

CABLE TROUGH UNIT WITH RETRACTABLE RESTRAINER

TECHNICAL FIELD

The present invention belongs to the technical field of cable installation within cable tunnels, in particular to a retractably supported cable trough unit for use in the vertical shafts leading into cable tunnels.

BACKGROUND

Many cities, large-scale power plants and the mining industry make use of underground transmission cable tunnels to supply electricity. Underground cable tunnels free up the ground for road traffic and architectural space and prevents dangerous accidental contact associated with overhead power lines. In densely populated cities, transmission cable tunnels may be constructed up to 60 meters below ground level to avoid congestion of existing underground services such as underground train systems and expressways and drainage pipes.

For fire safety and ease of maintenance, high-voltage power cables may be compartmentalised within cable troughs in the horizontal sections of the cable tunnel. In the vertical shafts leading into the cable tunnels, the power cable are typically affixed to the walls with cable supports. The conventional way of fulfilling the fire safety requirement in the vertical shafts is to apply fire retardant paint on the cables and the cable supports. However for deep cable tunnels, the vertical shafts may average 60 meters in depth. The risk of an explosion due to a power arc increases from the significant length of exposed high-voltage power cable and the fire retardant paint used may not be able to contain or stop the spread of the fire during such explosion.

It is therefore useful for high-voltage power cables in the vertical shafts to be compartmentalised within a system for sealing off fire and heat during a power arc incident.

SUMMARY OF THE INVENTION

The present invention concerns a substantially vertical cable trough unit supported by shaft supports extending out from the shaft wall. The cable trough unit, may be used within a cable management system that may include additional vertical trough members, horizontal trough members, junctions and couplings.

In a first aspect of the present invention, there is a substantially vertical cable trough unit formed by two parts, the cover trough and the base trough. The cover trough and base trough provides an enclosed cable pathway for receiving at least one circuit of electrical power cable. The base trough is mounted to shaft supports extending from the shaft walls while the cover trough is secured to the base trough by rigid bands strapped around the outer surface of the cable trough unit. Resilient means anchored to the shaft supports are coupled to the cover trough to retract the cover trough from a venting position during a power arc back to a normal, closed position.

In accordance with a second aspect of the present invention, a positioning clip with indented ends to opposingly receive the ends of sidewalls of both base trough and cover trough is fitted to the sidewalls of the base trough to allow ease of installation of the cover trough.

In accordance with a third aspect of the present invention, a stop means is provided to the resilient means to limit the extension of the resilient means.

In accordance with a fourth aspect of the present invention, the resilient means is a telescopic arm with recovery spring.

In accordance with a fifth aspect of the present invention, the stop means is a stop pin in the free extending arm that engages a slot in the fixed end of the telescopic arm.

In accordance with a sixth aspect of the present invention, guide plates are located between the outer surface of the cable trough unit and the rigid bands to prevent heat and flames from the interior of cable trough unit from damaging the rigid bands.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 - side view of a section of vertical cable trough unit according to the present invention.

FIG. 2 - a top down view of the vertical cable trough unit of FIG. 1 in normal condition.

FIG. 3 - a top down view of the vertical cable trough unit of FIG. 1 in a venting position

FIG. 4 - a detailed view of a retractable restrainer of the vertical cable trough unit of FIG. 1

DETAILED DESCRIPTION

The embodiments herein and the various features and advantageous details thereof are explained more fully with reference to the non-limiting embodiments that are illustrated in the accompanying drawings and detailed in the following description. Descriptions of well-known components and processing techniques are omitted so as to not unnecessarily obscure the embodiments herein. The examples used herein are intended merely to facilitate an understanding of ways in which the embodiments herein may be practiced and to further enable those of skill in the art to practice the invention.

Referring now to FIGS. 1-3, an example embodiment of a vertical cable trough unit 100 is shown. Vertical cable trough unit 100 generally includes a base trough member 110 and a cover trough member 120. Both the base trough member 110 and cover trough member 120 include upstanding sidewalls extending from a base defining a generally U-shaped trough. A positioning clip 150 of substantially the same length as base trough member 110 having indented ends to opposingly receive the ends of sidewalls of both base trough member 110 and cover trough member 120 is fastened to base trough member 110 by friction fit.

In a normal, closed position as shown in FIG 2, ends of the sidewalls of cover trough member 120 align with the corresponding end of sidewalls of base trough member 110 and fully inserts into receiving indent 160 of clip 150 forming a sealed cable pathway for receiving at least one circuit of electrical power cable. Base trough member 110 and cover trough member 120 may be 2.8m long with 750mm (W) x 550mm (D) cross section dimension and constructed from Flame Retardant Fibre-Reinforced Plastic (FR-FRP). A vertical cable

trough unit 100 may be coupled lengthwise to additional trough units or similar structures to form a cable management system.

During installation, base trough member 110 is coupled via its base with bolts and nuts to shaft supports 170 that extend outwardly from the interior wall of a vertical shaft. Next, telescopic retracting restrainer 200 is installed adjacent to the outer sidewall of trough members 110 by coupling baseplate 220 welded to the first end of restrainer 200 to shaft supports 170 with bolts and nuts. Cover trough member 120 is thereafter positioned in place by slotting the ends of its sidewalls into the receiving indent 160 of clip 150 forming an enclosed cable chamber as shown in FIG 2.

Referring to FIG 1, cover trough member 120 is held in place relative to base trough member 110 and restrained from movement by rigid bands 300 strapped around the exterior surface of vertical cable trough unit 100. Guide plates 310 provided in intervals along the exterior wall of vertical cable trough unit 100 indicate where the rigid bands 300 are to be strapped to cable trough unit 100 and are sandwiched between cable trough unit 100 and rigid bands 300 to provide a physical barrier against heat and flames escaping from the interior of cable trough unit 100 during a power arc from damaging rigid band 300.

For each vertical cable trough unit 100, two or more rigid bands 300 may be provided. Rigid bands 300 are selected amongst materials that can withstand explosive pressure occurring within enclosed chamber during a power arc and may be constructed with Aramid fibres or equivalent non-ferrous materials and fastened around the vertical cable trough unit 100 with securing means such as buckles.

With cover trough member 120 held in place by rigid bands 300, the base plate welded to the free extending end of restrainer 200 is coupled to cover trough member 120 with bolts and nuts. For each vertical cable trough unit 100, there may be four telescopic retracting restrainers 200, two restrainers positioned on each side of unit 100. Restrainer 200 permits restricted outward displacement of cover trough member 120 relative to base trough member 110. For the present embodiment, the maximum extension of the restrainer permitted is 25mm resulting from a power arc explosion.

Referring to FIG 3, when a power arc occurs within the enclosed chamber of the vertical cable trough unit 100, the sudden increase in internal pressure displaces cover trough member 120 outwards from base trough member 110 to an open, venting position in which the end of the sidewalls of cover trough member 120 no longer fully inserted into indent 160 of clip 150 and pressure is released through gaps between cover trough member 120 and clip 150. After release of sufficient pressure within cable trough unit 100, tension from the extended coiled spring located within the retracting restrainer 300 overcomes the residual outwards displacement internal pressure, retracting cover trough member 120 back into a closed position, thereby cutting out the supply of oxygen within the enclosed chamber of cable trough unit 100 and effectively containing or extinguishing the fire.

Referring to FIG 4, restrainer 200 comprises a hollow outer tube with square cross section and an inner hollow tube with square cross section ensleeved by the hollow outer tube. The inner tube may extend and retract telescopically with respect to the outer tube. A base plate 220 extending perpendicular from length of the restrainer is welded to the end of the hollow outer tube for attaching restrainer 200 to shaft support 170. A second baseplate 230 welded towards the free end of the inner tube is oriented to lie flush against and be coupled to the sidewall of cover trough member 120 when restrainer 200 is attached to shaft support 170.

A coiled spring with a first end attached to a pin 240 extending from base plate 220 and second end attached to a stop pin 210 perpendicularly extending across the height of the inner tube through slots located on the opposing sides of the inner and outer tube is disposed within the restrainer. When the inner hollow tube extends out from the hollow outer tube, the end of the slots in the inner tube engages the pin and pulls it outwards away from the base plate thereby extending the coiled spring. Further extension of the inner hollow tube results in stop pin 210 engaging the end of the slots on the hollow outer tube, restricting any further extension of the spring and the inner hollow tube. The inner tube is extended out from the hollow tube when cable trough unit 100 is in an opened position. Tension from the extended coiled spring retracts the hollow inner tube into the hollow outer tube, consequently drawing the cover trough member coupled to the inner tube back to a closed position.

The above specification, and preferred embodiment provide a description of the invention. Various alterations may be made to the preferred embodiment described above which would

still fall within the scope of the invention. The above descriptions and figures are therefore to be regarded as illustrative and not restrictive. Since many embodiments of the invention can be made without departing from the spirit and scope of the invention, the invention resides in the claims hereinafter appended.

CLAIMS

1. A vertical cable trough unit comprising:
 - a base trough member having upstanding sidewalls extending from a base defining a generally U-shaped trough mounted to shaft supports extending from a shaft wall;
 - a cover trough member having upstanding sidewalls extending from a base defining a generally U-shaped trough for removably covering the base trough member for providing an enclosed cable pathway for receiving at least one circuit of electrical power cable, the cover trough member configured to be displaced outward upon increase of internal pressure of the enclosed cable pathway to an open venting position with gaps to release the pressure; and
 - at least a pair of resilient means anchored to the shaft supports and coupled to opposed sides of the cover trough member, the resilient means configured to retract the cover trough from a venting position back to a closed position after releasing sufficient pressure from the enclosed cable pathway, wherein each of the resilient means comprises a telescopic retracting restrainer including telescopic arms and a recovery spring.
2. The vertical cable trough unit of claim 1 further comprising a positioning clip with indented ends to opposingly receive the ends of sidewalls of both base trough member and cover trough member and the positioning clip extending lengthwise along the sidewalls to mutually form the enclosed cable pathway with the base and cover trough members.
3. The vertical cable trough unit of claim 1 or 2 wherein the resilient means further comprises a stop means to limit extension of the resilient means when the cover trough member is in the venting position.
4. The vertical cable trough unit of claim 3 wherein the stop means is a stop pin coupled to the recovery spring engaging with a slot in the fixed end of the telescopic arm.
5. The vertical cable trough unit of claim 4 wherein the cover trough member is secured to the base trough member by a least one substantially rigid band encircling the base trough member and cover trough member.
6. The vertical cable trough unit of claim 5 further comprises a plurality of guide plates located between the outer surface of the cable trough unit and the rigid bands to prevent heat or flames escaping from the enclosed cable pathway through the gaps from damaging the rigid bands.
7. The vertical cable trough unit of claim 1, wherein at least a pair of resilient means comprises four telescopic retracting restrainers.

8. The vertical cable trough unit of claim 1, wherein the weight of the cover trough member is supported by the shaft wall through the resilient means anchored to the shaft support when the trough cover member is fully at the venting position.