

What is claimed is:

1. A conditioning system configured to provide cooling to a heat load and operable in a plurality of operating modes, the conditioning system comprising:
 - a scavenger plenum configured to direct scavenger air from an air inlet to an air outlet;
 - an evaporative cooler arranged inside the scavenger plenum and configured to circulate a cooling fluid from an EC inlet through the evaporative cooler to an EC outlet and to exchange energy between the cooling fluid and the scavenger air;
 - a recovery coil arranged inside the scavenger plenum between the evaporative cooler and the air outlet and configured to circulate the cooling fluid from an RC inlet through the recovery coil to an RC outlet and to exchange heat between the cooling fluid and the scavenger air; and
 - a manifold configured to distribute the cooling fluid from at least one of the EC outlet and the RC outlet to at least one of the EC inlet and the heat load based on the operating mode and environmental conditions, the manifold comprising:
 - a main conduit fluidically connected to the EC inlet and the heat load;
 - an EC conduit fluidically connected to the EC outlet and the main conduit;
 - a first RC conduit fluidically connected to the RC outlet and the main conduit;
 - a second RC conduit fluidically connected to the RC outlet and the main conduit, the EC conduit connected to the main conduit between the connection of the first RC conduit to the main conduit and the connection of the second RC conduit to the main conduit;
 - a flow control device variably distributing the cooling fluid from the RC outlet to one or both of the first and second RC conduits; and
 - a pressure regulation device to control a pressure of the cooling fluid in the evaporative cooler.
2. The conditioning system of claim 1 wherein the cooling fluid supplied to the heat load from the main conduit comprises at least one of:

substantially all of the cooling fluid from the RC outlet and substantially none of the cooling fluid from EC outlet;

substantially none of the cooling fluid from the RC outlet and substantially all of the cooling fluid from EC outlet; and

a mixture of the cooling fluid from the RC outlet and the cooling fluid from the EC outlet.

3. The conditioning system of claim 1 wherein the cooling fluid to the EC inlet from the main conduit comprises at least one of:

substantially all of the cooling fluid from the RC outlet and substantially none of the cooling fluid from EC outlet;

substantially none of the cooling fluid from the RC outlet and substantially all of the cooling fluid from EC outlet; and

a mixture of the cooling fluid from the RC outlet and the cooling fluid from the EC outlet.

4. The system of claim 1 wherein the conditioning system is configured to operate in one or more of an adiabatic mode, an evaporative mode, and a blended mode;

in the adiabatic mode, the flow control device distributes substantially all of the cooling fluid from the RC outlet and substantially none of the cooling fluid from EC outlet to the heat load;

in the evaporative mode, the flow control device distributes substantially none of the cooling fluid from the RC outlet and substantially all of the cooling fluid from EC outlet to the head load; and

in the blended mode, the flow control device distributes a mixture of the cooling fluid from the RC outlet and the cooling fluid from the EC outlet.

5. The system of claim 1 wherein the EC conduit connects to the main conduit at a T-junction.

6. The system of claim 1, wherein the first RC conduit is connected to the main conduit at a first RC junction on one side of the T-junction, and wherein the second RC conduit is connected to the main conduit at a second junction on the other side of the T-junction.
7. The system of claim 1 wherein the pressure regulation device includes at least one reservoir having a controlled level of water and fluidically connected to the main conduit, the controlled level of water selected to set the pressure of the cooling fluid in the evaporative cooler.
8. The system of claim 7 further comprising a reservoir conduit that connects to the at least one reservoir and to the main conduit, the reservoir conduit connected to the main conduit at or in proximity to a junction between the EC conduit and the main conduit.
9. The conditioning system of claim 7 wherein the water in the at least one reservoir is at a higher elevation than at least a portion of the manifold.
10. The conditioning system of claim 1 wherein the pressure regulation device controls a pressure of the cooling fluid at the connection between the EC conduit and the main conduit.
11. The conditioning system of claim 1 further comprising:
 - a first pump fluidically connected to the manifold and configured to deliver the cooling fluid to the heat load; and
 - a second pump fluidically connected to the manifold and configured to deliver the cooling fluid to the EC inlet.
12. The conditioning system of claim 1 wherein the flow control device includes a first valve in the first RC conduit and a second valve in the second RC conduit.

13. The conditioning system of claim 1 wherein the flow control device includes a three-way modulating valve between the RC outlet and the first and second RC conduits.
14. The conditioning system of claim 1 further comprising:
a sensor to measure a temperature of the cooling fluid supplied to the heat load, wherein the flow control device distributes the cooling fluid to maintain the temperature at or near a set point temperature for the heat load.
15. The conditioning system of claim 14 wherein the flow control device adjusts a position of one or more valves in the manifold depending on the operating mode and environmental conditions.
16. The conditioning system of claim 1 further comprising:
a pre-cooler arranged inside the scavenger plenum between the air inlet and the evaporative cooler, the pre-cooler configured to selectively condition the scavenger air prior to passing the scavenger air through the evaporative cooler, based on the environmental conditions.
17. The conditioning system of claim 1 wherein the evaporative cooler is a liquid-to-air membrane energy exchanger (LAMEE), and the cooling fluid is separated from the air flow path by a membrane, the LAMEE configured to condition the scavenger air and evaporatively cool the cooling fluid.
18. A method of controlling operation of a conditioning system configured to provide cooling to a heat load and operable in a plurality of operating modes, the method comprising:
selectively directing scavenger air through an evaporative cooler in a scavenger plenum depending on environmental conditions, the evaporative cooler configured to circulate a cooling fluid from an EC inlet through the evaporative cooler to an EC outlet, the evaporative cooler operating in an adiabatic mode or an evaporative mode, the evaporative cooler off or bypassed in an economizer mode;

directing the scavenger air through a recovery coil located in the scavenger plenum downstream of the evaporative cooler, the recovery coil circulating the cooling fluid from an RC inlet through the recovery coil to an RC outlet;

distributing the cooling fluid from at least one of the EC outlet and RC outlet into a manifold, the manifold comprising:

- a main conduit fluidically connected to the EC inlet and the heat load;
- an EC conduit fluidically connected to the EC outlet and the main conduit;
- a first RC conduit fluidically connected to the RC outlet and the main

conduit; and

- a second RC conduit fluidically connected to the RC outlet and the main conduit;

distributing the cooling fluid from the manifold to at least one of the EC inlet and the heat load based on the operating mode and environmental conditions; and

regulating a pressure of the cooling fluid in the evaporative cooler with a pressure control device in the manifold.

19. The method of claim 18 wherein distributing the cooling fluid from the manifold to at least one of the EC inlet and the heat load includes:

- pumping the cooling fluid to the heat load using a first pump; and
- pumping the cooling fluid to the EC inlet using a second pump.

20. The method of claim 19 further comprising:

- setting the first pump at a first flow rate; and

- setting the second pump at a second flow rate, wherein the first flow rate is higher than the second flow rate.

21. The method of claim 18 wherein distributing the cooling fluid from the manifold to at least one of the EC inlet and the heat load includes supplying the cooling fluid to the heat load from the main conduit, the cooling fluid to the heat load comprising at least one of:

substantially all of the cooling fluid from the RC outlet and substantially none of the cooling fluid from EC outlet;

substantially none of the cooling fluid from the RC outlet and substantially all of the cooling fluid from EC outlet; and

a mixture of the cooling fluid from the RC outlet and the cooling fluid from the EC outlet.

22. The method of claim 18 wherein distributing the cooling fluid from the manifold to at least one of the EC inlet and the heat load includes supplying the cooling fluid to the EC inlet from the main conduit, the cooling fluid to the EC inlet comprising at least one of:

substantially all of the cooling fluid from the RC outlet and substantially none of the cooling fluid from EC outlet;

substantially none of the cooling fluid from the RC outlet and substantially all of the cooling fluid from EC outlet; and

a mixture of the cooling fluid from the RC outlet and the cooling fluid from the EC outlet.

23. The method of claim 18 wherein regulating a pressure of the cooling fluid in the evaporative cooler includes regulating the pressure of the cooling fluid at the EC outlet.

24. The method of claim 18 wherein regulating a pressure of the cooling fluid in the evaporative cooler includes:

monitoring and controlling a water level in a reservoir;

controlling a water pressure in a reservoir conduit between the reservoir and the main conduit, the reservoir conduit located at or in proximity to a T-junction connecting the EC conduit and the main conduit.