

LINK DISCONNECTING BOX

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The invention relates to Underground Link Disconnecting Boxes (ULDBs), and more specifically to the chamber assembly for a link disconnecting box.

ULDBs facilitate the distribution of electricity to their subscriber customers through distribution networks that are connected to a parent ULDB's distribution network at a single or multiple connection points. Usually the ULDB's connected to the distribution network are Low Voltage (LV) connections.

For the purposes of the invention the term "low voltage" generally means a voltage lower than 1 kV.

A ULDB is also known as a link box, and both terms are used interchangeably in the following.

A link box is for connecting and disconnecting LV cables, for example, by means of connecting/disconnecting means such as solid links, fuses or switches arranged within chambers in the link box.

Generally the link boxes are used to split LV networks into different network sections, particularly for the purposes of limiting the effects of faults on the customers and facilitating the faults' localization.

The connecting/disconnecting means are described generically as switching means in the following. Typically, cables are connected to the link box, by way of contacts such as contact posts, with links arranged between the contact posts, and the links may, for example, be removable and replaceable, to selectively connect or disconnect the respective cables. The chambers of the link box are covered, to protect the chambers and contents from moisture build up and the entry of foreign bodies, such as leaves.

Link boxes are well-known in the art, see for example, WO 03/081727 A1 and the application, WO 09/083026 A1.

A heavy bell lid to can be provided to cover the chambers, which also seals the chambers using the Archimedes principle, thereby increasing the protection and preventing the flooding of the chambers by ground water.

The design of a bell lid allows condensation to gather on the internal bell lid surface during operation. With the build-up of moisture droplets over time, drips may fall onto the live components.

Bell lids are typically made from cast iron. This can corrode, and is heavy – at least 8kg for a two ways ULDB or at least 30kg for a four ways ULDB. This is especially a problem when the fitting and removal of the bell lid is carried out at

a level below ground, which means the operator may be working bending over, and generally causes handling issues. If there is a fault in the switching chamber and a connection is made to the bell lid, the metal bell lid effectively becomes live. This poses an electric shock danger to the operator and the general public. Also it is not possible to inspect the link box without removing the bell lid.

Other problems associated with existing link box designs include that they are easily damaged. Once damaged, they are not easily repairable and so the entire unit has to be replaced.

WO 03/081727 relates to an electrical link box having an inner enclosure for receiving links, an outer enclosure for receiving cables, and connectors passing from the outer enclosure to the inner enclosure for connecting cables to each other by way of respective links. The outer enclosure is filled with insulating material and the exterior of the inner enclosure is configured to interlock with the insulating material. The inner enclosure is in the form of a turret, with exterior walls formed with a shoulder or ledge from which the upper portion tapers inwardly. The turret lid is configured to engage the exterior of the upper portion with a close fit and to rest upon the shoulder.

The turret lid rests on the inner enclosure, which constitutes one piece with the base. In case of damage, the entire link box must be replaced. The turret lid is not fixed to the inner enclosure and it can rise up. Moisture and contaminants may occur at the interface between the inner enclosure and the turret lid and are not easily removed.

WO 02/43215 relates to an electrical cable interconnection system for interconnecting the stripped ends of at least two multi-phase high current, low voltage cables, to be used underground. A switch connection block is mounted to the ends of the cores of the cables. The switch connection block has three upper switch housings adapted to receive switching means to either connect or disconnect the connection between respective cores. A housing formed of two identical shells are bolted together around the connection, but leaving the switch connection block exposed for access, and resin is poured into the open top of the housing to encapsulate the connection. A further water exclusion device in the form of an inverted cylindrical dome is placed over the housing.

In the cylindrical dome condensation can form on the inner surface and drip onto the switching means.

WO 2009/055847 relates to a link box including a plurality of link switches in respective pockets with individual sealing caps. A plastic bell lid covers the switches to protect from moisture and is held in place by means of a clamping bar affixed by wing nuts to arms. The bottom of the bell housing includes a rim. As above, the bell housing has a problem of condensation. Also, because the bell lid is made of plastic, additional securing means in the form of the clamping bar is required, which increases complexity and may be open to failure as discussed above. Also, contaminants can gather in the clamping bar and they can penetrate the link box.

WO 2009/083026 relates to a link disconnecting unit for making a link between two distribution networks, and a device for deriving signals indicative of power consumption of one of the networks. The unit includes a cover in the form of a bell lid, which can be seen in Fig. 3E, similar to that shown in accompanying Fig. 1a.

SUMMARY OF INVENTION

The Applicant has noticed that the above known link boxes have some drawbacks.

The Applicant faced the problem by providing a link box chamber assembly comprising a base, at least one chamber body, defining at least one chamber, and a lid, wherein the assembly comprises a seal between the base and a chamber body, and a seal between a chamber body and the lid.

The chamber body defines a plurality of chambers. The lids cover the chamber or chambers, and there may be one lid or a plurality of lids. The base comprises one or more apertures corresponding to the chamber or chambers.

Preferably the chamber body is a single piece defining a plurality of chambers.

Preferably, the base is a single piece

Preferably at least one chamber body is for housing a means for interconnecting electrical cables.

Preferably the chamber body comprises a plurality of chambers, for housing means for interconnecting electrical cables. The means for interconnecting electrical cables are preferably switching means, removable links, switches or fuses or the like, for connecting and disconnecting cables. The chamber body protects the live parts of the apparatus (interconnections, contacts, cables etc), for example, from the operator and from environment, such as water, foreign bodies, and insulates them from each other.

Preferably the assembly comprises a single chamber body, with a lid on the chamber body. Alternatively there is at least one additional chamber body, with the chamber bodies stacked, for example, vertically, with the lid or lids on the uppermost chamber body.

An additional chamber body may include a chamber or chambers for housing additional ancillary equipment.

Preferably the chamber body housing the link elements is arranged directly on the base. Seals are provided between adjoining components, between adjoining chamber bodies, as well as between base and chamber body, and between lid and chamber body.

The modular design of the chamber assembly allows for additional chamber bodies, for housing ancillary equipment, such as testing equipment or monitoring equipment, such as a cable fault locator.

Preferably the link box chamber assembly comprises means for securing together a chamber body and base and/or for securing together a chamber body and a lid.

There may be one securing means securing together all of a base, chamber body or bodies and a lid, or more than one securing means, for example, a first securing means for securing the base to a chamber body, a second securing means for securing together a lid to a chamber body, and further securing means for securing together chamber bodies. The securing means preferably activate the seal.

If separate securing means are used, elements of the assembly can be removed, for example, for replacement if damaged, without necessarily dismantling the entire assembly, and possibly exposing other elements of the assembly, such as live components.

Preferably at least part of the lid or lids is transparent, thereby enabling the inside of the chambers to be seen.

Preferably, adjoining surfaces of the lid, base and chamber body or bodies are essentially co-planar, and abut or engage each other. Preferably, the seals are arranged on one or more surfaces of the lid, base and chamber body or bodies.

Preferably a seal or seals are arranged on the upper surface of a base, facing a lower surface of a chamber body, and seals are arranged on the other, upper, surface of a chamber body, facing a further chamber body or lid. However, seals can be arranged on other surfaces. The seals may be moulded onto surfaces, or provided separately, and, for example, activated by securing means. The seals are arranged at the joints of the elements of the assembly, namely the base, chamber body and lid (or plurality of those elements as appropriate).

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows a first example of a known link box;

Fig. 2 is an exploded perspective view of a link box chamber assembly according to a first embodiment of the invention;

Fig. 3 is an exploded perspective view of a link box chamber assembly according to a second embodiment of the invention;

Fig. 4 is an exploded perspective view of a link box chamber assembly according to a third embodiment of the invention;

Fig. 5 is an exploded perspective view of a link box chamber assembly according to a fourth embodiment of the invention;

Fig. 6 is an exploded perspective view of a link box chamber assembly according to a fifth embodiment of the invention;

Fig. 7 is an exploded perspective view of a link box assembly according to an embodiment of the invention;

Fig. 8 is an exploded perspective view of a link box assembly according to an embodiment of the invention;

DETAILED DESCRIPTION

Fig. 1 shows a known link box 2, which is a typical 2-way (2 mains cables) underground link disconnecting box for use on a Protective Multiple Earth (PME) network.. The link box includes a base 4 (base plate) on which are mounted three switching chambers 6. A switching mechanism 8 in the form of a removable link, switch or fuse is mounted within each switching chamber 6. Two low voltage mains cables, each having three cores 10, 12, 14, corresponding to three phases, are connected on either side of the link box. Typically, the mains cables are connected to the link box by bolted mechanical connectors, and the cables are connected to contact posts which extend within the switching chambers for connection to the switching mechanisms. A neutral / earth cable 16 is also provided. A bell lid 18 is placed over and encloses the switching chambers.

A known link box (not shown) can have 4-way (4 mains cables) underground link disconnecting box. In this link box there are four mains cables, and twelve switching chambers and switching mechanisms, and similarly the bell lid is larger.

A four way ULDB differs from a two way ULDB as stated by the fact that there are four cables instead of two entering the box. However, due to its design it is possible to switch any one cable to feed any combination or all of the other three cables. This is achieved by connecting together the internal connection posts of each of the switching chambers for similar phases.

The link box of Fig. 1 can be used in an SNE (separate neutral earth) network. In this case two low voltage mains cables, each having three cores, corresponding to three phases, and a neutral cable are connected on either side of the link box. The mains cables are connected to the link box by bolted mechanical connectors, and the cables are connected to contact posts which extend within the switching chambers for connection to the switching mechanisms. The neutral cable is connected to the link box by bolted mechanical connectors. An earth cable is connected to a separate generator connection point.

Fig. 2 shows a link box chamber assembly 21 according to a first embodiment of the invention.

The chamber assembly comprises an substantially planar and rectangular base 20 (chamber base), having three apertures 22, a chamber body 24, defining three chambers 26, and three lids 28, corresponding to respective chambers 26. On the upper surface of the base 20, facing the chamber body 24, a seal 29 in the form of an O-ring is arranged around each aperture 22. Similarly, a seal 30 in the form of an O-ring is arranged on the upper surface of the chamber body 24, facing the lids 28, around each chamber 26.

Screw holes 32 are provided on the base 20, in the chamber body 24, and in the lids 28. Securing means in the forms of screws (not shown) are used to secure the chamber body 24 to the base 20, and another set of screws are used to secure the lids 28 to the chamber body 24.

The screws seal the switching chambers 26 and provide secure closure of the switching chambers.

Alternatively, mechanical clamps (not shown) could be used to secure the plastic lid. Advantageously these clamps do not need any tool to gain access to the live parts of the ULDB. On the other hand the closure realized with these means may be less secure than the closure realized with the screws in certain environments.

The base 20, chamber body 24 and lids 28 of the assembly are preferably formed of moulded plastics material. The seals 29, 30 are O-rings, although other suitable seals, forming water-tight seals, can be used. The seals 29, 30 are sealed between the base 20 and chamber body 24, and chamber body 24 and lids 28, as a result of the securing means. Alternatively, the seals 29, 30 can be moulded onto elements of the assembly.

The link box chamber assembly replaces the base 4, switching chambers 6 and bell lids 18 of the link box of Fig. 1. Otherwise, the connections of the cables to the contact posts, which extend through the apertures in the chamber assembly base into the switching chambers, are the same. A switching mechanism is provided in each chamber.

The second embodiment of Fig. 3 is similar to the first embodiment of Fig. 2 except that the three lids 28 of Fig. 2 are replaced by a single lid 34 that covers all three switching chambers. A third embodiment is shown in Fig. 4. In the third embodiment, an additional chamber body 36 is provided. The additional

chamber body 36 also has three chambers 38 and respective seals 40 on the upper surface. The additional chamber body 36 is designed (shaped and sized) to received additional ancillary equipment, such as monitoring or testing equipment.

The additional chamber body 26 is stacked vertically on top of the first chamber body 24, and is secured to the first chamber body by screws. The lid is secured to the upper surface of the additional chamber body, as in the first and second embodiments. The additional chamber body 26 as shown has the same number and shape of chambers as the first chamber body, but these may be different.

Fig. 5 shows a fourth embodiment, in which two of the lids 28 of the first embodiment are replaced by lids 42 incorporating a plug and socket arrangement for use in conjunction with a generator. Connections to the cables in the link box are achieved by a spring loaded connector (not shown) that makes good electrical connection to the contact posts. The generator connection is then made to the sealed socket on the lid of the relevant phase.

Fig. 6 shows a link box having a link box chamber assembly similar to the first embodiment, except that the chamber base is integrated in a base plate 44 for mounted in the link access pit 46.

The link box is usually installed at the same level as the mains LV cable, typically around 450mm below ground level. In order to allow access to the unit, an access chamber or pit is constructed. The pit may be a modular construction where a number of segments are stacked on top of each other to ground level, or a single piece moulded access chamber. If required or desired an access chamber may be constructed from bricks, pre-fabricated concrete elements or the like. Fig. 7 shows a typical chamber assembly of Fig. 2 installed in the link box, together with additional build up pit segments 48 and a top closure element. The link box includes a base 46, on which is installed the chamber assembly 21. The chamber assembly 21 replaces the base 4, switching chambers 6 and bell lid 18 in the prior art arrangement shown in Fig. 1. As shown, there are three cables, corresponding to the three phases of a mains LV cable, and a neutral cable. The cables are connected as in the prior art, to contact posts (not shown). Although not shown in the Figures, the contact posts extend through the apertures in the base of the chamber assembly, and are connected by switching mechanisms, as in the prior art, arranged within respective switching chambers of the chamber assembly.

A cover cap 50 sits atop pit segments 48 placed on the box. The pit segments provide for additional height so that the cover cap can be at ground level, and thus not buried, for easy access. Preferably height adjusters 52 are used to adjust the position of the cover cap to ground level.

A similar link box, and pit segments and top closure element, is shown in Fig. 8. Accordingly, the link box includes 4 chamber assemblies 21, of Fig. 2, and therefore 12 switching mechanisms, and 12 switching chambers.

Any chamber assembly of an embodiment of the invention, including those described in this specification, can be used in a link box assembly such as of Fig. 7 or Fig. 8.

With embodiments according to the present invention, a the base plate and the electrical connections are provided in a single piece (e.g. by molding). The water seals and electrical properties of a link box made using this method would all be supplied by the injection molded material. Alternatively, resin-filling can be used.

Claims

1. A link box chamber assembly comprising a base, at least one chamber body, defining at least one chamber, and a lid, wherein the assembly comprises a seal between the base and a chamber body, and a seal between a chamber body and the lid.
2. The link box chamber assembly according to claim 1 further comprising means for securing together a chamber body and base and/or for securing together a chamber body and a lid.
3. The link box chamber assembly according to claim 2 wherein the securing means are screws.
4. The link box chamber assembly according to any preceding claim wherein the chamber body defines a plurality of chambers.
5. The link box chamber assembly according to claim 4 comprising a plurality of lids, each lid for a respective chamber.
6. The link box chamber assembly according to claim 4 or claim 5 comprising a plurality of seals, between each respective chamber and the lid or lids.
7. The link box chamber assembly according to any preceding claim wherein the base comprises a plurality of apertures.
8. The link box chamber assembly according to claim 7 comprising a plurality of seals, between each respective aperture and the chamber body.
9. The link box chamber assembly according to any preceding claim wherein the seals are watertight.
10. The link box chamber assembly according to any preceding claims wherein the seals are O-rings or gaskets.
11. The link box chamber assembly according to any preceding claim wherein one or more of the base, chamber body and lid or lids are made of plastic.
12. The link box chamber assembly according to any preceding claim wherein at least part of the lid or lids are transparent.
13. The link box chamber assembly according to any preceding claim wherein at least one lid has at least one generator connection port.
14. The link box chamber assembly according to any preceding claim wherein adjoining surfaces of the lid, base and chamber body or bodies are essentially co-planar.

15. The link box chamber assembly according to any preceding claim wherein the seals are arranged on one or more surfaces of the lid, base and chamber body or bodies.
16. The link box chamber assembly according to any preceding claim comprising a plurality of chamber bodies.
17. The link box chamber assembly according to claim 12 wherein the chamber bodies are stacked.
18. The link box chamber assembly according to claim 16 or claim 17 comprising further seals between adjoining chamber bodies.
19. The link box chamber assembly according to any preceding claim wherein at least one chamber body defines at least one chamber for housing at least one link for interconnecting electrical cables.
20. The link box chamber assembly according to claim 19 wherein the chamber body defining at least one chamber for housing at least one link for interconnecting electrical cables is arranged on the base.
21. The link box chamber assembly according to claim 20 wherein at least one further chamber body is arranged between the chamber body defining at least one chamber for housing at least one link for interconnecting electrical cables and the lid.
22. The link box chamber assembly according to any preceding claim wherein at least one chamber body defines at least one chamber for housing ancillary equipment.
23. A link box comprising a link box assembly as claimed in any preceding claim, one or more links housed within the chamber or chambers of a chamber body for connecting electrical cables, and connectors for connecting cables to said one or more links.
24. The link box according to claim 15 further comprising cables connected to said connectors.