

ENGINEERING

S Y S T E M S O L U T I O N S

WELCOME

Welcome to the first issue of *Engineering System Solutions*, a newsletter from McQuay written specifically for the engineering community.

Engineering System Solutions will contain commentaries, product updates, research findings and other information of value to consulting/specifying engineers.

Our feature article for this issue, "System Flexibility and ROI," is intended to give you background information on McQuay's mission to provide semi-custom system solutions for commercial HVAC applications. Future articles will focus on the specifics of this mission.

Engineering System Solutions will be produced and mailed to you. It will also be available on our website at www.mcquay.com.

Because we want this newsletter to be a truly informative and valuable tool, we will always welcome your comments, feedback and article suggestions. Please let us know what you think – and what you would like – at any time.

Dave Laurenz
Director of Sales
McQuay International

System Flexibility and ROI: *Adding Value to Commercial HVAC Applications*

In the eighth century, a caliph in Baghdad ordered snow to be packed between his walls to help cool his villa during the scorching summer months. Engineering science may have advanced considerably since then, but little has changed as far as what the caliph was looking for nearly 1200 years ago. Royalty or otherwise, individuals are demanding – more so than ever – HVAC solutions that are customized to their own, specific needs.

In today's world, however, "customized" solutions involve much more than indoor comfort. Increasingly, building owners and managers are thinking in terms of the overall quality of indoor environments – whereby IAQ, acoustics, and other elements must be considered in addition to the traditional temperature control features associated with HVAC systems.

The reason for this can be derived from simple economics. By now, you've probably heard the saying that people (or employees) cost ten times as much as building operating costs, and 100 times as much as utilities. Therefore, keeping employees or tenants satisfied makes good economic sense. When you add the risk of

litigation and potential healthcare costs, it becomes even clearer.

However, from the consulting and design engineer's perspective, it is not enough to create systems that reflect high quality indoor environment standards. In the vast majority of cases, systems must also be specified within tight space constraints, and with greater energy efficiency – all while satisfying the owner's demands to keep costs low.

See "Flexible Systems, Satisfied Customers" next page.

IN THIS ISSUE

- Welcome 1
- System Flexibility and ROI 1
- Flexible Systems,
Satisfied Customers 2
- Taking Advantage
of Flexibility 2
- Ventilation and
Rooftop Systems 3
- SuperMod™ High
Turndown Gas Burner 3

Flexible Systems, *Satisfied Customers*

From an HVAC equipment perspective, flexibility has become an imperative for design and consulting engineers with the ultimate goal of maintaining customer satisfaction over the long term. For McQuay, this has meant providing not only the ability to select between Rooftop, Air Handler and Chiller, Vertical Self-Contained, or Terminal Air Conditioning systems, but also the ability to customize the various components within these systems. This flexibility includes but is not limited to the following:

- Units that can be specified in a wide range of sizes, and with a wide variety of options that provide engineers with the ability to choose a packaged solution that is customized to the requirements of the job.
- Interior units that offer simplified teardown and buildup options, and multiple configurations to minimize the space requirement for tight squeezes in new and retrofit applications.
- Units that are interoperable, providing the ability to work within existing HVAC systems as well as other, possibly diverse components of the building's automation system.
- Advanced technology products, such as specialized software, that allow engineers to more effectively analyze the requirements and range of choices for a system before it is installed.

Regardless of the magnitude of the job, every HVAC system must satisfy local standards and requirements. As a result, theoretical performance and efficiencies can be meaningless if the real-world scenario will not accommodate them.

Taking advantage of flexibility can allow the engineer to meet building efficiency and performance requirements in a tighter package. While the initial product cost may not always be the least, the end result will be both a short- and long-term improvement in a system's ROI in terms of energy efficiency, installed and operating costs, and tenant satisfaction. From the

design and specifying engineer's specific point of view, the ROI is:

- **Less Design Work**
A wide range of packaged, customized solutions can eliminate the need for sub-components and the ancillary equipment needed to support them. For example, providing ancillary sound attenuation, filtration, or tempering equipment and a number of other add-ons may be difficult from a design perspective, and expensive if the system is not flexible enough to accommodate the additions from the very beginning.
- **Lower Installed Costs**
Flexible, tightly packaged products can also provide less components to install, thereby lowering first costs

and improving relationships with contractors and building owners.

- **Lower Life-Cycle Costs**
The less components to maintain, and the more these components are optimized to the application, the lower the operating and maintenance costs will be. From the design engineer to the building owner, the benefits are clear to everyone who is in some way responsible for the HVAC system.

Like the caliph who used snow to cool his building in ancient Baghdad, customers today still want to take advantage of the best resources and technologies available to achieve their desired levels of comfort. Flexibility gives the design and consulting engineers of today the power to do so. ■

Taking Advantage of Flexibility

While flexibility can be the design and consulting engineer's best ally in providing HVAC solutions, it can also add complexity to the initial design and specification process. This is where your local McQuay representative is available to assist you. In addition, technology is available to simplify the overall selection process for customized HVAC solutions.

An example is the Vision™ air handler from McQuay - a customized air handler featuring a patented product platform that offers the flexibility to meet a specific project's demands for indoor air quality and operating efficiency, in addition to low installation and maintenance costs. To complement the flexible design of the Vision air handler, McQuay has also released Vision SelectTOOLS™, a Windows®-based software package that allows specifying engineers to configure, size and select components within minutes. Using SelectTOOLS makes it possible to evaluate an infinite number of unit arrangements.

By prompting the user for pertinent data from all components required in the system, the program is designed to lead the engineer through the system selection process. Component sections are chosen by placing them on a configuration screen. After the unit layout is defined, the available options and accessories per component are defined.

SelectTOOLS gives immediate feedback on fan and coil selection, offering a choice of several different options based on the performance inputs. After the final component selections have been made, the program provides all output needed for specification and submittal purposes, including fan curves, coil performance psychometric charts, weights, dimensional drawings and a unit specification.

For a copy of SelectTOOLS software for Vision air handlers and other McQuay products, or for a demonstration, contact your local McQuay representative or call (800) 432-1342. ■

Ventilation and Rooftop Systems

Indoor Air Quality, public awareness, employee productivity, tenant retention, ASHRAE Standard 62-1989 – all of these factors have contributed to the higher ventilation rates demanded of HVAC systems today. While much of the industry focus has been on how to bring in sufficient outside air *quantity*, the resulting environmental impacts created by increased ventilation rates has presented new challenges for rooftop systems.

VAV systems are very sensitive to higher ventilation rates. As supply air volume is reduced in response to outdoor conditions and building internal load, the percent volume of outside air must increase to

maintain the fixed minimum ventilation rate. The resulting mixed air temperature (MAT) can vary widely with these changes in load and outdoor conditions and may require heating input to maintain space comfort conditions, even when the space is calling for cooling. This heating requirement may be very low, but it is no less critical.

Similarly, 100% make-up air and special dehumidification applications require close heating control. When high percentages of humid outside air are brought into the system, the latent load often requires the air to be overcooled and reheated to remove excess moisture. 100% make-up air systems condition large volumes of outside air that

is subject to wide variations in inlet temperature. In each case, a heat source with a wide range of modulation is required to maintain space comfort conditions.

Until now, the only sources capable of providing acceptable heating control in these varying conditions have been steam, hot water, or direct fired gas heat. However, these heat sources have their limitations in rooftop applications. Steam and hot water heating systems can be expensive to provide, and coil freeze-up can be an issue in a rooftop application. When the application is comfort conditioning, direct fired gas heat is not used due to safety concerns. ■

SuperMod™ High Turndown Gas Burner

To help consulting engineers address the challenges associated with increased ventilation and widely varying heating loads, McQuay has introduced the SuperMod High Turndown Gas Burner – the most advanced indirect gas fired heating system available today for rooftop applications. Unlike other burners on the market, the SuperMod burner features full 20:1 turndown and flexible sizing options which, as this article will illustrate, enable it to provide significantly closer temperature control.

modulation stage (i.e. 33%) to pilot, nor does it require unrealistic inlet gas pressures to achieve low end control.

To illustrate the benefits of superior modulation, let's assume you want to specify indirect gas fired heat for a 100% make-up air rooftop system supplying 15,000 CFM with a design discharge air temperature (DAT) of 75°F and a design minimum outside air (OA) temperature of -5°F. Table 1 compares 3:1 burners commonly found on the market with the 20:1 SuperMod burner.

specification requirements include using the rooftop unit's gas furnace for both morning warm-up heat and MAT tempering under the following conditions:

20,000 CFM, design air flow
8,000 CFM, minimum air flow
4,000 CFM minimum ventilation air
-10°F winter ambient
75°F return air
60°F DAT at minimum load, based on reset schedule
325 MBH morning warm-up requirement

Table 1.

3:1 Versus 20:1 Burner – 100% Make-Up Air System

	3:1	20:1
Design CFM	15,000 CFM	15,000 CFM
Design Temperature Rise -5°F to 75°F	80°F	80°F
Furnace Output Capacity 15,000 CFM • 1.085 • 80°F = 1,302 MBH.	1,302 MBH	1,302 MBH
Minimum Turndown 1,300,000 BTU • % Turndown Capability	433,000 BTU	65,000 BTU
Minimum Temperature Rise Minimum Turndown ÷ 1.085 ÷ 15,000 CFM	28.9°F	4.3°F

As Table 1 illustrates, the minimum controlled temperature rise for a 3:1 burner is 28.9°F. But what if the OA temperature is 55°F? The DAT for the 3:1 burner would cycle between 83.9°F while the burner is running, and 59°F when the burner cycles to pilot. From a control standpoint, this would be unacceptable without additional, expensive remote heat for light load tempering.

Table 2 compares a poorly matched 400 MBH furnace with a 3:1 burner to a well matched 320 MBH furnace with a 20:1 SuperMod burner at various OA temperatures.

Table 2.

400 MBH 3:1 Vs. 320 MBH 20:1 Burner - VAV System @ Minimum CFM

Outdoor Air Temperature	System MAT	3:1 DAT*	20:1 DAT*
-10°F	43.1°F	60°F	60°F
0°F	46.9°F	62.3°F	60°F
10°F	50.6°F	66.0°F	60°F
20°F	54.4°F	69.8°F	60°F
30°F	58.1°F	60.4°F**	60°F
40°F	61.9°F	COOLING	COOLING

*No allowance made for motor heat.

**Assumes burner can cycle to pilot output.

continued on next page

Superior Modulation

The SuperMod burner provides full 20:1 turndown with continuous modulation between 5% and 100% capacity at normal inlet gas pressures. Continuous, in this case, is defined as control at 5%, 6%, 7%, and so on, up to 100% capacity. SuperMod does not use any final fixed "step" of control where the burner will cycle down immediately from a minimum

In contrast, the SuperMod burner will provide significantly closer temperature control over the full modulation range required for make-up air units.

Flexible Sizing Options

The ability to properly match furnace capacity to application requirements can be as important as its modulation capability. To illustrate this point, let's assume you're

continued from page 3

A properly sized SuperMod burner provides close temperature control throughout the range, allowing the VAV unit to take advantage of a single, unit-mounted furnace for main heating and MAT tempering.

On the contrary, the oversized 3:1 burner cannot provide the required DAT over much of the system's operating range. Cycling the burner between 33% and pilot will introduce extensive variations in the temperature supplied to the VAV boxes, causing them to hunt. This will compromise system performance and tenant satisfaction, making the system unacceptable without additional heating

source(s) to handle low MAT tempering. The result is a system compromise with added cost and complexity.

Another factor that deserves mention when selecting a burner is the way the manufacturer rates the burner. All McQuay burner selections are based on btu **output** - what you're really interested in for your application. Most other manufacturers rate their furnaces based on btu **input**, meaning their output is typically only 80-82% of their rating. Be careful when a manufacturer tells you they can supply a 1,000 MBH furnace. If you are not careful in specification and selection, you may only get 800 MBH capacity and be unable to satisfy system requirements.

With the McQuay SuperMod burner, oversizing or guesswork in sizing are not necessary. With 14 available sizes ranging from 200 to 2,000 MBH **output** capacity, the right SuperMod burner is available to match your specific heating requirements. When combined with its superior modulation capabilities, McQuay's SuperMod burner will efficiently and economically meet your heating requirements, from full make-up air heat to tempering mixed air in VAV systems, without adding design, equipment, installation, and life cycle costs to your budget. ■

For comments or suggestions, please call or write:
Chris Sackrison, Editor
McQuay International
13600 Industrial Park Boulevard
Minneapolis, MN 55441
Phone: (612) 553-5419
E-mail: chris.sackrison@mcquay.com

For more information on McQuay products and services, or to speak with your local representative, call (800) 432-1342, or visit our web page at www.mcquay.com.



13600 Industrial Park Boulevard
Plymouth MN 55441