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<td>6/28/77</td>
<td>W. Sowers</td>
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<td>D. Dunfee</td>
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<td>Update to latest format, added information on neoprene inserts/water blocks. Per E3364</td>
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<td>J. Fernald</td>
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CARE, CLEANING, AND MAINTENANCE OF TDGO UNDERWATER ELECTRICAL PLUGS AND RECEPTACLES

1.0 INTRODUCTION

Teledyne D. G. O’Brien, (TDGO) connectors are precision, high-quality components. They should always be handled properly due to their critical function. Care and good judgment will go a long way toward giving reliable, trouble-free service.

This instruction manual serves as a general guide for the care, cleaning, testing and mating of TDGO glass-sealed receptacles and plugs. The products for which this manual is intended include the general TDGO product families 107, 110, 117, 128 and 148. The interface design of 107 and 117 connectors is based on Mil-C-24217.

Always check the specific product being used, the associated assembly drawing and product data sheet in order to be familiar with the specifics of the product before proceeding.

2.0 REFERENCES

- Material Safety Data sheets for any chemical mentioned in this procedure

3.0 IMPORTANT NOTICES

- WARNINGS:
  - This instruction manual is written based on the assumption that any person using it is trained and qualified in the proper use and operation of the equipment, tools, chemicals, and materials referenced herein. If you are not qualified or trained in these areas, do not proceed. Seek qualified assistance.

4.0 GENERAL DISCUSSION

4.1 The contact areas of underwater electrical connectors must, without exception, be kept free of contamination. Moisture, salt water, grime, rust particles, and most solvents are almost certain to cause circuit problems and often result in damage to the connectors.

NOTE: Dirt and moisture are the worst enemies of electrical connectors, especially in underwater and harsh environments. Dirt and moisture will affect electrical performance and O-ring seal integrity. Always be aware of O-ring sealing surfaces and inspect them for nicks, scratches, dings and contamination before each assembly. O-rings should be installed new and with a light coating of O-ring lubricant at each assembly.

4.2 The connectors, as manufactured and unterminated, have very high insulation resistance requirements (1000 megohms minimum at 500 volts DC is typical). Terminated connectors
have lower IR due to parallel resistance that is dependent on the cable/wire design and construction, number of conductors, conductor spacing, and the overall length of the cable/wire.

4.3 Because the physical spacing between the contacts and to ground within the connector are necessarily small, very little in the way of conductive contamination is required to cause current leakage. This can result in signal errors and, if moisture is present, erosion of the contacts through electrolysis will occur. This can be severe enough to burn the contacts through and often cause damage to the insulators.

5.0 RECEP'TACLE/PLUG DISASSEMBLY

5.1 Extreme care should be exercised when working with the connectors. Whenever plugs are being unmated from a receptacle, be sure all the water has been removed from around them before starting to loosen the coupling ring. This can best be accomplished using rags and blowing thoroughly with compressed air.

5.2 After all the water has been removed, back off the coupling ring just enough to relax the thread bind but not enough to start disengaging the plug. Rotate the coupling ring back and forth by hand to work the water from the threads. Wipe away the water with clean dry rags or paper towels, but do not use compressed air. This might blow water into the mating faces.

5.3 When it is believed that all possible water has been removed, start backing out the plug using the coupling ring to jack the parts apart. Gently rock the plug from side to side, by hand, while turning the coupling ring. This will overcome binding and friction, and greatly reduce the torque required to disengage the parts. As soon as the parts are unmated, carefully wipe away any water with paper towels and install clean, dry protective caps with proper face seal O-rings installed.

5.4 Inspect the receptacle bore for contamination or moisture. If any is observed, clean immediately per step 7.0.

5.5 When not in use, all plugs and receptacles should be capped by a protective cap (with O-ring properly installed) or a pressure-proof cap to prevent contamination.

5.6 Cable assemblies which have been removed from a system or that are to be installed in a system can be checked for contamination by measuring insulation resistance. A value of 1000 megohms minimum at 500V DC between each contact and the plug body is the typical requirement. Even a low voltage multi-tester will often give an indication of contamination. Be sure the plug bodies are connected together electrically and be sure the ground lead from the test instrument is used to connect to the plug body.
6.0 GENERAL CLEANING PROCEDURES

6.1 Glass Sealed Plugs and Receptacles can come in a variety of configurations. Both can have either pins or contacts, and insulators/waterblock can vary. Please contact TDGO for any questions regarding the configuration of the connector requiring maintenance.

**CAUTION 1:** Using solvents for cleaning the electrical portions of the connectors is not recommended. If a solvent must be used, use only those mentioned below and in the manner prescribed. This is because there are many coatings and materials used in the connectors which are attacked by many common solvents, and some solvents are conductive. Other solvents will leave conductive residue after evaporating. In addition, O-rings can swell and lose their effectiveness if exposed to some solvents. The best method is to avoid, if possible, having to clean the connectors by preventing interfacial contamination from occurring in the first place.

**CAUTION 2:** It is the user’s responsibility to be familiar with the health and safety issues involved with any and all chemicals and tools used in the cleaning and maintenance of connectors.

7.0 CLEANING GLASS-SEALED RECEPTACLES

7.1 A typical standard configuration of receptacle is shown in Figure 1. The receptacle has no insulators. TDGO only recommends cleaning the nose, face seal O-ring, and O-ring grooves. Be careful not to scratch or ding the plug nose between the end of the keyways and the flange as this is a 32 RMS o-ring sealing surface. IN NO CASE should a glass-sealed receptacle be dipped into or have poured into it a solvent of any kind.

7.2 If minor contamination is suspected or has occurred, wipe away with paper towels, tissue, and cotton swabs. Be very careful not to bend the pins out of alignment. A low velocity jet of dry (filtered) shop air, nitrogen or “CRC Duster” (or equivalent) is required to blow out liquid contamination from the interface.

**CAUTION:** Exercise care to completely remove any loose lint or cotton filaments as these can cause functional degradation.
FIGURE 1
GLASS SEAL RECEPTACLE

- **O-RING GROOVE**
- **CONTACT PIN**
- **FACE SEALING SURFACE**
- **KEY**
7.3 Some receptacles may be supplied with neoprene water block front insulators and contacts. See Figure 2. TDGO does not recommend removal of this insulator. Too much force can tear or rip the insulator. Do not probe, pry or insert sharp objects into the socket contact holes as this can damage the pins or sockets in the receptacle.

7.3.1 The front face of the insulator may be cleaned using isopropyl alcohol. Other type solvents may attack the neoprene insulators.

7.3.2 If salt water contamination has occurred, the front face of the insulator may be rinsed in warm water and blown dry, followed by a dip in clean isopropyl alcohol. It is critical to ensure that the alcohol is completely evaporated after cleaning.

7.4 Receptacles which do not have neoprene insulators that have excessive contamination shall be cleaned using clean isopropyl alcohol. It may be used on a cotton swab or with a soft brush for localized contamination. For more extensive contamination, the receptacle can be flooded with the alcohol, but must be drained quickly and thoroughly allowing plenty of time for the alcohol to evaporate before capping the plug. Blowing out the interface as described in step 7.2 will accelerate and promote complete drying.

7.5 Cap the receptacle with the appropriate protective cap or pressure-proof cap to prevent contamination and to protect the interface from humid environments (be sure O-rings are installed).
FIGURE 2

GLASS SEALED MID FLANGE RECEPTACLE
WITH NEOPRENE WATERBLOCK

RETIING COLLAR

CONTACT

SET SCREW

FACE SEALING SURFACE

NEOPRENE INSULATOR

RING COUPLING

CONTACT
8.0 CLEANING GLASS-SEALED PLUGS

8.1 There are two types of glass sealed plugs – those with hard plastic insulators, and those with neoprene insulators. Cleaning procedures are different depending on the configuration of the plug.

8.2 Some glass sealed plugs may have removable hard plastic insulators. See Figure 3. These should be removed before any cleaning is performed.

NOTE: Before starting, it may be helpful to make a notation of the pin/contact position identification relative to the key. Keep this note to check that the insulator is properly oriented after reassembly.

8.2.1 Remove the insulator retaining set screws.

8.2.2 Remove the front insulator half. This can be done by working the insulator out using scribes in the key slots and prying outward. It is a slow process and too much force can chip or break the insulators.

8.2.3 Pull out the double ended contacts, if configured as such.

8.2.4 Lift out the rear insulator.

8.2.5 Insulators and contacts may be cleaned using isopropyl alcohol. Other types of solvents may remove marking or craze the insulator plastic. If salt water contamination has occurred, the insulators may be rinsed in warm water and blown dry, followed by a dip in clean isopropyl alcohol. It is critical to insure that the alcohol is completely evaporated after cleaning.

8.2.6 Reinstall the insulator by following the steps above.

8.2.7 Check the insulator orientation relative to the main key against note taken above, or the drawing.

8.3 Some glass-sealed plugs (such as those used in oil filled cables) are supplied with neoprene water block front insulators. See Figure 4. TDGO only recommends cleaning the exterior of the nose, face seal O-ring, and O-ring surfaces on the plug. TDGO does not recommend removal of this insulator. Too much force can tear or rip the insulator. Do not probe, pry or insert sharp objects into the socket contact holes as this can damage the sockets. See step 7.3 for cleaning plugs with neoprene insulators.

8.4 Cap the plug with the appropriate protective cap or pressure-proof cap to prevent contamination and to protect the interface from humid environments. (be sure O-rings are installed).

8.5 Contact TDGO for assistance with specific part number identification of any parts that require replacement.
FIGURE 3

GLASS SEALED PLUG
WITH REMOVEABLE HARD PLASTIC INSULATORS

- FRONT INSULATOR
- REAR INSULATOR
- CONTACT
- SET SCREW
- FACE SEAL O-RING
- RING COUPLING
- CONTACT
- FRONT INSULATOR
- REAR INSULATOR
- SET SCREW
- FACE SEAL O-RING
- RING COUPLING
FIGURE 4

GLASS SEALED PLUG
WITH NEOPRENE WATERBLOCK

- RETAINING COLLAR
- SET SCREW
- NEOPRENE INSULATOR
- CONTACT
- FACE SEAL O-RING
- RING COUPLING
9.0 O-RING MAINTENANCE

9.1 General Conditions

9.1.1 The sealing O-rings should be inspected each time before a plug and receptacle are mated. They should be in place, clean and free of nicks, cuts, twists, and any indication of compression set. If not, they should be removed using wooden or plastic tools, never metallic, and wiped clean or replaced with new seals. It is generally good practice to replace any used seal with a new seal.

9.1.2 The O-rings specified for most 107, 110, 117 and 128 connectors are in accordance with M28775 or M83461. This is a Nitrile (Buna-N) compound of 70 durometer. Always refer to the relevant top level assembly drawing or product literature for the specific O-ring used with a product.

9.2 Clean all O-ring grooves and sealing surfaces with cotton swabs and clean isopropyl alcohol to remove dirt, film, or grit. Be certain that all alcohol has evaporated or been removed from O-ring grooves before installing O-rings in the grooves. Be careful the alcohol does not contaminate the insulator and contacts located within the plug body or the glass-sealed header. Inspect all O-ring contact areas for burrs, sharp edges, or scratches that could possibly damage O-rings and render the seal useless.

9.3 The O-ring should be wiped off and run through clean fingers to feel for nicks, cuts, and grit. If the O-ring looks deformed, discard it and replace it with a new seal. A light film of lubricant should be applied to the O-ring before it is installed. For standard Nitrile (Buna-N) O-rings, lubricate with a thin coating of silicone grease, Dow Corning DC-55 O-ring lubricant or DC-4, before assembly. The purpose of this lubricant is not to form a seal, but to make the rubber slide easily so that it maintains its shape and “flows” into position. Therefore, this should be a thin coating—only enough to give the O-ring a “shine”. Excessive lubricant can prevent O-rings from working properly.

10.0 RECEPTACLE ASSEMBLY INSTALLATION

10.1 Refer to the appropriate installation drawing for determining the correct part numbers.

10.2 Refer to the preceding section for O-ring preparation.

10.3 Refer to the preceding section 7.0 for cleaning before mating.

10.4 In accordance with the preceding section, inspect and install the appropriate face seal O-ring onto the back side of receptacle flange, inspect and install appropriate piston seal O-ring located on the external throat. See Figure 1.

10.5 In accordance with the preceding section, inspect and install the appropriate piston seal O-ring within the internal gland located in the plug mating interface. The O-ring should be positioned so that it exhibits minimal torsion. See Figure 1.

10.6 Install receptacle assembly into the appropriate pocket (prep) using specific mounting hardware (screws & lock washers) supplied with assembly.
11.0 PLUG ASSEMBLY INSTALLATION

11.1 Refer to the appropriate installation drawing for determining the correct part numbers.

11.2 Refer to the preceding section for O-ring preparation.

11.3 Refer to the preceding section 8.0 for cleaning before mating. When cleaning, be careful not to contaminate the glass-sealed area of the mating receptacle interface.

11.4 In accordance with the preceding section, inspect and install the appropriate face seal O-ring over the plug nose and position evenly in the gland located on the plug flange. The O-ring should be positioned so that it exhibits minimal torsion. See Figure 3.

11.5 In accordance with the preceding section, inspect and install the appropriate piston seal O-ring within the internal gland located in the receptacle mating interface. The O-ring should be positioned so that it exhibits minimal torsion. See Figure 1.

11.6 Being careful not to damage the external sealing face of the receptacle mating interface, align the plug/receptacle keying and insert plug assembly to allow for engagement of coupling ring on the receptacle threads. Using the appropriate spanner wrench, tighten the coupling ring until the plug flange seats against the receptacle mating interface (metal to metal). Full engagement is achieved when the coupling ring can no longer be turned. For standard connectors, apply torque as listed below.

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<th>Plug PN</th>
<th>Pin Config</th>
<th>Coupling Ring Diameter</th>
<th>Coupling Ring Thread</th>
<th>Spanner Wrench Number</th>
<th>Applied Torque (ft.-lb.)</th>
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11.7 At this time, it is advisable to check continuity and insulation resistance (IR) to ensure proper wiring and IR for the system.