IPS™ System Description

Williams Integrated Piping System (IPS™)
4-pipe hydronic systems are the best – now they are more affordable in smaller buildings by using the existing domestic water distribution for dual purpose, cost reduction, and increased comfort typical in high-end properties.

IPS™ was designed to reduce capital cost while increasing energy efficiency. This is accomplished by utilizing the standard piping and equipment in a building for dual function.

Heating
The domestic hot water lines in the building are used to supply not only domestic hot water, but also water for space heating. In order to supply hot water on demand, most commercial and some residential hot water systems are continuously circulated. The domestic hot water system includes both a supply to the fixtures and a return to the boiler through a storage tank.

Terminal units
IPS™ Terminal units are installed as another "fixture"; however, water does not go down the drain. The heating water is recycled through the existing return line to the storage tank to be reheated by the domestic water boiler. The domestic hot water is supplied to the IPS™ Terminal unit at 120-140˚F, enabling the unit to provide space heating. This has been a common practice either in a central system or standalone with circulating pumps to individual water heaters per apartment since the 1960s. The IPS™ Terminal units are rated for potable water and selected based on heat loss, CFM requirements, external static pressure, altitude, supply water temperature, and Delta T as per the engineer's specifications. Each Terminal unit has a **thermostat** allowing the occupant to have complete control of their living space. When the thermostat calls for heat, a valve opens and 120-140˚F **domestic** hot water flows through the 100% copper coil and the fan blows warm air into the space. Using the domestic hot water supply and return lines for heating eliminates the need for an additional set of heating supply and return lines, and an additional set of boilers and circulating pumps.

Energy consumption is reduced when equipment is "off". Obviously, it's most effective when the space heating equipment is "eliminated."

Because IPS™ uses the domestic hot water for heating, design steps must be taken to ensure the water is not contaminated. All equipment must be rated for potable use, i.e. domestic water boilers, bronze pumps, control valves, and glass lined storage tanks must be selected in accordance with local codes and design practices.

The IPS Terminal unit is factory wired with a controller that includes a "purge cycle control." This control opens the heating and cooling valve once per day allowing water to run through the coil, eliminating the possibility of dead legs and stagnation in the coil. **The controller also allows the application of any standard 24-volt fan coil thermostat.**

Typical installations have taken advantage of further installed cost reductions and application advantages by using CPVC and/or PEX piping. In addition to the elimination of pipe, selection of alternate materials can yield substantial cost savings.

Redundancy is built in to ensure there will always be hot water to provide heating in the building. For example, if the building load for heating and domestic water heating is 300,000 BTUs, two 150,000 BTU boilers are used. Should one boiler go down, the second boiler will carry the building until the first boiler can be returned to service.

Pumps are sized for 100% of the building load; however, this will likely never occur. In traditional systems, the pumps run at 100% capacity - 24/7 - wasting energy and causing unnecessary wear of piping.

Pipe sizing is determined by whichever service is greater. Although intermittent domestic water use is common, the flow required to the space is rarely increased due to HVAC flow which is also intermittent. Specific analysis is required by your design team. The IPS™ design typically incorporates a **VFD (variable frequency drive)**; these drives are operated by a differential pressure transducer which senses the pressure in the system at an appropriate location increasing or reducing the pump RPM to maintain the pressure as needed. This technique is also used to save energy (consumed pump horsepower) in common mechanical systems because the building is always operating at part load.

IPS™ adds the visual advantage in this application of verifying pressure at the fan coil because there is pressure at the fixture.

Also typical is the application of an exercise timer that will switch the pumps periodically to keep pump impellers free and wearing evenly.

Cooling
Cooling is achieved through the use of the domestic cold water line already in your design. However, a return line is added to the domestic cold water system to form a continuous loop; similar to the design of the hot water loop. All of the domestic water coming into the building is supplied through a double-wall stainless steel plate exchanger to isolate potable water from the central mechanical system, or other method as required by local code.

The building has an efficient **central chiller** or other system (GeoExchange) to provide chilled water; only it's confined to the mechanical room. The requirement for a separate chilled water distribution system is eliminated. The domestic cold water temperature is ideal for cooling with IPS™ Terminal units. The potable water is distributed to both the fan coils and fixtures.

The difference is that the water going to the fan coil is circulated back to the central plant AND could be the make–up water for the hot water system, if warmer than the domestic supply water temperature.

Heat Recovery by Design
Using the returned cold water as make-up to the hot water system means your building's "cooling load" is reclaimed to offset heating (space heating and domestic water heating) loads. IPS™ results in a heating economizer or heat recovery design at no additional cost.

Economizer Cooling
The returned cold water is from the fan coil units, the water that was used for fixtures has to be made-up from the building water supply. If municipal or ground water is below the return water temperature of 60˚F, then you have "free cooling." Cold water is circulated through the building and heated from the cooling process, new heat required to raise the make-up water to a design temperature is reduced by heat recycled; thus reducing boiler operating cost.

Isolate the Chiller
A packaged chiller is piped to the opposite side of the plate heat exchanger and if there is not enough cold water use in the building to meet the full cooling load, the chiller comes on to maintain the chilled water loop at the design supply temperature, typically 48-50˚F. The redundancy of equipment on the cooling side is built in as well. Chillers are selected with a minimum of two compressors; if one compressor fails, the second will "carry" the building until it can be repaired. The chillers are staged and will only stage "on" as needed to maintain the cooling supply water at the set temperature conserving over all building energy.

A by-product of this approach is that drinking water is already cold, reducing ice usage and water-coolers. The temperature is managed so that the coil sweats, not the fixtures.

Water Treatment
Only as required by local jurisdiction to make the water potable. The IPS™ Terminal, which now is supplied with potable water, has no need for strainers, or calculation of fouling factors. Typical applications have had water softeners added to the Hot Water return. The chiller system may have food grade glycol as well as dedicated outdoor air units, but the mechanical system water is completely isolated from the domestic distribution system.

The Fan Coil Advantage
The Williams IPS™ Terminal uses a low-flow, high-latent coil design, pre-selected for this application at 50˚ EWT and a10˚ Delta T. Reduced water temperatures only improve the cooling capacity. This ensures that the coil has latent capability as well as sensible capacity at lower flows. The IPS™ Terminal is a fan coil with special hydronic coils; and differs in operation from a DX packaged unit in that on a call for cooling the control valve allows the coil to fill with cold water instantly. The cold water temperature is well below the design dew point in the space for comfort conditions and will, therefore, control humidity. DX units utilize a compressor that produces hot gas and must create cold refrigerant through the refrigeration cycle. The DX disadvantage is that the refrigerant coils capability to remove moisture is only at 50% of rated capacity even after 10-13 minutes of continuous run time. DX units average only 60% of rated efficiency after six minutes of compressor run time. Unfortunately, most compressors operate less than five minutes per cycle.

The IPS™ Terminal includes three-speed fans as standard equipment that give the unit a wide capacity range. The availability of ECM blowers expands the application of Terminal units to include higher external static pressure and allow improved control strategies to increase comfort and reduce energy consumption even further.

System Efficiency - *Every case is different*!
It is conservative to say that a fan coil system will operate at 40-60% less energy consumption than a packaged (air-cooled) terminal air conditioner (PTAC) at substantially increased comfort. There are no compressors, no refrigerant, and no 16” by 42” holes in every room. Additionally, the electrical power service to each space is reduced; increasing the application options for emergency back-up power generation and lowering electric power consumption. The application could be on only heating or for reheat, or cooling only utilizing existing heating. IPS™ is a solution.

Williams offers multiple configurations and control options including the patented ComforTrac™ System and the TRACvalve™ option with Stainless Steel ball and stem. IPS™ units are also applied in the Williams ONDemand™ System.

RE-ENGINEERING COMFORT is our slogan, Williams realizes that there is no one typical building, therefore, multiple applications and hybrid systems are required.

Visit williamsapplied.com to locate your nearest Representative and learn more about how Williams Applied Products is re-engineering comfort for you.