Technical Bulletin

Special Domestic Water Piping for Combi Boilers

Combination space heating and water heating boilers ("combis") offer many advantages over the use of separate appliances for space heating and water heating. These include:

- Smaller installation footprint
- Combis are generally less expensive than separate comparable appliances.
- Elimination of the gas, electrical, and vent systems associated with the second appliance.
- Elimination of the flue losses associated with gas fired storage water heaters.

As with all things in life, however, these benefits come with tradeoffs. Some issues that should be carefully considered before selecting a combi include:

1) Because most combis only generate hot water (DHW) when a demand appears (e.g. when someone opens a faucet), and because the burner system takes some time to fire, the appearance of hot water at a given fixture will generally take longer (as much as a minute longer) than it would with a storage type water heater. In addition, if hot water was recently used, the water at the fixture itself may be hot when the fixture is first opened, but be followed by the cold water that made it through the combi between when the faucet was first opened and when the combi was able to fire. This second phenomena is sometimes referred to as a "cold water sandwich".
2) Combis do an excellent job of satisfying very long domestic water demands *as long as the rate at which water is being drawn is less than the manufacturers' published draw rate*. If there is even a short draw that exceeds this rate, the water temperature will drop because the combi has no reserve storage capacity to meet high demands of even short duration.
3) In most cases, combis can only satisfy a demand for domestic hot water or space heat. They cannot satisfy both at the same time. In most cases DHW demands are short enough that this is not a problem, but it could be on a design winter day.

If any of the above issues are deemed unacceptable, consider the use of an indirect water heater, such as the Mega-Stor 2. The Mega-Stor 2 uses a standard boiler as its source of heat, providing some of the installation benefits described above. Like a combi, the Mega-Stor 2 does not have water stored around a flue, so standby energy losses are minimized. A Mega-Stor 2 paired with a boiler does have a larger footprint than a combi alone, although in some cases, the Mega-Stor 2 can be located under a wall hung boiler.

In cases where a combi is used, the following diagrams show methods of minimizing some of the drawbacks described above:

Figure 1: Fixture Recirculation – The fixture recirculation system shown maintains hot water at the fixtures by periodically circulating water from the combi through the hot water piping near the fixtures. This reduces the time that it will take for hot water to appear at a fixture after it is opened. Note that the fixture recirculation line cannot be operated continuously – if it did, the combi would always see a call for DHW and would never be available to satisfy demands for space heat. The fixture recirculation pump must therefore be controlled by a timer that is set to only permit recirculation during the times of day when "instant" hot water is most desirable. Ideally, pump operation is also controlled by an aquastat that will only permit the pump to operate when the temperature at the end of the recirculation line falls to an unacceptable level.

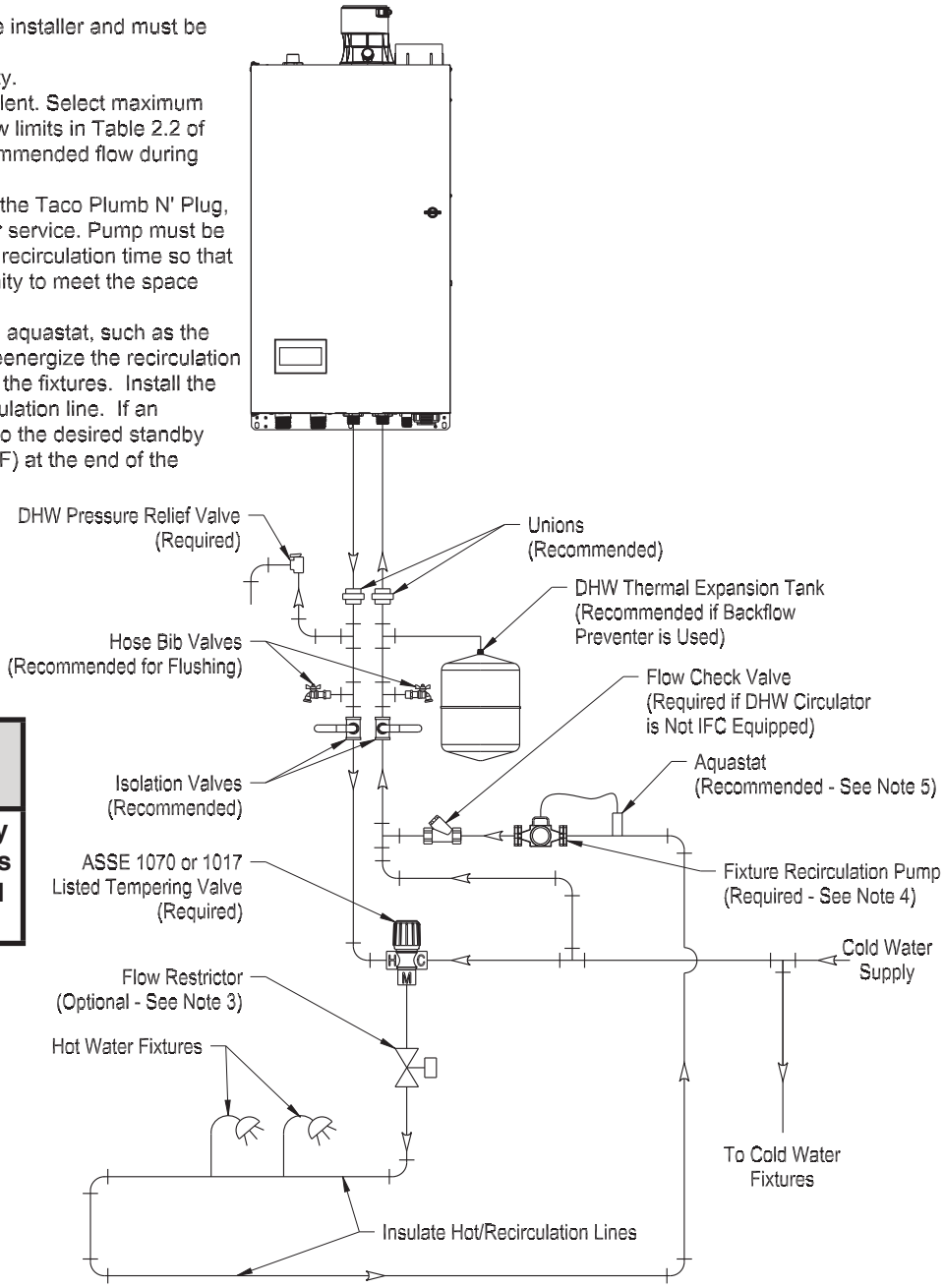
Figure 2: Storage Tank Recirculation – The system shown is useful if a combi has been installed and is subsequently found to be unable to meet a peak demand. In this system, the temperature of the DHW in the tank is maintained in a manner similar to a conventional storage type water heater; when the temperature at the tank aquastat falls below a set point, the tank recirculation pump starts. This closes the flow switch in the combi, creating a DHW demand. Water then circulates between the tank and the combi until the aquastat set point is reached.

Note that the heated water from the combi is introduced near the bottom of the tank. Natural convection carries this heated water to the top of the tank. This arrangement maximizes the probability that there will be hot water at the top of the tank when a fixture is opened.

This system really only makes sense for retrofit applications. If it is known that DHW storage will be needed at the time of the installation, use a "heat only" boiler and an indirect water heater, such as the Mega-Stor 2.

Notes:

1. All components are supplied by the installer and must be listed for domestic water service.
2. Space heat piping omitted for clarity.
3. McMaster-Carr 4762K45 or equivalent. Select maximum flow rating based on hot water draw limits in Table 2.2 of installation manual. Minimum recommended flow during recirculation is 2.0 GPM.
4. Use a recirculation pump, such as the Taco Plumb N' Plug, that is designed for domestic water service. Pump must be controlled by a timer that limits the recirculation time so that the boiler will have ample opportunity to meet the space heating demand.
5. In addition to a timer, the use of an aquastat, such as the Taco 563-2, is recommended to deenergize the recirculation pump when hot water is already at the fixtures. Install the aquastat near the end of the recirculation line. If an adjustable aquastat is used, set it to the desired standby temperature (typically around 115°F) at the end of the recirculation line.



CAUTION

It is installers responsibility to follow proper instructions supplied with circulator and adhere to all local codes.

NOTICE

During recirculation, boiler will not be able to respond to a call for space heat. Recirculation time must therefore be limited to avoid no-heat complaints and possible freeze damage. See Notes 4 and 5.

Figure 1: Fixture Recirculation, No Storage Tank

Notes:

1. All components are supplied by the installer and must be listed for domestic water service.
2. Space heat piping omitted for clarity.
3. Use a tank recirculation pump that is designed for domestic water service. Do not use a timer to control pump. Aquastat on tank starts pump when storage temperature drops below DHW set point. This creates DHW flow through the combi, which will cause it to fire in response to a call for DHW. Minimum recommended flow generated by recirculation pump is 3.0 GPM.
4. Bradford-White AST-**-6 Series or equivalent. Size to provide adequate storage for peak demand. This can usually be approximated using the following equation:

   Storage Vol. = (Peak Demand Flow Rate in GPM) x (Duration of Demand in Minutes) x 1.33

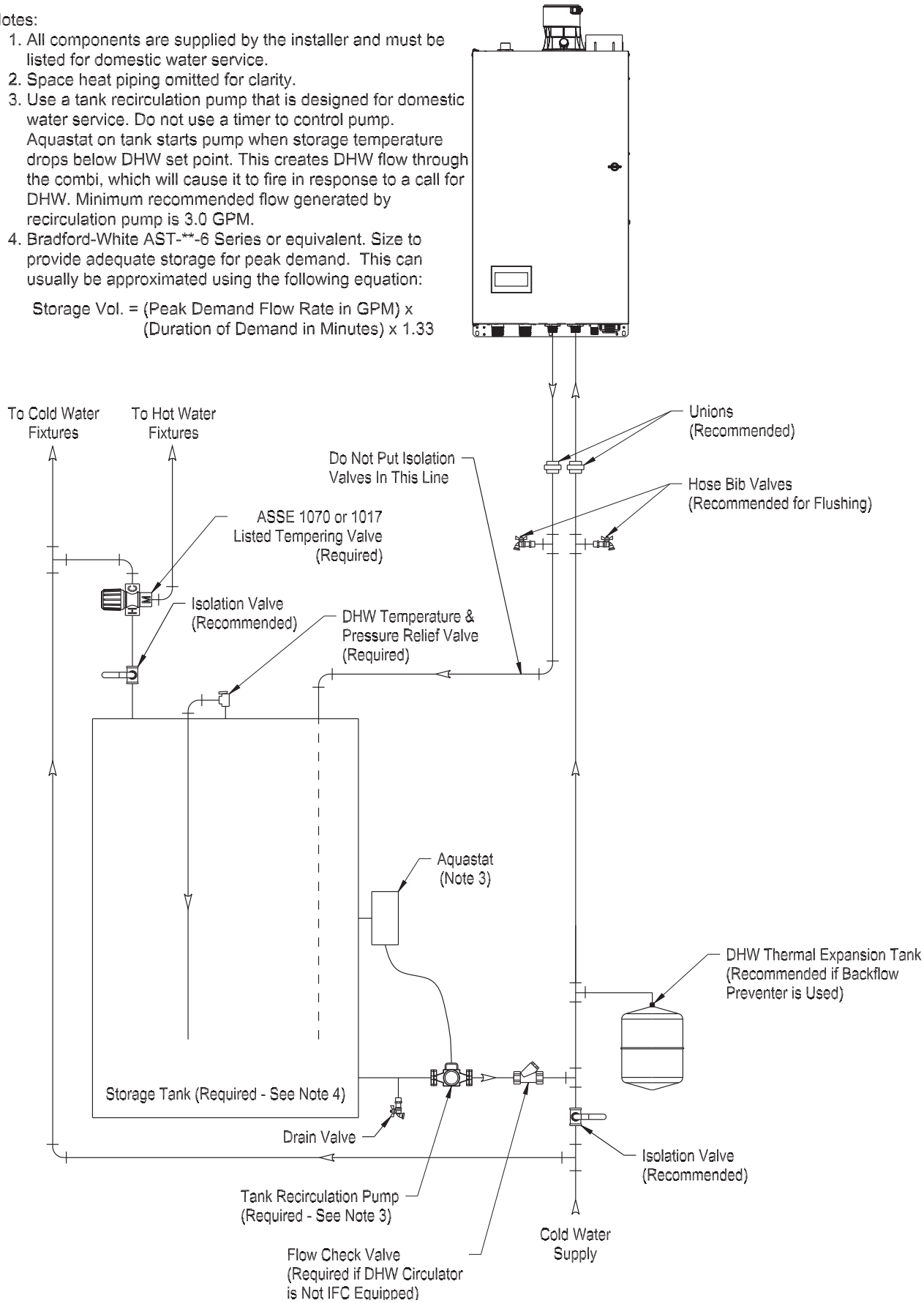


Figure 2: Storage Tank without Fixture Recirculation