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DEVICE FOR EXTRACTING AN INSERT FROM A CONNECTOR ASSEMBLY

STATEMENT OF GOVERNMENT INTEREST

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

BACKGROUNG OF THE INVENTION

(1) Field of the Invention

The present invention relates to a device to repair electrical connectors, and more specifically to a device to facilitate the extraction of connector inserts from underwater connector assemblies needing repair or replacement.

(2) Description of the Prior Art

Many applications, including acoustic arrays, employ standard Sea-Con brand MIN-BCR and FCR series connectors. These connectors, which are used widely throughout the Navy and private industry, are high density, machined connectors that are relatively expensive and have fragile plastic inserts. When used with acoustic arrays, the connectors are typically installed by mounting the connector shell into a bulkhead or flat panel. Necessary connections from wires fed through the shell from the rear are then made to contacts permanently molded into the connector insert. The connector insert, which
comprises a glass reinforced epoxy material, is then fitted with an O-ring and pressed into place in the connector shell from the front where it is retained with a snap ring.

At times, it becomes necessary to repair or alter the wiring at the connectors. The connectors, which are relatively small, have a high number of contacts (up to 203) per connector and are often installed in a location where access to the connector is restricted. Therefore, the connector insert must be removed to repair or alter the wiring. However, due to the close tolerances of the connector shell and insert and to the O-ring seal between the insert and the shell, a significant force must be applied to the rear of the connector to extract the insert from the shell. Furthermore, the glass reinforced epoxy insert is very brittle making it susceptible to binding and fracturing during removal if it does not remain true in the bore of the shell.

Current procedures for removing connector inserts use dowels, drift pins or the like to tap out the connector insert from the rear. Because the rear of the insert has numerous contacts with wires soldered thereto, removal of an insert is a time consuming task which often is not very successful. The current procedures offer little assurance for the removal of the insert without damaging the wires or connections, breaking the insert or damaging the connector itself. Therefore, it is often necessary to have spare connectors and inserts on hand. In addition to the cost of storing and replacing the inserts, replacement of an insert is often a difficult, time consuming
process involving substantial rewiring work which may itself
result in costly and time consuming wiring errors.

Thus, what is needed is a device to more readily and safely
extract connector inserts from the shell without breaking the
insert or damaging any connections to the insert.

SUMMARY OF THE INVENTION

Accordingly, it is a general purpose and object of the
present invention to provide an extraction device to remove a
connector insert from a connector shell.

Another object of the present invention is to provide a
device which maintains even pressure on a connector insert to
allow removal of the insert without binding or fracturing the
insert.

A further object of the present invention is the provision
of a device which remains true within a connector shell while
maintaining an even pressure on the insert during removal of the
insert.

These and other objects made apparent hereinafter are
accomplished with the present invention by providing an
extraction device adapted to push connector inserts from a
connector assembly. A substantially cylindrical extraction
device has an outer diameter which is tapered in steps, an inner
diameter defined by a central bore extending longitudinally
through the full length thereof and a slot running the length of
the device providing access to the central bore.
To remove an insert from the connector assembly, any wires connected to the insert are slipped through the slot and into the central bore and the extraction device is slid into the shell from the rear. A force is then applied to the device to push the insert out the connector shell. The tapered diameter holds the device true within the shell and allows the insert to be removed without damaging the insert or the shell.

**BRIEF DESCRIPTION OF THE DRAWINGS**

A more complete understanding of the invention and many of the attendant advantages thereto will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in conjunction with the accompanying drawings wherein like reference numerals and symbols designate identical or corresponding parts throughout the several views and wherein:

FIG. 1 is a side view of a connector insert extraction device in accordance with the present invention;

FIG. 2 is an end view of an extraction device in accordance with the present invention; and

FIGS. 3A, 3B and 3C illustrate various stages in the removal of a connector insert using an extraction device of the present invention.

**DESCRIPTION OF THE PREFERRED EMBODIMENT**

Referring now to FIGS. 1 and 2, there is shown a connector insert extraction device 10 in accordance with the present
invention. Extraction device 10 comprises a substantially cylindrical member 12 having an inner diameter D4 defined by a bore 14 extending longitudinally through the full length thereof and an outer diameter which is tapered, in steps, over the length of the extractor. Preferably, extractor 10 is tapered in two steps to divide cylindrical member 12 into three integral sections: a base section 16 having an outer diameter D1 over length L1, a guide section 18 defined by outer diameter D2 for a length L2 and an engagement section 20 having an outer diameter D3 for a length L3. Additionally, the steps in the outer diameter from D1 to D2 and from D2 to D3 define radially extending, circumferential shoulders 22 and 24. A slot 26 extending longitudinally through the full length of cylindrical member 12 allows the extractor to be slipped over wires connected to an insert which is to be removed.

The dimensions of extractor 10 are chosen to allow the extractor to remain true within a connector shell and to maintain an even pressure and uniform contact across the face of the insert. The insert can then be extracted by simply applying a linear force to extractor 10 to push the insert from the shell. This is shown more clearly with additional reference to FIGS. 3A - 3C which illustrate various stages in the removal of an insert using an extraction device of FIGS. 1 and 2.

Referring to FIGS. 3A - 3C, there is shown an extraction device 10 as described in reference to FIGS. 1 and 2 and a connector 30. In FIGS. 3A - 3C connector 30 is shown with a portion of shell 32 cut-away to reveal a connector insert 34.
with wires 36 connected to contacts 38 extending from the rear face 34A of insert 34. The wires 36 are shown extending from connector 30 in a bundle 40, although wires 36 need not be bundled. Typically, the shell 32 is mounted into a flat panel or bulkhead (not shown) after which wires 36 are fed completely through the shell. To complete the installation, the necessary connections of wires 36 to contacts 38 are made and insert 34 is fitted with an O-ring 42 and pressed into place in shell 32. A circumferential flange 44 extending radially inward divides shell 32 into a rearward base section 46 and a forward insert section 48 and prevents insert 34 from being inserted too far into the shell.

To remove insert 34 from shell 32 using device 10, wires 36 are slipped through slot 26 and into bore 14, thereby allowing the device to be slid into the base section 46 of connector shell 32 (FIG. 3A). Device 10 is slid into base section 46 of shell 32 until face 20A of engagement section 20 abuts face 34A of insert 34 (FIG. 3B). A force in the direction of arrow 50 is then applied to device 10 to push insert 34 out of shell 32 (FIGS. 3B and 3C). As the force is applied to device 10, the device continues to push insert 34 from shell 32 until circumferential shoulder 22 comes into contact with the shell and prevents further insertion of the device the shell 32.

As can be seen in FIGS. 3A and 3B, the width 28 of slot 26 only needs to be wide enough to slip wires 40 therethrough and into bore 14. Inner diameter D4 (FIG. 1) of device 10, however, is chosen to be large enough to provide clearance for all the
contacts 38 and any wires 36 connected thereto along with any heat shrink tubing or the like protecting and isolating the connections. This clearance provided by diameter D4 allows face 20A to abut face 34A without damaging the wires 36, contacts 38 or any connections between the two. It has been found that for most standard BCR and FCR series connectors a slot width 28 of approximately 0.740 - 0.760 inches is sufficient to slip wires therethrough while an inner diameter D4 of approximately 0.846 - 0.866 inches is necessary to provide clearance for the wires 36, contacts 38 and connections.

From FIGS. 3B and 3C, it can be seen that outer diameters D2 and D3 (FIG. 1) of sections 18 and 20 are chosen to correspond with the clearance available within shell 32. To push insert 34 from shell 32, diameter D3 must be smaller than the diameter of the opening defined by the radially inward extending flange 44. Preferably, diameter D3 is chosen to provide slip fit clearance between engagement section 20 and flange 44. Similarly, outer diameter D2 is preferably selected so as to provide slip fit clearance within base section 42, thereby allowing guide section 18 to slide in an axial direction within shell 32 while preventing movement of section 18 in a radial direction.

Preventing radial movement within shell 32 assures that device 10 remains true within the shell and that the force applied to the device will be substantially equally distributed across face 34A of insert 34 when it is transferred to the insert. When a force in the direction of arrow 48 is applied to
device 10, insert 34 will be pushed from shell 32 without binding and fracturing. It has been found that an outer diameter D3 of approximately 0.976 - 0.986 inches and an outer diameter D2 of approximately 1.065 - 1.075 inches will provide slip fit clearance and keep the device straight in the shell as it is pushed therethrough.

From FIGS. 3B and 3C it can be seen that lengths L2 and L3 of sections 18 and 20 are chosen with regard to the dimensions of shell 32. To fully push insert 34 from shell 32, the combined length (L2 + L3) of sections 18 and 20 should at least equal the length of the shell. Additionally, length L2 should be long enough to ensure device 10 will remain true within the bore, yet be short enough to prevent shoulder 24 from striking and damaging flange 44. Similarly, the length L3 of section 20 should be short enough to ensure that enough of section 18 is within shell 32 to keep device 10 true within the shell and maintain an even pressure across face 34A when a force is initially applied to the device. It has been found that a device with sections 18 and 20 having a combined length (L2 + L3) of approximately 1.541 - 1.561 inches with section 20 having a length L3 of approximately 0.630 - 0.650 inches will keep device 10 true within the shell and fully remove insert 34.

The outer diameter D1 of base section 16 is sized larger than the clearance within shell 32 to prevent the device from being inserted too far into the shell and to provide a surface to which a linear force can easily be applied. It has been found that an outer diameter D1 of approximately 1.148 - 1.168
inches provides a large enough surface area to allow application of a force to remove the insert while preventing device 10 from being inserted too far. Additionally, length L1 of section 16 should be long enough to provide an area to apply a force, yet be short enough to allow the device to be easily inserted when the connector is installed in tight spaces. It has been found that a device having an overall length (L1 + L2 + L3) of approximately 2.645 - 2.665 inches will allow access to tight spaces.

Thus, what has been described is a novel device for removing the insert from an underwater connector such as a Sea-Con brand MIN-BCR or FCR series connector that offers several significant advantages over prior art systems. The device allows the inserts to be quickly and easily extracted from the connector assemblies without damaging the insert, the connector or the wiring.

It will be understood that various changes in the details, materials, steps and arrangement of parts, which have been herein described and illustrated in order to explain the nature of the invention, may be made by those skilled in the art within the principle and scope of the invention.
DEVICE FOR EXTRACTING AN INSERT FROM A CONNECTOR ASSEMBLY

ABSTRACT OF THE DISCLOSURE

A substantially cylindrical extraction device adapted to push connector inserts from a connector assembly has an outer diameter which is tapered in steps, an inner diameter defined by a central bore extending longitudinally through the full length of the device. A slot running the length of the device allows wires extending from connector to be slid into the bore. Inserts are removed from the connector assembly by sliding the device into the connector from the rear and applying a linear force to the device to push the insert from the connector.