

WATER RESISTANT ELECTRICAL CABLE GLAND

5 FIELD OF THE INVENTION

This invention relates to a water resistant electrical cable gland of the general type adapted to be employed for terminating electrical cables where they enter an electrical connection box or other housing in which the electrical
10 conductors of the cable are connected to terminals of one form or another.

More particularly the invention relates to an electrical cable gland for use on cables of the type having what is generally termed armoring located between an inner electrically insulating sheath and an outer electrically insulating
15 sheath.

It is to be understood that the term armoring is used in this specification in a broad sense. The term thus includes armoring in the form of longitudinally extending stiff wires of significant thickness arranged to form a mechanically
20 protective layer that is generally electrically conductive (typically serving as an earth conductor) between the inner and outer insulating sheaths of the cable and having substantial tensile strength. The term in its broad sense also includes armoring in the form of fine, substantially more flexible wires that are optionally braided, as well as metal tape, neither of which has much
25 substantial tensile strength and that serve one or more of the functions of reinforcing the cable; providing an electromagnetic shield; or simply an electrically conductive path typically used as an earth.

These different forms of armoring have substantially different thickness and
30 the invention relates to a cable gland capable of accommodating such different thicknesses.

BACKGROUND TO THE INVENTION

It is common practice to design cable glands with an armor clamp in the form of a cone having an outer conical surface for engaging the inside of the armoring and adapted to cooperate with a clamping ring having an inner surface of complementary conical shape to clamp the armoring firmly between the two conical surfaces. The appropriate locking cone angle and other constraints on the length of the cable gland and material content do not naturally lend themselves to accommodating distinctly different thicknesses of armoring.

It is generally impractical and costly to provide different cable glands for each different thickness of armoring provided on electrical cables which are otherwise of a similar size and nature.

One solution to the problem is set out in British Patent No 2,269,710 which describes a substantially conventional cone and clamping ring in which the cone is made substantially longer, or the clamping ring shorter, or both, simply to accommodate different armor thickness with an otherwise substantially conventional arrangement. This proposal is not particularly appealing where a substantial difference in thickness of armoring is to be accommodated as the entire gland must be made substantially longer thereby requiring more material with accompanying increased cost.

British Patent No 2,269,711 describes another proposal in which the clamping ring has two conical surfaces facing in opposite axial directions and adapted to be selectively engaged with different thicknesses of cable armoring by selecting the correct one of two possible axially reversed positions in the gland. Installing such a gland is difficult as the correct orientation is difficult to perceive from the outer surface of the clamping ring. This arrangement is viewed by applicant as impractical and possibly even dangerous if the clamping ring is not installed in the correct orientation.

British Patent No 2,296,998 provides another proposal in which the outer conical surface of the cone is stepped to provide two different conical surfaces of the same cone angle for selective engagement, according to the thickness of the armoring, with the same clamping ring. Of necessity, the operative length of the clamping surface is limited and proper installation of such a cable gland requires that the free ends of the armoring be trimmed rather accurately which is extremely difficult to achieve and control in the field with normal hand tools available.

10 International patent publication number WO01/93396 describes an arrangement in which the clamping cone and clamping ring have two different apex angles so that peripheral clamping surfaces are provided for thinner armoring and the conventional locking cone angle is provided for the thicker armoring. Applicant prefers this arrangement.

15 In the instance of the latter arrangement as well as some of the other solutions mentioned, greater relative axial movement of an outer body is required relative to the inner body. The former typically cooperates directly with the clamping ring whilst the clamping cone is urged towards the clamping ring by the inner body that has a screw thread cooperating with a screw thread on the inner surface of the outer body.

In the instance of a water resistant cable gland [often referred to as a deluge resistant gland], one form of seal for preventing the ingress of water to the cable armor clamp is an O-ring seal carried in a groove in the outer surface of the inner cable gland body and that seals against a smooth cylindrical surface on the inner surface of the outer body of the gland. Of course, the different axial positions that the inner body assumes relative to the outer body consequent on different thicknesses of armor means that the length of the outer body that has the smooth inner surface cooperating with the O-ring needs to be long enough to accommodate both terminal axial positions.

The outer cable gland body is generally made by turning, on a suitable lathe, a metal extrusion that is typically of a suitable grade of brass, stainless steel or aluminium. Such extrusions are costly and, accordingly, it is desirable that the length of extrusion used for each cable gland be limited to only that which is necessary.

OBJECT OF THE INVENTION

It is an object of this invention to provide a cable gland of the general type discussed above and employing an O-ring or other endless seal between an outer and an inner cable gland body in which the length of the outer cable gland body is less than in the instance described above in which the O-ring seal is carried in a groove in the outer surface of the inner cable gland body.

SUMMARY OF THE INVENTION

In accordance with this invention there is provided a cable gland comprising an outer tubular body having a free end forming an entry end for a cable and an inner tubular body having an externally screw threaded portion in cooperating engagement with an internally screw threaded portion of the outer tubular body with the two bodies forming an internal cavity housing an armor clamp assembly that includes an armor clamping cone and a cooperating clamping ring that are operatively urged into cooperating relationship by screwing the inner tubular body into the outer tubular body, the cable gland being characterized in that the external screw thread on the inner tubular body is confined to an inner end region of the inner tubular body with a smooth outer cylindrical surface having a diameter no greater than the minimum diameter of the screw threaded end region extending from said screw threaded end region to a nut formation that is external of the outer tubular body, and in that the inner surface of the outer tubular body has a circumferential groove adjacent its end that receives the inner tubular body for accommodating an endless seal in the operative position with the endless

seal cooperating with the outer cylindrical surface of the inner tubular body, and wherein the endless seal is, prior to installation of the gland, located either in said circumferential groove in the outer tubular body or on the outer cylindrical surface of the inner tubular body adjacent the screw threaded end region thereof.

Further features of the invention provide for the endless seal to be an elastomeric O-ring seal; for the end of the outer tubular body receiving the inner tubular body to have a lead-in taper arranged such that an O-ring carried on the outer cylindrical surface of the inner tubular body immediately adjacent the screw threaded end region thereof will automatically be squeezed and rolled into the outer tubular body to snap into its operative position in the circumferential groove; for the inner tubular body to have a shallow circumferential groove immediately adjacent the screw threaded end region thereof for partially receiving an O-ring seal preparatory to introduction thereof into its operative position; for the internal screw thread in the outer tubular body to extend past the circumferential groove; and for the armor clamping cone and cooperating clamping ring to be configured to clamp different thicknesses of armor at different relative axial positions thereof.

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In a preferred arrangement, the armor clamping cone and clamping ring are as described in International patent publication number WO01/93396 with each having a first cooperating conical clamping surface of substantially conventional and relatively small cone angle and, at the larger diameter end of the first conical clamping surface of each of the cone and clamping ring, a second cooperating clamping surface diverging outwardly from the first conical surface.

The second cooperating clamping surfaces are thus adapted to clamp between them armoring of relatively small thickness whilst the first cooperating clamping surfaces are adapted to clamp between them armoring of relatively larger thickness. The cone angle of the first cooperating conical

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clamping surfaces may be 15 to 25 degrees and preferably about 20 degrees so that the first clamping surfaces make an angle of from 7.5 to 12.5 and preferably about 10 degrees with the axis of the cable gland. The second cooperating clamping surfaces in each case have a cone angle of between
5 about 60 and 90 degrees and preferably about 70 degrees so that the second clamping surfaces make an angle of from about 30 to about 45 degrees and preferably about 35 degrees with the axis of the cable gland.

The cable gland preferably has a two-part construction with the clamping
10 cone being held captive relative to the inner tubular body and the clamping ring being held at least temporarily captive in the outer tubular body.

The cable gland preferably embodies both inner and outer compression seals for sealing onto the inner and outer sheaths of a cable.

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In order that the invention may be more fully understood one embodiment thereof will now be described with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

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In the drawings:-

Figure 1 is an elevation of a cable gland according to the invention with the upper half thereof shown in section;

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Figure 2 is an enlarged sectional view showing the relationship between the outer tubular body and the inner tubular body with the cone and clamping ring separated by thicker armor wires that are clamped between them;

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Figure 3 is a view similar to Figure 2 [showing only the half that is in section] illustrating the outer tubular body and inner tubular

body with the cone and clamping ring separated by thinner armor wires that are clamped between them;

5 Figure 4 illustrates in similar view the inner tubular body and outer tubular body immediately prior to installation of the former in the latter; and,

10 Figure 5 illustrates in similar view the position of the O-ring of the prior art that is located in a groove in the outer surface of the inner tubular body and showing clearly the saving in length of the outer body.

DETAILED DESCRIPTION WITH REFERENCE TO THE DRAWINGS

15 In the embodiment of the invention illustrated in Figures 1 to 4 of the drawings, a cable gland comprises an outer tubular body [1] having a free end [2] forming an entry end for a cable [3] and an inner tubular body [4] having an externally screw threaded portion [5] in cooperating engagement with an internally screw threaded portion [6] of the outer tubular body.

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In the installed condition, the two bodies form an internal cavity housing an armor clamp assembly that includes an armor clamping cone [7] that is operatively urged into cooperating relationship with a cooperating clamping ring [8] by screwing the inner tubular body into the outer tubular body.

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As provided by this invention, the external screw thread on the inner tubular body is of short length and is confined to an inner end region of the inner tubular body. A smooth outer cylindrical surface [9] having a diameter slightly less than the minimum diameter of the screw threaded end region extends from said screw threaded end region to a nut formation [11] that is external of the outer tubular body.

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The inner surface of the outer tubular body has an endless O-ring seal [12] accommodated in a circumferential groove [13] adjacent its end that receives the inner tubular body. The O-ring seal engages the outer cylindrical surface of the inner tubular body to totally seal any ingress passage from the outside
5 to the cavity housing the armor clamp, and thus to the armor wires.

In order to facilitate assembly of the cable gland, the end of the outer tubular body receiving the inner tubular body has a lead-in taper [14] arranged such that an O-ring fitting snugly on the outer cylindrical surface of the inner
10 tubular body immediately adjacent the screw threaded end region, as illustrated in Figure 4, will automatically be squeezed and rolled into the outer tubular member and thereby caused to snap into its operative position in the circumferential groove. In order to assist in this procedure, the inner tubular body is provided with a shallow groove [21] immediately adjacent to the
15 externally screw threaded portion [5] so that the O-ring partially seats itself in the groove. Such a groove typically has a width less than that of the cross-sectional diameter of the O-ring, and preferably about one half of the cross-sectional diameter of the O-ring. This is illustrated in Figure 4. The internal screw thread in the outer tubular body may extend past the circumferential
20 groove for convenience of manufacture.

As indicated above, the armor clamping cone and clamping ring are as described in International patent publication number WO01/93396 with each having a first cooperating conical clamping surface [15] of substantially
25 conventional and relatively small cone angle and, at the larger diameter end of the first conical clamping surface of each of the cone and clamping ring, a second cooperating clamping surface [16] diverging outwardly from the first conical surface.

30 The second cooperating clamping surfaces are thus adapted to clamp between them armoring of relatively small thickness, as illustrated in Figure 3, whilst the first cooperating clamping surfaces are adapted to clamp

between them armoring of relatively larger thickness, as illustrated in Figure 2. The cone angles of these two surfaces are the preferred cone angles indicated above.

- 5 The cable gland, in this embodiment of the invention, has a two-part construction with the clamping cone being held captive relative to the inner tubular body and the clamping ring being held at least temporarily captive in the outer tubular body.
- 10 The cable gland embodies both inner [17] and outer [18] compression seals for sealing onto the inner [19] and outer sheaths [20] of a cable.

It will be understood that constructing the cable gland as described above enables an appreciable length of the extruded blank material from which the
15 outer tubular body is made to be saved. This is clearly shown in Figure 5 where there is illustrated part of a conventional gland having the O-ring [A] carried in a groove [B] in the inner tubular body [C] and cooperating with a smooth inner surface [D] of the outer tubular body [E]. Implementation of the present invention enables the outer tubular body to be terminated short of the
20 existing situation as indicated by the dotted line [F].

It will be understood that numerous variations may be made to the embodiment of the invention described above without departing from the scope hereof.

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CLAIMS:

1. A cable gland comprising an outer tubular body having a free end forming an entry end for a cable and an inner tubular body having an
5 externally screw threaded portion in cooperating engagement with an internally screw threaded portion of the outer tubular body with the two bodies forming an internal cavity housing an armor clamp assembly that includes an armor clamping cone and a cooperating clamping ring that are operatively urged into cooperating relationship by screwing
10 the inner tubular body into the outer tubular body, the cable gland being characterized in that the external screw thread on the inner tubular body is confined to an inner end region of the inner tubular body with a smooth outer cylindrical surface having a diameter no greater than the minimum diameter of the screw threaded end region
15 extending from said screw threaded end region to a nut formation that is external of the outer tubular body, and in that the inner surface of the outer tubular body has a circumferential groove adjacent its end that receives the inner tubular body for accommodating an endless seal in the operative position with the endless seal cooperating with
20 the outer cylindrical surface of the inner tubular body, and wherein the endless seal is, prior to installation of the gland, located either in said circumferential groove in the outer tubular body or on the outer cylindrical surface of the inner tubular body adjacent the screw threaded end region thereof.
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2. A cable gland as claimed in claim 1 in which the endless seal is an elastomeric O-ring seal.
3. A cable gland as claimed in claim 2 in which the end of the outer
30 tubular body receiving the inner tubular body has a lead-in taper arranged such that an O-ring carried on the outer cylindrical surface of the inner tubular body adjacent the screw threaded end region thereof

will automatically be squeezed and rolled into the outer tubular body to snap into an operative position in the circumferential groove as the inner tubular body is screwed into the outer tubular body.

- 5 4. A cable gland as claimed in claim 3 in which the inner tubular body has a shallow circumferential groove immediately adjacent the screw threaded end region thereof for partially receiving the O-ring seal preparatory to introduction thereof into its operative position.
- 10 5. A cable gland as claimed in any one of the preceding claims in which the internal screw thread in the outer tubular body extends past the circumferential groove.
- 15 6. A cable gland as claimed in any one of the preceding claims in which the armor clamping cone and cooperating clamping ring are configured to clamp different thicknesses of armor at different relative axial positions thereof.
- 20 7. A cable gland as claimed in claim 6 in which the armor clamping cone and clamping ring each have a first cooperating conical clamping surface of substantially conventional cone angle and, at the larger diameter end of the first conical clamping surface of each of the cone and clamping ring, a second cooperating clamping surface diverging outwardly from the first conical surface.
- 25 8. A cable gland as claimed in claim 7 in which the cone angle of the first cooperating conical clamping surface is from 15 to 25 degrees so that the first clamping surfaces make an angle of from 7.5 to 12.5 with the axis of the cable gland and the second cooperating clamping surfaces in each case have a cone angle of between 60 and 90 degrees so that
30 the second clamping surfaces make an angle of from 30 to 45 degrees with the axis of the cable gland.

9. A cable gland as claimed in any one of the preceding claims in which the cable gland has a two-part construction with the clamping cone being held captive relative to the inner tubular body and the clamping ring being held at least temporarily captive in the outer tubular body.

10. A cable gland as claimed in any one of the preceding claims in which the cable gland embodies both inner and outer compression seals for sealing onto the inner and outer sheaths of a cable.

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