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| REV                | A       | APPLICATION |         |
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| SHT                | 1       |             |         |
| NAVSEA DRAWING NO. | 8283420 |             |         |
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| REVISIONS |                                       |          |                       |
|-----------|---------------------------------------|----------|-----------------------|
| REV       | DESCRIPTION                           | DATE     | APPROVED              |
| A         | Revised plunger dimensions and colors | 05/08/07 | <i>Robert A Throm</i> |
|           |                                       |          |                       |
|           |                                       |          |                       |

**Scope**

This Navy Drawing contains the plunger endface and the applied load requirements for a fiber optic terminus retention clip seating tester. Different endface requirements are given that pertain to the MIL-PRF-29504/4 & /5 termini (for use with the MIL-DTL-38999 Series III connector), the MIL-PRF-29504/14 & /15 termini (for use with the MIL-PRF-28876 connector), and the MIL-PRF-29504/18 terminus (for use with the MIL-PRF- NGCon connector).

**Intent**

1. This Navy Drawing supports the Government's intent to provide the Fleet/Field maintainer with a means to inspect for and verify that a terminus is seated properly within the connector insert. Different seating configurations exist, dependent upon terminus type. The terminus that does not contain a retention clip is checked to ensure proper seating of the terminus within the retention clip of the connector insert. This configuration is found for termini used with the MIL-DTL-38999 Series III connector. The terminus containing a retention clip is checked to ensure proper seating of the retention clip within the connector insert. This configuration is found for termini used with the MIL-PRF-28876 and MIL-PRF-NGCon connectors.
2. This Navy Drawing supplements procurement documentation for this type tester.
3. This Navy Drawing minimizes variables in testing by standardizing areas of plunger interface with the terminus and applied loading. Minimizing test variables permits more accurate comparison of test results from multiple sources of supply for this tester.

**Notes**

1. Identification of the suggested items herein is not to be construed as a guarantee of present or continued availability.
2. Substitution of items is not allowed without approval of the Design Activities, NSWC DD Warfare Systems Department and NAVAIR 4.8.6.7. NAVAIR 4.4 and NAVAIR 4.5, in addition to NSWC DD Warfare Systems Department, provide technical support for this effort.
3. Individual items shall be procured using the vendor part number.
4. Complete tester, including the plungers, shall be procured using the base drawing number.
5. Source to obtain this document. A copy of this document can be obtained at Web Site: <https://fiberoptics.nswc.navy.mil/> in the NAVSEA Drawing section under Component Information.
6. Inquiries and clarifications on this Navy Drawing are to be placed in writing and sent by e-mail to NSWC DD Warfare Systems Department at DLGR\_NSWC\_Foweb@navy.mil.
7. Background.
  - a. Electrical contact. A tester is used to verify that an electrical contact is seated within the retention clip (contact retainer clip) of a MIL-DTL-38999 connector. If a "click" is heard, then it is assumed that the terminus is "locked" into place. This may not be the case. Each cavity in a MIL-DTL-38999 connector insert has a retention clip. Each retention clip has at least two fingers. If a contact (or fiber optic terminus) is not inserted completely, the fingers may not lock onto the contact (terminus) shoulder (i.e., the smaller diameter below the shoulder). The fingers of the retention clip remains sitting on top of the shoulder (i.e. the larger diameter of the terminus shoulder). When mated, the action of the two termini contacting can push back on the unlocked terminus.
  - b. Fiber optic termini. A similar tester was desired for verifying proper retention clip seating of a fiber optic terminus. Concerns with not shattering the optical fiber end and the appropriate applied load needed to be addressed prior to the tester design. This Navy drawing is in support of providing those requirements.

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| REV STATUS | REV   | A | A | A |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |
| OF SHEETS  | SHEET | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |

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| UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: | CAGE CODE CONTRACT NO. |                     |  | DEPARTMENT OF THE NAVY<br>NAVAL SEA SYSTEMS COMMAND<br>WASHINGTON, D.C. 20362-5101 |  |     |        |              |  |  |  |  |
|   | APPROVED               | B. McDermott        | 09/18/06   |  |  |     |        |              |  |  |  |  |
| FRACTIONS +/-   | DECIMALS .xx+/-        | CHECKED             | A. Michon  | 09/18/06   | TESTER, RETENTION CLIP SEATING,<br>TERMINI, FIBER OPTIC,<br>MIL-PRF-29504/4, /5, /14, /15, & /18 |     |        |              |  |  |  |  |
| ANGLES P  | .xxx+/-                | CHECKED             | C. Good  | 09/18/06   |  |     |        |              |  |  |  |  |
| DO NOT SCALE DRAWING  |                        | PREPARED            | E. Bluebond  | 09/15/06   | SIZE A CAGE 53711 ESWBS 499 DRAWING NO. 8283420 REV A  |     |        |              |  |  |  |  |
| MATERIAL:   |                        | ACCEPTED FOR NAVSEA | R. Throm   | 09/18/06   |  |     |        |              |  |  |  |  |
| FINISHES:   |                        | APPROVED BY NAVSEA  | (SIGN ONLY IF ENGINEERING HAS BEEN "PROVED" BY MANUFACTURE AND TEST) |  | SCALE: NONE  | UCI | WT GRP | SHEET 1 OF 5 |  |  |  |  |

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1. Plunger endface requirements.

- 1.1 Dimensional requirements. Plunger for socket termini and plunger with alignment sleeve affixed for pin termini shall meet the dimensions in the table specified for each terminus type in figure 1 (see sheet 3).
- 1.2 Color code. The various type termini plungers shall be color coded as follows:
  - 1.2.1 M29504/4 & /5. Violet.
  - 1.2.2 M29504/14 & /15. Yellow.
  - 1.2.3 M29504/18. Black.

2. Material.

- 2.1 Plunger. Stainless steel (303 stainless is acceptable).
- 2.2 Alignment sleeve. Stainless steel.

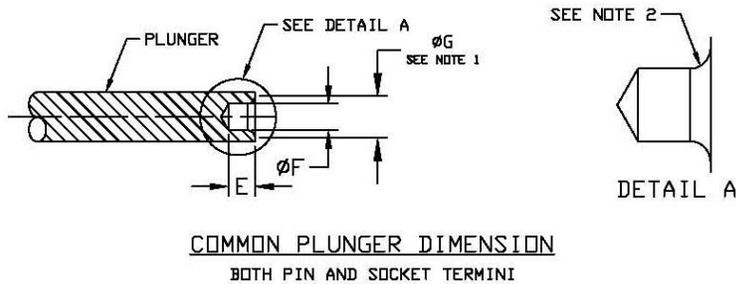
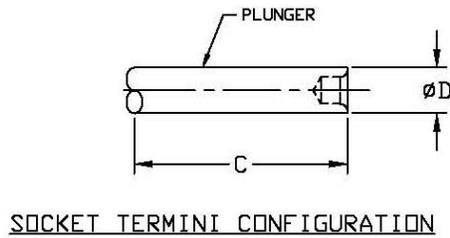
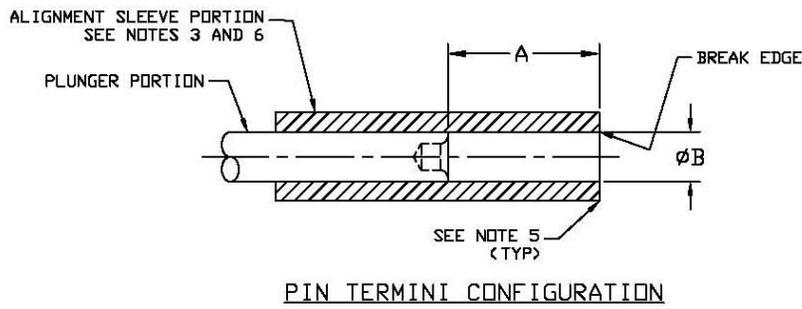
3. Applied load requirement.

- 3.1 Applied force.
  - 3.1.1 Tester shall allow a specified force (load) of  $4 \pm 1$  lb to be applied.
  - 3.1.2 Tester shall contain a visual indication when the specified force (see 3.1.1) has been obtained (reached). Visual indication of when at the specified force shall be detectable and easily noticed.
  - 3.1.3 Tester shall contain a means to calibrate the tester visual indicator, and any other indications (such as sound), at the specified force. Calibration is to be performed by a calibration laboratory, not the operator (using the tester).
- 3.2 Alignment. This alignment refers to the longitudinal axis of the tester plunger being in line with the longitudinal axis of the terminus.
  - 3.2.1 Axial alignment. Tester shall contain a means to prevent a side (off-axial) force from being applied to the terminus. This means of prevention shall work for multiple shell sizes (11 through 25 at a minimum).
  - 3.2.2 Visibility. Tester means of axial alignment shall be in a manner so as to minimize any restriction on visibility to the terminus.
- 3.3 Documentation. Tester to be provided with the following documentation when specified by the Procurement Activity.
  - 3.3.1 Calibration procedure.
  - 3.3.2 Certificate of calibration.

4. Verification of requirements.

- 4.1 Responsibility. Unless otherwise specified by the procuring activity, the supplier is responsible for the performance of all items contained herein with regard to the above requirements.
- 4.2 Performance verification. Dimensional data for the plunger end face and calibration data for the applied load may be provided to demonstrate performance; however, the Procuring Activity reserves the right to perform any of the inspections specified. When specified, test samples shall be submitted to the designated Design Activity for approval.

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| Designation<br>(See Figure 1) | Dimension   |           |           |           |           |               |
|-------------------------------|---|-----------|-----------|-----------|-----------|---------------|
|                               | M29504/4  | M29504/5  | M29504/14 | M29504/15 | M29504/18 | /18 w/ ASR 7/ |
| A                             | .100/.125   |           | .110/.140 |           | .157/.187 |               |
| B                             | .064/.065   |           | .080/.082 |           | .050/.053 |               |
| C                             |   | .285 MIN  |           | .270 MIN  |           | .150 MIN      |
| D                             |   | .060/.061 |           | .076/.077 |           | .045/.046     |
| E                             | .031 MIN  | .031 MIN  | .031 MIN  | .031 MIN  | .031 MIN  | .031 MIN      |
| F                             | .033/.037   | .033/.037 | .033/.037 | .033/.037 | .033/.037 | .033/.037     |
| NOTES:                        | 1/ Dimension G = Dimension F + .010<br>2/ .010 R MIN<br>3/ Alignment sleeve portion shall have a .140 maximum outside diameter<br>4/ All dimensions are in inches<br>5/ Break all sharp edges<br>6/ Alignment sleeve and plunger may be one piece or separate pieces. If the latter, the alignment sleeve shall be permanently affixed to the plunger.<br>7/ /18 w/ ASR = M29504/18 with an Alignment Sleeve Retainer installed.<br>8/ Color shall be in accordance with 1.2. |           |           |           |           |               |

Figure 1. Plunger and Alignment Sleeve Dimensions.

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## APPENDIX A

### CONSIDERATIONS FOR DETERMINING FIBER OPTIC RELATED REQUIREMENTS

1. Objective. Verify that the terminus is fully seated in the connector insert cavity by applying a force on the terminus endface.
2. Considerations for applied force.
  - 2.1 Maximum factors.
    - 2.1.1 Force for retention clip. MIL-DTL-38999 specifies a retention force of 22 lb.
    - 2.1.2 Only one locked finger. The retention clip in a MIL-DTL-38999 connector insert has at least two fingers. If a contact (or fiber optic terminus) is inserted at an angle, only one finger may come down and lock onto the contact (terminus) shoulder (i.e., the smaller diameter below the shoulder). The other finger(s) of the retention clip remains sitting on top of the shoulder (i.e. the larger diameter of the terminus shoulder). When mated, the action of the two termini contacting will place an additional applied load on the one locked finger. MIL-DTL-38999 specifies a retention force of 22 lb with both fingers of the retention clip engaged. If only one finger is engaged, the force will be applied only to that one finger. The maximum value for the force applied must be below the force that may cause the breakage to the one engaged finger.
    - 2.1.3 Terminus spring force. The maximum value for the force applied must be below the force that may cause damage to the terminus compression spring.
  - 2.2 Minimum factors.
    - 2.2.1 Frictional forces. Frictional forces may cause an unlocked terminus to be retained in place. Fingers on retention clip may rest on large diameter of shoulder. Retention sealing and obstructions can increase friction. Force applied must overcome the seals and any obstructions.
  - 2.3 Selection criteria.
    - 2.3.1 Upper limit. The upper limit is taken as the maximum force that can be applied and not damage the compression spring. The M29504/14 & /15 termini have the lowest value for this upper limit due to the non-resiliency of the spring type used. A very conservative limit of 5 lb is used so as not to discuss any proprietary information.
    - 2.3.2 Lower limit. The lower limit is taken as applying a sufficient force to move a non fully seated terminus back into the connector insert cavity. For a M29504/14 and 15 termini, each terminus is placed in the insert at a position just before the fingers on the retention clip engage the 45 degree chamfer (i.e., fingers sitting on the 0.104 inch diameter). Applied loads of 1, 2 and 3 lb were placed on the terminus. In multiple tests, it was found that a minimum force of 3 lb is required to push the terminus through (out of) the insert. Results for the M29504/18 will be similar. For a M29504/4 terminus, the test result show that the force required to move a non fully seated terminus is less than 0.5 lb. The M29504/4 pin terminus offers more conservative configuration over the M29504/5 socket terminus since additional friction must be overcome at the connector interface seal. The M29504/4 pin terminus was configured with heat shrink over jacketed cable to offer a more conservative configuration (additional fraction to overcome) at the rear grommet.
3. Conditions for endface configuration.
  - 3.1 No fiber contact.
  - 3.2 Historical basis of endface configuration (no contact with fiber). The removal of a MIL-PRF-29504/14 & /15 terminus is done by applying a force on the terminus endface. First, the tip of the removal tool guide depresses the terminus retention clip. Next, the plunger applies a force on the terminus end face and pushes the terminus to be removed from the rear of the connector insert. The removal tool includes design criteria to ensure that no contact with the optical fiber will occur. This tool has been used successfully by the maintainer for over 25 years.
4. Considerations for duration.
  - 4.1 Historical basis. MIL-STD-1344 specifies the duration of 5 to 10 seconds for the contact retention test. Several tests for verifying if electrical contacts are fully seated in the retention clips adopt a variation of this duration.
  - 4.2 Determination. The applied force specified in this drawing ensures that any non-fully seated termini are pushed back prior to obtaining this force. There is no advantage to maintain the specified applied force because only fully seated termini will be subjected to the specified applied force once it is obtained.

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5. User constraints.

- 5.1 End user process. Apply the specified force with a terminus retention clip seating tester. Next, perform a visual inspection of the terminus placement. Verify that the terminus has not been pushed back relative to the other termini in the connector insert.
- 5.2 Discrepancies verified by visual inspection. This test will verify if all fingers on the retention clip are engaged (locked). If not locked, any sufficient force applied to the terminus end face will push the terminus back further in the connector insert. This test will not determine if the terminus was inserted at an angle and in the situation that not all of the fingers have locked. If one finger has locked and the other(s) remains on the top of the shoulder (larger diameter), then the terminus will be displaced.

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