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Plumbing Eng

A TMB Publication | September 2010

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Digital Mechanical Design

Inside this issue

- CAD Solutions: Finding the Right Fit
- BIM is Not Just 3D Modeling
- Batteries of Solar Thermal Energy
- Rooftop Drainage Systems
- CSST System Advancements

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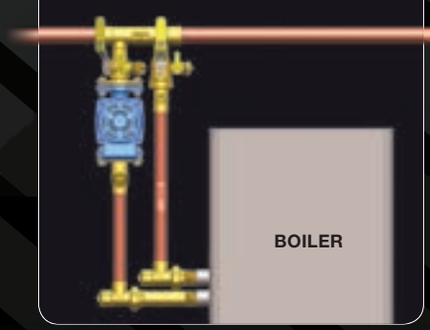

SECONDARY CIRCUIT LOOP APPLICATION

Two Hydro-Core Manifolds (Flange Left) utilized in a Secondary Circuit Loop application

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Circle 1 on Reader Reply form on page 57

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RE 34,832 other
patents pending

•14,700 fires per year* in non-adult schools

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

U.S. Fire Administration Report on School Fires, August 2007, Vol 8, Issue 1 findings.
*Average per year

Laws, Codes & Standards Compliance

- ADA 4.19.4, ICC/ANSI A117.1, ADAAG 606.5,
- International Building Code (IBC) Sec. 719.7,
- General Services Administration (GSA) P-100
- 2009 US Army Corps of Engineers/Military Facilities Specification (ASTM E84)
- IAPMO PS94 2008 Sec. 3.5 ASTM E84 25/450 Testing Laws, Codes & Standards Compliance

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Circle 2 on Reader Reply Form on page 57

INSIDE THIS ISSUE

Volume 38, Number 9, September 2010

Plumbing Engineer
A TWB Publication

FEATURES

Finding the Right Fit

With all of the CAD solutions on the market, how do you pick the right option for you?

Story on page 32

BIM is Not Just 3D Modeling

We are moving into an area where liability is shifting from the contractor to the engineer, and the engineer may not see it coming.

Story on page 36

Batteries of Solar Thermal Energy

Spec'ing storage tanks for solar domestic hot water sytems.

Story on page 44

Rainwater Roof Drainage Systems

Sort out the many considerations in the design of storm/rainwater systems.

Story on page 48

CSST System Advancements Take Aim at Lightning Safety

When using flexible gas piping or corrugated stainless steel tubing (CSST), it is essential to understand that proper installation is critical to ensure the most protection from the effects of lightning, which can potentially damage metallic systems.

Story on page 52

COLUMNS

The PHC industry is on the forefront of computer designs; open your eyes to the breadth of offerings.

Cover courtesy of Autodesk

INDUSTRY NEWS & OTHER DEPARTMENTS

Editor's Letter

John Mesenbrink
editor@plumbingengineer.com

To BIM or not to BIM?

That's a silly question, really. In the January 2010 issue of *Plumbing Engineer*, we explored the topic of Building Information Modeling, or BIM, and its many favorable attributes. There is no denying that BIM continues to help designers draw better specs, and it streamlines efficiency. In that issue, contributing writer Eric Winslow, Superior Air Handling in Clearfield, Utah, stated, "While CAD technology, including 3D modeling and the idea of utilizing embedded information from within the 3D model is certainly not new to the HVAC industry, BIM is now being applied to all building trades. It is now possible to create a virtual re-creation of the project including all necessary components from the structural steel skeleton all the way down to the fixtures and finishes. These components are united into a single integrated model for analysis. Many of the objects are rich in embedded information, which serves a multitude of purposes, while current trends in BIM implementation see 4D, 5D and XD technologies."

Moreover, most PHC manufacturers offer some sort of CAD/BIM offering to help end users better implement specific products. But it is important to understand software designs, and CAD and BIM technology. In this issue, Kate Morrical, technical marketing manager for Autodesk, offers up the unique advantages of CAD software in *Finding the Right Fit*, page 32. "Clients and other project stakeholders expect your designs to be digital and compatible with the best-in-class design software they are using," says Morrical. Make sure you are on the cutting edge of design software. The sky's the limit, right?

Well, on the other hand, we get a unique perspective from Peter Kraut in his offering, *BIM Is Not Just 3D Modeling*, page 36. Here, Kraut tells us that although BIM has its great advantages, be cognizant of all aspects of computer design modeling.

"Most future engineers graduating just a few years ago have never modeled in 3D... The problem with BIM is that we are now asking one of the least experienced designers to make major engineering decisions."

Kraut continues, "As engineers are adding layers of information to their drawings, the time required for design is increasing. And, as the burden of coordination has shifted toward the company producing construction documents, something has to give. The burden of liability and other responsibilities are shifting as well. BIM raises the bar and takes 3D modeling to a higher level. Just make sure you understand the difference."

The power, literally, is at your fingertips. It's up to you to keep your eyes open. ■

PLUMBING ENGINEER
(USPS 567-950)
ISSN 0192-1711

PLUMBING ENGINEER (USPS 567-950) ISSN 0192-1711 is published monthly by TMB Publishing Inc., 1838 Techny Court, Northbrook, IL 60062. Phone (847) 564-1127, Fax (847) 564-1264. Magazine is free to those who design and specify plumbing/piping systems in commercial, industrial, institutional and governmental buildings; as well as government officials and plumbing inspectors. Subscription rates for U.S. and Canada: $50 for one year, $90 for two years. Other countries: $300 per year. Periodical postage paid at Northbrook, IL, and additional mailing offices. POSTMASTER: Change of address should be sent to ***Plumbing Engineer***, 440 Quadrangle Dr., Suite E., Bolingbrook, IL 60440. Material and opinions contained in contributed articles are the responsibility of the authors, not of TMB Publishing Inc., *Plumbing Engineer* magazine or its Editorial Advisory Board. The publisher cannot assume responsibility for any claims made by advertisers.

Volume 38, Number 9. *Plumbing Engineer* is microfilmed by University Microfilms, Ann Arbor, MI, and indexed by Engineering Index Inc. Publications Mail Agreement No. 41499518. Return Undeliverable Canadian Addresses to PO Box 503, RPO West Beaver Creek, Richmond Hill ON L4B 4R6

Plumbing Engineer
A TMB Publication

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NEW

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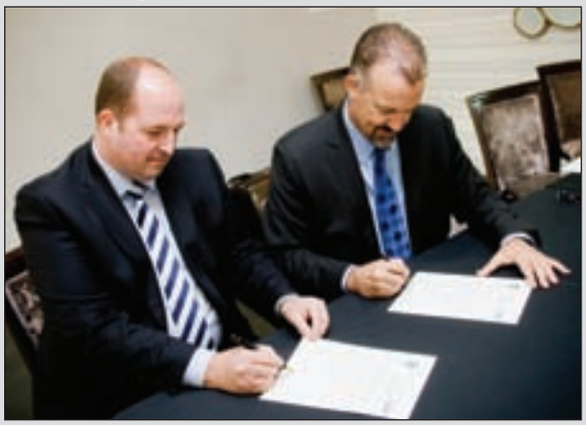
Circle 4 on Reader Reply Form on page 57

Industry News

ICC signs MOU with U.K. association to advance plumbing expertise

LONDON — The International Code Council (ICC) has signed a Memorandum of Understanding (MOU) with the Association of Plumbing & Heating Contractors of England and Wales (APHC). The MOU calls for both organizations to work together to advance the plumbing industry overall, including myriad mutual goals on local, national and global levels.



Signing the MOU in London are APHC CEO Clive Dicken (l) and Jay Peters, ICC's PMG group executive director.

This union will serve to share APHC and the Code Council's respective and combined expertise to help plumbing professionals to advance their trade through education about new techniques and technologies. Another key goal outlined in the MOU is to dramatically enhance perceptions among consumers and businesses of the important role that the plumbing industry plays in providing proper sanitation to communities throughout their respective countries.

While access to proper sanitation isn't an issue in either of these well developed nations, an additional key focus of both organizations is to join forces towards advancing proper sanitation efforts to assist the 2.6 billion people who do not currently have access to proper sanitation.

"Plumbing is one of the most important industries in the world. Good plumbing saves countless lives every single day. People working in the industry are rightly proud of what they do," said Clive Dicken, chief executive officer of APHC. "However, we face two issues: firstly, in the developed world, people have become complacent about sanitation and how their health depends on it; secondly, many parts of the developing world still do not have the luxury of decent sanitation, and 4,000 children die each day because of this."

The APHC and Code Council will collaborate on efforts independent of and alongside other sanitation-related organizations to advance global sanitation standards. One example of how the Code Council is already sharing their knowledge towards this goal is their extensive work serving on the committee that is developing the Global Guidelines for Proper Toilet Design. Working collaboratively with the World Toilet Organization (WTO) and other global sanitation organizations that focus on the global sanitation crisis, this document will serve to standardize the design, installation and maintenance of toilets throughout the world, making it easier for less developed nations to adopt and enforce these code provisions.

B&G's Little Red Schoolhouse announces fourth quarter schedule

MORTON GROVE, ILL. — Bell & Gossett, a leader in education for the hydronic heating and plumbing industries, has announced its training course schedule for the fourth quarter of 2010. The free training seminars are offered at the Bell & Gossett Little Red Schoolhouse Education Center in Morton Grove, Illinois, 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 fourth quarter Schoolhouse seminars include:

- Modern Hydronics Basic Seminar, October 4 – 6
- Steam System Operation & Maintenance October 11–13
- Design & Application Seminar November 1–3
- Large Chilled Water Design Seminar November 15 –17
- Steam System Design & Application December 6 – 8
- Modern Hydronics Advanced Seminar December 13 –15

For information, visit www.schoolhouse.itt.com.

Plumbing category added to AHR Expo® Innovation Awards

WESTPORT, CONN. — Reflecting its growing presence at the industry's leading HVAC/R event, "Plumbing" has been added as a new category to the 2011 AHR Expo Innovation Awards. Widely acclaimed as one of the most prestigious honors in the HVAC/R industry, the Innovation Awards recognize the most innovative and useful products among the thousands on display at the AHR Expo (www.ahrexpo.com). About 150 entries submitted by exhibitors each year are judged on the basis of design, unique performance, market impact and value to the HVAC/R industry.

Now in their ninth year, the Awards are also meant to

More Industry News on page 10

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Circle 5 on Reader Reply Form on page 57

Industry News

Continued from page 8

promote and encourage new product development in ten major categories:

- Building Automation
- Cooling
- Green Building
- Heating
- Indoor Air Quality (IAQ)
- Refrigeration
- Software
- Tools, Instruments
- Ventilation
- Plumbing

"Plumbing products, technologies and solutions have had a growing presence at AHR Expo for several years," said Clay Stevens, president of International Exposition Company, which produces and manages the AHR Expo. "Adding plumbing as a new category to the AHR Expo Innovation Awards allows us to include all the major segments represented at the show."

Entries for the 2011 awards are due September 15, 2010.

HydrationStation™ GreenSpec listed

SPARKS, NEV. — Haws® Corporation announced the recent GreenSpec listing of their revolutionary water delivery system, the HydrationStation. GreenSpec is an exclusive online directory of environmentally friendly products. GreenSpec researches and evaluates qualifying products based on how the product addresses key environmental issues and specific criteria. The HydrationStation was assessed under a wide range of environmental qualities and was listed as an innovative product because it allows users to reduce their dependency on single-use plastic water bottles. On average, the HydrationStation saves more than 37,800 16.9 oz. single-use plastic water bottles a year from entering landfills.

Hayes

The HydrationStation has received various accolades from sustainability groups across North America. The product has been on the market for over a year and has been installed in a variety of applications from universities to ski resorts, including the School of the Art Institute of Chicago, Zuda Yoga of Sacramento, City of Rancho Cucamonga, Monarch Mountain Ski Resort in Colorado and more.

Casey Hayes, Haws Corporation's director of engineered solutions, presented a workshop titled ANSI Z358.1-2009 Emergency Eyewash/Showers — Tepid Water in the Workplace at the Voluntary Protection Programs Participants' Association Conference in August. The presentation included information about the newly updated Z358.1-2009 standard, studies on tepid water and solutions for market needs.

Hayes has been with Haws for more than 20 years and has served on a wide variety of industry standard development committees, as well as having authored several hundred trade press articles and papers over the past ten years. As director of engineered solutions he organizes a complete line of custom engineered mixing valves, tempered water solutions, recirculation systems, air-charged systems and alarms and has a wide-breath of knowledge and experience with ANSI Standards.

To learn more about the HydrationStation, visit www.stayhydrated.net.

Danfoss president addresses energy efficiency during Clean Energy Ministerial

BALTIMORE — On July 19, Robert Wilkins, president of Danfoss North America, one of the world's leading manufacturers of high efficiency electronic and mechanical components and controls for air-conditioning, heating, refrigeration and motion systems, joined other industry leaders in discussions on renewable energy, energy efficiency, smart buildings and smart grid technologies during the Clean Energy Ministerial in Washington, D.C.

Hosted by the American Council On Renewable Energy (ACORE), the Alliance to Save Energy (ASE) and the U.S. Green Building Council (USGBC), the Stakeholder Meeting prefaced the Clean Energy Ministerial and

More Industry News on page 12

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"Not sold retail"

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"American Made"

"Bradford is just all around (a) better heater and company"

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The comments above are just a few taken from the 2009 CLEAReport* by Clear Seas Research. We wanted to let your industry colleagues speak for us. They prove that our commitment to the trade and our pledge to provide a premium product at the best possible price is the way to do business.

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*Ranking is based on the 2006, 2007, 2008 and 2009 CLEAReports by Clear Seas Research. Please visit www.clearseasresearch.com for additional information.

Circle 7 on Reader Reply Form on page 57

Industry News

Continued from page 10

Robert Wilkins (far right), president of Danfoss North America, joined other clean energy leaders during the first-ever Clean Energy Ministerial Stakeholder Meeting to discuss policies and mechanisms necessary for the acceleration of worldwide clean energy deployment.

included more than 150 clean energy leaders from technology companies, financial services, professional services, academia, associations, nonprofits and more, to discuss the policies and mechanisms necessary for the acceleration of worldwide clean energy deployment.

Wilkins, who addressed energy efficiency in end-use sectors alongside representatives from Sustainable Development Capital, Whirlpool, and Wal-Mart, called for action, saying, "Forty percent of all energy consumption in the U.S. is related to buildings. The built environment is divided between new construction and existing buildings. Each group has unique challenges and constraints, but both groups require strong energy policy. Specifically, we need tax incentives for replacing old, inefficient equipment. We need stronger building codes that are enforced. We need an effective building rating system to ensure investment in energy savings leads to increased building values."

Franklin Electric adds mobile facility

BLUFFTON, IND. — Franklin Electric announced the addition of a mobile training facility to its technical toolbox of service and training options, providing mobile, hands-on customer support opportunities to the water systems industry.

This new mobile training facility is the latest tool added to Franklin's already extensive training portfolio, which includes FranklinTECH factory training, on-the-road seminars, field service support and a technical service hotline. The facility focuses on two major product areas: drives for constant pressure apps and sump, sewage and effluent

Continued on page 56

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Circle 9 on Reader Reply Form on page 57

Designer's Guide

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

Heuristics and social captivity

Recently I read a great editorial on ENR.com by a gentleman named Jon Schmidt, P.E., a structural engineer in Kansas City, entitled *Don't Blame Engineering*. It focused on the Gulf oil spill, and the tendency to blame engineering for such a crisis, whereas the fault often lies more with management.

Engineering has a certain "social captivity" that produces market-driven value judgments rather than purely technical solutions to engineering challenges. When the boundary limits of engineering are stretched, the interests of an employer, client or government might drive the managerial-level decision making process more so than the technology. State-of-the-art heuristics are often tempered by social captivity in deriving engineering solutions.

"Roughly speaking," Schmidt wrote, "a heuristic is any plausible aid or direction in solving a problem that is, in the final analysis, unjustified, incapable of justification and potentially fallible." Hunter's Curve is an example of a heuristic. While it cannot be proven absolutely, its basis is practically derived and it has been used successfully for many, many years. However, one has to use Hunter's Curve discreetly. You would not use it, for example, for a sports arena, because the assumed diversities of the curve do not apply to halftime in a stadium, when your diversity is nearly 100%. "After all," Schmidt continued, "engineering is not deterministic; it routinely involves selecting a way forward from among multiple options when there is no one 'right' answer."

Heuristics generally draw a line in the sand that should not be crossed, and crossing that line can lead to failure. Social captivity can work to push that line further. If the line is pushed and no failure occurs, the heuristic is redefined to a new limit point. Social captivity will continue to push the limits of the heuristic until a failure occurs, and then we know where the line truly belonged – ahead of the failure. It was the social captivity that caused the failure, in an effort to save time or money or both — not the engineering.

This is why most engineers dislike the concept of value engineering. It is a form of social captivity that strives to determine the extent to which the engineer's design can be compromised in order to save money. Value engineering was the reason the Deepwater Horizon failed, although calling it value engineering is akin to putting lipstick on a pig. Cheating would be a better reference. Negligence would fit even better. I am sure it was not the engineers who made the decisions that compromised the design, but their non-technical managers looking to save money, boost profits and increase their bonuses.

The counterargument that supports the concept of social captivity is unfortunately created by the engineering community itself. Too many engineers are guilty of putting too much fat into their designs, either because of insecurity, or because of an addiction to the concept that "more is better." As an old colleague of mine once said about domestic hot water, "I've never heard anyone complain about having too much hot water, but they sure make a lot of noise when they run out." While this is true, it doesn't mean that you would be justified in specifying a 120-gallon water heater for a 3-bedroom, 2-bath spec home.

The other day I was asked by a client to investigate problems they were having with their domestic water pumps. A site visit quickly revealed that the controls for the pumps were a mess, but I also had to determine if the existing pumps were properly sized. A first pass at sizing the pumps revealed that the set should be rated for about

> State-of-the-art heuristics are often tempered by social captivity in deriving engineering solutions.

400 gpm and 400 feet TDH. I selected a triplex VFD package with each pump rated for 200 gpm, 400' TDH, and 30 HP. This selection allows for one pump to be taken out of service (i.e., n+1), which is a prudent design for an upscale high-rise office building.

After sizing the pumping station myself I looked at the pump schedule to assess the existing pumps. To my horror I found that the existing pumps had a 20 HP lead pump rated for 60 gpm and 540', plus two lag pumps with 60 HP, 290 gpm and 540'. That's 140 HP of pump capacity vs. 90 HP. Clearly some value engineering would have been warranted in this case.

Engineers need to trust the heuristics, trust the Code, trust the numbers that they generate, and not add factors of safety and wild assumptions over and above the Code and heuristics. Certainly it is reasonable to provide an n+1 design, as I did above in selecting a triplex pumping plant. But how did the design engineer for the referenced building select pumps with 540' of head rather than 400'? Perhaps he would have argued, "The street pressure might drop." Well, if the street pressure dropped from 105 psi to 45 psi, most of the buildings in the area would be in trouble and it would probably be indicative of a water main break.

Other engineers have said many times, "The Code is a minimum standard." While there are rare cases where the Code might be inadequate (such as the sports arena example above), the Code is in fact quite conservative, and to imply that it is a minimum and potentially inadequate is absurd for all but highly unusual projects.

Even NFPA, the national standard for fire protection systems, is conservative by design. While fire protection systems are static systems rarely put to the test, the Meridian Plaza fire in Philadelphia of 1991 did just that. After a fire that started on the 22nd floor of the building raged up eight unsprinklered floors, it finally was arrested 19 hours later on the 30th floor with the operation of just

Continued on page 16

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Circle 10 on Reader Reply Form on page 57

Continued from page 14

10 sprinkler heads. Most hydraulic sprinkler designs for office buildings include two to three times that number of sprinklers in the 1,500-sq.-ft. theoretical fire hazard area. Of course it is good to be conservative where life safety issues are concerned, but I've known engineers and fire marshals who add factors of safety to the requirements of NFPA, because once again, they viewed it as a minimum standard.

So on one hand we have companies like BP and many like them that use social captivity to cut corners despite the recommendations of their technical staff, and on the other we have engineers who produce designs that are more complex and expensive than the heuristics would require. In the middle we have the purist engineers, like those who engineered the space shuttle, who design on the cutting edge of the heuristics and achieve great things. But even the space shuttle fell victim to social captivity when the Challenger exploded.

We all remember the images of the Challenger when it broke apart 73 seconds after takeoff. The engineers involved in the design knew that the O-rings were flawed and that launch conditions were too cold, but their concerns were stifled by NASA's organizational culture. NASA managers, it was proved, frequently evaded safety regulations to maintain launch schedule.

After the disaster President Reagan appointed the Roger's Commission to investigate the failure. The report said in part that "...failures in communication... resulted in a decision to launch 51-L based on incomplete and sometimes misleading information, a conflict between engineering data and management judgments, and a NASA management structure that permitted internal flight safety problems to bypass key Shuttle managers."

Richard Feynman, one of the Commission's most prestigious members, said in the appendix of the report that the estimates of reliability offered by NASA management were wildly unrealistic, differing as much as a thousandfold from the estimates of working engineers. "For a successful technology," he concluded, "reality must take precedence over public relations, for nature cannot be fooled." ■

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Code Update

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

22 pitfalls to avoid when designing or installing a combined heating hot water and domestic hot water system – Part II (pitfalls 9-22)

The following is a list of problems or pitfalls (9-22) that I have found over the years that are related to combined heating hot water and domestic hot water systems. If you can avoid these pitfalls you will have a much safer system:

Pitfall Number 9: Cast iron boiler on an open system

Cast iron boilers do not perform well with open systems because of the large quantities of water that introduces oxygen and minerals that cause rust stains, oxidation and fouling of the heating surfaces. This mistake does not take long to find because of the rust stains that appear in sinks, bathtubs and showers. Cast iron boilers can work well, but they must have a separate closed loop of boiler water that is treated with corrosion inhibitors and other boiler chemicals as needed. The boiler water can then be piped to a coil in a hot water tank or to a heat exchanger to provide domestic hot water.

Pitfall Number 10: No storage tank with copper fin tube boilers

I have seen installations where someone thought they could save a few bucks by eliminating the storage tank and using the heating hot water main as the storage tank. This does not work in motels, hotels, apartment buildings and condos. In facilities like these there needs to be a stored volume of water ready for use in a dump load such as a morning shower period. Copper fin tube boilers are designed to raise the temperature of the water only 20 to 40 F as the water flows through the boiler. If the water flows too slowly through the boiler, it will scale up and if it flows too fast the copper will erode away. These types of boilers need to have a storage tank for plumbing applications with a dump load. In heating applications, the Btu input is matched to the heating load calculations, and the system works fine.

Pitfall Number 11: No thermal expansion tank

All heating hot water system and domestic hot water systems must have a thermal expansion tank rated for use in a potable water system, not a hydronic expansion tank. The tank should be sized for a system start-up from ambient to hot. If the system has one boiler and two piping systems with a heat exchanger each piping system should have a thermal expansion tank.

Pitfall Number 12: Scalding injuries and deaths

Many designers, contractors and owners forget that there are lives at stake when they design and build the combined hot water systems. People have been scalded to death or seriously injured when the systems are not designed, installed or maintained properly.

Pitfall Number 13: Litigation

If you are not willing to commit to properly maintaining the system for the life of the system, don't design it, don't install it or don't request that it be installed. Combined systems require an extensive amount of work and oversight to make sure someone does not get injured. You must document everything, because when someone is injured, everyone will be named in the lawsuit.

> A combined heating hot water and domestic hot water system is a hybrid system that utilizes a boiler or boilers to heat water for heating the building environment, and it uses boiler water to heat domestic hot water for bathing, washing and cleaning uses. The two systems are often combined in an effort to reduce the initial cost of installation, but there are a lot of differences between the two that, if not accounted for, could result in someone getting seriously injured.

Pitfall Number 14: Code requirements for thermostatic mixing valves

The 2009 International Plumbing Code (IPC) has the following language dealing with combined systems:

501.2 Water heater as space heater. *Where a combination potable water heating and space heating system requires water for space heating at temperatures higher than 140°F (60°C), a master thermostatic mixing valve complying with ASSE 1017 shall be provided to limit the water supplied to the potable hot water distribution system to a temperature of 140°F (60°C) or less. The potability of the water shall be maintained throughout the system.*

The 2009 IPC also has the following language addressing maximum water temperatures for instantaneous water heaters:

501.6 Water temperature control in piping from tankless heaters. *The temperature of water from tankless water heaters shall be a maximum of 140°F (60°C) when intended for domestic uses. This provision shall not super-*

Continued on page 20

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Code Update

Continued from page 18

sede the requirement for protective shower valves in accordance with Section 424.3.

Pitfall Number 15: Engineered system

I have seen a value engineering option offered by a contractor to combine the domestic hot water system with the heating hot water system. This was not a value to the owner, and it was not engineered. During the evaluation process, the owner decided to allow the contractor to combine the systems without having the contractor provide engineered drawings. This decision gave the contractor the ability to use whatever he wanted to use. The owner got a system that did not work.

Pitfall Number 16: Pipe materials

I have seen a cost cutting option labeled as a value engineering option given by a contractor. The option was accepted, and the contractor simply eliminated the domestic hot water system and changed the hydronic system from black steel to galvanized steel piping. This was in a condominium building that had about 500 condos that sold in the neighborhood of one million dollars each. The galvanized pipe started to rust significantly within two years of service and rust stains were significant in all fixtures. The seasonal dead legs from the heating coils allowed rust barnacles to form until the first call for heat. When the flow in these dead leg branches resumed on the first call for heat in the fall rust, debris, iron oxide and stagnant water would be flushed into the strainers of the control valves and into the domestic water system.

Galvanized steel pipe should never be used on a domestic hot water system because domestic hot water is an open system connected to the city water main, which introduces a large quantity of oxygenated water into the system. Oxygenated water will cause significant corrosion in ferrous metals such as black steel and galvanized pipe. All components of a combined system should be copper or another code approved non-ferrous material for domestic hot water service if they are in contact with the city water supply. I often see iron valves installed in these combined systems. This is usually the result of a heating contractor installing or performing maintenance on the combined system and of the contractor not being familiar with the requirements in the code for all components to be approved for domestic water use.

Pitfall Number 17: Pumps

When sizing pumps for a combined system there should be two separate systems and one boiler. The hydronic system should be a closed loop that can use large ductile iron-bodied pumps. The problem with an open system is that, when the large pumps are shut down for six months or more, the pumps, and all hydronic circuits to heating coils and baseboard heaters, become dead legs in the piping

system. This is why there should be a separate closed piping circuit for the heating system piping.

Pitfall Number 18: Corrosion

I have seen large cast iron and ductile iron hydronic pumps that were not approved for domestic water systems installed in combined systems. When such systems are first turned on in the fall, large slugs of iron oxide laden water are forced into the domestic hot water distribution system. This generally results in sinks and bathtubs filled with orange rusty looking water until the entire system gets flushed out significantly. The ferrous materials in the combined system typically lead to other problems with plugged strainers on control valves and other components.

Pitfall Number 19: Corrosion inhibitors and other boiler water treatment chemicals

I visited one building on the East Coast where the combined system consisted of eight- inch galvanized water pipes. The galvanized pipes were corroding to the point where the hot water was very cloudy and orange. The building maintenance personnel chose to add an injection pump to inject chemicals into the domestic water main entering the building to raise the PH of the water and to intentionally build up a layer of scale inside the galvanized piping to minimize the amount of corrosion. The problem was that the scale also formed on the heating surfaces and in the control valves, causing them to fail. Upon inspecting the barrel of the chemicals being injected into the water supply, I noted that there were warning labels stating that the materials were toxic to humans. I reported this to the building owner, who had to correct the situation immediately. This was another case of a heating contractor working on a plumbing system and not being familiar with plumbing code requirements. The solution he came up with would be a possible option for a hydronic system, but in a domestic water system that was a code violation.

Pitfall Number 20: Loss of both systems when there is a problem

When there is a problem with a combined system that causes the system to shut down, both the domestic hot water system and the heating hot water system are out of service. If it is a boiler problem or another major problem, the entire building could be without both systems for a long period of time.

Pitfall Number 21: Legionellae bacteria

A research report in 1988 authored by Al Steele, who was the president of the ASPE Research foundation at the time, recommended storing domestic hot water between

Continued on page 22

Code Update

Continued from page 21

135 F and 140 F and utilizing a thermostatic mixing valve to mix the hot water down to a safe delivery temperature below 120 F. With a storage temperature of 140 F, Legionellae bacteria will die within 32 minutes.

thermostat that controls a solenoid valve or circulating pumps on the water heater should never be used to control the temperature in a domestic hot water system. Thermostats allow too great a temperature variation and

Table 1: Legionellae Bacteria Growth and Disinfection Temperature Chart

158 to 176 F (70 to 80 C):	**Legionellae bacteria disinfection range**
At 151 F (66 C):	**Legionellae die within 2 minutes**
At 140 F (60 C):	**Legionellae die within 32 minutes**
At 135 F (57.5 C):	**Legionellae die within 2 hours**
At 131 F (55 C):	**Legionellae die within 5 to 6 hours**
Above 122 F (50 C):	**They can survive but do not multiply**
95 to 115 F (35 to 46 C):	**Ideal Legionellae bacteria growth range**
68 to 122 F (20 to 50 C):	**Legionellae bacteria growth range**
Below 68 F (20 C):	**Legionellae can survive but are dormant**

The Legionellae bacteria cannot survive water temperatures above *131 F (55 C)* for more than five or six hours. The bacteria die instantly at temperatures above *158 F (70 C)*. General protection against the bacteria can be achieved by designing an operating water temperature of at least *140 F (60 C)* or higher. As temperatures increase, so does the risk of scalding. For system water temperatures below 140 F (60 C) special provisions are necessary to allow for cleaning and chemical treatment procedures for addressing the Legionellae bacteria in the domestic hot water system.

A storage temperature of 140 F should be high enough to protect the water heater from the bacteria, but in open systems with Legionellae bacteria in the municipal water supply, the potable hot water system would continually be reseeded with high dosages of water that is potentially infested with Legionellae bacteria. This is another reason why combined systems should have a closed loop for the heating hot water system.

Pitfall Number 22: Leakage of boiler water

When boiler water at a higher temperature than 140 F, (180 to 210 degrees F) leaks through a faulty zone valve or solenoid valve or is allowed to flow by gravity circulation through a circulating pump that is de-energized, there is the potential for overheating the domestic hot water. A

there is potential for leakage and temperature creep. The best way to address this is to provide a thermostatic mixing valve that conforms to ASSE 1017 on the domestic hot water line coming from the hot water tank to provide a safe hot water distribution temperature.

If you are considering a combined system, avoiding these pitfalls should help keep your building warm and provide the occupants a safe temperature of hot water. If you don't avoid these pitfalls you could find yourself in hot water.

Another option would be to keep life simple and keep the systems separate. Then you will not have to worry about someone coming along later and messing up your system design with system modifications or poor maintenance that can create scalding issues. Steer clear of combined heating hot water and domestic hot water systems and you will also steer clear of potential litigation. ■

Ron George *is president of Ron George Design & Consulting Services. He has served as Chairman of the International Residential Plumbing & Mechanical Code Committee. To contact Ron, write to him at rgdc@rongeorgedesign.com.*

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FPE Corner

Samuel S. Dannaway, PE,
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A difficult decision

In a previous article it was noted that starting with the 2009 International Residential Code (IRC) all residential occupancies, including one- and two-family dwellings, must be provided with sprinkler protection. The adoption of a sprinkler requirement by the 2009 IRC and the apparent confirmation of that requirement in the 2012 edition sealed the deal. Now all U.S. model building codes, including NFPA 5000, Building Construction and Safety Code and NFPA 101, The Life Safety Code, are consistent in their requirement for complete sprinkler protection for all new residential occupancies. (NFPA 101 does have provisions that do not require sprinkler protection for certain existing residential occupancies.)

Now many jurisdictions across the country considering updating their building codes are faced with a very tough decision: Do they adopt the code with the requirements for sprinkler systems for one- and two-family homes or do they amend the building code to eliminate the requirement for sprinklers for these occupancies? Either choice has significant ramifications.

Imagine a city building official trying to make this decision in the midst of the current state of the U.S. housing market. Many would agree that adding a requirement for sprinklers is an additional burden that the private sector simply should not be subjected to at this time. This city official can expect a heavy lobbying effort, with opponents to the requirement providing all the reasons why sprinklers should not be required. The proponents, usually led by the fire chief, will be in there battling also.

The increased cost and the impact on a struggling housing industry are obvious arguments put forth against a home sprinkler mandate. However, there is a potential legal minefield for government entities to consider.

The problem for the building official is that he or she will be responsible for this decision, even if it is made with the help of a committee and even if approved by the mayor and city council. For most jurisdictions, it will be the first time they will be confronted with this type of decision. Until recently, the model codes did not uniformly require providing home sprinklers. This gave the building official some cover. Under previous codes in Honolulu, for example, builders were allowed the choice of complying with the 2003 IBC or the 2003 IRC. By choosing the IRC one could avoid the sprinkler requirement altogther.

I understand that many jurisdictions have code amendments that allow conditions that are less restrictive than the model code. The big difference is that these less restrictive provisions have the advantage of legacy. As time-tested amendments, there is less concern about allowing a lower level of safety. The residential sprinkler requirement, however, is a significant new and stricter public safety requirement. Also, in my opinion, by nature of being codified in all the model codes, sprinkler protection for one- and two- family homes represents the current Standard of Care for the industry.

The building official should consider the following hypothetical:

The building department opts to amend the 2009 I-codes to eliminate the requirement for sprinklers in one- and two-family homes. A few years later there is a fire fatality in an unsprinklered home constructed in accordance with the building code.

What are the chances that with the help of an akamai (that's smart in the local Hawaii vernacular) attorney a family brings a lawsuit both against the jurisdiction and personally against the building official? One hopes, for the building official's sake, that the political climate is one where the mayor does not leave him holding the bag.

The increased cost and the impact on a struggling housing industry are obvious arguments put forth against a home sprinkler mandate. However, there is a potential legal minefield for government entities to consider.

Fact or fiction? I believe that time will make this hypothetical fiction a fact. Does the building official want to be the first one forced to go to court to defend the code when the fire was in an unsprinklered home constructed subject to an amended 2009 IRC/IBC?

It is important that those promoting the implementation of the code requirement to sprinkler homes be aware of the impact that such a measure can cause and begin to look at addressing those concerns proactively.

First and most obvious is the impact of the additional cost of providing sprinkler protection. One way to address this issue is to provide tradeoffs in building and zoning codes that will help to offset the cost. For large subdivisions involving many dwelling units, substantial tradeoffs could be implemented to help balance the cost impact. Typical examples from the Home Fire Sprinkler Coalition website, www.homefiresprinkler.org/index.html, are described as follows:

- Increased distances for fire department turnarounds;
- Decreased property line and lot line set backs;
- Increased fire hydrant spacing;
- Reduced fire flow requirements;
- Minimum street width reductions;
- Longer dead-ends;
- Narrower traffic lanes (substantially reducing the amount of pavement);
- Tee-type turnarounds are permitted, rather than large

Continued on page 26

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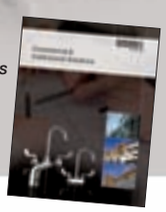

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FPE Corner

Continued from page 24

cul-de-sac turnarounds;

- Increased street grades;
- Increased densities; and
- Longer fire department response times (fewer fire stations).

As noted in previous articles, the sprinkler installation standard that applies to residential sprinklers for one- and two-family dwellings is NFPA 13D, Standard for Installation of Sprinklers in One and Two-Family Dwellings and Manufactured Housing. NFPA 13D systems that use the municipal water system for their supply typically share a connection to the municipal system with the domestic water service. In many cases, the standard size water meter provided will have to increase to ¾- or 1-inch in order to accommodate the flows required for the sprinklers. It would be beneficial if sprinkler protected homes did not have to pay an additional premium for the increased water meter size to the Board of Water Supply or Water Department. In Honolulu, for example, it cost me almost $2,000 to upgrade the size of my meter.

The authorities responsible also would be wise to take steps to ensure that contractors installing 13D sprinkler systems are properly licensed and qualified to do so. Requirements pertaining to licensing of contractors performing this work must be in place to address this situation. The demand for 13D contractors that the requirement will generate will likely create a lack of qualified contractors and the problems resulting from unqualified installations. Without proper regulation, we can expect solar water heater contractors to offer sprinkler system installs with their package (OK as long as they are qualified).

Additionally, homeowners will need to be educated on the care and maintenance of their sprinkler systems. No longer will Johnny and Suzy be allowed to play football in the house.

Regardless of the choice, all involved parties need to approach the decision with eyes completely open. Eventually, the opposition to sprinklers will fade and sprinklered homes will become commonplace. Until then, the building official has a tough decision.

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Solar Solutions

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

Bristol's Six Principles for Good Solar Hydronic Design

Instant hot water recirculation – innocuous energy thief

Instant domestic hot water (DHW) recirculation has been around for a long time. In buildings where the DHW source is a long way from the hot water fixtures, a circulator pump is used to force hot water from the water heater through the hot water supply pipes to the base of the fixture and then back to the water heater through a "recirc return" pipe. Originally, this was done mostly for convenience, so that the user did not have to wait for all the cold water stranded in the supply pipe to empty itself down the drain before the hot water finally arrived.

Over the years, this also became a standard method for saving water and, for that reason, is required by code in many locations. In the past it was common practice to install a continuous duty circulator and plug it in 24/7. In recent years it has become obvious that, using this method, water is saved by throwing energy at it (both heat and electricity). So it is worthwhile to rethink this situation by controlling both the waste of energy and the waste of water.

This issue has come up in nearly every recent solar hot water installation in which I have been involved. Sooner or later during the normal operation of a solar hot water heater, someone will notice that the solar hot water tank does not seem to store heat very well. The solar heat seems to disappear from the tank overnight, causing the backup heater to run in the morning. This is always a surprise and a disappointment to the owner or installer since the solar storage tank is very well insulated and costs more than a conventional DHW tank. Rather than "crossing your fingers" and hoping that this will not happen, it is better to forestall the situation by including an upgrade to the DHW recirc system as part of the solar heating installation. Offering this as an option will at least let your customers know that you are energy aware and have their best interests at heart.

> The electricity consumed by the circulator and other electrical elements causes fuel to be burned and water to be consumed at the electric power plant...
>
> ...the idea that we can save water by throwing electricity at it is probably mistaken if the electrical consumption is not carefully controlled.

Of course, with a conventional water heater the backup burner must work harder to make up for the heat loss as the hot water circulates constantly around the building, resulting in higher fuel bills. The electricity consumed by the circulator and other electrical elements causes fuel to be burned and water to be consumed at the electric power plant. In New Mexico, for example, the majority of that fuel is coal, and the water consumed at the power plant is something like ¾ of a gallon for every kilowatt hour generated. So the idea that we can save water by throwing electricity at it is probably mistaken if the electrical consumption is not carefully controlled. With this gentle reminder that in the world of energy there is no free lunch, let's take a look at some of the upgrades that are possible in a DHW recirculation system to eliminate energy waste.

Piping considerations

In new construction, the hot water supply and recirc return can be designed to minimize heat loss and maximize pumping efficiency. In a retrofit, sometimes the improvements are more difficult to install, but should always be seriously considered.

Pipe insulation. Both the hot supply and the recirc return must be well insulated, especially in locations where ground contact or cold air temperatures exist. I have seen many installations where the pipe insulation has been forgotten on the recirc return line.

Balanced flow. When a single recirculator is used on several parallel loops to various parts of the building, the flows must be balanced just like the loops in a hydronic heating system. Even a well-controlled recirc pump will waste energy pumping through an unbalanced piping system as most of the flow will go through the shortest (and hottest) loop. A balance valve placed on the recirc return pipe under each fixture can be well worth the extra effort.

Multiple circulators. In larger buildings, energy savings may be accomplished by using several different circulators instead of a single circulator feeding parallel loops. Both heat and electricity can be saved when each pump is controlled to provide hot water recirculation only to the occupied part of the building.

Control systems

The most common upgrade to any DHW recirc system, new or existing, is electrical controls. Here is a list of typical controls I have added in recent years in order of most common to least common.

Temperature setpoint switch. The easiest and cheapest way to limit the run-time of the recirc pump is to put a sensor on the recirc return pipe that turns the pump off when hot water comes back from the building. This can be a snap-disc, a cap-tube or an electronic set point con-

Continued on page 30

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Continued from page 28

troller. When the return pipe cools off, the pump runs only until hot water arrives back in the mechanical room and then pauses until the pipe cools again. For proper control it is important that the circulation loops be balanced.

Timer switch. It is very common for a timer switch to be used to allow the recirculation pump to run only during critical occupancy hours. The timer switch is often used along with the set point control. The biggest drawback of the common timer switch is that the clock must be reset after a power failure.

Manual demand switch. A momentary contact switch that resembles a door bell button can be placed at each hot water fixture. This is for users who are energy conscious and don't mind "asking for instant hot water" by pressing the button. Both wired and wireless button systems are available these days.

Good recirc control is just as important for non-solar as it is for solar water heater systems for peak energy performance.

Automatic demand switch. An automatic switch such as an Infrared Red (IR) motion detector or IR beam switch can be installed near each hot water fixture. This type of sensor uses a relay to "press the demand button" whenever it senses that somebody is nearby. A timer or setpoint switch is used to turn off the circulation after a reasonable amount of time.

The manufacturers of hot water recirculation pumps now offer many of these controls and features either built into their pumps or as add-on control packages. Some are fairly sophisticated, with sensors and timers built into the pumps and electrical connections for a demand switch. If you haven't seen this equipment at your local supplier, ask them about it. Good recirc control is just as important for non-solar as it is for solar water heater systems for peak energy performance.

Circulator pumps

When modifying these systems, sometimes the existing or originally specified recirc pump will just not do the job. This is most often the case when a continuously circulating system is modified to include a demand switch. In a demand switch system, the circulator only runs for a minute or two. In that short amount of time, the user expects the hot water to arrive without delay. If there is a long pipe run and/or high heat loss (typical of older retrofits) a larger circulator pump may be needed to provide the flow and pressure necessary to deliver the goods on time.

For example, in a recent retrofit solar heating system, a continuously circulating Taco 006 bronze pump was modified with demand buttons and a timer relay to minimize its run-time. The owner reported that it took seven minutes for the hot water to arrive at the far end of the house. Since it was a retrofit situation, with all the piping under a concrete slab floor, the plumbing and balancing could not be changed easily. When a Taco 009 bronze pump was substituted the hot water arrived in less than a minute. Since the 006 pump originally ran for hours, and the 009 pump runs only minutes per day, the electrical savings per day is substantial, and the heat savings in the solar water heater tank is easily evident. A good solar storage tank will indeed provide hot showers in the morning following a sunny day if the heat is not pumped out of it all night.

Final notes

At SolarLogic, we are developing integrated methods of design, installation, control and monitoring for Solar Combi heating systems based on our field experience from recent years. Our goal is not only to assure that a working system is installed but also that its proper performance can be monitored, verified and maintained over the years.

These articles are targeted toward residential and small commercial buildings smaller than 10,000 square feet. Brand names, organizations, suppliers and manufacturers are mentioned only to provide examples for illustration and discussion and do not constitute any recommendation or endorsement. Calculations and estimates are for example only and are not intended for any particular design application.

Special thanks to Dr. Fred Milder for original economic insights included in this article. ■

Bristol Stickney *has been designing, manufacturing, 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 in Santa Fe, N.M., where he is involved in development of solar heating control systems and design tools for solar heating professionals (visit www.solarlogicllc.com for more information.)*

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.

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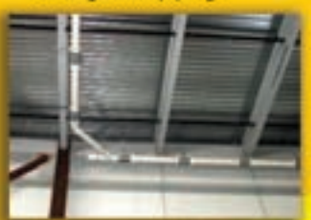
Full-Bore Siphonic Roof Drains from Jay R. Smith Mfg. Co.®

Fig. # 1005

Fig. # 1605

The Benefits of Using a Siphonic Roof Drain System

- The air baffle on the roof drain promotes full-bore flow.
- Full-bore flow within the piping reduces pipe diameter as compared to open channel, traditional gravity flow, which operates at 1/2 the capacity.
- Siphonic action is independent of pipe pitch or gradient. Horizontal piping is not pitched. The invert leaving the building is eliminated.
- Smaller pipe diameters allows maximum use of open space without intrusion of drainage piping. This also reduces material costs.
- The point of discharge for the roof can be concentrated to one corner, typically, rather than out of the building in several points.
- Slab installation costs are minimized, reducing excavation, backfill costs, and exterior underground piping.



The horizontal manifolds in a siphonic roof drain system installation.

- Siphonic systems promote self cleaning of debris from the piping system.

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Circle 20 on Reader Reply Form on page 57

Finding the Right Fit

By Kate Morrical

With all of the CAD solutions on the market, how do you pick the right option for you?

Having the right tools for the job is critical to success. And while you may think that means having the proper copper fittings, filters, hoses and pipes, a successful plumbing job actually starts well before you purchase supplies. It starts with design. But before you start your design, there's another choice to make: what tools to use? Pencil and graph paper? These days, that won't get the job done. Clients and other project stakeholders expect your designs to be digital and compatible with the best-in-class design software they are using.

But is it worth it to invest in computer-aided design (CAD) software? Yes. And here's why.

Move to CAD

The decision to move from hand-drawn plans to CAD can be intimidating—there are a lot of programs to choose from, the learning curve can be steep and, let's be honest, some CAD software can get pretty expensive. However, if you look really closely at the pros and cons, you'll realize: CAD is the way to go.

AutoCAD LT 2011 is the ideal tool for creating professionally designed documents.

• **Greater client satisfaction.** With a digital representation of your plans, you can more accurately demonstrate your design intent to clients.

• **Collaboration.** Working with several stakeholders on a project requires you to communicate in DWG or PDF, a format that is readable and sharable across the entire team; working in these formats means you are able to join that conversation.

• **Accuracy and speed.** Incorporating technology into your design process ensures that you are designing as accurately and efficiently as possible. Correct measurements in your designs mean you order the right type and amount of supplies.

• **Reuse.** With your designs drafted and saved in a design program, you can easily reuse drawings to quickly complete design projects on time with less wasted materials.

• **Permitting.** A plumbing permit is required for many jobs, such as altering piping inside a wall or for new installations or remodels. To get the permit, often a diagram presenting the changes must be submitted along with a list of materials — that's where software comes in. CAD software offers plumbers the ability to switch from hand-drawn to accurate, clear and professional looking diagrams.

Now that you realize moving to CAD software is the right decision for you, how do you chose the right CAD program for you?

Low investment, high return

Choosing the right software is important, and there are several factors to consider:

• **Financial investment.** How much are you willing to spend up front and what will be the cost of your learning curve?

• **Skill level.** How familiar are you with CAD software? Do you have some engineering experience that would allow you to utilize a more advanced program, or are you new to CAD software and need a simple, easy-to-use program?

• **Need.** What are your needs, and your client's needs? Do you need a program that offers simple lines, measurements, and DWG compatibility, or do you need a more advanced program that can perform engineering calculations?

Whatever the answers to those questions — whether

Continued on page 34

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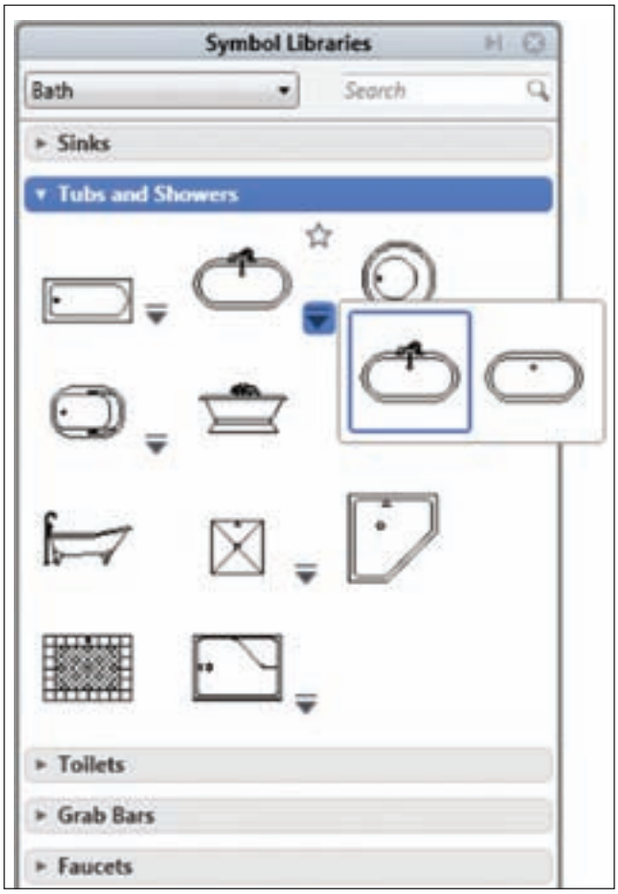
Circle 21 on Reader Reply Form on page 57

Continued from page 32

you're a newcomer to CAD or an experienced plumbing professional looking to update your software, Autodesk has a product to help you take your business to the next level.

• **AutoCAD LT.** AutoCAD LT 2011 is the ideal tool for creating professional design documents. Its extensive tool set is more advanced than some other products, and it helps to have some engineering experience, but the benefits of such robust and flexible software are unparalleled. Use layers and linetypes to organize pipes by size, material, or function. Add symbols and text to your drawings to fully convey your design intent. You can even save your favorite symbols and standard content to easily reuse them in other drawings. AutoCAD LT's genuine DWG file format provides stability and compatibility to ease communication with clients and colleagues.

• **AutoCAD Freestyle.** AutoCAD Freestyle is a simple design tool ideal if you are looking to ease into design software. It's an easy-to-use, low-cost 2D drawing software ideal for creating professional-looking drawings and plans. Freestyle eases collaboration because it produces drawings in the genuine DWG and PDF, the most common design file format. It has a simple user interface, with just the tools that plumbers need to start drawing right away — no training required. You can create accurate, detailed plans to scale with a simplified toolset for creating standard shapes, annotating drawings, sketching, and inserting images and symbols. The grid on the drawing surface helps set spatial dimensions, so you can easily solve problems and create accurate sketches. It's just like drawing on the graph paper you are used to. To save time, you can select from a library of pre-drawn, commonly used symbols — such as bathroom fixtures.

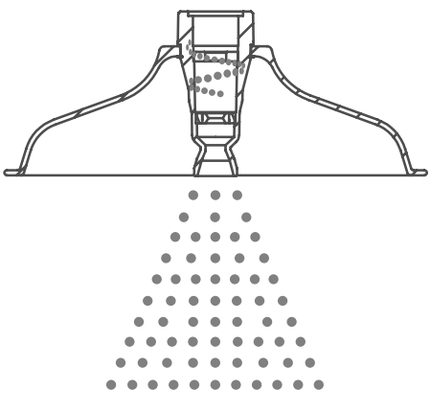


AutoCAD Freestyle has a simple user interface, with just the tools that designers need to start drawing right away — with no training required.

If you're looking for even more powerful software, Autodesk also offers AutoCAD, AutoCAD MEP and Revit MEP software with tools for plumbing and piping design, including 3D capabilities and support for building information modeling (BIM). With so many options available, Take the leap and try CAD software for your plumbing designs. How far can you take your business with the power of software behind you? ■

Kate Morrical is technical marketing manager for Autodesk.

WHO CARES IF YOUR SHOWER IS THE BEST?



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Circle 22 on Reader Reply Form on page 57

BIM is NOT just 3D modeling

We are moving into an area where liability is shifting from the contractor to the engineer, and the engineer may not see it coming.

By Peter A. Kraut, P.E., with images and technical assistance from Walter de la Cruz

Building information modeling, or BIM, has been widely portrayed as 3D modeling. Certainly, a 3D model is the foundation of BIM, but it is so much more than that. As this technology grows so rapidly, most draftsmen have barely scratched the surface of what it is capable. More unsettling is that the individuals in management who write contracts for BIM don't understand the pitfalls associated with it. Sadly, Wikipedia has a better understanding of BIM than most engineers in our industry. Mark my words; in the next 10 years, someone will lose a fortune from the liabilities inherited in a BIM contract. This is the future as I see it:

Unused capabilities

BIM software is not only capable of drawing a 3D model, it is capable of engineering it. Revit, for example, comes with fixture unit values associated with each fixture (see Image A). These can be edited as needed for each project. The default values are base on the IPC, leaving a little extra work for those using the UPC. You will need to differentiate between private and public use by establishing separate fixtures for each. Reduced fixture unit values for additional hose bibs are also rather difficult to manage. All that's left is to connect your fixtures with a network of piping.

The software then adds fixture units for waste and water and calculates water flow rates in gallons per minute. It also can back out the redundant fixture units when a cold water system feeds a hot water heater. I'm not exactly sure how it calculates a "predominantly flush valve" system since this is still an ongoing debate between the local plan checkers and me. Once the software has calculated the

Image A

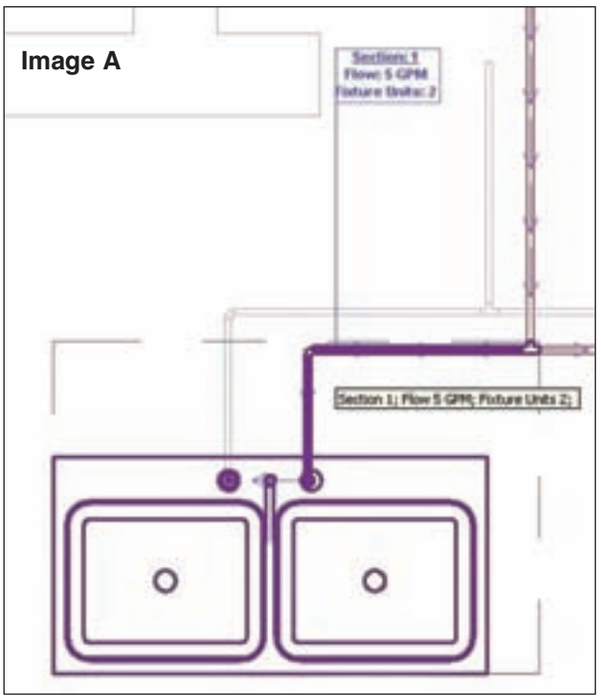
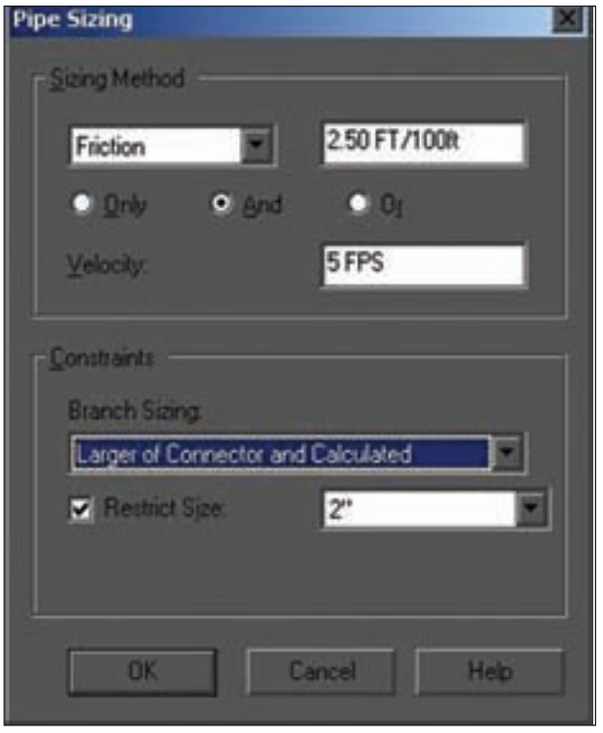


Image B



Continued on page 38

"Cleaner hydronic system water, more comfortable guests."

Steve Beretta
Director of Engineering
Renaissance Providence Hotel

In 2007, the 1929 Masonic Temple was reborn as the Renaissance Providence Hotel. As Steve Beretta tells it, guest complaints about poor air conditioning comfort became frequent and widespread. Taco worked with Steve to troubleshoot the HVAC closed loop system and determined that corrosive iron oxide gunk was fouling the system's components.

The clear solution.

The hotel installed two 4900 Series Air and Dirt Separators to eliminate air microbubbles, sand, dirt and rust in the system. With its patented Pall Ring design, the 4900 Series removes solid particles and air microbubbles as small as 18 x 10^{-6}m, delivering superior performance that's tested and certified by Delft Hydraulics. As a bonus, the 4900 saves money, energy, and component wear.

The proof is in hand.

"As the quality of the system water improved", says Steve, "the air conditioning improved." We're glad we could help, Steve. That's why we're all in business.

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Circle 23 on Reader Reply Form on page 57

Continued from page 36

flow rate, it can then size the pipes using the same methods we typically employ. Waste pipe is sized using a fixture unit table which can be edited to suit local codes or build in a safety cushion for future growth. Water pipe can be sized using a constant friction loss and velocity limitations while maintaining the fixture connector as a minimum size (see Image B).

But wait, a check of the pipe sizes in the copper table reveals that the pipe being modeled is Type K, not Type L as is typically used. Furthermore, Revit converts two fixture units to 5 gallons per minute (take another look at Image A). This is different from the Hunter's Curve conversion with which I am familiar. Combining these two will yield extremely large pipe sizes. The former can be solved by editing the table of pipe sizes and more carefully labeling the "copper" material. The latter is not so easy to solve. It appears that it is embedded in the code and Autodesk is looking into it.

Yet fixture units are just a fraction of the information contained in a Revit family. Take for example, a Kohler-Chesapeake lavatory, model K-1724. It can be downloaded from the manufacturer with length, width and height as well as pipe sizes and connection locations. The default elevation seems like a good feature to have in a BIM model, but it is left blank for the user to fill in. The material is embedded information and a link to the manufacturer's website is included, as well. But what about color? There is no mention of it, so I assume without a suffix, we are modeling the basic white. On the other hand, a a typical pump manufacturer file clearly indicates the finish as "seafoam green metallic." Good to know. It also records a 1 horsepower motor at 1,760 rpm, a 7" impeller and a weight of 113 pounds. Hopefully the full 7" impeller is being used, or this may need to be edited before erroneous information is passed on. To see how much information is included, take a look at a typical boiler manufacturer's boiler (see Image C). The manufacturer has even included the hardness of the water, although I am not sure how they know where I intend to use it.

Image C

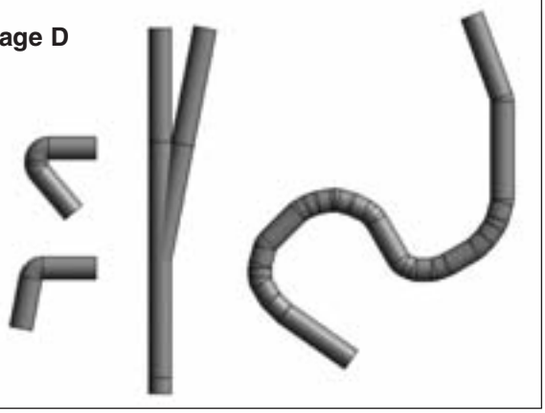
Family: AW700 — Load...
Type: AW 700 — Duplicate...
Rename...

Type Parameters

Parameter	Value
Electrical	
Voltage/Pump	120
Voltage/Heater	120
Voltage/Control	24
Total Amps W/Pumps	12.8
# of Electrical Connections	1
Plumbing	
Water Flow Rate (GPM)	59.0
Water Connections	2"
Relief Valve Temperature Rating (de	210
Relief Valve Size	3/4"
Relief Valve Rating (MBH)	1,912
Relief Valve Pressure Rating (PSI)	150
Max. Working Pressure (PSI)	160
Max. Water Hardness (Grains)	25
Heating Surface (Sq. Ft.)	57.8
Head Loss (Ft. of Hd.)	32.0
Gallon Capacity	5.0
GPH @ 70 Degrees F Rise	1163
GPH @ 140 Degrees F Rise	576
GPH @ 100 Degrees F Rise	814
Drain	3/4"
# of Relief Valves	1
Dimensions	
Width	15 1/2"
Height	42 1/2"
Depth	40 1/4"
Identity Data	
URL	http://lochinvar.com
Model	AW 700
Manufacturer	Lochinvar
Fuel Type	Natural/LP
Description	Armor Water Heater
Keynote	
Type Comments	
Assembly Description	
Assembly Code	
Type Mark	
Cost	
OmniClass Number	23.75.00.00
OmniClass Title	Climate Control (HVAC)
Other	
Vent Material	PVC/CPVC/SS
Vent Category	IV
Service Clearance Top	24"
Service Clearance Right	0"
Service Clearance Left (Piping)	24"
Service Clearance Front	24"
Service Clearance Back	24"
Min. Inlet Pressure (Nat)	4.0" w.c.
Min. Inlet Pressure (LP)	8.0" w.c.
Max. Inlet Pressure (Nat)	14.0" w.c.
Max. Inlet Pressure (LP)	14.0" w.c.
Inlet Connection	1"
Direct Vent Size	6"
BTU/HR Input	700,000

<< Preview — OK — Cancel — Apply

Image D



What good is all of this information if you can't access it quickly? That's why BIM software allows you to print a material take-off from your model. A few keystrokes and you will find that your model contains one typical boiler manufacturer's boiler, one typical pump manufacturer's pump, 32 lavatories (in white) of a typical fixture manufacturer, 647'-8 3/32" of ¾" Type K copper pipe, (74) ¾" Type K copper 90 degree fittings … and more. Interesting,

Continued on page 40

Continued from page 38

this makes me think about another data field typically empty in the manufacturer supplied entities — cost. This is where contractors are saying "cool!" and engineers should be saying "Get my lawyer on the phone!"

Misapplied technology

Any engineer with 25 years of experience would have graduated college after CAD became a requirement. Most future engineers graduating just a few years ago have never modeled in 3D. Nevertheless, our world if full of talented draftsmen and modelers who can create in Revit faster than conjure an image in my head. The problem with BIM is that we are now asking one of the least experienced designers to make major engineering decisions. Should I use type L or type K copper below the slab? At what voltage should I select my pump? What is the mounting height of the lavatory? There are simply way too many options and specifications to include on an engineer's red-line drawing. How will all of this information be conveyed to the draftsman?

Truthfully, it is usually not conveyed. The building information model is typically missing much information, or worse yet, carrying the wrong information. Pipe specs are a good example. Revit comes with generic pipe based on PVC dimensions. It has an inner and outer dimension. The former is used for flow calculations and the latter is used for spatial coordination. The pipe includes a roughness coefficient and the fittings include a k-factor, albeit blank. So what is done for cast iron waste pipe. Most often, since the engineering functions are not being used, it is just modeled in PVC. This creates a potential problem in the model. If a horizontal to vertical transition is supposed to occur within a wall, the model may be collision free, but in reality the pipe may not fit. This is because the laying length and other fitting dimensions of cast iron are different than PVC. The solution: spend more than $1,000 on a cast iron library or dozens of hours creating it yourself.

The use and placement of fittings is one of the greatest challenges that we face when switching for single line 2 dimensional drawings to BIM. When a less-than-seasoned designer is modeling waste pipe, a san tee can be laid on its side and a double wye can be laid on its back. Revit allows this, but our plumbing codes do not. A 90-degree turn in the pipe creates a bend, not a sweep. Better yet, if you're having a hard time finding the right fitting, Revit will create it for you (see image D). All of these issues will make for problems down the road when coordinating space with other trades, creating a material list or calculating friction losses.

Modeling pitfalls

I have seen engineers in the past sign contracts that included adherence to other's CAD standards, thinking

"How hard can it be?" Their projects were invariably sunk by double the drafting hours that were budgeted. 3D modeling compounds this pitfall. The contract must identify what will be modeled. Pipe, fittings, fixtures and equipment are the obvious choices. Modeling insulation is necessary for spatial coordination and should be included. Pipe hangers, too, are necessary and often required by contract, but they're not in Revit. Using the Component Tool, you can create your own family. Of course you'll want to make sure you provide spacing at the proper intervals, at each end and on every fitting. Unfortunately, Revit does not separate the cast iron pipe into 10-foot segments and modeling a hanger on each end of each pipe segment depends on which end of the run the cut piece is placed.

Modeling also should include valves, strainers and the like. Access panels are a key item that can be coordinated in a 3D model, but either the engineer or the architect will need to take on that responsibility. Unions, pressure gauges, thermometers, flow switches and similar appurtenances are typically not modeled, but it seems that their access is often in contention at the end of the job. All of this will need to be determined before a price can be determined for the model. During these early stages of BIM, it is also a good idea to see if your manufacturers have the entities you need and if the required information is complete and correct. If not, you will need to create them and that programming step could set you back much time and money.

Many engineers do not understand that Revit and BIM are not interchangeable. BIM is a process and Revit is a software program that helps perform that process. There are many other programs on the market. Architecture is also modeled in Archicad, Digital Project and Bentley Architecture to name a few. Many structural engineers prefer RISA because their calculations can be performed in the model. Mechanical and plumbing trades, especially contractors, use programs such as CAD Duct, Quickpen Pipedesigner and AutoSPRINK. Some of these have built-in estimating and fabricating tools that Revit does not. When the team members all use different platforms for modeling, it can help with certain construction tasks, but

> Most future engineers graduating just a few years ago have never modeled in 3D. Nevertheless, our world if full of talented draftsmen and modelers who can create in Revit faster than conjure an image in my head.

Continued on page 42

Continued from page 41

it slows down coordination

If everyone models in Revit, the included clash detection works well. When merging many platforms, separate clash detection software is needed. Autodesk Navisworks and Solibri Model Checker are two such programs. Someone then has the added task of managing the coordinated model. In addition, designers will often need to draw on one screen while simultaneously viewing the coordinated model on another.

Modelers entering the process late in the game create a big coordination problem for those that started early. Fire sprinklers are engineered by the installing contractor in most states. Getting them involved in a model during the construction document phase is difficult. Electrical engineers and contractors seldom model conduits under 2 or 3 inches. The hope is that they are too small to cause a problem. I have even had a framer show up to the table after

Modelers entering the process late in the game create a big coordination problem for those that started early.

modeling was complete asking for pipe to move between studs so that he did not have to head out the openings!

Inherited Liability

BIM will continue to evolve over the next 10 to 20 years. Will the 3D model replace the shop drawing phase? If so, does that put the sole responsibility for coordination on the engineer? Should hangers be modeled and who will model the attachment to the structure above? Will the model be used for fabricating? Will it be used for cost estimating? Does this process remove the contractor's responsibility for means and methods? Who will model the revised equipment room when manufacturer's are substituted? Will the requirement for as-built drawings be a thing of the past?

The answers to these questions are yet to be seen. Meanwhile, as draftsmen and designers are required to make bigger decisions, the capable ones are demanding higher salaries. As engineers are adding layers of information to their drawings, the time required for design is increasing. And, as the burden of coordination has shifted toward the company producing construction documents, something has to give. The burden of liability and other responsibilities are shifting as well. BIM raises the bar and takes 3D modeling to a higher level. Just make sure you understand the difference. ■

***Peter A. Kraut**, P.E., is a licensed Mechanical Engineer in 23 states. He founded South Coast Engineering Group, near Los Angeles, California in 2001. He can be reached at via email at pkraut@socoeng.com.*

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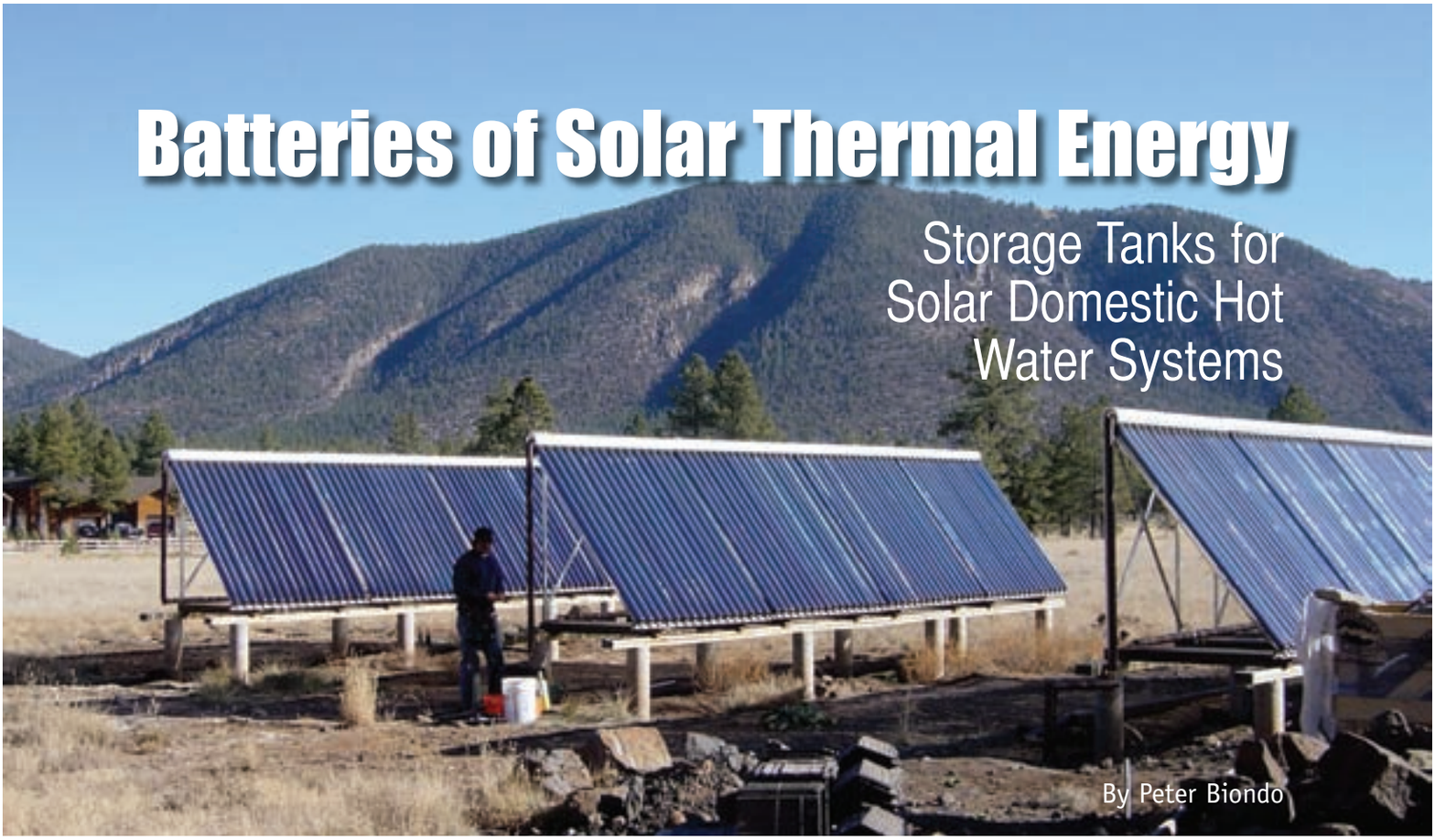

Batteries of Solar Thermal Energy

Storage Tanks for Solar Domestic Hot Water Systems

By Peter Biondo

"The sun is the source, the system is the battery." Given the variety of applications for which solar energy can be harnessed, the energy storage principle for a well planned and designed solar thermal system is extremely important for overall system efficiency. Solar electrical systems often tie right into the electrical power grid, so therefore no batteries are required to store electrical energy for the system. However, a solar hot water system requires sufficient storage capacity to absorb the energy produced by the collectors during the daytime collection hours. Working with many new solar hot water designers, I have noticed that designing in the appropriate volume of solar storage can be overlooked. It's by no accident that this tendency occurs. A solar collector can be viewed as a boiler — energy is captured and delivered. But unlike designing boilers for peak hot water demand, solar energy is only available for a limited time each day. Good solar hot water design not only includes sizing the solar collector area to carry a percentage of the total hot water or heating load, but also suggests sizing the solar storage vessel to absorb all of the thermal energy the collectors will produce throughout the day. If the solar vessel is not sized large enough to the total collector area and there is no hot water demand, the solar tank could reach the critical high limit temperature and the solar controller will turn off the solar collection cycle. On commercial projects, under-sizing solar storage tanks can lead to chronic problems associated with extreme glycol and tank temperatures, or the poor economic result of having collectors that are not in use as often as they could be, and excessive heat dumping. Because choosing solar storage vessels for commercial hot water systems is a matter of finding large volume bulk storage tanks, this article is to help you become familiar with different types of tanks that can be integrated for solar hot water systems.

Sizing the solar thermal tank

There are no hard and fast rules for sizing storage in solar hot water systems. The general rule of thumb for solar storage sizing is that for every square foot of collector aperture, you will need to store anywhere between 1 to 2½ gallons of water, depending on your location and the application. The strategy is to allow for a reserve, as water, to store the solar collection cycle if very little or no daytime load is present, such as for homes and apartments. In some commercial systems, daytime hot water load constitutes the majority of the total load, and if that is the case, a fully sized solar storage vessel may not be necessary. Buildings that are occupied 365 days per year, such as hospitals and nursing homes, fall into this category. Most commercial buildings, however, have load variations based on occupancy and would require full storage capacity. Hotels, schools, and offices that have weekly or seasonal load variations should size storage capacity for more rather than less.

The goal to meet with a solar hot water system is to raise the temperature in the solar tank so that it is at or above design temperature (i.e. 120 °F for DHW) while having enough storage volume to absorb the remaining daytime collection cycle. Because solar energy cannot be depended upon, and varies widely with cloud cover and seasonal changes, you cannot expect a consistent temperature output from the solar tank day in and day out. Solar radiation, the hot water load, and storage volume all are interrelated and affect the constantly changing temperature at the solar storage vessel. It is a reminder then to understand that solar for domestic hot water is designed as a preheating system.

There is a piping and control strategy for solar storage tanks that would provide a basis for high capacity storage and high output temperature — a solar hot water system that can absorb solar energy during the summer months (or

Continued on page 46

Introducing TempTAP™

The First ASSE 1070 Listed Thermostatic Faucet

TempTAP™ was designed with you in mind, to make ASSE 1070 lavatory tempering faster, simpler and safer. By integrating the tempering valve inside the faucet, thermostatic protection is just inches away from the point-of-use, where it's most effective. And now, thermostatic installation is above the sink, where it is easy to access. TempTAP features a powerful paraffin actuator that responds to pressure and temperature changes. TempTAP meets the latest lead free laws, has received the EPA's WaterSense® label, and complies with ADA activation requirements. So for your next specification, reach for TempTAP.

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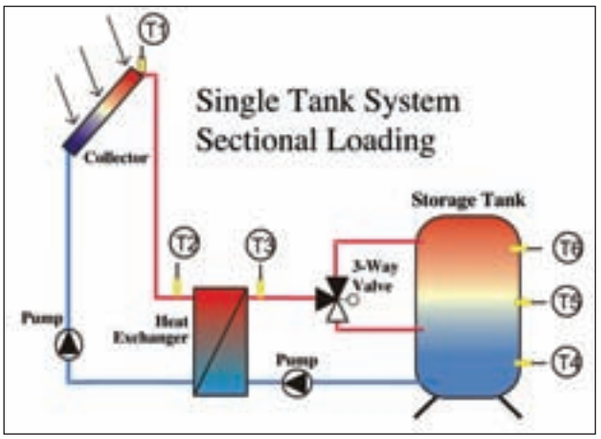
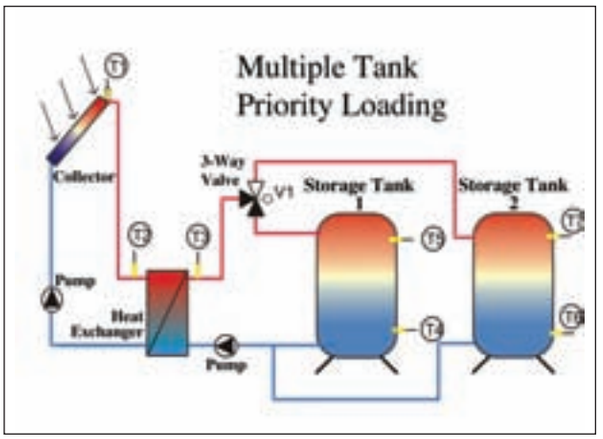
Continued from page 44



The concept is to load solar energy into a large vessel by sections.



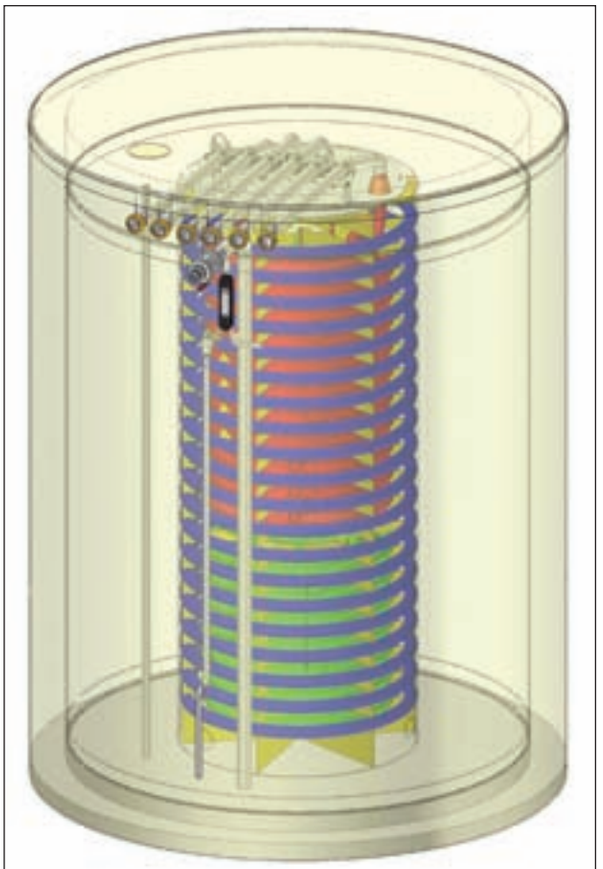
Solar energy is loaded with a three-way valve and a solar controller with the capabilities to divert solar energy on temperature rise after priority section or tank is satisfied.

during low- or no-load cycles) and also has a built-in mechanism for driving high temperatures during low solar energy winter months or cloudy days. The concept is to load solar energy into a large vessel by sections, or to prioritize one storage vessel over another auxiliary storage tank(s). This is commonly done with a three-way valve and a solar controller with the capabilities to divert solar energy on temperature rise after priority section or tank is satisfied (i.e. 140 to 180 °F). The practice is not widely carried out but it could be; the design makes better use of solar energy storage and the capability to produce design temperatures across the range of the sun's day-to-day and seasonal energy spectrum. For buildings with wide load variations and those in the northern climates, this design adapts the storage system to the changing relationship between the daily solar energy available and the hot water load.

The solar storage vessel

There are two basic tank categories for large volume bulk hot water storage vessels — pressurized tanks and atmospheric vessels. Pressurized tanks are commonly installed for residential or light commercial (80 to 120-gallon) solar hot water systems. Commercial solar hot water pressurized tanks can vary anywhere from 200 gallons up to several thousands of gallons. Although pressurized tanks are very common in the hot water industry and are often considered the standard option, atmospheric tanks shouldn't be ignored for solar commercial hot water storage. There is a distinct advantage that atmospheric vessels have with solar collection systems that gives them an economic edge. The atmospheric tank may have limited practical usage, but can play into enormous gains for long-term system integrity.

Atmospheric vessels are storage reservoirs which contain unpressurized water which is the energy storage and transfer medium. The water in the atmospheric vessel may be pumped into a gravity-drained solar collector system (referred to as "drainback") or the vessel can contain heat exchange coils installed for "closed loop" glycol solar collector transfer. Any atmospheric tank will need to be well insulated (no heat should be felt on the outside skin of the tank) and sealed tight against escaping evaporative steam. The main advantage of the atmospheric vessels is cost. Typically, dollars spent per each gallon of water stored can be considerably less than that of a same size pressurized vessel. This may not be true for all atmospheric tanks, but for all EPDM lined tanks it is the case. An atmospheric tank lined with EPDM rubber is one low-cost solution to large bulk storage. These can be purchased as square or round



Courtesy of Haase Tank USA

Atmospheric vessels are storage reservoirs which contain unpressurized water which is the energy storage and transfer medium.

tanks and can be assembled on site. Copper heat exchanger coils are normally placed in the tank for energy transfer. The typical lifecycle of an EPDM liner is 12 to 15 years if temperatures are controlled to remain under 170°F. Heat exchange coils may be removed and liners replaced at the end of a liner's lifecycle.

Large pressurized vessel sizes range from 240 to more than 4,000 gallons. Once in place, you want them to stay.

Another type of atmospheric tank manufactured in Europe has 15 years of technology behind it. It is designed to store hot water temperatures up to 185°F and includes a long 20+ year lifecycle. Packaged and built on site, the water-holding container wall consists of durable glass-fiber-reinforced plastic. These tanks range in size from 350 to 12,000 gallons. Stainless steel flexible heat exchangers are included for thermal energy transfer. This type of atmospheric tank may not be less expensive than a pressurized vessel, but has the advantage of fitting through a mechanical room doorway in individual parts and is built on site. The non-corrosive container wall would also suggest a longer operating lifecycle than that of a steel glass-lined tank.

Pressurized vessels are the most common tanks specified for commercial solar hot water systems. Tanks under 120 gallons are standard for residential and light commercial systems. They can be piped in parallel or in series for larger storage volumes without the costs for ASME-rated tanks above 120 gallons. These small solar storage tanks are constructed of stainless steel or as glass- or enamel-lined steel tanks. Some models are solar ready and include extra ports for heat exchangers or can be purchased with internal single wall heat exchange coils.

For larger pressurized tanks, think about longevity and check with your manufacturer. Large pressurized vessel sizes range from 240 to over 4,000 gallons. Once in place you want them to stay. Small commercial hot water storage tanks of 200 to 400 gallons that operate under heavy usage

An above-tank view shows the innards of the storage tank complete with coils.

are usually expected to fail within six years. They are large but designed to move through mechanical room doorways for easy replacement. For solar, the opportunity for a longer lifespan would include a double glass-lined manufactured tank. The process of double glass lining would not only strengthen the integrity of the glass liner itself, but also fill in any gaps the first layer might miss. Also consider tanks that are stone lined. The benefit to a stone-lined tank is not only a longer lifecycle, but that they can be relined to extend the life of the steel and insulation shell. On these 1,000+ gallon hot water storage vessels, manhole ports are included for this service.

Whatever tank you choose to specify, remember the golden rule of solar storage: Solar hot water is for the application of cold water preheating. The preheated solar tank feeds the water heater so the back up doesn't have to work so hard. This design principle is often not understood. Common mistakes to avoid are: (1) designing solar thermal collectors on a hot water storage tank already being heated to design temperature with a boiler and (2) piping the recirculation hot water return directly into the solar tank. In both cases, the opportunity to preheat cold water is eliminated, and the purpose of solar hot water to save energy is diminished. It just so happens that solar thermal collectors are at their most efficient collection cycle at lower water temperatures, and loading cold tanks increases the system's storage capacity. Design solar domestic hot water for cold water preheating and you will never go wrong. ■

Peter Biondo *is the technical sales coordinator for Oventrop Corporation. He has been involved in solar hot water and hydronic heating for more than 25 years. His primary work is assisting mechanical engineers and contractors with hydronic heating systems, as well as solar domestic hot water and heating for residential and commercial applications. His solar and hydronic workshops are featured at trade shows throughout the country.*

Rainwater Roof Drainage Systems

Don't take them for granted!

By S. Jerry McDanal, FASPE, CET, CPD

Many articles have been written over the years concerning storm/rainwater disposal systems. Although a small of the overall scope of a project, these systems are vitally important. I have been employed in the plumbing/drainage industry for many years, and it is apparent to me that some designers are comfortable with the basics and have taken some things for granted. Roof drainage and stormwater systems are often designed for the very minimum when, for various reasons, based on recent developments and conditions, it would have been prudent to exceed the minimum.

Beware when the weather bureau warns of flash flooding. Flash flooding can be very serious. The potential for flooding in the residential area of my hometown was regarded as remote, if not impossible. Flooding was considered only in relation to the river, which is quite a distance from my home. On May 7, 2009, my hometown experienced the most severe rainstorm in its recorded history. It rained relentlessly for four continuous hours without letting up and deposited 14.25 inches of rain on the east and north sides of the city. This exceeded NOAA's 100-year existing record of 10.26 inches for this area. Flooding was prevalent everywhere in the city. More than 800 structures (including homes) and 1,200 automobiles were flooded. There were numerous road washouts, bridge damage and associated secondary flooding damage and problems.

Flash flooding can cause havoc with the roof drainage system and structure. Witnessing this record rainfall confirmed my personal concerns regarding design parameters and the ability to look beyond the minimum. This rainstorm was just one of many that occur not only in the Southeast but also throughout the entire United States. It does seem as though rainstorms are continuing to increase in strength, intensity and duration. If an area is prone to frequent flash flooding, then do not hesitate to design drainage systems for greater protection that goes beyond the minimum.

Codes and standards establish a minimum acceptable standard for the design and installation of storm/rainwater systems. There are two major codes that most municipalities adopt, with local amendments that relate to conditions in their particular area. The information pertaining to storm/rainwater shown in the codes must be used as the primary source for accepted methods and sizing. All designs must meet or exceed the local requirements. Your sizing should be based on recent developments and changes in your area's climatic conditions.

The local code should be consulted to determine the rainfall rate that is applicable for the project location. A minimum design should be no less than 10-year/5-minute for the building roof and site unless other factors require designing for greater protection. For example, if the local code requires that the design be based on a minimum 10-year/5-minute storm but recent changes in the area's climatic conditions have consistently produced storms that have changed in frequency and intensity (even if temporary), then it is prudent to take this into consideration. Exercise good engineering judgment and use a greater severe storm frequency and duration to design beyond the minimum.

Many considerations should be weighed in the design of any storm/rainwater system. These include rainfall rate, snow depth, potential wind conditions, probable freeze conditions, building construction, type of roof, pattern of drainage slope, vertical wall heights, parapet heights, parapet scuppers (sizes, quantities and locations), emergency (secondary) overflow drain requirements and locations, ceiling space allocation, wall and chase space locations, etc.

Roof drains are subjected to stoppage, hence, the requirement for the dome. Free area ratios are 1.5 to 1. (See the following chart.) The dome (strainer) is required not to extend less than 4 inches above the roof per the applicable codes.

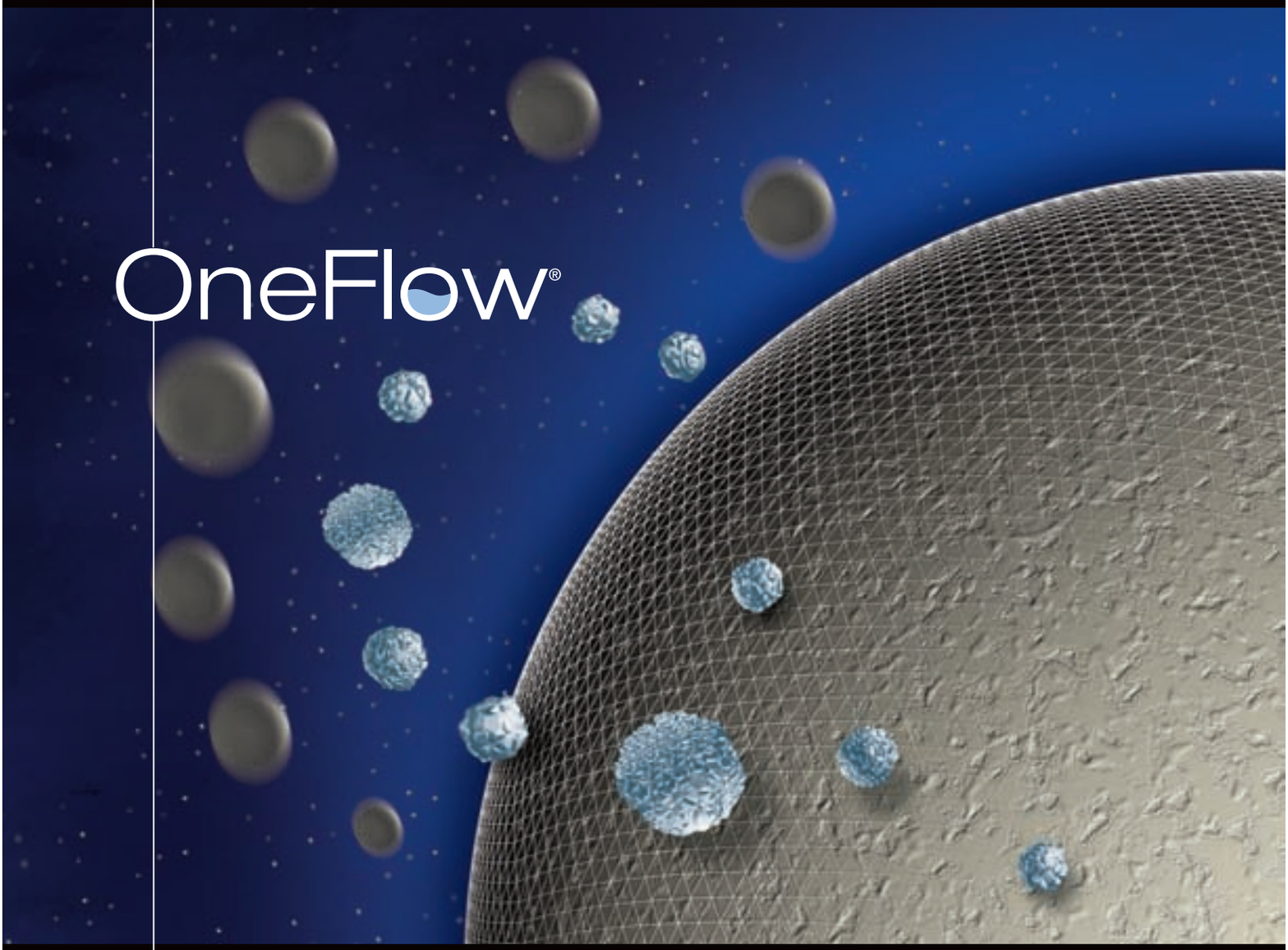
Roof drain manufacturers construct their drains in accordance with the applicable standards and codes. The codes provide charts with sizing criteria based on roof area in square feet, corresponding to the drain outlet/leader size and the rainfall rate/hour. A 4,600-sq.-

Outlet Size Outlet Free Area (Sq. In.)
Minimum Sq. In. Required (1.5 to 1) For Domes

2 in.	03.14	04.71
3 in.	07.065	10.575
4 in.	12.56	18.84
6 in.	28.26	42.39
8 in.	50.25	75.375
10 in.	78.5	117.75

Continued on page 50

Discover the New Frontier in Scale Prevention



The Intelligent Scale Solution

Building owners, property managers and facility engineers have fought the battle against scale and its destructive byproducts for too long. Now there is a better solution that is environmentally friendly and virtually maintenance free. OneFlow prevents scale by transforming dissolved hardness minerals into harmless, inactive microscopic crystal particles. These particles make their way through plumbing systems without latching on to pipes, fixtures, valves or heating elements. Scientifically tested and certified for performance, OneFlow provides scale control results backed by years of successful field applications. Make the intelligent choice in scale prevention, OneFlow from Watts.

For more information, visit our web site **TheScaleSolution.com**

Available in 3dCAD **at watts.com**

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Circle 29 on Reader Reply Form on page 57

Drainage

Continued from page 48

ft. roof area subjected to 4"/hr. requires a four-inch roof drain outlet and vertical leader. Once you turn horizontal, the piping must be sized using one of the horizontal rainwater sizing charts which are 1/8 inch, ¼ inch and ½ inch per foot slopes. In most cases the horizontal leader will increase in size, particularly when the roof areas to be drained are much larger.

Roof drains are designed for the architect, engineer and contractor for any application.

One of the most common design characteristics I have observed with large box roof areas is the preference to use fewer larger drains rather than additional smaller drains. The reasoning is simple; reducing the number of openings in the roof slab reduces the chances of the roof leaking. This adds stress to the roof structure, though, as it allows more rainwater to be ponded on the roof, waiting to be drained.

During severe conditions, rainwater may be pushed by the wind from one side of the roof to the other. This not only adds additional stress and weight but also overloads the drainage system. For example, a large box store located in southern Florida had two 10-inch roof drains for the entire roof. When Hurricane Andrew rambled through the area in the nineties, not only was it dumping severe, above average rainfall on the roof but the wind also blew all of the rainwater to the west side of the roof. This added so much additional stress, weight and rainwater to that side that a portion of the roof collapsed. In this case, several smaller drains may have been able to endure the storm.

One item of extreme importance is planning for emergency (or secondary) overflow drains. Yes, it was not that many years ago that they were not required. Presently, one major code requires an overflow drain to be piped and discharged separately while the other allows it to be connected back into the primary system, dependent upon appropriate increased sizing of the primary system.

Providing a separate system and discharging it separately, usually to a location that will be seen by pedestrians is the best application. If it is observed discharging, then someone is going to report it. It is good engineering practice to have a 1-to-1 ratio for primary to emergency overflow roof drains. In the event of an extreme storm, the emergency roof drains can assist in draining the roof if the primary system is overloaded. This is another reason to keep the emergency system separate from the primary system.

The horizontal section of the pipe and the roof drain body should be insulated with a vapor barrier to control condensation. Low-temperature liquid flow in the piping causes condensation to form on the outside of the piping, potentially causing stain damage to ceilings and drip marks on floors, along with other problems.

Piping layouts must be coordinated with all the trades that may be affected, such as the architect for furring-in the proper columns for vertical leaders, the structural engineer for pipe support and footing depths, the electrical engineer for conduits, etc., and the HVAC engineer for ductwork and piping.

Locating the roof drains should be a coordinated and cooperative effort among the architect, structural engineer and plumbing engineer. The architect is familiar with the building construction, parapets, walls and chase locations, available headroom for horizontal pipe runs, roof construction and waterproofing membrane. The structural engineer is familiar with the structural support layout, roof slopes, column orientation, footing sizes and depths and maximum allowable roof loading. The plumbing engineer can provide information concerning the maximum roof areas per drain, wall and col-

REMEMBER THESE FACTS:

• The characteristics of rainwater will vary, sometimes it is more sensitive than other times, according to temperature, pressure, composition (density), head, intensity, specific gravity and so forth all contributing to its mechanical behavior.

• A relatively large hydraulic head of rainwater is required to increase the flow through the drain and to achieve peak flow.

• A considerable amount of air is entrained with the rainwater as it enters the drain. This prevents the leader piping from flowing full. In a vertical installation the rainwater will actually swirl around the inside diameter of the piping. In a horizontal installation, the air will occupy the upper half of the leader piping. Consideration should be given for partially full piping during peak flow.

• For each primary roof drain, there should be the same size secondary (overflow) roof drain. A 1-1 ratio is desired.

umn furring-out requirements, ceiling space requirements, elevations of horizontal piping in ceiling space and inverts of horizontal piping once underground.

The plumbing engineer also should ensure that the drains are located in the low points of the roof to limit deflection which may cause ponding and shifting of the low roof point and to minimize the horizontal runs. The

Image 2: Roof drain and secondary overflow deck with deck plate.

plumbing engineer should determine the potential weight of ponded water and provide the structural engineer with such data. The roof structure must be able to support the weight of ponded water by design or by nature. It is always best to determine the worst possible situation in calculating the potential rainwater load in pounds of weight.

The building roof transfers the combined weight of live and dead loads to the supporting structure. Live loads include snow, rain, wind and water on the roof. Dead loads include all mechanical equipment, electrical equipment, other equipment and the roof deck. The importance of involving the structural engineer cannot be emphasized enough. The design of the roof structure

Raintrol roof drains from Jay R. Smith feature an adjustable flow rate control.

is critical, and the structural engineer must have complete information to make the correct decisions. Always design for the worst scenario. Determine the potential maximum volume of water (convert to pounds) that could pond on the roof if all roof (primary and emergency) drains were non-functional and no other means existed for draining the water.

Most roof drain manufacturers provide charts in their roof drainage technical sections. These charts are all taken from one of the various plumbing codes or other technical manuals. The sizing procedure is simple. A 4"/hour rainfall rate and a 4" roof drain outlet/vertical leader size intersects at a maximum of 4,600 square feet of roof area per drain or, depending on which code is being referenced, it could be slightly greater or less than 4,600 sq. ft. This does seem simple, but roof drainage is a major liability and must be carefully designed, sized and coordinated. Some designers fail to look past the simplicity of sizing the system to the results of a poor or inadequate design.

In defense of these charts, many thousands of roofs have been designed successfully based on the criteria they contained. There is, however, a small percentage of roof drainage systems that fail, usually because of a weather phenomenon and not because of the design or capacity of the system. This could happen after years of successful service with no problems, so why all of a sudden is the roof drain to blame? Other reasons have to be investigated, such as overloading, structure inadequacies, incorrect locations of drains, depressed roof areas causing ponding, drain or leader stoppage and lack of sufficient secondary overflow drainage.

In some cases, a designer may elect to use larger outlet roof drains to reduce the number of openings through the roof structure. This is normally acceptable, except when a weather phenomenon occurs. A hurricane, for example, will definitely overload a roof. Unless the structure is engineered to support this extraordinary load, the roof is likely to collapse. In the last several years, there have been an abundance of extreme storms causing flash flooding, having the same end effect as a hurricane.

Logic and good engineering practice must prevail when designing roof drainage systems. Some charts list allowable flow in gallons per minute (gpm). For example, one chart indicates a 4" vertical leader will flow 192 gpm. Okay, but at what head of water over the roof drain? Until the rainfall intensity and head of water builds up to a certain level, the drain will not flow 192 gpm. Some plumbing designers fail to realize that a specific volume of flow does not occur until a certain head of rainwater is achieved over the drain. Even an undersized roof drain will eventually drain the roof of the rainwater, but will the roof's structure hold up during this drain down period? For the flow of rainwater through the roof drain to increase the hydraulic head of rainwater over the drain must be heightened. ■

S. Jerry McDanal, FASPE, CET, CPD, is vice president engineering of Jay R. Smith Mfg. Co. He has 42 years of experience in the plumbing engineering and plumbing & drainage industry. He has been with Jay R. Smith for 31 years and is a 42 year member of the American Society of Plumbing Engineers. In 2008, he was an inaugural inductee into the ASPE College of Fellows.

CSST System Advancements Take Aim at Lightning Safety

By Craig Barry

Lightning is a highly destructive force and ensuring lightning safety in homes and businesses is critical for engineers and contractors. When using flexible gas piping or corrugated stainless steel tubing (CSST), it is essential to understand that proper installation is critical to ensure the most protection from the effects of lightning, which can potentially damage metallic systems. To a large extent, safety depends on how each building system is installed and the type of products that are used. To help maximize safety, end users should ensure proper installation of every CSST system per local codes and manufacturer's installation requirements.

Recent advancements in CSST systems now provide additional protection from potential damage from lightning energy. These systems incorporate conductive layers of materials over the CSST tubing. These layers can safely handle and dissipate great amounts of energy and heat while protecting the gas tubing underneath. The new CSST systems eliminate the need for additional bonding as required of standard CSST, while offering the highest level of lightning protection through the conductive layered jackets.

Conductive-layered jackets

One manufacturer's protective covering is comprised of two layers of semi-conductive polymer jacketing which sandwich a middle layer of aluminum mesh. The metal mesh material is the same material as used for lightning protection in the aircraft industry. This material was developed and is used to protect composite aircraft parts from the damaging effects of lightning as well. The multi-layered conductive jacket system makes this new CSST system the most resistant to damaging effects from lightning energy and electrical arcing.

The jacket system is engineered to thermal and UV resistance requirements. The protective jacket also creates a smooth outside surface over the corrugated tubing that greatly aids in pulling the tubing through tight building spaces and makes it suitable for outdoor use. Such new CSST systems are flexible enough for simple routing through complex building structures and concealed spaces. The jacket provides enough protection for the CSST not to be damaged, and the jacket on the new CSST system is pre-marked by the foot for easy measuring and installation.

Integral fitting

A corrosion-resistant brass fitting is an integral part of the system, as well. The jacket-lock fitting utilizes a multi-point seal for ease in obtaining the gas-tight seal. It also contains a bushing that bites through the jacket's outer polymer layer and into the metal mesh layer. This penetrating feature of the bushing provides the beneficial electrical continuity from the jacket system and through to the fittings, should the jacket system become energized. The fitting's jacket-lock feature also protects the stainless steel tubing inside of the fitting from contact with corrosives that could otherwise penetrate the interface. These new fittings have standard NPT threads and may be used in combination with all approved fuel gas piping materials. System components such as manifolds, tees and stub-outs are fabricated from other approved materials to be used with this new flexible CSST system — and no special tools required. This saves contractors time and money.

Certified lightning laboratory tested

This new multi-layered CSST system was tested under controlled conditions in a certified lightning materials test laboratory. The results showed that the multi-layered CSST system outperforms single layered conductive jacketed CSST by more than 10-times. This performance gives contractors and builders who specify the multi-layered system the highest level of lightning protection available in flexible gas piping systems. The CSST system was tested utilizing multiple current waveform testing, representing the return stroke, intermediate currents, and continuing currents. These tests were conducted with peak currents of 41-45 kA and action integrals of 51,000-56,000 A2s.

This multi-layered CSST system also was tested and listed in accordance with the American National Standard for Fuel Gas Systems Using Corrugated Stainless Steel Tubing, ANSI LC1-2005. This standard lists performance requirements for certification of CSST systems for use with all recognized fuel gases, including Natural Gas and Propane. An annealing process tempers the steel giving it added flexibility and ease of bending. It is also suitable for use with elevated pressure systems. The ANSI LC1 standard rates CSST for use at pressures up to 5PSI.

Lightning prone states to benefit

The multi-layered conductive jacketed CSST system provides all of the installation benefits of standard CSST and eliminates the need for the additional electrical bonding step that manufactures of the standard CSST products require. The product is bonded in the same way as black iron pipe (utilizing the third wire appliance bond) and as mandated by the NEC or local codes. Saving the additional bonding wire step associated with standard CSST is just another advantage of the conductive jacketed CSST products.

Areas with high lightning risk include but are not limited to: Alabama, Arkansas, Florida, Georgia, Illinois, Indiana, Iowa, Kentucky, Louisiana, Maryland, Michigan, Mississippi, Missouri, New Mexico, North Carolina, Ohio,

Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, Virginia and West Virginia. One currently available source of information regarding areas more prone to lightning than others is the flash density map provided by the National Weather Service which can be found at http://www.lightningsafety.noaa.gov/lightning_map.htm.

Safety first

It is important to always follow proper bonding and grounding procedures for CSST systems. These procedures may reduce the risk of damage and fire from a lightning strike. Even a nearby lightning strike that does not strike a structure directly can cause metallic systems in the structure to become electrically energized.

Bonding and grounding reduces the risk of electrical arcing and potential damage. A qualified contractor always refers to the manufacturer's design and installation guide for specific details on grounding and bonding of the CSST; he/she wants to make sure it has been properly bonded to the grounding electrode system of the premises.

Contractors are reminded to also take into account guidance provided by the National Fuel Gas Code, ANSIZ223.1/NFPA-54, National Standard of Canada, Natural Gas and Propane Installation Code, CSA-B149.1, the Uniform Plumbing Code, the International Code Series, the Federal Manufactured Home Construction and Safety Standards, 24 CR Part 3280, the Manufactured Housing Construction and Safety Standards, ICC/ANSI 2.0 or the Standard on Manufactured Housing, NFPA 501 and local codes.

FlashShield™ CSST

The new CSST system offers the highest level of lightning protection available in flexible gas piping systems and eliminates the need for one manufacturer-required bonding. Care should be taken when installing any type of fuel gas piping (including CSST, iron, or copper) by following the manufacturer's installation instructions. It's important to consult local building codes as to specific requirements.

Remember, lightning safety depends on you. ■

Craig Barry is vice president of marketing, Smiths Heating Solutions Group.

FlashShield™ Installation

Gastite, a leading manufacturer of Corrugated Stainless Steel Tubing (CSST), has launched FlashShield™, a new CSST system that provides more layers of resistance than any other CSST product currently in the marketplace. FlashShield CSST also eliminates the need for additional manufacturer-required bonding and offers the highest level of lightning protection available in flexible gas piping systems.

With no spacing requirements, this new CSST system is easy to install. Just follow the five simple steps outlined below.

Step 1: Cut-to-Length. Cut tubing to the desired length leaving approximately one inch for fitting attachment. Cut should be centered between two corrugations. Use light roller pressure with extra rotations in one direction to leave tubing round and free of burrs. Note: To ensure a quality flare, all cuts should be made on a straight section of tubing.

Step 2: Strip Jacket. Using a utility knife, strip jacket back to the valley of the second corrugation. Do not cut the jacket in such a way that the sealing surface of the tubing is scored. The short piece of jacket can easily be removed by placing the utility knife blade under the jacket to peel the jacket off. Caution: Tube ends are sharp, use care when handling.

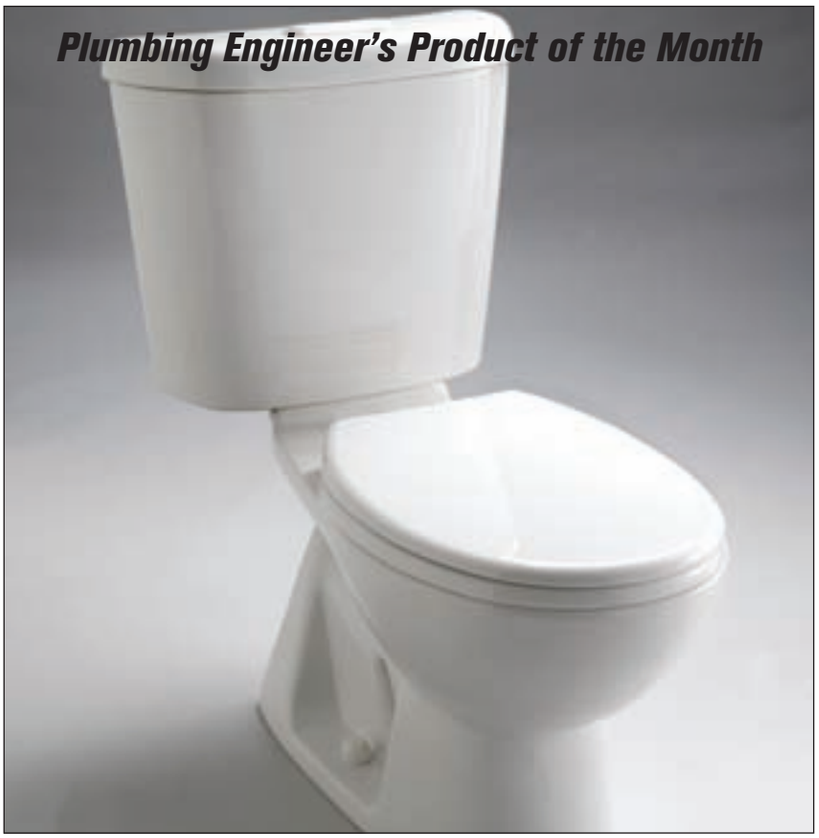
Step 3: Install Nut and Bushings. Thread fitting body into appliance. Slide nut over tubing. Separate bushings and position into the valley of the first corrugation leaving one corrugation exposed between the end of the bushing and tubing. It should be noted that the jacket lock feature must be utilized with this new CSST system and that pipe dope or sealant must not be used inside the fitting prior to assembly.

Step 4: Position Bushings. Insert bushings into fitting body. A small amount of resistance indicates the bushings are being compressed to further capture the jacket. Note: The piloting feature of the bushings ensures the tubing is aligned properly with the fitting body for a uniform flare and a gas tight seal.

Step 5: Wrench Fitting. Slide nut over bushings and thread onto fitting body. Some resistance will be experienced as the nut begins to compress the tubing and create the double wall flare. Continue to thread the nut until resistance to wrenching increases greatly and the double wall flare is tightly seated. It should be noted that during the tightening process rotate the nut only. Do not rotate the fitting body

This story is intended as a quick summary of those differences, and is not intended to replace any manufacturer official installation guide. Always refer to a manufacturer's installation guide for specific instructions.

Product News



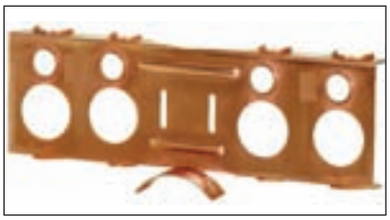
High efficiency dual flush WaterSense toilet provides maximum performance

The Sydney Smart provides significant water savings over other toilets and averages just 0.9 gallons per flush. This saves up to 44% more water than a single flush 1.6 gallon toilet and up to 74% more than a 3.5 gallon toilet. All Caroma toilets have a large trap through way, nearly double the industry average, virtually eliminating blockages and overflows. Stylish design. **Caroma.**

Circle 100 on Reader Reply
Form on page 57

Positioning bracket redesign

Sioux Chief has redesigned its Positioning Bracket, item #521-110. The changes include placing all ½"



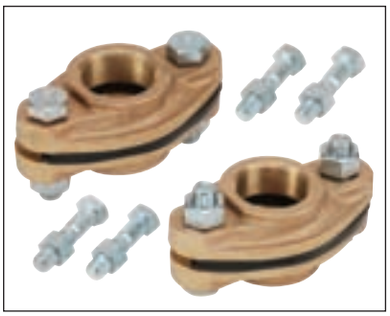
copper stub out holes at the same height, providing a 3.42" centerline in relation to the waste pipe. Other changes include a snap-lock band and the addition of an 8" piece of self-adhesive felt to each bag. **Sioux Chief.**

Circle 101 on Reader Reply
Form on page 57

Isolator with rotating flange & drain

Patented Isolator with Rotating Flange and Drain has been enhanced with two new versatile features: a newly designed snug-fit rotating flange that offers greater control over positioning during installation; and a multi-directional main valve that allows for draining from either side of the pump. **Webstone.**

Circle 102 on Reader Reply
Form on page 57



Bronze meter flange kits

For securing water meters into domestic potable water lines, Matco-Norca offers its 431 Bronze Oval Meter Flange Kits in 1½" and 2" IPS sizes. These kits contain two bronze oval flanges, two drop-in style neoprene gaskets (full face red rubber gaskets are available by request), four zinc plated grade 8 bolts and four zinc plated grade 8 nuts. Flanges conform to B584 C84400; bolts comply with ASTM A 307, and nuts comply with A 563. **Matco-Norca.**

Circle 103 on Reader Reply
Form on page 57

Residential fire sprinklers

New 5.8 (84) K factor pendent sprinkler have been added to leading Freedom® line of residential fire sprinkler products. The new VK472 is cULus listed for up to 20 × 20 ft. (6.1 × 6.1 m) coverage areas. With this new

product, Freedom® line now includes a 5.8 (84) K factor residential sprinkler in three distinct models; recessed pendent (VK472), horizontal sidewall (VK460), and flat plate concealed pendent (VK474) sprinkler. **Viking.**

Circle 104 on Reader Reply
Form on page 57

Tankless water & gas connection kits

Tankless water heater water and gas connection kits provide installers with all of the components needed to easily and economically install gas or electric tankless water heaters. Each kit consists of service valves designed specifically for tankless water heaters, and a high Btu gas connector (for gas applications) and two water connectors. **Dormont Mfg.**

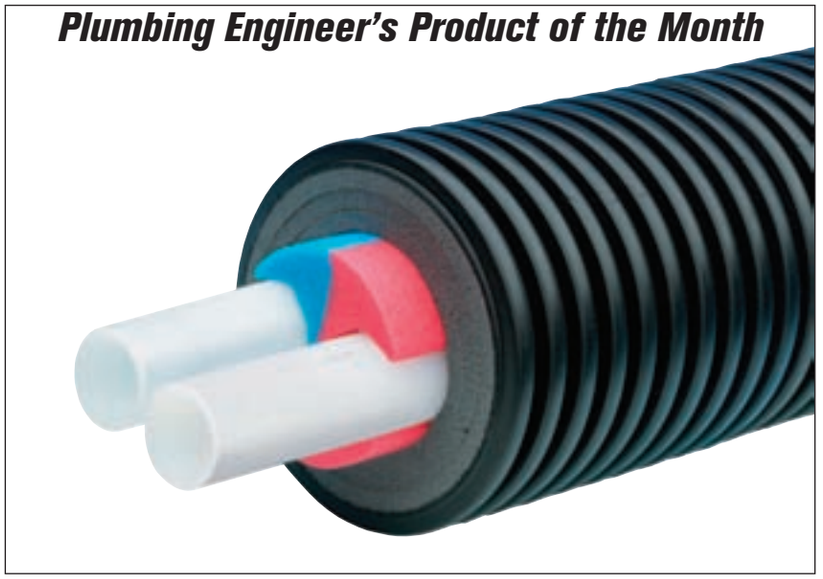
Circle 106 on Reader Reply
Form on page 57

PC-Series pumps

The new PC-Series saves valuable installation time by combining a primary 120 volt sump pump with a 12 volt DC back-up pump in a factory assembled compact unit. Available in 1/3 hp. and 1/2 hp. primary models, the new series boasts energy efficient performance utilizing only 5.2 and 7.5 amps respectively. In the event of a power outage or main pump failure, the 12 volt DC pump will take over automatically and protect the home or business from flooding. **Liberty Pumps.**

Circle 107 on Reader Reply
Form on page 57

Plumbing Engineer's Product of the Month



Pre-insulated piping comes in new sizes

Ecoflex® pre-insulated pipe in 1", 1¼" and 1½" ASTM sizes are offered. ASTM Ecoflex features Uponor's hePEX™ plus barrier tubing surrounded by closed-cell, PEX-foam insulation and covered by a waterproof, corrugated HDPE jacket, making it ideal for direct-burial applications. It is available in continuous lengths up to 600 feet, and uses either Uponor's durable ProPEX® fittings or the new WIPEX™ dezincification-resistant (DZR) brass compression fittings for a watertight, leak-resistant system. **Uponor.**

Circle 105 on Reader Reply
Form on page 57

Rough-in adapter

Dura-Coated™ cast iron rough-in adapter (RA) allows for vertical adjustment after the concrete pour ensuring your drain is flush with the finished flooring. The included cover replaces the strainer during construction keeping pipes clear of debris, eliminating backup, and protecting

the strainer. The RA is compatible with many of Zurn's proven strainers offering application versatility while conserving both time and money. **Zurn Industries, LLC.**

Circle 108 on Reader Reply
Form on page 57

SolPak solar water heating

Company has added two new environmentally-conscious solar water heating solutions to the company's line of SolPak active solar water heating systems: tankless gas products and Rheem Marathon™ storage tanks (pictured). With these additions, Rheem SolPak now provides contractors with an enhanced selection of energy-efficient solar options that can be tailored to any gas or electric job. **Rheem.**

Circle 109 on Reader Reply
Form on page 57

Industry News

Continued from page 12

pumps. This mobile unit can easily be converted to showcase one or the other of these product lines, allowing Franklin to take products and training directly to the distributor, contractor and installer.

Easily maneuverable, this truck/trailer combination allows Franklin Electric to participate in a wide variety of events within the continental United States. Franklin personnel present all training and demonstrations in this rolling showcase.

For info, visit www.franklin-electric.com.

IAPMO encourages DOE to adhere to Green Supplement

WASHINGTON — As it considers new rules emphasizing sustainability in the design and construction of federal buildings, the U.S. Department of Energy (DOE) has been urged by the International Association of Plumbing and Mechanical Officials (IAPMO) to employ the provisions of IAPMO's Green Plumbing and Mechanical Code Supplement.

The Energy Independence and Security Act of 2007 requires that the DOE establish revised performance standards for the construction of new and major renovations to existing federal buildings. The DOE recently published a notice of proposed rulemaking (NOPR) with the following goals:

- to reduce the total ownership cost of facilities;
- to improve energy efficiency and water conservation;
- to provide safe, healthy and productive built environments; and
- to promote sustainable environmental stewardship.

At a recent hearing at DOE headquarters, IAPMO and more than 20 other organizations argued that IAPMO's Green Plumbing and Mechanical Code Supplement provides viable, safe methods to achieve each of these goals.

A first-of-its-kind document, the Green Supplement smoothly bridges the previously troublesome gap between existing codes and green building rating programs. Where code language and established sustainable concepts lack cohesion, the Green Supplement creates harmony with provisions regarding alternate water sources, high-efficiency products, energy conservation and training/education.

TOLCO unveils revamped website

CORONA, CALIF. — TOLCO's revamped website demonstrates its capabilities in seismic bracing and custom fabricated supports.

"The true capabilities of TOLCO are now on display for the world to see," said director of marketing Greg Shaughnessy. "The new website walks you through all of our services and products. Our new project showcase demonstrates our position in the industry as an authority in seismic bracing."

"These projects display our expertise in project management, our understanding and assurance of code compliance, the superior levels of our products, services and solutions, not to mention the opportunity to save time and money. In essence, these are testimonials to the overall value of the TOLCO® brand," said Shaughnessy.

Case studies and testimonials on some of TOLCO's high-profile projects are highlighted, including Johns Hopkins Hospital in Baltimore, the Los Angeles Unified School District Learning Center, City Center in Las Vegas, Perris Valley Water Treatment Plant in Orange County, Calif., The Bay Bridge in San Francisco and Yankee Stadium in New York.

The new layout and presentation at www.tolco.com is easy to navigate.

DBIA releases revised contract documents

WASHINGTON — Design-Build Institute of America (DBIA) introduced a family of standard contract document forms more than a decade ago. Since then, the number of owners relying on the design-build project

Continued on page 58

Classified Ads

Advertiser Index

Continued from page 56

delivery method has increased exponentially. In the process, design-build team members have gained expertise and case law has evolved to address issues unique to design-build. In response, DBIA has released the next generation of contracts that address these issues and incorporate industry advances of the past decade.

The 2010 documents reflect DBIA's original risk allocation approach that distributes risk to the participant best able to manage it in the most cost effective manner. Like the originals, the new documents recognize the need for flexibility. As a result, the new contracts are user-friendly documents that are short on legalese and allow parties to customize contracts to their projects.

There is more than one way to address any contractual issue — be they time-related provisions or ones specifying ownership of design documents. "The menu approach will encourage the parties to discuss difficult contractual issues at the outset of their relationship," explained Bennett Greenberg, DBIA, a partner at Seyfarth Shaw LLP and the chair of the DBIA contract committee. "These conversations help owners and the design-build team arrive at a contract tailored to the unique project and each party's risk tolerance."

The new generation of documents also responds to some of the more contentious issues of the last 10 years. Scope of work, for example, is addressed through a more comprehensive framework that ensures that owner and design-builder expectations are more closely aligned. The owner's use of prescriptive specifications in project criteria is dealt with in a manner consistent with recent case law. Moreover, exhibits pertaining to sustainable design, building information modeling and electronic data handling round out this new edition of DBIA contract documents.

Trimble acquires Accubid assets

SUNNYVALE, CALIF. — Trimble has acquired the assets of privately-held Accubid Systems based in Concord, Ontario, Canada. Accubid is a leading provider of estimating, project management and service management software and services for electrical and mechanical contractors. Financial terms were not disclosed.

Accubid's family of software products allow electrical and mechanical contractors to analyze their estimates in great detail including CAD-based estimating and takeoff and then export the data into project management, accounting, and procurement applications. The acquisition of Accubid broadens Trimble's industry leading "BIM to field" solutions for mechanical, electrical and plumbing (MEP) contractors to automate project estimating and management, modeling, detailing, layout and construction.

HOLDRITE announces name change, launches new website

VISTA, CALIF. — HOLDRITE®, a manufacturer of construction products for both residential and commercial markets, announced an official name change. The company, formerly known as Hubbard Enterprises/HOLDRITE, will now be known as HOLDRITE.

In addition to the name change, HOLDRITE has launched a newly redesigned website focused on improved navigation, customer-driven content and highly dynamic search capabilities. The site, www.holdrite.com, features products such as pipe and equipment support systems, acoustical plumbing solutions, water heater accessories, and water and firestop sleeving systems.

Movers & Shakers

Danfoss VLT Drives appoints business manager

Taaning-Grundholm

BALTIMORE — Danfoss's VLT Drives division has appointed Frank Taaning-Grundholm as Global Pump OEM business manager. Taaning-Grundholm will be responsible for sales to all international and major regional pump original equipment manufacturers (OEMs), including business development, marketing, product portfolio and application support.

Elgin Fastener Group adds to sales force

ELGIN FASTENER GROUP has reached agreement for sales representation in Wisconsin and northern Illinois with Harwood Associates, based in Brookfield, Wis. Started in 1950 by Howard Harwood, the agency was purchased in 1985 by Howard's son, John. John's son, Joe, joined the business in 2008 and represents the third generation to actively participate in the operation. Harwood Associates has represented companies such as American Rivet, National Rivet, Accurate Threaded Fastener and Elco Screw over its 60-year history. The agency employs four sales associates and an office staff.

IAPMO R&T announces promotions

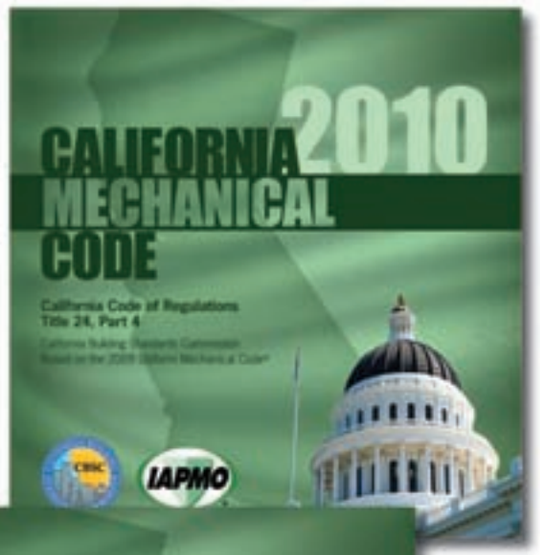
ONTARIO, CALIF. — IAPMO R & T has made two promotions:

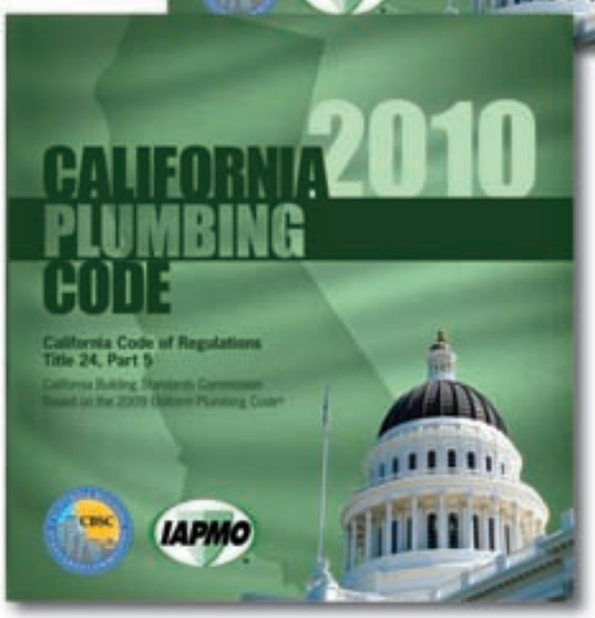
• Shirley Dewi has been promoted to director of IAPMO R&T's management system registration services, the quality management system certification arm of the agency.

• Ohannes Dembekjian was promoted to senior director of continuous compliance.

2010 California Codes *Now Available*

If you work or design for California projects, you need the latest editions of the *California Plumbing Code* and *California Mechanical Code*.





- Developed by the industry for the industry, the CPC includes specific:
  - Medical Gas and Vacuum Systems
  - Manufactured/Mobile Home Parks
  - Firefighting Breathing Air Replenishment Systems
  - Fuel Gas
  - Exhaust Venting
  - Private Sewage Disposal Systems
  - Installation Standards

  The CMC includes specific:
  - Fuel Gas
  - Sizing of Venting Systems
  - One- and Two-Family Dwellings
  - Appliances for Installation in Manufactured Housing
- Reduced personal liability from code change omissions — protect yourself and your clients by getting completely up to date
- Build your foundation on more than 80 years experience in the plumbing/mechanical field

2009 editions of the American National Standard *Uniform Plumbing Code*® and *Uniform Mechanical Code*® are also available at www.iapmostore.org.

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IAPMO

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Zurn has a 100-year tradition of developing quality engineered products to meet the growing needs of water conservation, water safety, water control and water comfort. Our product offering combines both value and performance to deliver significant savings for the building owner.

ZURN®

Green Construction | Labor Saving Products | Retrofit | Local Inventory

Committed to you. Committed to the environment.

Siphonic Drain Systems

A Patented, Specified Roof Drain Product for Siphonic Roof Drains

The Zurn Siphonic Roof Drain System provides green benefits to the building owner. The Zurn Siphonic Roof Drain design can help buildings reduce energy consumption, conserve water, reduce the depletion of natural resources, and reduce construction costs. Zurn Siphonic Drains provide full bore flow when used in conjunction with a fully engineered design piping system.

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Circle 31 on Reader Reply Form on page 57