ENGINEERING UPDATE

NOVEMBER 2014 - **VOLUME 16**

THIS PACKAGE INCLUDES A COLLECTION OF ARTICLES FROM VOLUME 16 OF THE NOVEMBER 2014 ENGINEERING UPDATE.

TABLE OF CONTENTS:

ENGINEERING UPDATE

November 2014 | **Vol. 16**

PRICE ALL-IN-ONE 3 – SILENCER SELECTION MADE EASY

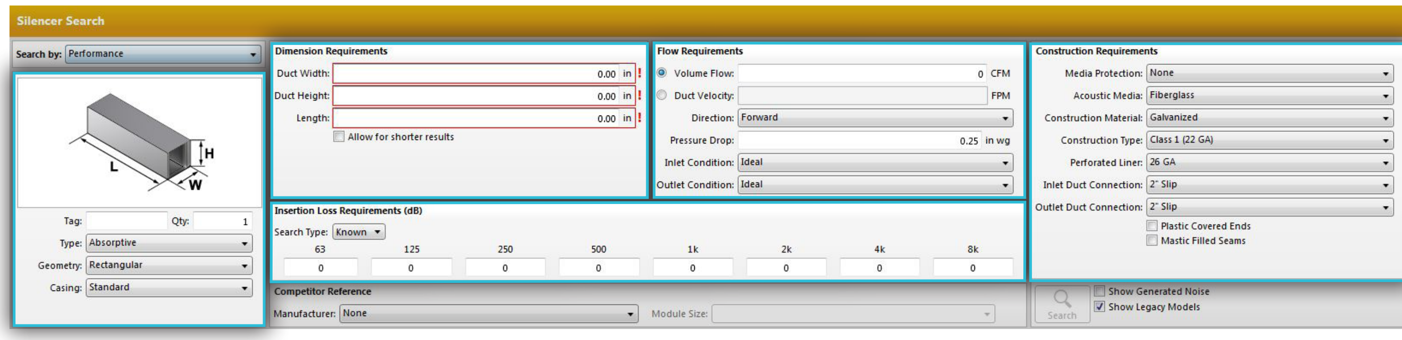

Figure 1 - Silencer Search

By Alex Michaud, MSc, INCE – Senior Product Manager, Noise Control

Price Industries is excited to offer the most intuitive and comprehensive noise control selection tool in the market. The noise control software module in All-In-One (AIO) 3 allows users to quickly change parameters during the design process. Typical project variables include airflow, pressure drop, insertion loss, and construction requirements. This article provides readers with a basic understanding of what to look for and consider.

Five major design parameters included in the main noise control selection view are each highlighted in **Figure 1** and discussed in further detail in this article.

SILENCER TYPE

Price AIO software allows for all types of silencer selection (rectangular, elbow, circular, absorptive, film-lined, etc.) depending on project requirements. In most cases, the designer knows where the silencer will fit since they are driven by ductwork layouts. **Figure 2** depicts the silencer type window for a typical packless circular elbow silencer.

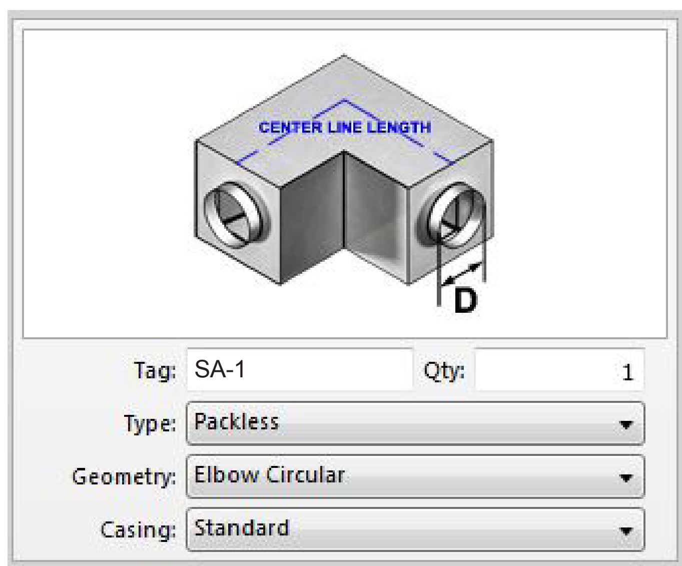

Figure 2 - Silencer type window

DIMENSION REQUIREMENTS

Figure 3 depicts typical dimensions for a rectangular silencer. AIO users can input silencer dimensions down to 0.01 inches. For projects requiring larger sizes, we typically recommend contacting your local representative or the noise control team directly. Checking the *Allow for shorter results* box will optimize silencer lengths to satisfy performance requirements. This feature is helpful for reducing costs and/or addressing duct layout constraints.

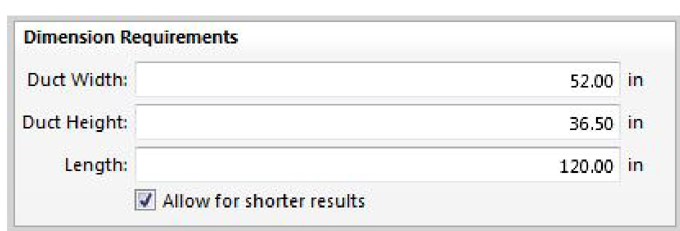

Figure 3 - Dimension requirements window

FLOW REQUIREMENTS

Figure 4 depicts various flow conditions that AIO users can modify (not all values need to be entered to obtain silencer results). We recommend entering as much information as possible to obtain the most accurate selections and reduce surprises later on.

Volume flow and duct velocity automatically update each other. Airflow direction is important to input since it affects the silencer insertion loss. Inlet and outlet conditions are incredibly important to consider since many project conditions do not provide the recommended three to five unobstructed duct diameters upstream and downstream of silencers. These non-ideal connections are common and can greatly increase the resulting system effect pressure drop. Outlet conditions that the AIO noise control module considers are depicted in **Figure 4** (based on the 2011 ASHRAE Applications Handbook Chapter 48.26, Table 27).

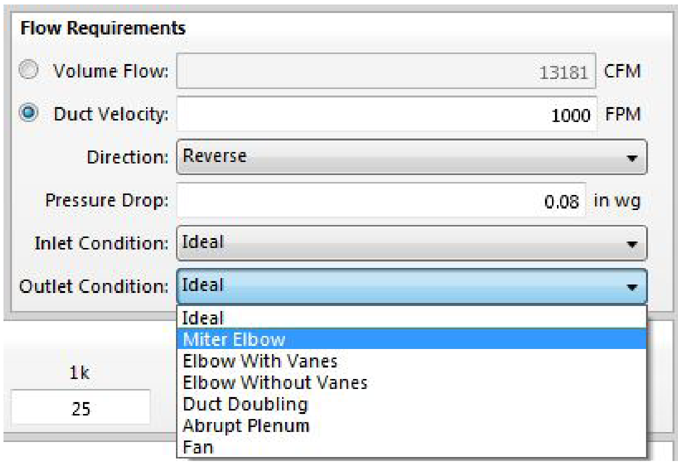

Figure 4 - Flow requirements window

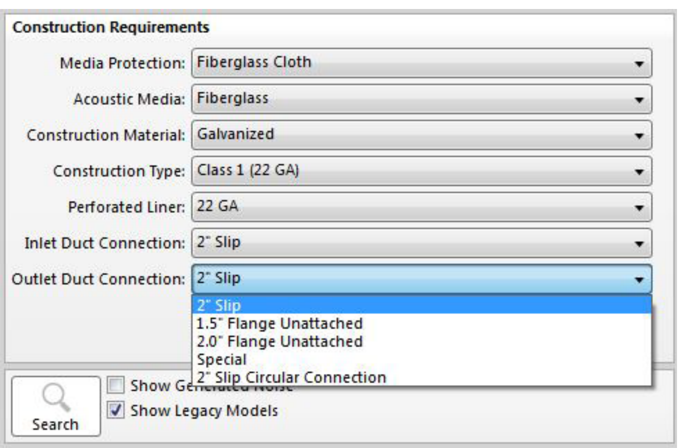

Figure 5 - Construction requirements window

CONSTRUCTION REQUIREMENTS

Figure 5 depicts various construction requirements. While these have a minimal impact on silencer performance, they can greatly impact cost and installation. The default casing construction is Class 1 (22 GA), but the AIO software allows for heavier options down to 10 GA. Inlet and outlet duct connections are important to consider. In most cases, slip connections are acceptable but in some applications flanges are more appropriate.

INSERTION LOSS REQUIREMENTS

If insertion loss values are known, they can be entered between 0 and 55 dB (see **Figure 6**). If insertion loss requirements are unknown, the low- or mid-frequency bands can be optimized in the 63-125 Hz or 250-1,000 Hz ranges by changing the search type. For many projects, the noise control requirements are driven by two to three octave bands typically in the lower frequency bands (63-250 Hz).

At a minimum, the dimensions and basic flow requirements should be established before selecting a silencer. Other variables are not always needed, but will improve silencer search result accuracy. Once input variables are defined, the user simply clicks the search button and appropriate silencers are listed based on insertion loss, pressure drop, and cost. Silencer selections and tags can be saved and a schedule can be created quickly. AIO also allows for the creation of submittals and schedules in both PDF and Excel formats. Most importantly, AIO files can be saved and easily shared or updated as needed during the project.

We hope this provided some basic context for silencer selection and encourage you to explore and download AIO at www.priceindustries.com/software/all-in-one. If you have any questions related to noise control, please contact our team at **noisecontrol**@priceindustries.com.

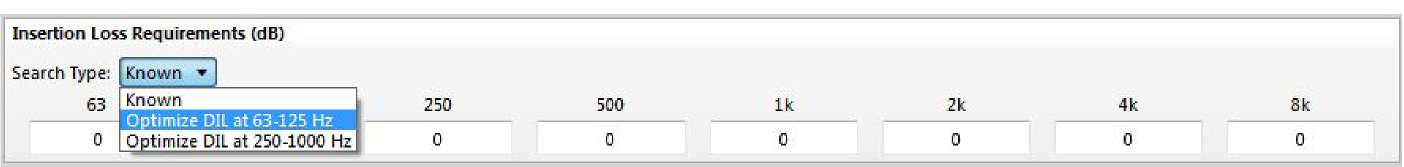

Figure 6 - Insertion loss requirements window

ENGINEERING UPDATE

November 2014 | **Vol. 16**

PRODUCT FEATURE: REDUCE OPERATING COSTS WITH NEW HIGH-EFFICIENCY FURNACES

By Wade Link – Custom Air Handling Units Product Manager, Price Mechanical

Price's new line of high-efficiency indirect fired gas heating products meets the goals of all good building designs by reducing operating costs and minimizing environmental impact. Almost all commercial style heating systems burn natural gas to generate heat. Typically, the most energy-intense unit in the HVAC system is the make-up air unit which uses as much as five times the natural gas of a standard unit. While plentiful, the cost of natural gas is rising. Even though natural gas burns twice as clean as coal and other fossil fuels, it still contributes to climate change through CO_2 emissions. The challenge is to improve the gas heating efficiency which will reduce operating costs and environmental impact.

THE SOLUTION

Price's new line of high-efficiency indirect fired units can help reduce operating costs by 11% with a less than two-year payback, as demonstrated by a project in Chicago (data in **Table 1**). Traditional gas fired units are only 80% efficient, meaning 20% of available energy in the natural gas and 20 cents of every dollar are going up the vent stack. The stack temperature on a traditional unit can be over 500°F – that's wasted heat that's not available for the building along with higher CO_2 emissions that lead to climate change.

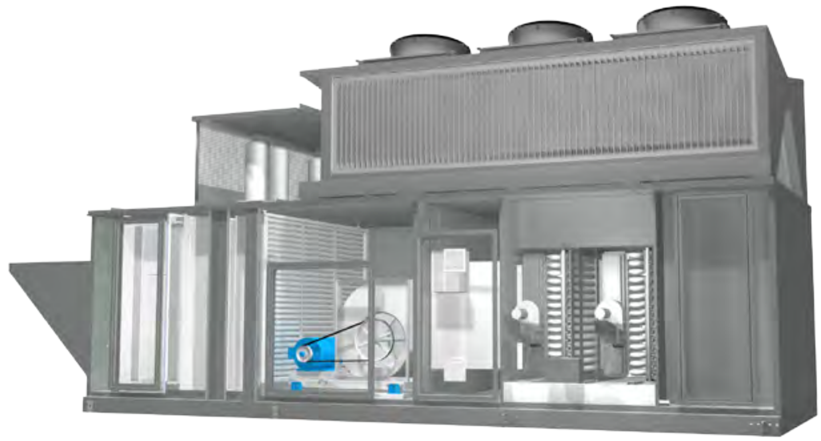

Figure 1 - New Price PMI-IF-H high-efficiency model.

Figure 2 - 90% efficient furnace for the PMI-IF-H unit.

The Price line of high-efficiency units have an impressive stack temperature of only 100°F and they are 90% efficient, so almost all of the heat released during combustion is used in the building.

PMI-IF-H HIGH-EFFICIENCY UNITS

At the heart of the high-efficiency unit is the new indirect fired convoluted tube furnace. The furnace includes a specially designed heat exchanger to extract as much of the heat from combustion as possible and transfer it to the supply airstream. The furnace is constructed from stainless steel and other corrosion-resistant materials to provide reliability and longevity.

INDIRECT FIRED DESIGN

The furnace is indirect fired, meaning no products of combustion enter the supply air. This helps maintain good indoor air quality. The burners are modulating which also allows for great temperature control and comfort.

The 90% efficient furnace can be used in Price's custom rooftop unit platform, allowing almost any configuration of components and variable geometry. For more information, please visit www.priceindustries.com or contact your local sales representative.

Temperature Range		Number of Occurrences	Heat Load		PMI-IF-S – 80% Efficient			PMI-IF-H – 90% Efficient		
					Gas Usage		Cost	Gas Usage		Cost
°F	°C	Hr	Btu/h	W/h	CFH	(m³/h)	$	CFH	(m³/h)	$
70-75	(21.1-23.9)	658	27,125	7,950	33	0.9	$109	29	0.8	$97
65-70	(18.3-21.1)	594	81,375	23,851	99	2.8	$295	88	2.5	$262
60-65	(15.6-18.3)	886	135,625	39,752	165	4.7	$733	147	4.2	$651
55-60	(12.8-15.6)	586	189,875	55,652	232	6.6	$678	206	5.8	$603
50-55	(10-12.8)	601	244,125	71,553	298	8.4	$ 895	265	7.5	$795
45-50	(7.2-10)	603	298,375	87,454	364	10.3	$1,097	323	9.2	$975
40-45	(4.4-7.2)	455	352,625	103,354	430	12.2	$978	382	10.8	$870
35-40	(1.7-4.4)	925	406,875	119,255	496	14.0	$2,295	441	12.5	$2,040
30-35	(-1.1-1.7)	814	461,125	135,156	562	15.9	$2,289	500	14.1	$2,034
25-30	(-3.9-[-1.1])	582	515,375	151,056	629	17.8	$1,829	559	15.8	$1,626
20-25	(-6.6-[-3.9])	314	569,625	166,957	695	19.7	$1,091	617	17.5	$969
15-20	(-9.4-[-6.6])	334	623,875	182,858	761	21.5	$1,271	676	19.1	$1,129
10-15	(-12.2-[-9.4])	127	678,125	198,758	827	23.4	$525	735	20.8	$467
5-10	(-15-[-12.2])	75	732,375	214,659	893	25.3	$335	794	22.5	$298
0-5	(-17.8-[-15])	57	786,625	230,560	959	27.1	$273	853	24.1	$243
-5-0	(-20.6-[-17.8])	31	840,875	246,460	1025	29.0	$159	912	25.8	$141
-10-(-5)	(-23.3-[-20.6])	28	895,125	262,361	1092	30.9	$153	970	27.5	$136

Table 1 - Gas Heat Savings

ENGINEERING UPDATE

November 2014 | **Vol. 16**

TECH TIP: CHANGES IN PRODUCT SELECTIONS TO MEET ASHRAE 90.1 STANDARDS

By Jerry Sipes, Ph.D., P.E.
– Vice President of Engineering

ASHRAE Standard 90.1, *Energy Standard for Buildings Except Low-Rise Residential Buildings*, is a document that is in a state of continuous maintenance. That means changes to the standard are ongoing, and addendum are submitted for public review and approval on a frequent basis. Since the 2004 version, there have been three additional printed/complete versions (2007, 2010, and 2013) where all the addendum that have gone through the public review process and have been approved are added to the prior release.

For example, between the 2007 version and the 2010 version there were over 100 approved addenda, 52 of which affect mechanical systems. A previous Price Tech Tip discussed the individual state implementation of the various versions of ASHRAE 90.1. This article will provide some guidance as to changes in selection of Price products to meet the requirements of ASHRAE 90.1-2010. A separate white paper detailing all the addendum/changes, *ASHRAE 90.1 Changes in the 2007 Version to the 2010 Version*, is available on the Price website.

CHANGES IN EQUIPMENT EFFICIENCY REQUIREMENTS

Air Volume Regulation

There is a requirement for all fan coil and air handling equipment with motors ≥ 5 HP to have either two-speed motors or variable-speed drives. At cooling demands of 50% or less than design, the air volume will be reduced to either half of the full fan speed or the air volume that will meet the ventilation requirements of ASHRAE 62.1. This primarily impacts our blower coils due to the motor size, however, the ability to vary the fan air volume is available on all of our fan products that use the electrically commutated motor (ECM) technology.

Discharge air temperature sensors may be required. This is due to the potential for high discharge air temperatures when providing reheat, as the air volume has been reduced. When electric reheat is selected, the first stage of heat should be sized by:

kW=(minimum airflow volume) / 70

Sizing electric reheat using the above formula will prevent hot spots from forming which can then cause the thermal limits to trip.

A common mistake made by new design engineers when selecting a two-stage electric heater is to divide the total kW by two. Since the reheat should start when the air volume is at the minimum cooling airflow, airflow volume should be divided by 70 to select the first stage of electric reheat.

If more than two stages of reheat are used, then the other stages should be selected based on the volume of supply air at the point of engaging the heater stage contactor. It may be that a simple analysis will show that our solid state electric heater control with discharge air temperature is a more economical selection and is very specifiable.

Motors and Transformers

Our motors and transformers meet the federal requirements outlined in the 2010 and 2013 versions of ASHRAE 90.1.

CHANGES IN SYSTEM CONTROL AND DESIGN REQUIREMENTS

Outside Air

Demand Control Ventilation

The 2010 version of ASHRAE 90.1 calls for zones with more than 40 occupants per 1,000 square feet to design using demand control ventilation. Our terminal controls have CO_2 sensors as an option, which would allow the local zone level sensing for demand control ventilation. One consideration is the minimum airflow when the zone is unoccupied but still requiring the base ventilation of outside air per square foot. The minimum volume of air may be lower than some terminal flow sensors can resolve. Our Price Intelligent Controller has a low-flow option that works very well for this scenario.

Airside

Overhead Heating with Supply Air

Where reheating is permitted by 90.1, zones that have both the supply and return air openings greater than six feet above the floor shall not supply heating air more than 20°F above the space temperature set point. Price terminals with reheat can use our discharge air temperature control technology to meet this requirement.

Dual Maximum Control on VAV Boxes

Addendum H was geared towards zones using direct digital controls. It is intended to take advantage of the energy-saving potential that direct digital controls offer when controlling the air volume and reheat. It establishes the heating maximum airflow volume to no more than 50% of the cooling airflow volume when it is modulated from the 20% minimum. See **Figure 1**.

This addendum allows the reheat airflow to increase from 20% to 50% when the reheat starts at the low end of the thermostat dead band. Most designers have been using a turndown of 30% before reheat would be started. This is somewhat concerning due to the potential for electric reheat to trip on the thermals or to provide air temperatures in excess of 20°F above the space temperature set point. The discharge air temperature control on our terminals with electric heat avoid this issue as the discharge air temperature is regulated to be no more than a specified amount.

VAV Control on Lab Exhaust

Hospitals and laboratories are now no longer exempt from the VAV requirement for spaces that don't require pressure control. Price has many different terminal and controls solutions that meet these needs. In particular, the Price Venturi Valves with Price Critical Controls should be considered.

Duct Leakage

For ductwork, the duct leakage is now required to be seal class A.

Seal Class A: A ductwork sealing category that requires sealing all transverse joints, longitudinal seams, and duct wall penetrations. Duct wall penetrations are openings made by pipes, holes, conduit, tie rods, or wires. Longitudinal seams are joints oriented in the direction of airflow. Transverse joints are connections of two duct sections oriented perpendicular to airflow.

- Openings for rotating shafts shall be sealed with bushings or other devices that seal off air leakage (standard on our terminal units).
- Pressure sensitive tape shall not be used as the primary sealant unless it is certified to comply with UL-181A or UL-181B and the tape is used in accordance with that certification (we comply as we don't use pressure sensitive tape).
- All connections shall be sealed. When terminals are ordered with the LLC option, we provide low-leakage construction and seal all appropriate leakage sites. For more information on this option, please see our leakage terminal options on page F-58 of the Price Catalog version 7.

Waterside

Radiant Panels

Radiant panels transfer heat (cooling or heating) via radiation from the room-side face of the panel. The back side of the panel may be exposed to spaces that may be unconditioned. A study showed that increasing the insulation thickness beyond the R-3.5 (from 1 in. to 4 in. thickness) had a minimal impact on the life-cycle cost of the application. As a result, radiant panels now require the non-occupied room side of the panel to be insulated with a minimum of R-3.5. This is a standard option of the Price radiant panels.

For more information on the changes between the 2007 and 2010 versions of ASHRAE 90.1, see the standards page on www.ashrae.org.
For assistance in selecting Price products, please contact our application engineering group.

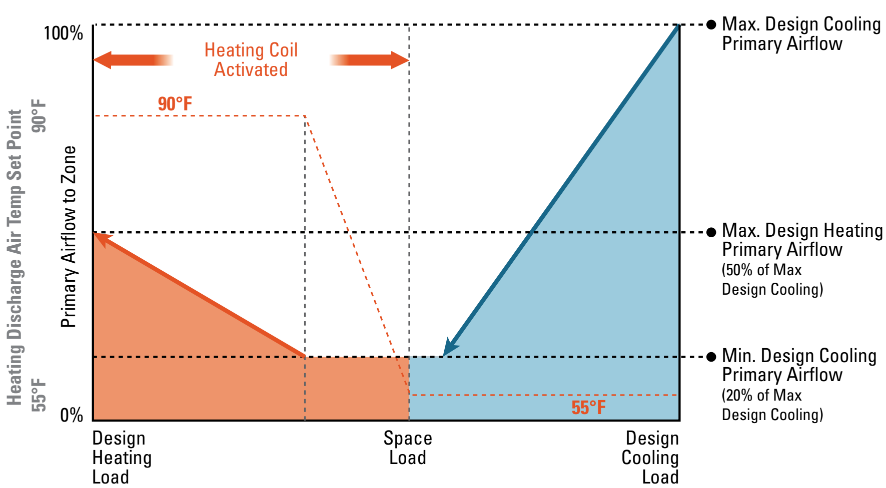

Figure 1 - Dual maximum control for zone