NOTICE OF CHANGE

INCH-POUND

MIL-HDBK-1032/2
NOTICE 1
15 May 1999

DEPARTMENT OF DEFENSE
HANDBOOK

COVERED STORAGE

TO ALL HOLDERS OF MIL-HDBK-1032/2:

1. THE FOLLOWING PAGES OF MIL-HDBK-1032/2 HAVE BEEN REVISED AND SUPERSEDE THE PAGES LISTED:

NEW PAGE	DATE	SUPERSEDED PAGE	DATE
45	30 September 1987	45	15 May 1999
46	30 September 1987	46	15 May 1999
73	30 September 1987	73	15 May 1999
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2. RETAIN THIS NOTICE AND INSERT BEFORE TABLE OF CONTENTS.

3. Holders of MIL-HDBK-1032/2 will verify that page changes and additions indicated above have been entered. This notice page will be retained as a check sheet. This issuance, together with appended pages, is a separate publication. Each notice is to be retained by stocking points until the handbook is completely revised or canceled.

Custodian:
Navy - YD2

Preparing Activity:
Navy - YD2
(Project FACR-5011)

AMSC N/A

AREA FACR

b) For measurement of floor flatness, require use of special floor flatness profile measurement equipment such as the "Profilograph" of the Edward W. Face Company (427 West 35th Street, Norfolk, Virginia 23508), the "Floor Crab" of the Austin Company-Kalman Floor Company (2942 Highway 74, Evergreen, Colorado 80439), or an equivalent measuring equipment technique which is certified as acceptable by the Headquarters Office of the truck manufacturer(s) and approved by the Contracting Officer.

c) Require in the specifications that the general contractor provide certification to be prepared by the measuring equipment operator. Certification states that the "wheel path" and other portions of the concrete floor to be used for turret truck and order-picking truck operations must completely meet maximum rated productivity floor flatness requirements of the Headquarters Office of the truck manufacturer(s). Floors which fail to meet the required tolerances will be corrected as directed by the Contracting Officer.

d) All noncritical floor slabs should be specified to be an ACI Class Bx floor. See ACI 302.1R-80 for Class Bx criteria.

3.6.3 Wire Guide Requirements. When electronic wire guide vehicle controls are used, observe the following floor design criteria:

3.6.3.1 Conduits. Avoid installing conduits in the floor.

3.6.3.2 Reinforcing. Reinforcing steel should be located at least 2 inches (50 mm) below the concrete surface. Wire mesh should be tack-welded together wherever possible. Rebars and wire mesh should be grounded.

3.6.3.3 Expansion Joints. Where possible, expansion joints should be located under storage racks. When expansion joints are located in the storage aisle, they should run parallel to the aisle and not be within 3 inches (75 mm) of the centerline of the storage aisle nor within materials handling equipment wheel tracks.

3.6.3.4 Hardening Agents. If a ferrous hardening agent is specified, this material must be distributed evenly over the entire floor.

3.7 Fire Protection. All storage structures should be designed to comply with the applicable sections of the fire safety codes governing the activity. Rack storage system fire protection should comply with the requirements of MIL-HDBK-1008A and Rack Storage of Materials, NFPA 231C. Floor storage over 12 feet (3660 mm) high should also comply with General Storage, NFPA 231.

3.7.1 Location of Buildings. Building location on the site should permit easy access by emergency vehicles. Orderly flow of people and equipment is essential to the conduct of a safe operation.

3.7.2 Fire Apparatus Access. Provide space between buildings sufficient to permit access by fire and emergency vehicles.

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3.7.3 Separation Distance. As an aid to fire prevention and protection, covered storage facilities should be separated by the distances described in par. 3.3. Multipurpose warehouses may be constructed as a single structure. These buildings may include a flammable/hazardous storage area contiguous to the general warehouse, provided the two storage areas are separated by a 4-hour fire wall.

3.7.4 Protected Area. Warehouse fire area between fire walls should comply with MIL-HDBK-1008A and be subject to the following:

3.7.4.1 General Storage. Warehouse area for storage of materials of moderate combustibility should not exceed 40,000 square feet (3716 square meters [m^2]) between fire walls in accordance with MIL-HDBK-1190, and should otherwise conform to NFPA 231. When such warehouses are located at depottype activities that furnish supply support to other activities, the area confined by fire walls may be increased upon a finding and determination by the Secretary of the Navy (with documentation submitted via cognizant claimant and NAVFAC fire protection engineers) that:

a) The increased size is required for efficient operation.
b) Additional loss potential has been recognized and is acceptable.
c) Other fire safety features have been designed to compensate for the additional hazard as far as such design is practical.

3.7.4.2 Flammable/Hazardous Storage. Warehouse areas for storage of flammable liquids, solids, and/or hazardous chemicals, should not exceed 20,000 square feet (1858 m^2) between fire walls in accordance with MIL-HDBK1190. Fire walls should have a 4-hour rating.

3.7.5 Sprinkler Systems. Provide automatic fire suppression systems in accordance with provisions of MIL-HDBK-1008A, NFPA 12; Standard for the Installation of Sprinkler Systems, NFPA 13; Deluge Foam-Water Sprinkler Systems and Foam-Water Spray Systems, NFPA 16; NFPA 231; and NFPA 231C. Water demand should be based on the hydraulic design of the sprinkler system.

3.7.5.1 Storage System Sprinklers. In general purpose, controlled humidity, refrigerated and other type warehouses where flammable/hazardous materials are not to be stored, nonadjustable face and flue sprinkler heads (see Figure 19) are required at or immediately below the 20-, 40-, 60- and 80-foot (6100 mm; 12 190 mm; 18 290 mm; and 24 380 mm) rack levels. Rack shelving at these levels should not be adjustable. Additional flue sprinklers may be required depending upon storage height and its relationship to the nonadjustable sprinklers. Face and flue sprinkler heads should be placed at or below each 108-inch (2745 mm) open frame shelf at the required levels in a manner which prevents sprinkler head damage during storage operations, as illustrated in Figure 20. The sprinklers at all other shelf levels should be capable of vertical adjustment (Figure 21) using mechanically grooved fittings. Depending upon Commodity Class and whether the load is encapsulated, rack systems with clear stacking height (SH) values of less than 25 feet (7620 mm) from floor to the top of material on the top shelf may be exempted from the in-rack sprinkler requirement.

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Section 4: FLAMMABLE/HAZARDOUS MATERIALS WAREHOUSE

4.1 Definition. Hazardous materials storage facilities are buildings designed and constructed in accordance with the standard references listed in subpar. 4.1.2 for storage of materials classified as hazardous to health, environment, and property, e.g., flammables, acids, caustics, oxidizers, water reactives, or others considered hazardous by the following CFR's: 29CFR - Part 1910; 40CFR - Protection of Environment; 49CFR - Parts 171-177, Hazardous Material; and Federal Standard 313B, Materials Safety Data Sheet, Preparation, and the Submission of (April 14, 1983). Refer to NAVFAC P-272, drawings 1404214 and 1404518, for typical building configurations. Section 4 provides additional specific criteria applicable to flammable/hazardous storage.

4.1.1 Compliance Standards. Comply with the following federal, industry, and association standards.

4.1.1.1 Federal Regulations. Comply with requirements of 29CFR, 40CFR, 49CFR, and Navy Hazardous Material Control Program, NAVSUPINST 5100.27.

4.1.1.2 National Fire Protection Association. The following NFPA standards should be applied to the design, construction, and fire protection of hazardous materials storage facilities:

a) NFPA 490	Ammonium Nitrate, Storage of
b) NFPA 72E	Automatic Fire Detectors
c) NFPA 220	Building Construction, Standard Types of
d) NFPA 12	Carbon Dioxide Extinguishing Systems
e) NFPA 491M	Chemical Reactions, Hazardous
f) NFPA 49	Chemicals Data, Hazardous
g) NFPA 16	Deluge Foam-Water Sprinkler Systems and Foam-Water Spray Systems
h) NFPA 17	Dry Chemical Extinguishing Systems
i) NFPA 70	Electrical Code, National
j) NFPA 497M	Classification of Gases, Vapors, and Dusts for Electrical Equipment in Hazardous Locations
k) NFPA 68	Explosion Venting
l) NFPA 80	Fire Doors and Windows
m) NFPA 704	Fire Hazards of Materials, Identification
n) NFPA 321	Flammable and Combustible Liquids, Classification
o) NFPA 30	Flammable and Combustible Liquids, Code
p) NFPA 325M	Flammable Liquids, Gases, and Volatile Solids, Fire Hazard Properties of
q) NFPA 101	Life Safety Code
r) NFPA 78	Lightning Protection Code
s) NFPA 72A	Local Protection Signaling Systems
t) NFPA 43C	Oxidizing Materials, Gaseous, Storage
u) NFPA 43A	Oxidizing Materials, Liquid and Solid Storage of
v) NFPA 43D	Pesticides in Portable Containers
w) NFPA 10	Portable Fire Extinguishers
x) NFPA 72D	Proprietary Protection Signaling Systems

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y) NFPA 231C Rack Storage of Materials
z) NFPA 231D Rubber Tires, Storage of
aa) NFPA 204M Smoke and Heat Venting
ab) NFPA 13 Sprinkler Systems, Installation
ac) NFPA 14 Standpipe and Hose Systems, Installation of
ad) NFPA 231 Storage, General Indoor

4.1.1.3 Other Criteria. For cylinder storage, also observe requirements of the Compressed Gas Association Handbook of Compressed Gases, and Storage and Handling of Compressed Gases and Gas Cylinders, NAVSUPINST 4440.128B.

4.1.2 Hazardous Materials Storage Facilities. Hazardous materials storage facilities should be designed and constructed to offer protection against the physical, health, or environmental hazards presented by the material. Storage and handling of hazardous materials should be confined to buildings or parts of buildings meeting the requirements of this section. Mixed occupancy buildings will not house hazardous materials storage and handling operations. Under no circumstances will office buildings contain hazardous material storage and handling operations.

4.1.3 Design Criteria. Facility design and layout should take into consideration the incompatibility of hazardous materials and hazardous material groups as described in subpar. 4.2.2. Further guidance is provided by the applicable standards of subpar. 4.1.1. Individual facility design and layout should be based upon the specific types and categories of hazardous materials that are to be handled and stored. Structural and fire control system design must be approved by a registered Professional Engineer licensed in Fire Protection Engineering. Perform a system safety analysis in accordance with Military Standard System Safety Program Requirements, MIL-STD-882B, as required by Chief of Naval Operations and NAVFAC direction. Specific guidance and assistance can be obtained through NAVFAC.

4.1.4 Storage Requirements. Accommodate the following storage requirements in the design of flammable/hazardous storage facilities.

a) The storage area should be designed to prevent surface or groundwater contamination in the event of a spill or leak, and to capture completely each class of material individually.

b) In acid or caustic liquid storage, a man-up type vehicle MUST be used. Otherwise, the liquids must be stored on the floor to keep the loads below the operator's eye level.

4.1.5 Materials Handling Equipment. Electrically powered materials handling equipment is the only type of powered material handling equipment rated for use in hazardous material storage areas. Use Type EE vehicles, which have all electrical equipment completely enclosed, in flammable and hazardous materials warehouses. Type EX vehicles, which have all fittings and equipment designed, constructed, and assembled for use in atmospheres containing flammable vapors, dust, and fibers, may be required for unique chemicals or applications. Verify the need for any additional requirements which may be imposed by special storage conditions.

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4.5.4 Containment. Use grate-covered interior 350 gallon (1323 L) sumps in conjunction with the trench system to provide spill or leakage containment for the lesser of 1,000 gallons (3785 L) or 10 percent of the total free flowing liquid volume of all containers stored in each room. Provide a containment capacity of 1,000 gallons (3785 L) at the truck apron adjacent to the shipping and receiving area. Include a controlled flow system to prevent spilled or leaking materials from entering the storm drainage system, stream, or body of water.

4.5.5 Drainage. Install pallet racks and associated mechanical vehicle guidance systems so as to permit the unimpeded flow of spilled liquids to collecting trenches. Maintain floor flatness requirements. Floor drains should not be installed in the storage areas of flammable/hazardous warehouses.

4.6 Automatic Fire Suppression Systems. Provide all areas with automatic fire suppression systems.

4.6.1 Design Requirements. System design should comply with the requirements of MIL-HDBK-1008A; Low Expansion Foam and Combined Agent Systems, NFPA 11; NFPA 12; NFPA 13; NFPA 30; NFPA 231; NFPA 231C; and 29CFR Part 1910. Water demand for sprinklers should be based on hydraulic design of the system. Sprinkler heads should be suitable for installation in a corrosive environment. Storage areas for water reactive materials should be protected by an NFPA or DOD approved system. Where nonwater systems are used, provide a 30-second audible warning prior to system activation. Provide automatic local fire department signaling upon system activation.

4.6.2 Sprinkler Adjustment. Provide adjustment of sprinkler positioning through use of mechanical grooved piping rather than threaded pipe fittings, as illustrated in Figure 21. Contact the Navy Warehouse Utilization Program at NAVSUP for guidance in specific applications.

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Section 5: HEAVY MATERIALS WAREHOUSE

5.1 Definition. Heavy materials warehouses are facilities designed for the storage and handling of loads which exceed the average size and weight of Navy standard pallets. Such facilities are usually associated with manufacturing/fabrication or steel storage. Overhead handling devices such as bridge cranes are important elements in the design of these facilities. Refer to NAVFAC P-272, drawing 1404213, for a typical configuration. Section 5 provides additional specific criteria applicable to heavy materials storage.

5.2 Construction. Observe the following requirements:

5.2.1 Doors/Windows. Provide windows for office and service structures.
A narrow row of windows should be considered along the top of exterior walls to supplement electric illumination.

5.2.2 Floors. Design concrete floors for the expected load conditions. Minimum floor thickness should be 6 inches (150 mm). Provide reinforcement for crack control or incorporate alternative methods of crack control. Increased floor thickness may be required for areas subject to heavy loading. Special toppings or hardening compounds may be specified for areas subjected to extreme loading, traffic conditions, or requiring the use of air film transporters.

5.2.3 Craneways. Design craneways for the intended load capacity and type equipment to be used. Craneway location should avoid interference with the building structure or areas of personnel activity. Provide clearance between adjacent cranes and between the crane and the building structure.

5.3 Site Planning. The location of a heavy materials warehouse will be determined by the source of materials, the destination of materials, associated shop operations, and internal shop operations required to rough size material before being sent to its destination. Consider the following:

5.3.1 Rail Access. Building location will be affected by the ability to provide rail access from nearby tracks. The possibility of running a track through the building should be considered. Inside tracks should be at floor level and be equipped with crossing plates to provide a continuous, smooth crossing over the entire length of the track. A rail pit, placing the car floor at the building floor level, is not recommended since such a pit will divide the warehouse and prevent efficient use of the facility.

5.3.2 Truck Access. Provide truck dock and apron space for truck access to the building. A combination of floor level drive-in doors and docks with dock levelers should be provided to handle any combination of vehicles. Drive-in doors should accommodate flatbed and semi-trailers and be located to permit overhead crane loading and unloading.

5.3.3 Expansion. Provide for expansion in proportion to the requirements expected of the associated operations to be supported by the heavy materials warehouse. Provisions should be made for the expansion of the building width and length to accommodate growth.

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