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Plumbing Engineer®

A TMB Publication

October 2009

2009 APEX® AWARDS FOR PUBLICATION EXCELLENCE

Designing a Water Purification System

What are you willing to risk?

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Also inside

- Understanding Backflow Valves
- Siphonic Roof Drainage: What's on the horizon?
- Manufacturer Spotlight: Chicago Faucets

Safety Is Our Shared Responsibility!

- IMPORTANT - Standards Update!

If you are specifying Plastic ADA Trap Covers that refer to ASTM D635 for *Insulation Material Flammability*,

BE ADVISED:

In 2006 ASTM updated their standard ASTM D635-06 to state that under the International Building Code (IBC) this test is limited to Light-Transmitting Plastics Only and is not applicable to any other plastic materials used in construction.

Since ASTM D-635 test is limited to light-transmitting plastics only and also lacks a smoke test, this test is not applicable for plastic insulation and pipe covering materials that are used or installed under the IBC (International Building Code).

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School Fire Statistics

- ***An average of 6,300 structural school fires per year***
- ***The leading area of fire origin of structural school fires is the lavatory***
- ***Plastics ranked second as materials first ignited in school structural fires***

-The U.S. Department of Homeland Security and the U.S. Fire Administration Report on School Fires, August 2007, Vol 8, Issue 1 findings.

Eliminates Potential Liability!

Meets Mandatory Accessibility Laws (ADA) & Mandatory Building Code (IBC) Material Fire/Smoke Rated Test Standards

Accessiblity Requirements:

ADA 4.19.4 Exposed Pipes and Surfaces. Hot water and drain pipes under lavatories ***shall be insulated*** or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under lavatories. (ICC/A117.1 sec. 606.6 and ADAAG 606.5).

Building Code Requirements:

IBC Chapter 11 Accessibility sec,1101.2 Design. Buildings and facilities shall be designed and constructed to be accessible in accordance with this code and ICC A117.1.

IBC Chapter 7, sec. 719.1 Thermal and Sound Insulating Materials...Where a flame spread index or a smoke-developed index is specified in this section, such index shall be determined in accordance with ASTM E 84.

Chapter 7, sec. 719.7 Insulation and covering on pipe and tubing. Insulation and covering on pipe and tubing shall have a flame spread of not more than 25 and a smoke-developed index of not more than 450.

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Plumbing Engineer
A TWB Publication

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Understanding Backwater Valves

When sewage is not following the rules, you are going to need a backwater valve.

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What Are You Willing to Risk?

Key considerations when designing a water purification system.

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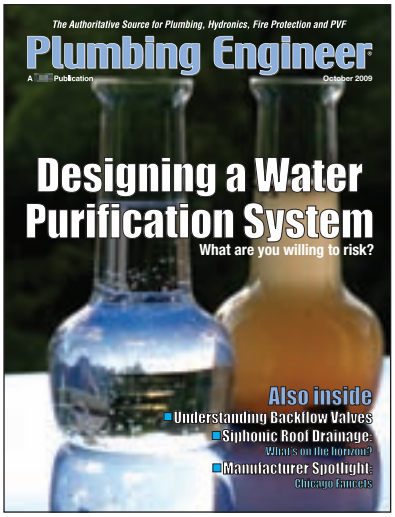
Manufacturer Spotlight

Chicago Faucets designs and manufactures high quality faucets, fixtures and components for commercial and institutional applications. **Story on page 52**

Siphonic Roof Drainage

The size and complexity of buildings continues to increase; it is good engineering practice to examine flexible solutions to roof drainage. **Story on page 58**



COLUMNS

INDUSTRY NEWS & OTHER DEPARTMENTS

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- GS submersible well pumps
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Editor's Letter

Difficulty finding well-designed public toilets?

Contributed by Steven Soifer, Ph.D.

In August 2004, the American Restroom Association (ARA) was founded as a 501(3)c non-profit grassroots organization with the vision that the United States should be a toilet-friendly place wherever its citizens choose to work, travel, shop, eat and play. While most communities have well-functioning sewer systems and most homes have excellent toilets, Americans have much more difficulty finding toilets when they are away from home. The lack of availability of toilets has a huge impact on the physical and mental health of Americans.

According to Steven Soifer, Ph.D., an Associate Professor of Social Work at the University of Maryland, Baltimore, and co-founder and board member of the ARA, "The United States is far behind most Asian and European countries in its awareness of the importance of adequate public toilet facilities for their people." The availability and standards of public restrooms affects all Americans regardless of race, income, gender, age and other factors. Almost any individual when approached could think of a time when they needed a bathroom and there was none open to the public, or it was too unkempt to use. Clearly, it is an ignored issues in most cities and states in the U.S., and becomes a public health issue and worthy of concern.

ARA's mission is to advocate for the availability of clean, safe and well-designed public restrooms. In order to achieve its mission the organization focuses on four specific areas:

- Restroom design and technology;
- Restroom availability and accessibility;
- Pertinent legislation and regulations regarding public restrooms; and
- Document the problems faced by people who hesitate to travel or who avoid activities that put them out of range of proper toilet facilities.

In order to achieve the mission the ARA has set fourth eight goals to focus on as an organization:

- Generate public relations campaigns that result in positive coverage by the press;
- Address regulatory and legislative weaknesses;
- Act as a health impact clearinghouse;
- Survey and develop a Municipal Friendliness Ratings system;
- Communicate with other similar associations around the world;
- Develop brochures and other needed publications;
- Serve as a focal point for companies and individuals promoting these products and design; and
- Develop lines of communication with malls and building associations.

The ARA website (www.americanrestroom.org) attracts close to 100,000 hits per month with little or no publicity. The ARA began with only a $5,000 grant from its sister organization, the International Paruresis Association (www.paruresis.org), which has allowed it to work toward the above stated goals as much as possible on a completely volunteer basis without staff.

America's workers are guaranteed the right to use the toilet under the Occupational Health and Safety Administration of the U.S. Department of Labor. The ARA believes the general public deserves the same basic right as a public health issue under the U.S. government's Department of Health and Human Services. Moreover, every state, under either the International Plumbing Code (IPC), the Uniform Plumbing Code (UPC) or the National Standard Plumbing Code (NSPC), requires cities to allow the public to use public restrooms pretty much anywhere. However, these codes are rarely, if ever, enforced. The ARA wants to see these codes universally enforced. The ARA strives to implement provisions built upon research by IPC, reflecting studies by Dr. Sandra Rawls at the University of Virginia, the Stevens Institute of Technology, the National Restaurant Association and the ASPE Research foundation. This silent issue, especially in light of the H1N1 virus and other diseases, becomes a high priority public health issue. The ARA is working to be the spark to bring these concerns to the forefront of public consciousness and to the attention of policy makers at all levels of government. ■

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Industry News

Manufacturers predict improving economy, AHR Expo to provide needed boost

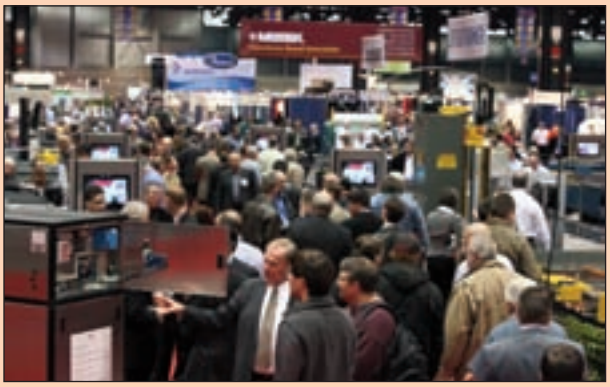
WESTPORT, CONN. — According to a recent survey of more than 1,000 manufacturers, 70 percent of the respondents said that they expect the economy to be stronger in the first quarter of 2010. This bodes well for the 2010 AHR Expo® in Orlando this coming January as nearly 72 percent of respondents predicted that their customers will start buying more products in the first quarter.

In keeping with the optimistic outlook, 69 percent of the AHR Expo exhibitors believe their customers have been delaying purchases of new products and that this pent-up demand will result in more sales during the first quarter of 2010. Twenty-four percent of exhibitors expect sales to increase over 10 percent and nearly 30 percent expect sales increases of 5-10 percent in the first quarter of 2010. Close to 25 percent of respondents expect a smaller first quarter increase of between 1 and 4 percent while less than 5 percent see a decline in sales.

The 2010 AHR Expo will take place January 25-27, and will feature more than 1,600 exhibitors showcasing hundreds of innovative new products to over 45,000 attendees and exhibitor personnel from nearly 100 countries. So far, Show exhibitors have reserved over 310,000 net square feet of exhibit space.

Industry experts will also be providing valuable educational perspectives on such critical topics as:

- Building Automation & Control
- Specialized Climate Control
- Radiant & Hydronic Heating
- Solar and Geothermal Systems
- Energy Efficiency
- Indoor Air Quality
- Building System Integration



- Green Building Initiatives/Sustainability
- Information Technology & Business Management
- Energy Recovery
- Mold & Moisture Control

In addition, the show will also include Special Features that offer practical information, certification and in many cases, continuing education credits. These include:

- New Product Technology Theaters
- Building Automation & Control Showcase
- The Software Center
- Various certification testing
- More than two dozen educational sessions and workshops presented by AHR Expo and its endorsing associations
- More than 30 Technical Sessions and Short Courses presented by ASHRAE, many of which carry CEUs.

Habitat for Humanity goes solar

MORRISVILLE, N.C. — SOLARHOT, a manufacturer of renewable energy products in Morrisville, North Carolina, has donated a solar energy system to the Chatham Habitat for Humanity, for one of their recently constructed homes located in Pittsboro, North Carolina.

The solar equipment donated by SOLARHOT, valued at over $7000, included a SolVelox drainback pump/control/heat exchanger module mounted on an 80-gallon electric water heater, a 10-gallon stainless steel drainback reservoir, four 4' × 8' Silver collectors, mounting hardware and connection fittings. This equipment was primarily installed by Solar Consultants, a solar energy installation company based in Carrboro, North Carolina, who donated over 50 worker-hours on this project.

Sloan Valve plumbing in LEED® Gold in high-rise

FRANKLIN PARK, ILL. — Sloan Valve Company's water-efficient plumbing products and systems have been installed in the new Bay Adelaide Centre in Toronto, a LEED® Gold-compliant commercial property that welcomed initial occupants to its 50-story West Tower this past summer.

Indoor water use reduction features in the West Tower include Sloan's dual-flush Flushometers and water-efficient electronic faucets. Phases two and three of the development will include mixed-use hotel/residential buildings.

John Watson, water efficiency director for Sloan, said that large commercial property owners and developers are increasingly cognizant of the financial and environmental benefits of installing water- and energy-efficient plumbing systems in their buildings. "The savings grow exponentially with the size of the building and its occupancy," said Watson.

Goulds Pumps awards 14 scholarships

WHITE PLAINS, N.Y. — Fourteen high school graduates from across the United States and Canada have received $1,000 scholarships from Goulds Pumps, a brand of ITT Corporation. All of the 14 collegiate aspirants are part of the Goulds Professional Dealers

More Industry News on page 10

Introducing The New

Ultra Commercial

The Leader In High Efficiency Condensing Gas Innovation Introduces 2 New Models

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12% lead over the nearest competition

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- 94% Combustion Efficiency
- CSD -1 Compliant is Standard
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- PVC Venting for Direct Vent and Direct Exhaust
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- Fully Integrated Multiple Boiler Control
- 3 Distinct Temperatures with Individual Outdoor Resets
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For more information visit us at **www.weil-mclain.com**

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Industry News

Continued from page 8

Association (GPDA) family — the industry's oldest and largest association comprised solely of more than 7,800 independent water systems professionals.

In addition, Goulds Pumps has created the Future Professional Dealers of America as an offshoot to GPDA, where young people aspiring to follow in their parents' footsteps receive technical information and support to further their studies. Independent dealers also receive extensive technical and product training through GPDA.

Since Goulds Pumps established a Pump School for customers in the early 1960s, the company has graduated more than 20,000 independent dealers and distributors.

Rheem named exclusive solar supplier for largest U.S. solar water heating program

(l to r) Jeff Mahoney of Rheem, Ed Begley Jr., star of HGTV's Living with Ed and Tom Husted, CEO of Valley Electric Association.

ATLANTA — Rheem Manufacturing Co. announced a groundbreaking association with the Valley Electric Association (VEA) to launch the largest domestic solar water heating (DSWH) program ever undertaken in the United States. This program offers each member of the VEA, an electrical co-op servicing more than 22,000 meters within Nevada and California, an opportunity to install a Rheem solar water heating system in their residence.

By installing a Rheem SolPak water heating system, participating residents and business owners will achieve significant water and energy savings. It's estimated that members switching from electric or propane water heating systems will save between $250 and $550 annually on water heating. According to the VEA, this program will also help to eliminate 15.4 million pounds of carbon dioxide annually and save $34 million or more, collectively, on energy costs over the next 20 years.

Webb Pump partners with Dover Pump Solutions

CRANSTON, R.I. — Webb Pump, a market-focused division of the F.W. Webb Company targeting the Commercial and Industrial Pump marketplace, has partnered with Dover Pump Solutions Group. The Dover Pump Solutions Group (PSG) features the world's largest manufacturer of air-operated double-diaphragm pumps (Wilden) and the world's largest provider of sliding vane and eccentric disc pumps (Blackmer). Other members of the PSG include: Neptune, a premier manufacturer of chemical metering pumps, Almatec, a provider of premium diaphragm pumps for chemical, semiconductor and solar markets and Griswold, a quality centrifugal pump manufacturer.

Anvil Intl. launches new website

PORTSMOUTH, N.H. — Anvil International, a subsidiary of Mueller Water Products, Inc., announced the launch of a dramatically enhanced new website with the same address: www.anvilintl.com. The new website was developed to provide more information on Anvil's extensive line of products and services. The site features a variety of tools for customers and end users to quickly and easily access the more than 1,200 pages of technical content.

IAPMO publishes codes online

SCOTTSDALE, ARIZ. — The International Association of Plumbing and Mechanical Officials (IAPMO) is providing a green alternative to code users. IAPMO is now providing online access to its most current Uniform Plumbing and Mechanical Codes, as well as prior editions.

Users can review codes and leave annotations, pictures, site notes, or links to third-party documents and websites. This unique means of accessing IAPMO's codes enables the preservation of institutional knowledge and research where it matters most — within the codes themselves. By reviewing data on the Internet and leaving digital notes, users can further green practices by reducing paper needs.

Code enforcers, design professionals, and contractors can obtain the codes, standards, and regulations necessary to competently use, apply, and/or enforce the following codes:

- 2009 Uniform Plumbing Code and Uniform Mechanical Code;
- 2006 Uniform Plumbing Code and Uniform Mechanical Code;
- 2003 Uniform Plumbing Code and Uniform Mechanical Code;
- 2007 California Plumbing Code and California Mechanical Code; and
- 2008 Uniform Plumbing Code – India.

Industry News continued on page 12

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2009 NEW CHEM SHOW announces pumping course

WESTPORT, CONN. — According to studies by the US Department of Energy, nearly 25% of electricity demand comes from industrial motor systems, over 50% of pump life cycle costs result from energy and maintenance expense, and energy savings of 20% or more are possible with systems optimization. With the goal of helping CPI professionals improve energy efficiency, The 2009 NEW CHEM SHOW will introduce a "Pumping Systems Optimization: Opportunities to Improve Life Cycle Performance" course on Wednesday, November 18, 2009, during The NEW CHEM SHOW, November 17-19 at the Javits Convention Center in New York City.

For more info, www.chemshow.com.

Little Red Schoolhouse announces 4Q schedule

MORTON GROVE, ILL. — Bell & Gossett has announced its training course schedule for the fourth quarter of 2009. The free training seminars are offered at the Bell & Gossett Little Red Schoolhouse Education Center in Morton Grove, Ill., a suburb of Chicago, and are open to engineers, contractors and facility maintenance professionals.

The seminars are tailored to various industry occupations and cover a wide range of important topics. The lead seminar instructor is LEED certified for all programs. Upon completion of the three-day seminars, CEU credits are awarded to graduates.

The 4th quarter Schoolhouse seminars include:

- Steam Operation and Maintenance Seminar – October 19-21;
- Large Chilled Water Seminar – November 2-4;
- Modern Hydronics Basic Seminar – November 16-18;
- Steam System Design Seminar – December 7-9; and
- Design and Application Seminar – December 14-16.

Expanded, revised ASSE Series 5000 available

WESTLAKE, OHIO — The American Society of Sanitary Engineering (ASSE) has released the newly revised and expanded edition of the ASSE Series 5000. The ASSE Series 5000-2009, which is the only Cross-Connection Control Professional Qualification Standard approved by the American National Standards Institute, has been released with two new standards and a collection of updated and revised appendices.

Because of the changing needs and requirements of the plumbing industry, the current Series 5000 features two highly anticipated new standards: the Fire Sprinkler System Cross-Connection Control Tester Professional Qualification Standard, and the Backflow Prevention Program Administrator Professional Qualification Standard. In addition to the two new standards, the revised ASSE Series 5000 defines the minimum performance requirements for testing backflow preventers that meet the requirements of ASSE Standards and covers the minimum performance requirements needed to be ASSE certified as a backflow prevention assembly tester, a backflow assembly repairer, and a cross-connection control surveyor. The Series 5000 also features appendices that have been updated, expanded, and improved. The appendices include revised sections of flowcharts, schematics, report forms, troubleshooting guides, ASSE test procedures, definitions and an all new appendix of One-Hose Test procedures.

Series 7000 receives ANSI approval

ASSE's Series 7000-2008, a Professional Qualifications Standard for Plumbing Based Residential Fire Protection Systems Installers and Inspectors, has been approved by the American National Standards Institute. The recent approval makes this standard the only Plumbing-Based Residential Fire Protection Systems Installers and Inspectors Professional Qualifications Standard to be approved by ANSI.

The ASSE Series 7000-2008 consists of two standards: the 7010 Standard and the 7020 Standard. The 7010 standard applies to individuals who provide layouts, details, and calculations for plumbing-based residential fire protection systems for one and two-family dwellings and install such systems. The 7020 Standard applies to individuals who inspect plumbing-based residential fire protection systems for one and two-family dwellings. Neither of these standards apply to the installation of stand-alone fire protection systems.

Designer's Guide

Timothy Allinson, P.E., Murray Co., Long Beach, Calif.

Fuel gas design

At the end of this month, ASPE will hold its biannual Technical Symposium in Dearborn, Mich. I will be teaching a class on Fuel Gas Design so I thought I would give a synopsis of the lecture as this month's column for those of you who can't attend.

Fuel gas design is governed by NFPA 54 and either the IFGC (International Fuel Gas Code), UPC (Uniform Plumbing Code), or other local jurisdictional Code, depending on your project's location. Additional design information can be found in the ASPE Design Handbook #2, Chapter 7, and there are miscellaneous requirements dictated by the American Gas Association, insurance carriers like FM and IRI, and various ASTM and CSA publications for individual components.

The properties of natural gas are that it has a specific gravity of 0.6, meaning 60% the weight of air. It is colorless and odorless, but odor is added by the utility to make leaks apparent. The heat content is approximately 1,050 BTUs per cubic foot, and 10 cubic feet of air are required to burn one cubic foot of gas. Its flame temperature is 3,416ºF.

Most gas utilities offer gas service as either firm service or interruptible service, meaning that during peak gas demand periods your gas can be shut off by the utility and you must switch to an alternate fuel such as fuel oil or propane. This is done of course to save money. Utility pressure is most often low pressure, which is less than 2 psi but is often as low as 4" to 6" water column. The average is 6" to 14" w.c. Medium pressure service is sometimes available depending on the utility and the projects demand. When available it is generally 5 psi. High pressure gas (50 psi +/-) is generally only used for utility distribution and only in some areas.

Gas regulators are provided on all but low pressure utility distribution systems. The regulator that reduces utility pressure to service pressure is called a service regulator and is provided by the utility ahead of the meter. If your project has a hybrid pressure design — meaning portions of medium and low pressure, the regulator that reduces the medium pressure distribution to a low pressure zone is a zone pressure regulator or appliance regulator if it is only serving one piece of equipment.

Seismic areas frequently require the use of earthquake valves that close based on seismic movement to prevent fires. Some utilities require the use of excess flow valves that close in the event the gas service has a sudden and unusually large increase in flow, indicating a dangerous malfunction of some sort.

Gas piping is generally run in black steel with threaded malleable fittings for smaller diameters, while larger pipes are welded. My own firm usually transitions to weld at 2½", although some contractors start welding at 4". The larger the pipe, the harder it is to make a threaded joint that doesn't leak. Medium pressure pipe is always welded.

Corrugated stainless steel tubing (CSST) has become popular as of late and can be run in spools of 3/8" up to 2". Copper pipe can only be used where the gas has been documented by the utility as non-corrosive (less than 0.3 grains of H_2S per 100 cu. ft.). Plastic (PE, not PVC) can be used — buried outdoors.

Gas load is determined simply by totaling the demand of all the equipment and appliances on the system. Each appliance has a gas input rating listed by the manufacturer in BTUs. Since there are approximately 1,000 BTUs per cubic foot of gas, the BTUs of the appliance divided by 1,000 gives cubic feet per hour (CFH.) All of the gas sizing tables are listed in CFH. This system is inherently inefficient, as no diversities are taken, and it assumes all the appliances in the building are burning at full capacity at the same time, and this is absurd for a large building. In my opinion the gas sizing process could benefit from the equivalent of Hunter's Curve, but no Code authorities have gone through the effort.

If the actual appliance load is not known because the owner has not made specific selections, they can be approximated using Tables contained in all the major Codes, and these Tables all closely approximate Table 5.4.2.1 in NFPA 54. A gas oven and range, for example, is listed as 65 CFH. This assumes 10 CFH for each of four burners, plus 25 CFH for the oven/broiler. So if your project has 100 ranges, the load would be 6,500 CFH, and you can surely see the absurdity in assuming that all 100 ranges have all four burners and oven burning at maximum capacity at the same time — even on Thanksgiving — but this is the way the Codes are all written.

Final pipe sizing is determined using two variables — the load, as described above, as well as the pipe length. The major Codes all recognize three different methods of determining pipe length — the longest length method, the branch length method, and the hybrid pressure method.

The longest length method is the most simplistic and generates the most generous pipe sizes. With this method you measure the length of the longest pipe run and allow for fittings (I usually use 20%) for the total developed length. With the system length known, the appropriate sizing chart is used to determine the various pipe sizes based on load. The most commonly used sizing table is the low pressure table (less than 2 psi in NFPA 54) with 0.5" w.c. pressure drop. Thus one row of one chart can be used to size the entire system. What could be easier?

The branch length method starts out the same as the longest length method, but for the branches and risers that are successively closer to the source (gas meter), the total length can be commensurately reduced by the amount the branch is closer to the meter. This means that the total developed length (TDL) for each major branch or riser will be reduced and might result in slightly smaller pipe sizes for each branch or riser. This method is more time consuming but also more efficient. It is particularly useful

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if you are adding a branch to an existing system.

The hybrid pressure method is best suited for large systems. This method employs the use of medium pressure gas (MPG) for major distribution. Pressure regulators are provided where required to reduce to low pressure, such as for rooftop equipment and low pressure distribution zones to appliances. In the hybrid method the MPG is sized based on the load and distance from the source to the regulator(s) using the 5 psi chart with a 3.5 psi pressure drop. The low pressure piping is sized based on cumulative load and distance from the regulator to the furthest appliance. Note that both the MPG and low pressure system can be sized using either the longest length or branch length methods.

While a picture is worth a thousand words, it is impossible to print all of the necessary images needed to thoroughly depict examples of this process. However, the NFPA, IFGC, and UPC all have sizing examples. Refer to NFPA 54 Annex C, IFGC Appendix A, and UPC Figure 21-2.

Note that if you are designing with CSST or underground PE there are dedicated tables in the Codes to address these systems at various pressures. CSST has lesser capacity that steel because of the corrugations, while PE has greater capacity because it is so smooth.

On rare occasion you might encounter a situation requiring a gas booster pump. This has only come up once in my 25 year a career, in NYC (which supplies only low pressure gas, 4"-6" w.c.) for a pair of rooftop chillers that required 14" of gas pressure. The key to gas boosters is that there are two means of control. Either direct actuation, such that when chiller #1 runs, gas booster #1 turns on, or automatic control that would be required to boost the pressure to multiple appliances. This control system is fairly complex, requiring a radiator to cool the gas to prevent it from overheating. ASPE has good information on this in Chapter 7 of Data Book 2.

There are other considerations in gas design that go beyond the scope of this article, such as combustion air, altitude correction, pressure testing of piping, and propane design, but the NFPA and related Codes are very good references for all of this information. ■

***Timothy Allinson** is a senior professional engineer with Murray Co., Mechanical Contractors, in Long Beach, Calif. He holds a BSME from Tufts University and an MBA from New York University. He is a professional engineer licensed in both mechanical and fire protection engineering in various states, and is a LEED accredited professional. Allinson is a past-president of ASPE, both the New York and Orange County Chapters.*

Code Update

By Ron George, CIPE, CPD
President, Ron George Design & Consulting Services

International terminology

I recently made a trip to India to speak at a plumbing conference for the Indian Plumbing Association (IPA). India has been operating without building codes and enforcement, and this has led to inadequate plumbing systems throughout the country.

While there, I noted many plastic piping systems in use. One of the booths I visited during the product show was promoting PVC piping for both hot and cold water. I had a discussion with the piping manufacturer about the prohibition of PVC piping for hot water systems in the model codes in the States. He was concerned because he said they use PVC in a lot of projects in India for hot water. He did say they had a temperature limit of 120 degrees Fahrenheit or 48.89 degrees Celsius.

When there is a major development, typically the engineers would design the building to the codes and standards from European countries or North America. However, the new developments must rely on the abilities of the engineers or contractors to provide a safe plumbing, electrical or structural system. Many areas of the country do not have basic water and sewer services. The lack of basic water and sewer services in many areas has caused many of the people to rely on water in streams and rivers for bathing, washing and drinking. India does not have an official plumbing code adopted by the government. There are no building officials or inspectors, there are no contractor licensing requirements and there are no education programs in place for apprentices. Recently, the International Association of Plumbing and Mechanical Officials (IAPMO) developed a Plumbing Code for India — taking into account that it must be in metric units — and it had a group of people addressing many local issues in the plumbing code. This was a fist step in a long journey to improve the living conditions in India.

Ron George, second from left, on location in India.

During my travels there I noted many people along the roadside brewing tea and coffee. Later, I realized the boiling of the water for tea or coffee sterilized the water and minimized dysentery. Tea was quite popular in India and I surmised the practice probably came from the British occupation of India, which lasted for almost 200 years.

The British occupation also brought roads, railways and modern architecture to India mostly with British or European influence. The British also brought the English language to India. While I was there, I found that a large number of people spoke and understood English. There were many languages and dialects spoken in India. Often, language is one of the identifiers of a person's ethnic background. There are about 18 official Indian languages. They are: Assamese, Bengali, Gujarati, Hindi, Kannada, Kashmiri, Konkani, Malayalam, Manipuri, Marathi, Nepali, Oriya, Punjabi, Sanskrit, Sindhi, Tamil, Telugu and Urdu. Almost all of these 18 languages include different dialects or variations of that language. Besides these 18 languages, there are other languages that are recognized by the central government, including English, but not as official languages. There are other languages that aren't recognized by the central government. Some of India's state boundaries were created based on the boundaries of the main Indian languages, as recognized by the Indian constitution.

India will be an emerging market force in the future. They are projected to surpass China in population by the year 2030. However, the task of modernizing the plumbing for the entire country will be a daunting challenge. India has about one-third the land area of the United States, yet there are currently about four times as many people in India. (U.S. has about 307 million people, India has about 1.2 billion people)

During the IPA conference there was a panel discussion that included participants from several countries around the world. The panelists each gave a presentation on the "Do's and Don't's for Plumbing Systems." This was followed by the moderator posting plumbing questions to the panelists on monitors and on projection screens for the more than 800 attendees. The panelists took turns addressing how each issue would be addressed in their country. One of the questions asked of the panelists was to evaluate the drainage systems commonly designed and used in some of the newer developments in India. Several panelists were stumped when some of the terminology was posted in the questions. Apparently there are terms they use that were not familiar to many of the panelists. There also were common terms that meant something different depending on where you are from. The questions began with a statement of how the systems were designed and

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installed followed by a question of if this was an acceptable plumbing installation in each panelist's country. The panelists faced a bit of terminology challenge when some of the questions were posted to the panelists for discussion. One of the statements and following questions was worded like this:

Indian Plumbing Design Statement

In India, sanitary drainage installations are usually installed as a two-pipe system with separate soil & waste pipes up to the building sewer. Waste pipes are trapped thrice – at the fixture, fixture outlet pipe then connected to the trapped floor gulley and waste stack, and finally it is connected to an externally trapped gully before the building sewer. The waste pipe system is not vented except in cases of very long branches. Soil and waste stacks are extended to the roof with a vent cowl. Vent stacks are provided to soil waste stacks on buildings taller than three floors.

Question: Is this an acceptable installation?

There were no drawings accompanying the questions. This had a few people scratching their heads, including me as I turned to the Indian engineer next to me and asked what a gully drain was. The first question was directed to a gentleman from Great Britain who asked the obvious question, "What is a gully drain?" I had never heard of a "gully drain" and I was envisioning something like a trench drain. When it was my turn to address the question, I said the model codes in the United States would probably prohibit multiple trapping because they could become air-bound and provide resistance to flow.

During the discussions, an engineer from India, sitting next to me, sketched a drawing on a napkin of what he called a "gully trap" and the associated piping system. That sketch was worth a thousand words.

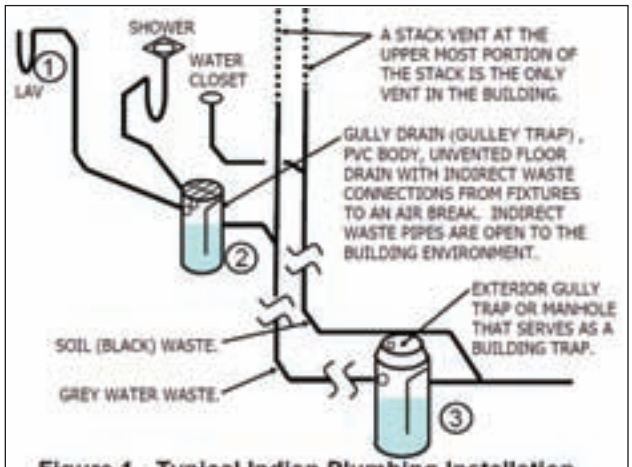

Figure 1 - Typical Indian Plumbing Installation

To me trapped thrice meant three traps in series that is not allowed in the model codes. The issue of multiple trapping was discussed by others on the panel, but the others were still struggling to understand how the system was piped without a drawing.

One of the Indian civil engineers on the panel explained that the three traps would not air-bind because they were indirectly connected to each gully trap.

What the sketch showed was a fixture similar to a floor drain or floor sink with an auxiliary inlet in the body above the outlet or P-trap. This created an indirect waste or air break connection, but it exposed the entire indirect waste line to the room with the floor drain or gully drain.

The gully drain (*see Figure 1*) had a built-in trap that consisted of a removable partition. This would not be permissible according to the model codes in the United States. The following is some code language that would apply in this case.

2009 International Plumbing Code – Section 1002.2 Design of traps.

Fixture traps shall be self-scouring.

Fixture traps shall not have interior partitions, except where such traps are integral with the fixture or where such traps are constructed of an approved material that is resistant to corrosion and degradation. Slip joints shall be made with an approved elastomeric gasket and shall be installed only on the trap inlet, trap outlet and within the trap seal.

This above code section appears to prohibit traps that are not self scouring and traps with interior partitions such as the gully traps.

2009 International Plumbing Code — Section 1002.3 — Prohibited traps.

The following types of traps are prohibited:

1. Traps that depend on moving parts to maintain the seal.

2. Bell traps.

3. Crown-vented traps.

4. Traps not integral with a fixture and that depend on interior partitions for the seal, except those traps constructed of an approved material that is resistant to corrosion and degradation.

5. "S" traps.

6. Drum traps.

Exception: Drum traps used as solids interceptors and drum traps serving chemical waste systems shall not be prohibited.

The gully trap design is basically a drum trap and appears to be prohibited in accordance with the above code section.

2009 International Plumbing Code — Section 1002.5 Size of fixture traps.

Fixture trap size shall be sufficient to drain the fixture rapidly and not less than the size indicated in Table 709.1.A trap shall not be larger than the drainage pipe into which the trap discharges.

The gully trap body is larger than the pipe size, which would allow the waste to slow down and solids would settle in the drain piping. The above code section appears to not allow the gully trap design in this example.

2009 International Plumbing Code — Section 1002.6 Building traps.

Building (house) traps shall be prohibited, except where local conditions necessitate such traps.

Building traps shall be provided with a cleanout and a relief vent or fresh air intake on the inlet side of the trap. The size of the relief vent or fresh air intake shall not be less than one-half the diameter of the drain to which the relief vent or air intake connects. Such relief vent or fresh air intake shall be carried above grade and shall be terminated in a screened outlet located outside the building.

There did not appear to be any logical reason for the building or house trap or gully trap in the installation that was described.

The Uniform Plumbing Code has the following language addressing traps.

2009 Uniform Plumbing Code – Section 1002.0 - Traps Protected by Vent Pipes.

1002.1 Each plumbing fixture trap, except as otherwise provided in this code, shall be protected against siphonage, backpressure, and air circulation shall be assured throughout all

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parts of the drainage system by means of a vent pipe installed in accordance with the requirements of this code.

1002.2 Each fixture trap shall have a protecting vent so located that the developed length of the trap arm from the trap weir to the inner edge of the vent shall be within the distance given in Table 10-1, but in no case less than two (2) times the diameter of the trap arm.

The above text from the 2009 Uniform Plumbing Code would require individual vents for each fixture or some form of venting to assure that pressure fluctuations from slugs of water in the drain pipe do not cause the trap to blow out or siphon.

2009 Uniform Plumbing Code — Section 1004.0 - Traps — Prohibited.

No form of trap that depends for its seal upon the action of movable parts shall be used. No trap that has concealed interior partitions, except those of plastic, glass, or similar corrosion-resisting material, shall be used. "S" traps, bell traps, and crown-vented traps shall be prohibited. No fixture shall be double trapped. Drum and bottle traps shall be installed only for special conditions. No trap shall be installed without a vent, except as otherwise provided in this code.

The above text from the 2009 Uniform Plumbing Code would prohibit traps with interior partitions, double trapping, drum traps and unvented traps.

To me, a two-pipe sanitary drainage system meant a waste stack and a vent stack. The Indian engineers understood a two-pipe sanitary system to mean two single stack waste systems with no venting except for the stack vent. One stack was for black waste or water closet waste discharge and the other stack as for greywater discharge. The sketch on the napkin cleared up this for me, and one of the other panelists suggested a flip chart for illustrations next time for the panelists and attendees.

Air admittance valves

There was a question asking if they used air admittance valves in Indian plumbing systems, and if they could eliminate the vent through the roof. I mentioned the engineers and installers must follow the limitations of the codes, and the manufacturers' installation instructions. Most manufacturers require at least one vent through the roof to address positive pressures. The laws of physics will not change when you cross borders, but the codes and laws will likely change.

Water hammer arrestors

Another question asked was why they needed to have water hammer arrestors. Water hammer arrestors are required for quick closing valves (near washing machines and dishwashers) in the Uniform Plumbing Code for India (which is currently a voluntary code).

The concern was the only water hammer manufacturers were in the United States. I suggested they download the Plumbing & Drainage Institutes standard from the Internet for free (www.pdionline.org). The standard gives water pipe sizing information, water hammer arrestor sizing and placement information, and information on how to build an air chamber that is rechargeable.

Later in the trip. I had the opportunity to visit a construction site and photograph the plumbing installations in a complex that had more than five million square feet under construction in 15 buildings. We drove past at least 100 construction sites for international corporations building high rise offices, hotels and support facilities in the High Tech City area of Hyderabad.

At the conference there were representatives from the Green Plumbers USA, IAPMO, The World Plumbing Council, the Chartered Institute of Plumbing & Heating Engineering in the United Kingdom, and Robert Burgon from Scotland, among many other international dignitaries. I enjoyed the wonderful hospitality and the IPA officials said they will plan to have me back for a full day of seminars during the Plumbex Conference and Exposition in Mumbai next spring, and I am looking forward to it. ■

Ron George *is President of Ron George Design & Consulting Services. He has served as Chairman of the International Residential Plumbing & Mechanical Code Committee. He is active in plumbing code and plumbing product standard development committees with ICC, IAPMO, ASSE, ASME, ISEA and ASTM. His company specializes in plumbing, piping, fire protection and HVAC system design and consulting services. He also provides plumbing and mechanical code consulting services and he provides investigations of mechanical system failures and litigation support. His company also provides 3D cad services and Building Information Modeling (BIM) services.*

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FPE Corner

By Samuel S. Dannaway, PE,
President, S.S. Dannaway Associates, Inc., Honolulu

Avoiding obstructions to sprinklers

A study of sprinkler system reliability[1] included an analysis of cases where a sprinkler system was located in the area of fire origin and did not function effectively. The most common reason for ineffective performance was that water did not reach the fire, accounting for 55% of the total occurrences. One reason that discharge from a sprinkler would not reach a fire is the inability of the discharge to penetrate the fire plume generated by high heat release rate fires as may be expected in high challenge storage occupancies.

More commonly, it is a physical obstruction, which prevents sprinkler discharge from reaching the fire. In addition to blocking sprinkler coverage, obstructions also can serve to delay or prevent sprinkler activation by interfering with the flow of heat to the sprinkler release element. This article will review the rules in the 2007 edition of NFPA 13[2] for locating sprinklers to avoid obstructions.

A description of typical sprinkler discharge distribution patterns will aid in understanding of the various obstruction rules. Standard spray upright and pendent sprinklers have a discharge pattern that provides an 8' diameter spray pattern at a distance of 18" vertically below the sprinkler deflector and a 16' diameter spray pattern 48" vertically down from the sprinkler deflector. In looking at the FM test criteria[3] for sidewall sprinklers the spray is required to completely wet down all walls at a distance 48" below the elevation of the sprinkler deflector. In a review of NFPA 13, one sees that the obstruction rules for residential sprinklers are more severe than for standard sprinklers. This is because residential sprinkler test criteria[4] requires a thorough wet down of all walls at a level of 28" below the sprinkler deflector. This higher level of wall wet down is needed by residential sprinklers to meet their key design objective of preventing flashover.

> Sprinklers have a documented success rate of approximately 89%. Considering all the things that can impair a sprinkler system's performance, this is an extraordinary rate.

Now let's look at some of the obstruction rules.

NFPA 13 contains a few rules related to obstruction by sprinkler system components. This is a concern primarily for upright sprinklers. Pipe hangers are not permitted to be less than 3" from the centerline of the sprinkler (NFPA 13, 9.2.3.3). Seismic bracing and restraints must be located to avoid obstructing sprinklers (NFPA 13, 9.3.1.4).

To minimize disruption of the spray pattern, upright sprinklers must be installed on branch lines with frame arms parallel with the piping (8.3.1.3). There are also special rules for large drop sprinklers to avoid obstruction due to large diameter pipe (see discussion of the "Three Times Rule" below). Large drop sprinklers installed on branch lines with a diameter of $2^1/_2$" must be installed on a riser nipple so the deflector is at least 13" above the pipe. For 3" branch lines, the deflector must be located at least 15" above the pipe.

In addition to these sprinkler system component rules NFPA 13 contains obstruction requirements specific to the following types of sprinklers:

1. Upright (SSU) and pendent (SSP) sprinklers
2. Standard sidewall sprinklers
3. Extended coverage upright and pendent sprinklers
4. Extended coverage sidewall sprinklers
5. Residential upright and pendent sprinklers
6. Residential sidewall sprinklers
7. Large drop sprinklers*
8. ESFR Sprinklers

The obstruction rules for specific sprinklers were first introduced in the 1999 edition of NFPA 13.

With the exception of the obstruction rules for ESFR sprinklers, the rules for sprinkler obstructions are arranged similarly.

For each type of sprinkler there is a set of general rules for sprinkler location with respect to continuous obstructions and a set of more specific obstruction rules for 1) noncontinuous obstructions to sprinkler discharge pattern development and 2) obstructions, continuous or noncontinuous, that prevent sprinkler discharge from reaching the hazard.

The general obstruction rules contain a performance objective statement which reads:

"Sprinklers shall be located so as to minimize obstructions to discharge as defined in …, or additional sprinklers shall be provided to ensure adequate coverage of the hazard."

Then there are the so-called "beam obstruction rules," which indicate sprinkler deflector location with respect to continuous obstructions either within the room or against to the wall. The rules establish the distance the sprinkler must be from the beam for a given deflector distance above the bottom of the beam. For example, for a standard upright sprinkler located four feet from the side of the beam the sprinkler deflector must be no more than 14" above the bottom of the beam (NFPA 13, Table 8.6.5.1.2), and for a residential sprinkler located 4' from the side of the beam the sprinkler deflector must be no more than five inches above the bottom of the beam (NFPA 13, Table 8.10.6.1.2).

In the case of beams/soffits less than 30" wide against walls, the beam rules for upright and pendent sprinklers provide conditions where coverage by sprinklers adjacent

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to the beam are permitted. Of course, if the beam/soffit obstruction is greater than 30" wide, then a sprinkler must be provided below the obstruction.

Obstructions to sprinkler discharge pattern development include the "Three Times Rule," which can be applied to fixed items, columns, and pipes that are 24" or less from sprinklers. The rule states that if the clearance from the sprinkler is greater than three times the largest dimension of the obstruction (the diameter of a pipe column for instance), then no obstruction exists. This is based on the premise that the ability of the sprinkler to throw water on either side of the obstruction or over and under the obstruction overcomes any potential dry shadow area caused by the obstruction Also, the "Three Times Rule" does not apply to sprinkler piping that is less than 3" in diameter. It is noted that for extended coverage spray sprinklers this rule becomes the "Four Times Rule" as the clearance is increased to four times the largest obstruction dimension.

There are also some rules that apply to open trusses, bar joists and beams with limited member widths.

The next set of rules for obstructions to the discharge pattern apply to the location of sprinklers with respect to suspended or floor mounted obstructions. This would include privacy curtains commonly found in patient rooms in health care facilities or free-standing partial height partitions.

The rules for ensuring obstructions do not prevent water from reaching the hazard include the "Wide Obstructions Rule," which requires additional sprinklers under fixed horizontal obstructions over 4' wide such as ducts, decks and cutting tables that are fixed in place. Another common occurrence of a wide obstruction is with overhead doors when in the open position.

Though not specifically identified as obstruction rules, provisions for clearance of sprinkler deflectors above storage for certain sprinklers are intended to ensure that the discharge pattern development is not unobstructed. The clearance is at least 18" for standard and extended coverage upright and pendent spray sprinklers and standard sidewall spray sprinklers. For large drop and ESFR sprinklers the clearance is 36". An annex note in NFPA 13 reminds us that the clearance requirement should not be applied to storage on shelving that is either against the wall or mounted on the wall.

Large drop and ESFR sprinklers have additional rules that are needed to assure that the sprinkler discharge reaches protected commodities with minimum interference from obstructions.

A few more items on obstructions. In-rack sprinklers are not required to observe the obstruction rules. Also, in motion picture and television production studio soundstages and approved production facilities, where obstruction issues are common, the sprinkler discharge obstruction rules do not apply if "approved mitigation techniques are employed" or if the sprinkler system meets design criteria for extra hazard Group 2.

Sprinklers have a documented success rate of approximately 89%[1]. Considering all the things that can impair a sprinkler system's performance, this is an extraordinary rate.

Knowledge of NFPA 13 obstructions rule should help improve the performance and reliability of fire suppression systems with which you are involved. ■

References:

1. John R. Hall, Jr., Ph.D., An Analysis of Automatic Sprinkler System Reliability Using Current Data, National Fire Protection Association, February 2, 2006

2. NFPA 13, Standard for Installation of Sprinkler Systems, National Fire Protection Association, 2007

3. FM Standard 2000, Approval Standard for Automatic Control Mode Sprinklers for Fire Protection, FM Global, March 2006

4. FM Standard 2030, Approval Standard for Residential Automatic Sprinklers for Fire Protection, FM Global, August 2009

* In the soon to be released 2010 edition of NFPA 13 the requirements for large drop sprinklers will be grouped in the larger category of Control Mode Specific Application sprinklers, (see next month's article "Changes in the 2010 Edition of NFPA 13").

***Samuel S. Dannaway**, PE, is a registered fire protection engineer and mechanical engineer with bachelors and masters degrees from the University of Maryland Department of Fire Protection Engineering. He is past president and a Fellow of the Society of Fire Protection Engineers. He is president of S. S. Dannaway Associates, Inc., a 15-person fire protection engineering consulting firm with offices in Honolulu, Hawaii and Guam.*

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Circle 21 on Reader Reply Form on page 65

Modern Hydronics

By Paul Rohrs, Radiant Expert, Biggerstaff Radiant Solutions, Lincoln, Neb.

Request for change

When you opened up your very first computer, you methodically went through the set up and had to contend with this new concept called a mouse. "Hey look, when I move this device, the cursor follows it." It may have seemed like an innovative thing at the time, but now it is commonplace. Along those lines, everyone had access to a game called Solitaire, a common card game to be sure, but why have it on my new computer? The real answer is that Solitaire is placed on computers to get users comfortable with the concept of click, drag and drop to quickly navigate files, folders and application software. What in the world does this have to do with hydronics? We'll come back to this at the end of the article.

Now fast-forward to the reality of our current economy. There are a lot of plumbers and hydronic contractors that have stayed in the residential market, but the residential new construction market nationally is in the "crapper," to use a plumbing term we all understand. These plumbers and hydronicians need to grease the wheels of their bank accounts by putting as much ink on a deposit slip as possible, but what to do? Diversify in your market, as well as start bidding commercial projects. These businessmen and women are accustomed to proficiency and autonomy in residential projects, directly dealing with the owner and builders to accept changes and make course corrections as needed to give the end user the desired product.

> Commercial projects have a clearly laid out set of plans that are followed, and if there is a change to be made, there is a protocol that must be followed...

To recap, we are going to accept that there are a lot of primarily residential plumbers moving into the commercial arena just to stay afloat in economic times.

Commercial projects have a clearly laid out set of plans that are followed, and if there is a change to be made, there is a protocol that must be followed if the plumbing contractor is going to maintain profitability in the project. Let's say that the contractor on the job is completing the separate phases of a project but notices a category-3 boiler with zones of radiant heat. The radiant floor heat zones will feature outdoor-reset with variable-speed injection-mixing. The contractor notes that this is going to chew up a bunch of money as it requires installing AL29 stainless vent pipe and the additional piping for the VSIM. A better solution would be to install a Cat IV boiler that has outdoor reset as a standard feature and vents with PVC Sch40. Does the contractor just eat the difference and install the Cat IV condensing boiler? Of course not. The contractor has to submit a Request for Change (RFC) so that this change-order can be reviewed by the engineer and accepted. At this time, the RFC can call out the cost changes so that the contract can be altered. A request for change is not that difficult to write and submit, although it might take writing a few drafts to get comfortable with the process, kind of like playing Solitaire on the computer. You are learning to navigate the commercial project with changes that can enhance or maintain profitability.

To start, you are going to want to list the current date, the name of the project with the architect and engineer listed. You also will want to list the print you are working off of, and who you are. Additionally, ask how many copies to submit, and it should usually be in a binder with the specification and submittal of the product to which you are requesting to change. A quick and simple written overview of what was slated to be installed and why this new product or process will be the same, or better outcome.

I have submitted on boiler changes before, as well as submitting an RFC to use Pro-Press ™ fittings as opposed to wrought-copper sweat fittings.

Be aware that time frames are always critical. Waiting until the final phase of a project is not advisable unless a problem manifests itself that requires the change be made in the first place. If you can identify problems or foresee issues that can enhance the project early in the process, it will help the process along and will identify you as the qualified and professional contractor that you are.

The old saying is that "The only constant is change." Be prepared for these job-site changes by knowing how to write a Request for Change. You can prepare yourself and your business for these changes by having a RFC template prepared so that you can be ready to insert the pertinent information and submit. If you would like to see copies of RFCs that I have submitted, email me at paulrohrs@neb.rr.com and I will email them to you. Writing these changes is not hard, but it takes a little practice, just like learning how to use that computer mouse for the first time. Now…back to that game of solitaire. ■

Paul Rohrs welcomes your comments. Contact Paul at paul@biggerstaffradiantsolutions.com.

CORRECTION

In Paul Rohrs' September column, "Don't leave me Hangin'," Paul stated that Frank Wilsey and his company, All Steamed Up, were located in New York. They are located in Baltimore, Md. Also, Frank Wilsey's partner's name is Gordon Schwiezer. Paul Rohrs and *Plumbing Engineer* regret the error.

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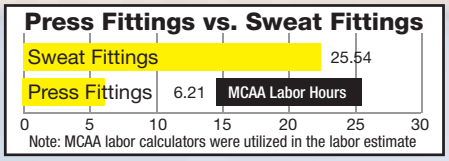

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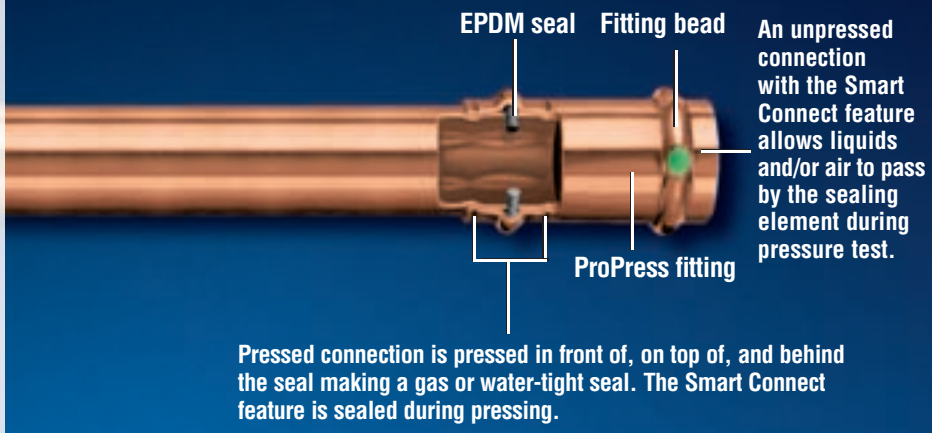

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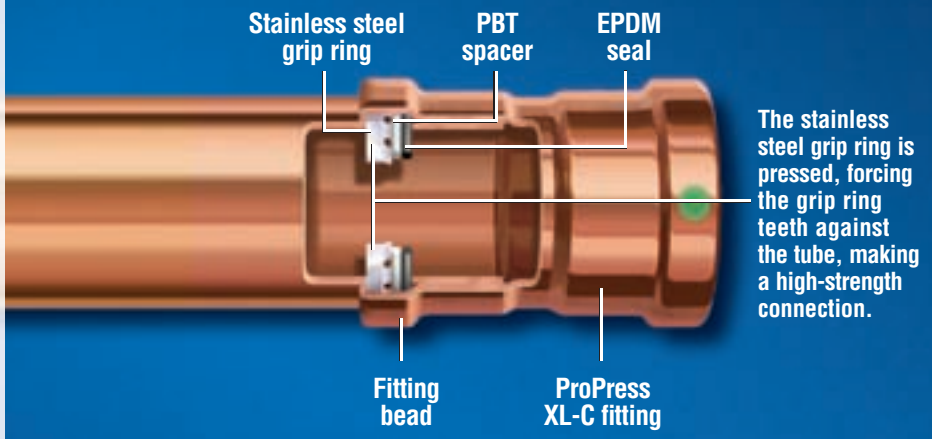

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Solar Solutions

Bristol Stickney, technical director, Cedar Mountain Solar Systems, Santa Fe, N.M.

Bristol's six principles of good solar hydronic design

Thermal mass for space heating – water vs. concrete

In this series of articles, I have been making the case that the key ingredients for solar/hydronic design and installation can be divided into six categories, listed below, roughly in order of their importance.

1. RELIABILITY
2. EFFECTIVENESS
3. COMPATIBILITY
4. ELEGANCE
5. SERVICEABILITY
6. EFFICIENCY

The success of any solar hydronic home heating installation depends on the often-conflicting balance between any of these six principles. Finding the balance between them defines the art of solar heating design.

In previous columns I have mentioned thermal mass and its application in solar hydronic heating systems many times. Thermal mass is any dense material that is used to store heat. Water and masonry materials are the most common. It has long been standard practice in the solar heating industry to store all the solar heat in insulated water tanks before sending it out in response to a call for space heat. In our region we have found that large heat-storage water tanks are only necessary when hot water baseboards or fan coils require it but not when the house is all-mass-floor hydronic heat. Insulated hydronic slab floors contain a tremendous amount of heat storage capacity, and when controlled properly this can reduce or eliminate the need for water tank solar heat-storage. Fewer tanks mean simpler plumbing, simpler controls and a lower cost solar heating installation.

Because water has a higher heat storage capacity than concrete, but has a lower density, while the concrete is often available in a much higher volume, the comparison between the two heat storage systems is not obvious. It is no wonder that people have trouble visualizing how much heat is involved and at what temperatures. Let's look at the difference in performance of direct solar heated concrete compared to the more common solar heated water tanks by comparing two hypothetical heating systems in our climate (Santa Fe, N.M.).

The following simplified analysis is intended to establish the general magnitude of the solar heat storage effects to allow the reader to get a realistic feeling for the amount of heating energy involved. I round off the numbers and make assumptions based on my own experience in order to get us into the "ballpark" for a reasonable comparison.

Please review the previous columns in the *Plumbing Engineer.com* archives for more details regarding the many other factors that make up a complete solar heating design.

Water and concrete by the numbers

A good snapshot of these two heat-storage systems must include the storage capacity as well as the heat loss from the different configurations. The storage capacity is defined by the specific heat capacity and the density of the heat storage material. The heat loss is driven by the temperature difference between the warm mass material and the environment, the insulating value, and the surface area. Table 15-1 lists a summary of the key conditions needed to make a comparison.

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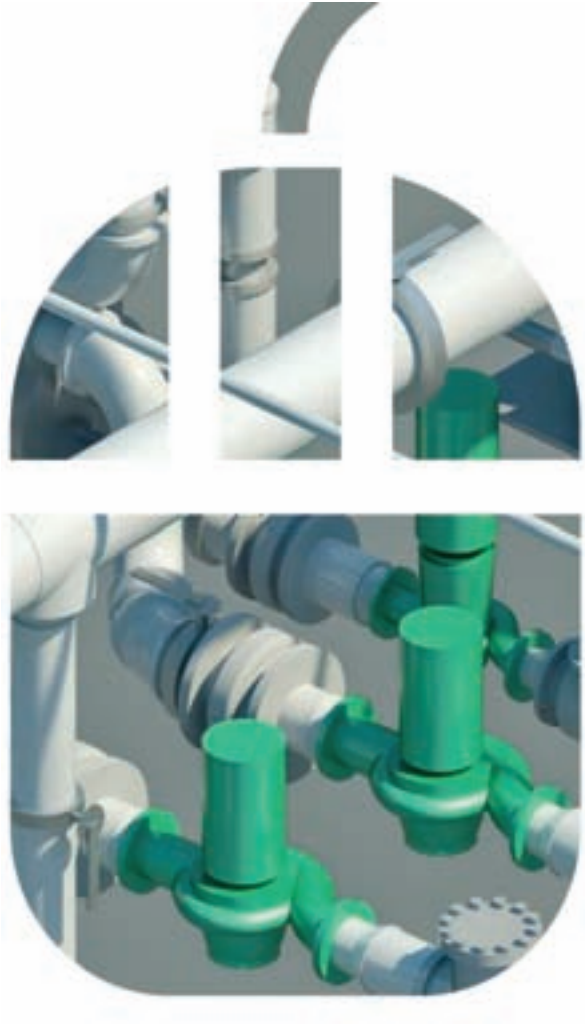
Table 15-1 Physical Properties and Conditions Assumed for Comparison

Property	Water	Concrete	Units	Comments
Specific Heat Capacity	1.0	0.2	Btu/lb.-F	Heat stored in one pound when the temperature rises 1 degree F.
Density	62	120	Lb./cubic ft.	Weight per unit volume. Water is 8.3 lb./gallon.
Earth Temp.	50	50	F degrees	Earth temperature 6 feet below the house is similar to the average annual temperature.
Heat Load	7	7	Btu/square foot floor	Average hourly heat load on a cold day in a well-constructed house.
R Value	15	15	Ft2-F-Hr./Btu	Insulation value surrounding the tank and under the slab foor.
Room Temp	70	70	F degrees	Typical Average Daily Room Air
Slab Temp	73	73	F degrees	Typical Average Daily Slab Surface



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Heat loss is calculated by multiplying the surface area by the temperature difference and dividing by the "R" value. Heat storage is calculated by multiplying the specific heat by the density and then by the temperature rise (or drop) in the material.

vide 2 gallons for each 1 square foot of collector, or 640 gallons. Setting aside the other obvious design issues such as integrated DHW, room temperature control strategies and over-heat protection, let's focus on how much heat is involved and how the thermal storage systems react to it.

Table 15-2 Specifications: Sample 3,200-Square-Foot Solar Heated House

Item	Tanks	Floor	Comments
Size	640 Gallons	3200 Sq. Ft.	Assume cylindrical tanks containing boiler fluid (low pressure water).
Weight	5312 Pounds	128000 Pounds	Weight of slab 4" thick.
Heat Capacity	5312 Btu/F	25600 Btu/F	Heat stored when average temperature rises 1 degree F.
Heat Loss	1693 Btu/hr	4907 Btu/hr	Tanks lose heat to the mechanical room. Floor loses heat to the ground.
Solar Panel	320 Ft2	320 Ft2	Eight flat plate panels, 4' x 10' each.
Solar Heat	320000 Btu/Day	320000 Btu/Day	Useful solar heat delivered to the house on a clear day. (1000 Btus per square foot per day)
Boiler	80000 Btu/hr	80000 Btu/hr	Minimum hydronic boiler output size typical for this type of house.

A sample solar heated house

Let's consider a residential house with 3,200 square feet of heated living space that is well constructed with the energy use and performance temperatures as seen in Table 15-1. The owner decides to include eight large (4×10 flat plate) solar heat panels to supplement the heat from a hot water heating system using a hydronic boiler. One plan proposes storing all the solar space heat in water tanks and another plan uses "direct" heat storage using insulated "slab on grade" hydronic radiant concrete floors. The size of the collectors is typical of systems installed in our area, using about 10% of the floor area in collectors. A water tank system would be typically sized in our climate to pro-

It is interesting to note that even though the concrete floor weighs 24 times as much as the water, its total heat storage capacity is only about 5 times that of the water. The backup boiler is capable of burning the equivalent of about 1 gallon of propane per hour at full output. The solar collectors deliver about 4 times this amount of heat per day.

Thermal response of water vs. concrete heat storage

Using the data shown in Table 15-2, we can calculate the temperature rise in the thermal mass driven by the available solar heat. We also can calculate the heat loss from the tanks, the heat loss from the floor, and the heat

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TABLE 15-3 Daily Solar Heat Response: Sample 3,200-Square-Foot Solar Heated House

Item	Tanks	Floor	Comments
Temp. Gain	60.2 F rise	12.5 F rise	Maximum average temperature rise in storage possible in one sunny day.
Temp. Loss	7.7 F drop	4.6 F drop	Typical temperature drops in the storage. mass due to heat loss through the insulation per day
Temp. Net Gain	52.5 F rise	7.9 F rise	Useful temperature rise available per sunny day for space heating.
Net Solar Heat Delivered	161120 Btu/Day	202240 Btu/Day	Floor loses heat to the ground. Tanks lose heat to the mechanical room and also to the ground when heat is finally delivered to the floor.
Boiler Run-time Saved	2.01 Hours/Day	2.53 Hours/Day	Boiler running at full output (80000 Btu/hr).
Boiler Run-time No Solar	6.72 Hours/Day	6.72 Hours/Day	Boiler runtime with no solar at full output on a cold day.
Solar Percent	29.9%	37.6%	Solar heat contribution expressed as a percent of the normal boiler routine.

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needed by the building. The net solar heat delivered can then be determined and the solar savings compared. These results are summarized in Table 15-3. Note that the water tanks must operate at a much higher temperature range than the concrete floors in order to store the daily ration of solar heat. The tanks can gain over 50 degrees of net temperature rise while the floors gain less than 8 degrees. If the tank begins the day at 100ºF, it will be 150ºF at the end of a sunny day. The concrete floor surfaces will typically stay below 80ºF. Lower temperatures are generally associated with higher solar thermal efficiencies.

The direct floor system is capable of providing over 25% more solar savings than the storage tank system with the same solar collectors in this example, based on the daily heating summary.

When the thermal mass of the concrete floors is used directly, the concrete becomes the solar heat accumulator. Even though the concrete has a lower specific heat storage capacity, because there is so much of it, the temperatures can be maintained easily within the range of human comfort. The room temperature can be allowed to drift as much as 8 degrees from day to night without exceeding the limits of the human comfort range. Using programmable 2-stage thermostats, this comfort range can be controlled to the user's needs on a room by room basis. In some rooms, a wider temperature fluctuation can be tolerated, and this will result in higher solar savings in those rooms.

Keep in mind that a solar heated house must be well constructed to achieve a high solar heating fraction. The solar collectors provide a finite amount of heat each sunny day. In this example, the solar heating fraction does not exceed 40% on this cold hypothetical day. During milder cold weather, the solar contribution will be higher. It is possible to design buildings with solar collectors where the heating energy balance is engineered to provide a high solar contribution.

Regional Results Will Vary

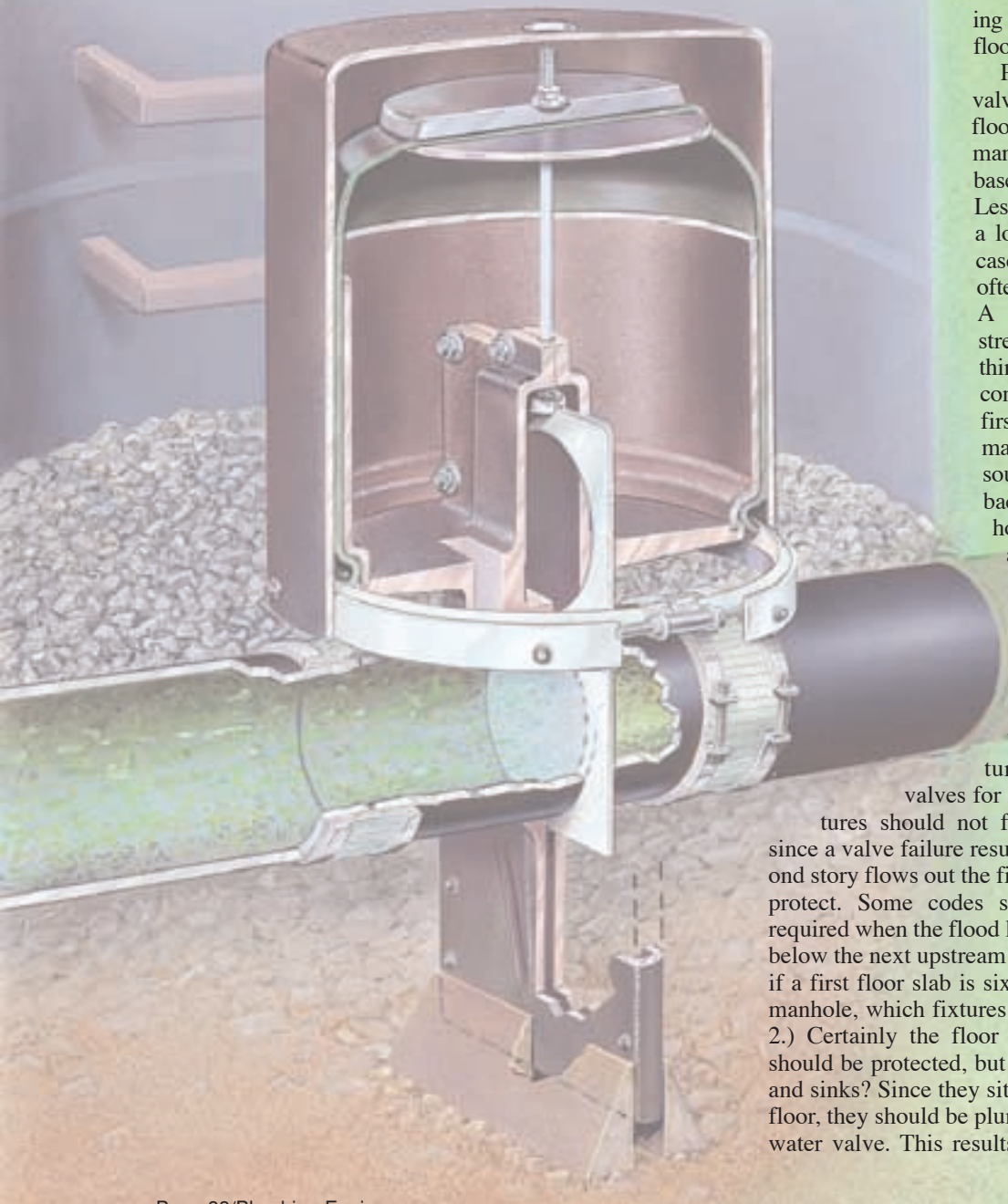
This example is intended only to illustrate the concepts involved in solar heat and thermal mass when used for solar space heating. Tables 15-1 and 15-2 show only a short summary of all the variables that can affect the performance of a solar heated building. These and other variables will change in different regions, resulting in different solar performance results.

Bristol Stickney, partner and technical director at Cedar Mountain Solar Systems in Santa Fe, N.M., has been designing, manufacturing, engineering, repairing and installing solar hydronic heating systems for more than 30 years. He holds a Bachelor of Science in Mechanical Engineering and is a licensed Mechanical Contractor in New Mexico. He is the Chief Technical Officer for SolarLogic LLC and is involved in training programs for solar heating professionals (visit www.cedarmountainsolar.com for more training information.)

Understanding Backwater Valves

The first rule of plumbing is "sewage flows downhill." When sewage is not following the rules, you're going to need a backwater valve. These little understood devices are often overlooked, improperly placed or incorrectly specified in design. They are required by code but should be used only where necessary. They come in many styles and have very specific installation requirements. They can be a source of frequent problems when they are working and when they are not.

BY PETER KRAUT



A backwater valve is simply a device in the waste pipe that prevents sewage from flowing back into the building. When the city sewer in the street backs up downstream of your connection, there is a potential for the upstream flows to find their way into your building and work back uphill to your fixtures. In these instances, the effluent flows out of the lowest opening it can find, typically a basement floor drain or similar fixture.

Plumbing codes require backwater valves when a fixture is installed on a floor that is below the next upstream manhole. The obvious example is the basement floor drain. (See figure 1.) Less obvious is a first floor fixture in a lot at the bottom of a hill. In this case, the next upstream manhole is often higher than the first floor slab. A sewer clog in the street downstream of the lot can collect everything from the top of the hill until it comes flowing out of the unprotected first floor fixtures. The next upstream manhole is key, because it is the source of relief. When the street backs up to the next upstream manhole, the sewage will lift the cover and the flow will cascade down the street. It's not a pretty site and certainly bad for the ocean to have that in our storm drain, but it's better than having it in your living room.

As much as the codes require backwater valves for lower fixtures, they prohibit backwater valves for higher fixtures. Second story fixtures should not flow through a backwater valve since a valve failure resulting in a clog will divert the second story flows out the first floor fixtures you are trying to protect. Some codes state that backwater valves are required when the flood level rim of the fixture is installed below the next upstream manhole. Taken to the next level, if a first floor slab is six inches below the next upstream manhole, which fixtures should be protected? (See figure 2.) Certainly the floor drains, mop sinks and showers should be protected, but what about the toilets, lavatories and sinks? Since they sit 15", 30" and even 36" above the floor, they should be plumbed separately around the backwater valve. This results in additional piping and invert

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Backwater Valves

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challenges where the two lines may cross. Nevertheless, they should be separated.

The first design task is then to separate and route the flows from fixtures that need protection and those that don't. When doing so, avoid crossing lines where it may lead to lower inverts. If you must cross, route the unprotected line lower than the line going to the backwater valve. You will need the

This backwater valve was installed outside of a church. During heavy rain, the main sewer backed up into a nursery through the floor drains of the church. The city determined that there was insufficient "fall" in the three lines running from the church into the main line to protect it from back flow. A contributing problem was that the old flapper valve, which had been protecting the church, had rusted, allowing water to get into the nursery's basement.

additional height for the proper operation of the valve. Locate the valve where it can be accessed. This too is a code requirement. Consider that it may need frequent access for maintenance and this will be a messy, foul smelling task. Check the inverts in and out of the valve. Additional design requirements will depend on the type of valve selected.

Backwater valves come in both manual and automatic versions. For manual valves, the user notices the sewage flowing into the building and proceeds to the valve access panel. This is typically right in the middle of the spill, about 6 inches under "water." Lifting the cover, the user then turns the wheel handle until the backflow has stopped. He then waits for the city to correct the problem in the street, opens the valve, and cleans up the mess. In the automatic versions, there are two variations. The original is similar to a check valve. This lift gate prevents the flow from getting back into the building, eliminating the human response time. Unfortunately, as a restriction in the line, they often trap waste flowing out as well and can become a source of frequent maintenance and problems. An improvement on the automatic version incorporates a float with a blade style gate. When the sewage rises, the float lifts and the guillotine like gate rises to close off the flow. These are preferred by some, but have greater installation challenges.

The manual-type works well in retrofit applications because there is typically no invert change aside from the slope of the pipe. Since it will need access in an emergency, its location will need to be obvious and outside of the area that will be flooding. If located below a basement floor, put it at the bottom of the stairs, elevated on a pad or provide a curb around it.

Check valve style devices typically have an invert difference of a few inches from inlet to outlet. (See figure 3.) As such, they usually cannot be cut into an existing line and will need careful planning in most installations. Although they are self operating, they are in fact "valves" and can not be buried in the structure. These valves come with covers that often look like cleanouts and can be extended deeper if necessary. They need access for maintenance, but should not need to be opened during each and every backflow event. Nevertheless, the servicing of these units is a foul task and they should be located accordingly.

The float-type seems like the obvious choice, but not all authorities would agree. A blade-style gate has less restriction during normal operation, but can be blocked from closing and does not have the self-sealing back-pressure that a check valve has. They also need the sewage to rise up to a foot or more above the valve to close. As such, be sure to locate the valve way downstream and provide sufficient tailpieces to allow for this needed rise. As the most complicated of these devices, maintenance needs are more likely and access should be considered accordingly.

Single-point-of-use valves also include floor drains with integral check valves and tailpieces with ball floats. The latter use a floating ball to rise up and block a smaller hole at the top of the tailpiece. When a single basement floor drain needs protection, either of these may be a good choice. When multiple fixtures are in danger of backing up, a single system valve should be used.

To this point, the topic of concern has been sewage backup. Storm drains, however, should not be overlooked. It is unlikely that a roof drain is located below the next upstream

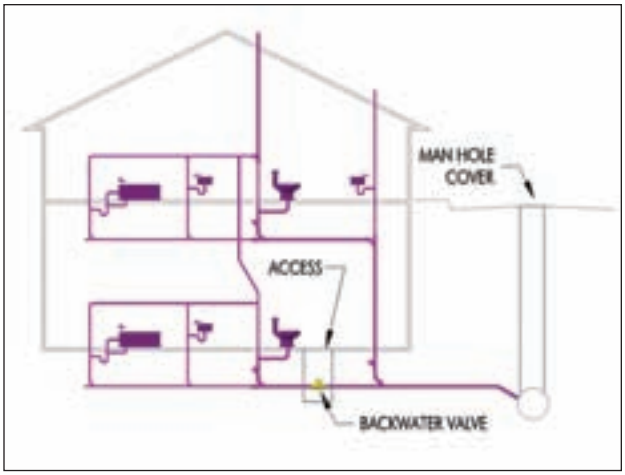

Figure 1: Basement backwater valve application.

manhole, but an area drain in a first floor atrium connected to the storm drain can experience the same issues as a floor drain in a toilet room connected to the sanitary sewer. Window well and areaway drains also can see backflow. As before, route drains above the next upstream manhole separately around any backwater valves

Some authorities do not allow emergency floor drains to tie into the storm drain system. Others require backwater

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Backwater Valves

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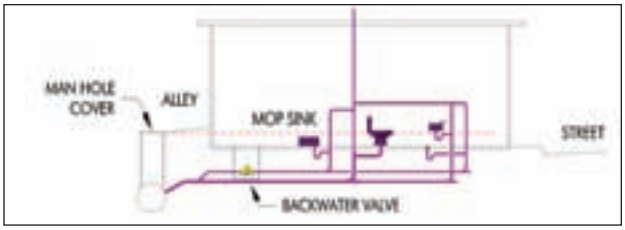

Figure 2: Flood level rim backwater valve application.

valves to separate sub-soil drains from areaways and floor drains. Perhaps the backwater valve is a third level of protection, just in case the duplex sump pump fails. I suspect that more often it is being incorrectly used. I believe the more common problem in these systems is not pump failure, but storm surges in one system overwhelming another.

In the example of a subterranean parking garage, there will likely be a sump pump. It may have a single pipe

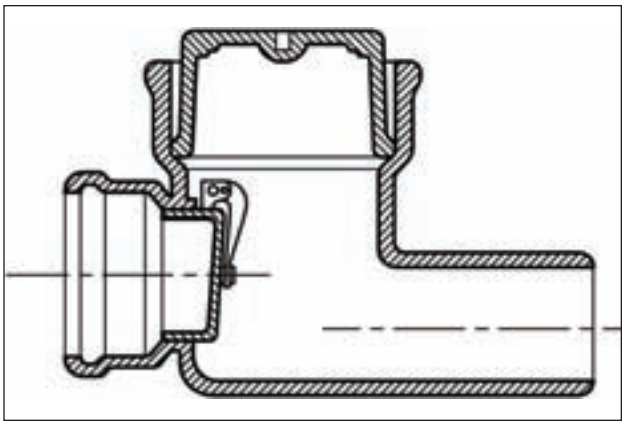

Figure 3: Typical backwater valve.

flowing into the basin. That pipe may have branches coming from air intake shafts open to the sky, emergency floor drains within the parking garage and a perimeter sub-soil drainage pipe to relieve hydrostatic pressure on the outside of the foundation. Each of these flow rates need to be carefully analyzed. The area drain needs to be sized for the 100-year storm. Be sure to include vertical area where appropriate. The sub-soil drain should be sized to handle a continual flow rate as indicated in the geotechnical report. The emergency drains should be sized as required by local codes. The combined pipe must be sized for the total combined flow rate of all of these systems. If not, the common pipe will flow full and the additional water will surcharge up and out of the path of least resistance. Typically, the emergency floor drains become decorative fountains! In most cases, when flows combine, an increase in the pipe size or an increase in the slope will prevent the flows from backing up. Backwater valves should be used sparingly. Remember, it should all flow downhill. ■

Peter A. Kraut, P.E., CPD is a licensed Mechanical Engineer in 22 states. He founded South Coast Engineering Group, near Los Angeles in 2001. In addition to conventional plumbing and HVAC projects, he has designed more than five million square feet of siphonic roof drainage systems in the United States. He can be reached at (818) 224-2700 or via email at pkraut@socoeng.com.

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What are you willing to risk?

BY ROD McNELLY

Proper planning is the key to any successful project, especially when it comes to designing a water purification system. Let's say you're a plumbing engineer for a major manufacturer that relies on purified water for part of its assembly process. What would happen if that water treatment system was to fail? Are you willing to shut down a $35,000 per hour paint line in a production facility because your water treatment system isn't working properly? Would the entire plant be at risk for shutting down? What kind of service is your water treatment provider willing to commit to? The implications of ceasing production might cost the plant hundreds of thousands of dollars in downtime and delayed orders.

What would you be willing to risk? Plumbing engineers, designers, specifiers and contractors involved in the development of industrial water treatment systems understand that there's no room for costly error or miscalculations when designing large scale, high purity water systems for industrial manufacturing applications. They know the value of not only innovative plumbing design, but of effective materials and energy use — and how these elements can contribute to further cost savings and minimized downtime. They also recognize the value of partnering with a company that understands the essential components of the early planning and discovery phase to execute the plan in the most efficient way.

For professionals involved in the design and engineering of plumbing systems, this early planning and discovery phase is the most critical time in the process, because the beginning stages will lay the framework for the entire project. Important considerations will be made to determine the quality and quantity of water needed before recommending a reliable system to fit the unique requirements of the application. The right partner should guide you through the necessary steps to design the best water treatment solution — one that is custom-tailored to fit the exacting specifications of your business — and eliminates any guesswork or surprises downstream

The ideal partner should have a water system discovery tool with a systematic set of guidelines. Better water considerations result in better business, and a better environment. Teaming with a company or consultant who has a proven, comprehensive tool in place will ensure that you are in line with every requirement in the early planning stages to achieve your company's desired goals for a water purification solution.

The advantages of a systematic approach

There are several advantages to finding a partner who has proven expertise and a successful discovery tool process in place. From experience, I have seen industrial clients that followed a comprehensive water system discovery tool yield higher margins for their business. That's because their plumbing engineers incorporated the process into a sustainable business model for their entire company.

When you and your partner utilize a good systematic discovery tool, you are able to be directly involved with the project every step of the way, from inception to completion. You will be able to create a conceptual model for how a water treatment system will work early on in the process. For example, your organization might require a reverse osmosis (RO) system that pumps 100 gallons per minute, five days a week, not consuming more than a certain amount of water, and not

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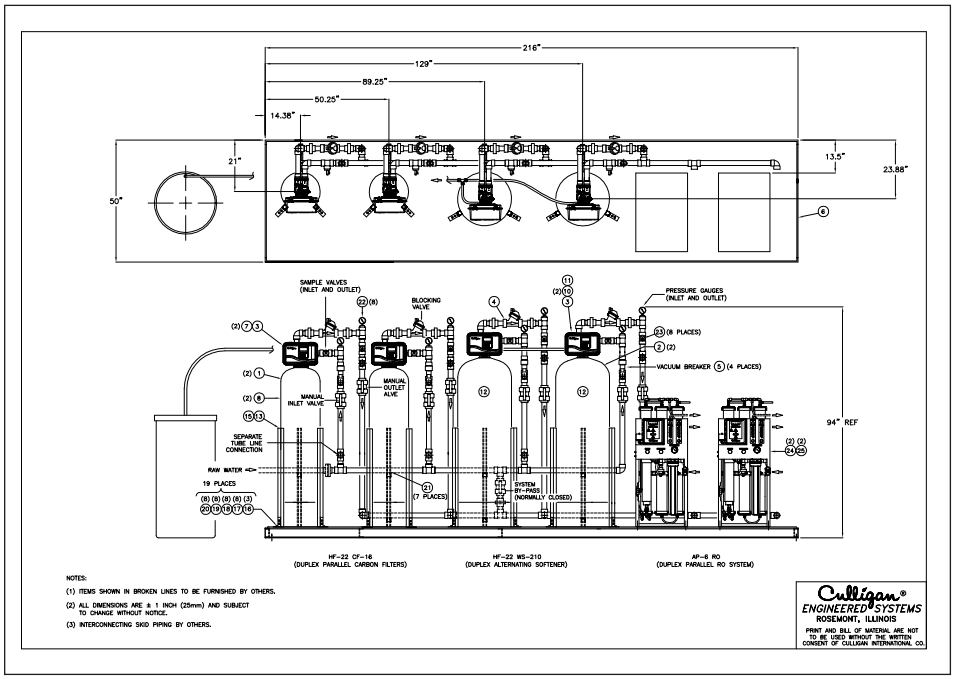
rejecting water back greater than 25 percent with less than 10 parts per billion silica and less than 5 parts per billion total organic carbon in the product water. Asking the right questions — and uncovering the right criteria — through the water system discovery tool will guide you to achieve the optimal outcome.

By gathering the right data points upfront, you'll be in the best position to design a water purification system that allows for the flexibility and performance that you seek today, and for many years down the line. This is a serious cost benefit to you – not to mention the countless hours you will save because you built in the right level of scalability at the beginning to accommodate future expansion.



A rendering of an equipment layout engineering design for a modular water treatment solution.

How flexible will you be?

Today's companies and individuals desire products and processes that are custom designed for their unique needs. Likewise, to succeed in the industrial marketplace, plumbing engineers and contractors also need to create highly customized water treatment systems that suit the exact requirements of their business.

Let's say you're a plumbing engineer for an international oil and natural gas exploration and production company. Your operation utilizes a proprietary heavy oil recovery process that's comprised of in-situ combustion technology for the recovery of bitumen and heavy oil. The company needs ultra-soft water for its oil field steam generators that are part of this process. Your water treatment approach requires a four tank duplex alternate softener system that produces 50 GPM used to provide ultra-soft water to the steam generators, as well as pre-filters to reduce sediments in the raw water supply.

As you can see, this is no ordinary off-the-shelf system. You need to ensure that your ultra-soft system is designed to match the exact water quality specifications that this patented oil recovery process require. Without ensuring continuous ultra-soft water to the steam generators, the process will fail. The competitive and monetary consequences of failure cannot be underestimated, nor can the importance of your role in designing a flexible water treatment system that can avert a potential malfunction.

What are some of the features of a water discovery system tool that allow for this increased level of flexibility? First, it is important to look at the design criteria data. An ideal partner will be able to help you gather and evaluate data on these requirements and generate a detailed usage profile. From there, each aspect of the system should allow freedom to customize anything such as materials for construction or selection of specific components. Your partner should also be able to offer cost effective default standards.

Next, it is important to look at the process preferences. A variety of methods to achieve the same results are well known in the water treatment industry, but your partner can potentially offer more affordable or efficient alternatives.

If you are using the correct discovery system process tool, a rapid response approach should be inherent. A good tool will allow you to make quick design changes or alterations throughout the fabrication process without affecting the delivery date. The ability to be flexible and nimble to meet the evolving needs of your water treatment project is essential. Many of today's industrial RO systems, for example, are specially engineered. They are built on a modular platform that is readily expandable and can be built much faster — often with an eight-week turnaround — compared to the industry average of 18 weeks.

Remember that several combinations of these features can be utilized to create a comprehensive, customized water system based the need for the output water. A one sized solution does not fit all. Your integrated solution should be designed to eliminate costly water problems, enhance the performance of current equipment and improve the efficiency of your operation — now and in the future.

What to look for when creating a quality design checklist

To uncover the initial design criteria, plumbing engineers and their partners will use the water system discovery tool to create a quality design checklist. This checklist encompasses many key criteria required to design the right water purification or treatment system.

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Water Purification

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For example, you and your partner must carefully evaluate the unique needs of your company's specific industry and/or market before beginning the project. The water treatment requirements of oil and gas companies are very different than those of pharmaceutical manufacturers.

Today's industrial water treatment systems are built on a modular platform that is custom-designed to your needs.

Even the type of facility and the specific application will dictate the system design. Do you need process water? Capture and re-use? Waste water treatment? The quality design checklist will prompt you through these and many other questions.

Another area for evaluation is your feed water source and usage. Was there any previous treatment to the feed water source such as chlorine injection or softening? Determine the usage requirements and for a detailed list of concerns. The more granular your questions, the better. For an industrial manufacturing company, a plumbing engineer will probably want to know such things as:

- How much water will be used in an eight-hour shift?
- How many shifts per day?
- How many days per week?
- If there were to be an interruption in make-up water (city feed issue or pre-treatment service) how much reserve water for production is desired?

From there, determine what the desired final product water specifications will be. There may be additional purity requirements to consider. Each project will be different. Several considerations — such conductivity or resistivity, total organic carbon, bacteria specification and endotoxin specification — should be addressed.

Finally, costs must always be factored into the equation. Determine your capital versus operating costs. Some companies will be more concerned with one over the other, and your partner should be able to help guide you. In addition, look at utility costs such as power at your facility. City feed water, wastewater disposal and other expenses are also wise

to take into account when budgeting and designing a high purity water system.

The final phase of the discovery methodology

The last part of the early planning stage involves the discovery methodology or phases facilitated by the water system tool. The P&ID and System Selection will determine pretreatment, reverse osmosis, make-up polish, storage tank and accessories, and distribution and final polish.

For each of these selections, the following should be evaluated:

- cost effective defaults
- alternate material options
- alternate treatment technologies or options
- component options and brand
- equipment configurations

From there, work with your partner to determine a controls package. Control packages may range from simple lights and switches designed to permit safe operation of the equipment or more complex packages that utilize Programmable Logic Controllers, Human Machine Interface, data acquisition or remote communication. All of the control packages can be designed to suit your company's specific needs.

Service when you need it most

Another important, yet sometimes overlooked, part of the discovery process is taking an honest assessment of what your partner can offer before you engage together on a project.

It is important to choose a partner who is solutions-oriented rather than just product-oriented. When it comes to designing industrial water treatment systems, the value is in taking multiple products and technologies and combining them into a system that provides the right solution for your environment. It is not necessarily looking at the individual components, but how that whole solution operates and fits best with your water source and long-term requirements.

Your partner should also be able to help you anticipate — and address — your service requirements for the project. For example, what is the monetary risk of having to shut down production because your facility cannot discharge, there is no proper redundancy or temporary trailers are not available at a power plant? When the associated costs could potentially exceed hundreds of thousands of dollars per hour, the ability to provide prompt service becomes critical.

Look for a partner that has a solid reputation for meeting service requirements on deadline and can provide long-term service throughout the lifecycle of your equipment. Alongside servicing your system in a timely fashion, you should also determine if the selected partner has a well stocked inventory. Many vendors may guarantee immediate service, but if a part is not in stock then there will be a delay in the service. Also, in the unlikely event of potential property or equipment damage should a system component fail,

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Custom-engineered multi-stage filtration systems help companies effectively treat water while reducing costs.

what is the vendor's policy? What about provisions for leak detection?

Another important factor to consider is the assembly. Find out if your partner will provide assembly on-site. Many vendors provide a technician to come and install the solution. As mentioned previously, today's industry trend is customization. A key differentiator between you and your competitors is speed to market. Therefore, seek a partner that guarantees quick delivery and efficient installation of your industrial high purity water system.

Finally, it's important to find a partner that has financial viability, because some of the projects you will be involved in will be quite large in nature. You need to determine if your partner will still be in business two years down the road to provide parts and service. You should also consider your company's location needs. Some organizations may need international service, which may require you to find a global partner with facilities around the world.

In the end, a partner that has a good water discovery tool will be able to help you not only conceptualize and design the right water treatment upfront, but meet your needs throughout the process and even after installation. Flexibility, performance and service are critical in today's economically challenged and fast-paced industrial manufacturing environment. Plumbing engineers and professionals will benefit by teaming with a strategic advisor with the expertise and proven formula for a process that takes into consideration criteria, costs and collaboration. ■

***Rod McNelly**, vice president, North America Industrial Sales for Culligan International, is responsible for leading and growing the company's industrial business which consists of large scale customized, engineered water treatment solutions. McNelly can be reached at: rod.mcnelly@culligan.com.*

Chicago Faucets:

Flexibility and Functionality Keys to Success

Chicago Faucets has been America's leading manufacturer of commercial faucets for more than 100 years. With manufacturing, research and development facilities located solely in the United States, products are made with an unwavering commitment to quality backed by know-how and determination that is uniquely American.

The company's foundry, manufacturing, assembly and distribution facilities are located within a 350-mile radius of the Des Plaines-Ill. corporate office. This provides unparalleled control of product quality and an ability to effectively deliver products to any point in the United States. Since A.C. Brown founded the company in 1901, Chicago Faucets changed the world of plumbing forever with more than 50 patents, the most significant being the Quaturn cartridge. Patented in 1913, this remarkable cartridge is still interchangeable with any Quaturn in existence and is truly the standard of reliability, durability and value in the commercial faucet industry. In 2002, the Geberit Group acquired Chicago Faucets.

The following is an exclusive Q&A with John Fitzgerald, director of marketing, The Chicago Faucet Company.

PE: What is your core business?

Fitzgerald: Chicago Faucets designs and manufactures high quality faucets, fixtures and components for commercial and institutional applications.

PE: How has Chicago Faucets weathered this recessive economy?

Fitzgerald: Like many other manufacturers, the current economy has played havoc with business. However, Chicago Faucets has distinct advantages over other manufacturers in dealing with that havoc. First, our products are made within a controlled geography. This gives us unprecedented capability to control the quality and delivery of our product. Second, we continually prepare for "what lies ahead." We are constantly gathering data, analyzing it — including social and economic trends — and then determining what we need to do to stay one step ahead.

Our corporate management philosophy allowed us to enter this current economic phase in a strong financial position. As a result, we have been in a position to make investments that we believe will put us in a position to grow out of this economy.

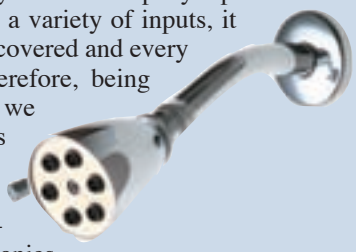
Chicago Faucets operates around many core principles that have helped the company weather the storm — two of which stand out that would interest *Plumbing Engineer* readers. First, the company's products are designed around flexibility — that is, parts that are interchangeable within the entire product line. This means a distributor — the company aggressively supports two-step distribution — need only carry a handful of SKUs to satisfy the customer. The focus at Chicago Faucets is production cost and manufacturability.

A second core principle is functionality. The company's faucet designs ensure appropriateness for getting the "job done right." The reliability and integrity of our products is time-proven, and with the largest installed base of commercial faucets in the country. Management understands that they have a distinct advantage of knowing what works, and what doesn't.

Finally, sustainability is a core value. While the green movement is relatively new, Chicago Faucets has been green since their founding. The interchangeability of parts saves resources and caters to present and future needs. The focus on users of products empowers the company by providing ongoing feedback — giving an emotional connection with customers, which translates into loyalty.

PE: Any shifts in the business model or philosophy to combat the economy?

Fitzgerald: Our business model works quite well. Good design, properly integrated into an organization like Chicago Faucets, offers a perspective that looks very deliberately and objectively at that company's products and services. Through a variety of inputs, it ensures that every angle is covered and every possibility considered. Therefore, being continually aware of what we can offer customers allows us to maintain relationships, trust and loyalty. When the economy recovers, it will be those companies that have paid attention to their customers, thought carefully about their offerings and prepared intelligently for a changing future that will succeed.



If anything, we have become more aggressive in new product development and enhancing customer service programs. We believe that our new product advancements and constant improvements in customer support programs will put us in a position for significant growth in the years ahead.

PE: How are you addressing the lead-free topic?

Fitzgerald: As in the case of NSF 61, we have strived to be out in front of our industry. In 2010, new laws regarding lead content in plumbing products that deliver water for human consump-

tion will take effect in California and Vermont. Once again, Chicago Faucets is leading the way to respond to these new low lead initiatives with ECAST™.

We introduced ECAST in October 2008, a full 14 months prior to the law being enacted. We have continued to expand the products that meet this new standard with a goal of offering the most expansive line of lead-free compliant commercial faucets.

PE: Any new product offerings?

Fitzgerald: Actually, there's quite a bit of new product news from Chicago Faucets. We continue to expand our line of electronic faucets. Our experience with HyTronic™ reinforces our position that the HyTronic line is the most reliable electronic faucet on the market. We have recently expanded this line with the E-Tronic™ 40; a lavatory faucet that we believe can bring our advanced electronic design to a broader range of installations such as gas stations, public restrooms, restaurants and small offices.

We also have introduced a new single handle lavatory faucet — the 420-CP — that we believe also will expand Chicago Faucets quality to a wider range of commercial installations. We've introduced antimicrobial handles that can be used to quickly retrofit existing Chicago Faucets installations; and we've introduced new thermostatic point-of-use mixing valves that are an ideal addition to our electronic faucets or any installation where the control of water temperature is essential or dictated by code. We also have introduced a complete line of new tub and shower mixing valves.

PE: Where are the products manufactured?

Fitzgerald: First of all, it is important to point out that 95% of our products — over 1,700 items — meet the "Buy American Act" requirements. That is an important distinction for many of our customers, especially for government installations, that demand Amercan-made products. We are able to meet this requirement with manufacturing, research and development facilities located in the United States.

We conduct product research, development and testing in Des Plaines, Illinois. Foundry, manufacturing and plating takes place in Milwaukee. We manufacture components and assemblies in Elyria, Ohio. We handle assembly and distribution in Michigan City, Indiana.

PE: Can you talk briefly about R&D and your durability testing of products?

Fitzgerald: We have a product testing lab in our Des Plaines facility that is constantly subjecting new and existing products to rigorous cycle and durability standards. We truly have a global research and development team for our products — our product engineers from our Des Plaines facility, as well as the parent office in Jona, Switzerland. Our goal is to consistently produce products that exceed all industry cycle and durability standards.

Excellence in sanitary technology. Worldwide. That's the Geberit Group's focus, and that's why Geberit sets trends in sanitary technology. Geberit's activities are based on a global approach — not just a specific region. That thinking is one of the reasons they purchased Chicago Faucets — it fit their strategy. For example, investment in research and development (R&D) was almost $20 million. R&D of the whole range of products is made centrally by Geberit International AG. As such, Geberit carries out applied research and development in the entire field of sanitary technology, as well as in related areas. Highly qualified engineers and specialists apply their knowledge and experience to fundamental sanitary technology research and the development of new products. Our research activity allows us to continuously introduce new and innovative products to the market, which thereby satisfy the requirements of our customers.

PE: Can you describe your priority ship program?

Fitzgerald: A good example of our continued investment to support to our customers is CFNow! This program assures our customers that orders for some of our most popular products will ship within five days. We have continued to expand the products offered in this program and recently introduced CFNow! Express that provides next-day shipment.

PE: How big of a role does customer service play in the end game for Chicago Faucets?

Fitzgerald: Customer service is the most important role for our company. If you don't listen to your customers, who should you listen to? Many companies practice VOC (Voice of the Customer), but they often only want to hear what they want their customers saying. Listening, really listening, is difficult, because what you hear isn't all good. Chicago Faucets' success stems from

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Manufacturer Spotlight — Chicago Faucets

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taking all that information and translating it into products and service meaningful to our customers. That takes a serious commitment from the top of the corporation downward. It's evident here. Combined with extremely well experienced customer service personnel and sales representatives, our goal is to lead the industry in this area.

PE: Look into your crystal ball and tell me where you see Chicago Faucets in five years?

Fitzgerald: Following the lead of our founder, A.C. Brown, I see our company continuing to advance faucet design with a focus on new technologies and water conservation.

Chicago Faucets product line includes innovative faucets: the E-Tronic™ 40 electronic faucet (upper left); right is the HyTronic electronic faucet; and lower left is the 802-CP (manual faucet).

While I believe that we will see continued growth in the United States, I believe that our company's reach will expand to new emerging economies across the globe.

Chicago Faucets will maintain its leadership position in the commercial faucet industry. Our development of new ideas isn't focused adding more features to new or existing products — we focus on adding customer benefits. We believe in continually working with our customers and markets and determining their needs. Performance, reliability and durability have governed us for more than 100 years, and I can't see anything changing these in the future. If anything, the future will re-emphasize the need for these basic tenants of manufacturing. ■

A.C. Brown founded the company in 1901.

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Chemistry keeps Winter Olympics cool

MIDLAND, MICH. — In February 2010, the Dow Performance Fluids Business' chemistry will be front and center at the Nordic Ski Jump Venue in Whistler, British Columbia, home of the 2010 Winter Olympics and Paralympic Games. The Dow Chemical Company delivered and installed 900 gallons of pure DOWFROST™ HD inhibited propylene glycol-based heat transfer fluid to the ski jump venue in late December 2007. Since then, the ski ramp has hosted several competitions leading up to the 2010 Winter Olympic and Paralympic Games.

Chemistry from Dow will help keep 100 meters of ice uniformly frozen on the Nordic Ski Jump ramp. It takes more than a frozen pond or the ability to simply freeze water to foster world-class winter sports competition. Whether for figure skating, speed skating, curling, or ski jumping, venue operators need the right equipment and the right chemistry to produce a frozen surface that helps ensure the best athletic performances. When scores and winning are down to fractions of an inch or thousandths of a second, the best surface that technology can deliver is required. Very exact temperature control is necessary to optimize sliding surfaces for skis, skates, or curling stones.

The Dow Chemical Company's Performance Fluids business is the official heat transfer fluids supplier for the 2010 Vancouver Winter and Paralympic Games. At venues like the Nordic ski jump, chemistry from Dow is helping maintain surfaces for Olympic athletic competitions.

Keeping ski jump ramp conditions optimal

Precise temperature control is extremely important for hosting a successful ski jumping competition. The temperature of the track must be maintained as consistently as possible from top to bottom to provide a safe run with the same conditions for all jumpers. However, environmental conditions can change significantly through the course of a day; a morning that begins at 10 degrees Fahrenheit may reach 45 degrees Fahrenheit in the afternoon. At air temperatures above approximately 38 degrees Fahrenheit, the ramp's surface can begin to melt and accumulate moisture

that will slow jumpers down, especially near the critical takeoff point at the bottom. Not only can this cost jumpers distance, it can also be dangerous.

"To ensure the best conditions, a ramp refrigeration system must be able to respond to changes in temperature and humidity of the surrounding air, as well as variations in the amount of direct sunlight the track is exposed to," said Kevin Connor of Dow Chemical's Technical Service Group for DOWFROST™ HD Fluid. "A system using chilled DOWFROST™ HD Fluid helps keep the temperature of sliding surfaces more uniform despite these varying conditions. In this way, chemistry from Dow contributes to Olympic-level athletic performance."

Connor said that better performance is only one advantage of using an inhibited glycol heat transfer fluid such as DOWFROST™ HD Fluid at this and other winter sports venues. In addition to keeping temperatures uniformly cold, Connor said, "This chemistry provides corrosion protection for pipes and pumps that other fluids do not. The fill in Vancouver will last for many years. In fact, the original fill will likely last for 30 years, if not longer, with proper maintenance." ■

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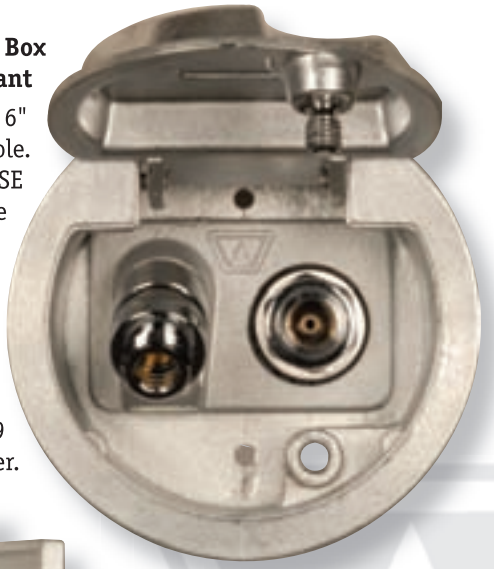

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Siphonic roof drainage: What's on the horizon?

BY JERRY CARSON

Looking to the east from my office I can almost see into the far distance — the Ivory Towers of the Wise Siphonic Roof Drainage Men. The paths leading to them are little used and overgrown, far from what they had expected. If I turn about and listen closely I can hear the Medicine Man in the West, "The building's not sick, it doesn't need a new solution," he murmurs. Of course the Young Braves, keen to make their mark, are singing the praises of "new technology"; but they are still in awe of the thinking of the Elders who tell them, "For generations we've worked with open channel flow and Manning's formula. Our technique is simple to understand and easy to apply using tables that dictate the flow rates under given situations. Change can be good but what we know is better." So say the Elders.

Is change inevitable?

Traditional thinking and techniques have determined not only drainage strategies but also how roofs have been designed for generations. Yet the size and complexity of buildings continues to increase, so it is surely good engineering practice to actively examine more flexible and appropriate solutions to draining roofs.

Siphonic Roof Drainage (SRD) is such a solution, so what's the fuss about?

How does it work?

Put simply, SRD is the application of a technique to drain large roofs with minimal pipework comprising vertical pipes and lateral pipes without grade.

SRD utilizes the potential energy inherent in the collected rainwater on a roof as it descends to the point of discharge. As the water falls through the roof drains and into the pipework, potential energy is converted to kinetic energy. As the water flows through the pipe system, the pressure drops. This lower or negative pressure will, in turn, draw into the piping a homogenous mixture of water and air through the roof drain[s] above it. If, however, air is prevented from entering into the system, the negative pressure can only draw in more water, further reducing the volume of air entrained in the pipework. The pressure within the pipe system will reduce until a point is reached where all air has been evacuated and only water remains, completely filling the pipes. The stage of what is termed "full bore flow" has now been reached and the system is working at its maximum capacity. During full bore flow, the system is depressurized so there is no need for inclined pipes to induce the flow of water to the discharge point.

Clearly, a siphonic system will not work at full capacity every time it rains. Under light rainfall, or at the beginning of a storm, water will enter the roof drains and, since water will always find the point of least energy (and take the path of least resistance), flow slowly along the pipes draining the roof in the traditional manner. The smaller pipe size and absence of inclination in the pipes initially limits the flow rate allowing the rainwater to build up around the roof drain. However once the water level reaches the air baffle, (see "Anatomy of a system" below) the flow rate through the roof drain increases dramatically as siphonic action begins.

Anatomy of a system

Siphonic roof drains are a little more sophisticated than conventional types. The significant difference is the inclusion of an "air baffle," located just above the top of the siphonic roof drain and extending some way beyond the throat of the drain. Crucially, a siphonic roof drain must be thoroughly tested to ensure that it operates in a predictable manner and its hydrodynamic characteristics are fully understood and documented.

The significant difference between a siphonic roof drain and a conventional type is the inclusion of an "air baffle," located just above the top of the siphonic roof drain and extending some way beyond the throat of the drain.

Connecting to each siphonic roof drain, is a "tail pipe," — consisting of a vertical section and a horizontal section — that links each roof drain to a lateral collector pipe. In the majority of systems, multiple tailpipes connect to the collector pipe(s), which ultimately branch into a vertical downpipe. In any siphonic roof drainage system, it is the tailpipes that first operate siphonically. The increased flow rate generated by the siphonic action in the tailpipes forces air out of the lateral collector and downpipe and facilitates siphonage throughout the whole system. It is important to note that while identical roof drains may be

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used at each drainage point on the roof, the capacity of individual drains may well be completely different. Drainage capacity is determined not only by the roof drain but also by the pressure in the connected tailpipe.

For the whole system to function correctly, it is important that, once fully-filled [primed], each tailpipe continues to operate siphonically. If one tailpipe has insufficient water to maintain its primed state, it could allow air to enter the pipework and break the siphonic action throughout the entire system. It is for this reason that each drain must be "balanced" to minimize the head difference.

In general terms, the collector will have a greater diameter than tailpipes and increases in diameter as more tailpipes are connected to it. At no point should the collector decrease in diameter along its length though it is possible that in some designs the collector may be of a single diameter along its entire length. The downpipe should never have a greater diameter than the collector at its maximum and it is commonplace to reduce the diameter of the downpipe as it descends. While this may seem alien compared to traditional drainage solutions, it is an accepted and extremely effective method of controlling the pressure in the system and hence its capacity.

Controlling the pressure within a siphonic system is often the most difficult aspect of the design phase. If large negative pressures are allowed to be generated in the tailpipes, extremely high fluid velocities may be experienced in the small diameter pipes (typically 3"). While high flow velocities are rarely a real problem, it is preferable to control them. Of far greater concern is where the pressure is allowed to drop too low (below the vapor pressure) and bubbles are generated in the water, a condition known as cavitation. At this stage, the water is effectively boiling, and

The elimination of air and less reliance on gravity means that design professionals can reduce costs, improve design efficiency, protect the environment and save money in a multitude of ways.

as the steam bubbles reach regions of higher pressure, they implode, generating significant noise and energy. Once initiated, cavitation may continue even as the pressure rises, producing noisy systems with unpredictable results. For this reason, the pressure in siphonic system pipework should be limited to 29.5 feet water column below atmospheric — at sea level. The effect of pressure also should be considered in relation to the choice of pipe material. While the pressure regime in operational siphonic systems tends to be negative, there are often instances (particularly in high rise installations), where positive pressures may require attention both under drainage conditions and in the theoretical [albeit unlikely] case of a total blockage. Safety first! For cast iron systems the pressure is hardly ever an issue. For plastic pipes, the thickness of the pipe is the critical factor. It must be noted that pressure ratings for pipe are always stated for positive pressure, the consequences and performance under negative pressure are quite different.

Siphonic roof drainage differs from conventional systems in that a design must be engineered for each and every installation. Nevertheless, it is still only a technique for draining rainwater from roofs. The huge debt should be acknowledged to those Wise Siphonic Roof Drainage Men for their great efforts in identifying and exploiting the potential of this technology. They have taken the concept around the world and have proved both the technique and the technology beyond doubt.

To design and implement a siphonic roof drainage solution certainly requires more thought and effort than the "old methods" but it can provide exceptional rewards. Recently, I designed a siphonic solution to drain the roof of a large distribution warehouse. The design took a morning to produce and the client realized a saving of $240,000. That's really what the fuss is about! ■

Jerry Carson is vice president of Siphonix — MIFAB's UK siphonic roof drain partner.

Product News

Condensing hydronic boiler

The XPak, a new wall-hung condensing residential hydronic boiler, features an innovative extruded aluminum alloy heat exchanger that is state of the art advancement.

Initial model sizes are 85 and 130. Other unique features include modulation with 4:1 turn down, synchronized with a three speed Grundfos non ferrous pump; two section heat exchanger to minimize condensate dwell time; 3" CPVC, Stainless Steel or Polypropylene vent, all US Certified; user friendly, easy access controls; ASME H stamp; and a 20-year prorated warranty. **Raypak.**

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High efficiency toilet

The Sydney Low Profile high efficiency dual flush toilet averages just 0.96 gallons/flush and is ideal for installations that want to conserve water and require a shorter toilet (26½" tall), such as under a counter or a grab bar in ADA installations. This unique feature allows it into many commercial installations where standard height dual flush toilets don't fit, such as condominiums, townhouses, apartments or hotels where countertops extend over the toilet. **Caroma.**

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Intelligent control valve

The ICON System™ is a next-generation gas control valve, which will be standard equipment on virtually every Bradford White residential and light duty commercial product* with no additional cost. Developed in collaboration with Honeywell®, the new valve features advanced temperature control, exclusive performance software, intelligent diagnostics, pilot-on-indication, millivolt powered operation, separate immersed thermowell, and an integrated Piezo igniter. Also available are universal replacement kits that allow for direct replacement of an ICON System™ control valve or a previous generation gas control valve on most existing models. **Bradford White.**

**All Atmospheric Vent and Direct Vent Residential and Light Duty Models except High Performance and Mobile Home Models.*

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Heat transfer for commercial solar

New line of plug and play heat transfer appliances, the Commercial Solar Station (HCOM), is a packaged closed-loop heat transfer appliance for accommodating large solar hot water projects of up to 100 flat plate collectors with a single module, while still larger projects can combine modules in parallel for limitless sizing potential. **Heliodyne.**

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Infrared camera

The new FLIR i7 couples RESNET-compliant 120×120 (14,400) pixel infrared resolution with 2% accuracy and 0.1ºC thermal sensitivity — a robust combination of capabilities to quickly detect moisture issues, missing insulation, HVAC leaks, electrical problems, thermal leaks, and numerous energy-audit-related problems. The compact FLIR i7 reveals abnormal temperature readings with crisp images displayed on a large 2.8" (71mm) high-resolution color LCD. The FLIR i7 leverages FLIR's extensive user input with a fully-automatic design, intuitive menu navigation, and focus-free lens that make it easy to use even for newcomers to thermal imaging. **Flir Systems, Inc.**

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No-hub couplings

STAR no-hub couplings are independently certified to the ASTM standards for Standard and wide body heavy duty applications. Engineered for maximum performance and ease of installation, the Standard 60, Heavy 80, and Super Heavy 80 couplings feature all stainless steel construction and premium neoprene gaskets. Committed to quality service for over 25 years, Star Pipe Products offers an industry leading 5-year warranty for STAR cast iron soil pipes, fittings and no-hub couplings. **Star Pipe Products.**

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Condensing tankless water heater

Takagi's new T-H2 is a high efficiency condensing tankless water heater that will allow installers to vent with PVC instead of stainless steel. It features a front panel LED screen that displays temperature settings and codes for easier maintenance and troubleshooting, a thermal efficiency around 92% and a maximum flow rate of 9 GPM. Four units can be linked without an additional control box, making the T-H2 ideal for light commercial and heavy residential applications. **Takagi.**

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Lead-free bubbler

The new stainless steel bubbler and waterway components are 100 percent lead-free, and are recognized by the metal manufacturing industry's lead standard. As with any of Acorn's products, the stainless steel construction offers the assurance of a clean material. Now 100 percent free of lead, the Stainless Steel waterways ensure our drinking water is conveyed in an even safer way. **Acorn Aqua.**

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M•Press metering faucets

M•Press™ is a new line of metering faucets with unmatched reliability, durability and performance. Exclusive sealed silicon metering mechanism provides consistent water flow with accurate timing and proper shut-off, while protecting against impurities and clogs. In addition, the M•Press metering cartridge uses an internal pressure-balancing spool, so varying water pressures will not affect faucet performance. Each faucet is factory tested to ensure years of water savings and dependable operation. **Moen Commercial.**

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Tankless water heater

Super-efficient N-0842MC condensing unit for residential use is an extension of commercial N-0841MC tankless water heater, and its new condensing technology yields an astounding 94% energy efficiency versus only 60% of a typical tank

water heater. The N-0842MC will be housed in Noritz's traditional powder coat casing and has a built-in PVC adapter (PVC adapter purchased separately on commercial unit). **Noritz.**

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Standard Handsink

The 7-PS-76 Standard Handsink with dual side splashes and removable rear utility tray is ideal for any prep area. The new 7-PS-76 contained unit is constructed from stainless steel and comes complete with dual 12" high side splashes, removable rear utility tray, splash mounted faucet, lever operated drain with built in overflow and wall brackets. This unit features a keyhole bracket for easier installation and more stability. The standard 10"×14"×5" bowl is seamless. Unit is NSF approved. **Advance Tabco.**

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Thermostatic mixing valves

7600 thermostatic and pressure-balanced mixing valves are designed for shower and bath applications in healthcare, educational, penal, indus-

trial, recreational and other commercial/institutional applications. The Showermaster 7600 concealed models provide dependable control of water temperature for showers or baths. **Leonard Valve.**

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Letters to the editor

Dear Ron,

I read your article regarding hot water temperatures and thought it was excellent (What are safe hot water temperatures? — August 2009). We always get questions regarding available hot water in a tank heater and we have researched and contacted tank heater manufacturers only to get the round around. They always refer back to First Hour Rating, but never address the question.

How many gallons of hot water can you draw on a continuous basis from a tank heater before you run out of hot water? (Say a 50-gallon tank heater with water in tank set at 120ºF, as you recommend, and inlet of 55ºF on average?)

Can you give us some guidance to get some answers on this simple question?

Carlos A. Cabrera,
President of Operations
EcoSmart US L.L.C.

Carlos,

I see where you are going with your line of questioning. Generally, storage-type water heaters can deliver 70-75 percent of the first hour delivery demand plus the Btu/h recovery rate in the first hour. If the Btu/h input is 100 percent of the peak hour load, then it would deliver the entire tank volume at a usable temperature in 15 minutes. Since the hot water in a storage heater is stored at a temperature above the user temperature and is generally mixed with cold water (using your 55ºF incoming cold water example), you should have well over 30 minutes of hot water for a continuous draw. This should handle the hot water demand for most normal applications. If the storage water heater energy input is sized to cover the instantaneous demand factor or (semi-instantaneous) then it can provide adequate hot water all day with no drop off in performance because the storage tank acts as a buffer against temperature fluctuations. Tankless heaters generally only heat the water up to the user temperature. I generally do not recommend tankless water heaters for commercial projects or large residential projects because of their poor temperature fluctuation or pressure fluctuation performance with varying demand (more than one fixture flowing or colder than 55ºF incoming water) Their general inability to heat incoming cold water below 55ºF up to a usable temperature at adequate flow rates makes then a poor choice for my design projects.

Best Regards,
Ron George

Industry Movers

RJA/San Francisco names operations manager

CHICAGO — Rolf Jensen & Associates, Inc. (RJA) has announced that Thomas M. Dusza, P.E. has joined the company as operations manager for the RJA/San Francisco office. A former RJA employee and most recently the head of the Schirmer San Francisco office, Dusza is a registered Fire Protection Engineer in California, Nevada and Arizona with over 34 years of experience in life safety code consulting and fire protection systems design.

HTP appoints regional managers

EAST FREETOWN, MASS. — Heat Transfer Products (HTP), a leading manufacturer of energy-efficient water heaters and condensing-modulating boilers, has announced the appointments of two new regional sales managers — Michael Klas and Harold "Doug" McElwain.


Klas


McElwain

Advertiser Index

Plumbing Engineer
A TMS Publication

October 2009

Please fill out this Reader Reply form and fax it to us at 630.739.9700 to receive the information you have requested.

1 I wish to receive (continue receiving) **Plumbing Engineer** for **FREE**
☐ Yes ☐ No

2 I am engaged in plumbing engineering: ☐ Yes ☐ No

3 I am also engaged in the following kinds of engineering work:
☐ Piping (a) ☐ HVAC (b) ☐ Hydronic Heating (c) ☐ Plumbing (d)
☐ Sprinkler/Fire Protection (e)

4 I am employed by one of the following:
☐ Architect/Engineer (a) ☐ Mechanical Engineer (b) ☐ Building (c) Owner/Engineer (d) ☐ Consulting Engineer (e) ☐ Mechanical Contracting Firm (f) ☐ Contractor (g) ☐ Design-Construct Engineer (h)
☐ Manufacturer (i) ☐ Manufacturers Rep (j) ☐ Government (k)
☐ Architect (l) ☐ Other (m) _____

5 My title is: ☐ Construction Manager (a) ☐ Specifier/Designer (b)
☐ Owner (c) ☐ President (d) ☐ Vice President (e) ☐ Engineer (f) ☐ Other (g) _____

6 Do you design and specify products? ☐ Yes ☐ No

7 I belong to the following professional organizations:
☐ ASPE (a) ☐ ASSE (b) ☐ ASHRAE (c) ☐ NSPE (d) ☐ SFPE (e)

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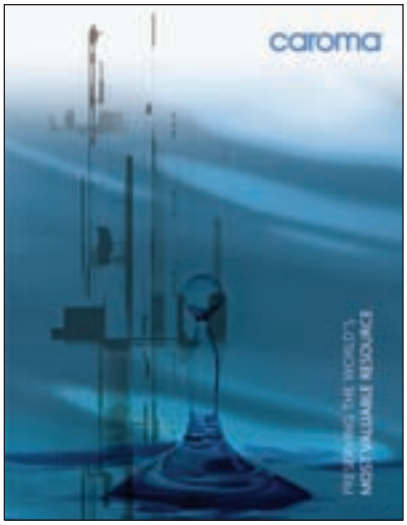

Caroma products brochure

Providing high efficiency dual flush toilets, high efficiency and waterless urinals and stylish bathroom sinks, the Caroma multi-fold brochure contains all products available, water savings potential compared to other toilets and an explanation of siphonic versus washdown technology. **Caroma.**

Circle 125 on Reader Reply Form on page 65

Complete fixture line

Line of vitreous china fixtures can be paired with water-efficient faucets and Flushometers. Brochure explains the various lavatory sink, toilet and urinal fixtures, which are natural additions to Sloan's plumbing systems. High-efficiency toilets and urinals have been specifically optimized to work with low-consumption electronic and manual flush valves. **Sloan Valve Co.**

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Shield™ commercial water heater

A brochure is available for SHIELD™ commercial water heater, designed for long-lasting lifecycle efficiency. With 96% thermal efficiency, inputs up to 500,000 Btu/hr and storage up to 125 gallons, SHIELD has everything it takes to provide the ultimate green operation – without efficiency loss due to lime scale. **Lochinvar Corp.**

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Reinventing educational facilities

"Reinventing Educational Facilities," a new education-focused publication from company's Commercial Division, provides information on Moen's complete line of products built to withstand the demands of educational environments, with items for the lavatory, classroom, laboratory, kitchen and locker room. **Moen Commercial.**

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Grease recovery device

The Grease+Gard™ automatic grease recovery device relies on a belt and heater assembly to extract grease from sink and disposal discharge. Illustrates how the system works in a commercial kitchen app. Grease+Gard™ can be retrofitted on any metal or plastic grease interceptor or purchased as a system complete with unit and solids interceptor. **Jay R. Smith Mfg. Co.**

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Webstone innovations

Brochure showcases labor-saving products for the PHC trades. Easy-to-read brochure highlights Isolator Uni-flange ball valves, Isolator EXP tankless water heater service valves, Pro-Pal valves, along with the Pro-Connect Push & Universal product lines. **Webstone.**

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We've done the math for you.

The new Bell & Gossett Technologic® 502 pump controller and variable speed drive saves energy. And that's just for starters.

Introducing the new Bell & Gossett 502 pump controller and variable speed drive, designed with exclusive Bell & Gossett Technologic pumping software and proven algorithms. The result is a smart, efficient and cost-saving pump system suitable for HVAC and pressure booster applications.

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ITT

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The Zurn Z1199 Grease Interceptor automatically draws grease out of the interceptor during normal operation. No additional action is needed. The simple design does not require any internal cleaning like most interceptors, saving time and money. The removed grease is free of water, making it easy to recycle. Grease removal prevents clogging of pipes and reduces environmental issues at landfills and waterways.

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