



Taco LoadMatch®. Real world hydronic system technology for Green Building design.





For more information
on Taco Green Building
technology and hydronic
components, please visit

www.taco-hvac.com

You'll also find industry
links, online tools, and
technical articles relating
to LoadMatch® and Green
Building applications.



An Important Choice.

As the Green Building movement gathers momentum, design engineers, builders, and owners are re-examining materials, systems, and technologies to meet the challenges of comfort, conservation, replenishment, safety, and cost. The choice is between a hydronic system or an air system.

Hydronic Systems Save Energy And Materials.

Both kinds of HVAC systems impact the environment in two ways: 1) Each consumes non-regenerative raw materials in construction. 2) Each consumes energy to operate. Again, hydronic systems win. Advanced LoadMatch® single pipe hydronic systems require less raw materials for construction by virtue of a reduction in pipe, fittings, insulation, control valves, and balancing valves. To move BTUs around a building, hydronic systems require about half the energy of a comparable air system, because water has a higher specific heat and higher density than air.

Hydronic Systems Are More Comfortable.

Because of the higher thermal inertia of water, the temperature in a room heated or cooled by hydronics will be more even and thus more comfortable. Additionally, when the room is heated or cooled by a LoadMatch® single pipe system, the temperature will be more consistent and, therefore, even more comfortable. A LoadMatch® system is self balancing; tweaking balance valves to get the water to the right location in the right quantity isn't necessary.

Hydronic Systems Are Healthier.

Airborne contaminants are a constant concern to building dwellers and owners alike. Because a hydronic system is a sealed system, molds, viruses, pollen, dust, and bacteria can't be blown around the building.

The Taco LoadMatch® System: Next Generation Hydronics For Green Building Design.

Essentially, the LoadMatch® single pipe system replaces all the expensive and energy-consuming control valves and most balancing valves with small, low kW circulators. The circulators HELP deliver the water to where it needs to go, as opposed to FORCING the water to go where it doesn't want to. The savings in raw material, installation costs, and energy consumption are substantial.

LoadMatch® Means Better Comfort.

Because a LoadMatch® system is self balancing, consistent temperature delivers better comfort. All loads operate separately from one another. The secondary flow that circulates through each terminal is independent of the system's primary distribution pumps.

LoadMatch® Saves More Energy

In addition to the energy savings inherent in hydronic systems, LoadMatch® eliminates head loss by eliminating control valves, balance valves, and some pipe (when compared to a conventional reverse return system). The result is lower pump head and less energy consumption to move the water.



The LoadMatch® Concept (see Fig. 1 & 2)

System Configuration

A LoadMatch® system is the marriage of two old ideas wrapped around a new technology. The old ideas are *single pipe distribution* and *primary-secondary pumping*. The new technology consists of the use of maintenance-free wet rotor circulators. The primary distribution system is a single pipe loop; the secondary distribution system is a decoupled secondary piping loop for each terminal unit in the system. The wet rotor circulator provides the specified flow to each terminal unit at all times. The simplicity of the Load-Match® concept allows you to specify one size of pipe for large portions

of the system. In single loop installations, there is no limit to the number of coils you can install. Final pipe size is determined by the total load of the loop and ΔT . If your loop is heavily loaded, it's practical to split the system into two loops with smaller pipe sizes. This change saves installation costs, energy, and money, and can reduce pump head, and lower hp. When loops are carrying equal loads and arranged symmetrically, they will nearly self-balance. The resulting configuration will keep balancing losses down and will lower ongoing energy costs.

FIGURE 1

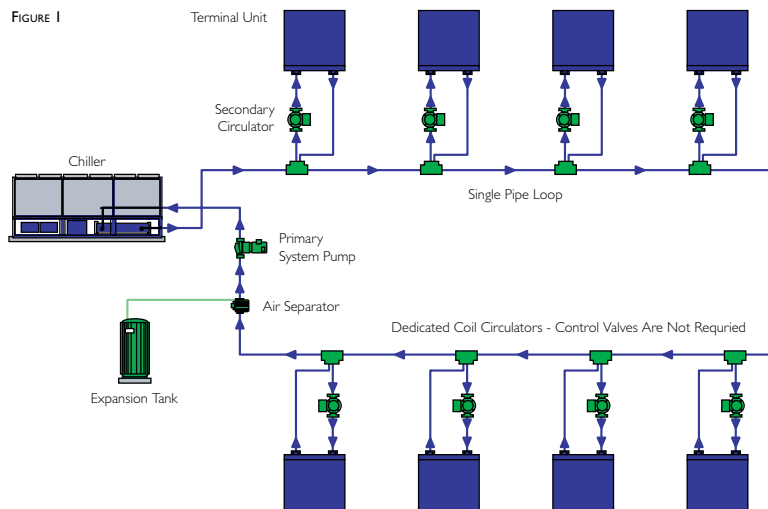
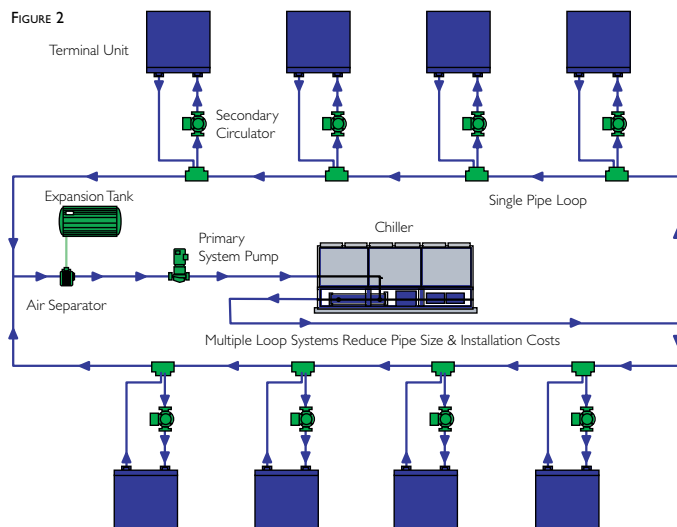


FIGURE 2





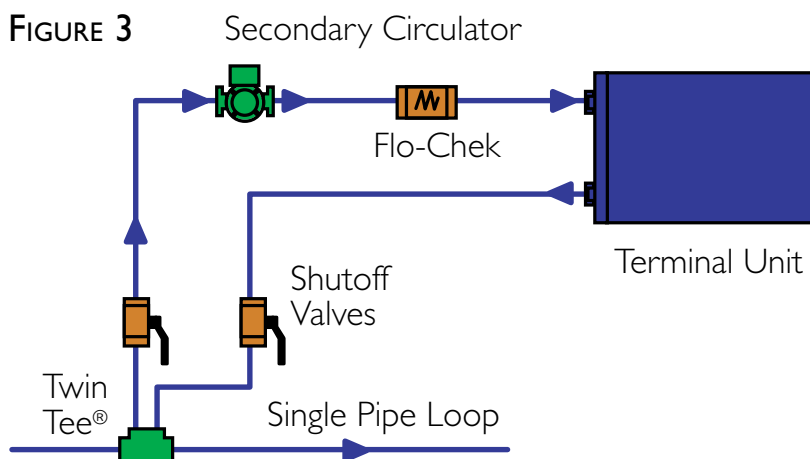
Cutting Design Time

The simplicity of the Taco LoadMatch® system shaves hours of planning off the job. Taco's powerful new Hydronic System Solutions intelligent CAD software reduces errors, typically saving 30% in total design and construction administration time.

The LoadMatch® Building Blocks (see Fig. 3)

The run-out piping between the single-pipe loop and the terminal unit follows conventional design practice. When a coil is farther away from the loop, simply extend the run-out length and adjust the circulator for any increase in head.

Boilers, chillers, and terminal units are always sized based upon heat gain and heat loss calculations, and are selected to suit the loads. Unlike reverse return systems, LoadMatch® provides highly efficient BTU transport between the generators and the heating or cooling terminal units.





Managing The Temperature (see Fig. 4)

Two pipe systems control comfort indirectly by attempting to manage flow or gpm to a terminal unit. Single pipe systems, however, control comfort directly by managing the temperature or BTU's to a terminal unit. This temperature or cascade can be calculated at the design stage and used to properly select a terminal unit that provides the required capacity throughout the system or piping loop. Whether in heating or cooling mode, this mixed water temperature can be used to calculate ΔT 's, flow rates, and pipe sizing. What's more,

large safety factors are not required when designing a LoadMatch® system. To further increase the system's efficiency, small, fractional HP circulators are specified to match the design's flow rate for each fan coil, air handling unit, heat pump, or other terminal unit. These dedicated small circulators provide finely-tuned control to yield substantially higher system efficiencies. The use of integral variable speed drives on the circulators can provide precise modulating flow control for the ultimate in comfort.

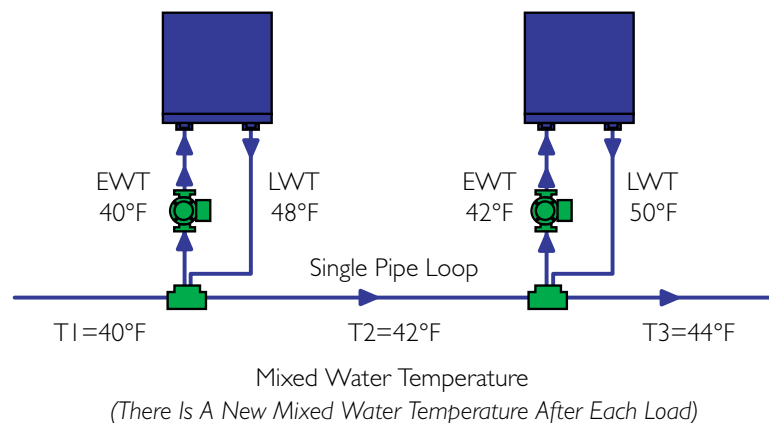
FIGURE 4

$$\text{Mixed Water Temperature} = \frac{(\text{Coil GPM} \times \text{LWT}) + (\text{Loop GPM} - \text{Coil GPM}) \times \text{EWT}}{\text{Loop GPM}}$$

$$\text{MWT T2} = \frac{(6 \times 48) + (25-6) \times 40}{25} = 42^\circ\text{F}$$

Loads - 24 MBH EA., 6 GPM @ 8° F ΔT

Primary Loop - 25 GPM @ 10° F ΔT

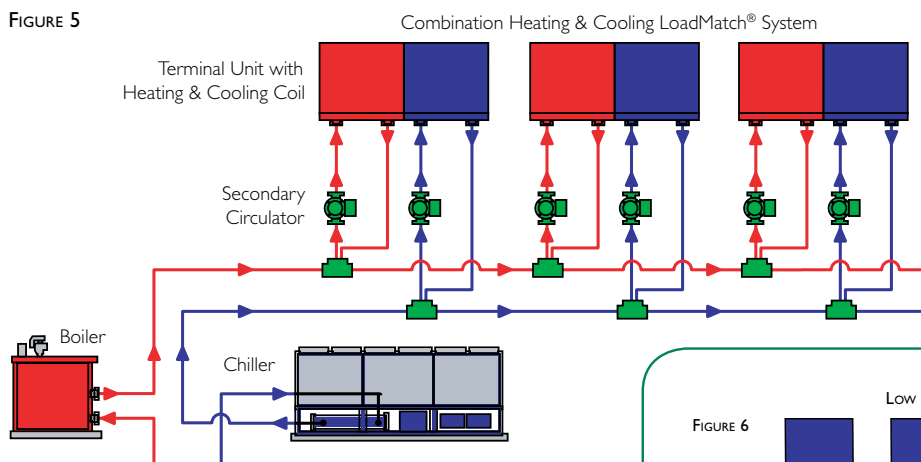




Heating & Cooling Combined (see Fig. 5)

Every LoadMatch® system can provide both heating and cooling capabilities in single-pipe circuits, using common terminal units. The desired heating/cooling mode is chosen at the thermostat and the corresponding circulator is automatically selected.

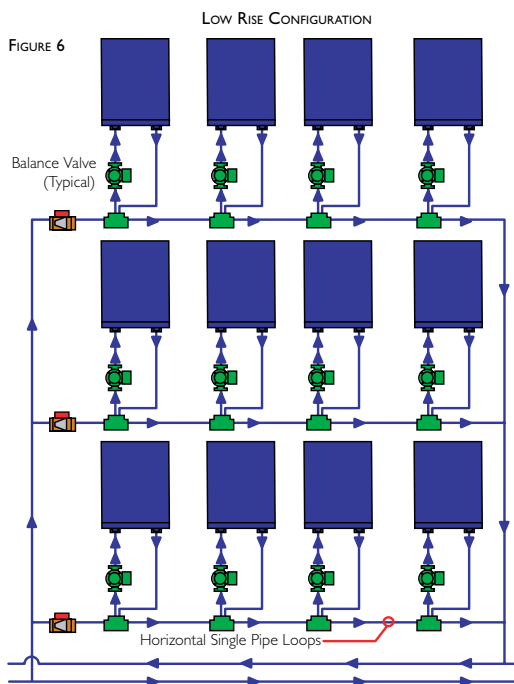
FIGURE 5



Horizontal Distribution or Low Rise (see Fig. 6)

LoadMatch® Horizontal fan coil, AHU, or heat pump loops provide the ultimate in flexibility for any building, any size, anywhere. Generally, one loop per floor and exposure will suffice. However, grouping two loops per floor (the south with the west and the north with the east) using common risers is also practical. Distribution mains supply the parallel loops by direct return or by reverse-return, and require balance valves, service valves, and air vents as indicated.

FIGURE 6

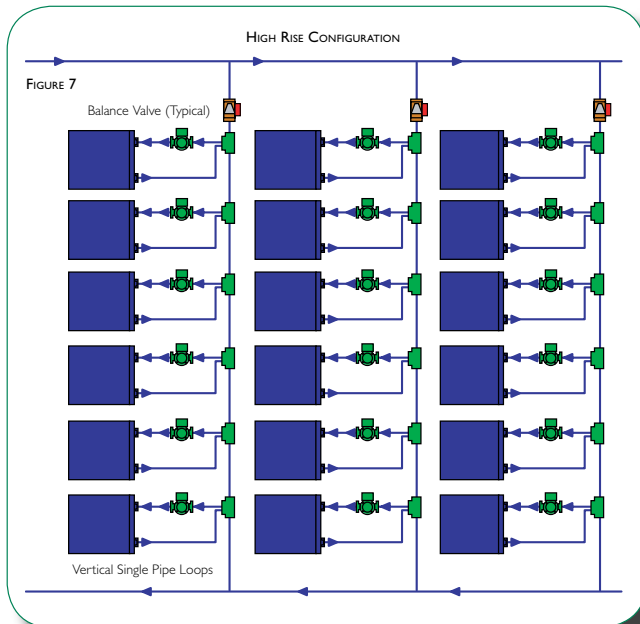




Vertical Distribution or High Rise (see Fig. 7)

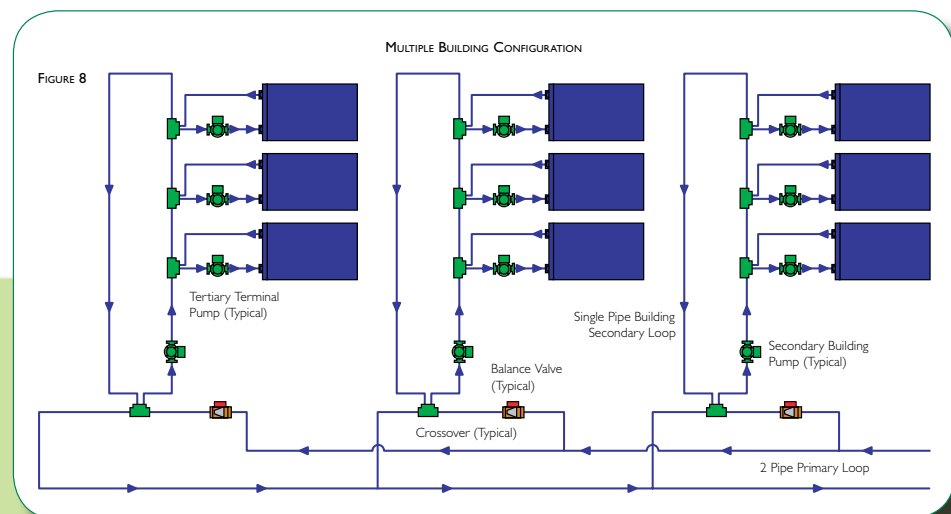
There are no height limitations in designing a LoadMatch® heating and cooling system. Vertical single-pipe loops with return mains in the upper and lower floors are the most popular form of design. If height exceeds working pressure limitations, a second and third set of

piping is stacked to overcome the issue. Equipment rooms are midway between the piping sets. Major equipment for each set of floors is isolated by plate and frame heat exchangers. With independent systems, all working pressure is kept within allowable constraints.



Multi-Building Configurations (see Fig. 8)

With LoadMatch®, the size and location of the hydronic systems is not an issue. A large structure utilizes the same single-pipe loop concept that a small building employs – only more of them. The interconnection of several loops is actually no different than current industry practice in connecting large once through loads. But with LoadMatch®, no valve losses and only half the piping translates to big energy savings.





The Economics of Taco LoadMatch® Single Pipe Hydronic Systems For Green Building Design.

While Green Building experts agree that initial construction costs for Green Buildings are somewhat higher, LoadMatch® can help keep those costs down – both in the construction phase AND in the payout phase. Fewer parts, about 40% less pipe and fittings, no control valves and almost no balancing valves reduce first costs (see Fig. 9). Lower pump head and operation of pumps to match the load reduce energy costs (see Fig. 10). Replacement of control valves with highly reliable maintenance free wet rotor circulators reduce maintenance costs. All this adds up to big savings on the system – up to 30% of life cycle costs (see Fig. 11).

The Taco LoadMatch® System. Next Generation Hydronics For Green Building Design.

Essentially, the LoadMatch® single pipe system replaces all the expensive and energy-consuming control valves and most balancing valves with small, low kW circulators. The circulators HELP deliver the water to where it needs to go, as opposed to FORCING the water to go where it doesn't want to. The savings in raw material, installation costs, and energy consumption are substantial.

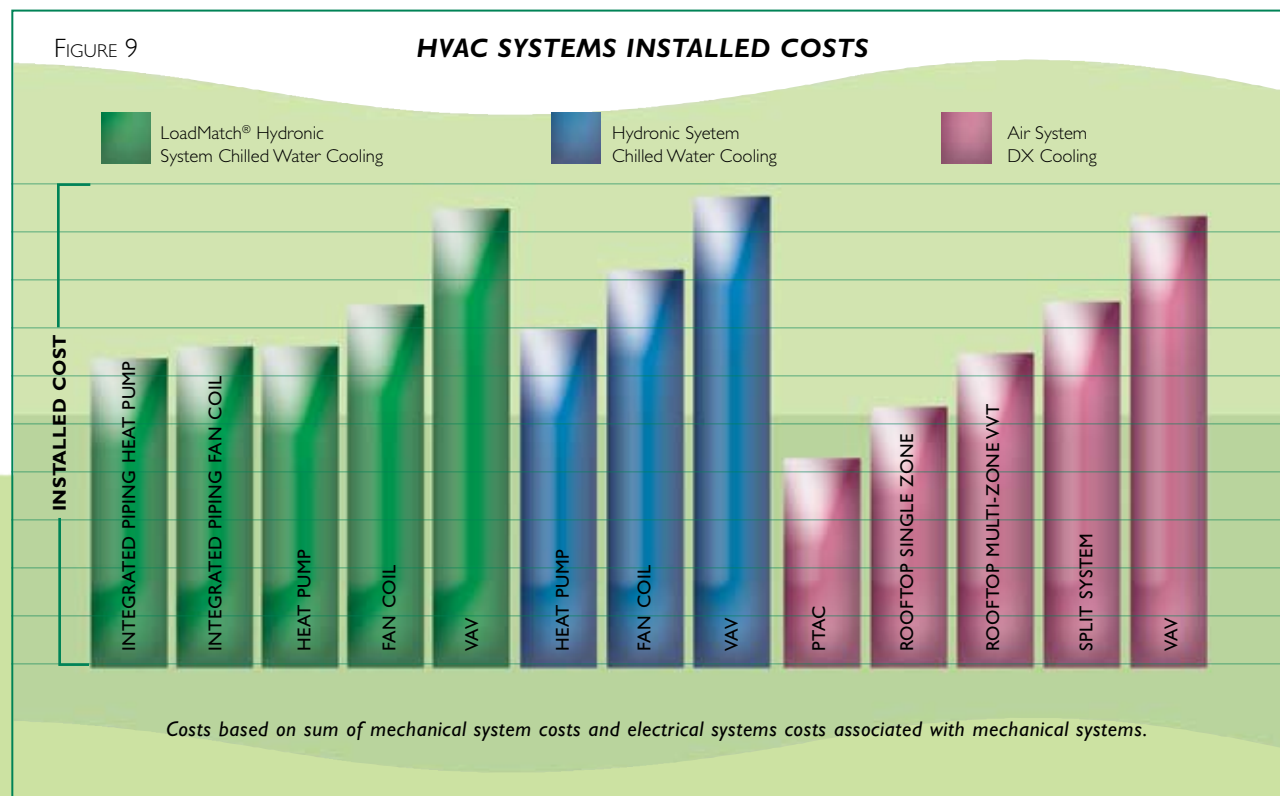
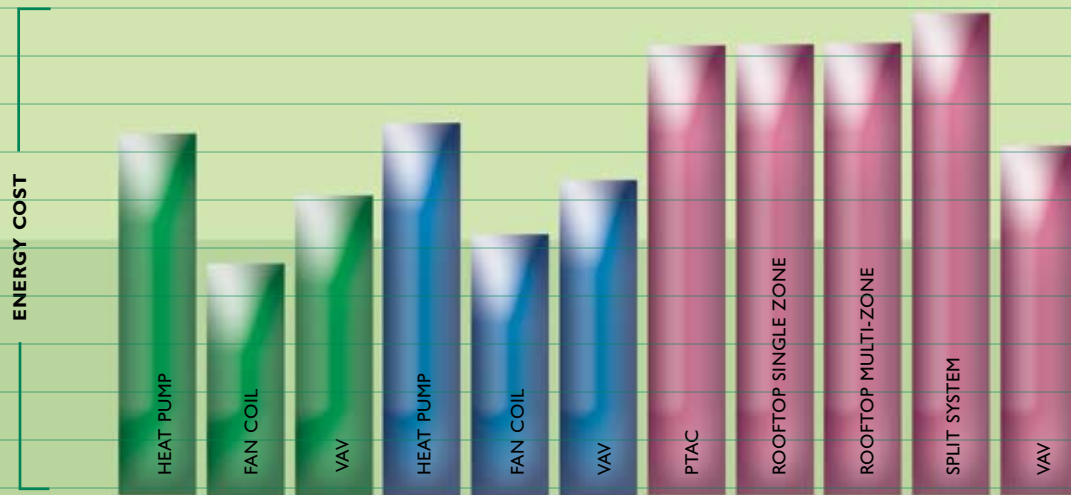




FIGURE 10

HVAC SYSTEMS ENERGY COSTS

LoadMatch® Hydronic System Chilled Water Cooling Hydronic System Chilled Water Cooling Air System DX Cooling

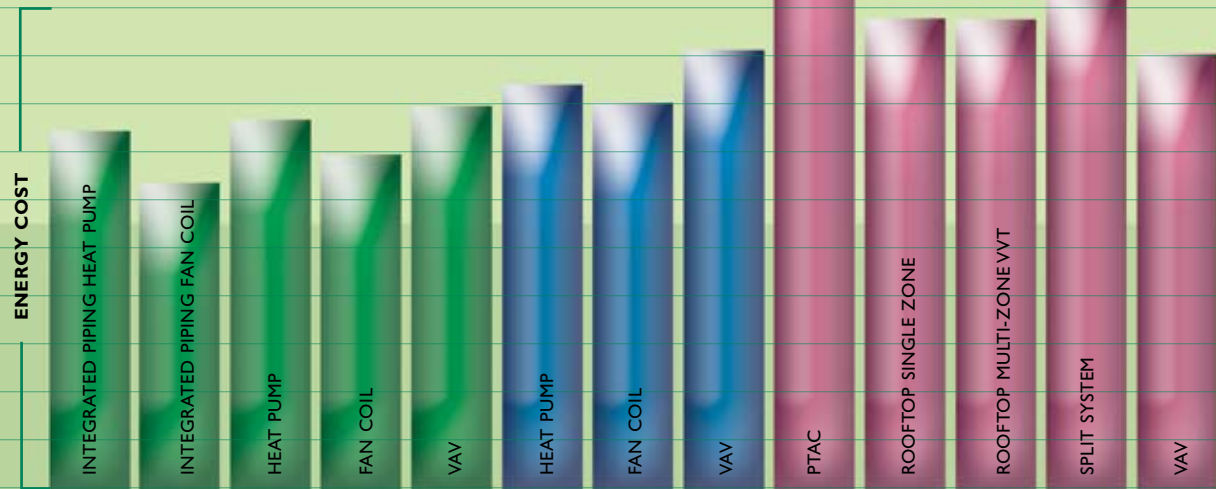


Costs based on average utility rates from APPA, AGA, and average US climatic conditions.

FIGURE 11

HVAC SYSTEMS LIFE CYCLE COSTS

LoadMatch® Hydronic System Chilled Water Cooling Hydronic System Chilled Water Cooling Air System DX Cooling



Costs based on 20 year life cycle, 8% rate of return, 4% inflation rate, and costs derived from HVAC construction and maintenance cost survey.



You'll be more comfortable.

LoadMatch® provides better comfort than all air-systems, as well as conventional hydronic systems. LoadMatch® is a self balancing system and assures the required flow to all heating and cooling units at all times. Your heating and air conditioning system will deliver BTU's where they're needed, and when they're needed.

You'll have total control.

With separate LoadMatch® circulators in place for every zone in the building, the water will behave exactly the way you want it. All loads operate separately from one another. The secondary flow that circulates through each terminal is independent of the system's primary distribution pumps.

You'll save energy.

With less pipe and the elimination of control valves and most balancing valves, lower pump head and less power is required to move the water.

You'll spend less time designing.

The simplicity of the LoadMatch® system shaves hours of planning off your job. And our revolutionary new Taco Hydronic System Solutions® intelligent CAD software will reduce errors and save you typically 30% in total design and construction administration time.

You'll save money.

Fewer parts, about 40% less pipe and fittings, no control valves and almost no balancing valves reduce first costs. Lower pump head and operation of circulators to match the load reduce operating and maintenance costs. All this adds up to big savings on the system, typically up to 30% of life cycle costs.

Contact Us

Taco engineers are at the forefront of
Green Building hydronics, designing
components and systems to help you meet
the challenges of environmentally sensitive
– and budget conscious – design and build.
Visit our web site at taco-hvac.com or
e-mail greenteam@taco-hvac for more
information or to talk to a Taco Green
Building professional.



Taco, Inc., 1160 Cranston St., Cranston, RI 02920 (401-942-8000) fax (401) 942-2360
Taco (Canada) Ltd., 6180 Ordan Drive, Mississauga, Ontario L5T 2B3 (905) 564-9422 fax (905) 564-9436

www.taco-hvac.com