

THE BR**HEAT**HE SYSTEM

MECHANICAL HEATING AND VENTILATION



COMPILED BY



COLD CLIMATE HOUSING RESEARCH CENTER

CCHRC

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[Photo of the mechanical room in an integrated truss home - Galena 2014]



[HRV (left) and Coil Filter box (right) - Galena 2014]

INTRODUCTION

A new prototype system developed by CCHRC locks together heating and ventilation—two crucial elements of life in Alaska.

CCHRC researchers developed the integrated heating and ventilation system, called BrHEAThe, to ensure that new energy efficient homes are getting ample fresh air.

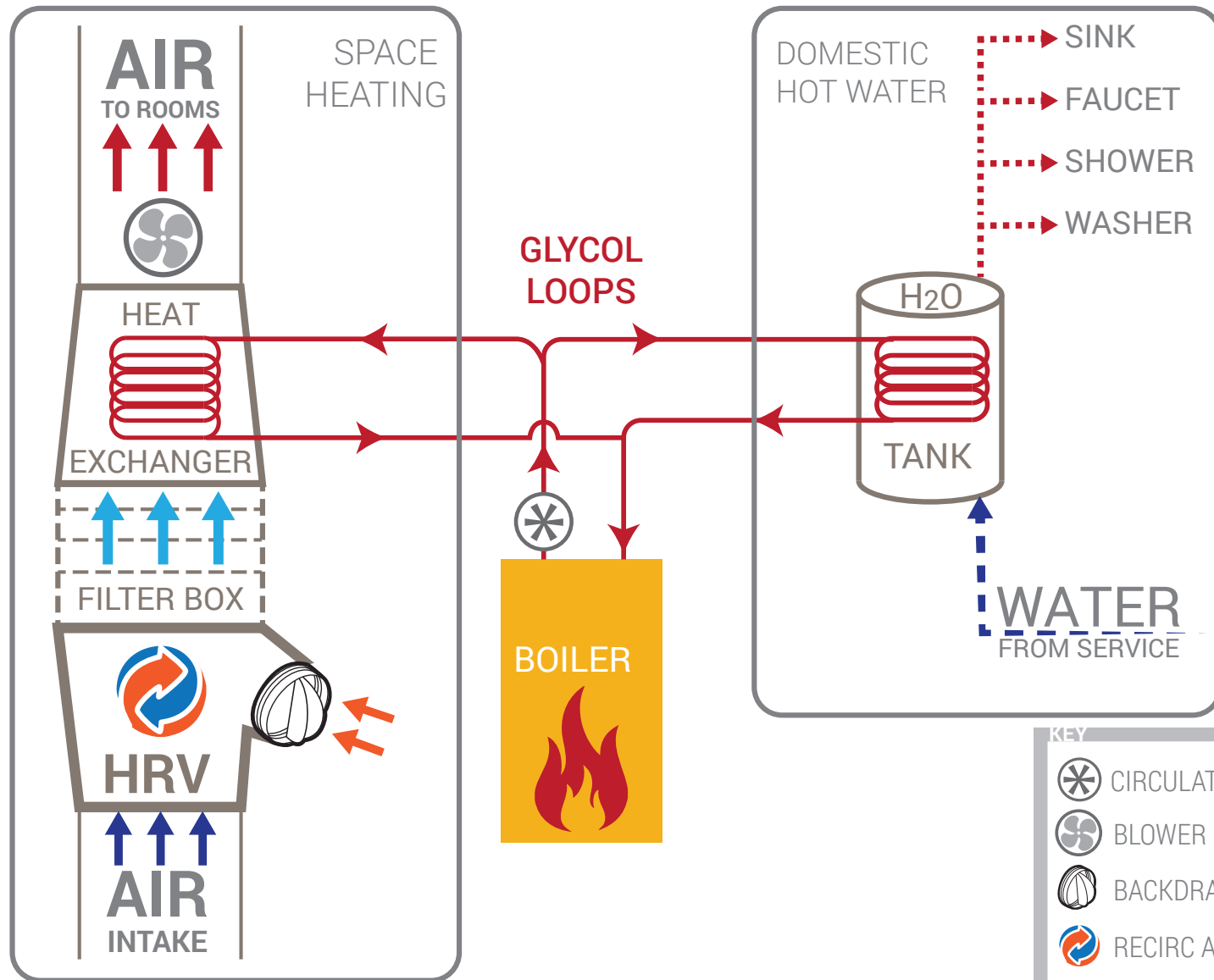
As homes are being built tighter in Alaska to save energy, less air is able to leak into or out of the building, so things like water vapor and chemicals generated from cooking or off-gassing furniture can be trapped inside. Without ventilation, they can build up to harmful levels for both humans and buildings.

Some Alaska homeowners are wary of mechanical ventilation, such as fans or heat recovery ventilators (HRVs), because they use electricity and replace heated air with cooler air. As a result, some people turn off or disable their ventilation systems.

The BrHEAThe system marries heating and ventilation so that incoming air is always hot and fresh.

The following pages outline the various pieces and components of the BrHEAThe system. The intent of this booklet is to provide quick reference information for homeowners.

BRHEATHE SYSTEM SKETCH

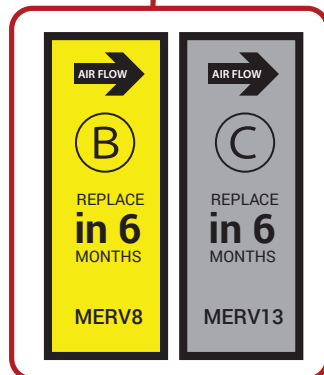
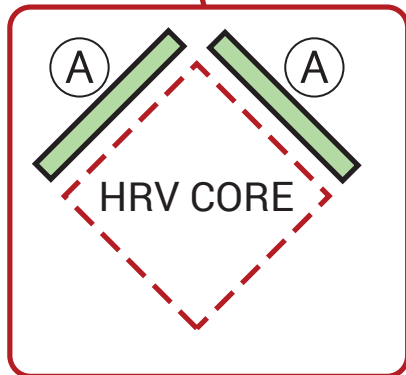
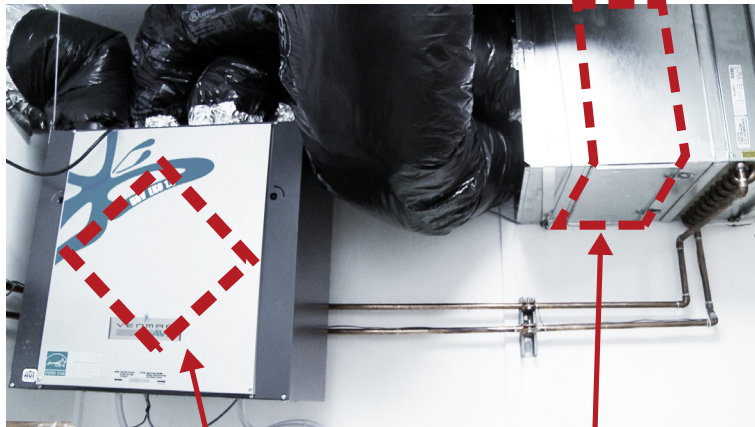


MECHANICAL ROOM AIR FILTERS

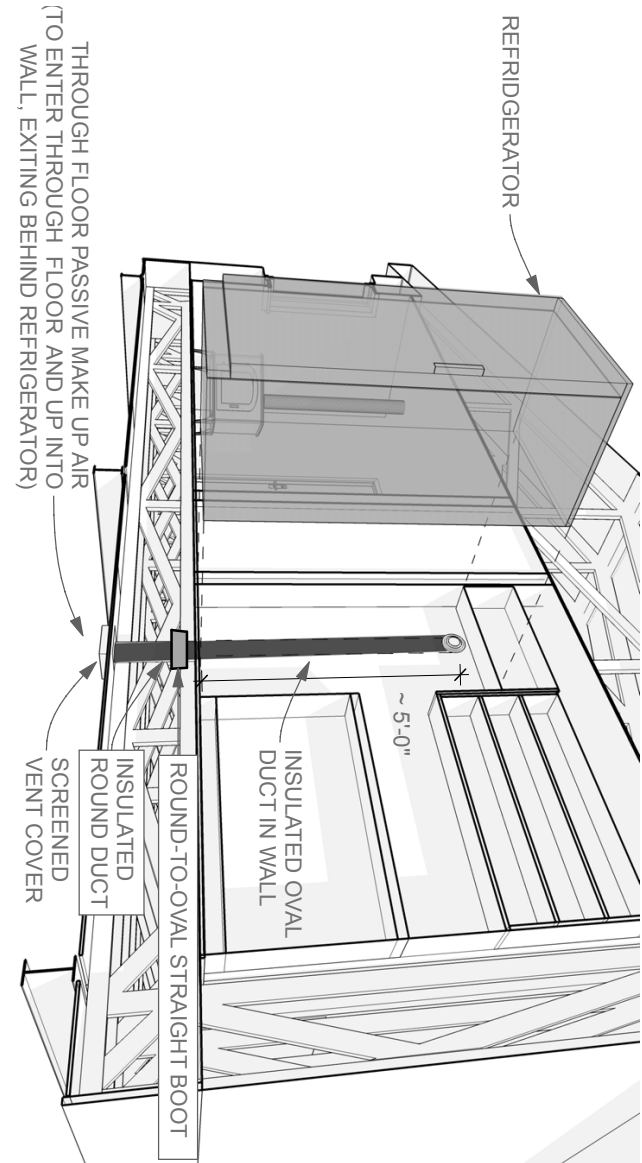
The brHEAThe system contains a number of filters.

- Ⓐ **HRV filters**; clean with water monthly
- Ⓑ **MERV 8 filter**; replace every 3-4 months
- Ⓒ **MERV 13 filter**; replace every 3-4 months

(refer to the training video and back cover for additional info)

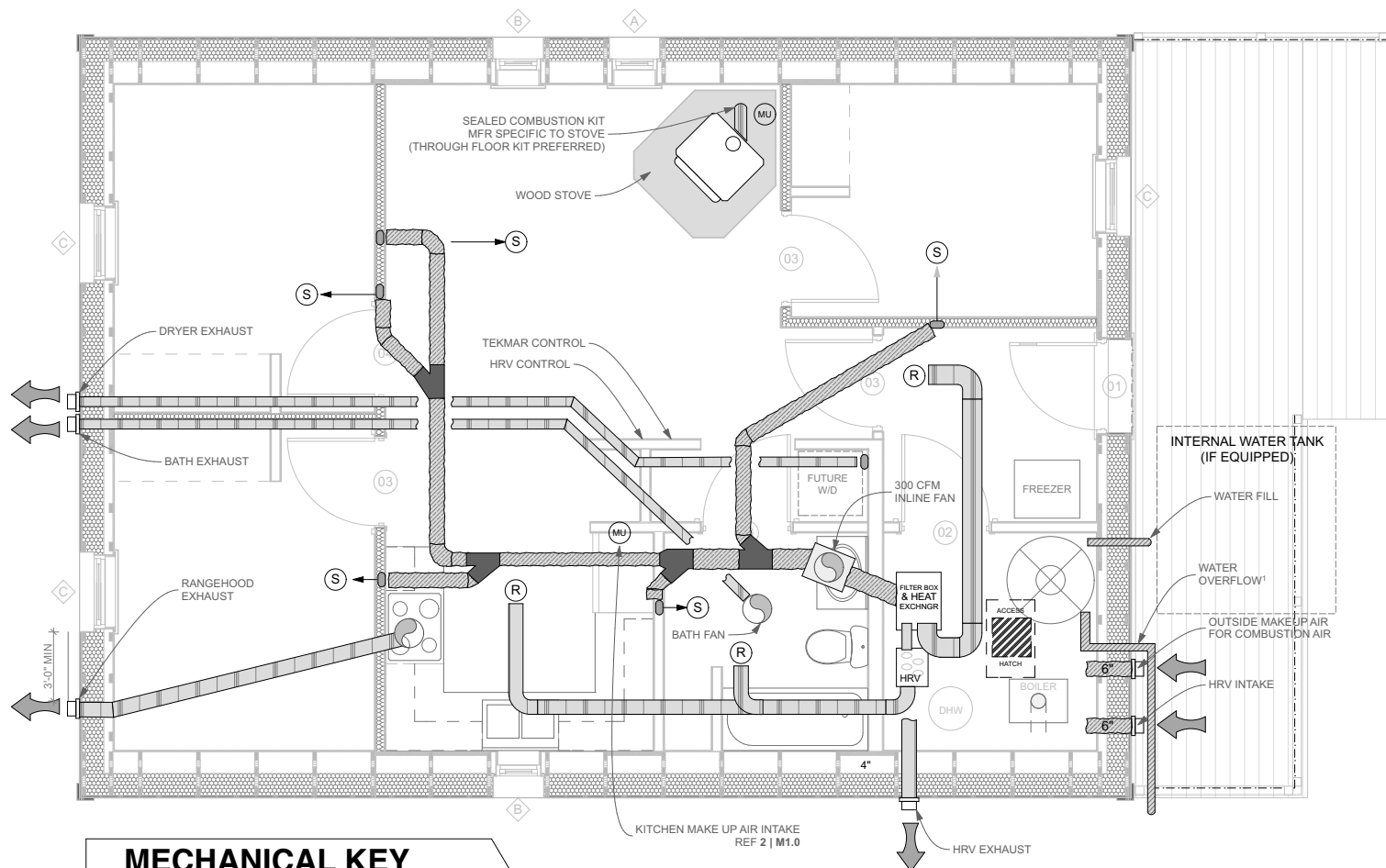


KITCHEN MAKE-UP AIR

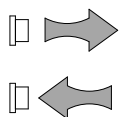


MECHANICAL SYSTEM PLAN

Plans reference the Integrated Truss Homes built in Galena in 2014; deviations may exist

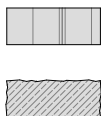


MECHANICAL KEY



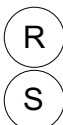
EXHAUST

INTAKE



RIGID DUCT

FLEX DUCT



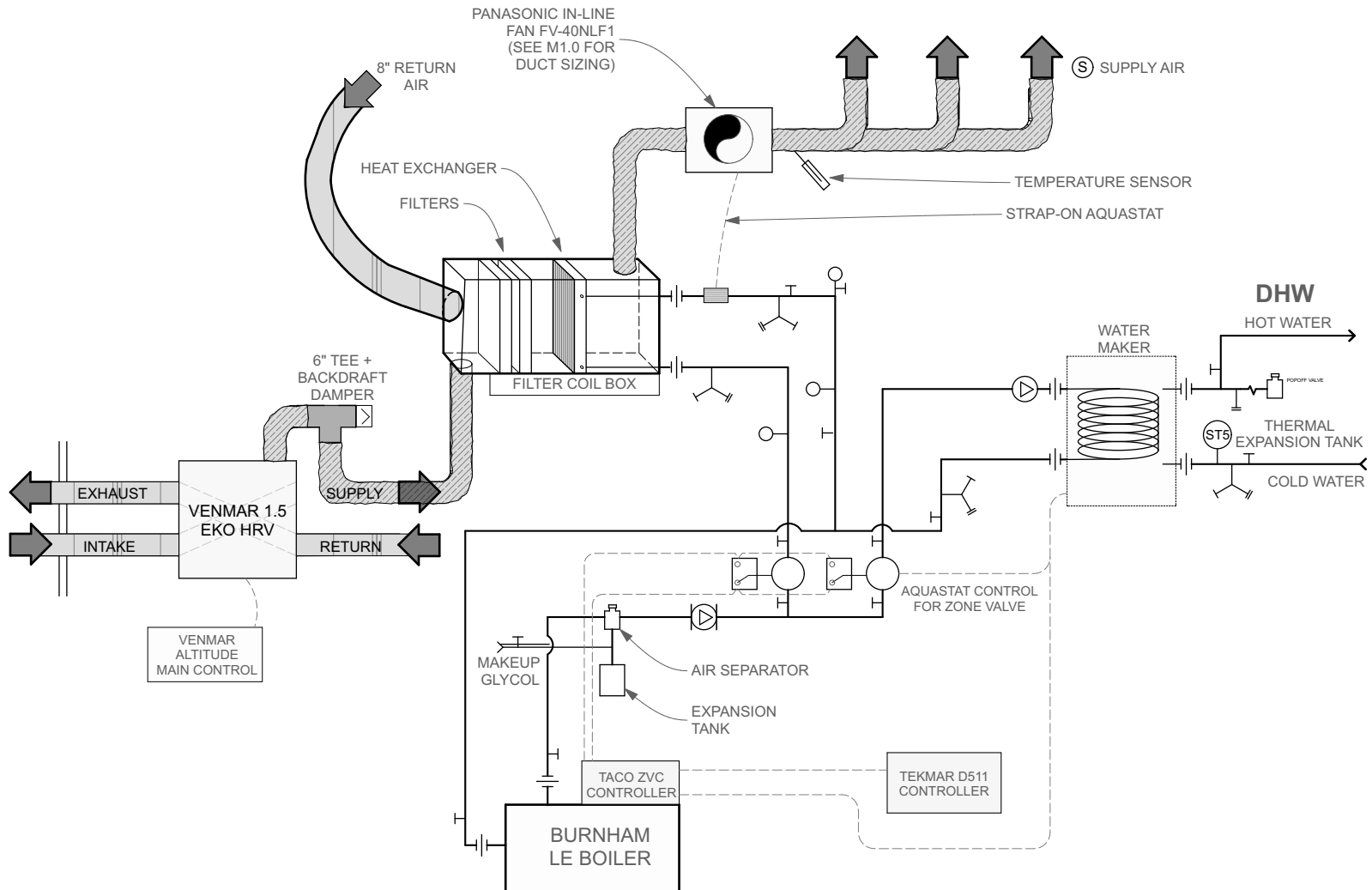
RETURN AIR

SUPPLY AIR



MAKE UP AIR

BRHEATHE SYSTEM SCHEMATIC



BRHEATHE SYSTEM WIRING

Plans reference the Integrated Truss Homes built in Galena in 2014; deviations may exist

Recommended Control Wiring Diagram for TACO ZVC-403

The ZVC403 zone valve control is used to control power to the circulator pump and the inline fan based on a call from the thermostat and aquastat..

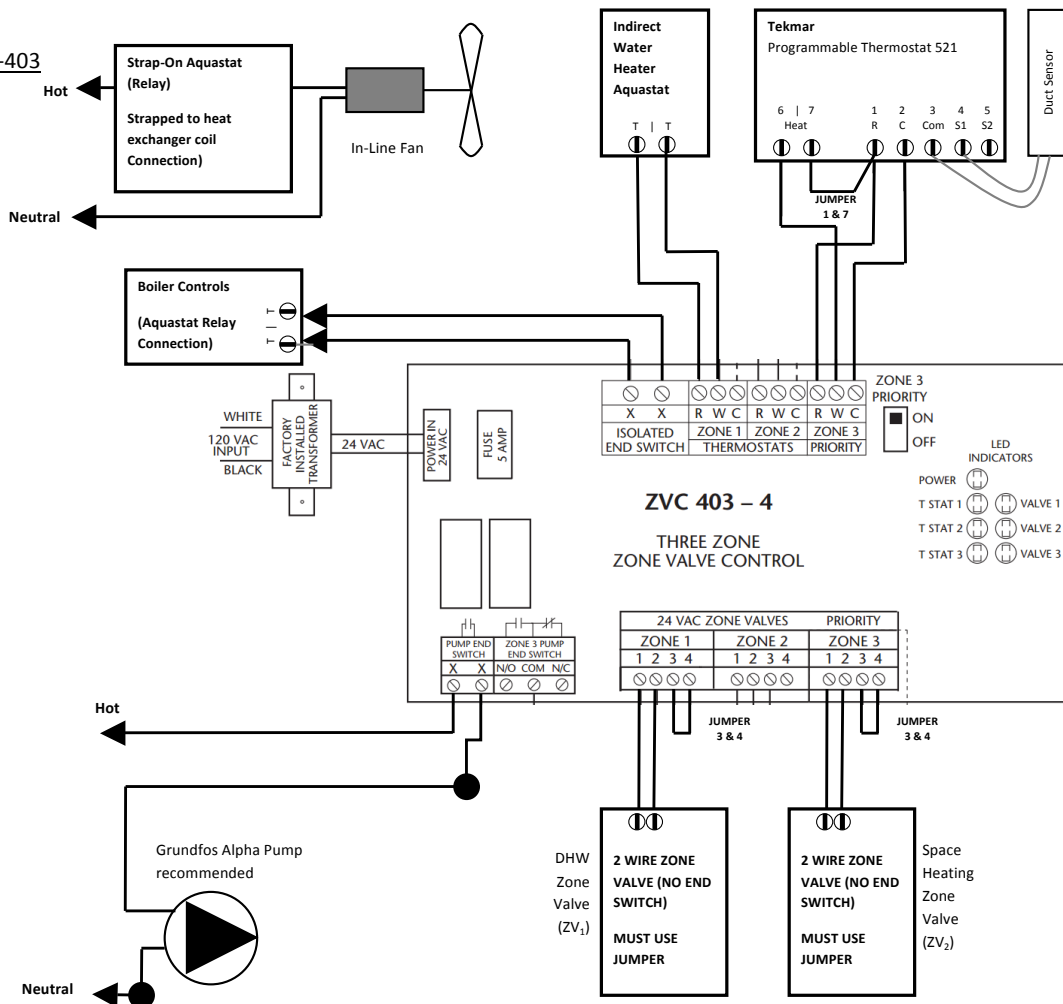
Domestic Hot Water (DHW) Order of Operation

1. Aquastat on indirect fired water heater calls for heat.
2. "Zone 1" is activated on ZVC 403
 - a. DHW Zone Valve (ZV₁) allows flow to heating coil in water tank.
 - b. Boiler senses call for heat via isolated end switch.
3. Pump end switch is activated and 120VAC power is sent to pump to circulate fluid through hydronic system.
4. Hot water is sent to heating coil in water tank until water temperature is satisfied.

Space Heating Order of Operation

1. Tekmar thermostat calls for heat.
 - a. Calls for heat to satisfy room temperature OR
 - b. Calls for heat to ensure minimum duct air temperature (so no cold air blows into bedrooms when HRV is ventilating)
2. "Zone 3" is activated on ZVC 403
 - a. Space Heating Zone Valve (ZV₂) allows flow to heating coil in filter box.
 - b. Boiler senses call for heat via isolated end switch.
3. Pump end switch is activated and 120VAC power is sent to pump to circulate fluid through hydronic system.
4. The strap-on aquastat senses heat flow to the heat exchanger and once the heat reaches approx 140°F, 120VAC power is sent to in-line fan to circulate air through duct system.
5. Hot water is sent to heating coil in filter box assembly until temperature is satisfied.

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BRHEATHE EQUIPMENT LIST

01 Venmar Altitude Controller

This controls the operation and functionality of the HRV. It can be programmed for a multitude of settings.

01 Venmar EKO 1.5

The Heat Recovery Ventilator exchanges, cleans, preheats, recirculates interior air, and provides heat exchange on incoming exterior fresh air.

01 HRV 3-Button Controller

Controls the HRV by overriding the main Altitude controller to exhaust interior air as quickly as possible. It is mostly used to remove smells from the bathroom and kitchen.

02 Tekmar Controller

A thermostat that tells the boiler to provide heat.

03 Filter coil box

The box in the mechanical room that cleans (filters) the air and then heats the air (with the heating coil/exchanger).

03 HRV Filters

The two filters inside the HRV that should be cleaned regularly. They can be washed in the sink.

04 In-Line Fan

A booster fan that delivers heated air to the living space.

05 Burnham LE Boiler

This provides space heating and produces the hot line of the domestic hot water (DHW) system.

06 Circulator Pump

A small pump that moves the heated fluid from the boiler to the heat exchanger in the duct or to the domestic hot water tank.

07 Taco Zone Valve Controller

Controls the movement of hot fluid between appliances, does all the deep thinking and brain work.

08 Axiom Glycol Feeder

A reservoir of fluid for the boiler. It is to make sure the boiler heat loop does not run out of fluid to heat the house.

Additional detailed information, and product manuals can be found on the enclosed CCHRC USB thumb drive

GLOSSARY of TERMS

Aquastat

Aquastats control water temperature in boilers and other hydronic heating systems. They are usually set to have a high limit temperature and a low limit temperature. If the heating appliance causes the water to reach the high limit temperature, they will shut off the heating appliance. Also, if water reaches the low limit temperature, they will cause the heating appliance to fire to raise the water temperature.

Backdraft Damper

A damper refers to a device that regulates airflow. Dampers are often located in flues and chimneys. They can be closed when the heating appliance is not in use to prevent heated air from escaping up the chimney, and opened when the heating appliance is firing, to allow exhaust gases to exit. A backdraft damper is a damper that only allows flow in one direction, preventing combustion gases from flowing back into the house.

Bowtie Damper

A bowtie damper is a damper that regulates how much air is provided to or removed from a space. It sits behind the diffusers and is locked into position so that the air delivered and removed from the space is balanced.

Boiler

A boiler is a heating appliance that produces heated water that is delivered to a house by a hydronic (piped) distribution system. A boiler can use electricity or combustion from burning fuel oil, natural gas, or wood to heat water.

BrHEAThe system

A combined heating and ventilation system developed at the Cold Climate Housing Research Center. The design further marries domestic hot water to using a single heat source (boiler).

CFM - Cubic Feet per Minute

The volume of air that flows through the ducts.

Circulator pump

A small pump that moves heated liquid from the boiler to the heat exchanger in the duct.

Controller

A stand-alone device that interfaces with a peripheral device. Within the

BrHEAThe operations, this controller is a link between two parts of the system (the thermostat/sensor data, and the boiler/zone valves) that manages the operation of the boiler/zone valves.

DHW - Domestic Hot Water

Domestic hot water refers to the hot water used by a household that is produced by a domestic hot water heating appliance. It includes hot water needed for showers, faucets, dishwashers, clothes washers and other appliances.

Diffuser/Grille

A grille, or register, is a vent through which hot air from a forced air distribution system is delivered to a room or returned to the heating appliance. Technically, registers contain dampers and grilles do not, but the terms are often used interchangeably.

Duct

The tube, or conduit, that air is transported through. Ducts are used in distribution systems to deliver heated air. They can be made of metal, fiberglass or a material consisting of wire and plastic.

Duct Sensor

A device in the duct that tells the boiler if the incoming air is too cold.

Exhaust

Exhaust refers to gases that result from combustion. Typically exhaust contains mostly nitrogen and carbon dioxide, although proportions will depend on the type of fuel burned. Exhaust also contains a small proportion of toxic gases and should be vented outside. Incomplete combustion will result in higher concentrations of toxic gases such as carbon monoxide (CO).

Fresh Air

Air from outside of the house which is brought into the house as stale air is removed from the house

Glycol

A liquid that is mixed with water and heated in the boiler. It is used to keep the water heating the duct from freezing when the incoming air is too cold.

Heating Fuel

Diesel fuel that burns in the boiler to supply heat for the house.

Heat Exchanger

A unit in the duct to that house that has warm fluid from the boiler flowing through it. The warm fluid heats the air that flows across the exchanger.

HRV Heat Recovery Ventilator

An energy recovery ventilation system using equipment known as a heat recovery ventilator which employs a counter-flow heat exchanger between the inbound and outbound air flow. HRV provides fresh air and improved climate control, while also saving energy by reducing heating (and cooling) requirements. **HRV Core** The flat plate heat exchanger that is in the HRV. It uses the exhaust air to heat the incoming fresh air while not allowing the air to mix. It should be cleaned about every 6 months.

In-line fan

A fan in the duct after the heat exchanger that boosts the heat delivery to the living space.

Make-up Air

Air that comes into the house from behind the refrigerator or in the mechanical room if air is required. Make-up air will be drawn into the house if the bathroom fan or kitchen range fan is running. It is to protect the occupants of the house from pulling air from the woodstove or boiler. They should never be blocked off.

Passive

Something that happens without action on the part of the homeowner. The make-up air system is passive.

Recirculate (HRV mode)

The HRV will stop bringing in fresh outside air and will just move the stale air around the house until the mode is changed.

Return Air

Air that is returning to the HRV from the house. It is stale air that will be removed from the house and replaced with fresh air.

Sensor

A device that tells the heating system what the temperature is so that the heating system should supply heat.

Space Heating

Heat to a small enclosed space.

Stale Air

Air inside the house that contains moisture, smells and other airborne particulates that are produced by house occupants.

Supply Air

Warm fresh air that is being delivered to the living space.

Ventilate (HRV mode)

The HRV will bring fresh air from outside the house in and remove stale air from the inside of the house.

Zone

An area of the house that has a separate thermostat. The house is a zone and the domestic hot water is a separate zone.

Zone Valve

A valve that directs that heated fluid from the boiler to the zone which needs the heat.

MAINTENANCE SCHEDULE

HRV Filters (Clean and wash)	1 time per MONTH
HRV Core (Clean and wash)	1 time per 6 MONTHS
M-8 and M-13 FILTERS (Check/replace the filters in the heat exchanger housing as needed)	1 time per 3-4 MONTHS
Glycol Reservoir (Check the reservoir periodically to make sure that a sufficient amount of liquid is in it. Fluid level should be ABOVE the MIN. line)	REGULAR INSPECTION
BOILER SERVICING (Technician maintenance and tune up)	1 time per YEAR