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Emergency	911
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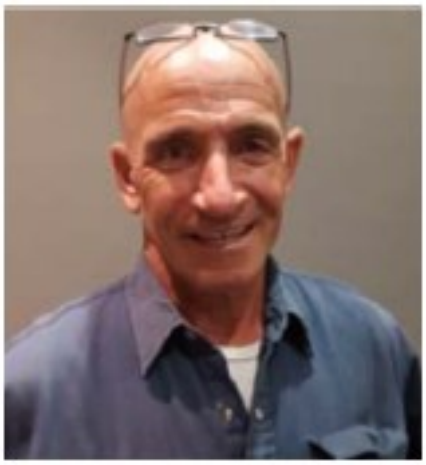
Alberta Labour (Emergency)	403 297 2222
Buried Utility Locations	1 800 242 3447
City Of Calgary (All Departments)	311
Dangerous Goods Incidents	1 800 272 9600
Environmental Emergency	1 800 222 6514
Poison Centre	403 670 1414
Weather Information (24hr)	403 299 7878

President's Message

I hope this message finds you & yours well and in good



The Building Operators Association Canada is coming to the end of another season.

We will be back in September with more guest speaker meetings, presenting topics of interest to people working in facilities. We will continue to publish the monthly magazine with articles of interest. The executive will not be taking these two months off, we will continue to organise the 2025 season to give you the best we can.

I would like personally to thank the members of our association who work hard at putting our best foot forward. **Mark Arton** who organizes the best guest speakers. **Monika Bhandari**, she puts together the publications going out you each month. **Carrissa Speager** our valued treasurer. **Kyle D'Agostino,** who manages the mailouts each month, and **Leonard Maglalang**, who assists wherever needed. Thank you, for all the marvellous work you do.

We are still trying to work out the logistics in a trade show this year. The time and people required to do this is more than we have at the moment. If you are interested in assisting in this, we are looking for volunteers and are looking to have it in the fall. We are hoping for it to be at the Danish Canadian Club but are open to other venues. Please reach out to me if you have an interest in participating in the organization of the trade show. I am best reached at **lesa@telus.net**.

Have a great summer and I will see you in September!

SMILES))

With kind regards,

BOA Building Operators Association of Canada

TEST YOUR OPERATOR IQ!

Are you equally adept at troubleshooting problems in the boardroom and the boiler room? As the resident facility guru, there's a lot riding on whether or not you know the difference between sounds control and a sound investment.

Try our monthly Operator IQ challenge...*answers on page 27*

1. A mixing box is an example of a:
a. manual damper
b. modulating damper
c. two-position damper
d. relief damper
e. louver

2. Air louvers are:
a. often used for mixing boxes
b. always used for fire and smoke dampers
c. suited for two position damper operation
d. used in fresh air intake openings to minimize the amount of water and snow entering the air handling system
e used as relief dampers

3. Classifications of air conditioning ducts include:
a. low pressure and medium pressure
b. low pressure, medium pressure, and high pressure
c. medium pressure and high pressure
d. absorption and compression
e.heating and cooling

4. **Damper designs include:**
a. only parallel blade types
b. only single blade types
c. opposed blade, parallel blade, and single blade types
d. only opposed blade types
e. none of the above

5. Duct liners:
a. eliminate corrosion
b. reduce the noise level of air flowing in the duct system
c. reduce fire hazard
d. increase erosion to the duct
e. increase the pressure

Building Safety - Employers Must Protect Their Young Workers

by Maureen Shaw

Injury statistics for young workers are startling. StatsCan reports that every day 189 young workers between the ages of 15 and 24 are injured on the job. That grim toll adds up to 69,000 injuries each year.

Some studies found 80 percent of young workers don't receive training in occupational health and safety. These numbers are brought to life when you consider a real-life tragedy. In late 1994, Sean Kells was only 19 years old when on the third day of his part-time job. The chemical fluid that he was pouring ignited, and Sean was engulfed in a burst of flames. He received third-degree burns to 95 percent of his body and died the following day. With proper safety and emergency training, Sean's death could have been prevented.

The Industrial Accident Prevention Association (IAPA), Canada's largest health and safety organization, strongly believes workplace injuries and deaths, such as the death of Sean Kells, can be prevented. In 2015, we worked closely with the Workers Health and Safety Centre (WHSC) to develop the Young Worker Awareness Program (YWAP).
In 2000, volunteers and staff of both organizations delivered the program to more than 50,000 Ontario students. YWAP provides young workers with basic knowledge of workplace health and safety hazards, their rights and their responsibilities.

The program is available at no cost to Ontario schools and combines a general assembly with classroom instruction to provide basic health and safety information.
Also available are educational health and safety materials, including videos, brochures, take-home resource books and posters. As part of the "Know Your Risks, Know Your Rights" campaign, the IAPA set up a toll-free hotline to handle calls from young workers, parents, and employers.

The responsibility for health and safety in the workplace must be shared by the employer and the worker. This summer, the IAPA and the WHSC launched a joint media campaign aimed at reaching young people during the peak summer employment period.

The goal of the campaign was to try to raise awareness of their rights and responsibilities under the Occupational Health and Safety Act. Studies show that 35 percent of those asked feel they regularly

encounter harmful situations at work, and 24 percent say they have felt obligated to do dangerous work.

As president and chief executive officer of IAPA, I personally understand the message. My son was injured on the job three years ago in a workplace incident that almost claimed his life.

It is important that we use this program as a vehicle to reach young workers to reduce the number of needless injuries, illnesses and deaths. In the manufacturing sector alone, the injury rate for young workers is 35 percent higher than for other workers.

What should I review with my employees?

Young workers need answers to basic health and safety questions. Lack of practical experience, a carefree "it won't happen to me" attitude, and fear for their jobs are all reasons why young workers may not ask questions about safety.

As an employer or supervisor of young workers, you should be prepared to cover a wide range of health and safety topics as components of your orientation training program. Young workers need to be made aware of job hazards, including training and protective equipment, and the rights and responsibilities of both workers and employers.

If you are a supervisor, it's up to you to make sure workers follow the OH&S Act and your company's policies and rules, to work safely, and use protective equipment. Inform workers about known hazards and demonstrate to workers how to work safely. What can you do?

There are a number of precautions you can take to ensure a safe workplace for young workers, including:

- Develop an effective health and safety training program for all new employees;
- Provide and maintain a safe workplace, including equipment and protective devices;
- Provide training so workers can work safely with materials used in your workplace, including equipment and protective devices;
- Inform new workers of any known hazards in your workplace, and provide training to work safely with the hazard.

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Greening Up Restrooms

by Stephen Ashkin

Many areas of facilities can benefit from efforts to become more environmentally friendly, but restrooms offer managers some of the biggest opportunities.

The green movement has affected restrooms at least as much as it has other areas of facilities. Among the most intensively used areas in facilities, restrooms offer opportunities to reduce water use and improve health and hygiene.

By applying green thinking to restrooms, managers can take advantage of product advances designed to reduce materials, curtail water use, reduce negative affects from cleaning chemicals, encourage greener technologies and infrastructure, and otherwise improve facilities' environmental friendliness.

Managers have three good reasons to focus green efforts on restrooms. While restrooms constitute a fraction of a building's square footage, they consume a large portion of its cleaning materials: Restrooms use about 70 percent of chemicals and 90 percent of paper products. So the return on the investment in the form of environmental and health benefits is excellent.

Restrooms also are a logical place to begin because they play a prominent role in the image occupants get from a facility and organization. In addition, the investment to get started can be kept in check: Products are readily available and cost-competitive, relative to their traditional counterparts.

Chemical considerations

Managers should select chemical cleaning products and processes for restrooms that reduce toxicity and the overall quantities of chemicals used. Managers in federal facilities should take an especially close look at products derived from renewable resources — corn, soy and citrus fruits, for example — as opposed to traditional products derived from nonrenewable resources, such as petroleum. Numerous types of such products exist.

For example, products made from non-pathogenic — not harmful — bacteria and enzymes that mimic

the way nature cleans can replace caustic drain cleaners.

Also, chlorinated grout cleaners and mold and mildew removers can burn eyes and skin, irritate lungs, and produce a poisonous gas when mixed with other cleaning chemicals. They can be replaced with hydrogen peroxide-based products or vapor-cleaning and pressure-washing systems.
Disinfectants that use chlorine or phenolic compounds create health and environmental concerns. Those products can be replaced with quaternary ammonium compounds and sanitizers using hydrogen peroxide. Specifying these products with a neutral pH makes them even safer.

Air fresheners often contain high levels of volatile organic compounds that contribute to poor indoor air quality and, ultimately, atmospheric smog. These products mask odor problems often caused by ineffective cleaning, drain-line and plumbing problems, and malfunctioning exhaust systems. Identifying and solving the cause of the problem is preferable to using air fresheners. If their use is unavoidable, do so only when and where necessary, as compared to using dispensers that work constantly.

Hand-soap dispensers
Public-health experts say that if restroom visitors wash their hands just five times per day, the rate of illness could drop by 50 percent. So having a pleasant-smelling soap and a reliable dispenser is critical to encouraging hand-washing.

Bulk-fill dispensers, including wall and under- counter units, can reduce product packaging, but they require a thorough cleaning each month to prevent the spread of bacteria, which can grow in the dispenser.

Large cartridges reduce the amount of packaging and the need for numerous dispensers that hold multiple containers. They also allow visitors to use every ounce of soap before requiring replacement. Foaming hand soaps reduce the amount of soap used, and people enjoy using them.

Finally, hands-free dispensers that incorporate sensors are part of many touch-free restrooms. But because users wash their hands after touching the dispenser, such dispensers are perhaps less critical when compared to touch-free towel dispensers. If opting to use touch-free sensor equipment, be sure to carry green management principles through to the maintenance of the equipment by having a plan in place to recycle batteries.

Paper and dispensers
Managers often can produce health and environmental benefits while reducing costs by rethinking their approach to specifying janitorial paper products, such as toilet tissue, hand towels and dispensers.

Performance varies widely with paper products. In the early years of the green movement, the only recycled paper products available were low-cost, low-quality, brown products made from cardboard.

Today, high-quality recycled products are available at competitive prices that can meet the needs of most

occupants. Their recycled content varies widely. One popular approach is to specify products made with a high percentage of post-consumer recycled content, which helps build a more efficient infrastructure for recycling programs.

Bleaching of paper products historically has involved a chlorine-based product. Moving from elemental chlorine to chlorine dioxide and, finally, to paper processed without chlorine reduces the potential harmful effects of chlorine and its by-products entering the waste stream.

Dispensers for hand towels and toilet tissue can have a significant impact on the total amount of paper used and the associated environmental impacts. Larger rolls of paper are preferable to smaller rolls or multifold hand towels. Large rolls can reduce paper use by up to 30 percent. Multiple rolls in a toilet tissue dispenser eliminates the risk of replacing partial rolls too soon.

Limiting-type dispensers measure the amount of paper dispensed and, as a result, conserve paper. Hands-free dispensers eliminate cranks and levers that can transfer bacteria. Hand-towel dispensers can be manual — the user simply pulls on an exposed sheet of clean paper — or automatic, featuring sensors to dispense the sheet.

Electric hand dryers can be an alternative to paper hand towels. But a trade-off exists between the environmental benefits of eliminating paper and potential health problems caused when high-velocity air blows bacteria and contaminated water off the hands.

Equipment issues

In buying more durable equipment for cleaning

crews, managers can minimize the amount of equipment that crews use, as well as their environmental impacts. New, greener products also can replace some of the more hazardous chemicals.

For example, managers can replace mop buckets, wringers, and caddies with more durable tools and equipment, which reduces the impact from extracting raw materials, natural-resource consumption, pollution from manufacturing, and waste from product disposal.

Vapor and steam cleaning machines also can be excellent options for removing hard-water deposits and eliminating mold and mildew stains. Touch-free systems that combine high-pressure water and a wet vacuum use pressure to remove soils, eliminating several chemicals and saving time and money.

Plumbing systems

Managers can specify the installation of automated valves on most existing plumbing fixtures, which will reduce water consumption and cross-contamination when people touch valves, handles and knobs. Again, be sure to have a plan to recycle batteries.

Finally, waterless urinals can help organizations save thousands of gallons of water per fixture. To ensure proper performance, managers should investigate the most appropriate applications and arrange for training in the products' installation and cleaning

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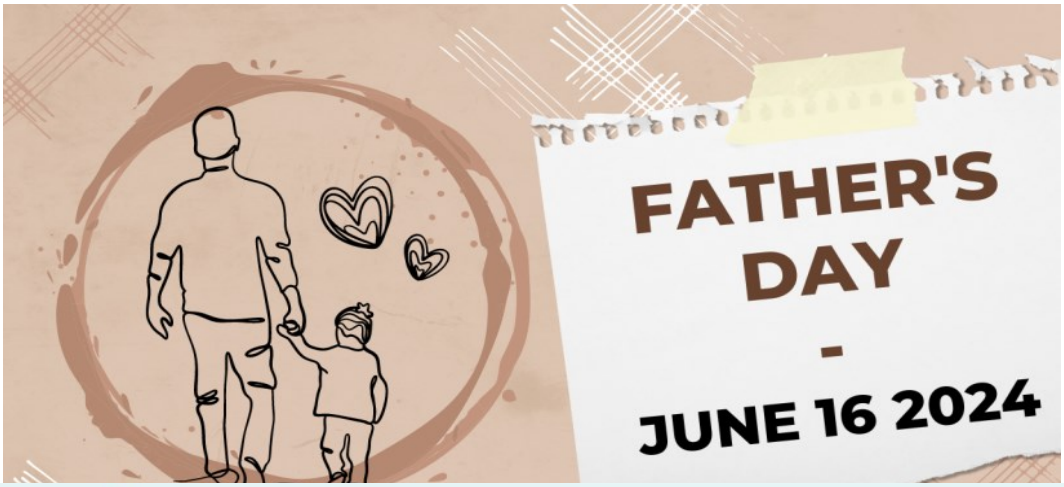
KenKen Puzzle

How to solve the Kenken puzzle:

(Answers on page 27)

- Fill in the numbers from 1 –6
- Do not repeat the number in any row or column
- The numbers in each heavily outlined set of squares, called cages, must combine (in any order) to produce the target number in the top corner using the mathematical operation indicated
- Cages with just one square should be filled in with the target number in the top corner
- A number can be repeated within a cage as long as it in the same or column

9	8			4		5	3	
					8	2		7
2	5		3		6		4	8
5	6		1					4
7	2		9	8			1	3
				6	7	9		
4			8	3				2
		2				4		
	1	6	2		4	3		9



Plumbing, Piping and Savings

by Thomas A. Westerkamp - Maintenance Solutions

Ensuring the cost-effective performance of essential systems and technology requires a comprehensive maintenance program

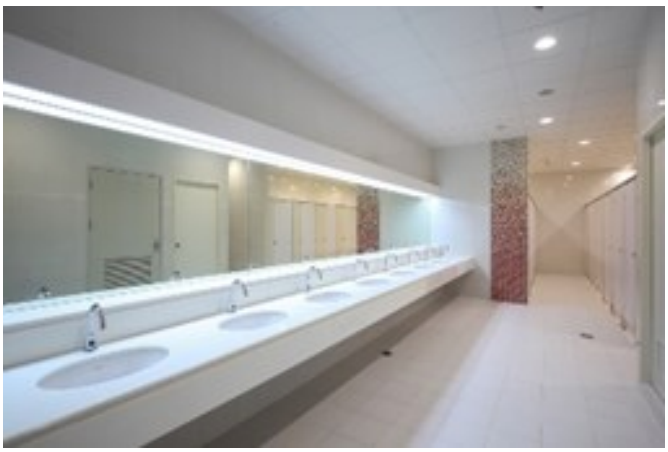
Facility plumbing and piping systems in institutional and commercial facilities have come under growing scrutiny in recent years. As organizations realize the growing costs related to moving water through these systems, managers have taken a closer look at their decisions related to new-product specification, as well as installation and maintenance.

With proper consideration, managers can help their organizations control water-use costs and ensure reliable service throughout facilities.

Restroom plumbing

Recent generations of plumbing fixtures feature technology that aims to reduce water use, extend performance life and minimize maintenance. Managers should consider these products in planning upgrade projects:

- **Water filters.** Water filters can reduce stains on fixtures and corrosion in pipes. Stains result from minerals or other chemicals in the water, such as iron, sulfur or chlorine. Iron leaves a rust-colored stain on sinks and toilets. Sulfur causes a strong odor and can corrode pipes, drains and appliances that use water. Low-pH water often leaves a bluish-green stain on copper pipes and corrodes pipes and drains. Turbidity can make water cloudy and foul pipes and drains.
- **Low-flow fittings.** Investing in low-flow aerator nozzles for sinks cuts water use, but the volume used varies. For example, up-to-date sink faucets with low-flow aerators can reduce water flow rates by up to one-half, to 0.5 gallons per minute (gpm).
- Specifying battery-operated, touchless faucets also not only lowers water use. It also creates a healthier environment by eliminating the possible transfer of germs from handling faucets. No-hands faucets deliver water only when a user places hands under the faucet and breaks a sensor beam. When the beam is restored, the sensor turns off the flow.
- **Low-flow flush valves.** Low-flow designs for urinals and toilets are available in flush valves with battery-operated, no-hands operation. Urinal flush-valve volume varies from 1-1.5 gpm, a 50 percent variation. Toilet flush-valve volumes vary from 1.6-4.5 gpm, a 180 percent variation. By sizing valves' flow rates for optimum performance, managers can dramatically reduced water costs.



- Managers should remember, however, that the goal is optimum flow, not minimum flow. A common complaint related to low-flow fixtures is that they are not strong enough and, in fact, cause pipe stoppages by failing to

flush completely. Pending legislation would remove mandatory low-flow rates, so managers should check local codes and consult with building inspectors before finalizing specifications.

Managers also can generate water savings and improve cleanliness at the same time by retrofitting existing valves with the automatic, battery-operated, vandal-resistant type, or replacing the old manual valves with the new automatic type.

Keeping it flowing

Maintenance and custodial tasks ensure that completed projects continue to perform as designed.

As each new round of regulations takes effect, managers should implement a maintenance program that aims to keep the finished project in top shape.

Daily maintenance of the restroom and equipment is essential. Each day, cleaning crews should follow a planned routine when cleaning all toilets, sinks, flush valves, dispensers, mirrors, light fixtures, stalls, walls and floors are spotless.

Technicians also should replace low batteries and burned out lights.

Most importantly, maintenance managers must use weekly performance reports to ensure proper staffing levels and check that workers use proper cleaning methods and equipment. It is essential that maintenance crews use all resources productively and cost-effectively and that the system upgrade meets objectives for both function and cost.

Power plant piping

Piping in facility power plants is designed for the pressure and service required for each application. For drain lines, vent lines and other pressure service, managers can specify schedule 40 pipe with 150 pounds per square inch (psi) working pressure. For high-pressure steam lines, such as 175 psi, managers can specify extra-heavy-schedule 80 pipe with 300 psi working pressure.

Maintenance of piping systems starts with selecting the right piping for the service. A sure sign of

incorrect selection is frequent problems, such as leakage due to corrosion, cracking or rupturing in service. If these problems are occurring, selecting the correct specification — even if initially more expensive — will reduce overall cost and improve reliability.

If the piping last a long time but fails without warning, one good predictive technique is to insert a

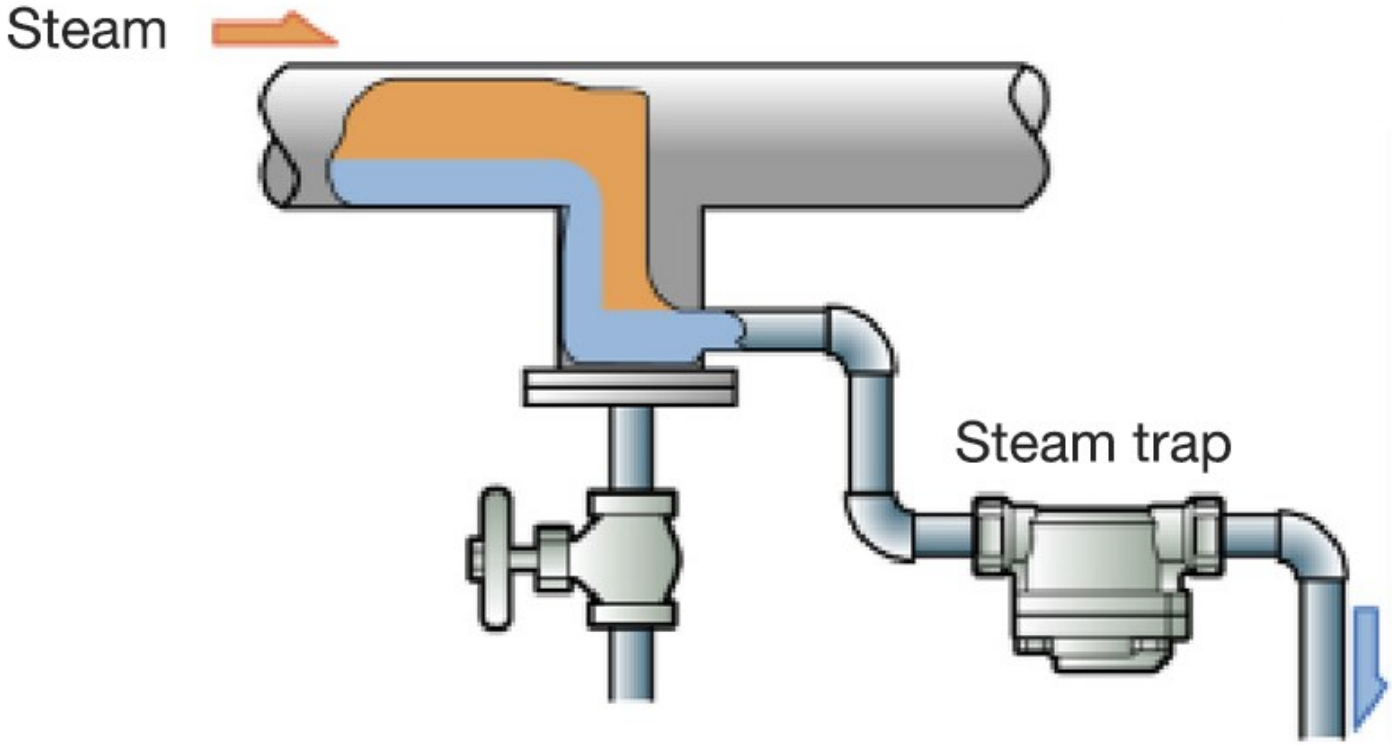
test section of pipe in the line at the trouble area. Periodic measurements of mils — thousandths of an inch — of metal loss in the specimen will indicate the optimum time to replace the pipe.

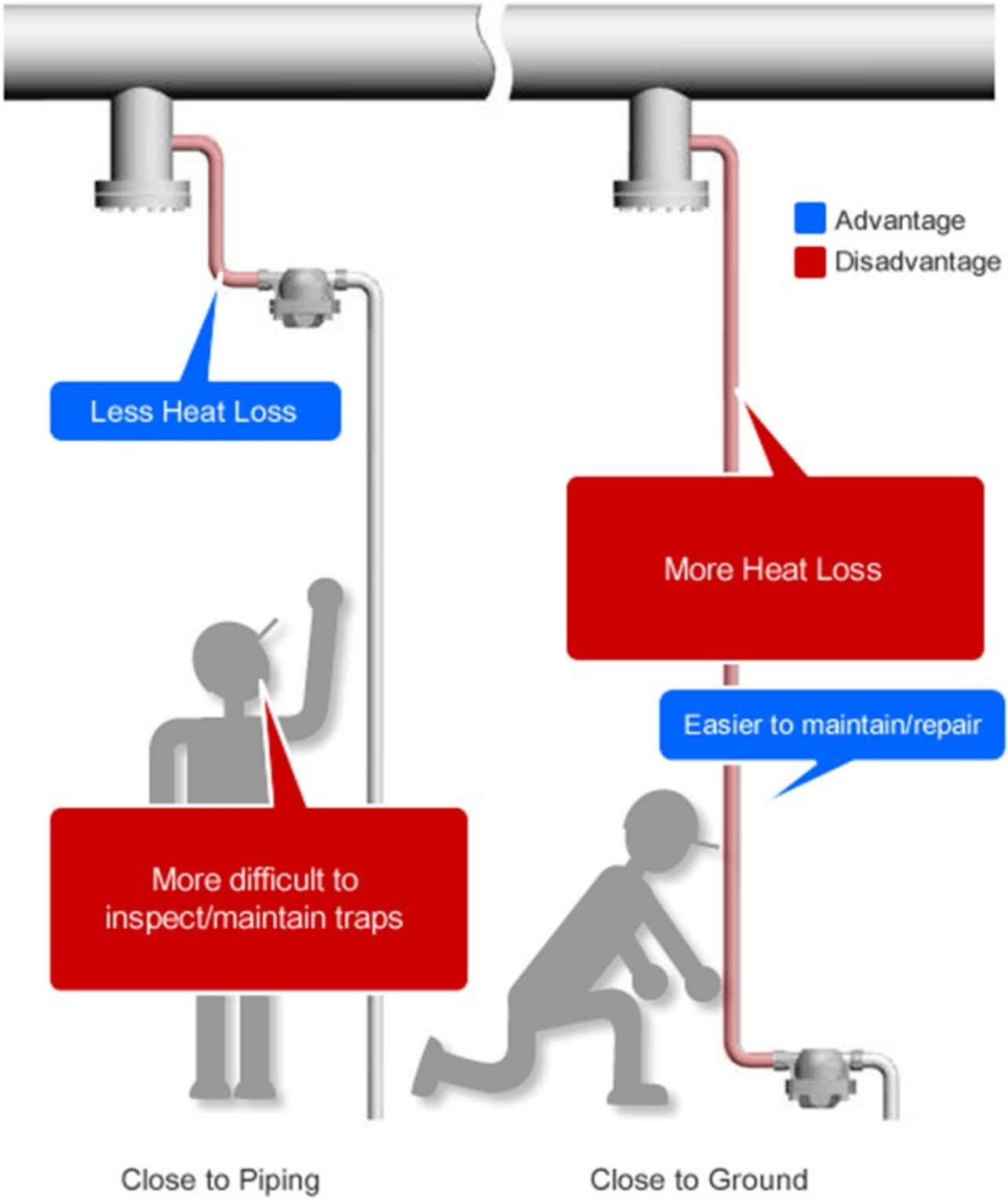
Technicians also must periodically inspect safety valves, also called pop valves, to ensure service reliability. The best way to test a valve is to increase the steam pressure to the popping point and actually trip the safety mechanism. If the valve trips at a pressure that is too high or too low, technicians should take it out of service and rebuild it.

Testing frequency depends on the operating pressure and condition of the equipment. Daily popping is never needed. In fact, it will cause cause premature leakage by wire drawing the valve seat and disk. A boiler in very poor condition might require weekly safety valve checking, but more importantly, the condition should be upgraded if it is necessary to trip the valve that often.

If a boiler has several safety valves, having a spare one is a good investment. Technicians then can replace a bad valve and rebuild it with minimum downtime.

Steam traps placed in steam lines allow the discharge of condensate and air while preventing steam loss. One of the most common indicators that a steam trap is not working or is installed in the wrong location is water hammer — condensate buildup colliding at high speed at a bend in the pipeline or at some other obstruction. Another indication is the steady discharge of steam and water vapor at the steam-trap vent line.





If these conditions occur, it is time to inspect the internal mechanism and replace it if it is worn or corroded from service. This also is a good time to check its size and make sure it is the correct for the service conditions. If the trap is working, the technician will be able to feel a difference in the temperature of the steam — higher — and in the condensate line — lower. More accurately, the technician can measure the temperature by placing a pyrometer probe on a clean metal spot on the pipe line on both sides of the trap.

In all cases of maintenance for plumbing and piping systems, the goal is to catch small problems before they become larger and more costly.

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Pump Up Energy Efficiency

by David Kozlowski

Often overlooked, pumps give facilities much-needed opportunities for energy savings.

When it comes to providing comfortable temperatures energy efficiently, cost savings don't begin with air-handling units or end with chillers and boilers. To think so would overlook a significant amount of energy used in pumping systems that deliver chilled or hot water to air-handling units. Maintenance and engineering managers tend not to give much thought to pumping systems' energy demands, as long as systems meet room temperature requirements and chillers or boilers hum along. Yet up to one-half of energy used in commercial and institutional facilities for pumping systems can be wasted if facilities rely only on control valves to regulate flow.

Managers often are far more concerned about the energy needed to move air than water, and that is a mistake, say engineering experts. Many inefficient pumping systems are operating today, and they cost organizations a great deal of money in operating costs. Strategic improvements in pump system design and operation can improve overall efficiency of the system substantially — with a quick payback.

Efficient design

The place to begin improving efficiency is to recognize that a system's component efficiency is not equal to its overall efficiency. Energy efficiency benefits of even the most efficient pump or motor can be wiped out by inefficiency elsewhere in the system. And the culprit need not be another inefficient component. Sometimes, an otherwise efficient pump might be unnecessarily oversized.

"It is important to understand that in such inefficient systems, the pump and motor may be operating at relatively high efficiencies," says Don Casada, a consulting engineer based in Knoxville and former researcher at the Oak Ridge National Laboratory. "But they are having to provide more hydraulic energy to the system than is ideal because of artificial losses caused by the valve throttling and/or bypass operation."

Among the basic design changes that have taken hold in recent years is the switch from

constant-flow systems to variable-flow systems that use primary and secondary loops, especially in chilled-water systems, says Mike Maybaum, P.E., executive vice president at Cosentini, an architectural and engineering firm based in New York City.

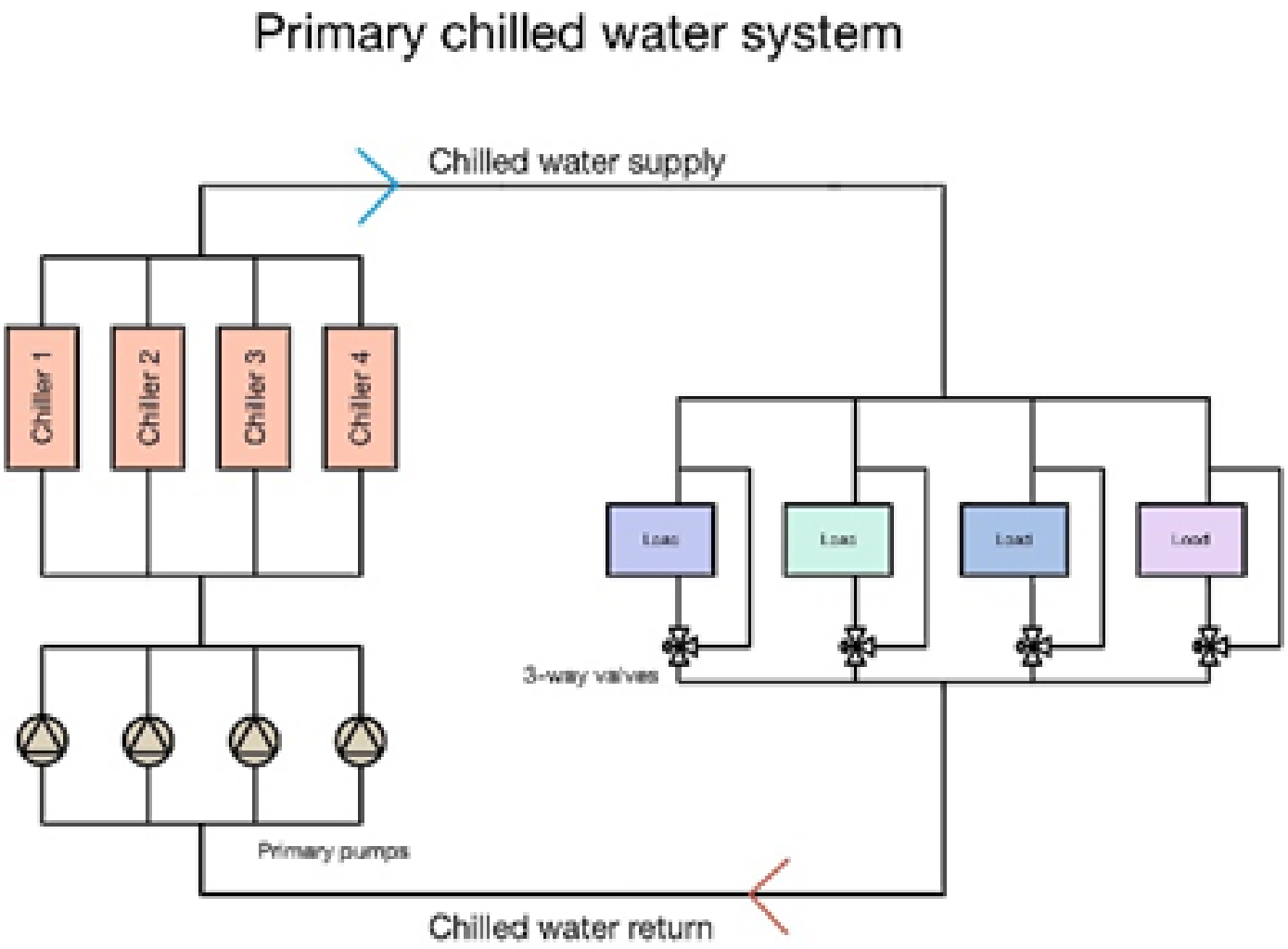
Primary-secondary systems generate efficiency gains because the system is split in two. The chilled-water flow around the chiller is generally constant, but the secondary and sometimes tertiary loops use variable-speed drives (VSDs) to throttle back flow instead of relying entirely on control valves.

“The switch from an all-constant-flow system to a primary and secondary loop system can cut pumping energy costs by 30-50 percent,” Maybaum says. This arrangement can help make even oversized systems run more efficiently by providing better control of oversized pumps, he says.

Using VSDs for pumping systems is a relatively new idea, even though the drives have a good track record of varying chiller operation, and their cost effectiveness has been very positive so far, Maybaum says.

Control valves are and have been standard in facilities, but control valves can waste about 25 percent of a pump’s energy efficiency.

They do this by creating frictional losses, and it



takes a great deal of energy to overcome those losses. Casada equates the situation to driving a car but using the brake to control the speed. In HVAC systems, it is much better to size a pump correctly or use an alternative means of control, such as VSDs. While VSDs initially are more expensive, the energy cost savings are quite good, and the payback on VSDs can be as short as one to two years.

Besides VSDs, managers can reduce energy waste by sizing pumps to minimize valve losses.

Case in point

For example, Casada says, assume that in a water pumping system, a pump has a discharge pressure of 250 pounds per square inch per gallon (psig) at 3,000 gallons per minute (gpm). Also, assume the system only needs 210 psig downstream of the control valve, and pressure is reduced 40 psig at the control valve.

If the motor is operating at 95 percent efficiency and the pump is operating at 85 percent efficiency — both are very good values in such an application — the system would use about 65 kilowatts of electric power to cover the valve losses. If the facility operates 90 percent of the time at an average electric rate of 5 cents per kilowatt-hour, the annual cost of the valve losses would be more than $25,000.

If a manager changes the pump, trims the impeller or slows the pump down so it only develops 220 psig discharge pressure at 3,000 gpm, the loss across the valve would be reduced to 10 psig. This move saves about $19,000 per year if pump and motor efficiencies don't change.

Of course, the valve frictional loss will cost more than $6,000 per year, Casada says.

A third way to vary the flow is to use multiple pumps. But unless the system is made as efficient as possible, turning on another pump will not double flow. Instead, it will provide only partial support, due to frictional loss in the system. The change would double the energy used to pump, but it would not double the flow.

Finally, even if managers are committed to control valves, they should understand how different types of valves have different effects on system efficiency. According to Casada, globe valves provide significant losses, even when they are fully open. Considering the amount of energy wasted and the rising cost of energy, replacing globe valves with butterfly valves could be cost effective. The return on this investment could be four months to one year.

Maintenance

There's an additional benefit to changing out control valves in a system: less valve maintenance. Maintenance can play a critical role in ensuring the pumping system operates as efficiently as possible.

There are four general signs of system

inefficiency: heavy valve throttling, open recirculation lines in cooling towers, cavitation or rapid phase changes in the system, and multiple running pumps. All four situations affect efficiency and maintenance.

For example, cavitation could lead to pipe and valve deterioration. Technicians can identify this problem by listening for a sound like gravel being run through the valve. Control valves also could be stuck, requiring that another pump be turned on to increase head pressure. Valves need to be checked regularly and replaced as needed.

Another maintenance challenge is scale build-up, which can occur on filters, pipes and valves, decreasing flow rates and increasing system friction. Technicians should clean filters and heat exchangers regularly.

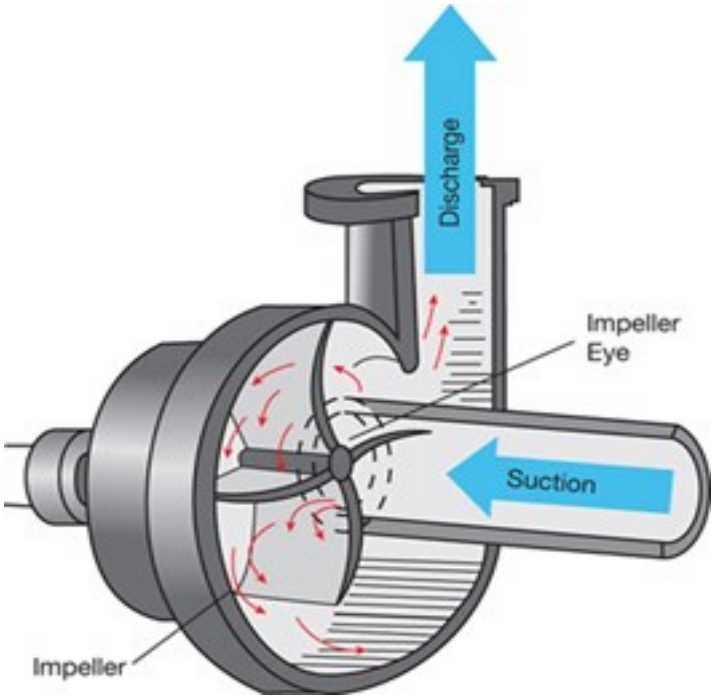
Pumps also have wear rings that should be periodically checked. Wear rings provide the minimum clearance — usually a few ten-thousandths of an inch — between the pump housing and the impeller. Excessive wear of this ring leads to reduced pump efficiency.

The key to preventive maintenance on pumping systems is monitoring their performance, Casada says.

“Install a few flow meters and pressure gauges that you can trust, and read them regularly,” he says. Casada prefers to use temporary gauges, since permanent gauges are not always accurate. For example, he says he has pulled a gauge out of a system that still read 50 pounds of pressure.

Casada also recommends that maintenance technicians track system performance by reading flow rates every day and taking pressure readings every 6 months to one year.

Managers can rely on manufacturers’ pump head or pressure ratings for sizing the system, but they should be careful about using those numbers in place of field measurements; too many field conditions can affect the pumping system efficiency.



Performing even basic maintenance and changes to a pumping system can produce significant savings.

“It’s not hard to find ways to increase efficiency by 15 percent in most systems,” Casada says.

Above article appeared previously in Maintenance Solutions

Pumps: The Heart of HVAC

by James Piper

Proper maintenance remains essential for efficient pump operation, but new technologies offer managers greater opportunities to control costs.

The centrifugal pump has long been the workhorse of HVAC systems, supporting the operation of chillers, boilers, cooling towers, domestic water systems, and hydronic distribution systems. And while practically every other component in an HVAC system has been greatly modified to meet ever changing requirements for efficiency and reliability, centrifugal pumps have not changed very much.

That does not mean today's centrifugal pumps are the same as those of 20 years ago. Manufacturers have made significant improvements in impeller designs, construction materials, bearing and seal designs, and couplings. But these changes have been more evolutionary than revolutionary.

As a result, many managers simply overlook the pump as an opportunity to improve the performance and reliability of HVAC systems. Building designers replicate designs used in the past in new building designs or renovation plans. System operating practices simply follow past tried and true practices. And when pumps fail, technicians replace them with new ones with the same characteristics.

The situation is changing today. Many advances that have affected other areas of building HVAC operation are being applied to pumps and their operation. As a result, engineering and maintenance managers can achieve levels of operating efficiency that were unheard of as recently as 10 years ago. And while improved operating efficiency is a primary benefits of today's pump installations, it is not the only one. System performance has improved. Reliability has increased. Maintenance requirements have been reduced

Improving pump efficiency

The overall efficiency of any pump used in a building HVAC system is determined by a number of factors, including:

- the efficiency of the pump and motor
- the efficiency of the pump control
- how well technicians maintain the pump and its related components.

New pump designs and high-efficiency drive motors can improve operating

efficiency. For example, by replacing a pump motor with a high-efficiency model, managers can achieve a reduction in energy requirements of 1-5 percent. Similarly, installing a high-efficiency pump can reduce energy requirements 1-3 percent. While these efficiency improvement numbers are relatively small, the typical annual hours of operation for many pump applications can make the resulting savings very significant.

While using higher-efficiency pumps and motors will improve operating efficiency somewhat, the greatest improvements in efficiency come from new designs of pump controls. Traditional pump installations use constant-speed pumps. Technicians use building, balancing, throttle or bypass valves to reduce flow when demand is low or to balance the flow to different areas of the building.

These valves restrict the flow of water through the end device, but the pump still uses the same amount of energy to operate. Also, technicians tend to set these valves and forget them. Conditions and loads change in a building, but the valve setting remains the same.

An alternative to throttling flow that improves both performance and energy efficiency is the use of variable-frequency drive (VFD). VFDs have slowly gained acceptance in use with building HVAC pumps because of their ability to effectively control the operation of a pump over a wide range of flow requirements, while also significantly reducing the energy requirements for the pumping system.

For example, as control valves cut back on the flow of water through terminal heating or cooling devices, the control system senses the reduced flow requirement and directs the VFD to reduce the pump speed to match the conditions found. Since the vast majority of systems operate at loads below peak capacity 95 percent of the time or more, VFDs can greatly reduce pumping energy requirements. In a typical HVAC application, pump energy savings typically are 20-50 percent annually.

Enter the intelligent controller

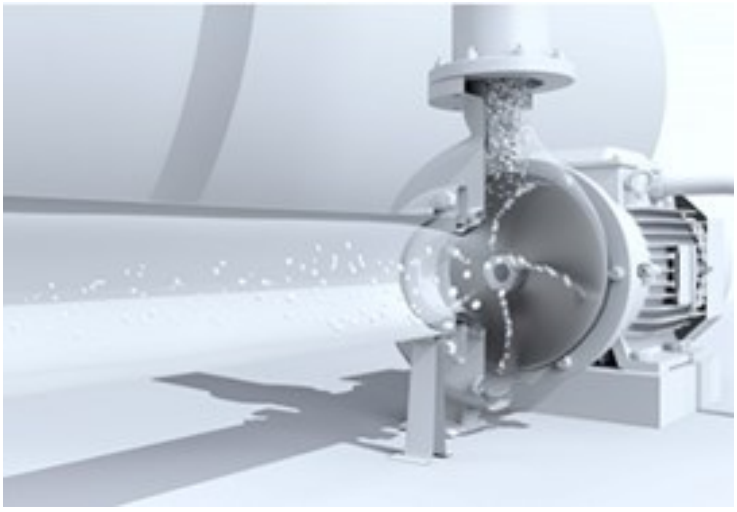
While VFDs can greatly improve the energy efficiency and control effectiveness of pumping systems, manufacturers have developed a new generation of controls that goes even further. This new generation of pump controls — intelligent pump controllers — offers improvements in pump reliability while further improving system performance.

Intelligent controls can better adjust to system load changes, better control pump operations, and provide control over a wider range of load conditions, and produce smoother pump startups. Intelligent controllers also use VFDs to regulate pump speed, but they do so not as a standalone device, but as another element in the overall building automation system. By connecting the pump and its controller to a digital field bus, data from the pump and its sensors can integrate into the system. Software monitors the operating conditions and identifies conditions that are outside normal operations and those that could damage the pump.

For example, if the flow to a pump is

restricted, the flow rate through the pump decreases. A conventional VFD control systems then signals the pump to increase its speed, possibly resulting in cavitation, a condition that can rapidly damage pump components. In contrast, an intelligent pump controller detects cavitation condition, notifies the operator of the situation, and — if programmed to do so — reduces the flow rate sufficiently to prevent cavitation without shutting down the system.

Cavitation is just one condition that intelligent controllers can detect. Operators can program the software to detect abnormalities, from sticking control valves to system leaks. Technicians can use the system to identify recurring or intermittent problems that otherwise might go undetected.



Don’t overlook maintenance

No matter how advanced the control system or how good the design, pump systems will operate effectively and efficiently only if managers schedule maintenance properly. Too often, though, they ignore maintenance until something goes wrong.

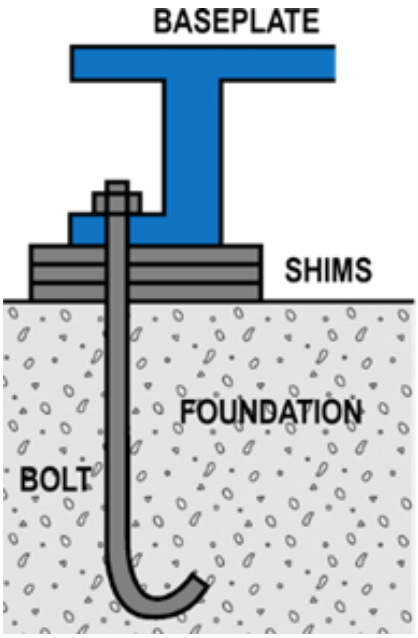
The resulting costs from pump repairs and disruption to building operations typically exceed the cost of ongoing pump maintenance by a factor of 10 or more. Maintenance activities and the frequency with which they must be performed vary with the capacity of the pump and the nature of the load that it is serving.

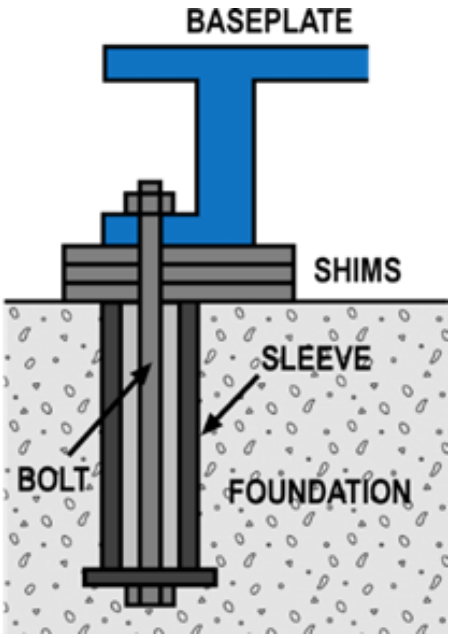
One of the most important maintenance tasks is to pay attention to a pump’s operation. Does it look and sound normal, or has it developed unusual sounds or vibrations? Louder-than-normal or unusual sounds can indicate a range of problems, from misalignment and bad bearings to cavitation.

A small leak rate at pump seals is normal, but a sudden flooding of the area near pump shafts indicates that a seal has failed and needs replacing. Excessive heat can indicate a failing bearing or a motor that might need replacing. By checking the pump regularly, maintenance technicians can identify pump problems early, reducing repair costs and disruptions to operations. Although it might be too late to prevent having to overhaul or replace the pump, at least the maintenance department, rather than the pump itself, will be able to pick the time when the pump is out of service.

Beyond periodic checks on pump operations, maintenance personnel should follow the manufacturer’s recommended schedule of maintenance activities. But these are the minimum maintenance requirements. Pumps serving critical applications in a building will require additional maintenance activities if they are to enhance system reliability. A successful pump installation requires that

managers change their ways of thinking about pumps. Sticking with old design and operating practices will prevent the system from operating as efficiently and reliably as it could, and waiting to adopt new technologies that are available means missed opportunities to ensure smooth building operation and enhanced energy efficiency.





Finding Failure

Even with proper maintenance, pumps fail. When they do, instead of simply replacing or rebuilding the existing pump, maintenance and engineering managers should take the time to determine the cause of the failure.

Pump failures fall into four general categories:

- a defective pump
- a poor application design
- improper maintenance
- poor operating practices.

Unless managers and technicians determine the cause of the failure, it will be impossible to ensure that the failure will not be repeated with the new pump.

For example, if a pump fails because of contamination in the circulating fluid, replacing the pump without taking steps to remove the contaminants will only result in the premature failure of the replacement pump. Similarly, if a pump fails due to stress induced by thermal expansion and contraction in the piping system, the replacement pump also will fail unless technicians properly install expansion joints at the pump connections.

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Examples of problems caused by incorrect pump specification

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9	8	1	7	4	2	5	3	6
6	4	3	5	1	8	2	9	7
2	5	7	3	9	6	1	4	8
5	6	9	1	2	3	8	7	4
7	2	4	9	8	5	6	1	3
1	3	8	4	6	7	9	2	5
4	9	5	8	3	1	7	6	2
3	7	2	6	5	9	4	8	1
8	1	6	2	7	4	3	5	9

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Answers: 1)b 2)d 3)b 4)c 5)b

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