

# Northeast Radiant Technology, LLC.

## Plan For Job #0304-05

### Gordon McAlister Radiant Floor Heating System and Propex Plumbing System Construction Copy

### Contents

### Revision History

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6.....	Controls and Wiring diagrams

Date	Rev.#	Page(s)	Description
4/16/04	Orig.	1-4	Construction Copy #1: Distribution and Propex Only

#### **Job Owner/Installer:**

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Ridgewood, NJ 07450  
ph 201-444-9647

**Please note:** These plans are to be used with any and all instructions and manuals that accompany parts to the job site. Frequently these manuals will include more specific information than we have included in our job design notes.

site conditions may force changes from the planned installation; changes should be reviewed if possible by Northeast Radiant Technology for impact on the overall system design. Changes to the scope of the job can potentially invalidate this plan.



# Performance Specs

Rm. #	Room Name	Room Temp	Wall R.	Ceil. R.	SbFl. R.	Win R.	ACH	Flooring Type	Floor R.	BTUs S.F./HR	Water Temp
1	Garage	70	24	5*	10	3	.3	None	0	15	80
2	Base Bath	70	24	5*	10	3	.3	Tile	1.4	13	85
3	Wet Bar	70	24	5*	10	3	.3	Tile	1.4	16	87
4	Family Room	70	24	5*	10	3	.3	Carpet	2	12	105
5	M. Bed	70	11	0*	5*	3	.75	Larch Pine	1.8	30	140*
6	M. Bath	70	11	0*	5*	3	.75	Larch Pine	1.8	30	140*
7	Entry	70	11	5*	5*	3	.75	Tile	1.4	16	115
8	Kitchen	70	11	0*	5*	3	.75	Larch Pine	1.8	20	140
9	Main Room	70	11	41	5*	3	.75	Larch Pine	1.8	41	140*
10	Upper Bath	70	11	41	5*	3	.75	Pine + Plank	2	33	140*
11	Loft	70	11	41	0*	3	.75	N/A	N/A	27	140
12	Bed 1	70	11	41	0*	3	.75	N/A	N/A	31	140
13	Bed 2	70	11	41	0*	3	.75	N/A	N/A	31	140

Outdoor Design Temperature: -10 Deg. F. Total HeatLoad w/o DHW: 75kBTUs/hr

## Explanation of Terms : Performance Specs

- Rm. #:** The Room Number as listed on the Tubing layout, if applicable
- Room Name:** The Room Name
- Room Temp:** The maximum expected setpoint temperature for this room
- Wall R.:** The required R-Value of any outside walls
- Ceil. R.:** The required R-Value of the ceiling. \* Indicates heated space above
- SbFl. R.:** The required R-Value under the floor. \* Indicates heated space below.
- Win R.:** The required R-Value of any windows
- ACH:** The expected Air Changes per Hour in this space
- Flooring Type:** The expected finished flooring for this area
- Floor R.:** The R-value of the floor and subfloor assembly between the tubing and the living space.
- BTUs S.F./HR:** The BTUs per square foot per hour required to heat the space under design conditions.
- Water Temp:** The Maximum water temp required to heat the space under design conditions. \* indicates Supplementary Heat source is used.

# Loop Schedule

Man. #	Loop #	Zone	Install. Type	Tube Type	Loop Length	Cut List	Loop Bal.	Flow	5" W	9" W	W
M1	L1	1- Garage	Slab Below Grade	1/2" Hepex	300	1000' #1	8	.79	0	0	0
M1	L2	1- Garage	Slab Below Grade	1/2" Hepex	295	300 A	8	.94	0	0	0
M2	L3	2- Family Room	Slab Below Grade	1/2" Hepex	285	300 B	7	.48	0	0	0
M2	L4	2- Family Room	Slab Below Grade	1/2" Hepex	330	1000' #2	8	.83	0	0	0
M2	L5	2- Family Room	Slab Below Grade	1/2" Hepex	215	1000' #2	5	.54	0	0	0
M3	L6	3- Master Suite	Underfit Plates	1/2" Hepex	240	1000' #1	8	.67	88	0	0
M3	L7	3- Master Suite	Underfit Plates	1/2" Hepex	245	1000' #3	8	.69	82	0	0
M3	L8	3- Master Suite	Underfit Plates	1/2" Hepex	220	1000' #1	7	.54	72	0	0
M3	L9	3- Master Suite	Towel Warmer	1/2" Hepex	45	1000' #2	2	1.00	0	0	0
M4	L10	4- Main Room	Underfit Plates	1/2" Hepex	275	300 C	8	.54	100	0	0
M4	L11	4- Main Room	Underfit Plates	1/2" Hepex	260	1000' #3	7	.64	85	0	0
M4	L12	4- Main Room	Underfit Plates	1/2" Hepex	225	1000' #1	6	.55	65	0	0
M4	L13	4- Main Room	Underfit Plates	1/2" Hepex	210	1000' #3	6	.52	66	0	0
M4	L14	4- Main Room	Underfit Plates	1/2" Hepex	210	1000' #3	6	.52	65	0	0
M4	L15	4- Main Room	Underfit Plates	1/2" Hepex	225	1000' #2	6	.55	80	0	0
M5	L16	5- Upper Bath	Radiant Wall	1/2" Hepex	65	1000' #2	8	.45	0	16	0
M5	L17	5- Upper Bath	Towel Warmer	1/2" Hepex	25	1000' #2	3	1.00	0	0	0

Approx. Plate Counts

## Explanation of Terms : Loop Schedule

- Man. #:** The Manifold Station this Loop attaches to. Single loops are direct connections to the Mech Room
- Loop #:** Loop Number
- Zone:** The zone this loop services
- Install. Type:** The radiant installation method used for this loop
- Tube Type:** The brand and diameter of the tubing used for this loop
- Loop Length:** The expected linear length of this loop. This number should be field verified for any major deviations.
- Cut List:** The specific roll of tubing to cut this loop from. Mark tubing rolls prior to cutting to minimize waste!
- Loop Bal.:** The number of QUARTER turns from CLOSED to set this loop's balancing valve. 2 full turns is full open.
- Flow:** The minimum GPM required by this loop under design conditions. ASSUMES 30% GLYCOL SOLUTION.

# Installation Notes

- Read through the Wirsbo Installation Manual
- Prior to installation, open all boxes and verify that parts received match up to the parts list included with these drawings! **Number the Tubing boxes as indicated on the "Cut List" on the loop schedule on this page.** Make sure to cut all runs from the correct rolls of tubing to prevent unnecessary tubing waste!
- PEX is sensitive to prolonged exposure to UV Radiation. Do not allow PEX to remain exposed to direct sunlight or other UV sources for more than 30 days.
- Use a tubing cutter to ensure smooth tubing cuts.
- When tight loop bends are required, it is acceptable to make the bend wider than the on-center of the runs to simplify installation. Allowing tubing to "bow out" at the loop head will not affect performance. If a kink occurs, using a heat gun to reform the tubing is recommended: see page 14 of the Wirsbo Installation manual.

-Manifolds should be installed so all propex fittings and balancing valves on the loops are easily accessible. Typically the return manifold is against the wall with its tubing running behind the valveless supply manifold, which is mounted below and in front of the return manifold. Make sure to label each loop as you attach it to the manifold and attach the supply and return ends in the same order on each manifold! **Black caps on balancing valves should be affixed loosely so they do not push down the plunger.**

-Threaded connections with gaskets or O-rings do NOT require thread tape or sealing compound! O-rings should be moistened with water or saliva before attempting to seal the connection, in order to help prevent tearing.

- Pressure Testing will be done directly on the manifolds using Wirsbo Pressure Test Kits. Directions for pressure testing are included in the Wirsbo installation manual, Section 9. System should be under pressure before the concrete pour and should remain under pressure until all floor penetrations for wall plates, flooring, etc. are made.

-Purging the entire system of air is required after installation is completed.

-Balancing loops are required; Use the initial settings listed under the Loop Schedule. Instructions for balancing are in the Wirsbo Installation manual, section 9.

-RTU and thermostat locations are approximate. Run 18-2 wire from the controls location to the RTU locations.

## In Slab Areas:

-Before laying tubing it is a good idea to spray paint the outline of internal partition walls on the rigid foam as a guideline while running tubing. **IF tubing passes under walls, NO masonry nails should be used to affix wall plates.** Use of construction adhesive in such areas is recommended.

-Slab installations use the "full round" PVC bend supports for the tubing connection to the manifolds.

-Do not install splices in concrete if it is avoidable.

-Instructions for tubing installation around control joints, expansion joints and construction joints are in the Wirsbo installation manual, chapter 8.

- Manifolds mounted near the controls location do not require a valve on the manifold itself; Isolation occurs at the controls piping.

## Underfit Plate Notes:

-Joist penetrations for tubing should be 1-1/2" in diameter near any bends in the tubing, 1" minimum for "straight shot" penetrations. Drill them prior to tubing installation.

-Feed the tubing through the supply penetrations and back through the return penetrations, and affix one end to the manifold. Leave the other end loose, leading to an uncoiler or an assistant. Then, starting at the furthest bay, pull the loose end up the joist bay and give the loop a 180 degree twist to make an expansion loop. Hook the tubing around an angled nail or use a tube talon to hold the tubing loosely in place while you continue this process for each joist bay in the loop. A diagram of this process is in the wirsbo installation manual, page 59. This process may have to be modified in areas where tubing must penetrate solid blocking.

-This installation uses 5-3/4" wide plates 8" o.c. in the joist bays. **Plates should never touch or overlap.** Use the sample plate layouts as a guideline for plate installation density.

-Use at LEAST ten staples per plate. Plate must be as flat against the subfloor as possible to be effective. Use additional staples to ensure contact if the plates bow out away from the subfloor.

-Plates can be by scoring them with a utility knife, then snapped over a knee or a hard corner.

-Do NOT affix the head of the loop bends! Bend heads must be able to expand and contract with the tubing to prevent noise. Always leave 6" from the head of a loop to the end of joist bay insulation to give room for expansion.

-Underfit installations use the smaller nylon bend supports for the connection of loop tubing to the manifolds.

-All joists must be insulated, as specified in the performance specs on this page, under the plates. Where multiple zones share the same joist bay, the zones should be separated by some form of insulation.

# Manifold/Feed Schedule

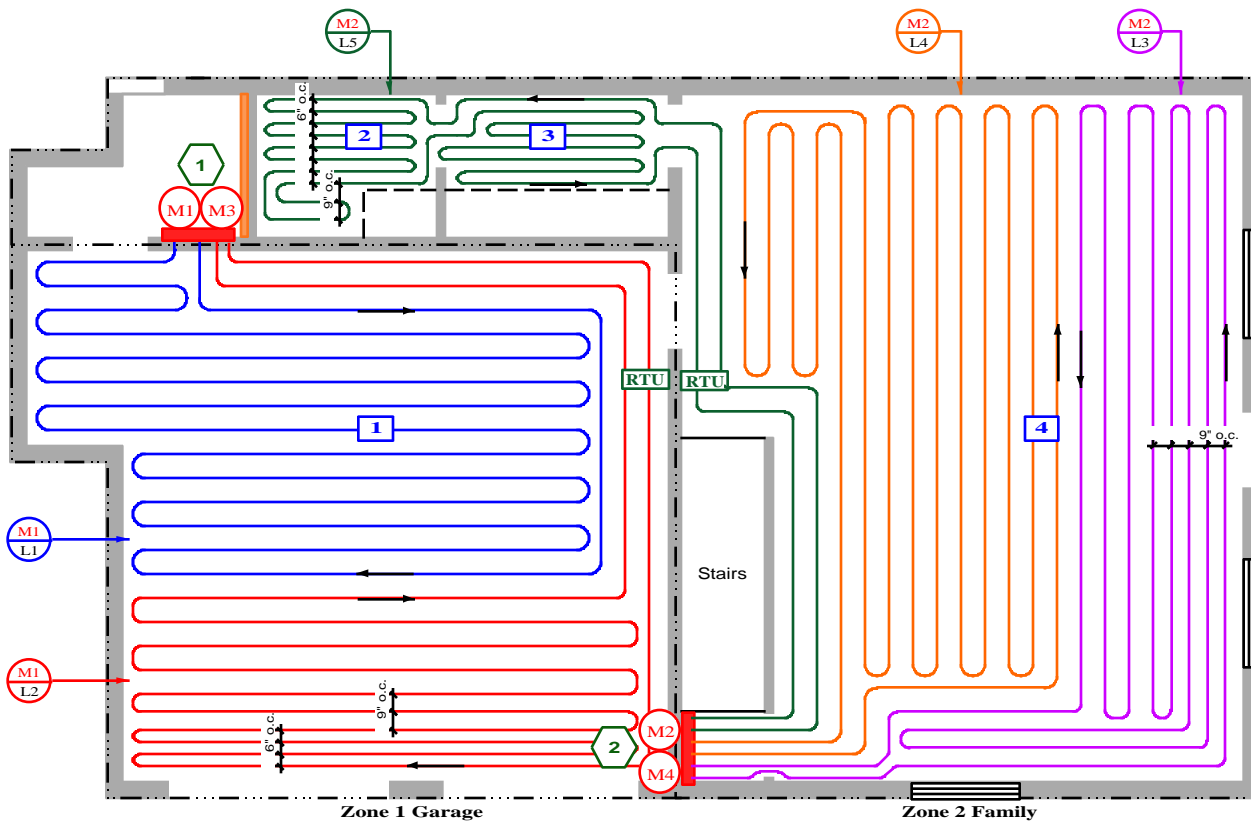
Man. #	# of Loops	Valve Operators	Feed Tubing	GPM	Feed Length	Loop Press	Feed Press	Tot. Press
M1	2	None	3/4" Hepex	1.7	5	10.9	.1	11.0
M2	3	None	3/4" Hepex	1.9	90	10.5	2.2	12.7
M3	4	None	3/4" Hepex	2.9	5	5.1	.7	5.8
M4	6	None	3/4" Hepex	3.3	95	3.1	6.1	9.2
M5	2	None	3/4" Hepex	1.5	100	0.84	1.5	2.3

## Explanation of Terms : Manifold Schedule

- Man. #:** The Manifold Station Number. Single loops indicate a direct connection is present, see loop schedule.
- # of Loops:** The number of loops attached to this manifold station
- Valve Ops.:** The number/type of any mechanical valve operators on this manifold
- Feed Tubing:** The type and diameter of the tubing used to feed this manifold
- GPM:** The minimum flow rate required by this manifold under design conditions
- Feed Length:** The expected total length of supply and return for this manifold's feed lines
- Loop Press:** The Pressure Loss of the longest loop on this manifold in Feet of Head. ASSUMES 30% GLYCOL SOLUTION.
- Feed Press:** The Pressure Loss of the feed lines of this manifold in Feet of Head. ASSUMES 30% GLYCOL SOLUTION.
- Tot Press:** The Total Pressure Loss on this manifold in Feet of Head. ASSUMES 30% GLYCOL SOLUTION.



**Construction Copy**  
**Drawing Scale: 1/4" = 1'-0"**



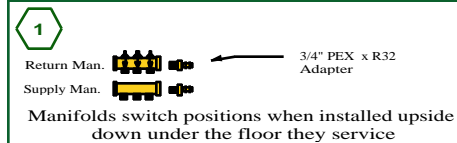
**Page Notes:**

-All loops on this page are 12" o.c. unless otherwise marked or noted.  
 -Manifolds servicing upper floor are mounted over slab manifolds, higher up on the stud wall and upside down to provide easier joist access.

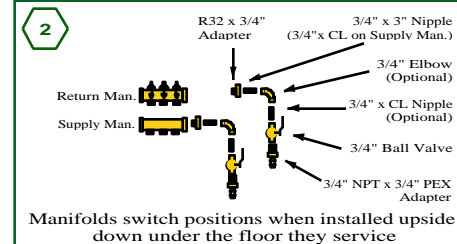
**Key To Symbols**  
**(Tubing Layout)**

	Manifold Station Number
	Control Piping Location
	Manifold Station Location
	Loop Label (manifold and Loop numbers)
	Zone Label and Outline
	Flow Directional Arrow
	Approx. Room Temperature Unit Location
	Aluminum Diffuser Plate (Sample Run)
	Installation Detail Ref #
	Room Number Label (see performance specs)

**Detail: Close Manifold Fittings for 3/4" Pex Feeds**



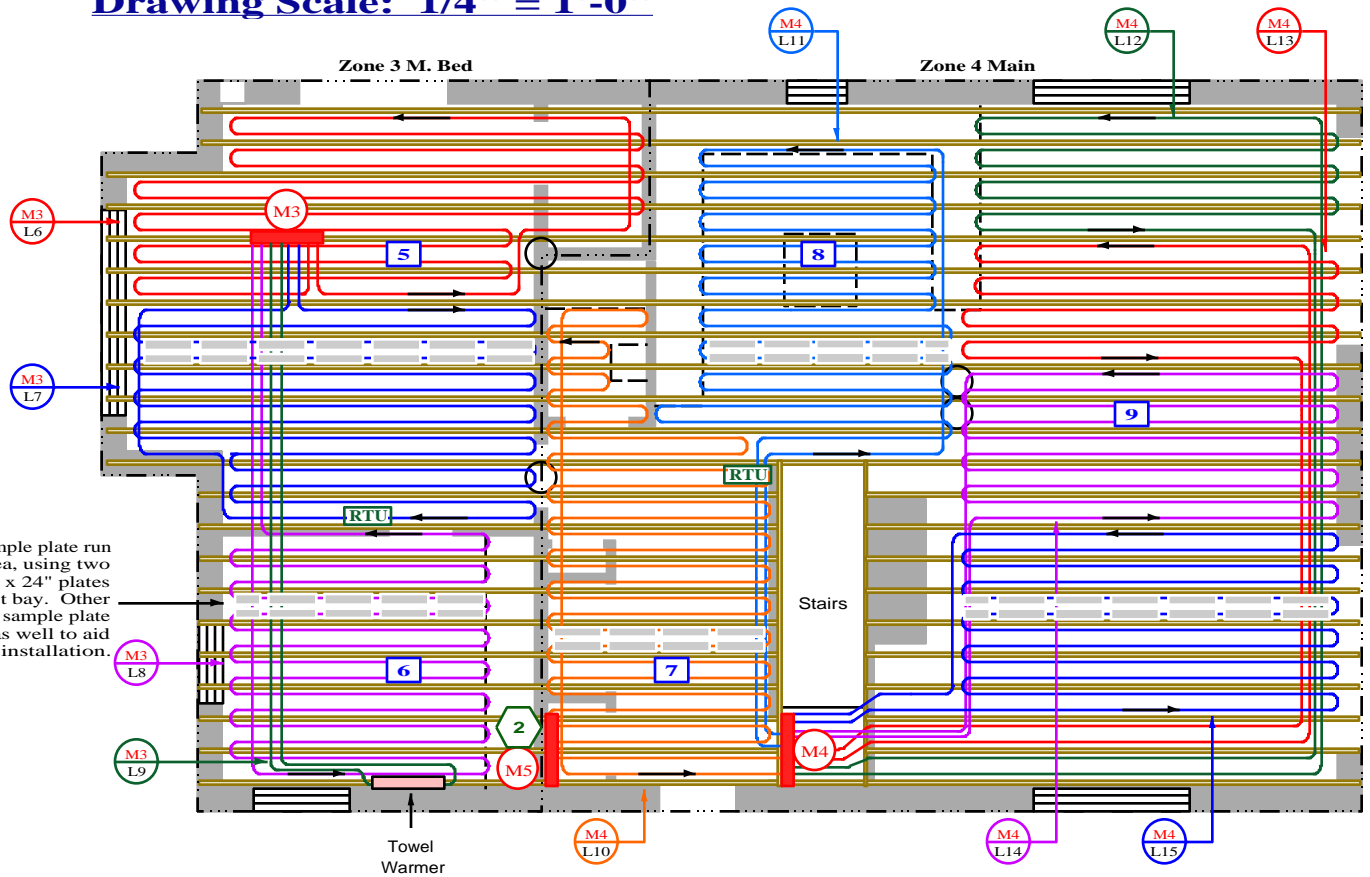
**Detail: Remote Manifold Fittings for 3/4" Pex Feeds**



PAGE NOTES:

- ALL LOOPS ARE 8" O.C. AND USES DOUBLE RUNS OF 5" X 24" PLATES SPACED AS SHOWN BY THE SAMPLE PLATE RUNS
- MANIFOLDS 3 AND 4 ARE POSITIONED IN THE BASEMENT. MANIFOLD 5 IS POSITIONED TO SERVICE THE UPPER BATHROOM ZONE.
- SOME INSULATION SHOULD BE USED TO SEPARATE THE MAIN ROOM ZONE FROM THE MASTER SUITE ZONE, WHICH SHARE JOIST BAYS.
- TUBING IS DRAWN FOR TWO DIMENSIONAL CLARITY. ACTUAL JOIST PENETRATIONS MAY VARY SOMEWHAT.
- ANY TUBING PLACED UNDER THE TOILET SHOULD BE ISOLATED FROM THE TOILET ASSEMBLY BY INSULATION TO PREVENT THE POSSIBILITY OF MELTING ANY WAX SEALS. DRAWING SHOWS TUBING AVOIDING TOILET AREAS.
- ALWAYS USE EXPANSION LOOPS WHEN TUBING BENDS NEAR A JOIST PENETRATION.
- LOOPS IN THE "TOP" AND "BOTTOM" TWO JOIST BAYS ON THIS DRAWING MUST PENETRATE REPEATED SOLID BLOCKING. THIS WILL REQUIRE SOME THREADING OF THE TUBING. PENETRATIONS FOR "STRAIGHT SHOT" TUBING CAN BE 1" IN DIAMETER.
- BLACK CIRCLES SHOW POSITIONS OF ADDITIONAL SOLID BLOCKING OUTSIDE OF THE UPPER AND LOWER TWO JOIST BAYS. TUBING IS NOT RUN THROUGH THESE SOLID BLOCKING POSITIONS.
- TUBING THAT RUNS UNDER CABINETS DO NOT REQUIRE PLATE COVERAGE.

This is a sample plate run for this area, using two runs of 5" x 24" plates per joist bay. Other areas have sample plate runs as well to aid installation.



Radiant Wall Detail For Upper Bathroom

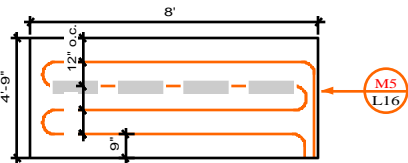
Radiant Wall Installation Notes:

-Wall should be strapped with 11" wide strips of 3/4" plywood at 12" o.c. to provide suitable stapling surface for the aluminum plates. Additional strapping may be used above the radiant area at any appropriate o.c. for hanging drywall, to keep the wall surface flat. Bottom strapping will be less than 9" to stagger tubing channels with panel finish nailing runs.

-Loops must be run horizontally to minimize the chance of accumulating air bubbles in line.

-Radiant Walls uses 9" x 24" aluminum plates, with the fins on the surface of the plywood, and the tubing groove in the channels. Use the sample plate layout shown to gauge plate density.

-2" minimum space must be left at each loop bend to allow for tubing expansion.



M5 L17 Serves Upper Bath Towel Warmer

Basement Bath Fixtures			
C2	H2	P1	Sink: 15' Run, 1/2"
C3		P1	Toilet: 10' Run, 1/2"
C4	H3	P2	Shower: 10' Run, 1/2"

Wet Bar Fixtures			
C5	H4	P1	Sink: 20' Run, 1/2"

Master Bath Fixtures			
C6	H5	P1	Sink 1: 35' Run, 1/2"
C6A	H5A	P1	Sink 2: 5' Run, 1/2"
C7	H6	P2	Shower: 25' Run, 1/2"
C8	H7	P2	Shower 2: 25' Run, 1/2"
C1	H1	P6	Whirlpool: 35' Run, 3/4"
C9		P1	Toilet: 45' Run, 1/2"

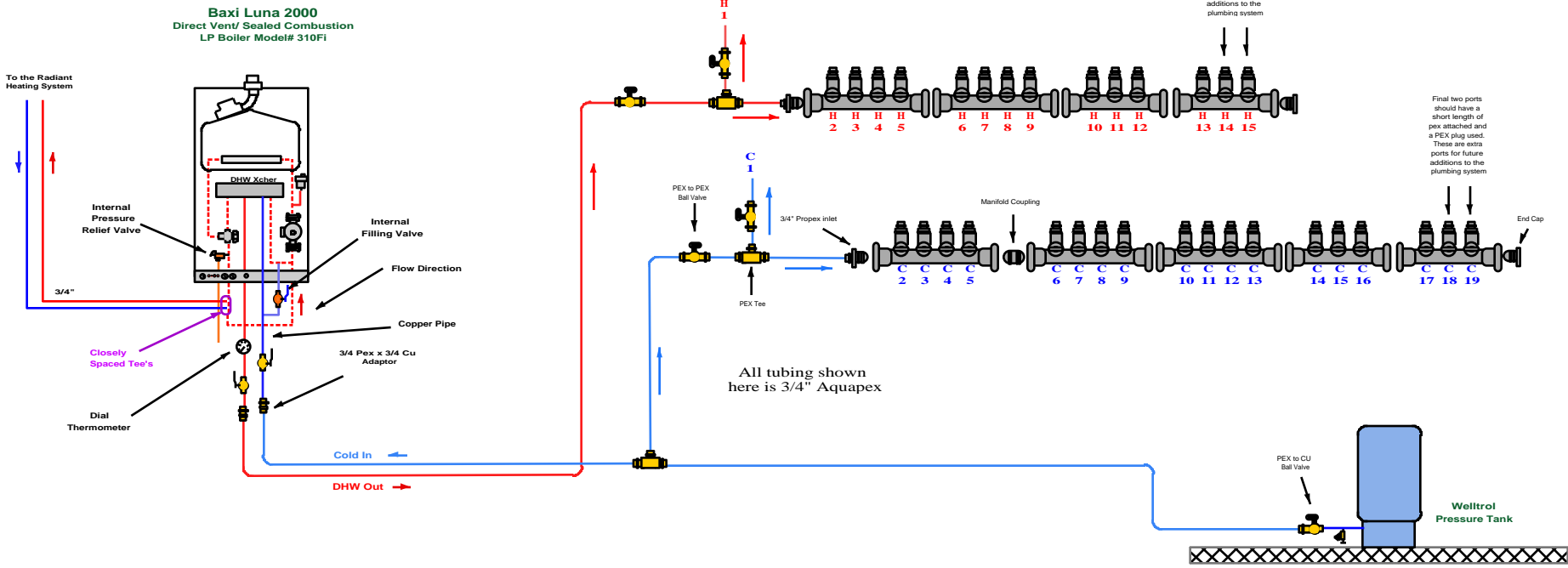
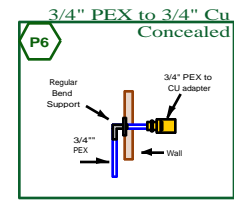
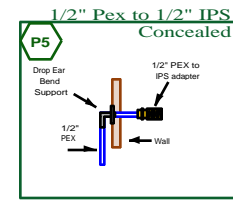
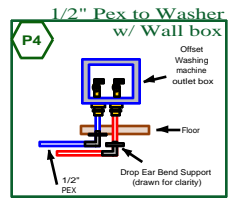
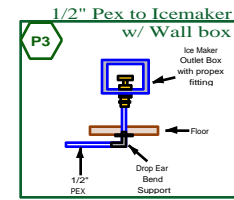
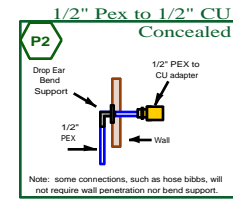
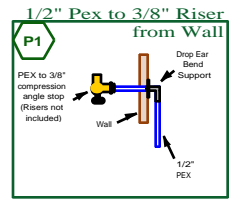
Laundry Fixtures			
C10	H8	P4	Washer: 35' Run, 1/2"

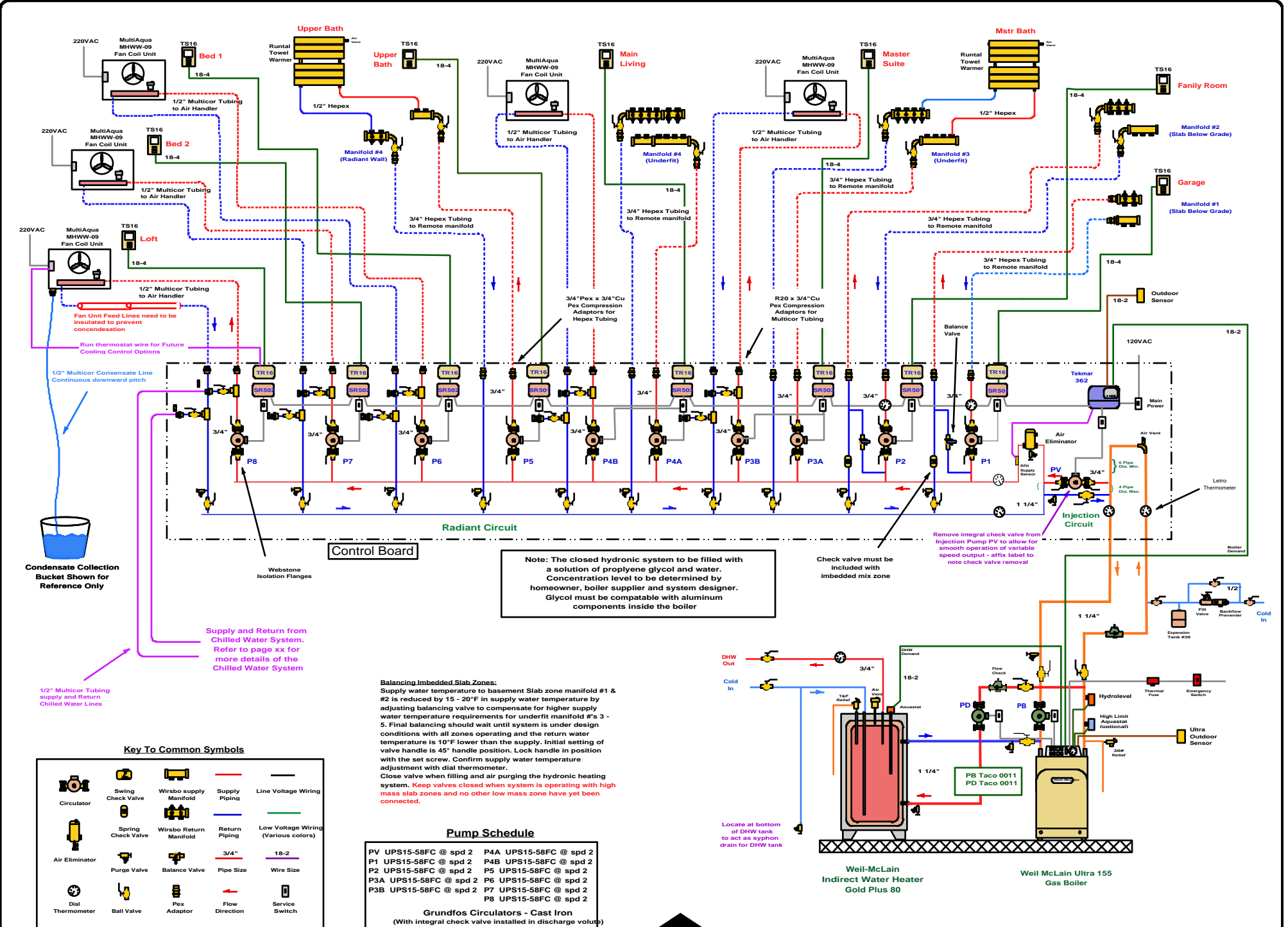
1st Floor Half Bath Fixtures			
C11	H9	P1	Sink: 35' Run, 1/2"
C12		P1	Toilet: 40' Run, 1/2"

Kitchen Fixtures			
C13	H10	P1	Main Sink: 35' Run, 1/2"
C13A		P3	Icemaker: 10' Run, 1/2"
	H11	P2	Dishwasher: 40' Run, 1/2"

2nd Floor Bath Fixtures			
C14	H12	P1	Sink: 65' Run, 1/2"
C15	H13	P2	Tub: 60' Run, 1/2"
C16		P1	Toilet: 55' Run, 1/2"

Outdoor Fixtures			
C17		P2	Hose 1: 80' Run, 1/2"
C18		P2	Hose 2: 30' Run, 1/2"





Condensate Collection Bucket Shown for Reference Only

Fan Unit Feed Lines need to be insulated to prevent condensation  
Run thermostat wire for Future Cooling Control Options

1/2" Multicor Consensate Line Continuous downward pitch

Supply and Return from Chilled Water System. Refer to page xx for more details of the Chilled Water System

1/2" Multicor Tubing supply and Return Chilled Water Lines

Webstone Isolation Flanges

Radiant Circuit

Control Board

Note: The closed hydronic system to be filled with a solution of propylene glycol and water. Concentration level to be determined by homeowner, boiler supplier and system designer. Glycol must be compatible with aluminum components inside the boiler

Check valve must be included with imbedded mix zone

Remove integral check valve from Injection Pump PV to allow for smooth operation of variable speed output - affix label to note check valve removal

Key To Common Symbols


**Balancing Imbedded Slab Zones:**  
Supply water temperature to basement Slab zone manifold #1 & #2 is reduced by 15 - 20°F in supply water temperature by adjusting balancing valve to compensate for higher supply water temperature requirements for underfit manifold #'s 3 - 5. Final balancing should wait until system is under design conditions with all zones operating and the return water temperature is 10°F lower than the supply. Initial setting of valve handle is 45° handle position. Lock handle in position with the set screw. Confirm supply water temperature adjustment with dial thermometer.  
Close valve when filling and air purging the hydronic heating system. Keep valves closed when system is operating with high mass slab zones and no other low mass zone have yet been connected.

Pump Schedule

PV UPS15-58FC @ spd 2	P4A UPS15-58FC @ spd 2
P1 UPS15-58FC @ spd 2	P4B UPS15-58FC @ spd 2
P2 UPS15-58FC @ spd 2	P5 UPS15-58FC @ spd 2
P3A UPS15-58FC @ spd 2	P6 UPS15-58FC @ spd 2
P3B UPS15-58FC @ spd 2	P7 UPS15-58FC @ spd 2
	P8 UPS15-58FC @ spd 2

Grundfos Circulators - Cast Iron  
(With integral check valve installed in discharge volume)

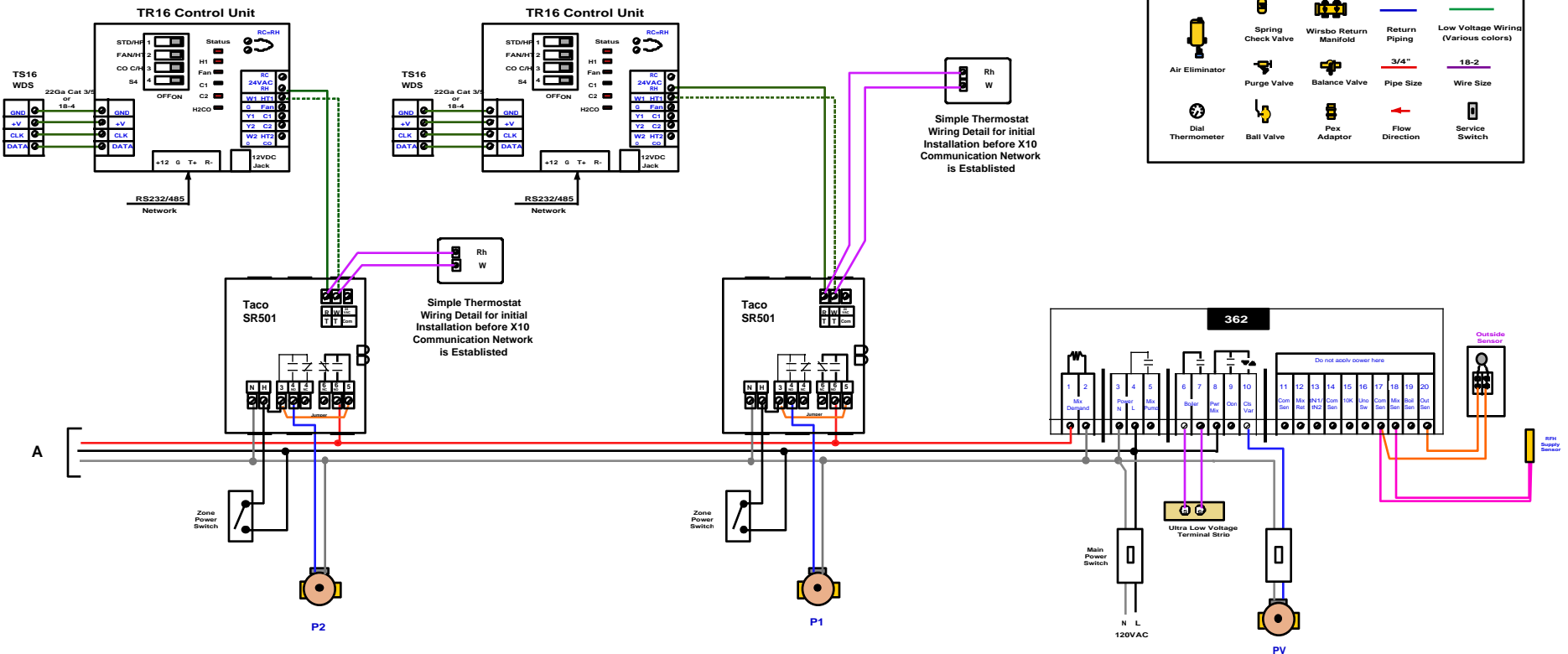
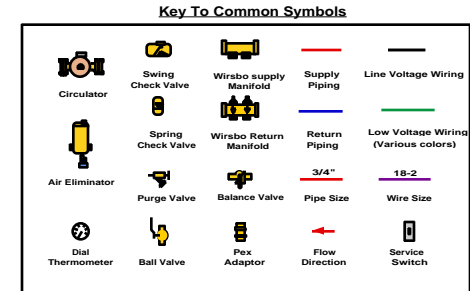
Locate at bottom of DHW tank to act as syphon drain for DHW tank

Weil-McLain Indirect Water Heater Gold Plus 80

Weil-McLain Ultra 155 Gas Boiler

**Family Room Zone**  
Heating Zone (Radiant Floor Heating)

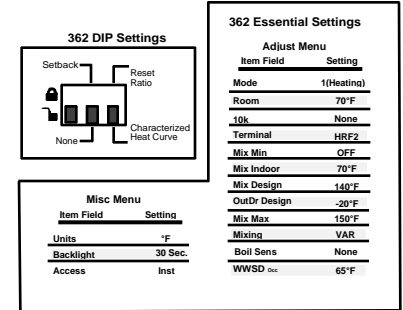
**Garage Zone**  
Heating Zone (Radiant Floor Heating)



Note: The 063 RTU is to be configured for both slab and air sensing by using a 10k slab sensor connected to Rs3 and Com terminals (3 & 5) and the air sensor in 82P 88Åium and max 8/0 slab temperatures and the air temperature settings are adjusted at the RTU. The minimum and maximum slab setpoints have priority over the air temperature setpoint. If the air temperature sensor at the RTU is turned off, the air temperature is ignored.

Note: The 063 RTU comes with four Access Level settings. These Access Level settings restrict the number of control settings that can be accessed by the user. The four access levels are Limited (LTD), User (USER), Installer (INST) and Advanced (ADV). The access level of the RTU is found in the miscellaneous (MISC) menu when the Lock/Unlock DIP switch is set to the unlocked position. In the Advanced access level, all the control settings are available to the user. In the User access level, only a few of the menus and items are available. The control's factory setting is Installer (INST). Once the control is set up, the appropriate access level should be selected for the people that deal with the control on a regular basis. The Lock/Unlock DIP switch is used to lock the access level of the control and RTU. To determine if the control is locked a small segment representing a padlock is viewed in the bottom right hand corner of the display. As long as the DIP switch is in the locked position, the access level of the control and RTU can no longer be viewed or adjusted in its Miscellaneous (MISC) menu.

Note: The 362 control comes with four Access Level settings. These Access Level settings restrict the number of control settings that can be accessed by the user. The four access levels are Limited (LTD), User (USER), Installer (INST) and Advanced (ADV). The access level of the control is found in the Miscellaneous (MISC) menu when the Lock/Unlock DIP switch is set to the unlocked position. In the Advanced access level, all the control settings are available to the user. In the User access level, only a few of the menus and items are available. The control's factory setting is Installer (INST). Once the control is set up, the appropriate access level should be selected for the people that deal with the control on a regular basis. The Lock/Unlock DIP switch is used to lock the access level of the control and RTU. To determine if the control is locked a small segment representing a padlock is viewed in the bottom right hand corner of the display. As long as the DIP switch is in the locked position, the access level of the control and RTU can no longer be viewed or adjusted in its Miscellaneous (MISC) menu.



### Upper Bath

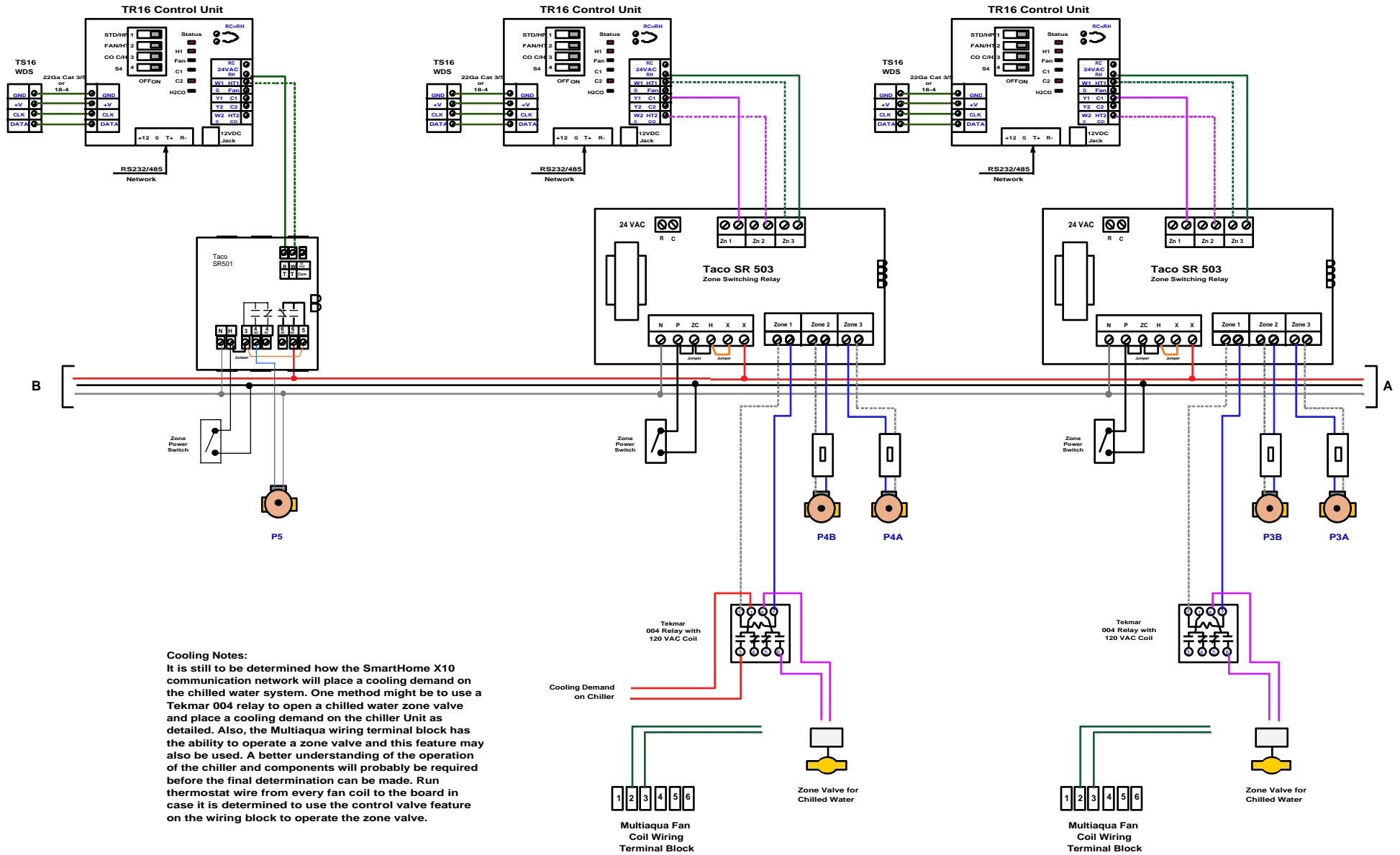
Heating Zone (Radiant Floor Heating)

### Main Living

Heating Zone (Radiant Floor Heating)  
 Staged Heating Zone (Multiaqua Fan Coil)  
 Cooling Zone (Multiaqua Fan Coil)

### Master Suite

Heating Zone (Radiant Floor Heating)  
 Staged Heating Zone (Multiaqua Fan Coil)  
 Cooling Zone (Multiaqua Fan Coil)



**Cooling Notes:**  
 It is still to be determined how the SmartHome X10 communication network will place a cooling demand on the chilled water system. One method might be to use a Tekmar 004 relay to open a chilled water zone valve and place a cooling demand on the chiller Unit as detailed. Also, the Multiaqua wiring terminal block has the ability to operate a zone valve and this feature may also be used. A better understanding of the operation of the chiller and components will probably be required before the final determination can be made. Run thermostat wire from every fan coil to the board in case it is determined to use the control valve feature on the wiring block to operate the zone valve.



**Loft**

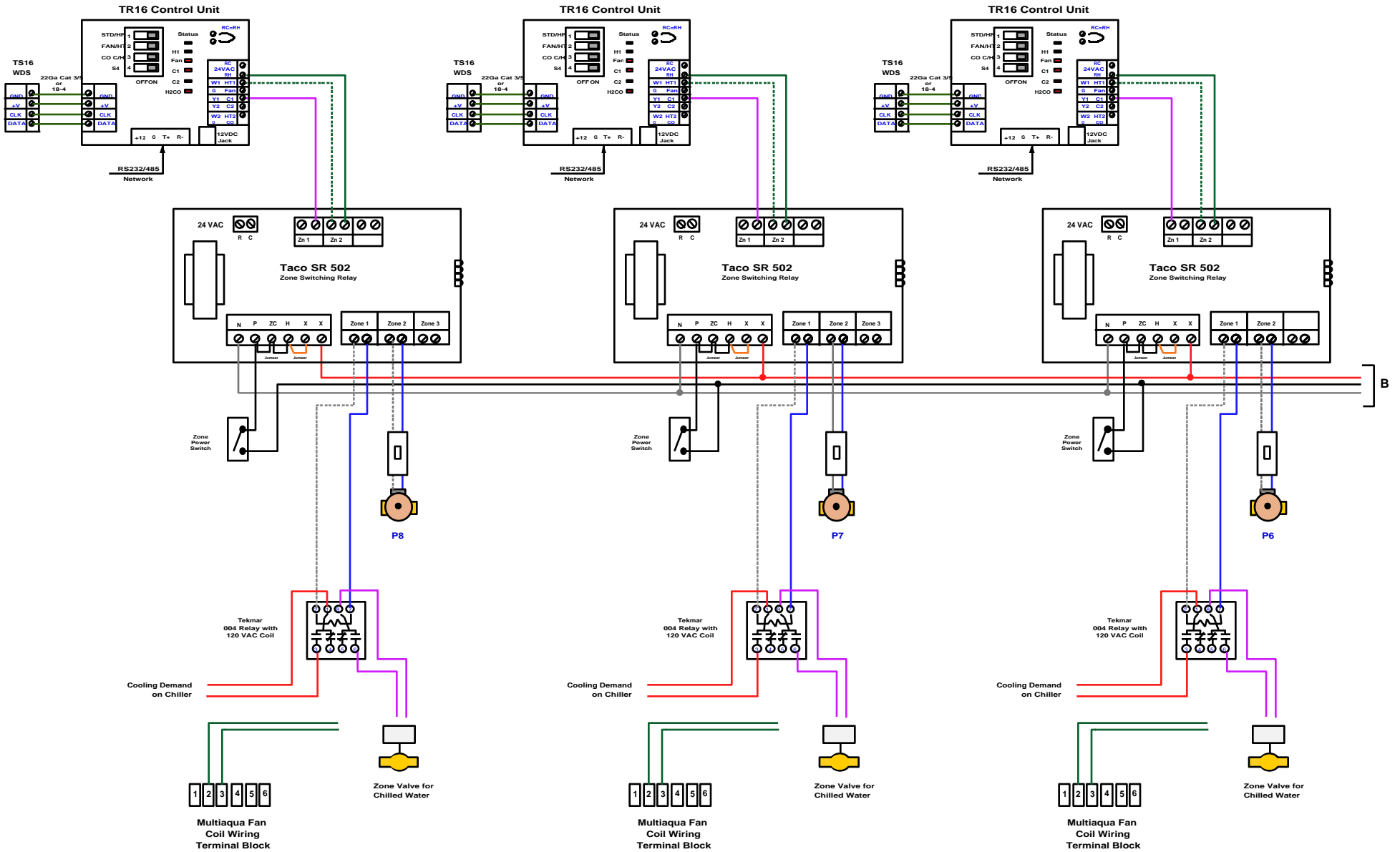
Heating Zone (Multiaqua Fan Coil)  
Cooling Zone (Multiaqua Fan Coil)

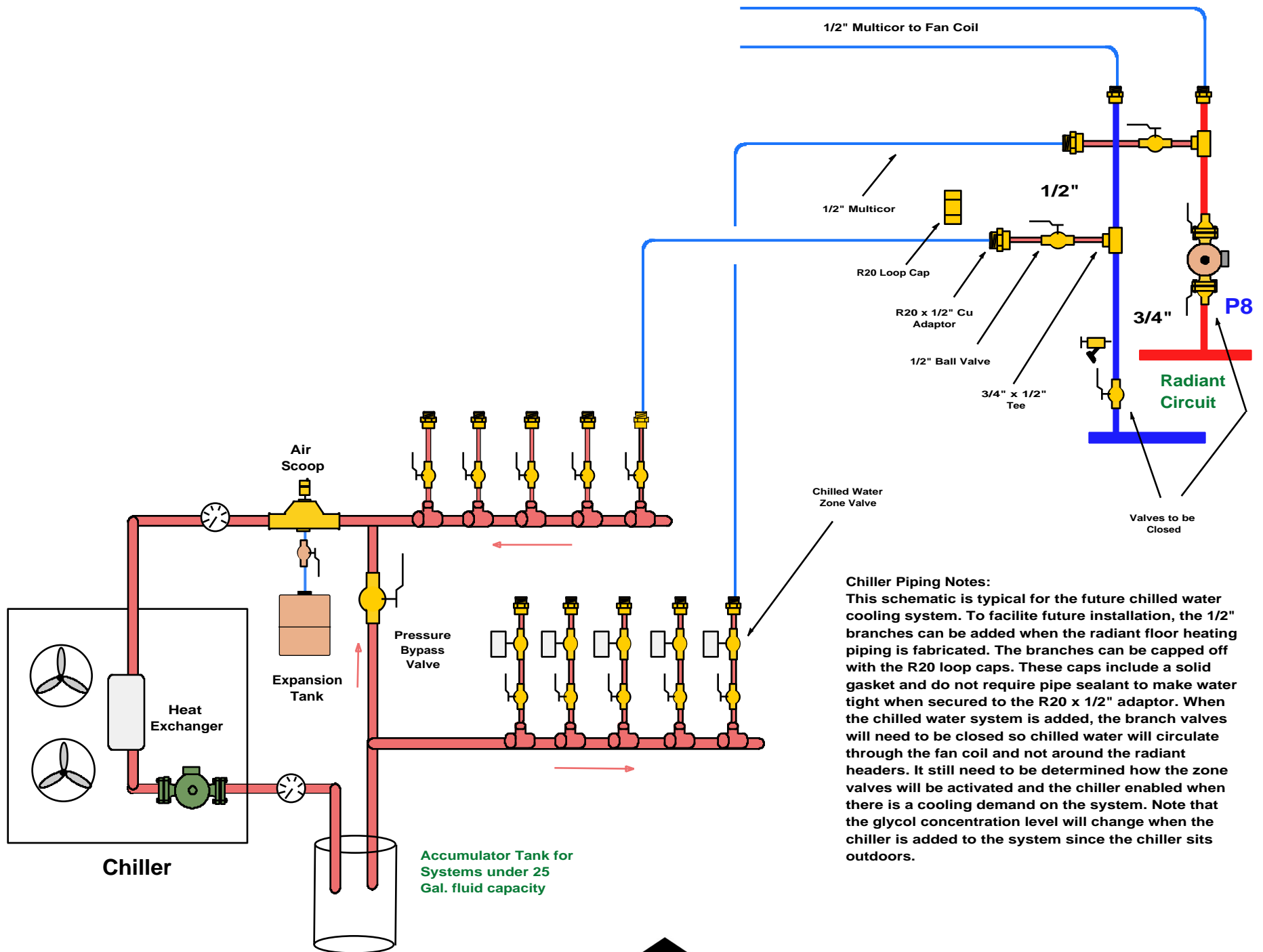
**Bed 2**

Heating Zone (Multiaqua Fan Coil)  
Cooling Zone (Multiaqua Fan Coil)

**Bed 1**

Heating Zone (Multiaqua Fan Coil)  
Cooling Zone (Multiaqua Fan Coil)





**Chiller Piping Notes:**

This schematic is typical for the future chilled water cooling system. To facilitate future installation, the 1/2" branches can be added when the radiant floor heating piping is fabricated. The branches can be capped off with the R20 loop caps. These caps include a solid gasket and do not require pipe sealant to make water tight when secured to the R20 x 1/2" adaptor. When the chilled water system is added, the branch valves will need to be closed so chilled water will circulate through the fan coil and not around the radiant headers. It still need to be determined how the zone valves will be activated and the chiller enabled when there is a cooling demand on the system. Note that the glycol concentration level will change when the chiller is added to the system since the chiller sits outdoors.