Healthcare Facility Plumbing Design

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• Warming up to Snowmelt Design
• Understanding Solar Collector Efficiency
• Grease Recovery Device Helps Restaurant Alleviate Discharge Problem
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Warming up to Snowmelt Technology
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Understanding Solar Collector Efficiency
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Learning to fly

New Radiant & Hydronics Council spreading its wings with support from ACCA

Pink Floyd’s 1987 single “Learning to Fly,” from the Momentary Lapse of Reason CD, could be argued as a strong analogy for the band’s rebirth after the departure of lead man Roger Waters, and David Gilmour’s piloting of the “new” Floyd, post-Waters.

It takes strong leadership to captain and redirect a wayward vessel — in this case, the radiant and hydronics’ past attempts at leading successful industry think tanks — but I do think ACCA’s newly formed Radiant & Hydronics (RHC) council is headed in the right direction to become a successful organization. Created from the need to have a viable radiant organization, the RHC is now led by some of the biggest names in the radiant/hydronics industry, and their veteran leadership can’t be understated. “Since it is an organization of, by, and for the contractor, it gives us one strong voice in advocacy, while providing services specific to radiant professionals through the council,” says Dan Foley, first chairman of the RHC Advisory Council. Foley stresses the fact that this is a contractor-led organization, leaving manufacturers beyond the white lines.

“This is a win-win for the industry,” says Dave Yates, owner of F.W. Behler, Inc., York, Pa. “The more information relating to hydronics out there can only be a good thing for the industry.” And the members on this new council will be dedicated to sharing information and enhancing the awareness of radiant.

“Radiant contractors have been seeking a dynamic, contractor-focused organization for some time; many have asked ACCA to expand an emphasis into that sector,” said Joe Nichter, ACCA 2011-2012 chairman. “The RHC will provide first-class representation and services for radiant and hydronics professionals that wish to be the best in their field.”

Some of the new features of RHC:
- The addition of a new Radiant & Hydronics educational track at the 2012 ACCA Conference, held March 5 – 8 in Las Vegas;
- Development of a new, two-day educational meeting specifically for radiant and hydronics professionals — the Hydronics Roundtable;
- Development of a new radiant-specific section of the ACCA website; and
- Inclusion of RHC input in ACCA’s broader activities in government relations.

“I’m looking forward to a well-focused and experienced approach to the RHC creation and implementation. ACCA has had a long-standing reputation and history to make this happen. If hydronics is to be a player in the market, the RHC is the group to ‘get ’er done,’” says Bob “hot rod” Rohr. “I’m looking forward to the exchange with current and long-time ACCA members. With a slow economy, this is an ideal time to access more training, form alliances and learn to promote new technologies. Fasten your seatbelt, this should be an exciting journey.”

To see the full ACCA RHC news release, turn to page 8.

Editor’s Letter

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November 2011
Something’s happening here

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Industry News

ACCA launches Radiant & Hydronics Council

WASHINGTON — The Air Conditioning Contractors of America (ACCA), the nation’s largest organization of indoor environment and energy services contracting businesses, has launched a new Radiant & Hydronics Council (RHC) within ACCA to provide specific services to this vital segment of the HVAC/R industry.

“Radiant contractors have been seeking a dynamic, contractor-focused organization for some time; many have asked ACCA to expand an emphasis into that sector,” said Joe Nichter, ACCA 2011 – 2012 chairman. “The RHC will provide first-class representation and services for radiant and hydronics professionals that wish to be the best in their field.”

The changing indoor environment sector requires contractors of all kinds to master a wide variety of technologies, including air, hydronic, solar, geothermal and other alternative energy services. The addition of the RHC to the ACCA umbrella is a key part of the association’s strategic plan to help its members compete in the modern business climate.

The RHC will be guided by an advisory committee comprised of the nation’s leaders in this vital industry segment. The first chairman of the RHC Advisory Council will be Plumbing Engineer and Phc News columnist Dan Foley. Foley is president of Foley Mechanical in Lorton, Virginia, a recognized leader among hydronics contractors and a past chairman of the Radiant Panel Association (RPA).

In addition to Foley, others serving on the RHC Advisory Committee are:
• Greg Jannone, William Jannone & Son, Bound Brook, N.J. (past chair, RPA)
• John Abularrage, Advanced Radiant Design, Stone Ridge, N.Y.
• Brian Stack, Stack Heating & Cooling, Avon, Ohio
• John Siegenthaler, Appropriate Designs, Holland Patent, N.Y.
• Mark Hotel, Harvey W. Hotel Inc., Gaithersburg, Md.
• Bob “Hot Rod” Rohr, Caleffi, Milwaukee, Wis. (past chair, RPA)
• Bill Shady, PE, Sustainable Design and Product Management, Santa Cruz, Calif.

“As a longtime active member of associations in both the air and radiant field, I am excited to see ACCA create this new organization,” said Foley. “It is definitely time for the many different elements of the indoor environment industry to come together under one umbrella for the betterment of all contractors. ACCA offers us an incredible opportunity to do just that. Since it is an organization of, by and for the contractor, it gives us one strong voice in advocacy, while providing services specific to radiant professionals through the council.”

The RHC’s initial scope of work includes:
• The addition of a new Radiant & Hydronics educational track at the 2012 ACCA Conference, held March 5 – 8 in Las Vegas;
• The launch of a new monthly e-newsletter, Radiant Trends, specifically for RHC members;
• Development of a new, two-day educational meeting specifically for radiant and hydronics professionals — the Hydronics Roundtable — to be held in fall 2012 as part of ACCA’s annual Contracting Week;
• Development of a new radiant-specific section of the ACCA website, featuring webinars, articles and resources exclusively for RHC members;
• Addition of a hydronics-specific Contractor Directory on the ACCA website;
• Inclusion of RHC input in ACCA’s broader activities in government relations, industry advocacy, education, communications and standards development.

Membership in RHC will be open to all ACCA member companies; in addition to ACCA membership dues, a nominal RHC fee of $95 per year will be charged for participation in the council. Details about the RHC, including information on how to join, will soon be available on ACCA’s website at www.acca.org.

ITT board of directors approves spinoffs of Xylem and ITT Exelis

WHITE PLAINS, N.Y. — ITT Corporation’s board of directors has approved the distribution to its shareholders of all the outstanding shares of Exelis Inc., its defense and information solutions business, which will also be known as ITT Exelis and Xylem Inc., its water technology and services business, which will result in three distinct, publicly traded companies. Each ITT shareholder of record as of the close of business on October 17, 2011, the record date for the distribution, received one share of ITT Exelis common stock and one share of Xylem common stock for each share of ITT common stock held as of the record date. The ITT Board also approved a 1:2 reverse stock split for ITT, which will become effective after market close on October 31, 2011, the distribution date for the spinoffs.

NFPA symposium slated for December

QUINCY, MASS. — The National Fire Protection Association (NFPA) and its affiliate, the Fire Protection Research Foundation (the Foundation) will host a 1-day Alternative Energy Technologies and Electrical Safety Standards Symposium December 6, 2011 in Atlanta.

The symposium comes at a significant turning point, as more businesses and consumers are turning to alternative energy sources and technologies. Developments in the field are proliferating at an ever increasing rate, and new questions about safety and reliability continue to be raised.

Visit NFPA’s website at www.nfpa.org/AEsymposium for more information or to register online or call 800/344-3555, Monday – Friday, 8:30 a.m. – 5:00 p.m. (EST).

More Industry News on page 10
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University of Maryland’s Watershed house wins top spot at Solar Decathlon

WASHINGTON — On Oct. 3, the U.S. Department of Energy announced the winner of the 2011 Solar Decathlon competition, which awards collegiate teams for designing, building and operating the most cost effective, energy efficient and functional solar-powered homes. The University of Maryland’s WaterShed house, which features an Uponor PEX plumbing system, came out on top, with a total of 951.151 points out of 1,000.

Two other Solar Decathlon homes also featured Uponor: sixth-place Southern California Institute of Architecture (SCI-Arc) and California Institute of Technology (Caltech) team, and ninth-place Team Massachusetts, which included Massachusetts College of Art and Design and the University of Massachusetts at Lowell.

BrassCraft celebrates 65 years

NOVI, MICH. — BrassCraft Manufacturing Company, a pioneer in the development of plumbing products, is celebrating its sixty-fifth anniversary. Founded in 1946, BrassCraft is headquartered in Novi, Michigan, and has grown to include distribution and manufacturing facilities in Michigan, California, North Carolina and Texas.

The company provides a complete range of long-lasting plumbing supplies to professionals in the new construction and repair/remodel markets.

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InnoFlue the first UL-1738 listed polymeric vent system in North America.

ALBANY, N.Y. — Centrotherm Eco Systems, a leader in polypropylene venting technology, announced that their InnoFlue® branded, single wall, flexible and concentric vent systems have been tested and are now listed to UL-1738. To date, according to the company, InnoFlue is the only plastic vent that has earned this listing under the only standard in the U.S. that is specifically designed to test and list vent systems for Category II & IV heating appliances.

IAPMO, PMI sign MoU

ROLLING MEADOWS, ILL. — The International Association of Plumbing and Mechanical Officials (IAPMO) and Plumbing Manufacturers International (PMI) have entered into a Memorandum of Understanding (MoU) specifically detailing ways in which the two venerable organizations will work together to jointly advance and promote mutual industry interests as related to education, training and advocacy. IAPMO CEO GP Russ Chaney and PMI executive director Barbara C. Higgins signed the MoU on October 13 in Washington, D.C. For more information, visit www.pmihome.org.

SolarLogic announces new software patent

SANTA FE, N.M. — SolarLogic LLC, a New Mexico solar heating technology company, has received U.S. patent approval of its SLASH-D design software. SLASH-D uses a small set of inputs about a building requiring a solar heating system and delivers an analysis of solar heat availability and utilization, a system parts list, estimated cost and a detailed piping schematic, enabling any qualified heating contractor to proceed with quoting, procurement and installation of a solar home heating system.

In addition, SLASH-D outputs a data file used by SolarLogic’s complementary flagship product, the
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SLIC (SolarLogic Integrated Controller), patented in 2010. The SLIC is an integrated hardware-software device that replaces all conventional and solar-specific heating controls with a single component, is interactive on the Internet and, because it is loaded with the SLASH-D output as part of installation, requires no programming upon system start-up and commissioning.

**Taco tops off Innovation & Development Center**

Cranston, R.I. — Taco marked an important milestone in the construction of its new Innovation & Development Center, the centerpiece of its $18 million expansion project, with beam raising and topping off ceremonies in September.

The Taco Innovation & Development Center will consist of a 24,037-square-foot addition to the current building. It will be a state-of-the-art learning and training environment, complete with new classroom spaces, conference rooms, a business center and functional labs for testing and teaching.

**AFSA elects chairman**

Dallas — The American Fire Sprinkler Association (AFSA) has elected Dwight Bateman, founder and president, Southeast Fire Protection Inc., Houston, chairman of the 2011–2012 AFSA board of directors. Bateman was elected during the Wednesday, September 14 board of directors’ meeting at the AFSA convention in San Antonio and was installed at the close of the convention.

**ASSE, ASPE to develop plumbing dictionary**

Chicago and Westlake, Ohio — The American Society of Sanitary Engineering (ASSE) and the American Society of Plumbing Engineers (ASPE), the two global leaders serving the sanitary and plumbing engineering professions, have agreed to work together to develop a joint plumbing dictionary. The dictionary will combine the current publications issued by each organization, bringing the plumbing community one step closer to having consistent, globally accepted terminology.

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Highland Tank and Flight 93

American dream and American heartbreak

Every once in a while I receive an invitation to visit the facilities of one of the manufacturers whose products I specify for an opportunity to see firsthand how their manufacturing is achieved. I always value these opportunities, because I find the transformation of raw materials into finished product absolutely fascinating. Manufacturing has become somewhat of a dying art here in the United States, as more and more of our products are produced overseas. I hope that, as the financial powers of this world of ours rebalance themselves in our global economic crisis, we recapture more manufacturing on our home soil.

One of the dwindling number of manufacturers still making its product here in our homeland is Highland Tank. Highland manufactures steel tanks for water storage, fuel dispensary, oil-water separation, grease removal and virtually anything else for which you might need a steel or stainless steel tank. Tanks can be atmospheric or pressure vessels, either single or double wall.

Founded in 1946, Highland Tank made about six tanks per year in the 5,000-gallon range during their initial production years. Then one day the phone rang, and founder Robert Jacob received a request for a single order of five tanks, to which he happily agreed. Minutes later the phone rang again, and the same client increased the order to 10 tanks. Another phone call increased the order to 20 tanks, then 50 and then 100. As the saying goes, “When it rains it pours,” and this was a storm of intimidating scale for Highland Tank. The next time the phone rang, it was Robert’s brother and partner Vincent, bursting at the seams with excitement, informing him that he just took an order for 500 tanks! So, in the course of one day, Highland Tank had increased their production by two orders of immense magnitude.

Needless to say, the Jacob brothers had to beg, borrow and mortgage their homes to purchase the steel required for these orders, but they succeeded in producing all 600 tanks on time. Highland Tank had become an overnight success, but without a great deal of effort and risk, both factors of the long-embraced American dream.

Today, Highland Tank still produces its tanks in Stoystown, Pennsylvania, the town where the company was founded, as well as at five other facilities in western Pennsylvania. Their primary product line includes 5,000-to 60,000-gallon steel tanks, either single- or double-wall construction for either above or below ground installation. The tanks are made to order, so the product can be specified with virtually any array of materials and accessories. During our visit, we witnessed the construction of single wall tanks with 35,000-gallon containment dikes, as well as 6,000-gallon stainless steel tanks with blue steel double containment surrounds. In the yard there were 35,000-gallon Titan tanks, a blue steel interior tank with an exterior fusion bond high molecular weight resin polymer for secondary containment, which reduces weight and cost.

Regardless of the configuration specified, the construction methods are very much the same. Tanks are made from sheet steel welded together in pieces. The shapes of the pieces are a function of the size and type of tank. An atmospheric tank might be cylindrical or rectangular and made of 1/4" or 3/8" thick steel plate. After welding, the various tappings and connections are installed; then it is pressure tested. If the tank is double-wall, the secondary wall is then welded around the primary wall and a secondary pressure test is performed. The tanks are shipped with the secondary containment void under a 23" Hg vacuum to ensure the integrity of both the inner and outer tank walls.

Once all the welding, shaping, tappings and pressure tests are completed, the tank is prepared for finishing. First, the steel surfaces are pressure blasted with steel shot, triangular in shape, in what might be considered sand blasting on steroids. The surface is made so rough that an accidental brush against a rough tank could easily take the skin off your elbow. This rough surface is ideal for the application of finish material. Water tanks receive an NSF 61 approved polymer to keep the interior steel up to drinking water standards. Most fuel tanks are not coated inside,
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since hydrocarbons do not denigrate the steel surface. The exterior coating depends on whether a tank is meant for above or below grade installation. Buried tanks receive a polymer primer followed by 70 mm of green protective polymer to safeguard the tank for 30 years below grade. Surface installations are primed and given 30 mm of white finish paint for protection against the elements.

Surface installations are also available in a “Fireguard” design, which has 3” of concrete between the two walls of the tank, protecting it from accidental or intentional damage from vehicles or other potential threats.

This is a snapshot of Highland Tank today, a successful and thriving example of the American dream. On September 11, 2001, at 10:03 a.m., the scene was very different, as Flight 93 passed directly overhead, upside-down, at an altitude of 200 feet and a speed of 593 mph. The Highland employees who happened to be outside between buildings at the time were surely among the last people to see Flight 93 before it crashed into the ground only seconds later, two miles from the plant. Needless to say, one cannot visit Highland Tank without visiting the Flight 93 memorial that is, literally, in their backyard. The day of our visit happened to be an unusually warm October day; it was Columbus Day, a work holiday for many people, so the memorial was well attended. It was also just one month after the 10th anniversary of 9/11, so the memorial had been well prepared for the president’s visit.

Prior to this visit, my knowledge of the Flight 93 Memorial was shamefully limited. Its development was slow, since the site covered many acres with many different owners, land that had to be acquired in an arduous process. Today, Phase 1 construction of the memorial has been completed. This includes a series of viewing benches of the crash site memorial stone, accessible only to family members of the 40 victims. The flight path just prior to impact is marked by a series of 40 stone slabs, each with the name of one of the victims chiseled on its façade.

Future phases of the memorial will include a Field of Honor, outlined by a ring of 40 memorial trees, a Tower of Voices with 40 wind chimes and a Flight Path Walkway flanked by large stone slabs, symbolizing the plane’s final approach to the crash site. I think a second visit will be warranted once the construction is complete.

You can learn more about Highland Tank at www.highlandtank.com and more about the Flight 93 Memorial at www.nps.gov/flni.

Timothy Allinson is a senior professional engineer with Murray Co. mechanical contractors in Long Beach, Calif. He is licensed in both mechanical and fire protection engineering in various states and is LEED accredited. He can be reached at laguna_tim@yahoo.com.

The views and opinions expressed in this column are those of the author and do not reflect those of Plumbing Engineer nor its publisher, TMB Publishing.
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The deadline for code change proposals to the 2015 International Building Code (IBC) and the International Plumbing Code (IPC) is January 3, 2012, so, by the time you read this column, you will have just over a month until the code changes are due. Better order your 2012 codes now if you plan on proposing a code change for the 2015 editions.

The International Code Council (ICC) board has modified the code development process by reviewing changes it has made to code change procedures over the past few years. This review led to further refinements to the process. The changes include splitting the 13 existing International Codes into two groups and establishing one cycle of code development for each group between each edition of those codes.

Code development on the first set of codes, Group A, will be heard in 2012. Group A codes include:
- The International Building Code (IBC).
- IBC-Fire Safety (Chapters 7, 8, 9, 14, 26 and App. D).
- International Fuel Gas Code.
- International Mechanical Code.
- International Plumbing Code.
- International Private Sewage Disposal Code.

Code development for Group B codes will be heard in 2013. Group B codes include:
- Administrative Provisions (Chapter 1 all codes except IRC). 
- IECC, Performance Code, designated definitions and referenced standards administrative update).
- International Existing Building Code.
- International Fire Code.
- International Green Construction Code Committees: 
  IgCC—Energy/Water Committee (Chapter: 6 and 7)
  IgCC—General Committee (Chapters: 2 – 5, 8 – 11 and Appendices)
- International Performance Code.
- International Property Maintenance Code.
- International Wildland-Urban Interface Code.
- International Zoning Code.
- International Residential Code.
- IRC-M/P (Chapters: 12 – 33 and App. I, P).
- IRC-E (Chapter 11 – see Note).
- ICSF—Fire Safety (Chapters 7, 8, 9, 14, 26 and App. D).
- International Swimming Pool and Spa Code.

The purpose of having one cycle of code development for each new edition of the International Codes is to reduce the amount of time spent at code hearings. The new schedule also allows the final action hearings for each group of codes to be held in conjunction with one of the ICC’s annual business meetings.

This change has resulted in shorter code hearing schedules, raising concerns about the time available for consideration of each code change proposal brought forth. The code change committees will consider each proposal only one time between editions of the codes. Proponents are allowed only three minutes to explain the reason for proposed changes; even less time is allotted for rebuttals.

In order to allow more time for discussion of some of the more complicated issues, the ICC board of directors created a Code Technology Committee (CTC) in 2006. The board can assign specific topics to the CTC for further study. In some cases, these assignments are made as a result of a recommendation from the ICC code change committee.

**ICC establishes code action committees (CAC)**

Extending the concept of the CTC, the ICC has established four discipline-specific code action committees to “act as a forum to deal with complex technical issues ahead of the code development process, identify emerging issues and draft proposed code changes of importance to the membership.” Two of these committees with potential significance to our industry are the Plumbing Code Action Committee and the Residential Code Action Committee.

A third CAC of potential significance to our industry will be the ICC Sustainability, Energy & High-Performance Building Code Action Committee. This committee will be responsible for the International Energy Conservation Code and the International Green Construction Code, both of which are Group B codes. A meeting of the committee will be scheduled in the near future. Stay tuned to the ICC website for details.

**ICC retains assembly voting**

The ICC board of directors voted to retain a number of other changes that were made in recent years to the ICC code change process. These include retaining the use of assembly voting at the code development hearings and continuing to restrict the final vote on the content of the International Codes to representatives of active ICC members who are responsible for the enforcement of these codes by a local jurisdiction.

Although the board has established a goal of putting into place remote voting by 2015, it is not anticipated that it will be used during the 2012 code change cycle.

**International Green Construction Code grows**

A number of U.S. jurisdictions have adopted all or part of the IgCC as a green design option for commercial buildings within their jurisdiction. These include the states of Florida, New Hampshire, North Carolina, Oregon and Rhode Island, as well as the cities of Scottsdale and Phoenix, Ariz., and Richmond, Wash. In some of these jurisdictions, such as Florida, use of the IgCC is limited to publicly owned buildings. Use of the IgCC is optional, so compliance is not required. However, if a building owner or designer within these jurisdictions wishes to provide a green building, they may use the IgCC to establish the requirements.

_Ron George is president of Plumb-Tech Design and Consulting Services LLC._

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As we noted last month, the current state of the art in water mist fire protection system design is that there is no comprehensive set of guidelines that can be used to design a water mist system. Designers are limited to providing protection for hazards that fit into the small number of approved pre-engineered system designs. This is codified in paragraph 8.1.1 of the 2010 edition of NFPA 750: “Water mist protection systems shall be designed and installed for the specific hazards and protection objectives specified in the listing.”

The explanatory information in the annex paragraph A8.1 aptly explains the need for this approach: “Currently, no generic design method is recognized for water mist protection systems. The relationship between flux density or nozzle spacing and performance in controlling fires is not consistent between systems designed by different manufacturers. The system features, such as nozzle spacing, flow rate, drop size distribution, cone angle and other characteristics, need to be determined for each manufacturer’s system through full-scale fire testing to obtain a listing for each specific application.”

Designers are limited to providing protection for hazards that fit into the small number of approved pre-engineered system designs.

There are two established avenues for gaining approvals for pre-engineered water mist fire protection systems, one for systems on passenger ships and one for land-based hazards.

In order for water mist fire protection systems to be approved for use on passenger ships, the system must be deemed equivalent to a shipboard automatic sprinkler system based on fire testing. This is done by meeting the requirements of Appendices 1 and 2 of The International Maritime Organization publication IMO 800 (19), Revised Guidelines for Approval of Sprinkler Systems Equivalent to that Referred to in SOLAS Regulation II-2/12. Appendix 1 contains the test protocols for evaluation of water mist nozzles. Appendix 2 contains the fire test protocols for water mist systems for use in passenger accommodation spaces, public areas and service areas.

There are several approving authorities for systems on passenger ships. These include the U.S. Coast Guard, the Danish Maritime Authority and Bureau Veritas.

For water mist systems on other than passenger ships, we must rely on approvals provided by Factory Mutual Global. FM evaluates water mist components and systems by FM Approval Standard 5560, Water Mist Systems. FM approvals are provided for complete systems and for water mist nozzles for use in light hazard occupancies.

Current FM system approvals are provided in the following categories:

- **Local Application Protection**
  - Combustion or Steam Turbines in Enclosures with Volumes < 9175 ft³ (260 m³)
  - Combustion or Steam Turbines in Enclosures with Volumes > 9175 ft³ (260 m³)
  - Combustion or Steam Turbines in Enclosures with Volumes < 2825 ft³ (80 m³)
  - Machinery in Enclosures with Volumes < 9175 ft³ (260 m³)
  - Machinery in Enclosures with Volumes > 9175 ft³ (260 m³)
  - Machinery in Enclosures with Volumes < 2825 ft³ (80 m³)
- **Computer Room Subfloors**
- **Industrial Oil Cookers**
- **Wet Benches and Similar Processing Equipment**
- **Continuous Wood Board Presses**
- **Light Hazard Occupancies**
- **Machinery in Enclosures with Volumes < 2825 ft³ (80 m³)**

Fire tests of machinery enclosures and turbines include tests in which the fire is both shielded and unshielded from the water spray. Non-fire testing of combustion turbines is done to ensure that the thermal shock caused by the cooling effect of the water mist nozzles will not adversely affect turbines. Computer room subfloors, industrial oil cookers, wet benches and continuous wood board presses are fire tested in full scale mock-ups of each hazard.

The various fire tests for these hazards include at least one test in which the water spray nozzle is obstructed. Testing for light hazard occupancies is done in three compartments; a small room (130 sq ft with ceiling at 8 feet), a large room (400 sq ft room with ceiling at 8 feet) and a large open space with a minimum 860 sq ft ceiling area that is 16.4 feet high. To pass the tests the maximum ceiling temperature must not exceed 500 F. Damage to combustible fuel packages is limited to a certain percentage for each test. For the large room, a nozzle located in the doorway must not open. In the open space test, a maximum of five nozzles are permitted to open.

Both the FM and NFPA water mist standards permit a limit amounted of flexibility for purposes of adapting a specific hazard situation to a particular approved system. Section of 3.3 of FM Data Sheet 4-2 Water Mist Systems allows use of systems approved for a specific hazard to be used for protection of other hazards as long as the hazard is similar. Similarly, NFPA 750 requires the application of approved systems to situations where the hazard and compartment characteristics are “consistent with the listing of the system” (paragraph 8.1.2). The standard also cautions the designer that, “Pre-engineered water mist systems for compartment enclosures shall not be extrapolated beyond
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Occupancies Listed in Table 1 of FM Data Sheet 3-26

Fire Protection Water Demand for Nonstorage Sprinklered Properties

Table 1 of FM Data Sheet 3-26 lists several occupancies classified into one of three hazard categories, HC-1, HC-2 and HC-3. HC-1 is similar to the light hazard sprinkler hazard classification. Though Appendix O indicates FM's interest in protection of Table 1 occupancies with water mist, paragraph 2.1.1.12 of Data Sheet 3-26 indicates that water mist should only be used to protect HC-1 occupancies. This paragraph also contains several other requirements and restraints for use of water mist fire protection systems for light hazard occupancies.

For the time being, approved use of water mist fire protection will be limited to those hazards in which full scale fire testing has been performed.

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Solar Solutions

Bristol Stickney, chief technical director, SolarLogic LLC, Santa Fe, N.M.

The Solar Combi 101-Mini: for the cabin or guest house

Anyone who works with home-heating construction projects has probably heard this before. The most common response from the person in charge of the budget has got to be either; “Can’t you make it cheaper?” or “Can’t you make it less complicated?” or both.

A few years ago, I took this challenge to heart when a number of construction jobs crossed my desk that seemed to be ideal applications for a solar combisystem but seemed too small to justify the full-blown primary loop (flow center), multi-zone treatment that I use as my standard design for typical home heating projects.(I refer to this as Combi 101, mentioned in previous columns.) These smaller buildings typically resembled guest houses or cabins, and some of them were off-grid with photovoltaic (PV) electric systems.

The standard Combi 101 makes sense when connecting (1) solar heat with (2) a boiler or other backup heat source, (3) a DHW heat storage tank and (4) hydronic radiant floors (HRF), because it simplifies the interaction and control of these four most common components. To save on cost and complexity in a small building that is well-insulated with only a single heating zone, the solar heating system can be further condensed to only the essential functions.

Figure 1 shows a piping and wiring diagram with details combined from several “as-built” installation drawings from small solar heating systems installed between 2007 and 2009. Since the number and size of all components normally found in a Combi 101 system have been minimized here, the system is referred to as the “101-Mini”. Although this system was intended to be lower cost and simpler, it was designed to preserve the essential function and “feel” of the larger Combi 101 solar heating systems.

The essence of the Combi 101 controls

The most important features of a Solar Combi 101 control system allow it to function automatically and reliably, to provide heating comfort for the occupants, for both DHW and HRF, without any special knowledge required by the users for normal operation from day to day. This includes automatic backup heat, solar preheat, solar only and solar overheat control. These features are provided by the 101-Mini as follows: DHW heat is delivered directly to the in-tank heat exchanger by a low voltage circulator powered directly from a PV panel. The heat storage capacity of the potable water is also used to heat the floors.
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through the in-tank heat exchanger.

Solar domestic hot water tank control (DHW) features include:
- Low-limit aqua stat (AQ), comes with the electric element in the hot water tank
- Solar heat storage ON, PV-powered circulator runs when sun is up
- Solar heat storage OFF, PV-powered circulator stops when sun is down
- High-limit, provided by thermal switch 4E117
- Safety high-limit, P & T relief valve on the DHW tank in Fig. 40-1

The heat storage capacity of masonry warm floors is used for solar heat storage, controlled within the human comfort range by a two-stage room thermostat. The room temperature is allowed to drift upwards when “free” solar heat (Stage 1) is available. A second low voltage circulator is switched ON and OFF to provide HRF heat.

Solar heated warm masonry floor zone control (HRF) features include:
- Auxiliary low-limit Stage 2 heat ON (backup heat is allowed)
- Minimum comfort temperature Stage 2 heat OFF (auxiliary OFF)
- Solar heat-banking allowed — Stage 1 solar room heat ON
- Maximum comfort temperature — Stage 1 solar room heat OFF

The solar glycol circulator is used to deliver heat directly to the DHW tank and the HRF space heating system with adjustable temperature priority, using low-limit controls. It is also used to cool the DHW tank by circulating after sunset when a high-limit temperature is reached in the tank.

Solar collector heat control features include:
- Solar collector low-limit, provided by thermal switch 4MY93
- Solar HRF heat banking low-limit, provided by thermal switch 4E116
- Evening heat dissipation high-limit, provided by thermal switch 4E117

Unique design features in the Solar Combi 101-Mini

In this design, piping and wiring are simplified and costs are cut by eliminating components and using low voltage circulators. This results in unexpected opportunities for both thermal and electrical efficiency. Here are some of the highlights:

There is no separate backup boiler. The solar heat storage tank, DHW and backup (electric) heat are all integrated into one unit.

The solar heat collection and distribution can be powered from AC or DC electrical sources. The pumps and controls can be powered by an automotive battery during an emergency.

Low voltage DC circulators (only two) allow low voltage switching and wiring.

The main heat exchanger between the solar collectors and the house is eliminated, which maximizes the solar heat transfer to the DHW and HRF loads.

The primary loop or “flow center” is not used here (to simplify the piping). This is not recommended in systems with more heating loads, more collectors or other added complexity of any kind.

Solar heat is joined to the floor heating system using two tees, shown as T1 and T2 on the diagram.

All “boiler fluid” is propylene glycol antifreeze mixture, even in the floor tubing.

The glycol expansion tank doubles as a small refill reservoir.

Snap disk or capillary tube thermal switches are used for low-limit and overheat protection. (Grainger part numbers are shown for example.)

There are no motorized zone valves or transformers to power them.

Room thermostats are two-stage, with programmable “solar” temperature swing.

Overheat protection is provided by absorbing heat into the DHW tank and releasing it back through the solar panels at night.

Some optional choices

The diagram presents the bare minimum (yet fully functional) Combi 101 system I would ever recommend. There are a number of options that can be added to this design to improve its response and adapt to other needs of a project.

Here are some of the most common:

- Upsize the tubing diameters to lower the pumping power needed (floors and solar heat supplies).
- Upsize the collector and the DHW tank to increase the heat storage for night use.
- The use of integral flow check (IFC) pump bodies can be substituted with a spring check valve at the pump outlet.
- Multiple heat exchangers are available in top and bottom along with the electric heating element (e.g., Solar Contender tanks).
- Integral gas burners are available with in-tank heat exchangers. These have been used (at greater expense) in locations where electric heat is not practical.
- A two-tank DHW system (in series) can be used to separate the solar heat storage from the conventional heat source.
- Upgrade the thermo-mechanical switches with electronic differential and set point controls.
- An anti-stratification circulator is sometimes added to the water tank to stir the tank from top to bottom when a single heat exchanger in the tank is located near the bottom.

There are a number of compromises made in the Combi 101-Mini system that allow lower cost and greater simplicity at the expense of precise control and ideal thermal performance. This system is presented here mainly to illustrate the basic piping and control issues involved in any solar combsystem and are based on our experience with a number of successful field installations.

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.

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The healthcare industry touches the life of every person in the United States, either as a healthcare worker or as a patient. According to a recent survey, there are more than half a million healthcare facilities of various sizes throughout the United States. These facilities admit upwards of 36 million patients a year. Hospitals and healthcare facilities are among the most complex building types to design because they have critical plumbing systems. They also require special equipment for life support systems, which include medical gas systems and plumbing connections to other medical equipment. Equipment utilizing plumbing connections includes heart and lung machines, dialysis machines, distilled water systems, reverse osmosis water systems, lab water systems, ethylene oxide sterilizers, steam sterilizers, acid waste systems, lab sinks, chemical fume hoods, dietary equipment, back-up water supplies emergency power, and many others. Many of these systems require duplex equipment or back up systems to assure continuous operation.

Hospitals must also comply with regulations from numerous entities, including the Joint Commission for the Accreditation of Healthcare Facilities, the American Institute of Architects (AIA) Design Guides for healthcare facilities, numerous National Fire Protection Association (NFPA) documents, building code requirements and many other specialty and health code documents.

The plumbing design for a healthcare facility is a very involved process. Accredited hospitals must meet minimum requirements based on the type and level of care of the facility. Facility types include, but are not limited to, new hospitals, replacement or renovated hospitals, ambulatory care facilities, adult care homes, assisted living facilities, birthing centers, HIV support facilities, outpatient diagnostic centers, prescribed child care centers, residential homes for the aged, end stage renal disease centers, nursing homes, hospices, rehabilitation facilities, intermediate care facilities, occupational therapy centers, rural health clinics, clinical additions, energy centers or power plants, outpatient clinics, animal research facilities and laboratory facilities.

Commissioning

Ideally, the building owner should select the architect, engineer, construction management firm and a commissioning firm or person prior to beginning the design process. If one is not selected prior to the design, the commissioning agent should be involved during the preliminary or schematic design phase of a project. The design team can then employ total building commissioning practices tailored to the size and complexity of the building and its system components. This allows a commissioning firm or authority to verify performance of building components and systems when the building is occupied. The commissioning person or commissioning authority should perform the fol-
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following tasks on a healthcare facility project:

1. Include commissioning requirements in construction documents.
2. Provide a commissioning plan.
3. Field verify the installation and performance of systems to be commissioned.
4. Provide a commissioning report upon completion of the project.

We continually improve the healthcare environment in the United States to the point that we have one of the best healthcare systems in the world. Dr. Lewis Thomas was the former head of New York’s Sloan Kettering Cancer Research Center and the author of numerous books and articles explaining the advances in medicine. In the spring edition of the 1984 foreign policy journal, Foreign Matters, he wrote:

“There is no question that our health has improved in the last century. One thing seems certain: It did not happen because of medicine or medical science or even the presence of doctors. Much of the credit should go to the plumbers and sanitary engineers of the Western world. The contamination of drinking water by human feces was at one time the single greatest cause of human disease and death. It remains so, even with starvation and malaria, for the Third world countries. Typhoid fever, cholera and dysentery were chief threats to survival in the early years of the 19th century in New York City and other major east coast cities in the United States. When the plumbers and sanitary engineers had done their work in the construction of our cities, these diseases began to vanish. Today, cholera is unheard of in this country, but it would surely reappear if we went back to the old fashioned ways of finding water to drink.”
— Dr. Lewis Thomas

**Water service entrance**

The water service in a hospital is critical and needs to be from a reliable source. Water service entrance should be from two sources or water mains. A water quality test should be performed periodically on the water supplied to a healthcare facility to assure there is not a high bacteria content in the water supply that may warrant additional water treatment on site. Many connect to water mains from two different streets that are separated by isolation valves and backflow preventers. This assures that water is available in the event of a water main break or loss of water supply. If the hospital is in a remote location where dual service lines are not an option, a water storage tank may be required in which case water treatment will be necessary to assure that the water does not become contaminated.

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additional water treatment on site. Water meters, backflow preventers, chlorine injection pumps, ozonation equipment, copper silver ionization units, water softeners and other water treatment equipment should be located at the water service entrance, with duplex equipment where practical or with bypass lines to assure continuous operation during servicing of equipment. The designer should also provide a preliminary fixture unit count and determine a peak water flow calculation to determine whether there is a need for a booster pumping package.

Water quality
While the different types of healthcare facilities in the institutional market have many needs in common, it is the hospital environment that presents the most unique plumbing challenges. Sanitation is a key requirement for the plumbing areas in this environment. Generally, patients in hospitals that have a suppressed immune system are more susceptible to exposure of bacteria from patient to patient contact by staff or from exposure to organic pathogens growing in the water supply. Hand wash sinks in patient rooms must have a clean supply of water for staff to wash their hands. Water for cleaning instruments and equipment is also an important part of sanitation. For this reason, many healthcare facilities are exempt from water and energy conservation regulations. A recent study suggested that there may be a correlation between water conservation and increased bacteria content in the water. There was a study at John’s Hopkins University Hospital that indicated that there was a high bacteria content in metering faucets as compared to the bacteria count in non-metering faucets. The study implied that the hospital faucets with low-flow self metering faucets had lower flow rates. The lower flow rates did not allow enough flow to maintain the residual chlorine levels. The lower chlorine levels allowed the chlorine to dissipate over time in the branch piping to the low-flow faucets. Lower chlorine levels would allow bio-films to grow on the walls of the branch piping increasing the number of organic pathogens like Legionella. This study has caused quite a stir in both the plumbing and healthcare industries and it is being reviewed by many in the plumbing industry including members of the American Society of Plumbing Engineers to assure the research was not flawed and that the data is reliable. There will likely be additional information on this issue with recommended actions to minimize bacterial growth in hospital water systems in the near future.

Plumbing utilities
In the early stages of a project, it is important for the design professional to work closely with the architect and structural engineer to establish where plumbing chase walls will need to be. Adequate space should be provided for fixture carriers; there needs to be enough room so that plumbing risers can be routed up and down efficiently in multi-story buildings. The plumbing supply and return risers should be grouped together at one end of a plumbing chase or shaft, as agreed with the other trades, to minimize conflicts with walls, structural elements, ductwork, cable trays and other utilities. The storm drain should be routed in vertical chases whenever possible.

Medical equipment
The medical air compressors, oxygen manifolds, nitrogen manifolds, nitrous oxide manifolds and medical vacuum pump systems are all life support systems that are part of the medical gas system and according to NFPA Standards need redundancy or duplex systems to provide a back-up or a reserve supply. These systems are generally located at the mechanical room, central utility plant or basement mechanical room. Cylinder manifolds are generally located in manifold storage rooms and they should meet the building code and the NFPA standard requirements based on the size and volume of the cylinders that are stored. When bulk liquid cylinders are used in larger hospitals for nitrogen or oxygen service, the liquid is always boiling off and being released or vaporized as a gas. This process causes a constant build-up of pressure. If the demand for that particular gas is not sufficient the pressure will build and the relief valve will discharge. The relief valve should be routed to a safe location as directed by NFPA 99. It is for this reason that bulk liquid cylinders should not be used in a reserve or stand-by situation, because the tank will continue to vaporize the liquid into a gas and it would be possible for a liquid storage tank to become empty in a stand-by or reserve condition. Reserve supplies of medical gases for nitrogen, and oxygen

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Circle 22 on Reader Reply Form on page 54
Healthcare

Continued from page 32

should be in gas cylinders unless special provisions are taken to draw from both bulk storage tanks and a bank of cylinders should still be utilized for a reserve supply. The designer should review NFPA requirements for bulk oxygen storage on site and determine the bulk oxygen tank location and make sure it has appropriate clearances from buildings if required.

Equipment schedules

Equipment schedules should be shown on the drawings to indicate the basis of design, including each plumbing utility, (cold water, hot water, gas, electrical voltage, horsepower, amps, steam, pressure, notes, etc.) The schedule should also indicate the utility connection sizes, the type of equipment, the maximum dimensions (if space is an issue), flow rates, the manufacturer and model number selected and performance requirements. The following is a list of common equipment schedules on the plumbing drawings: Plumbing fixture schedule, water filter schedule, water softener schedule, domestic water thermal expansion tank schedule, plumbing pump schedule, plumbing packaged booster pump schedule, storage tank schedule, electric water heater schedule, gas-fired water heater schedule, steam to hot water heat exchanger schedule, liquid to liquid heat exchanger schedule, storage tank with heat exchanger schedule, steam booster hot water heat exchanger schedule, packaged reverse osmosis water unit schedule, deionization water packaged unit schedule, gas pressure regulator valve schedule, pressure reducing valve station schedule, food service equipment utility demand schedule, medical equipment connection schedule, air compressor system schedule, vacuum pump system schedule, gas manifold systems.

Equipment pads

All floor-mounted equipment should be placed on concrete housekeeping pads that are 4 to 6 inches thick. Floor drains should be located near the equipment pads so equipment drains can be piped to the floor drains without causing trip hazards.

Gathering information

Obtain utility maps and drawings showing all of the adjacent utilities. Get a flow test report from a nearby fire hydrant from the water department or the fire department, showing the static and the residual or flowing water pressures with the flow rate shown for the residual pressure. The flow test report should include the information required to help determine whether a pressure booster system is required, and it should allow the designer to determine what the approximate suction pressure will be for the fire pump and the domestic water booster pump. The site utility plan should also include natural gas, sanitary sewer and storm water sewer information.

Code review

Work closely with the architect to perform a review of the building and plumbing code requirements to determine which model code or state code and which year edition of the codes will be enforced by the authority having jurisdiction (AHJ) for the project. Determine which year edition of the NFPA codes for medical gas systems and bulk oxygen storage systems will be used and identify any local health department requirements that address health care facilities. Inquire about local requirements for kitchen equipment, air gaps and grease interceptors.

Ask local authorities or the local drain commission about any stormwater management requirements for retention ponds sizing criteria. Stormwater retention basins receive the storm flow in a large pond and allow the stormwater to drain out through a controlled outlet to minimize flash flooding downstream.

Utility coordination with civil engineers

Coordinate the utility requirements with the civil engineer by obtaining the existing and finished grades on a topographical plan, as well as temporary or intermediate grades used for any construction phasing purpose. Request the soil boring information, including ground water level for determining whether sub soil and perimeter drains will be required. The soil boring will indicate the soil type and the possible infiltration flow rate from that type of soil. Coordinate with the project civil engineer to prepare a formal letter to the water and sewer utility requesting the following information for the project files:

1. Site plan from the utility company showing all water mains adjacent to the site
2. Depth of the bury of the water mains based on the datum taken from the site plan
3. Static and residual pressures in the water main(s)
4. Proposed location of domestic meter assembly installations
5. Requirements for minimum utility connection sizes for water and sewer taps
6. Requirements for pipe material requirements for water and sewer building service lines
7. Breakdown of work that will be performed by the utility and any work required by the contractor on water service lines.
8. Requirements for backflow preventers
9. Minimum depth of bury acceptable for freeze protection of water mains in the jurisdiction.

Coordinate water meter and backflow preventer assembly requirements and locations and prepare coordination documents that provide the following information to other design team members.

To civil engineer:
- Natural gas loads
- Building service water line size and water supply fixture unit totals
- Building sanitary and storm sewer line size and waste fixture unit totals

To electrical engineer:
- Plumbing equipment electrical requirements
- To the medical facility engineer:
- Oxygen demand (also to gas supplier) If it is an existing hospital determine if the existing bulk supply has sufficient capacity)
- Medical gas and vacuum demand, If it is an addition,

Continued on page 36
Superior efficiency rules the water.

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determine whether existing equipment has sufficient capacity
- Compressed air demand If it is an addition, determine whether existing equipment has sufficient capacity.

To the architect:
- Plumbing chase space/clearance requirements

To the mechanical engineer:
- Available water makeup line from a backflow preventer location
- Energy Management Control System (EMCS) point data

Riser diagrams
If the drawings are in two-dimension CAD format, the plumbing designer needs to sketch riser diagrams for domestic cold water, hot water, and hot water return piping, medical air piping, medical gas piping, medical vacuum piping and natural gas piping. With 3D CAD drawings in a Building Information Model (BIM) format, isometric riser drawings can be created by adjusting the view for a 3D image of the actual piping drawings. If a one-line riser diagram is preferred, the designer still may need to sketch the riser using the 3D model as a guide; pipe sizes must and fixture unit valves should be transferred to the one-line drawing. Riser diagrams should include all fixtures, equipment and rooms where plumbing fixtures and equipment are located.

Building Information Modeling (BIM)
Building information modeling has become a necessity on healthcare projects because of the complexity of the buildings. Each trade draws their systems in 3D, and the 3D files are merged into a 3D model using software designed to identify conflicts or collisions between the trades. The collisions are worked out among the trades and final dimensioned drawings are produced. Every contractor signs off on the drawings, agreeing to install their system at the elevation and locations indicated.

BIM has saved tens of millions of dollars on some larger projects by allowing design professionals and contractors to build the building in a 3D virtual world prior to actually starting construction. This minimizes the amount of money spent on rework related to moving pipes or ducts to avoid interferences when one trade installs their system early and creates conflicts for other trades. BIM reduces the paperwork associated with requests for information (RFIs) and change orders and the associated conflicts that, in some cases, require removal and reinstallation of some systems.

The plumbing designer also needs to prepare one-line riser drawings or 3D images of the waste and vent stacks in the building showing fixture unit values and pipe sizes on each section of pipe.

Plumbing plan drawings
The following systems should be shown on plumbing drawings when indicated: domestic cold water, domestic hot water, domestic hot water return, laboratory (pure) water, process water, make-up water, building sanitary sewer, sanitary vent/sanitary waste, acid waste and vent systems, roof drains and roof conductors or roof drain lead-ers, reagent water, hemodialysis water, reverse osmosis water systems, demineralization or deionization water, natural gas, medical gases (oxygen, nitrogen, nitrous oxide, carbon dioxide), medical vacuum, compressed air, dental air, oral evacuation systems, hydro-therapy pool piping, potable water treatment, sub-soil drainage, reverse osmosis and other pure water equipment, water softeners, resin tanks and brine tanks, equipment pads and seismic restraint systems. This list does not include all of the systems that may be required for a healthcare facility project.

Pipe routing over critical areas
Plumbing over operating rooms; food preparation, serving and storage areas; and electrical rooms containing main distribution panels or motor control centers should be avoided where possible. Supply piping over such areas should only be made only after discussions with the architect and approval from the medical facility engineers. When piping is necessary in these areas, provide drain pans under the piping with tie rods on all drains in ceilings over critical areas. Indicate leakage protection or detection systems on the drawings or in the specifications and provide indirect drains from the drain pans to a visible area.

Floor penetration fire-stopping/waterproofing
Plumbing risers or stacks penetrating a floor above grade (not floor drains) should have sleeves that extend 3 inches above the floor and 1 inch below the floor and include a built-in water stop and appropriate seal. All penetrations should be protected according to the latest edition of the building code. This is to prevent a water leak on an upper floor from pouring down to the floors below through the void space between the pipe and the slab. Fire-stopping material, in accordance with ASTM E-119 and/or ASTM E-814, should also be used for pipes penetrating fire wall or floors to prevent fire from migrating upward through a building when pipes pass through elevated floor slabs.

Hospital equipment plumbing connections
There is generally a medical equipment planner for a large hospital project. The healthcare medical equipment planner provides manufacturer cut sheets for the equipment that will be used in the hospital. The manufacturer’s data sheets typically give the manufacturer and model number for the piece of equipment along with an equipment number that corresponds to an equipment plan. The manufacturer’s data sheets also give the utility requirements and the capacities. The medical equipment manufacturer planner generally provides equipment drawings and an equipment schedule along with an equipment book showing the equipment selected for the project.

Next month, part 2 of this article will start with the medical equipment items that are commonly found in healthcare projects.

Ron George is president of Plumb-Tech Design and Consulting Services LLC. He has served as chairman of the International Residential Plumbing & Mechanical Code Committee. Visit www.Plumb-TechLLC.com, email Ron@Plumb-TechLLC.com or phone 734/755-1908.
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J. B. Hunt, one of the largest trucking companies in North America, takes transportation seriously. Their reputation for safety and efficiency played into a decision they made to install an extensive snowmelt system for their new headquarters building in Lowell, Ark.

The 22,000-sq.-ft. snowmelt system has been hard at work for the trucking firm for the past three winters, easily dealing with the rigors of Midwestern ice and snow. Yet, in a sad irony that hit them hard, founder Johnnie Bryant Hunt slipped on ice at a nearby restaurant in early December 2006. He died in the hospital five days later. Had the restaurant installed a snowmelt system to protect its patrons, perhaps he’d be alive today.

Barricade to liability claims
Most of us in the trade readily see the value of snowmelt systems. Yet, many building and facility owners have yet to embrace them.

Frequently, a key obstacle to winning their interest is the up-front cost for installation. It’s not relatively cheap. But there are benefits that balance out the equation. These include convenience, environmental enhancements and the greatly reduced labor and hardware costs that are otherwise needed to do the job.

One of the key obstacles is neutralized if a facility has waste heat that can be exchanged. If excess heat is available, or if all that’s needed is an additional geothermal or water-sourced heat pump during the design phase, an upgrade may be feasible.

Snow and ice removal employs tubing buried outside in a mass (concrete, asphalt, stone pavers) to gently melt off winter precipitation to keep pathways, driveways and other areas dry and clear. For commercial applications, especially those areas deemed critical, radiant heat performs a valuable, perhaps life-saving, function.

According to Keith Whitworth, regional manager for Watts Water Technologies, another advantage is the proactive heading-off of liability claims and added safety overall. “Given today’s litigious society, snowmelts don’t cost money; they can save it,” he said. “The cost of the system is more than returned with one avoided lawsuit. Also, some insurers recognize the value of these systems, rewarding building owners with reduced insurance rates.”

Snowmelt classifications
For the sake of easy reference, snowmelt uses are grouped into classifications. These allow us to quantify the level of snowmelting a system is designed to perform. There are two essential systems of classification—old ASHRAE (American Society of Heating, Refrigeration and Air-conditioning Engineers) and new ASHRAE.

The old ASHRAE classifications split snowmelting systems into three groups. These classes split systems into the amount of snow actually melted at design conditions:

• Class I – Systems designed not to melt snow while it is falling, but afterwards
• Class II – Half the snow is melted during snowfall, the rest afterwards
• Class III – All snow and ice is melted continuously

The key to these classifications are the design conditions. If a system were designed as a Class I for 36 inches of snow per day, it could act as a Class III system with a minor snowfall of eight inches. Conversely, a Class III system designed...
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For more information, visit WoodfordMfg.com.
Snowmelt

Continued from page 38

for around six inches of snow per day would act as a Class I system, with 36 inches of snowfall. To guide your decisions, know your snowfall.

New ASHRAE standards still keep the Class I, II and III designations, but ASHRAE now calls it 0, 0.5 and 1 for ratio of snow melted. They also add a new twist, a percentage to quantify how often the maximum amount of snow occurs. Some professionals tend to over-design a system to handle worst-case scenarios. ASHRAE snowmelt percentages are essentially classified into 75%, 90% 95%, 98%, 99% and 100%, with 100% being the maximum snowfall foreseeable for an area.

It takes a lot of energy to melt snow, about five to six times the load required to heat a building of similar size. For example, it generally takes 25 – 40 Btu/hr per square foot to radiantly heat a structure. But a snowmelt system may require up to 150 Btu/hr-square foot or more. Why so much energy? Chiefly, the components make up the load. There are five basic parts to a snow/ice melt system:

Sensible heat ($Q_s$): The first load factor is the sensible heat required to raise the snow or ice from ambient temperatures to 32 F. The colder the ambient conditions are when precipitation is detected, the higher the sensible load will be.

Heat of fusion ($Q_f$): Once the mass has reached 32 F, the second phase of the snowmelt process can begin. This phase is called the heat of fusion, which is the amount of energy required to change states from a solid to a liquid. This phase generally requires the most energy.

Heat of evaporation ($Q_e$): As the mass temperature increases, natural evaporation will begin to take place directly from the snow to the atmosphere. This phase is generally a small part of the overall process.

Heat loss to the atmosphere ($Q_a$): Atmospheric losses are the fourth phase of the snowmelt process. Once snow starts melting, there will begin to be voids in the snow cover; areas that may not have initially contained as much snow as other areas due to drifting or solar gain. These areas clear faster in patches, allowing for greater losses to the atmosphere. The cold atmosphere will literally “suck” the heat from the slab — energy that must be continually replaced.

Back and edge losses ($Q_b$): Back and edge losses refer to losses not directly associated with snow- and ice-melting. This includes the ground below the mass as well as to the side. Energy in a snowmelt system is such that heat moves from a warm source (tubing) to a cold source (the mass). When a snowmelt first starts, energy moves in all directions equally, since the surrounding mass is of equal temperature. Conditions change the longer the system runs. Since the ground is not an exposed surface, it will begin to retain energy, thus allowing its temperature to rise. Conversely, the exposed surface of the mass continuously loses energy to the snow and atmosphere. Surprisingly, heat loss to the ground is generally only three to five percent of the total system load.

Typical snowmelts employ tubing buried in a concrete slab. The most popular tubing used is either synthetic rubber (EPDM) or cross-linked polyethylene (PEX). EPDM is derived from synthetic rubber and is cross linked, much the same way PEX is. Both types of tubing have a long history of performance and longevity in high temperature apps.

Tubing comes in a variety of sizes; typically 1/2" ID (inside diameter) to 3/4" ID will be used in a snowmelt system. The tubing ties into the supply and return piping via twin distribution manifolds. The layout is usually easiest if these manifold pairs are located together next to the zone, the area to be snowmelted. Manifolds can be located away from the zone, but then more tubing will be required to get to and from the manifold pair. Tubing lengths vary according to manifold placement.

Tubing is spaced six to 12 inches on center and circulates water that’s been heated to 110 to 140 F. Tube spacing is varied according to the degree of snowmelting required. More snowfall that needs to be melted at a faster rate will require closer spacing of tubes. More material over the top of the tubing increases resistance to heat transfer, requiring a higher supply water temperature.

Common snowmelt applications include:

- **Helipads**. Helipads are excellent examples of snowmelts. With space becoming more and more precious, many hospitals, for example, are forced to install helipads on building roofs. These helipads can become extremely slick and dangerous when covered with ice and snow.

- **Sidewalks**. Convenient and more inviting to passersby, sidewalk snowmelts can increase business and decrease liability. Customers are probably more apt to shop stores with cleared sidewalks.

- **Stairs**. Of course, stairs can be dangerous. With snowmelt, pedestrians can use steps safely. The spacing of tubes for stairs varies according to application, but they’re usually installed with two lengths of tubing in the tread and one in the riser.

- **Car washes**. Water is always present in car washes. Using snowmelt, property owners can keep car washes open and ice-free. The control strategy for car washes is simple. Either air temperature or slab temperature is monitored. If the temperature of the slab or the air drops below 35 F, the system is activated. When temperatures exceed 35 F, the system is disabled.

- **Hospital entrances/sidewalks**. Because they are usually considered Class III systems, tube spacing for hospital entrance ramps are usually set closely, at 6" OC. Further, these systems are idled, or operated at a reduced output, to decrease system lag time. When sensors detect precipitation, the system is operated at full output. Hospitals may have waste heat from steam or condensate readily available, greatly reducing or eliminating energy needs.

- **Parking garage ramps**. Snowmelting systems ensure cars driving in off the street can safely navigate parking garage ramps. One note of caution: Be sure to place sensors for these controls where they can detect snowfall or precipitation and temperature.
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GREEN DEMAND.

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Loading docks. Moving goods is important work, even during winter months. Large area “hot pads.” Instead of melting an entire area, which is sometimes cost prohibitive, smaller areas where snow may be deposited are melted. This technique is often used for airport runways and large parking lots. Typically, tubing for hot pad slabs is spaced at 4” to 6” OC to accommodate a large amount of snow. Remember, six inches of snow from a runway or parking lot will be collected and deposited on the pad. It’s not uncommon to have a hot pad of perhaps 30’ by 30’ with snow piled four to six feet high.

Hot pads are usually operated manually, activated whenever the need arises. Twist timers can be used in place of on-off switches, so the operator doesn’t have to remember to switch the system off.

Principles of operation

On-off operation. Some snowmelts are operated only when there is ice or snow. These systems are operated in the presence of precipitation, when the ambient temperature is below 35 F. While less costly to operate, these systems take longer to melt precipitation, because they must first increase the slab temperature.

Controls. These include sensors to detect precipitation when temperatures fall below 35 to 38 F. Because these controls are simple, their cost is relatively low.

After precipitation and temperature conditions are met, the system will operate until precipitation stops. Most controls will continue to operate the snowmelt for a period of four to six hours after precipitation has ended, ensuring an ice-free surface.

Twist timers can also be used in parallel with the snowmelting control to allow some manual control. If it’s known that a winter storm is approaching, the system can be started several hours before its arrival to reduce system lag time. Conversely, if snow happens to drift onto the snowmelting surface but does not engage the precipitation sensor, the system can be started manually.

Sophisticated controls sense slab temperature, outdoor temperature and precipitation. These are more costly than on-off controls but allow for much greater system control. They usually have settings for warm- and cold-weather shutdown and slab idle temperature. Cold weather shutdown is necessary, because snowmelt systems cease to be effective below about 0 F. We simply can’t provide enough energy below 0 F to get the job done. This is rarely a challenge, however, because snow below 0 F contains very little water.

In order to help them respond faster, some systems are idled, or operated at a reduced output, until precipitation is sensed with a temperature below 35 to 38 F, when the system is operated at full output. These systems allow for a faster response, and no snow or ice accumulates.

Operating cost. Snowmelts themselves are not that expensive to operate, since they’re only activated occasionally. The biggest cost incurred with a snowmelt system is the up-front cost. Glycol antifreeze is required for all systems, because system fluid is either dormant or could go dormant for a period of time. Relatively large pumps may be required to move slushy water-glycol mixture on initial system startup. Larger heat sources are required to deliver the 100 – 300 Btu/hr-sq ft. Supply and return piping is required to get the energy from the boiler to the manifolds for the tubing buried in the slab. With all these factors, including a larger heat source, a snowmelt system can typically cost between $6 – $12 per square foot.

• On-off systems. The cheapest systems to operate are on-off snowmelts, because they are only used five or 10 times a year. As an example, a Class II system in Buffalo, N.Y. may cost about $0.21 per square foot per year. The same system in Chicago may cost $0.12 per square foot per year. In Minneapolis, cost of operation might be $0.25 per square foot per year.

• Idled systems. Idled systems cost more to operate, because they operate any time the temperature is below 38 F. These typically consume up to 100 Btu/hr-sq ft whenever they are idling and up to 300 Btu/hr-sq ft. during full operation.

Whether you’re trying to eliminate snow in Lowell, Ark. as is the case for J.B. Hunt — or warming a hospital entrance in Nome, Alaska, a snowmelt system, could be the answer you are seeking. ■

John Vastyan owns Common Ground, a trade communications firm based in Manheim, Pa. He has researched and written about plumbing and mechanical, HVAC, solar, geothermal and radiant heat systems for decades.
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Circle 29 on Reader Reply Form on page 54
Efficiency is a topic that is much discussed throughout the plumbing and heating industry and solar thermal, with its increasing relevancy in the market, is no exception. Solar thermal, or hot water, collector efficiency is being used in marketing campaigns, engineering analysis and other situations where the performance of two products is compared head to head to decide which product is “better.” Without a general understanding of what these numbers mean, one may be easily misled into thinking one product is superior when that may not be the case.

Solar thermal collector efficiency is, at its core, no different than other efficiency numbers. It considers how much energy the collector can convert and transfer to a fluid from the amount of available solar energy (known as insolation). Trying to calculate, or rate, a collector’s efficiency is complicated, since the conditions surrounding the collector are constantly changing. The fluid temperature, air temperature, amount of sunlight available and the angle of the sunlight striking the collector all affect the efficiency of conversion.

In order to calculate the efficiency, the area to be analyzed must first be defined. For flat plate collectors this is easy, since the total area and the area that absorbs the sun’s energy are almost the same size. For evacuated tube collectors that have a round absorber and spaces between tubes, this becomes a bit more difficult, since the areas are different. When evaluating a product, it is important to use an area that represents the end goal of the analysis. For example, if roof space is tight, then using the overall, or gross area, would be wise. If a pure analysis of the collector’s efficiency is being completed then the absorber area may be more appropriate. In Europe, collectors are usually rated using absorber or aperture area; collectors in the North American market are rated using gross and aperture area by the Solar Rating and Certification Corporation (SRCC).

Once a collector is certified to the SRCC OG-100 standard, it is listed with an accompanying certification sheet. This is a great resource when comparing technologies, since the test conditions for each collector are more or less the same. On the lower portion of a rating table (section A in the figure left, bottom) is a list of technical information; the right column lists values for Y-Intercept and Slope. These two numbers can be used to build the collector’s efficiency graph by using the following formula:

\[
\text{Efficiency} = \text{Y Intercept} + \text{Slope} \times \left(\frac{\text{Inlet Temperature} - \text{Ambient Temperature}}{\text{Insolation}}\right)
\]

The value in parentheses is a ratio of the available sunlight and the difference in temperature between the fluid and air (ambient) during operation known as the fluid inlet parameter. The closer to 0, the more “ideal” the environment (a hot summer day, for example) and the higher the efficiency will be. Temperature difference between the fluid and the air is one of the most important values to keep in mind when comparing collectors or evaluating efficiency. For example, a solar thermal system running at 180 F will have a completely different performance than the same system operating at 120 F due to the difference in fluid temperature. The Y Intercept from the certification sheet will tell you the maximum efficiency a collector can achieve, while the slope will tell you how fast the efficiency will decrease as conditions worsen.

Efficiency values are taken during testing and represent the performance of the collector with a light source directly perpendicular to the collector (i.e. midday). It does not, however, take into consideration the changes in geometry, which, throughout the day, month and year, affect how efficiently a collector performs.

Continued on page 46
“We will definitely use LoadMatch again.” – Tom Baker, P.E., President Hurst-Rosche Engineers

For efficiency, LoadMatch® is the logical choice.

When Tom Baker and his team at Hurst-Rosche Engineers were called in to design the mechanical systems at the new Waterloo, IL High School, the challenge was twofold: the heating/cooling solution had to comply with a new state energy conservation code and it had to provide built-in redundancy with flexibility to accommodate a geothermal option down the road. Tom went with a Taco LoadMatch® single pipe heat pump-based system and a complete BAS energy management system supplied by Johnson Controls.

Designed with HSS software.

Hurst-Rosche engineers utilized the Taco Hydronic System Solutions® software to design and equip the heating and cooling system. “HSS is a great time-saver,” says Tom. “It allowed us to check and then guarantee our design with Taco, and to link with associated disciplines working on the project.”

Easy installation.

The installing contractor was equally as enthusiastic about LoadMatch®. “One pipe really helps in terms of installation time. The system operates flawlessly; control and maintenance are a breeze”, said Marcus Frederick of Custom Mechanical, LLC.

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Solar Collector Efficiency

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Each SRCC rating sheet has a table that shows how changes in the sun’s angle affects performance (section B, previous page). These values can be used to build graphs that show how a collector’s efficiency reacts to changes in the sun’s angle in the sky. Known as incidence angle modifiers (IAM), the values can be used, along with the following equation, to produce a graph that shows how the sun’s path through the sky affects efficiency. The higher the IAM value, the higher the efficiency will be at that time of day when compared to midday. This relationship is shown by the first line of IAM values. The second line is used to calculate the relationship in the other direction; for example, when the sun is lower in the sky during the winter months. This value is used when the relationship between installation angle and time of year is being evaluated.

The IAM value multiplies the efficiency curve that was previously discussed and gives a “geometry corrected” value for efficiency. For flat plate collectors the benefit is not substantial, since the testing of the collector with a perpendicular light source correlates to peak efficiency, at midday. For collectors with round absorbers, however, the inclusion of an IAM value can increase the standard efficiency values by as much as 25%.

Since the geometry can play a large role in a collector’s performance throughout the day it is useful to use the instantaneous efficiency equations and the IAM values to average out a collector’s performance over a day. This type of analysis is also done as part of a collector’s SRCC OG100 certification and is provided in a ratings table near the top of a collector’s certificate (Section C, previous page). These values take into account both the instantaneous efficiency and the IAM values.

The table has 15 values that represent a range of conditions and applications that are typical for the United States. Each of the rows (A – E) represents a different temperature differential (fluid - air) and lists a typical application underneath the table for a quick reference (Section C, previous page). The columns are labeled Clear, Mildly Cloudy and Cloudy, which are different values of daily insolation levels. These insolation values can be compared to locations throughout the U.S.

These daily production values can be used to compare how two collectors will perform under certain conditions. Unlike instantaneous efficiency values, however, the numbers in the rating table are related to the size of the collector. It is important to keep this in mind when looking at how much energy a collector produces per day. It is recommended that the ratings be normalized by dividing the output by the collector size to give an energy/area/day rating. This will give the best representation of how well a collector will perform.

The data can be analyzed in two ways by fixing the amount of sunlight or the temperature difference and then creating a graph to have a visual representation of how two collectors compare. In the graph below, it is clear that there is a point where one is more efficient than the other. It is then up to whomever is doing the analysis to determine how much time the collectors will operate on either side of the cross-over point.

When making a decision on which type of collector is best for the application, a cost analysis would be the next step in comparing two products. Based on the information graphed below it is clear that there is a point where one product outperforms the other, but at what cost? Small increases in efficiency may cause a large increase in cost. Dividing the cost by the energy/area/day number above will yield a number that can be used to compare the overall value of a product by showing how much money must be spent for the efficiency or output. This would provide a picture of a product’s overall performance value, not just efficiency.

Beyond efficiency and cost, much can be said for a company’s ability to support their product and support a customer. Saving a few dollars on a product may not be worth the headaches later if an issue arises and a company is not able to support its product. Installation costs should also be taken into consideration. Using the methods above can help one understand a collector’s performance and value and allow someone to make an informed decision.

Eric Skiba is the technical engineer for Apricus Inc.
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A Watts Water Technologies Company
Operating 24 hours a day, Shari’s is a restaurant chain in the Northwest. Shari’s had a 20 GPM interceptor installed in-the-floor in their mechanical room. The interceptor was recessed in-the-floor and only connected to their double compartment sink. The pre-rinse was not picked up by an interceptor. The City of Hillsboro was not happy with Shari’s discharge; they had them pump out the GI twice a week. With the pre-rinse sink not being hooked up to the interceptor this facility was discharging a lot of grease into the sewer system.

Shari’s had Grease+Gard™ look at their application to see what could be done to bring them in compliance with the city. They were able to take the pre-rinse sink and the double bowl sink and run the two sinks through a solids interceptor, then to the GI. They were able to take the Grease+Gard™, 8175GG and mount it on top of the grease interceptor.

Now Shari’s was able to remove the solids at the source and remove the grease out of the GI daily. This allowed Shari’s to go two months without pumping out their interceptor.

Grease+Gard™ Retrofit Skimmer and Grease Recovery Device

The Grease+Gard™ system was engineered with the commercial plumber and food facility owner in mind. It is easy to install and can efficiently and economically accommodate most food service application operating on a continuous basis.

The Grease+Gard™ can be configured to work with most existing grease interceptors. It can be retrofitted on any grease interceptor, metal or plastic and can be purchased as a system complete with unit. The Grease+Gard™ are available in the most common sizes. The 8165 and 8175GRDs are available in 20, 25, 35 and 50 g.p.m. The 8166 and 8176, Low Type GRD’s are available in 20, 35, and 50 g.p.m.

The goal at Jay R. Smith Mfg. Co. is to provide a solution and the equipment to minimize your initial cost and investment into FOG management, while maximizing the benefits you will receive from a technology that achieves efficient and practical method for grease removal. The Grease+Gard™ Retrofit Skimmer and Grease Recovery Device (GRD).

The Grease+Gard™ system uses patent pending technology that automatically removes fats, oils, and grease (FOG) from any interceptor before it becomes a problem. The main principles of the system are easily understood. The Grease+Gard™ system has a belt and heater assembly that is controlled by a 24-hour timer. Upon a given schedule the heater warms up the water in the interceptor and the Agitator propeller helps to liquefy the FOG to be extracted. The belt assembly picks up the FOG that is skimmed into a trough. From there it flows into a storage reservoir attached to the side of the Grease+Gard™ Skimmer. The FOG reservoir is then emptied as needed.

By using the Grease+Gard™ Retrofit Skimmer (installed on an existing grease interceptor) or by installing a Grease+Gard™ GRD you are able to remove FOG before it gets out of the kitchen area. A Grease+Gard™ system will protect the pipes between the kitchen and the outside interceptor.
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Product News

Water-conserving aerator
The ONE-TAP™ Metering Aerator offers a cost-effective alternative to expensive electronic faucets. Water flow starts with a single touch and the adjustable metering activator automatically stops the flow in two to 20 seconds. This action reduces the risk of cross-contamination and provides up to 87% water savings over conventional faucets. Encore®, a division of Component Hardware Group, Inc. Circle 101 on Reader Reply Form on page 54

Hydrant product line and brochure
New hydrant product line and hydrant brochure showcases the expanded offering in a clear layout for a faster understanding of the hydrant’s application. New, 22-page brochure features 16 new hydrants for institutional, commercial and light commercial markets. It has been redesigned with enhanced product images, clearer product descriptions, user-friendly hydrant feature charts and a clean, modern look. Murdock Super Secur. Circle 102 on Reader Reply Form on page 54

Check valve & flow regulator
The redesigned CV-FR flow regulating check valves come in compact 14 and 15mm cartridges easy to insert directly into your application device. Available in flow rates from 0.5 to 4 gpm, they provide drip tight backflow protection and reliable pressure compensating flow regulation from 15 to 150 psi. Selected flow rates help meet the requirements of ASME A112.18.1M and CSA B125 (flow rate limits) and A112.18.3M (tightness in backflow conditions and endurance). Units certified to ANSI/NSF 61. Neoperl. Circle 103 on Reader Reply Form on page 54

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Circle 33 on Reader Reply Form on page 54
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- Optional built-in recirculation system with buffer tank
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- Industry’s best warranty!
Industry Movers

Grundfos names director

OLATHE, KAN. — Grundfos Pumps promoted Greg Bretz to director of regional program management. Bretz will be responsible for continuing to develop the strategic direction for regional program management and accelerating program management development across the entire Grundfos North America organization.

Elkay adds to board of directors

OAK BROOK, ILL. — Robert R. Buck has been elected to serve on Elkay’s board of directors. The addition of Buck to Elkay’s board of directors reaffirms the company’s continued role as a leader in the plumbing, cabinet and decorative surfaces industries.

Girard Engineering announces promotions

FALLS CHURCH, VA. — Girard Engineering, PC, has promoted David Schaeffer and Susan Sheridan to principals with the firm.

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