TXV	144	210

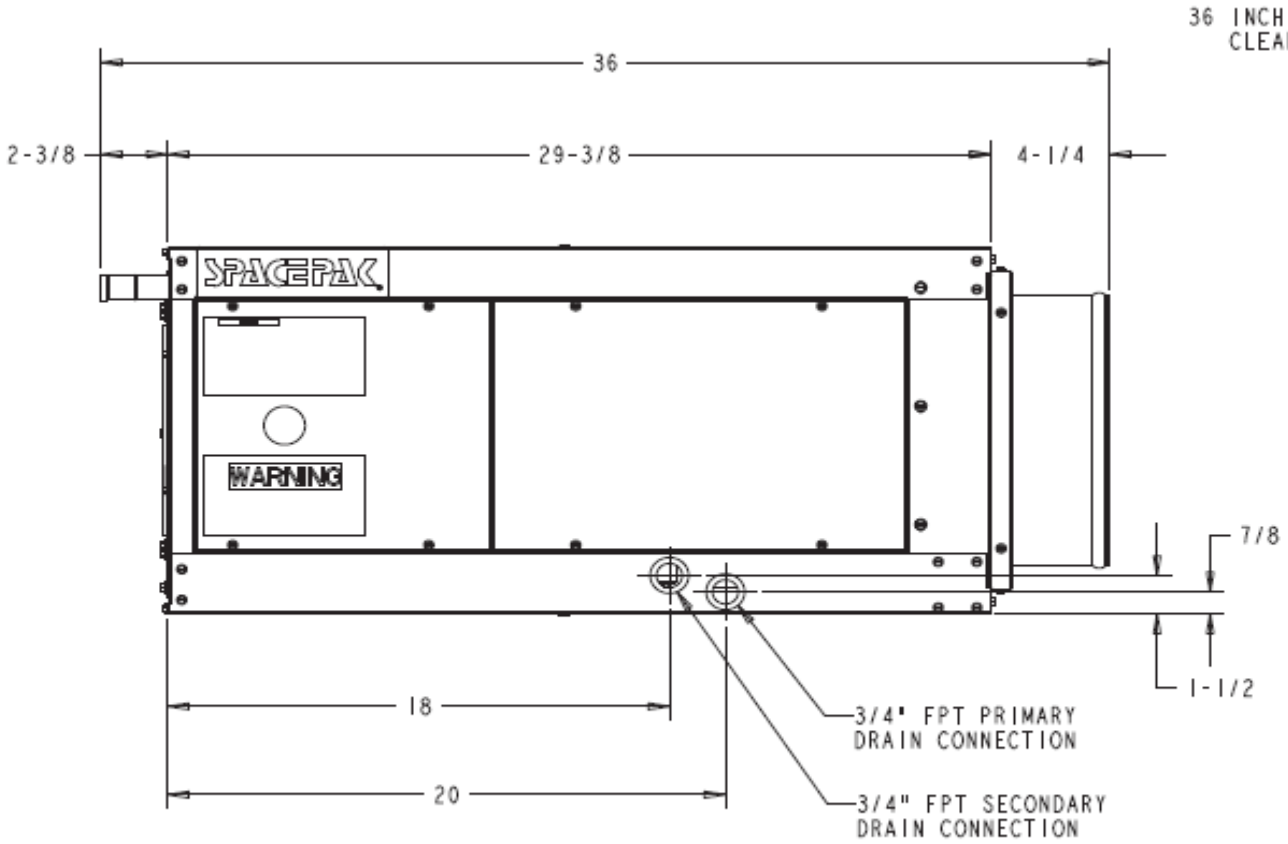
*Unit includes optional conversion kit to 115V.

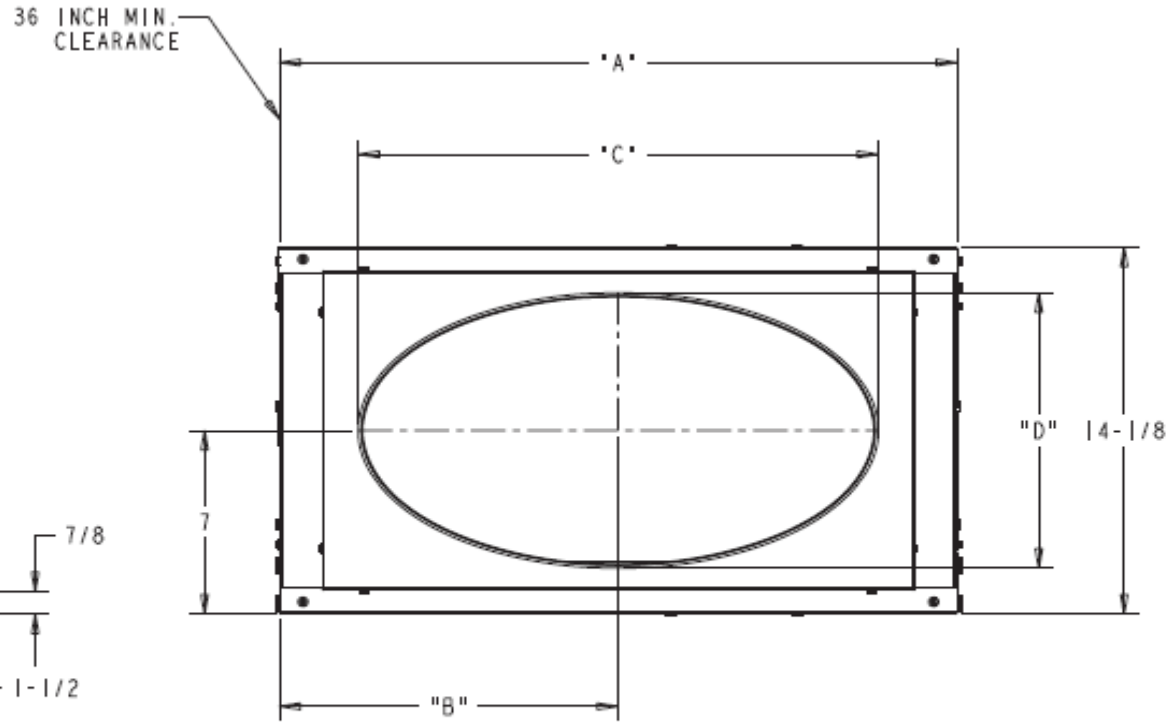
ESP- J Series DX Horizontal Air Handler

Standard Features

- J+ Advanced Control
- 2 Line Display for Easier Setup
- High Efficiency EC Integrated Motor/Blower Assembly
- Mode Specific Adjustable Speed Control
- Heat Pump Compatible
- Chatleff Thermal Expansion Valve
- 6-Row Copper/Aluminum Evaporator Coil
- Slide Out Blower
- Sweat-Type Refrigerant Connections
- 24V 50/60hz Transformer
- Insulated Grey Cabinet
- Float Switch
- Mold Resistant Primary Drain Pan
- Anti-Vibration Foam Strips

ESP- J Series DX Horizontal Dimensions





MODEL	A	B	C	D
2430J	24-1/4	12	18-1/2	10-1/2
3642J	33-1/4	16-1/2	25-3/4	10
4860J	43-1/4	21-1/2	34-1/4	10-1/4

SPL-WG0958_A

ESP- J Series DX Horizontal Air Handler

Match up with your favorite condenser!

Visit AHRI website frequently to see the growing list of certified matches

SpacePak is currently in process for testing and approval for air handler compatibility with the upcoming A2L refrigerant requirements.

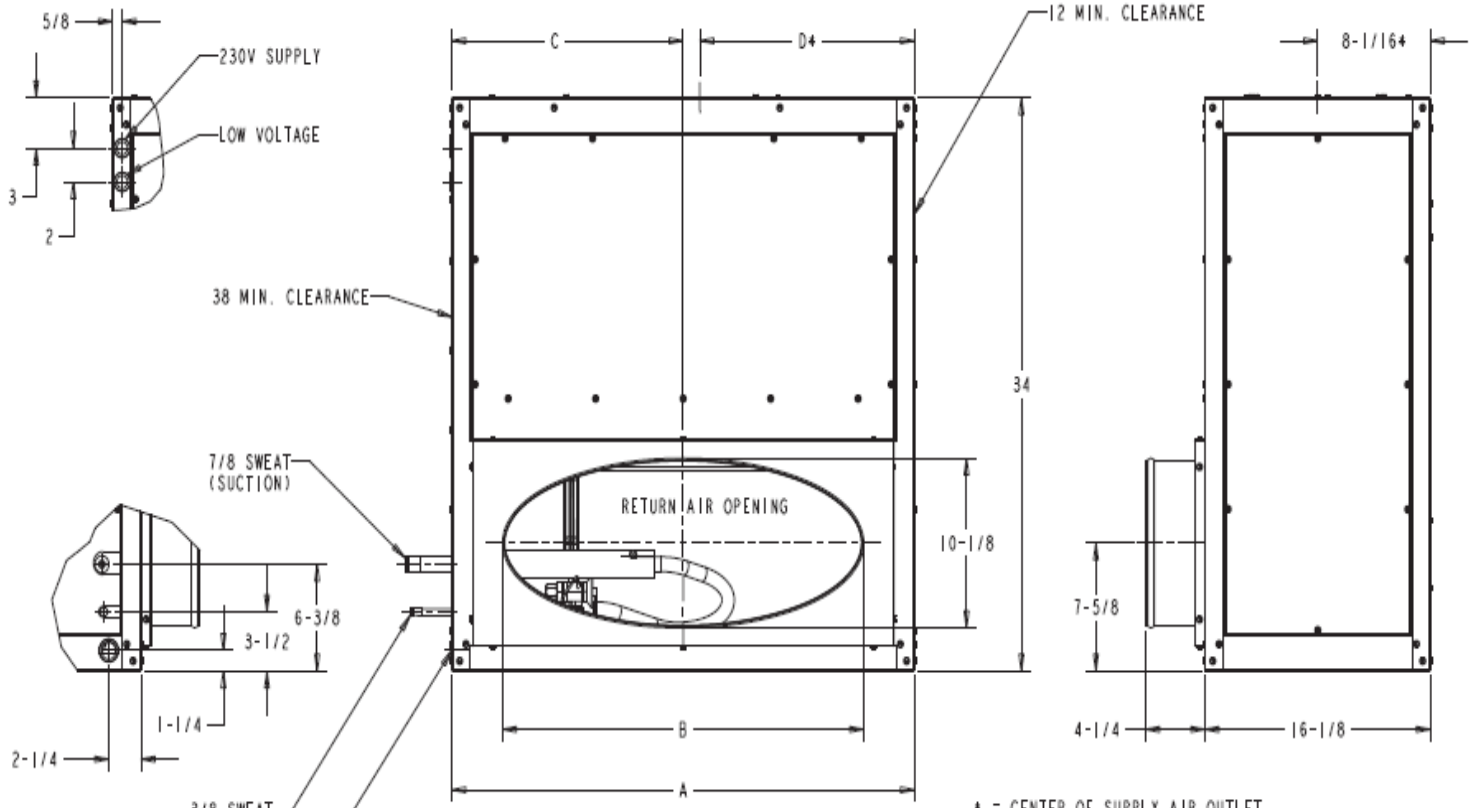
Steps For How to Find SpacePak Match Ups on AHRI Directory:
https://www.spacepak.com/AHRI-Search

ESP- J Series DX Vertical Air Handler

Standard Features

- J+ Advanced Control
- 2 Line Display for Easier Setup
- High Efficiency EC Integrated Motor/Blower Assembly
- Mode Specific Adjustable Speed Control
- Heat Pump Compatible
- Chatleff Thermal Expansion Valve
- 6-Row Copper/Aluminum Evaporator Coil
- Slide Out Blower
- Sweat-Type Refrigerant Connections
- 24V 50/60hz Transformer
- Insulated Grey Cabinet
- Float Switch
- Mold Resistant Primary Drain Pan
- Anti-Vibration Foam Strips
- Stainless Steel Primary Drain Pan

ESP- J Series DX Vertical Dimensions



ESP-3642JV SHOWN

MODEL	A	B	C	D
ESP-2430JV	24	18-5/8	12	10-7/8
ESP-3642JV	33	25-7/8	16-1/2	15-3/8
ESP-4860JV	43	34-1/4	21-1/2	20-3/8

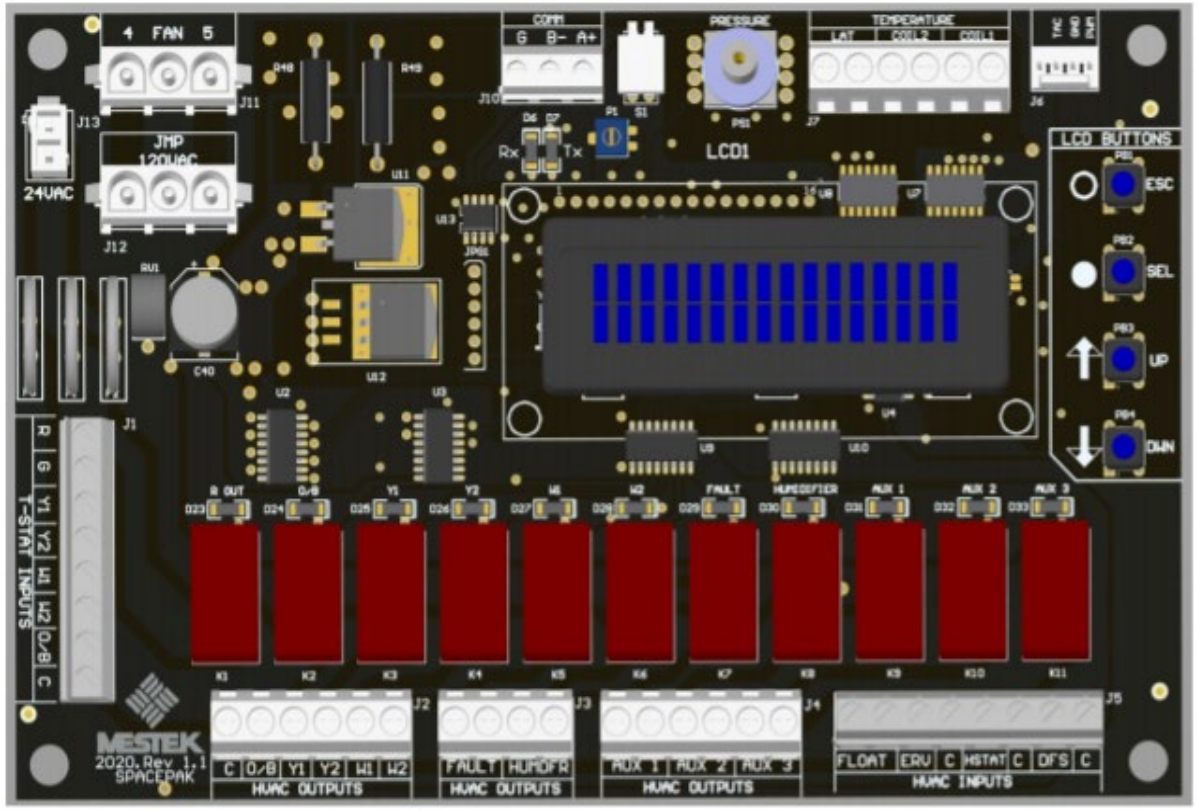
SPL-WG0985_A


SPACE PAK

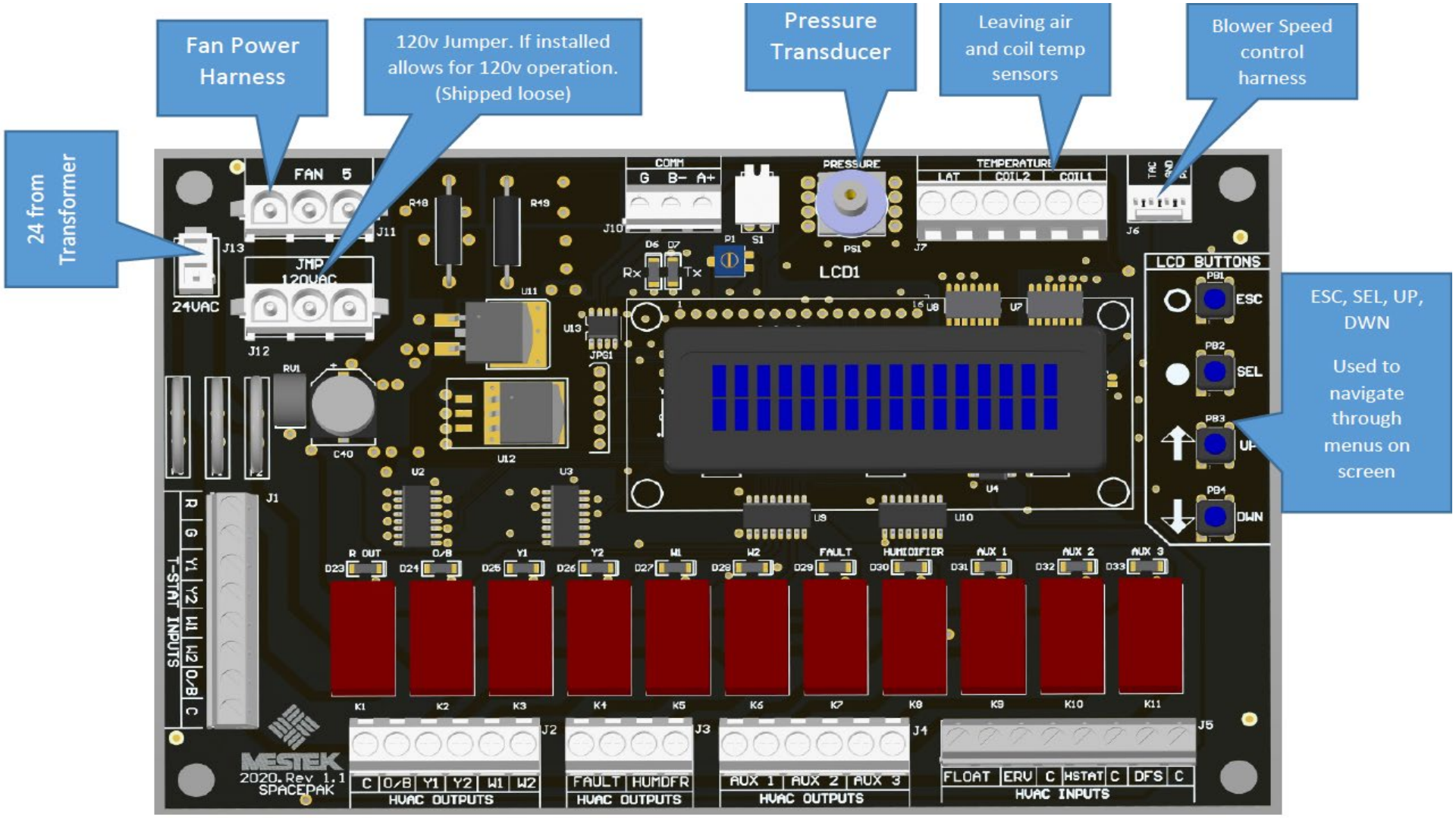

SPACE PAK

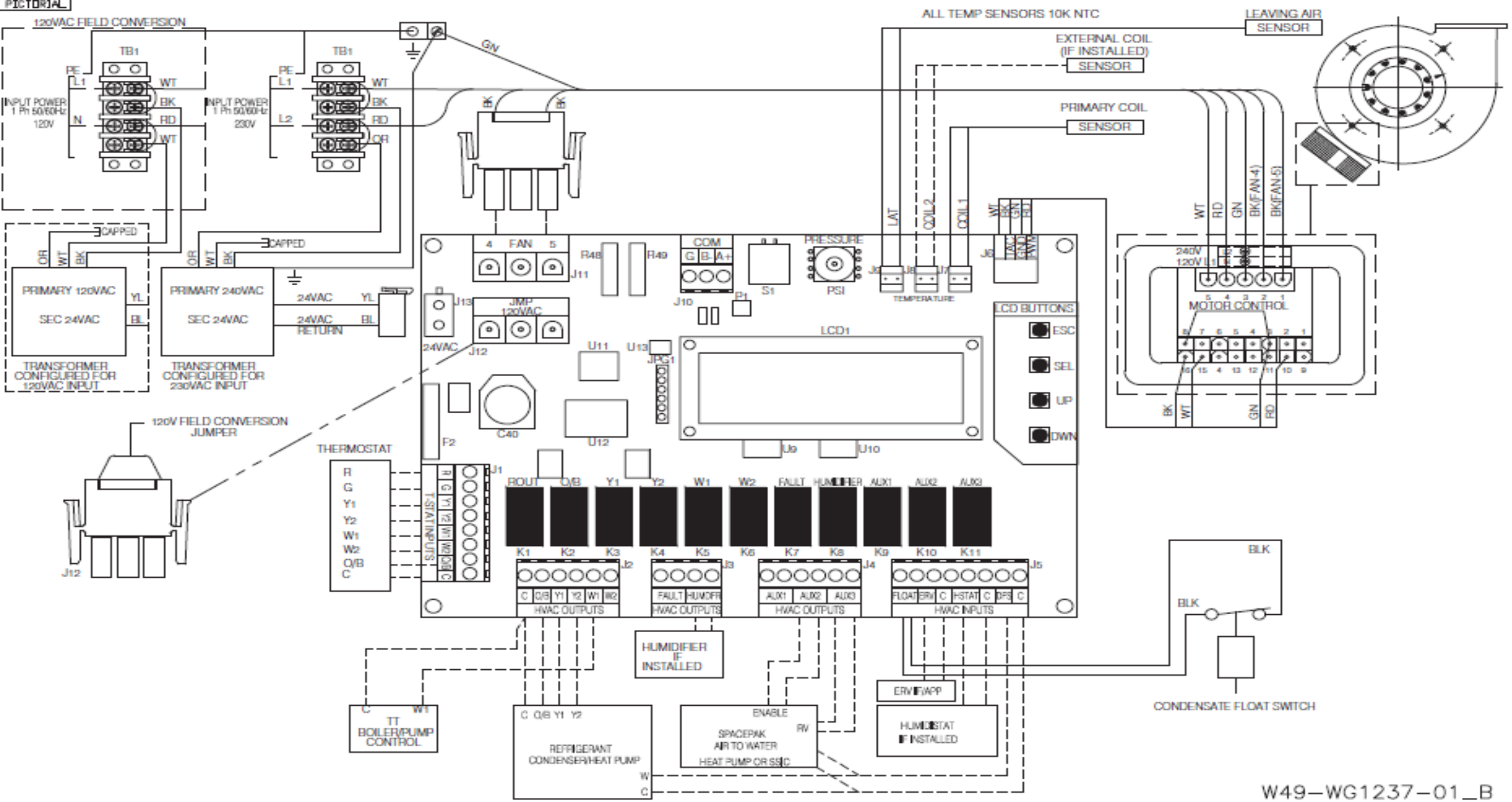
J Plus Control Board

- More features and benefits for the contractor
- Digital display screen
- Screen displays (operating mode, cfm, % speed, S.P.)
- Speed is controlled by a static pressure tap on the blower
- Simpler wiring with less components
- Infinite speed variation
- Easy load matching
- Temperature sensors allow for delayed fan operation
- IAQ FRIENDLY!!!!!



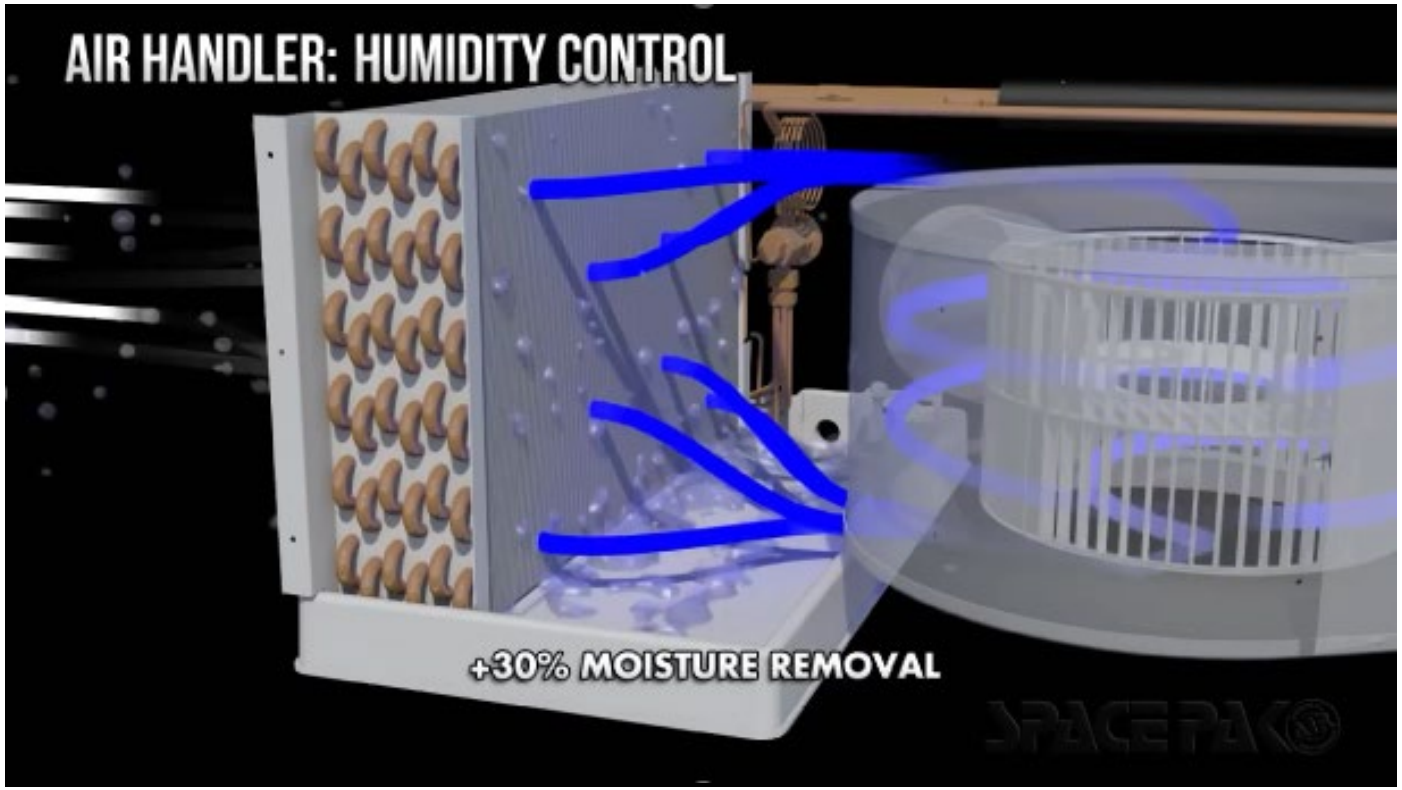
J Plus Control Board




PICTORIAL
120VAC FIELD CONVERSION
TB1
PE
L1
N
WT
BK
RD
INPUT POWER 1 Ph 50/60Hz 120V
INPUT POWER 1 Ph 50/60Hz 230V
L2
OR
GN
CAPPED
PRIMARY 120VAC
SEC 24VAC
YL
BL
TRANSFORMER CONFIGURED FOR 120VAC INPUT
PRIMARY 240VAC
TRANSFORMER CONFIGURED FOR 230VAC INPUT
24VAC
24VAC RETURN
120V FIELD CONVERSION JUMPER
THERMOSTAT
R
G
Y1
Y2
W1
W2
O/B
C
T-STAT INPUTS
ALL TEMP SENSORS 10K NTC
LEAVING AIR SENSOR
EXTERNAL COIL (IF INSTALLED) SENSOR
PRIMARY COIL SENSOR
LAT
COIL2
COIL1
4 FAN 5
J11
R48
R49
COM
G
B-
A+
J10
P1
S1
PRESSURE
PSI
TEMPERATURE
J6
J13
JMP 120VAC
J12
U11
U13
JPC1
LCD1
U9
U10
LCD BUTTONS
ESC
SEL
UP
DWN
F2
C40
U12
J1
ROUT
O/B
Y1
Y2
W1
W2
FAULT
HUMIDIFIER
AUX1
AUX2
AUX3
K1
K2
K3
K4
K5
K6
K7
K8
K9
K10
K11
J2
J3
J4
J5
HVAC OUTPUTS
HVAC INPUTS
FLOAT
ERV
HSTAT
DFS
240V
120V
MOTOR CONTROL
BK(FAN-4)
BK(FAN-5)
BLK
CONDENSATE FLOAT SWITCH
HUMIDIFIER IF INSTALLED
TT BOILER/PUMP CONTROL
REFRIGERANT CONDENSER/HEAT PUMP
ENABLE
SPACEPAK AIR TO WATER HEAT PUMP OR SSHC
RV
ERV IF/APP
HUMIDISTAT IF INSTALLED
W49—WG1237—01_B

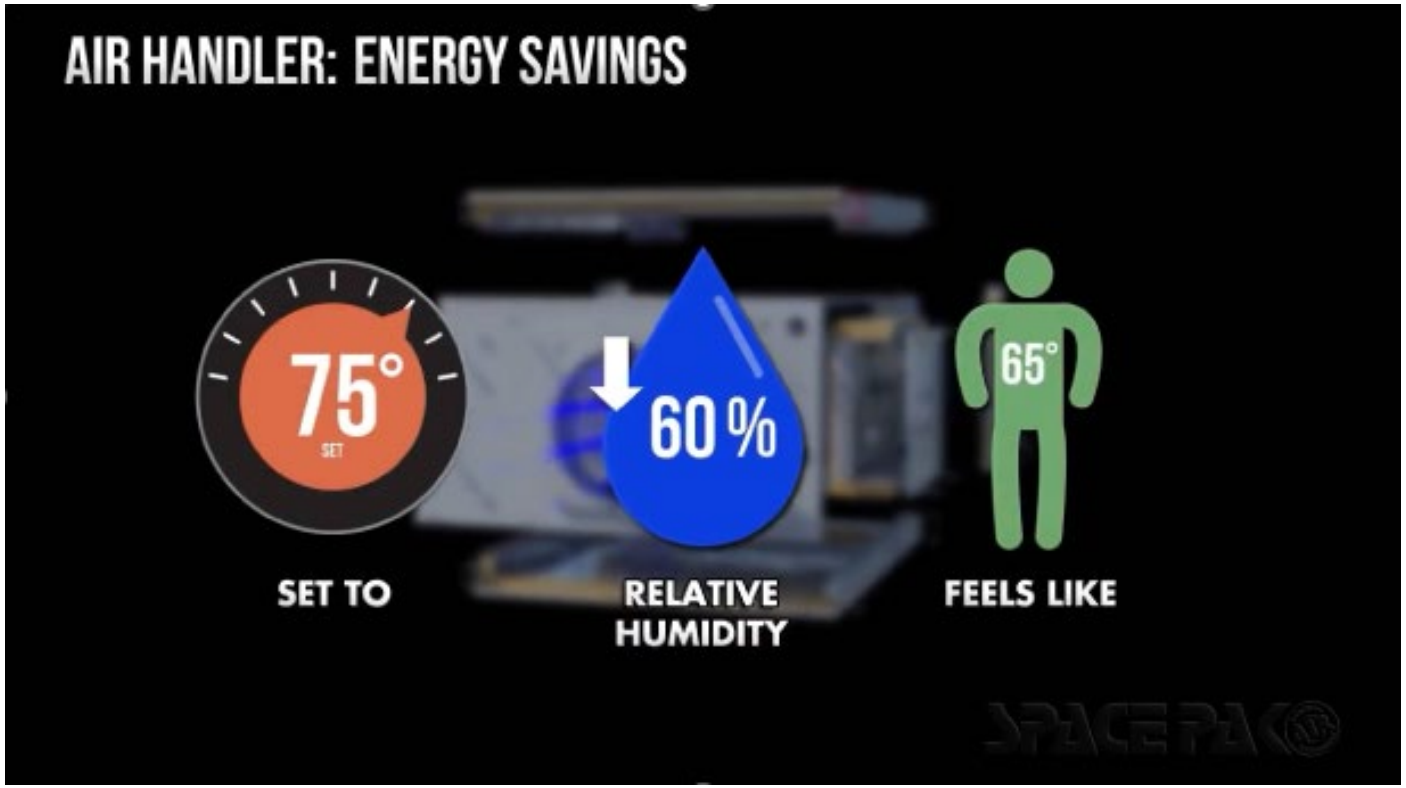
SUPERIOR COIL

- 6-row copper coil
- More coil surface = greater humidity removal
- 30% more moisture removed
- More Btus at lower CFMs
- Up to a 28°F air delta across the coil
- Colder discharge allows for lower volumes of air movement
- Suitable for R-410A refrigerants



SUPERIOR COIL

- With more moisture removed a higher temperature set point will feel “Cooler”

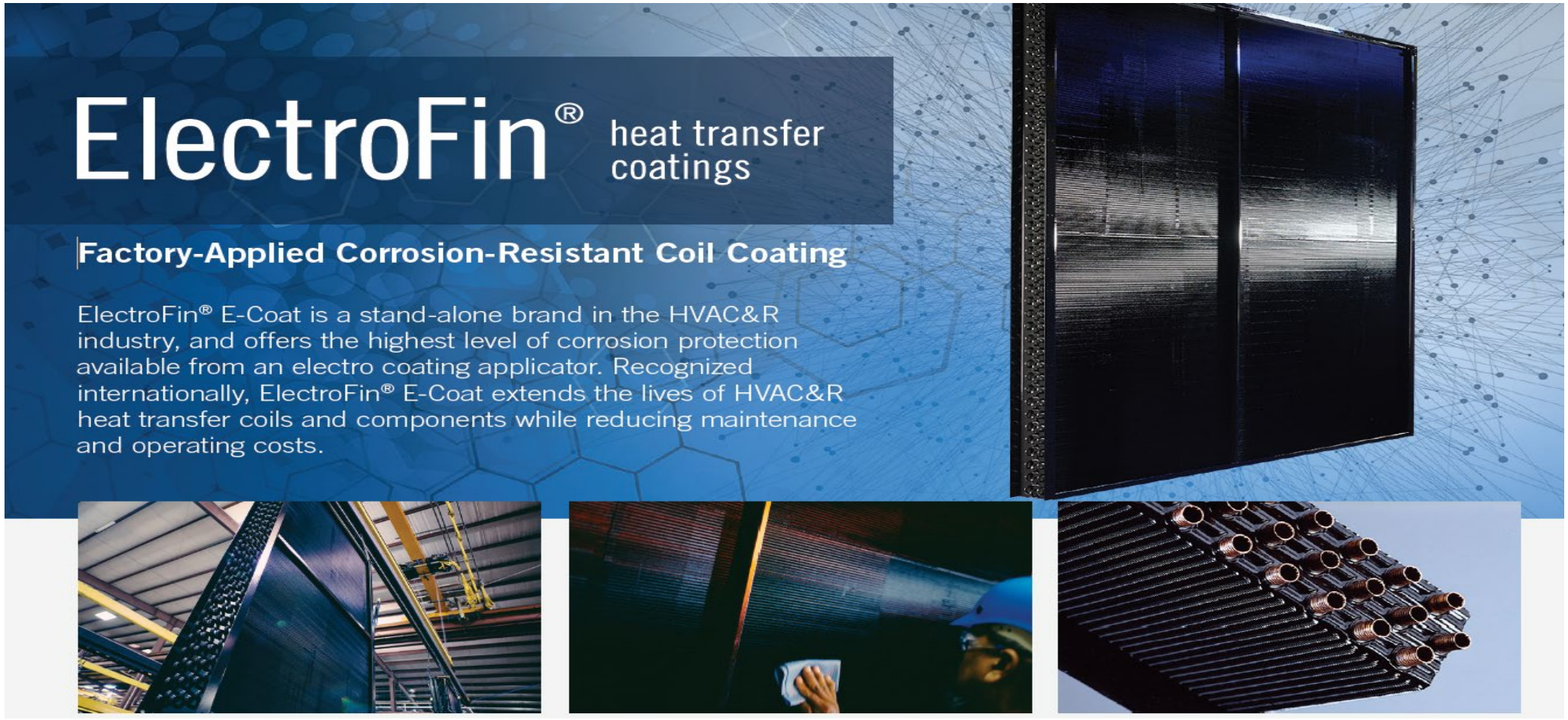


System Charging Basics

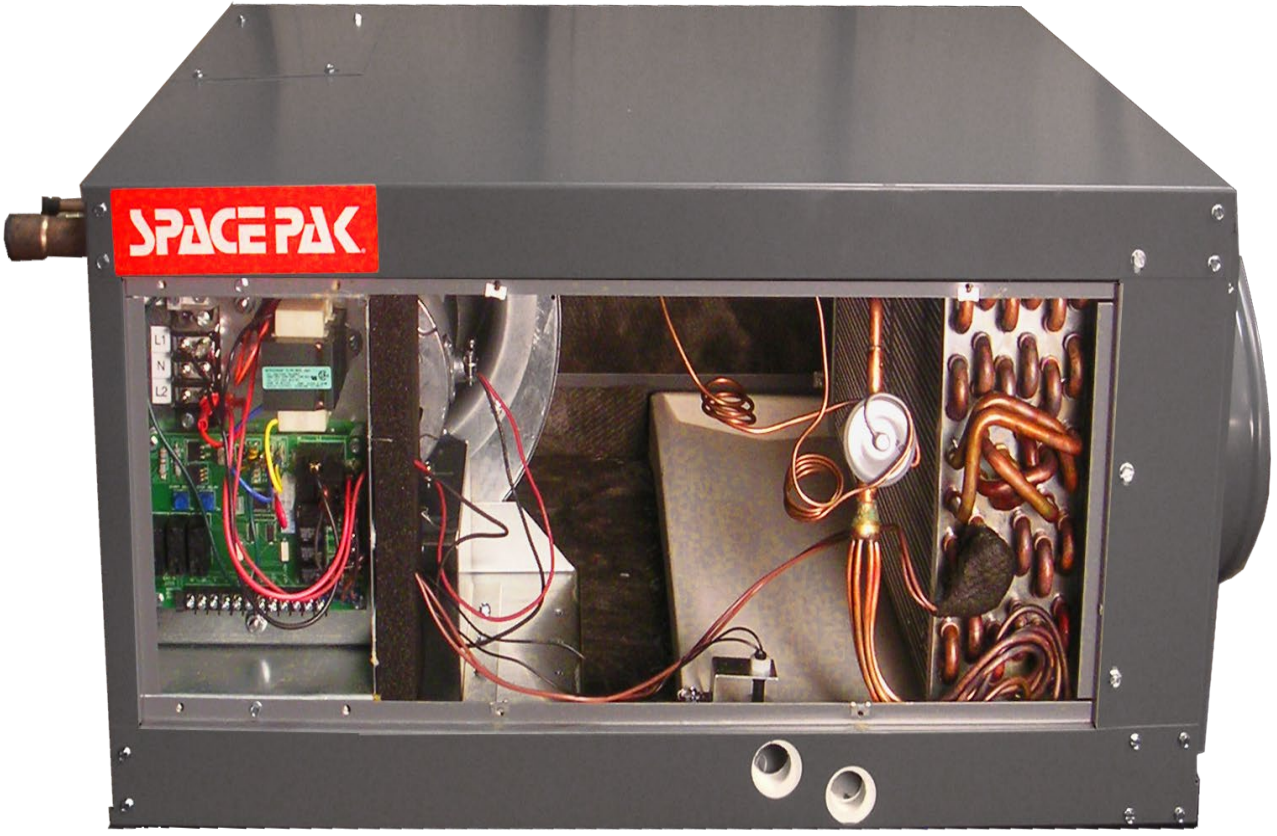
Follow Outdoor Condenser Manufacturer Instructions For

- All charging procedures
- Temperature and Pressure charts

Coated Replacement Coils



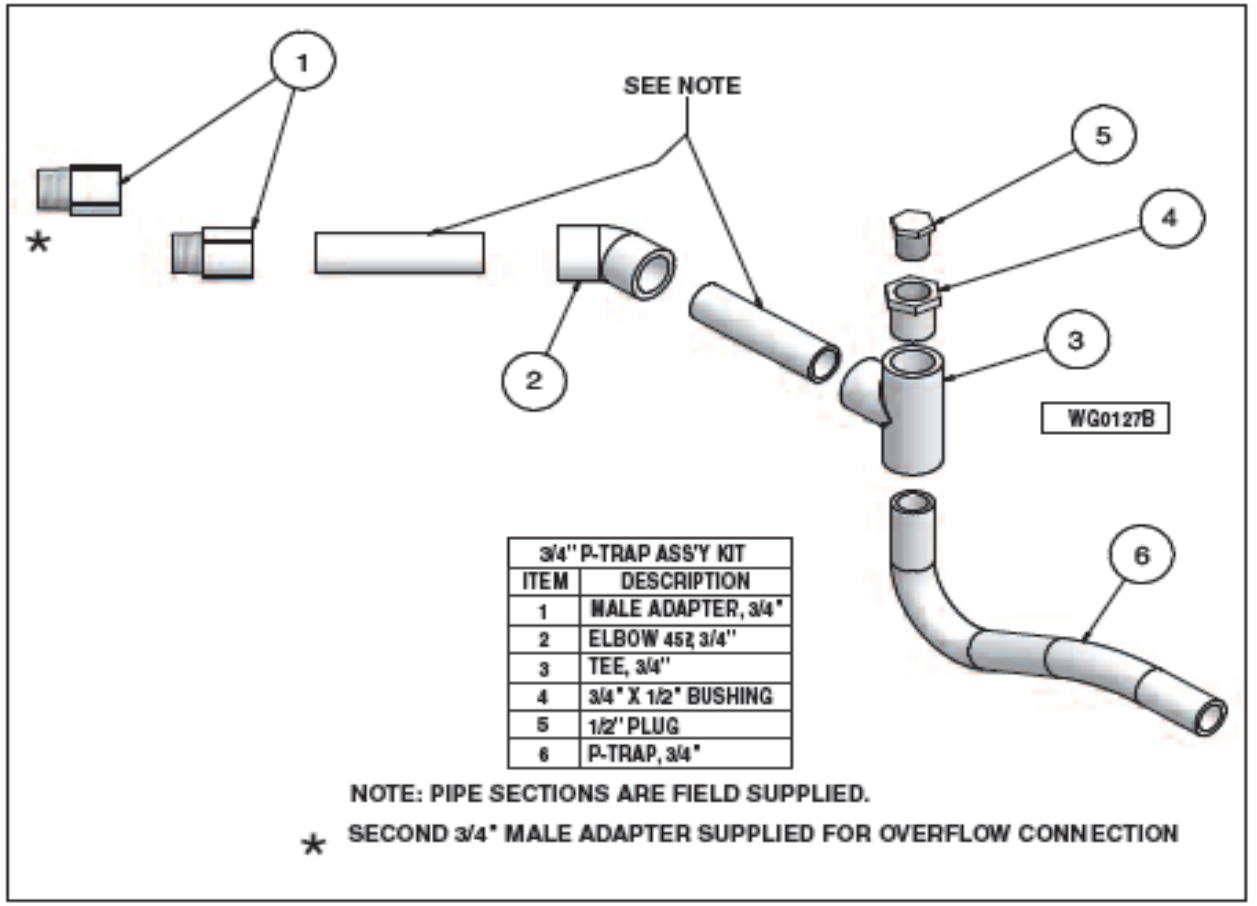
TXVS: Then & Now



Note: Our current chatliff TXV has NO internal check valves, so it is suitable for use in air-to-air heat pump applications.

Condensate Trap Assembly

- The proper installation of the trap is critical to the correct operation of the system!
- Supplied by SpacePak



3/4" P-TRAP ASS'Y KIT	
ITEM	DESCRIPTION
1	MALE ADAPTER, 3/4"
2	ELBOW 45º 3/4"
3	TEE, 3/4"
4	3/4" X 1/2" BUSHING
5	1/2" PLUG
6	P-TRAP, 3/4"

NOTE: PIPE SECTIONS ARE FIELD SUPPLIED.

* SECOND 3/4" MALE ADAPTER SUPPLIED FOR OVERFLOW CONNECTION

Additional Heating & Cooling

EEH Direct Mount Electric Heater

6 Sizes Available

2kw

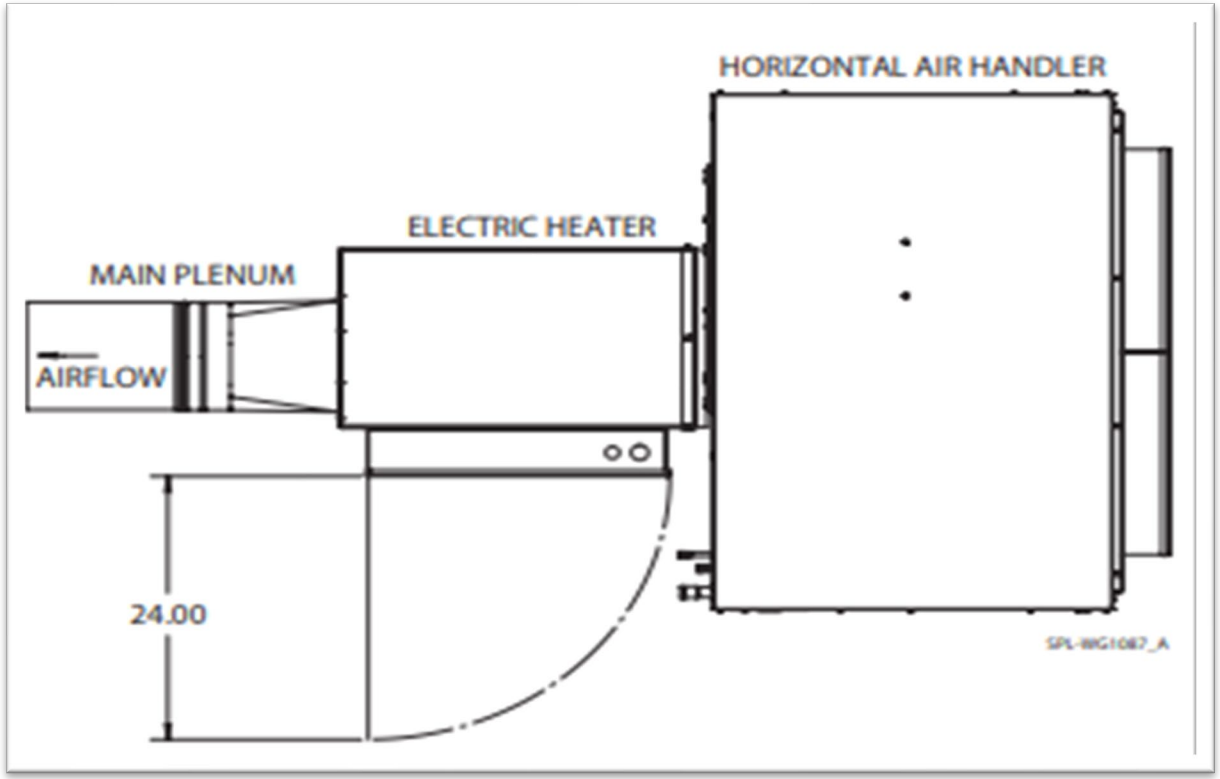
5kw

7.5kw

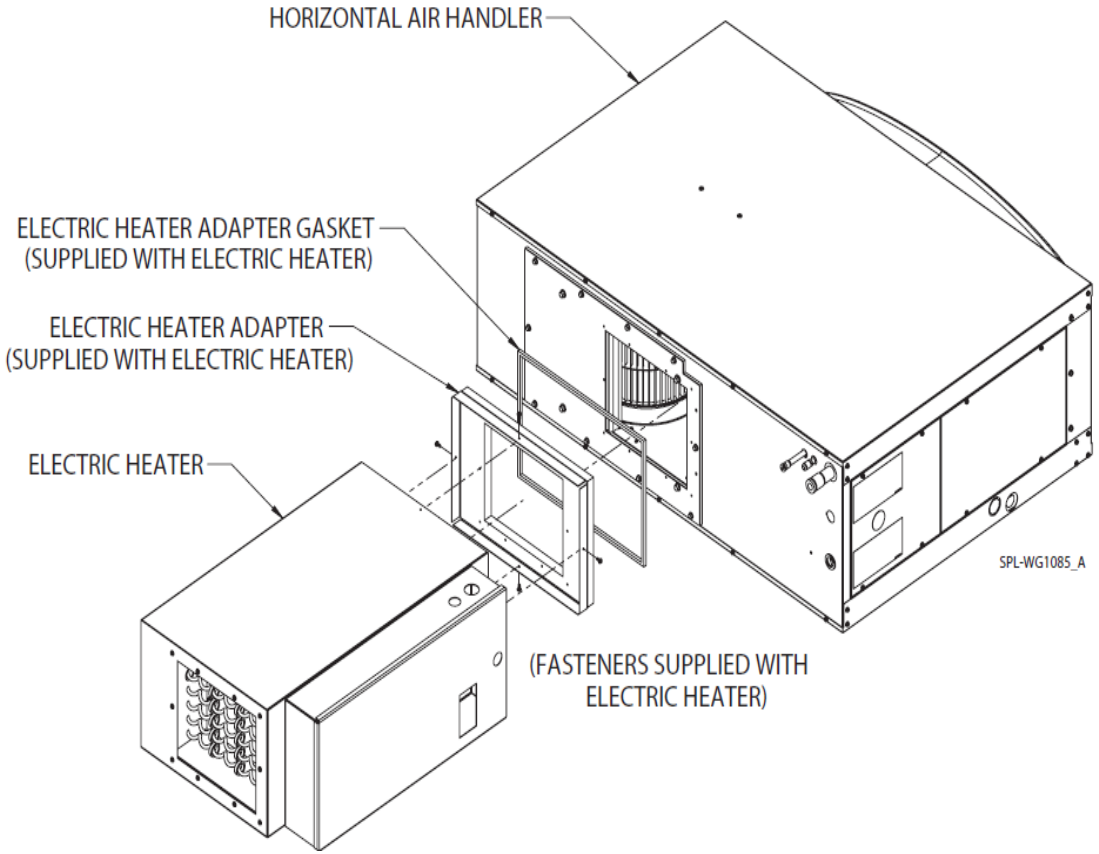
10kw

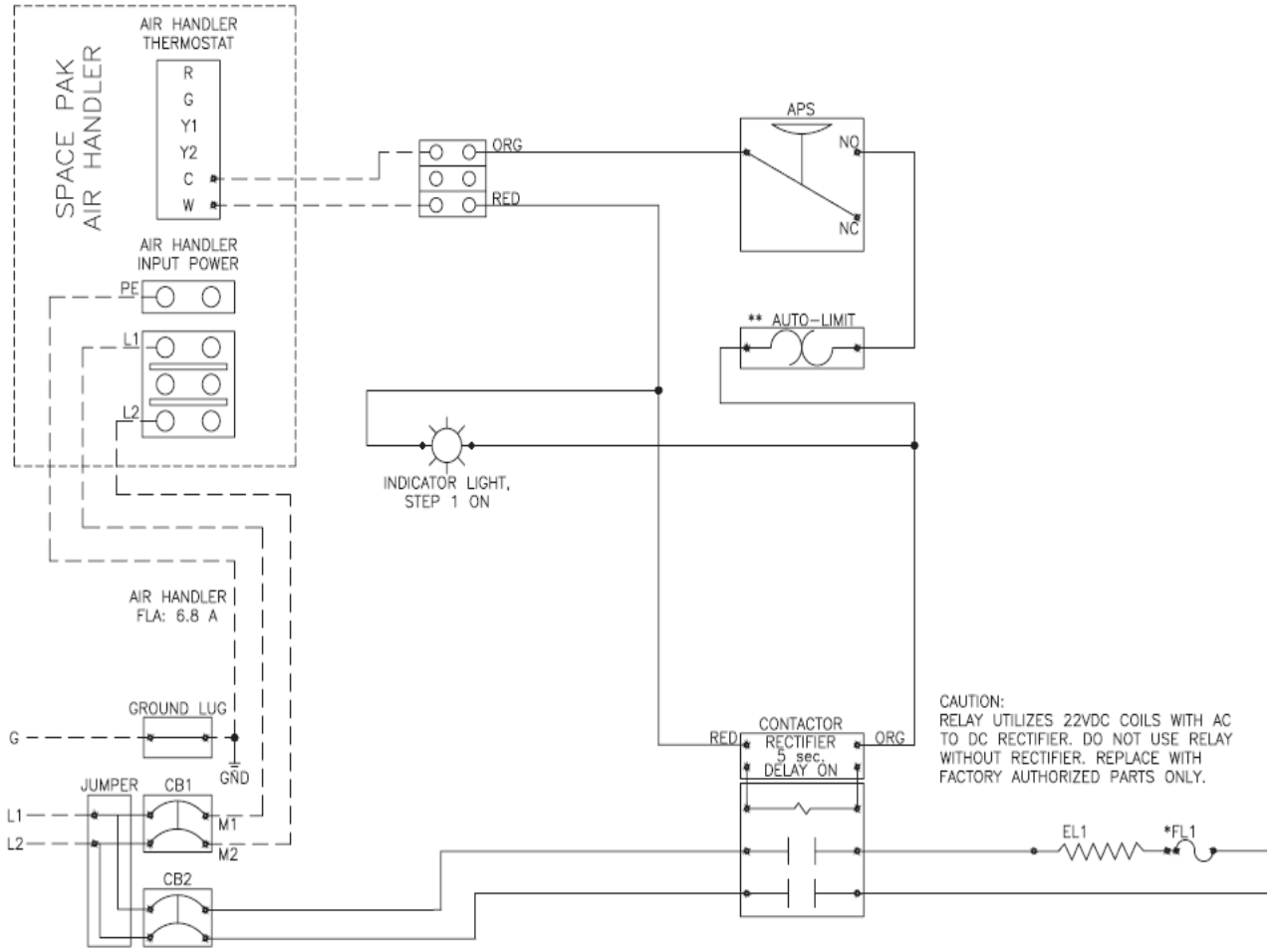
15kw

20kw

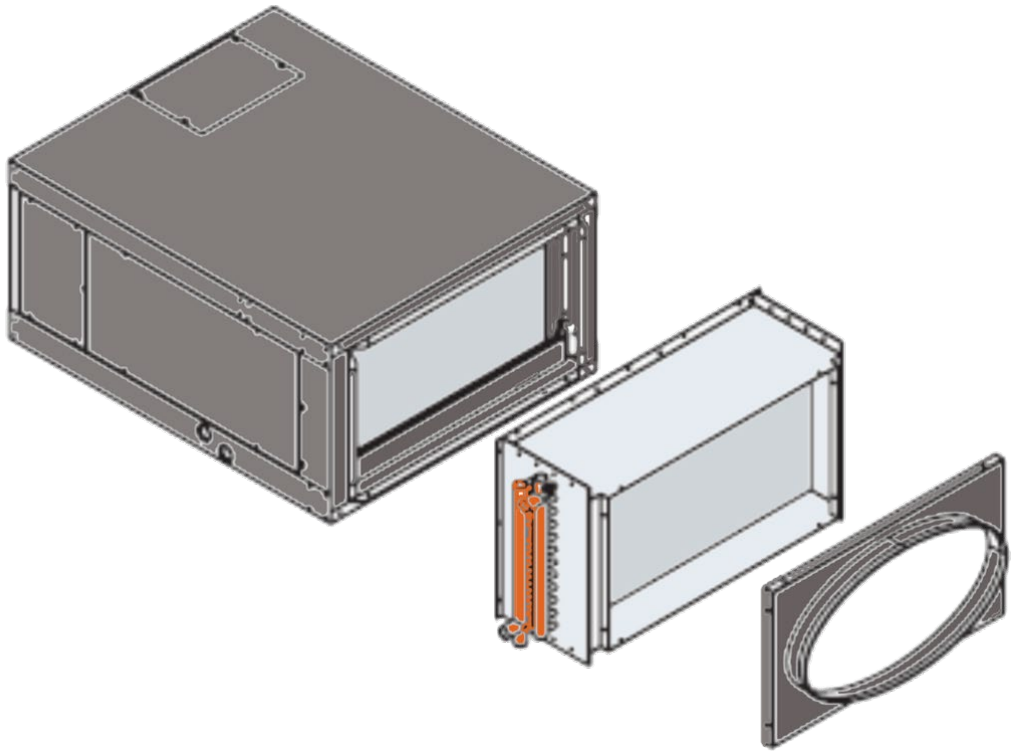


EEH Electric Heating Mounting & Wiring





Hot Water Coil



Model AC-WPAK-60 for ESP 2430

	Entering Water Temperature °F				
GPM	120	140	160	180	200
2	20.5	30.0	39.1	48.1	57.2
4	25.2	35.6	46.1	56.6	67.1
6	26.6	37.4	48.3	59.2	70.2
8	27.2	38.2	49.3	60.4	71.6
10	27.5	38.7	49.9	61.1	72.3

At 550 CFM and 70°F Entering Air Temperature*

Model AC-WPAK-90 for ESP 3642

	Entering Water Temperature °F				
GPM	120	140	160	180	200
2	28.8	39.2	51.6	63.4	75.2
4	36.0	50.8	65.7	80.8	95.8
6	39.0	54.9	70.9	87.0	103.1
8	40.4	56.8	73.3	89.9	106.5
10	41.2	57.9	74.7	91.5	108.4

At 850 CFM and 70°F Entering Air Temperature*

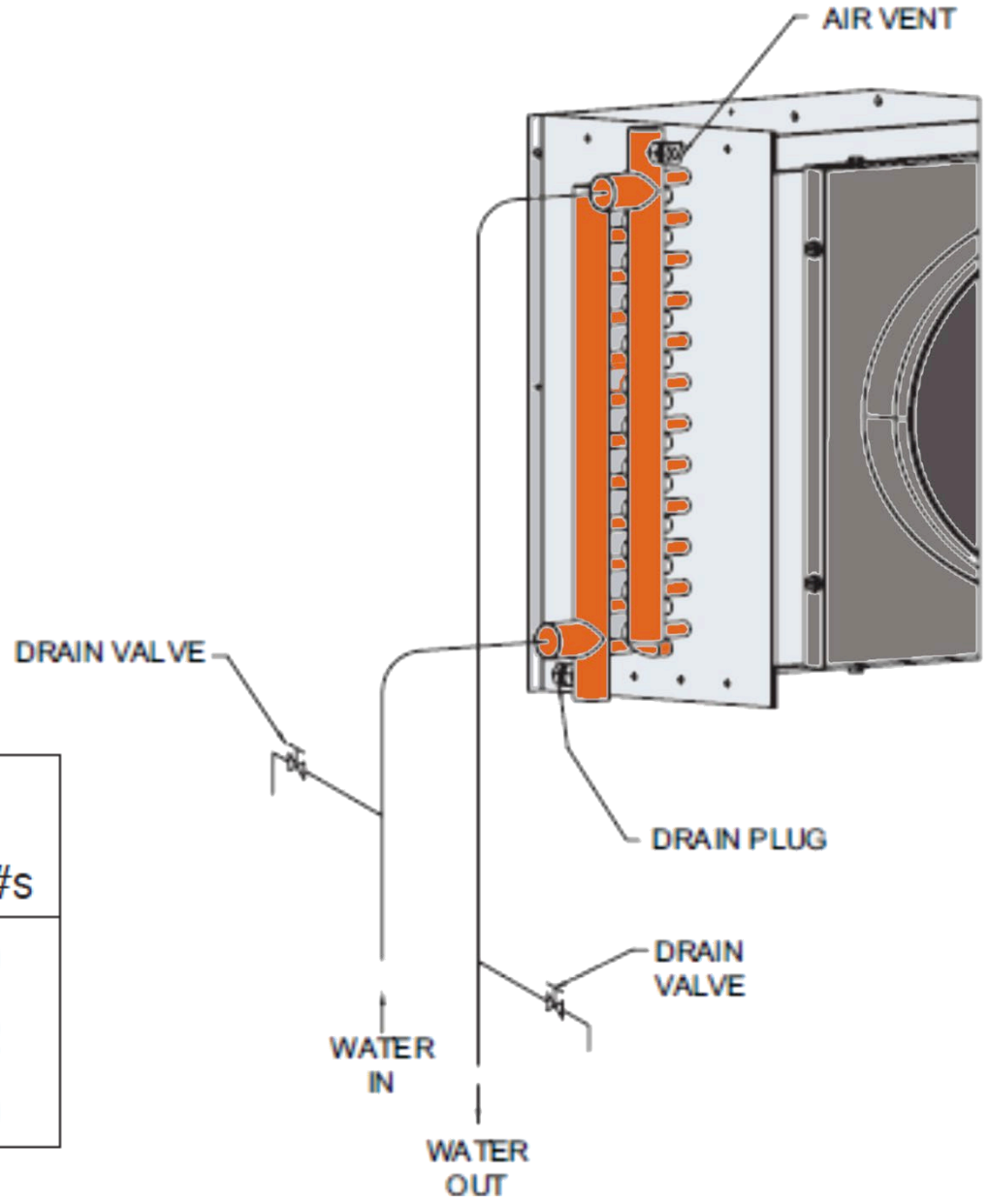
Model AC-WPAK-120 for ESP 4860

	Entering Water Temperature °F				
GPM	120	140	160	180	200
2	31.7	46.2	61.2	75.1	89.0
4	45.6	64.2	83.0	102.0	120.9
6	50.6	71.2	92.0	112.9	133.8
8	53.1	74.7	96.4	118.2	140.1
10	54.6	76.7	98.9	121.2	143.6

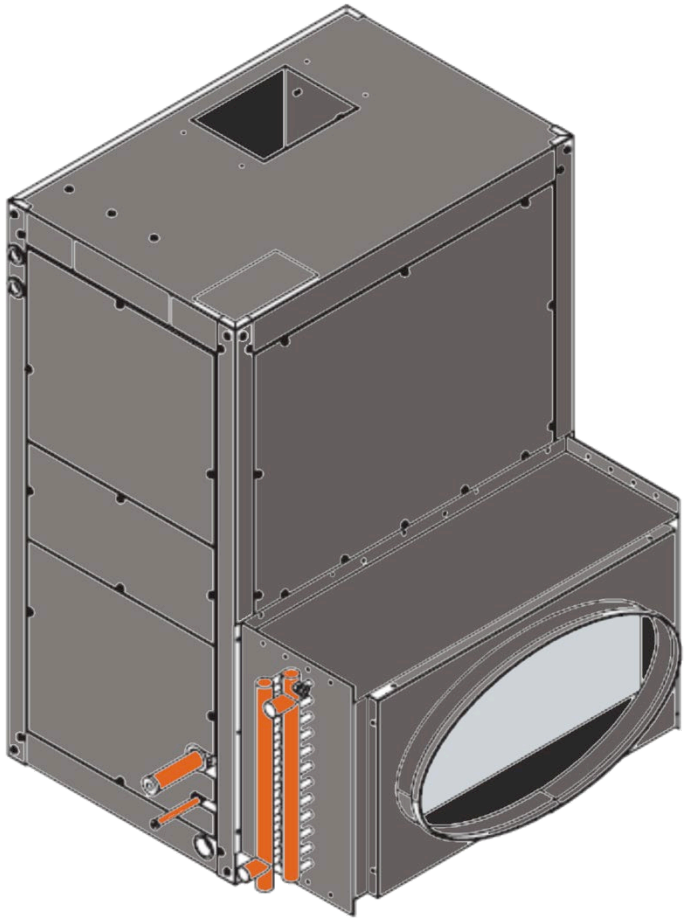
At 1150 CFM and 70°F Entering Air Temperature*

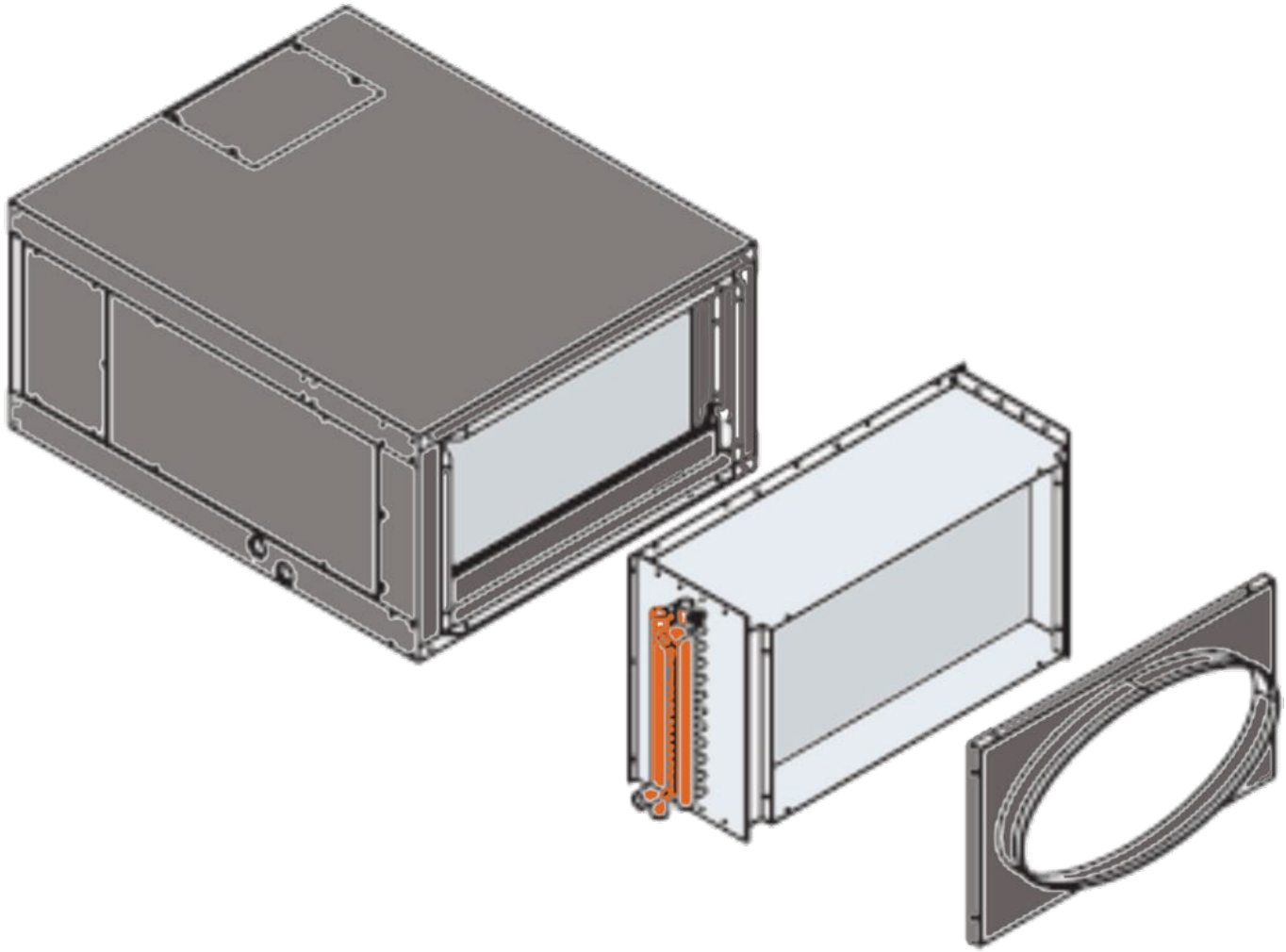
Hot Water Coil Installation

Hot Water Coil Model #	BTUH Capacity (Nominal)	Return Air Duct Adaptor* Model #	Fan Coil Unit Model #s
AC-WPAK-60	60,000	AC-WRDA-60	ESP-2430
AC-WPAK-90	90,000	AC-WRDA-90	ESP-3642
AC-WPAK-120	120,000	AC-WRDA-120	ESP-4860



Hot Water Coil Installation Location

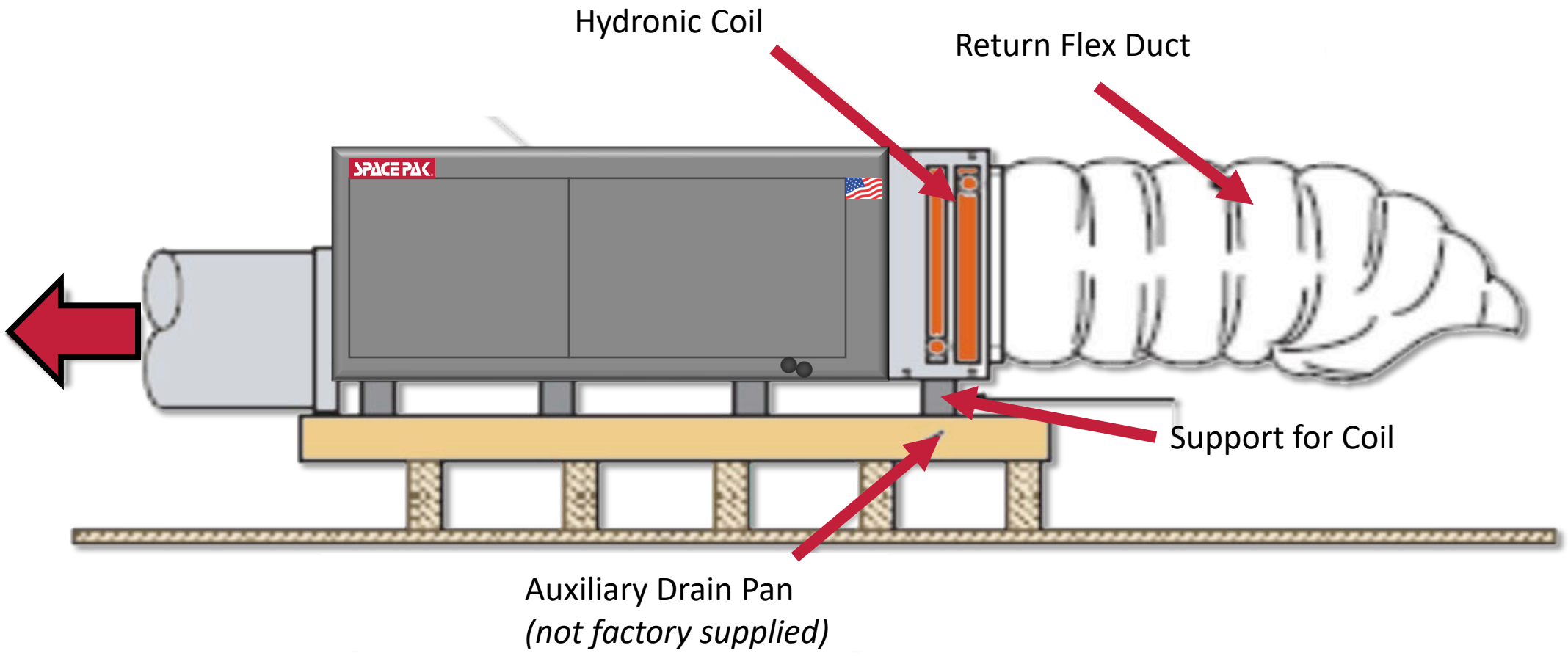




BasePak Secondary Drain Pans for Horizontal Fan Coils

- Durable polyethylene will not rust
- Resistant to mold growth
- UL recognized material
- Integral, multi-function support channels
- Supports unit when suspended with threaded rod
- Fits through hole-cut used for Return Air Box
- Threaded ¾’’ drain connection
- Meets international mechanical code 307.2.3

Hot Water Installation with Drain Pan



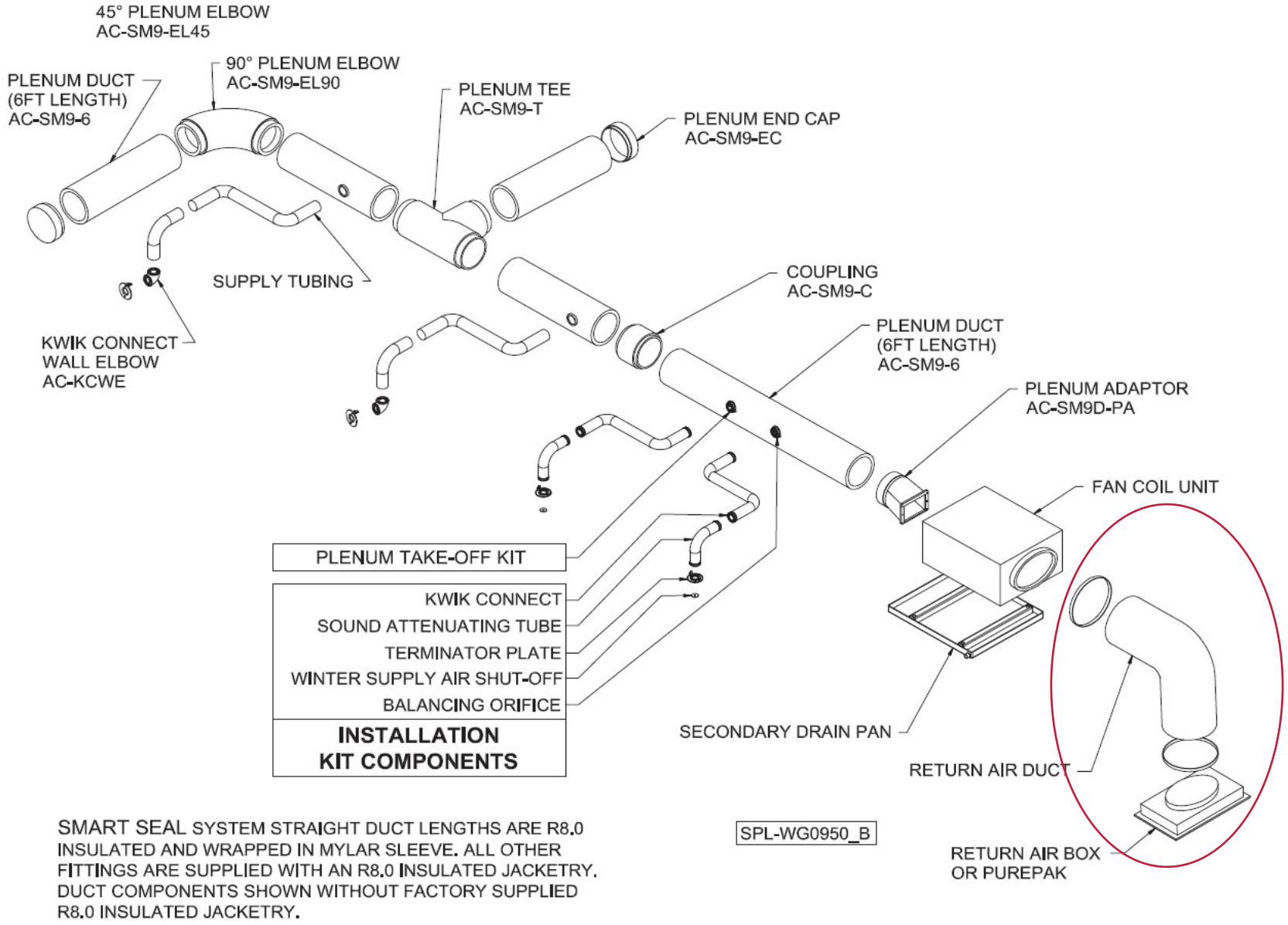
Note: Be sure that the drain pan installed is large enough to protect anything that may drip, this is cheap insurance!

?

Questions

The Return

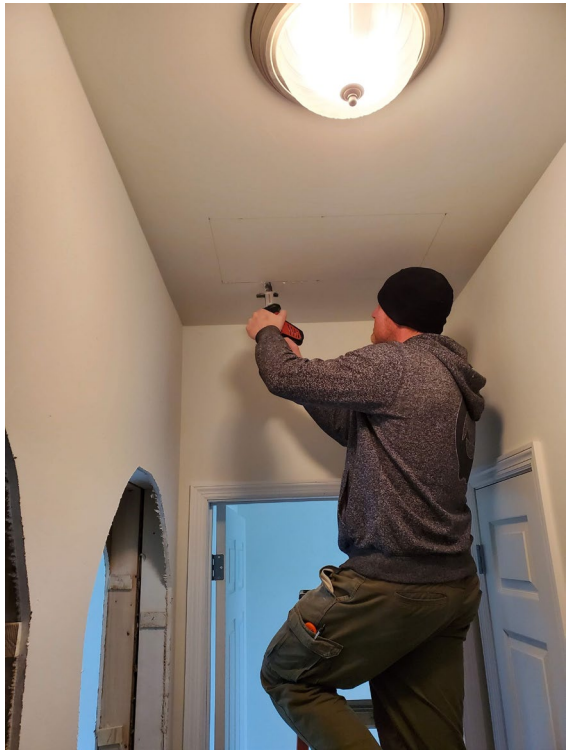
Option of Central or Multiple Returns

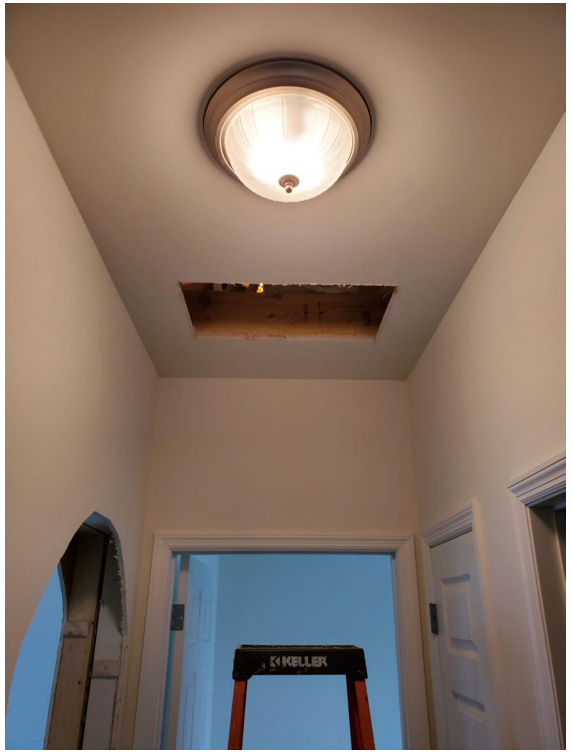


SMART SEAL SYSTEM STRAIGHT DUCT LENGTHS ARE R8.0 INSULATED AND WRAPPED IN MYLAR SLEEVE. ALL OTHER FITTINGS ARE SUPPLIED WITH AN R8.0 INSULATED JACKETRY. DUCT COMPONENTS SHOWN WITHOUT FACTORY SUPPLIED R8.0 INSULATED JACKETRY.

Locate and Roughing in the Return

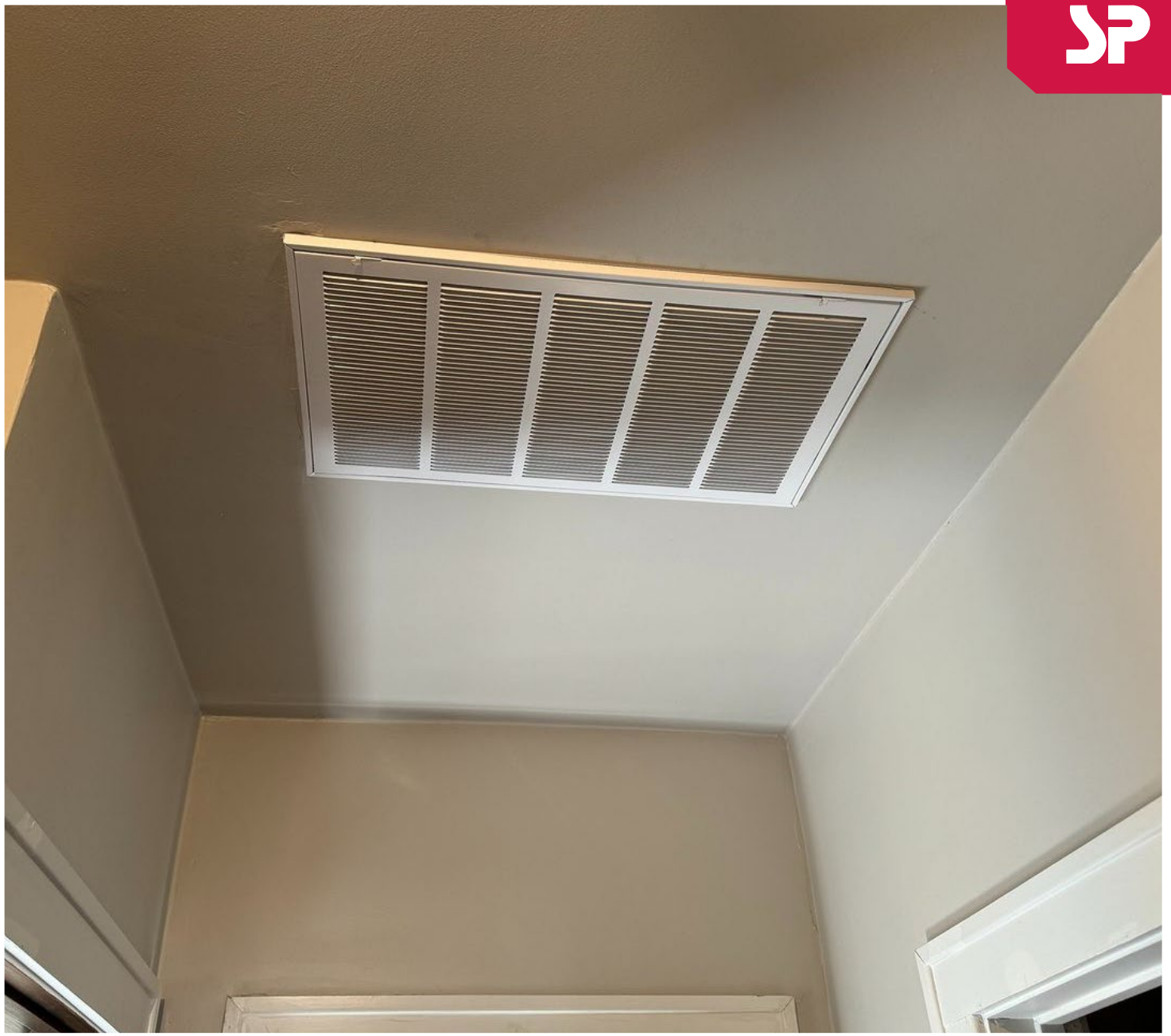
- Central Location (Hallway/Foyer)
- All Equipment Can Fit through the Return Hole Cut Including the Air Handler
- Be Sure to Have More than Enough Return Air for the System
- Do Not “Skimp” On Return. You cannot have too much.





Return Basics

- Air Mixing vs. Air Change
- Less Return Air Volume
- Cooling And Heating By Temperature, Not Volume
- One Central Return Is Sufficient
- Multiple Returns Are Okay
- Smaller Return Air Duct Than Conventional
- **You can never have too much return air!!!!**

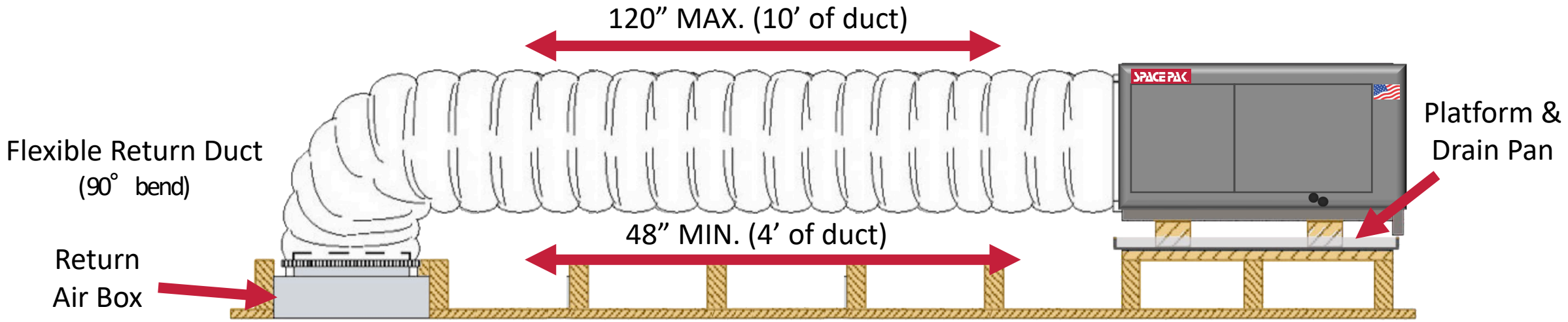


Return Basics

- Size Return in each location for less than 500 FPM (similar to conventional)
- Size Return in each location for a total -.25” static or less including the filter
- Install at least One 90-degree elbow (this will aid in the abatement of unwanted noise)
- Return Box must be lined with sound attenuation material (also for noise abatement)
- Size transfer grills for the CFM and Free Area (use standard duct sizing chart)

Note: If return creates to much “suction” over -.5”wc this suggests the lack of return air and creates the potential to cause issues with proper condensate draining resulting in faults or water damage.

Return Considerations



Model	Return Duct
ESP-2430	15”
ESP-3642	19”
ESP-4860	24”

NOTE: When return lengths of longer than 10ft exist, using a standard return duct sizing chart at 500 FPM and no more than -0.25’’ WC may be necessary for proper upsizing.

Central Floor Return

This was a central return for (1) 5-ton heating and cooling system (approx. 30” x 30”)

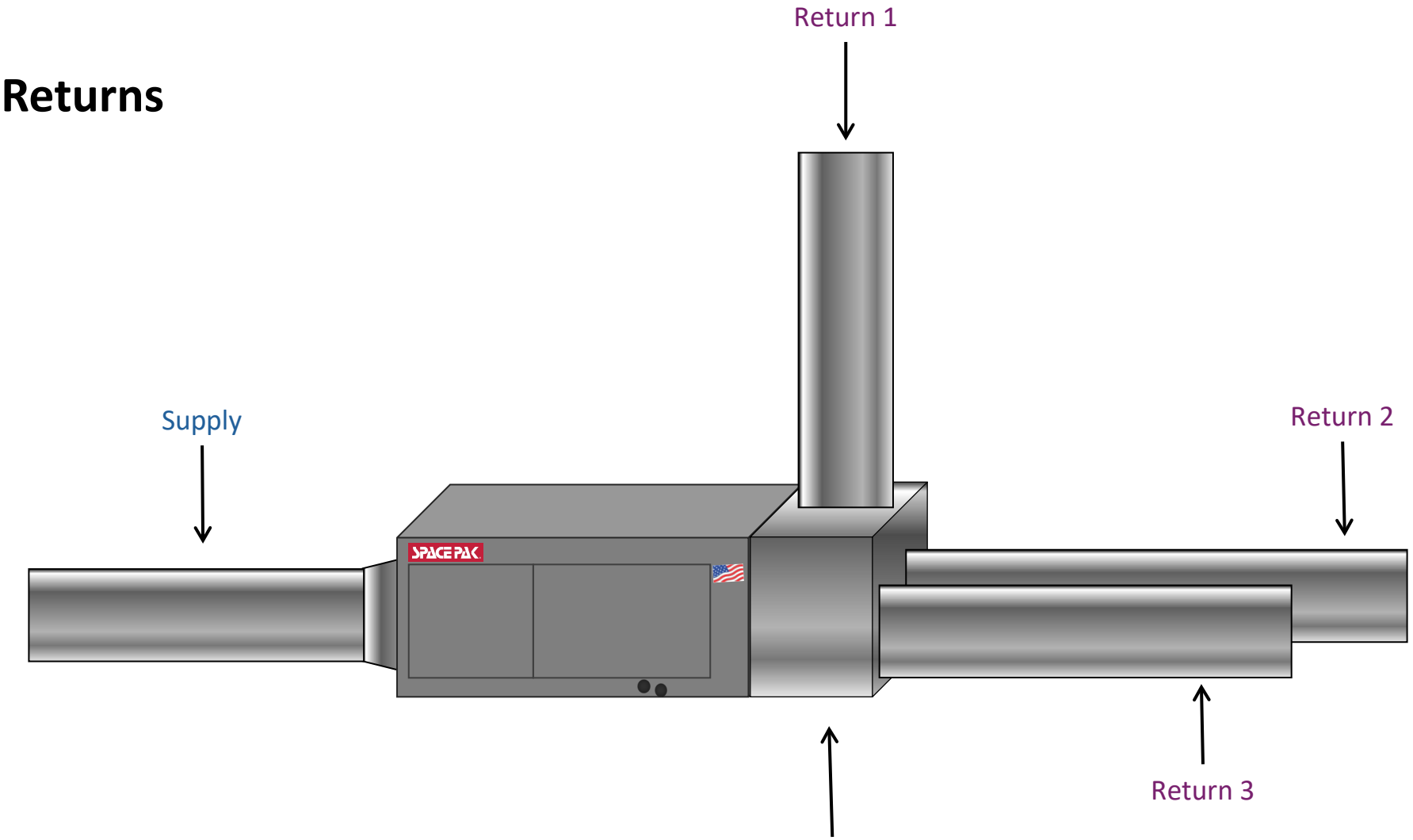
Best Practices for Multiple Returns

MULTIPLE RETURN ACCEPTABLE DUCT SIZE BY TONNAGE

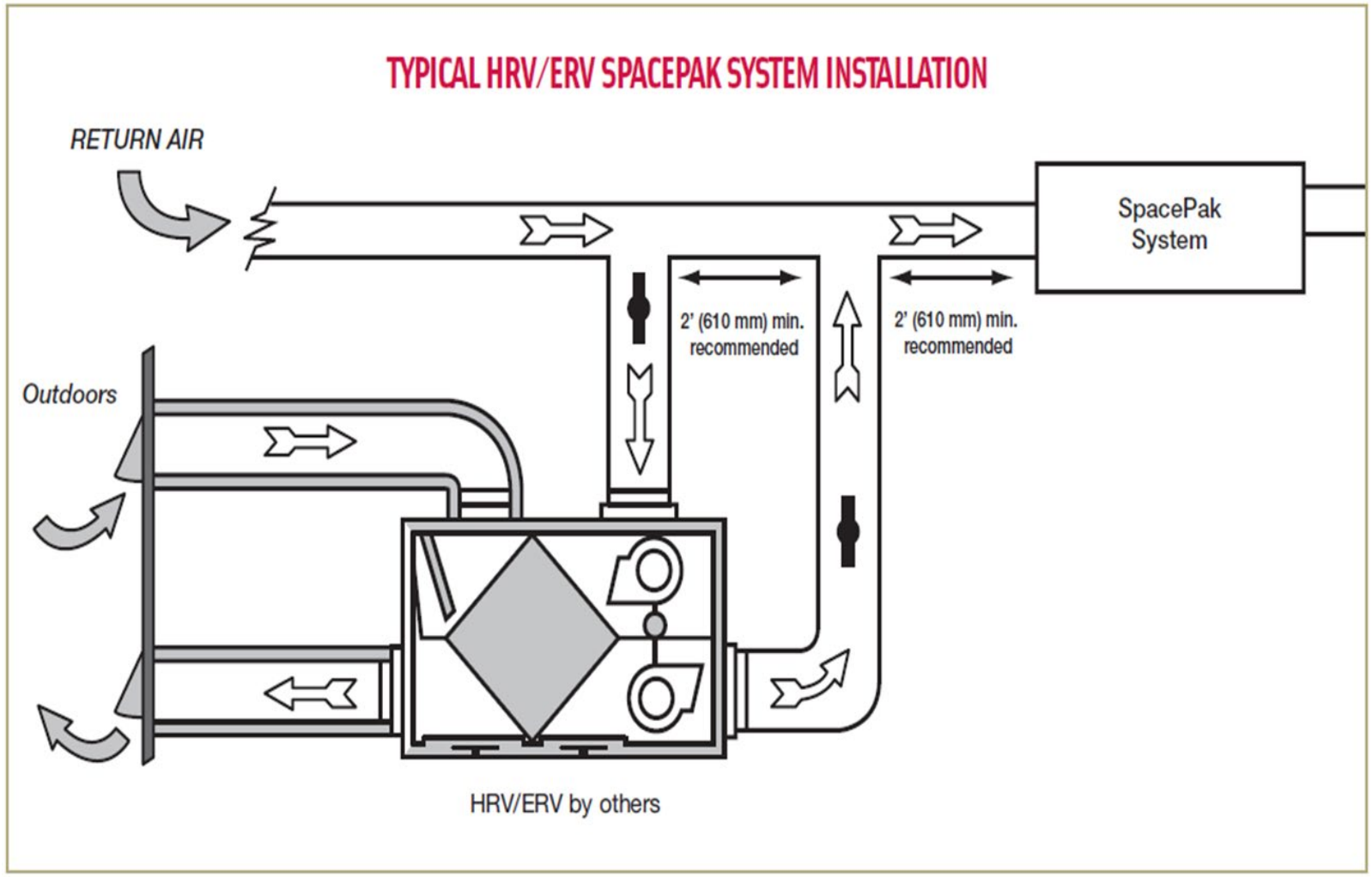
ROUND DUCT SIZE, THESE SIZES WILL INSURE A QUIET AIR SPEED OF LESS THAN 500 FPM

	2 TON	2.5 TON	3 TON	3.5 TON	4 TON	5 TON
AIR FLOW	440	550	660	770	880	1100
			2 RETURNS			
10' OR LESS	9”	10”	11”	12”	13”	15”
10' TO 20'	10”	11”	12”	13”	13”	15”
30' TO 40'	11”	12”	13”	13”	14”	16”
			3 RETURNS			
10' OR LESS	8”	9”	9”	10”	12”	12”
10' TO 20'	8”	9”	10”	11”	12”	12”
30' TO 40'	9”	10”	11”	12”	13”	13”

Multiple Returns



IAQ Options (J Series + Control Board)

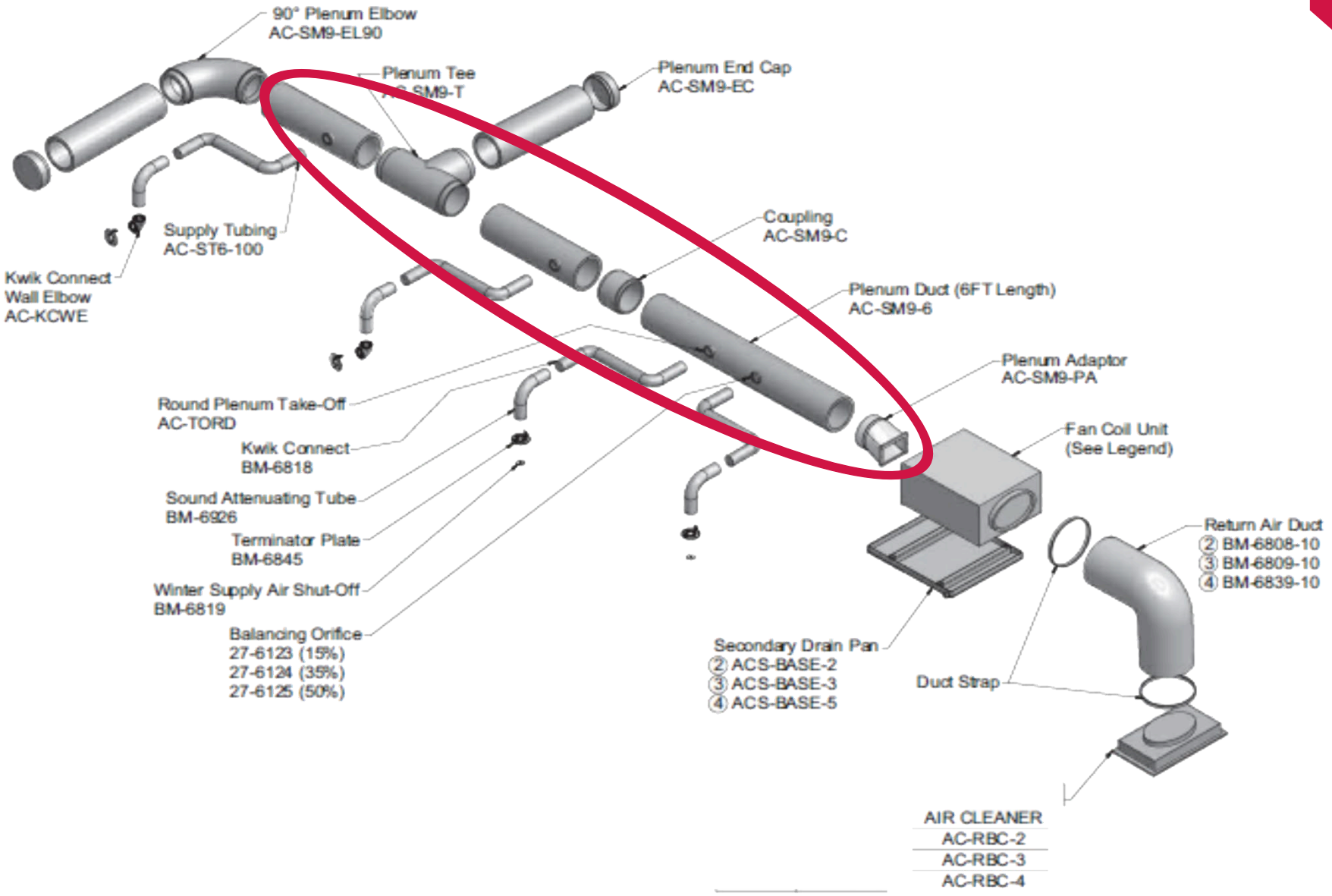


Note: Aftermarket air cleaning solutions are okay to use, but please be sure that the correct amount of return air is maintained, and that the third-party product is certified for use with SDHV.

?

Questions

Main Trunk


90° Plenum Elbow
AC-SM9-EL90
Plenum Tee
Plenum End Cap
AC-SM9-EC
Supply Tubing
AC-ST6-100
Kwik Connect
Wall Elbow
AC-KCWE
Coupling
AC-SM9-C
Plenum Duct (6FT Length)
AC-SM9-6
Plenum Adaptor
AC-SM9-PA
Fan Coil Unit
(See Legend)
Round Plenum Take-Off
AC-TORD
Kwik Connect
BM-6818
Sound Attenuating Tube
BM-6926
Terminator Plate
BM-6845
Winter Supply Air Shut-Off
BM-6819
Balancing Orifice
27-6123 (15%)
27-6124 (35%)
27-6125 (50%)
Return Air Duct
② BM-6808-10
③ BM-6809-10
④ BM-6839-10
Secondary Drain Pan
② ACS-BASE-2
③ ACS-BASE-3
④ ACS-BASE-5
Duct Strap
AIR CLEANER
AC-RBC-2
AC-RBC-3
AC-RBC-4

Maximum Allowable Plenum Length

250 ft (or equivalent) at 9” Round IF:

- All fittings are long radius
- The system is sealed to stop duct leakage “**completely**”
- Fittings reduce length by:
  - 30 ft for Tees
  - 15 ft for Elbows

Main Trunk Line “Topics”

- Static Regain replaces Static Reduction
- Allows simpler rules for design
- Easier installation practices
- Less energy loss
- More plenum/Less duct=$$

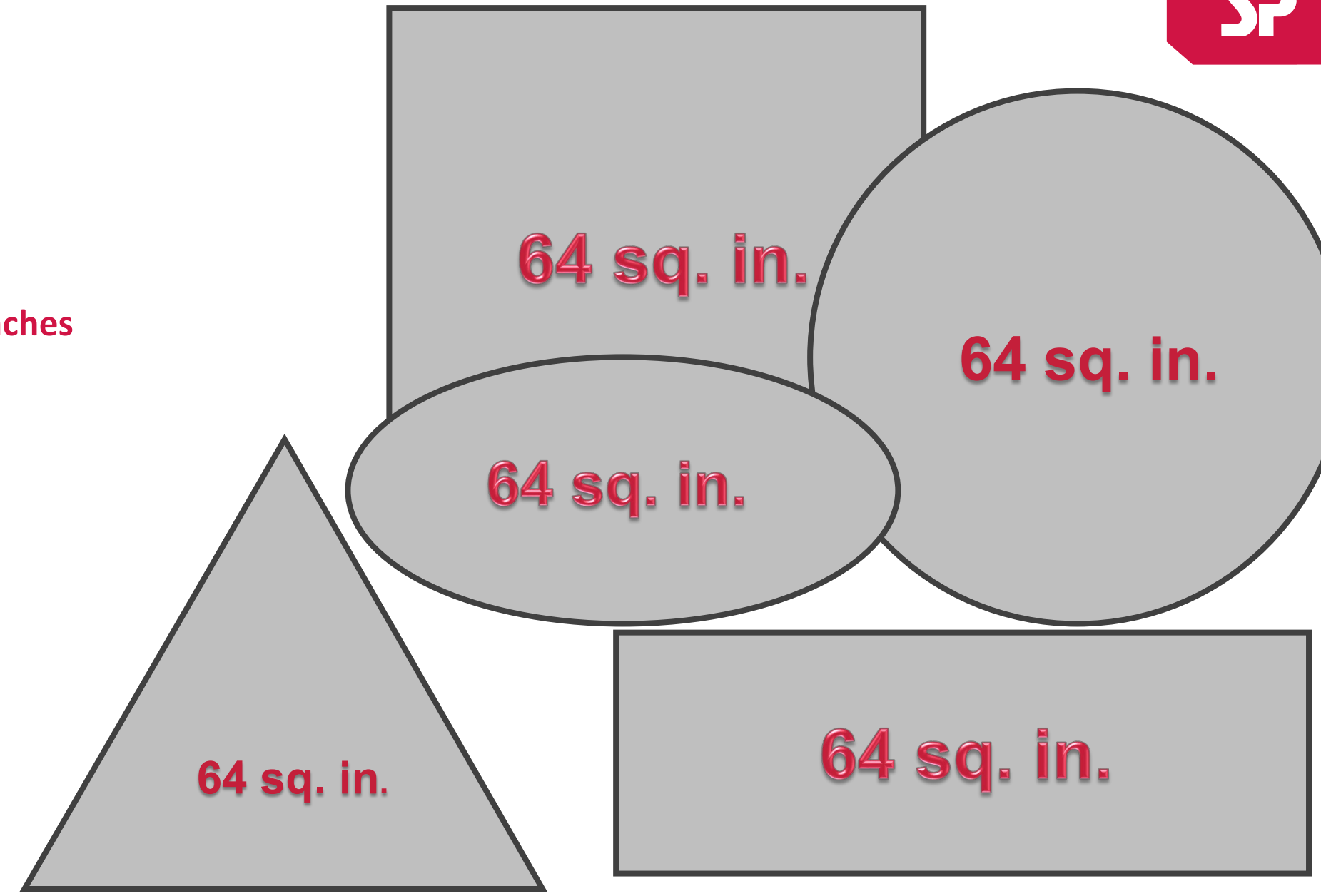
Plenum Rules & Topics

- Plenum requirements and allowances
- Round, Rectangular and Square will work
- Minimum and Maximum allowable run lengths
- Fittings (tees, elbows, couplings and endcaps)
- Most Common Mistakes

Plenum Size

9-inch round = 64 square inches

- 8 X 8-inch square
- 7 X 9 rectangular
- 6 X 11 rectangular
- 5 X 13 rectangular
- 4 X 16 rectangular
- 3 X 21 rectangular



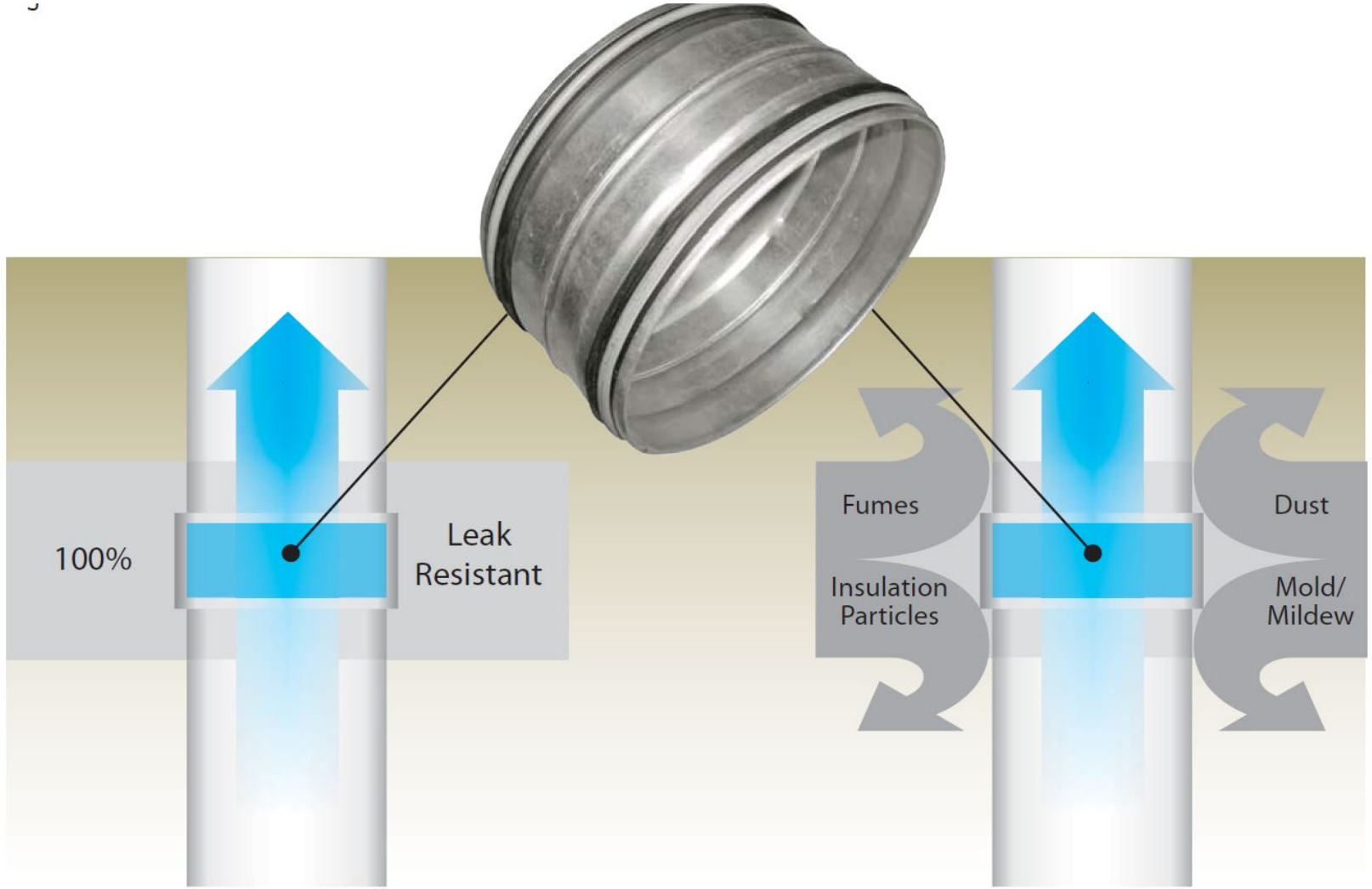
SmartSeal Pipe & Fittings

Standard Smart Seal System Duct Features

- Approved to SMACNA Duct Construction Standards and Leakage Class 3
- 100% Leak Resistant (to 10" W.C.)
- Fittings & Couplings Have Factory Installed Gasket
- Operating Temperature Range -20°F to 212°F
- Gasket is on the Leading Edge of Fittings, Allowing Substantial Space for Screw Insertion
- Recyclable Material
- Contains up to 58% Recycled Materials
- Eligible for LEED Points
- Significantly Reduced Installation Time

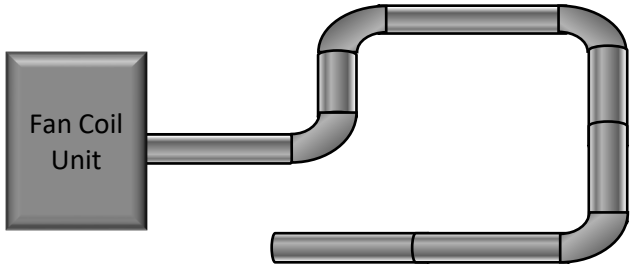
SmartSeal

Keeps pressure IN &
keeps contaminants OUT

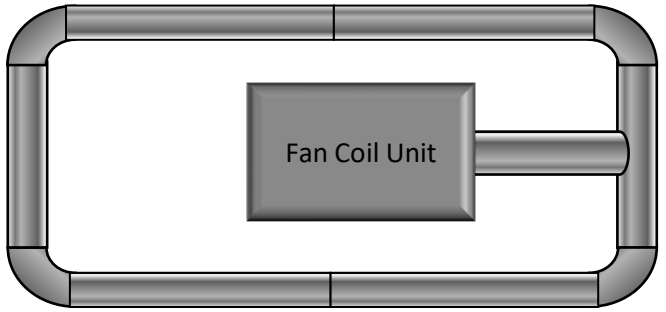


4 Main Plenum Configurations

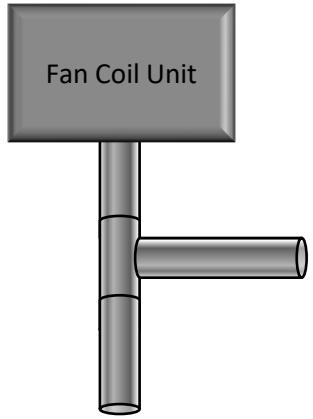
Shotgun



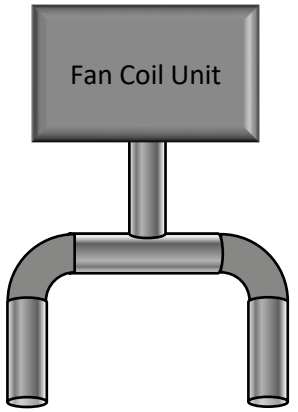
Perimeter Loop



Side Branch



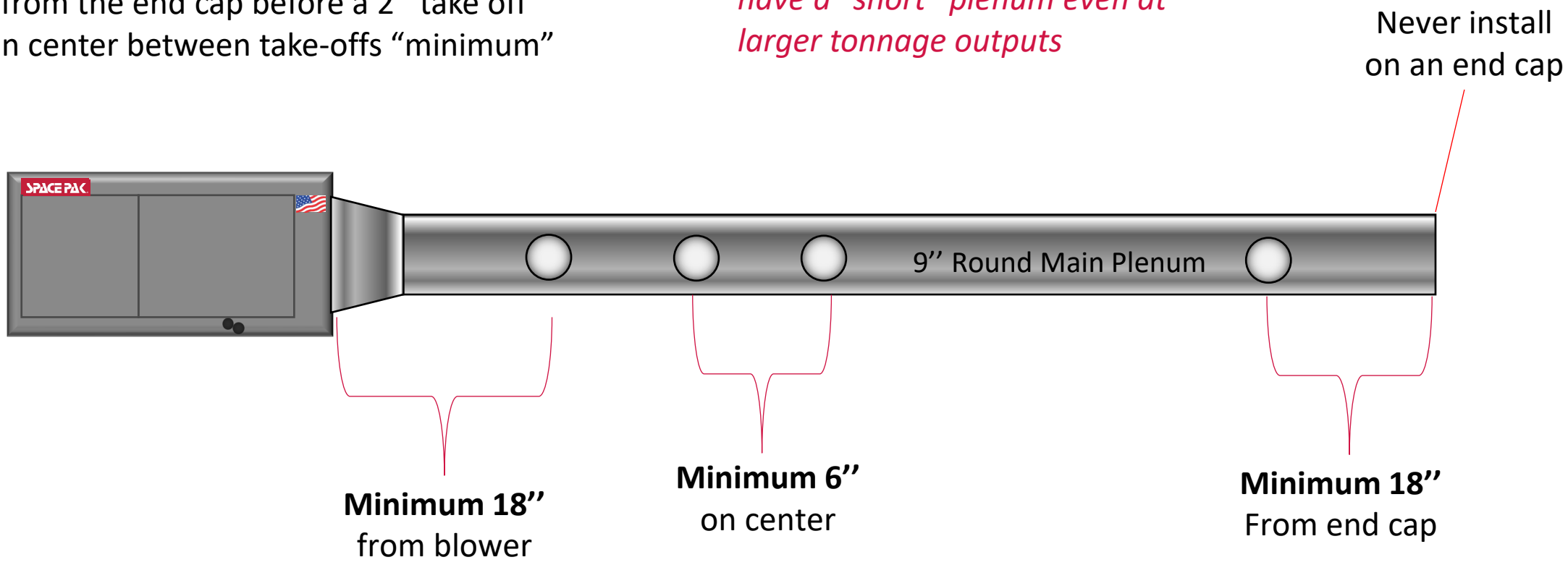
Horseshoe



Minimum Plenum Length Determined By

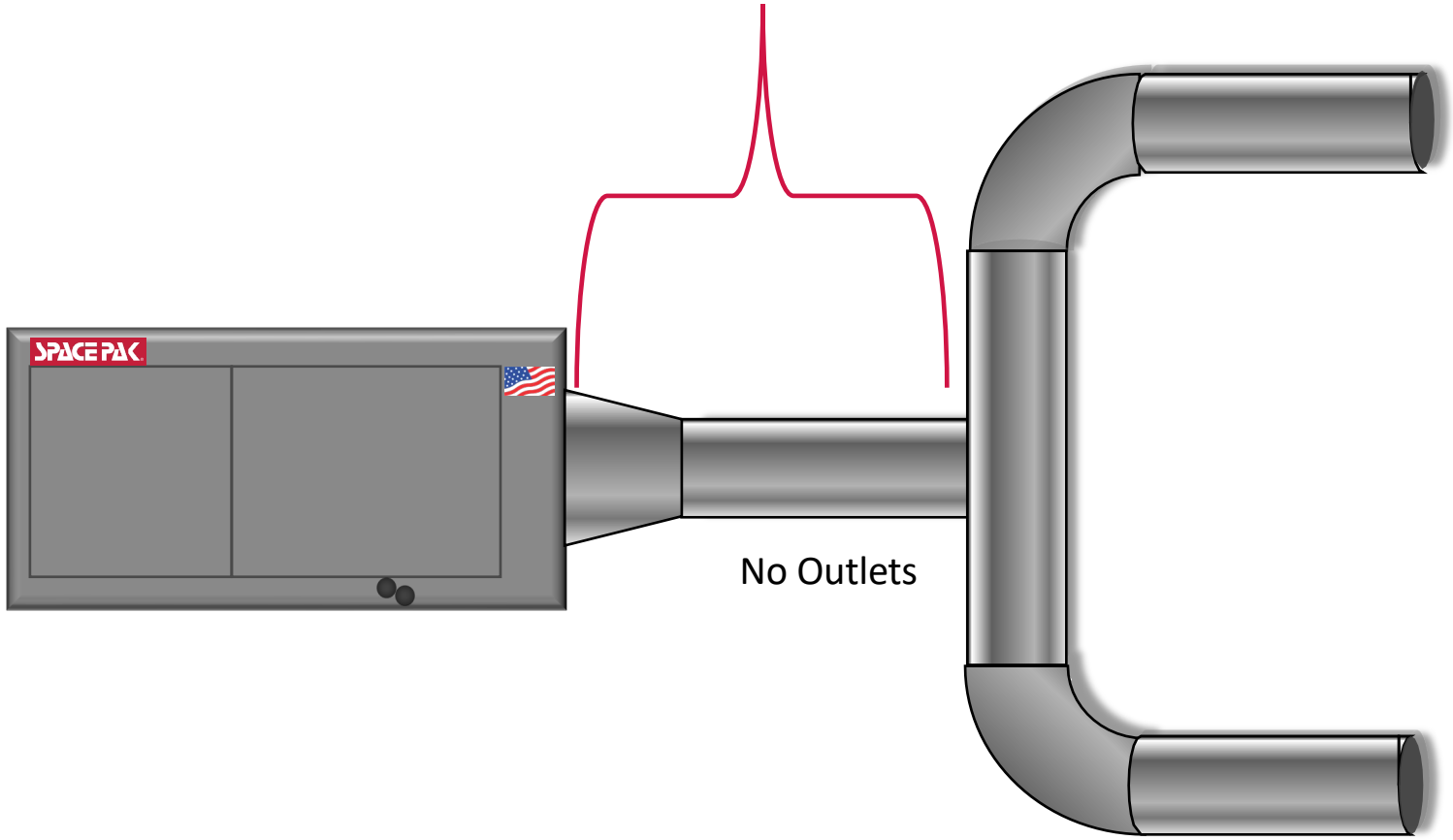
- 18’’ from blower before a 2’’ take off
- 18’’ from a fitting before a 2’’ take off
- 18’’ from the end cap before a 2’’ take off
- 6’’ on center between take-offs “minimum”

So, with straight pipe you can have a “short” plenum even at larger tonnage outputs



Horseshoe

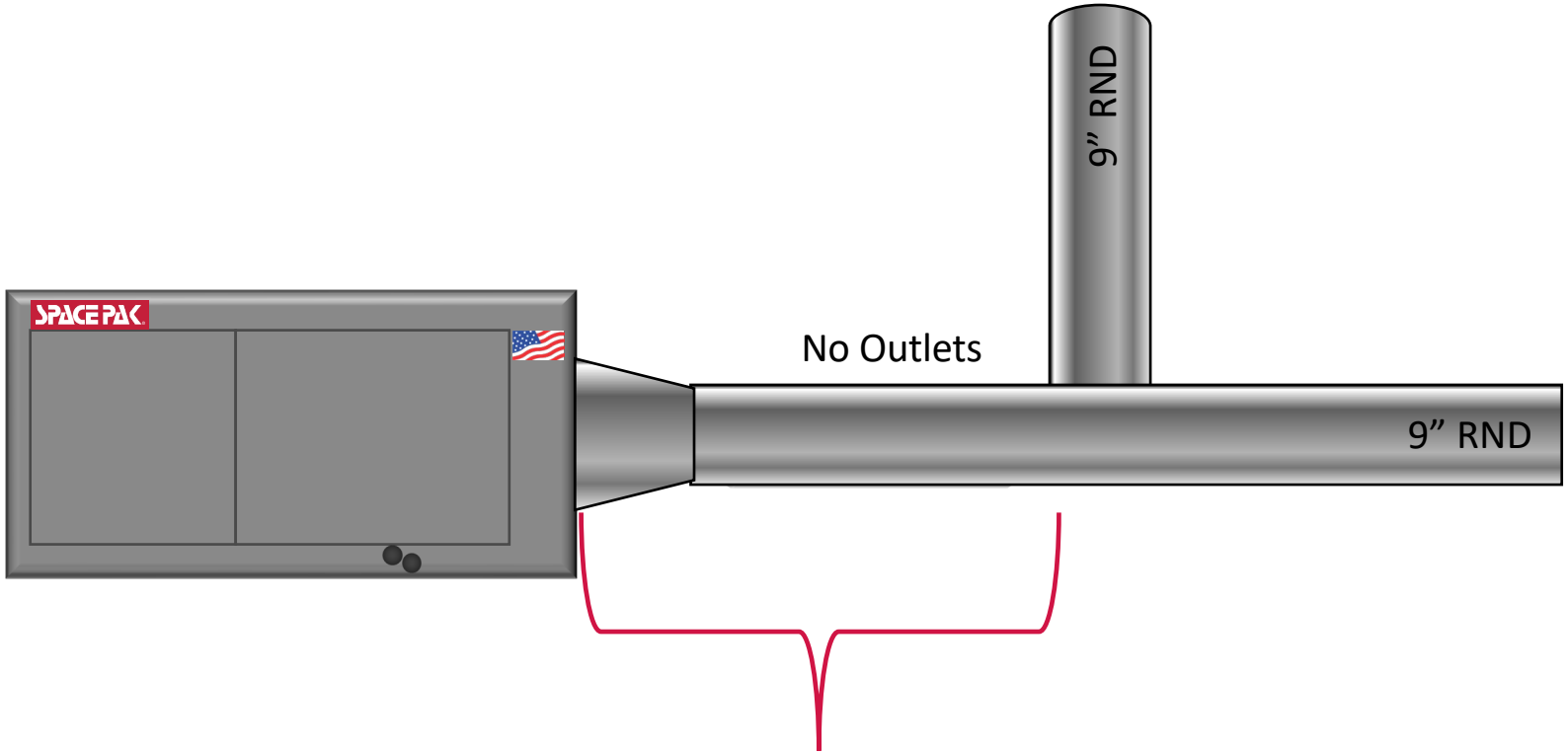
Minimum 18’’ after the blower & before a tee, elbow, or 2’’ take-off



Maximum 60%
capacity on one side

Side Branch

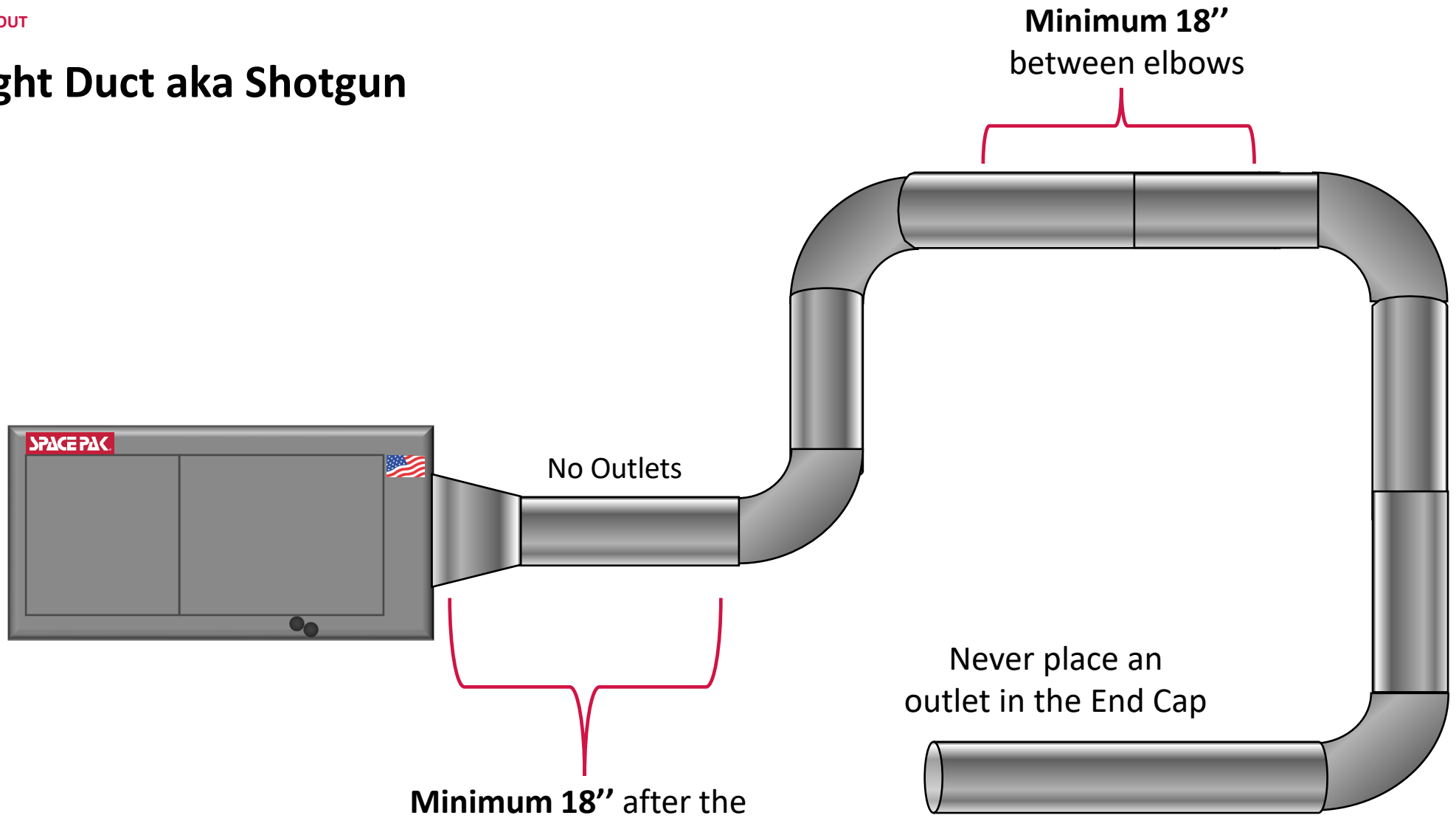
Maximum 30%
capacity



Maximum 70%
capacity

Minimum 18’’ after the blower & before a tee, elbow, or 2’’ take-off

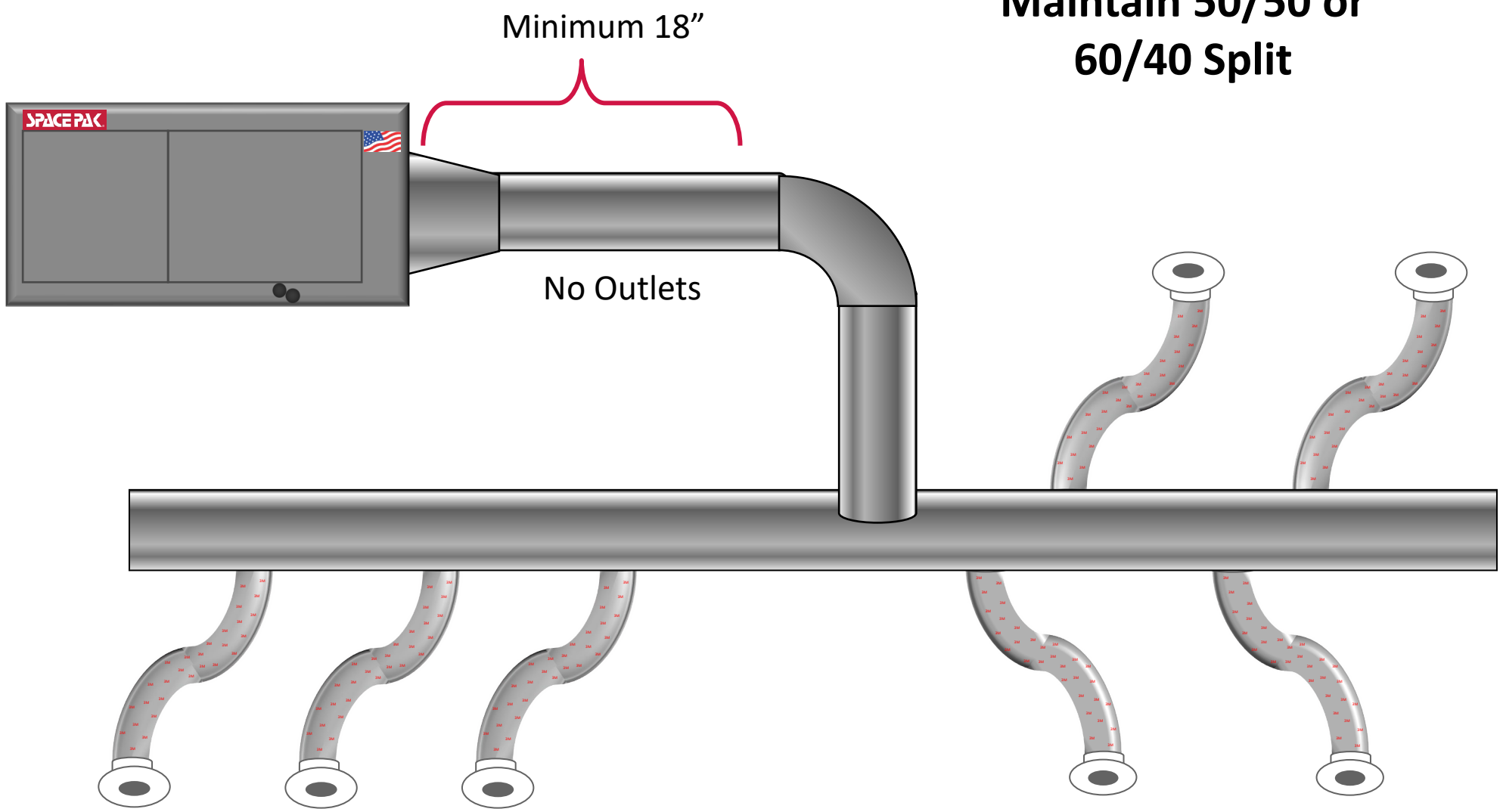
Straight Duct aka Shotgun



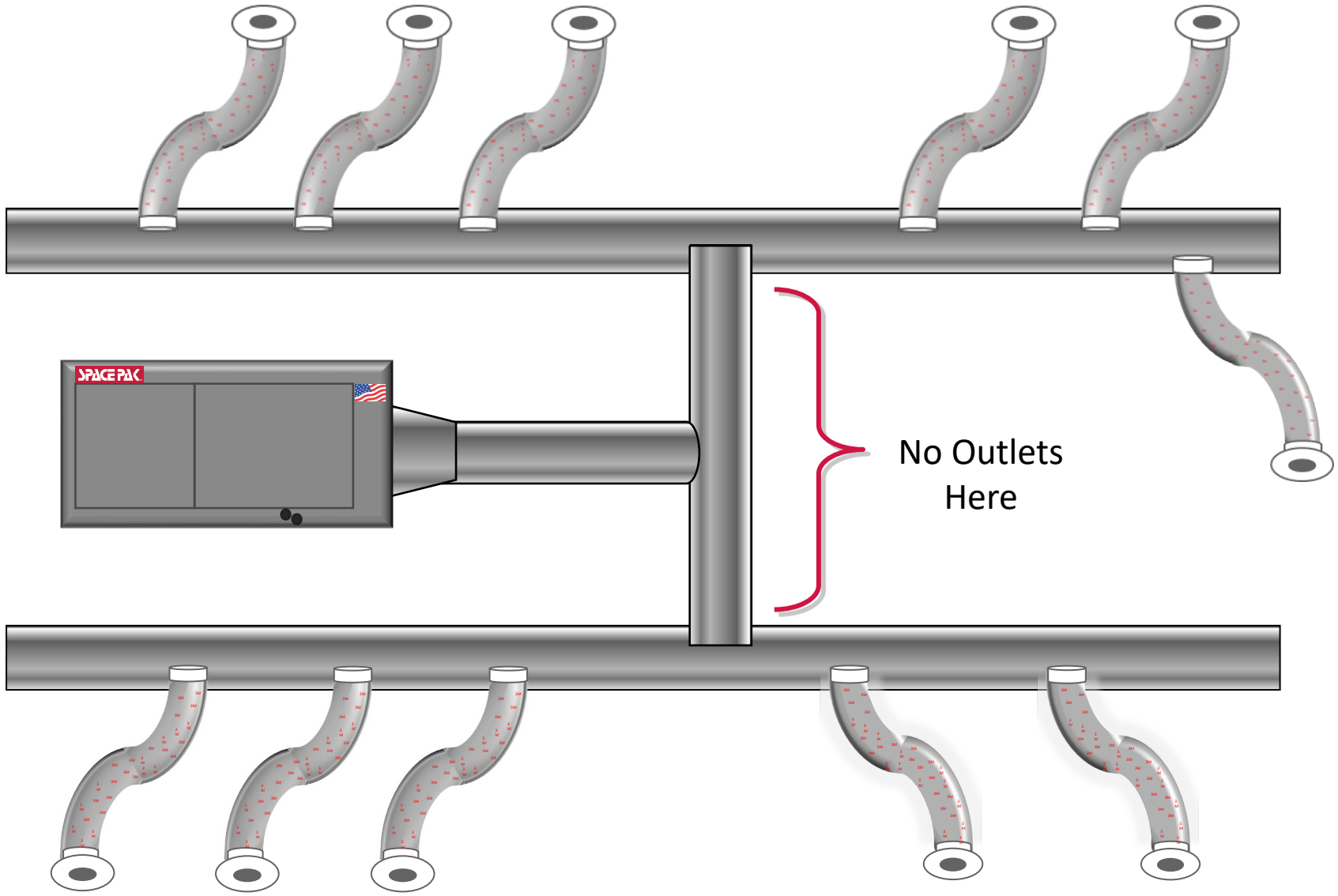
Example of a Side Branch Tee

Former G Series

Shotgun with a Tee



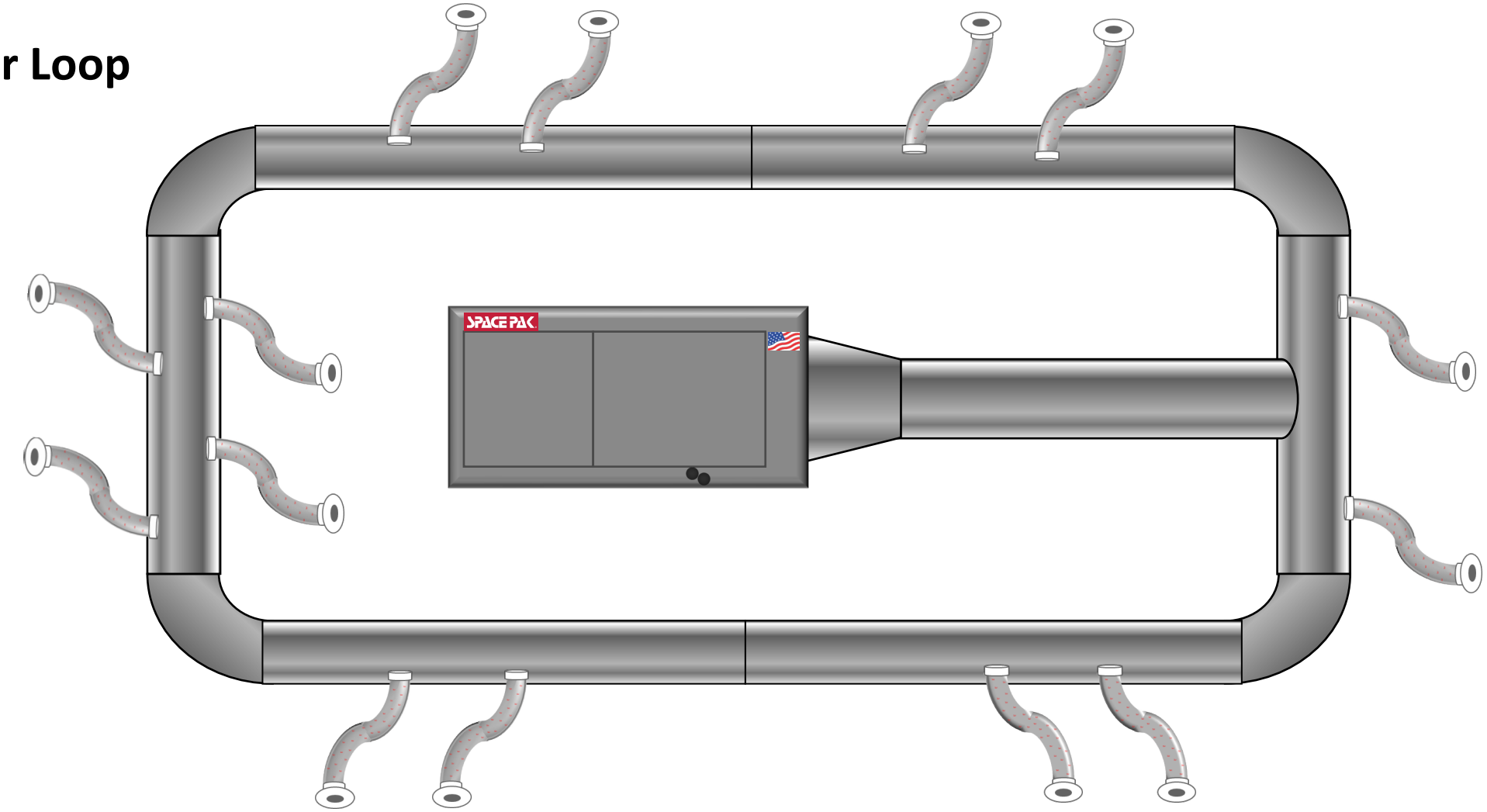
System One
50/50 Split



System Two
60/40 Split

Think of it as Two Systems!

Perimeter Loop



Note: Takeoffs can be evenly spaced or mostly one side or the other, the 50/50 rules do not apply when dealing with a perimeter loop. This set up will balance regardless of the layout.

What do you see wrong?

What do you see wrong?

?

Questions

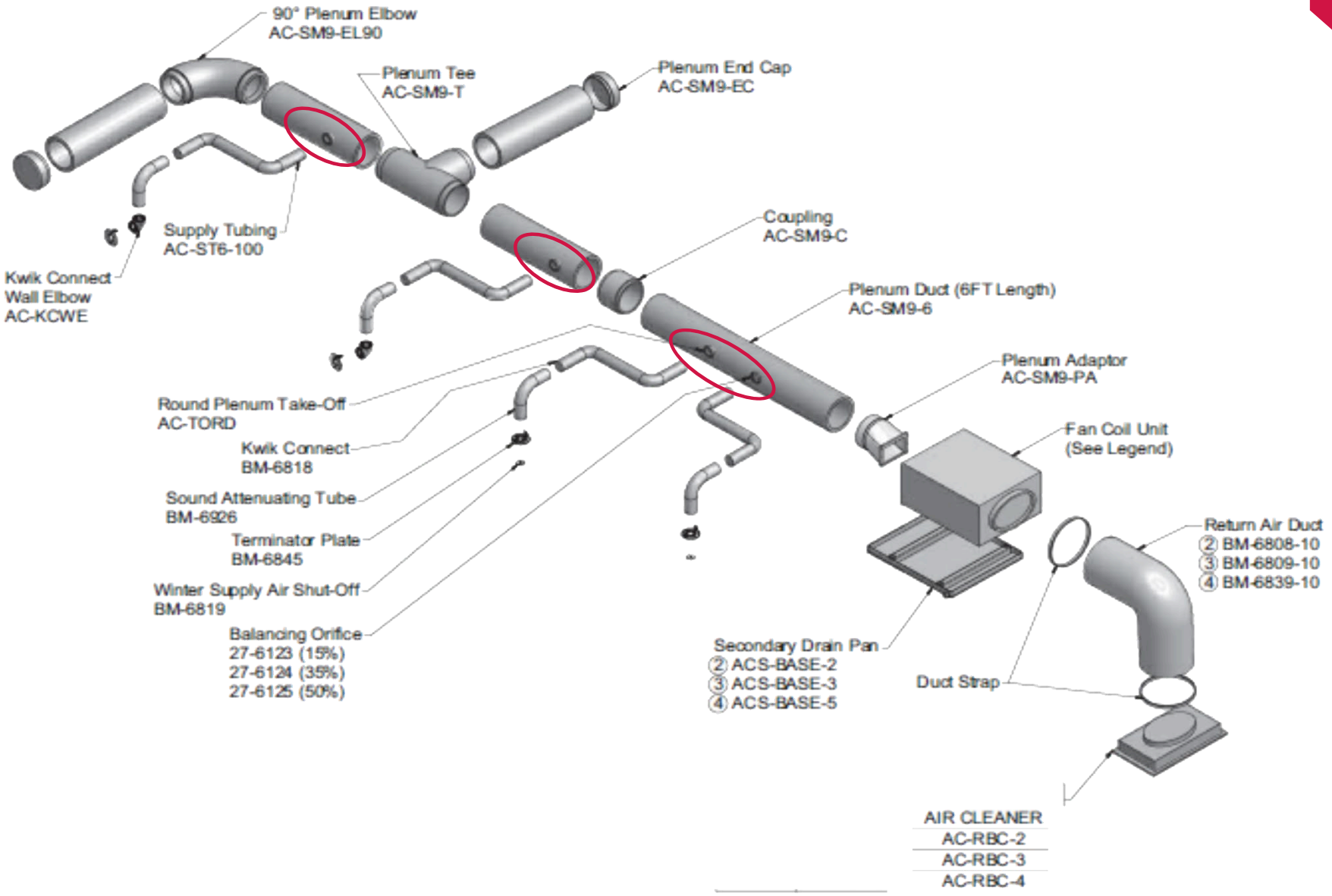
RETROFIT CONSIDERATIONS!

- Just because a 2-, 3- or 5-ton unit was installed DOES NOT mean the same unit can go back in without looking at the existing system, its layout and available CFM's
- IT IS STILL GOOD TO DO A LOAD CALCULATION. Many times, if a system has been installed for many years there may have been considerable efficiency improvements to the home. Ex.(the house may no longer require 5 tons of cooling due to window, roof and insulation upgrades)
- Count the total existing supply terminations
- If the blower in the existing system runs (even if the condenser does not) turn it on and take CFM readings at ALL outlets. Confirm total available CFMs are equal or greater than the amount required for the new system. (220-250 CFM PER TON)
- Verify, when possible, the main trunk "inside" diameter and overall length
- If the evaluation of the existing system reveals anything that may lead to the new system not operating properly without improvements, please note the specifics on your installation proposal.

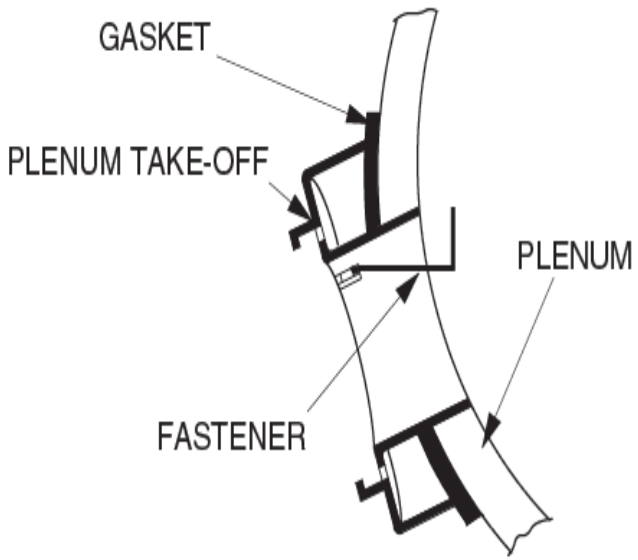
?

Questions

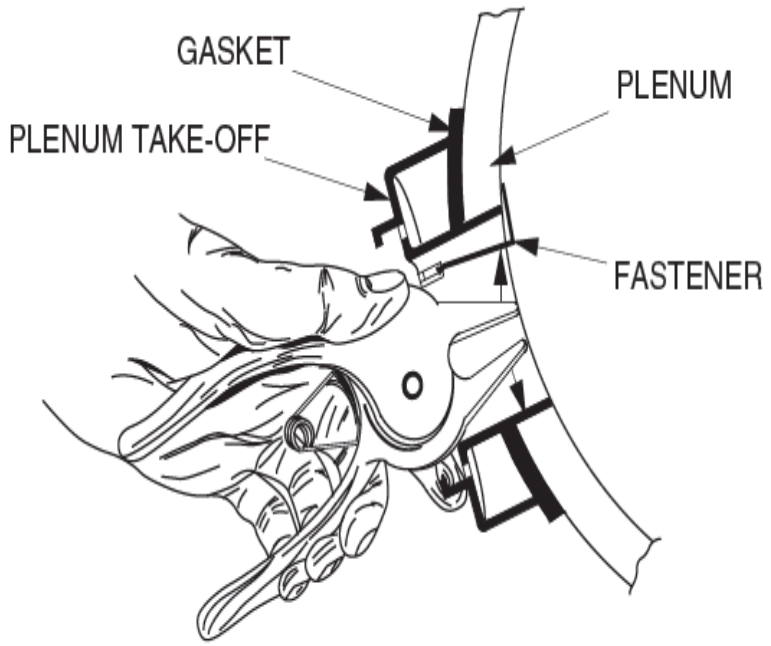
Plenum Take-Offs



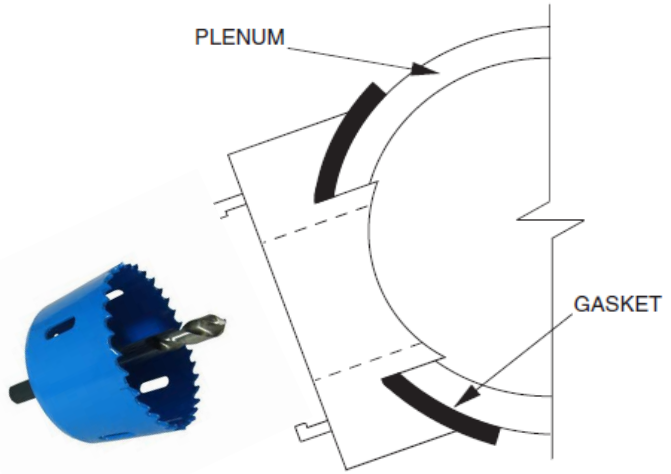
Plenum Take-Off Installation



1. HAND INSERT FASTENER INTO PLENUM TAKE-OFF



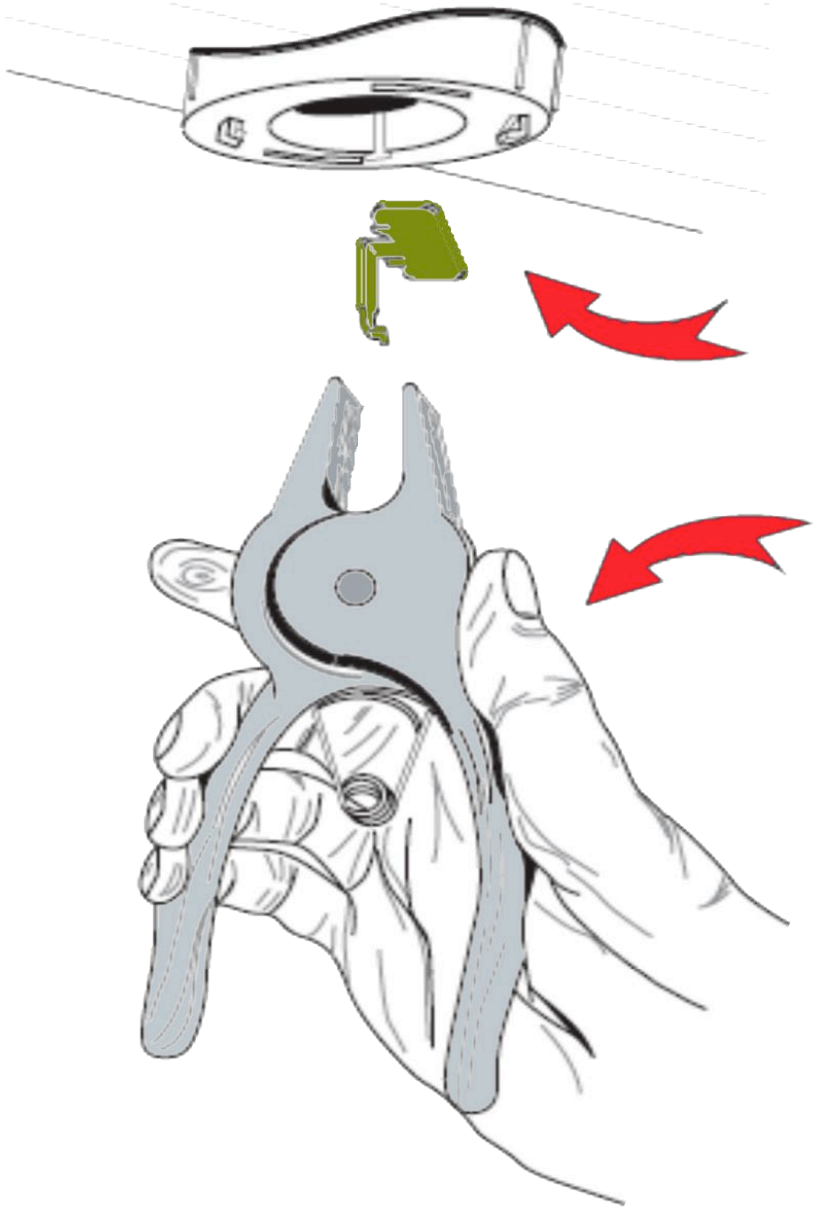
2. WITH PLIERS, SNAP FASTENER INTO PLACE UNTIL IT LOCKS IN PLACE



Pliers

2 and 1/8’’ Hole Saw

Pliers Part #
BM-6998



Note: Be sure to install **ALL** 4 retainer clips on each takeoff to maintain a good seal

Plenum Take-Off Kits

Come in packs of 2 or 5 to match **Installation Kits**

Available for both:

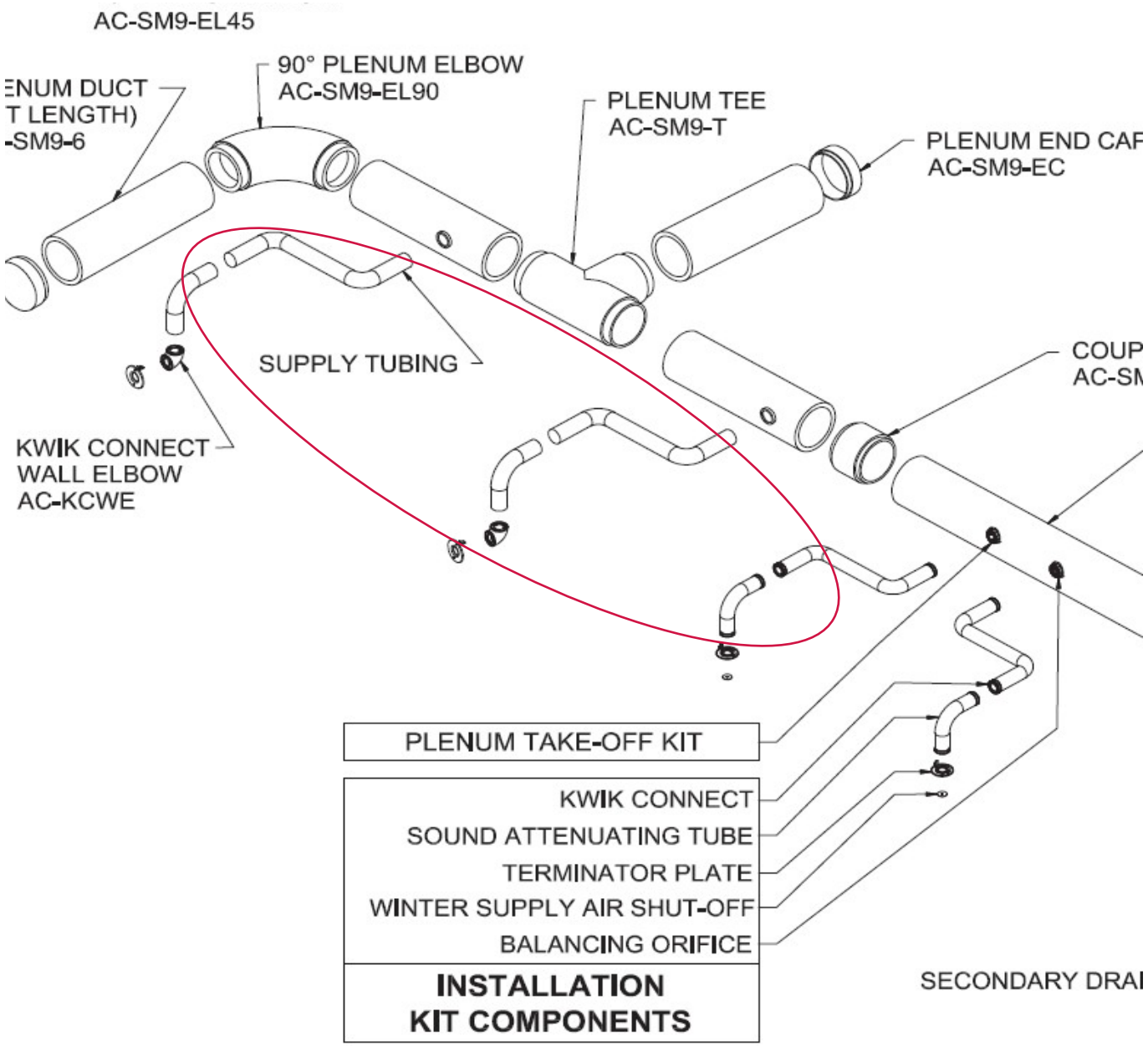
- Round Sheet Metal Duct (MR)
- 1’’ Square Fiberboard Plenum Duct (FS)

Order Codes	FS	MR
2 - Outlets	AC-TKFS-2	AC-TKMR-2
5 - Outlets	AC-TKFS-5	AC-TKMR-5

Note: You will receive these in the box

Example Take-Off Kit for (2) Outlets

Supply Tubing



Small Duct Supply Tubing

Note: Local building codes will be the deciding factor in your R-Value required for installation

R-6

- Boxes of 100 Feet
- Total diameter 3.75’’

R-8

- Boxes of 75 Feet
- Total diameter 7’’

Small Duct Supply Tubing

- Rated pressure 0.0 – 2.5 W.C.
- Resistant to fungi growth
- Class 1, 25/50 flame/smoke spread
- Max operating temperature 250°F
- Duct closure tape min to max temperature range: -37 °F to 260 °F
- Meets surface burning characteristics & limited combustibility per UL 723, NFPA 90A & 90B, ASTM E84, CAN/ULC S102-1188
- Meets Buy American Standard
- SCS Certified for Green Building Recycled Content

Unique Tubing Machine

Farmville North Carolina

Supply Rules & Topics

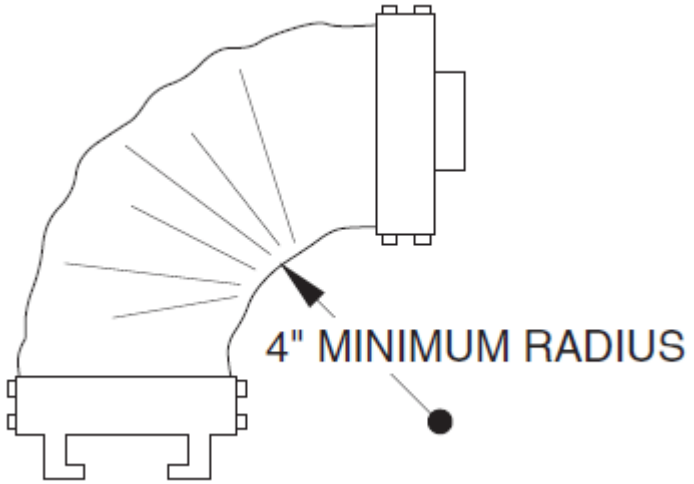
- 6-7 outlets minimum per Ton on an AC-only
- In cooling only above 5000’ use 8 outlets per ton and above 6500’ use 9 outlets per ton
- 7-8 outlets minimum per Ton on a Heat Pump System (due to higher coil pressures)
- 2,000 BTUs per outlet (fully rated) in Cooling at 37 cfm
- 3,000 BTUs per outlet (fully rated) in Heating at 37 cfm
- Outlet placement in a room
- Room-by-room load Calculations to ensure the number of outlets in a room
- Best length of a duct run (includes sound attenuator)
- Maximum length of a duct run (9’ to 15’ this length includes the 3’ sound attenuator)
- If the termination “hole” is closer to the trunk than 9 feet you can also loosely coil the supply (not tight)

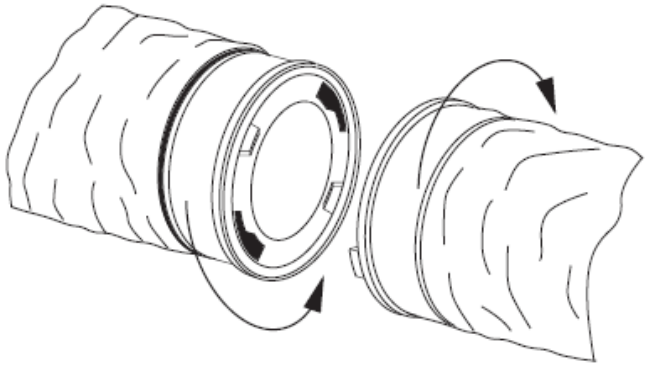
Best Length of Duct Run

- Best length to balance the outlets run: 9 to 15 feet (with attenuator)
- Shorter than 9 feet work with duct orifice balancers
- Longer runs work if more runs are added to make up for the CFM lost
- 10% rule (after 15’ of supply run you lose 10% for every additional 5’) Loss of CFM and BTU’s
- CFMs directly affect the amount of Btu’s delivered

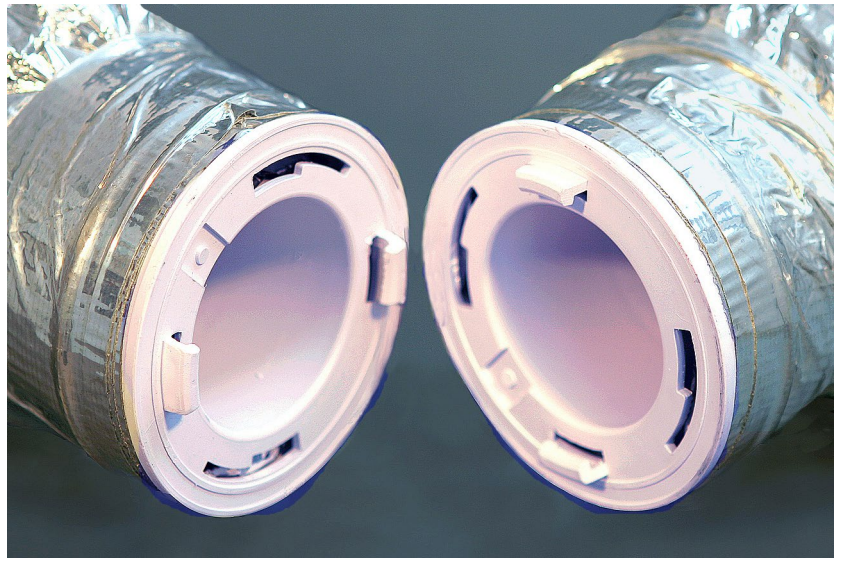
2" SUPPLY TUBING LENGTH ADJUSTMENT FACTOR CHART								
RUN	6'	8'	10'	12'	15'	20'	25'	30'
FACTOR	1.18	1.14	1.11	1.06	1.0	.9	.8	.66

Kwik Connects / Radius





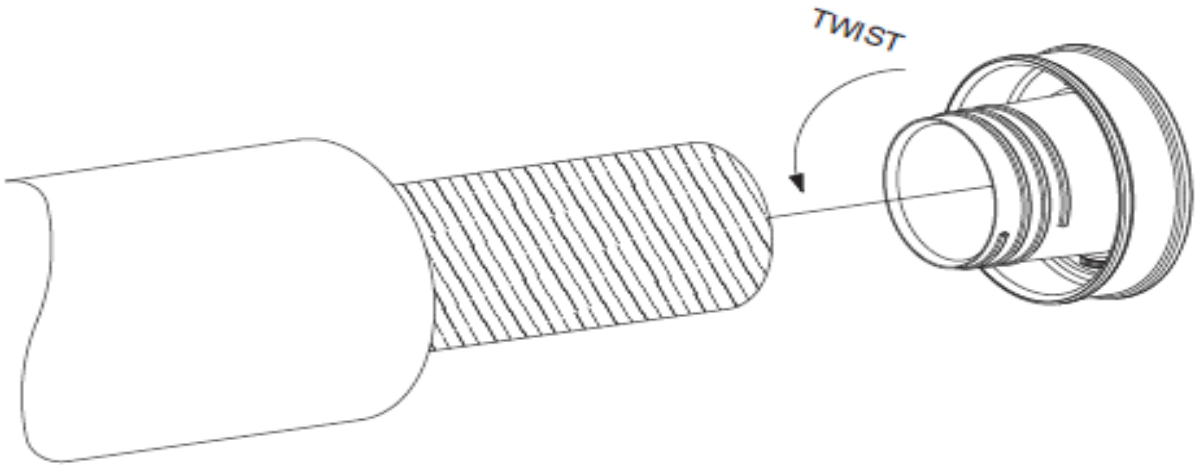
- Minimum 4” radius for tubing
- For tighter radius use ridged elbow
- Tube cuts easily with bread knife or similar
-
- “crunch” down 2” of aluminum core before twisting in quick connect
- No need to overtighten
- Tuck remaining insulation under twist collar
- Tape connection



Kwik Connects / Radius

No need to screw or fasten beyond tape

No need to overtighten



Sound Attenuator

- 3-foot standard section
- Pre-assembled connectors
- Reduces velocity noise/cloth-lined
- End of every run
- Included in the total run length

6 Outlets Per Ton Minimum

System Size	System CFM	Number of Outlets	Average CFM	COOLING BTUs per outlet	HEATING BTUs per outlet
2 Ton	440	12	37	2000	3000
2.5 Ton	550	15	37	2000	3000
3 Ton	660	18	37	2000	3000
3.5 Ton	770	21	37	2000	3000
4 Ton	880	24	37	2000	3000
5 Ton	1100	30	37	2000	3000

10 Outlets Per Ton Maximum

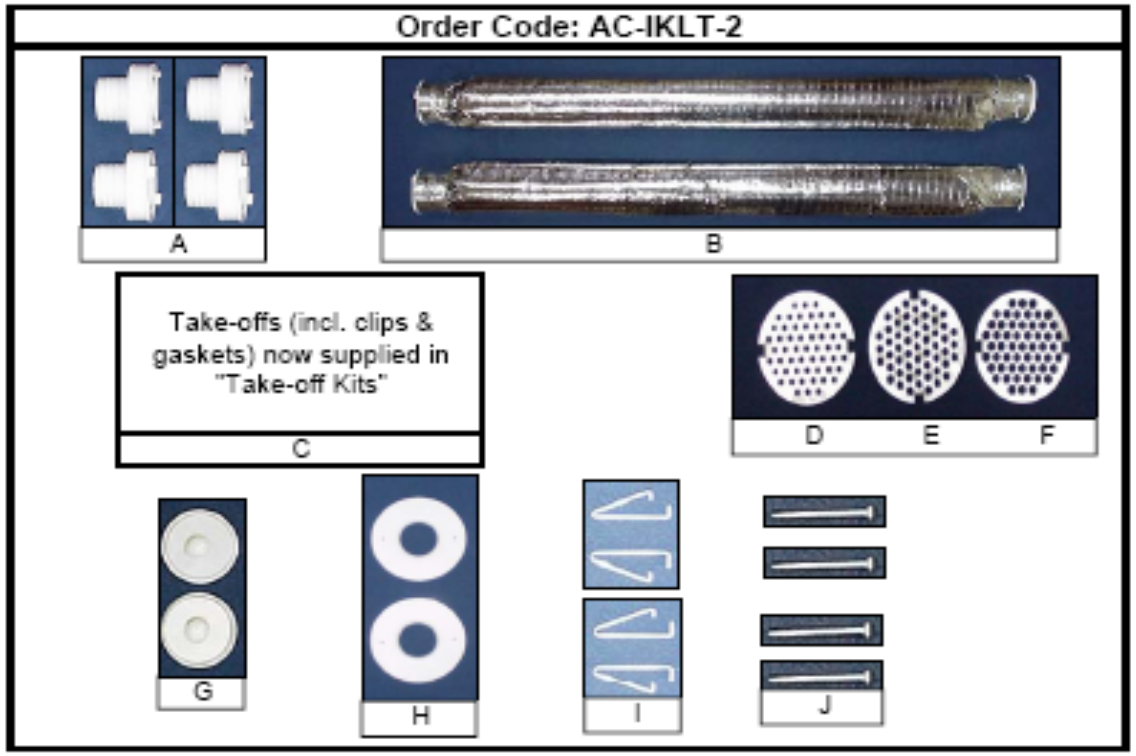
System Size	System CFM	Number of Outlets	Average CFM	COOLING BTUs per outlet	HEATING BTUs per outlet
2 Ton	440	20	22	1200	1800
2.5 Ton	550	25	22	1200	1800
3 Ton	660	30	22	1200	1800
3.5 Ton	770	35	22	1200	1800
4 Ton	880	40	22	1200	1800
5 Ton	1100	50	22	1200	1800

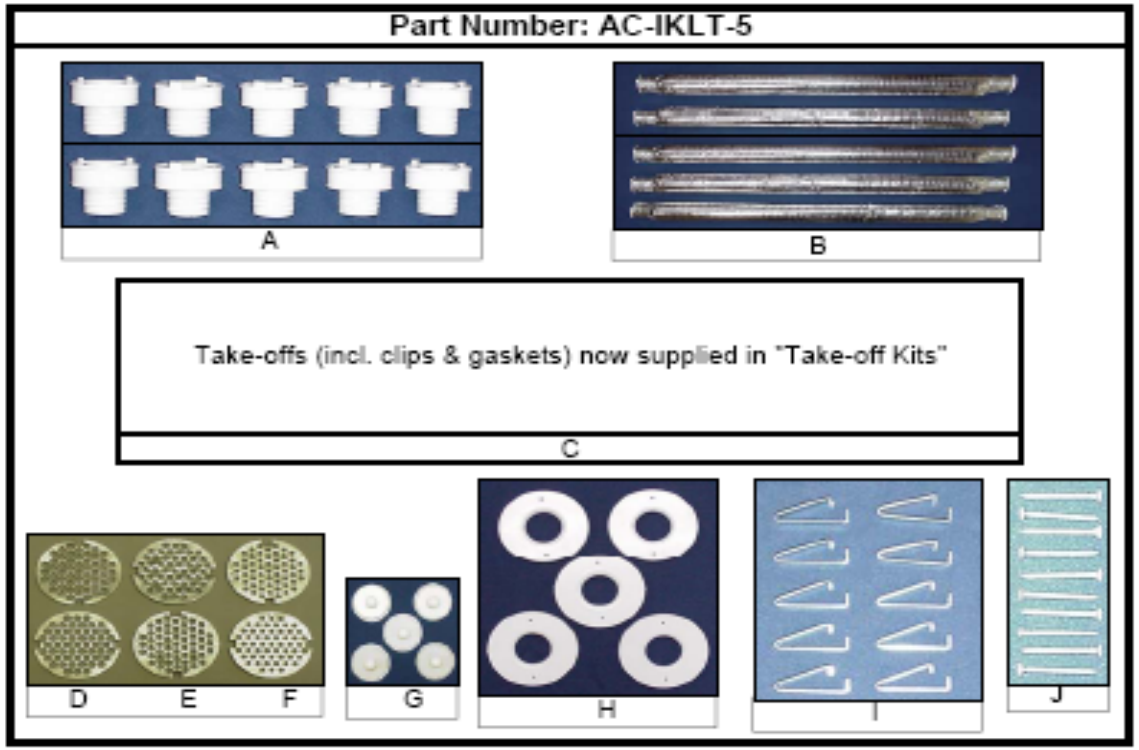
CFM per Outlet

	CFM Per Outlet				
	Plenum Static Pressure "WC				
Supply Tube Length	1.8	1.5	1.2	1	0.5
10	45	40	36	33	22
15	37	33	30	27	18
20	32	28	26	23	15
25	29	25	23	21	14
30	26	23	21	19	13
35	24	22	19	18	12
40	23	20	18	16	11

Note: When delivered CFMs are low additional supplies may have to be added in a room to achieve the required Btus

Installation Kits / Common Parts Box





Installation Kits / Common Parts Box

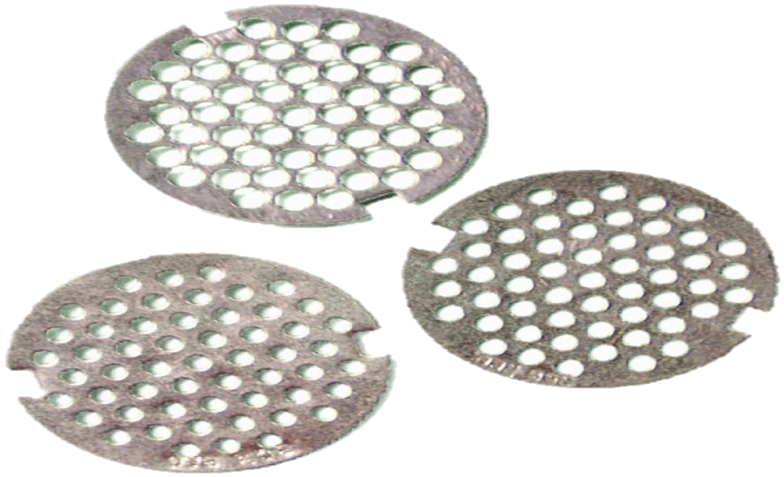
Used for all duct system types

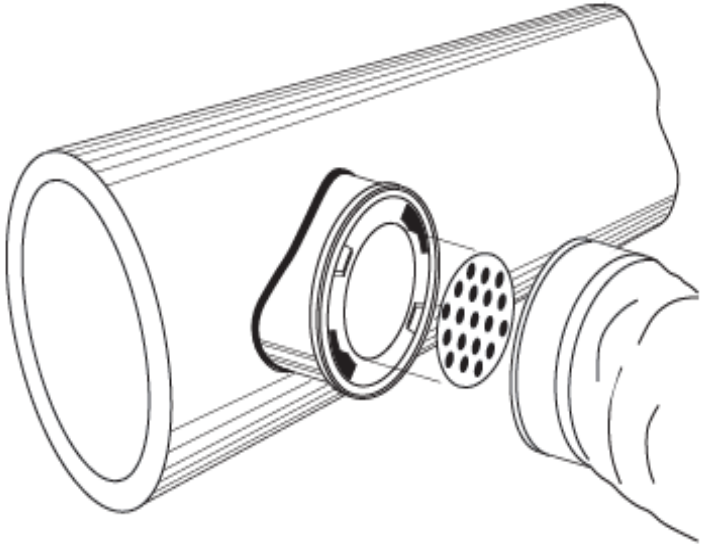
Note: Take-off clips and gaskets now supplied in “Take-Off Kits”

Balancing Orifices

Available in 3 sizes 15, 35, 50% (restriction)

- Install ONLY in the Plenum
- Do NOT install in the room-side termination
- Only used for balancing or areas that need reduced BTUs
- Most commonly used for small room/ bathroom supplies
- If installed, please mark plenum and make a note for future service.





Balancing Orifices

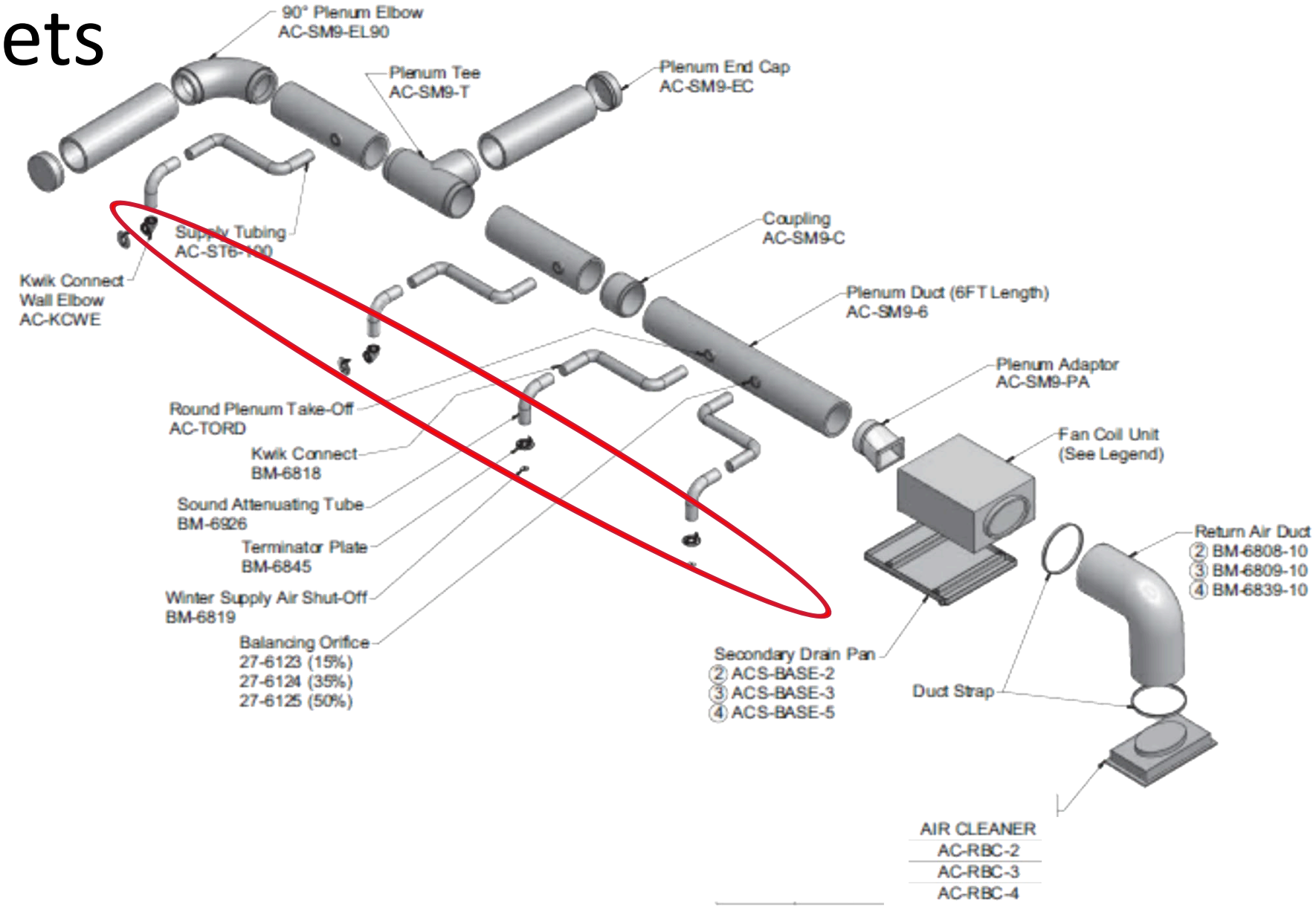
- WILL result in unwanted noise and reduction of output
- Only to be installed at the plenum and only used for balancing and BTU reduction

NOTE: Use ¼‘” screen for floor installs to prevent the introduction of small objects

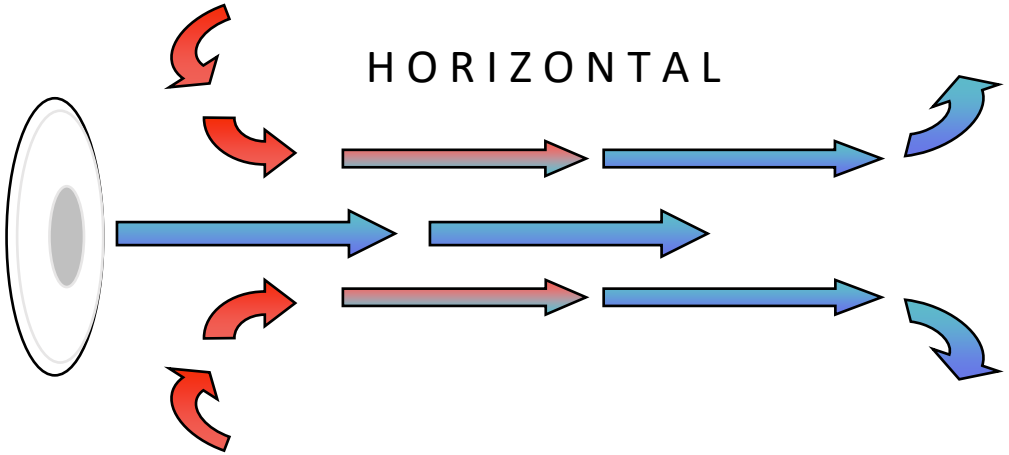
?

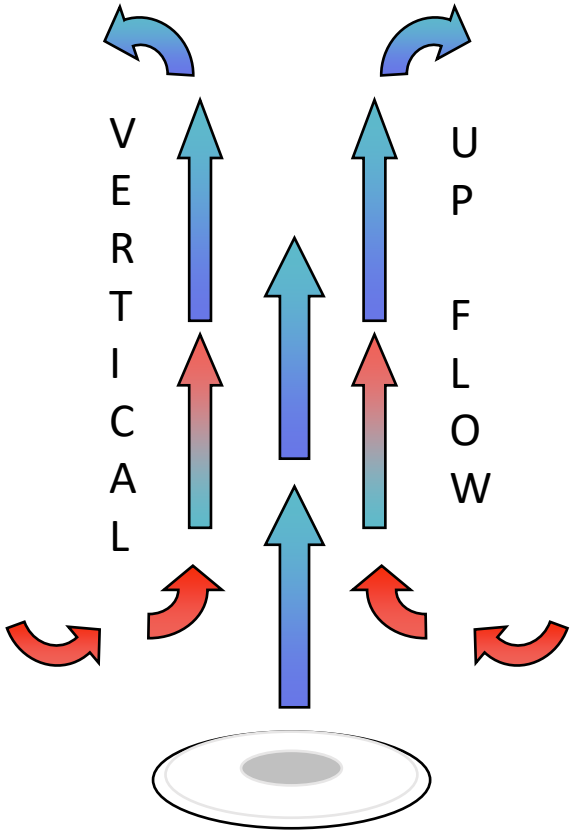
Questions

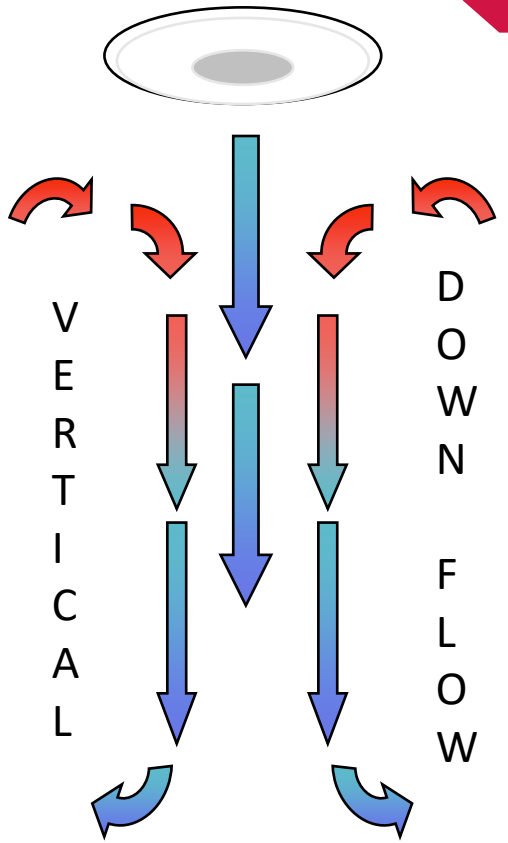
Outlets


90° Plenum Elbow
AC-SM9-EL90
Plenum Tee
AC-SM9-T
Plenum End Cap
AC-SM9-EC
Supply Tubing
AC-ST6-100
Kwik Connect
Wall Elbow
AC-KCWE
Coupling
AC-SM9-C
Plenum Duct (6FT Length)
AC-SM9-6
Plenum Adaptor
AC-SM9-PA
Fan Coil Unit
(See Legend)
Round Plenum Take-Off
AC-TORD
Kwik Connect
BM-6818
Sound Attenuating Tube
BM-6926
Terminator Plate
BM-6845
Winter Supply Air Shut-Off
BM-6819
Balancing Orifice
27-6123 (15%)
27-6124 (35%)
27-6125 (50%)
Secondary Drain Pan
② ACS-BASE-2
③ ACS-BASE-3
④ ACS-BASE-5
Return Air Duct
② BM-6808-10
③ BM-6809-10
④ BM-6839-10
Duct Strap
AIR CLEANER
AC-RBC-2
AC-RBC-3
AC-RBC-4

Outlet Orientation







Outlet Placement Rules

DON'T DO THESE

- Place in traffic patterns *(room ceiling & floor corners, and behind door swings are ideal)*
- where it will blow on someone *(air can travel 15+ Feet)*
- where it will blow on something that will move *(example; curtains)*
- Never block an outlet *(reduction of airflow can reduce system performance)*
- Have at least 6 inches from the center of an outlet to a wall

- If an outlet is mounted in the floor, a ¼" screen can be used to prevent the introduction of foreign objects into the system.

- Ceiling, sidewall, or floor are all ok! ***Aspiration will work anywhere!!!***

The number of outlets in a room is determined by:

- A proper Room by Room Load Calculation
- The BTU’S required in the room based on the load
- CFM per outlet based on supply run and trunk layout
- Length of the run

SpacePak offers presale support to help with load calculations

Basic System Overview

Residential House in Albany N.Y.

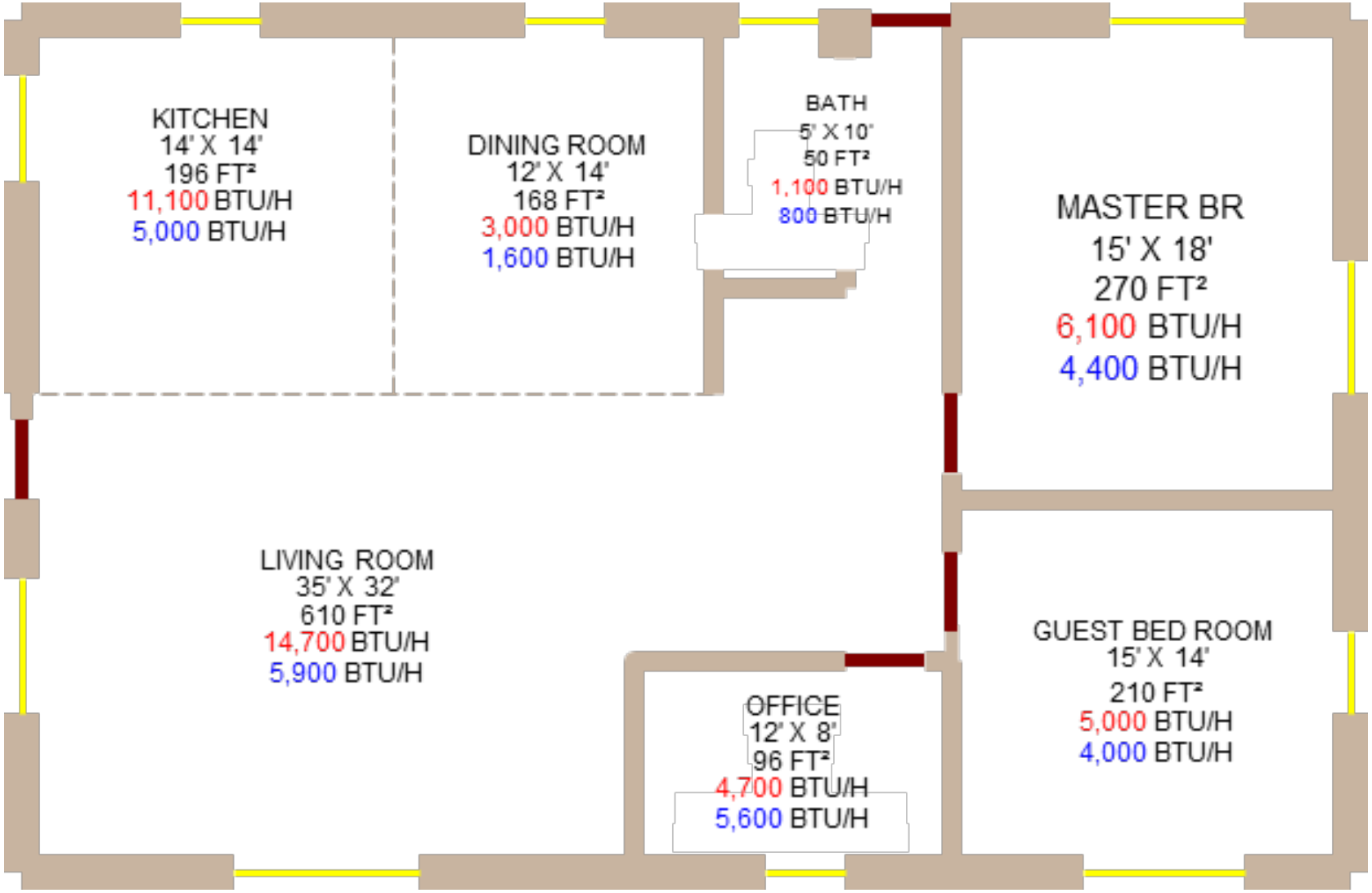
Heating

45,700/ 3000 BTU per full rated outlet = **15.2 outlets minimum**

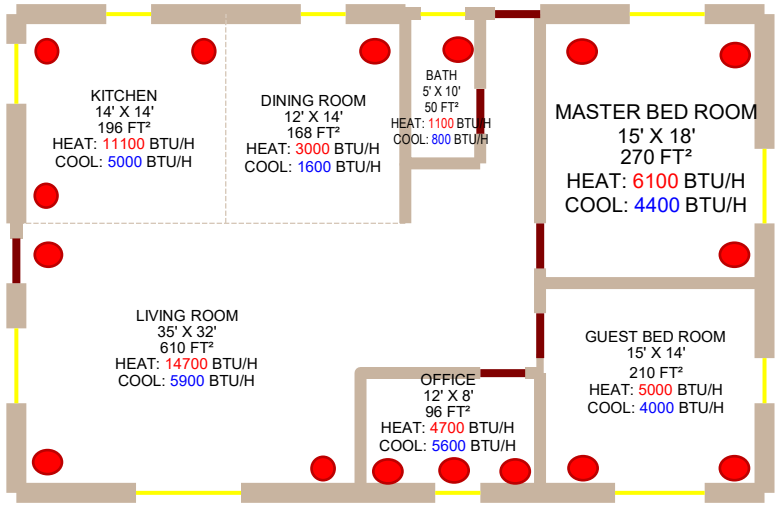
Cooling

27,300/ 2000 BTU per full rated outlet = **13.6 outlets minimum**

Note: This is a good way to get an approximate system size; however, a full room-by-room load calculation should be done to ensure that the individual rooms are supplied properly.



DX Coil Cooling Only



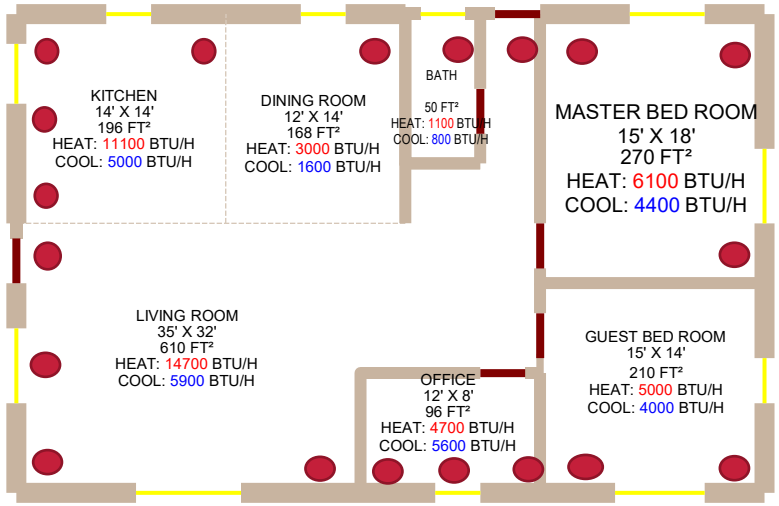
Kitchen
5,000 Btu Cooling
÷ 2,000 = 2.5

How Many outlets?

3 Outlets

- Dining Room 1, Bath Room 1, Master Bed 3, Guest Bed 2, Office 3, Living Room 3
- Our Cooling Load is 27, 300 BTUH ÷ 2000 = 13.65 outlets.
- The unit we would use is an ESP-2430JH4MB DX FAN COIL with a 2.5 ton Condenser, 30,000 BTUH ÷ 2000 requires 15 Outlets we have 16 so your good to go !

Dx Coil Option With Hydronic Coil For Heating



Kitchen
11,100 Btuh
Heating
÷ 3,000 = 3.7

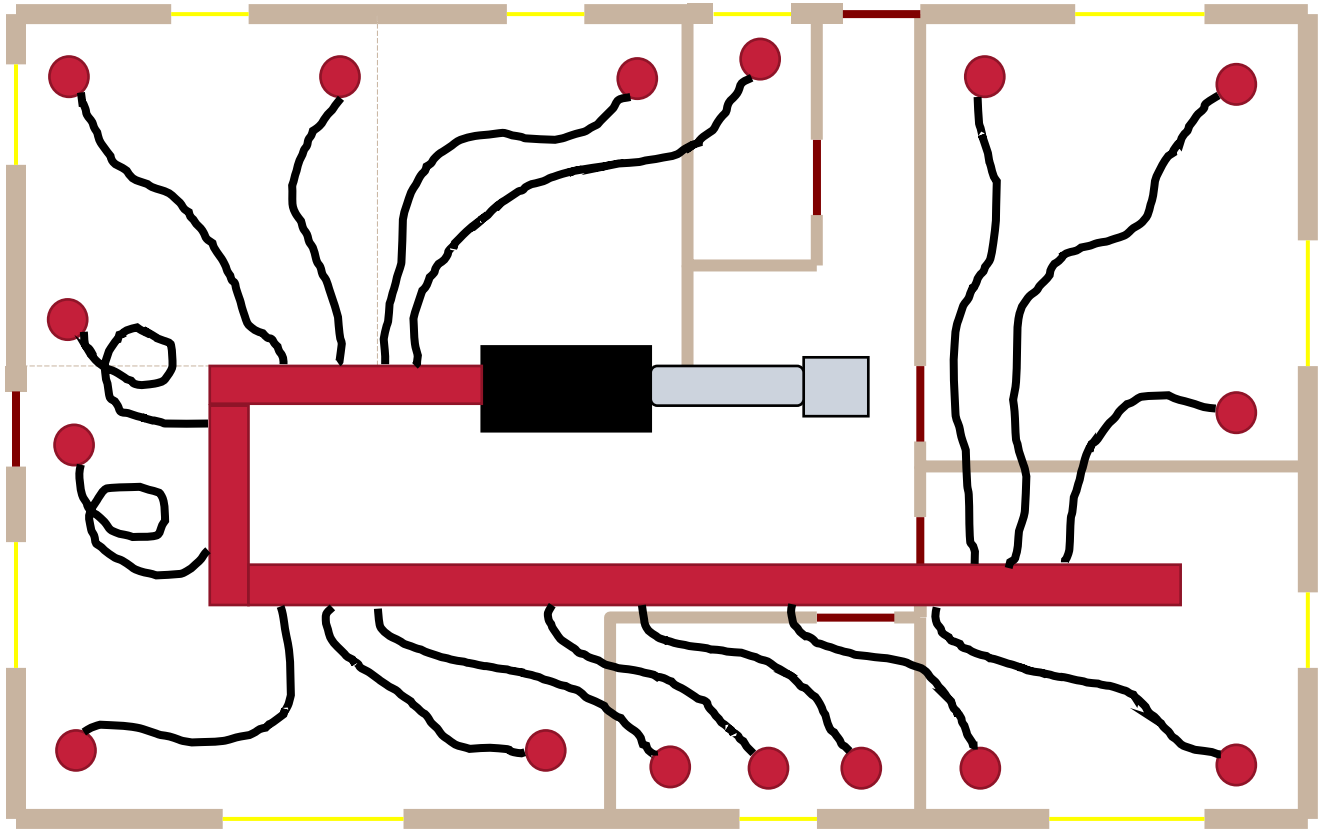
5,000 Btuh Cooling
÷ 2,000 = 2.5

How Many outlets ?

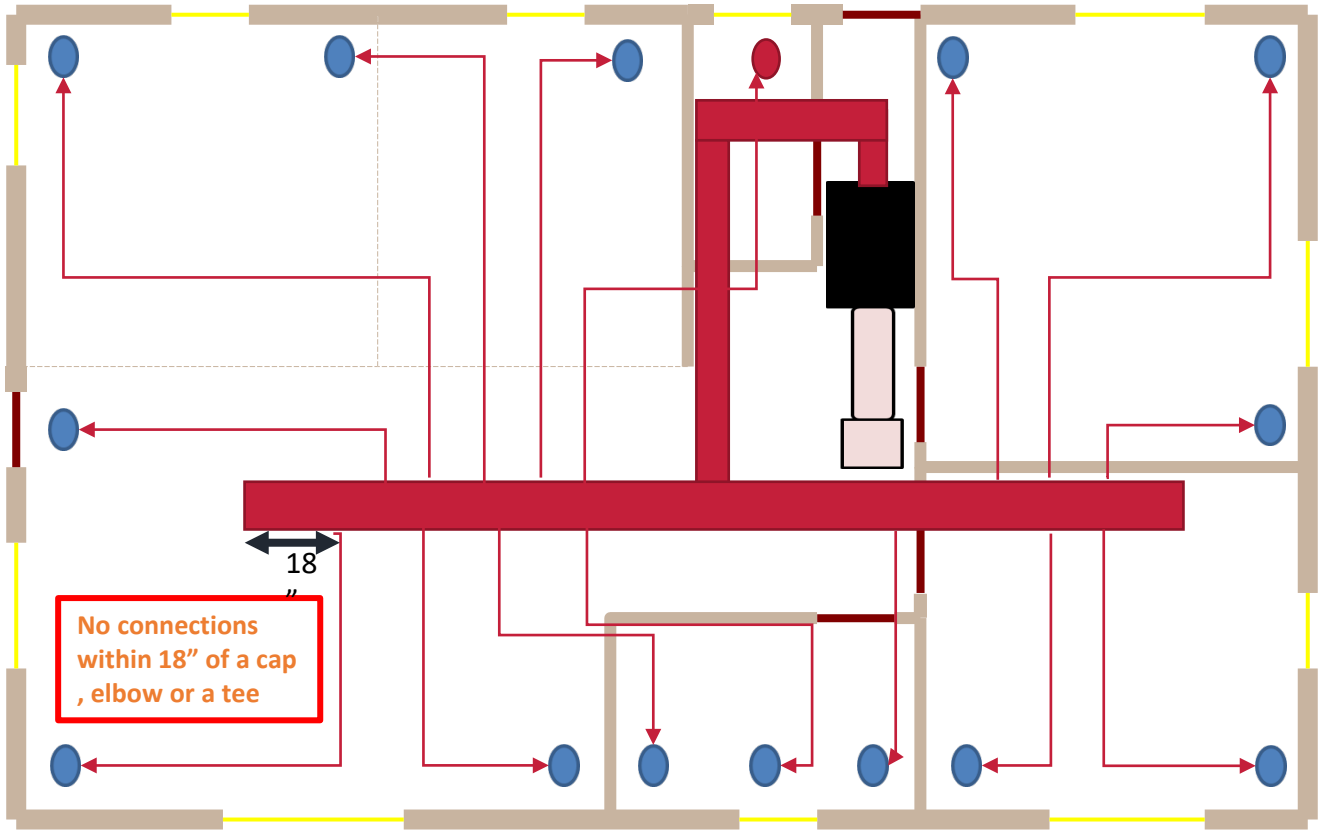
4 Outlets

- Dining Room 1, Bathroom 1, Master Bed 3, Guest Bed 2, Office 3, Living Room 5
- Our Largest Load is the Heating Load of 45,700 BTUH ÷ 3000 = 15.2 outlets.
- The unit we would use is an ESP-3642JH4MB DX FAN COIL combined with a 2.5-ton Condenser, add an AC-WPAK-90 Hydronic Coil requiring 16 Outlets we have 19 so your good to go !

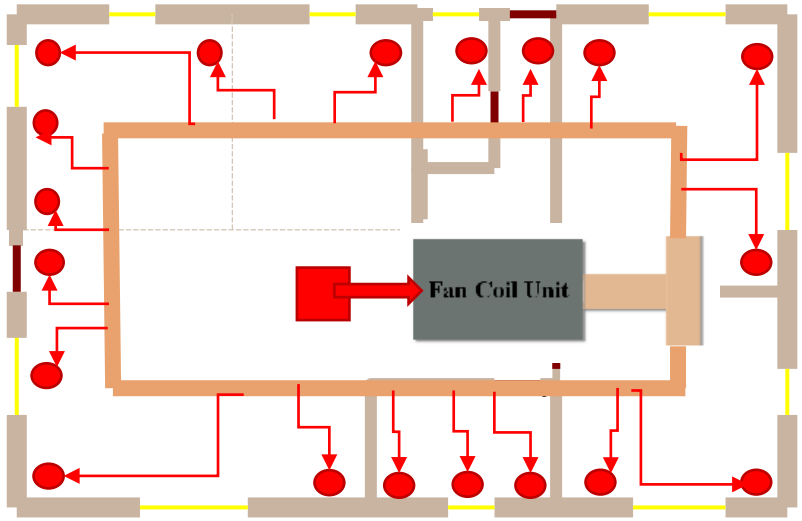
The Shotgun Duct System



The Shotgun with a Tee (be sure to follow the “TEE” rules)



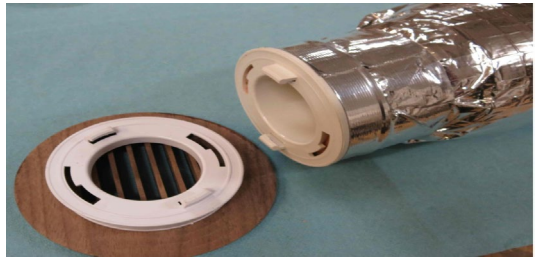
Perimeter Loop

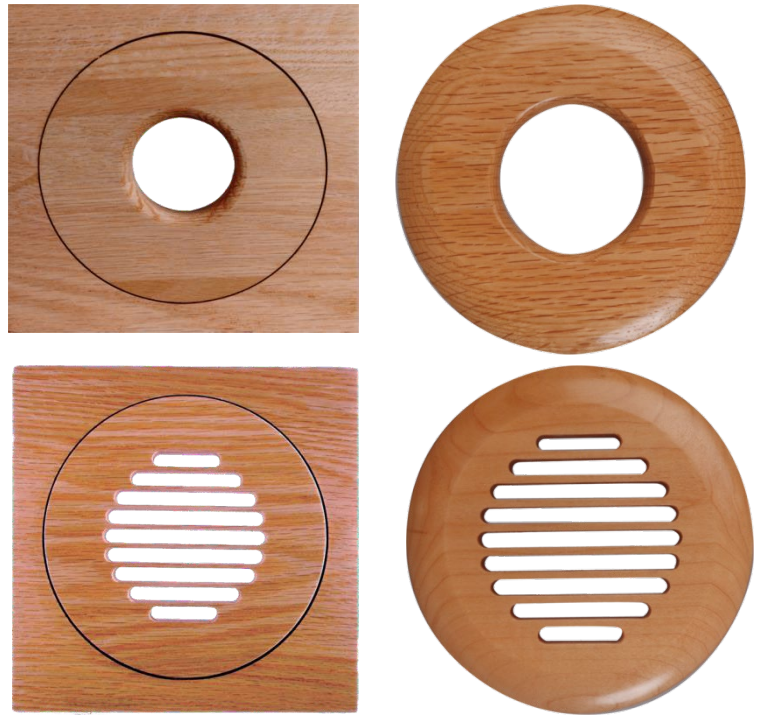


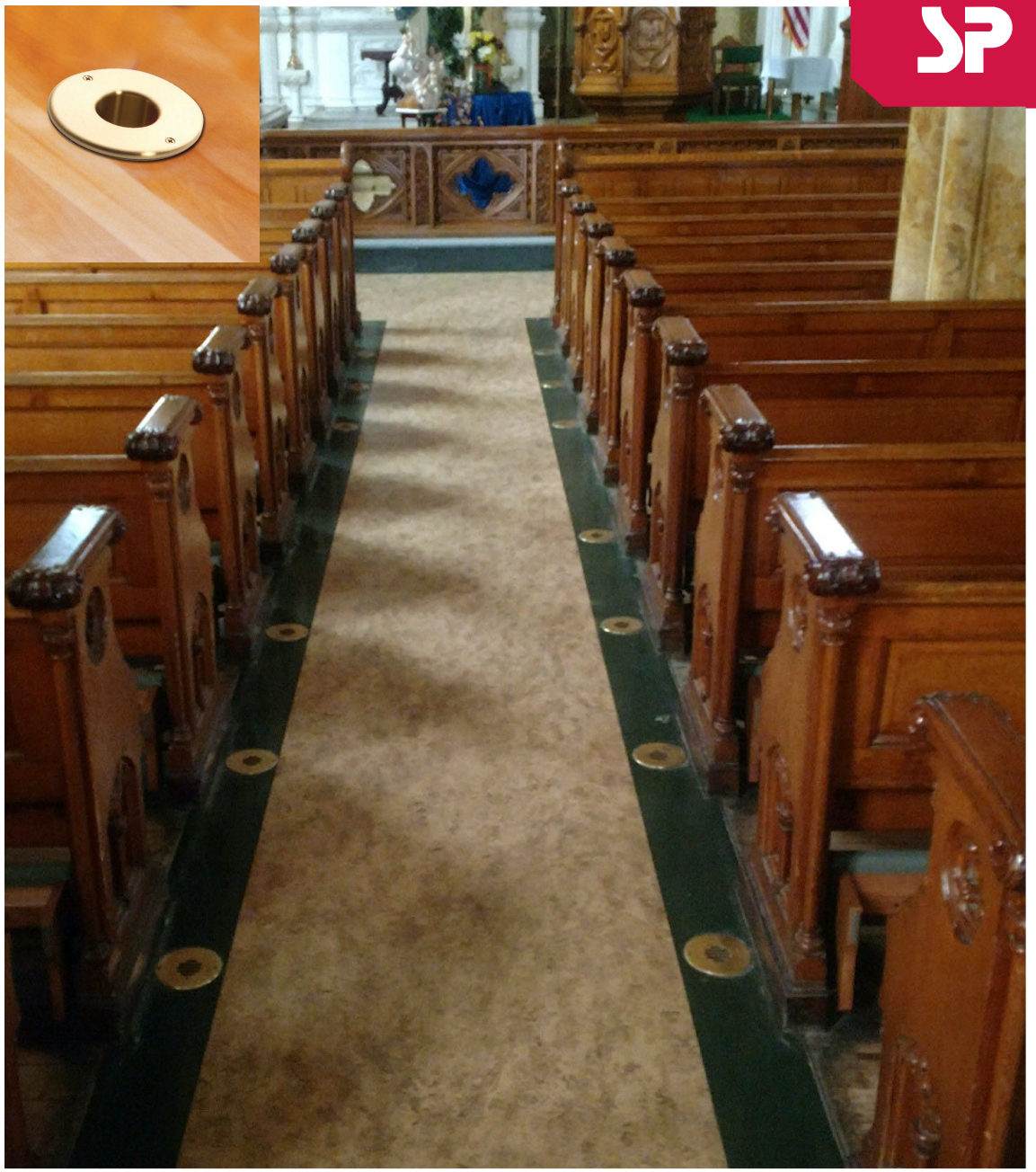
Layout with a centrally located return, this system would need no “extra balancing” based on our load calculations and duct design chosen.

Note: Since this is a heating and cooling system resulting in being slightly oversized for one setting you can use the variable speed blower to ensure the air flow match and btu delivery without the concern of unwanted noise.

Supply Outlets and Terminations



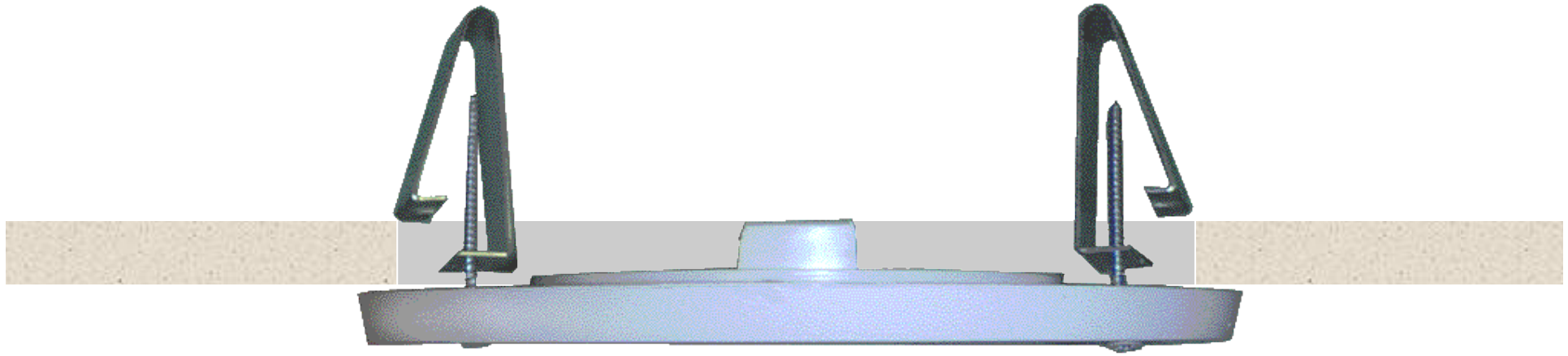




Outlets

When installing in a standard sheetrock ceiling be sure to use a 4” hole saw other ceiling and floor material may require a slightly different installation processes.

Installation of termination plate and mounting clips



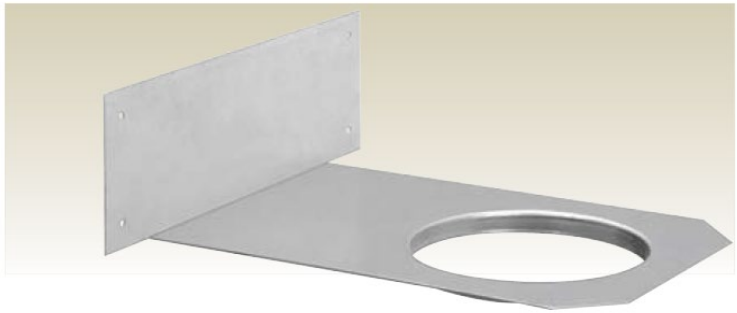
- The sound attenuator is usually attached to the termination plate at this time
- Altering the clips or hole size may be required in some applications for proper fastening as different installations may require adjustments - this is all considered ok as long as you are not restricting air flow (should not have any effect on system performance)

Additional Installation Parts

KWIK CONNECT WALL ELBOW

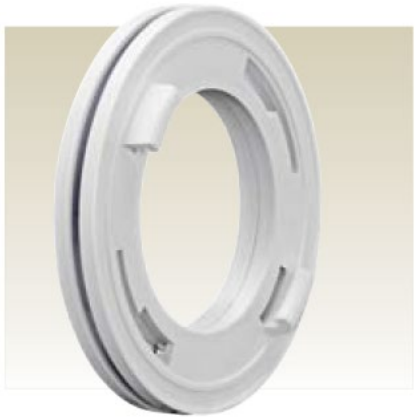
Kwik Connect wall elbows simply snap into place for fast, easy installation.

ROUGH-IN BRACKET



Serves as a reference point for sheetrock outlet locations during the framing portion of new construction.

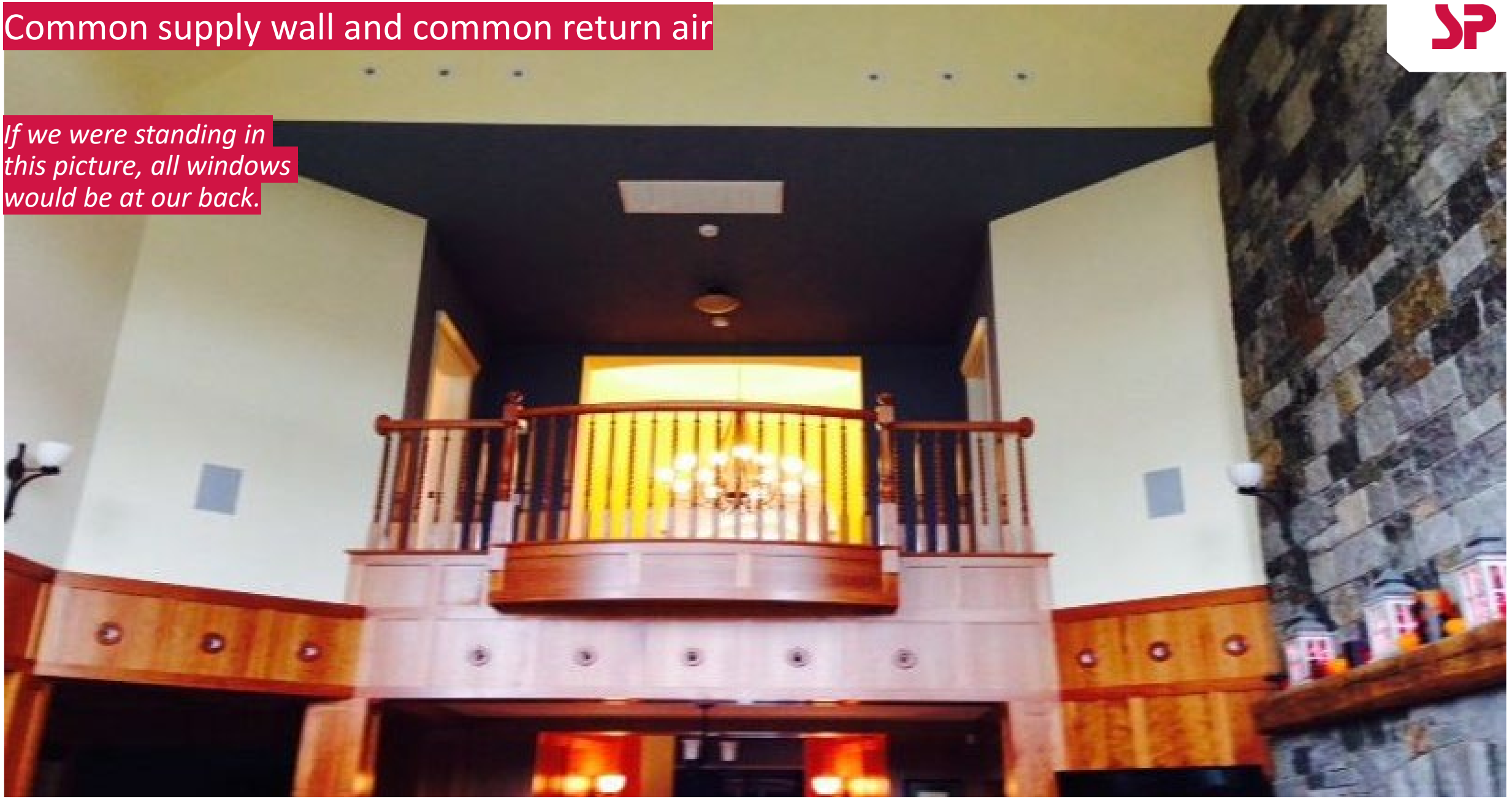
KWIK CONNECT EXTENSION



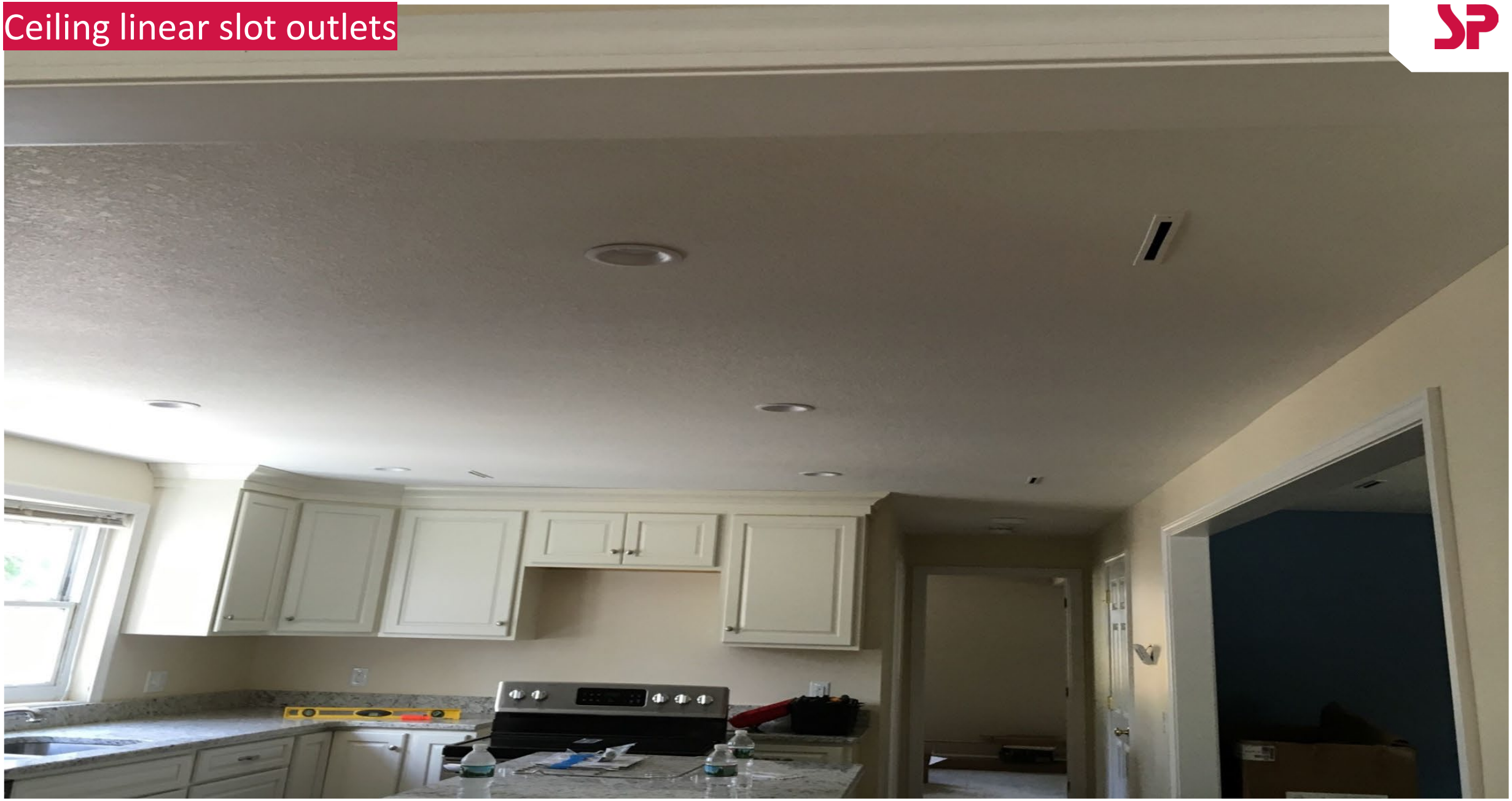
Designed for installations using wall thicknesses above 1/2".

Common supply wall and common return air

If we were standing in this picture, all windows would be at our back.



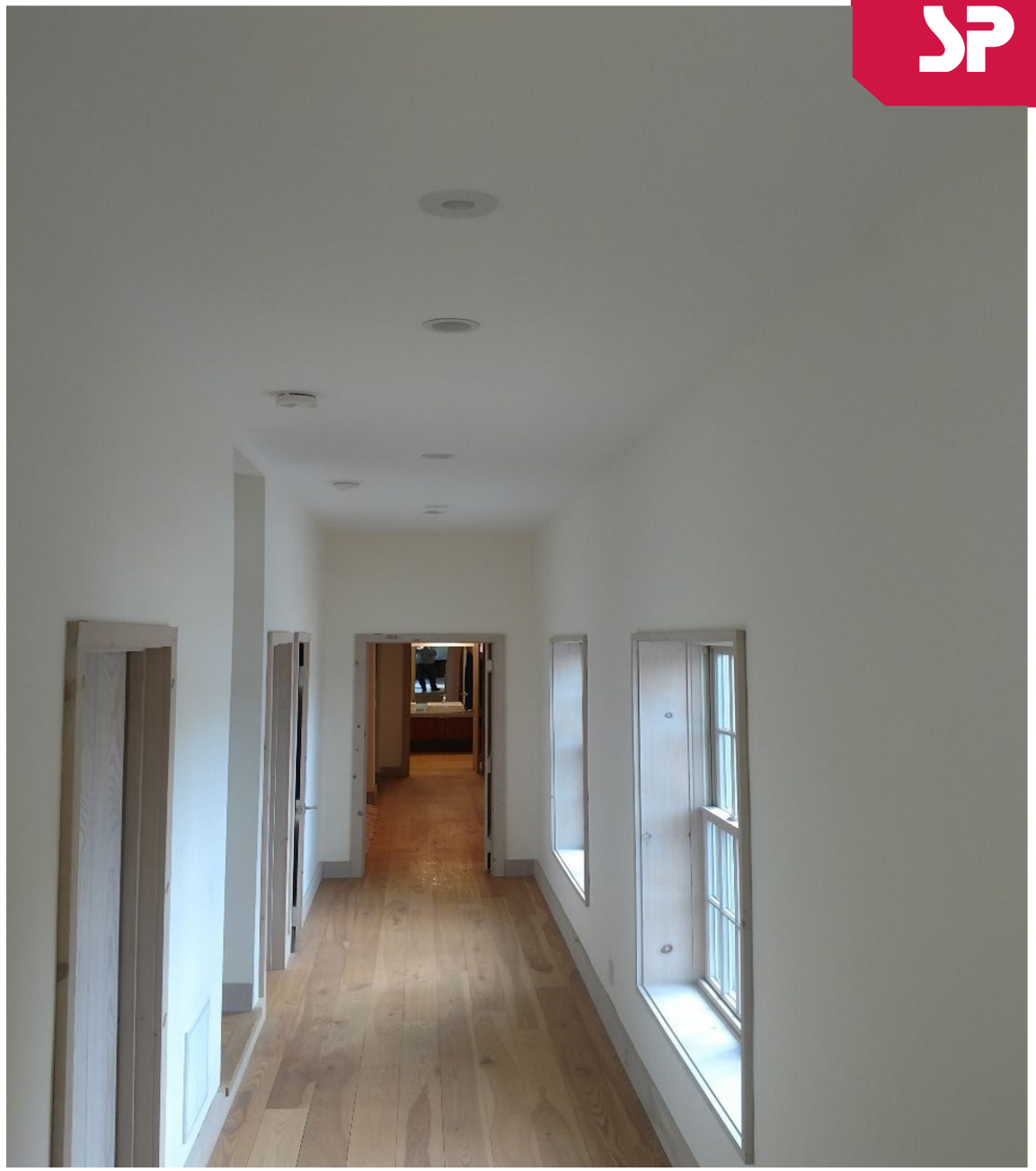
Ceiling linear slot outlets



APPLICATION

Hallway Ceiling Installation

- Notice the best place for outlet termination is in the center of the hall
- Rough-in plates were used in this installation to ensure proper locations



Side wall outlets

Ceiling outlets

9 - 10 runs per ton were used in this installation to ensure that air noise would not be an issue due to the lack of natural sound deadening material (full carpets, low ceilings, etc.).

Exterior wall outlets

The main trunk was rectangle and located in the floor.

The supplies were run up the outside walls between the windows and out creating a thermal curtain.

This rooms cooling load was 42,000 btu.

No termination plates

The cabinet maker made holes and the contractor attached to the back of the top plate. Notice the slight angle to the top plate. This will allow the air to travel under the timbers and across the room.

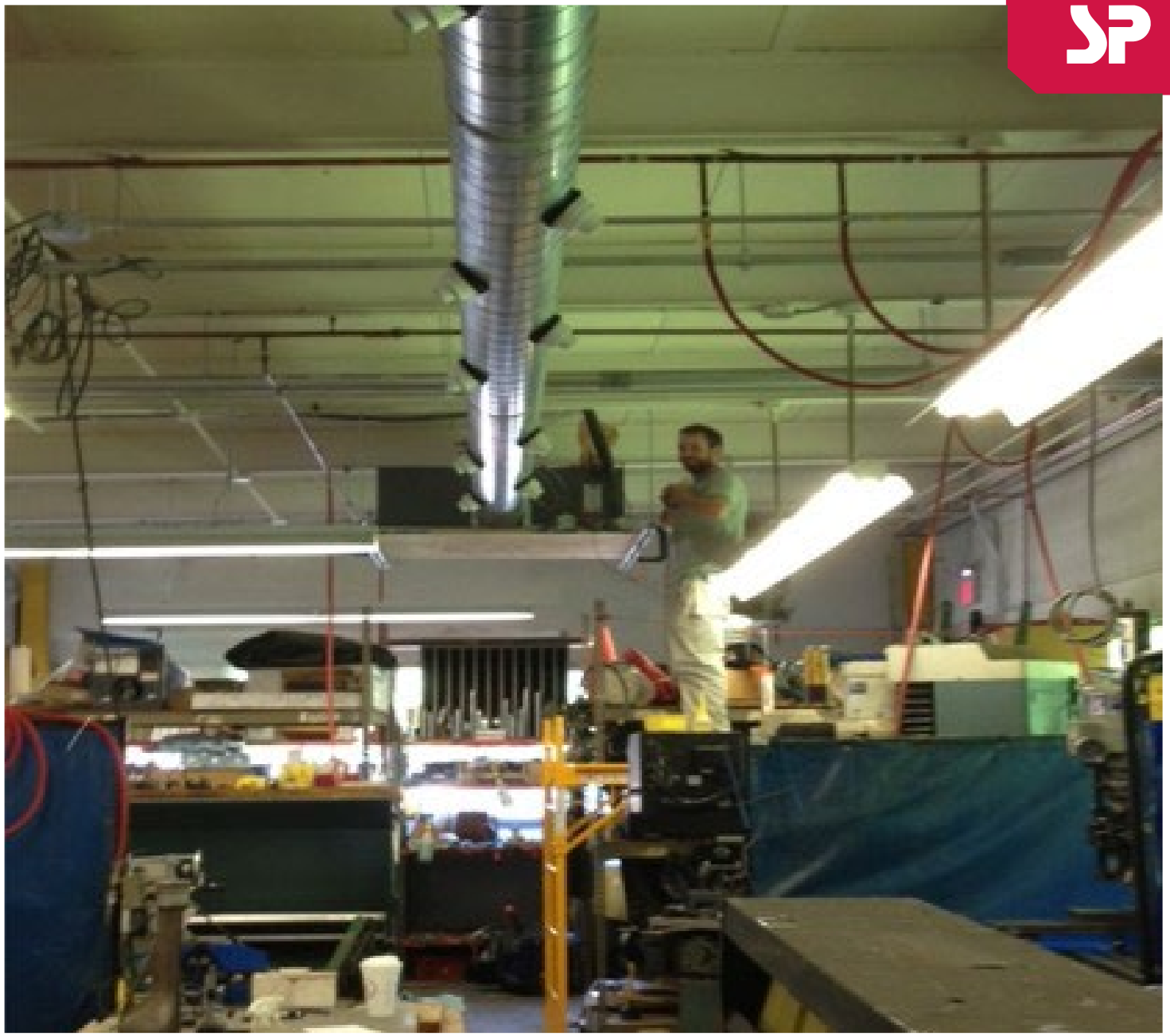
APPLICATION

Spot Conditioning

Great for

- areas where it would be financially exhausting to condition the entire space
- kitchen prep lines
- Assembly lines

- Gives a great commercial look
- You can run fewer outlets per ton due to the loss of restriction applied by the normally installed supply tubing
- Generally, 4-5 outlets per ton will work here

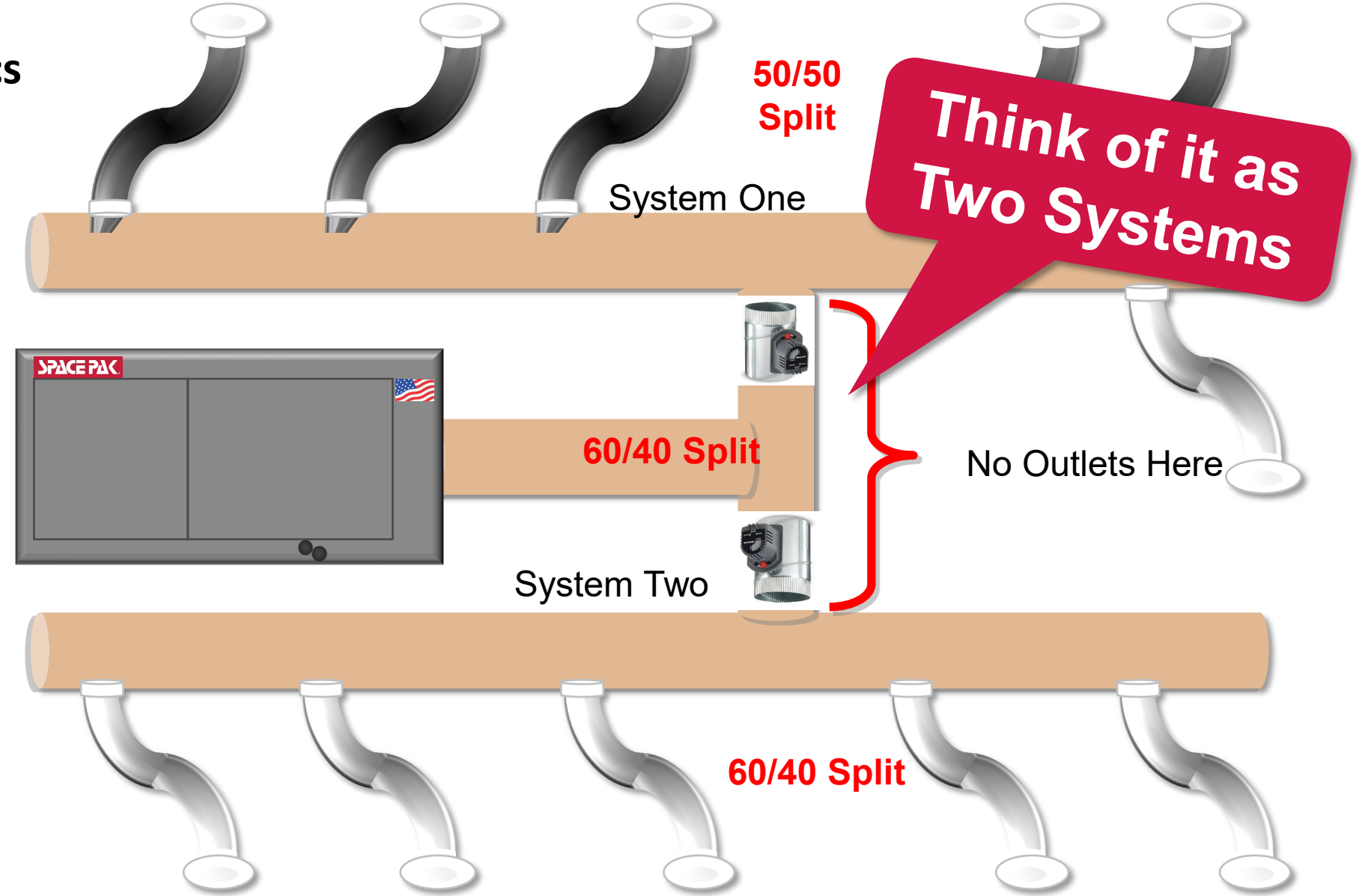


Zoning Basics

- A staged or fully inverter condenser MUST be used.
- In a multi-zone system, the smallest zone must be the same size or have a larger output than the compressor's lowest turned-down capacity.

  Example: if the inverter condenser turns down to 12,000 btu, the smallest zone must be capable of handling that one-ton capacity.
- When using multiple zones, the J Plus Control allows you to match air flow to specific system needs.
- Be sure to follow all duct design rules.
- DO NOT UNDER ANY CIRCUMSTANCES USE AN AIR BYPASS.

Zoning Basics



REMINDER

Pre-Sale Application Support Team

PreSaleSupport@SpacePak.com

Available to Representatives, Wholesalers and Contractors

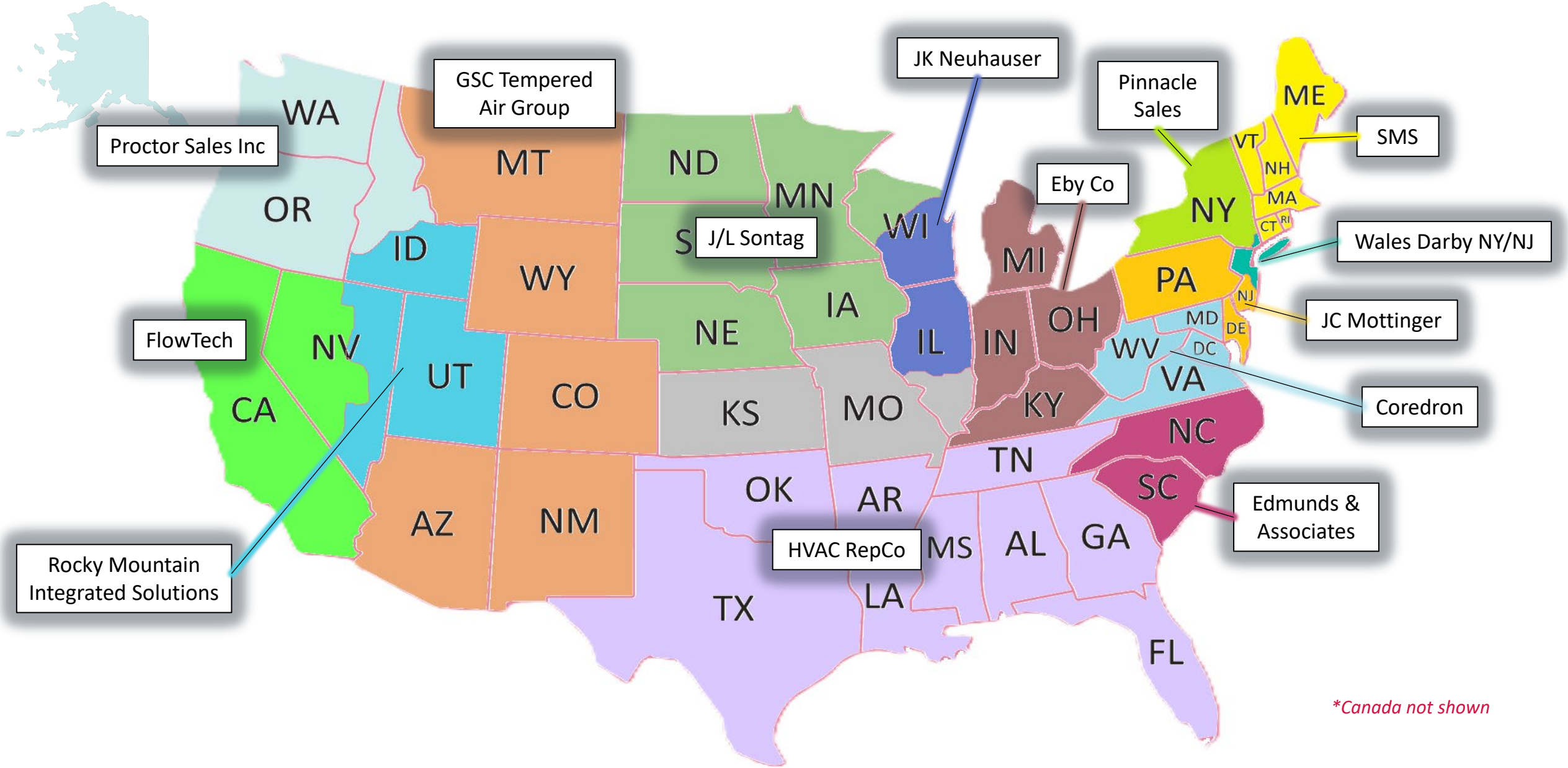
- System application support
- Equipment selection
- Load calculation and rough material list

Any questions regarding equipment already shipped should be directed to

TechnicalService@SpacePak.com (413) 564 - 5530

More questions?

www.SpacePak.com/RepLocator



**Canada not shown*

Let’s Connect

@spacepaksystem

@thespacepakjim

#spacepak #hydronics
#airtowaterheatpumps

?

Questions