Indirect Water Heaters
Conventional Applications / New applications

Conventional Indirects

For many years indirect water heaters have been used as an improved DWH system when compared to cast iron boilers with tankless coils. The advantages include the abundance of hot water that is available from both the water stored in the tank and the relatively high heating input of the boiler and reduced operating cost. The reduction in operating cost is due to some of the following factors:

- **Reduce boiler input:** Tankless coils usually need boilers with the higher firing rates needed to satisfy the water heating demand.
- **Reduced boiler cycling:** A typical 40 gallon indirect can be designed to start after 16 gallons has been drawn. The boiler can be asked to start and heat the 16 gallons with a 180 deg. F or lower boiler outlet temperature. With a tankless coil, boiler temperatures need to be maintained at a higher temperature. Some of these systems will cycle on and off after drawing a couple of gallons at a sink.
- **Lower boiler standby losses:** Boiler high limits can be set lower, and a boiler low limit is usually not needed.

In a typical residential application, the boiler is sized based on the space heating load, and the indirect is sized based on the water heating requirement.

Modern low mass boilers provided with built in DWH heat exchangers also have limitations with respect to keeping up with high draws. These units are limited to the BTU input of the boiler and have little or no storage. For example, a 120,000 BTU boiler with an efficiency of 90% will provide only 3.2 gpm at a 65 deg. F rise, or 2.4 gpm at a 90 deg. F rise. Well insulated storage tanks with built in dip tubes to circulate water through DHW heat exchangers have been applied to satisfy the higher draw requirements of multiple baths and other fixtures. Piping storage tanks to these boilers improves the heat input / storage volume tradeoff, and less boiler cycling will result.

High DWH Demands

While the typical one boiler and one indirect application will suit most residential installations, it is sorely inadequate in some of the higher end homes. The luxury homes with 5 or more bathrooms, multiple hot tubs, body sprays, hot water falls and other such high demand loads have one common denominator. They require a huge amount of hot water. One possible solution is a high capacity indirect water heater. Single coil indirects are available with 120-gallon tanks and high output heat exchangers that can take 175,000 or more BTUs. Multiple high input indirects and boilers can be banked together. The equipment can be piped, controlled, and applied in a number of ways to achieve the desired result.

Another possible solution to high DWH demand is a dual coil indirect.

Dual Coil Indirects

Dual coil indirects are built with two heating coils and two thermostats. One heating coil is located in the bottom of the tank, and the other heating coil is located in the top half of the tank. See figure 1. Each heating coil has its own thermostat so that each coil can be controlled independently. Since the lower heating coil is located in the bottom of the tank, it will heat the whole tank in a recovery cycle. Heat from a boiler or another source can be piped to the bottom coil and it can be controlled independently. The top coil is located in the top half of the tank, and also has its own thermostat. Heat from the same or another source can be piped to the top coil and be controlled independently. The top coil will heat the top half of the tank only.

There are many ways to apply this type of an indirect water heater. A few typical applications are outlined below.

Application #1 – High DWH Demand (See figure 2A)
Two coils, double the heat transfer
The boiler can be piped to the two coils in series or in parallel depending on the heating coil pressure drops and flows needed. This can double the amount of the continuous hot water supply. 120 gallon units are available that will take 275,000 BTU/HR of heat input, and produce over 500 gal/hr continuous at a 65 deg. F rise.
This arrangement can be piped to a single high output boiler or multiple staged boilers.

Application #2- Radiant Loops (See Figure 2B)
Top coil piped to a radiant loop
Bottom coil piped to boiler
Dual coil indirect water heaters can be applied to the simple addition of any kind of a radiant loop whether it be for the additional living space or snow melting that may require substantial heat transfer, or for low input zones such as short radiant loops, a small panel radiator, or a towel warmer. In some cases, systems may have several minizones calling for heat at different times resulting in boiler short cycling. Using the top coil of a dual coil indirect to serve the radiant loops can have its advantages because the entire tank volume is actioning as a large thermal mass that is supplying energy to the small zones. This will result in reduced boiler cycling.

Application #3 – Solar with Boiler Backup (See fig. 2C)
Top Coil is piped to the boiler
Bottom coil is piped to the solar panels

Solar water heating is another application for a dual coil indirect. Since the bottom coil heats the whole tank from the bottom up, the solar panels are piped to the bottom coil and are controlled by their own thermostat. The boiler is piped to the top coil and is controlled by the top coil thermostat and will heat the top half of the tank whenever the solar input can't keep up with the demand. Stored solar energy and backup are built into one tank.

Application #4 - Condensing Boiler (See fig. 2D)

Top coil heats the top half of the tank
Bottom coil used to increase condensing

Currently there are many choices in high efficiency condensing boilers. Boilers with efficiency ratings over 90% have become common. These boilers have more heat transfer surface area inside. The heat exchangers are designed to reduce the flue gas temperature to the dew point, to condense the water vapor out of the flue gas, and to drain the condensate. To maximize the operating efficiency of these boilers it must be kept in mind that the combustion products in the boiler need to be in contact with surface temperatures that are less than about 130 deg. F in the case of gas-fired boilers. If the boiler is not supplied with low return water temperature, it will not condense. The lower the return water temperature, the more the boiler will condense.

One possible solution to increase condensing is to use a dual coil indirect that is piped and controlled to deliberately stack the top half of the tank with hot water and leave the bottom half of the tank with a supply of cold water for the next recovery cycle. The two coils can be piped in series in a parallel / counter flow arrangement. See Fig 2D. Hot boiler supply is piped to the bottom of the top coil and the outlet of the top coil is piped to the top of the bottom coil. The bottom of the bottom coil is piped to the boiler return. This arrangement will stack the top of the tank with hot water and leave the bottom of the tank with a reservoir of cold water for the next recovery cycle. The boiler is controlled using the thermostat on the top coil. With the additional surface area of the bottom coil and the cold water reserved in the bottom of the tank, more condensing and higher operating efficiencies will result. It must be kept in mind when sizing the tank that only the top half of the tank has hot water when the thermostat satisfies.

Single and dual coil indirects, storage tanks, and buffer tanks can be applied in many different and interesting ways in DWH and hydronic systems. If you have other applications that you have tried with these products, please drop us an e-mail.

Heat-Flo designs, engineers and manufactures high quality, cost effective water heating and storage products for residential, commercial, and industrial applications. Our solutions span from multi-energy/solar and electric based hot water heating systems, to hydronic and radiant heating applications. We can be reached at 508-422-9880, e-mail support@heat-flo.com

Figure 1: Dual Coil Indirect

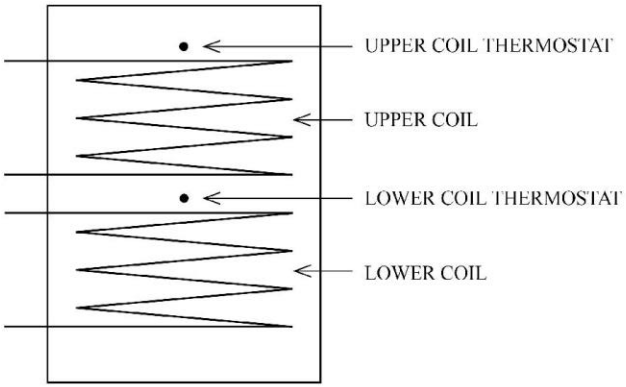

Figure 2A: High DWH Demand

Two Coils, Double Heat Transfer

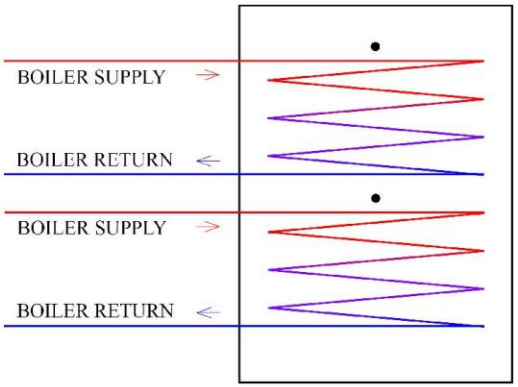

Figure 2B: Radiant Loops

Top Coil Piped to Radiant, Bottom to Boiler

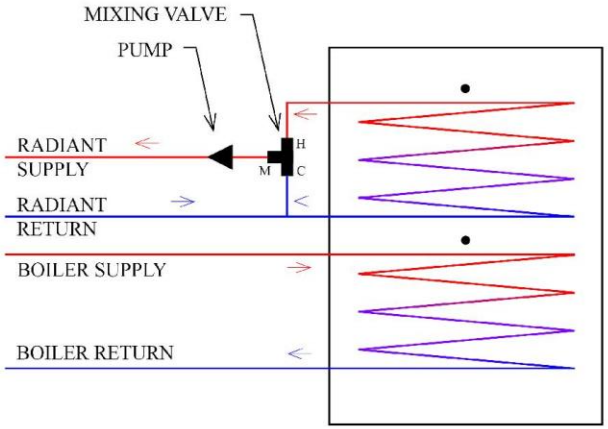

Figure 2C: Solar with Boiler Backup

Top Coil Piped to Boiler, Bottom to Solar

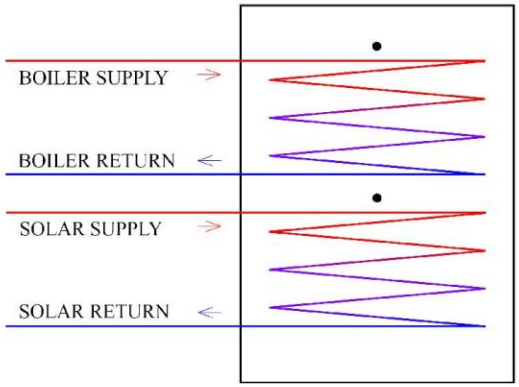

Figure 2D: High Efficiency Condensing Boilers

Series Parallel/ Counter Flow