CLAIMS

1. A computer room cooling system including a plurality of bifurcated heated air return pathways for heated air generated by a plurality of server rack rows operating in a computer room with a false ceiling plenum and a heated air collection duct,

(a) wherein each bifurcated heated air return pathway is associated with one server rack row in the computer room, one hot aisle located adjacent the one server rack row, and one hot aisle duct positioned above a ceiling of the one hot aisle, and further each bifurcated heated air return pathway includes:

(i) a first heated air return pathway for the heated air generated by the one server rack row, the first heated air return pathway progressing:

(1) from the one server rack row associated with the bifurcated heated air return pathway;

(2) into the one hot aisle located adjacent the one server rack row;

(3) through a plurality of first dampers mounted on the ceiling of the one hot aisle;

(4) into the one hot aisle duct positioned above the ceiling of the one hot aisle; and

(5) into the heated air collection duct; and

(ii) a second heated air return pathway for the heated air generated by the one server rack row, the second heated air return pathway progressing:

(1) from the one server rack row associated with the bifurcated heated air return pathway;

(2) into the one hot aisle located adjacent the one server rack row;

(3) through the plurality of first dampers mounted on the ceiling of the one hot aisle;

(4) into the one hot aisle duct positioned above the ceiling of the one hot aisle;

(5) through a plurality of second dampers mounted on sides or atop the one hot aisle duct;

(6) into the false ceiling plenum;

(7) through a plurality of third dampers mounted between the false ceiling plenum and the heated air collection duct; and

(8) into the heated air collection duct;

(b) wherein each of the first dampers, each of the second dampers, and each of the third dampers include at least one mechanical thermostat in mechanical connection to a series of louvers,

(i) wherein each mechanical thermostat is exposed to an adjacent heated air having an adjacent temperature, the mechanical thermostat configured to increase or decrease a louver free area percentage of the series of louvers in mechanical connection to the mechanical thermostat in response to each change in the adjacent temperature such that:

(1) the mechanical thermostat is configured to increase the louver free area percentage of the series of louvers in mechanical connection to the mechanical thermostat when the adjacent temperature for the mechanical thermostat is above a preset threshold temperature for the mechanical thermostat; and

(2) the mechanical thermostat is configured to decrease the louver free area percentage of the series of louvers in mechanical connection to the mechanical thermostat when the adjacent temperature for the mechanical thermostat is below the preset threshold temperature; and

(ii) wherein each of the louvers of the series of louvers has a preset minimum louver free area percentage;

(c) wherein each first damper associated with each hot aisle is configured to:

(i) control a first variable airflow of the heated air from the hot aisle into the hot aisle duct associated with the hot aisle; and

(ii) preset a first thermostat setting, the first thermostat setting including:

(1) a first threshold temperature for the preset threshold temperature for the mechanical thermostat of the first damper; and

(2) a first minimum louver free area percentage for the preset minimum louver free area percentage for the series of louvers of the first damper;

(d) wherein each second damper associated with each hot aisle duct is configured to:

(i) control a second variable airflow of the heated air from the hot aisle duct into the false ceiling plenum; and

(ii) preset a second thermostat setting, the second thermostat setting including:

(1) a second threshold temperature for the preset threshold temperature for the mechanical thermostat of the second damper; and

(2) a second minimum louver free area percentage for the preset minimum louver free area percentage for the series of louvers of the second damper; and

(e) wherein each third damper is configured to:

(i) control a third variable airflow of the heated air from the false ceiling plenum to the heated air collection duct; and

(ii) preset a third thermostat setting, the third thermostat setting including:

(1) a third threshold temperature for the preset threshold temperature for the mechanical thermostat of the third damper; and

(2) a third minimum louver free area percentage for the preset minimum louver free area percentage for the series of louvers of the third damper.

2. The system of claim 1,

(a) wherein each hot aisle duct includes:

(i) a hot aisle duct top surface of the hot aisle duct along a first horizontal plane, the first horizontal plane co-planar with a false ceiling plenum top surface of the false ceiling plenum; and

(ii) a hot aisle duct bottom surface of the hot aisle duct along a second horizontal plane that is:

(1) co-planar with the hot aisle ceiling associated with the hot aisle duct; and

(2) co-planar with a false ceiling plenum bottom surface of the false ceiling plenum;

(b) wherein each of the first dampers of each hot aisle is mounted:

(i) in the second horizontal plane; and

(ii) between:

(1) the hot aisle ceiling; and

(2) the hot aisle duct bottom surface of the hot aisle duct; and

(c) wherein each of the second dampers of each hot aisle duct is mounted:

(i) in at least one of:

(1) a first vertical plane along a first vertical side of the hot aisle duct; and

(2) a second vertical plane along a second vertical side of the hot aisle duct; and

(ii) between:

(1) the first vertical side or the second vertical side of the hot aisle duct; and

(2) the false ceiling plenum.

3. The system of claim 1,

(a) wherein each hot aisle duct includes:

(i) a hot aisle duct top surface of the hot aisle duct along a second horizontal plane, the second horizontal plane co-planar with a false ceiling plenum bottom surface of the false ceiling plenum; and

(ii) a hot aisle duct bottom surface of the hot aisle duct along a second alternative horizontal plane that is:

(1) co-planar with the hot aisle ceiling associated with the hot aisle duct; and

(2) located in parallel and between the second horizontal plane and a third horizontal plane that is co-planar with a floor area of the hot aisle associated with the hot aisle duct; and

(b) wherein each of the first dampers of each hot aisle is mounted:

(i) in the second alternative horizontal plane; and

(ii) between:

(1) the hot aisle ceiling; and

(2) the hot aisle duct bottom surface of the hot aisle duct; and

(c) wherein each of the second dampers of each hot aisle duct is mounted:

(i) in the second horizontal plane; and

(ii) between:

(1) the hot aisle duct top surface of the hot aisle duct; and

(2) the false ceiling plenum bottom surface of the false ceiling plenum.

4. The system of claim 1, wherein the third dampers are mounted:

(a) in a third vertical plane along at least one edge side of the false ceiling plenum; and

(b) between the false ceiling plenum and the heated air collection duct.

5. The system of claim 1, wherein a first volume of each hot aisle duct is less than 25 percent of a second volume of the false ceiling plenum.

6. The system of claim 1,

(a) wherein the first threshold temperature is selected from a first threshold temperature range from 35 to 39 degrees Celsius; and

(b) wherein the second threshold temperature is selected from a second threshold temperature range from 37 to 41 degrees Celsius.

7. The system of claim 1, wherein the first minimum louver free area percentage is in a first free area range of 8 to 12 percent.

8. The system of claim 1, wherein the second minimum louver free area percentage is in a second free area range of 0 to 3 percent.

9. The system of claim 1,

(a) wherein a maximum louver free area percentage of each of the first dampers, each of the second dampers, and each of the third dampers is in a maximum free area range of 25 to 35 percent;

(b) wherein each of the mechanical thermostats has an adjacent temperature response time of less than 15 seconds; and

(c) wherein each of the mechanical thermostats has an optimized temperature response range of 30 to 45 degrees Celsius.

10. The system of claim 1, wherein the at least one mechanical thermostat associated with each series of louvers is mounted on an upstream side of the series of louvers.

11. The system of any of the preceding claims, the system further including:

(a) for each server rack row, at least one cooled air inlet into a cold aisle associated with the server rack row; and

(b) an air handling unit (AHU) in fluid connection with:

(i) the heated air collection duct, wherein the AHU is configured to receive the heated air via the heated air collection duct to create cooled air; and

(ii) the at least one cooled air inlet of each cold aisle, wherein the at least one cooled air inlet is configured to receive the cooled air from the AHU.

12. The system of claim 11,

(a) wherein the cooled air received into each cold aisle from the AHU is in a cooled air temperature range of 23 to 27 degrees Celsius; and

(b) wherein the heated air received by the AHU via the heated air collection duct is in a heated air temperature range of 38 to 42 degrees Celsius.

13. The system of claim 11, the system further including a free cooling tower and a chiller,

(a) wherein the AHU includes a free cooling coil configured to receive a first free coolant flow from the free cooling tower; and

(b) wherein the AHU includes a trim cooling coil configured to receive a trim coolant flow from an evaporator passage of the chiller.

14. The system of claim 13, wherein the chiller includes a condenser passage to receive a second free coolant flow from the free cooling tower.

15. The system of claim 13, wherein the free cooling tower receives ambient air from an outer environment in an ambient temperature range of 25 to 32 degrees Celsius.

16. The system of claim 11,

(a) wherein the AHU further includes an AHU controller and a variable speed fan;

(b) wherein each bifurcated heated air return pathway includes a plurality of networked temperature sensors, each networked temperature sensor configured to:

(i) detect a series of current local temperatures; and

(ii) transmit the series of current local temperatures to the AHU controller; and

(c) wherein the AHU controller is configured to:

(i) reduce a speed of the variable speed fan of the AHU when at least one of the current local temperatures received from one of the networked temperature sensors is below a heated air threshold temperature; and

(ii) increase the speed of the variable speed fan of the AHU when at least one of the current local temperatures received from one of the networked temperature sensors is above the heated air threshold temperature.

17. The system of claim 16, wherein the heated air threshold temperature is selected from a heated air threshold temperature range of 38 to 42 degrees Celsius.