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CABLE ASSEMBLY INCLUDING A HOOD ADAPTER AND HOOD

Abstract

A cable assembly includes a cable including an outer sheath and at least one conductor within the sheath, a connector coupled to an end of the cable, the connector having at least one contact that is coupled to the at least one conductor, an adapter and a hood. The adapter has a first part and a second part that define an adapter cavity, a first adapter opening at a first end of the adapter and a second adapter opening at a second end of the adapter, and the first part and the second part being movable relative to each other. The hood has a sidewall that defines a hood interior and includes a first hood opening at a first end of the hood and a second hood opening at a second end of the hood. The adapter has a first position in which part of the cable may be inserted into the adapter cavity, and the adapter has a second position in which the part of the cable is trapped within the adapter, in the second position the cable extends out of the second adapter opening and the connector extends out of the first adapter opening. The adapter is received within the hood interior so that the connector extends at least partly out of the first opening and the cable extends through the second opening.

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Background/Summary

RELATED APPLICATIONS [0001] This application claims the benefit of priority of U.S. Provisional Application No. 63/551,770, filed on Feb. 9, 2024, and GB Application No. GB2407887.5, filed Jun. 4, 2024. The entire contents of those applications are relied upon and incorporated herein by reference in their entirety.

TECHNICAL FIELD

[0002] The present disclosure relates generally to cable assembly including an adapter for the cable and a hood of the cable assembly.

BACKGROUND

[0003] To enable a more robust cable with an end connector to be provided with a hood and gland, the cable was provided without any end connector installed on the cable, or the cable was cut to remove the end connector. Then, the hood and gland were installed onto the cable and then the end connector installed onto the cable and relative to the hood. It can be difficult and time consuming to make the various connections between multiple wires of the cable and the end connector, and the robustness of the connections can be reduced compared to an end connector that is factory installed on the cable.

SUMMARY

[0004] In at least some implementations, a cable assembly includes a cable including an outer sheath and at least one conductor within the sheath, a connector coupled to an end of the cable, the connector having at least one contact that is coupled to the at least one conductor, an adapter and a hood. The adapter has a first part and a second part that define an adapter cavity, a first adapter opening at a first end of the adapter and a second adapter opening at a second end of the adapter, and the first part and the second part being movable relative to each other. The hood has a sidewall that defines a hood interior and includes a first hood opening at a first end of the hood and a second hood opening at a second end of the hood. The adapter has a first position in which part of the cable may be inserted into the adapter cavity, and the adapter has a second position in which the part of the cable is trapped within the adapter, in the second position the cable extends out of the second adapter opening and the connector extends out of the first adapter opening. The adapter is received within the hood interior so that the connector extends at least partly out of the first opening and the cable extends through the second opening.

[0005] In at least some embodiments, the cable assembly is configured for operation and installation in industrial applications, in particular for harsh environments where high demands are placed on tightness against water and dirt, and where the cable assembly is subjected to vibrations with high magnitudes. The hood used to receive the adapter and cable is preferably a heavy-duty electrical connector that is sealed to withstand harsh environmental conditions.

[0006] In at least some implementations, the sidewall of the hood is circumferentially continuous along at least part of a length of the hood between the first end and the second end. In at least some

implementations, a retainer that couples together the hood and the adapter to retain a position of the adapter in the hood interior.

[0007] In at least some implementations, the adapter includes a seal that engages and surrounds a periphery of part of the connector to provide a seal between the adapter and the connector.

[0008] In at least some implementations, the adapter includes a hinge between the first part and the second part that permits hinged relative movement between the first part and the second part. In at least some implementations, the hinge extends in a direction parallel to a central axis of the cable. In at least some implementations, the adapter is a clamshell body. In at least some implementations, the hinge extends in a direction perpendicular to a central axis of the cable.

[0009] In at least some implementations, the first part is separate from the second part in the first position of the adapter and the first part is releasably coupled to the second part in the second position of the adapter. In at least some implementations, the first part and the second part have complementary connection features that are releasably connected in the second position of the adapter. In at least some implementations, the first part is a U-shaped body having two spaced apart legs each having a first end and a second end opposite to the first end, and the U-shaped body has a central portion connected to the first end of each leg, and wherein the U-shaped body is connected to the second part of the adapter by connection features on the legs and so that the central portion overlies part of the connector.

[0010] In at least some implementations, the adapter includes a compliant body that defines at least part of the adapter cavity, and which is compressed against one or both of the connector and the cable in the second position of the adapter.

[0011] In at least some implementations, the connector includes a retainer tab arranged to releasably retain the connector in a socket of a mating connector, and wherein the retainer tab is located outside of the adapter. In at least some implementations, the adapter when in the second position moves the retainer tab to a position permitting removal of the connector from said mating connector.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The following detailed description of preferred implementations and best mode will be set forth with regard to the accompanying drawings, in which:

[0013] FIG. 1 is a perspective view of a cable assembly showing a cable with a connector at one end, a gland and an outer hood between the gland and the connector;

[0014] FIG. 2 is a sectional view of the cable assembly showing an adapter received within the hood;

[0015] FIG. 3 is a perspective view of the cable assembly with the hood and gland removed;

[0016] FIG. 4 is a side view of a cable assembly showing an adapter in a first position;

[0017] FIG. 5 is a perspective view of the adapter in the first position;

[0018] FIG. 6 is a perspective view of the adapter in the first position;

[0019] FIG. 7 is a perspective view of a cable assembly showing an adapter in a first position and a cable received in the adapter;

[0020] FIG. 8 is a perspective view of the adapter in the first position with the cable removed;

[0021] FIG. 9 is a perspective view of the adapter in the first position;

[0022] FIG. 10 is a perspective view of a cable assembly with an adapter shown in a second position with a cable received therein;

[0023] FIG. 11 is a perspective view of the adapter in the second position; and

[0024] FIG. 12 is a perspective view of the adapter in the first position.

DETAILED DESCRIPTION

[0025] Referring in more detail to the drawings, FIG. 1 shows a cable assembly **10** including a cable **12** and a connector **14** at an end of the cable **12**. In this embodiment, the cable assembly **10** is for a RJ45 type cable **12** and connector **14**, although other cable and connector types may be used. As shown in FIG. 2, the cable **12** extends between opposite ends **16**, **18** and has a central axis **20**. An outer sheath **22** or insulator layer typically of a polymeric material extends between the ends **16**, **18**, as does one or more conductors **24** that are received within and surrounded by the outer sheath **22**. The conductor(s) **24** typically are solid or twisted metal wires that are electrically conductive (e.g. copper or aluminum). The cable **12** can include other things, like internal insulators or shields, as desired and as is known in the art.

[0026] To facilitate connecting the conductor(s) **24** to another device, a connector **14** is provided at one or both ends of the cable **12**. The connector **14** includes a body **26** with an exterior shape designed to facilitate connection with a mating connector, such as by a plug-in coupling. Accessible from an exterior of the body **26**, the connector **14** includes one or more contacts **28** that may each be coupled to a separate conductor **24** of the cable **12**, and are arranged for electrically conductive coupling with a contact of a mating connector, within an interior of the body **26**, in known manner. The connector **14** may include a retaining structure adapted to releasably retain the connector **14** in a coupled position relative to a mating connector. In the example shown, the retaining structure is a retaining tab **30** that is cantilevered at one end to the connector **14** body **26** and that is flexible, resilient and arranged for a snap-fit within a slot of the mating connector, in a known manner.

[0027] For a more robust cable assembly **10**, a gland **32** is secured to the cable **12** spaced from the connector **14** and a hood **34** is provided over the cable **12** between the gland **32** and the connector **14**. The gland **32** and the hood **34** may provide protection from contaminants and facilitate coupling and uncoupling the cable **12** and/or the connector **14** to a mating connector of a device or bulkhead, which may be arranged for connection with multiple cables, in at least some implementations. The gland **32** is tubular and may include multiple components fitted together. An inner surface of the gland **32** defines a gland passage **36** (FIG. 2) and may be securely received on the outer sheath **22** of the cable **12** with a forward end of the gland **32** arranged at a desired distance from the connector **14**. The outer diameter of the gland passage **36** may be slightly smaller than the outer diameter of the cable **12**, such that the gland **32** may provide strain relief for the cable **12**. The distance may be such that the hood **34** is located in a desired orientation and position relative to the connector **14** when in contact or connected with the gland **32**. To facilitate assembly of the cable assembly **10**, the gland **32** may be designed so that it can be installed onto the cable **12** with the connector **14** attached to the cable **12**. And the gland **32** and hood **34** may be connected together prior to installation onto the cable **12**, if desired.

[0028] The hood **34** is received between the gland **32** and the connector **14**, and may be connected to the gland **32** if desired. The hood **34** is tubular and includes a sidewall **38** with an inner surface **40** that defines at least part of a hood interior **42** through which the cable **12** extends and an outer surface **44** that defines part of an exterior **46** of the hood **34**. The hood interior **42** extends between a first hood opening **48** at a first end **50** of the hood **34** and a second hood opening **52** at a second end **54** of the hood **34**. The second hood opening **52** is adjacent to and aligned with the gland passage **36** and the second end **54** of the hood **34** is adjacent to and may be in contact with the gland **32** in the assembled state of the cable assembly **10**. The first end **50** of the hood **34** is open, may define the first hood opening **48**, and is received adjacent to and may partially axially overlap the connector **14**. The sidewall **38** may be circumferentially continuous and may provide a barrier surrounding the end of the cable **12** adjacent to the connector **14**. The first and second hood openings **48**, **52** may be sized to permit the connector **14** to pass through the hood **34**, such that the hood **34** can be installed onto the cable **12** with the connector **14** already attached to the cable **12**. In at least some implementations, suitable seals to prevent contaminants from entering the hood interior **42** may be provided between the hood **34** and the gland **32** and/or the hood **34** and cable **12**, as desired. As used herein, terms like axial or axially, radial or radially and circumferential or

circumferentially relate to the central axis **20** of the cable **12**.

[0029] With the hood **34** designed to permit installation onto the cable **12** with the connector **14** already attached to the cable **12**, the hood interior **42** and the hood openings **48**, **52** are larger than and shaped to permit the cable **12** to pass therethrough. To more securely arrange the cable **12** relative to the hood **34**, the cable assembly **10** includes an adapter **56**. The adapter **56** is secured to the cable **12** and is received within the hood interior **42**. To receive the cable **12**, the adapter **56** includes a first adapter opening **58** at a first end **60** of the adapter **56** and a second adapter opening **62** at a second end **64** of the adapter **56** and an internal cavity **66** that is communicated with the adapter openings **58**, **62**. An exterior of the adapter **56** may be sized and shaped for close receipt within the hood interior **42**, if desired, to limit relative movement or play between them. Further, a connector, such as a threaded fastener **68** as shown in FIGS. **2** and **3**, may be installed through an opening in the hood **34** sidewall **38** and engaging the adapter **56** or within an aligned opening of the adapter **56**, to connect the adapter **56** to the hood **34** and inhibit or prevent relative movement between them. In FIG. **3**, the threaded fastener **68** is shown without the hood **34** for illustrative purposes only.

[0030] To permit the adapter **56** to be fitted onto the cable **12** with the connector **14** already attached to the cable **12**, the adapter **56** includes a first part **70** and a second part **72** that is movable relative and releasably connectable to the first part **70**. The adapter **56** is elongated and has the shape of a rectangular cube, and the cable **12** extends along a longitudinal central axis **12** of the adapter **56** between the first and second parts **70**, **72**. Both the first part **70** and the second part **72** define at least a portion of the adapter openings **58**, **62** and the adapter cavity **66**. When the adapter **56** is in a first opened position, the first part **70** and the second part **72** are arranged to permit the cable **12** and/or part of the connector **14** to be received within the openings **58**, **62** and the adapter cavity **66**.

[0031] When the adapter **56** is in a second closed position, the cable **12** is secured within the adapter cavity **66**, at least one of the openings **58**, **62** may be smaller than the connector **14** such that the connector cannot be moved with respect to the opening. In the second position, the first part **70** and second part **72** may be coupled together, as shown in FIG. **3**, by a connector or engaged connection features **74** of the parts **70**, **72**, if desired. One or both adapter parts **70**, **72** may be movable relative to the other part to define the first and second positions of the adapter **56**, which may be constructed in different ways.

[0032] The adapter **56** can be made of a plastic material. More preferably, the adapter **56** is made of a material with increased flexibility, such as an elastomeric material (e.g., silicone, rubber). The channel passing through the opening **62** can be sized to form a friction fit with the outer sheath **22** of the cable **12**, thereby providing additional strain relief.

[0033] In the implementation shown in FIGS. **2** and **3**, the adapter **56** is a clamshell type structure with the first part **70** and the second part **72** connected together by a hinge **76** (FIG. **3**) that extends along a side of the adapter **56**, for example as shown extending in a longitudinal direction at an elongated side between the first and second ends **60**, **64** of the adapter **56** and parallel to or generally parallel to (i.e. within ten degrees of parallel) the cable axis **20**. In this example, the first part **70** and the second part **72** both extend to the first and second ends **60**, **64** of the adapter **56** and are separable along a plane that extends parallel to and through the hinge **76**, and the parts **70**, **72** include oppositely facing interior surfaces **78**, **80** (FIG. **2**) that define the internal cavity **66**. The interior surfaces **78**, **80** are farther apart in the first position than in the second position.

[0034] The hinge **76** may be a separate component from either or both of the adapter parts **70**, **72**, or it may be a so-called “living hinge **76**” defined by a thin section of material that defines the adapter parts **70**, **72**, which may be formed from the same piece of material in a unitary structure (i.e., the hinge **76** is integrally formed with a perimeter edge of the adapter parts **70**, **72**). So arranged, the adapter parts **70**, **72** may be pivoted or hingedly moved relative to each other to the first position in which the cable **12** can be inserted into the adapter cavity **66** and then to the second

position in which the cable **12** is locked to the adapter **56** whereby removal of the cable **12** from the adapter **56** is inhibited or prevented.

[0035] The first and second parts **70**, **72** of the adapter **56** may include connection features **74** by which the parts are releasably coupled together, such as by a snap-fit or other arrangement. In the example of FIG. **3**, the first part **70** includes a barb **82** that is releasably received in a window **84** of a flange **86** of the second part **72** when the adapter **56** is in the second position. The flange **86** is sufficiently flexible to move outward to slide over the barb **84** until the barb **82** is aligned with the window **84**, at which point the flange **86** is spring biased back inward so that the barb **82** enters the window **84** to releasably lock the barb **82** to the flange **86**. The flange **86** and barb **82** may be located on a side of the adapter **56** opposite to the hinge **76**, or elsewhere, as desired. The flange **86** may snap over the barb **82** when the adapter **56** is moved to the second position, at which the flange **86** is releasably locked with the barb **82** and thereby the adapter **56** is locked to the cable **12**, and the flange **86** may be flexed outward to clear the barb **82** to move the adapter **56** from the first position to or toward the second position. The adapter **56** can be removed from the cable **12** by pulling the flange **86** outward until it clears the barb **82**, and then separating the first and second parts **70**, **72**. Of course, other connection features and arrangements may be used, as desired.

[0036] In the example shown, the adapter **56** has a length between the ends **60**, **64** such that the adapter **56** engages a stop surface **88** (FIG. **2**) in the hood interior **42** and overlaps part of the connector **14**, while leaving the connector contacts **28** accessible from an outside of the hood **34** and so that the connector **14** is accessible for coupling with a mating connector. So arranged, the hood **34** may be axially trapped between the adapter **56** and the gland **32**, and the hood **34** may, as noted above, be connected to the adapter **56** such as by a fastener **68**.

[0037] To form the cable assembly **10**, the gland **32** is slid over the connector **14** and on the cable **12** and then the second end **54** of the hood **34** is slid over the connector **14** until the connector **14** is exposed from the first distal end **50** of the hood **34** sufficiently to permit the adapter **56** to be installed on the cable **12**. For example, the cable **12** can be extended until the connector **14** extends a distance from the end of the first distal end **50** of the hood **34** that is greater than the length of the adapter **56**, so that the adapter **56** can be fully positioned between the first distal end **50** and the connector **14**. The adapter **56** is opened or moved to the first position and the cable **12** is inserted into the adapter cavity **66** with the connector **14** exposed from the first adapter opening **58** and the cable **12** extending out of the second adapter opening **62**. The adapter **56** is then closed or moved to the second position so that part of the cable **12** is trapped within the adapter **56**.

[0038] Next, the hood **34** can be slid back toward the connector **14** until the adapter **56** is received within the hood interior **42** and abuts the stop surface **88** within the hood **34**. If provided, the fastener **68** can be installed to couple the hood **34** to the adapter **56** and limit or prevent relative movement between them. Finally, the gland **32** can be slid toward and into contact with the second end **54** of the hood **34**, and then secured to the cable **12**. The gland **32** can be threadably coupled with the hood **34** and screwed into the hood **34** to provide a watertight connection. The gland **32** can be secured to the cable **12** by a fastener.

[0039] The cable assembly **10** provides strain relief to the cable **12** and the connector **14**. The gland **32** is coupled to the second proximal end **54** of the hood **34**, for example the gland **32** can be threadably coupled to the hood **34**, or coupled by a fastener or the like. That prevents the cable **12** from sliding longitudinally forward and rearward with respect to the adapter **56** and the hood **34**. The force of any rearward pulling on the cable **12** would be on the gland **32**, and not on the connector **14**. In addition, the hood **34** is fixedly coupled to the adapter **56** by the fastener **68**, which further provides strain relief to the connector **14**. The adapter proximal end **64** engages the stop surface **88** of the hood **34** to prevent the cable **12** from sliding rearward out of the adapter **56** and the hood **34**. And, the adapter **56** can prevent the cable **12** from rotating (clockwise and counterclockwise) with respect to the adapter **56**. Thus, the connector **14** remains at a fixed position with respect to the adapter **56** and the hood **34**.

[0040] The cable **12** end is now provided with a robust hood **34** and gland **32** arrangement, and this was accomplished with the connector **14** attached to the cable **12** and without having to cut off the connector **14** or later attach the connector **14** to the cable **12** after installation of the gland **32** and hood **34** on the cable **12**. The hood **34** may be grasped by a person when plugging the connector **14** into and removing the connector **14**/cable assembly **10** from a mating connector. The hood **34** and gland **32** may inhibit contaminants from fouling the connector **14** and cable **12**, and the hood **34** may be connected to a structure to maintain the cable assembly **10** coupled to the structure, such as, but not limited to, a bulkhead, cabinet or the like.

[0041] The hood **34** is made of a rigid material such as a metal or rigid plastic. The adapter **56** can be rigid or somewhat flexible, and can be plastic or alternatively a metal. The first end is shown to have an outer flange that can be utilized to connect to a corresponding bulkhead connector, though other shapes and connection interfaces can be provided.

[0042] Another adapter **90** for a cable assembly **10'** is shown in FIGS. **4-6** with the hood **34** removed/not shown for purposes of illustrating the adapter **90**. This adapter **90** can be used with the same cable **12**, connector **14**, hood **34** and gland **32**, and for ease of description, the same reference numerals will be used as those used with regard to the embodiment shown in FIGS. **1-3**. As noted above with regard to adapter **56**, adapter **90** can be used with other types of cables **12** and connectors **14**, as desired.

[0043] The adapter **90** includes a first part **92** and a second part **94** that define an interior cavity **96**, and a first opening **98** (FIG. **6**) at a first end **100** of the adapter **90** and a second opening **102** (FIG. **5**) at a second end **104** of the adapter **90**. In this example, the first part **92** is coupled to the second part **94** at a hinge **106** for hinged or pivoted movement about a line or axis that is perpendicular to the axis **20** of the cable **12** and the hinge **106** overlies the cable **12** (whereas in FIGS. **1-3**, the hinge **76** of adapter **56** was parallel to and offset from the side of the cable **12**). In the example shown, the first part **92** is coupled to the second part **94** between the first and second ends **100**, **104** of the adapter **90**, and the second part **94** does not extend to or define part of one end of the adapter **90**, shown as the first end **100** in this example. As shown, the hinge **106** is positioned between the first distal end **100** and the second proximal end **104** of the adapter **90**, and in some embodiments the hinge **106** is substantially closer to the first end **100** (approximately one-third the length of the adapter **90**) to guide the connector **14** into and through the first rear opening **98**.

[0044] The second part **94** extends to the second end **104** of the adapter **90**, and so the second opening **102** is defined by both the first part **92** and second part **94**, but the first opening **98** is defined only within the first part **92** (and is bounded on all sides by material of the first part **92**). The cavity **96** is defined between and by oppositely facing interior surfaces **108**, **110** of the first part **92** and the second part **94**, and these interior surfaces **108**, **110** (which together define the interior cavity **96**) are farther apart in the first open position than in the second closed position. Of course, the second part **94** could be coextensive with the first part **92** such that the second part **94** also defines part of the first opening **98**, if desired, or the second part **94** could define part of the first opening **98** but not the second opening **102**.

[0045] In at least some implementations, the adapter **90** includes at least one flexible or compliant body **112** that defines at least part of the adapter cavity **96** at the first part **92** and/or the second part **94**, and which may be carried by or connected to one or both of the adapter parts **92**, **94**. The compliant body **112** is arranged to engage one or both of the connector **14** and the cable **12**, and to deform against and around the connector **14** or cable **12** when the adapter **90** is closed or moved to the second position. The compliant body **112** may damp vibrations, provide insulation and/or provide a seal or structure that inhibits contaminants from entering the adapter cavity **96**. In the example shown, a first compliant body **112a** is carried by the first part **92**, a second compliant body **112b** is carried by the second part **94**. The compliant bodies **112** may extend along any length of the adapter **90** between the ends of the adapter **90** and they may have any desired thickness and width. In at least some implementations, the compliant bodies **112** engage each other on opposite sides of

the cable **12** when the cable **12** is received in the adapter **90** and the adapter **90** is in the second position, to provide a peripherally (e.g. circumferentially) continuous seal around the cable **12**, and/or the connector **14**.

[0046] In the embodiment shown, the first part **92** is elongated and forms a base having a first distal end portion, a second proximal end portion, and an intermediate portion therebetween, which together form a general L-shape. The first distal end portion of the first part **92** has a rectangular or square cross-section, and the window **98** is formed in the first distal end portion. The intermediate portion and second proximal end portion have a general U-shape cross-section with a bottom and side walls. The bottom and side walls define a first channel which receives the rectangular or square first compliant body **112b**. A rearward mating ledge is formed between the intermediate portion and the first distal end portion. The hinge **106** is formed at the top edge of the ledge, between the intermediate portion and the first distal end portion.

[0047] The second part **94** is elongated and forms a cover with a top and side walls that forms a similar U-shape cross section that is aligned with and inverted with respect to the base. The top and side walls form a second channel that is aligned with the first channel, and the second channel receives the rectangular or square second compliant body **112a**. The first and second parts **92**, **94** form a rigid protective outer housing.

[0048] To form the cable assembly **10'**, the gland **32** is slid over the connector **14** and on the cable **12** and then the second end **54** of the hood **34** is slid over the connector **14** until the connector **14** is exposed from the hood **34** sufficiently (as with the embodiment of FIGS. **1-3**) to permit the adapter **90** to be installed on the cable **12**. The adapter **90** is opened or moved to the first position in which, at the second end **104** of the adapter **90**, the second part **94** is spaced from the first part **92**. The connector **14** is inserted into the adapter cavity **96** from the second end **104** of the adapter **90**, and is passed through the first opening **98** of the adapter **90** until some or all of the connector **14** is out of or exposed from the first opening **98** and with the cable **12** extending out of the second opening **102** or second end **104** of the adapter **90**. The second part **94** is only shown partially open in FIGS. **4-6**, and can be opened wider, such as up to about 90 degrees with respect to the first part **92**. The adapter **90** is then closed or moved to the second position so that part of the cable **12** is trapped within the adapter **90**, between the first part **92** and the second part **94**. Next, the hood **34** can be slid back toward the connector **14** until the adapter **90** is received within the hood interior **42** and abuts the stop surface **88** within the hood **34**. If provided, a fastener **68** can be installed to couple the hood **34** to the adapter **90** and limit or prevent relative movement between them. Finally, the gland **32** can be slid toward and into contact with the second end **54** of the hood **34**, and then secured to the cable **12**.

[0049] Another adapter **114** for a cable assembly **10''** is shown in FIGS. **7-9**, with the hood removed **34** from the assembly shown in FIG. **7**, to better illustrate the adapter **114**. This adapter **114** can be used with the same cable **12**, connector **14**, hood **34** and gland **32**, and for ease of description, the same reference numerals will be used as those used with regard to the embodiment shown in FIGS. **1-3**. As noted above with regard to adapter **56**, adapter **114** can be used with other types of cables **12** and connectors **14**, as desired.

[0050] The adapter **114** includes a discrete first part **116** and a discrete second part **118** that is separate from the first part **116**, and together define an interior cavity **120** between them. A first opening **122** is provided at a first end **124** of the adapter **114** and a second opening **126** is provided at a second end **128** of the adapter **114**. In this example, the first part **116** and second part **118** are separable along a parting line **130** or plane that is parallel to the cable axis **20** to permit the adapter **114** to be opened (e.g. moved to the first position) for receipt of the cable **12** and/or part of the connector **14** therein. In the example shown, both parts **116**, **118** extend to the first and second ends **124**, **128** of the adapter **114** and both parts define portions of both openings **122**, **126** in the adapter **114**, but other arrangements can be utilized (e.g. where one opening is formed by only one of the parts). One or both of the adapter parts **116**, **118** may include a compliant body **112** at the first part

116 and/or the second part **118** that defines part of the adapter cavity **120**.

[0051] The first and second adapter parts **116**, **118** may include one or more cooperating connection features **132** that releasably or yieldably couple the parts together, such as by a press-fit, interference fit, snap-fit or the like. The parts **116**, **118** could also be connected by a separate fastener or retainer, like a clip or screw or clamp, or by an adhesive or weld, as desired. As shown in FIGS. **8** and **9**, the second part **118** includes flanges **134** that extend from opposite sides of the second part **118** and beyond an interior surface **136** of the second part **118** and which include inwardly extending tabs **138**. The first part **116** includes corresponding slots or cavities **140** extending into opposite sides of the first part **116** below an interior surface **142** thereof, and arranged to receive the tabs **138** when the second part **118** is received on the first part **116** and the adapter **114** is in the second position. Multiple connection features **132** could be provided to enable multiple positions of the second part **118** relative to the first part **116**, with sliding relative motion (movement parallel to the parting line **130** or plane parallel to a cable axis) between the parts. For this purpose, the length of the slots or cavities **140** can be greater than the width of the flanges **134** in order to enable displacement.

[0052] This can facilitate insertion of the cable **12** and connector **14** into the adapter **114** in one position in which the interior surfaces **136**, **142** of the first and second parts **116**, **118** are farther apart than in a second position, without requiring complete separation of the first and second parts **116**, **118**.

[0053] To form the cable assembly **10''**, the gland **32** is slid over the connector **14** and on the cable **12** and then the second end **54** of the hood **34** is slid over the connector **14** until the connector **14** is exposed from the hood **34** sufficiently (as with the embodiment of FIGS. **1-3**) to permit the adapter **114** to be installed on the cable **12**. The adapter **114** is opened or moved to the first position by pulling the flange **134** outward to remove the inward tabs **138** from the slot **140** and then pulling the first and second parts **116**, **118** apart to separate the first and second parts **116**, **118**, and the cable **12** is inserted into the adapter cavity **120** with the connector **14** exposed from the first opening **122** and the cable **12** extending out of the second opening **126**. The adapter **114** is then closed or moved to the second position so that the inward tabs **138** enter the slot **140** and so that part of the cable **12** is trapped within the adapter **114**. Next, the hood **34** can be slid back toward the connector **14** until the adapter **114** is received within the hood interior **42** and abuts the stop surface within the hood **34**. If provided, the fastener can be installed to couple the hood **34** to the adapter **114** and limit or prevent relative movement between them. Finally, the gland **32** can be slid toward and into contact with the second end **54** of the hood **34**, and then secured to the cable **12**.

[0054] Another adapter **144** for a cable assembly **10'''** is shown in FIGS. **10-12**, with the hood **34** removed from the assembly shown in FIG. **10**, to best illustrate the adapter **144**. This adapter **144** can be used with the same cable **12**, connector **14**, hood **34** and gland **32**, and for ease of description, the same reference numerals will be used as those used with regard to the embodiment shown in FIGS. **1-3**. As noted above with regard to adapter **56**, adapter **144** can be used with other types of cables and connectors, as desired.

[0055] The adapter **144** is similar to the adapter **114** of FIGS. **7-9** and has a first part **152** and a second part **146**. The second part **146** defines part of only opening (shown as the first opening **148**) and not also the second opening **150** which is defined entirely by the first part **152**, in this example. In the example shown, the first part **152** is a base that has a distal end portion, an intermediate portion and a proximal end portion. The distal end portion has a general U-shape cross section with a bottom and side walls extending upward from the bottom to define an adapter cavity **162** therebetween. The distal end portion forms a cable mating section that includes one or more slots or recesses **164** that extend longitudinally along the outer surface of the side walls at least partly along the distal end portion. The intermediate portion has a general square or rectangular cross-section and further defines the adapter cavity **162**. The proximal end portion includes one or more elongated flat flanges **168** that extend from the proximal end of the intermediate portion to the

proximal end of the adapter **144**.

[0056] The second part **146** is a U-shaped body having two spaced apart flanges or legs **154** that each have a first end **156** and a second end **158** opposite to the first end **156**, and a curved central portion **160** connected to the first end **156** of each leg **154**. The second part **146** can be thin to form a clip that extends about and releasably engages the outer sides of the distal portion of the first part **152**. In this example, an inner surface of the central portion **160** of the U-shaped body defines an interior surface of the second part **146** that defines part of the adapter cavity **162**, and the central portion **160** is arranged to overlie part of the connector **14** and/or the cable **12**, to secure the cable **12** relative to the adapter **56**. As shown, the adapter cavity **162** can have the general shape of the connector **14**, with a bottom channel that receives the retaining feature of the connector **14**.

[0057] Each leg **154** of the second part **146** includes one or more connection features that cooperate with mating or cooperating connection features on the first part **152** to releasably couple the parts together, and/or to permit slidable movement of the parts to separate or move closer together the interior surfaces of the parts. In the implementation shown, the connection features of the adapter parts **152**, **146** are defined by the multiple slots or recesses **164** in opposite outer side surfaces of the first part **152**, and by one or more tabs **166** extending inward from the inner surfaces of the legs **154** and arranged for receipt in a slot or recess **164** of the first part **152** when the legs **154** are arranged outboard of the side surfaces of the first part **152**, as shown in FIGS. **10** and **11**. So arranged, the second part **146** can be moved (upward/downward or inward/outward) relative to the first part **152** to enlarge or reduce the size of the first opening **148** to facilitate insertion of the connector **14** through the first opening **148** and then securing the connector **14**/cable **12** in the adapter **56**. The second part **146** can be removed by flexing the legs **154** outward and moving the second part **146** away from the first part **152**. Or, by sliding the second part off of the first part **152**. Further, a stop tab can be placed at the distalmost end of the slots **164** to prevent the second part **146** from sliding off the distal end **156** of the first part **152**.

[0058] In the implementation shown, the first part **152** further includes rearwardly extending flanges **168** adapted to engage a stop surface **88** in the hood **34** to locate the adapter **144** relative to the hood **34**. The cable assembly **10'''** can be formed in the same manner described above, with reference to adapter **114**, for example.

[0059] While specifically shown and described in a couple of the embodiments (e.g., FIGS. **4-6**, **7-9**) of the adapters (e.g., adapters **10'**, **10''**), one or more compliant or flexible bodies **112** or seals or insulators, etc., may be used in all forms of adapters, as desired (e.g., including any of the adapters **10**, **10''** of FIGS. **1-3**, **10-12**). Further, in assembly, the retaining tabs or other retaining feature of a connector **14** can be received outside the adapter **56** or they can be actuated (e.g. depressed/flexed as shown in FIG. **2**) by the adapter **56** to prevent operation of the retaining tab **30** to prevent their interference from connection and disconnection of the connector **14** with a mating connector. This can be useful, for example, when the hood **34** is coupled to a structure like a bulkhead or cabinet (e.g. by a coupler or fastener) such that other retainers avoid unintended decoupling of the mated connectors and the retaining tab **30** is not needed to maintain a connection.

[0060] Thus, the hood protects against water, dust and dirt and provides strain relief. The hood and adapter also cooperate to center the cable **12** and connector **14** when mating.

[0061] It is noted that in the embodiments shown and described, the adapter can be removably attached to the hood and/or to the cable. In other implementations, the adapter need not be removable, but can be fixed to the hood and/or to the cable.

[0062] It is further noted that the drawings may illustrate and the description and claims may use several geometric or relational terms and directional or positioning terms, such as rectangular cube, between, planar, elongated, curved, surrounds, perpendicular, flat, top, bottom, side, distal, and proximal. Those terms are merely for convenience to facilitate the description based on the embodiments shown in the figures, and are not intended to limit the disclosure. Thus, it should be recognized that the disclosure can be described in other ways without those geometric, relational,

directional or positioning terms. In addition, the geometric or relational terms may not be exact. For instance, walls or surfaces may not be exactly flat, perpendicular or parallel to one another but still be considered to be substantially perpendicular or parallel because of, for example, roughness of surfaces, tolerances allowed in manufacturing, etc. And, other suitable geometries and relationships can be provided without departing from the spirit and scope of the disclosure.

[0063] All terms used in the claims are intended to be given their broadest reasonable construction and their ordinary meanings as understood by those skilled in the art unless an explicit indication to the contrary is made herein. In particular, use of the singular articles such as “a,” “the,” “said,” etc. should be read to recite one or more of the indicated elements unless a claim recites an explicit limitation to the contrary.

Claims

1. A cable assembly, comprising: a cable including an outer sheath and at least one conductor within the sheath; a connector coupled to an end of the cable, the connector having at least one contact that is coupled to the at least one conductor; an adapter having a first part and a second part that define an adapter cavity, a first adapter opening at a first end of the adapter and a second adapter opening at a second end of the adapter, and the first part and the second part being movable relative to each other; and a hood having a sidewall that defines a hood interior and includes a first hood opening at a first end of the hood and a second hood opening at a second end of the hood, wherein the adapter has a first position in which part of the cable may be inserted into the adapter cavity, and the adapter has a second position in which the part of the cable is trapped within the adapter, in the second position the cable extends out of the second adapter opening and the connector extends out of the first adapter opening, and wherein the adapter is received within the hood interior so that the connector extends at least partly out of the first opening and the cable extends through the second opening.
2. The cable assembly of claim 1 wherein the sidewall of the hood is circumferentially continuous along at least part of a length of the hood between the first end and the second end.
3. The cable assembly of claim 2 which includes a retainer that couples together the hood and the adapter to retain a position of the adapter in the hood interior.
4. The cable assembly of claim 1 wherein the adapter includes a seal that engages and surrounds a periphery of part of the connector to provide a seal between the adapter and the connector.
5. The cable assembly of claim 1 wherein the adapter includes a hinge between the first part and the second part that permits hinged relative movement between the first part and the second part.
6. The cable assembly of claim 5 wherein the hinge extends in a direction parallel to a central axis of the cable.
7. The cable assembly of claim 6 wherein the adapter is a clamshell body.
8. The cable assembly of claim 5 wherein the hinge extends in a direction perpendicular to a central axis of the cable.
9. The cable assembly of claim 1 wherein the first part is separate from the second part in the first position of the adapter and the first part is releasably coupled to the second part in the second position of the adapter.
10. The cable assembly of claim 9 wherein the first part and the second part have complementary connection features that are releasably connected in the second position of the adapter.
11. The cable assembly of claim 9 wherein the first part is a U-shaped body having two spaced apart legs each having a first end and a second end opposite to the first end, and the U-shaped body has a central portion connected to the first end of each leg, and wherein the U-shaped body is connected to the second part of the adapter by connection features on the legs and so that the central portion overlies part of the connector.
12. The cable assembly of claim 1 wherein the adapter includes a compliant body that defines at

least part of the adapter cavity, and which is compressed against one or both of the connector and the cable in the second position of the adapter.

13. The cable assembly of claim 1 wherein the connector includes a retainer tab arranged to releasably retain the connector in a socket of a mating connector, and wherein the retainer tab is located outside of the adapter.

14. The cable assembly of claim 13 wherein the adapter when in the second position moves the retainer tab to a position permitting removal of the connector from said mating connector.
