MIL-HDBK-1028/3
31 DECEMBER 1987
SUPERSEDING
NAVFAC DM-28.03
NOVEMBER 1981

MILITARY HANDBOOK

MAINTENANCE FACILITIES FOR

AMMUNITION, EXPLOSIVES,

AND TOXINS

AMSC N/A

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ABSTRACT

This handbook presents basic design guidance for ammunition, explosives, and toxins maintenance facilities covered by Category Group 216 For Military Real Property. It has been developed from extensive re-evaluation of facilities and it is intended for use by experienced architects and engineers. The contents include design data for buildings and shop areas to provide facilities for repairing and maintaining ammunition, rockets, bombs, mines, grenades, torpedos, depth charges, air/underwater weapons, demolition materials, pyrotechnics, guided missile fuels, ammunition parts, and related chemicals.

FOREWORD

This handbook has been developed from an evaluation of facilities in the Shore Establishment, surveys of the availiability of new materials and construction methods, and selection of the best design practices of the Naval Facilities Engineering Command (NAVFACENGCOM), other Government agencies, and the private sector. This handbook uses, to the maximum extent feasible, national professional society, association, and institute standards. Deviations from this criteria, in the planning, engineering, design, and construction of Naval shore facilities, cannot be made without prior approval of NAVFACENGCOM Code 04.

Recommendations for improvement are encouraged from within the Navy, other Government agencies, and the private sector and should be furnished on the DOD Form 1426 provided inside the back cover to Commander, Atlantic Division, Code 04A4, Naval Facilities Engineering Command, Norfolk, VA 23511-6287, telephone commercial (804) 444-9970.

THIS HANDBOOK SHALL NOT BE USED AS A REFERENCE DOCUMENT FOR PROCUREMENT OF FACILITIES CONSTRUCTION. IT IS TO BE USED IN THE PURCHASE OF FACILITIES ENGINEERING STUDIES AND DESIGN (FINAL PLANS, SPECIFICATIONS, AND COST ESTIMATES). DO NOT REFERENCE IT IN MILITARY OR FEDERAL SPECIFICATIONS OR OTHER PROCUREMENT DOCUMENTS.

MAINTENANCE FACILITIES CRITERIA MANUALS

Criteria Number	Title	PA
MIL-HDBK-1028/1	Aircraft Maintenance Facilities	LANTDIV
MIL-HDBK-1028/3	Maintenance Facilities for Ammunition, Explosives, and Toxins	LANTDIV
DM-28.04	General Maintenance Facilities	WESTDIV
DM-28.05	Environmental Control - Design of Clean Rooms	LANTDIV
MIL-HDBK-1028/6	Aircraft Fixed Point Utility Systems	HDQTRS
MIL-HDBK-1028/8	Pest Control Facilities	HDQTRS

NOTE: Design manuals, when revised, will be converted to military handbooks.

This handbook is issued to provide immediate guidance to the user. However, it may or may not conform to format requirements of MIL-HDBK-1006/3 and will be corrected on the next update.

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Section 1: *INTRODUCTION*

1.1 Scope. This handbook presents criteria for ammunition, explosives, and toxins maintenance facilities at naval shore activities. Special requirements for the individual project must be obtained from Naval Facilities Engineering Command Headquarters (NAVFACENGCOM HQ) or the cognizant management command or bureau.

1.2 Cancellation. This handbook cancels and supersedes NAVFAC DM-28.03, November 1981, and NAVFAC DD-1291743, Air/Underwater WeaponsShop. Refer to Facility Plate Sheets in Appendix A.

1.3 General Structural Requirements. The structural design shall be in accord with NAVFAC P-355, Structural Engineering - Seismic Design for Buildings,, NAVFAC DM-2 Series, Structural Engineering, and NAVFAC P-397, Structures to Resist the Effects of Accidental Explosions.

1.4 Energy Conservation. Energy conservation shall be a major consideration in the design of building envelopes, mechanical systems, and electrical systems for maintenance facilities for ammunition, explosives, and toxins (refer to NAVFAC DM-3.03, Heating, Ventilating, Air Conditioning and Dehumidifying Systems, and NAVFACINST 4101.1, Energy Budgets for New Facilities). Each building envelope shall be insulated to provide the minimum heat transmission ("U") factors practical to meet Energy Budgets and to comply with the requirements of MIL-HDBK-1190, Facility Planning and Design Guide.

1.5 Building Protection. The building structure of all maintenance facilities, including corners, doors, structural members, etc., shall be protected from damage by vehicles and moving loads by the installation of concrete filled pipe guards, bumpers, railings, corner guards, and similar protective features.

1.6 Loading Dock Ramp Protection. Each facility requiring a loading dock ramp shall be provided side edge protection in accord with Section 1910.23c, Occupational Safety and Health Act Standards Manual.

1.7 Fire Protection. Fire protection for all maintenance facilities for ammunition, explosives, and toxins shall be provided in accord with requirements in para. 3.2, NAVSEA OP-5, Volume 1, Ammunition and Explosives Ashore, and MIL-HDBK-1008, Fire Protection for Facilities Engineering Design and Construction.

1.8 Radio Frequency Interference Protection. Where Electro-Explosive Devices (EED) are handled, tested, and installed, consideration should be given to specifying a Radio Frequency Interference (RFI) shielded room that provides decibel attenuation to reduce the field intensities to a NON-HERO unsafe ordnance level. For further details regarding RFI hazards, refer to NAVSEA OP-3565, Electromagentic Radiation Hazards (Hazards to Ordnance), and NAVAIR TM 16-1-529, Technical Manual.

1.9 Security. Maintenance facilities for ammunition, explosives, and toxins shall be located so that physical security can be provided in accord

with OPNAVINST 5530.14A, United States Navy Physical Security Manual and Loss Prevention Manual.

1.10 Safety. Designs of facilities shall comply with MIL-HDBK-1006/1, Policy and Procedures for Construction Drawings and Specifications Preparation, and appropriately meet the latest change of Vol. 1, NAVSEA OP-5.

1.10.1 Minimum Separation Distances. When locating structures, refer to data in Vol. 1, NAVSEA OP-5, to safeguard personnel and neighboring structures.

1.10.2 System Safety Engineering. For general information on the Department of the Navy's System Safety Engineering Program, refer to NAVFAC DM-1.01, Basic Architectural Requirements and Design Considerations.

1.11 Occupational Health Assistance. NAVFACINST 5100.11, Command Safety and Health Program, requires that activities coordinate with their local Naval Medical Command (NAVMEDCOM) industrial hygienist during facility planning stages. In addition, NAVMEDCOM has agreed to assign to each EFD the full-time service of an industrial hygienist to help with system safety engineering and provide technical health/industrial hygiene support as necessary. The EFD industrial hygienist will identify, evaluate, and provide recommendations for controlling potential health hazards such as toxic materials, non-ionizing radiation, and noise. They shall participate in design review of plans and specifications for the selected projects.

Section 2: GENERAL AMMUNITION MAINTENANCE SHOPS

2.1 Function. General ammunition maintenance shops provide facilities for maintenance of projectiles, fixed ammunition, rockets, fuses, primers, black powder cartridges and units, mortar ammunition, small-arms ammunition, pyrotechnic material, and inert material. Most ammunition rework and overhaul shops and most rocket rework and overhaul shops would be included in this grouping.

2.2 Architectural and Structural Requirements

2.2.1 Spaces. Paras. 2.2.1.1 through 2.2.1.8 describe areas that are normally required in general ammunition maintenance shops.

2.2.1.1 Main Shop Area. A main shop area is usually an extensive area occupying the major portion of the building and sometimes divided into a series of work bays. Normally included in the main shop area are assembly/disassembly, leak testing, component testing, and repair operations.

2.2.1.2 Office Space. An enclosed office space, which must be kept to a minimum, shall be provided for clerical tasks and record storage.

2.2.1.3 Toilets. Toilet facilities shall be provided for both male and female personnel.

2.2.1.4 Cleaning Gear. Cleaning gear and janitorial storage space shall be provided.

2.2.1.5 Storage. Space shall be provided for storing and maintaining tools and equipment used in shop operations.

2.2.1.6 Mechanical Equipment Room. An equipment room shall be provided to house mechanical equipment necessary to support building and shop functions.

2.2.1.7 Paint Shop. An enclosed paint shop shall be provided in accord with National Fire Protection Association, Inc., NFPA 33, Spray Application Using Flammable and Combustible Materials, NFPA 91, Blower and Exhaust Systems, when requirements for painting are a part of ammunition maintenance operations. A spray paint booth should be considered depending on the type of painting operation required. Exterior lockers, located at least 50 ft (15.24 m) from the maintenance building, or an approved flammable liquid storage room shall be provided for paint storage. Space for a grit blast chamber shall be provided in facilities where major repainting is done on heavy, thick-walled containers such as projectiles. Locate dust collector and/or a baghouse for grit blast cleaning equipment outside the building. Grit blast chamber construction shall comply with American National Standards Institute (ANSI) standards, ANSI Z9.4-1985, Ventilation and Safe Practices of Abrasive Blasting Operations.

2.2.1.8 Test Cells. A reinforced concrete test cell may be required when ordnance disassembly, check out, and reassembly are a part of the ammunition maintenance operations. The latest test cell requirements should be obtained from the Naval Civil Engineering Laboratory (NCEL), Port Hueneme, CA.

2.2.2 Design. The building will normally be a single-story structure and shall be constructed of noncombustible materials. Refer to para. 6-3.1, NAVSEA OP-5, Volume 1, and NAVFAC P-397, for general design and construction requirements for ammunition and explosive operating buildings. Loading/unloading docks shall be provided for rail cars or trucks as determined by the location of the facility. Standard construction materials, and finishes shall be in accord with NAVFAC DM-1 Series, Architecture, and NAVFAC DM-2 Series, Structural Engineering. Special construction, materials, and finishes shall be in accord with paras. 2.2.2.1 through 2.2.2.4.

2.2.2.1 Walls. Walls of main shop areas shall be reinforced concrete. Utilize barricades and blast walls to separate shop bays or work areas when explosive hazards exist, depending on the nature of the operations involved. Refer to para. 6-3.1.2d, Volume 1, NAVSEA OP-5, for further information on substantial dividing walls.

2.2.2.2 Floors. Floors shall be reinforced concrete. Conductive spark proof floor finish shall be provided in areas where black powder or other high explosive is handled. Spark-resistant floors shall conform to Guide Specification NFGS-09785, Metallic-Type Conductive and Spark-Resistant Concrete Floor Finish. Resilient floor finish shall be provided for office space only.

2.2.2.3 Roofs. Roofs in nonexplosives areas should normally be reinforced concrete. Frangible roof sections shall be provided in explosive areas in accord with NAVFAC P-397.

2.2.2.4 Doors. Blastproof sliding doors shall be provided at both ends of main shop areas. Door openings shall be of adequate size to allow forklifts to move the largest anticipated containers in and out of the shop area. Blastproof personnel access doors with panic hardware shall be provided at both ends of shop areas. With the use of additional blastproof doors, the facility may be segmented as necessary. Refer to para. 6-3.1.3, Volume 1, NAVSEA OP-5, for further information on building exits.

2.3 Mechanical Requirements. Mechanical requirements are defined in paras. 2.3.1 through 2.3.5 of this handbook.

2.3.1 Heating and Air Conditioning. Heating and air conditioning, including humidity control, shall be provided for main shop areas as required by the type of ordnance being maintained and in accord with NAVFAC DM-3.03. Where air conditioning is required for main shop areas, office spaces shall also be air conditioned. Heating only shall be provided for other spaces. Inside design temperatures, for controlled areas, shall be 78° F (26° C) with a maximum relative humidity of 50 percent for cooling and 65° F (18° C) for heating unless type of ordnance requires different conditions. Refer to paras. 6-3.2.6 and 6-3.2.7, Volume 1, NAVSEA OP-5, for general guidance.

2.3.2 Ventilation. Ventilation shall be provided in accord with NAVFAC DM-3.03 and para. 6-3.2.7, Volume 1, NAVSEA OP-5. Specifically provide:

a) Exhaust ventilation system with makeup air, heated as required, for the paint shop. The ventilation system shall be in accord with NFPA 33.

b) Makeup air, heated as required, for dust collector exhaust system if grit blast cleaning equipment is provided.

c) Ventilation for battery shop, if battery charging equipment is supplied, as required by Section 5, Part 6, NAVFAC DM-28.04, General Maintenance Facilities.

2.3.3 Plumbing. Plumbing shall be provided in accordance with NAVFAC DM-3.01, Mechanical Engineering - Plumbing Systems. Specifically provide:

a) Cold water supplies with hose-bibb outlets to main shop areas. Steam or hot water supplies to main shop areas that require washout operations. Cold water supply to the paint booth when waterwash type is provided. Hose-bibb outlets shall be equipped with vacuum breakers.

b) Floor drains in main shop areas and a drainage system for the paint booth when waterwash type is used. Connect drains to waste systems as required to comply with pollution control requirements (refer to para. 6-3.2.2, Vol. 1, NAVSEA OP-5, for requirements concerning drain lines handling explosive wastes). There shall be no drains from the paint spray booths. Floor drains may be connected to the sanitary system in areas where there is no Otto fuel present. There shall be no floor drains in the Otto fuel areas or provide trench and sump system for spill control.

c) Emergency showers and eyewashes when pyrotechnic or toxic chemical materials are handled in the facility. Determine specific requirements based on materials used in the facility.

2.3.4 Compressed Air. Compressed air shall be provided at 100 psi (689 kPa) in accord with NAVFAC DM-3.05, Compressed Air and Vacuum Systems, for air hoist motors, painting equipment, tools, etc. Provide outlets at work benches and other work areas. Compressed air supplies shall be clean, dry and utilize filters and dryers. Consider the requirements of the facility to determine if a separate air compressor should be provided rather than utilizing a central air supply. A separate air compressor would assure that an adequate quantity of compressed air is available. Separate air compressors may also provide lower operating and distribution costs. Refer to para. 7-2.5, Vol. 1, NAVSEA OP-5, for authorized use of compressed air.

2.3.5 Noise and Vibration Control. All mechanical systems and equipment shall be designed to limit noise and vibration in accord with NAVFAC DM-3.10, Noise and Vibration Control for Mechanical Equipment (ARMY).

2.4 Electrical Requirements. Electrical requirements, including power generation and distribution, lighting, grounding, and lightning protection shall be in accord with Chapter 4, Vol. 1, NAVSEA OP-5, NFPA 70, National Electrical Code, NAVFAC DM-4 Series, Electrical Engineering, and as defined in paras. 2.4.1 through 2.4.3 of this handbook.

2.4.1 Power. Single-phase, 120 Vac, 20 A, 60 Hz, convenience outlets shall be provided in all spaces with spacing as required by NFPA 70 and the using activity. Equipment and wiring in the paint shop shall be in accord with NFPA 33.

2.4.2 Lighting. Lighting shall meet the following criteria:

a) Interior lighting shall normally be fluorescent.

b) Exterior lighting shall be high-pressure sodium vapor where practical.

c) Design for lighting intensities shall be in accordance with MIL-HDBK-1190, Facility Planning and Design Guide.

d) Fixtures and wiring in the paint shop shall be in accord with NFPA 33.

2.4.3 Grounding and Lightning Protection. Grounding and lighting protection shall meet the following requirements:

a) Primary and secondary systems shall be provided (refer to Chapter 4, Volume 1, NAVSEA OP-5).

b) Consider the use of cable reels for grounding conductors for ordnance equipment in shop areas. Cable reels must be located so that they do not interfere with overhead weight-handling equipment operations.

c) Grounding in the paint shop shall be in accord with NFPA 33.

2.5 Explosion-Proof Weight-Handling Equipment. Monorail hoists and/or bridge cranes shall be provided in main shop areas, when the size of the ammunition units to be maintained are large enough to warrant weight-handling equipment. Monorail hoists and bridge cranes shall be of sparkproof construction with explosion- proof motors if electric powered. Controls shall be operable from floor level and, when they are electric, shall be explosion proof. Classification of hazardous locations shall be as defined in NFPA 70. Refer to NAVFAC DM-38.01, Weight-Handling Equipment, for additional criteria. Colors for weight-handling equipment shall be accord with NAVFAC P-309, Color for Naval Shore Facilities.

Section 3: BOMB-TYPE AMMUNITION MAINTENANCE SHOPS

3.1 Function. These buildings provide facilities and shops for maintenance of Class 1, Division 1 ammunition such as bombs, mines, warheads, depth charges, and demolition material. Mine and depth charge rework and overhaul shops would be included in this grouping.

3.2 Architectural and Structural Requirements

3.2.1 Spaces. Spaces will generally be required as described in para. 2.2.1. The following spaces shall also be required:

a) instrument rack storage,

b) instrument test room, and

c) battery maintenance area for mine rework facilities.

3.2.2 Design. Design requirements described in para. 2.2.2 are applicable to these facilities.

Battery charging equipment shall be provided for mine rework facilities in accord with Section 5, Part 6, NAVFAC DM-28.04.

3.3 Mechanical Requirements

3.3.1 Heating and Air Conditioning. Heating and air conditioning, including humidity control, shall be provided for instrument test rooms in accord with NAVFAC DM-3.03. Heating and air conditioning shall be provided for main shop areas and the office. Humidity control shall be provided for instrument rack storage for mine rework facilities. Heating only shall be provided for other spaces. Inside design temperatures, for controlled areas, shall be 78° F (26° C) with a maximum relative humidity of 50 percent for cooling and 65° F (18° C) for heating. Maximum relative humidity for the instrument test rooms and the instrument rack storage shall be as required for the instruments to be maintained and stored in this area. Refer to paras. 6-3.2.6 and 6-3.2.7, Volume 1, NAVSEA OP-5, for general guidance.

3.3.2 Ventilation. Ventilation requirements described in para. 2.3.2, are applicable to these facilities and for the battery charging room in compliance with Part 6, para. 7.b, DM-28.04.

3.3.3 Plumbing. Plumbing shall be provided in accord with NAVFAC DM-3.01 and the following:

a) Cold water supplies, with hose-bibb outlets, to main shop areas for normal floor maintenance. When waterwash type is supplied, cold water supply to the paint booth. Hose-bibb outlets shall be equipped with vacuum breakers.

b) Floor drains in main shop areas and a drainage system for the paint booth when waterwash type is supplied. Connect drains to waste systems

as required to comply with pollution control requirements. Refer to para.6-3.2.2, Volume 1, NAVSEA OP-5, for requirements concerning drainlines handling explosive wastes. There shall be no drains from the paint spray booths. Floor drains may be connected to the sanitary system in areas where there is no Otto fuel present. There shall be no floor drains in the Otto fuel areas or provide trench and sump system for spill control.

c) Plumbing for the battery charging area in compliance with Part 6, para. 7.c, DM-28.04.

3.3.4 Compressed Air. Compressed air shall be provided in accord with NAVFAC DM-3.05. Specifically provide:

a) low-pressure compressed air as described in para. 2.3.4, and

b) high-pressure compressed air at 3,000 psi (20,684 kPa) to main shop areas of torpedo rework facilities. Dryers and filters shall be specified to assure a clean and dry air supply.

3.3.5 Noise and Vibration Control. All mechanical systems and equipment shall be designed to limit noise and vibration in accord with NAVFAC DM-3.10.

3.4 Electrical Requirements. Electrical requirements, including power generation and distribution, lighting, grounding, and lightning protection shall be in accord with Chapter 4, Volume 1 of NAVSEA OP-5; NFPA 70; NAVFAC DM-4 Series; and the requirements defined in paras. 3.4.1 through 3.4.4. shall also apply.

3.4.1 Power. The following power requirements shall apply:

a) Single-phase, 120 Vac, 20 A, 60 Hz convenience outlets shall be provided in all spaces with spacing as required by NFPA 70 and user requirements.

b) Three-phase, 120/208 Vac, 60 Hz power outlets shall be provided in main shop areas and instrument test rooms.

c) Three-phase, 115/200 Vac, 400 Hz and 28 Vdc power is required for main shop areas and the instrument test room (refer to MIL-STD-704, Aircraft Electric Power Characteristics, for 400 Hz and 28 Vdc requirements).

d) The ampacity of 3-phase and direct-current outlets shall be as required by the using agency for the specific facility. Provide name plates to indicate outlet characteristics.

e) Equipment and wiring in the paint shop shall be in accord with NFPA 33.

3.4.2 Lighting. Lighting shall conform to the following criteria:

a) Interior lighting shall normally be fluorescent.

b) Exterior lighting shall be high-pressure sodium vapor where practical.

c) Design for lighting intensities shall be in accordance with MIL-HDBK-1190.

d) Fixtures and wiring in the paint shop shall be in accord with NFPA 33.

3.4.3 Emergency Power. Emergency power for lighting and battery charging equipment shall be provided in mine rework facilities to protect batteries used in mine components during an extended power outage.

3.4.4 Grounding and Lightning Protection. The following grounding and lighting protection requirements shall apply:

a) Primary and secondary systems shall be provided. Refer to Chapter 4, Volume 1 of NAVSEA OP-5.

b) Consider the use of cable reels for grounding conductors for ordnance equipment in main shop areas. Cable reels must be located so that they do not interfere with overhead weight-handling equipment operations.

c) Grounding in the paint shop shall be in accord with NFPA 33.

3.5 Explosion-Proof Weight-Handling Equipment. A bridge crane, with capacity as required by the ordnance to be maintained, shall be provided in the assembly-disassembly area. Bridge cranes and/or monorail hoists in other areas shall be provided when the weight of components warrants weight-handling equipment. Bridge cranes and monorail hoists shall be of sparkproof construction with explosion-proof motors if electrically powered. Controls shall be operable from floor level and, when they are electric, shall be explosion-proof. Classification of hazardous locations shall be as defined in NFPA 70 (refer to NAVFAC DM-38.01 for additional criteria).

Section 4: PROPELLANT POWDER MAINTENANCE SHOPS

4.1 Function. Propellant powder maintenance shops provide facilities and shops for maintenance of bulk smokeless powder, bulk jet propulsion powder, bag charges, propelling charges, separate rocket motors, and propulsion units. Some ammunition rework and overhaul shops and some rocket rework and overhaul shops would be included in this grouping.

4.2 Architectural and Structural Requirements

4.2.1 Spaces. Spaces will generally be required as described in para. 2.2.1.

4.2.2 Design. Design requirements described in para. 2.2.2, are applicable to these facilities. Facilities where smokeless powder is handled shall be designed to prevent exposure of the powder to the direct rays of the sun.

4.3 Mechanical Requirements. Mechanical requirements are defined in paras. 4.3.1 through 4.3.5.

4.3.1 Heating and Air Conditioning. Requirements in para. 2.3.1, are applicable to these facilities. Areas where smokeless powder is handled will require humidity control.

4.3.2 Ventilation. Requirements in para. 2.3.2, (except para. 2.3.2c), are applicable to these facilities.

4.3.3 Plumbing. Requirements in para. 2.3.3, are applicable to these facilities, except do not provide water to areas handling smokeless powder.

4.3.4 Compressed Air. Requirements in para. 2.3.4, are applicable to these facilities.

4.3.5 Noise and Vibration Control. All mechanical systems and equipment shall be designed to limit noise and vibration in accord with NAVFAC DM-3.10.

4.4 Electrical Requirements. Electrical requirements, including power generation and distribution, lighting, grounding, and lightning protection, shall be in accord with Chapter 4, Volume 1 of NAVSEA OP-5; NFPA 70; and NAVFAC DM-4 Series. Electrical sources must be more than 10 ft (3 m) from assembled rocket motors to prevent accidental ignition from induced currents (refer to Chapter 18, Vol. 1, NAVSEA OP-5. The requirements stated in para. 2.4 are also applicable to this facility.

Section 5: AIR/UNDERWATER WEAPONS SHOPS

5.1 Function and Scope

5.1.1 Function. The Air/Underwater Weapons (AUW) shop provides space and equipment for the storage, test, check, assembly, and limited maintenance of weapons. Included are intermediate maintenance facilities for airborne torpedoes, other airdrop weapons, surface and subsurface launched torpedoes and weapons.

5.1.2 Scope. This section defines the design criteria for intermediate maintenance facilities. Storage and issue-only facilities are not covered. Depot level facilities must have these requirements expanded and modified.

5.2 Location. The AUW Shop shall be located so as to minimize the hazards of electromagnetic radiation. For guidance, refer to NAVSEA OD 30393, Design Principles and Practices for Controlling Hazards of Electromagnetic Radiation to Ordnance (HERO Design Guide). It shall also be located so that physical security can be provided in accordance with OPNAVINST 5530.14A.

5.3 Architectural and Structural Requirements

5.3.1 Layout. Space allocations for this facility are given in NAVFAC P-80, Volume I, Facility Planning Criteria for Navy and Marine Corps Shore Installations. The arrangement and functional layout shall be as shown in the facility plates of Appendix A. Toilet facilities shall be provided for male and female personnel.

5.3.2 Design. Standard construction, materials, and finishes shall be in accordance with NAVFAC DM-1 and DM-2 Series. Special areas, construction, and finishes shall be as described in paras. 5.3.2.1, 5.3.2.2, 5.3.2.3, 5.3.2.4, and 5.3.2.5.

5.3.2.1 Shops and Torpedo Storage. The walls of Shop No. 1, Torpedo Storage, and Shop No. 2 shall be a minimum of 12 in. (305 mm) thick, reinforced concrete, designed for blast resistance. Floors shall be concrete with a nonslip finish. Conductive flooring is not required. The roof system shall support a 2,000-lb (907 kg) capacity monorail system in Shop No. 1 and Shop No 2, and a 3,000-lb (1,360 kg) capacity bridge crane in Torpedo Storage.

5.3.2.2 Otto Fuel Ready Storage Room. This room shall be sized to handle and store ten 55-gal (208.2 L) drums of Otto fuel. The floor of the room shall be 4-in. (101 mm) lower than normal building floor level and shall be sloped to a center grating covered floor sump. The floor shall be concrete, steel troweled to a hard smooth surface, and coated with three coats of epoxy paint conforming to Military Specification MIL-P-24441 General Specifications for Paint, Epoxy Polyamide. All other surfaces that may come in contact with the Otto fuel shall be of a material compatible with Otto fuel or protected with multiple coats of epoxy paint (refer to NAVSEA S6340-AA-MMA-010 Otto Fuel II: Safety, Storage, and Handling Instructions).

5.3.2.3 Defueling/Fueling/Afterbody Breakdown Room. The requirements for this shop shall be as given in para. 5.3.2.2, except the floor is at normal building level and there is no Otto fuel storage. Floor sumps shall be 2 ft. (0.61 m) wide, 4 ft. (1.2 m) long, and 1.5 ft. (.46 m) deep. An emergency shower and eyewash shall be provided.

5.3.2.4 Vaults. Vaults shall be provided as shown in Facility Plates and shall meet requirements in OPNAVINST 5510.1G Chapter 14, Department of the Navy Information and Personnel Security Program Regulation.

5.3.2.5 Vehicle Storage Shed. An emergency shower and eyewash shall be provided. When provided, battery charging facilities shall be in accordance with requirements in Part 6, Section 5, NAVFAC DM-28.04.

5.3.2.6 Paint Shop. Since paint functions may vary, verify requirements with the local using activity. For facilities requiring a complete paint shop, the roof system shall support a 1,000-pound (453 kg) capacity monorail system. The pair of bifolding doors will require special closure and weather stripping to seal around the monorail penetrations. A spray paint booth should be considered for this shop. The type of exhaust paint containment selected, dry filter or waterwash, should be based on pollution control costs (water treatment versus filter disposal) in combination with construction and operating costs when determining life-cycle costs. Paint storage shall be provided at the end of the vehicle storage shed.

Due to the small amount of painting and touch up work required at some Torpedo Intermediate Maintenance Activities, a complete paint shop is not necessary. Only a small cosmetic area is required. Exterior flammable locker or storage room should be provided for paint and flammable liquid storage.

5.3.2.7 Shower and Change Rooms. Shower, eyewash, and change facilities shall be provided for personnel that work around Otto fuel to meet the requirements for personnel hygiene in NAVSEA S6340-AA-MMA-010. Shower and eyewash facilities shall meet ANSI Z358.1 (1981) requirements.

5.3.2.8 Coffee Mess. A kitchen unit with sink, hot and cold water, and heating equipment shall be provided in the coffee mess room.

5.3.2.9 Exterior Pavement. Exterior pavement shall be in accordance with NAVFAC DM-5 Series, Civil Engineering.

5.4 Mechanical Requirements. Mechanical requirements are described in paras. 5.4.1 through 5.4.5.

5.4.1 Heating and Air Conditioning. Heating, air conditioning, and humidity control shall be provided in accordance with NAVFAC DM-3.03 for all spaces except for the paint shop, mechanical equipment room, transformer and emergency generator room, afterbody shop, Otto fuel ready storage room, and garage. These spaces shall be provided with heating only. Inside design conditions for the environmentally-controlled spaces shall be 78° F (26° C) with a maximum relative humidity of 50 percent for cooling and 65° F (18° C) for heating.

5.4.2 Ventilation. Ventilation shall be provided in accordance with NAVFAC DM-3.03 and Chapter 6, NAVSEA S6430-AA-MMA-010, and the following:

a) Exhaust ventilation with makeup air, heated as required by geographic location, for the fueling/defueling/afterbody breakdown room.

b) Exhaust ventilation system with makeup air, heated as required, for the paint shop. The ventilation system shall be in accordance with NFPA 33.

5.4.3 Plumbing

5.4.3.1 Design Requirements. Plumbing shall be provided in accordance with NAVFAC DM-3.01. Specifically provide the following:

a) Piping for Otto fuel from the Otto fuel storage room to the Otto fuel filling location in the afterbody shop (refer to Chapter 6 of NAVSEA S6340-AA-MMA-010 for valves, pipe, and fitting requirements).

b) An exterior underground storage tank for Otto fuel waste with drainage piping from the sumps in the Otto fuel ready storage room and afterbody shop (refer to Chapter 6, NAVSEA S6340-AA-MMA-010 for material requirements). New exterior underground storage tanks for Otto Fuel II waste must conform to EPA standards (40 CFR 264; Subpart J) for hazardous waste storage tanks and appropriate state standards. These new standards require double walled tank construction with a leak detection system capable of detecting leaks within 24 hours of failure of either the primary or secondary containment structure or the presence of liquid in the secondary containment structure. This requirement may be satisfied by:

(1) installing probes to monitor for liquid accumulation between the primary and secondary containment structures;

(2) maintaining a vacuum or pressure between the primary and secondary containment structures;

(3) designing tanks with enough space between the primary and secondary containment structures to allow for visual inspection of inner walls.

c) There may also be regulations for underground piping. Unless otherwise controlled, all piping should be contained by either a liner system back to the tank or by double-walled pipe with appropriate inspection manholes as required.

d) Cold water supplies, with hose-bibb outlets, to Otto fuel areas for flushing Otto fuel spills and to Shop No. 1, Shop No. 2, Torpedo Storage, and garage for normal floor maintenance. Hot and cold water to the kitchen unit in the coffee mess. Hose-bibb outlets shall be equipped with vacuum breakers.

e) Floor drains in Shop No. 1, Shop No. 2, torpedo storage, and garage. Connect drains to industrial waste system as required to comply with pollution control requirements. There shall be no drains to storm or

sanitary systems where Otto fuel exists. Use trench/sump system and contain spills inside the shop areas.

f) An emergency eyewash and shower fixture in areas where the possibility of exposure to Otto fuel exists.

5.4.3.2 Station Responsibility. In EPA/state regulated areas, a Hazardous Waste Part B permit must be obtained prior to tank installation. Obtaining this permit is sometimes a lengthy process. It is recommended that the designer contact the appropriate station personnel early in the design process to ensure the permit application process has begun.

5.4.4 Compressed Air. Compressed air shall be provided in accordance with NAVFAC DM-3.05. Specifically provide the following:

a) Low pressure compressed air as described in para. 2.3.4.

b) High pressure oil-free compressed air at 1,000 psi (20,684 kPa) to Shop No. 1 and No. 2. Dryers and filters shall be specified to assure a clean and dry air supply. High-pressure nitrogen may be provided in lieu of air.

5.4.5 Noise and Vibration Control. All mechanical systems and equipment shall be designed to limit noise and vibration in accordance with NAVFAC DM-3.10.

5.5 Otto Fuel II Requirements

5.5.1 General. The MK-46 and MK-48 torpedoes are propelled by a very toxic and highly volatile Otto fuel II. The fuel contains propylene glycol dinitrate (PGDN) as the major constituent, representing approximately 75 percent of the total fuel. PGDN has been found to be a health hazard at relatively low concentrations in air. During the maintenance cycle of the torpedo, the fuel cell system, which contains Otto fuel II, must be defueled before disassembly and refueled after assembly. This work is done in the so called "Dirty Areas" of the facility which include the Fuel Tank Turnaround and the Afterbody Breakdown Rooms. During the defueling and refueling operations, the operators are exposed to the fumes of the toxic Otto fuels. NAVMEDCOM INSTRUCTION 6270.1, Health Hazards of Otto Fuel II, requires that personnel exposure be limited to those levels in the most current Threshold Limit Value-Time Weighted Average (TLV-TWA) tables for PGDN as listed in American Conference of Governmental Industrial Hygienists (ACGIH), Threshold Limit Values for Chemical Substances in the Work Environment. The TWA concept refers to a usual 8-hour workday and 40-hour workweek. The current ACGIH publication lists the TLV-TWA as 0.05 parts per million (ppm) or 0.3 milligrams per cubic meter (mg/m^3). Consult the latest edition for limits in force at time of design.

5.5.2 Fuel Tank Turnaround/Afterbody Breakdown Rooms Layout. A certain configuration and size must be considered to accommodate the workload and the ventilation. Within these rooms, the location of fuel tank breakdown bench, parts washers, floor hood (or ventilator), etc., is vital to the proper operation of the ventilation system. The layout should allow all contaminated parts to be in a controlled area at all times. Thus, the

contaminated parts may be moved from workbench to parts washer without being removed from the ventilated control zone.

5.5.3 Ventilation System

5.5.3.1 Otto Fuel II Handling. The Otto Fuel II handling rooms must have an integrated ventilation system which simultaneously exhausts contaminated air and supplies fresh air. The design of the ventilation system should prevent Otto fuel II fumes from reaching the breathing zone of the operators.

A negative pressure with respect to outside and clean areas is required to prevent the spread of fumes outside of the fueling and defueling room. The negative pressure range should be 0.05 - 0.10 in H_2O (12 - 24 Pa) gauge.

5.5.3.2 Air Supply System. The design supply air quantity should be 90 percent of exhaust air quantity to provide the negative pressure in the room. Supply air should be heated or cooled and filtered to provide 68° to 74° F (20° to 23° C) space temperature. Exhaust air fan and supply air fan systems should be interconnected so that both units work as an integrated system. Supply air should be introduced to the room in a laminar flow arrangement, either by a supply air plenum on one wall, withperforated metal sidewall air outlets and exhaust system components on opposite wall, or by a supply of air through perforated ceiling air panels with exhaust system components along side walls. The first alternative is the better method and is recommended. By sizing perforated air outlets for reasonably low air velocity, the designer can reduce probability of drafty conditions in the room and maintain the proper crossflow ventilation in the work area.

5.5.3.3 Exhaust System. The exhaust fan shall be located outside of the fueling and defueling areas and preferably on the roof. The exhaust stack outlet height should be 1-1/2 times the building roof height measured from grade. When hills or buildings obstruct natural airflow, increase the stack outlet height to two times the building roof height measured from grade. The exhaust stack should be a no-loss design as shown in ACGIH, Industrial Ventilation, Manual of Recommended Practice. All exhaust system components exposed to the Otto fuel II fumes should be fabricated of stainless steel (Type 316 recommended) and welded construction. Both the supply air fans and exhaust fans should be of the backward, curved blade, nonoverloading type, and Class II.

5.5.4 Hood Requirements. Hoods shall be designed in accordance with ACGIH, Industrial Ventilation, Manual of Recommended Practice, to fit each operation. Designs for the following items should be similar to the facility plates in Appendix A:

a) Floor hoods or floor ventilators

b) Bench ventilator

c) Parts washer

All exhaust ducts and hoods shall be stainless steel material (Type 316 recommended) and welded construction. All hood slots should be

faced with stainless steel mesh with openings no larger than one-half inch to prevent light material such as wiping cloths from entering the exhaust hoods. The hood designs should feature a spill-retaining-lip.

5.5.5 Air Velocity Requirements. The crossflow supply air velocity should be 2.5 fps (0.7 m/s) minimum. The exhaust air transport velocity of the exhaust duct shall be designed for 33.33 fps (10 m/s). The capture velocity of the Otto fuel fumes at 24 in. (609 mm) from the face of the working edge shall not be less than 2.5 fps (0.7 m/s). All hood slots shall provide at least 33.3 fpm (10 m/s) air velocity through the slot.

5.5.6 System Controls. Supply and exhaust fans must be interlocked to function simultaneously. The duct system must have adequate dampers to assure proper balancing. Static pressure monitoring devices shall be provided to warn occupants when there is a loss of negative pressure and when filter change is needed.

5.5.7 Other Design Considerations. Afterbody Breakdown and Fueling/Defueling Rooms require a properly sized sump for Otto fuel II containment. Room floors must gently slope toward the sump. Special attention should be devoted to containment of an Otto fuel II spill or washdown liquids. Fume-resistant washable walls and floors shall be provided. The sump shall have a grate. The subject rooms should have drop ceilings. T-bar type ceilings with integral lighting are acceptable. The lighting level should be 100 footcandles (fc) at working level.

5.5.8 Design Review Requirements. In addition to Section 1 requirements, Commander, NAVFACENGCOM, requires that bases for design and 35 percent complete project drawings for facilities involving MK-46 or MK-48 IMA operations shall be forwarded to NAVSEAWARENGSTA (22G), Keyport, Washington, for review.

5.6 Electrical Requirements. Electrical service, lighting, and communications shall be provided in accordance with NFPA 70, NAVFAC DM-4 Series, and as defined in paras. 5.6.1 through 5.6.6.

5.6.1 Power. The capacity of the shop, as shown on Facility Plates in Appendix A, should be verified for each design due to constantly changing electrical requirements.

a) Single-phase, e.g. 120 Vac, 20 A, 60 Hz convenience outlets shall be provided in all spaces with spacing as required by NFPA 70 and user requirements.

b) Three-phase, 120/208 Vac, 60 Hz; three-phase, 115/200 Vac, 400 Hz; and 28 Vdc power shall be provided in Shop No. 1, Shop No. 2, and the instrument testing room (refer to MIL-STD-704, Aircraft Electric Power characteristics, for 400 Hz and 28 Vdc power requirements). Three-phase, 220-v, 60-Hz power shall be provided where the Mark 540 Test Set is used in testing the Mark 46 Torpedo.

c) The ampacity of 3-phase and direct-current outlets shall be as required by the using agency for the specific facility.

d) Equipment and wiring in the paint shop shall be in accordance with NFPA 33.

5.6.2 Lighting. The lighting requirements of para. 2.4.2 are applicable to this facility.

5.6.3 Emergency Power. An emergency diesel electric generator shall be provided, with capacity as required by the using agency to meet the essential loads of the facility.

5.6.4 Shielding. An electromagnetic radiation survey shall be conducted to determine if shop spaces require shielding. Shielding for Shop No. 1 and Shop No. 2 shall be provided when a requirement is established by the survey. Refer to NAVSEA OP-3565.

5.6.5 Grounding and Lightning Protection. Grounding requirements of para. 2.4.3, are applicable to this facility. Lightning protection shall be provided in accordance with NAVFAC DM-4.06, Lightning (and Cathodic) Protection, and NAVSEA OP-5.

5.6.6 Communications. A two-way communication system shall be provided between the duty office and the guard house, shop areas, instrument testing, and garage.

5.7 Security. Security features shall be provided in accordance with mandatory requirements which must be obtained from NAVFACENGCOM HQ. Selected light fixtures and the alarm control center shall be connected to the emergency diesel generator.

5.8 Explosion-Proof Weight-Handling Equipment. The overhead bridge crane in the torpedo storage room shall have electric motorized bridge, trolley, and hoist with 3,000-lb. (1,360 kg) capacity. The monorail hoist in Shop No. 1 and No. 2 shall have electric motorized trolley and hoist with 2,000-lb (907 kg) capacity. The monorail hoist in the paint shop shall be a hand-operated hoist and trolley with 1,000-lb. (453 kg) capacity. Electric bridge, trolley, and hoist motors shall be operated from floor level by push button pendent controls and shall be capable of operating at slow speeds for positioning loads and at higher speeds for moving loads. Classification of hazardous locations shall be as defined in NFPA 70 (refer to NAVFAC DM-38.01 for additional criteria).

Section 6: QUALITY EVALUATION LABORATORY

6.1 Function. Quality Evaluation Laboratories (QEL) provide the necessary facilities for performing analyses and tests to determine and maintain quality assurance of ammunition, explosives, and toxins.

6.2 Location. These facilities shall be located to meet the requirements of minimum separation and safety distances for the materials to be handled in the QEL in accordance with criteria in Volumes 1 and 2 of NAVSEA OP 5.

6.3 Layout. The layout of this facility normally provides the four major areas described in paras. 6.3.1 through 6.3.4. These major areas should be situated in individual wings which contain spaces having similar functions.

6.3.1 Office Wing. This area includes offices, technical library, vault, conference rooms, and male and female toilet facilities.

6.3.2 Chemical Testing Wing. This area includes a chemical laboratory, boiler room, machine shop, photo laboratory, spectrophoto chemistry area, and male and female toilet and locker facilities.

6.3.3 Test Cell Wing. This area includes test cells for various testing purposes, magazines for storage, and a general work area.

6.3.4 Mechanical and Electronics Wing. This area consists of a mechanical laboratory, electronics laboratory, maintenance and calibration rooms, endurance test room, proximity fuse test room, and an X-ray room.

6.4 Architectural and Structural Requirements. Construction materials and finishes shall be in accordance with NAVFAC DM-1.01 and DM-1.02 Materials and Building Components, Vol. 1, Chapters 6 and 25, NAVSEA OP-5, and as defined in paras. 6.4.1 through 6.4.4 of this handbook.

6.4.1 Walls. Where explosion hazards exist and NAVSEA OP-5 criteria requires "substantial dividing walls." Walls shall be reinforced concrete designed for blast resistance. Walls for other areas shall be of non-combustible materials.

6.4.2 Roofs. Explosive areas shall have frangible roof sections in accordance with NAVFAC P-397 and NAVSEA OP-5. Other roofs shall be reinforced concrete.

6.4.3 Floors. Floors shall be of concrete and finished as follows:

a) Provide suitable resilient floor finish for offices, library, conference rooms, and laboratories that do not require conductive floors (refer to para. 4-7.4.4.b, Volume 1, NAVSEA OP-5).

b) Provide ceramic tile in toilet and locker room facilities.

c) Provide conductive concrete or similar conductive flooring

material for test cells, magazines, loading platforms, and any work area where conductive floors are required by para. 4-7.4.4.b, Volume 1 of NAVSEA OP 5, Volume 1. Conductive flooring material shall be in accordance with NAVFAC Guide Specification NFGS-09785.

6.4.4 Retaining Walls and Barricades. Concrete retaining walls and earth barricades shall be provided around the test cell wing to reduce explosion hazards to personnel and nearby structures. Current test cell requirements should be obtained from the Naval Civil Engineering Laboratory (NCEL), Port Hueneme, CA.

6.5 Mechanical Requirements

6.5.1 Heating and Air Conditioning. Heating and air conditioning shall be provided in accordance with NAVFAC DM-3.03.

6.5.2 Ventilation. Ventilation shall be provided in accordance with DM-3.03. Photo and x-ray laboratories and printing and developing rooms shall be provided with filtered supply air. Filtered supply air shall be provided for exhaust systems and fume hoods. Provide heating system for supply air when required.

6.5.3 Plumbing. Plumbing shall be provided in accordance with NAVFAC DM-3.01. In addition, provide a waste recovery system for film developing operations to segregate and collect silver bearing waste in accordance with NAVSUPINST 4570.23, Recovery and Utilization of Precious Metals.

6.5.4 Compressed Air. Compressed air at 100 psi (689 kPa) shall be provided to laboratories and general work areas in accordance with NAVFAC DM-3.05.

6.5.5 Noise and Vibration Control. All mechanical systems and equipment shall be designed to limit noise and vibration in accordance with NAVFAC DM-3.10.

6.6 Electrical Requirements. Electrical requirements, including power generation and distribution, lighting, grounding, and lightning protection shall be in accordance with Chapter 4, Volume 1, NAVSEA OP-5, NFPA 70, NAVFAC DM-4 Series, and paras. 6.6.1 through 6.6.3 of this handbook.

6.6.1 Shielding. Proximity fuse test rooms shall be shielded to prevent interference with electronic testing operations. For shielding requirements, refer to Volume II, NAVSEA OP 3565.

6.6.2 Power. Power shall be provided as follows:

a) Single-phase, 120 Vac, 20 A, 60 Hz convenience outlets shall be provided in all spaces with spacing as required by NFPA 70 and using activity requirements.

b) Three-phase, 120/208 Vac and 480 Vac, 60 Hz; three-phase, 115/200 Vac, 400 Hz; and 28 Vdc power shall be provided in laboratories and shops as required by the using agency.

6.6.3 Lighting. Lighting shall be provided as follows:

a) Interior lighting shall normally be fluorescent.

b) Exterior lighting shall be high-pressure sodium vapor where practical.

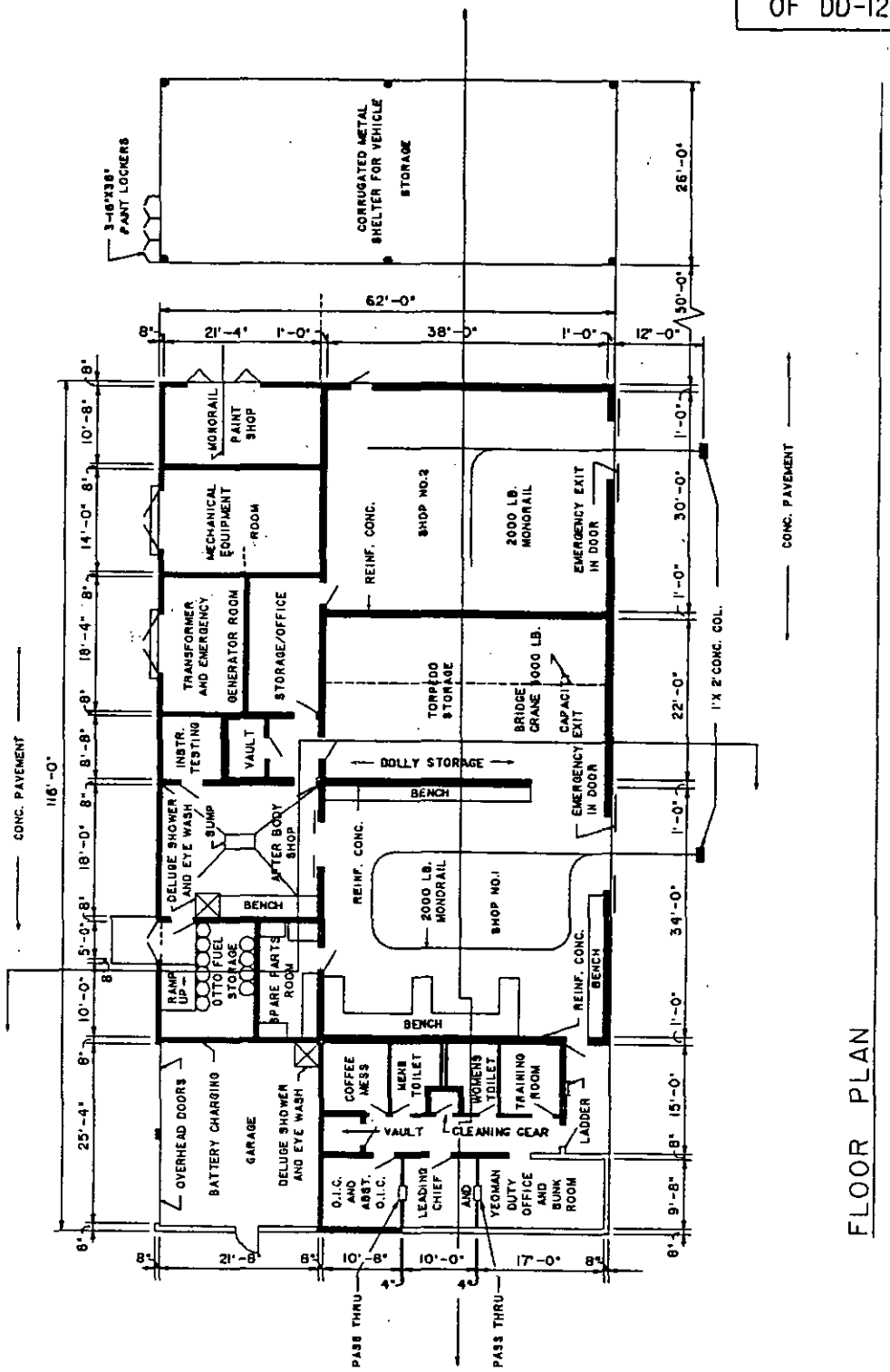
c) Design for lighting intensities shall be in accordance with MIL-HDBK-1190.

d) Photo and X-ray laboratories and printing and developing rooms shall be provided with a means to prevent inadvertent activation of the lighting in the rooms.

FACILITY PLATES

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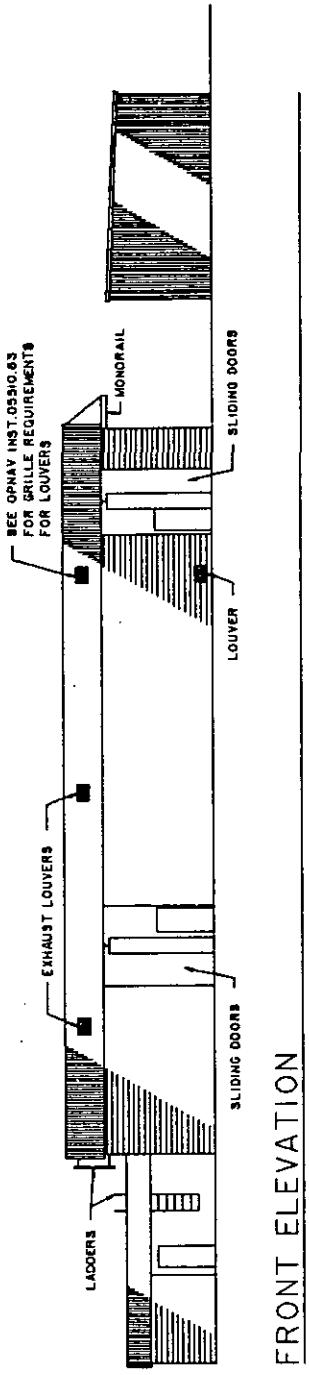
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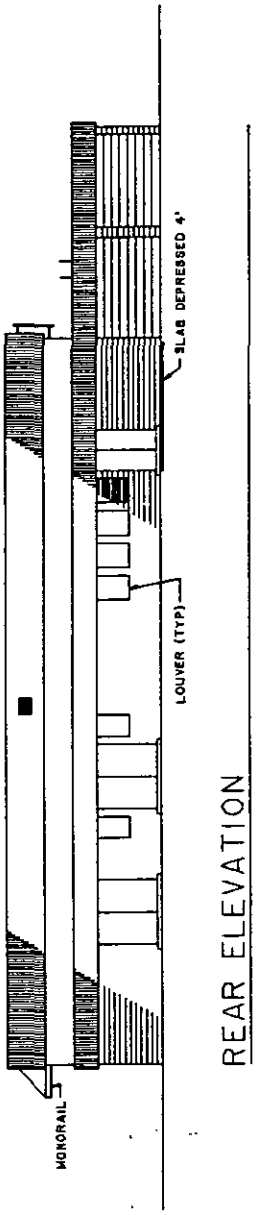
FLOOR PLAN

TITLE	DATE	FACILITY PLATE NO.	SHEET
AIR/UNDERWATER WEAPONS SHOP	SEP 86	216-55	1 OF 8

SUPERSEDES PART OF DD-1291743



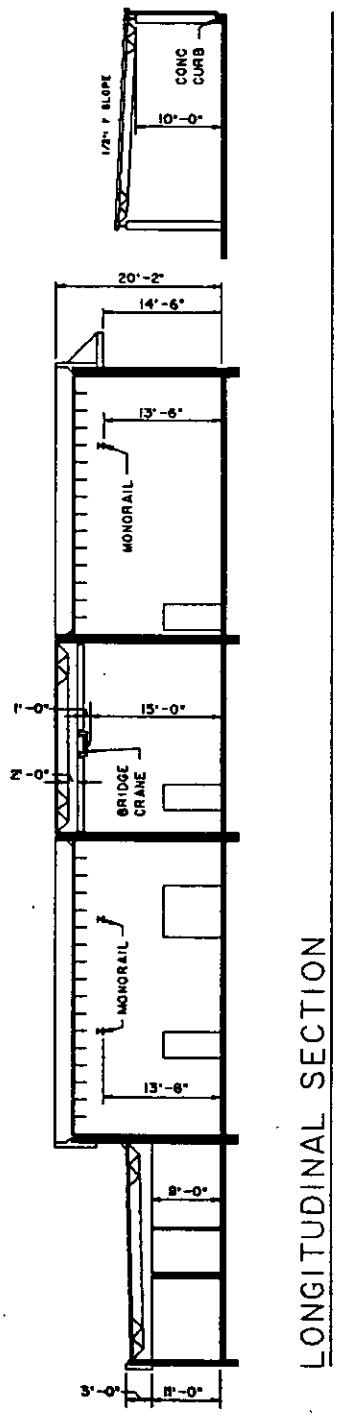
FRONT ELEVATION



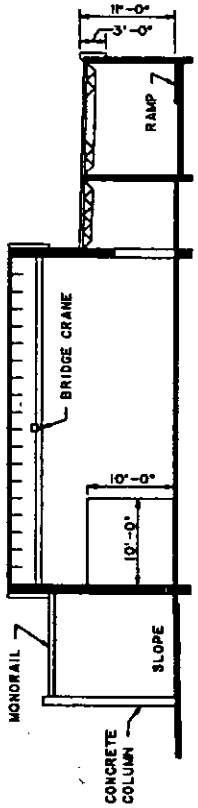
REAR ELEVATION

TITLE	DATE	FACILITY PLATE NO.	SHEET
AIR/UNDERWATER WEAPONS SHOP	SEP 86	216-55	2 OF 8

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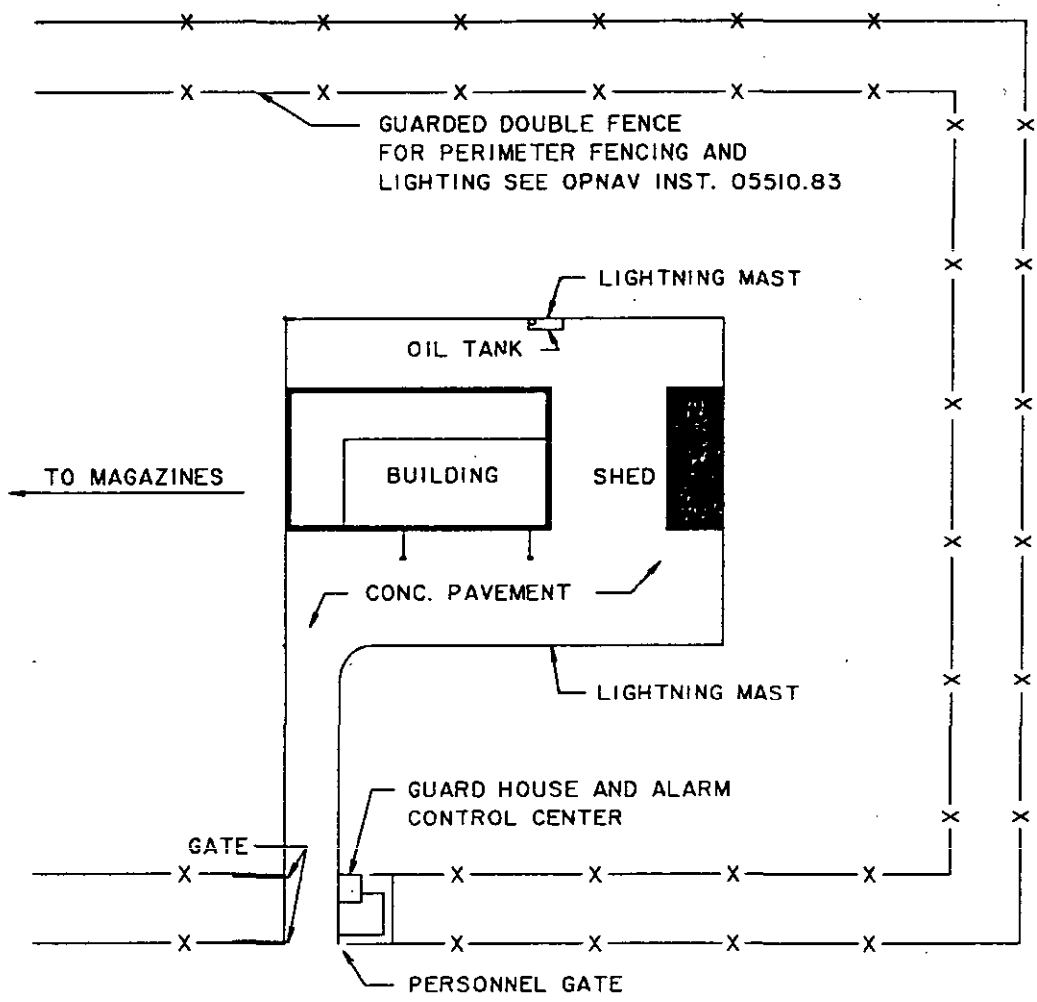
LONGITUDINAL SECTION



CROSS SECTION

TITLE	DATE	FACILITY PLATE NO.	SHEET
AIR/UNDERWATER WEAPONS SHOP	SEP 86	216-55	3 OF 8

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TYPICAL SITE PLAN

1. COVERED STORAGE FOR CONTAINERS
2. EXTERIOR PAINT LOCKER

TITLE	DATE	FACILITY PLATE NO.	SHEET
AIR/UNDERWATER WEAPONS SHOP	SEP 86	216-55	4 OF 8

SUPERSEDES PART OF DD-1291743

NOTES

PLUMBING REQUIREMENTS

COLD WATER	65 G.P.M.
HOT WATER	
RECOVERY RATE (THRU 100° RISE)	60 G.P.H.
STORAGE	70 GAL.

THE ABOVE RATES DO NOT INCLUDE REQUIREMENTS FOR FIRE PROTECTION

HEATING REQUIREMENTS (M BTU/HR)

INSIDE DESIGN TEMPERATURRE 70° F

OUTSIDE DESIGN TEMPERATURE

-5° F	+5° F	+15° F	+25° F
504	432	367	302

AIR CONDITIONING REQUIREMENTS

SHOP SPACES	
INSIDE DESIGN TEMPERATURE	MIN. 70° F.D.B. MAX. 40° F.D.B.
INSIDE DESIGN HUMIDITY	40% R.H.
PERSONNEL SPACES	
INSIDE DESIGN TEMPERATURE	78° F.D.B.
INSIDE DESIGN HUMIDITY	50% R.H.
COOLING LOAD (MBTU.HR)	492

ELECTRICAL REQUIREMENTS (KW)

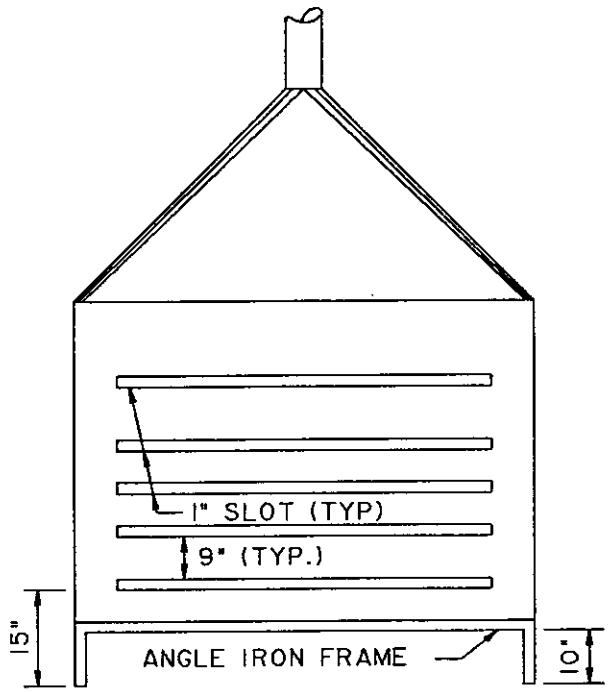
LIGHTS	
CONNECTED LOAD	72.0
ESTIMATED DEMAND	57.6
POWER	
CONNECTED LOAD	41.8
ESTIMATED DEMAND	33.4
TOTAL	
CONNECTED LOAD	113.8
ESTIMATED DEMAND	91.0
ADDITIONAL DEMAND FOR AIRCONDITIONING	41.0

AREAS

GROSS AREA INCLUDING MECHANICAL EQUIPMENT ROOM	7,192 S.F.
VEHICLE SHED	1,550 S.F.

TITLE	DATE	FACILITY PLATE NO.	SHEET
AIR/UNDERWATER WEAPONS SHOP	SEP 86	216-55	5 OF 8

FLOOR VENTILATOR



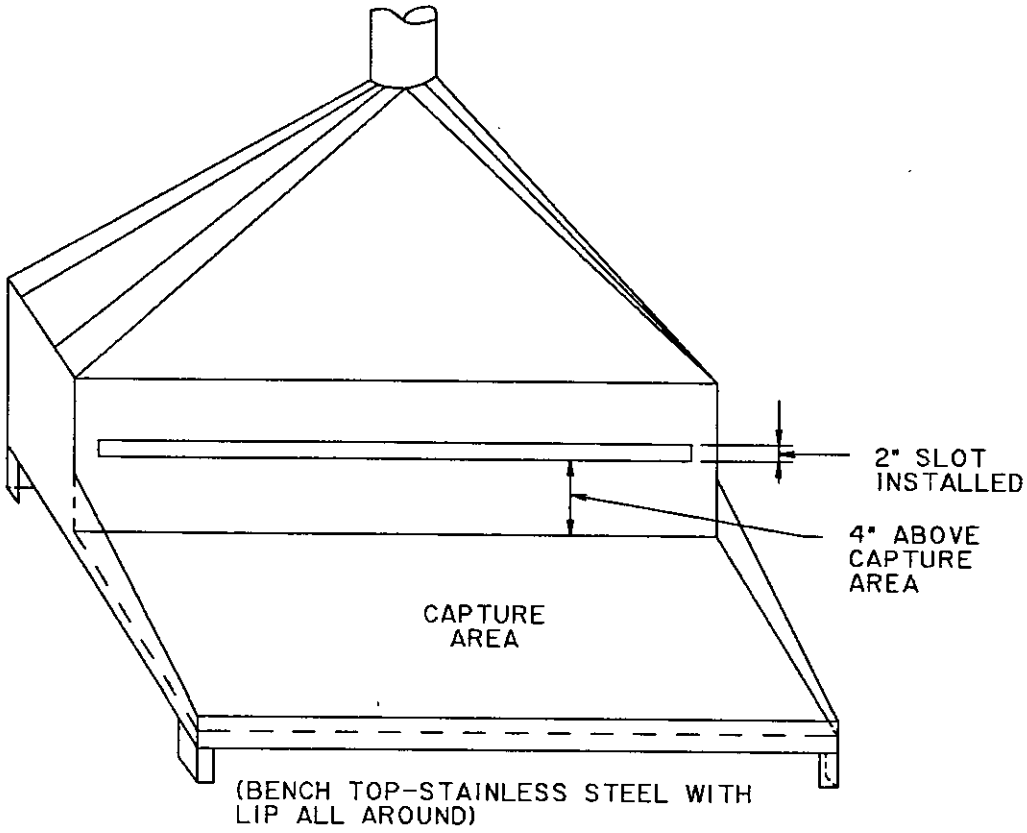
ELEVATION VIEW

NOT TO SCALE

MAX. PLENUM VELOCITY	(1000 F.P.M.)
SLOT VELOCITY	(MIN) (2000 F.P.M.)
CAPTURE VELOCITY	(150 F.P.M. AT 24")
DUCT VELOCITY	(MIN) (2000 F.P.M.)
AIR VOLUME	(4167 C.F.M.)

TITLE	DATE	FACILITY PLATE NO.	SHEET
AIR/UNDERWATER WEAPONS SHOP	SEP 86	216-55	6 OF 8

BENCH VENTILATOR



ISOMETRIC

NOT TO SCALE

DUCT VELOCITY	(2000 F.P.M.) (MIN)
SLOT VELOCITY	(2000 F.P.M.) (MIN)
CAPTURE VELOCITY	(150 F.P.M. AT 24")
PLENUM VELOCITY	1/2 SLOT VELOCITY OR LESS

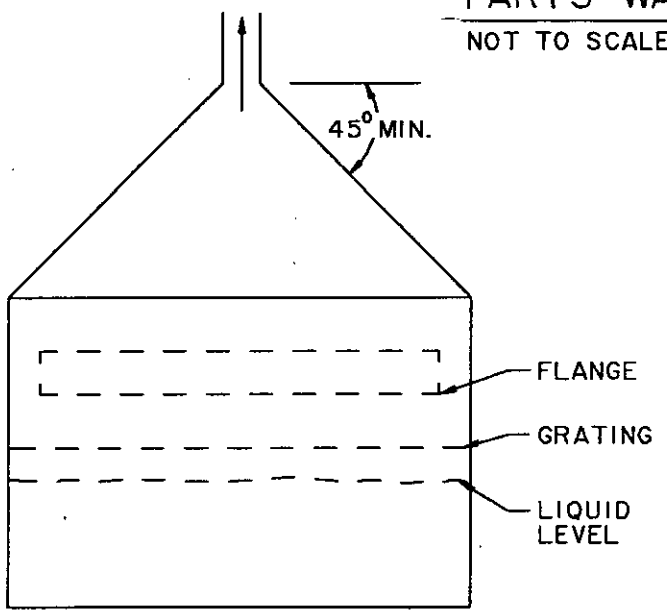
SLOT LENGTH	CAPTURE AREA	AIR VOLUME
(48")	(8 SQ.FT.)	(1333 C.F.M.)
(60")	(10 SQ.FT.)	(1667 C.F.M.)
(72")	(12 SQ.FT.)	(2000 C.F.M.)

SLOT LENGTHS (72") OR GREATER REQUIRE MULTIPLE TAKE-OFFS

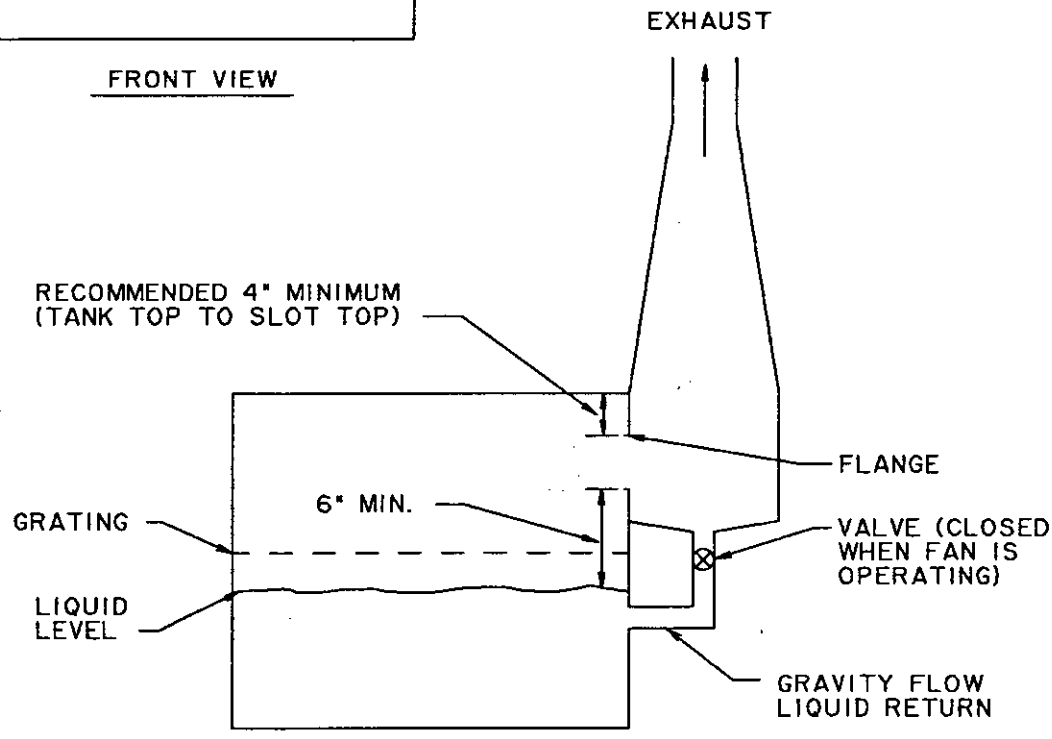
TITLE	DATE	FACILITY PLATE NO.	SHEET
AIR/UNDERWATER WEAPONS SHOP	SEP 86	216-55	7 OF 8

PARTS WASHER

NOT TO SCALE



FRONT VIEW



SECTION

SLOT VELOCITY	(MIN) (2000 F.P.M.)
CAPTURE VELOCITY	1/2 SLOT VELOCITY (MAX.)
DUCT VELOCITY	SLOT VELOCITY (MIN.)
AIR VOLUME	125 CFM/SQ. FT. TANK SURFACE AREA PLUS DRAINBOARD AREA (MIN.)

TITLE	DATE	FACILITY PLATE NO.	SHEET
AIR/UNDERWATER WEAPONS SHOP	SEP 86	216-55	8 OF 8

REFERENCES

American Conference of Governmental Industrial Hygienists (ACGIH). Bldg. D-5, 6500 Glenway, Cincinnatti, OH 45211

Industrial Ventilation, Manual of Recommended Practice

Threshold Limit Values for Chemical Substances in the Work Environment

American National Standards Institute (ANSI) Standards, 1430 Broadway, New York, NY 10018

Z358.01-81	Emergency Eyewash and Shower Equipment
Z9.04-85	Exhaust Systems - Abrasive Blasting Operations - Ventilation and Safe Practices

Military Standards (MIL-STD) and Specifications (MIL-SPEC)

MIL-STD-704	Aircraft Electric Power Characteristics
MIL-P-24441	General Specifications for Paint, Epoxy Polyamide

Military Documents are available from the Commanding Officer, Publications and Forms Center, 5801 Tabor Ave., Philadelphia, PA 19120. Telephone: AUTOVON (DOD only) 442-3321; Commercial 215/697-3321. TWX: 710-670-1685.

National Fire Protection Association (NFPA) Standards, Batterymarch Park, Quincy, MA 02269

33	Spray Application Using Flammable and Combustible Materials
70-87	National Electric Code
91	Blower and Exhaust Systems

Naval Facilities Engineering Command (NAVFACENGCOM) Documents

DM-1 Series	Architecture
DM-1.01	Basic Architectural Requirements and Design Considerations
DM-1.02	Materials and Building Components
DM-2 Series	Structural Engineering

DM-3 Series	Mechanical Engineering
DM-3.01	Plumbing Systems
DM-3.03	Heating, Ventilating, Air Conditioning and Dehumidifying Systems
DM-3.05	Compressed Air and Vacuum Systems
DM-3.10	Noise and Vibration Control for Mechanical Equipment (ARMY)
DM-4 Series	Electrical Engineering
DM-4.06	Lightning and Cathodic Protection
DM-5	Civil Engineering
MIL-HDBK-1006/1	Policy and Procedures for Construction Drawings and Specification Preparation
DM-7 Series	Soil Mechanics, Foundations, and Earth Structures
MIL-HDBK-1008	Fire Protection for Facilities Engineering Design and Construction
MIL-HDBK-1013/1	Physical Security of Land-based Facilities
MIL-HDBK-1028/3	Maintenance Facilities for Ammunition, Explosives, and Toxins
MIL-HDBK-1190	Facility Planning and Design Guide
DM-28.04	General Maintenance Facilities
DM-38.01	Weight-Handling Equipment
INST 4101.1	Energy Budgets for New Facilities
INST 5100.11	Command Safety and Health Program
P-80, Volume I	Facility Planning Criteria for Navy and Marine Corps Shore Installations
P-272	Definitive Designs for Naval Shore Facilities
P-309	Color For Naval Shore Facilities
P-355	Seismic Design for Buildings
P-397	Structures to Resist the Effects of Accidental Explosions

NFGS-09785	Metallic-Type Conductive and Spark-Resistant Concrete Floor Finish

NAVAIRSYSCOM Publication

NAVAIR TM 16-1-529	Technical Manual

NAVMEDCOM Publication

NAVMEDCOMINST 6270.1	Health Hazards of Otto Fuel II

NAVSEASYSCOM Publications

OP-5	Ammunition and Explosives Ashore
S6340-AA-MMA-010	Otto Fuel II, Safety, Storage, and Handling Instructions
OP 3565, Volume II	Electromagnetic Radiation Hazards (Hazards to Ordnance) Part I - (Hazards to Unclassified Ordnance Systems) Part II - (Hazards to Classified Ordnance Systems)
OD 30393	Design Principles and Practices for Controlling Hazards of Electromagnetic Radiation to Ordnance (Hero Design Guide)

NAVSUP Publicaton

INST 4570.23	Recovery and Utilization of Precious Metals

OPNAV Instructions

INST 5510.1G	Department of Navy Information and Personnel Security Program Regulation
INST 5510.83	Navy Nuclear Weapon Security Manual
INST 5530.14A	United States Navy Physical Security and Loss Prevention Manual

Department of Defense activities may obtain copies of Design Manuals, P-Publications, and Definitive Drawings from the Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120. Department of Defense activities must use the Military Standard Requisitioning and Issue Procedure (MILSTRIP), using the stock control number obtained from NAVSUP Publication 2002.

Other Government agencies and commercial organizations may procure Design Manuals, P-Publications, and Definitive Drawings from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

Occupational Safety and Health Administration (OSHA) Standard, U.S. Government Printing Office, Washington. DC 20402.

2040	Occupational Safety and Health Act Standards Manual, Regulations Construction

CUSTODIAN:
NAVY - YD

PREPARING ACTIVITY
NAVY - YD

PROJECT NO.
FACR-0221

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-HDBK-1028/3	MAINTENANCE FACILITIES FOR AMMUNITION, EXPLOSIVES AND TOXINS

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR
	☐ USER
5. ADDRESS *(Street, City, State, ZIP Code)*	☐ MANUFACTURER
	☐ OTHER *(Specify)*:

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

DD FORM 82 MAR 1426

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