REV	SHT	NAVSEA DRAWING NO.	ESWBS
B	1	8283460	499

APPLICATION	
NEXT ASSY	USED ON

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	Revised Table 1, revised appendix A, added appendix B	13 Dec 2006	Robert A Throm
B	NGCon -> M64266, Revise appendix B polishing	16 Oct 2007	Robert A Throm

This Navy Drawing contains test sample configurations (including the fiber optic components/materials used), test sample fabrication (preparation), launch condition method, specific test practices pertaining to the MIL-PRF-29504/18 terminus.

Intent

1. This Navy Drawing supports the Qualified Products List (QPL) testing for the MIL-PRF-29504/18 terminus for both temperature range 1 (shipboard/aircraft: -40 to 85 ^{o}C) and temperature range 2 (aircraft: -55 to 165 ^{o}C).
2. This Navy Drawing supplements MIL-PRF-29504/18.
3. This Navy Drawing minimizes variables in testing by standardizing areas in fabrication and testing. Minimizing test variables permits more accurate comparison of test results from multiple sources of supply when testing is performed by multiple test laboratories. This consistency with test results allows the comparison with Fleet/Field performance, and if needed, the redress of performance requirements or test methodology.
4. Appendix B to this Navy Drawing supplements MIL-PRF-64266 when tested in conjunction with MIL-PRF-29504/18 or when tested for connector only.

REV STATUS OF SHEETS	REV	B	B	B	B	B	B	B	B	B	B	B	B	.	.	B		B	B		B
	SHEET	1	2	3	4	5	6	7	8	9	10	11	12	.	.	13	to	33	34	to	38

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DEPARTMENT OF THE NAVY
NAVAL SEA SYSTEMS COMMAND
WASHINGTON, D.C. 20362-5101

TERMINI, FIBER OPTIC, MIL-PRF-29504/18,
TEST SAMPLE CONFIGURATIONS/FABRICATION
& SPECIFIC METHODS/PRACTICES

SIZE	CAGE	ESWBS	DRAWING NO.	REV
A	53711	499	8283460	B

SCALE: NONE | UCI | WT GRP | SHEET 1 OF 35

Contents

Qualification, except interoperability: Temperature range 1
Qualification, except interoperability: Temperature range 2
Interoperability
Appendices:
A: Termini termination for MIL-PRF-29504/18.
B: MIL-PRF-64266 qualification in conjunction with MIL-PRF-29504/18 or stand alone.

Notes

1. Background.
   a. Test sample configurations (except interoperability). Dependent upon the inspection/test performed, the termini test samples shall be in one of three configurations:
      (1) Un-terminated termini,
      (2) Termini as part of a single fiber cable,
      (3) Termini as an integral part of a multiple termini connector.
      The inspection/test sequence for each of the three termini test sample configurations is listed in table I. The construction details for each of the three test sample configurations are listed under the section in this drawing for "Qualification except interoperability".
   b. Interoperability. Separate test sample configurations are required for interoperability testing. These test sample configurations are in addition to the ones to be used for the other qualification tests. Test sample configurations for interoperability are described in this drawing under the section "Interoperability".
   c. Multiple party testing considerations. The incentive to minimize test variables, resulting in a level playing field for multiple parties testing, leads the Government to establish a baseline. This baseline includes considerations for fabrication of test samples, methods to employ launch conditions and use of specific test practices in addition to specifics for test sample configurations.
2. MIL-PRF-64266 connectors. Termini, tested independently and not in conjunction with a MIL-PRF-64266 qualification, must be tested in a MIL-PRF-64266 connector, shell size 15 with a 10 cavity insert to qualify for MIL-PRF-29504/18. At least 16 mated termini pair must be tested for each inspection or test performed (with a minimum of 8 active termini per connector in different cavity locations per connector). This requirement is consistent with termini that are tested in conjunction with a MIL-PRF-64266 connector. Full qualification is performed for the shell size 15, and a limited subset of tests is redone for other shell sizes (see sample preparation for MIL-PRF-64266).
3. 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.
4. Inquiries and clarifications on this NAVSEA Drawing are to be placed in writing and sent by e-mail to DSCC VQP. Current DSCC-VQP point of contact can be obtained at Web Site: http://www.dscc.dla.mil/programs/qmlqpl/. To obtain current technical contact, select Programs/Contacts followed by selecting on Passive Devices Team.
5. Submittal of vendor documentation (termination procedures and test reports). Original and two copies are to be submitted to DSCC VQP.
6. MIL-PRF-64266 connectors were referred to initially as MIL-PRF-NGCon connectors until the MIL-SPEC number was assigned.

Table I. Qualification inspections (except interoperability).

TEMPERATURE RANGE:	Temperature Range 1		Temperature Range 2 15/			N/A
TEST PERFORMED	Initial Qual 13/ SM Fiber	Initial Qual 14/ MM Fiber	TR2 After TR1, SM Fiber	TR2 After TR1, 14/ MM Fiber	TR2 MM 100/140 After MM	M29504 /19 After /18 Pass
Tests for Unterminated Termini						
Group 1 3/						
Size 1/	X	X	X	X	X	X
Weight 1/	X					X
Identification markings 1/	X		X			X
Workmanship 1/	X		X			X
Circular runout 1/	X	X	X	X		
Group 2 (16 pair minimum) 2/						
Terminus insertion & removal forces	X					
Terminus retention 1/	X					
Maintenance aging	X					
Terminus cleaning	X					
Group 3 (polymeric materials)						
Ozone	X					
Fungus resistance	X					
Modified SO2/salt spray			X			

TEMPERATURE RANGE:	Temperature Range 1		Temperature Range 2 15/			N/A
TEST PERFORMED	Initial Qual 13/ SM Fiber	Initial Qual 14/ MM Fiber	TR2 After TR1, SM Fiber	TR2 After TR1, 14/ MM Fiber	TR2 MM 100/140 After MM	M29504 /19 After /18 Pass
Tests for Termini As Part Of A Single Fiber Cable						
Group 1						
None						
Group 2 (16 pair – minimum each test)						
Fiber pull out force 4/	X					
Cable pull out force 4/	X					
Group 3 (16 pair from cable pull out force)						
Salt spray			X			
Fluid immersion			X			
Tests for Termini As An Integral Part Of A Multiple Termini Connector						
Group I (4 mated connectors)						
Interoperability 7/	X	X				
Optical tests						
Insertion loss	X	X	X	X	X	
Return loss	X		X	16/		
Group II (2 mated connectors)						
Mating durability	X					
Terminus cleaning	X					
Return loss 10/	X					
Group III (2 mated connectors)						
Mechanical tests 8/						
Twist	X 5/		X			
Impact	X					
Vibration 9/	X		X	X	X	
Shock, MIL-S-901 9/	X	X	X	X	X	
Environmental						
Thermal shock	X		X	X		
Temperature humidity cycling	X					
Temperature cycling	X		X			
Altitude immersion	X		X			
Temperature life	X		X			
Flammability 8/	X					
Insertion loss verification 11/	X		X	X		
Return loss 11/	X		X	16/		

1/ These inspections are to be performed by the manufacturer at the production facility.

2/ Test fixture for this test is to include fiber optic; MIL-PRF-64266 connectors; both plug and receptacle for retaining the termini during testing.

3/ Sample size. One pair = one pin terminus and one socket terminus. A minimum sample size shall be used to ensure sufficient quantity for termini inspections as part of a single fiber cable and for termini inspections as an integral part of a multiple fiber connector.

4/ Each terminus is to be terminated on one end of a single fiber cable. Cable used is to have provisions compatible with termini strain relief, as applicable. Termini, selected from the group that underwent inspections for un-terminated termini, shall be used. A minimum sample size of 16 pin termini and 16 of the applicable counterpart socket termini, selected from the group that underwent inspections for un-terminated termini, shall be used for each of these tests.
Fiber pullout. Separate test samples for the socket termini must be prepared on single fiber cable without any strain relief. The change in optical transmittance shall be met after the test for pin termini and both during and after the test for socket termini.
Cable pullout. Separate test samples for the socket termini must be prepared on single fiber cable with strain relief (arimid yarn on cable affixed to terminus via the crimp sleeve). The change in optical transmittance shall be met after the test for pin termini and both during and after the test for socket termini.

5/ Test samples for Temperature range 2 only.

6/ After passing single mode requirements, these tests must be done for meeting multimode requirements for temperature range 1 or temperature range 2, as listed.

7/ Interoperability. This testing is done by DSCC-TEB which maintains/retains the interoperability standards. Please note that separate test samples are required for interoperability testing. These test samples will then be retained by DSCC as interoperability standards.

8/ Mechanical tests. Either 2 connector mated pair from Group II or 2 connector mated pair from Group III may be used.

9/ Shock and vibration. Two connector mated pair must be tested. At least four termini pair in the two connector mated pair are to be monitored for optical signal discontinuity (and for change in optical transmittance). Any other mated pair not monitored for optical signal discontinuity is to be monitored for change in optical transmittance.

10/ Return loss after mating durability. If failure occurs, ferrule end faces may be repolished and test redone.

11/ Per MIL-PRF-64266, an insertion loss verification and a return loss test is required near or after the conclusion of the mechanical tests and after the environmental tests. If both the mechanical tests and the environmental tests are done on the

same mated pair, then only one insertion loss verification and one return loss test is performed (after the conclusion of the mechanical and environmental tests).

12/ This column is for Temperature range 1 (TR1) initial qualification.
13/ Complete test sequence is to be done for test samples with single mode fiber.
14/ Limited test sequence may be done for test samples with multimode fiber if complete test sequence performed with test samples with single mode fiber either before or concurrently.
15/ Assumes same terminus material and physical configuration as used for Temperature Range 1.
16/ Multimode return loss data requested. Multimode return loss data to be obtained per sheet 6 of NAVSEA Drawing 8283460.

Qualification, except Interoperability: Temperature range 1.

1. Test sample configuration for MIL-PRF-29504/18.
   a. Applicable documentation.
      (1) End Face Geometry. Ferrule end face geometry for domed ferrule with a PC polish shall be inspected for conformance to parameters specified in NSWCCD-SSES ltr 9504 Ser 96315/067 of 31 October 2003. A copy of this document can be obtained at Web Site: https://fiberoptics.nswc.navy.mil/ in the Policy and Guidance section under Testing Information.
      (2) Termination procedures. Termination procedure for the test samples shall be in accordance with appendix A of this NAVSEA Drawing. Vendors shall be required to use these termination procedures and mark up any deviations taken (such as strip lengths). The marked up drafts shall be submitted before test sample fabrication. Government personnel will verify adequacy of the marked up draft submitted as part of the QPL process. Upon verification, the Government will finalize the procedures for incorporation into Government documentation.
   b. Test samples: Un-terminated termini
      (1) Quantity: Minimum of 80 pin termini and 80 socket termini for each fiber type (single mode, multimode)
      (2) Allocation of these 80 pin termini and 80 socket termini for remaining testing is as follows (see table II):
         (a) Termini as part of a single fiber cable.
            i Group 2 Cable pullout: 16 pin termini and 16 socket termini.
            ii Group 2 Fiber pullout: 16 pin termini and 16 socket termini.
         (b) Termini as an integral part of a multiple termini connector
            i Interoperability: 2 connector mated pair (16 pin termini and 16 socket termini from the 80 pin termini and 80 socket termini that undergo the un-terminated termini testing above). An additional 16 pin termini and 16 socket termini (that are un-terminated) are required for the Terminus insertion and removal force and for Terminus retention force. These termini are not included in the 80 pin termini and 80 socket termini that undergo the un-terminated termini testing above. Also, 20 more pin termini and socket termini are required to test for MIL-PRF-64266 connector interoperability once the termini are qualified (refer to "Component to be submitted" under Interoperability). These 20 pin termini and 20 socket termini (submitted as cable assemblies) are not included in the 80 pin termini and 80 socket termini that undergo the un-terminated termini testing above.
            ii Group 1 Optical (Insertion loss & Return loss) then Group 2 Mechanical tests: 2 connector mated pair (16 pin termini and 16 socket termini).
            iii Group 1 Optical (Insertion loss & Return loss) then Group 3 Environmental tests: 2 connector mated pair (16 pin termini and 16 socket termini).

Table II. Termini allocation table. 1/

TEST PERFORMED	Number of Pin Termini	Number of Socket Termini
Unterminated Termini Tests		
Group 1	80	80
Group 2 (16 pair minimum)	16 of 80	16 of 80
Group 3 (polymeric materials only)	None	None
Termini As Part Of A Single Fiber Cable Tests		
Group 1	None	None
Group 2 (16 pair – minimum each test)	32 of 80	32 of 80
Fiber pull out force	16 3/	16 3/
Cable pull out force	16 3/	16 3/
Group 3	None	None
Termini As An Integral Part Of A Multiple Termini Connector		
Group I (4 connector mated pair)	32 of 80	32 of 80
Interoperability 2/	16 of 80	16 of 80
Group II (2 mated connectors)	From Group I	From Group I
Group III (2 connector mated pair)	From Group I	From Group I

1/ See 1.b(2) and notes with table I for further detail.
2/ See 1.b(2)i for an additional 16 pin termini and 16 socket termini required.
3/ 16 termini from the 32 termini designed for Group 2.

c. Test samples: Termini as part of a single fiber cable.
(1) End Face Geometry. End face geometry requirement shall be a domed ferrule end face with a PC polish for both termini and for ST connectors (or other instrumentation-end connectors). Cable assemblies for submission are to be fabricated per appendix A of this NAVSEA Drawing. Termini are to be polished using the standard dome polish specified in appendix A. (A standard dome and enhanced dome polish are in appendix A.)
(2) Quantity: 16 pin termini and 16 socket termini from the lot of un-terminated termini for cable pullout, 16 pin termini and 16 socket termini from the lot of un-terminated termini for fiber pullout.
(3) Configurations and fabrication. Test sample configurations (single mode and multimode on tight buffer cable) and fabrication of termini-to-ST connector jumpers shall conform as specified below. Other instrumentation-end connectors may be used in lieu of ST connectors. Each cable assembly shall consist of 10 meters of cable with the DUT in the middle (at 5 meters) and single ferrule connectors on the ends to mate with the optical instrumentation. This cable assembly configuration requires each terminus-to-ST connector jumper to have a cable length of 5 meters. Submit request for any alternate cable length proposal to DSCC-VQP. A justification with proposed length deviation and test setup that would allow for successful performance with the proposed deviated length must be included.
(a) Cable pullout. Separate test samples for the pin and the socket termini must be prepared on single fiber cable with strain relief (i.e., arimid yarn on cable affixed to terminus via the crimp sleeve).
(b) Fiber pullout. Separate test samples for the pin and the socket termini must be prepared on single fiber cable without any strain relief.
(4) Cable type. Cable used must be of same configuration as MIL-PRF-85045/16; however, this cable does not need to meet environmental specifications in MIL-PRF-85045/16. The fiber in the cable used must be the same or equivalent to MIL-PRF-49291/6 for multimode optical fiber or MIL-PRF-49291/7 for single mode fiber. Submit request for alternate cable to DSCC-VQP. Requesting party must submit documentation showing equivalency for optical, mechanical, environmental, material and other applicable performance parameters for both fiber being requested and for fiber in which equivalency is being claimed. Documentation is to include specification sheets and a prepared equivalency matrix/table. Otherwise, MIL-PRF-85045/16 cable shall be used.
(5) Test methods and practices. Launch conditions and measurements for the change in optical transmittance shall conform as specified in 3.a below.

d. Test samples: Termini as an integral part of a multiple termini connector
(1) End Face Geometry. End face geometry requirement shall be a domed ferrule end face with a PC polish for both termini and for ST connectors (or other instrumentation-end connectors). Cable assemblies for submission are to be fabricated per appendix A of this NAVSEA Drawing. Termini are to be polished using the standard dome polish specified in appendix A. (A standard dome and enhanced dome polish are in appendix A.)
(2) Cable type. Cable used must be MIL-PRF-85045 eight (8) fiber cable to MIL-PRF-85045/13 or MIL-PRF-85045/17.
(3) Fabrication: A complete set of test samples shall be tested on cable assemblies fabricated with single mode fiber, and a reduced set of test samples shall be tested on cable assemblies with multimode fiber. The reduced set (two connector mated pair) of test sample for cable assemblies tested with multimode fiber is made under the provision that a full qualification is being done with single mode fiber and a qualification by similarity will be followed with multimode fiber. A MIL-PRF-64266 shell size 15 connector shall be used with at least 8 cavities of the insert populated. These 8 channels are to be active optically for termini qualification testing. Otherwise, connector configurations used for termini qualification shall conform to 4.4.1.1 of MIL-PRF-64266.
(a) Single mode. Termini on cable assemblies with instrumentation connectors (such as ST connectors) on the other end and with single mode cable shall conform as follows:
Ferrule hole diameter: Termini shall be selected for best (tightest) fit to the optical fiber to achieve maximum connector (optical) performance. Fitting the optical fiber to the next larger ferrule hole diameter may affect connector performance.
Fiber size: Single mode (9.3/125 micron at 1310 nm per MIL-PRF-49291/7).
Cable type: MIL-PRF-85045/13 or /17.
Epoxy type: Approved sources of supply for MIL-PRF-24792, PIN M24729-A, as listed in the Navy Recommended Fiber Optic Components Parts List. A copy of this document can be obtained at Web Site: https://fiberoptics.nswc.navy.mil/ in the Recommended Parts List section under Recommended Parts List.
Quantity: 4 mated pair.
Tests performed: Full test sequence, see 1.d (4) (b) below.
(b) Multimode. Termini on cable assemblies with instrumentation connectors (such as ST connectors) on the other end and with multimode cable shall conform as follows:

Ferrule hole diameter: Termini shall be selected for best (tightest) fit to the optical fiber to achieve maximum connector (optical) performance. Fitting the optical fiber to the next larger ferrule hole diameter may affect connector performance.

Fiber size: Multimode (62.5/125 micron per MIL-PRF-49291/6).

Cable type: MIL-PRF-85045/13 or /17.

Epoxy type: Approved sources of supply for MIL-PRF-24792, PIN M24729-A, as listed in the Navy Recommended Fiber Optic Components Parts List. A copy of this document can be obtained at Web Site: https://fiberoptics.nswc.navy.mil/ in the Recommended Parts List section under Recommended Parts List.

Quantity: 2 connector mated pair for temperature range 1. 2 or 4 connector mated pair for temperature range 2, at the discretion of the vendor.

Tests performed: Must first qualify with single mode fiber, then qualify with multimode fiber under the qualification by similarity (see table 1) with a reduce set of test samples.

(4) Quantities and tests performed for termini undergoing the full qualification.

(a) Cable assembly configuration. In general, each cable assembly shall consist of 10 meters of cable with the DUT in the middle (at 5 meters) and single ferrule connectors on the ends to mate with the optical instrumentation. For insertion loss tests on multiple termini connectors where a cut-back must be performed, a 13 meter length of cable is required with the DUT placed 8 meters from the launch end of the cable. This allows 3 cut-backs to be performed, each cut-back being one meter long.

(b) Full test sequence for qualifying with single mode fiber. Four connector mated pair with single mode fiber and 2 mated pair with multimode fiber. Each four connector mated pair (using Shell Size 15 MIL-PRF-64266 qualified connectors) shall contain a total of 32 pin termini and 32 socket termini from the lot of un-terminated termini. Each connector shall contain a 10 channel (cavity) insert and be populated with at least 8 active termini. Full test sequence is to be performed on cable assemblies fabricated with single mode fiber (4 connector mated pair) and the reduced test sequence per the qualification by similarity shall be performed with multimode fiber (2 connector mated pair). Each connector mated pair shall contain only one fiber type.

(c) Reduced test sequence for qualifying with multimode fiber once single mode is qualified. Each two connector mated pair (using Shell Size 15 MIL-PRF-64266 qualified connectors) shall contain a minimum of 16 pin termini and 16 socket termini from the lot of un-terminated termini. Each connector shall contain a 10 channel (cavity) insert and be populated with at least 8 active termini. Each connector mated pair shall contain only one fiber type.

2. Other fabrication and test sample assembly requirements.

a. Hand versus machine polish. Test samples may be terminated using a machine polish for one or more of the polishing steps. This leeway does not exclude the vendor from submitting a marked up procedure (in appendix A) with a hand polish for use in the Fleet/Field.

3. Test methods and practices.

a. Launch conditions.

(1) Fiber size 9/125 micron. A mandrel diameter shall be used as the means of mode conditioning to filter out higher order modes. The technique of wrapping the fiber around a mandrel shall be performed as specified see 3.5 of TIA/EIA-455-34. A diameter of 30 mm shall be used with 3 complete turns of the fiber wrapped around the mandrel.

(2) Fiber size 62.5/125 micron. For 62.5/125 micron optical fiber, use a 2 meter minimum length of 50/125 micron optical fiber with a 0.2 NA.

b. Specific test practices. Testing shall be performed as specified in MIL-PRF-29504/18 using cited test standards (such as TIA/EIA). Specific test practices for the optical performance tests, including clarifications and further details, are found in the Optical Test Measurement Guide. A copy of this document can be obtained at Web Site: https://fiberoptics.nswc.navy.mil/ in the Policy and Guidance section under Testing Information.

(1) Shock test. Standard shock fixture 4A for bulkhead mounting shall be used. Supplement test fixture that shall be used and the mounting shall be performed as specified in Mechanical Shock (Hi-Impact) Test and Measurement Guide letter. A copy of this document can be obtained at Web Site: https://fiberoptics.nswc.navy.mil/ in the Policy and Guidance section under Testing Information.

(2) Return loss requirements for multimode fiber. Whenever in the test sequence a return loss measurement for single mode fiber size is specified, a measurement for the multimode fiber size shall be performed also (when test samples with multimode fiber are being tested). The optical performance requirement for return loss using multimode fiber shall be determined from tests results obtained during the QPL testing. For standardization (consistency), the multimode return loss shall be performed using a single mode coupler or single mode ORLM. The optical source used shall be at the 1310 nm wavelength. Specific test practices shall be used for return loss and the other optical performance tests as cited in the Optical Test measurement Guide. A copy of this document can be obtained at Web Site: https://fiberoptics.nswc.navy.mil/ in the Policy and Guidance section under Testing Information.

Qualification, except Interoperability: Temperature range 2.

1. Test sample configuration for MIL-PRF-29504/18.
   a. Applicable documentation.
      (1) End Face Geometry. Ferrule end face geometry for domed ferrule with a PC polish shall conform to parameters specified in NSWCCD-SSES ltr 9504 Ser 96315/067 of 31 October 2003. A copy of this document can be obtained at Web Site: https://fiberoptics.nswc.navy.mil/ in the Policy and Guidance section under Testing Information.
      (2) Termination procedure. Termination procedure for the test samples shall be in accordance with appendix A of this NAVSEA Drawing. Vendors shall be required to use these termination procedures and mark up any deviations taken (such as strip lengths). The marked up drafts shall be submitted before test sample fabrication. Government personnel will verify adequacy of the marked up draft submitted as part of the QPL process. Upon verification, the Government will finalize the procedures for incorporation into Government documentation.
   b. Test samples: Un-terminated termini
      (1) Quantity: Minimum of 64 pin termini and 64 socket termini for each fiber type (single mode, multimode, multimode 100)
      (2) Allocation of these 64 pin termini and 64 socket termini for remaining testing is as follows (see table III):
         (a) Termini as part of a single fiber cable.
            i Group 2 Cable pullout: 16 pin termini and 16 socket termini.
            ii Group 3 Salt spray: use test samples from Group 3 Cable pullout.
         (b) Termini as an integral part of a multiple termini connector
            i Interoperability: 2 connector mated pair (16 pin termini and 16 socket termini).
            ii Group 1 Optical (Insertion loss & Return loss) then Group tests: 2 mated pair (16 pin termini and 16 socket termini).
            iii Group 1 Optical (Insertion loss & Return loss) then Group 3 Mechanical & Environmental tests: 2 mated pair (16 pin termini and 16 socket termini).

Table III. Termini allocation table. 1/

TEST PERFORMED	Number of Pin Termini	Number of Socket Termini
Unterminated Termini Tests		
Group 1	64	64
Group 2 (16 pair minimum)	16 of 64	16 of 64
Group 3 (polymeric materials only)	None	None
Termini As Part Of A Single Fiber Cable Tests		
Group 1	None	None
Group 2 (16 pair – cable pull out force)	16 of 64	16 of 64
Group 3	None	None
Termini As An Integral Part Of A Multiple Termini Connector		
Group I (4 connector mated pair)	32 of 64	32 of 64
Interoperability 2/	16 of 64	16 of 64
Group II (2 mated connectors)	From Group I	From Group I
Group III (2 connector mated pair)	From Group I	From Group I

1/ See 1.b(2) and notes with table I for further detail.
2/ See 1.b(2)i for an additional 16 pin termini and 16 socket termini required beyond those in the 4 connector mated pair required for testing.

   c. Test samples: Termini as part of a single fiber cable
      (1) Quantity: 16 pin termini and 16 socket termini from the lot of un-terminated termini
      (2) Configurations and fabrication. Test sample configurations (single mode and multimode on tight buffer cable) and fabrication of termini-to-ST connector jumpers shall conform as specified in 1.d below.
      (3) Configurations and fabrication. Test sample configurations and fabrication of termini-to-ST connector jumpers shall conform as specified below. Other instrumentation-end connectors may be used in lieu of ST connectors. Each cable assembly shall consist of 10 meters of cable with the DUT in the middle (at 5 meters) and single ferrule connectors on the ends to mate with the optical instrumentation. This cable assembly configuration requires each terminus-to-ST connector jumper to have a cable length of 5 meters. Submit request for any alternate cable length proposal to DSCC-VQP. A justification with proposed length deviation and test setup that would allow for successful performance with the proposed deviated length must be included.

a. Cable pullout. Separate test samples for the pin and the socket termini must be prepared on single fiber cable with strain relief (e.g., arimid yarn on cable affixed to terminus via the crimp sleeve).

(4) Cable type. Cable used must be of same configuration specified in 1.d (2) below; however, this cable does not need to meet environmental specifications in MIL-PRF-29504/18. The fiber in the cable used must be the same or equivalent to the approved cabling as stated in 1.d (2) below. Submit request for alternate cable to DSCC-VQP. Requesting party must submit documentation showing equivalency for optical, mechanical, environmental, material and other applicable performance parameters for both fiber being requested and for fiber in which equivalency is being claimed. Documentation is to include specification sheets and a prepared equivalency matrix/table.

(5) Test methods and practices. Launch conditions and measurements for the change in optical transmittance shall conform as specified in 3.a below.

d. Test samples: Termini as an integral part of a multiple termini connector

(1) End Face Geometry. End face geometry requirement shall be a domed ferrule end face with a PC polish for both termini and for ST connectors (or other instrumentation-end connectors). Cable assemblies for submission are to be fabricated per appendix A of this NAVSEA Drawing. Termini are to be polished using the standard dome polish specified in appendix A. (A standard dome and enhanced dome polish are in appendix A.)

(2) Cable type. The Government must approve cable brand and part number prior to test sample termination. Cable approved to date include:

Tight buffer type: 5/125 micron: OFS part number C10026 or BC06814
9/125 micron: OFS part number C14447.
50/125 micron: OFS part number C10027 or BC06815
100/140/172 micron: OFS part number BC05082

Test samples used for insertion loss only. Cable used must be of same configuration specified; however, this cable does not need to meet environmental specifications in MIL-PRF-29504/18. The fiber in the cable used must be the same or equivalent to the approved cabling as stated above. NAVAIR 4.5 will determine if the fiber is equivalent. Requesting party must submit documentation to DSCC-VQP showing equivalency for optical, mechanical, environmental, material and other applicable performance parameters for both fiber being requested and for fiber in which equivalency is being claimed. Documentation is to include specification sheets and a prepared equivalency matrix/table.

(3) Fabrication: At a minimum, separate sets of test samples shall be tested on cable assemblies fabricated with single mode fiber, with multimode fiber and with multimode 100 fiber. A MIL-PRF-64266 shell size 15 connector shall be used with 10 cavity inserts and at least 8 cavities of the insert populated for each connector mated pair to be tested. These 8 channels are to be active optically for termini qualification testing. Otherwise, connector configurations used for termini qualification shall conform to 4.4.1.1 of MIL-PRF-64266.

(a) Single mode 5. Termini on cable assemblies (such as terminus-to-ST connector jumpers) with single mode 5/125 micron cable shall conform as follows:
Ferrule hole diameter: 125 or 125.5 +1/-0 um
Fiber size: 5/ 125 micron (5.1/125 micron at 1310 nm, 5.8/125 micron at 1550 nm)
Cable type: Tight buffer, per 1.d (2) above
Epoxy type: Epo-tek 353ND
Quantity: 4 connector mated pair, see 1.d (4) (b) below.
Tests performed: Full test sequence, see 1.d (4) (b) below.

(b) Single mode 9. (Only if not doing Single mode 5) Termini on cable assemblies (such as terminus-to-ST connector jumpers) with single mode 9/125 micron cable shall conform as follows:
Ferrule hole diameter: 126 +1/-0 um
Fiber size: 9/ 125 micron (9.3/125 micron at 1310 nm)
Cable type: Tight buffer, per 1.d(2) above
Epoxy type: Epo-tek 353ND
Quantity: 4 connector mated pair, see 1.d (4) (b) below.
Tests performed: Full test sequence, see 1.d (4) (b) below. Qualification by Similarity if do Single Mode 5.

(c) Multimode. Termini on cable assemblies (such as terminus-to-ST connector jumpers) with multimode cable containing 50/125 micron fiber shall conform as follows:
Ferrule hole diameter: 126 +1/-0 um
Fiber size: 50/ 125 micron
Cable type: Tight buffer, per 1.d(2) above
Epoxy type: Epo-tek 353ND
Quantity: 4 connector mated pair, see 1.d (4) (b) below.
Tests performed: Full test sequence, see 1.d (4) (b) below.

(d) Multimode 100. Termini on cable assemblies (such as terminus-to-ST connector jumpers) with multimode cable containing 100/140/172 micron fiber shall conform as follows:

Ferrule hole diameter: 175 +3/-0 um
Fiber size: 100/140/172 micron
Cable type: Tight buffer, per 1.d(2) above
Epoxy type: Epo-tek 353ND
Quantity: 2 connector mated pair, see 1.d (4) (c) below.
Tests performed: Size and insertion loss, see 1.d (4) (c) below.

(4) Quantities and tests performed.

(a) Cable assembly configuration. In general, each cable assembly (connector mated pair) shall consist of 10 meters of cable with the DUT in the middle (at 5 meters) and single ferrule connectors on the ends to mate with the optical instrumentation. For insertion loss tests on multiple termini connectors where a cut-back must be performed, a 13 meter length of cable is required with the DUT placed 8 meters from the launch end of the cable. This allows 3 cut-backs to be performed, each cut-back being one meter long.

(b) Multimode and either Single Mode 5 or Single Mode 9. Four connector mated pair with single mode fiber and 4 connector mated pair with multimode fiber. Each four connector mated pair (4 MIL-PRF-64266 Shell Size 15, qualified connectors with 10 cavity inserts and populated with at least 8 active termini per connector) shall contain a total of 32 pin termini and 32 socket termini from the lot of un-terminated termini. Full test sequence is to be performed on cable assemblies fabricated with single mode fiber (4 connector mated pair) and with multimode fiber (4 connector mated pair). Each connector mated pair shall contain only one fiber type.

(c) Multimode 100. For test samples with termini using multimode 100, only 2 connector mated pair (2 MIL-PRF-64266 Shell Size 15, qualified connectors with 10 cavity inserts and populated with at least 8 active termini per connector) shall contain a total of 16 pin termini and 16 socket termini from the lot of un-terminated termini. Size inspection is to be done prior to termination. Optical insertion loss testing is to be done using 2 MIL-PRF-64266, Shell Size 15, qualified connectors. These connectors shall have 10 cavity inserts and be populated with at least 8 active termini per connector with constraints stated for the single mode and multimode test samples. This quantity (i.e., test sample size of 2 connector mated pair) and limited testing is applicable only if qualification requirements are met for the cable assembly configuration with multimode 50/125 fiber.

2. Other fabrication and test sample assembly requirements.

a. Epoxy cure schedule.

(1) Epo-tek 353ND. The cure schedule shall be as follows:

(a) Ramp: From ambient to 80 C in 5 minutes
(b) Soak: 80 C for 10 minutes
(c) Ramp: 105 C for 5 minutes
(d) Soak: 105 C for 5 minutes
(e) Ramp: 120 C for 5 minutes
(f) Soak: 120 C for 5 minutes
(g) Ramp: 150 C for 5 minutes
(h) Soak: 150 C for 5 minutes
(i) Ramp: Turn heat off and let sit in oven for 15 minutes before removal

b. Hand versus machine polish. Test samples may be terminated using a machine polish for one or more of the polishing steps. This leeway does not exclude the vendor from submitting a marked up procedure (in appendix A) with a hand polish for use in the Fleet/Field.

3. Test methods and practices.

a. Launch conditions.

(1) Fiber size 5/125 micron. A mandrel diameter shall be used as the means of mode conditioning to filter out higher order modes. The technique of wrapping the fiber around a mandrel shall be performed as specified see 3.5 of TIA/EIA-455-34. A diameter of 60 mm shall be used with 1 complete turn of the fiber wrapped around the mandrel.

(2) Fiber size 9/125 micron. A mandrel diameter shall be used as the means of mode conditioning to filter out higher order modes. The technique of wrapping the fiber around a mandrel shall be performed as specified see 3.5 of TIA/EIA-455-34. A diameter of 30 mm shall be used with 3 complete turns of the fiber wrapped around the mandrel.

(3) Fiber size 50/125 micron. A 2 meter length of OFS optical fiber BF06819 or OFS fiber optic cable C16133 is to be used as the launch condition cable.

Note: Policy for Government provisioning of launch conditioning cable.

Eligible parties. The Government, at their discretion, may provide the test laboratory or vendor doing the testing (the recipient) with 70 meter spool of the required launch condition cable (sufficient length of OFS C16133 fiber optic cable to terminate connectors on the ends of 32 two meter lengths of launch conditioning jumpers). Only

recipients doing the testing are to receive cable. Only one provision (70 meter spool) of cable will be provided even if the recipient is testing multiple vendors.

Intended use. Sole use of cable provisioned shall be for QPL testing. Cable shall not be used to fabricate MQJ (Measurement Quality Jumper) cables or other type cables.

Recipient responsibilities. The recipient shall make the connector terminations and retain the terminated cable for future use. Recipients that do not complete the QPL process shall return the cable. Unused lengths shall be returned to the Government. The recipient shall bare shipping costs.

Method to request launch condition cable. Requests for launch condition cable shall be made to DSCC-VQP Qualifications Group. Requests are to be submitted via e-mail and include the following information: Recipient (company) name, shipping address, point of contact with telephone number and e-mail address, DSCC test report number located on Form 19P, recipient's express mail shipping company, recipient's account number for the express mail shipping company.

(4) Fiber size 62.5/125 micron. For 62.5/125 micron optical fiber, use a 2 meter minimum length of 50/125 micron optical fiber with a 0.2 NA.

(5) Fiber size 100/140 micron. ASA 100 restricted launch condition shall be used as the means to provide a restricted launch.

Note: Government to provide details on standard method to implement this launch condition at a later date.

b. Specific test practices. Testing shall be performed as specified in MIL-PRF-29504/18 using cited test standards (such as TIA/EIA). Specific test practices for the optical performance tests, including clarifications and further details, are found in the Optical Test Measurement Guide. A copy of this document can be obtained at Web Site: https://fiberoptics.nswc.navy.mil/ in the Policy and Guidance section under Testing Information.

(1) Shock test. Standard shock fixture 4A for bulkhead mounting shall be used. Supplement test fixture that shall be used and the mounting shall be performed as specified in Mechanical Shock (Hi-Impact) Test and Measurement Guide letter. A copy of this document can be obtained at Web Site: https://fiberoptics.nswc.navy.mil/ in the Policy and Guidance section under Testing Information.

Interoperability.

1. Policy to perform testing.
   a. Background. In the past, the Government has partnered with termini/connector companies that were undergoing Qualified Products List testing in an effort to verify interoperability of fiber optic, multiple termini connectors that conform to MIL-PRF-28876. This partnership allows the Government to verify the interoperability of connectors with that of participating companies. DSCC-TEB is now the Government entity that performs the testing for interoperability. This partnership for interoperability testing is now extended to other termini/connectors including qualifying only the MIL-PRF-29504/18 termini & MIL-PRF-64266 connectors.
   b. Test sample retention. One stipulation is that the test samples are to be retained by the Government for use as standards in future interoperability testing to be performed by the Government in-house personnel. Only personnel to be present during interoperability testing are Government, in-house personnel. At no time would other parties have access to or examination of the interoperability standards.
   c. Replacement/refurbishment. Another stipulation is that your company agrees to replace or refurbish these interoperability standards as the need arises. Any items requiring replacement/refurbishment in this agreement is to be performed by your company at no cost to the Government.

2. Test Sample submission. Vendors are responsible for the fabrication and submittal of cable assemblies (test samples) in the configurations specified below to the Government for Interoperability testing.
   a. Notification for submission. Initial notification to submit test samples for interoperability shall be made to DSCC-VQP Qualifications Group.
   b. Arrangements to perform interoperability testing. Once approved by DSCC-VQP, the vendor shall make financial, test and shipping arrangements with the DSCC-TEB Passive Test Section.

      Point of contact: DSCC-VQP will provide current DSCC-TEB point of contact.
      Shipping address: Defense Supply Center Columbus
      3990 East Broad St.
      Bldg 11, Section 7, TEB
      Columbus OH 43213-1199

3. Test sample configuration for MIL-PRF-29504/18.
   a. Applicable documentation.
      (1) End Face Geometry. Ferrule end face geometry for domed ferrule with a PC polish shall be inspected for conformance to parameters specified in NSWCCD-SSES ltr 9504 Ser 96315/067 of 31 October 2003. A copy of this document can be obtained at Web Site: https://fiberoptics.nswc.navy.mil/ in the Policy and Guidance section under Testing Information.
      (2) Termination procedure for the test samples shall be in accordance with appendix A. Vendors shall be required to use these termination procedures and mark up (red line) any deviations taken (such as strip lengths). The marked up drafts shall be submitted before test sample fabrication. Government personnel will verify adequacy of the marked up draft

submitted as part of the QPL process. Upon verification, the Government will finalize the procedures for incorporation into Government documentation.

b. Test configurations that must be interoperable. All termini of the same PIN shall be interoperable.

c. Designated cable assemblies. Testing shall be performed using two separately designated cable assemblies with fully populated, MIL-PRF-64266 Shell Size 15 connectors. Each connector shall contain a 10 channel (cavity) insert.

d. Components to be submitted:

(1) Interoperability of counterpart terminus.

(a) Connector receptacle. MIL-PRF-64266 Shell Size 15 qualified flanged connector receptacle, 10 channel (cavity) insert, no backshell (minimum quantity: 1).

(b) Connector plug. MIL-PRF-64266 Shell Size 15 qualified flanged connector plug, 10 channel (cavity) insert, no backshell (minimum quantity: 1).

(c) Candidate pin terminus-to-ST connector jumper (minimum quantity: 36 of each fiber size to be tested). 1/, 2/, 3/, 4/, 5/

(d) Candidate socket terminus-to-ST connector jumper (minimum quantity: 36 of each fiber size to be tested). 1/, 2/, 3/, 4/, 5/

1/ Cable with minimum length of 2 meters and terminated with terminus on one end and commercial ST connector on instrument end. End face geometry requirement is for a domed ferrule end face and PC polish for both terminus and for ST connector. Cable assemblies for submission are to be fabricated per appendix A. Termini and ST connectors are to be polished using the standard dome polish specified in Part 5. (A standard dome and enhanced dome polish are in appendix A.)

2/ Quantities listed are for one fiber type. Applicable fiber types for termini are single mode and multimode. A minimum quantity of 36 cable assemblies required to perform interoperability testing is based on the shell size 23 connector. For this reason, the specified number of cable assemblies must be submitted. This case applies even if only termini, and not termini in conjunction with the MIL-PRF-64266 connector, are being qualified. The 36 submitted cable assemblies become interoperability standards for future testing.

3/ Cable type. Interoperability test samples are to be constructed using MIL-PRF-85045/16 single fiber cable.
9/125 micron: M85045/16-02.
62.5/125 micron: M85045/16-01

4/ Fabrication:

i Single mode test samples. Candidate terminus-to-ST connector jumpers with single mode 9/125 micron cable shall conform as follows:

Ferrule hole diameter: Termini shall be selected for best (tightest) fit to the optical fiber to achieve maximum connector (optical) performance. Fitting the optical fiber to the next larger ferrule hole diameter may affect connector performance.

Fiber size: Single mode (9.3/125 micron at 1310 nm per MIL-PRF-49291/7)

Cable type: MIL-PRF-85045/16.

Epoxy type: Approved sources of supply for MIL-PRF-24792, PIN M24729-A, as listed in the Navy Recommended Fiber Optic Components Parts List. A copy of this document can be obtained at Web Site: https://fiberoptics.nswc.navy.mil/ in the Recommended Parts List section under Recommended Parts List.

ii Multimode test samples. Candidate terminus-to-ST connector jumpers with multimode cable containing 62.5/125 micron fiber shall conform as follows:

Ferrule hole diameter: Termini shall be selected for best (tightest) fit to the optical fiber to achieve maximum connector (optical) performance. Fitting the optical fiber to the next larger ferrule hole diameter may affect connector performance.

Fiber size: Multimode (62.5/125 micron per MIL-PRF-49291/6).

Cable type: MIL-PRF-85045/16.

Epoxy type: Approved sources of supply for MIL-PRF-24792, PIN M24729-A, as listed in the Navy Recommended Fiber Optic Components Parts List. A copy of this document can be obtained at Web Site: https://fiberoptics.nswc.navy.mil/ in the Recommended Parts List section under Recommended Parts List.

(2) Insert-to-terminus compatibility (Terminus insertion and removal forces, Terminus retention). When both single mode and multimode test configurations are submitted, only 16 socket termini and 16 pin termini need to be submitted. Test samples may be either or a combination of single mode and multimode.

(a) Candidate pin terminus (minimum quantity: 16).

(b) Candidate socket terminus (minimum quantity: 16, un-terminated, with alignment sleeves).

4. Other fabrication and test sample assembly requirements.

a. Hand versus machine polish. Test samples may be terminated using a machine polish for one or more of the polishing steps. This leeway does not exclude the vendor from submitting a marked up procedure with a hand polish for use in the Fleet/Field.

b. Launch conditions. No launch condition jumpers are required for the multimode fiber sizes. Overfilled launch conditions are used for interoperability testing.

(1) Fiber size 9.3/125 micron. A mandrel diameter shall be used as the means of mode conditioning to filter out higher order modes. The technique of wrapping the fiber around a mandrel shall be performed as specified see 3.5 of TIA/EIA-455-34. A diameter of 30 mm shall be used with 3 complete turns of the fiber wrapped around the mandrel.

(2) Fiber size 62.5/125 micron. For 62.5/125 micron optical fiber, use an overfilled launch condition.

c. Specific test practices. Testing shall be performed as specified in MIL-PRF-29504/18 using cited test standards (such as TIA/EIA). Specific test practices for the optical performance tests, including clarifications and further details, are found in the Optical Test measurement Guide. A copy of this document can be obtained at Web Site: https://fiberoptics.nswc.navy.mil/ in the Policy and Guidance section under Testing Information.

d. Return loss requirements for multimode fiber. Whenever in the test sequence a return loss measurement for single mode fiber size is specified, a measurement for the multimode fiber size shall be performed also (when test samples with multimode fiber are being tested). The optical performance requirement for return loss using multimode fiber shall be determined from tests results obtained during the QPL testing. For standardization (consistency), the multimode return loss shall be performed using a single mode coupler or single mode ORLM. The optical source used shall be at the 1310 nm wavelength. Specific test practices shall be used for return loss and the other optical performance tests as cited in the Optical Test measurement Guide. A copy of this document can be obtained at Web Site: https://fiberoptics.nswc.navy.mil/ in the Policy and Guidance section under Testing Information.

This appendix is to be used for termination of the M29504/18 terminus onto the end on a fiber optic cable. Recommendations for any revisions are welcome and are to be submitted for approval.

Appendix A
Termini Termination for M29504/18

Reference Material

Definitions ..... WP 003 01
Safety ..... WP 004 01
HAZMAT..... WP 004 02
Handling ..... WP 006 01
Inspection ..... WP 008 01
Manual Cleaning Procedures ..... WP 008 02
Programming Curing Oven ..... WP 010 02

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Record of Applicable Technical Directives

None

Support Equipment Required

Item	Description	Quantity	Cage Code	Part or Identifying No.
Termination Tools & Accessories				
	Cutting and Stripping			
102	Strip tool, buffer (micro strip), commercial & M85045/16 fiber, w/ red blades NSN 5110-01-419-4361	1	08RC6	0700-3070
102A	Blades, aircraft fiber, strip tool, buffer (micro strip), light blue blades	1	59984	MS1-RB-10S
103	Alternate strip tool, buffer (no nicks), commercial & M85045/16 fiber, red handle	1	71827	NN203
103A	Alternate strip tool, buffer (no nicks), aircraft fiber, blue handle	1	71827	NN254
104	Strip tool, OFCC, AWG 18, commercial & M85045/16 cable	1	75347	11045
			64959	104 278 478
104A	Strip tool, OFCC, aircraft tight buffered cable	1	30119	45-162
104B	Strip tool, OFCC, aircraft loose tube cable	1	30119	45-163
105	Shears, Aramid yarn (Kevlar) NSN 5110-01-419-5283	1	71827	86 1 /2S
			OKN34	744
109A	Template, cut length, MIL-PRF-29504/18 (64266)	1	08RC6	
			OYPM2	FSST100021 5/
			06324	182-020 5/
110	Ruler, Machinist	1	81348	GGG-R-79
	NSN 5200-00-725-7347		32445	SS-6
111	Cleaning wire, 125 um, w/ container (3 pieces min)	1	08RC6	0700-3210

Item	Description	Quantity	Cage Code	Part or Identifying No.
	NSN 9505-01-376-9398			
112	Pick, for separating braided aramid yarn (fiber glass)			
	Injecting & crimping			
	Crimp Tool with die set having .0945 hex, for MIL-PRF-29504/14, /15 & /18	1	53669	1143130-9S
			08RC6	0701-2001
	Cleaving			
146	Scribe, fiber optic, carbide NSN 5110-01-419-4360	1	08RC6	0700-3750
			0YPM2	FSTP0010 5/
147	Debris bottle, flip-top, for cleaved fiber ends	1	08RC6	0700-9975
	Curing for temperature range 2			
143	Cure adapter, pin terminus, M29504/18 (used with MIL-PRF-64266 connectors)	12	08RC6	
			0YPM2	FSPP-124-00-003 5/
145	Microclip	16	76545	BU-34
148	Needle nose pliers 1/	1	08RC6	0745-2260
	Curing oven for temperature range 2	1	0LDN2	T-S50V-BRC
	Curing for temperature range 1			
A143	Curing oven, NSN 4430-01-419-6384	1	08RC6	0701-4010
A144	Heater block, for MIL-PRF-29504	1	08RC6	0701-4020
A145	Cure adapters for MIL-PRF-29504/18 (used with MIL-PRF-64266 connectors)	16	08RC6	
			0YPM2	FSPP-124-00-003 5/
A146	Cable stand for curing oven	1	08RC6	0701-4030
A147	Cable stand ring for curing oven	1	08RC6	0701-4040
	Polishing			
151	Polishing tool (puck), M29504/18 pin	1	06324	182-021 5/
			0YPM2	FSTF10062-1 5/
			53669	4568334-7H 5/
	Polishing tool (puck), 1.25 mm ferrule, generic	1	08RC6	0700-1725 ???
			0YPM2	FSPP-113-00-003 5/
			06324	182-022 5/
160	Polishing plate (glass, 6x6 min) NSN 6080-01-377-4502	1	08RC6	0700-4110
161	Resilient pad, 70 durometer, 5 " diameter	1	3ZCB8	SP2-P-070
162	Resilient pad, 90 durometer, 5" diameter	1	3ZCB8	SP2-P-090
165	Water bottle, 4 oz Squeeze, w/ cap NSN 8125-01-428-8839	1	08RC6	0700-9700
	Connector assembly			
171	Screwdriver, reversible	1	08RC6	4300-9000
	Insertion tool, for MIL-PRF-29504/14, /15 & /18	1	53669	1093784S
			08RC6	0701-3820
			0YPM2	FSTF0076 5/
			06324	182-023 5/
			71468	274-0058-001 5/
	Insertion tool, 90 deg, for M29504/14, /15 & /18	1	53669	1143042-2S
			08RC6	0701-3810
			0YPM2	FSTS0077 5/
			06324	182-024 5/
	Removal tool, for MIL-PRF-29504/18	1	53669	1021238H…5/
			08RC6	
			0YPM2	FSTS1411-1 5/
			06324	182-025 5/
			71468	274-0058-000 5/
	ASR assembly tool for alignment sleeve, for MIL-PRF-29504/18	1	53669	1021280H 5/
			08RC6	
			0YPM2	FSTS1006-1 5/
			06324	182-026 5/
190	**Miscellaneous**			
190	Flashlight	1	62576	230
			7J761	1900C

Item	Description	Quantity	Cage Code	Part or Identifying No.
191	Foreign Object Debris (FOD) pouch	6	08RC6	0400-3020
192	Tweezers	1	08RC6	0700-8911
	Safety			
001	Safety glasses NSN 6540-01-433-7953	1	75347 7J61	60050 TK110
002	Tweezers, Teflon coated NSN 6635-01-232-9536	1	32218 7J761	GTP-293 6005268
003	Mat, black, non-reflective work surface, 12”x18” min.	1	71827	FS100
Standard Connector Termination Supplies				
	Cutting & stripping			
A101	Masking tape, ¾” x 40 yards minimum	1	08RC6	3300-6010
	Injecting & crimping: general			
A112	Syringe barrel (reservoir), 3 ml, for epoxy injection into connector/terminus	50 per box	0XUL4	5109LL-B
A112A	Syringe plunger with piston (piston = flexible plastic bottom cap), for epoxy injection into connector/terminus	ea	0XUL4	5109P
A112B	Dispensing tip, twist on, 20 gage, 1 inch long, blunt end, for epoxy injection into all connector types except SC	50 per box	0XUL4	5120-1-B
A112C	Dispensing tip, twist on, 18 gage, 0.5 inch long, chamfered end, for epoxy injection into SC connector only	50 per box	0XUL4	5120-1-B
A112D	Syringe (barrel, plunger & piston) w/twist on dispensing tips (needles), 3 ml capacity for dispensing epoxy NSN 5120-01-438-6563 Alternative to ordering A112, A112A and A112B since packaged as a set.	20	08RC6	0700-5100
A114	Dental floss, un-waxed, 50 yards minimum NSN 6520-00-092-3181	1	32132	9215
	Injecting & crimping: temperature range 2			
A111	Epoxy, heat cured, 2 part, 353ND, 2 gram A-PAKS	100 min	64201	353ND-2g
		6	08RC6	3700-5520
A113	Epoxy, fast cured, Double Bubble Red, 2 part, 3.5 gram, 100/box for NSN NSN 8040-00-092-2816	1 box	96900	04001
		6	08RC6	0700-5510
	Injecting & crimping: temperature range 1			
B113	Epoxy, 2 part, bi-pack, MIL-A-24792	1 box	96900	04001
	NSN 8040-0-421-3510	6	08RC6	0700-5510
	Curing			
	None			
	Polishing papers for temperature range 2			
A121	Polishing paper, 5um, foam backed, 5”x5” min, 50 sht NSN 5350-01-420-1454	2	64959 41946	105 488 175 915-05-604
A122	Polishing paper, 1um, mylar backed, aluminum oxide, 10 sht NSN 5350-01-376-9388	2	64956 41946	105 076 798 915-01-301
A123	Polishing paper, 0.1um, mylar backed, diamond, 10 sht	1	078Z1	60-0000-2856-7
	Polishing paper, ultrafine (0.5 um silica), mylar backed, 5” dia.	100 sht	30CX5	HF5D
	Polishing papers for temperature range 1			
B121	Polishing paper, 5um, foam backed, 5”x5” min, 50 sht NSN 5350-01-420-1454	2	64959 41946	105 488 175 915-05-604
B122	Polishing paper, 1um, mylar backed, aluminum oxide, 10 sht NSN 5350-01-376-9388	2	64956 41946	105 076 798 915-01-301
B123	Polishing paper, 0.1um, mylar backed, diamond, 10 sht	1	078Z1	60-0000-2856-7
B124	Polishing paper, ultrafine (0.5 um silica), mylar backed, 5” dia.	100 sht	30CX5	HF5D
	Connector assembly			
	None			
	Miscellaneous			

Item	Description	Quantity	Cage Code	Part or Identifying No.
	Cleaning supplies: See note below table.			
	Safety			
A001	Gloves,examining,nitrile,powder-free,6 mil thick,100/bx	1	59728	5761R08

1/ Usage for needle nose pliers. Polishing: Removal of cure adapters if stick in oven due to epoxy leakage onto oven heating well bottom. Connector assembly: Removal of alignment sleeves from terminus pins.
2/ Cleaning consumable supplies only. Cleaning supplies are not listed in this table.
3/ Recommend cleaning inspection equipment includes a Fiber Optic Video Inspection System (FOVIS) with applicable inspection probe tips.
4/ Part numbers listed are for manufacturers' products that have been identified to meet the full requirements for the item. Other manufacturers are welcome to produce equivalent products for outfitting the set. Applicability to be determined through the applicable supply process.
5/ Item listed in this table for reference only. Item must be evaluated by the Government for approval prior to being placed on final listing.

Materials Required

Fiber Size (core/cladding) um	Ferrule Hole Diameter um	TICC (1st = Temp. Range)	Cage 0YPM2 Part Number COTS Equivalent	Cage 53669 Part Number COTS Equivalent	Cage 06324 Part Number COTS Equivalent	Cage 71468 Part Number COTS Equivalent
Temperature Range 1						
Single Mode 9/125	125 +1/-0	-101	M29N0101	1020880-1250H	181-043-101	031-9747-001
Single Mode 9/125	125.5 +1/-0	-102	M29N0102	1020880-1255H	181-043-102	031-9747-003
Single Mode 9/125	126 +1/-0	-103	M29N0103	1020880-1260H	181-043-103	031-9747-004
50/125, 62.5/125	126 +1/-0	-126	M29N0126	1020880-1261H	181-043-126	031-9747-005
50/125, 62.5/125	127 +1/-0	-127	M29N0127	1020880-1270H	181-043-127	031-9747-002
Temperature Range 2						
SM < 9/125	125 +1/-0	-204	M29N0204	1020880-2250H	181-043-204	031-9747-012
SM < 9/125	125.5 +1/-0	-205	M20N0205	1020880-2255H	181-043-205	031-9747-013
SM < 9/125	126 +1/-0	-206	M29N0206	1020880-2260H	181-043-206	031-9747-014
Single Mode 9/125	125 +1/-0	-201	M29N0201	1020880-2251H	181-043-201	031-9747-001
Single Mode 9/125	125.5 +1/-0	-202	M29N0202	1020880-2252H	181-043-202	031-9747-003
Single Mode 9/125	126 +1/-0	-203	M29N0203	1020880-2261H	181-043-203	031-9747-004
50/125, 62.5/125	126 +1/-0	-226	M29N0226	1020880-2263H	181-043-226	031-9747-005
50/125, 62.5/125	127 +1/-0	-227	M29N0227	1020880-2270H	181-043-227	031-9747-002
100/140	142 +1/-0	-242	M29N0242	1020880-2420H	181-043-242	031-9747-006
100/140	145 +1/-0	-245	M29N0245	1020880-2450H	181-043-245	031-9747-007
62.5/125/155	156 +3/-0	-256	M29N0256	1020880-2560H	181-043-256	031-9747-008
62.5/125/155	157 +3/-0	-257	M29N0257	1020880-2570H	181-043-257	031-9747-009
100/140/172	173 +3/-0	-273	M29N0273	1020880-2730H	181-043-273	031-9747-010
100/140/172	175 +3/-0	-275	M29N0275	1020880-2750H	181-043-275	031-9747-011

NOTE: Once there is a qualified source of supply to MIL-PRF-29504/18, only those qualified source(s) will be listed.

1. **INTRODUCTION**.

2. This termination procedure is the method to be used by personnel for placing M29504/18 termini onto the ends of fiber optic cable on aircraft platforms.

3. Termini termination method for M29504/18 (onto tight buffered cable or loose tube cable).

This termination method is for placing a MIL-PRF-29504/18 terminus onto the end of a tight buffered, fiber optic, single fiber (simplex) cable or onto the end of a loose tube, fiber optic, simplex cable. The MIL-PRF-29504/18 terminus is used with a MIL-PRF-64266 multiple termini connector. This termination method is applicable for both Temperature Range 1 (-40 to +85 ^{o}C) and for Temperature Range 2 (-55 to +165 ^{o}C). When the platform specific maintenance manual does not specify the temperature range, perform terminations using temperature range 2.

CAUTION: Throughout the termination process, cleanliness is critical to obtaining a high optical quality connector. Make sure that your hands and the work area are as clean as possible to minimize the ingress of dirt into the connector parts.

NOTE: Verify that the epoxy shelf life has not expired. Do not use epoxy with an expiration date that has passed.

a. Safety summary. The following safety precautions shall be observed:

(1) Safety glasses shall be worn at all times when handling bare fibers or dispensing epoxy.

(2) Do not touch the ends of the fiber as they may be razor sharp. Wash your hands after handling bare fiber.

(3) Avoid skin contact with epoxies and cleaners (alcohol). Gloves or finger cots are recommended to prevent biological reactions to the cleaning chemicals and epoxy and to prevent the transfer of skin oils to the fiber optic components.

(4) Do not stare into the end of a fiber until verifying that the fiber is not connected to a laser light source or LED.

b. Cable and fiber preparation.

NOTE: Refer to table 021-06-I and figure 021-06-1 for cable stripping dimensions.

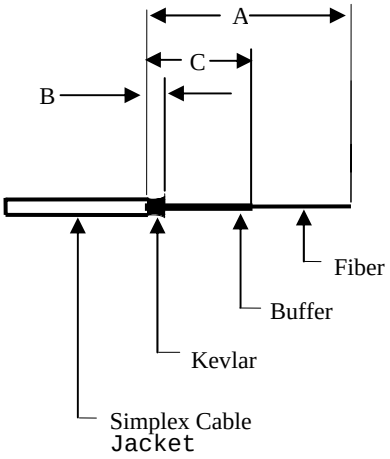

Figure 021-06-1. Cable stripping dimensions.

Table 021-06-I. Cable stripping dimensions.

Dimensions mm (in) 1/, 2/ M29504/18 Pin Terminus		
A	B	C
43.2 (1.71)	4.5 (0.18)	21.7 (0.85)

1/ Tolerances on all dimensions are ± 0.8 mm (0.03 in), where feasible, use vendor preferred tolerance of ± .5 mm (0.02in).
2/ Dimension B assumes a non-braided Kevlar strength member is used.

Step 1 - Feed each simplex cable (single fiber cable) into the supplied crimp sleeve, that is packaged with the M29504/18 termini, and slide the crimp sleeve back from the end of the simplex cable.

NOTE: Only use the crimp sleeve that is supplied with the M29504/18 termini for the Kevlar capture/strain relief mechanism. Do not use crimp sleeves intended for other type connectors. The standard crimp sleeve for this terminus may be oriented in either direction.

Step 2 - Mark the simplex cable outer jackets to dimension A and to dimension B in table 021-06-I.

Step 3 - Remove the simplex cable jackets back to dimension B in table 021-06-I using the simplex cable stripper and trim the Kevlar (aramid yarn) using the Kevlar shears so that it is even with the simplex cable jacket.

NOTE: The optimum way to remove the simplex cable jackets is to ring cut the jacket with the simplex cable stripper and pull the jacket off by hand. Pushing off the simplex cable jacket with a tightly held simplex cable stripper can lead to fiber breakage.

Step 4 - Next remove the simplex cable jackets back to dimension A in table 021-06-I using the simplex cable stripper. This step will expose the Kevlar to the appropriate length.

Step 5 - WARNING: Wear safety glasses when removing the fiber buffer and coating to avoid possible eye injury.

Remove the fiber buffers and coatings back to dimension C in table 021-06-I using the buffer stripper. Remove the buffer and coating in small sections (approximately 6 mm (0.25 in) at a time.)

NOTE: Normally, the buffer and coating are tightly adhered to one another and come off of the fiber at the same time.

NOTE: Some aerospace cables have a silicone buffer which can be remove in one section, using the buffer stripper, instead of having to be removed in 6 mm (0.25 in) increments.

NOTE: Polyimide coatings are not to be removed.

Step 6 - CAUTION: The uncoated/bare (or polyimide coated) fiber is in its most vulnerable state. Take extreme care not to damage the fiber. Breakage of any one fiber from this point until the connector is completely assembled will require repetition of this and the following steps in order to maintain approximately equal length of all the fibers in the cable.

Remove any residual coating material from the bare fibers with a wipe dampened with alcohol. Wipe only once from the end of the buffer towards the end of the fiber. (NOTE: Do not repeatedly wipe the bare fiber, as this will weaken the fiber.)

NOTE: Do not dampen the Kevlar strength member while cleaning the fiber. Alcohol will contaminate the epoxy and compromise the bond of the strength member to the terminus.

NOTE: Tolerance on and fabrication method for the cable harness is Platform dependent. The example that follows is based on requirements for a tighter tolerance cable harness. Tolerance on the overall length of the cable harness shall be +13/-0 mm (+0.5/-0.0 in). Tolerance for each cable in the cable harness shall be +7/-0 mm (+0.25/-0.0 in). One approach to fabricate a cable with this tolerance is given by providing an example of a cable with a face-of-termini to face-of-termini required length of 2.540 m (100 inches). Start with a cut cable length of 2.69 to 2.84 m (106 to 112 inches). This length will allow two to three terminations of the first end in the event the terminus must be cut off and replaced. No leeway can be given for re-termination of the second end. After successful termination of the first end, measure to 2.559 m (100.75 inches) from the face of the terminus to the cut point. Do second end termination. After a 1.5 mm (0.63 inch) length of fiber cleaved from the end, the face-of-termini to face-of-termini length should be about 2.543 m (100.13 inch). The cable length falls midrange between the allowed cable length of 2.540 to 2.546 m (100 to 100.25 inches).

NOTE: Recommended time that the bare fiber be exposed to the environment before installation into the terminus is 60 minutes or less.

c. Installation of the termini onto the fibers.

NOTE: This procedure describes the process for installing ceramic termini onto either multimode or single-mode fibers. Epoxy is used to secure the fiber in the termini for mating purposes. The crimp sleeve is used to secure the Kevlar onto the outside of the termini for the required tensile strength.

NOTE: Verify that the programmable oven is programmed with the curing sequence in WP 010 02. (The programmable oven is for temperature range 2 only.)

NOTE: The programmable oven does not have an On/Off switch.

NOTE: Step 1 below needs to be accomplished prior to installing the termini onto the simplex cable.

Step 1 - Plug in the programmable oven. There will be numbers in the upper and lower displays, however the oven is not running the curing program. Verify that the oven is programmed properly. For temperature range 1, just turn on the oven.

Step 2 - Inspect the terminus and verify that the ferrule hole is free and clean of dirt. This can be accomplished by holding the front of the terminus up to a light and verifying that the light is visible from the rear of the terminus. If light cannot be seen through the terminus, push music wire through the terminus hole to clear it. Then blow dry air through the hole to remove any debris. (See note below for tight ferrule hole tolerance applications).

NOTE: Do not use music wire that is oxidized or rusted.

NOTE: For some applications, there may be a tight ferrule hole tolerance requirement. If the application requires a tight ferrule hole tolerance, then several termini with different ferrule hole diameters will need to be kept on hand. Dry fit the termini onto the fiber, to ensure proper ferrule hole clearance, before injecting epoxy into the termini. Try the smaller ferrule hole diameter first; if the termini will not fit then proceed to the next larger ferrule hole diameter.

Step 3 - Remove the divider from a 2-part epoxy package and slowly mix the two parts together until the epoxy is a smooth uniform color (see figure 021-06-2). The epoxy can be mixed by either repeatedly rolling the divider over the package or gently sliding the divider over the package.

CAUTION: Do not introduce large air bubbles into the epoxy during the mixing process. Mix the epoxy slowly to minimize the introduction of air bubbles. Large air bubbles in the epoxy can lead to connector failure during temperature extremes.

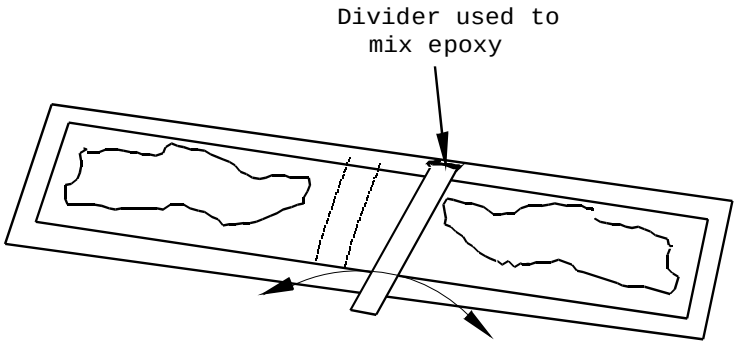

Figure 021-06-2. Mixing the epoxy.

NOTE: Alternatively, the epoxy may be mixed by slowly massaging the epoxy package by hand.

Step 4 - Install the syringe tip on the syringe, remove the plunger, and squeeze the epoxy into the syringe. Replace the plunger.

Step 5 - WARNING: Wear safety glasses while dispensing the epoxy to avoid possible eye injury.

Remove air pockets in the syringe by holding the tip of the syringe upward and dispensing epoxy onto a wipe until it runs free and clear.

Step 6 - Slide the terminus, rear first, onto the syringe tip (see figure 021-06-3). Keeping the syringe vertical, depress the plunger and slowly inject epoxy into the terminus until it escapes out of the ferrule, forming a very small bead. Do not overfill.

NOTE: Be extremely careful not to get epoxy on the spring or other terminus moving parts.

NOTE: While depressing the plunger and slowly ejecting the epoxy, push the terminus against the syringe tip. This applied pressure will prevent the terminus lifting off the tip before the terminus is filled.

NOTE: Minimize air bubbles by holding syringe at a slight angle to the vertical while filling the terminus with epoxy.

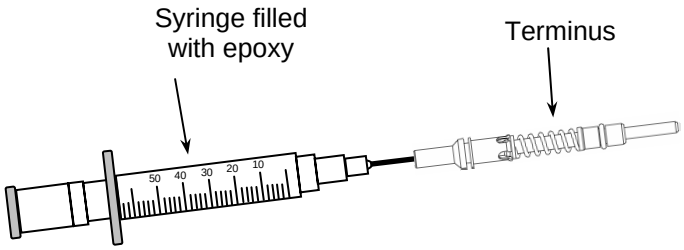

Figure 021-06-3. Injecting epoxy into the terminus.

Step 7 - Withdraw the syringe from the terminus. Maintain some pressure on the plunger as the syringe is withdrawn so that the terminus is completely filled with epoxy. Using a wipe dampened with alcohol, wipe away any epoxy on the outer diameter of ferrule without disturbing the epoxy bead.

NOTE: Avoid trapping air in the epoxy during syringe tip removal. Keep the syringe tip in the epoxy while filling the remainder of the terminus.

NOTE: Alternatively, the terminus may be completely filled by maintaining a light pressure on the syringe plunger and allowing the epoxy to push the terminus off of the syringe tip.

Step 8 - Feather the Kevlar evenly around the fiber and insert the fiber into the rear of the terminus (see figure 021-06-4). Gently work the fiber through the terminus until the fiber fully seats inside the terminus. (The terminus should be rotated around the fiber as the fiber is inserted.) The cable outer jacket should come up to the rear of the terminus and the Kevlar should surround the rear of the terminus. Once inserted, do not allow the fiber to slip back.

NOTE: Wetting the fiber with a thin layer of epoxy before inserting into the terminus reduces the chance of entrapping air (being "dragged" next to the fiber) during terminus insertion.

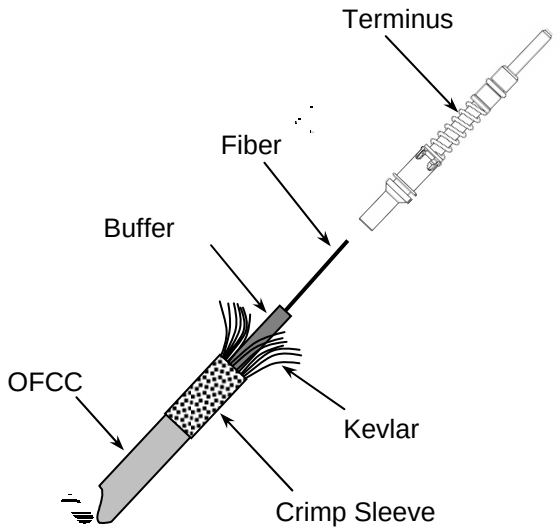

Figure 021-06-4. Inserting the fiber into the terminus.

Step 9 - Perform this step only for a tight buffered cable. Perform this step for temperature range 2 only. Apply a thin line of fast cure epoxy (Hardman Double Bubble #04001) on the Kevlar, at the base of the outer jacket, of the tight buffered simplex cable.

NOTE: Do not allow this line of fast cured epoxy to extend down the length of the Kevlar. Keep the line of fast cured epoxy on the Kevlar at the base of the outer jacket.

NOTE: This step is done to prevent the Epo Tech 353ND epoxy from wicking up the Kevlar and under the simplex cable jacket.

NOTE: The thin line of fast cure epoxy may be applied with a toothpick.

NOTE: This fast cure epoxy does not need to be dry (takes about 5 minutes) prior to performing the next step.

Step 10 - Slide the crimp sleeve over the Kevlar and crimp it to the rear of the terminus using an approved crimp tool.

NOTE: A small amount of epoxy may be added on the Kevlar near the rear of the terminus before the crimp sleeve is installed. No epoxy should be visible once the crimp sleeve is installed.

Step 11 - Verify that the Kevlar does not protrude excessively from under the crimp sleeve. Excessive Kevlar protrusion will cause the terminus to not seat properly in the finished connector. If excessive Kevlar protrudes from under the heat shrink, trim it back using Kevlar shears.

NOTE: Ideally, no Kevlar should be visible. Verify that the cable is bottomed in the terminus.

Step 12 - Verify that there is a small amount of epoxy around the fiber where it protrudes from the ferrule. If it is found that there is no small bead of epoxy on the terminus tip, carefully add a small amount of epoxy around the fiber. (NOTE: There should only be a small amount of epoxy around the fiber to support it later during the polishing process. If too much epoxy is around the fiber during the curing process, it may cause damage to the optical glass fiber.

Step 13 - Use a wipe dampened with alcohol, to carefully wipe away any excess epoxy on the fiber that is more than 2 mm (0.1 in) from the ferrule tip surface.

NOTE: Ensure that no epoxy gets onto the spring on the terminus. If epoxy does get onto the spring, then remove and replace the terminus.

NOTE: Perform steps 13 through 17 for temperature range 2.
Perform steps 18 through 22 for temperature range 1.

Step 14 - Insert the terminus into the cure adapter until it rests against the metal section (sometimes referred to as the barrel), behind the ceramic ferrule (see figure 021-06-5).

WARNING: Do not get epoxy on the outside of the ceramic ferrule of the termini. Wipe off any excess epoxy on the outside of the ceramic ferrule using a lint free cloth.

NOTE: Configuration of the cure adapter provided with the oven may be different than that shown. One cure adapter configuration has a loose hole for the ferrule. This cure adapter configuration necessitates that the cure adapters be placed in the oven before terminus insertion into the adapter (and preferably before heating). Next place the terminus into the cure adapter and position the cable vertically over the oven.

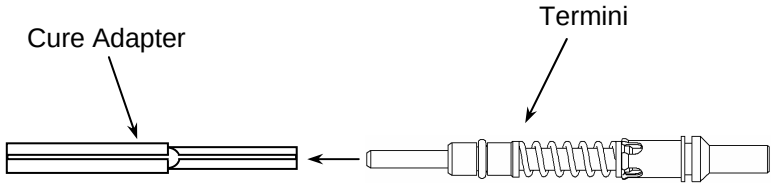

Figure 021-06-5. Inserting a terminus into a cure adapter.

Step 15 - Repeat steps 2 through 14 for each fiber to be terminated.

Step 16 - Place the cure adapters in the curing oven, and position the cable vertically over the oven using the cable stand. (see figure 021-06-6). Cure the epoxy, with the programmable oven, using the curing schedule in WP 010 01. (NOTE: When the cable is positioned above the terminus, make sure that no bends are placed in the simplex cables. Each simplex cable should enter the terminus parallel to the terminus.)

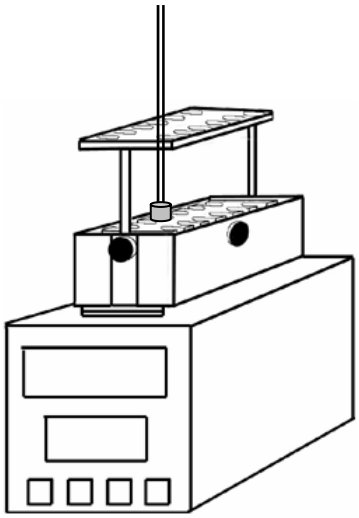

Figure 021-06-6a. Termini in the curing oven (Temperature range 2).

NOTE: Once the programmable oven is programmed, the curing program will be retained in the oven's memory.

NOTE: Observe the two displays on the oven for set point temperature and for oven temperature. Ensure oven temperature is rising by placing your hand above, but do not touch, the heating block. This measure is done to cover instances where the relays do not actuate the heating elements.

Step 17 - The curing program will turn off the oven after the cool down cycle. This is indicated by seeing the number 20 (for 20 degrees Celsius) in the lower display. Remove the cure adapters and termini from the curing oven. Allow the cure adapters and termini to cool for approximately 4 minutes.

Step 18 - Insert the terminus into the cure adapter until it snaps into place (see figure 5A1-6).

Step 19 - Repeat steps 2 through 14 for each fiber to be terminated.

Step 20 - Place the cure adapters in the curing oven, and position the cable vertically over the oven using the cable stand, cable stand ring and cable clip (see figure 021-06-6b). Cure the epoxy for a minimum of 10 minutes (maximum of 30 minutes) at 120^{o}C (248^{o}F). (NOTE: When the cable is positioned above the terminus, make sure that no bends are placed in the OFCCs. Each OFCC should enter the terminus parallel to the terminus.)

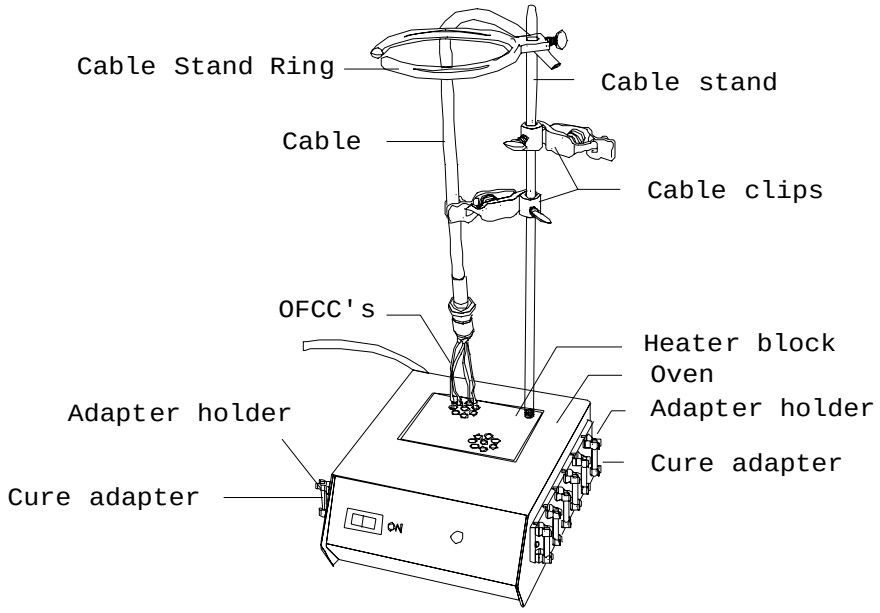

Figure 021-06-6b. Termini in the curing oven (Temperature range 1).

Step 21 - Turn the curing oven off and remove the cure adapters and termini from the curing oven. Allow the cure adapters and termini to cool for approximately 4 minutes.

d. Polishing the fiber ends.

NOTE: Use one of the two following procedures, whichever is applicable.

(1) Procedure 1: Standard polish for domed ferrules.

NOTE: This procedure will produce a Physical contact (PC) polish on a terminus with a domed end face on the ferrule. This procedure is typically used for single mode applications with a minimum return loss requirement of 30 db. This procedure is used for multimode also.

NOTE: Procedures for hand polishing are contained herein. Machine polishing may be used as an alternate method, provided the following requirements are satisfied:

(a) The manufacturer's instructions will be rigidly adhered to, except that the polishing papers or disks shall be 5 um aluminum oxide foam backed or mylar backed and the other polishing papers listed in table 021-06-II for the particular vendor's terminus as used in hand polishing. (NOTE: Alternate polishing materials may be used if authorized approval is obtained and the polishing machine includes the appropriate stops to prevent changes to the ferrule length.)

(b) The machine polished terminus shall undergo the same quality check used for the manually polished terminus as described herein.

Step 1 - WARNING: Wear safety glasses when scoring the fiber to avoid possible eye injury.

Remove the terminus from the cure adapter and score the fiber close to the terminus tip at the epoxy interface. Hold the cleaving tool perpendicular to the fiber and rest the wedge of the cleaving tool on the corner of the terminus. Use one short light stroke with cleaving tool (see figure 021-06-7) to score the fiber.

(NOTE: Do not break the fibers with the cleaving tool.) Pull off each fiber with a gentle, straight pull. Deposit the waste fiber in a trash container.

NOTE: Holding the cleaving tool perpendicular to the fiber assures that the fiber will be cleaved above the ferrule end face.

NOTE: Do not perform multiple strokes or a sawing motion to score the fiber. Splintering of the fiber, rather than a clean break, can result.

NOTE: The termini not being polished should be left in the cure adapters during the polishing process to protect the fibers from breakage.

NOTE: The termini may bond to the cure adapter. Use a pair of needle nose pliers to hold behind the metal shoulder of the termini and then slowly rotate the cure adapter to break the termini free of the cure adapter. Be careful not to break the fiber during this process. Use a razor blade to clean excess epoxy from the side of the ferrule. Afterwards, verify that the terminus has not been damaged.

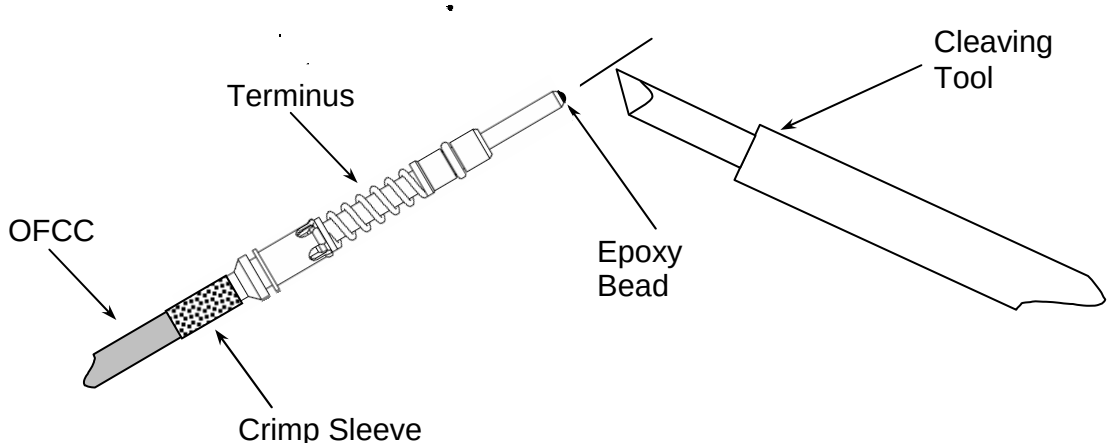

Figure 021-06-7. Scoring the fiber.

Step 2 - Air polishing (preliminary and optional step). Before inserting the terminus into the polishing tool, the terminus may be held vertically and the end of the fiber polished off by lightly running the 5 um polishing paper over the top of the terminus tip. (This is referred to as air polishing the terminus.) Use only the weight of the polishing paper on top of the terminus. Polish the terminus tip using a circular motion. Epoxy bead may be polished until there remains only a small layer on the termini tip (ferrule end face). Alternately, air polish may be done only until glass is not exposed above the epoxy.

NOTE: Use the specified polishing puck for this terminus (See figure 021-06-8).

NOTE: Experienced maintainers will achieve the required ferrule end face geometry after polishing using a standard polishing puck for the 1.25 mm ferrule. Less experienced maintainers would benefit from using the polishing puck specific to the MIL-PRF-29504/18 terminus (i.e., the custom puck).

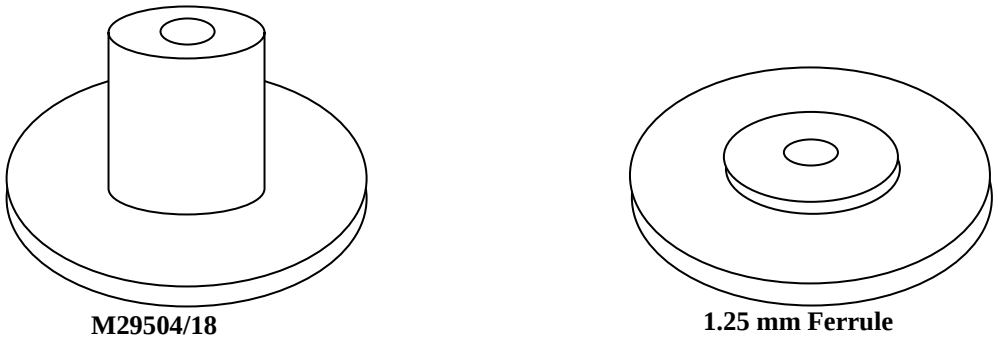

Figure 021-06-8. Polishing pucks for M29504/18 terminus.

Step 3 - Clean the glass polishing plate, the resilient pad, the backs of the polishing papers, and the surface of the polishing tool using a wipe dampened with alcohol. Blow all of the surfaces dry with air.

NOTE: Inspect the spring on the terminus after scoring (cleaving) and prior to polishing to ensure spring movement. If full spring movement is not evident, then the terminus must be removed and replaced.

Step 4 - Insert the terminus into the polishing tool (see figure 021-06-9).

NOTE: Difficulty in inserting the connector ferrule into the polishing tool may indicate epoxy on outside of the ferrule that must be removed before proceeding.

NOTE: Clean the terminus and polishing tool prior to terminus insertion into the polishing tool as stated in step 2.

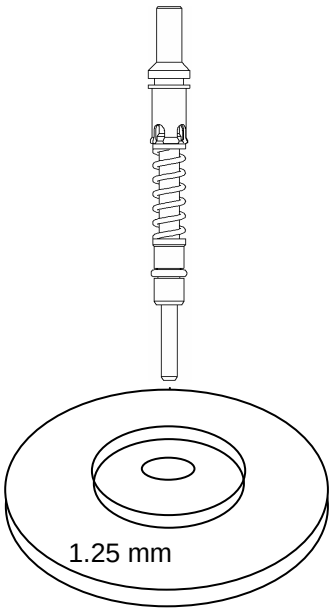

Figure 021-06-9. Inserting the terminus into the polishing tool.

Step 5 - 1st polish on plate. Place the 5 um polishing paper on the glass plate and start polishing the terminus with very light pressure (the weight of the tool) using a figure-8 motion until only a slight epoxy haze is present. Do not overpolish the terminus so that all of the epoxy is removed.

NOTE: The first polish is complete when almost all, but not all, of the epoxy is gone from the tip of the terminus.

NOTE: Since the polishing time varies with the amount of epoxy present on the tip of the terminus, inspect the terminus tip frequently. Perform a rough inspection of the ferrule end using the eye loop.

NOTE: Whenever the polishing tool is lifted, remove the grit from the tool and the terminus with a wipe dampened with alcohol or with air. When polishing is complete, clean the terminus and the polishing tool using a wipe dampened with alcohol and blow them dry with air.

NOTE: The figure 8's should be approximately 4 inches in height (error on high and not low side, i.e., 4 to 4.5 inch height). Each half of the figure 8 should appear more circular than elliptical (the figure 8 should be about 2 inch wide, error on the high side of 2 to 2.5 inches wide).

NOTE: This step may be completed using an air polish in lieu of polishing with the 5 micron aluminum oxide on a glass plate. If air polished, the method listed in the note under step 1 is to be used.

NOTE: Non-availability of 5 micron, aluminum oxide, foam backed paper. The purpose of the foam back paper is to cushion the fiber and prevent it from breaking when polishing on the glass plate. A 5 micron aluminum oxide mylar backed polishing paper may be used in lieu of the foam backed paper if a resilient pad is placed between the polishing paper and the glass plate. The resilient pad acts as a substitute for this cushioning function. A grit size larger than 5 microns is not used to limit the size and depth of the scratches from this first polishing step. If a larger grit size is used, then more care must be exercised to retain a slightly larger haze of epoxy on the terminus tip after this step is completed (to polish out the deeper scratches in the fiber during the next polishing step). Since success in polishing out the deeper scratches is not assured, 5 micron polishing paper is used whenever available.

NOTE: Light pressure on the polishing puck is the weight of the hand on the polishing puck without any exerting any further downward pressure on the polishing puck.

Step 6 - 2nd polish on plate. Place the resilient pad on top of the glass plate. Place polishing paper for the 2nd polish on the plate listed in table 021-06-II for the particular vendor's terminus on the resilient pad. Wet the paper (optional) and polish the terminus with no pressure using a figure-8 motion until all of the epoxy is removed from the tip of the terminus. Inspect frequently during this step since the polish must be completed just after all epoxy is removed. Do not over polish. Inspect the terminus endface with the 400X inspection scope to verify that all of the epoxy has been removed. When polishing is complete, clean the terminus and the polishing tool using a wipe dampened with alcohol and blow them dry with air.

NOTE: Clean per step 3 prior to placing the terminus on the polishing paper.

NOTE: The polish tool should hydroplane above the paper surface during this polish if the paper is wet.

NOTE: The 2nd polish on the plate is complete when all of the epoxy is gone from the tip of the terminus.

NOTE: The 2nd polish on the plate may also be performed using dry paper.

NOTE: The figure 8's should be approximately 4 inches in height (error on high and not low side, i.e., 4 to 4.5 inch height). Each half of the figure 8 should appear more circular than elliptical (the figure 8 should be about 2 inch wide, error on the high side of 2 to 2.5 inches wide).

NOTE: No pressure on the polishing puck is exerting only a sideway force or motion without any downward pressure or the weight of the hand on the polishing puck.

Step 7 - 3rd polish on plate. Replace the polishing paper for the 2nd polish on the plate with the polishing paper for the 3rd polish on the plate listed in table 021-06-II for the particular vendor's terminus. Wet the paper and polish the terminus with no pressure using the specified number of figure-8 motions listed in table 021-06-II or until the endface is free of scratches. When polishing is complete, clean the terminus and the polishing tool using a wipe dampened with alcohol and blow them dry with air.

NOTE: The polish tool should hydroplane above the paper surface during this polish.

NOTE: The figure 8's should be approximately 4 inches in height (error on high and not low side, i.e., 4 to 4.5 inch height). Each half of the figure 8 should appear more circular than elliptical (the figure 8 should be about 2 inch wide, error on the high side of 2 to 2.5 inches wide).

Step 8 - Trim any loose strength member strands from the back of the terminus.

NOTE: Kevlar strands exiting from the back of the terminus can interfere with the insertion and removal tools and may cause terminus misalignment.

Step 9 - Repeat steps 1 through 8 for all of the termini.

(2) Procedure 2: Enhanced polish for domed ferrules.

NOTE: This procedure will produce a PC polish on a terminus with a domed end face on the ferrule. This procedure is typically used for single mode applications with a minimum return loss requirement of 40 db.

NOTE: Procedures for hand polishing are contained herein. Machine polishing may be used as an alternate method, provided the following requirements are satisfied:

(a) The manufacturer's instructions will be rigidly adhered to, except that the polishing papers or disks shall be 5 um aluminum oxide foam backed or mylar backed and the other polishing papers listed in table 021-06-II for the particular vendor's terminus as used in hand polishing. (NOTE: Alternate polishing materials may be used if authorized approval is obtained and the polishing machine includes the appropriate stops to prevent changes to the ferrule length.)

(b) The machine polished terminus shall undergo the same quality check used for the manually polished terminus as described herein.

Step 1 - Perform steps 1 through 8 of the standard polish procedure.

Step 2 - 4th polish on plate. Replace the polishing paper for the 3rd polish on the plate with the ultrafine paper listed in table 021-06-II for the particular vendor's terminus. Wet the paper and polish the terminus with no pressure using the listed number of figure-8 motion motions in table 021-06-II for the particular vendor's terminus.

NOTE: Clean per step 4 of standard polish procedure prior to placing the terminus on the polishing paper.

NOTE: The glossy side of the ultrafine paper should be placed facing the resilient pad.

NOTE: The polish tool should hydroplane above the paper surface during this polish.

Step 3 - Clean the terminus and the polishing tool with a wipe dampened with alcohol then dry.

Step 4 - Repeat steps 1 through 3 for all of the termini.

Table 0021-06-II. Post Polish Ferrule End Face Geometry: Domed, PC & Enhanced Domed, PC

Polishing Step	**Materials & process to use per polish**	
Application	**Temperature Range 1**	**Temperature Range 2**
Air Polish		
Paper grit size	5 micron alumina (Al_2O_3)	5 micron alumina
# of Figure 8's	Until fiber at top of bead	Until fiber at top of bead
1st Polish on Plate		
Paper grit size	5 micron alumina	5 micron alumina
# of Figure 8's	10 figure 8's 2/ Until thin haze of epoxy left	10 figure 8's 2/ Until thin haze of epoxy left
Polishing pad	90 durometer 1/	90 durometer 1/
Lubricant	none	none

2nd Polish on Plate		
Paper grit size	1 micron Al_2O_3	1 micron alumina
# of Figure 8's	10 figure 8's 3/ Until no epoxy left	10 figure 8's 3/ Until no epoxy left
Polishing pad	90 durometer 1/	90 durometer 1/
Lubricant	none	none
3rd Polish on Plate		
Paper grit size	0.1 micron diamond	0.1 micron diamond
# of Figure 8's	20 fig 8's	20 fig 8's
Polishing pad	90 durometer 1/	90 durometer 1/
Lubricant	Distilled water	Distilled water
End of procedure for Ferrule End Face Geometry: Domed, PC		
Use 4th polish on plate as final step for Ferrule End Face Geometry: Enhanced Domed, PC		
4th Polish on Plate		
Paper grit size	"ultrafine"	"ultrafine"
# of Figure 8's	10 to 30 fig 8's	10 to 30 fig 8's
Polishing pad	90 durometer 1/	90 durometer 1/
Lubricant	Distilled water	Distilled water

1/ Use specifically a 90 durometer pad in lieu of the 70 to 90 durometer pad contained in some kits.
2/ Verify that only a thin haze of epoxy is left after 10 figure 8's; however, do not over-polish.
3/ Verify that no epoxy is left after 10 figure 8's; however, do not over-polish.

e. Quality check.

Step 1 - Examine the terminus with a 400x inspection scope to ensure that the optical surface is smooth and free of scratches, pits, chips, and fractures (see figure 021-06-10). If any defects are present, repeat the polish with the 0.1 um paper. Re-terminate the fiber if necessary. (NOTE: Do not polish the terminus more than necessary to pass the quality check.) A high intensity back light may be used to illuminate the fiber during the quality check.

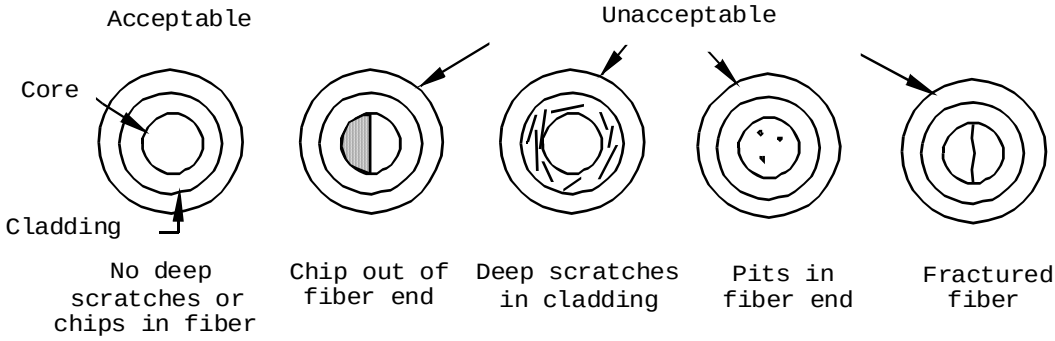

Figure 021-06-10. Quality check.

f. Installation of the terminus into the connector.

Caution: Do not install a terminus into the connector if the alignment sleeve retainer (ASR) is affixed to the connector. If affixed, remove ASR prior to installation of a terminus. Do not remove the alignment sleeve from the ASR.

NOTE: Any connector fitting adapter must be installed onto the cable, prior to the installation of the termini into the connector.

NOTE: Ensure tube on insertion tool is not bent. A bent tube could cut the grommet inside the connector.

NOTE: Before using the terminus insertion tool, inspect the tool for damage to the tip.

NOTE: The termini must be installed after the connector backshell components have been placed onto the connector shell. If the connector backshell has been assembled to the connector shell, the backshell sheath must be removed in order to install the termini.

Step 1 - CAUTION: Be careful not to rip or tear the rubber grommet at the rear of the connector.

Place the end of the terminus insertion tool at the rear of the crimp sleeve with the single fiber cable laid in the tool channel (see figure 021-06-11).

Step 2 - If the connector has a removable insert and it has not already been installed, install the insert into the connector shell. Otherwise, proceed to step 3. (NOTE: Make sure that the insert key is properly aligned in the connector shell keyway before installing the insert.)

Step 3 - Place the terminus in the proper cavity in the rear of the connector insert. Apply pressure with the insertion tool until the terminus snaps into place (see figure 021-06-11). Remove the tool by pulling straight back. (NOTE: A properly inserted terminus will have some axial "play" within the insert cavity.)

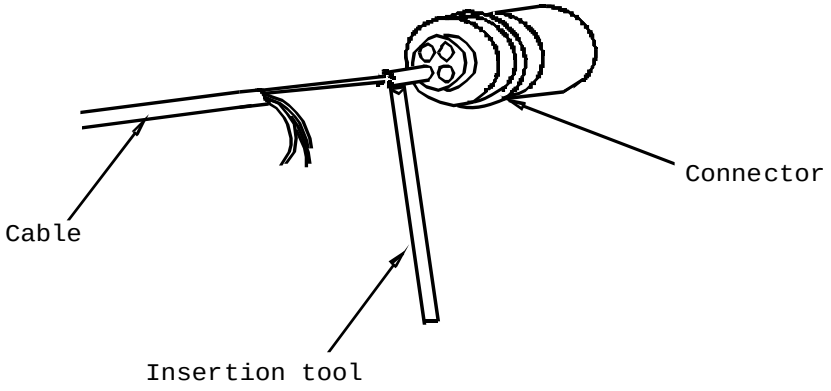

Figure 021-06-11. Installing the terminus in the connector insert.

Step 4 - Remove the tool by pulling straight back.

Step 5 - Repeat steps 1 through 4 for all of the termini.

g. Removal of the termini from the connector insert.

Caution: Do not remove a terminus from the connector if the alignment sleeve retainer (ASR) is affixed to the connector. If affixed, remove ASR prior to removal of a terminus. Do not dissemble the ASR or try to remove the alignment sleeves.

NOTE: Ensure tube on removal tool is not bent. A bent tube could cut the terminus o-ring (pressure seal) during terminus removal from the connector.

NOTE: Perform this procedure only if the termini are to be removed from the connector.

Step 1 - Insert the terminus removal tool into the terminus cavity from the rear of the insert and press until it snaps into place (see figure 021-06-12). Slide the terminus out the rear of the insert.

Step 2 - Repeat step 1 for all of the termini.

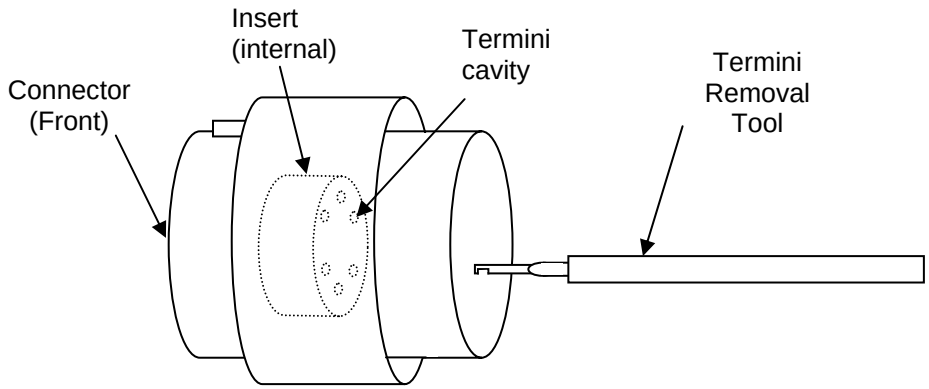

Figure 021-06-12. Removing the terminus from the connector insert.

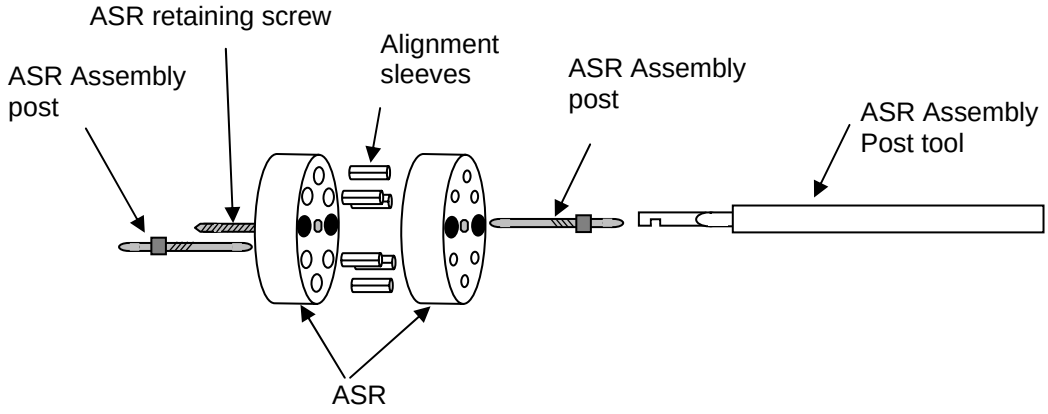

Figure 021-06-13 ASR/alignment sleeve disassembly.

h. Assembly of the ASR with alignment sleeves.

CAUTION: Take care when handling bare alignment sleeves. They are easily cracked and damaged.

NOTE: Perform this procedure only when the ASR is removed from the connector.

NOTE: Replacement of cracked or otherwise damaged alignment sleeves is one reason to use this procedure.

NOTE: Take care to not drop or lose the alignment sleeves once the ASR is no longer held together.

Step 1 Place the ASR Assembly Post tool on to the flats on the ASR assembly posts and rotate counter clockwise to unscrew and remove the post.

Step 2 Repeat step 1 on the other side of the assembled ASR to remove the second ASR Assembly post. Take care to hold the ASR together with your fingers until you are ready to separate both halves. The alignment sleeves are held in place by the mated ASR halves. Once the ASR is separated the alignment sleeves will fall out.

Note: During assembly of the ASR take care not to over tighten the ASR Assembly posts. These posts should only be tightened to a sung fit.

Note: To reassemble the ASR an alignment sleeve should be inserted into each cavity (channel) then the halves of the ASR put together carefully and held firmly while the ASR Assembly posts are inserted and tightened.

Appendix B

MIL-PRF-64266 qualification in conjunction with MIL-PRF-29504/18 or stand alone

Table A: Test Agenda
MIL-PRF-64266 Multiple Termini Connector
Initial Qualification

TEST PERFORMED	Temperature Range 1 (TR1)			Temperature Range 2 (TR2)			TR2 After TR1 is Qualified		
	Initial	Qual by Similarity		Initial	Qual by Similarity		Initial	Qual by Similarity	
	Qual	Other Shell Size by Test 2/	Other Shell Size by Xtension	Qual	Other Shell Size by Test 2/	Other Shell Size by Xtension	Qual	Other Shell Size by Test 2/	Other Shell Size by Xtension
Group 1 (4 mated pairs)									
Interoperability 11/	X	X	X	X	X	X			
Visual & Mechanical									
Size	X	X	X	X	X	X			
Weight	X	X	X	X	X	X			
Identification Marking	X	X	X	X	X	X			
Workmanship	X	X	X	X	X	X			
Screw thread	X	X	X	X	X	X			
Functional (Group 2 parts only)									
Insert retention radial strength	X	X		X	X				
Insert retention axial strength	X	X		X	X				
Terminus insert & removal forces	X			X					
Terminus retention force	X			X					
Maintenance aging	X			X					
Shell to shell conductivity	X			X					
Con coup engage&disengage Torq	X	X		X	X				
Backshell& dust cover attachment	X	X	X	X	X	X			
Optical									
Insertion loss (initial)	X	X		X	X		X	X	
Return loss (SM only)	X	X		X	X		X	X	
Crosstalk	X			X					
Group 2 (2 mated pairs)									
Cable pull out force (retention) 13/	X								
External bending moment 13/	X			X					
Cable seal flexing 13/	X			X					
Twist 13/, 17/	X			X					
Mating durability	X	X		X	X				
Return loss (SM only)	X	X		X	X				
Impact	X	X		X	X				
Crush 13/	X	X		X	X				
Vibration									
Swept sine (TR1)	X	X							
Swept sine (TR2)				X	X		X	X	
Random at temperature (TR2only)				X	X		X	X	
Random at ambient (TR1)	X	X							
Random at ambient (TR2)				X	X		X	X	
Return loss	X			X			X	X	
Shock									
MIL-S-901 (TR1 & TR2) 10/	X	X		X	X				
Half-sine pulse (TR2 only)				X	X		X	X	
Insertion loss (verification)	X			X					

Water pressure	X	X		X	X				
Modified SO2/salt spray	X			X					
Group 3 (2 mated pairs)									
Thermal shock (TR1)	X	X							
Thermal shock (TR2)				X	X		X	X	
Temperature/humidity cycling	X			X					
Temperature cycling (TR1)	X	X							
Temperature cycling (TR2)				X	X		X	X	
Altitude immersion	X	X		X	X		X	X	
Life aging (Temperature life) (TR1)	X	14/							
Life aging (Temperature life) (TR2)				X	14/		X	14/	
Insert retention radial str 6/	X			X					
Insert retention axial str 6/	X			X					
Freezing water	X			X					
Insertion loss (verification)	X	X		X	X		X	X	
Return loss	X	X		X	X		X	X	
Sand & dust	X			X					
Con coup engage-disengage torque	X			X					
Terminus cleaning	X			X					
Identification marking	X			X					
Group 4 (2 mated pair + parts) 1/									
Electromagnetic effects (2mp) 8/	X	X		X	X				
Fluid immersion (2 mated pair)	X			X					
Salt spray (2 mated pair) 3/	X			X					
Coupling engage-disengage torque	X			X					
Shell to shell conductivity	X			X					
Flammability (1 mated pair) 4/, 7/	X			X					
Fungus resistance (parts) 5/	X			X					
Ozone exposure (parts) 5/	X			X					

TR1 = Temperature range 1 (-40 to 85°C, operational)
Other shell sizes by test – applicable when testing larger shell sizes from initial shell size qualified

TR2 = Temperature range 2 (-55 to 165°C, operational)
Other shell sizes by extension – applicable when testing smaller shell sizes from initial shell size qualified

For notes 1/ through 17/, see the notes that follow table B.

Table B: Test Agenda
MIL-PRF-64266 Multiple Termini Connector With MIL-PRF-29504/18 Terminus
Initial Qualification

	Initial Qualification Termini M29504/18				**Same Time Qual Both Connector & Termini**			
	Temperature Range 1		**Temperature Range 2 after TR 1**		**Temperature Range 1**		**Temperature Range 2 after TR 1**	
TEST PERFORMED 9/	**(SM Fiber)**	**(MM Fiber)**	**(SM Fiber)**	**(MM Fiber)**	**(SM Fiber)**	**(MM Fiber)**	**(SM Fiber)**	**(MM Fiber)**
Group 1 (4 mated pairs)								
Interoperability 11/	T	T			T,C 12/	T,C 12/		
Visual & Mechanical								
Size	T	T	T	T	T,C	T	T	T
Weight	T				T,C			
Identification Marking	T		T		T,C		T	
Workmanship	T		T		T,C		T	
Screw thread					C			
Termini only: Circular runout	T	T	T	T	T	T	T	T
Functional (Group 2 parts only)								
Insert retention radial strength					C			
Insert retention axial strength					C			

Terminus insert & removal forces	T				T+C			
Terminus retention force	T				T+C			
Terminus engage&separation	T				T,C			
Maintenance aging	T				T,C			
Termini only: Terminus cleaning	T				T			
Shell to shell conductivity					C			
Con coup engage&disengage Torq					C			
Backshell& dust cover attachment					C			
Optical								
Insertion loss (initial)	T	T	T	T	T+C	T+C	T+C	T+C
Return loss (SM only)	T	15/	T	15/	T+C	15/	T+C	15/
Crosstalk					C			
Termini only: on single fiber cable								
Fiber pull out force	T				T			
Cable pull out force	T				T			
Salt spray			T				T	
Fluid immersion			T				T	
Group 2 (2 mated pairs)								
Cable pull out force (retention) 13/					C			
External bending moment 13/					C			
Cable seal flexing 13/					C			
Twist 13/, 17/	T		T		T,C		T,C	
Mating durability	T				T+C			
Termini only: Terminus cleaning	T				T			
Return loss (SM only)	T				T+C			
Impact	T				T,C			
Crush 13/					C			
Vibration								
Swept sine (TR1)	T				T+C			
Swept sine (TR2)			T	T			T+C	T
Random at temperature			T	T			T+C	T
Random at ambient (TR1)	T				T+C			
Random at ambient (TR2)			T	T			T+C	T
Return loss	T	15/	T	15/	T+C	15/	T+C	15/
Shock								
MIL-S-901 (TR1 & TR2) 10/	T	T	T	T	T+C	T+C	T+C	T+C
Half-sine pulse (TR2 only)			T	T			T+C	T+C
Insertion loss (verification)					T+C	T+C		
Return loss								
Water pressure					T+C			
Modified SO2/salt spray			T		C		T	
Group 3 (2 mated pairs)								
Thermal shock (TR1)	T				T+C			
Thermal shock (TR2)			T	T			T+C	T
Temperature/humidity cycling	T				T+C			
Temperature cycling (TR1)	T				T+C			
Temperature cycling (TR2)			T				T+C	
Altitude immersion	T		T		T+C		T+C	
Life aging (Temperature life)	T				T+C			
Life aging (Temperature life)			T				T+C	
Insert retention radial str 6/								
Insert retention axial str 6/								
Freezing water					C			
Insertion loss (verification)	T		T	T	T+C		T+C	
Return loss	T	15/	T	15/	T+C	15/	T+C	15/
Sand & dust					C			
Con coup engage-disengage torque					C			
Terminus cleaning								
Identification marking					C			

Group 4 (2 mated pair + parts) 1/								
Electromagnetic effects (2mp) 8/					C			
Fluid immersion (2 mated pair)					C			
Salt spray (2 mated pair) 3/					C		C 18/	
Coupling engage-disengage torque					C			
Shell to shell conductivity					C			
Flammability (1 mated pair) 4/, 7/	T				T+C			
Fungus resistance (parts) 5/	T				T,C			
Ozone exposure (parts) 5/	T				T,C			

T = Termini, test as termini configuration only	Temperature range 1, operational = -40 to 85 °C	C = Connector, test as connector configuration only
T,C = Termini & Connector separately, test both configurations and do separately	Temperature range 2, operational = -55 to 165 °C	T+C = Termini & Connector, test together in connector configuration

1/ Group 1 mated pair are to be used for Groups 2 and 3 tests. Group 4 can be done before Group 1 with separate samples.
2/ Only if shell size is larger than one for initial qualification, otherwise perform qualification y extension. This note is applicable for Table A only.
3/ Two options: a. Use same two mated pair from the fluid immersion test. b. Use separate mate pair (If option b, can use one cable of sufficient length to loop around to the cable entrance of each backshell).
4/ 2 mated pair from the fluid immersion, salt spray, or Group 2/3 samples after that Group's test completion may be used.
5/ Parts only, assembly not required.
6/ For non-metallic inserts, perform insert retention axial strength and insert retention radial strength after conclusion of the temperature life test.
7/ For non-metallic inserts, perform 60 second (test condition A) to region of mated pair interface also.
8/ Specific test practices for this test, including clarifications and further details, are found in the Electromagnetic Effects Test & Measurement Guide. A copy of this document can be obtained at Web Site: https://fiberoptics.nswc.navy.mil/ in the Policy and Guidance section under Testing Information.
9/ Specific test practices. Testing shall be performed as specified in MIL-PRF-29504/18 using cited test standards (such as TIA/EIA). Specific test practices for the optical performance tests, including clarifications and further details, are found in the Optical Test Measurement Guide. A copy of this document can be obtained at Web Site: https://fiberoptics.nswc.navy.mil/ in the Policy and Guidance section under Testing Information.
10/ Shock test. Standard shock fixture 4A for bulkhead mounting shall be used. Supplement test fixture that shall be used and the mounting shall be performed as specified in Mechanical Shock (Hi-Impact) Test and Measurement Guide letter. A copy of this document can be obtained at Web Site: https://fiberoptics.nswc.navy.mil/ in the Policy and Guidance section under Testing Information.
11/ Interoperability. This testing is done by DSCC-TEB which maintains/retains the interoperability standards. Please note that separate test samples are required for interoperability testing. These test samples will then be retained by DSCC as interoperability standards.
12/ Interoperability is performed on both single mode and multimode for each shell size.
13/ For temperature range 1, perform only for connectors with specific backshell configuration (such as heavy duty).
14/ Perform for connector only if they are not the same materials (including insert) and/or manufacturing process.
15/ Multimode return loss data requested. Multimode return loss data to be obtained per sheet 12 of NAVSEA Drawing 8283460.
16/ Perform this test on test samples with multimode fiber in addition to test samples with single mode fiber.
17/ For temperature range 2, perform regardless of backshell configuration.
18/ Salt spray test for connector in un-mated configuration only.

Initial Connector Qualification, Except Interoperability.

1. Initial qualification for first shell size (shell size 23 recommended). Test samples shall be constructed as specified in this drawing (see sheets 1 through 6, 8 and 9) with the following exceptions and clarifications:
   a. Shell size used. The first shell size recommended to be qualified is shell size 23 using the 36 cavity insert. Minimum shell size that can be qualified first is shell size 15 using the 10 cavity insert.
   b. Number of connector mated pair, single mode. Four connector mated pair shall be prepared for Group 1 testing. After completion of Group 1 testing two mated pair shall be used for Group 2 testing and the other two mated pair shall be used for Group 3 testing. Single mode 9 fiber shall be used.
   c. Number of connector mated pair, multimode. Two connector mated pair shall be prepared for the limited test sequence specified. Multimode fiber size used shall be 62.5/125 micron for temperature range 1 and 50/125 micron for temperature range 2.
   d. Number of cavities to populate in the connector insert. Insert cavities are to be fully populated.

e. Number of termini positions (channels) monitored With the exception of optical discontinuity for vibration and shock, at least eight termini mated pair per connector are to be monitored for optical performance during each test (i.e., there shall be at least eight active channels per connector per test) for shell sizes 15 and larger.

2. Initial qualification for small shell sizes. See test sample construction for interoperability test samples.

Initial Connector Qualification, Interoperability.

1. Initial qualification for first shell size (either shell size 15 or 23 only).
   a. Number of connector mated pair. One plug connector and one socket connector must be submitted.
   b. Number of channels to monitor. Test measurements must be obtained for each cavity in the connector.
   c. Number of cavities to populate in the connector insert. Insert cavities are to be fully populated with MIL-PRF-29504/18 termini for each test measurement. Beyond 16 termini mated pair per connector (i.e., termini-to-ST jumpers) for a shell size 23 connector, the remaining 20 cavities may be populated with un-terminated termini. If un-terminated termini are used, then cavities positions must be switched with termini jumpers so that test measurements are obtained for each cavity position. Use of dummy termini or unfilled cavities is not allowed for qualification testing, including interoperability.
   d. Number of termini mated pair, single mode. If qualifying termini in addition to connectors, test samples shall be constructed as specified in this drawing (see sheets 6 through 8). The number of additional termini-to-ST jumpers or un-terminated termini, as applicable, shall be provided so that the connector insert is fully populated.
   e. Number of termini mated pair, multimode. If qualifying termini in addition to connectors, test samples shall be constructed as specified in this drawing (see sheets 6 through 8). The number of additional termini-to-ST jumpers or un-terminated termini, as applicable, shall be provided so that the connector insert is fully populated.
2. Initial qualification for other shell sizes (once the first shell size is qualified to MIL-PRF-64266).
   a. Number of connector mated pair. One plug connector and one socket connector must be submitted for each shell size to be qualified. The number of cavities (channels) in the connector insert for each shell size shall be as follows: Shell size 11 = 2, shell size 13 = 6, shell size 15 =10, shell size 23 = 36.
   b. Number of channels to monitor. Test measurements must be obtained for each cavity in the connector for that shell size.
   c. Number of cavities to populate in the connector insert. Insert cavities are to be fully populated with MIL-PRF-29504/18 termini for each test measurement. For shell size 23, each connector shall contain 16 termini mated pair, the remainder of the cavities may be populated with un-terminated termini. If un-terminated termini are used, then cavities positions must be switched with termini jumpers so that test measurements are obtained for each cavity position. Use of dummy termini or unfilled cavities is not allowed for qualification testing, including interoperability.
   d. Number of termini mated pair, single mode. If qualifying termini in addition to connectors, test samples shall be constructed as specified in this drawing (see sheets 6 through 8). The number of additional termini-to-ST jumpers (or, if applicable, including 6 un-terminated termini for shell size 23) shall be provided so that the connector insert is fully populated.
   e. Number of termini mated pair, multimode. If qualifying termini in addition to connectors, test samples shall be constructed as specified in this drawing (see sheets 6 through 8). The number of additional termini-to-ST jumpers (or, if applicable, including 6 un-terminated termini for shell size 23) shall be provided so that the connector insert is fully populated.