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**SAFETY DESIGN CRITERIA FOR STOWAGE COMPARTMENTS CONTAINING
HAZARDOUS MATERIALS ON SURFACE SHIPS**

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077-1.1 References

The following documents have been used in compiling this Design Data Sheet:

1. Publication, NAVSEA S9AAO-AA-SPN-010/GEN SPEC, General Specifications for Ships of the United States Navy; 1981 EDITION.
2. MIL-STD-1624, Ship Compartment Standard Nomenclature.
3. Publication, NAVSUP 4500, Consolidated Hazardous Items List, Storage and Handling (CHIL).

4. NAVSEA Publication S9086-RQ-STM-000/CH 510, Ventilation, Heating, Cooling and Air Conditioning Systems for Surface Ships of the United States Navy.

5. NAVSEA Publication S9086-TQ-STM-000/CH 670, Naval Ships Technical Manual, Chapter 670: Stowage, Handling and Disposal of Hazardous General Use Consumables.

6. NAVSEA Publication 0901-LP-230-0002, Naval Ships Technical Manual, Chapter 550: Industrial Gasses; Generating, Handling and Stowage.

7. NAVSEA Publication S9086-CN-STM-020/CH 079 Vol. 2, Naval Ships Technical Manual, Chapter 079, Section II: Practical Damage Control.

8. NAVSEA Publication S9086-KR-STM-000/CH 313, Naval Ships Technical Manual, Chapter 313: Portable Storage and Dry Batteries.

9. NAVSEA Publication 0938-018-0010, Air Conditioning, Ventilation and Heating Design Criteria Manual for Surface Ships of the United States Navy.

077-1.2 Scope and Use

This Design Data Sheet lists the basic criteria applicable to the location and design of compartments designated for the stowage of hazardous materials. The criteria apply to compartments only; requirements for bulk (tankage) stowage are not specified herein.

This Design Data Sheet will be used as an internal design guidance document for preparing Ship Specifications and SHIPALTS.

A compartment versus discipline matrix is provided whereby a designer may find the criteria imposed for and designated compartment used for the stowage of hazardous materials such as compartment location, electrical, ventilation, piping, temperature, fire protection, or other miscellaneous requirements. As an example, to find the criteria applicable to the Acid Storeroom, referring to the matrix it is noted that location criteria L1, Ventilation criteria V2, 7, 9, 13, Piping criteria P1, and Miscellaneous M3, 5 apply. The full criteria are quoted in the applicable sections of the Design Data Sheet including the rationale for the criteria and its source document. Referring to Location criteria paragraph 077-1.7, it is found that criteria L1 requires acid stowage below the full load waterline. Similarly, the Ventilation and Miscellaneous requirements are found by referring to criteria V2, 7, 9, 13 and M3, 5 specified in paragraphs 077-1.11 and 077-1.8.

077-1.3 General

(1) Due to their hazardous nature, certain materials require special stowage compartments to protect life, health and property. Hazardous material as used in this Design Data Sheet, is defined as any material, which by virtue

of its potentially dangerous nature requires controls to assure adequate protection of life, health and material. The definition for the purpose of this Design Data Sheet only, excludes ammunition, weapons, explosives, explosive actuated devices, propellants, pyrotechnics, chemical and biological warfare materials, medical and pharmaceutical supplies, and bulk fuels.

(2) Compartment titles listed in the Criteria Matrix are the latest official shipboard compartment designations as recorded in MIL-STD-1624.

(3) Determination of the required volumes of hazardous materials is under the cognizance of the Navy Supply System Command. The NAVSEA point of contact for such volumes is SEA 3211. Design of stowage facilities to accommodate hazardous materials is the cognizance of NAVSEA 3211.

(4) If a separate compartment is provided for Ship Stores flammable liquids, the compartment requirements shall be identical to those required for the Flammable Liquids Storerooms.

(5) Criteria for fixed flooding CO2 systems do not appear in this Design Data Sheet. It is intended that HALON 1301 fire protection systems will be installed in lieu of CO2 fixed flooding systems in spaces where hazardous materials are stowed in all new construction and major modification ships. The detailed requirements for HALON 1301 systems are given in Mil. Spec. MIL-E-24572.

(6) Damage Control closure classifications for ventilation systems are not called out in this Design Data Sheet. Consult the HVAC Manual, reference 9, for these requirements.

(7) The following materials have specific stowage requirements:

- (a) Bromine cartridges
- (b) Sodium Nitrite
- (c) Potassium Hydroxide
- (d) Aerosol containers
- (e) Mercury.

The special stowage requirements for these materials can be found in GENSPECS Sect. 670, NSTM Chapter 313 and the CHIL (references 1, 8 and 3).

077-1.4 CRITERIA MATRIX

Issue Date: 1 July 1980
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COMPARTMENTS	ELECTRICAL	FIRE PROTECTION	LOCATION	MISCELLANEOUS REQUIREMENTS	PIPING	TEMPERATURE	VENTILATION
ACID STOREROOM			L1	M3,5	P1		V2,7,9,13
ALCOHOL STOREROOM	E1,2,3,4, 5,6,7	F2 or 4,7	L3	M2,11	P2,3,7,8		V1,7,8
AVIATION FLAMMABLE LIQUID READY ISSUE ROOM	E1,2,3,4, 5,6,7	F2,7		M2,4,5,11	P2,3,7,8		V1,7,8
AVIATION PAINT AND FLAMMABLE LIQUIDS READY ISSUE ROOM	E1,2,3,4, 5,6,7	F2,7		M2,4,5,11	P2,3,7,8		V1,7,8
STORAGE BATTERY SHOP (ALKALINE) OR AVIATION ALKALINE BATTERY SHOP	E1,2,3,4, 5,6,8	F6,7	L10,11	M5,7,8,10	P3,10	T2	V6,7,13
STORAGE BATTERY SHOP (LEAD-ACID)	E1,2,3, 4,8	F8	L10	M5,7,8,9	P3,10		V6,7,13
CARGO STOREROOM (BULK ACID AND CHEMICAL)		F4	L1		P1,8		V1,8,9,13
CARGO STOREROOM (FLAMMABLE LIQUIDS)	E1,2,3,4, 5,6,7	F2 and 1,7	L2,3		P1,3,6,7,8		V1,8
CARGO STOREROOM (FLAMMABLE GAS CYLINDERS)	E1,2,3,4, 5,6,7	F2	L4,5,7	M2,11	P7,8	T1	V1,8
CARGO STOREROOM (INERT GAS CYLINDERS)	E5,6		L6		P7,8	T1	V3,9
CARGO STOREROOM (LUBRICATING OIL)	E1,2,3,4, 5,6	F2 or 1, 4,7		M2,6	P1,3,7,8		V1,8

077-1.4 CRITERIA MATRIX

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COMPARTMENTS	ELECTRICAL	FIRE PROTECTION	LOCATION	MISCELLANEOUS REQUIREMENTS	PIPING	TEMPERATURE	VENTILATION
FLAMMABLE LIQUIDS READY SERVICE STOREROOM	E1,2,3,4,5,6,7	F2,7		M2,4,5,11	P2,3,7,8		V1,8
FLAMMABLE LIQUIDS STOREROOM	E1,2,3,4,5,6,7	F2,7	L2,3	M1,2,5,11	P1,3,7,8		V1,7,8
GAS CYLINDER STOREROOM (ACETYLENE)	E1,2,3,4,5,6,7	F2	L4,7,8	M2,11	P7,8	T1	V1,7,8
GAS CYLINDER STOREROOM (CO ₂ / HALON)	E5,6		L4,6		P7,8	T1	V3,7,8,9
GAS CYLINDER STOREROOM (FLAMMABLE)	E1,2,3,4,5,6,7	F2	L4,5,7	M2,11	P7,8	T1	V1,7,8
GAS CYLINDER STOREROOM (HELIUM)	E5,6		L4,6		P7,8	T1	V3,7,8,9
GAS CYLINDER STOREROOM (INERT)	E5,6		L4,6		P7,8	T1	V3,7,8,9
GAS CYLINDER STOREROOM (OXYGEN/CHLORINE)	E5,6,7		L4,9		P7,8	T1	V3,7,8
OXYGEN/NITROGEN STORAGE ROOM	L5,6	F2			P4,7,8	T1	V10
PAINT MIXING AND ISSUÉ ROOM	E1,2,3,4,5,6,7	F2,7		M2,4,5,11	P2,3,7,8		V1,7,8
PAINTING AND MAINTENANCE ROOM	E1,2,3,4,5,6,7	F1,2		M2,5,11	P3,7,8		V1,7,8,11,12

077-1.4 CRITERIA MATRIX

COMPARTMENTS	ELECTRICAL	FIRE PROTECTION	LOCATION	MISCELLANEOUS REQUIREMENTS	PIPING	TEMPERATURE	VENTILATION
PACKAGED GASOLINE STORAGE COMPARTMENT	E1,2,3,4,5,6,7	F2 and 3	L2,3	M1,2,11	P3,5,6,7,8		V1,7,8,14
S. D. STOREROOM (AIRCRAFT TIRES)	E5	F5			P8		
S. D. STOREROOM (AVIATION FLAMMABLES)	E1,2,3,4,5,6,7	F2 or 4	L3	M2,11	P1,3,7,8		V1,7,8
S. D. STOREROOM (FLAMMABLE MATERIALS)	E1,2,3,4,5,6,7	F2 or 4	L3	M2,11	P1,3,7,8		V1,7,8
S. D. STOREROOM (AVIATION LUBRICATION OIL)	E1,2,3,4,5,6	F2 or 1		M2,11	P1,3,7,8		V7,8
INCINERATOR ROOM		F4,7			P8,9		V4
TRASH STOREROOM	E5,6	F4,7			P8,9		V4

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077-1.5 Electrical Criteria

CRITERIA	RATIONALE	SOURCE	MATRIX PARA NO.
<p>Explosion proof enclosures are required; only electrical equipment essential to the space shall be installed. Explosion proof, group D incandescent fixtures, or explosion proof fan-cooled, group B enclosures shall be installed. Inclosed spaces adjoining and opening into spaces which require explosion proof enclosures, shall also have explosion proof enclosures unless the doors opening into the spaces are classified X, V, Z, Circle X or Circle Y.</p> <p>Additionally, explosion proof enclosures are required in areas within an open horizontal distance of 15 feet and below 4 feet above the deck of the weather access to paint and flammable liquid storeroom or issue rooms and gasoline hazard areas, and in compartments containing ventilation exhaust ductwork serving gasoline hazard areas.</p> <p>Where explosion proof enclosures are required, shields shall be provided where required to protect such equipment from spraying or dripping liquids.</p>	<p>Explosion proof enclosures are required in spaces in which flammable liquids, vapors, or gases may be present and in adjacent spaces into which such fluids could readily pass, to minimize dangers of fire and explosion. A group D explosion proof enclosure is so constructed as to withstand an explosion within and to prevent emission therefrom of sparks, flashes, flames, or hot products which might ignite surrounding combustible or explosive material.</p> <p>Spraying or dripping liquids could cause damage to electrical equipment, or corrode enclosures to the point where they would no longer provide the necessary explosion proof protection.</p>	<p>GEN SPECS SECT 300</p>	<p>E1</p>
<p>Non-explosion proof switchboxes and controllers for space fixtures shall be located outside of the compartment, but as near as possible to the access.</p>	<p>Exterior switch locations reduce the possibility of spark-ignited explosions within the compartment.</p>	<p>GEN SPECS SECT 331</p>	<p>E2</p>
<p>Cable runs shall be avoided through hazardous spaces except such cable runs that terminate in or cannot be routed around these spaces.</p> <p>Cables within hazardous spaces shall be protected against mechanical damage. This protection shall be in the form of non-tight metal guards (expanded or solid) of sufficient strength to provide the required protection. Clearance shall be provided between the protective guards and the cables to provide ample ventilation. Protective guards shall be provided with drainage holes where required. Cables protected by the ship structure or by permanently installed equipment are considered adequately protected.</p>	<p>These measures are intended to minimize the possibility of fire in compartments containing hazardous materials.</p> <p>Cables that must be installed in such spaces shall be protected to avoid damage to the insulation which could result in exposed conductors and the danger of sparking and ignition of combustible material in the space. The protective guards must allow adequate heat dissipation and drainage to prevent thermal and moisture damage to cable insulation. Non-tight protective guards reduce the possibility of temperature build up and accumulation of condensation around cables.</p>	<p>GEN SPECS SECT 304</p>	<p>E3</p>
<p>E</p>	<p>Page 7</p>	<p>Page 7</p>	<p>E</p>

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077-1.5 Electrical Criteria

CRITERIA	RATIONALE	SOURCE	MATRIX PARA NO.
<p>Only cables having conductor insulation of silicone rubber shall be used.</p> <p>Through cables shall be of unbroken length within compartments. Cables terminating at lighting fixtures or other equipment shall be of unbroken lengths. Separate cables to each lighting fixture are not required; a single cable may be run between fixtures where more than one fixture is installed in a space.</p>	<p>Silicone rubber conductor insulation provides greater protection against contamination of the cable from water or moisture.</p> <p>Cable junctions and splices could become a source of local overheating or sparking, with the danger of igniting combustible material in hazardous spaces.</p>	<p>GEN SPECS SECT 304</p>	<p>E3 (Cont)</p>
<p>Lanterns shall not be installed in any locations where explosion proof enclosures are required.</p>	<p>Lanterns with relay and hand lantern switches and battery connections could spark and thereby are hazardous inside spaces subject to accumulation of flammable fumes.</p>	<p>GEN SPECS SECT 332</p>	<p>E4</p>
<p>High temperature alarm systems shall be provided. The installation shall consist of two or more thermostats in accordance with Mil. Spec. MIL-A-17196, Type IC/J-105, Type IC/J-125 or Type IC/J-150 per Dwg. No. 015-1197118. Not less than one thermostat shall be installed for each 250 square feet of deck area, or fraction thereof, and not less than two thermostats per compartment. If a compartment is divided by arches or large projecting overhead girders, the number of thermostats shall be based on the areas of the compartment divisions. All thermostats in one compartment shall be wired in parallel and connected to the same line unit of the switchboard. Thermostats that are installed in spaces exposed to the radiant heat of the sun shall be insulated from the steel structure.</p> <p>High temperature in any of the compartments containing thermostats shall be indicated on a type IC/SM alarm switchboard installed in a station which is continuously manned when underway. The location of the</p>	<p>High temperature can cause flammable liquids or gases to ignite and/or explode. Installation of high temperature thermostat actuated alarms will signal a temperature build up condition.</p> <p>A sufficient number of thermostats are installed to provide prompt detection of fire in any portion of the compartment. The thermostats require a free circulation of air for efficient operations, and barriers or obstructions within a compartment must be considered in the placement of the sensors. A minimum of two thermostats are installed to ensure coverage in the event of damage or malfunction of one of the units. The specified connections allow the operation of any one of the thermostats in a group to sound the alarm and energize the compartment designation light on the switchboard. Thermostats are wired in parallel to prevent a damaged unit from deactivating the remaining thermostats in a compartment. The insulation prevents normally warm surfaces from overheating thermostats and sounding false alarms.</p> <p>Ships personnel must be aware of the first sign of high temperature so that early corrective actions may be taken.</p>	<p>GEN SPECS SECT 436</p>	<p>E6</p>
<p>Page 8</p>	<p>Page 8</p>	<p>Page 8</p>	<p>E</p>

077-1.5 Electrical Criteria

	CRITERIA	RATIONALE	SOURCE	MATRIX PARA NO.
	<p>switchboard shall comply with the following order of preference:</p> <p>Control control station or damage control control</p> <p>IC or combined IC and gyro room</p> <p>Pilot House</p> <p>In destroyer type ships, the alarm switchboard shall be located in the IC or combined IC and gyro room.</p>		<p>GEN SPECS SECT 436</p>	<p>E5 (Cont.)</p>
	<p>Audible and visual extension alarm signals shall be installed in the Pilot House, each deck office (OOD station), damage control station, and each interior communication room. The extension alarm in the deck offices or OOD stations shall incorporate the signals for the extension signals for circuits IH and F, as applicable. (In destroyer type ships, audible and visual extension alarm signals shall also be installed in damage control control). The audible alarm signal in the Pilot House, secondary damage control station, and deck offices (OOD station), shall be connected through a rotary snap switch. A warning plate with a red inscription "THIS SWITCH SHALL BE CLOSED ONLY WHEN THIS STATION IS MANNED" shall be installed adjacent to the switch in each of these stations.</p>	<p>Rapid and wide communication of emergencies is essential for prompt reaction to minimize damage and casualties. Extensions in damage control spaces and communications rooms permit mobilizing repair parties and spreading the alarm throughout the ship. Extensions in deck offices inform duty officers of existence of fire (circuit F).</p>	<p>GEN SPECS SECT 436</p>	<p>E6</p>
	<p>Flammable liquid compartments shall be fitted with a circuit HF air flow indicator and alarm system. This system shall provide a means of activating audible and visual alarms when the rate of air flow decreases below a pre-set level for compartments designed to accommodate storage of hazardous materials.</p> <p>The installation for each compartment shall consist of an airflow sensor and an indication and control panel in accordance with NAVSWIPS drawing B15-1853145. The airflow sensor shall be located in the exhaust duct</p>	<p>Means are provided for indicating the rate of flow in the ventilation exhaust ducts to ensure adequate air circulation to prevent accumulation of flammable or toxic vapors. An alarm is required to signal low air flow and permit prompt corrective action.</p>	<p>GEN SPECS SECT 437</p>	<p>E7</p>
<p>Page 9</p>			<p>Page 9</p>	<p>E</p>

077-1.5 Electrical Criteria

	CRITERIA	RATIONALE	SOURCE	MATRIX PARA NO.
	<p>of each compartment and connected to the indication and control panel located external to the compartment and adjacent to the access.</p> <p>An extension audible and visual alarm capability shall be provided in Central Control Station or in the EOS for ships not having a Central Control Station.</p> <p>The pre-set air flow rate for actuating the alarm shall be designated by a point established midway between the airflow indicator pointer position, when the compartment access is secured, with supply and exhaust fans operating and the pointer position with supply fan operating and exhaust fan secured.</p> <p>A warning plate shall be installed in a conspicuous location on the exterior of the access door to the monitored compartment. The plate shall be inscribed as follows:</p> <p>"WARNING - ALARM INDICATES LOW AIR FLOW IN VENTILATION SYSTEM SERVING THIS COMPARTMENT. TAKE IMMEDIATE ACTION TO RESTORE VENTILATION. DO NOT ENTER WITHOUT RESPIRATORY PROTECTION OR UNTIL COMPARTMENT VENTILATION HAS BEEN RESTORED FOR AT LEAST 15 MINUTES. EVACUATE THE COMPARTMENT IMMEDIATELY UPON VENTILATION SHUTDOWN."</p> <p>Separate circuit categories shall be designated as follows:</p> <ul style="list-style-type: none"> 1NF - Paint Mixing & Issue Rooms 2NF - Flammable Liquids Issue and Storerooms 3NF - Gas Cylinder Storerooms (flammable) 4NF - Gasoline Pump Rooms and other rooms where small gasoline motors and fuel tanks may be stored. 		<p>GEN SPECS SECT 437</p>	<p>E7 (Cont.)</p>
	<p>The power supply to battery chargers in battery shops shall be interlocked with the battery shop exhaust fans to prevent charging of batteries when the fans are not operating.</p>	<p>Explosive and noxious gases are generated by lead-acid and alkaline storage batteries on charge. Ventilation removes these gases and prevents their accumulation to form an explosive or toxic atmosphere. Neglect of battery ventilation involves a serious danger of an explosion and may impair the health of personnel.</p>	<p>GEN SPECS SECT 313</p>	<p>E8</p>
<p>E</p>			<p>Page 10</p>	<p>E</p>

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077-1.6 Fire Protection Criteria

	CRITERIA	RATIONALE	SOURCE	MATRIX PARA NO.
	<p>Aqueous film forming foam (AFFF) sprinkler systems shall be installed to protect spaces or areas where flammable liquid fires might develop to such proportions as to render other extinguishing systems ineffective.</p>	<p>AFFF sprinkler systems are installed to combat flammable liquid fires which could develop to such proportions as to render other extinguishing systems ineffective. AFFF solutions produce foam which acts as surface barriers to exclude air and halt fuel vaporization. In addition, these agents form a water solution film which suppresses vaporization and cools the fuel. This double action combines to make AFFF highly effective against liquid fires in terms of amount of agent and time required for extinguishment.</p>	<p>GEN SPECS SECT 555</p>	<p>F1</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Page 11</p>	<p>MALON 1301 fixed flooding fire extinguishing system shall be provided with components in accordance with Mil. Spec. MIL-E-24572(SH).</p> <p>The MALON cylinders of each system shall be located in the compartment protected. Each system shall have installed sufficient MALON cylinders for a single discharge.</p> <p>MALON system actuation devices for protected spaces shall be installed outside each protected space, one adjacent to the access and one along the route of egress which will remain tenable with a fire in the space.</p> <p>Each control system shall be designed and installed so that actuating any pneumatic actuation device installed in a MALON 1301 flooding system shall actuate local and remote alarms to indicate system actuation, shut down ventilation fans, and following a suitable delay to permit ventilation wind down, actuate remote discharge indicators and discharge MALON gas into the protected space.</p> <p>A time delay device shall be installed in each actuating line to delay opening of MALON cylinder valves and allow for shut down of ventilation fans. The time delay device installed in each MALON 1301 system protecting a non-machinery space shall be set at 30 seconds and shall be so marked.</p>	<p>The MALON 1301 system provides improved fire fighting capability and improves the ability to effectively combat high risk fires involving flammable liquids and gases.</p> <p>Reduces the piping runs which makes the system more effective. Each MALON system shall be self-contained.</p> <p>MALON system actuation is designed to allow personnel departing the space involved in the fire to actuate the system. A remote control is required to safely actuate the system in the event the control at the access is not available.</p> <p>The actuation device starts the sequence of system events that insures that the system will function properly and alerts the proper ship's personnel, such as the OOD and damage control personnel in DEC.</p> <p>The delay provides time for the ventilation fans to be secured to avoid loss of the extinguishing agent.</p>	<p>GEN SPECS SECT 555</p>	<p>F2</p>
<p style="text-align: center;">F</p>			<p>Page 11</p>	<p style="text-align: center;">F</p>

077-1.6 Fire Protection Criteria

	CRITERIA	RATIONALE	SOURCE	MATRIX PARA NO.
	<p>Pressure operated electrical switches with manual reset shall be installed in the CO₂ actuating line of each HALON 1301 total flooding system upstream of the time delay device. These switches shall activate local and remote alarms and indicators and shall shut down ventilation fans. A pressure operated electrical switch with manual reset shall be installed in the CO₂ actuating line of each HALON 1301 total flooding system downstream of the time delay device. This switch shall activate remote indicators as required to show discharge of the HALON 1301 system.</p> <p>Each HALON total flooding system shall be designed so as to discharge HALON 1301 gas into each protected space so that the concentration of HALON 1301 gas by volume in the protected space is developed within 10 seconds following start of discharge.</p> <p>Concentration in all protected spaces except the flammable gas cylinder storeroom shall be not less than 8 percent at 50°F nor greater than 7 percent at 150°F. Concentration in the flammable gas cylinder storeroom shall be not less than 20 percent at 50°F.</p> <p>HALON 1301 total flooding system equipment installed shall be furnished by one contractor.</p> <p>Each HALON cylinder shall be installed in an upright position.</p> <p>Each actuation cylinder valve shall be fitted with a self-energizing lock-open device and shall be manually operated.</p> <p>For manifolded systems: Distribution piping shall be installed in the overhead of all spaces protected. The required number of nozzles shall be based on the area coverage per nozzle and the gross deck area. Where possible, feed branches with large volume differences shall be avoided. Pipe tees supplying branch lines shall be installed with both outlets discharging horizontally. Branches serving two or more nozzles in series shall be kept at a minimum. Discharge nozzles shall be located to give uniform distribution of HALON. Nozzles shall be installed in the pendant position.</p>	<p>Alarms are required to alert personnel to evacuate the space and to notify Damage Control Central.</p> <p>Rapid discharge (10 seconds maximum) keeps decomposition products at a low level.</p> <p>The designed flooding factors are the recommended minimum to rapidly extinguish hazardous material fires.</p> <p>To ensure interchangeability of parts.</p> <p>Ensures proper operation of the system.</p> <p>Ensures full discharge.</p> <p>Uniform branch volume assures simultaneous nozzle discharge. Horizontal tee arrangement prevents vapor phase separation. Minimizing the number of nozzles served by each branch permits equal discharge rates to all nozzles, using a common nozzle size.</p>	<p>GEN SPECS SECT 555</p>	<p>F2 (Cont.)</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Page 12</p> <p style="text-align: center; font-size: 2em;">F</p>			<p>Page 12</p>	<p style="text-align: center; font-size: 2em;">F</p>

077-1.6 Fire Protection Criteria

	CRITERIA	RATIONALE	SOURCE	MATRIX PARA NO.
F	<p>They shall have a minimum radius of coverage of 15 feet and shall be installed on maximum 30-foot centers along branch lines. Branch lines shall be a maximum of 30 feet apart.</p> <p>The following warning plate shall be installed outside each access to spaces protected by HALON 1301 total flooding systems:</p> <p style="text-align: center;">WARNING HALON 1301 MAY PRODUCE TOXIC BY-PRODUCTS WHEN EXPOSED TO FIRE. PERSONNEL MUST LEAVE THE SPACE WHEN THE HALON SYSTEM IS ACTIVATED. AFTER THE FIRE HAS BEEN EXTINGUISHED, RESET VENTILATION SHUTDOWN PRESSURE SWITCHES IN THE HALON SYSTEM AND OPERATE VENTILATION SUPPLY AND EXHAUST SYSTEM AT HIGH SPEED FOR 15 MINUTES PRIOR TO RE-ENTRY WITHOUT AN IMA.</p> <p>Instruction Plates: Label plates shall be installed above each control to indicate locations of controls for ventilation supply and exhaust fans. An instruction plate shall be installed above each HALON flooding system actuator to explain how to operate the system and how to silence the alarm bell.</p>	<p>Alerts personnel to possible toxic hazard.</p> <p>These plates are required to ensure that operating personnel will be able to properly operate the system both automatically and manually. They provide vital information to the personnel involved in the operation of the system.</p>	<p>GEN SPECS SECT 555</p>	<p>F2 (Cont)</p>
	<p>In packaged gasoline stowage compartments an AFFF sprinkler system sized for the entire area shall be installed and connected to a permanently installed IP-100 or ICFE station.</p>	<p>The foam sprinkler system is in addition to the HALON flooding system specified. The HALON system is used initially to extinguish a fire occurring in these compartments. However, a fire apparently extinguished by HALON may reignite after the smothering atmosphere has been dissipated if hot surfaces remain. The foam sprinkler provides cooling to prevent such reflash following the discharge of HALON.</p>	<p>GEN SPECS SECT 555</p>	<p>F3</p>
	<p>Overhead sprinkler systems shall be installed in the Incinerator Room and Trash Storeroom where these spaces are combined, and in hazardous material cargo storerooms. The system shall consist of spray heads, MII, Spec. MII-N-193H7, and hydraulically operated salt water control valves with test castings. The hydraulic control system shall be in accordance with</p>	<p>Sprinkler systems provide a rapid means for extinguishing and preventing the spread of fire. Stowed trash may be combustible and could possibly ignite when stowed in the same compartment with and subject to the heat from the incinerator. The incinerator will only be operated when ship's personnel are in attendance, therefore automatic controls are not required. Also,</p>	<p>GEN SPECS SECT 521</p>	<p>F4</p>
			<p>Page 13</p>	<p>F</p>

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077-1.6 Fire Protection Criteria

F	CRITERIA	RATIONALE	SOURCE	MATRIX PARA NO.
	<p>publication, NAVSEA 0348-1P-078-1000, dry type, except that no automatic controls shall be installed. The control valves shall be arranged for local control only and located outside the space adjacent to the access.</p> <p>The sprinkling rate shall be 0.2 gpm per square foot of overhead area.</p>	<p>an automatic control system could prematurely activate the system due to heat from the trash burner. Controls outside of the spaces adjacent to the accesses allow personnel to activate the sprinklers without hazardous exposure to heat and smoke.</p> <p>The sprinkling rate of 0.2 gpm is effective in combating Class A fires in these spaces.</p>	<p>GEN SPECS SECT 521</p>	<p>F4 (Cont)</p>
	<p>A dry type non-automatic sprinkling system shall be installed in each aviation tire storeroom.</p> <p>The control valve shall be located outside the sprinkled area and shall be operated from an area outside of, but adjacent to the aviation tire storeroom access.</p>	<p>This system provides a rapid means for extinguishing and prevents the spread of fire.</p> <p>Controls outside of the spaces adjacent to the accesses allow personnel to activate the sprinklers without hazardous exposure to heat and smoke.</p>	<p>GEN SPECS SECT 521</p>	<p>F5</p>
	<p>The charging bench in the Storage Battery Shop (Alkaline) shall have a CO₂ fire extinguisher (15 lb.) mounted at each end of the bench for use in case of thermal-run-away.</p>	<p>Provides immediate and rapid cooling of the batteries to preclude catastrophic failure (explosion) due to the adverse effects of thermal-run-away.</p>	<p>GEN SPECS SECT 556</p>	<p>F6</p>
	<p>An 10 pound portable dry chemical fire extinguisher and mounting brackets in accordance with Mil. Spec. MIL-E-24091 shall be provided.</p>	<p>Portable dry chemical fire extinguishers are provided in areas containing potential for small flammable liquid fires.</p>	<p>GEN SPECS SECT 556</p>	<p>F7</p>
	<p>A portable 15 pound CO₂ fire extinguisher and mounting brackets in accordance with Mil. Spec. MIL-E-24269 shall be provided.</p>	<p>Portable CO₂ extinguishers are provided for extinguishing fires in electrical equipment, flammable liquids and other fires by smothering.</p>	<p>GEN SPECS SECT 555</p>	<p>F8</p>
<p>Page 14</p>	<p>Page 14</p>			<p>F</p>

077-1.7 Location Criteria

CRITERIA	RATIONALE	SOURCE	MATRIX PARA NO.
<p>Acid shall be stowed in the flammable liquids storeroom or acid storeroom, if provided, except that medical acid shall be stowed in the medical storeroom. Acid containers in the flammable liquids storeroom or medical storeroom shall be stowed in leakproof, lead-lined boxes, chests or lockers. A label plate with the following inscription in letters approximately 1/8-inch high, "ACID BOTTLE STORAGE", shall be securely fitted on each door or lid. The acid storeroom shall be located below the full load waterline.</p>	<p>Liquid and solid organic acid vapors, in general, may form explosive mixtures with air and therefore require the same stowage requirements as flammable liquids. Medical acid, subject to the same conditions, shall be stowed separately for ready usage. Storeroom locations below the full load waterline are less subject to ship motion and to shock from gun fire that could be a source of damage to glass or plastic acid containers.</p>	<p>GEN SPECS SECT 671</p>	<p>L1</p>
<p>Drums or cans containing gasoline shall be stowed in packaged gasoline stowage compartments, or on the weather deck. Gasoline stowage on weather decks shall be near the stern of the ship, where practicable. Weather deck stowage shall not be in the vicinity of hatches, galleys, heat producing spaces, ventilation weather openings for such spaces, ready service magazines, gun and missile blast areas, or other hazardous locations. Quick release type racks in accordance with drawing NAVSHIPS No. 810-444641, shall be used for stowage of gasoline on weather decks, with the racks arranged and located so that the containers may be readily jettisoned overboard.</p>	<p>Gasoline is a highly volatile liquid requiring special stowage and handling considerations. Stowage of large quantities of gasoline in any one area should be avoided. Weather deck stowage near the stern provides rapid dissipation of fumes to the atmosphere and provides the best area for fast overboard discharge of containers if necessary. Vapors could accumulate, if adequate ventilation is not provided, and could result in a hazard, especially in the presence of heat.</p>	<p>GEN SPECS SECT 542</p>	<p>L2</p>
<p>Flammable liquids' storerooms shall be located below the full load waterline near the extreme ends of the ship and not adjacent to pyro stowages or ammunition spaces. Passage through a magazine to gain access to a flammable liquids storeroom or through a flammable liquids storeroom to gain access to a magazine is prohibited. There shall be at least one space separating the flammable liquids storeroom from the steering gear room.</p>	<p>Isolation of the storeroom is required in order to minimize the hazards to surrounding spaces. Compartment access restrictions isolate magazine stowage areas and ordnance stowage from flammable or explosive liquids.</p>	<p>GEN SPECS SECT 670</p>	<p>L3</p>
<p>Racks fitted with metal collars, similar to drawings, NAVSHIPS Nos. 805-184899, 805-184950, 805-184951, and 805-184952, modified to stow cylinders with minor variations in diameter, shall be installed for the vertical stowage of cylinders with valve end up.</p>	<p>Stowage of cylinders in racks, individually secured so that handling of the cylinders is reduced to a minimum, prevents hazards due to shock. Cylinders shall be stowed with the valve end up to avoid the possibility of withdrawing a liquid when the cylinder is being</p>	<p>GEN SPECS SECT 671</p>	<p>L4</p>
		<p>Page 15</p>	<p>L</p>

077-1.7 Location Criteria

CRITERIA	RATIONALE	SOURCE	MATRIX PARA NO.
<p>Wherever practicable, stowage shall permit the removal of any cylinder without disturbing other cylinders. Cylinder stowage shall meet grade B shock.</p> <p>Compressed gas cylinders shall be stowed on the weather decks unless compartments are designated for compressed gas cylinder stowage.</p> <p>Weather deck stowage shall be located in shaded areas, or where shaded areas are not available, cylinders shall be protected from direct sunlight by fittings such as awnings. In either case, the temperature of the cylinders shall not exceed 130°F. The weather deck stowage areas shall be as remote as practicable from navigation, fire control, and gun stations and located so as to involve the least possible danger from heat, mechanical injury, gun blast, missile blast or heat, or open fire.</p>	<p>discharged. Compressed gas cylinders contain high pressures and present a hazard when exposed to heat. Location isolated from explosive causing conditions and vital spaces is mandatory.</p>	<p>GEN SPECS SECT 671</p>	<p>L4 (Cont)</p>
<p>Cylinders of carbamide and ethylene oxide (also flammable) and other toxic gases shall be stowed on a weather deck.</p>	<p>Toxic gases will produce fatal results, if breathed in large quantities. In small quantities, they are irritants and cause acute distress by attacking the tissues of the lungs. Weather deck stowage prevents an accumulation of the vapors.</p>	<p>GEN SPECS SECT 671</p>	<p>L5</p>
<p>Cylinders of inert gas may be stowed in any compartment designated for compressed gas stowage (except acetylene) provided that they are unmistakably segregated and can be readily identified. Where a gas cylinder storeroom (inert) is provided, it shall be an airtight space above or a watertight space below the main deck. Replacement refrigerant gas cylinders not stowed in the refrigeration machinery room shall have stowage facilities meeting these requirements and shall be located as close as practicable to the refrigeration machinery room.</p>	<p>Helium, nitrogen, carbon dioxide, and argon are non-flammable gases and may be stowed with flammable gases. The inert characteristics of these gases provide fire protection but they will not support respiration and sufficient concentration in a closed space will cause asphyxiation. Escape of inert gas to other spaces presents a possible asphyxiation hazard to personnel in those spaces. A minimum of airtight construction will contain the gas to its compartment. "Freon", used in refrigeration machinery, likewise is non-flammable, but in the presence of fire or red hot metal will decompose into phosgene gas which is toxic.</p>	<p>GEN SPECS SECT 671</p>	<p>L6</p>
<p>Flammable or explosive gases shall be stowed on weather decks unless a gas cylinder storeroom (flammable) is provided. The gas cylinder storeroom</p>	<p>Accumulations of gases presents an acute fire and explosive hazard. Weather deck stowage is preferred, however stowage in gas cylinder storeroom (flammable).</p>	<p>GEN SPECS SECT 671</p> <p>Page 16</p>	<p>L7</p>

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077-1.7 Location Criteria

CRITERIA	RATIONALE	SOURCE	MATRIX PARA NO.
<p>(flammable) shall be a watertight compartment in either the extreme forward or extreme aft portion of the ship. There shall be at least one other compartment intervening between it and the steering gear compartment or any stowage space for combustibles or explosives such as ammunition, gasoline, oil or flammable liquids.</p>	<p>If provided, is acceptable if all pertinent criteria for the storeroom are met. An intervening compartment acts as a "buffer zone" to prevent the spread of fire.</p>	<p>GEN SPICS SECT 671</p>	<p>L7 (Cont)</p>
<p>Acetylene stowage compartments shall be located so as to reduce the handling of the cylinders to a minimum. Acetylene shall be stowed in a vertical position wherever possible. Horizontal stowage must be avoided. Stowage locations should be as close to deck delivery access as possible.</p>	<p>Acetylene is inherently unstable and at pressures greater than 15 PSI may dissociate violently when subjected to heat or shock. Acetylene cylinders must be used or stored only in the upright position, valve end up, to avoid the possibility of withdrawing acetone when the cylinders are being discharged.</p>	<p>GEN SPICS SECT 671</p>	<p>L8</p>
<p>Oxygen and chlorine cylinders shall be stowed on weather decks and shall be kept as far away as practicable from butane, propane, acetylene, and other flammable gas cylinders. Oxygen and chlorine cylinders stowed within the ship shall be in a separate gas cylinder storeroom (oxygen) and not with any other flammable gas cylinders or flammable liquids. The gas cylinder storeroom (oxygen) shall meet the location requirements listed in above for gas cylinder storeroom (flammable) and in addition, have a compartment intervening between gas cylinder storeroom (flammable) and gas cylinder storeroom (oxygen).</p>	<p>Oxygen, although itself not flammable, is essential to combustion. Compressed oxygen is under high pressure. If the container is broken due to shock or exposed to high temperature, an explosion or fire may result. Shock can also shatter a compressed chlorine gas container with explosive force. When heated, chlorine emits highly toxic fumes. It will react with water or steam to produce toxic and corrosive fumes or hydrogen chloride.</p>	<p>GEN SPICS SECT 671</p>	<p>L9</p>
<p>Lead-acid batteries and alkaline batteries (NiCad) shall be stowed in separate spaces.</p>	<p>Since the electrolyte used in lead-acid batteries is a strong solution of sulfuric acid, it is imperative that alkaline batteries (NiCad) be separated to avoid the possibility of contamination.</p>	<p>GEN SPICS SECT 313</p>	<p>L10</p>
<p>The alkaline battery charging shop, facilities and tools shall be kept separate from those of the acid type battery shop.</p>	<p>See rationale for item L10. All sources of acid contamination shall be kept separate from alkaline batteries and the alkaline electrolyte.</p>	<p>GEN SPICS SECT 313</p>	<p>L11</p>
<p>Page 17</p>			<p>L</p>

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077-1.8 Miscellaneous Criteria

CRITERIA	RATIONALE	SOURCE	MATRIX PARA NO.
<p>A warning plate shall be installed in a conspicuous place or places near the access to and in gasoline hazard areas and any other area where gasoline may be stored or handled, or where gasoline vapors may accumulate. The inscription, in red letters one-inch high shall be:</p> <p style="text-align: center;">GASOLINE HAZARD AREA SMOKING, USE OF NAKED LIGHTS, MATCHES OR LIGHTERS, USE OF TOOLS WHICH MAY PRODUCE SPARKS, WEARING OF CLOTHES OR SHOES WITH EXPOSED METAL ATTACHMENTS, AND ANY OTHER ACTIONS WHICH MIGHT LEAD TO IGNITION OF GASOLINE VAPORS ARE NOT PERMITTED</p>	<p>Gasoline vapors, when exposed to either an open flame or a spark, are a fire and explosion hazard.</p>	<p>GEN SPECS SECT 542</p>	<p>M1</p>
<p>Where a HALON flooding system is installed, a warning plate shall be installed in a conspicuous location in the protected compartment and inscribed:</p> <p style="text-align: center;">WARNING LEAVE THIS SPACE IMMEDIATELY WHEN ALARM SOUNDS</p> <p>A warning plate shall also be installed outside at each access to the compartment and inscribed:</p> <p style="text-align: center;">WARNING RED LIGHT INDICATES HALON HAS BEEN RELEASED. DO NOT ENTER WITHOUT RESPIRATORY PROTECTION UN TILL COMPARTMENT HAS BEEN VENTILATED AT LEAST 15 MINUTES. RESET SWAP SWITCH TO NORMAL POSITION TO EXTINGUISH RED LIGHT AND RESTORE ALARM CIRCUIT TO NORMAL CONDITION AFTER PRESSURE SWITCH HAS BEEN RESET. DO NOT ENTER IF WHITE PILOT LIGHT IS OUT.</p> <p>Label plates indicating the location of switches for restarting the ventilation fans shall be installed on the bulkhead adjacent to the pressure operated shut-down switch.</p>	<p>To prevent exposure of personnel to possible toxic products in a compartment when HALON is released in a fire, or who may try to enter a compartment after the fire is extinguished.</p>	<p>GEN SPECS SECT 555</p>	<p>M2</p>
<p style="text-align: center;">M</p>		<p>Page 18</p>	<p>M</p>

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077-1.8 Miscellaneous Criteria

Issue Date: 1 July 1980
 Rev Date: 1 March 1982

	CRITERIA	RATIONALE	SOURCE	MATRIX PARA NO
	Acid storerooms shall be covered on the deck and up to 4 inches on bulkheads and stiffeners with rubber sheet, MIL Spec. MIL-S-2912, Type II, and shall have wood gratings.	Acids have a corrosive effect on metal decks but not on rubber sheeting.	GEN SPECS SECT 634	M3
	Door sills should be sufficiently high to contain spills.	The issue room is usually located high in the ship, and flaming spills could travel to other spaces.	GEN SPECS SECT 624	M4
	In each storage battery shop or locker, a fresh water outlet fitted with a deluge shower head; eye/face bath and drains shall be installed for personnel protection. The shower head shall be in accordance with FED. SPEC. MW-P-5417, Part C, type II. Supply for this service shall be taken from a fresh water supply line at reduced pressure to deliver 15 to 20 lbs/in ² at the outlets. The root valve to the shower and eye/face bath supply shall be locked open and classified "W". If fresh water and drainage are not readily available, as determined by the Supervisor, a tank type portable combination shower and eye/face bath, with dedicated storage rack, shall be provided. Portable units shall be gravity or pressure fed with self-contained supply of fresh water (not less than 3 nor more than 5 gallons), operated by inversion hose release from storage rack, pull chain or squeeze-type valve at outlet opening. Unit shall be of the unbreakable type. Acid storerooms and flammable liquid issue rooms shall have portable units as described above. A single shower or eye/face bath facility may be provided where spaces requiring such facilities are contiguous and readily accessible to operating personnel.	Should concentrated acid, electrolyte, or other hazardous material come in contact with the skin or eyes, the affected area must be immediately washed with a large quantity of fresh water.	GEN SPECS SECT 644	M5
	Boundaries of spaces designated for cargo stowage of oil or flammable liquid containers shall be airtight.	To prevent the spread of flammable liquids to other spaces in the event of a container leak/spill. Prevents the escape of HALON to other spaces which would reduce its effectiveness to protect a compartment against fire.	GEN SPECS SECT 100	M6
M				M

077-1.8 Miscellaneous Criteria

M	CRITERIA	RATIONALE	SOURCE	MATRIX PARA NO.
		The battery shops shall be provided with first aid material, properly labeled, for the neutralization of battery acid/alkaline electrolyte that might come in contact with eyes and skin.	First aid materials are essential to ensure that acid/alkaline splashes or spills can be immediately treated if they come in contact with personnel.	GEN SPECS SECT 313
	The deck of storage battery shops shall be covered with slip resistant covering.	To prevent slips while handling corrosive materials.	GEN SPECS SECT 634	N8
	Each Storage Battery Shop (lead-acid) shall be provided with one soda water container.	Minimize personnel burns by providing ready means for neutralizing sulfuric acid electrolyte spills and splashes.	GEN SPECS SECT 313	N9
	Each Storage Battery Shop (Alkaline) shall be provided with one 3 percent boric acid solution container.	Minimize personnel burns by furnishing ready means for neutralizing potassium hydroxide electrolyte spills and splashes.	GEN SPECS SECT 313	N10
	NALM protected spaces shall be a minimum of airtight.	Prevents loss of fire suppressing gas.	GEN SPECS SECT 666	N11
			Page 20	M

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077-1.9 Piping Criteria

	CRITERIA	RATIONALE	SOURCE	MATRIX PARA NO.
	Independent drainage systems shall be installed for compartments used for stowage of flammable liquids or other liquids hazardous to personnel or material. The selection of materials for these systems shall be based on the fire and explosive hazards, corrosion, miscibility with water, and resistance of packing to penetration of the liquid to be handled.	Drain systems must be compatible with the chemical and physical properties of the specific fluid to be drained. Independent systems prevent introducing the fluids into other systems which are not designed to contain these fluids, and which could lead to the dangers of fires, corrosive action, or the release of toxic materials.	GEN SPECS SECT 529	P1
	Deck drains shall not be installed in paint mixing and issue spaces or flammable liquid storerooms.	Should a fire occur in such a space, the burning fluid could spread to other areas through drainage lines. These spaces are protected with MADM flooding systems which can extinguish fires if the fluid is confined to the compartment.	GEN SPECS SECT 528	P2
	Steam piping shall not be led through paint mixing rooms, paint and flammable liquid storerooms or other spaces containing heat-sensitive hazardous materials.	Excessive heat temperatures from steam piping could ignite flammable liquid vapors. Condensate moisture due to possible leaks in steam piping could adversely react with materials stored in the storerooms.	GEN SPECS SECT 505	P3
	Flammable liquid piping shall not be led through liquid oxygen stowage spaces except to serve equipment therein. If waivers are given to this requirement to suit unavoidable situations, no teledown joints shall be installed.	A pipe rupture or leak would increase the possibility of fire.	GEN SPECS SECT 505	P4
	In packaged gasoline stowage compartments no fixed drainage piping shall be installed. Portable eductors shall be used to drain these compartments.	Eliminates need to purge fixed drain piping.	GEN SPECS SECT 529	P5
	Compartments that are contiguous to packaged gasoline stowage compartment and are also adjacent to the shell shall be drained directly overboard by a permanent independent drainage system. Groups of these compartments within the same main transverse subdivision may be drained by a common system. Where these compartments are not adjacent to the shell, portable eductors shall be used.	These compartments are considered the second envelope surrounding gasoline stowage from possible sources of ignition. The presence of gasoline in such spaces would indicate leakage or ineffective drainage from the primary stowage compartment. Such leakage is safely discharged overboard through direct drainage where practicable, or by portable eductors where necessary. An independent drain system discharging directly over-	GEN SPECS SECT 529	P6
P	Page 21			P

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077-1.9 Piping Criteria

CRITERIA	RATIONALE	SOURCE	MATRIX PARA NO.
	<p>board prevents flammable liquids from entering the ship's main drainage system. If this were to occur, the liquid could be transported to some other area of the ship where a potential hazard may result.</p>	<p>GEN SPECS SECT 529</p>	<p>P6 (Cont)</p>
<p>Air escapes shall be installed for all bottled gas storage compartments.</p> <p>Compartments having carbon dioxide or MALON flooding systems or in which high pressure air piping is located, and which may be closed tightly under any material condition, shall have a vent independent of ventilation ducts unless the test head of the space is in excess of the pressure which can be built up by a leak in the carbon dioxide, MALON, or air piping when the compartment is secured.</p>	<p>Air escapes prevent hazardous gas accumulations and resultant pressure rises that would occur should the gas bottles leak or sustain damage.</p> <p>The vent provides a means of escape for leaking gases and prevents dangerous pressure buildup within the compartment when the MALON System is discharged.</p>	<p>GEN SPECS SECT 606</p>	<p>P7</p>
<p>Air escapes shall be installed for all compartments having filling, suction, flooding, or slushing arrangements, unless the compartment is always open to atmospheric pressure.</p> <p>Additional air escapes shall be installed for compartments wherever the shape of the space prevents complete venting by one air escape. If more than one air escape is required, they may be combined and led to an air escape main or to the weather deck. Each branch shall be sized for the full compartment venting rate. Air escapes shall be combined with overflow pipes, where practicable.</p> <p>Air escapes from compartments carrying flammable or toxic vapors shall terminate clear of airpurs, ventilation intakes, other openings into the ship, and sources of ignition such as missile blast and combustion exhaust gas outlets.</p> <p>To prevent intercompartment flooding air escapes shall terminate at a height not less than the light-mass level of adjacent main transverse bulkheads.</p>	<p>Compartments subject to changing pressures must be vented to prevent structural damage. Differential pressure could also prevent the opening of access closures and trap personnel within the compartment.</p> <p>Complete venting is necessary to preclude accumulations of air pockets in spaces which could result in incomplete removal of hazardous gases.</p> <p>Avoid flammable and noxious atmospheres within the ship and prevent exposure of flammable fluids to potential ignition sources.</p> <p>Eliminate opportunities for flood waters to spread beyond watertight boundaries.</p>	<p>GEN SPECS SECTION 606</p>	<p>P8</p>
<p>P</p>	<p>Page 22</p>	<p>P</p>	

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077-1.9 Piping Criteria

CRITERIA	RATIONALE	SOURCE	MATRIX PARA NO.
<p>Combined air escapes which serve compartments in different main subdivisions shall be terminated above the tightness level of the subdividing transverse bulkheads.</p> <p>All air escapes, shall terminate in return bands.</p>	<p>Reverse bands minimize the entrance of seawater, debris, sparks, etc., into the escape piping resulting in possible system contamination or fire hazard.</p>	<p>GEN SPECS SECT 506</p>	<p>P8 (Cont)</p>
<p>A 2-inch 1.p.s. deck drain shall be installed in the trash stowage and burner rooms.</p>	<p>To provide adequate drainage for spilled liquid garbage, fire fighting water, sprinkling or wash down water.</p>	<p>GEN SPECS SECT 528</p>	<p>P9</p>
<p>Storage Battery Shops shall be provided with sinks that are resistant to the corrosive effects of acid or alkaline battery electrolytes, as appropriate. Piping for sinks in battery shops shall be in accordance with Section 528.</p>	<p>Corrosion resistant sinks and drain piping are required to safely contain and dispose of battery acids and alkaline electrolytes which could otherwise injure personnel or damage ship's decks and structures.</p>	<p>GEN SPECS SECT 644</p>	<p>P10</p>
<p>P</p>		<p>Page 23</p>	<p>P</p>

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077-1.10 Temperature Criteria

	CRITERIA	RATIONALE	SOURCE	MATRIX PARA NO.
	<p>The maximum temperature of compressed gas cylinder storerooms shall not exceed 130°F, with ventilation secured.</p>	<p>High temperature may cause a pressure build up in the gas cylinders which could cause the cylinder to burst with explosive force.</p>	<p>GEN SPECS SECT 671</p>	<p>11</p>
<p>Alkaline (NiCad) storage battery shops shall be maintained at an ambient temperature of 70°F (not to exceed 80°F) during charging operations and no higher than 100°F under any other condition.</p>	<p>Alkaline batteries are temperature critical. Charging must be accomplished at 70°F ±10°F. If the battery temperature exceeds 100°F there is a possibility of thermal-run-away.</p>	<p>GEN SPECS SECT 612</p>	<p>12</p>	
<p>T</p>	<p>Page 24</p>			<p>T</p>

077-1.11 Ventilation Criteria

	CRITERIA	RATIONALE	SOURCE	MATRIX PARA NO.
<p>Page 25</p> <p>V</p>	<p>Supply terminals shall have eight mesh 0.035 inch aluminum wire screen</p> <p>Compartments subject to contamination by heavier-than-air vapors shall have exhaust terminals installed nine inches above the deck.</p> <p>If compartment exhaust quantity exceeds 10 percent of system quantity a non-sparking centrifugal fan (located outside the compartment) shall be used for the system.</p> <p>A minimum negative pressure of 0.25 inches of water pressure shall be maintained, when access doors are closed.</p>	<p>Installed to promote heat dissipation in event of fire.</p> <p>Insure effective exhaust of dense vapors settling to the deck which otherwise would not be removed through overhead terminals. The fumes from flammable liquids are generally heavier than air and will concentrate near the deck. Exhausting air near the deck eliminates the fumes at the source and prevents their permeating the entire space.</p> <p>If the compartment air quantity exceeds 10 percent of the system quantity, then an easily ignitable mixture of fumes can be formed. Since the motor of a centrifugal fan is mounted external to the fan casing, locating the fan outside the compartment prevents ignition of fumes due to motor sparking.</p> <p>A negative pressure in a compartment ensures positive exhausting of compartment air via the ventilation system to evacuate fumes.</p>	<p>HVAC DESIGN CRITERIA MANUAL 0938-018-0010</p> <p>GEN SPECS SECT 512</p>	<p>V1</p>
	<p>Natural supply, if used, shall be taken from surrounding areas.</p>	<p>Natural supply provides forced inflow of air to compartment, thereby containing fumes for venting by exhaust system within space and preventing propagation of fumes to surrounding spaces.</p>	<p>HVAC DESIGN CRITERIA MANUAL 0938-018-0010</p>	<p>V2</p>
	<p>Natural supply, if used, shall be taken from the weather.</p>	<p>Preferable method is natural supply. If mechanical supply is used a separate system is not required; supply is taken from a normal system which also serves other spaces.</p>	<p>HVAC DESIGN CRITERIA MANUAL 0938-018-0010</p>	<p>V3</p>
	<p>Provide an independent mechanical supply system sized to equal integral exhaust system air quantity. The supply fan motor shall be interlocked with the motors of the integral trash burner exhaust fans so that all fans are secured or activated simultaneously.</p>	<p>This arrangement guarantees sufficient air at all times during trash burner operation. Without the interlock, inadvertent securing of the supply fan would affect burner operation.</p>	<p>HVAC DESIGN CRITERIA MANUAL 0938-018-0010</p>	<p>V4</p>
			<p>Page 25</p>	<p>V</p>

077-1.11 Ventilation Criteria

CRITERIA	RATIONALE	SOURCE	MATRIX PARA NO.
Exhaust fans will be an integral part of the incinerator. The fans will take their suction from the room and discharge through the trash burner and smoke pipes to the weather.	fans are supplied by the burner manufacturer and sized to provide sufficient combustion air. Taking combustion air suction from the compartment provides positive evacuation of smoke and fumes through the burner smoke pipe.	HVAC DESIGN CRITERIA MANUAL 0930-010-0010	V6 (Cont)
Supply system intakes shall be located to prevent recirculation of exhaust air, and noxious or toxic fumes and smoke.	Prevent harmful effects on personnel through exposure to hazardous toxic fumes.	GEN SPECS SECT 512	V5
Provide an exhaust terminal over battery charging racks. Ventilation from the lead-acid battery shop (stowage) shall be such that the exhaust will not contaminate the alkaline battery shop (stowage).	Batteries under charge produce explosive gas. Exhausting of the gas to the weather prevents an explosive hazard. fumes from the lead-acid batteries will adversely affect the alkaline batteries and cause failures and/or reduced performance.	HVAC DESIGN CRITERIA MANUAL 0930-010-0010	V6
Exhaust shall be discharged to the weather, clear of supply air intakes, and shall not discharge across walking areas.	Reduce fire/asphyxiation hazards by avoiding contact of flammable or noxious fumes with personnel and possible ignition source. Buildup of toxic and explosive fumes is hazardous in any enclosed area.	GEN SPECS SECT 512	V7
Watertight closures are required at boundary penetrations in ducts serving flammable liquids storeroom, paint mixing and issue room, if ducts are connected to a system that serves other compartments.	fire can be propagated between compartments via ventilation ductwork. Dampers or closures, that can be readily closed, prevent this propagation and contain fire to its space of origin. Remote control except where specifically permitted increases the probability of malfunction due to damage to remote linkage. Remote operation of closures, where permitted, facilitates closing vent system to the space without the necessity of personnel entering a hazardous atmosphere.	GEN SPECS SECT 512	V8
Blowout ventilation shall be provided.	Compartment not normally ventilated during periods of non-occupancy. Prior to occupancy, blowout fans are turned on to provide ventilation to purge the space of toxic or noxious fumes.	HVAC DESIGN CRITERIA MANUAL 0930-010-0010	V9
V		Page 26	V

077-1.11 Ventilation Criteria

CRITERIA	RATIONALE	SOURCE	MATRIX PARA NO.
<p>A minimum positive pressure of 0.25 inches of water shall be maintained in the space with access doors closed.</p> <p>Supply air to be filtered.</p> <p>Fan controllers shall be located outside the main access to the oxygen-nitrogen spaces.</p> <p>Supply and exhaust fans shall be connected to one controller with the provision that if one fan fails, the other is shut off.</p> <p>Supply inlets shall not be closer than ten feet to an exhaust outlet.</p> <p>Ductwork shall be watertight from the space to the weather.</p>	<p>To prevent contaminants from entering the space.</p> <p>To minimize contaminants entering the space.</p> <p>To prevent ignition of possible oxygen enriched air mixture in the space by sparks from controller.</p> <p>To maintain designed positive pressure at all times when fans are operating.</p> <p>To prevent recirculation of exhaust.</p> <p>To prevent leakage of possible oxygen enriched air mixture into compartments through which the ductwork passes.</p>	<p>NVAC DESIGN CRITERIA MANUAL 0938-018-0010</p>	<p>V10</p>
<p>Paint spray booths shall be equipped with an independent exhaust system.</p>	<p>Independent exhaust systems are required for paint spray booths to ensure that potentially hazardous fumes are exhausted directly from their source.</p>	<p>NVAC DESIGN CRITERIA MANUAL 0938-018-0010</p>	<p>V11</p>
<p>Exhaust hoods shall be provided over equipment emitting noxious or toxic fumes or excessive quantities of heat.</p>	<p>Provide proper type of ventilation for noxious or toxic fumes or gases.</p>	<p>NVAC DESIGN CRITERIA MANUAL 0938-018-0010</p>	<p>V12</p>
<p>Internal surfaces of ducts handling corrosive fumes shall be covered with synthetic rubber (MIL-N-1505B).</p>	<p>To prevent corrosion failure of ductwork and the danger of release of toxic fumes.</p>	<p>GEN SPECS SECT 631</p>	<p>V13</p>
<p>Flame arresters shall conform to MIL Spec. MIL-F-1754M and shall be installed as specified in the Design Criteria Manual.</p>	<p>Flame arresters prevent the spread of fire from or into closed spaces by diffusing the heat and lowering the temperature. They are installed in the flow of</p>	<p>GEN SPECS SECT 631</p>	<p>V14</p>
<p>V</p>		<p>Page 27</p>	<p>V</p>

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077-1.11 Ventilation Criteria

	CRITERIA	RATIONALE	SOURCE	MATRIX PARA NO.
<p style="text-align: center;">V</p>	<p>Flame arresters shall be installed on the intake side of the exhaust fan, outside of the compartment protected, and in a nonwatertight section of the exhaust branch.</p>	<p>flammable gases and will not permit any flame which occurs on one side of the screen to pass through its openings. MIL-F-13548 requires the flame arrester assembly to be provided with an arrow or similar means indicating the direction of airflow. This is to assure proper orientation with respect to airflow during arrester installation or replacement. The assembly includes a filter which must face the air entering side to protect the arresting media from dust.</p> <p>MIL: latest Navy safety requirements provide continuous ventilation for flammable liquids storerooms. This prevents the accumulation of combustible fumes in the spaces and eliminates the need for flame arresters which become ineffective if not properly maintained.</p> <p>Equipment location is such so as to afford maximum fire protection by placing the fan, a potential ignition source, external to the compartment and upstream of the arrester. Flame arresters are installed in nonwatertight duct section because the arrester assemblies are nonwatertight and would jeopardize the tightness integrity of the duct.</p>	<p>4A SPIC5 SIC 631</p>	<p>114 (Cont)</p>
	<p>Page 28</p>	<p style="text-align: center;">V</p>		