

LIQUID COOLING UNIT, APPARATUS AND METHOD FOR COOLING INDOOR SPACES

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority benefit under Title 35, U.S.C. §119(e) of U.S. Provisional Patent Application No. 62/280,131 entitled LIQUID COOLING UNIT, APPARATUS AND METHOD FOR COOLING INDOOR SPACES, filed on November 16, 2021, the entire disclosure of which is expressly incorporated herein.

TECHNICAL FIELD

[0002] The present disclosure relates generally to cooling systems. Embodiments of the disclosure are a liquid cooling unit, apparatus and method for cooling indoor spaces.

BACKGROUND

[0003] Thermal comfort in commercial and industrial buildings is primarily achieved using conventional vapour compression systems. Many high electricity demand applications, such as data centers, are also adopting this conventional approach for mechanical cooling due to its high stability and cooling capabilities. These are especially important in the data centers, where server or IT heat loads are high and frequent downtimes are not acceptable. Additionally, as sustainable practices and environmental stewardships evolve to a primary focus in the global economy, there is a need to adopt technologies that could reduce the energy intensity and carbon footprint in the data centers.

[0004] With data center market growing rapidly due to digital transformation, we need to be cognizant of the need for sustainability in the data centers to increase efficiency and adopt clean energy solutions for data center infrastructure. Studies have reported that cooling needs account for a substantial amount of the total energy demand in a data center. This makes energy efficient cooling technologies a key area of focus for data center operators to reduce energy consumption which translates to lower costs

as well. Industry players in the data center landscape should deviate from the conventional approaches and instead embrace new technologies, such as liquid cooling solutions, smart controls and clean energy etc. which can radically improve energy efficiency.

[0005] Evaporative cooling is widely adopted in many applications due to its reliability in delivering at high efficiencies and being environmentally sustainable which translate to considerable savings and relatively lower energy footprint over conventional vapour compression systems. The evaporative cooling uses the latent heat of vaporization of water to achieve a water temperature reduction that is close to the passing air wet bulb temperature whilst increasing the moisture content and reducing the temperature of the passing air. However, this advantage is limited by the ambient air psychrometric conditions, in this regard it works best in hot and dry weather conditions but not in humid climates unless with supplemental cooling equipment. There remains a need for the data center operators to increase the data centers power usage effectiveness, in other words, the energy efficiency of the data center, by reducing the energy consumption of the cooling equipment through the adoption of alternative cooling technologies to supplement or replace the existing cooling infrastructure.

SUMMARY

[0006] In accordance with a first aspect, a liquid cooling unit comprises a cold-water generation unit (CGU) adapted to receive outdoor air from a first outdoor air inlet through a first air stream and to cool water; and a main cooling unit (MCU) adapted to receive outdoor air from a second outdoor air inlet through a second air stream and to cool the outdoor air so received from the second outdoor air inlet. The cold-water generation unit comprises a first evaporative media configured to circulate evaporative cooling water therethrough, wherein airflow through first air stream is separate from airflow through the second streams such that the airflows do not mix with one another, and the main cooling unit and the cold-water generation unit are arranged in fluid communication with the water management system via a first fluid stream.

[0007] The summary above, as well as the following detailed description of illustrative embodiments, is better understood when read in conjunction with the appended drawings. For the purpose of illustrating the present disclosure, exemplary constructions of the disclosure are shown in the drawings. However, the disclosure is not limited to specific methods and instrumentalities disclosed herein. Moreover, those in the art will understand that the drawings are not to scale. Wherever possible, like elements have been indicated by identical numbers.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] **FIGS. 1 to 4** illustrate schematic diagram of a liquid cooling unit for cooling indoor spaces, showing several embodiments.

[0009] **FIGS. 5 to 12** illustrate schematic diagram of liquid cooling apparatus for cooling indoor spaces, showing several more embodiments.

DETAILED DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

[0010] The particular configurations discussed in the following description are non-limiting examples that can be varied and are cited merely to illustrate at least one embodiment and are not intended to limit the scope thereof.

[0011] The liquid cooling unit is used in tandem with other equipment, to serve as a key or supplementary cooling system in the data centers. With a combination of fluid pathways within the cooling system of different configurations, it serves to provide a comprehensive suite of cooling solution of different efficiencies to suit varying ambient conditions and load requirements. A detailed disclosure of the various fluid pathways within the liquid cooling unit and the system configurations are illustrated below.

[0012] Referring to **FIG. 1**: A liquid cooling unit **104** comprising a cold-water generation unit (CGU), a main cooling unit (MCU) and a water management system is enclosed herein. The CGU comprises a first evaporative media **108** for evaporative

cooling fluid/water circulating therethrough. The evaporative media 108 comprise, for example, cellulose pads, stack of fibrous, cotton, or plastic layers. An exhaust fan **106** is configured to draw in outdoor air from the surroundings through a first outdoor air inlet and direct the outdoor air through the CGU for exhausting into an outdoor environment through a first exhaust outlet. The MCU comprises an air-to-water heat exchanger **110** and a second evaporative media **112**, which can also comprise cellulose pads, stack of fibrous, cotton, or plastic layers. The dashed lines in Fig. 1 represent fluid flow and the solid line represents air flow. A supply fan **114** is configured to draw in outdoor air from the surroundings through a second outdoor air inlet and direct the outdoor air through the MCU for producing deeply cooled air through a second exhaust outlet. In accordance with a highly advantageous element, the airflow through the CGU and MCU form separate dedicated air streams that do not mix with one another, that is, a first or CGU air stream is not in air flow communication with a second or MCU air stream inside the liquid cooling unit **104**. Both air streams (CGU/MCU) undergo separate steps of cooling, i.e., the second air stream for the MCU undergoes dry/sensible cooling first before evaporative cooling, which can achieve a much lower resultant water temperature. In addition, the MCU and CGU are advantageously arranged in fluid communication via a first fluid stream with the water management system which comprises components such as water reservoirs, pumps, valves and flow restriction devices, for enabling water flow circulation and regulation through the various fluid pathways.

[0013] The air-to-water heat exchanger **110** in the MCU provides sensible cooling to the outdoor air. That is, heat is removed from the outdoor air with little or no change to the moisture content. At the same time, the fluid/water circulating through the heat exchanger **110** is heated during the process. This heated water is then circulated via the first fluid stream to the first evaporative media **108** for cold water regeneration and thereafter delivered to the water reservoir **120** sequentially, forming an open water loop in the first fluid stream. Cooled air exiting the air-to-water heat exchanger **110** of the MCU then enters the second evaporative media **112** for further treatment that produces deep cooled air and water via direct evaporative cooling process. The deep cooled water is then supplied to the water reservoir **120** and thereafter delivered to the second evaporative media **112**, forming another open water loop or second fluid stream between a valve **116** to the second evaporative media **112** of the MCU and

then to the water reservoir **120**. The fluid streams can be in fluid communication with one another. In the embodiment of Fig. 1, both loops/fluid streams are in fluid communication with the water reservoir **120**. The deep cooled air produced by the MCU is then be supplied to an external unit to provide cooling, such as a computer room air handler, either directly or through a series of heat exchangers. A pump **118** is used to drive the fluid/liquid water through at least one of the water loops while the valve **116** is used to regulate the water flow through the respective water loops. As shown in Fig. 1, the pump **118** is located between the water reservoir **120** and the valve **116** where the first fluid stream splits from the second fluid stream. Beyond the valve, the first fluid stream may extend to a heat exchanger **110** positioned in the MCU, such that the pump is located between the water reservoir and the heat exchanger.

[0014] **FIG. 2** shows another embodiment where the fluid streams are modified and a second water reservoir **302** is added: The air-to-water heat exchanger **110** in the MCU provides sensible cooling to the outdoor air. At the same time, the fluid/water circulating through the heat exchanger **110** is heated during the process, as before. This heated water is then circulated to the first evaporative media **108** for cold water regeneration along the first fluid stream and thereafter delivered to the first water reservoir **120**, forming an open water loop. A pump **118** is used to drive the liquid water through this water loop. The pump **118** is positioned along the first fluid stream between the first water reservoir **120** and the heat exchanger **110**. Cooled air exiting the air-to-water heat exchanger **110** along the second air stream then enters the second evaporative media **112** for further treatment that produces deep cooled air and water (in the first fluid stream) via the direct evaporative cooling process as before. The deep cooled stream of air and water are then be supplied to an external unit to provide cooling, such as a computer room air handler, either directly or through a series of heat exchangers. Heated water is circulated to the first evaporative media **108** via the first fluid stream. Fluid can be split from the first evaporative media and travel to the second evaporative media **112** via the second fluid stream for cold water regeneration, and thereafter delivered to the second water reservoir **302**, forming another open water loop. A pump **304** is used to drive the liquid water through this water loop. As shown in Fig. 2, second water reservoir **302** is positioned along the second fluid stream between the evaporative media **112** and the pump **304**.

Fluid/water travels from the first evaporative media **108** to the second evaporative media **112** and then to the second water reservoir **302** along the second fluid stream. Optionally, the first water reservoir **120** and second water reservoir **302** can also be in fluid connection such that the water temperatures for the first water reservoir and second water reservoir is kept the same, similar to the configuration of Fig. 1 with only one water reservoir. In one embodiment, it should also be noted that it is possible that all the fluid/water flowing to the first evaporative media **108** can be entirely diverted to the second evaporative media **112** before flowing to the second reservoir **302** which is fluidly connected to the first reservoir **120**, instead of flowing directly into the first reservoir **120**. This can be accomplished by a diversion valve (between the evaporative media **108** and the water reservoir **120** along the first fluid stream) and control system, or direct physical separation, for example. The embodiment of Fig. 2 shows another variation, where the first fluid stream is represented by fluid flow from first water reservoir **120**, pump **118**, heat exchanger **110**, first evaporative media **108**, second evaporative media **112**, second water reservoir **302**, then back to the first reservoir **120**. The second fluid stream is then represented by fluid flow from second water reservoir **302**, pump **304**, first evaporative media **108**, second evaporative media **112**, then back to second water reservoir **302**. The fluid flowing from the pump **304** is connected to an external unit to provide cooling, such as a computer room air handler, either directly or through a series of heat exchangers, before flowing back to the first evaporative media **108** and second evaporative media **112** to produce deep cooled water again.

[0015] Referring to the embodiment of **FIG. 3** where the fluid stream have been modified: The air-to-water heat exchanger **110** in the MCU provides sensible cooling to the outdoor air. At the same time, the water circulating through the heat exchanger **110** is heated during the process, as before. This heated water is then circulated to the first evaporative media **108** for cold water regeneration and thereafter delivered to the first water reservoir **120**, forming an open water loop along the first fluid stream, as in the embodiment of Fig. 2. A pump **118** is used to drive the liquid water through this water loop. Cooled air exiting the air-to-water heat exchanger **110** then enters the second evaporative media **112** for further treatment that produces deep cooled air and water which is collected in the second reservoir **302** via direct evaporative cooling process. These two deep cooled streams of air and water produced are then be

supplied to an external unit to provide cooling, such as a computer room air handler, either directly or through a series of heat exchangers. In the embodiment of Fig. 3, water that is being driven by pump **304** for cooling application is circulated directly to the second evaporative media **112** for cooling via evaporative process and collected in the second reservoir **302**.

[0016] Referring to the embodiment of **FIG. 4**: The air-to-water heat exchanger **110** in the MCU provides sensible cooling to the outdoor air. At the same time, the water circulating through the heat exchanger **110** is heated as before. This heated water is then circulated to the first evaporative media **108** for cold water regeneration and thereafter delivered to the first water reservoir **120**, forming an open water loop/first fluid stream. Cooled air exiting the air-to-water heat exchanger **110** then enters the second evaporative media **112** for further treatment that produces deep cooled air and water via direct evaporative cooling process. The deep cooled water is then supplied to the first water reservoir **120** and thereafter delivered to the second evaporative media **112**, forming another open water loop/modified first fluid stream operatively connecting fluid flowing from the water reservoir **120** to the evaporative media **112**. The deep cooled air produced is then be supplied to an external unit to provide cooling, such as a computer room air handler, either directly or through a series of heat exchangers. A pump **118** is used to drive the liquid water to either the heat exchanger **110** or to the evaporative media through a split (by for example, a valve, not shown) in the first fluid stream. Heated water after gaining heat from providing cooling to an indoor space through a series of heat exchanger, is circulated to the first evaporative media **108** in the liquid cooling unit for cold water regeneration and thereafter delivered to the second water reservoir **302**, forming another open water loop/second fluid stream. A pump **304** is used to drive the liquid water through this water loop in a manner similar to the pump **304** in the embodiments of Figs. 2 and 3.

[0017] Referring to the embodiment of **FIG. 5**: The deep cooled air produced by the liquid cooling unit is used to pre-cool the hot aisle return air (RA) entering the Computer Room Air Handler ("CRAH") unit, via a series of heat exchangers. Heat from heated air of the hot aisle RA is transferred to the cooling water circulating therethrough in an air-to-water heat exchanger **126** positioned outside of but operatively connected to the liquid cooling unit, and the liquid cooling unit is the same as the embodiment of Fig. 1,

for example. Further heat exchange occurs in an air-to-water heat exchanger **122**, operatively connected to the cool air outlet from the MCU, where heated water from the air-to-water heat exchanger **126** is cooled by the deep cooled air running therethrough which is then expelled to the surroundings as exhaust air. A pump **124** is used to drive the liquid water through the closed water loop/third fluid stream that comprises the air-to-water heat exchanger **126** and **122**. The hot aisle RA is pre-cooled in the air-to-water heat exchanger **126** before subsequent treatment by an additional heat exchanger **128** in the CRAH unit. A fan **130** is configured to draw in the hot aisle RA and direct it through the heat exchangers for supplying to an indoor environment e.g. cold aisle of a data center.

[0018] Referring to the embodiment of **FIG. 6**: The deep cooled air produced by the liquid cooling unit (which can be the same as the liquid cooling unit of the embodiment of Fig. 1, for example) is used to pre-cool the hot aisle RA entering the CRAH unit via an air-to-air heat exchanger **202**, where heat from the hot aisle RA is transferred to the cooling air passing therethrough which is then expelled to the surroundings as exhaust air. The hot aisle RA is pre-cooled in the air-to-air heat exchanger **202** before subsequent treatment by an additional heat exchanger **128** in the CRAH unit at a third air stream. A fan **130** is configured to draw in the hot aisle RA and direct it through the heat exchangers for supplying cold air to an indoor environment e.g., cold aisle of a data center.

[0019] Referring to the embodiment of **FIG. 7**: The deep cooled air and water produced by the liquid cooling unit (which can be the same as the liquid cooling unit of the embodiment of Fig. 2, for example) is used to pre-cool the hot aisle RA entering the CRAH unit, via a series of heat exchangers. Part of the heat from the hot aisle RA is transferred via a third air stream in fluid connection with the second air stream, the deep cooled air passing therethrough in an air-to-air heat exchanger **202**. The air is then expelled to the surroundings as exhaust air. On the other hand, the deep cooled water is used to take care of the remaining hot aisle RA pre-cooling load. Heat from the hot aisle RA is transferred to the cooling water circulating therethrough in an air-to-water heat exchanger **126**. Further heat exchange occurs in a water-to-water heat exchanger **306**, operatively connected to the liquid cooling unit. That is, heated water from the air-to-water heat exchanger **126** is cooled by the deep cooled water

circulating therethrough along a third fluid stream which is then circulated back to the liquid cooling unit for cold water regeneration. This allows the water circulating through heat exchanger **126** to remain as a closed loop configuration, which could be a consideration for certain applications to reduce maintenance of the heat exchangers in the CRAH. A pump **124**, typically positioned outside to liquid cooling unit as shown in Fig. 7, is used to drive the liquid water through a third water stream/closed water loop that comprises the air-to-water heat exchanger **126** and water-to-water heat exchanger **306**. Mixing of the two pre-cooled air streams at the outlet of the air-to-air heat exchanger **202** and air-to-water heat exchanger **126** occurs before subsequent treatment by an additional heat exchanger **128** in the CRAH unit. A fan **130** is configured to draw in the hot aisle RA and direct it through the heat exchangers for supplying to an indoor environment e.g., cold aisle of a data center.

[0020] Referring to the embodiment of **FIG. 8**: The deep cooled air and water produced by the liquid cooling unit (which can be the same as the liquid cooling unit of Fig. 2, for example) is used to pre-cool the hot aisle RA entering the CRAH unit, via a series of heat exchangers. Heat from the hot aisle RA is transferred to the cooling water circulating therethrough in an air-to-water heat exchanger **126**. Further heat exchange occurs in a water-to-water heat exchanger **306**, (similar to the water-to-water heat exchanger of Fig. 7) where heated water from the air-to-water heat exchanger **126** is cooled by the deep cooled water circulating therethrough along a third fluid stream. A pump **124** in the third fluid stream is used to drive the liquid water through the closed water loop that comprises the air-to-water heat exchanger **126** and water-to-water heat exchanger **122**. On the other hand, the deep cooled air is used to cool the heated water exiting the water-to-water heat exchanger **306**, in an air-to-water heat exchanger **122**. Heat absorbed from the heated water is expelled to the surroundings in exhaust air. The water exiting the air-to-water heat exchanger **122** is circulated back to the liquid cooling unit and/or the evaporative media **112** for cold water regeneration. The hot aisle RA is pre-cooled in the air-to-water heat exchanger **126** before subsequent treatment by an additional heat exchanger **128** in CRAH unit. A fan **130** is configured to draw in the hot aisle RA and direct it through the heat exchangers for supplying to an indoor environment e.g., cold aisle of a data center.

[0021] Referring to the embodiment of **FIG. 9**: The deep cooled air and water

produced by the liquid cooling unit (which can be the same as the liquid cooling unit of Fig. 2, for example) is used to pre-cool the hot aisle RA entering the CRAH unit, via a series of heat exchangers. Heat from the hot aisle RA is transferred to the cooling water circulating therethrough in an air-to-water heat exchanger **126**. Further heat exchange occurs in an air-to-water heat exchanger **122** (similar to the air-to-water heat exchanger of the embodiment of Fig. 8), where the heated water from the air-to-water heat exchanger **126** is cooled by the deep cool air running therethrough which is then expelled to the surroundings as exhaust air. The water exiting the air-to-water heat exchanger **122** is circulated back to the liquid cooling unit for cold water regeneration. The hot aisle RA is pre-cooled in the air-to-water heat exchanger **126** before subsequent treatment by an additional heat exchanger **128** in the CRAH unit. A fan **130** is configured to draw in the hot aisle RA and direct it through the heat exchangers **126** and then **128** for supplying to an indoor environment e.g. cold aisle of a data center.

[0022] Referring to the embodiment of **FIG. 10**: The deep cooled air and water produced by the liquid cooling unit (which can be the same as the liquid cooling unit of Fig. 2, for example) is used to pre-cool the hot aisle RA entering the CRAH unit, via a series of heat exchangers. Heat from the hot aisle RA is transferred to the cooling water circulating therethrough in an air-to-water heat exchanger **126**. Further heat exchange occurs in an air-to-air heat exchanger **122** (similar to the air-to-water heat exchanger of the embodiment of Fig. 8), where heated water from the air-to-water heat exchanger **126** is cooled by the deep cooled air running therethrough which is then expelled to the surroundings as exhaust air. The water exiting the air-to-water heat exchanger **122** then enters a water-to-water heat exchanger **306** where it is further cooled by the deep cooled water produced by the liquid cooling unit. The cooled water from the water-to-water heat exchanger **306** (similar to the water-to-water heat exchanger of Fig. 7) is then circulated back to the air-to-water heat exchanger **126**, forming a closed water loop which is driven by a pump **124**. On the other hand, the deep cooled water that has been heated in the process, is circulated back to the liquid cooling unit for cold water regeneration. The hot aisle RA is pre-cooled in the air-to-water heat exchanger **126** before subsequent treatment by an additional heat exchanger **128** in the CRAH unit. A fan **130** is configured to draw in the hot aisle RA and direct it through the heat exchangers for supplying to an indoor environment e.g.,

cold aisle of a data center.

[0023] Referring to the embodiment of **FIG. 11**: The deep cooled air and water produced by the liquid cooling unit (which can be the same as the liquid cooling unit of Fig. 2, for example) is used to pre-cool the hot aisle RA entering the CRAH unit, via a series of heat exchangers. Heat from the hot aisle RA is transferred to the cooling water circulating therethrough in an air-to-water heat exchanger **126**. Heated water circulated from the air-to-water heat exchanger **126** is cooled by an air-to-water heat exchanger **122** (similar to the air-to-water heat exchanger of the embodiment of Fig. 8) and a water-to-water heat exchanger **306** (similar to the water-to-water heat exchanger of Fig. 7), both arranged in a parallel configuration. A valve **308** is used to regulate the water flow through both the heat exchangers. Heat absorbed by the deep cooled air in the air-to-water heat exchanger **122** is expelled to the surroundings in exhaust air while the heat absorbed by the deep cooled water in the water-to-water heat exchanger **306** is rejected to the surroundings by the liquid cooling unit via a cold-water regeneration process. The cooled water streams at the outlet of the air-to-air heat exchanger **122** and the air-to-water heat exchanger **306** are mixed before circulating back to the air-to-water heat exchanger **126**, forming a closed water loop which is driven by a pump **124**. The hot aisle RA is pre-cooled in the air-to-water heat exchanger **126** before subsequent treatment by an additional heat exchanger **128** in the CRAH unit. A fan **130** is configured to draw in the hot aisle RA and direct it through the heat exchangers for supplying to an indoor environment e.g. cold aisle of a data center.

[0024] Referring to the embodiment of **FIG. 12**: The deep cooled air and water produced by the liquid cooling unit (which can be the same as the liquid cooling unit of Fig. 2, for example) is used to pre-cool the hot aisle RA entering the CRAH unit, via a series of heat exchangers. Heat from the hot aisle RA is transferred to the cooling water circulating therethrough in an air-to-water heat exchanger **126**. Heated water circulated from the air-to-water heat exchanger **126** is cooled by an air-to-water heat exchanger **122** (similar to the air-to-water heat exchanger of the embodiment of Fig. 8) and at least one evaporative media in the liquid cooling unit, both arranged in a parallel configuration. A valve **308** is used to regulate the water flow through the heat exchanger and evaporative media. Heat exchange occurs in the air-to-water heat

exchanger **122**, where part of the heat load from the heated water is absorbed by the deep cooled air and expelled to the surroundings in exhaust air. The remaining heat load from the heated water is rejected to the surroundings by the liquid cooling unit via a cold-water regeneration process. The cooled water streams exiting the air-to-water heat exchanger **122** and the liquid cooling unit are mixed before circulating back to the air-to-water heat exchanger **126**, forming an open water loop. The hot aisle RA is precooled in the air-to-water heat exchanger **126** before subsequent treatment by an additional heat exchanger **128** in the CRAH unit. A fan **130** is configured to draw in the hot aisle RA and direct it through the heat exchangers for supplying to an indoor environment e.g., cold aisle of a data center.

[0025] It will be appreciated that variations of the above disclosed and other features and functions, or alternatives thereof, may be desirably combined into many other different systems or applications. Also, various present unforeseen or unanticipated alternatives, modifications, variations or improvements therein may subsequently be made by those skilled in the art which are also intended to be encompassed by the following claims.

[0026] Although embodiments of the current disclosure have been described comprehensively in considerable detail to cover the possible aspects, those skilled in the art, given the benefit of this disclosure, would recognize that other versions of the disclosure are also possible.

CLAIMS

1. A liquid cooling unit comprising, in combination:
 - a cold-water generation unit (CGU) adapted to receive outdoor air from a first outdoor air inlet through a first air stream and to cool water; and
 - a main cooling unit (MCU) adapted to receive outdoor air from a second outdoor air inlet through a second air stream and to cool the outdoor air so received from the second outdoor air inlet;wherein the cold-water generation unit comprises a first evaporative media configured to circulate evaporative cooling water therethrough;
 - wherein airflow through first air stream is separate from airflow through the second streams such that the airflows do not mix with one another, and the main cooling unit and the cold-water generation unit are arranged in fluid communication with the water management system via a first fluid stream.
2. The liquid cooling unit of claim 1, wherein the first fluid stream is provided with a pump, for enabling water flow circulation and regulation, wherein the pump is located between a water reservoir and a heat exchanger positioned in the MCU.
3. The liquid cooling unit of claim 2, wherein the heat exchanger of the MCU comprises an air-to-water heat exchanger.
4. The liquid cooling unit of claim 3, wherein the water reservoir is positioned in the first fluid stream between the first evaporative media and the heat exchanger, wherein water circulating through the air-to-water heat exchanger is heated, and the heated water is circulated to the first evaporative media for cold water regeneration and delivered to the water reservoir sequentially along the first fluid stream.
5. The liquid cooling unit of claim 4, further comprising a second evaporative media positioned in the MCU, and a second fluid stream in fluid connection with the second evaporative media.

6. The liquid cooling unit of claim 5 wherein the second fluid stream provides fluid connection between the second evaporative media and the water reservoir.
7. The liquid cooling unit of claim 6, wherein a cooled air exits the air-to-water heat exchanger and enters the second evaporative media for treatment to produce a deep cooled air via a direct evaporative cooling process.
8. The liquid cooling unit of claim 5, further comprising a second fluid reservoir, wherein water travels from the second evaporative media, and then to the second water reservoir along the second fluid stream.
9. The liquid cooling unit of claim 8 wherein water travels from the first evaporative media to the second evaporative media along the second fluid stream.
10. The liquid cooling unit of claim 5 further comprising a second fluid reservoir, wherein water travels from the first evaporative media to the second fluid reservoir along a part of the first fluid stream which bypasses the second evaporative media.
11. The liquid cooling unit of claim 5 further comprising an air-to-air heat exchanger in fluid connection with the MCU along the second air stream.
12. The liquid cooling unit of claim 5 further comprising a water-to-water heat exchanger connected to the second reservoir along a third fluid stream, wherein heated water from the air-to-water heat exchanger is cooled by deep cooled water circulating therethrough along the third fluid stream which is then circulated back to the CGU for cold water regeneration.
13. The liquid cooling unit of claim 1 further comprising a first water reservoir is in fluid connection with a second water reservoir.
14. The liquid cooling unit of claim 13 wherein a second evaporative media is positioned between the first water reservoir, the second water reservoir, and water from the evaporative media is entirely routed from the first water reservoir to the second evaporative media.