HEAT EXCHANGER AND METHOD FOR COOLING NETWORK CABINETS

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ABSTRACT

The invention relates to a heat exchanger for water-cooled network cabinets and to a method for cooling network cabinets, particularly server cabinets. The heat exchanger is constructed as an air-water heat exchanger in redundant form and ensures a leak-tight arrangement and cooling in a network cabinet. The heat exchanger has two heat exchanger elements with separate cooling water connections which, accompanied by the formation of a space, are provided for the supply of exhaust air from the cabinet interior. A partition is adjustably placed in the space and in the case of a fault, e.g. if one heat exchanger element or a cooling circuit fails, the corresponding heat exchanger element is aerodynamically blocked with the aid of the partition. The entire exhaust air is cooled in the intact heat exchanger element and supplied to the cabinet interior, so that no interruption of operation is necessary.
HEAT EXCHANGER AND METHOD FOR COOLING NETWORK CABINETS

[0001] The invention relates to a heat exchanger for liquid-cooled network cabinets according to the preamble of claim 1 and to a method for cooling network cabinets according to the preamble of claim 19.

[0002] Known heat exchangers for liquid-cooled network cabinets are air-liquid heat exchangers, particularly air-water heat exchangers, which are suitable for removing high power losses from the network cabinet, particularly server cabinets.

[0003] In DE 20 04 065 521 U1 and WO 2005/104 642 A1 and the "CoolTherm" internet entry of KNURR AG a liquid-cooled server cabinet is known, which has in the lower area and therefore below the superimposed servers an air-water heat exchanger. The heat exchanger is connected to the cold water supply of the building, the initial water temperature is approximately 12°C and the total waste heat is eliminated to the outside via the cooling water circuit without impairing the air conditioning. The air in the cabinet flows in a closed circuit and advantageously there are equally long flow paths through all the servers. The cooling air is frontally sucked out of the heat exchanger by the server fans at a temperature of 20 to 25°C and is removed at the back with an increased temperature. This exhaust air is sucked in behind the servers and is forced with the aid of fans through an exhaust air duct in the rear door of the cabinet downwards into the heat exchanger.

[0004] The known CoolTherm server cabinet with the air-water heat exchanger located at the bottom ensures high cooling capacities above 4 to 6 kW per cabinet, so that high power servers can be installed and server cabinets with a very high packing density can be set up, also in interlinked manner, in computing centres and the like.

[0005] There is an increasing need in the case of server cabinets for high availability or fault tolerant computing centres to redundantly design all the functionally critical components.

[0006] In the case of the CoolTherm server cabinet fans are e.g. provided with a n+1 redundancy. The air-water heat exchanger as a purely passive component admittedly has a relatively limited probability of failure. However, there is no 100% fail safety.

[0007] The Liquid Cooling Package (LCP) of RITTAL (cf. RITTAL internet entry, product catalogue H331/System Air Conditioning) permits the formation of redundancies on the heat exchanger side. The LCP comprises a cooling rack, which is laterally located on a server cabinet or also between two server cabinets and can receive up to three or even four air-water heat exchanger cooling modules, which are superimposed. When there are two server cabinets with a LCP between them and in each case one lateral LCP, the central LCP constitutes the redundancy for the in each case right and left-hand server cabinet.

[0008] As a result of the lateral arrangement of the heat exchanger modules or the cooling rack, said cooling system has a greater leak risk and also leads to greater space requirements and due to the greater width does not satisfy the reference grid of cabinet rows in computing centers.

[0009] The object of the invention is to develop an air-liquid heat exchanger, which is redundantly constructed and also ensures a compact assembly-friendly and maintenance-friendly, as well as leaktight arrangement in a network cabinet, particularly in a server cabinet. At the same time the redundant heat exchanger must be compatible with the efficient air-liquid heat exchangers hitherto used in the CoolTherm server cabinet. Through a method for cooling network cabinets, particularly server cabinets, with the aid of a redundantly constructed air-water heat exchanger it must be possible to ensure the full cooling capacity without any interruption of operation in the case of a fault.

[0010] From the apparatus standpoint the object is achieved according to the invention through the features of claim 1. From the method standpoint the object according to the invention is achieved through the features of claim 19. Appropriate and advantageous developments appear in the sub-claims and the specific description relative to the drawings.

[0011] A fundamental idea of the invention is to achieve compatibility and redundancy through an appropriate arrangement of two heat exchanger elements in a heat exchanger housing and to provide the two independent heat exchanger elements with separate cooling water connections. It is advantageous if the two heat exchanger elements, which can e.g. be constructed as mutually independent tubular/finned blocks, can in each case be detachably connected to the forward and return run of separate lines of a cold water network or main or a recirculator.

[0012] According to the invention a partition is adjustably placed in an air intake-side open space of the heat exchanger formed by the heat exchanger elements arranged at an angle to one another. This partition can be pivoted from a position in which both heat exchanger elements are subject to the action of the exhaust air to be cooled and which is preferably a central position, into a blockade position. The blockade position leads to a covering of in each case one of the two heat exchanger elements and therefore to an aerodynamic blocking of the exhaust air supply with the consequence that in each case the other heat exchanger element is subject to the action of the entire exhaust air flow.

[0013] From the method standpoint, in normal operation the two heat exchanger elements are subject to the action of a cooling liquid, preferably cold water from the building mains or cooling water from a special cooling water network or main of the computing center and also the exhaust air subject to the dissipated heat. In normal operation the adjustable partition is in the central position and the exhaust air flow entering the heat exchanger via an air intake side is distributed over both heat exchanger elements. The air flowing through both heat exchanger elements passes out as cooling air from said two heat exchanger elements into an air exit area and is supplied to the servers and/or similar components to be cooled.

[0014] In the case of a fault the partition is brought into the blockade position. A fault can be the failure of a heat exchanger element, e.g. due to a leak or a stoppage. Another fault case is constituted by a failure of a cooling circuit, when the connected heat exchanger element can no longer be supplied with cooling water. If a cooling circuit fails then through a temporary pivoting of the air conduction flap the entire exhaust air flow can be passed through the heat exchanger element connected to the intact cooling circuit. Thus, the server cabinet can continue to be operated until the fault is removed. It is merely necessary to pivot the air conduction flap in such a way that an aerodynamic blocking of the exhaust air supply to the heat exchanger element with the failed cold water supply is ensured. The prerequisite is an
independent cooling water supply of the two heat exchanger elements, which is particularly advantageous in high availability computing centers.

[0015] In a preferred embodiment the two heat exchanger elements have a parallelepiped construction and are so positioned that the air intake-side space is V-shaped in horizontal section and the air exit area is roughly W-shaped. Generally the air intake side of the heat exchanger housing of an inventive heat exchanger placed in a server cabinet e.g. at bottom, is located on the rear of the cabinet and an air exit side of the heat exchanger housing is located in the front cabinet area. Thus, air flows in the front direction through the heat exchanger from the cabinet rear. However, a turned-around arrangement or an arrangement modified by 90°, including the cabinet side walls, is also possible.

[0016] Appropriately the adjustable partition located in the air intake-side space is vertical and is dimensioned corresponding to the vertical longitudinal side of the identically constructed heat exchanger units, which bound the roughly V-shaped space and if necessary are to be covered by the partition, so that the necessary “unilateral” blockade for the exhaust air flow is ensured.

[0017] It is advantageous that the partition can be adjusted about a vertical pivoting axis, which in the space is located close to the air exit area. Appropriately the pivoting axis is located in the zone of the virtually adjacent, vertical inner edges of the two heat exchanger elements.

[0018] If the two heat exchanger elements are in each case placed on a separate, horizontally adjustable support element, each support element with the relevant heat exchanger element and independently of the other support element can be extracted from the heat exchanger housing. In the case of a fault due to a defect to one of the heat exchanger elements, e.g. when a leak or stoppage occurs, the defective heat exchanger element can be extracted from the heat exchanger housing after separation from the cooling water system, then dismantled and repaired or replaced by a new element. There is no need to interrupt operation for this and the removal of the dissipated heat from the exhaust air flow takes place entirely in the second, operable heat exchanger element as soon as the defective heat exchanger element is covered following a pivoting movement of the partition.

[0019] Appropriately the lower part of the heat exchanger housing is bounded by a condensate/leakage water collection tank, which is constructed continuously and can be connected to a condensate drain pipe. Thus, a leakage risk is reduced to a minimum or is virtually excluded.

[0020] It is advantageous if the partition can be fixed in the central position implementing the normal position and optionally also in the two possible blockade positions. This ensures that there can be no change to the partition position in an unintentional manner.

[0021] After releasing the fastening or a locking action, the partition can be adjusted from the central position by hand or with the aid of a drive, e.g. a gas pressure spring or an electric motor and brought into the blocking position. In the same way the return to the central position can be brought about when the fault is removed and normal operation can again be carried out with action on both heat exchanger elements.

[0022] Appropriately in the vicinity of the two heat exchanger elements and their cooling water supplies there are sensors for fault detection and for emitting fault or warning signals, particularly flow and leak sensors. The pivoting of the partition for blocking the in each case no longer operable heat exchanger element takes place manually or by means of a drive following the warning signal. There can also be an automatic partition adjustment.

[0023] If the movable partition is pivoted against one of the heat exchanger elements and prevents the air flow through said element, so that the entire airflow is guided through the other heat exchanger element, the servers, switches and the like installed in the cabinet are supplied with cooling air from the flowed-through heat exchanger element. To ensure a uniform server cooling air supply, air conducting elements, which are preferably adjustable and can be in the form of flaps, are located in the air exit area and/or in the cabinet area following the air exit from the heat exchanger housing. The unilaterally exiting cooling air flow can be directed and spread out over the entire cabinet width by the air conducting elements in order to ensure the uniform cooling air supply for the servers, etc.

[0024] In order to ensure the full cooling capacity in the case of a fault with one operable heat exchanger element, it can be appropriate to operate the fans for the exhaust air flow at a higher speed. The cooling air flow can then be maintained even against an increased flow resistance. It is also possible to specify one server cabinet or network cabinet with a redundant heat exchanger with a lower nominal cooling capacity. The servers and similar components installed in the cabinet can then continue to operate uninterrupted with an adequate cooling capacity until the fault is removed. Operation does not have to be interrupted.

[0025] This also applies when replacing a heat exchanger element with extracted support element and an opened cabinet door. The installed servers and the like then suck the ambient air from the installation area, which is not exposed to heated exhaust air. The server exhaust air subject to the dissipated power is dehumidified in the second, operable heat exchanger element, i.e. cooled back and blown in heat-neutral manner into the ambient air. It is advantageous that the service technician can work outside the cooling air flow, because the air supply to the defective heat exchanger element is interrupted with the aid of the partition pivotable into the blockade position.

[0026] The adjustable partition can be extended over and beyond its vertical pivoting axis in the direction of the air exit side and can extend up to a covering of the air exit side or up to the front door of the cabinet. At least in the air exit area the extended partition is positioned in fixed manner and together with the pivotable partition subdivides the heat exchanger into two virtually identically sized areas.

[0027] In a further development of the heat exchanger and a network cabinet, particularly a server cabinet, in which the inventive redundant heat exchanger is located, on the air exit side the heat exchanger housing is separately covered by two coverings, which are associated with the given heat exchanger element and can e.g. be constructed in flap or door-like manner. The cabinet door can then be shortened. For example the lower edge of the cabinet door can extend close to the upper covering of the heat exchanger housing. In this construction it is advantageous that the cabinet door does not have to be opened if a heat exchanger element has to be extracted for removing a fault. There is no air suction from the installation area of the cabinets.

[0028] It is appropriate if on the air exit side each heat exchanger element is provided with an arresting element which, when the heat exchanger element is extracted, prevents ambient air from entering the supply air duct of the
The arresting element can be constructed as an additional flap or also as a horizontally adjustable or displaceable plate and is e.g. arranged or guided on the heat exchanger housing. The two arresting elements associated with the heat exchanger elements are appropriately operable independently of one another.

On replacing a heat exchanger element initially the particular covering or flap or door is opened in order to be able to extract the support element with the heat exchanger element, whilst the covering of the second, operable heat exchanger element remains closed. The entire cooling air flow from said second heat exchanger element can then, appropriately with the arresting element in the arrested position and by means of guiding elements, be directed upwards into the suction area of the servers. After replacing the defective heat exchanger element the air exit side covering is closed again, the arresting position of the arresting element is cancelled out and the adjustable partition is pivoted back from its blockade position into the central position for effecting normal operation.

The space between the air exit side of the heat exchanger housing and the front door of the server cabinet can contain a guiding device for deflecting the cooling air flow. Such a guiding device can be basically constructed as described in DE 20 2004 016 492 U1 and as shown in exemplified manner in FIGS. 3 to 5 thereof. Corresponding to the two heat exchanger units and a unilateral cooling air flow in the case of a fault it is appropriate to construct the air guiding device in one or two parts and then a vertical separating element is located in the center and is aligned with the fixed partition. The fixed partition part can, in an alternative construction, also be an integral part of said air guiding device. The guiding device can be located on the heat exchanger housing or on the inside of the cabinet front door. When positioning on the heat exchanger housing the air guiding device should be fixed in detachable manner, so as to ensure the extraction of the heat exchanger elements.

The connection of the heat exchanger elements to a cold water network or main of the building, a specific cold water main of the computing center or a recooler for a cooling liquid can, as desired, take place on the air intake or air outlet side. If the detachable connections are brought about by quick couplers, the connection can be automatically released in a drip-free, sealing manner on extracting a heat exchanger element and can be restored on inserting the heat exchanger element.

The inventive, redundant heat exchanger is not restricted to use in network cabinets and server cabinets and can instead be used for all cooling concepts and cooling arrangements. The advantages are a complete redundancy accomplished by a relatively limited constructional and manufacturing expenditure. A network cabinet, particularly a server cabinet, which is equipped with the inventive heat exchanger can, in the case of a fault in the area of one of the two heat exchanger elements or in the cooling water main, can continue to be operated. A defective heat exchanger element can also be replaced without interrupting operation and without either problems or particular urgency.

The invention is described in greater detail herein after relative to the attached diagrammatic drawings, wherein show:

FIG. 1 A perspective view of an inventive, redundant heat exchanger with a partition in the central position for normal operation and with an in part removed housing.

FIG. 2 A heat exchanger according to FIG. 1, but with a partition in the blockade position provided for a fault.

FIG. 3 A network cabinet with an inventive, redundant heat exchanger and with a partition in the blockade position and an extracted heat exchanger element.

The heat exchanger 2 of FIGS. 1 to 3 has a housing 6, which for a clear reproduction is broken away in the area of an upper covering 26 and a side wall 28. Two heat exchanger elements 3, 4 are positioned at an angle to one another in the housing 6, so as to form a V-shaped space 5 between the heat exchanger elements 3, 4. The identically constructed heat exchanger elements 3, 4 are arranged in virtually adjacent manner with vertical inner edges 15 in the vicinity of an air exit side 8 of the heat exchanger housing 6, so that exhaust air, which enters the space 5 on the opposite air intake side 7 of the heat exchanger 2, is guided through the two heat exchanger elements 3, 4 arranged in an edge manner.

In the space 5 is provided a partition 10, which can be pivoted to the right and left about a vertical pivoting axis 11 until engagement takes place on the given vertical, inside longitudinal side 19 of the heat exchanger elements 3, 4.

For normal operation the partition 10 in FIG. 1 is located in a central position. The exhaust air entering at an open air intake side 7 (black arrow) is subdivided by the partition 10 and passes into both heat exchanger elements 3, 4, is cooled and then passes in the form of cooling air into an air exit area 9 and via the air exit side 8 of the heat exchanger 2 into a not shown, supply air duct and is sucked in by the server fans, which are in each case located in a housing.

The partition 10 is vertically oriented and dimensioned for covering the vertical longitudinal sides 19 of the heat exchanger elements 3, 4 in each case bounding the space 5. In this embodiment the heat exchanger elements 3, 4 are parallelepipedic and engage with their narrow longitudinal sides on the bottom support elements 16, 17.

On the air intake side 7 are provided detachable connections 13, 14 for a separate connection of the heat exchanger elements 3, 4 to the building cold water main or to a recooler. The connections 13, 14 for the forward and return passage of a cooling agent, e.g. cold water from the building cold water main, are advantageously constructed as quick couplers.

In this embodiment the separate support elements 16, 17 are support plates, which are virtually adjacent to one another and which can be forwardly separately extracted (cf. FIG. 3). The partition 10 shown in FIG. 1, as a result of the symmetrically arranged heat exchanger elements 3, 4, also constitutes the separation line of support elements 16, 17. Below the support elements 16, 17 is provided a condensate/leakage water receiving tank 18, which can be connected to a not shown condensate drain pipe.

FIG. 2 shows the heat exchanger 2 in the case of a fault. When a fault occurs in one of the two connected cooling water circuits 13, 14 or in one of the heat exchanger elements 3, 4, which leads to an interruption of the cooling water supply, the partition 10 is pivoted against the failed heat exchanger element, which in FIG. 2 is the left-hand element 4. The pivoting of partition 10, which can take place manually, mechanically or automatically (not shown), takes place up to the blockade position, in which the air flow is completely diverted to the heat exchanger element 3. In the embodiment of FIG. 2 the partition 10 engages on the heat exchanger element 4 and covers the air intake side 19. The exhaust air flowing into the space 5 is now exclusively guided
through the operable heat exchanger element 3 and the exiting cooling air passes via the air outlet area 9 and the air outlet side 8 of the heat exchanger 2, e.g. via a supply air duct 21 (FIG. 3), to the servers of a server cabinet.

[0044] In the operating state of the redundant heat exchanger 2 shown in FIG. 2 said servers are supplied solely with cooling air from the single heat exchanger element 3. There is no need to interrupt operation for eliminating a defect or for carrying out a repair due to the redundant construction of the heat exchanger 2.

[0045] FIG. 3 shows a server cabinet 20 equipped with the inventive, redundant heat exchanger 2, which is positioned at the bottom and below an inner area 25. With respect to said server cabinet 20 whose right-hand, front corner region is broken away to facilitate understanding, are shown parts of the basic frame 29, an upper covering 30 with cable bushing 31 and vertical installation beams 24, which are inter alia used for the installation of the not shown servers. At the front there is a supply air duct 21 for the cooling air (light arrows) from the heat exchanger 2 and at the rear an exhaust air duct 22 with fans, wherein it is only possible to see the openings 23 in a wall 27 of the exhaust air duct 22.

[0046] The defective heat exchanger element 4 together with the associated support element 7 is frontally extracted from the heat exchanger 2 and therefore from the server cabinet 20 and can in this position be replaced or repaired.

[0047] If the front cabinet door extends over the entire height of the cabinet 20 (not shown), opening thereof is necessary. The servers (not shown) stacked in the inner area 25 of the cabinet 20, during this time are supplied with ambient air which, as a result of the cooling air guided in closed circuit form, is suitable for cooling in the individual cabinets. The entire exhaust air is cooled in the heat exchanger element 3 and passes as cooling air via the frontally opened cabinet into the room or environment.

[0048] The inventive heat exchanger 2 of FIGS. 1 to 3 is provided in the air exit area 9 with a fixed partition 12, which can be constructed as an extension of the pivotable partition 5. Said fixed partition 12 in this embodiment projects over and beyond the air exit side 8 of the heat exchanger 2 and extends virtually up to the not shown, front door of the cabinet 20 in FIG. 3.

[0049] In broken line form in FIG. 3 is shown an alternatively constructed cabinet, which has a shortened front door 33 and a covering 35 on the heat exchanger 2, as well as an arresting element 37.

[0050] The shortened front door 33 of the cabinet 20 extends up to the heat exchanger housing 6 or to the upper covering 26 and the horizontally oriented arresting element 37 in the arresting position. The arresting element 37 is associated with the left-hand heat exchanger element 4 which, when the covering 35 is opened is extracted together with support element 17 from the cabinet in order to eliminate a defect. The air cooled in the right-hand heat exchanger element 3, as a result of the fixed partition 12 and a not shown covering of the right-hand heat exchanger element 3 which in the operating state extends from the side wall 28 to the fixed partition 12 and to the upper covering 26, is passed into the supply air duct 21. As a result of the arresting element 37 in the arresting position there is no interchange with ambient air.

[0051] In the vicinity of the heat exchanger element 3 there is also an arresting element, but which in FIG. 3 must not be in the arresting position and which is not shown so as not to overburden representation.

[0052] A locking device for the pivotable partition 10 in the central position according to FIG. 1 and in the two possible blockade positions with the covering of one of the two heat exchanger elements 3,4 according to FIG. 2 is not shown so as not to overburden representation, and also sensors and air guiding devices in the vicinity of the air intake side and air outlet side are not shown.

1. Heat A heat exchanger for water-cooled network cabinets having a housing, which has an air intake side for an exhaust air flow and an air exit side for the cooling air from the heat exchanger and in which there are two heat exchanger elements arranged at an angle to one another and accompanied by the formation of a space open on the air intake side, characterized in that comprising
for a redundant construction of the heat exchanger the heat exchanger elements have separate cooling water connections,
that a partition is located in the space between the two heat exchanger elements and that the partition can be adjusted from a position for supplying the exhaust air flow to the two heat exchanger elements into a blockade position for the aerodynamic blocking of one of the two heat exchanger elements and for supplying the exhaust air flow to the in each case other heat exchanger element.
2. The heat exchanger according to claim 1, wherein
the position of the partition for supplying the exhaust air flow to the two heat exchanger elements is a central position and that the partition in the blockade position in each case covers one of the two heat exchanger elements.
3. The heat exchanger according to claim 1, wherein the heat exchanger elements are parallelepipedic and positioned in such a way that the air intake-side space is in horizontal section V-shaped and an air exit area is virtually W-shaped.
4. The heat exchanger according to claim 1, wherein the partition is positioned vertically and is dimensioned corresponding to the vertical longitudinal side of each heat exchanger element bounding the space to be covered.
5. The heat exchanger according to claim 1, wherein the partition is adjustable about a pivoting axis and that the pivoting axis is positioned vertically in an area of the space facing the air exit side.
6. The heat exchanger according to claim 1, wherein the partition is adjustable about a pivoting axis, which is positioned in the vicinity of the mutually adjacent, vertical inner edges of the two heat exchanger elements.
7. The heat exchanger according to claim 1, wherein the heat exchanger elements are constructed as tubular/finned blocks and are in each case detachably connected to the forward and return run of independent lines of a cold water mains or a recouler.
8. The heat exchanger according to claim 1, wherein each heat exchanger element is located on a separate support and is constructed so as to be extractable together with the given support element from the housing of heat exchanger for repair or replacement purposes.
9. The heat exchanger according to claim 1, wherein the lower part of the heat exchanger housing is constructed as a condensate/leakage water collecting tank.

10. The heat exchanger according to claim 1, wherein the partition can be fixed and/or locked in the central position for normal operation and/or in two blockade positions provided in the case of a fault.

11. The heat exchanger according to claim 1, wherein the adjustment of the partition takes place manually or using a drive and e.g. a gas pressure spring or an electric motor is provided.

12. The heat exchanger according to claim 1, wherein in the vicinity of the two heat exchanger elements and their cooling lines are provided sensors for fault detection and for emitting fault and warning signals, particularly flow and leak sensors.

13. The heat exchanger according to claim 1, wherein at least in the air exit area, is provided a fixed partition constructed as an extension of the adjustable partition.

14. The heat exchanger according to one of the preceding claims, claim 1, wherein in the air exit area and/or in a cabinet area on the air exit side of the heat exchanger are provided adjustable air guiding elements for the distribution over the cabinet width of the cooling air flow unilaterally exiting in a partition blockade position.

15. The heat exchanger according to claim 1, wherein on the air exit side is provided an air guiding device, which can be detachably fixed to the heat exchanger housing or to the inside of the cabinet door.

16. The heat exchanger according to claim 1, wherein it is positioned at the bottom in a cabinet, particularly a server cabinet, and the cabinet door, which extends to above the heat exchanger, is to be opened for extracting a heat exchanger element for repair or replacement purposes.

17. The heat exchanger according to claim 1, wherein at the bottom it is placed in a cabinet, particularly a server cabinet and a front door of the cabinet extends up to the upper edge of heat exchanger, that on the air exit side the heat exchanger has separate coverings, which are in each case associated with a heat exchanger element and are vertically positioned and that arresting elements are provided and are in each case associated with a heat exchanger element and in each case can be brought into the arresting position after extracting a heat exchanger element in order to prevent an interchange of the cooled supply air with ambient air.

18. The heat exchanger according to claim 1, wherein the heat exchanger elements are connected via quick couplers to the lines of a cold water main or a cooler.

19. A method for cooling network cabinets, particularly server cabinets, with the aid of an air-water heat exchanger, comprising the steps of:

   in the air-water heat exchanger providing two heat exchanger elements and connecting to separate cooling water connections and that in normal operation supplying both heat exchanger elements with exhaust air and in the case of a fault one heat exchanger element is aerodynamically blocked and the other heat exchanger element is supplied with all the exhaust air.

20. The method according to claim 19, wherein the cooling air which in normal operation passes out of both heat exchanger elements and in the case of a fault only a single element is supplied to the inner area of the network cabinet via a frontal supply air duct.

21. The method according to claim 19, wherein in the case of a failure of a heat exchanger element or a cooling circuit, the given heat exchanger element is aerodynamically blocked and the network cabinet with the intact heat exchanger element and/or with the supply air sideward opened, is cooled by the ambient air.

22. The method according to claim 19, wherein there is a flow through the heat exchanger elements from the rear in the direction of the front of the cabinet and if a fault occurs one heat exchanger element is blocked with the aid of an air intake-side partition.

23. The method according to claim 19, wherein the cooling air passing out of the heat exchanger elements is guided separately and distributed with the aid of air guiding elements into a cabinet supply air duct.

24. The method according to claim 19, wherein the heat exchanger elements are placed on separate support elements and can be extracted from the heat exchanger housing and/or the cabinet, without interrupting operation, for repair or disassembly purposes.

25. The method according to claim 19, wherein the cooling air flow passing out of a heat exchanger element in the case of a fault is directed and spread out with the aid of air guiding elements over the entire cabinet width and that the cooling air flow mixed with ambient air or with the aid of coverings on the front and top of the air exit area of each heat exchanger element the exiting cooling air is supplied in unmixed form to the cabinet interior.

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