

**METRIC**MIL-STD-454N  
NOTICE 1  
30 JUN 93

## MILITARY STANDARD

## STANDARD GENERAL REQUIREMENTS FOR ELECTRONIC EQUIPMENT

TO ALL HOLDERS OF MIL-STD-454N:

## 1. THE FOLLOWING PAGES OF MIL-STD-454N HAVE BEEN REVISED OR ADDED AND SUPERSEDE THE PAGES LISTED:

NEW PAGES	DATE	SUPERSEDED PAGES	DATE
66-1 through 66-6	30 Jun 93	66-1 through 66-6	30 Jun 92
77-1 through 77-2	30 Jun 93	NEW REQUIREMENT	---

## 2. MAKE THE FOLLOWING PEN AND INK CHANGES:

- a. Page iii, FOREWORD: Delete "MIL-I-983" and title and substitute:

"MIL-STD-2036 General Requirements for Electronic Equipment Specifications."

Delete "MIL-E-11991" in its entirety and substitute:

"MIL-STD-11991 Electrical, Electronic, and Electro-mechanical Equipment, Guided Missile and Associated Weapon Systems, General Standard for the Design of."

Delete "MIL-T-21200" in its entirety.

- b. Page vi, CONTENTS: Add "Requirement 77 - Integrated Diagnostics".

- c. Page 1, 1.2, delete second sentence.

- d. Requirement 2, page 2-1, paragraph 4.1: Delete "MILSTD-198" and substitute "MIL-STD-198".

- e. Requirement 11, page 11-1, paragraph 2: Delete "MIL-P-79" and "MIL-P-997" in their entirety and substitute:

"MIL-I-24768 Insulation, Plastics, Laminated, Thermosetting, General Specifications for."

Delete "MIL-P-15037", "MIL-P-15047", and "MIL-I-19161" in their entirety.

Page 11-2, paragraph 4.2: Delete "included" in first line.

- f. Requirement 20, paragraph 2: Delete "MIL-W-5845 Wire, Electrical, Iron and Constantan, Thermocouple".

MIL-W-5846: Delete "/or" in title.

Delete "MIL-W-5908 Wire, Electrical, Copper and Constantan, Thermocouple."

MIL-W-22759: Delete "Electric" and substitute "Electrical" in title.

- g. Requirement 20, page 20-7, section 5, paragraph 5.3, on second line: Delete "MIL-W-5845," and ", or MIL-W-5908".

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- h. Requirement 26, page 26-1, paragraph 2: Delete "MIL-P-79" and "MIL-P-997" in their entirety and substitute:

"MIL-I-24768 Insulation, Plastics, Laminated, Thermosetting, General Specification for."

Delete: "MIL-P-15037" and "MIL-P-19161" in their entirety.

- i. Requirement 41, page 41-4, table 41-1: Delete "QQ-C-586".

- j. Requirement 46, page 46-2, paragraph 4.3: Delete "MIL-M-9397" and substitute "MIL-F-9397".

Delete: "MIL-M-13787", "MIL-M-17054", "MIL-M-19167", and "MIL-M-19283" in their entirety.

- k. Requirement 56, page 56-1, paragraph 2: Delete "MIL-E-81512" in its entirety.

- l. Requirement 62, page 62-1, paragraph 1: In first sentence following "guidance", delete "as to" and substitute "for".

- m. Requirement 63, page 63-1, paragraph 2: Delete "documents" and substitute "Documents".

- n. Requirement 65, page 65-1, paragraph 2, MIL-C-17: Delete "Cable" and substitute "Cables".  
MIL-C-22931: Delete "Cable" and substitute "Cables". MIL-L-3890: Add ", General Specification for" at end of title.

- o. Requirement 68, page 68-1, paragraph 4.1: Delete "Incandescent" and substitute "Optoelectronic".

- p. Requirement 72, page 72-1, paragraph 2: Delete "MIL-STD-480" in its entirety and substitute:

"MIL-STD-973 Configuration Management".

Paragraph 4.1, 4.2, and 4.3: Delete "MIL-STD-480" and substitute "MIL-STD-973" (3 places).

- q. Requirement 76, page 76-1, paragraph 2: Delete "Optic" under MIL-H-24626 and insert after "Fiber".

Page 76-3, paragraph 2: Delete "Systems" under MIL-HDBK-415 and insert after "Communications".

Delete - "IEEE-STD-812-84" and substitute:

"MIL-STD-2196(SH) Glossary, Fiber Optics"

3. RETAIN THIS NOTICE AND INSERT BEFORE TABLE OF CONTENTS.

4. Holders of MIL-STD-454N will verify that page changes and additions indicated above have been entered. This notice page will be retained as a check sheet. This issuance, together with appended pages, is a separate publication. Each notice is to be retained by stocking points until the Military Standard is completely revised or cancelled.

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CONCLUDING MATERIAL

Custodians:

Army - ER  
Navy - AS  
Air Force - 11

Review activities:

Army - AR, AV, CR, ME, MI, PT, TE  
Navy - EC, OS, SH  
Air Force - 17, 19, 85, 99

Other:

DLA - ES  
FAA

Preparing activity:

Air Force - 10

Agent:

DLA - ES

(Project GDRQ-0121)

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## REQUIREMENT 66

## CABLE, MULTICONDUCTOR

1. Purpose. This requirement establishes criteria for selection and application of electrical multiconductor cable for use within electronic equipment.

\* 2. Documents applicable to Requirement 66:

00-W-343	Wire, Electrical, Copper (Uninsulated)
MIL-C-17	Cables, Radio Frequency, Flexible and Semirigid, General Specification for
MIL-C-442	Cable (Wire), Two Conductor, Parallel
MIL-C-3432	Cable (Power and Special Purpose) and Wire, Electrical (300 and 600 Volts)
MIL-W-5086	Wire, Electric, Polyvinyl Chloride Insulated, Copper or Copper Alloy
MIL-W-5846	Wire, Electrical, Chromel and Alumel, Thermocouple
MIL-C-7078	Cable, Electric, Aerospace Vehicle, General Specification for
MIL-W-8777	Wire, Electrical, Silicone-Insulated, Copper, 600 Volt, +200°C
MIL-C-13777	Cable, Special Purpose, Electrical: General Specification for
MIL-W-16878	Wire, Electrical, Insulated, General Specification for
MIL-C-19547	Cable, Electrical, Special Purpose, Shore Use
MIL-W-22759	Wire, Electric, Fluoropolymer-Insulated, Copper or Copper Alloy
MIL-C-23437	Cable, Special Purpose, Electrical
MIL-C-24640	Cable, Electrical, Lightweight, for Shipboard Use, General Specification for
MIL-C-24643	Cable and Cord, Electrical, Low Smoke, for Shipboard Use, General Specification for
MIL-W-25038	Wire, Electrical, High Temperature and Fire Resistant, General Specification for
MIL-C-27072	Cable, Power, Electrical and Cable, Special Purpose Electrical, Multiconductor and Single Shielded, General Specification for
MIL-C-27500	Cable, Electrical, Shielded and Unshielded, General Specification for
MIL-C-49055	Cable, Electrical (Flexible, Flat, Unshielded) (Round Conductor), General Specification for
MIL-C-55021	Cable, Electrical, Shielded Singles, Shielded and Jacketed Singles, Twisted Pairs and Triples, Internal Hookup, General Specification for
MIL-W-81044	Wire, Electric, Crosslinked Polyalkene, Crosslinked Alkane-imide Polymer, or Polyarylene Insulated, Copper or Copper Alloy
MIL-W-81381	Wire, Electric, Polyimide-Insulated, Copper or Copper Alloy
ASTM A580	Wire, Steel, Stainless and Heat Resisting
ASTM B33	Tinned Soft or Annealed Copper Wire for Electrical Purposes

3. Definitions. Not applicable.

4. Requirements.

4.1 Selection and application. Selection and application of multiconductor cable shall be in accordance with table 66-1.

4.2 Solid or stranded. Either solid or stranded conductors may be used (within the restrictions of the particular wire or cable specification) except that (a) with the exception of thermocouple and flat cable wire, only stranded wire shall be used in aerospace applications, and (b) for other applications stranded wire shall be used when so indicated by the equipment application. Specifically, with the exception of flat multiconductor flexible cable, stranded wire shall be used for wires and cables which are normally flexed in use and servicing of the equipment, such as cables attached to the movable half of detachable connectors.

4.3 Application restrictions.

4.3.1 Cable containing MIL-W-16878 wire. Cable containing MIL-W-16878 wire shall not be used for Air Force or Navy aerospace applications.

4.3.2 Polyvinyl chloride insulation. Cables with polyvinyl chloride insulation shall not be used in aerospace applications. Use of these cables in any other application requires prior approval of the procuring activity.

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4.3.3 Single polytetrafluoroethylene insulation. MIL-W-22759 wire with only single polytetrafluoroethylene insulation used in Air Force space and missile applications shall require the approval of the acquiring activity.

4.3.4 Silver plated copper wire. Silver plated copper wire shall not be used in applications involving Army missile systems.

5. Information for guidance only. Not applicable.

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TABLE 66-1. Cable, multiconductor.

No.	Title	Basic Wire Specs	Conductor		Shield Braid 3/			Jacket 3/		Remarks	
			No. of Cond.	Volts RMS	Temp 2/	Strand Material	Strand Coating	Percent Coverage	Material 1/		Type
MIL-C-442	Cable, (Wire), Two Conductor, Parallel	DD-V-343 and Insulation	2	300	Flexibility at -40°C or -55°C				Vinyl-polymer or synthetic (styrene butadiene) rubber or natural rubber	Lead wire for firing explosive charges	
MIL-C-3432	Cable (Power and Special Purpose) and Wire, Electrical (300 V and 600 V)	DD-V-343 and Insulation	Unlimited and mixed sizes 5/ 5/	300 and 600	-40°C to +65°C or -55°C to +75°C	None or Copper	Tin	85	Styrene butadiene rubber, chloroprene rubber, ethylene-propylene diene, rubber, polyurethane thermoplastic elastomer, or natural rubber	Extruded or vulcanized	
MIL-C-7078	Cable, Electric, Aerospace Vehicle	M5086/1	2-7	600	+105°C	Copper	Tin		None	Extruded or ImpregBraid	(a) Fluorinated ethylene propylene (b) Polytetrafluoroethylene
		M5086/2	1-7			Copper	Tin		Polyamide (Nylon)		
		M5086/3	1-7								
		M22759/12	1-7	+260°C	Copper	Nickel	85	(a)	Extruded		
		M22759/23	1-7	+260°C	Copper	Nickel	85	(b)	Extruded or Tape		
MIL-C-13777	Cable, Special Purpose Electrical	M81044/9	1-7		+110°C	Copper	Tin	85	Polyvinylidene fluoride	Extruded	
		M81381/8	2-7		+200°C	Copper	Nickel	85	FEP/polyimide	Film Tape	
		M81381/10 and /14	1-7		+200°C						
		M81381/11	2-7		+200°C						
		M81381/12	1-7		+150°C	Copper	Tin	85	FEP/polyimide	Film Tape	
MIL-C-13777	Cable, Special Purpose Electrical	M81381/13	1-7		+200°C	Copper	Nickel	85			
		MIL-C-17 DD-V-343 ASTM-A580 and Insulation	2-78 6/	600	-53°C to +71°C	Copper	Tin	80	Sheath Poly-chloroprene Primary Insulation Polyethylene	Extruded and vulcanized Extruded	See Note 7

TABLE 66-1. Cable, multiconductor - Continued.

Spec. No.	Title	Basic Wire Specs	Conductor			Shield Braid			Jacket		Remarks
			No. of Cond.	Volts RMS	Temp $^{\circ}\text{C}$	Strand Material	Strand Coating	Percent Coverage	Material 1/	Type 3/	
MIL-C-19547	Cable, Electrical, Special Purpose, Shore Use	ASTM B33-74 and Insulation	Multiple twisted pairs, 6 - 100 pairs	600	+75°C	Corrugated Aluminum		100	Polyethylene	Extruded	For use as telephone and telegraph signal cables in shore communications
MIL-C-23437	Cable, Electrical, Shielded Pairs	MIL-W-16878/1	Shielded and jacketed pairs 1 pair-104 pairs	600	+105°C	Copper	Tin	90	PVC	Extruded	For use within shore communications stations, not to be used on board ship
MIL-C-24640	Cable, Electrical, Lightweight, for shipboard use	MIL-W-81044	2-77 pair	600	+150°C	Copper tape	Tinned	85	Cross-linked, poly-alkene, cross-linked alkane-imid, poly-mer, or polyarylene	Extruded	
MIL-C-27072	Cable, Special Purpose Electrical, Multi-conductor	MIL-C-17 MIL-W-5846 M16878/1 M16878/2 M16878/3 M16878/4 M16878/5 M16878/6 M16878/10 M16878/13	2-36	Various 600 1,000 3,000 600 1,000 250	Not Spec +105°C +105°C +105°C +200°C +200°C	Copper	Tin, Silver	85	Sheath of PVC, polyethylene, polychloroprene, polyamide, TFE-Teflon, or FEP-Teflon		Flexible multi-conductor cable for use in protected areas: tunnels, wire ways, instrument racks, and conduit. Polyethylene jacketed cable suitable for underwater or direct burial applications only. M16878/6 and /13 not for aerospace applications.

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TABLE 66-1. Cable, multiconductor - Continued.

Spec. No.	Title	Basic Wire Specs	Conductor			Shield Braid 3/		Jacket 3/		Remarks	
			No. of Cond.	Volts RMS	Temp 2/	Strand Material	Strand Coating	Percent Coverage	Material 1/		Type
MIL-C-27500	Cable, Electrical, Shielded and Unshielded, Aerospace	MIL-W-8777	1-7	600	+200°C	Various	Various	85	Various	Braided	For general aerospace flight vehicle applications
		MIL-W-22759	1-7	Various	Various	Various	Various	85	Various	Extruded or Braided	
		MIL-W-25038	1-7	600	+260°C	Various	Various	85	TFE coated glass fiber	Braided	
		MIL-W-81044	1-7	600	+150°C	Various	Various	85	Various	Extruded	
		MIL-W-81381	1-7	600	Various	Various	Various	85	Various	Tape	
MIL-C-49055	Cables, Power Electrical, (Flexible, Flat, Unshielded), (Round Conductor), General Specification for	MIL-C-49055/1 MIL-C-49055/11 MIL-C-49055/12 MIL-C-49055/13 MIL-C-49055/14 MIL-C-49055/15 MIL-C-49055/16 MIL-C-49055/17	Note: MIL-C-49055 applicable detail specification sheets control the number of conductors and materials for each specific cable configuration.								
MIL-C-55021	Cable, Twisted Pairs and Triples, Internal Hook-Up, General Specification for	MIL-W-16878	2-3	600 to 1,000	-40°C to +105°C or -65°C to +200°C	None or Copper	Tin, Silver or Nickel	90	None PVC, Nylon TFE-Teflon	Extruded  Extruded or Tape	

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TABLE 66-1. Cable, multiconductor - Continued.

- 1/ Polyester: Polyethylene terephthalate  
TFE-Teflon: Polytetrafluoroethylene  
PVC: Polyvinyl chloride (not to be used in airborne applications)  
KEL-F: Polymonochlorotrifluoroethylene  
FEP-Teflon: Fluorinated ethylene propylene  
PVF: Polyvinylidene fluoride
- 2/ See applicable detail specification sheet for temperature limitation.
- 3/ See applicable detail specification sheet for materials control of specific cable configurations.
- 4/ Although the specification does not limit the number of conductors in a cable, the size, weight, and flexibility are determining factors.
- 5/ Available in three classifications:
  - Class L: Light duty: To withstand severe flexing and frequent manipulation.
  - Class M: Medium duty: To withstand severe flexing and mechanical abuse.
  - Class H: Heavy duty: To withstand severe flexing and mechanical abuse and ability to withstand severe service impacts such as to be run over by tanks or trucks.
- 6/ See applicable detail specification sheet for mechanical test requirements for cold bend, cold bend torque, impact bend, and twist.
- 7/ For use under abusive mechanical conditions and where resistance to weather, oil, and ozone are requirements.

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## REQUIREMENT 77

## INTEGRATED DIAGNOSTICS

1. Purpose. This requirement establishes a design process for integrating all elements which constitute a weapon system's diagnostic capability. It does not establish requirements, and must not be referenced in contractual documents. Engineering analyses, qualitative and quantitative requirements, design analysis, demonstration and maturation requirements must be specified in the contract or system/equipment specification, as appropriate.

2. Documents applicable to Requirement 77:

MIL-H-46855	Human Engineering Requirement for Military Systems, Equipment and Facilities
MIL-STD-415	Test Provisions for Electronic Systems and Associated Equipment, Design Criteria for
MIL-STD-470	Maintainability Program for Systems and Equipment
MIL-STD-471	Maintainability Verification/Demonstration/Evaluation
MIL-STD-499	Engineering Management
MIL-STD-2165	Testability Program for Electronic Systems and Equipments
MIL-STD-1814	Integrated Diagnostics
MIL-STD-1326	Test Point, Test Point Selection and Interface Requirements for Equipments Monitored by Shipboard On-line Automatic Test Equipment
MIL-STD-1388-1	Logistics Support Analysis
AFGS-87256	AF Guide Specification on Integrated Diagnostics
ASTM-F-1166	Standard Practices for Human Engineering Design for Marine Systems, Equipment, and Facilities

3. Definitions.

3.1 Integrated diagnostics process. Integrated diagnostics is defined as a structured process which maximizes the effectiveness of diagnostics by integrating pertinent elements, such as testability, automatic and manual testing, training, maintenance aiding, and technical information as a means for providing a cost-effective capability to detect and unambiguously isolate all faults known or expected to occur in weapon systems and equipment and to satisfy weapon system mission requirements. This emphasis on the design and acquisition of the diagnostic capability is required because this capability tends to become fractionated. MIL-STD-2165 is the overall document for testability. However, because it is a multidisciplinary process, reference to other portions of military documents that may be invoked or may be cited directly as a basis for contract requirements are MIL-STD-470, MIL-STD-471, MIL-STD-499, MIL-STD-1814, MIL-STD-1388-1, MIL-H-46855, AFGS-87256, and ASTM-F-1166.

4. Requirements. Not applicable.

5. Information for guidance only.

5.1 Test provisions.

5.1.1 Testability programs. When specified by the acquiring activity, a testability program should be implemented in accordance with MIL-STD-2165.

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5.1.2 Built-in-test devices. Built-in test devices should maintain their accuracy under all operating conditions required by the equipment under test. These devices should be provided with connections or access for their operational checkouts or calibration.

5.1.3 Test provisions. Test provisions should provide means for monitoring performance, calibration, and fault isolation in accordance with MIL-STD-415. Equipment which is required to be tested by on-line automatic test equipment (ATE) should provide test points in accordance with MIL-STD-1326.

5.1.4 Test cables. Test cables and extender cards should be provided and fitted with connectors to allow removable subassemblies to be electrically reconnected for maintenance.

5.1.5 External test points. Protection should be provided in the test point circuitry to prevent equipment damage caused by the external grounding of test points.

5.1.6 Failure effect. Provisions for testing should be designed that any failure of built-in test devices will not degrade equipment operation or cause equipment shut down.

5.2 Safety criteria. Safety criteria should be applied during equipment hardware design, selection, end construction to eliminate or control hazards that could cause injury to personnel during transportation, storage, installation, operation, maintenance or disposal, or damage to equipment or property.