

ELECTRICAL CONNECTOR ASSEMBLY

FIELD OF THE INVENTION

- 5 The disclosures made herein relate generally to the field of electric circuits and more particularly relates to an electrical connector assembly for an electrical device located in a fluid chamber.

BACKGROUND OF THE INVENTION

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- In general, electronic devices such as diodes, transistors, integrated circuits (IC) and the like, are formed on a substrate element through different techniques. For example, ready-made electronics such as various surface mount devices (SMD) may be mounted on a substrate surface that ultimately forms an inner or outer
15 interface layer of a multilayer structure. Development of technologies has led to printed electronics, wherein the electronic devices are printed on a rigid or flexible substrate.

- Introduction of printed electronics had widened the opportunities for applying
20 electronics, particularly in complex operations viz. monitoring internal operations of a gearbox, motor, generator and the like. However, printed electronics are mostly prone to damage when involved in such complex operations under harsh environments.

Indian Patent Publication No.: IN-2011DN07596-A discloses an encapsulated circuit device used in a vehicle engine compartment. The device comprises an encapsulation around an electronic device, which includes a set of electronic components disposed on a rigid substrate. The encapsulation includes a
5 compressible inner layer and a rigid outer layer, wherein the inner layer is between the components and the outer layer and the outer layer is attached to the inner layer. The inner layer is configured to absorb deformation due to thermally induced movement of the substrate surface and the components.

10 Hence, there is a need for an electrical connector assembly, which protects electrical connectors such as flexible printed circuit (FPC), from external damaging factors without causing any stress or vibration to such connectors. Furthermore, there is a need for preventing mixing of fluids in two chambers to provide accurate measurements, while allowing electrical connection between
15 devices in the two chambers.

SUMMARY OF THE INVENTION

The present invention relates to an electrical connector assembly for an electrical
20 device located in a first fluid chamber. The assembly comprises an electrical connector connected to the electrical device extending between the first fluid chamber and a second fluid chamber through a junction between the chambers. The assembly further comprises a housing positioned at the junction and at least partially enclosing the electrical connector.

The housing includes an inner layer and an outer layer, wherein the inner layer is formed by low-pressure molding and the outer layer is formed by high-pressure molding. The inner layer encapsulates at least a portion of the electrical connector,
5 while the outer layer encapsulates at least a portion of the inner layer. Furthermore, the outer layer forms an airtight seal between the fluid chambers. Each of the chambers contain a fluid same as or different from one another.

Preferably, at least one of the inner layer and the outer layer is formed of plastic
10 material. More preferably, the plastic material is at least one of polyamide and glass fiber-reinforced polymer.

In one aspect of the present invention, the outer layer includes at least one rubber seal coming in contact with the junction when the assembly is positioned at the
15 junction. Furthermore, the outer layer is snap-fitted to at least one of the fluid chambers.

In one embodiment, the electrical device is a sensor for detecting a parameter of a gearbox and the electrical connector is at least one of a flexible printed circuit
20 (FPC), a rigid printed circuit i.e. printed circuit board (PCB), and a flat electric cable.

Since the outer layer is formed by high pressure molding, the outer layer forms a hard cover over the inner layer, thus protecting the inner layer and the electrical

connector encapsulated therein from any external damages caused by the fluids in the chambers, heat, vibration and the like. On the other hand, since the inner layer is formed by low-pressure molding, the inner layer functions as a buffer layer between the outer layer and the electrical connector, such that the electrical connector is protected from any stress caused during the high-pressure molding of the outer layer. Furthermore, the outer layer forms the airtight seal between the chambers, thus preventing an entry of the fluids from one chamber to the other chamber, and therefore protecting the fluids from contamination, while allowing the FPC to extend between the two chambers.

Various objects, features, aspects and advantages of the invention will become more apparent from the following detailed description of preferred embodiments, along with the accompanying drawing figures in which like numerals represent like components.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWING

In the figure, similar components and/or features may have the same reference numerals. Further, various components of the same type may be distinguished by following the reference numerals with a second numeral that distinguishes among the similar components. If only the first reference numeral is used in the specification, the description is applicable to any one of the similar components having the same first reference numeral irrespective of the second reference numeral.

FIGURE 1 shows a cross sectional view of an electrical connector assembly, in accordance with an exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

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In accordance with the present disclosure, there is provided an electrical connector assembly for an electrical device located in a fluid chamber, which will now be described with reference to the embodiments shown in the accompanying drawing. The embodiments do not limit the scope and ambit of the disclosure.

10 The description relates purely to the embodiments and suggested applications thereof.

The embodiments herein and the various features and advantageous details thereof are explained with reference to the non-limiting embodiment in the following description. Descriptions of well-known components and processes are
15 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 embodiment herein. Accordingly, the description should not be construed as limiting the scope of the embodiment herein.

20 The description hereinafter, of the specific embodiment will so fully reveal the general nature of the embodiments herein that others can, by applying current knowledge, readily modify or adapt or perform both for various applications such specific embodiment without departing from the generic concept, and, therefore,

such adaptations and modifications should and are intended to be comprehended within the meaning and range of equivalents of the disclosed embodiments. It is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

- 5 **FIGURE 1** shows a longitudinal sectional view of an electrical connector assembly, in accordance with an exemplary embodiment of the present invention. The assembly (10) comprises an electrical connector in the form of a flexible printed circuit (FPC) (11) and a housing at least partially enclosing the FPC (11). The FPC is connected to an electrical device (1) located in a first fluid chamber
- 10 (3) and extends between the first fluid chamber (3) and a second fluid chamber (4) through a junction (not shown) between the chambers (3, 4). Preferably, each of the fluid chambers (3, 4) contains a fluid same as or different from one another, and the housing (12) is positioned at the junction to block passage of the fluids from one of the chambers (3, 4) to the other of the chambers (3, 4).
- 15 The housing (12) includes an inner layer (13) encapsulating at least a portion of the FPC (11) and an outer layer (14) encapsulating at least a portion of the inner layer (13). The inner layer (13) is formed by low-pressure molding and the outer layer (14) is formed by high-pressure molding. The inner layer (13) and the outer layer (14) are formed of same or different plastic materials. Preferably, the inner
- 20 layer (13) and the outer layer (14) are formed of different polymer materials. More preferably, the inner layer (13) is formed of a polyamide and the outer layer is formed of a glass fiber-reinforced polymer. Most preferably, the inner layer (13) is formed of Macromelt 6839S and the outer layer (14) is formed of BFG30-

BN00B2. The outer layer (14) is configured to form an airtight seal between the fluid chambers (2, 3), when the assembly (10) is positioned at the junction. In one embodiment, the outer layer (14) includes at least one gasket (15) in the form of a rubber seal. The gasket comes in contact with the junction when the assembly
 5 (10) is positioned at the junction, such that the airtight seal is formed between the fluid chambers (2, 3).

In one embodiment, the outer layer (14) is snap-fitted to at least one of the chambers (3, 4). Alternatively, the outer layer (14) is removably fastened to at least one of the chambers (3, 4) by any other conventional means e.g. mechanical
 10 fastener, adhesives, etc. In a preferred embodiment, the electrical device (1) is a sensor for detecting a parameter e.g. temperature, vibration, etc., of a gearbox such as vehicle gearbox.

Since the outer layer (14) is formed by high pressure molding, the outer layer (14) forms a hard cover over the inner layer (13), thus protecting the inner layer (13)
 15 and the FPC (11) encapsulated therein from any external damages caused by the fluids in the chambers (3, 4), heat, vibration and the like. On the other hand, since the inner layer (13) is formed by low-pressure molding, the inner layer (13) functions as a buffer layer between the outer layer (14) and the FPC (11), such that the FPC (11) is protected from any stress and/or vibration caused during the
 20 high-pressure molding of the outer layer (14). Furthermore, the outer layer (14) forms the air-tight seal between the chambers (3, 4), thus preventing movement of the fluids between the chamber (3, 4), and therefore protecting the fluids from

contamination, while allowing the FPC to extend between the two chambers, which in turn helps in accurate operation of the electrical device (1).

Even though the present invention is described as being applied for protecting the FPC (11), it is to be understood that the present invention can also be used for protecting any electrical component including but not limited to rigid printed circuits i.e. printed circuit board (PCB), flat cables and any other conventional electrical connectors.

The terminology used herein is for the purpose of describing particular example embodiments only and is not intended to be limiting. As used herein, the singular forms "a", "an" and "the" may be intended to include the plural forms as well, unless the context clearly indicates otherwise. The terms "comprises", "comprising", "including" and "having" are inclusive and therefore specify the presence of stated features, integers, steps, operations, elements and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components and/or groups thereof.

The method steps, processes and operations described herein are not to be construed as necessarily requiring their performance in the particular order discussed or illustrated, unless specifically identified as an order of performance. It is also to be understood that additional or alternative steps may be employed. The use of the expression "at least" or "at least one" suggests the use of one or

more elements, as the use may be in one of the embodiments to achieve one or more of the desired objects or results.

CLAIMS

1. An electrical connector assembly (10) for an electrical device (1),
comprising:
 - 5 a) an electrical connector connected to said electrical device (1)
extending between a first fluid chamber (3) and a second fluid
chamber (4) through a junction between said chambers (3, 4), wherein
each of said fluid chambers (3, 4) contain fluid; and
 - b) a housing (12) positioned at said junction and at least partially
10 enclosing said electrical connector,
characterized in that said housing (12) includes:
 - i. an inner layer (13) formed by low pressure molding and
encapsulating at least a portion of said electrical connector; and
 - ii. an outer layer (14) formed by high pressure molding and
15 encapsulating said inner layer (13), wherein said outer layer (14)
is configured to form an air-tight seal between said fluid chambers
(2, 3), when the electrical connector assembly (10) is positioned
at said junction.
2. The electrical connector assembly (10) of claim 1, wherein said outer layer
20 (14) includes at least one gasket (15) coming in contact with said junction
when the electrical connector assembly (10) is positioned at said junction.
3. The electrical connector assembly (10) of claim 1, wherein said outer layer
(14) is snap-fitted to at least one of said fluid chambers (3, 4).

4. The electrical connector assembly (10) of claim 1, wherein said electrical device (1) is a sensor for detecting a parameter of a gearbox.
5. The electrical connector assembly (10) of claim 1, wherein at least one of said inner layer (13) and said outer layer (14) is formed of plastic material.
- 5 6. The electrical connector assembly (10) of claim 5, wherein said plastic material is at least one of polyamide and glass fiber-reinforced polymer.
7. The electrical connector assembly (10) of claim 5, wherein said inner layer (13) is formed of Macromelt 6839S and said outer layer (14) is formed of BFG30-BN00B2.
- 10 8. The electrical connector assembly (10) of claim 1, wherein said electrical connector is at least one of a flexible printed circuit (11), rigid printed circuit and flat electric cable.