(54) Title: METHOD FOR PLACING A HOLDING ARRANGEMENT FOR HOLDING SUPPORT EQUIPMENT PROVIDING OPERATIONAL SUPPORT TO A DATA CENTRE MODULE ON TOP OF A DATA CENTRE MODULE, HOLDING ARRANGEMENT AND LIFTING ARRANGEMENT

(57) Abstract: Method for placing a holding arrangement for holding support equipment providing operational support to a data centre module on top of a data centre module, said holding arrangement comprising a rectangular frame for mounting the support equipment onto, said method comprising: providing a lifting arrangement comprising a lifting table with a top table, wherein the top table has substantially the same dimensions as the frame of the holding arrangement and the lifting table, placing said holding support equipment on said top table, moving said lifting table to a location adjacent to said data centre module, such that the top surface of said top table is level with and adjacent to the top surface of said data centre module, and providing a transport device engaging said frame and moving the holding arrangement substantially horizontally over said top table surface to the top of said data centre module.
METHOD FOR PLACING A HOLDING ARRANGEMENT FOR HOLDING SUPPORT EQUIPMENT PROVIDING OPERATIONAL SUPPORT TO A DATA CENTRE MODULE ON TOP OF A DATA CENTRE MODULE, HOLDING ARRANGEMENT AND LIFTING ARRANGEMENT

TECHNICAL FIELD

The invention relates to a method for placing a holding arrangement for holding support equipment providing operational support to a data centre module on top of a data centre module. Further aspects and embodiments thereof relate to providing support equipment for providing operational support to a data centre and to equipment for applying support equipment to the data centre.

BACKGROUND

With a growing demand for cloud storage need, a growing demand for data centres for storing data are required. Such data centres are preferably to be brought in an operational state as fast as possible. This requires components and equipment for quick and efficient assembly of data centres. Heavy equipment like cranes are not always preferred for handling delicate equipment and because assembly of data centres may not always be built in open air, but rather in large halls with limited or virtually no overhead room above or next to the data centre to be built.

SUMMARY

To that end said holding arrangement comprises a rectangular frame for mounting the support equipment onto, and said method comprises providing a lifting arrangement comprising a lifting table with a top table, wherein the top table has substantially the same dimensions as the frame of the holding arrangement and the lifting table, placing said holding support equipment on said top table, moving said lifting table to a location adjacent to said data centre module, such that the top surface of said top table is level with and adjacent to the top surface of said data centre module, providing a transport device engaging said frame and moving the holding arrangement substantially horizontally over said top table surface to the top of said data centre module.

The invention also relates to a holding arrangement for holding support equipment for providing operational support to a data centre module arranged for housing at least one computer server, the holding arrangement comprising a rectangular frame for mounting the support equipment onto, the frame being provided with at least one transport device engagement arrangement for engaging with a transport device for enabling a substantially horizontal movement of the arrangement over a surface.
This arrangement enables building a fully equipped data centre in a modular way, because most, if not all, support equipment can be provided in one module. This module can subsequently be conveniently and easily transported to the data centre module and, if placed on top of the data centre module, also be moved over the data centre module to be placed at the intended position where the equipment is to service and support the server equipment that may be housed in the data centre module.

In an embodiment the transport device engagement arrangement comprises at least one indentation for accommodating the transport device.

By providing indentations, transport devices can be provided to the arrangement without increasing the footprint of the arrangement. This provides an advantage over mounting arrangements at the side of for example the frame, where transport devices can be mounted to the side of the frame. Certain passages or equipment for lifting the arrangement may be limited in size to the dimensions of the frame, which means that the arrangement with transport devices outside the perimeter of the frame pose challenges for handling.

In another embodiment the transport device comprises an air skate. Use of air skates rather than casters or other transport devices comprising rolling parts implies several drawbacks that are alleviated or even removed when using air skates. Use of air skates significantly reduces friction, reducing force for moving the arrangement. Furthermore, vibrations are reduced, which is an important issue when moving delicate equipment like electric and electronic equipment. And whereas wheeled transport devices exert a pressure concentrated in a very small area to a surface they stand on, with air skates pressure is more evenly distributed over a larger area.

In a further embodiment the support equipment comprises an air handling unit for providing an air flow to the data centre, the air handling unit comprising a first air inlet for taking in air from the data centre and a first air outlet for providing handled air to the data centre.

Cooling of air is an important requirement for data centres. Cooling units are large devices that may relatively heavy. Providing them on a holding arrangement like a skid frame that is in use provided with transport devices results in a module that may be conveniently transported and placed on the data centre module - other otherwise combined with the data centre module. In this way, a data centre can be provided in a relatively quick and efficient way.
The invention also relates to a lifting arrangement for lifting the holding arrangement and to allow
the holding arrangement to be placed on top of the data centre module, the lifting arrangement
comprising a lifting table comprising a top table and a pair of lifting scissors for supporting the top
table and, wherein the top table has substantially the same dimensions as the frame of the holding
arrangement and the table.

This lifting arrangement contributes to simple and convenient handling of the arrangement
according to the first aspect. It may require only little more footprint than the arrangement
according to the first aspect, if any. Furthermore, this lifting arrangement does not need to reach
higher than the upper limit of the data centre module, thus allowing for assembly of a data centre
within a closed space only as high as the fully assembled data centre.

In an embodiment the top table comprises a substantially airtight top surface arranged to serve as a
carrier for air skates moving from said top table to said top of the data centre module adjacent to it.

Such flooring is well suited for use of air skates as transport devices, of which the advantages have
been provided above. Within this context, the requirement for air tightness of the flooring is such
that air leaving the air skates does - at least for the largest part - not pass through the flooring in
order to create a lifting force and allow the frame to hover above the flooring when the air skates
are activated. Should the flooring be relatively porous, all air leaving the air skates would directly
pass through the floor.

In another embodiment the top table comprises table mounting elements at least one side of the top
table for mounting the top table to an upper edge of the data centre module.

In order to properly and securely transfer the holding arrangement from the lifting arrangement on
top of the data centre, a secure and reliable connection between the lifting arrangement and the data
centre is important. Table mounting elements enable establishment of such connection.

In a further embodiment the table mounting elements comprise table holes for mounting a support
bar arranged for providing a bridge between the lifting arrangement and the upper edge of the data
centre module.

A support bar provides a simple bridge between the lifting arrangement and the upper edge of the
data centre module by means of for example nut-and-bolt connections.
Yet another embodiment comprises three pairs of lifting scissors; and a frame for holding the lifting scissors substantially parallel to one another; wherein the size of the frame is substantially equal to the size of the table top.

The lifting arrangement according to this embodiment has a small overall footprint, thus allowing assembly of an equipped data centre without requiring a lot of additional space. This means in particular that if the data centre is to be built in a closed space, like a big hall, the space can be virtually fully filed by the data centre.

BRIEF DESCRIPTION OF THE DRAWINGS
The various aspects and embodiments thereof will now be discussed in further detail. In the Figures,

Figure 1: shows a cross-section of a data centre built in a modular fashion;

Figure 2 A: shows a skid comprising a skid frame and a cooling unit mounted thereon;

Figure 2 B: shows a skid comprising a skid frame and a cooling unit and cabinets for housing equipment mounted thereon;

Figure 3 A: shows a detail of the skid frame with an inactive air skate mounted thereon;

Figure 3 B: shows a detail of the skid frame with an activated air skate mounted thereon;

Figure 4 A: shows a side view of a table lift combination adjacent to a data centre module;

Figure 4 B: shows another side view of a table lift combination;

Figure 4 C: shows a top view of a table lift combination adjacent to a data centre module;

Figure 4 D: shows a side view of a lift combination adjacent to a data centre module with a skid provided on top of both;

Figure 5: shows a detail of a top table of a table lift adjacent to a data centre module and a support bar between the first two; and
Figure 6: shows another detail of a top table with a holding plate fix to the side of the top table.

DETAILED DESCRIPTION

Figure 1 shows a data centre 100 comprising a server housing module 110. The server housing module 110 is compartmentalised in two side corridors 112 and a middle corridor 114. Between the middle corridor 114 and the two side corridors data cabinets 116 for housing servers are provided on either side of the middle corridor 114. The server housing module 110 comprises a first data centre module 111 and a second data centre module 111’. The first data centre module 111 and the second data centre module 111’ may be substantially equal to one another or mirrored with respect to one another for forming the server housing module 110.

On top of the server housing module, a cooling unit 200 for cooling air is provided for handling air and in particular for cooling air. The cooling unit 200 has been provided on a skid frame 202 that serves as a holding arrangement for holding the cooling unit 200. The cooling unit 200 takes in air from the server housing module 110 via a data room intake duct 132. The cooling unit 200 also takes in air from a source other than the server housing module 110, in this embodiment in particular from outside, via an outside intake duct 122. The cooling unit 200 exhausts air to the server housing module 110 and in particular the right side corridor 112 via a data room exhaust duct 134. The cooling unit 200 is also arranged to exhaust air to the outside via an outside exhaust duct 124. The data room exhaust duct 134 is coupled to an optional data room diffuser plenum 136 comprising a diffuser medium 138. The operation of the cooling unit 200 is controlled by a controlling unit 140 coupled to the cooling unit 200. The controlling unit 140 is coupled to an outside temperature sensor 142.

In operation, the cooling unit 200 exhausts cool air in the right side corridor 112 through the data room diffuser plenum 136. The exhausted air flows through the servers in the data cabinets 116; this flow is indicated by a first arrow 162. It is noted that this flow is at least aided by fan units available in servers housed in the data cabinets 116. The air is heated by heat dissipated by the servers. The cooling unit 200 takes in air from the middle corridor 114 via the data room intake duct 132, establishing an air flow through the servers as indicated by the second arrow 164. In this way, a circular air flow is established from the cooling unit 200, through the right side corridor 112, the right data cabinet 116, the middle corridor 114, back to the cooling unit 200.

As air cooled by the cooling unit 200 is exhausted in the right side corridor 112, the temperature in the right side corridor is relatively cool. Analogously, the air flowing into the middle corridor 114
is relatively high as it is heated up by the server in the data cabinet 116. This means that the airflow from the data room diffuser plenum 136 flowing via the data cabinets 116 towards the data room intake duct 132 is at least partially provided by means of convection. Cool air exhausted via the data room diffuser plenum 136 drops in the right side corridor 112 and air heated by the servers in the data cabinets 116 rises in the middle corridor 114 towards the data room intake duct 132. Because of this convection, the server housing module 110 does not necessarily have to be compartmentalised to enable cooling and airflow. However, compartmentalisation is preferred to prevent cool air exhausted by the cooling unit 200 via the data room diffuser plenum 136 being taken in without having flown through the servers in the data cabinets 116, as this would lead to less efficient cooling operation in the server housing module 110.

Analogous to cooled air being provided to the right side corridor 112, also cool air is provided to the left side corridor 112 for cooling servers in the left data cabinets 116. For reasons of clarity, details on cooling of the left data cabinets 116 have been omitted in Figure 1.

Figure 2 shows the cooling unit 200 and the skid frame 202 in further detail. The skid frame 202 comprises a first long beam 212 at a first side of the skid frame 202 and a second long beam 214 at a second side of the skid frame 202. The first long beam 212 and the second long beam 214 are provided parallel to one another and at opposite sides of the skid frame 202. The skid frame 202 further comprises a first short beam 216 at a third side of the skid frame 202 and a second short beam 218 at a fourth side of the skid frame 202. The first short beam 216 and the second short beam 218 are provided parallel to one another and at opposite sides of the skid frame 202. The short beams are provided substantially perpendicular to the long beams, thus forming a rectangle. The long side of the skid frame 202 preferably has substantially the same length as the width of the first data centre module 111 as shown by Figure 1.

The skid frame 202 further comprises a longitudinal support beam 230 for supporting the cooling unit 200 within the perimeter of the skid frame. The cooling unit 200 preferably does not take up the full width of the skid frame 202 as to leave room for other support equipment to be placed on the skid frame 202. The skid frame 202 also comprises a first cross-beam 232 and a second cross-beam 234 for supporting the cooling unit 220 and/or other support equipment.

At the corners of the skid frame 202, indentations are provided. Between the first long beam and the first short beam, a first indentation 224 is provided, between the first long beam and the second short beam 218 a second indentation 222 is provided and between the second long beam 214 and the first short beam 216 a third indentation 226 is provided. And though not visible in Figure 2 A,
between the second long beam 214 and the second short beam 218 a fourth indentation is provided at a corner of the skid frame 202.

In this embodiment, the indentations are provided as transport device engagement arrangements for mounting transport devices for enabling movement of the skid frame 202 and a horizontal movement in particular. Such transport devices may be casters or other types of wheels. These casters may be provided as collapsible casters. Collapsible casters are mounted in a collapsed fashion at the top of the indentation while they do not touch a surface the skid frame 202 is resting on. After mounting, the casters are adjusted to their working state in which they extend below the skid frame 202 for carrying the skid frame 202 and the equipment it holds, thus enabling movement of the skid frame 202 in a substantially horizontal way.

Alternatively, in stead of wheeled transport devices, air skates may be used. This will be discussed in further detail below. Additionally or alternatively, the indentations in the skid frame 202 may also be provided along the longer sides of the beams of the skid frame. Although this may in certain scenarios be at the cost of stability of movement of the skid frame, it does provide opportunities for mounting more than four transport devices. Using more than four transport devices reduces the pressure exerted on a surface below the skid frame 202 by each individual transport device. The indentations along the longer sides of the beams may be several small ones or one or more longer ones, depending on the type of transport device used and strength of the beams that is required for the skid frame 202 to perform its intended function.

As an alternatively or as an addition to indentations, also other provisions may be provided to the skid frame 202 to serve as transport device engagement arrangements. Casters, other wheeled or otherwise rolling devices, air skates or a combination thereof may also be connected to the beams of the skid frame 202 to enable substantially horizontal movement of the skid frame 202. Such other provisions may be retractive or collapsible wheels in the beams of the skid frame 202, holes in the sides or in the bottom of the beams for connecting any transport devices, small indentations at the underside of the beams to slide any devices under, other, or a combination thereof.

Preferably, the transport devices do not extend outside the perimeter of the skid frame 202 in order to keep the footprint of the skid frame, with all kinds of devices and equipment mounted to it, as small as possible and in particular preferable as small as the footprint of the skid frame itself.

Figure 2B shows the skid frame 202 supporting, in addition to the cooling unit 202, additional first cabinets 240 and additional second cabinet 250. The additional first cabinets 240 and the additional second cabinet 250 may be used for holding further support equipment for supporting operation of
the servers in the first data centre module 111. Such support equipment may be power regulation, UPS (uninterruptible power supply), routing equipment for routing data network traffic for the servers, other equipment or a combination thereof.

Figure 3 A shows the first indentation 224 in the skid frame 202 in further detail sided by the first long beam 212 and the first short beam 216. The first indentation 224 has an air skate 310 mounted in it. As can be see in Figure 2 A, the first indentation 224 is covered by a first mounting plate 254 to which the air skate 310 may be mounted. Such mounting may be performed by means of screws or nut-and-bolt connections. Alternatively, the air skate 310 is merely provided with pins that fit in holes provides in the first mounting plate 254 or vice versa. In yet another embodiment, no specific mounting means are provided, in which case the air skate 310 is kept in place during horizontal movement of the skid frame 202 by virtue of friction between the air skate 310 and the first mounting plate 254.

The air skate 310 comprises a base unit 312 to which a preferably flexible tube 330 is connected for providing air under pressure, preferably compressed air. Below the base unit 312 a skirt 314 is provided for receiving the air under pressure that is provided by the tube 330. The skirt 314 is preferably provided in a flexible and resilient material, like natural rubber, vulcanised rubber, artificial rubber like silicon rubber, another material with similar characteristics or a combination thereof. The skirt 314 is preferably provided in a circular shaped, viewed from above and below. Alternatively, the skirt 314 may be provided in an elongated shape to be placed at indentations along the lengths of the beams of the skid frame 202.

Figure 3 A shows the air skate 310 and in particular the skirt 314 in a resting position. In this embodiment, the skirt 314 is in this embodiment in resting position retracted towards the base unit 312.

Figure 3 B shows the skid frame 202 with the air skate 310 in active position. The tube 330 provides a flow of pressurised air in the direction of the light arrow 332. The base unit 312 is arranged to direct the compressed air to the inner perimeter of the skirt 314. By virtue of the compressed air entering the skirt 314, the skirt 314 is expelled, extending below the skid frame 202. In an alternative embodiment, the skirt 314 does not substantially change shape due to the pressurised air entering the inner perimeter of the skirt 314. This means the bottom of the skirt 314 may in the latter case not extend below the skid frame 202. However, it is highly preferred the bottom of the skirt 314 extends in active position almost and preferably fully downwards towards
the bottom of the skid frame 202 and even more preferably below the bottom side of the skid frame 202.

In Figure 3 B, two block arrows 334 are depicted to show air flow from the inner perimeter of the skirt 314. Figure 3 B also depicts a foundation surface 340 over which the skid frame 202 is to be moved. Pressurised air flowing into the skirt 314 flows out of the skirt 314 below the bottom rim of the skirt 314. As indicated above, it is highly preferred the skirt 314 extends in active position almost and preferably fully downwards towards the bottom of the skid frame 202. In such case, air can only escape by pushing away the skirt 314, in upward direction. With movement of the skirt 314 upwards, the base unit 312, the first mounting plate 254 and with that the skid frame 202 are lifted from the surface 340. Without contact between the surface 340 and the skid frame 202, no friction force exists between these two bodies. This allows relatively free movement of the skid frame 202 over the surface 340.

An additional advantage of using air skates is reduction of vibrations, compared for example with the use of casters. This is particularly relevant for the various embodiments discussed here, as electrical and electronic equipment that may be mounted on the skid frame 202 is sensitive to vibrations. Hence, use of air skates is preferred over use of casters or other wheeled or otherwise rolling transport devices.

As indicated above, additionally or alternatively, indentations serving as transport device engagement arrangements may also be provided along or in the sides of the beams forming the skid frame 202 and such indentations may have an elongated shape. In the latter case, multiple air skates or elongated air skates may be provided in said indentations.

Figure 4 A shows a side view of the table lift combination 400 as a lifting device for lifting the skid frame 202 with the cooling unit 200 to enable the skid frame to be moved on top of the first data centre module 111. The table lift combination 400 comprises a first table lift 450 that is at the bottom fit in a lift frame 402 and provided with a top table 404. The first table lift 450 comprises in this embodiment two groups of scissor mechanisms.

A top scissor mechanism is provided with a first pair of scissor legs 414 and a second pair of scissor legs 416 that pivot relative to one another over a first axle 418. The first pair of scissor legs 414 comprises two legs that are provided parallel to one another, which means that in figure 4 A only the front leg is shown. This applies to all pairs of legs shown by Figure 4 A - and Figure 4 D as will appear later.
Furthermore, a bottom scissor mechanism is provided with a third pair of scissor legs 424 and a fourth pair of scissor legs 426 that pivot relative to one another over a second axle 428. The first table lift 450 is provided with a first lift table 412, on which the top table 404 is provided. Further details of the top table 404 will be provided in Figure 5 and Figure 6.

Figure 4 B shows another side view of the table lift combination 400, turned 90 degrees over its top axis compared to the view shown by figure 4 A. Figure 4 B shows that in this embodiment, the table lift combination 400 comprises the first table lift 450, a second table lift 450' and a third table lift 450".

The individual table lifts 450 comprise individual lift tables, on which the top table 404 is provided. The individual lifts are with their bases fit in the lift frame 402 for holding them together in the table lift combination 400.

Figure 4 C shows a top view of the table lift combination 400, also showing an embodiment in which the table lift combination 400 comprises the first table lift 450, a second table lift 450' and a third table lift 450". Furthermore, Figure 4 C shows a preferred embodiment in which the top table 404 is as wide as the first data centre module 111. The dimensions of the top table 404 are preferably the same as those of the skid frame 202.

Figure 4 D shows a similar side view of the table lift combination 400 and the first data centre module 111 with the skid frame 202 and the cooling module 200 mounted on the skid frame 202. The skid frame is in Figure 4 D shown with the first short beam 216 or the second short beam 218 facing forward. The top table 404 of the table lift combination 400 has on the side shown by Figure 4 D substantially the same length as the first short beam 216 and the second short beam 218 of the skid frame 200. With the air skates 310 mounted on the skid frame 202 activated, the skid frame 202 with the cooling unit 200 on top thereof can be conveniently transported from the table lift combination 400 on top of the first data centre module 111.

In the embodiments disclosed so far, the table lift combination 400 comprises off-the-shelf table lifts as the first table lift 450 and the other table lifts that are combined by means of the lift frame 402 and the top table 404. Alternatively, more or less table lifts may be used or one single dedicated table lift may be provided as a lifting arrangement for lifting the holding arrangement like the skid frame 202 with the cooling unit 200.
Thus far, the table lift combination 400 has been shown in its upper position. The table lift combination 400 may also be lowered to a lower position, in which the skid frame 202 may be loaded on the table lift combination 400 directly from a transportation device like a lorry or otherwise from a pallet, either placed on a ground floor on a transportation device.

Figure 5 shows a part of Figure 4 A in further detail an in particular a part at the top of the table lift combination 400 adjacent to the first data centre module 111. In order to safely move the skid frame 202 with equipment on top, a secure transition between the table lift combination 400 and the first data centre module 111 is preferred. In order secure the transition, a U-shaped bar 500 as a support bar is provided between the table lift combination 400 and the first data centre module 111.

Figure 5 shows a u-shaped top table side profile 510 that is part of the top table 404. On top of the top table 404, a substantially smooth and preferably substantially air tight lift flooring 532 is provided. The requirement for the lift flooring 532 is such that air leaving the air skates 310 does - at least for the largest part - not pass through the lift flooring 532 in order to create a lifting force and allow the skid frame 202 to hover above the lift flooring 532 when the air skates are activated. Optionally, small protrusions 534 are provided at the bottom of the lift flooring 532 for providing suspension to the lift flooring.

Figure 5 also shows a data centre module side profile 544 that is part of the first data centre module 111. On top of the first data centre module 111, a substantially air tight data centre module flooring 542 is provided. The requirements for air tightness are substantially the same as discussed above.

The U-shaped bar 500 is connected to the top table side profile 510 by means of a lift side bolt 514 that is provided through a first hole 502 in a first leg of the U-shaped bar 500 and a second hole 512 in the top table side profile 510. The lift side bolt 514 is fixed by means of a lift side nut 516 provided around the lift side bolt 514. In the bottom part of the top table side profile 510, a hole may be provided for easy access to the lift side nut 516 for applying and removing the lift side nut 516. Additional bolt-holes-nut combinations may be provided.

The U-shaped bar 500 is connected to the data centre module side profile 544 by means of a data centre side bolt 524 that is provided through a third hole 504 in a second leg of the U-shaped bar 500 and a fourth hole 522 in the data centre module side profile 544. The data centre side bolt 524 is fixed by means of a data centre side nut 526 provided around the data centre side bolt 524. In the bottom part of the data centre module side profile 544 a hole may be provided for easy access to the data centre side nut 526 for applying and removing the data centre side nut 526. Additional
bolt-holes-nut combinations may be provided to further secure the connection between the U-shaped bar 500 and the data centre module side profile 544.

In this embodiment, a sealing material 550 is provided between the U-shaped bar 500 and the top table side profile 510 for providing an air tight connection between the two for reasons discussed above. The sealing material 550 may be a sheet of PVC or another preferably flexible and resilient material. However, it is noted that other materials not being flexible and/or resilient that are equally suitable for the function required are not excluded. Additionally or alternatively, a sealing is provided between the U-shaped bar 500 and the data centre module side profile 544 as well.

Figure 6 shows a part of Figure 4 A in further detail an in particular a part at the top of the table lift combination 400 not being adjacent to the first data centre module 111. Figure 6 shows a holding plate 600 being affixed to a further top table side profile 610 provided at a side of the top table 404. The holding plate 600 is provided for keeping the skid frame 202 in its proper place during lifting of the skid frame 202 and while moving the skid frame from the top table 404 of the table lift combination 400 on top of the first data centre module 111.

As indicated above, the top table 404 has substantially the same dimensions as the skid frame 202 and with the air skates 310 activated, the skid frame is movable without much effort. Therefore, confinement of the skid frame 202 on top of the top table 404 is preferred. The holding plate 600 extends above the top of the top table 404, thus confining the skid frame 202 on top of the top table 404. Additional holding plates are provided at other sides of the top table 404 as well, though preferably not at the side that is adjacent to the first data centre module 111.

The holding plate 600 is connected to the further top table side profile 610 by means of a holding plate bolt 614 that is provided through a first holding hole 602 in the holding plate 600 and a second holding hole 612 in the further top table side profile 610. The holding plate bolt 614 is affixed by means of a holding plate nut 616.

In the bottom part of the further top table side profile 610 a hole may be provided for easy access to the holding plate nut 616 for applying and removing the holding plate nut 616. Additional bolt-holes-nut combinations may be provided to further secure the connection between the U-shaped bar 500 and the further top table side profile 610.

For loading of the skid frame 202 with equipment like the cooling module 200 provided on it on top of the first data centre module 111, the table lift combination 400 is adjusted to a lower
position in which the skid frame 202 is loaded on top table 404. This may be done by using the activated air skates 310 to enable convenient loading of the skid frame 202 and equipment mounted thereon on the top table 404. The air skates 310 are preferably de-activated after loading. Preferably, the table lift combination 400 is provided directly adjacent to the first data centre module 111 before loading the skid frame 202 on top of it.

After loading of the skid frame 202, the holding plates 600 are provided at side of the top table 404 not directly adjacent to the first data centre module 111 by means of nut and bolt combinations discussed above. Alternatively, other fixing means may be provided like clips, screws, other fixing materials or a combination thereof. In one embodiment, a holding plate 600 may also be provided at side of the top table 404 directly adjacent to the first data centre module 111.

Subsequently, the table lift combination 400 is lifted to a higher position with the top table 404 being at substantially the same level as the data centre module flooring 542. At this position, the U-shaped bar 500 is applied to the top table 404 and the first data centre module 111 as discussed above. In case a holding plate 600 has been applied to this side of the top table 404, the holding plate 600 at the side of the top table directly adjacent to the first data centre module 111 is removed first. The other holding plates are preferably kept in plates to prevent movement of the skid frame 202 in an unwanted direction, which may cause the skid frame 202 to fall off the top table 404.

With the U-shaped bar 500 in place as discussed above, the air skates 310 are activated and the skid frame 202 with equipment is moved from the top table 404 onto the first data centre module 111, over the data centre module flooring 542. This is done until the skid frame 202 and in particular the cooling module 200 are at the right position where data room intake duct 132 is at the right position above the middle corridor 114 and the data room exhaust duct 134 is at the right position above the side corridor 112. The first data centre module 111 preferably comprises ducts right above the middle corridor 114 and the side corridor 112 that can be connected to the data room intake duct 132 and the data room exhaust duct 134 of the cooling module 200.

Expressions such as "comprise", "include", "incorporate", "contain", "is" and "have" are to be construed in a non-exclusive manner when interpreting the description and its associated claims, namely construed to allow for other items or components which are not explicitly defined also to be present. Reference to the singular is also to be construed in be a reference to the plural and vice versa.
In the description above, it will be understood that when an element such as layer, region or substrate is referred to as being "on", "onto", "mounted to" or "connected to" another element, the element is either directly on or connected to the other element, or intervening elements may also be present.

Furthermore, the invention may also be embodied with less components than provided in the embodiments described here, wherein one component carries out multiple functions. Just as well may the invention be embodied using more elements than depicted in the Figures, wherein functions carried out by one component in the embodiment provided are distributed over multiple components.

It is stipulated that the reference signs in the claims do not limit the scope of the claims, but are merely inserted to enhance the legibility of the claims.
CLAIMS

1. Method for placing a holding arrangement for holding support equipment providing operational support to a data centre module on top of a data centre module, said holding arrangement comprising a rectangular frame for mounting the support equipment onto, said method comprising:
   providing a lifting arrangement comprising a lifting table with a top table, wherein the top table has substantially the same dimensions as the frame of the holding arrangement and the lifting table,
   placing said holding support equipment on said top table,
   moving said lifting table to a location adjacent to said data centre module, such that the top surface of said top table is level with and adjacent to the top surface of said data centre module, and
   providing a transport device engaging said frame and moving the holding arrangement substantially horizontally over said top table surface to the top of said data centre module.

2. Method according to claim 1, wherein said lifting arrangement comprises a pair of lifting scissors for supporting and lifting the top table, wherein said method comprises lifting said top table with said holding support equipment from a lower level to the level of said top of said data centre module.

3. Holding arrangement for holding support equipment for providing operational support to a data centre module arranged for housing at least one computer server, the holding arrangement comprising a rectangular frame for mounting the support equipment onto, the frame being provided with at least one transport device engagement arrangement for engaging with a transport device for enabling a substantially horizontal movement of the arrangement over a surface.

4. Holding arrangement according to claim 3, the frame comprising:
   - a first short beam;
   - a second short beam opposite to and parallel to the first short beam;
   - a first long beam perpendicular to the first short beam and the second short beam; and
   - a second long beam opposite to and parallel to the first long beam.

5. Holding arrangement according to claim 3 or 4, wherein the transport device engagement arrangement comprises at least one indentation for accommodating the transport device.
6. Holding arrangement according to claim 5, the frame comprising a plurality of indentations, wherein indentations are provided at least near each corner of the frame.

7. Holding arrangement according to claim 5, the frame comprising a plurality of indentations, wherein elongated indentations are provided along longitudinal sides of the frame.

8. Holding arrangement according to any of the preceding claims 3 - 7, wherein the transport device is a rolling device or an air skate.

9. Holding arrangement according to any of the preceding claims 3 - 8, wherein the support equipment comprises an air handling unit for providing an air flow to the data centre, the air handling unit comprising a first air inlet for taking in air from the data centre and a first air outlet for providing handled air to the data centre.

10. Lifting arrangement for carrying out the method in accordance with claim 1 or 2, the lifting arrangement comprising a lifting table comprising a top table and a pair of lifting scissors for supporting the top table and, wherein the top table has substantially the same dimensions as the frame of the holding arrangement to be lifted and the lifting table.

11. Lifting arrangement according to claim 10, wherein the top table comprises a substantially airtight top surface arranged to serve as a carrier for air skates moving from said top table to said top of the data centre module adjacent to it.

12. Lifting arrangement according to claim 10 or 11, wherein the top table comprises table mounting elements at least one side of the top table for mounting the top table to an upper edge of the data centre module.

13. Lifting arrangement according to claim 12, wherein the table mounting elements comprise table holes for mounting a mounting support bar arranged for providing a bridge between the lifting arrangement and the upper edge of the data centre module.

14. Lifting arrangement according to claim 13, wherein the mounting support bar is mounted and comprises bar holes, the bar holes being aligned with the table holes, the mounting support bar being connected by means of connecting elements provided through the table holes and the bar holes and a sealing is provided between the table top and the support bar.
15. Lifting arrangement according to claim 14, wherein:
- the support bar is a U-profile bar;
- the support bar is mounted to the at least one side of the table top with an opening of the U-profile facing downward
- the bar holes being provided in a first leg of the U-profile bar; and
- in a second leg of the U-profile bar further bar holes are provided for mounting the support bar to the upper edge of the data centre module

16. Lifting arrangement according to any of the claims 10 to 14, further comprising:
- three pairs of lifting scissor; and
- a frame for holding the lifting scissors substantially parallel to one another;
wherein the size of the frame is substantially equal to the size of the table top.
INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/078033

A. CLASSIFICATION OF SUBJECT MATTER

INV. H05K7/14 H05K7/20 B65G7/Q6 B66F7/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H05K B65G B66F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<th>Category*</th>
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Date of the actual completion of the international search: 4 March 2015
Date of mailing of the international search report: 11/03/2015

Name and mailing address of the ISA:
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 MV Rijswijk
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Authorized officer:
Kal uza, Andreas
# INTERNATIONAL SEARCH REPORT

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