Armstrong International

We provide intelligent system solutions that improve utility performance, lower energy consumption, and reduce environmental emissions . . . while providing an “enjoyable experience”!

Intelligent System Solutions® STEAM • AIR • HOT WATER

“Expect many **enjoyable experiences**!”

David M. Armstrong


Plumbing systems&design
July/August 2008
A publication of the American Society of Plumbing Engineers
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The magazine for plumbing engineers, designers, specifiers, code officials, contractors, manufacturers, master plumbers, and plumbing professionals

Water Temperature Control

Are You Picking the Right Horse for the Course?

By Paul Knight

An old saying goes, "horses for courses," meaning that di erent horses run well under di erent course designs and conditions. When they don't perform, we may conclude that it just wasn't the right horse for the course.

Much the same can be said of water temperature controls, speci cally thermostatic mixing valves (TMVs). In fact, selecting the correct mixing valve might have more to do with the application in which it is being installed and less to do with the manufacturer or the product's performance capability.

TMV POINTS OF INSTALLATION

First introduced in the early 1900s, the TMV has proven to be a very reliable, quite dependable staple of the institutional plumbing system. While thermostat designs, internal proportioning mechanisms, and materials have changed and improved over the years, the principle of operation today is the same as the principle of operation in the early 1900s. Some TMVs have large inlet-to-outlet temperature di erential requirements, and some struggle with water that has a high mineral content. Yet, for the most part, TMVs work as advertised by the manufacturer.

A TMV can be used in multiple installation applications, including:

- Point-of-use showers and point-of-use lavatories
- Group shower control
- Central recirculation system control

use applications (and combinations thereof) are determined by the speci c requirements of the code and the authority having jurisdiction, the building type and usage, the plumbing designer's or the owner's preference, and any speci c system capability the facility might require.

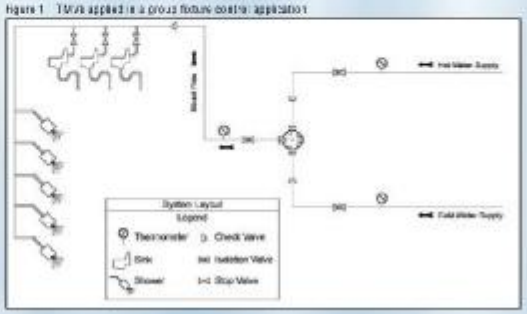
Application #1: Point-of-Use Showers and Lavatories

is article does not speci cally address the point-of-use showering application because, for the most part in the U.S. market, these mixing valves are primarily the pressure-balancing type of design listed to American Society of Sanitary Engineering (ASSE) 1016, *Performance Requirements for Automatic Compensating Valves for Individual Showers and Tub/Shower Combinations*.

Lavatories sometimes call for a TMV. In applications with only one valve per lavatory, the valves are often inch or ½ inch in size and are used to temper the incoming hot water supply directly at the point of use. is is a very basic application for a TMV. It is mixing hot water with cold water to deliver a third temperature somewhere in between, typically at a relatively xed ow rate. However, in large facilities with hundreds of sinks, the maintenance requirements often associated with TMVs may create an overbearing, ongoing service program.

A TMV installed at a point of use should by design prevent high-temperature water from exiting the shure. However, this renders the periodic high-temperature system and shure ush recommendation appearing within Legionella guidelines from the Occupational Safety and Health Administration, Centers for Disease Control and Prevention, and New York Department of

Figure 1 TMVs applied in a group fixture control application



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David M. Armstrong

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Long Beach, CA

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"Expect m

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Water Temperatrure Control for the Domestic Water System

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System Issues & Concerns

- Thermal – Scalding Dangers **WARNING!**

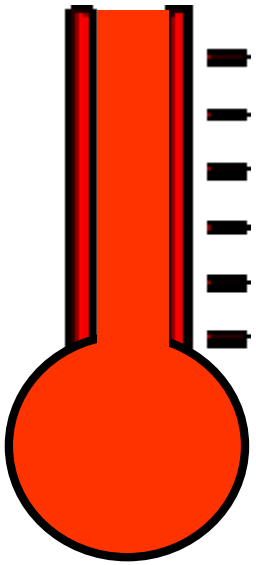
- Bacterial - Legionellae

Presentation Position Statement

Institutional Hot Water System Design, Operation and Maintenance must always include an integral Legionella Risk Reduction and Enhanced User Safety precaution with an appropriate ongoing action plan.

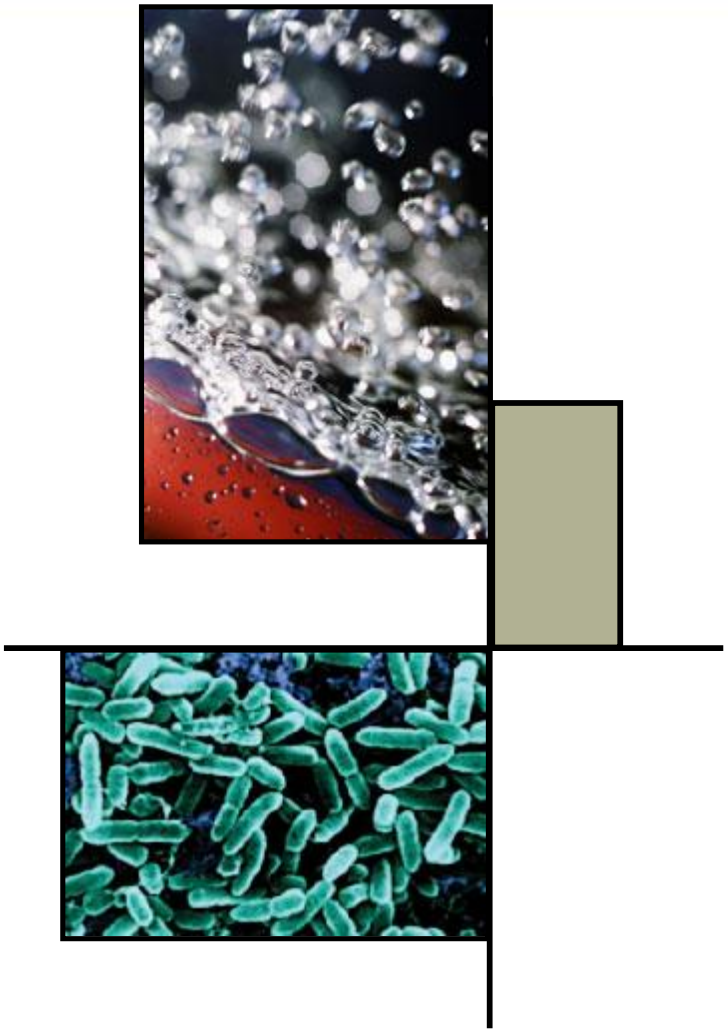
ASPE, OSHA, CDC, ASHRAE ++

- 140°F Water Storage Temperatures



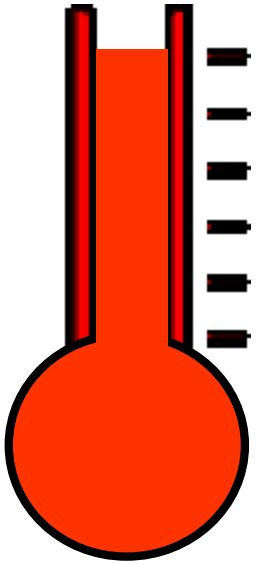
Legionellae and Temperature

- Below 68°F legionellae can survive but are dormant
- Legionellae growth range (68°F - 122°F)
- Ideal growth range (95°F - 115°F)
- Above 122°F legionellae can survive but do not multiply
- At 130°F legionellae die within 5 to 6 hours
- At 140°F legionellae die within 32 minutes
- At 150°F legionellae die within 2 minutes
- Disinfection range (158°F - 176°F)



Safety Issue

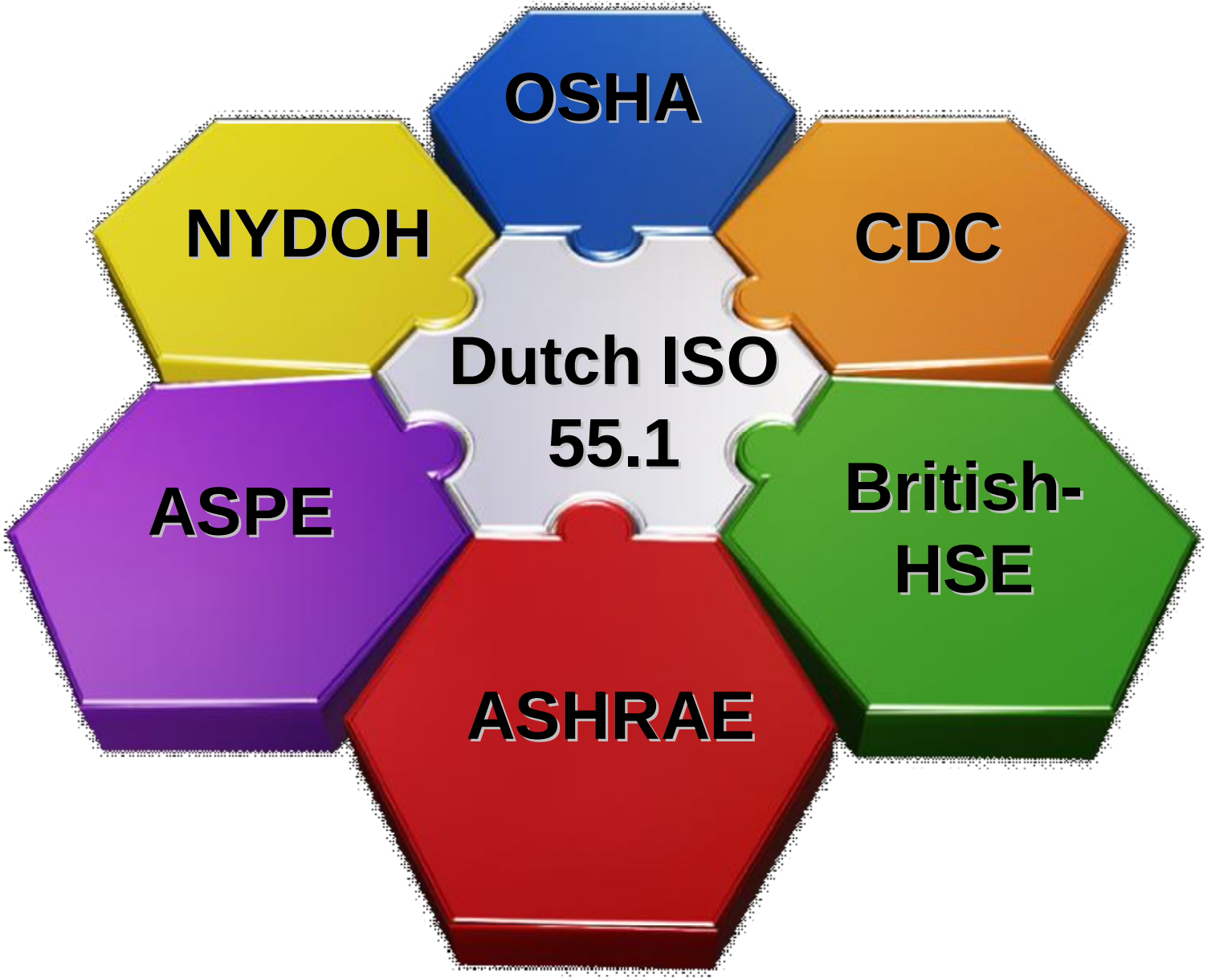
140°F.



Temperature/Time Burn Chart

Temperature in F°	Time for 1st degree burn
110°F	5 hours
118°F	10 minutes
122°F	1 minute
131°F	5 seconds
140°F	2 seconds
149°F	1 second
158°F	-------

Interpreting Legionella Guidelines



A System is “At Risk” for Legionella incubation IF . . .

There are “Dead-Leg” pipe run/take-offs from the central re-circulating hot water loop to remote points of use

There are Water Heaters with set points below 60°C/140°F or water temperatures which fall below 122°F at any point in the circuit before draw off

The building is a place where the elderly or people with depressed immune systems reside or visit

There are individual showers and lavatories which can go for extended periods of time with infrequent operation

There is an aqua-stat to shut off the pump to either save energy or as a safety measure if the re-circulating hot water system exceeds a pre-set temperature

SECTION III: CHAPTER 7 LEGIONNAIRES' DISEASE

DOMESTIC HOT WATER SYSTEMS.

- **Background**. Domestic hot-water systems are frequently linked to Legionnaires' outbreaks.

SECTION III: CHAPTER 7 LEGIONNAIRES' DISEASE

DOMESTIC HOT WATER SYSTEMS.

– **Maintenance**. To minimize the growth of *Legionella* in the system, domestic hot water should be stored at a minimum of 60°C (140°F) and delivered at a minimum of 50°C (122°F) to all outlets.

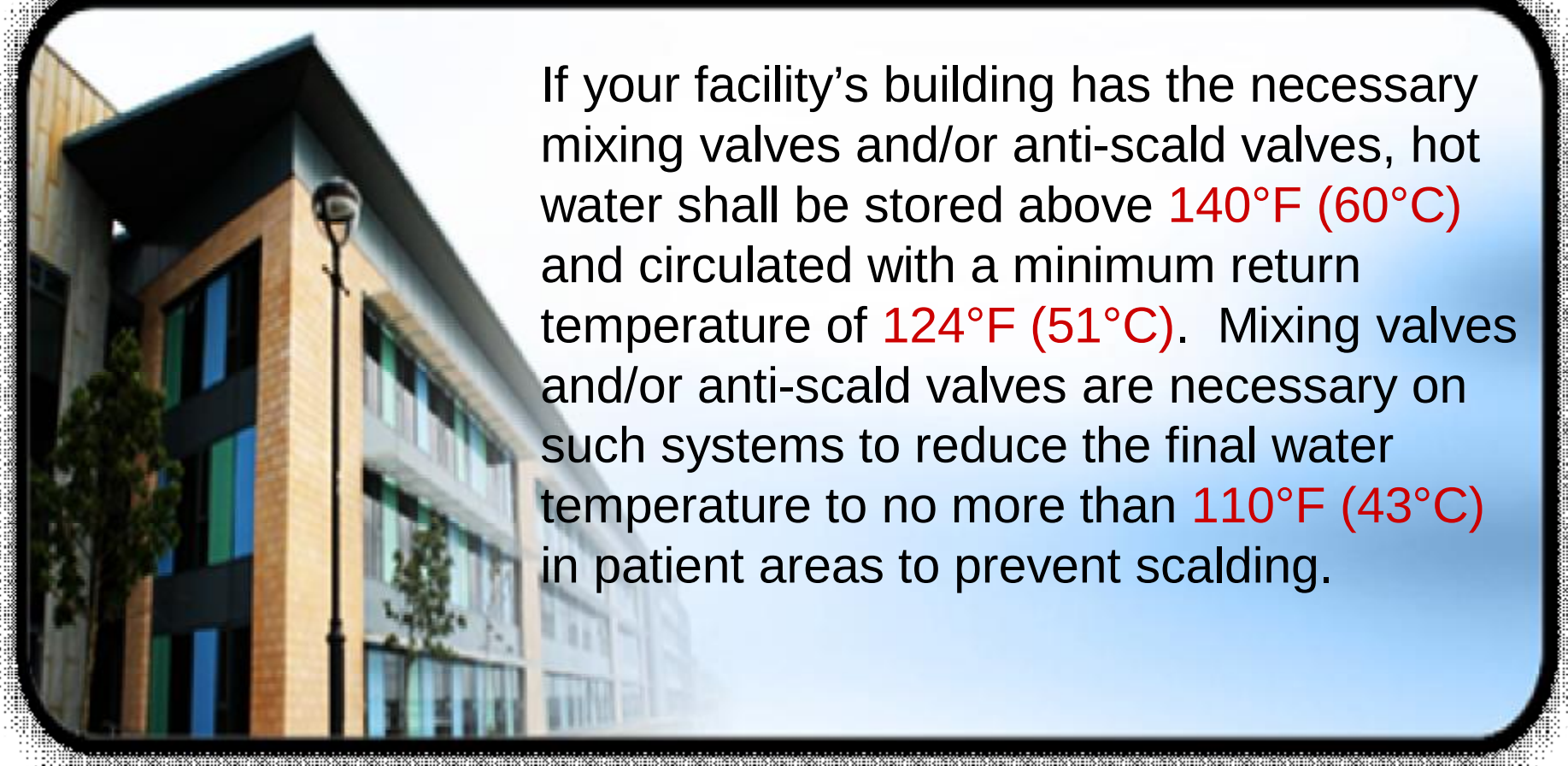
SECTION III: CHAPTER 7 LEGIONNAIRES' DISEASE

DOMESTIC HOT WATER SYSTEMS.

- **Control**. Raising the water-heater temperature can control or eliminate *Legionella* growth. Pasteurize the hot water system by raising the water-heater temperature to a minimum of 70°C (158°F) for 24 hours and then flushing each outlet for 20 minutes. It is important to flush all taps with the hot water because stagnant areas can "re-seed" the system.

New York State Department of Health Guidelines 7-14-05 Update

Excerpt



If your facility's building has the necessary mixing valves and/or anti-scald valves, hot water shall be stored above 140°F (60°C) and circulated with a minimum return temperature of 124°F (51°C). Mixing valves and/or anti-scald valves are necessary on such systems to reduce the final water temperature to no more than 110°F (43°C) in patient areas to prevent scalding.

New York State Department of Health Guidelines 7-14-05 Update

Excerpt

Facilities that do not have the necessary mixing valves and/or anti-scald valves to operate according to the temperatures described above, or have not implemented other long term control measures, shall, at least semiannually, disinfect their distribution system using a high temperature or a chlorination flush.

Institutional People Washing

Hotels

Universities

Hospitals

Schools

Prisons

Nursing Homes

Temperature/Time Burn Chart

Temperature in F°	Time for 1st degree burn
110°F	5 hours
118°F	10 minutes
122°F	1 minute
131°F	5 seconds
140°F	2 seconds
149°F	1 second
158°F	-------

Where does a Mixing Valve go?

- Point of Use
- Groups of Fixtures
- Central Re-Circulation System Control

Thermostatic Mixing Valves

What do Thermostatic Mixing Valves do?

Takes heated water at a higher temperature and maintains it at a lower utilization temperature

120ºF+ for clothing, bed sheets, dish washing, industrial process

120ºF- for people washing, emergency fixtures

Uniform Plumbing Code (2006) Section 413.1

- Limitation of Hot Water Temperature for Public Lavatories states: "Hot water delivered from public-use lavatories shall be limited to a maximum temperature of 120°F. The water heater thermostat shall not be considered a control for meeting this provision."

ASSE Standard #1070
Point of Use

- "Water Temperature Control Devices shall control and limit the water temperature to fittings for fixtures such as sinks, lavatories or bathtubs and are intended to reduce the risk of scalding."

EXAMPLE:

A thermostatic mixing valve located remotely from the mechanical room and supplying tempered water to a lavatory with single level faucets. (user adjusts final temperature at fixture).

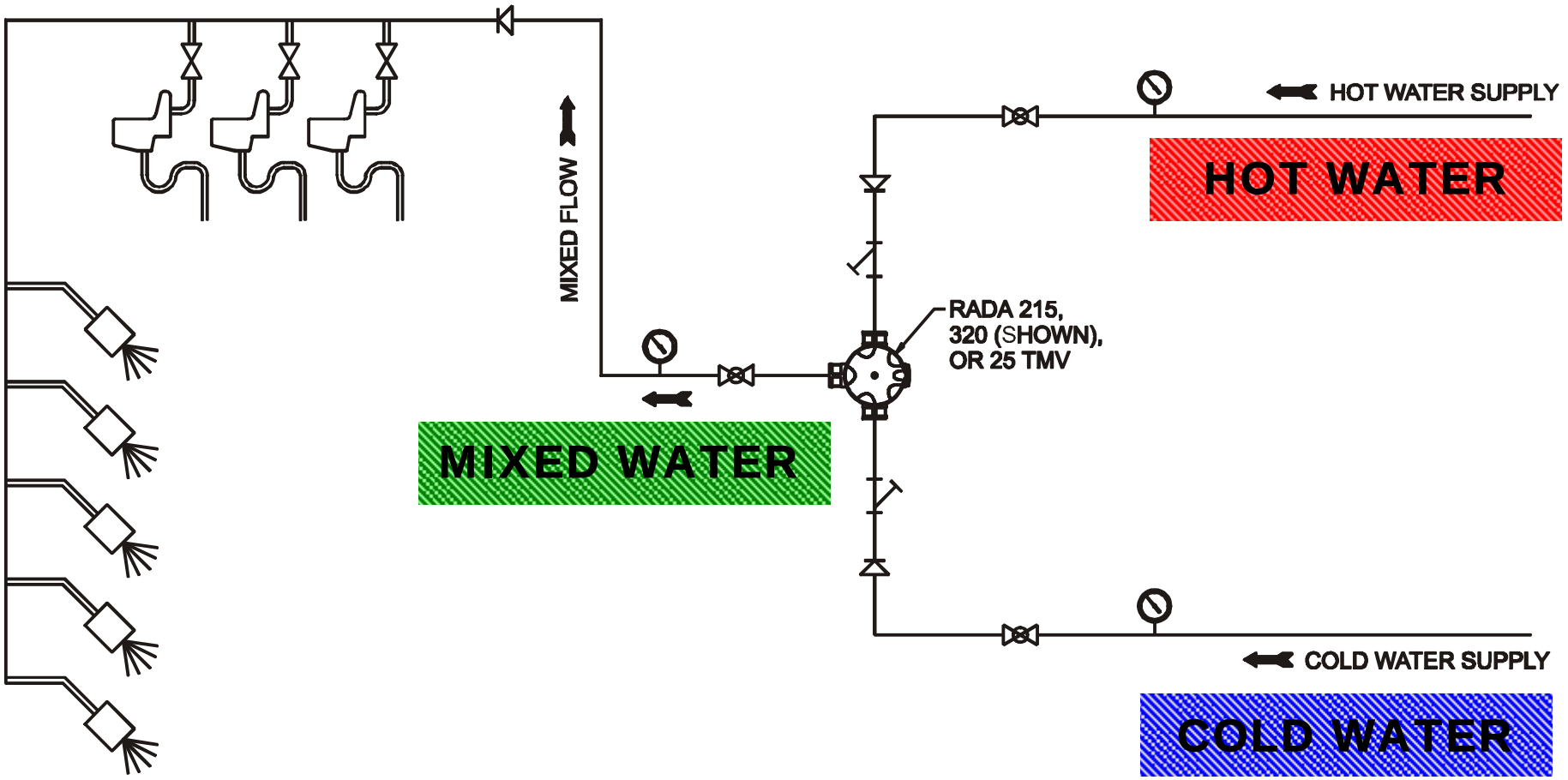
ASSE Standard #1069
Group Fixture Control

- "These devices are intended to control water temperature to individual or multiple fixtures to reduce the risk of scalding and thermal shock."
- "These devices are intended to be installed where the bather has no access to the temperature adjustment means, and where no further mixing occurs downstream of the device."

EXAMPLE:

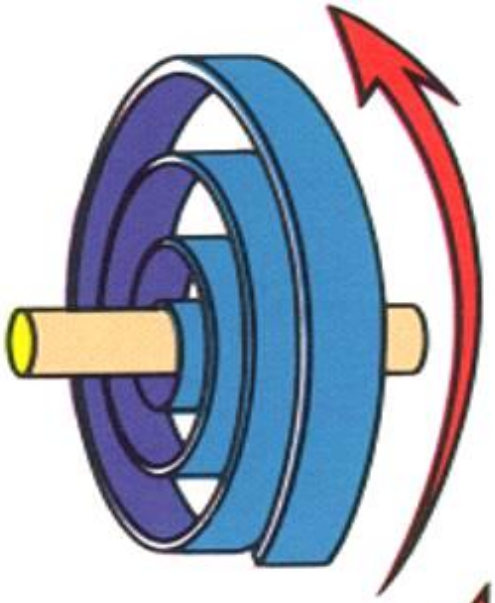
A thermostatic mixing valve located remotely from the mechanical room and supplying tempered water to a shower room with push button metering valves.

Group Fixture Control



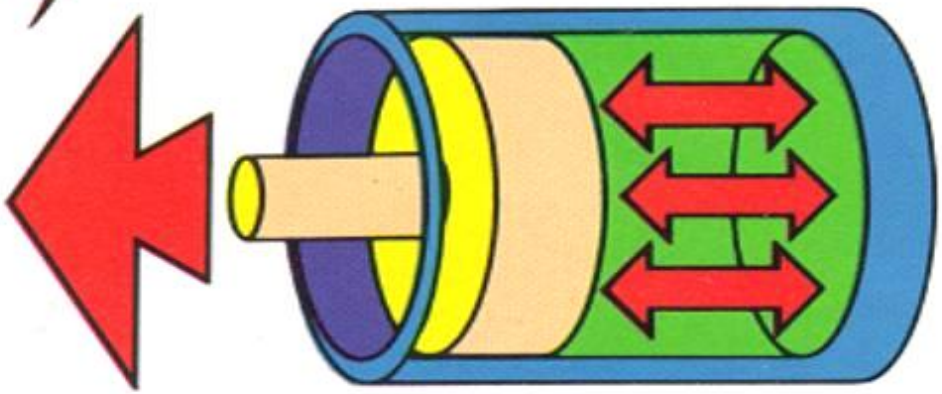
How does a Mixing Valve work ?

The Thermostat

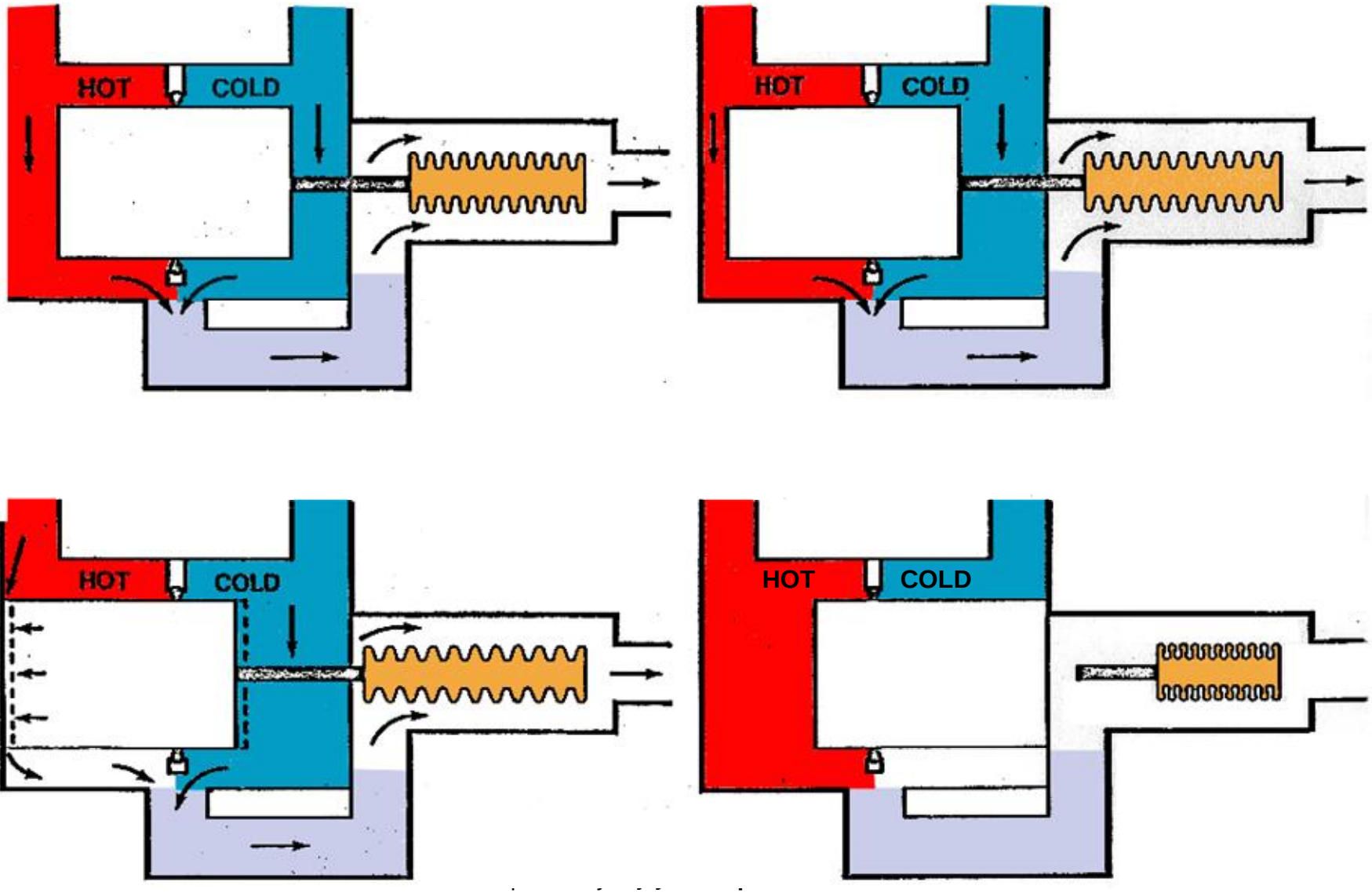


Bi-Metal Principle

Filled Capsule Principle

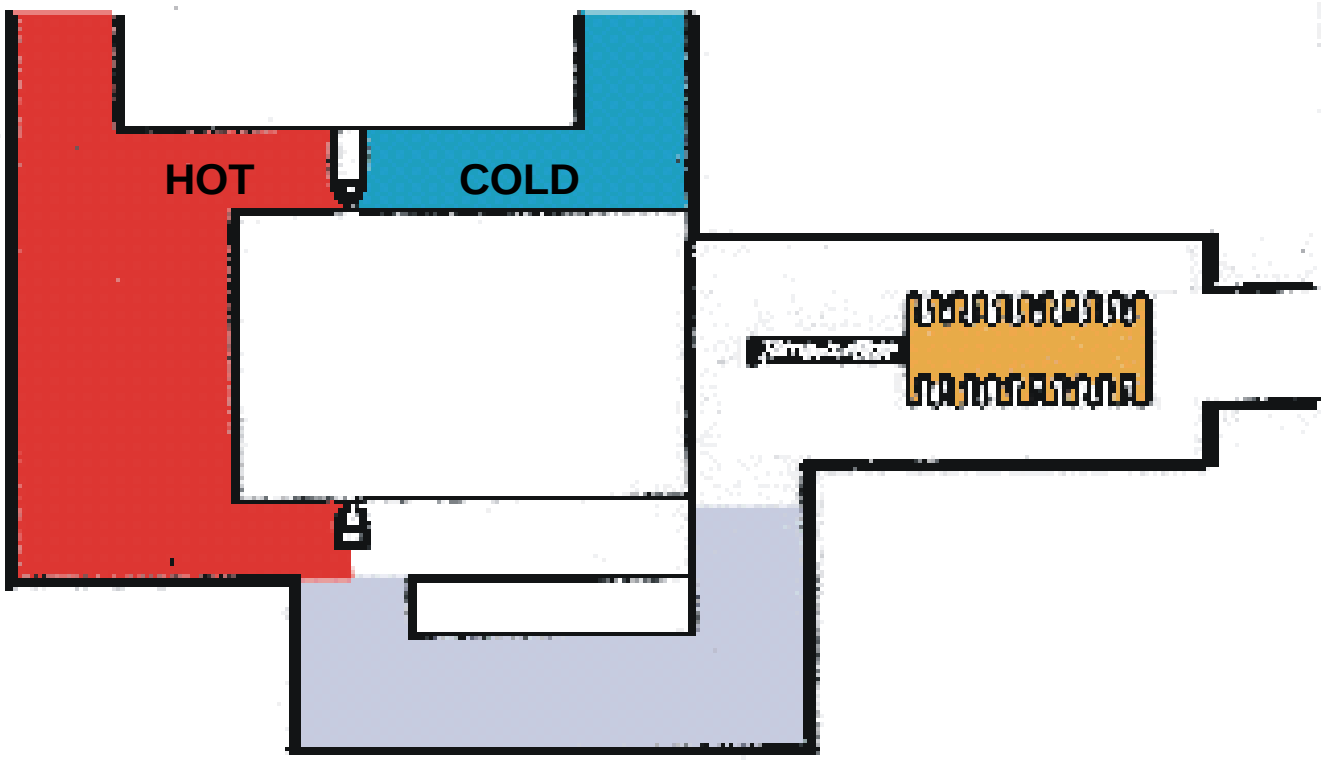


The Proportioning Mechanism

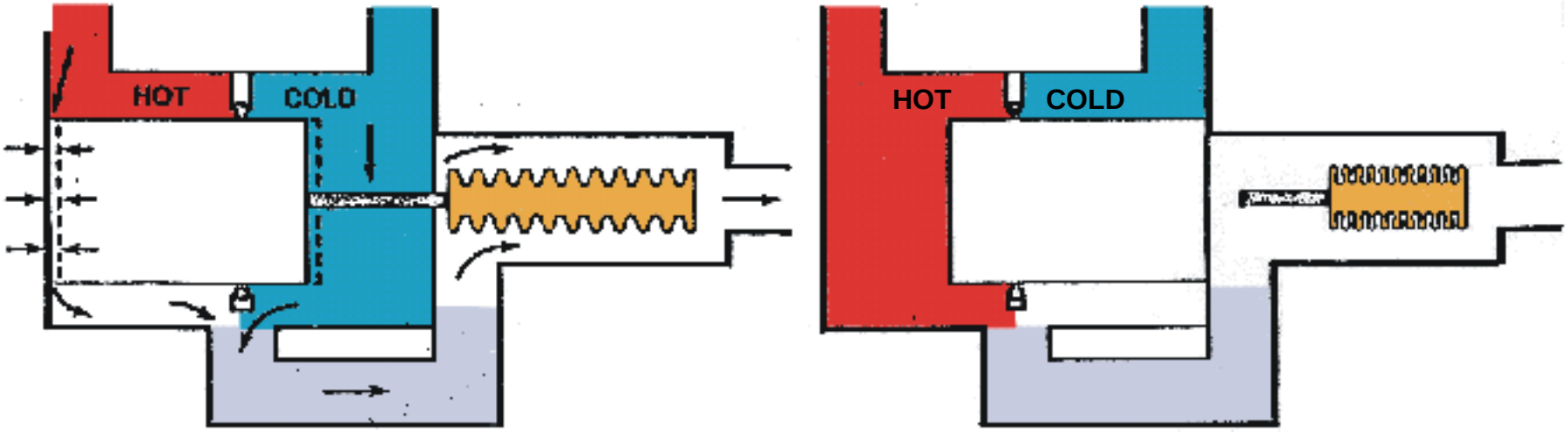


Where do "Group" TMV's tend to struggle?

“Low Seepage”



Thermal Shutdown



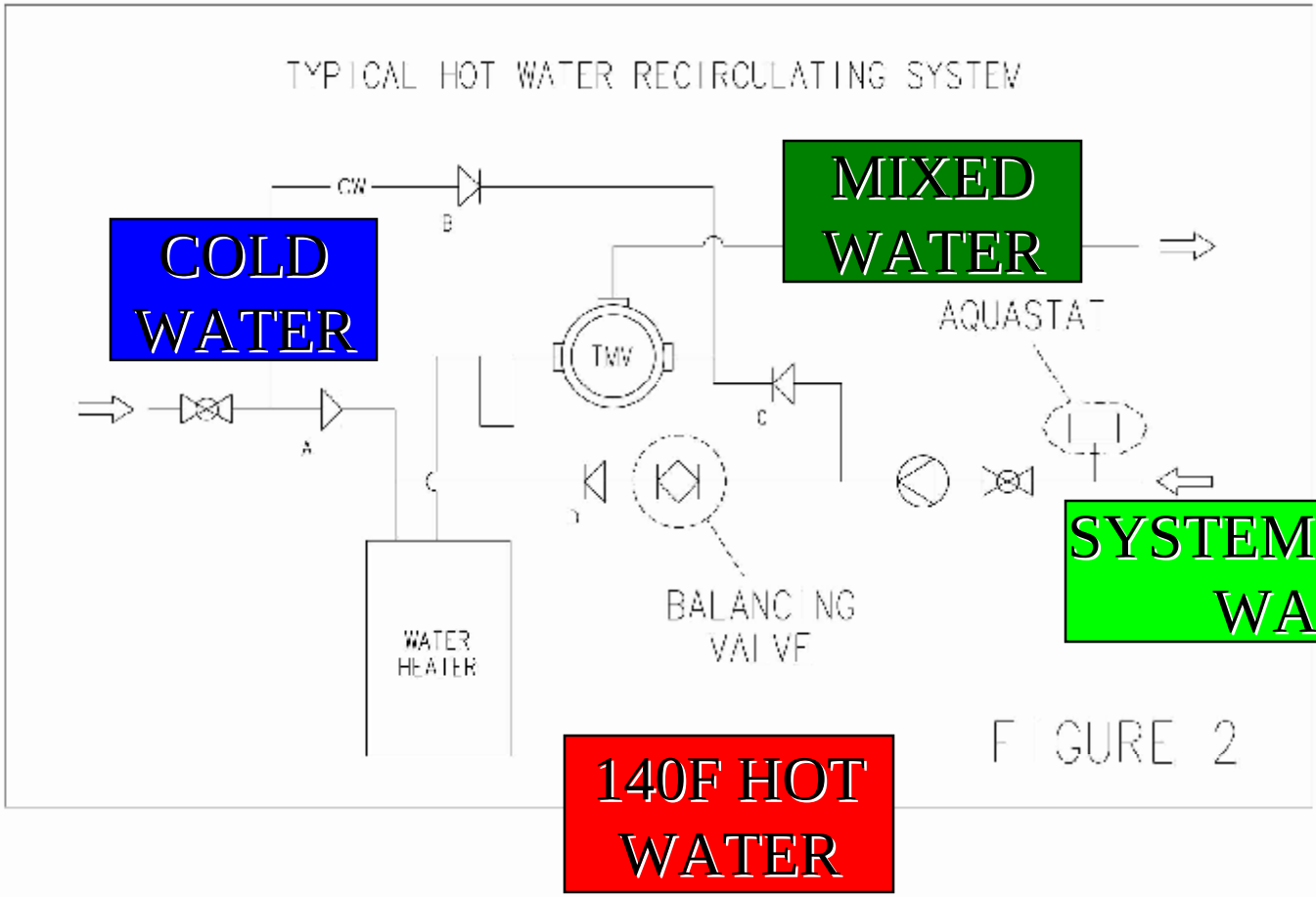
ASSE Standard #1017
Central Re-Circulation System Control

- "Temperature Actuated Valves for Hot Water Distribution Systems are used for controlling in-line water temperatures in domestic hot water systems and shall be installed at the hot water source."

EXAMPLE:

A thermostatic mixing valve located in a mechanical room with a hot water source supplying tempered water to the rooms within a hospital.

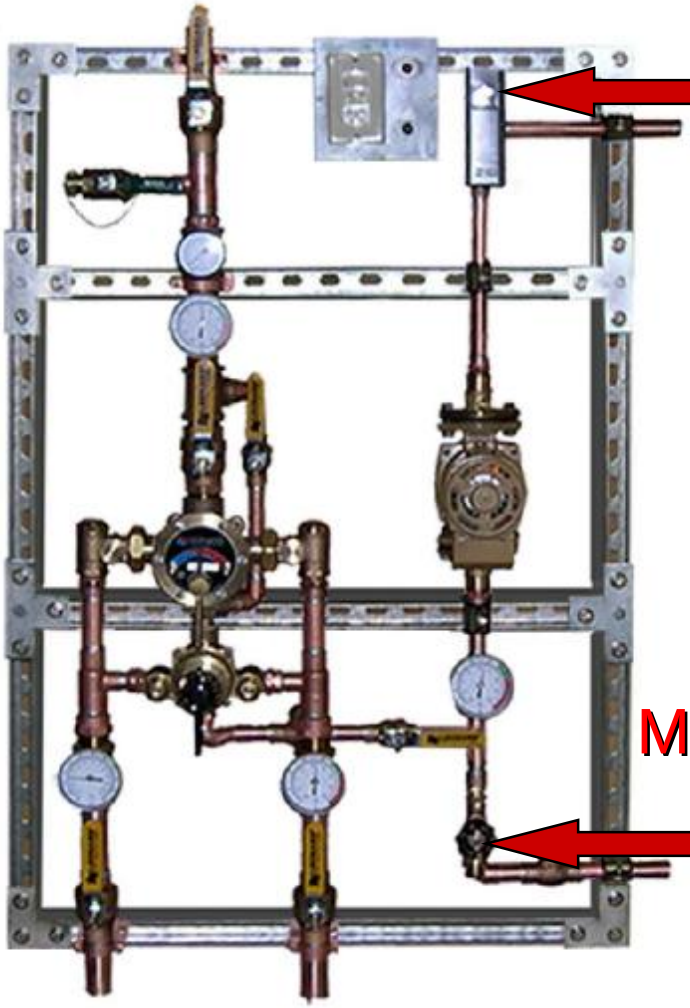
Where do “Loop” TMV’s tend to struggle?



Expect many **enjoyable experiences**!

David M. Armstrong

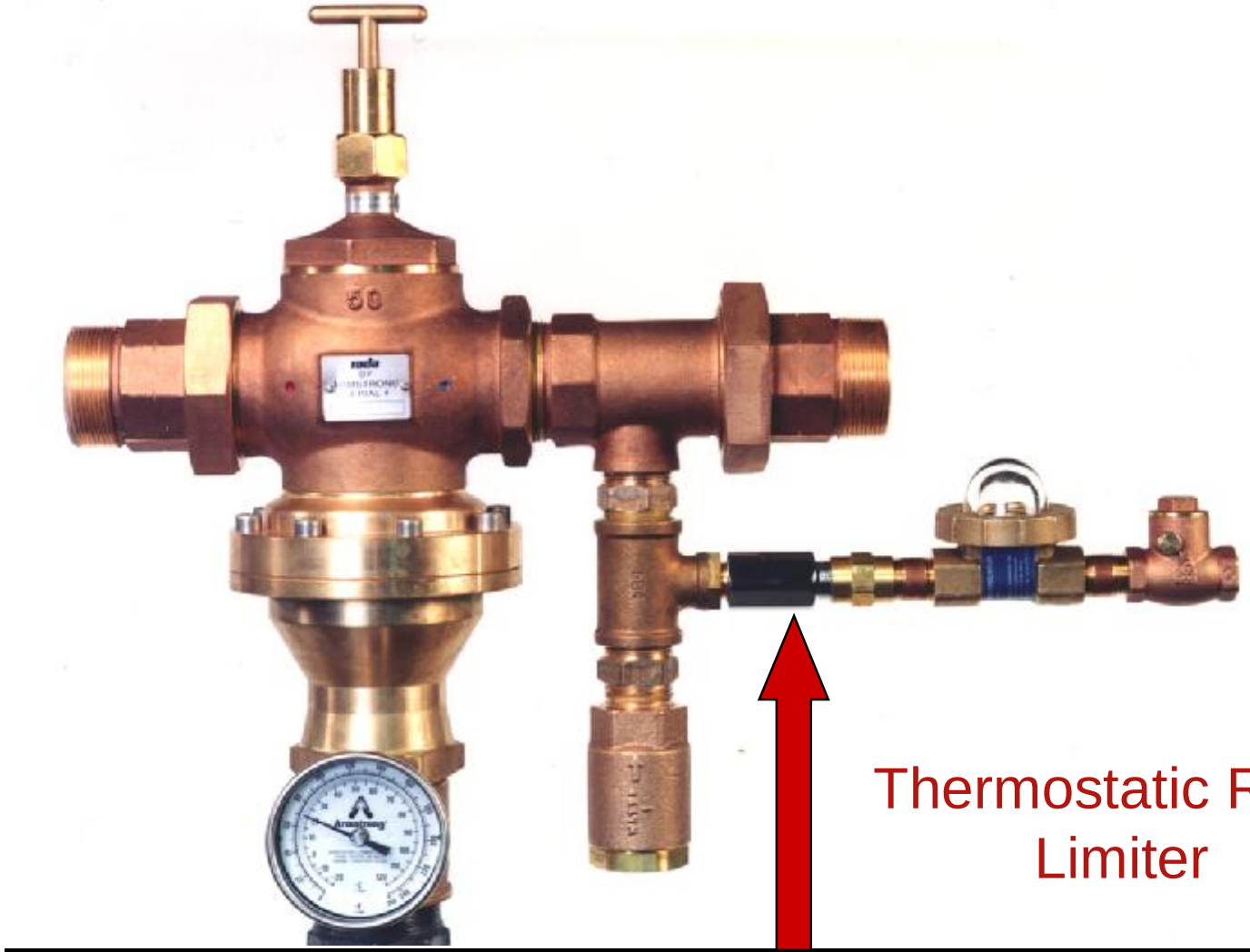
TMV “re-circ” Package



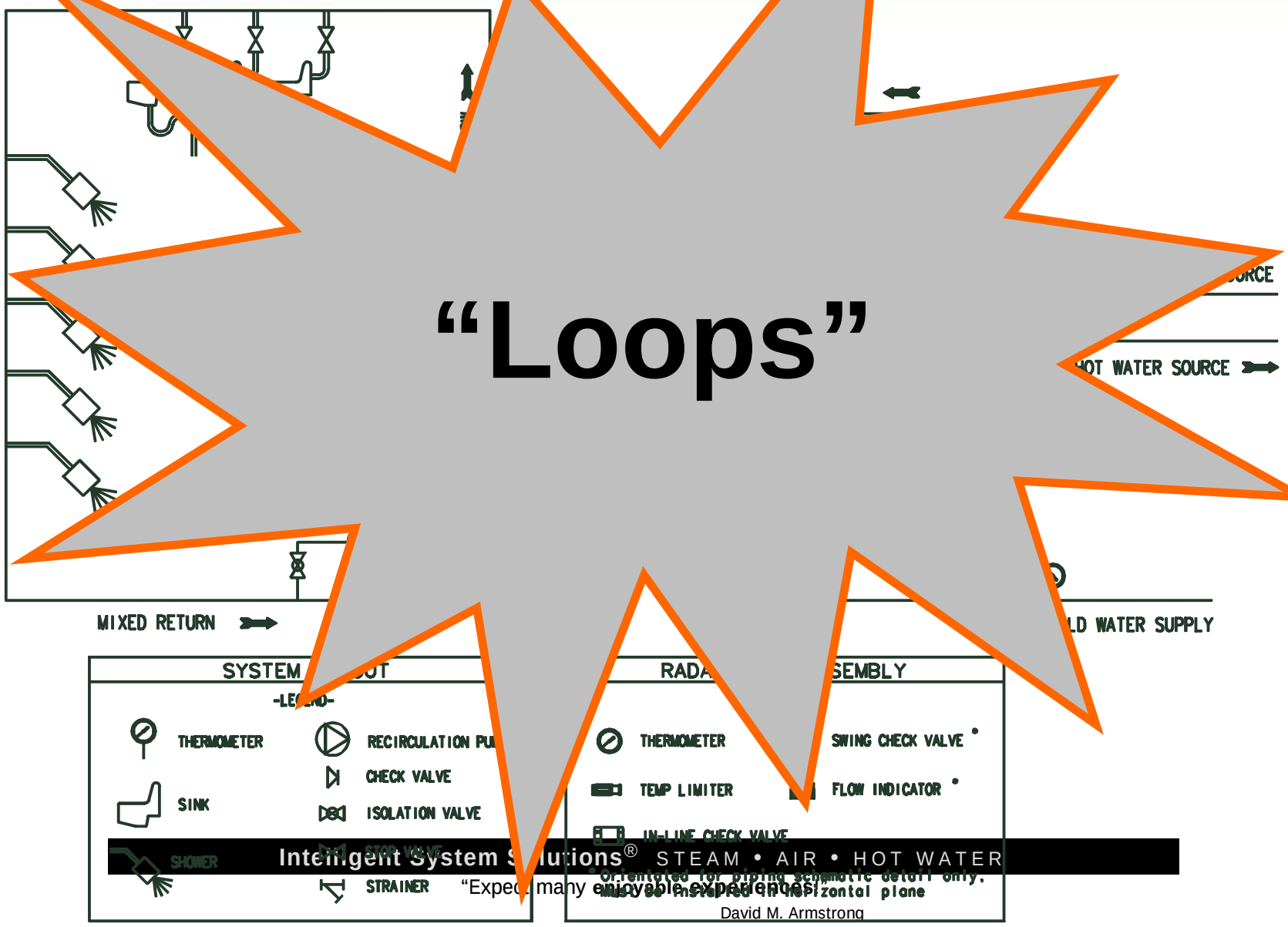
Aqua Stat on Pump

Manual Throttling Valve

Thermostatic Mixing Valve



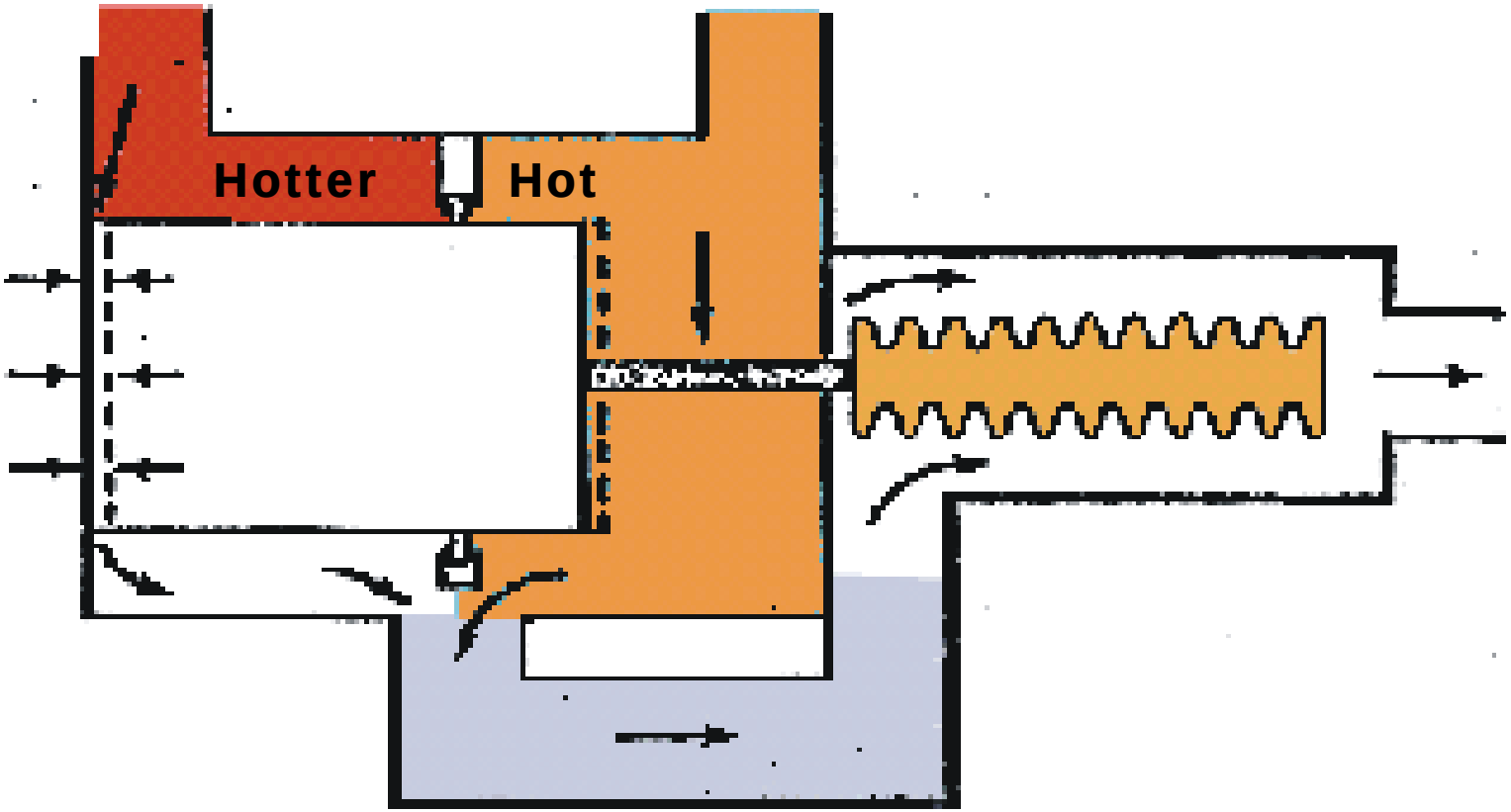
Mixing Valve Applications



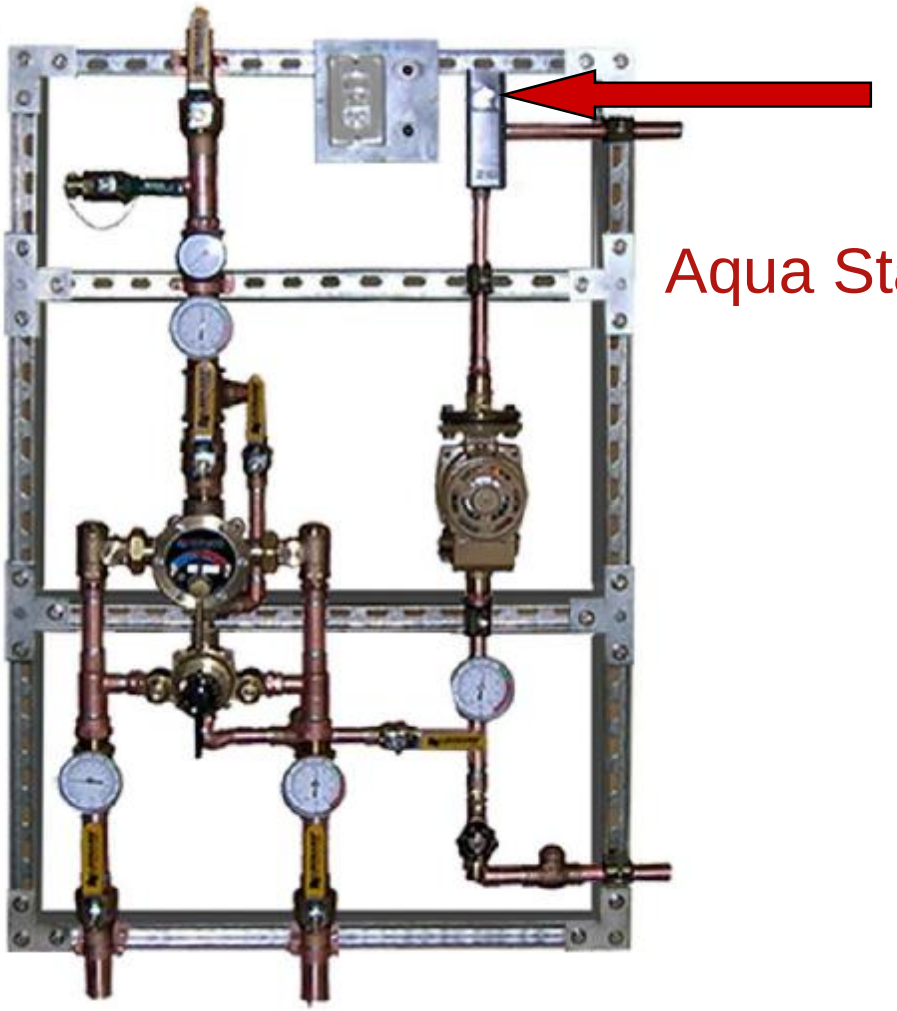
"Loops"

"Expect many enjoyable experiences."
David M. Armstrong

Temperature Creep



TMV “re-circ” Package



Aqua Stat on Pump

The answer points towards “Technology” based solutions such as Digital ReCirculating Valves (DRV’s)

Digital Intelligence

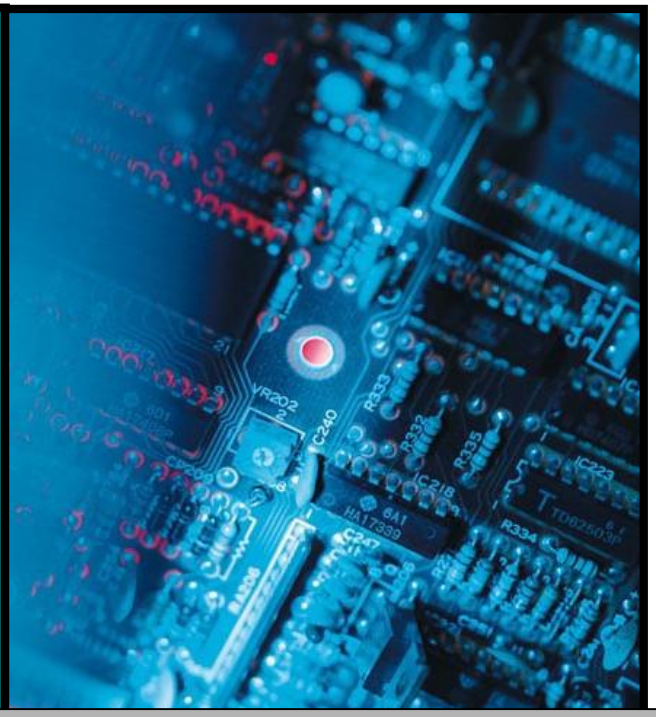
- DRV’s are engineered exclusively for Recirculating Hot Water Systems
- DRV’s think for themselves and talk to the building

Digital Safety & Hygiene

DRV's offer:

- Programmable system safety alerts with integral relays
- Shut off upon inlet supply failure
- Shut off Hot Water upon power failure
- Promote compliance with OSHA & CDC Legionella Guidelines

Digital Stability and Control



DRV's are designed to:

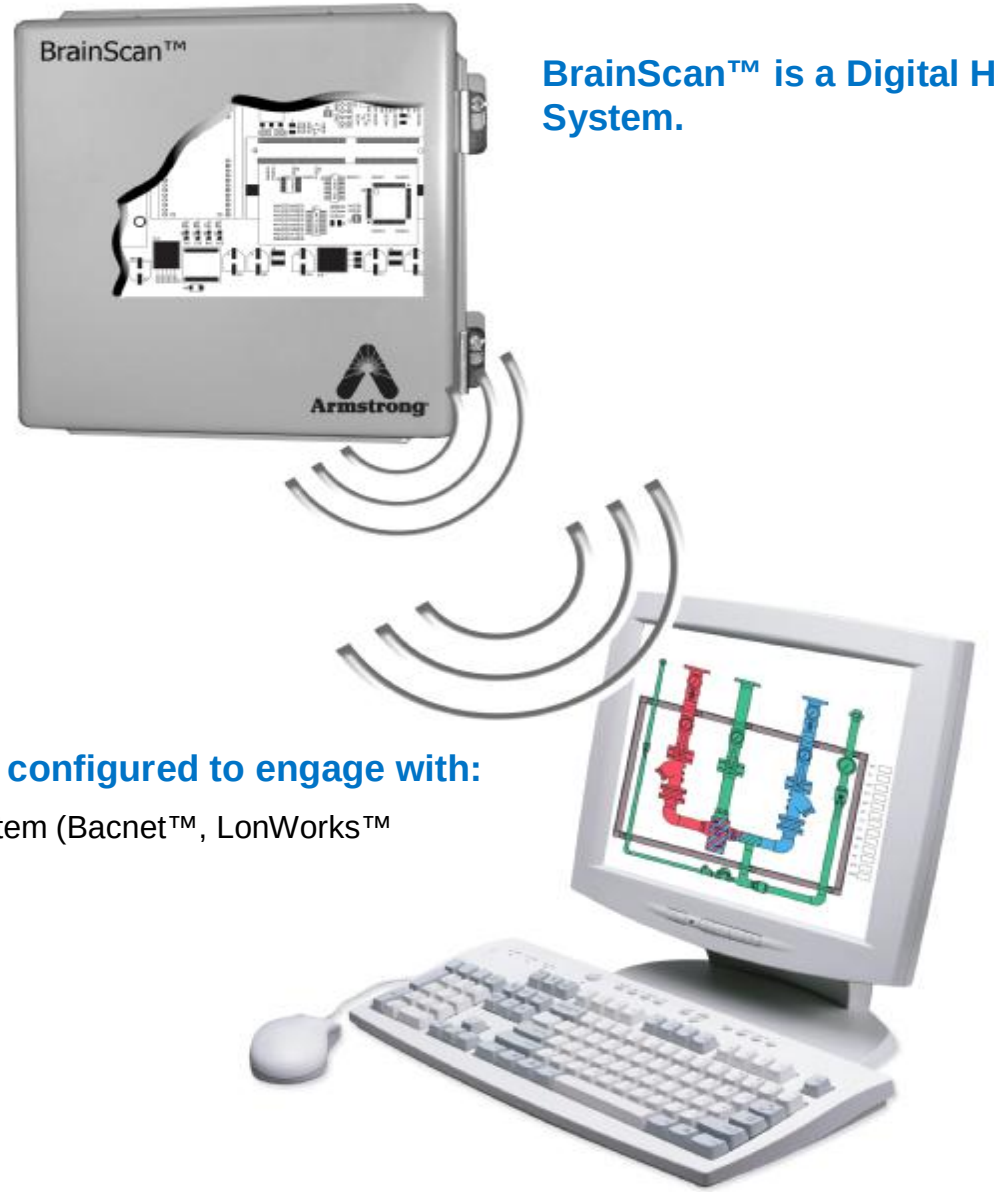
- Deliver a Typical System Temperature Control +/-2°F
- Control system "temperature creep" without supplemental components
- Control at zero system draw-off (0-150 GPM)

Digital Connectivity

DRV’s have integral:

- BAS & LAN interface capability
- Serial Data Ports
- BacNet, Lonworks, Modbus compatible

BAS & Networking - BrainScan™



BrainScan™ is a Digital Hot Water Management System.

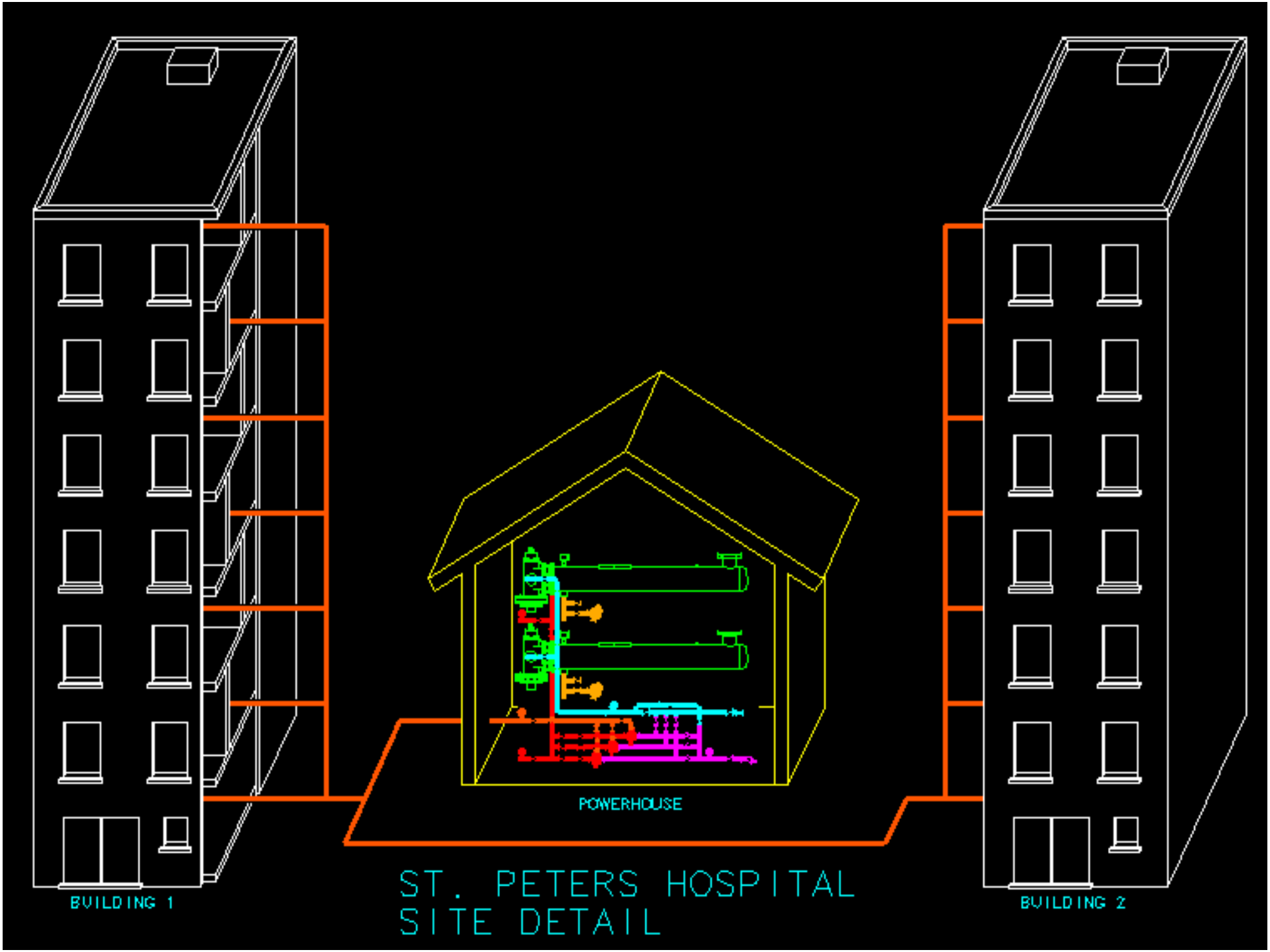
BrainScan™ is factory configured to engage with:

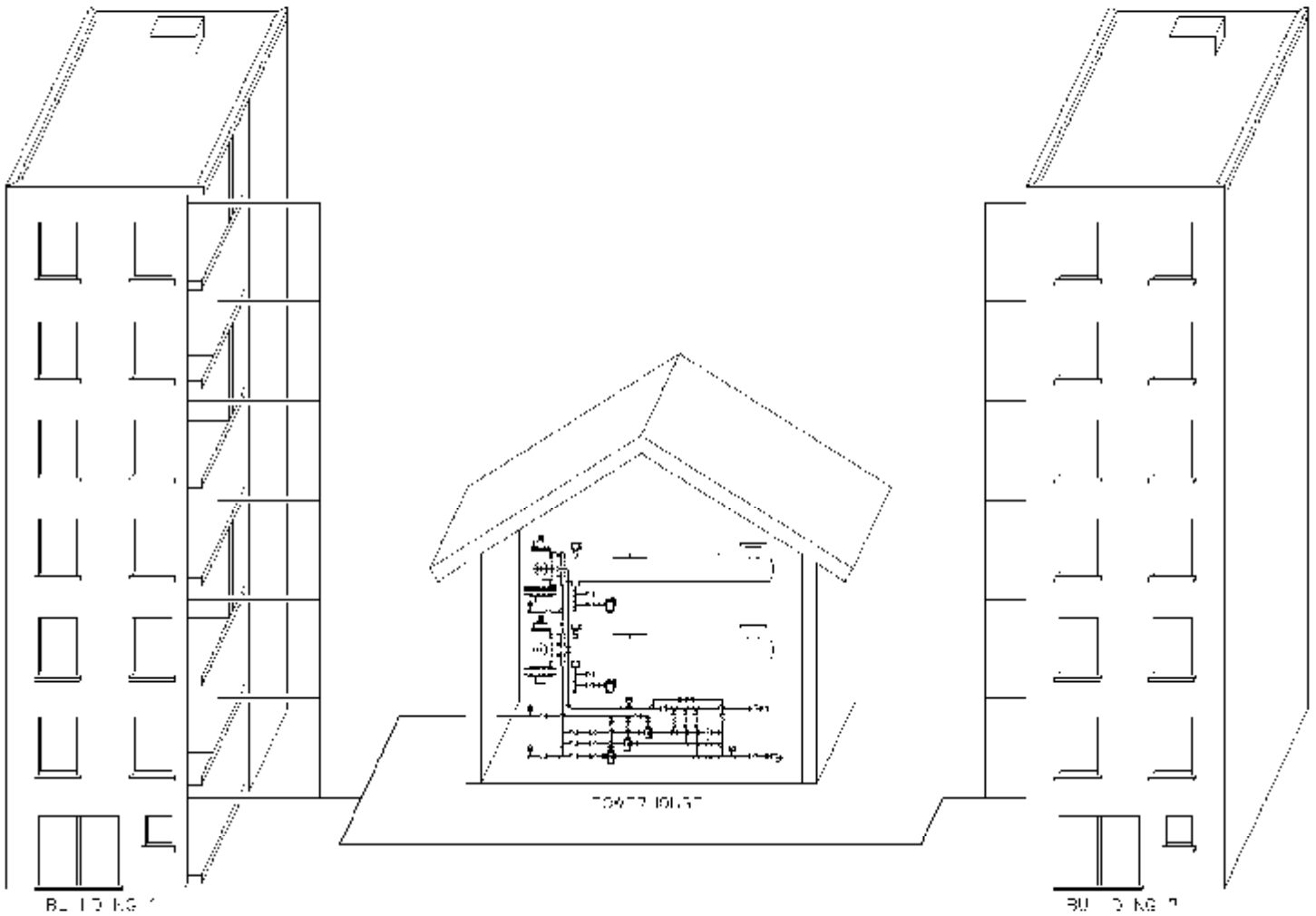
- Building Automation System (Bacnet™, LonWorks™ Modbus)
- Local Area Network
- Internet Service Provider

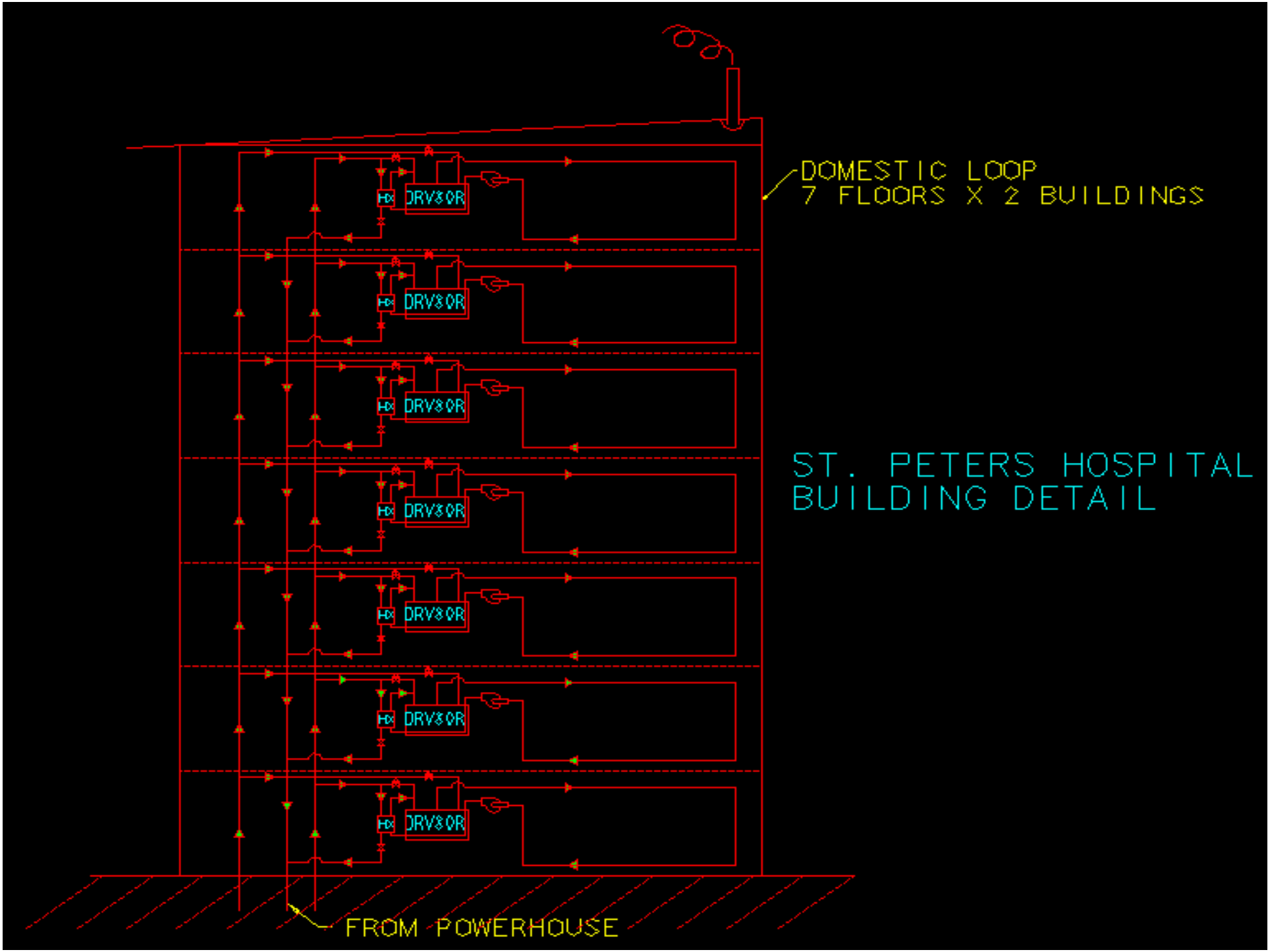
New York State Department of Health Guidelines 7-14-05 Update

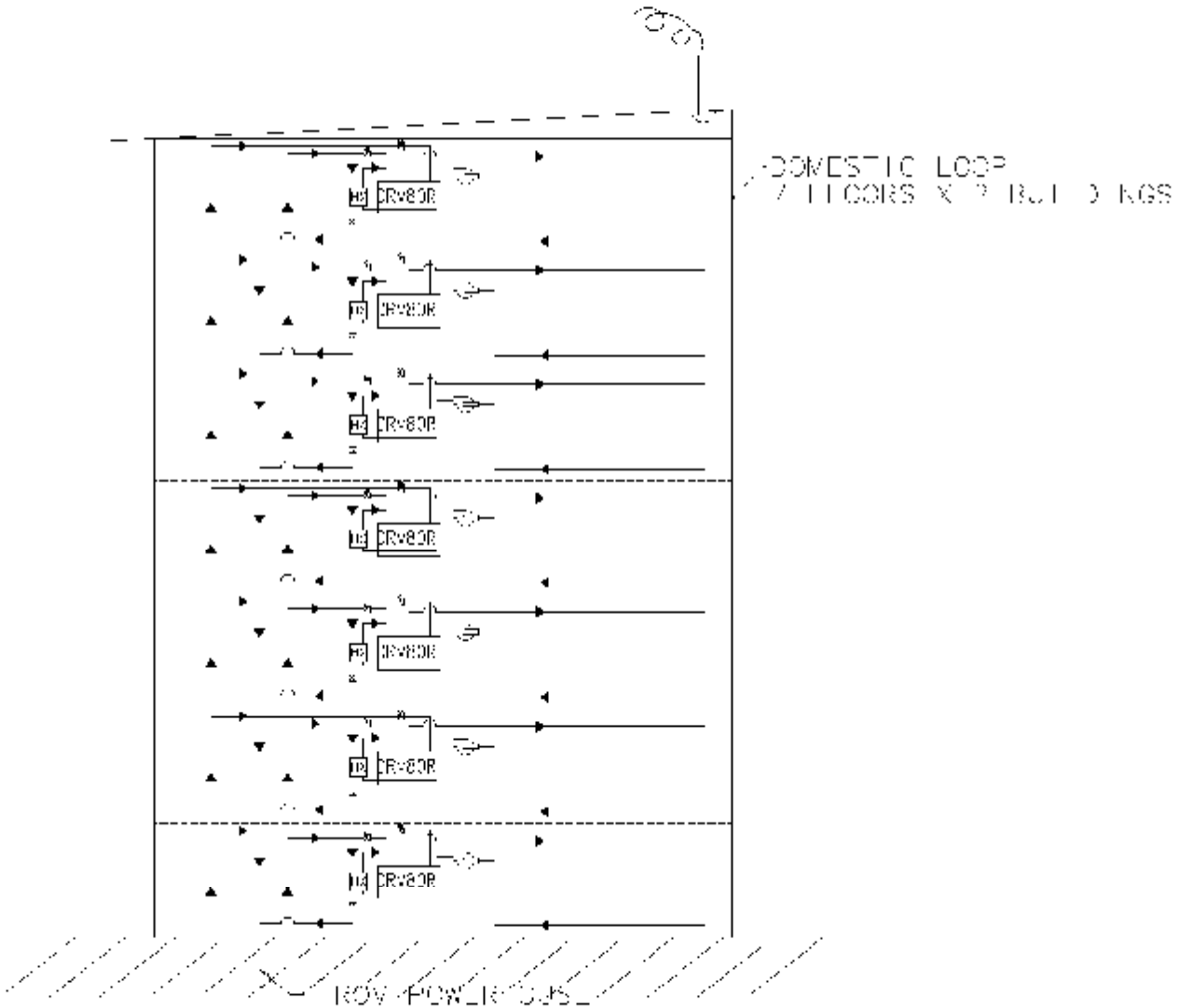
Excerpt

To routinely (e.g., at least semiannually) disinfect a hot water distribution system, each outlet should be flushed for ≥ 5 minutes with water at 160°F – 170°F (71 to 76°C), or with water containing ≥ 2 ppm free chlorine residual.


BUILDING 1
POWERHOUSE
BUILDING 2
ST. PETERS HOSPITAL
SITE DETAIL




DOMESTIC LOOP
7 FLOORS X 2 BUILDINGS
ST. PETERS HOSPITAL
BUILDING DETAIL
DRV&OR
FROM POWERHOUSE


DOMESTIC LOOP
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CRV-60R
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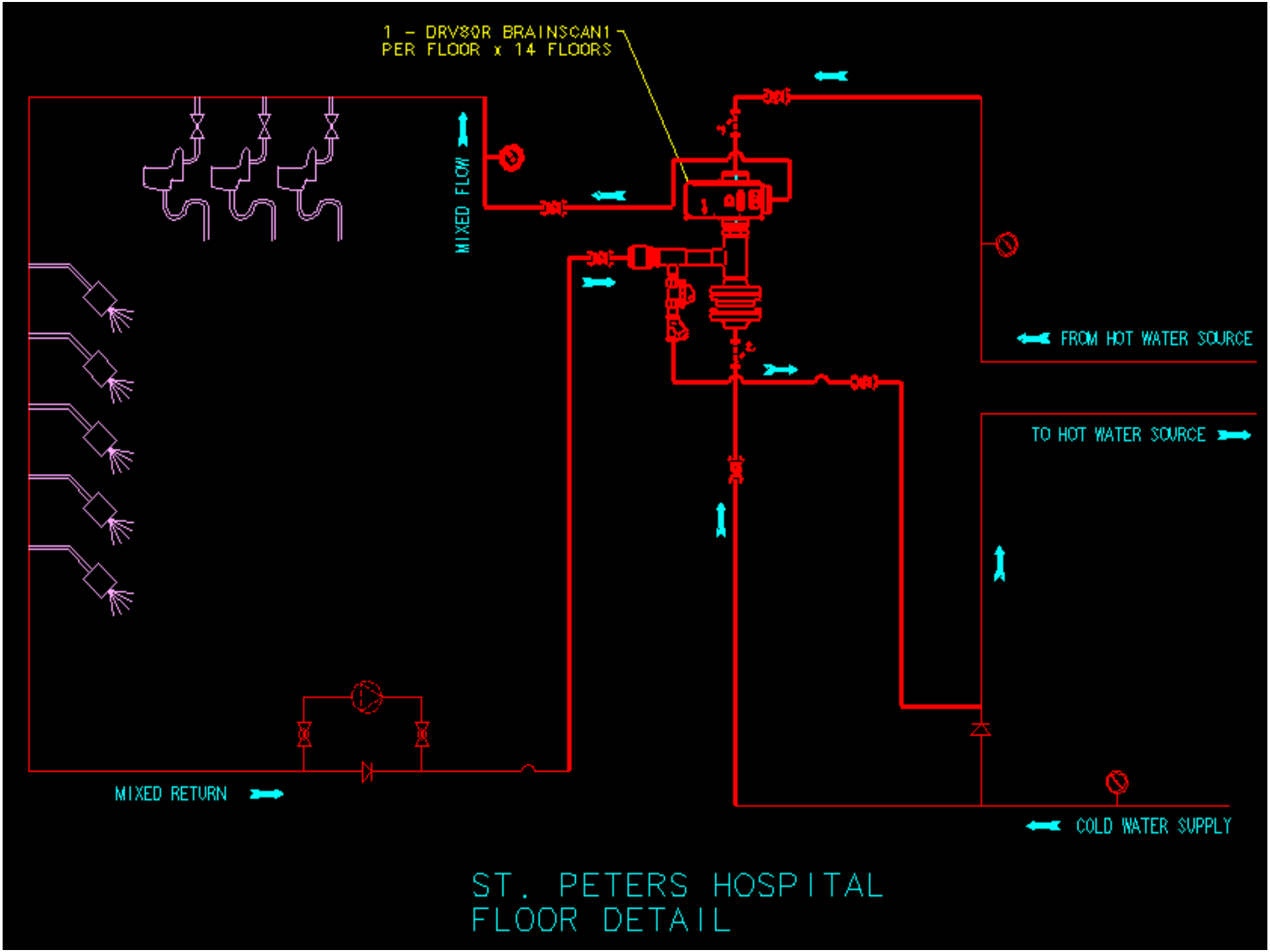
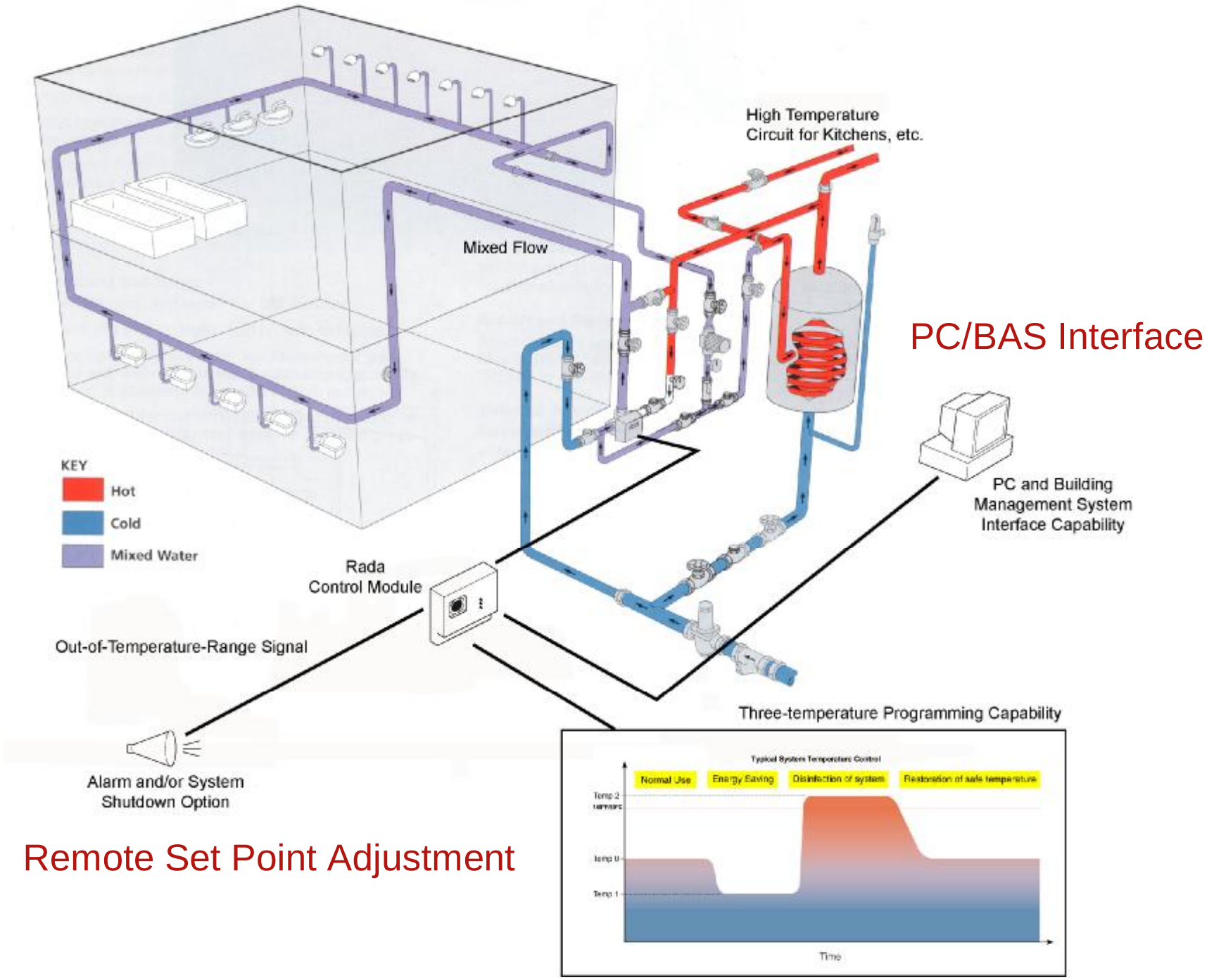
CRV-60R
CRV-60R
CRV-60R


1 - DRV8QR BRAINSCAN1
PER FLOOR x 14 FLOORS
MIXED FLOW
FROM HOT WATER SOURCE
TO HOT WATER SOURCE
MIXED RETURN
COLD WATER SUPPLY
ST. PETERS HOSPITAL
FLOOR DETAIL



Remote Set Point Adjustment

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hotwater@armstronginternational.com