

**INCH-POUND**

MIL-STD-1399A(NAVY)

Section 072.2

24 October 1991

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SUPERSEDING

MIL-STD-1399(NAVY)

Section 072.2

1 December 1976

# **MILITARY STANDARD**

## **INTERFACE STANDARD FOR SHIPBOARD SYSTEMS SECTION 072.2 BLAST ENVIRONMENT, GUN MUZZLE**



AMSC N/A

FSC 1990

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## FOREWORD

1. This Military Standard is approved for use by all departments and agencies of the Department of Defense.

2 Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, Sea 5523. Department of the Navy, Washington, DC 20362-5101, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document, or by letter.

3. Navy ships are subject to the blast created by firing their own guns. The blast environment is variable both in its nature and in its effects which may weaken or deform ship structure and degrade the performance of shipboard systems and equipment. To reduce the potentially adverse effects of the blast environment, ship structure is required to meet established design standards, while ship systems and equipment must be protected through proper arrangement and installation practices.

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## 1. SCOPE

1.1 Purpose Policies and prodcures established by MIL-STD-1399 are mandatory. (This section defines the standard interface requirements for the design of system, equipment, and structure which may be subjected to the blast generated by own ship guns.) This section and the basic standard are to be viewed as an integral single document.

1.2 Scope. This section addresses the interface characteristics of gun blast effects for ship guns ranging from 78 millimeter (mm), 3 inch/50 to 16 inch/50, and the characteristics of Hi-Frag ammunition versus standard ammunition. Small caliber guns, such as Close-in-Weapon System (CIWS) are excluded since they produce insignificant blast effects, and may generally be ignored for ship and equipment design purposes.

1.3 Interfaces. The basic characteristics and constraint categories of this interface are shown symbolically in figure 1. The specific interface characteristics and constraints pertinent to this section are described in section 5.

1.4 Applicability. The criteria of this section are applicable to new ship acquisitions, modernizations, or conversions, and to system and equipment intended for installation on board such ships. Systems and equipment intended for installation on board active fleet ships shall possess blast resistance characteristics not less than those originally required for the ship in question. The criteria of this section apply only to ships designed for the installation of guns.

## 2. APPLICABLE DOCUMENTS

2.1 Government publications. The following Government publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

### PUBLICATIONS

NAVAL SEA SYSTEMS COMMAND (NAVSEA)

S9072-AJ-MAN-010/BLAST PROT

Design Guidance Manual for Gun and  
Missile Blast Protection.

(Application for copies should be addressed to Standardization Document Order Desk, BLDG. 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094)

2.2 Order of precedence. In the event if a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained

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### 3. DEFINITIONS

3.1 Gun blast. Gun blast is the high energy shock wave created by a gun when it is fired. The shock wave produces a sudden pressure rise on nearby surfaces with resultant high acceleration shock motions.

3.2 Gun blast debris Gun blast debris are the pieces of plastic and cork plugs, cardboard wads, and fragmenting rotating bands which are ejected from the muzzle at high speed when a gun is fired.

3.3 Blast shield. Blast shields are structural plates used to protect an item from damage by gun blast debris and the overpressure effects of the shock wave.

3.4 Gun blast areas. Gun blast areas are designated areas of the ship in the vicinity of gun mounts where the line of fire of the gun mount will subject deck and bulkhead surfaces and the interior and exterior equipment mounted thereto, to the effects of gun blast and debris.

### 4. GENERAL REQUIREMENTS

4.1 General requirements. The specific interface requirements and constraints established herein are mandatory and shall be adhered to by SYSCOMs. Project managers, contractors, and all others engaged in any aspect of shipboard design to which these requirements and constraints apply including systems/equipment design, production, and installation.

### 5. DETAILED REQUIREMENTS

5.1 General considerations. The firing of ship's guns creates high localized overpressures, high energy debris, and noxious gases within the vicinity of the gun mount.. The repetitive nature of this environment may cause significant and extensive damage to nearby equipment and structure, and cause discomfort to crew members exposed to the gases. Typical shipboard problems resulting from gun blast that require special design considerations to prevent their occurrence, are as follows:

#### a. Electronic and electrical equipment

1. Momentary interruptions
2. Circuit breaker tripping
3. Mechanical damage

#### b. Lights

1. Shattered glass
2. Broken lighting filaments



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- 3. Fatigue failure of mounts
- c. ventilation systems
  - 1. Split ducts
  - 2. Noxious gas ingestion
- d. Piping systems
  - 1. Leakage at joints and valves
  - 2. Failure of attachments
- e. Items attached to plating
  - 1. Attachment failures due to flexure of plating
- f. Structural damage
  - 1. Fatigue failures of welded joints
  - 2. Bulkhead/deck deformations and cracking from repetitive overstressing
- g. Blast debris
  - 1. Puncture damage to “soft” items such as boats, antennas, and missiles on launchers.

5.2 Interface characteristics. The interface characteristics of the gun blast environment consist of the following elements:

- a. Overpressure (see 5.2.1)
- b. Shock (see 5.2.2)
- c. Gun ejected debris (see 5.2.3)
- d. Noxious gas products (see 5.2.4).

These characteristics will be present on all ships with installed guns.

5.2.1 Overpressure Gun blast is an airborne shock wave (blast wave) created by the sudden release of high pressure gas. An object located in the path of the blast wave experiences a very rapid increase in pressure as the wave crosses the object which is then followed by a rapid decay to atmospheric pressure as the wave passes by. A characteristic of blast waves is that the blast wave diffracts around objects. Diffraction permits the blast wave to impinge on objects mounted on bulkheads and decks that are not directly oriented toward the blast source, and to enter into the weather openings of ventilation ducts. Use of Hi-Frag type ammunition results in a more severe blast environment than that produced by conventional ammunition

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5.2.2 Shock The sharp pressure rise of the blast wave over a very short period of time gives rise to high acceleration motions of the structure and equipment exposed to the blast Blast-induced shock motions are dependent upon both the direct pressure load on the item and the response of the structure to which the item is attached. Shock motions are experienced by both exterior and interior mounted equipment.

5.2.3 Gun ejected debris Along with the blast wave, particles from plastic and cork plugs, cardboard wads and fragmenting rotating bands are ejected from the muzzle with great force when a gun is fired Because of the high energy with which these particles are ejected, topside equipment such as boats and antennas may be damaged Use of Hi-Frag type ammunition results in a more severe debris environment than that produced by standard ammunition.

5.2.4 Noxious gas products The gas fumes resulting from gun fire are an irritant (in small quantities) to personnel as opposed to an immediate threat to life. The primary hazardous combustion product of propellant powder is carbon monoxide.

5.3 parameters The gun blast parameters for application to any specific ship or equipment design must be developed on a case basis from:

- a Gun size
- b. Type of ammunition/propellant used
- c. Ship configuration
- d. Gun train and elevation arcs
- e. Equipment location

The blast characteristics are determined from gun blast curves specific to each gun caliber which plot free-field overpressure as a function of distance and angle from the muzzle and line of fire as shown on figure 2 for a 5 inch/54 gun. These curves, which when applied to a specific ship configuration along with the arcs of gun mount train and elevation, determine the local free-field overpressure as shown in the example on figure 3. The actual pressure experienced by any object subject to the blast is a function of the free-field overpressure and the angle of blast wave impingement on the exposed surfaces of the object. The local blast pressures can be developed by hand for rough approximations, by computer program, or by actual shipboard measurements. Zones of debris impingement are determined by similar means.

5.4 Areas of application. The gun blast areas will be designated by the Principal Development Activity (PDA).

5.5 Interface constraints. Interface characteristics of the gun blast environment impose certain constraints on the design of ship structure, and on the design and installation of systems and equipment. These constraints are described in 5.5.1 through 5.5.3.

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5.5.1 System/equipment location and installation criteria. To the maximum extent practicable, equipment which may be damaged by or malfunction as a result of the gun blast interface characteristics, shall be located out of designated gun blast areas. The susceptibility of equipment to damage by gun blast shall be determined by the developing activity. Items located in blast areas shall be installed, shielded or otherwise protected in accordance with NAVSEA S9072-AJ-MAN-010/BLAST PROT and other applicable specifications

5.5.2 Weather openings. Weather openings for heating, ventilation, air conditioning, or collective protection systems shall not be located in blast areas. In cases where compliance with these requirements is unrealistic, protective devices shall be provided. Such protective devices include automatic closure devices to prevent ingestion of fumes, structural reinforcement of ductwork, and louvers at weather openings to prevent the entry of the blast wave into the duct. NAVSEA S9072-AJ-MAN-01 O/BLAST PROT provides further guidance for the protection of weather openings.

5.5.3 Structural design. Ship structure located in gun blast areas is subjected to overpressure, shock, and gun-ejected debris, and shall be designed in accordance with NAVSEA S9072-AJ-MAN-010/BLAST PROT. Design of shields required in gun blast areas are also addressed in NAVSEA S9072-AJ-MAN-10/BLAST PROT.

5.6 Compatibility. Design, location, and installation of ship systems, equipment, and structure shall be compatible with the gun blast interface characteristics given in 5.2 to the extent specified by the PDA.

## 5.7 DEVIATIONS

5.7.1 Conditions. In achieving the purpose of this section, it is recognized that there must be some flexibility of application. If during the design of ship structure and systems/equipment, it becomes apparent that significant advantages can be achieved by deviating from the standard characteristics specified herein, then the provisions of 5.7.2 shall be complied with.

5.7.2 Deviation procedure. When a deviation from the requirements of this standard can be justified, requests for deviation shall be prepared (see 6.2).

## 6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. This standard is to be used in technical development plans and in design and acquisition specifications for ship acquisitions, modernizations, or , and shipboard systems and equipment.

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6.2 Data requirements. The following Data Item Descriptions (DID's) must be listed, as applicable, on the Contract Data Requirements List (DD Form 1423) when this standard is applied on a contract, in order to obtain the data, except where DOD FAR Supplement 27.475-1 exempts the requirement for a DD Form 1423.

Reference paragraph	DID No.	DID title	Suggested tailoring
5.7.2	DI-CMAN-80639	Engineer change Proposals (ECP's)	
5.7.2	DI-CMAN-80644	Engineer Change Proposals (ECP's) (Short Form)	

The above DID's were those chaired as of the date of this standard The current issue of DOD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DID's are cited on the DD Form 1423.

6.3 Subject term (key word) listing.

Gun blast  
Gun blast debris  
Blast shield  
Gun blast area

6.4 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Review activities:  
EC, AS, OS

Preparing activity  
NAVY-SH  
(Project 1990-N071)

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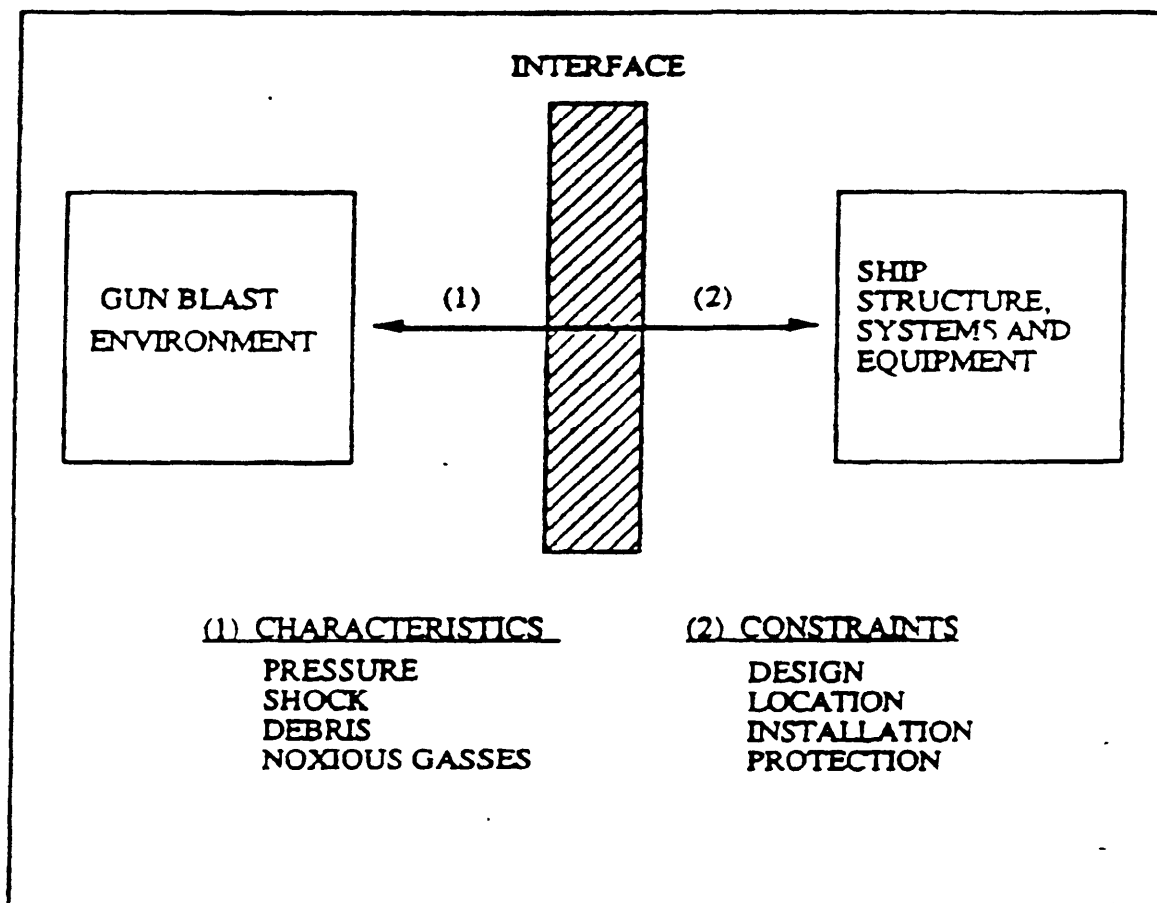


FIGURE 1. Gun blast interface diagram.

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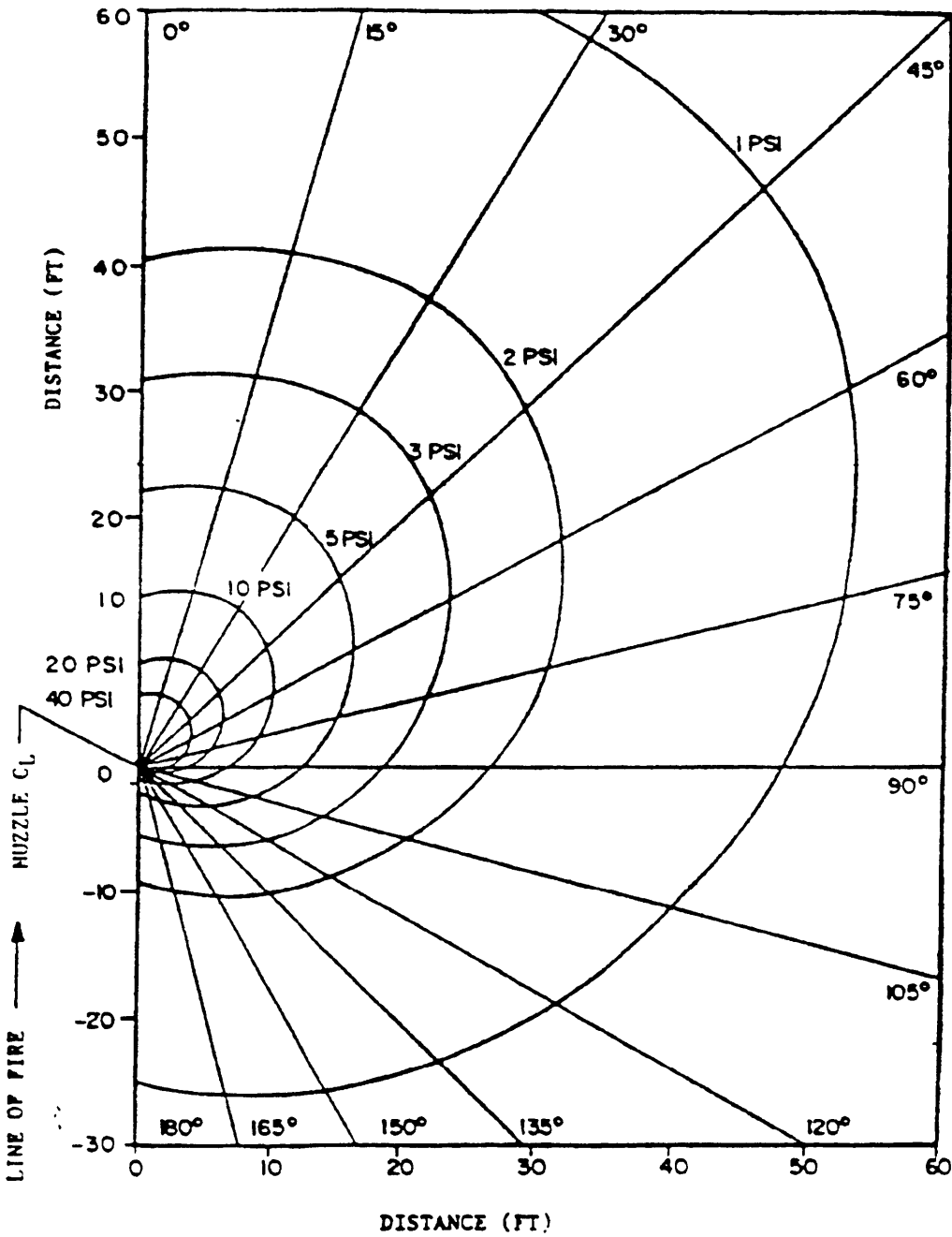


FIGURE 2. Free-field overpressure curves for 5 inch/54 gun using standard ammunition.

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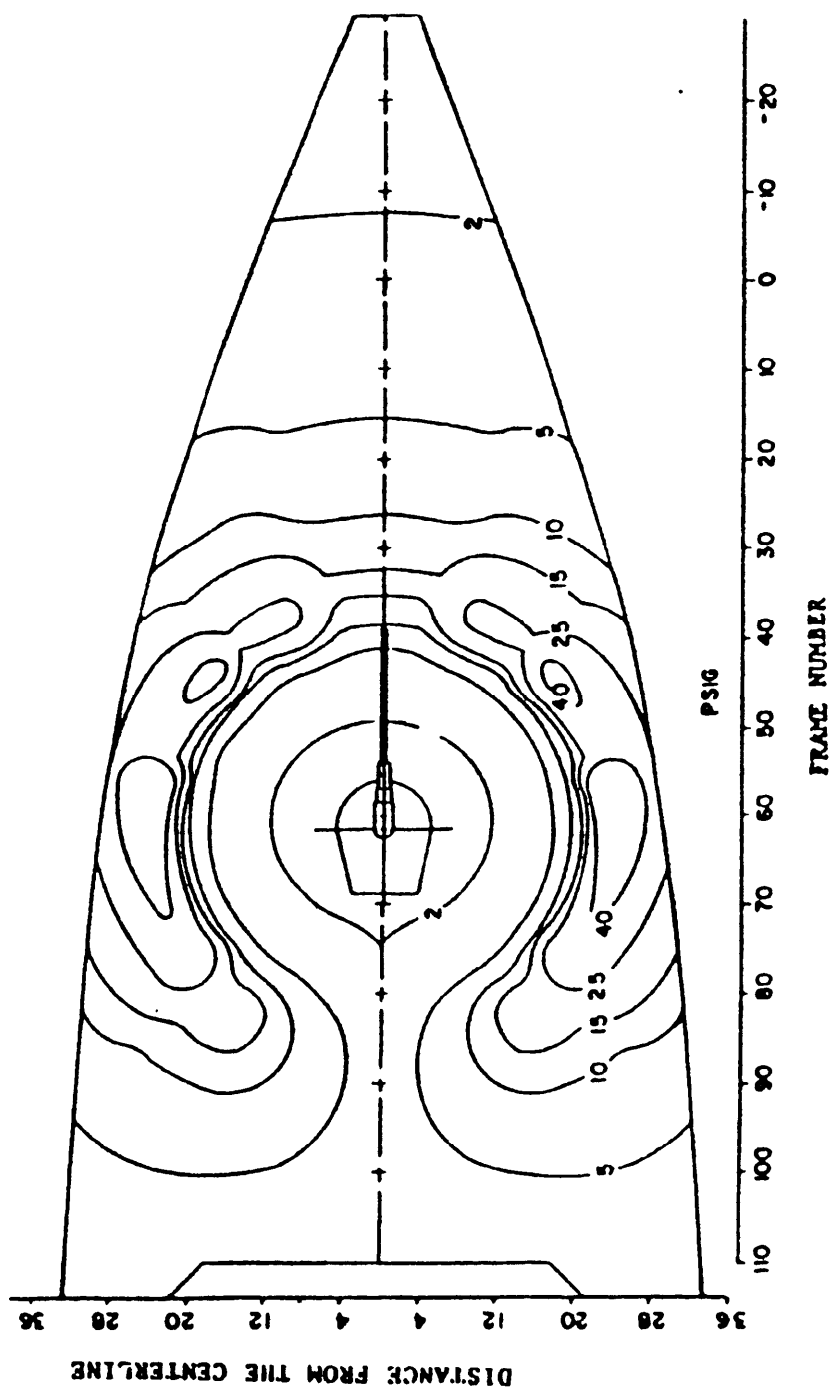


FIGURE 3. Peak overpressure contours on forward deck of DDG 51  
for 5 inch/54 gun using standard ammunition.

# STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

## INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

**NOTE:** This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

1. DOCUMENT NUMBER MIL-STD-1399A(NAVY)072.2	SECTION 072.2	2. DOCUMENT DATE (YYMMDD) 911024
3. DOCUMENT TITLE INTERFACE STANDARD FOR SHIPBOARD SYSTEMS SECTION 072.2 BLAST ENVIRONMENT, GUN MUZZLE		
4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)		

## 5. REASON FOR RECOMMENDATION

6. PREPARING ACTIVITY NAME ADDRESS CITY STATE ZIP	7. ORGANIZATION (Include Project Area Code) DATE SUBMITTED (Month/Day/Year)
--	--

## 8. PREPARING ACTIVITY

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c. ADDRESS (Include Zip Code) COMMANDER, NAVAL SEA SYSTEMS COMMAND SEA 5523 WASHINGTON, DC 20362-5101	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340