HYDRONIC ZONING SEMINAR

Residential and Light Commercial Applications

Taco®
LEARNING
CENTER

CATALOG 100-4.3

INTRODUCTION

This is a reference text for our seminar on Residential and Light Commercial Hydronic Zoning. While Taco products are used in some cases to illustrate specific examples, this information applies also to products manufactured by other companies. All of the art used in this text is available in overhead and slide formats.

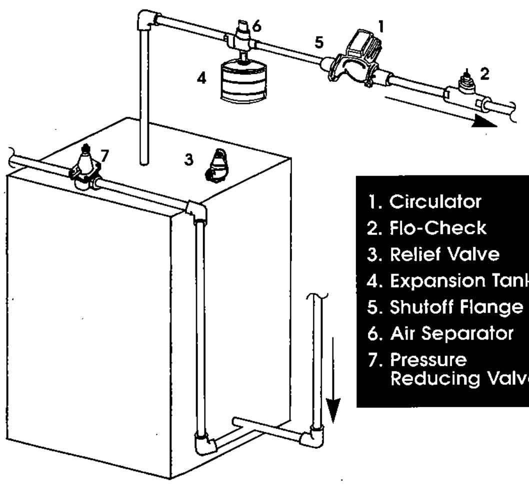
TABLE OF CONTENTS

I. Fundamentals of Hydronic Heating

DEFINITION

In a hydronic heating system, hot water conveys heat to a conditioned space — through piping from a boiler or heat exchanger — to terminal heat transfer units. It is designed to warm a structure to its inside design temperature on the coldest day, replacing heat lost through roofs, walls, floors, windows, doors, etc.

HYDRONIC HEATING



1. Circulator
2. Flo-Check
3. Relief Valve
4. Expansion Tank
5. Shutoff Flange
6. Air Separator
7. Pressure Reducing Valve

BASIC SYSTEM COMPONENTS

BOILER

For residential hydronic heating, the most common hot-water generator is a cast-iron or steel boiler fired by any of the conventional fuels including oil, gas. coal. wood and LP gas.

Cast-iron boilers may be either *wet base,* in which water in the heat exchanger surrounds the combustion chamber; or *dry base,* where the water-filled heat exchanger sits on a base above the combustion chamber.

Steel boilers may be either *fire tube,* in which the combustion gases pass through tubes and the boiler water circulates around them; or *water tube,* where the gases circulate around the tubes and water passes through them.

RELIEF VALVE

The ASME Code requires that each boiler be protected by an ASME-rated relief valve, installed directly into a tapping at or near the top of the boiler. This pressure-operated safety device is designed to open at the set pressure, relieve the pressure on the boiler and prevent further pressure buildup. A typical residential boiler will use a relief valve rated at 30 PSI.

HIGH LIMIT CONTROL

The ASME Code allows a maximum temperature of 250°F for a low-pressure heating vessel. The thermally-activated, high limit control switch opens at a set temperature and interrupts operation of the system. It closes when the water temperature drops 10°- 15°. This safety function may be performed by a separate control, or be included as a function of a multiple-action controller.

EXPANSION TANK

A hydronic heating system is initially filled with cold water to design pressure, usually 12 PSIG for a residential system. An expansion tank provides space for the heated water to expand without creating excessive pressure in the system. A **conventional tank** traps and compresses the air, creating an air cushion which exerts a pressure equal to the fill pressure. A **diaphragm tank** differs in that it is factory precharged to the minimum operating pressure (usually 12 PSIG) and uses it diaphragm to keep system water separate from the air charge.

REDUCING VALVE (FILL VALVE)

A makeup water line is connected to the system to enable system fill and pressurization. A reducing valve is added to this makeup water line to automatically maintain system pressure. When the discharge side of the valve senses a system pressure below the setpoint, it will open until the normal residential system pressure of 12-15 PSI is restored. Both the relief valve and the reducing valve should be connected to the boiler on the expansion tank side, which is the *point of no pressure change.*

Some local codes require a backflow preventer on the makeup water line. A check valve may also be required.

FLOW CONTROL VALVE ("FLO-CHEK")

When the circulator is not operating, a flow control valve prevents gravity flow of hot water into a heating circuit. A heavy disc sits on the valve seat until the circulator starts, which causes the disc to lift and stay open as long as it is running.

AIR VENTS

Either manually-operated key vents or automatic float vents are installed at selected high points to remove trapped air in the circuit. When sufficient air accumulates in the automatic-vent valve body, the float drops and the valve opens to release air. As the air passes out, water again fills the body, raises the float, and closes the valve.

VORTECH™ AIR SEPARATOR

The Vortech Air Separator utilizes a tangential design to create a vortex chamber of swirling water and air which forms a low-pressure area in the center. Since the water flows in a downward direction before exiting, air is quickly and effectively released upward and out through the high capacity 3/4″ Hy-Vent. The Vortech Air Separator does not require 18″ of straight pipe to provide laminar flow for maximum air removal, as does a standard "air scoop." This makes the Vortech ideal for use in high-efficiency, compact installations.

SYSTEM DESIGN & OPERATION

GRAVITY SYSTEMS

In early gravity systems, circulation occurred due to the difference in weight between the supply and return water columns. Large pipe diameters were required to achieve sufficient gravity circulation without a pump.

Since burner operation was thermostat-controlled, water circulation and radiator heat output were continuous once cold weather started. On a call for heat, the burner would heat up a few degrees. During the off cycle, water to the radiator would continue to circulate and gradually cool until output was less than the heat loss in the room — causing the thermostat to call again.

This cycle was such that the boiler was never required to heat water from a relatively cold start to much higher temperatures. Boilers tended to be large, holding large water volumes. Many of these gravity systems have been modernized by replacing the boiler and adding a circulator to speed up response time.

FORCED HYDRONIC SYSTEMS

Today's forced hydronic systems use an electric circulating pump to maintain required flow to terminal units. When hot water is circulated through a piping system to radiators, finned pipe or other terminal heat transfer units, heat is transferred by convection, radiation and conduction from the hot water to the cooler room air. Rate of heat transfer depends on the temperature difference between the heating surface and the room air, the amount of heating surface available in the heat transfer unit, and the water flow rate through the unit. **Baseboard** and **finned tube radiation** are most frequently chosen for residential system design as they enable the blanketing of exposed surfaces for maximum comfort.

In a closed hydronic system, the height of the system piping does not affect the pump head requirement. The energy gain of water dropping down the return piping provides the energy required to raise water up the supply riser. In pump selection for a closed loop system, the only head or resistance of concern is the *friction head*: the pressure drop caused by the water moving through pipe. valves, and fittings.

SYSTEM PIPING

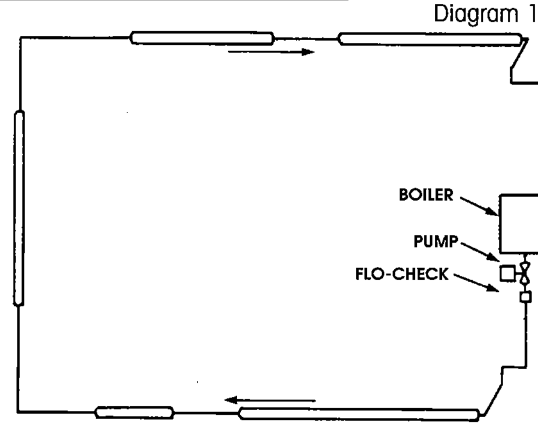
SERIES LOOP SYSTEMS

The piping distribution system most often used in residences and small buildings is the **single-circuit series loop system**. (Diagram 1)

In this system, a single pipe is connected directly into the baseboard. The terminal heating equipment serves as part of the distribution pipe and water flows through each finned tube or other terminal equipment connected in series.

SINGLE CIRCUIT
PIPING DISTRIBUTION SYSTEM

Diagram 1



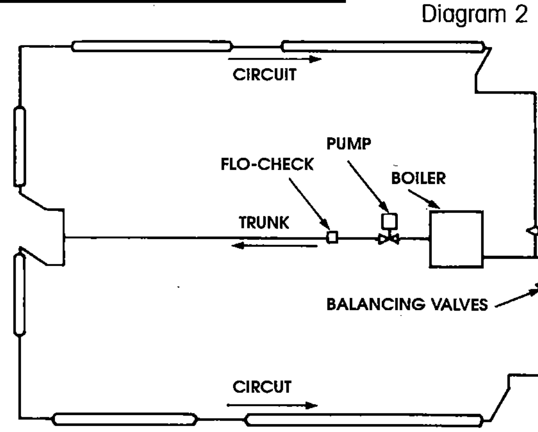
SERIES LOOP BASEBOARD SYSTEM

In **multi-circuit series loop systems**, two or more circuits are used and the water flow is divided into approximately equal flows through each loop. (Diagram 2)

By minimizing the cost of pipe fittings and labor, series loop systems — single or multi-circuit — are the most cost-effective to install.

DOUBLE CIRCUIT
PIPING DISTRIBUTION SYSTEM

Diagram 2



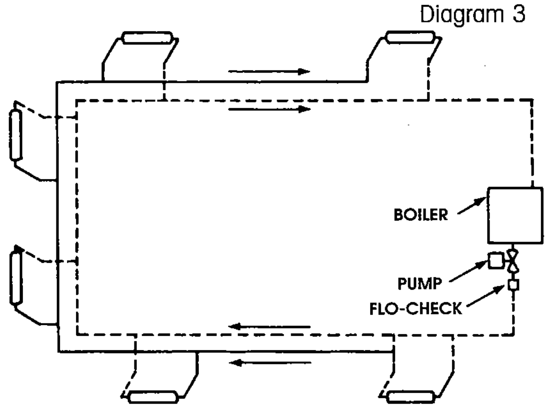
SERIES LOOP BASEBOARD SYSTEM

TWO-PIPE SYSTEMS

The **two-pipe, reverse return** system, used almost exclusively in larger commercial systems, has separate mains for supply and return water. (Diagram 3)

TWO-PIPE REVERSE RETURN
PIPING DISTRIBUTION SYSTEM

Diagram 3



In this system, the first terminal heat transfer unit (in relation to the boiler) taken off the supply main is the last one connected to the return main. Conversely, the last unit of the supply is the first connected to the return. Since the length of flow path is the same for each terminal heat transfer unit, the two-pipe, reverse return system provides a uniform flow and each terminal unit receives its proper share of water.

The **two-pipe direct return** system also has separate mains for supply and return water. (Diagram 4) However, the first terminal heat transfer unit (in relation to the boiler) taken off the supply is also the first connected to the return main. Conversely, the last unit taken off the supply main is the last one connected to the return. Since the water flow path is different for each terminal unit in a two-pipe direct return system, an unbalanced system exists and provisions must be made to balance each supply and return branch.

Note: Two-pipe systems may also be designed with two or more circuits.

RADIANT SYSTEMS

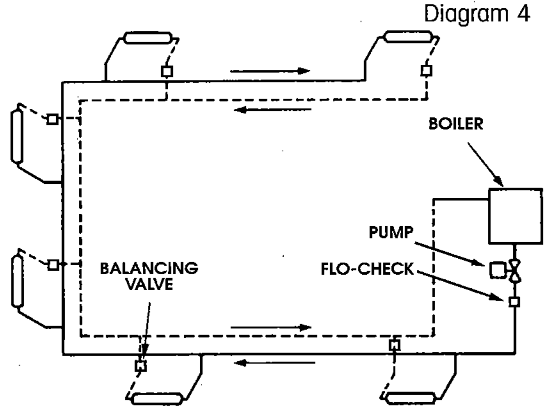
Radiant or panel systems are two-pipe hydronic systems using pex tubing or hoses within the floor or ceiling structure as the heat-distributing units. These systems utilize a supply and return header where all of the heating coils are brought together.

Radiant tubing in the slab, or stapled up under flooring, are the most widely used methods of providing energy-efficient, comfortable heating for living spaces.
An increasingly popular choice, radiant systems are also an effective solution for snow-melt applications.

Floor temperature should be a maximum of 85°F to maintain a comfort level. As temperatures can vary from 110°F to 160°F, depending on floor-covering material, a means of mixing boiler water with system return water must be installed. Almost all radiant manufacturers offer computer software to help ensure correct system design.

TWO-PIPE DIRECT RETURN
PIPING DISTRIBUTION SYSTEM

Diagram 4



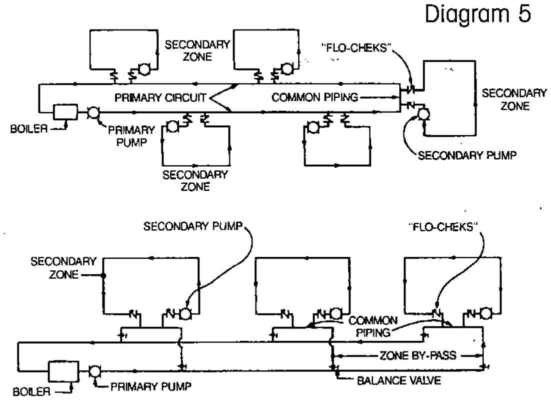
PRIMARY-SECONDARY SYSTEM

For larger systems requiring zone control, the primary-secondary pumping system is sometimes utilized. Here, a primary distribution system and one or more secondary pumps circulate water from the primary circuit throughout the secondary zones. (Diagram 5)

The connection between primary and secondary circuits is such that the pressure drop in the piping common to both is eliminated — and neither pump can cause flow in the other circuit. To prevent the small flow which could be induced by a slight pressure-drop in the common piping connection, Flo-Chek valves are installed in the secondary zone supply and return piping.

PRIMARY-SECONDARY
PIPING DISTRIBUTION SYSTEMS

Diagram 5



LOCATION OF SYSTEM COMPONENTS

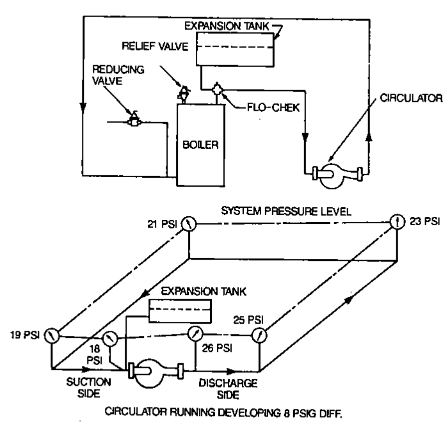
The basic component parts of a forced hot water heating system — particularly the pump, relief and reducing valves, and expansion tank — have important relationships to one another in a properly functioning hydronic heating system. Improper location of these basic components can lead to undesirable effects, including pump cavitation and the production of minus pressure in the system.

The pressure in the expansion tank is a constant pressure, if there is no temperature change. It is not influenced by pump operation and the junction of the tank with the system is a point of no pressure change, whether or not the pump is operating.

With a **tank on the suction side** of the pump, the pump suction pressure is unchanged when running, and the pump head appears as an increase of pressure on the system. (Diagram 6)

POINT-OF-NO PRESSURE CHANGE
EXPANSION TANK ON SUCTION SIDE

Diagram 6



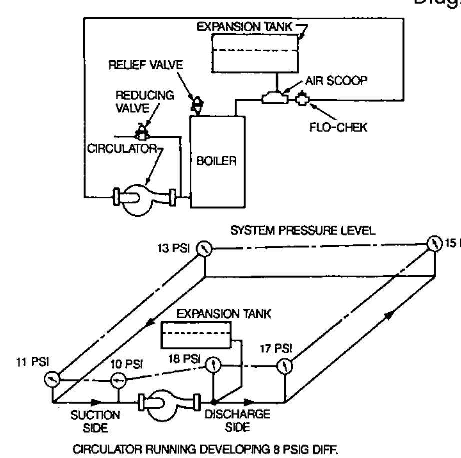
With a **tank on the discharge side** of the pump, the pump pressure is unchanged at that point when running, and the pump head appears as a decrease in pressure at the pump suction and on the system. (Diagram 7)

Under some conditions, negative pressure is developed. This can cause pump cavitation and additional problems with air that may be taken into the system. In a commercial system, it is always best to pump away from the boiler and expansion tank. For residential and light commercial applications, pressure heads are usually low enough to be disregarded and pump location is not critical. However, pump location can reduce air problems in the system and reduce return service calls.

Both the relief and reducing valves should be connected to the boiler on the expansion tank side, the point of no pressure change.

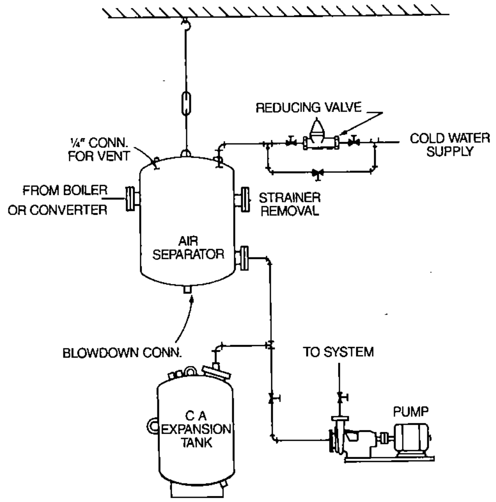
POINT-OF-NO PRESSURE CHANGE
EXPANSION TANK ON DISCHARGE SIDE

Diagram 7



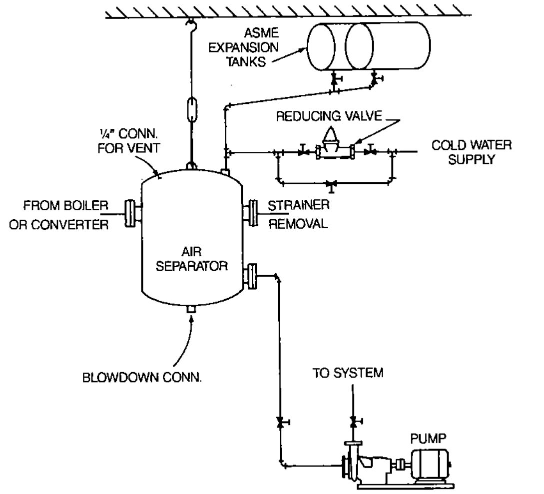
BLADDER-TYPE EXPANSION TANK
RECOMMENDED COMMERCIAL DESIGN

Diagram 8



CONVENTIONAL EXPANSION TANK
RECOMMENDED COMMERCIAL DESIGN

Diagram 9



DETERMINING LOAD REQUIREMENTS

HEAT LOSS

Heat loss calculations should be made when sizing new hydronic systems. These calculations will be used to size boilers, pipe diameters and baseboard lengths; to determine radiation capacities; and to select pumps.

DETERMINING FLOW RATES IN ZONES AND SYSTEMS

$$\frac{\text{Net BTUH Load}}{10{,}000} = \text{Flow Rate (in GPM)}$$

EXAMPLE: $\frac{\text{100,000 BTUH Boiler}}{10{,}000} = \text{10 GPM}$

60	x	8.33	x	ΔT (20)	+	specific weight	+	specific gravity	=	9998
min/hr		lbs/gal		temp diff		1 for H2O		1 for H2O		

PUMP HEAD SELECTION

Pump head and trunk pipe size can be determined by applying the GPM requirement and total circuit length to a sizing table. Once head pressure has been determined, pump selection is accomplished by 1) entering the manufacturer's pump curve at the total GPM of the system: and 2) selecting a pump with a head pressure equal to, or greater than, the highest head pressure required. Taco provides a quick pump-selection method for residential systems using zone valves. Applying the BTU/h heat losses to the Taco Selection Graph will provide the circulator model, trunk pipe size and the pipe sizes for each zone.

STEPS FOR SELECTING PUMP HEAD:

1. Measure the longest run in feet
   In a closed system, measure from the boiler to the farthest piece of radiation and back to the boiler.
2. Add 50% to allow for elbows and fittings
3. Multiply by .04

EXAMPLE:

100′ longest run + 50% = 150′ x .04 = 6′
Circulator needed: 10 GPM @ 6′ head

II. Fundamentals of Zoning

DEFINITION

A zone can be thought of as any room, group of rooms, section or floor of a building in which the temperature is intended to be controlled separately. Zoning helps deliver the required amount of heating or cooling to the proper space. This provides occupants with the ability to maintain different temperature settings in different rooms and levels.

BENEFITS OF ZONING

Continuing trends in modern residential construction have upset the interior comfort level of a single-zone heating system: expansive multi-level designs with large window areas, fireplaces, sliding glass doors, increased use of insulation in walls and ceilings, etc. Zoning compensates for the varying heat-loss requirements, while minimizing the effects of sun and wind on structures with variable exposure conditions and internal load.

Zoning improves temperature balance between rooms while helping to compensate for errors made in system design or installation. It also provides efficient operation and reduced fuel consumption by preventing overheating, and by permitting reduced temperatures in unoccupied areas. In both residential and commercial applications, zoning is the key to control — and the key to saving energy.

WHEN TO ZONE

While almost every home built today can benefit from zoning, it is more critical for larger structures. Types of buildings that should always be zoned include:

- Buildings with variable conditions of construction, such as large window areas, sliding glass doors exposed to the sun, variations in exterior wall composition, etc.
- Buildings with occupancy requirements that change over time, or from unit to unit.
- Buildings using systems designed for multiple types of radiation or multiple water temperatures.
- Multi-level residences that need to prevent overheating of the upper levels and/or cool, drafty conditions in the lower level.
- Commercial structures such as motels, nursing homes and hospitals, where it's essentialy to control each room separately.

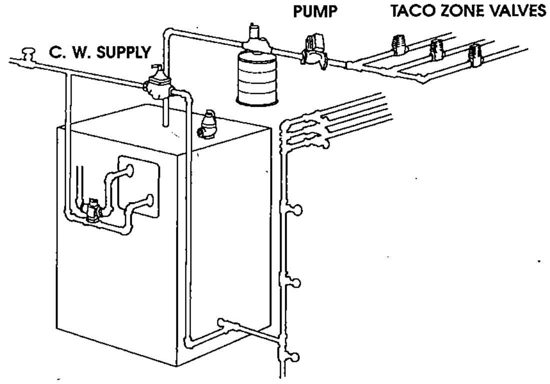
III. Zoning with Electric Valves

INTRODUCTION

The most widely-used method of residential zoning, an electric zone valve system provide an installed cost advantage compared to multiple circulators. Since zone valves eliminate the need for a Flo-Chek and relay on each zone, and system piping is simplified, a single circulator can supply many valves. (Diagram 10)

ZONING WITH ELECTRIC ZONE VALVES

Diagram 10



SYSTEM DESIGN AND OPERATION

The flow of water through each zone is controlled by a thermostat connected to each valve. In most residential systems, the single circulator is also connected to this circuit and operates whenever one or more thermostats call for heat. Taco zone valves accomplish this with an end-switch that permits the valve in each zone to operate the circulator relay.

Proper location of zone valves depends on system size and type. In a series loop residential system, the zone valves can be located either on the supply or the return side of the boiler. In a two-pipe commercial zoned system, the valves are placed out at the radiation-unit supply or return.

THERMOSTATS

HEAT ANTICIPATION

Thermostats usually have a heat anticipation device that adjusts for the operating differential of the system. The anticipator is a resistance heater, near the bi-metal element in the thermostat, which heats up when the thermostat contacts are closed. By raising the bi-metal element temperature slightly faster than the surrounding area temperature, it causes the thermostat to shut off the heating system sooner than if it depended on room air temperature alone. In this way, it "anticipates" the need to shut off the system.

Without an anticipator, the bi-metal element temperature would lag behind the room air temperature, and an objectionable temperature override could occur. Most low-voltage thermostats have adjustable anticipation, so the heater can be matched closely to the exact current draw of the equipment being controlled.

PROPER LOCATION

For best results, thermostats should be on an inside wall, at least four feet above the floor. Thermostats should never be located where they can be affected by direct heat/cold or poor air circulation.

TRANSFORMERS

Transformers do not use or create power: they simply transfer energy. A transformer consists of two coils in close proximity to one another so that current is induced from the powered (primary) coil to the secondary coil connected to a load.

The ratio of the number of primary turns or windings to the number of secondary turns will determine the type and rating of a transformer. A transformer having fewer secondary turns than primary turns will reduce voltage and is called a **step-down transformer**.

Since zone valves for residential single-family applications are rated at 24 volts, a step-down transformer rated at 115/24V-40 VA is used to reduce line voltage to low control circuit voltage. The Taco 569 Step-Down Transformer is suitable for a maximum of three Taco zone valves.

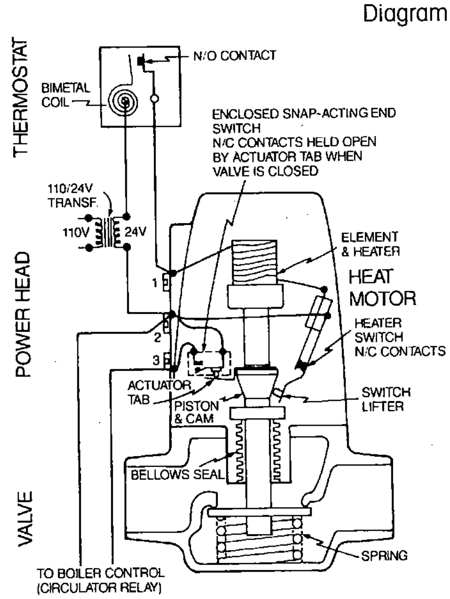
Note: Low-voltage transformers are often referred to as "Class 2" transformers, since low-voltage control circuits are referred to by the NEC as Class 2 circuits.

TACO ZONE VALVE OPERATION AND WIRING

For current models with a snap-action end switch; 560 & 570 Zone Valves; and GT Series Valves.

TACO ZONE VALVE CUTAWAY
WITH SNAP-ACTION END SWITCH

Diagram 11



As the air temperature at a zone's thermostat drops to the desired setting, the thermostat's contacts will close. The circuit between the thermostat, the zone valve transformer, and the heat motor of the zone valve power head is now complete. Current now flows to the resistance heater wrapped around the heat motor element in the power head. The heater is in series with the normally closed contacts of the heater switch between terminals #1 and #2 of the power head.

As the expandable substance inside the element is heated, it pushes the element's piston down against the valve stem. Since the valve is an upside-down globe valve, this downward push on its stem opens the valves by moving the valve disc away from its seat. The conical cam at the end of the piston, and the tab just above it, actuate the switches.

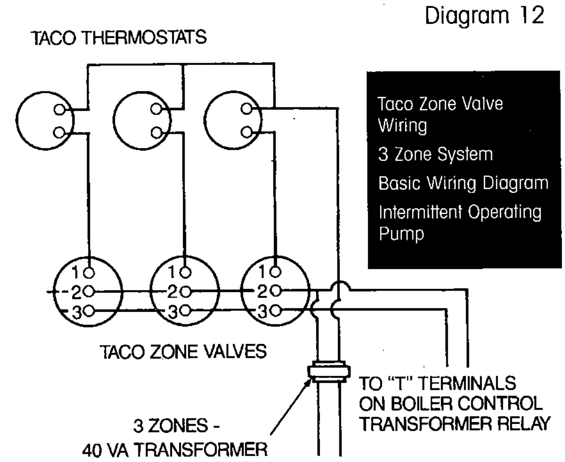
As the piston moves down, the contacts inside the enclosed snap-action endswitch close as the tub on the piston moves away from the switch. In a typical residential heating system, this completes the circuit through terminals #2 and #3 of the power head to the boiler control (with its relay and separate transformer). The relay in the boiler control starts the circulator. The piston continues to move down until the valve is fully open.

An interruption of current to the power-unit heater occurs in the "fully open" mode, as the deflection of the outer blade of the heater switch causes the heater contacts to open. As the piston retracts slightly, the heater contacts connect again. This slight back-and-forth motion is repeated as long as the thermostats are closed.

When the thermostat is satisfied, its contacts open and cut off current to the power head heater. The element cools, the expandable substance contracts, and the force of the valve closing spring moves the valve disc up against the valve seat. The valve stem also moves up, pushing the piston back up into the power head element to the "cold" position. Now the heater switch contacts are closed, and the snap-action end switch contacts between terminals #2 and #3 are open.
The valve will stay closed until the thermostat calls again for heat.

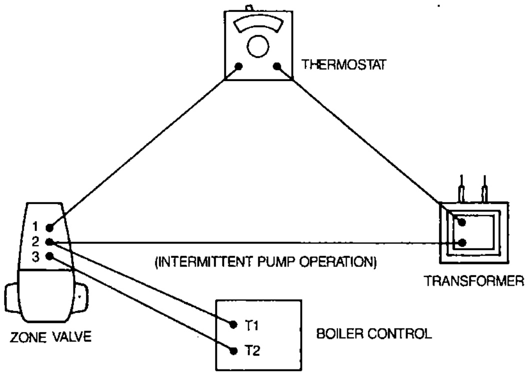
3-ZONE SYSTEM/BASIC WIRING
INTERMITTENT OPERATING PUMP

Diagram 12



SIMPLIFIED DIAGRAM
TACO WIRING

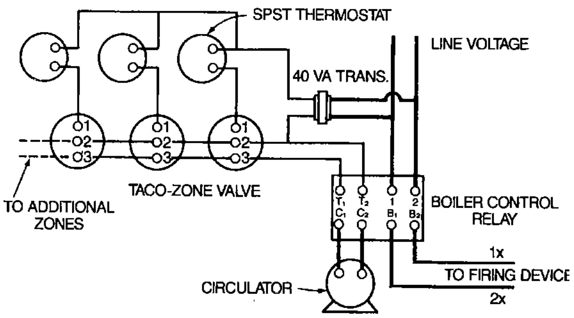
Diagram 13



The wiring diagram for additional TACO zone valves with an intermittent pump is shown in diagram 13.

COMPLETE SYSTEM
TACO WIRING

Diagram 15



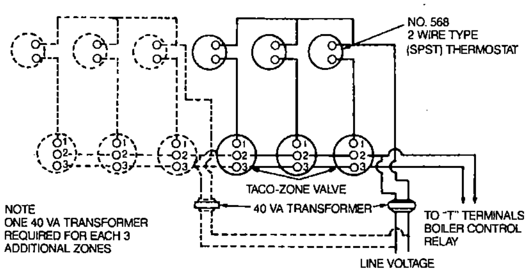
TACO-ZONE WIRING DIAGRAM SHOWING TRIPLE FUNCTION HIGH & LOW LIMIT, CIRCULATORS & BURNER CONTROL RELAY FOR FORCED HOT WATER HEAT WITH DOMISTIC HOT WATER. GAS OR OIL FIRED BOILERS.

The circuit between terminals #2 and #3 is electrically independent of the valve operating circuit between terminals #1 and #2. The two circuits do not interfere with each other at any time.

ADDITIONAL ZONES
TACO WIRING

Diagram 14

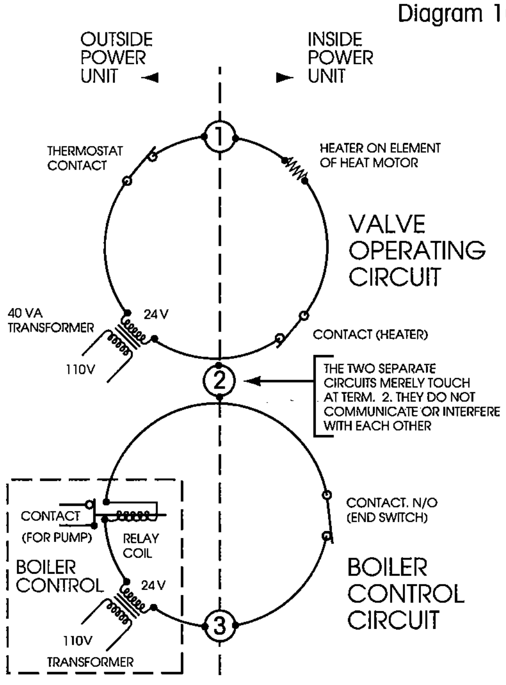
BASIC TACO-ZONE WIRING DIAGRAM FOR 3 ZONES
(DOTTED LINES SHOW NECESSARY WIRING FOR 3 ADDITIONAL ZONES)



NOTE EACH TACO-ZONE VALVE IS RATED AT 0.9 AMPS AT 24 VOLTS. A MAX OF 3 VALVES REPRESENTS AN INTERMITTENT LOAD WHICH CAN BE ADEQUATELT CARRIED BY ONE 40 VA CONT. DUTY TRANSFORMER

3-TERMINAL CIRCUITRY
TACO WIRING

Diagram 16



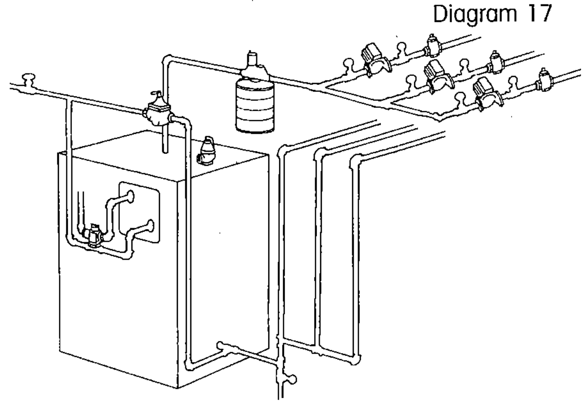
IV. Zoning with Circulators

DESIGN AND OPERATION

In systems zoned with circulators, each thermostat controls its own circulator. Therefore, each circulator serves a dual function: acting both as a circulator and as a control for its zone. To prevent flow of heated water through non-operating zones, a Flo-Chek must be installed in each zone.

ZONING WITH CIRCULATORS

Diagram 17



In residential systems using circulators with less than 12 feet of shutoff head, circulator location is not critical. However in a commercial system, it is always best to pump away from the boiler and expansion tank.

TABLE 1
PIPE SIZING CHART

NOMINAL PIPE OR TUBING SIZE IN..	MINIMUM GPM	VELOCITY FT./SEC.	MAXIMUM GPM	VELOCITY FT./SEC.
STEEL PIPE				
1/2"	—	—	1.8	1.9
3/4"	1.8	1.1	4.0	2.4
1"	4.0	1.5	7.2	2.7
1-1/4"	7.2	1.6	16.0	3.5
1-1/2"	14.0	2.2	23.0	3.7
2"	23.0	2.3	45.0	4.6
2-1/2"	40.0	2.7	70.0	4.7
3"	70.0	3.0	120.0	5.2
3-1/2"	100.0	3.2	170.0	5.4
4"	140.0	3.5	230.0	5.8
5"	230.0	3.7	400.0	6.4
6"	350.0	3.8	610.0	6.6
8"	600.0	3.8	1200.0	7.6
10"	1000.0	4.1	1800.0	7.4
12"	1500.0	4.3	2800.0	8.1
COPPER TUBING				
1/2"	—	—	1.5	2.1
3/4"	1.5	1.0	3.5	2.3
1"	3.5	1.4	7.5	3.0
1-1/4"	7.0	1.9	13.0	3.5
1-1/2"	12.0	2.1	20.0	3.6
2"	20.0	2.1	40.0	4.1
2-1/2"	40.0	2.7	75.0	5.1
3"	65.0	3.0	110.0	5.2
3-1/2"	90.0	3.1	150.0	5.2
4"	130.0	3.5	210.0	5.6

DESIGN CONSIDERATIONS

If a system has more than two zones, the installed cost is higher for circulator-zoned systems than for those designed with zone valves. This results from the need for a Flo-Chek and relay for each circulator, along with the higher cost of circulators versus zone valves. However, some installers prefer using circulators — since multiple circulators reduce the chance of complete system failure while providing faster recovery.

CIRCULATOR SELECTION

Heat loss, GPM and pump head requirements can be determined as outlined earlier in the Hydronic Fundamentals Section.

For TACO circulator selection when zoning with circulators, use Table I below. Based on the IBR Installation Guide for Residential Hydronic Systems, Table I indicates that the 005 and 007 models are more than adequate for residential and light commercial zoning.

TABLE 2
CIRCULATOR SELECTION WHEN ZONING WITH CIRCULATORS

PIPE SIZE	GPM	BTU/H	PUMP (20° DROP)	MAX. ALLOWABLE LOOP LENGTH (FT)
1/2"	1.5	15,000	005	240
			007	240
1/2"	2.0	20,000	005	120
			007	130
1/2"	2.5	25,000	005	80
			007	90
3/4"	3.0	30,000	005	240
			007	280
3/4"	3.5	35,000	005	180
			007	200
3/4"	4.0	40,000	005	130
			007	150
1"	5.5	55,000	005	260
			007	300
1"	6.5	65,000	005	160
			007	190
1"	7.5	75,000	005	120
			007	140
1"	8.0	80,000	005	100
			007	110

PRIORITY ZONING

BASICS OF OPERATION

With Taco Priority Zoning "00" Circulators, an installer can choose a zone that requires the most priority. When activated, all other zones are turned off and only the prioritized circulator will run. This allows the installer to ensure adequate heating levels in a crucial area, and/or to compensate for an imbalance in system distribution.

When its thermostat calls for heat, the prioritized circulator turns "on" and turns any non-priority circulators to "off." The dry contact switch to the boiler controls then closes, allowing the boiler to operate.

Taco Priority Zoning Circulators combine the reliability of the "00" Circulator with the convenience and efficiency of a PC board-mounted, switching relay. A single, modular PC board plugs into all Taco "00" circulators. Each unit is equipped with a priority switch mounted directly on the board, along with a green LED light that indicates when the circulator is "on."

APPLICATIONS

While fully compatible with digital thermostats, Taco Priority Zoning Circulators can be used in conjunction with traditional circulators or zone valves. Some of the most common applications for priority zoning are:

- Indirect hot water heaters
- Zone add-ons to existing heating systems
- Zoning with circulators
- Prioritizing of undersized zones that never come up for heat

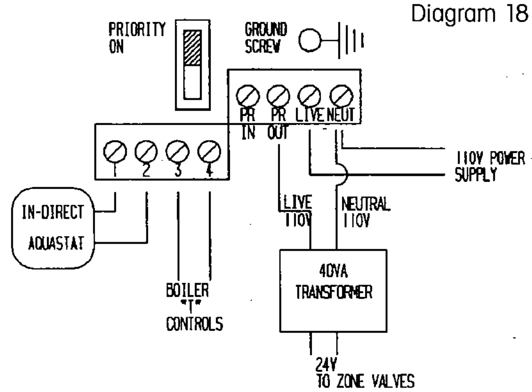
WIRING

Since all switching components are soldered to a single PC board, Taco Priority Zoning Circulators are both simple and quick to install.

There are no complex controls or remote relay box to wire — all wiring is done from one circulator to the next. Both low-voltage and high-voltage terminal strips are provided for electrical hookup. All electrical connection are clearly identified on the PC board legend.

WIRING A PRIORITY CIRCULATOR

Diagram 18

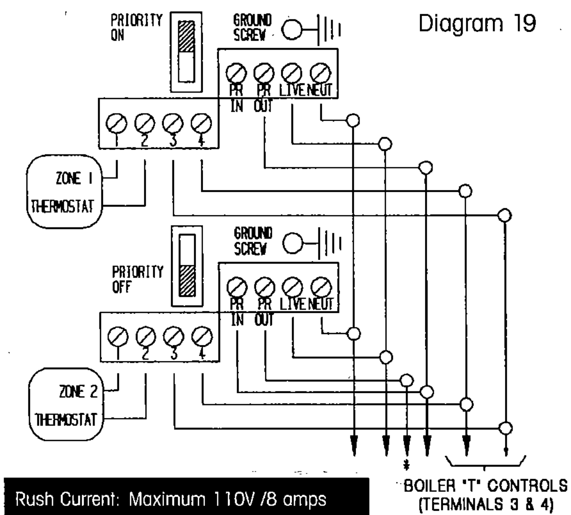


With Zone Valves
Rush Current: Maximum 110V /8 amps
Zone Valves: Maximum of three .9 amp units
Transformers: Maximum of two 40VA/110V with maximum draw of .9 amps per zone valve

The switch on the priority circulator is set to the ON position, while all non-priority circulators are set to OFF. A maximum of one priority "00" circulator and three non-priority "00" circulators may be connected in sequence.

MULTIPLE PRIORITY CIRCULATOR

Diagram 19

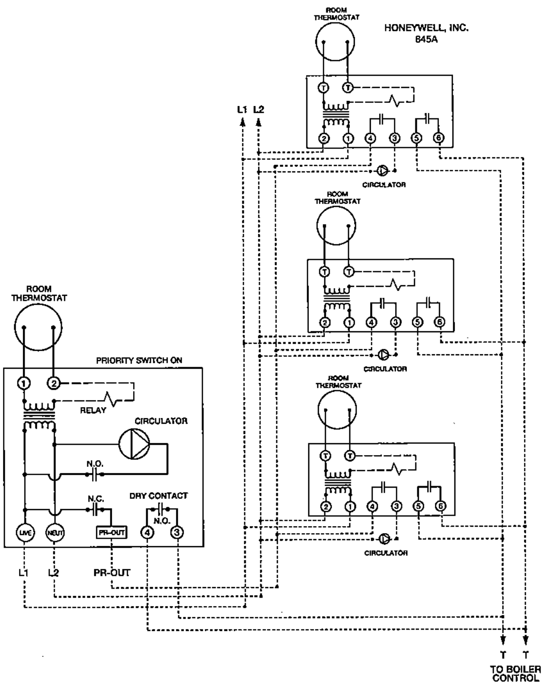


Rush Current: Maximum 110V /8 amps
Zones: Maximum of four zones, with one zone set for priority

Note: Priority Zoning PC boards are available on the 005, 006, 007 and 008 circulators. Each Priority Zoning Circulator can also be ordered with an optional Taco 219 Flo-Chek, pre-packed at the factory.

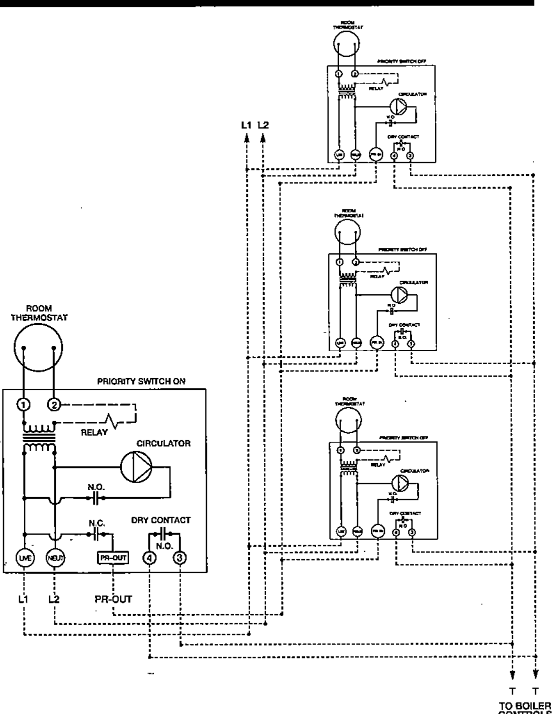
PRIORITY ZONING CIRCULATOR

PRIORITIZING A BANK OF 845A/CIRCULATOR RELAY COMBINATIONS.



PRIORITY ZONING CIRCULATOR

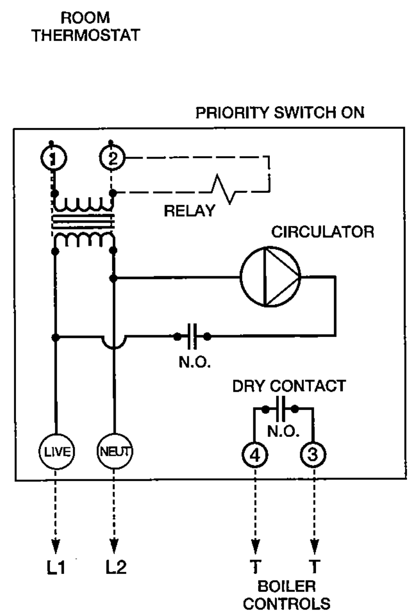
PRIORITIZING A BANK OF ZONING CIRCULA-



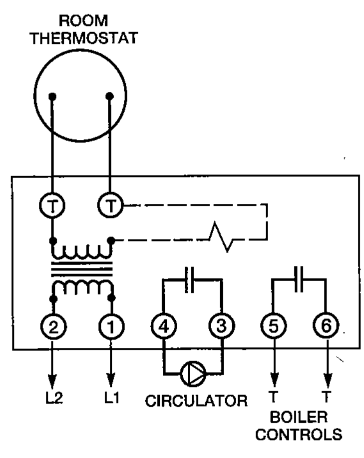
PRIORITY ZONING CIRCULATOR

REPLACING AN 845A/CIRCULATOR COMBINATION WITH A TACO ZONING CIRCULATOR.

TACO, INC.
ZONING CIRCULATOR



HONEYWELL, INC.
845A and CIRCULATOR



Connections @ Zoning Circulator:
- L1 to Live
- L2 to Neutral
- Room Thermostat to 1 & 2
- TT Boiler Controls to 3 & 4

V. Zoning with Thermostatic Radiator Valves

DESIGN AND OPERATION

Thermostatic valves are an excellent way to zone either new or existing systems. Installation is simple, since neither electric wiring nor pneumatic lines to the valve are required. Self-contained and wireless, thermostatic valves sense changes in temperature and automatically modulate the flow of heat. They may be used to control baseboard and convector types of space heating units, but are more frequently used to replace hand radiator valves in old public, commercial and institutional buildings.

TWO-PIPE VENTURI RETROFIT

Two-pipe venturi systems are well suited for thermostatic valves. The retrofit procedure is accomplished by replacing existing hand radiator valves with same-size thermostatic valves. A pump is required to maintain the required flow, and the system functions much like the electric valve system (described earlier) with a constant operating pump.

SERIES LOOP ZONING

While thermostatic valves can be used in a multi-zone series loop system, electric zone valves or circulators are a better choice for series loop zoning. The reason: the modulating characteristic of thermostatic valve operation can result in unbalanced heating within each zone space.

If thermostatic valves must be used for series loop system zoning, it may be necessary to balance radiation by adjusting baseboard dampers, or by removing radiation fins in a room that is overheating. An outdoor reset control may also be required.

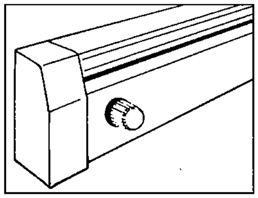
SYSTEM DESIGN CONSIDERATIONS

Thermostatic valves precisely modulate the flow of hot water. Therefore, flow is greatly reduced much of the time, as compared to the "full on" cycles of electric valve or pump zoned systems. Accordingly, shutoff pump heads in thermostatic valve systems should be kept below 40 feet to avoid velocity or chattering noise thru the valve.

In a new system, piping design should allow selection of a low head pump. In an existing system to be retrofitted, a high shutoff pump head should be reduced by trimming the pump's impeller, installing a differential pressure regulator, or by installing bypass valves.

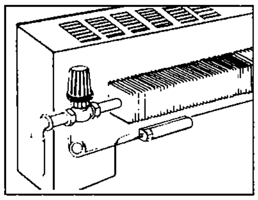
Note: In two-pipe steam retrofits, it is recommended to cycle the boiler.

TYPICAL HEAT-GUARD™ INSTALLATIONS



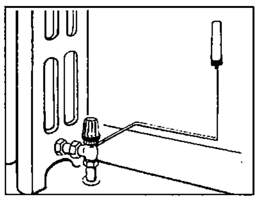
BASEBOARDS

In-line straight valve with direct control mounted through the cover so that it may sense air temperature in open space.



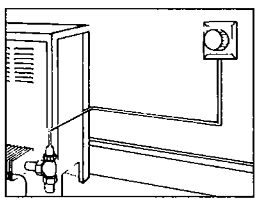
FINTUBE CONVECTOR

Valve installed inside cover at access door with remote sensor under the radiation so that it will sense the returning air.



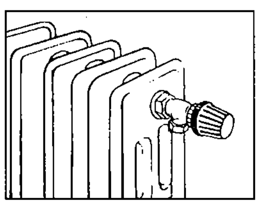
FREE STANDING RADIATOR

Remote sensor allowing accurate sensing of air temperature by removing sensor from direct heat influence of radiator.



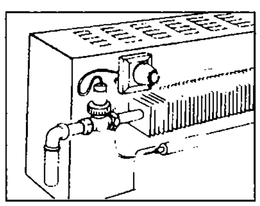
CONVECTOR OR ENCLOSURE

Wall mount dial mounted away from heat influence of radiator on nearby wall or actually on convector cover if provision is made to insulate sensor from heat influence of cover.



FREE STANDING RADIATOR

Direct mount operator on a sidemount angle valve. Sensor is away from direct heat of pipe and radiator. Shown at top, valve can also be placed at bottom of radiator.



CONVECTOR OR BASEBOARD

Remote bulb sensor 6' capillary and cabinet or wall mount dial 6' capillary. Used where sensing is to be done remotely and individual access to adjustment is desired. Double capillary tube model.

LEARNING CENTER

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