

NAVSEA
STANDARD ITEM

FY-27

ITEM NO: 009-073

DATE: 01 OCT 2024

CATEGORY: I

1. SCOPE:

1.1 Title: Shipboard Electrical/Electronic Cable Procedure; inspect, test, install, remove, and repair

2. REFERENCES:

2.1 MIL-STD-2003, Electric Plant Installation Standard Methods for Surface Ships and Submarines

2.2 SE000-01-IMB-010, Navy Installation and Maintenance Book (NIMB), Section IX, Installation Standards (Source CD: N0002400003)

2.3 MIL-STD-2042, Fiber Optic Cable Topology Installation Standard Methods for Naval Ships

2.4 S9086-KC-STM-010/CH-300, Electric Plant - General

2.5 MIL-STD-1310, Shipboard Bonding, Grounding, and Other Techniques for Electromagnetic Compatibility, Electromagnetic Pulse (EMP) Mitigation, and Safety

2.6 S9300-A6-GYD-010, Electrical Workmanship Inspection Guide for Surface Ships and Submarines

2.7 S9AA0-AB-GOS-010, General Specifications for Overhaul of Surface Ships (GSO)

2.8 IA PUB-5239/31, Information Assurance Shipboard Red/Black Installation Publication

2.9 CNSSAM TEMPEST/01-13, (U) RED/BLACK Installation Guidance

2.10 ANSI/TIA-568.2 – Commercial Building Telecommunications Cabling Standard – Part 2: Balanced Twisted-Pair Cabling Components

2.11 NAVSEAINST 9304.1, SHIPBOARD CABLE AND CABLEWAY INSPECTION AND REPORTING PROCEDURES

3. REQUIREMENTS:

3.1 Ensure only Qualified Personnel prepare electrical cable endings to receive connectors, assemble connector parts on the cable endings, attach the connectors to the cable endings, supervise, and inspect the execution of the process. (See 4.5 and 4.6)

3.1.1 Submit one legible copy, in hard copy or approved transferrable media, of the credentials of the Qualified Personnel accomplishing connector fabrication, Supervision, and QA Inspection to the SUPERVISOR prior to the start or continuation of work. Submit any change as it occurs.

3.2 Inspect existing affected cable installations and interferences within the first 25 percent of contract completion. Inspect for conformance in accordance with 2.1, 2.3 and 2.11.

3.2.1 Submit one legible copy, in hard copy or approved transferrable media, of a report listing inspection results including cable installation conditions not in compliance with 2.1, 2.3 and 2.11 to the SUPERVISOR, using Attachments A and B, within 4 days of completion of inspections. (See 4.7)

3.3 Accomplish a shipboard electrical/electronic cable test on affected cables.

3.3.1 Accomplish an insulation resistance test of each electric cable conductor using the appropriate direct current megger using Table 300-3-4 of 2.4 for guidance.

3.3.1.1 Disconnect low voltage equipment associated with circuits to be tested to prevent damage during tests.

3.3.1.2 Ensure the minimum acceptable readings of each cable conductor to ground and between conductors are:

Lighting Circuit	0.5 Megohm
Power Circuit	1.0 Megohm
Degaussing Circuit	0.1 Megohm
Interconnecting Control Circuit	1.0 Megohm
Interior Communication Circuit	0.2 Megohm
Sound Powered Telephone Circuit (with telephone disconnected)	0.05 Megohm
Multiconductor Cables (with circ mil less than 1700)	0.05 Megohm

3.3.1.3 Ensure the minimum acceptable reading of coaxial cable are in accordance with Section 2.8.3.3 of 2.2:

cable with Coax...	Length (feet)	Insulation resistance in megohms (To equal or exceed)
Polyethylene or polytetrafluorethylene	100 (or less)	40,000
	200	20,000

cable with Coax...	Length (feet)	Insulation resistance in megohms (To equal or exceed)
(Teflon) dielectric	500	8,000
	1,000	4,000
Synthetic rubber dielectric	Up to 1,000	1,000
Magnesium oxide dielectric	Up to 1,000	10,000
Dielectric material arranged in layers of conducting and non-conducting rubber	Up to 1,000	500

3.3.1.4 Discharge coaxial cable to ground following insulation resistance test.

3.3.2 Test each cable conductor for continuity and complete circuit. Ensure terminal connections are tight.

3.3.3 Test each cable for conductor continuity, complete circuit, all swept electrical parameters, and bandwidth per 2.10 using a SCAT 4465 cable tester. Ensure cable connectors are tight.

3.4 Install each new cable, cableway, penetration, sleeving, lug, and connector in accordance with 2.1, 2.2, 2.5 and referenced drawings, to support work required by the individual Work Items. (See 4.2.1)

3.4.1 Ensure new cable conforms to MIL-DTL-24643 (low smoke) and MIL-DTL-24640 (lightweight). New Radio Frequency (RF) cables must conform to MIL-DTL-17 (low smoke).

3.4.2 Use existing cableways and penetrations wherever possible.

3.4.3 Ensure penetrations are the correct size in accordance with 2.1.

3.4.4 Install new cable conductor identification sleeving conforming to SAE AS23053, Class One, white, marked with indelible ink. Mark in accordance with the referenced drawings and/or equipment technical manual.

3.4.5 Install new lugs of correct size and shape conforming to MIL-T-16366 or SAE-AS7928. Do not cut off strands of copper to reduce size of lead to fit lug. Use correct barrel and hole size.

3.4.6 Accomplish the requirements of 009-025 of NAVSEA Standard Items for conducting a local air hose test after the installation, removal or relocation of cables of each new and disturbed multi-cable transit device, multi-cable penetration, stuffing tube, kick pipe, and cable penetration of tightness boundaries.

3.4.7 Band disturbed cable in accordance with Part 4 of 2.1.

3.4.8 Bond and ground cable in accordance with 2.5.

3.4.9 Accomplish the requirements of 3.3 through 3.3.1.4 immediately prior to conductor or cable termination.

3.4.10 Accomplish requirement 3.3.2 immediately prior to conductor or cable termination except for cables conforming to MIL-DTL-24643/59 - 77.

3.4.11 Accomplish requirement 3.3.3 for cables conforming to MIL-DTL-24643/59 - 77 after cable termination.

3.4.12 Connect each cable using referenced drawings.

3.4.13 Install new cable identification tags in accordance with 2.1 and 2.2.

3.5 Disconnect and remove each cable to be replaced in its entirety. Record and retain electrical hook-up data. (See 4.2.7)

3.5.1 Accomplish the requirements of 3.4 through 3.4.11.

3.6 Identify, disconnect and isolate each cable to be pulled back, reused, rerouted, relocated, or repurposed. Record and retain electrical hook-up data. (See 4.2.2 through 4.2.5)

3.6.1 Inspect each cable end to be disconnected for correct conductor identification sleeving, including size, type, and legible lettering in accordance with referenced drawing. Ensure lugs are secured to leads and are of correct size and type, and the insulation is not damaged. Accept and reject criteria for lugs and sleeving for cables must be in accordance with Chapters 3 and 4 of 2.6.

3.6.2 Accomplish the requirements of 3.3 through 3.3.1.4 for disconnected cables.

3.6.3 Accomplish requirement 3.3.2 for disconnected cables except for cables conforming to MIL-DTL-24643/59 - 77.

3.6.4 Accomplish requirement 3.3.3 for disconnected cables conforming to MIL-DTL-24643/59 - 77.

3.6.5 Remove each cable from equipment and pull back to predetermined locations. Coil each cable and secure to prevent damage. Protect disconnected connectors and wiring from the industrial environment and weather.

3.6.6 Accomplish the requirements of 3.4.2 through 3.4.11. Use retained electrical hook-up data.

3.7. Identify, disconnect, isolate and remove each cable designated for removal. (See 4.2.6)

3.7.1 Blank each bulkhead, deck penetration, and multi-cable transit device from which cable was removed and which will not be reused, in accordance with Part 3 of 2.1.

3.7.2 Blank each unused hole in equipment, in accordance with 2.1.

3.7.3 Remove unused hangers from which cable was removed and which will not be reused, in accordance with Section 070a of 2.7.

3.7.4 Install new banding for cableways affected by cable removals, in accordance with Part 4 of 2.1.

3.7.5 Accomplish the requirements of 3.4.6.

3.8 Weatherproof and seal connectors exposed to the weather in accordance with 2.10.

3.9 Remove, install, and relocate cables which are part of the secure electrical information processing systems or are located within a secure processing space in accordance with 2.8 and 2.9.

3.10 Accomplish the requirements of 009-032 of NAVSEA Standard Items for each new and disturbed surface.

3.11 Submit one legible copy, in hard copy or approved transferrable media, of a report listing results of the requirements of 3.4.9 and 3.6.2, including circuit numbers, lead numbers, and readings obtained, to the SUPERVISOR within 3 days of completion of tests. Record data in Attachment C or equivalent form that contains the requirements of "Attachment C".

4. NOTES:

4.1 The requirements in this NAVSEA Standard Item apply to installation, repair, disconnect, connect, removal, relocation, test, and inspection of electrical/electronic cables affected by the work required by individual Work Items on Naval surface ships and submarines and personnel supporting these tasks. This NAVSEA Standard Item applies to the following cable usages; new, removed, replaced, pulled back, reused, rerouted and repurposed.

4.2 Cable Definitions

4.2.1 New Cable – a cable not previously installed.

4.2.2 Pulled Back Cable – a cable disconnected and physically removed from a wireway, conduit, or cableway to protect the cable from industrial use.

4.2.3 Reused Cable – a cable disconnected from the equipment to facilitate equipment removal.

4.2.4 Rerouted Cable – a cable disconnected from equipment and physically moved to a new wireway, conduit, or cableway and then reconnected in the new location to the same equipment.

4.2.5 Repurposed Cable – a cable with termination points changed.

4.2.6 Removed Cable – a cable disconnected from equipment and physically removed in its entirety and not being replaced.

4.2.7 Replaced Cable – a cable disconnected from equipment and physically removed to install with a new cable.

4.3 Cable installations consist of cable, banding, boxes, equipment, penetrations, cableways, hangers, cable separation and connection(s) and associated components.

4.4 Electrical connector fabrication is the preparation of cable endings to receive multi-pin connectors, coaxial connectors, and securing connectors to cables.

4.5 A Qualified Person is defined as a person who has successfully completed connector fabrication training and meets the qualification requirements stated below.

4.5.1 Emphasizes the importance of connector fabrication to the performance and long-term reliability of shipboard systems.

4.5.2 Uses 2.1, 2.2, and 2.6 for basic instructional material supplemented by connector manufacturer's instructional material as desired.

4.5.3 Requires classroom lecture, study, and demonstration of each topic in Appendix A of Part 5 of 2.1.

4.5.4 Requires individual student practice in the use of specified tools and performance of connector fabrication techniques and procedures described in Appendices B through H of Part 5 of 2.1 and Paragraph 2-20.2 of 2.2.

4.5.5 Requires a minimum of 32 hours of combined classroom lecture and laboratory practice in the type of connectors to be fabricated.

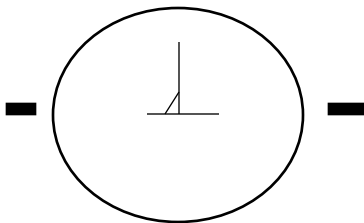
4.6 Connector fabrication qualifications consist of:

4.6.1 Connector Fabricator Qualification requirement: Successful completion of the training course required in 4.5.5 followed by successful completion of 40 hours on-the-job training under the tutelage of a qualified connector fabricator or a qualified connector fabrication supervisor in the type of connectors to be fabricated.

4.6.2 Connector Fabrication Supervisor Qualification requirement: Successful completion of the classroom training required in 4.5.5 plus be the incumbent of a supervisory electrical or electronic mechanic position.

4.6.3 Connector Fabrication Quality Assurance Inspector Qualification requirement: Successful completion of the classroom training required in 4.5.5 plus be the incumbent of a quality assurance specialist or inspector position.

4.7 Attachment B is provided as an aid to completion of Electrical Cableway Inspection Form.



ATTACHMENT A
ELECTRICAL CABLEWAY INSPECTION FORM

DATE _____ HULL NUMBER _____

INSPECTED BY _____ INSPECTING ORGANIZATION _____

SER #	COMPT	DECK	FRAME	P/S	POS	CABLE CIRCUIT DESIG	CABLE TYPE	*CAT	*NAVSEA DWG NO.	EQUIPMENT
DESCRIPTION										
DESCRIPTION										
DESCRIPTION										
DESCRIPTION										

* SEE ATTACHMENT B FOR "CATEGORY" GUIDANCE

ATTACHMENT B

INSPECTION CRITERIA FOR CABLES AND CABLEWAYS

Criteria	Category			Reference(s)
	Surface	Submarine	Aircraft Carrier ^{1/-}	
I. Cables				
A. Installation				
1. Bend radius less than minimum, causing visible damage to cable.	1	1	1 (96 hours)	(f), (i)
2. Bend radius less than minimum, no visible cable damage, cable rings out and meggers satisfactorily.	2	2	2	(b), (c), (g), (h), (i)
3. Equipment connector supporting weight of cable (more than 32 <i>inches</i> of cable from last support to end use equipment) (18 <i>inches</i> from shock mounted motors).	2	2	1 (90 days ^{2/-})	(b), (i)
4. Cables run on or near hot objects (steam or exhaust pipes, griddles, ovens, etc.).	1	1	1 (96 hours)	(b), (g), (h), (i)
5. Cables run outside of hangers.	3	3	3	(b), (c)
6. Lack of slack at expansion joints.	2	2	2	(b)
7. Excess slack between hangers (minimum distance of 6 <i>feet</i> 4 <i>inches</i> between deck and cables).	3	3	3	(b), (g), (h), (i)
8. Excess cable slack stored in wireway.	3	3	3	(b), (g), (h), (i)
9. Missing, damaged, or illegible cable tags.	3	3	3	(b), (c)
B. Damage				
1. Bulging, bubbling, or discoloration of cable jacket (evidence of overloading, overheating, or hot spots).	1	1	1 (96 hours)	(g), (h)
2. Bulging, bubbling, or discolored cable jacket, but cable rings out and meggers satisfactorily.	1	1	1	(g), (h)
3. Cable chafed or cut through outer jacket only.	2	2	2	(b), (c)
4. Cable chafed or cut through, inner wire insulation damage.	1	1	1 (96 hours)	(b)
5. Cable pulled out of equipment/junction box penetrations and bare conductor exposed.	1	1	1 (96 hours)	(b), (g), (h)

ATTACHMENT B

Criteria	Category			Reference(s)
	Surface	Submarine	Aircraft Carrier ¹⁷	
6. Cable pulled out of equipment/junction box penetrations and inner insulation exposed.	1	1	1	(b), (c), (g), (h)
7. Armored and unarmored cables in contact at an oblique angle causing chafing of unarmored jacket.	2	2	2	(b)
C. Dead-Ended				
1. Cable dead-ended, not end sealed properly at known end.	1	1	1 (96 hours)	(b), (g), (h), (i)
2. Cable dead-ended, properly end sealed, but not labeled (serialized) at known end(s).	2	2	2	(b), (c), (g), (h), (i)
3. Cable dead-ended, end sealed, and labeled (serialized) properly at known end.	3	3	3	(b), (c), (g), (h), (i)
4. Cable for future use or other cables where both ends are known, properly end sealed and labeled (serialized).	3	3	3	(b), (c), (g), (h), (i)
D. Spliced				
1. Improper materials/methods used for splicing or evidence of loose joints.	1	1	1 (90 days ²¹)	(b), (c)
2. Splice located in bend of cable.	2	2	2	(b)
II. Banding				
A. All Cable Runs				
1. Banding or other restraints cut cable outer jacket.	1	1	1 (96 hours)	(b), (c)
2. Banding compressing outer jacket (banding too tight, but not cutting jacket).	3	3	3	(b), (c)
3. Plastic tie wraps used in place of banding straps (metal banding strap required).	3	3	3	(b), (c)
4. Cables secured to hanger with bailing wire or rope.	2	2	1 (90 days ²¹)	(b), (c)
5. Bands cut and left in wireway.	3	3	3	(b), (c)
6. Channel rubber not installed where required.	2	2	2	(b), (c)
7. Cable saddles missing where required.	3	3	3	(c)

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Criteria	Category			Reference(s)
	Surface	Submarine	Aircraft Carrier ¹⁷	
B. Horizontal Cable Runs				
1. Banding not installed at breakout hangers before and after penetrations or at change of direction of wireway.	2	2	2	(b)
C. Vertical Cable Runs				
1. No banding or loose banding (banding required on every hanger).	2	2	2	(b), (c)
III. Cableways				
A. Cableways				
1. Cable hangers or hardware cutting into the cable jacket.	1	1	1 (96 hours)	(b), (c)
2. Improper hanger spacing. Required at least every 32 <i>inches</i> (16 <i>inches</i> for hangers for multiple tier overhead aluminum decks).	2	2	2	(b), (i)
3. Inadequate cableway support (hangers, hardware, tiers, or cable straps missing) or welds cracked.	2	2	2	(b)
4. Overloaded/Overcrowded cable hangers.	3	3	3	(b), (i)
5. Maximum number of tiers exceeded.	3	3	3	(b)
6. Inadequate fastener length.	3	3	3	(b)
7. ½ <i>inch</i> clearance not maintained between cable run and hangers or structure above.	2	2	2	(b), (i)
8. EMI separation not maintained.	2	2	2	(b)
9. Fiber optic cables not installed on top layer of cableway.	3	3	3	(c)
IV. Equipment				
A. Covers				
1. Junction box or equipment covers loose or missing.	1	1	1 (96 hours)	(g), (h)
B. Mounting				
1. Cable supporting the weight of equipment (power junction boxes, lighting fixtures switch boxes, etc.).	1	1	1 (96 hours)	(b), (g), (h)

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2. Missing loose or improperly installed mounting hardware on equipment.	2	2	2	(b), (c), (g), (h)
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Criteria	Category			Reference(s)
	Surface	Submarine	Aircraft Carrier ¹⁷	
C. Cable Entrance				
1. Watertight penetrators not utilized for entrance to watertight equipment enclosures.	2	1	1 (90 days ²¹)	(b), (c), (i)
2. Drip loops, drip shields plastic sealer, or bottom penetration not utilized for entrance to non-watertight drip proof equipment.	2	1	1 (90 days ²¹)	(b), (i)
3. Cable can be moved in and out of tube. Improperly packed or not packed.	2	1	1 (90 days ²¹)	(b), (c)
4. Nylon tube base loose in enclosure (O-ring missing).	2	1	1 (90 days ²¹)	(b), (c)
V. Deck/Bulkhead Penetrations				
A. Non-Watertight Deck or Bulkhead Cable Penetration				
1. No plastic sealer around cables through collars where required.	2	2	1 (90 days ²¹)	(b), (g), (h)
2. Chafing protection not installed at non-watertight deck or bulkhead cableway penetrations.	2	2	2	(b)
3. Chafing ring overloaded.	3	3	3	(b)
4. Inadequate chafing protection and damage evident.	1	1	1 (90 days ²¹)	(b), (i)
B. Watertight Deck or Bulkhead Single Cable Penetrations				
1. No plastic sealer around cable at stuffing tubes that are exposed to the weather. Note: If plastic sealer is installed at locations other than those exposed to the weather, it is not required to be removed.	2	1	2	(b)
2. Stuffing tube or kickpipe not utilized (cable installed without tube).	2	1	1 (90 days ²¹)	(b), (g), (h), (i)
3. Unused stuffing tube or kickpipe not plugged.	2	1	1 (90 days ²¹)	(b)
4. Stuffing tube or kickpipe assembly incomplete (missing gland nut, packing, or pipe connector).	2	1	1 (90 days ²¹)	(b)
5. Stuffing tube assembly incorrect (improper packing).	2	1	2	(b)
6. Stuffing tube or kickpipe too large for size of cable.	3	1	3	(b)

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Criteria	Category			Reference(s)
	Surface	Submarine	Aircraft Carrier ^{1/}	
7. Multiple cable in a single stuffing tube or kickpipe.	2	1	2	(b)
8. Stuffing tube or kickpipe damaged to point where complete assembly not possible (cracked welds, damaged threads, out-of-round, etc.) if fire stop material is installed.	2	1	2	(b)
C. Watertight Deck or Bulkhead Penetrations Utilizing Multiple Cable Penetrations (MCPs)				
1. Insert blocks, compression bolts, or filler blocks missing.	2	1	1 (90 days ^{2/})	(b), (g), (h)
2. Improper size blocks used for size cable installed violating watertight integrity.	2	1	2	(b)
3. Incorrect type or missing fire stop caulk used to seal armored cable through MCP blocks.	2	1	1 (90 days ^{2/})	(b)
4. RISE® type MCP not properly sealed with a soft-seal sealant (FIWA Catalog #80-0900, or equivalent) or missing soft-seal sealant.	2	N/A ^{3/}	1 (90 days ^{2/})	(b)
NOTES: ^{1/} Information in parentheses is the no-later-than time to repair/downgrade. ^{2/} 90 days or prior to deployment, whichever occurs first. ^{3/} The use of RISE® is not permitted on submarines.				

ATTACHMENT C

SHIPBOARD ELECTRIC CABLE: DISCONNECT & RECONNECT

DATE: _____ HULL NUMBER: _____ JOB ORDER: _____ WORK ORDER: _____

WORK ITEM NO: _____ TITLE: _____

NAMEPLATE DATA: _____

MANUFACTURER: _____ VOLT: _____ AMPS: _____

HZ: _____ HP: _____ CAT#: _____ ID#: _____

Calibrated Inst #:

CABLE TYPE	CIRCUIT ID	CONDUCTOR ID	LEAD COLOR	CABLE START TERM PT	CABLE END TERM PT	Megger Readings		Continuity	Cable Condition			Cable Length *
						Disconnect	Reconnect		Term Lug	Insulation	Sleeving	

* Report Cable Length for Defective Cables Only.

Disconnected by: _____

Date: _____

Reconnected by: _____

Date: _____

Remarks: _____

