

Hydronic Heating for MicroHouse 4

Test-Driven Requirements

Requirements

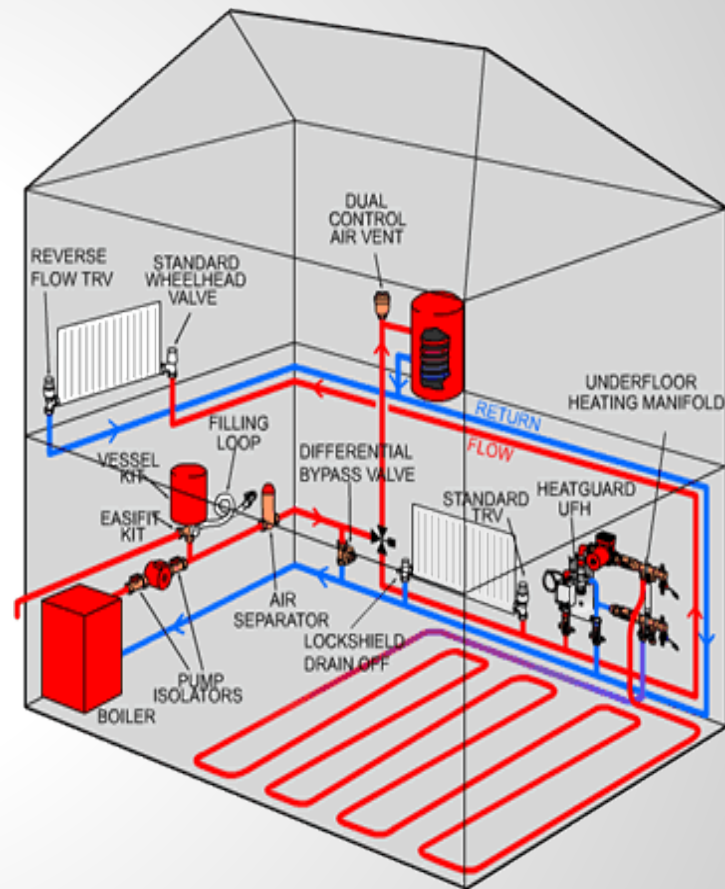
- Integration with on-demand heater and existing 50 psi water pressure system (municipal water). This possibility has been vetted by Tech Support from Glenwood 7020
 - Sidearm heat exchanger and hot water tank - installed later in bathroom from existing hydronic line tee-in
- Heated water to radiators and in-ground heat at 15 PSI, 180F
- Heat balancing of radiators and hydronics principles:
 - Equivalent distance for all parallel circuits
 - 4 Zones at 250 ft each
 - Parallel radiator and in-ground system
 - 100k BTU stove, and sized for 100k BTU output
 - System balancing - via 50/50 divider valve?
 - Allow Buderus radiators to be turned off
 - Circuit starts at S side, 30k BTU from Buderus radiators can be turned off, diverted fully to in-ground heating

Components and System Design

- Use in-ground heating system
 - Menards system sourcing
- Use [Buderus radiators](#)
 - Design Manual - [Buderus Panel Radiators](#)
- [Glenwood 7020](#) - 100k BTU
- **System design** - [documentation](#) from Woodstoves.net
- Inspiration - [Drake's Landing Alberta](#) - year-round heat storage
- Future Work -
 - Side Arm Heat Exchanger
 - Large mass heat storage - Ben Nusz, MSTC, Wisconsin
 - Solar concentrator install
 - Charcoal gas generation

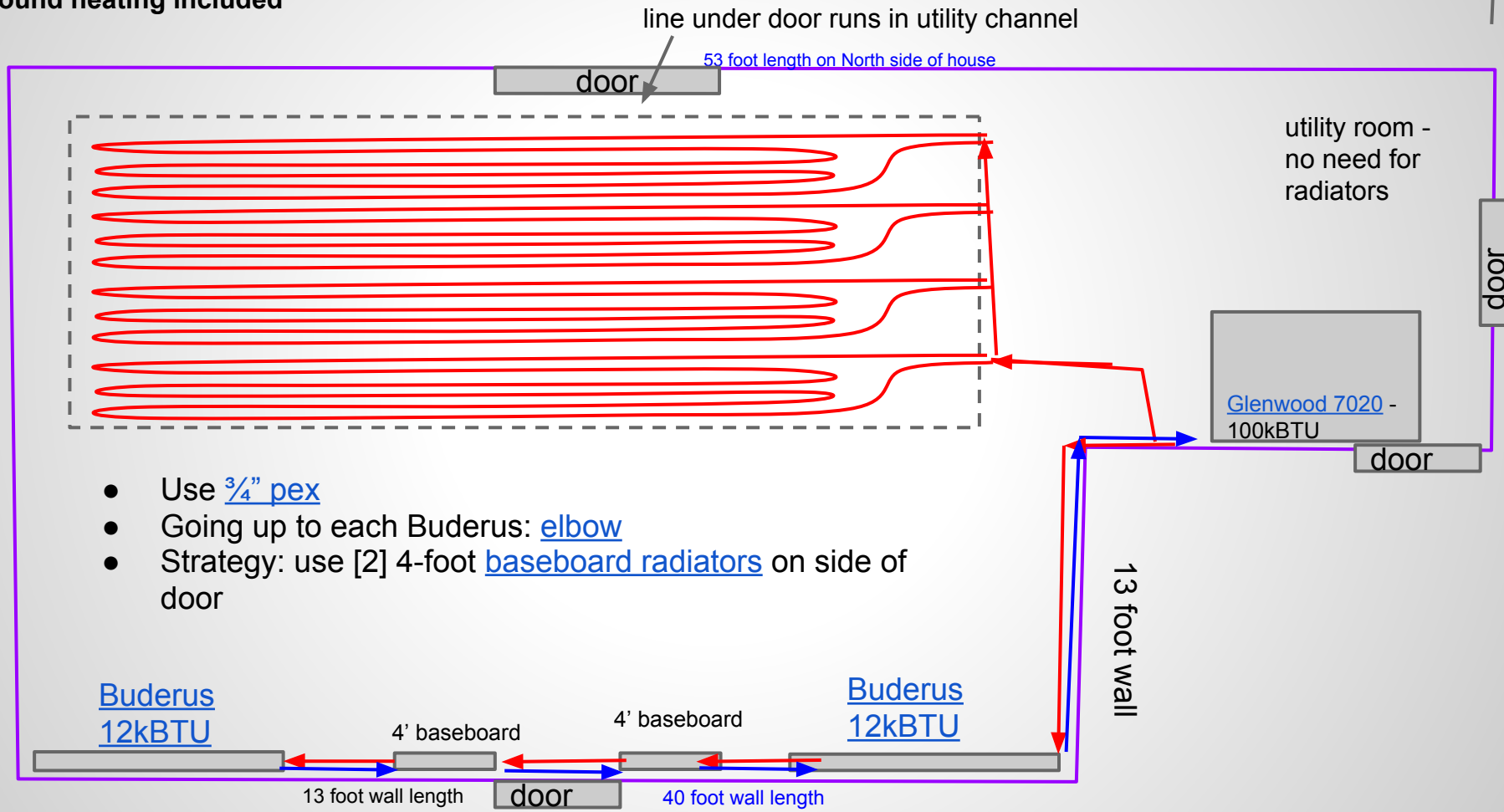
Hydronic System Calculations

- 1200 sf house, 140' perimeter
- Need: Need 40 BTU/sf of house - or 50k btu/1200sf.
 - [BTU to KW](#) conversion
- Total 140' perimeter of house, including 4 doors
 - 51 foot length on North side of house, 36 for South, 54 for E and W
- Suggested design: parallel circuit for in-ground and hydronic radiators
- Baseboard radiators - [300](#)-500 BTU/ft of radiator. Buderus - 2000BTU/ft of radiator
- Cost -
 - Baseboard: [\\$25](#)/1000 BTU from Lowes
 - Buderus: [\\$50](#)/1000 BTU for larger radiator



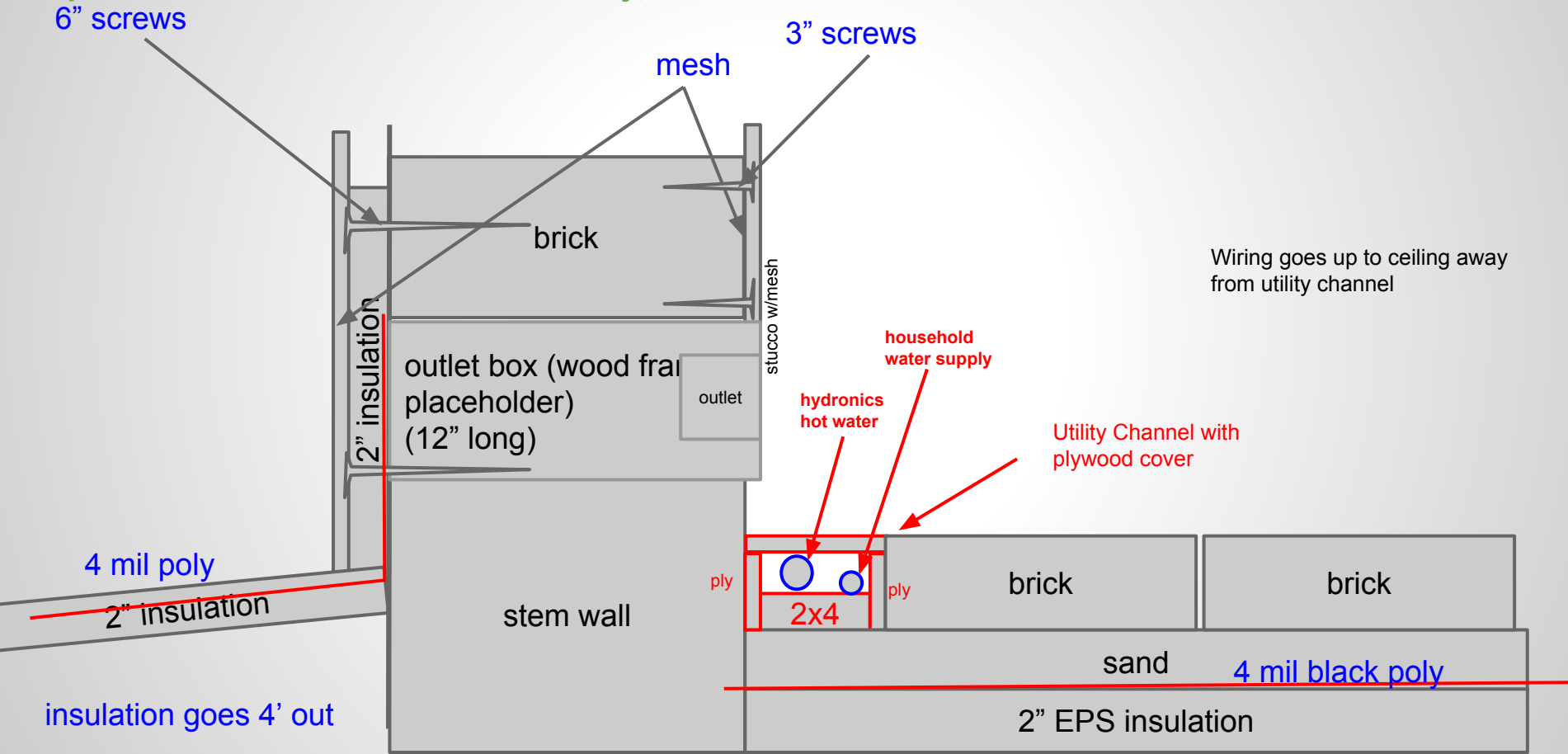
Hydronic System Concept - v3

In-ground heating included



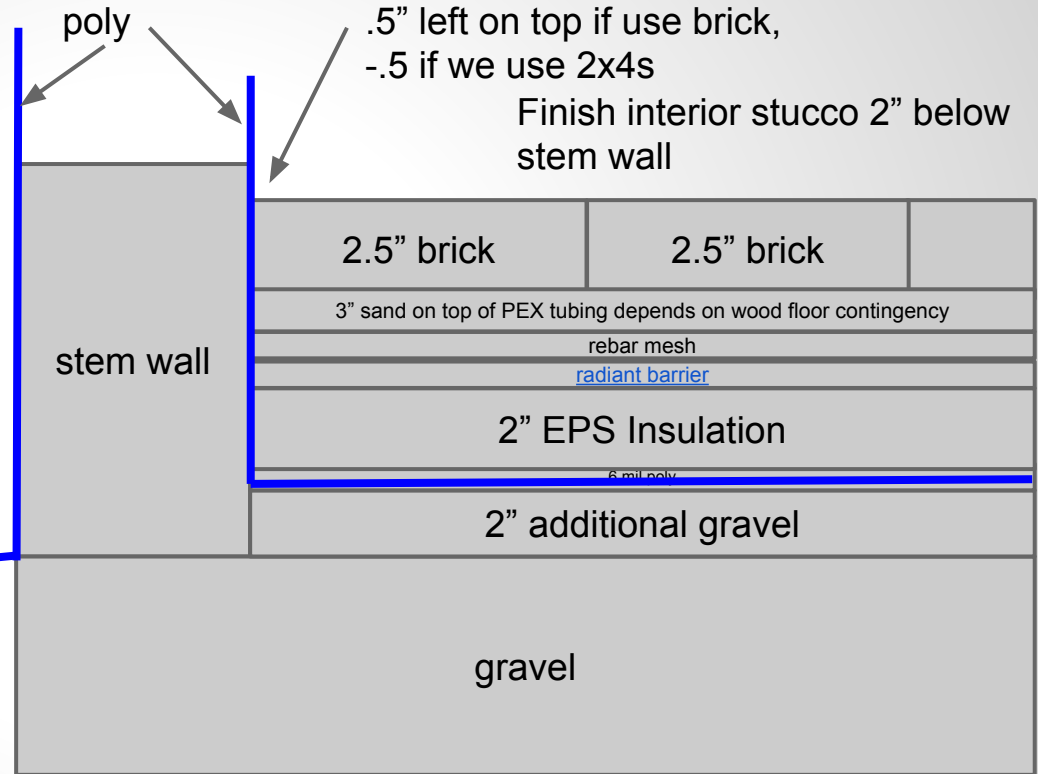
Utility Channel - Perimeter of House for Hydronic Line

Updates: do it on one side of house only, on MH1 side for water connection.



Floor Preparation for Hydronics

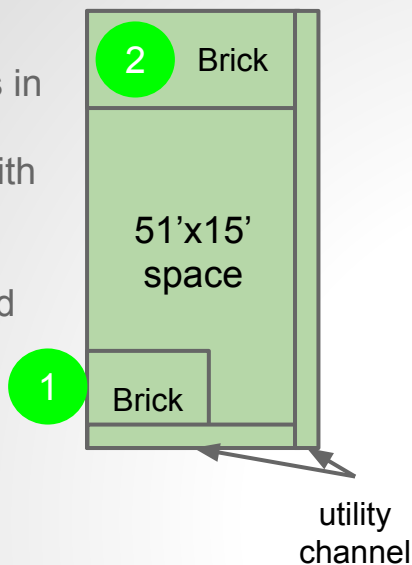
- Start with gravel base - fill in so that the finished floor is even with top of foundation stem wall
- Stem wall is 9" tall
- 2" gravel level
- 6 mil poly
- 2" EPS Insulation
- 1" Sand
- Radiant barrier
- 4 x 8 rebar mesh - for tying down hydronic tubing foundation
- ½" Pex tubing
- 1" sand
- 2.5" brick



Contingency plan: if we are not capable of pressing bricks, then we need to frame the floor in using precision fit via 'plywood edge ruler' with pre-cut plywood sheets

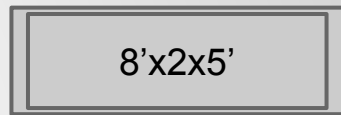
PLAN B:

- Do brick sections in Utility Room and Office, starting with Office
- Fill in rest with framing and wood floor



CEB Floor Contingency Plan

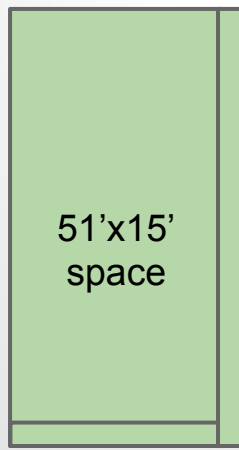
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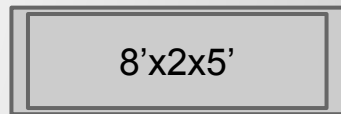
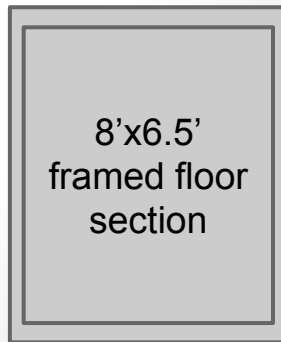
[1]

PLAN C:

- All wood framed floor



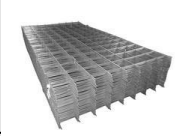
[6]



[1]

(one piece has cutout
of 3.5'x6.5' for stove
cement slab)

Parts

	Reflectix 4' x 25' Radiant Barrier - need 7 rolls to cover 40x15 = 600 sf	Reflectix 4' x 25' Reflective Foil Insulation Model Number: BP48025 Menards® SKU: 1613577 Sale Price: \$30.99	Associated search items
	4 x 8 Rebar Mesh - need 20 sheets for 40'x15'	Mazel 4' x 8' Remesh - 10-gauge Model Number: 1831016 Menards® SKU: 1831016 Sale Price: \$6.99	Associated search items
	6 Mil poly - 50x20 is all they had in stock; 16' width would be optimal. 1 roll.	Polar Plastics 6-Mil Black Poly All-Purpose Plastic Sheeting - 6' x 100' Roll Model Number: 5680295 Menards® SKU: 5680295 Variation: Black \$29.77	Associated search items
	2" EPS aged foam insulation - need 26 for 52x15 - get 19 sheets, we have 7	2" Aged EPS form for EIFS use Model Number: 1632007 Menards® SKU: 1632007 \$29.69	Associated search items

MAIN COMPONENTS

Stove Connection Detail -Components

1. Water Fill Line
2. Expansion Tank #15 - 26 Gal. Max.
3. [2] Taco 007 Circulating Water Pump (110 volt)
 - a. [Link](#)
4. 1" Sw. Mixing Valve Taco 5000 Ser
5. Air Purge - 1" FPT - Air Purge (Does not include Autovent)
6. TACO Single Zone Switching Relay
7. Taco 1"- 3 Way Zone Valve
8. 1" AIR Purger to pull air from system
9. 1/2" NPT Pressure Reducing Valve
10. Temperature Sensor
11. [2] Temperature Pressure Gauge
12. Temperature sensor turns pump on and off
13. 3/4" x 300' - O2 Barrier HeatLink® UV Stabilized PEX pipe
14. [2] [Baseboard heaters](#) (ordered)
- 15.

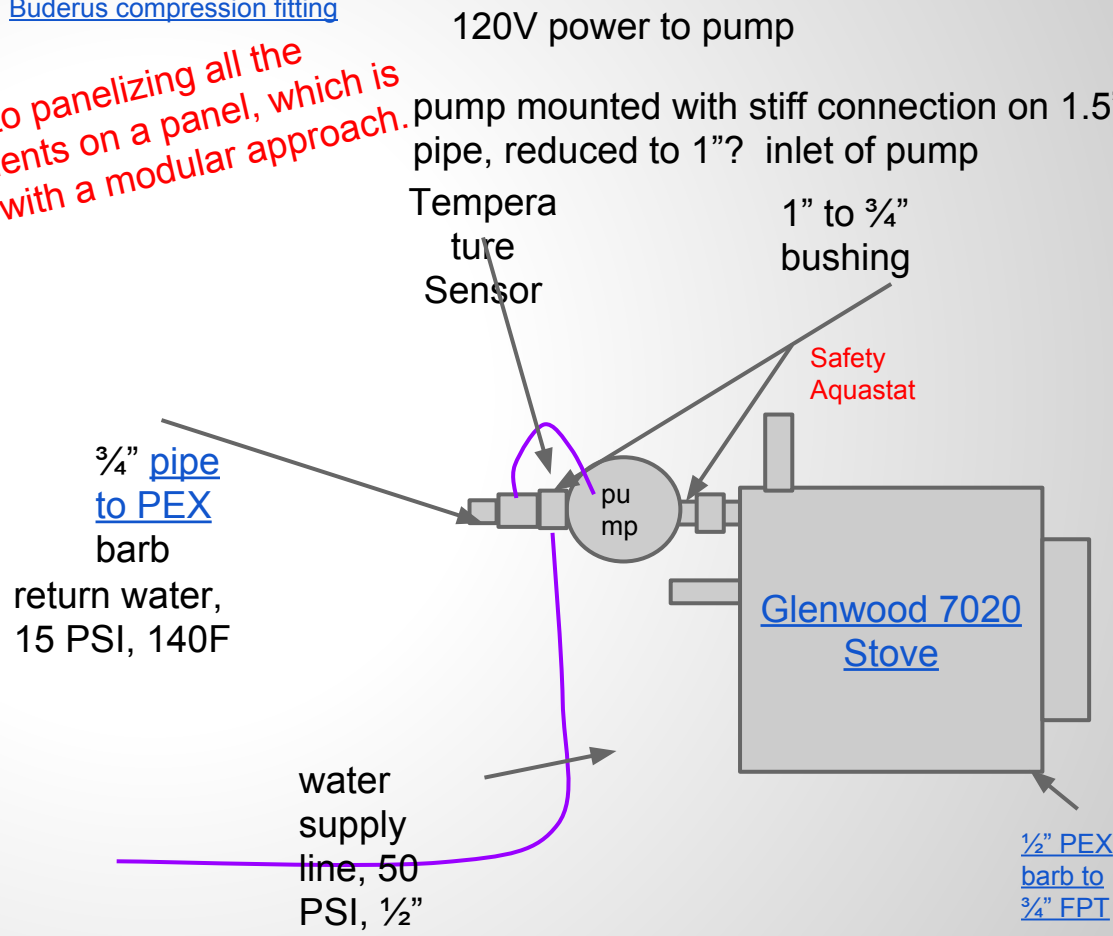
FROM WOODY

1. 1" Pump Flange- 1" Ball Valve x 1" Female Sweat
2. [2] 1" Pump Flange- 1" Ball Valve x 1" Female Sweat
3. Autoevent
4. 3/4" Boiler Drain- Iron Pipe
5. 1" Check Valve Butterfly
6. Boiler Treatment - 5 Gallons
7. [2] 1 1/2" x 1 1/4" Black Reducer
8. PH Test Kit (50 Strips per Pack)
9. [2] 2 Loop SS Manifold with Flow Meter Balancing Supply and Z.V. Return
10. 3/4" Pipe to Manifold connector with nut
11. AQUA PURE Head and Filter Anti Scale and Corrosion Filter

FITTINGS

1. [Buderus compression fitting](#)
- 2.

note: this is prior to panelizing all the hydronic components on a panel, which is more consistent with a modular approach.



Hydronic Basics Video

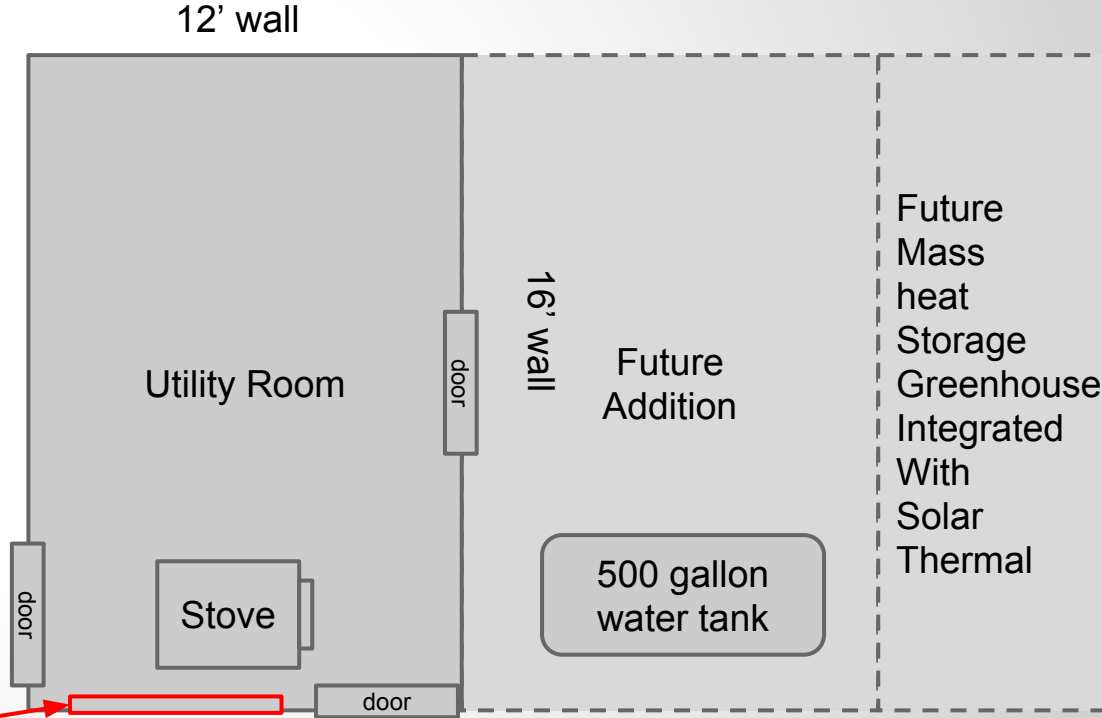


- [Taco Flo Pro Team](#)
 - [Tech support form](#)
- [Example Taco Flo Pro Training - Hydronics Step by step](#)
- Also has free software for calculations
- [FloPro University Videos](#)
- http://digital-magic.tv/digitalplanet/resources/109_Hydronics%20Step%20by%20Step%20Cheat%20Sheet.pdf

Utility Room Plan



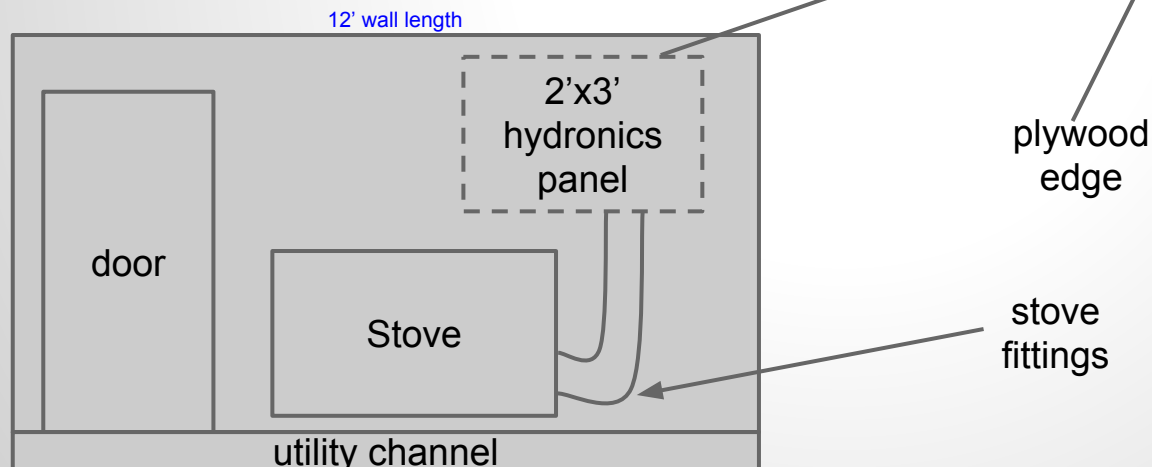
- Stove 1' away to south CEB wall
- Stove 4' away from W door
- 4' to E and W walls
- Fan can be placed W of stove for additional forced air heat into house
 - There is a long room to the W
- Future expansion: 500 gallon water tank in adjacent room, and solar thermal panels with mass heat storage bed to E
- Sidearm Heat Exchanger + water tank to be placed in bathroom



Hydronic Panel
Module

Hydronic Heat Panel Mount in Utility Room

1. Mount 3'8" long 2x4s to the wall of the utility module
 - a. To make edges nice, use 2x4's that are 2" shorter than the plywood height, so stucco can be applied under the mousing panel
 - b. Use 4x8 plywood covers the edge
 - c. Use 4 inch screws to screw 2x4s into wall at 6" of spacing
 - d. This can be done prior to interior stucco
2. Assemble entire hydronics panel separately, then mount it on the 2x4s
3. Locate this based on stove fittings:



Hydronic Heat Panel with Backup Pump- 2

1. Interface design:
 - a. Inlet/outlet of stove
 - b. Feedwater inlet
 - c. Outlets to 2 zones of hydronics, 500' each
2. Expansion tank - sizing - $\frac{MBH}{10} = \text{BTU rating of stove}$
 - a. Use [4.4 gallon tank](#)
3. [2] Pump - 1 speed - [Taco 007](#)
 - a. General calculation - 10kBTU/1 GPM of flow at 20 degree T drop
 - b. [4] [isolation pump flanges](#) or [flanges](#)
 - c. [1 zone controller](#)
 - d. Aube thermostat with [floor sensor](#)
 - e. [Check valve](#)
4. Manifold - 4 loops of 250 ft
5. [Thermostatic mixing valve](#)
 - a. Bypasses hot water to return to stove
6. [Feed water pressure regulator](#)
7. [Air Purge](#)
8. [Tees](#), [Cross](#), [Ball Valve](#), [Union](#), [pipe to PEX](#), pipe to PEX [1 to 3/4](#), [elbow](#), [1" copper to NPT](#)
9. 4 Branch [manifold](#)
10. [Pressure/Temperature gauge](#)
11. [3/4" pressure relief valve](#)

complete manifold

to Utility Channel for in-ground PEX

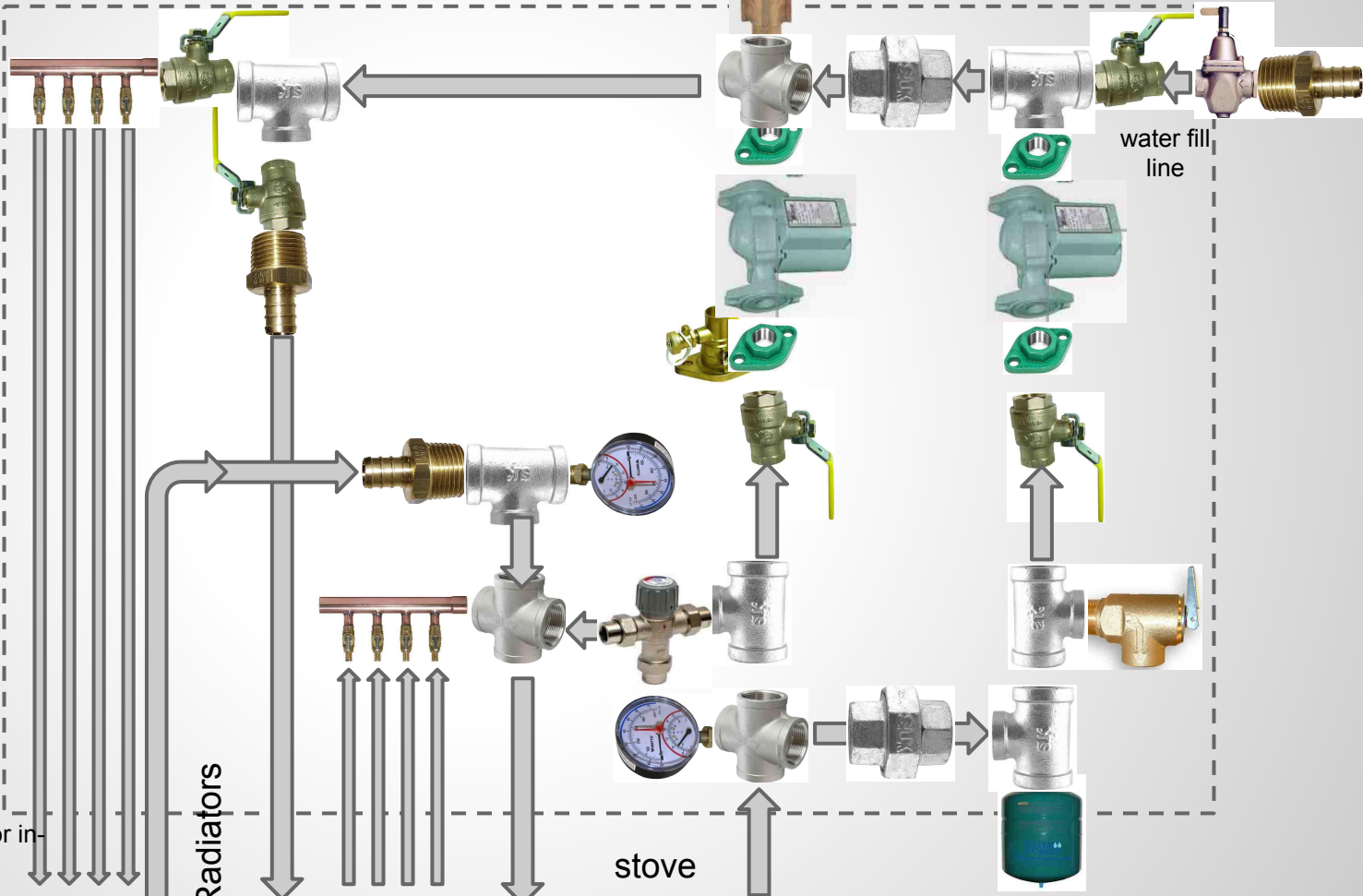
Radiators

stove

air purge

check valve

water fill line



Hydronic Heat Panel - Simplified

Interface design:

- Inlet/outlet of stove
- Feedwater inlet
- Outlets to 2 zones of hydronics, 500' each
- Panel stands 3" off wall
- Components stand off 3" from wall
-

Expansion tank - sizing - [MBH](#) = BTU rating of stove

- Use [4.4 gallon tank](#)

[2] Pump - 1 speed - [Taco 007](#)

- General calculation - 10kBTU/1 GPM of flow at 20 degree T drop
- [4] [isolation pump flanges](#) or [flanges](#)
- [1 zone controller](#)
- Aube thermostat with [floor sensor](#)
- [Check valve](#)

Manifold - 4 loops of 250 ft each
[Thermostatic mixing valve](#)

- Bypasses hot water to return to stove

[Feed water pressure regulator](#)
[Air Purge](#)
[Tees](#) , [Cross](#) , [Ball Valve](#) , [Union](#) , [pipe to PEX](#) , pipe to PEX [1 to 3/4](#) , [elbow](#) , 1" [copper to NPT](#)
4 Branch [manifold](#)
[Pressure/Temperature gauge](#)
[3/4" pressure relief valve](#)

to in-floor circuit

air purge

pressure regulator

3/4" PEX to 1" NPT

1/2" Temperature/Pressure Gauge

stove

stove

Taco 007 Pump

Thermostat

1 zone pump controller

4 branch manifold

1" mixing valve

30 PSI relief

1/2" expansion tank

Radiators

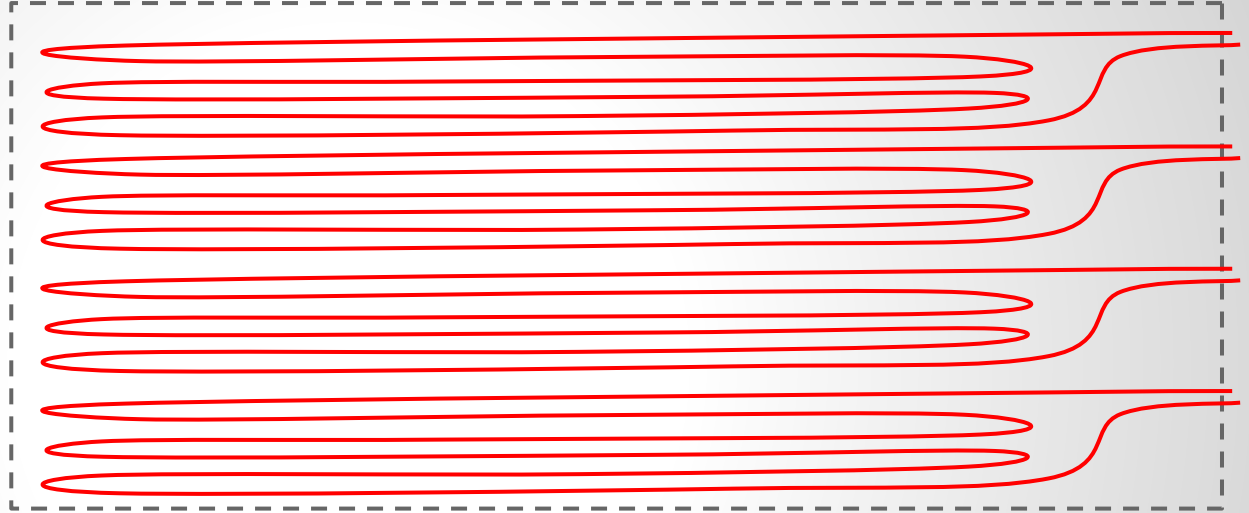
Radiators

to in-floor circuit

1. Inference design:
 - a. Inlet/outlet of stove
 - b. Feedwater inlet
 - c. Outlets to 2 zones of hydronics, 500' each
 - d. Panel stands 3" off wall
 - e. Components stand off 3" from wall
 - f.
2. Expansion tank - sizing - [MBH](#) = BTU rating of stove
 - a. Use [4.4 gallon tank](#)
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 - a. General calculation - 10kBTU/1 GPM of flow at 20 degree T drop
 - b. [\[4\] isolation pump flanges or flanges](#)
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 - d. Aube thermostat with [floor sensor](#)
 - e. [Check valve](#)
4. Manifold - 4 loops of 250 ft each
5. [Thermostatic mixing valve](#)
 - a. Bypasses hot water to return to stove
6. [Feed water pressure regulator](#)
7. [Air Purge](#)
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9. 4 Branch [manifold](#)
10. [Pressure/Temperature gauge](#)
11. [3/4" pressure relief valve](#)

In-Ground Tubing Design

1. Interface design:
 - a. In/out for circuits through divider wall between utility room and meeting room
 - b. Plastic staples into underlying 2" EPS
2. Basics of length
 - a. no more than 300' for ½" tubing
 - i. Use 250' for 4 team swarm
 - b. For 40' runs, allows for 6x back and forth
 - c. 24 lines over 13' means



N ←

Hydronics BOM

1. Control Panel Items

2. In-Floor Heat

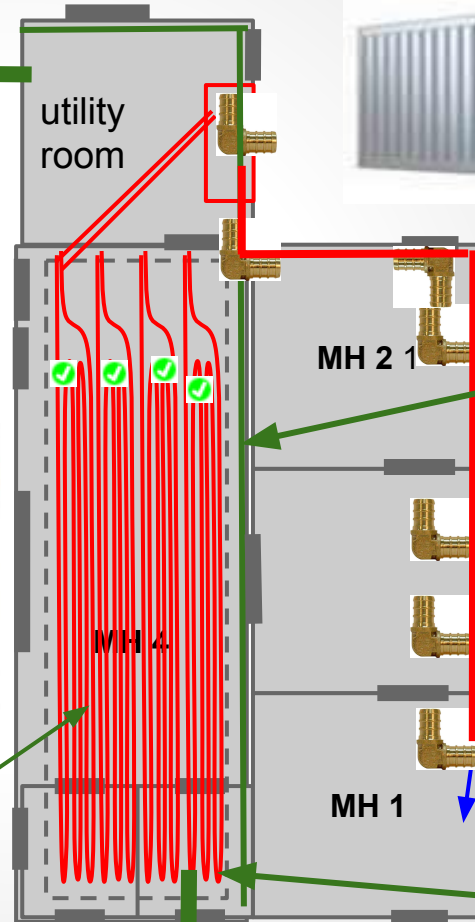
- [4] 300' of PEX ✓
- [8] Crimp rings ✓
- [1] Clamp too ✓
- [20] Metal mesh ✓
- Radiant barrier ✓
- [500] Cable ties ✓
- Vapor barrier ✓
- 2" insulation ✓

3. Radiators

- [2] 100' ¾" PEX
- [14] ¾" elbows

4. Utility Channel

- [264'] of 1"x4"
- Water supply ½" PEX to Utility room



spacing between
lines is 7"

utility
channel

Bathroom

Hydronic Floor Layers



Radiator Detail

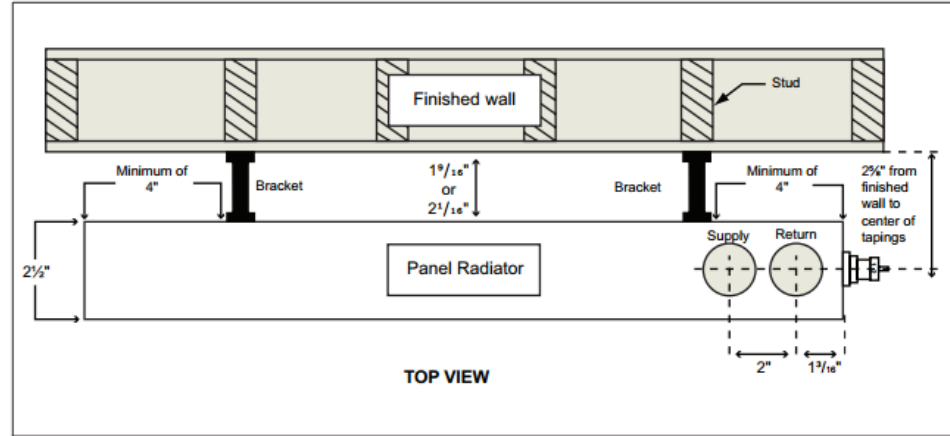
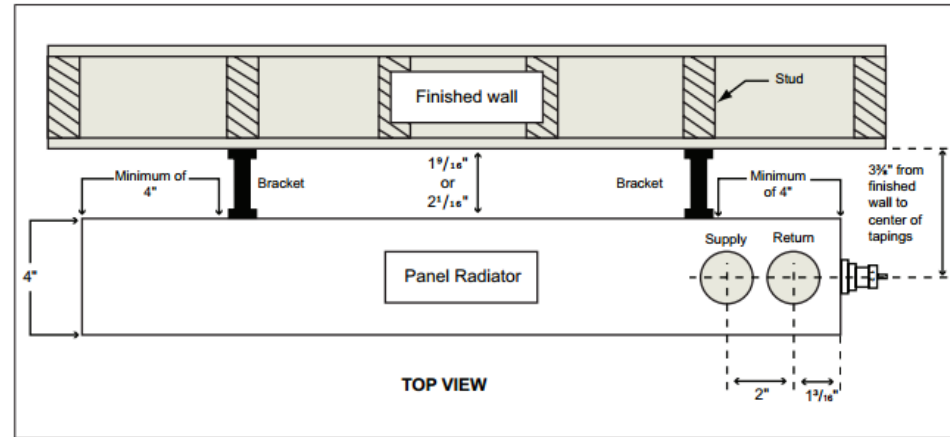
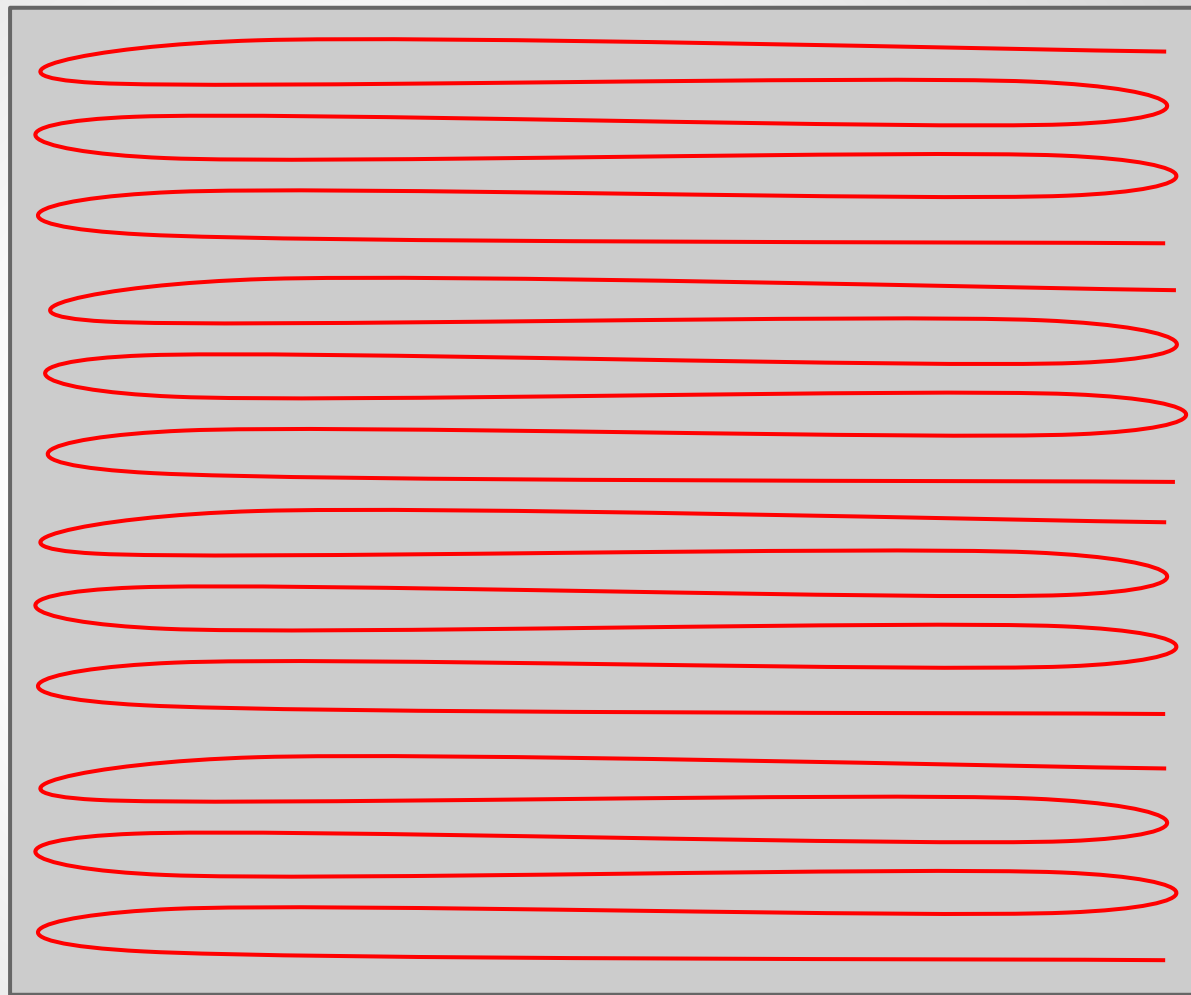


Fig. 8 Model 21 Panel Radiator Rough in Dimensions in inches for wall mounting





ON FLOOR
PLAN

ROOM-1
53' X 15'
795 FT²
HEAT: 196.00 BTU/H
COOL: 3500 BTU/H

ROOM-2
40' X 13'
520 FT²
HEAT: 13200 BTU/H
COOL: 2400 BTU/H

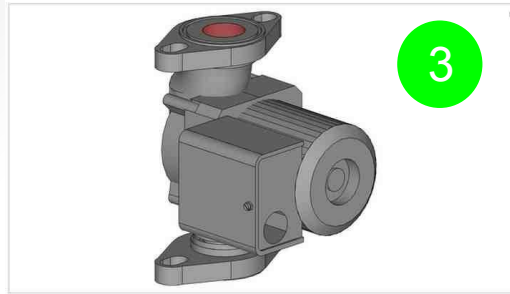




Hydronics 3D CAD Examples

1. [Radiant Floor Heat Substation](#)
2. [Residential Boiler Room](#)
3. [1/25 hp Circulator](#)
4. [15 lb Expansion Tank](#)

1/25 HP CIRCULATOR



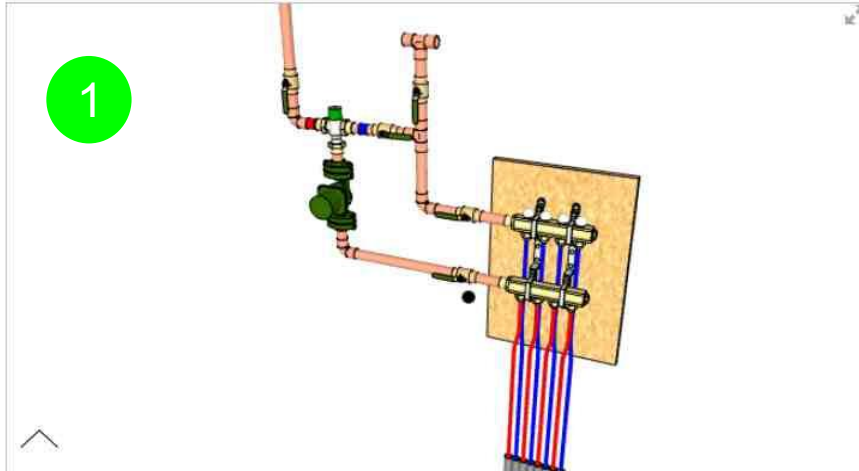
To fully benefit from the dynamic features of this Generic component, visit www.iDrawnics.com for a FREE TRIAL of the iDrawnics plugins. You will be surprised at how easy it is to design a hydronic system.

EXPANSION TANK 15# 1/2 in



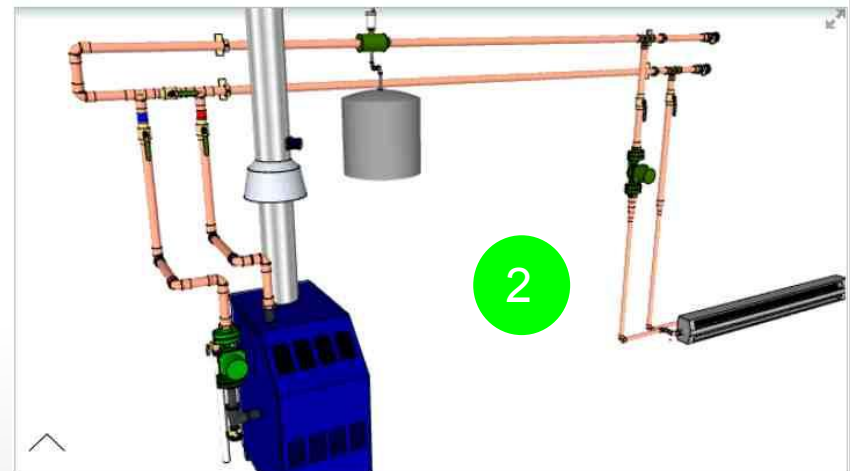
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Radiant Floor Heat substation



Radiant Floor Heat substation for open architecture system ... 1 zone

Residential Boiler Room



Residential Boiler room with Baseboard heat ... open architecture design to allow adding various zones