

MIL-STD-1399A(NAVY)
SECTION 409
31 AUGUST 1973

MILITARY STANDARD

**INTERFACE STANDARD FOR
SHIPBOARD SYSTEMS**

SECTION 409

**ELECTROMAGNETIC RADIATION
HAZARDS TO ORDNANCE**



FSC MISC

MIL-STD-1399A (NAVY)
SECTION 409
31 August 1973

DEPARTMENT OF THE NAVY
WASHINGTON, D.C. 20362

Interface Standard for Shipboard Systems,
Electromagnetic Radiation Hazards to Ordnance

MIL-STD-1399A (NAVY)
SECTION 409

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2. Recommended corrections, additions, or deletions should be addressed to the Naval Ship Engineering Center, Center Building, Prince George's Center, Hyattsville, Maryland 20782.

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FOREWORD

Purpose. This section defines the standard interface requirements which exist between the ship and shipboard ordnance whose performance may be adversely affected by the shipboard electromagnetic radiation environment.

Nature of the interface. The electromagnetic radiation environment which exists on or about Navy ships is potentially hazardous to shipboard ordnance which contain electroexplosive devices. It is, therefore, essential that such ordnance be designed to provide protection from this hazard. It is also necessary that the location of electromagnetic radiation emitters and basic ship design and layout considerations provide protection to the maximum extent possible.

Structure of this section. The technical content first delineates the characteristics of the shipboard environment in terms of the electromagnetic field levels which shipboard ordnance must be protected against. The constraints on ship design and layout and on ordnance design to achieve the necessary compatibility are then established.

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1. GENERAL, SCOPE, INTERFACE AND APPLICABILITY

1.1 General. The policies and procedures established by MIL-STD-1399 are mandatory. This section and the basic standard are to be viewed as an integral single document.

1.2 Scope. This section establishes interface requirements between the ship and shipboard ordnance containing electroexplosive devices to ensure compatibility of such shipboard ordnance with the electromagnetic radiation environment.

1.3 Interface. The basic characteristic and constraint categories concerned with this interface are shown symbolically on figure 1 (see paragraph "Definitions" of MIL-STD-1399).

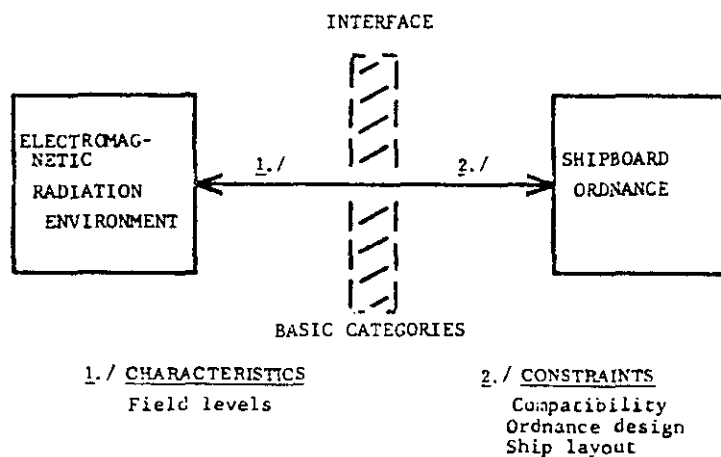


Figure 1 - Interface.

The particular interface characteristics and constraints pertinent to this section are described in 5.2 and 5.3.

1.4 Applicability. This section applies to shipboard ordnance containing electroexplosive devices which may be adversely affected by the electromagnetic environment.

2. REFERENCED DOCUMENTS

2.1 The issues of the following documents in effect on date of invitation for bids form a part of this standard to the extent specified herein.

GOVERNMENTAL

SPECIFICATION

MIL-I-23659 - Initiators, Electric, Design and Evaluation of.

STANDARD

MIL-STD-1385 - Preclusion of Hazards from Electromagnetic Radiation to Ordnance, General Requirements for.

PUBLICATIONS

NAVORD OP 3565/NAVAIR 16-1-529 - Hazards of Electromagnetic Radiation to Ordnance (HERO)

OD 30393 - Design Principles and Practices for Controlling Hazards from Electromagnetic Radiation to Ordnance (Hero Design Guide).

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(Application for copies of DD 3039) should be addressed to the Commanding Officer, Naval Ordnance Station, Louisville, Kentucky, 40214, Attn: Center Documentation Technical Office.)

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

3. DEFINITIONS

3.1 Electromagnetic radiation. Electromagnetic radiation is the emission of energy in the form of electromagnetic waves.

3.1.1 Electromagnetic waves. Electromagnetic waves are waves characterized by variations of the electric and magnetic fields radiated by transmitting devices in the electromagnetic spectrum.

3.2 Electromagnetic radiation environment. The electromagnetic radiation environment of a ship, as used in this section, is the electromagnetic energy field which is present onboard ship.

3.3 Electroexplosive device. Any single discrete unit, device, or subassembly whose actuation is caused by the application of electric energy which in turn initiates an explosive, propellant or pyrotechnic material contained therein. The term electroexplosive device does not include complete assemblies which have electric initiators as subassemblies, but includes only subassemblies themselves. Synonymous with electric initiator.

3.4 Shipboard ordnance. Shipboard ordnance, as used in this section, is any military hardware containing electroexplosive devices which is introduced onboard a Naval ship. Such ordnance includes guided missiles, rockets, pyrotechnics, torpedoes, bombs, and gun ammunition.

4. REQUIREMENTS

4.1 The specific interface requirements and constraints established herein are mandatory and shall be adhered to by SYSCOMs, PMs, contractors and all others engaged in any aspect of shipboard electronic design, including shipboard ordnance design and installation, to which these requirements and constraints apply (see paragraph "Requirements" of MIL-STD-1399).

5. INTERFACE CHARACTERISTICS AND CONSTRAINTS

5.1 General considerations. Shipboard electronic transmitting equipment, such as radio, radar, electronic countermeasures (ECM), electronic counter-countermeasures (ECCM), produce electromagnetic radiation fields around the ship. These fields are not uniform and, due to the many variables involved, are not reliably predictable except on a rather gross basis. These environmental fields can be hazardous to shipboard ordnance in that they can cause premature initiation of electroexplosive devices and lead to a major catastrophe or to dudding which will result in an ineffective weapon delivery. To protect against this hazard it is necessary that ordnance be designed so that it may be handled safely and without degradation of its own reliability in the anticipated electromagnetic radiation environment. Consideration must also be given to the arrangement of shipboard antennas and other potential emitters, and to the provision of adequate shielding of ordnance areas.

5.2 Interface characteristics. The interface characteristics of the ships electromagnetic radiation environment are specified in 5.2.1 and 5.2.1.1.

5.2.1 Electromagnetic environmental levels. Table I gives electromagnetic environmental levels which will be used in the design of shipboard ordnance.

Table I - Electromagnetic environmental levels.

Frequency megahertz (MHz)	Field intensity ^{1/} volts (rms)/meter	Average power density (milliwatts/square centimeter)
<u>Communications</u>		
0.25 - 0.535	300	----
2 - 32	100	----
100 - 156	---	0.01
225 - 400	---	.01
<u>Radars/other electronic equipment</u>		
200 - 1215	---	10
1215 - 1365	---	5
2700 - 3600	---	78
5400 - 5900	---	105
7900 - 8400	---	175
8500 - 10440	---	150
33200 - 40000	---	4

^{1/} These intensities apply to the smaller of the following field components:

- (a) The vertical component of the electric field (E).
- (b) The directional maximum component of the horizontal magnetic field in ampere turns/meter (H), multiplied by 377 ohms.

5.2.1.1 When electromagnetic radiating sources associated with a specific ordnance system are capable of producing environmental levels in excess of those specified in table I, the higher levels shall apply.

5.3 Interface constraints. The interface characteristics of the ships electromagnetic environment impose certain constraints on the design of shipboard ordnance; the location of ordnance areas and ordnance installations; and on the location of potential electromagnetic radiation emitters. These constraints are described in 5.3.1 through 5.3.4.

5.3.1 Compatibility. The design of shipboard ordnance shall be compatible with the characteristics given in 5.2.

5.3.1.1 General requirements for design of shipboard ordnance to preclude the deleterious effect of electromagnetic radiation are specified in MIL-STD-1385. Principles and specific guidance for detailed design may be found in OP 30393.

5.3.2 Basic ordnance design considerations.

5.3.2.1 The use of electroexplosive devices in weapon systems shall be restricted to cases where no other device can satisfactorily perform the required ignition function.

5.3.2.2 When the use of electroexplosive devices is necessary, they shall be designed and evaluated in accordance with MIL-1-23659.

5.3.2.3 Electroexplosive devices with the minimum sensitivity compatible with the required ordnance function shall be employed. Adequate shielding and filtering of the firing circuits shall be provided.

5.3.2.4 Radio frequency (rf) coupling of environmental electromagnetic fields into electroexplosive devices shall be minimized.

5.3.2.5 Requirements for on deck assembly and external testing shall be minimized in the basic design of shipboard ordnance.

5.3.3 Basic ship design and layout considerations. Shipboard design and layout shall give consideration to the electromagnetic radiation hazards to shipboard ordnance. These considerations are described herein.

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5.3.3.1 Ordnance work areas onboard ship, where any weapons maintenance, assembly, or disassembly is conducted, shall be removed from transmitting antennas and other potential emitters to the extent practicable. Safe field intensity levels for such ordnance work areas are shown on figures 2 and 3. When necessary, such areas shall be provided with adequate structural shielding.

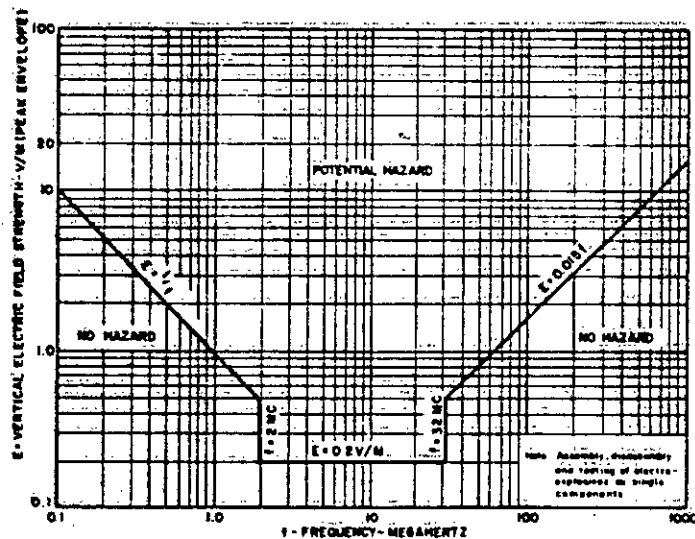


Figure 2 - Field intensity potentially hazardous to ordnance in optimum coupling configuration-communication frequencies.

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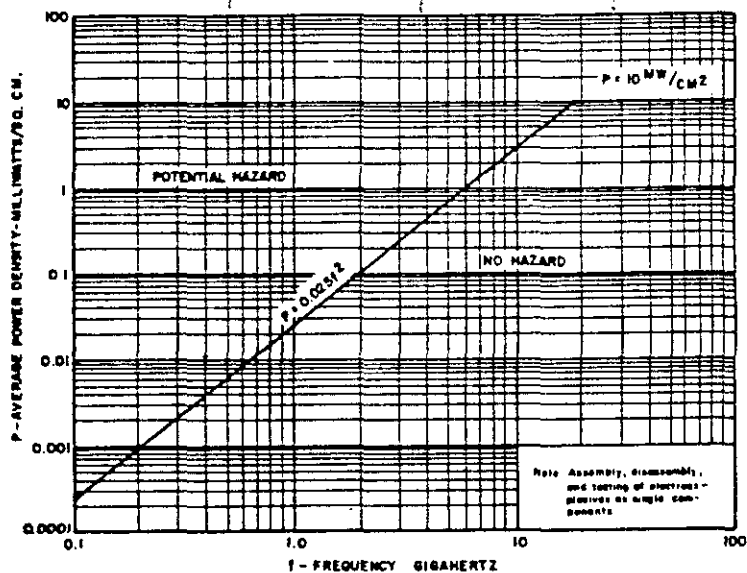


Figure 3 - Field intensity potentially hazardous to ordnance in optimum coupling configurations-radar frequencies.

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5.3.3.2 Ordnance installations onboard ship shall be located so as to minimize re-
arcing. These installations shall also be located to minimize the radiation hazard from
antennas and other potential emitters.

5.3.3.3 Shipboard antennas and other potential electromagnetic radiation emitters
shall be arranged with due regard to the possible hazard to shipboard ordnance (see 5.3.4).

5.3.4 Additional guidance - operational. The hazard to shipboard ordnance from the
ship electromagnetic environment is related not only to engineering factors (the subject
of this section) but is also intimately enmeshed with operational considerations. Additional
operational guidance and typical requirements are presented herein for information.

5.3.4.1 The responsibility for certification that ordnance may be handled safely and
without degradation of its own reliability in anticipated electromagnetic radiation environ-
ments is assigned to the Naval Ordnance Systems Command (NAVORD). Under this responsibility
NAVORD publishes an operational manual NAVORD OP 3564/NAVAIR 16-1-529. This manual provides
a listing of "HERO SAFE" ordnance; the "HERO SUSCEPTIBILITY" of other in-service weapons or
explosive devices; restrictions on ordnance handling; and operational control of shipboard
electromagnetic radiation required to ensure successful fleet operations without electro-
magnetic radiation hazard or weapon degradation.

5.3.4.2 Typical requirements are as follows:

- (a) "HERO SAFE" ordnance shall be at least 10 feet from the nearest extremity
of any communications antenna radiating more than 5 watts of power.
- (b) "HERO SUSCEPTIBLE" ordnance safe distances must be determined using the
susceptibility curves for each particular type of ordnance.

6. DEVIATIONS

6.1 Conditions. In achieving the purpose of this section it is recognized that there
must be some flexibility of application. During the early design stage of shipboard ordnance
installations it may become apparent that some deviation from the standard characteristics
specified herein is required. In such instance, the provisions of the "Deviations" para-
graph of MIL-STD-1399 must be complied with.

6.1.1 Deviation procedure. Requests for deviations shall be submitted to NAVSHIPS
with copies to:

- (a) Program/Project manager.
- (b) NAVSEC 6170.
- (c) NAVORD 048.

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