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FACILITIES CRITERIA (FC)
FACILITY PLANNING FOR NAVY AND MARINE CORPS SHORE INSTALLATIONS

Series 400: Supply Facilities

Record of Changes:

Date	CCN #	CCN Title	Description of change
Jan 2017	Section 420	Ammunition Storage	Complete revision of magazine sizing and siting criteria. Implementation of Magazine Storage and Requirements Calculator (MSRC).
Jan 2017	Section 421	Ammunition Storage Depot and Installation	Revisions to magazine category codes within 421 series.
Jan 2017	42112	Fuse And Detonator Magazine	Consolidated into CCN 42122 High Explosive Magazine. CCN deleted from iNFADS.
Jan 2017	42152	Smokeless Powder And Projectile Magazine	Consolidated into CCN 42122 High Explosive Magazine. CCN deleted from iNFADS.
Jan 2017	42172	Missile Magazine	Consolidated into CCN 42122 High Explosive Magazine. CCN deleted from iNFADS.
Jan 2017	NEW-Table 420-1	Various CCNs	Provides new list of CCNs within the UFC 2-000-05N that require explosive safety site approval.
June 2018	42511	Explosive Storage Site Pad	Added new CCN for site pads for non-RP ordnance storage.
Sep 2019	Section 420	Ammunition Storage	Updated to reflect 10-digit CODEX. Added new requirement for ordnance handling loading/offloading area for all new Earth Covered Magazines.
Sep 2019	41160	Liquefied Petroleum Gas Storage	FAC Code changed to 1244
Sep 2019	42182	Submarine Launched Ballistic Missile	FAC Code changed to 4211
July 2020	42510	Open Ammunition Storage Pad	FAC code changed to 8526
July 2020	42511	Explosive Storage Site Pad	FAC code changed to 8526; revised criteria verbiage.

Date	CCN #	CCN Title	Description of change
8 August 2022	421 36	Ammunition Storage Building	1. Corrected Table 420-2 “MSRC Stowage Matrix.” 2. Added Table 420-3 “Magazine Type and Gross Square Footage.” 3. Added Containerized Long Weapons Storage (CLWS) magazine storage matrix and GSF to tables 420-2 and 420-3.
October 3 2022	420	Ammunition Storage	Updated CCN 420 hyperlinks to flankspeed site. Added CLWS Magazines to the storage matrix of Table 420-2. Changed sf for CLWS Magazines in Table 420-3 Added note to 420-10.7 concerning Army MSM magazines being sited by NOSSA.
4 January 2023	420 Series	Ammunition Storage	Updated Section 420-10.7 Estimating Future Magazines to address magazine spacing and continuous earth cover.
2 Mar 2023	400 Series	UFC 2-000-05N	Change UFC 2-000-05N to FC 2-000-05N document due to the fact that this planning criteria is not unified among the other DoD services.
17 Mar 2023	400 Series, Section 411-1	General Requirements	Change URL to access UFC 3-460-01 Petroleum Fuel Facilities.
17 Mar 2023	411-52	Cut and Cover Jet Engine Fuel Storage	Change URL to access UFC 3-460-01 Petroleum Fuel Facilities.
17 Mar 2023	411-60, Section 41160.2	Liquefied Petroleum Gas Storage	Change URL to access UFC 3-460—01 Petroleum Fuel Facilities.
13 Apr 2023	441-30, Section 44130-1	Hazardous and Flammables Storehouse	Replace references MIL-HDBK 1032/2 and UFC 4-442-01N with UFC 4-440-01.
30 May 2023	420 Series	Ammunition Storage	Updated 420-4 Ordnance Handling, Loading and Offloading Area to define paved area as a single continuous plane with a 0.5% min to 2% max slope to allow for proper drainage away from the ECM. Redefined the size of loading area for Box Type C,D,G,H, MSM, and CLWS magazines

400 SERIES
SUPPLY FACILITIES

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411 LIQUID FUEL STORAGE – BULK

411-1 GENERAL REQUIREMENTS

The availability of commercial facilities, intended service, and government resources (available developable area, security and safety of operations, and operation) should be considered as part of the overall planning process. Special care should be noted of site conditions to ensure design criteria can be met. This information can be found in the most current version of Unified Facilities Criteria Design: Petroleum Fuel Facilities (UFC 3-460-01), located on the Whole Building Design Guide (WBDG) website at the following link:

https://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc/ufc-3-460-01

This document also provides information on the ancillary equipment associated with liquid fuel storage (i.e., pumping station, pipelines, etc.). These facilities will typically have separate category codes.

Note that the real property components associated with the category codes having FAC codes of 4111, 4112, and 4113 include the tanks and any containment structures associated with them, such as berms, liners, and monitoring wells. In the case of "cut and cover" type fuel storage under FAC 4113, the integral deep well turbine pumps are also included in the associated category codes and are not to be counted as separate real property assets.

411-2 STORAGE QUANTITIES

The quantities and types of petroleum products to be stored are based on consumption of fuels by the ships, aircraft, vehicles and equipment at the activities served and what type of delivery system that is utilized. Depot fuel storage facilities must be of sufficient capacity to provide an adequate operating and reserve supply of fuel for the activities served. A barrel is the standard 42 U.S. gallon capacity.

411-2.1 **Capacities.** For planning purposes, the capacities of individual tanks should be approximately 25% of the ultimate storage for each type of fuel, subject to the following:

411-2.1.1 The minimum capacity of a tank for fuel depot bulk storage shall not be less than:

- Diesel Fuel 13,500 barrels
- Fuel Oil 27,000 barrels

411-2.1.2 Standard tank sizes should be used.

411-2.1.3 A minimum of two tanks will be provided for each type of fuel. One will serve as the working tank and the other the receiving tank for new deliveries.

411-2.1.4 It is necessary for impurities in MoGas, AvGas and jet fuels to settle prior to the use. The time required for jet fuel to settle is one hour per foot of depth of the fuel in the tank.

411-3 CATEGORY CODES

The category codes in this section include fuel storage tanks of the following classifications: operational; bulk fuel; cut and cover; liquefied petroleum (LP); contaminated; and heating oil. CCNs 411-10 through 411-52 represent the fuel types associated with operational (10,000-100,000 barrel capacity), bulk fuel (greater than 100,000 barrel capacity), and cut and cover storage tanks (earth covered for hostile environments). CCNs 411-60 through 411-84 represent the remaining fuel types associated with this section.

411 10 SHIP FUEL STORAGE 10K-100K (BL)

FAC: 4111
BFR Required: Y

411 11 SHIP FUEL STORAGE > 100K (BL)

FAC: 4112
BFR Required: Y

411 12 CUT AND COVER SHIP FUEL STORAGE (BL)

FAC: 4113
BFR Required: Y

411 20 AVIATION FUEL STORAGE 10K-100K (BL)

FAC: 4111
BFR Required: Y

411 21 AVIATION FUEL STORAGE > 100K (BL)

FAC: 4112
BFR Required: Y

411 22 CUT AND COVER AVIATION FUEL STORAGE (BL)

FAC: 4113
BFR Required: Y

411 30 DIESEL FUEL STORAGE 10K-100K (BL)

FAC: 4111
BFR Required: Y

411 31 DIESEL FUEL STORAGE > 100K (BL)

FAC: 4112
BFR Required: Y

411 32 CUT AND COVER DIESEL FUEL STORAGE (BL)

FAC: 4113
BFR Required: Y

411 40 MOTOR GASOLINE STORAGE 10K-100K (BL)

FAC: 4111
BFR Required: Y

411 41 MOTOR GASOLINE STORAGE >100K (BL)

FAC: 4112
BFR Required: Y

411 42 CUT AND COVER MOTOR GASOLINE STORAGE (BL)

FAC: 4113
BFR Required: Y

411 50 JET ENGINE FUEL STORAGE 10K-100K (BL)

FAC: 4111
BFR Required: Y

411 51 JET ENGINE FUEL STORAGE >100K (BL)

FAC: 4112
BFR Required: Y

411 52 CUT AND COVER JET ENGINE FUEL STORAGE (BL)

FAC: 4113
BFR Required: Y

DEFINITION. The fuel products in these category codes 411-10 through 411-52 are organized into three basic categories: operational fuel storage, bulk fuel storage, and “cut and cover” fuel storage. Operational storage tanks are designed with capacities between 10K and 100K BL; bulk storage tanks are designed with capacities greater than 100K BL; and “cut and cover” storage tanks are designed with capacities typically between 10K and 100K BL (these are operational tanks used in potentially hostile environments). Bulk fuel storage tanks are supplied by pipelines, tank trucks, or rail

tanker cars. The bulk tanks in turn, supply operational fuel tanks and “cut and cover” storage tanks, which then supply the various fueling systems at an installation.

The Fleet Fuels Officer, Code N413F, within the US Fleet Forces Command in collaboration with Defense Logistics Agency’s (DLA) Defense Energy Support Center (DESC) Code B (Bulk Fuels) will determine the fuel storage requirement. Design guidance, including safety features, can be found in the most current version of Unified Facilities Criteria Design: Petroleum Fuel Facilities (UFC 3-460-01), located on the Whole Building Design Guide (WBDG) website at the following link:

https://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc/ufc-3-460-01

Note that the real property components associated with the above category codes include the tanks and any containment structures associated with them, such as berms, liners, and monitoring wells. In the case of “cut and cover” type fuel storage, the integral deep well turbine pumps are also included in the associated category codes and are not to be counted as separate real property assets.

411 55 BULK/READY FUEL ADDITIVE STORAGE (BL)

FAC: 4114
BFR Required: Y

411 60 LIQUEFIED PETROLEUM GAS STORAGE (BL)

FAC: 1244
BFR Required: Y

41160-1 **DEFINITION.** The Navy uses liquefied petroleum gas, commonly known as LPG, for heating, metal cutting, brazing, in dental laboratories, aboard ships, and in similar installations. LPG consists predominantly of propane, propylene, with minor amounts of butane, isobutene, and butylene.

41160-2 **REQUIREMENT.** LPG is normally supplied in 100-pound cylinders or delivered by tanker truck or train car. The bulk storage capacity requirements for LPG depend on activity requirements, frequency of deliveries, and dependability of supply as well as lack LPG on base operations. Historical data is a good resource for developing a requirement looking for predictable changes in demand (i.e., loss of metal shop, increase in ship homeporting, increase in local dental operations, etc.). Otherwise, review equipment specifications for consumption rate as well as equipment usage to determine basic requirement. Again, allow for impacts from delivery schedules and dependability. Design guidance, including safety features, can be found in the most current version of Unified Facilities Criteria Design: Petroleum Fuel Facilities (UFC 3-

460-01), located on the Whole Building Design Guide (WBDG) website at the following link:

https://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc/ufc-3-460-01

411 82 CONTAMINATED FUEL STORAGE (BL)

FAC: 4211
BFR Required: Y

41182-1 **DEFINITION.** A fuel storage facility requires temporary storage for off-specification (contaminated) fuel.

41182-2 **REQUIREMENT.** Separate tanks should be provided for each type of fuel stored and consumed in large quantities. Review historical data to determine typical volume of delivery and method and schedule of disposal to determine tank size.

411 84 BULK (DEPOT) HEATING FUEL STORAGE (BL)

FAC: 4111
BFR Required: Y

41184-1 **DEFINITION.** Heating fuel oil storage may include storage tanks for kerosene and several different grades of diesel oil.

41184-2 **REQUIREMENT.** The station's requirements and mission will determine the quantity of any type of heating fuel oil stored. Some bases may rely on contract deliveries versus depot support. In these instances, depot storage should not be provided.

412 LIQUID STORAGE OTHER THAN WATER, FUEL AND PROPELLANTS

412-1 GENERAL DESCRIPTION

This group includes tank storage, accessories and piping for organic liquids such as cottonseed, linseed or soybean oils and other non-fuel liquids such as lubricants, ballast, or waste oils. Historical data should be available to determine rate of delivery and storage requirement. For waste liquids and oils, methods and schedule of disposals should be considered when determining storage requirement.

412-2 STORAGE QUANTITIES

No specific planning factors for the following category codes are currently available. Historical data may be used to develop the basic requirement including review of delivery schedules and removal of materials. Method of delivery/removal (i.e., pipeline to barge, truck, etc.), maximum quantity delivered/removed (is incoming quantity greater than outgoing quantity) and frequency (how often is material delivered to tanks and how often is material taken from tank) should also be considered.

412-3 CATEGORY CODES

The individual category codes in this group are shown below:

412 15 ROAD OIL STORAGE (GA)

FAC: 4121
BFR Required: N

412 25 LUBRICANT STORAGE (GA)

FAC: 4121
BFR Required: N

412 35 BALLAST AND SLUDGE STORAGE (GA)

FAC: 4121
BFR Required: N

412 40 ORGANIC OIL STORAGE (GA)

FAC: 4121
BFR Required: N

412 45 MISCELLANEOUS LIQUID STORAGE (GA)

FAC: 4121
BFR Required: N

412 50 INDUSTRIAL/POL WASTE STORAGE FACILITY (GA)

FAC: 4121
BFR Required: N

420 AMMUNITION STORAGE

420-1 DEFINITION

Ammunition storage utilizes magazines, general purpose and refrigerated storehouses, tanks, open storage pads and associated stationary equipment for storage of Ammunition, Inert Ammunition Components, Liquid Propellants and Weapon-Related Batteries.

Category groups pertaining to these facilities are as follows:

Code 421 Ammunition Storage (Tables 420-I thru 420-19)

The 421 series category codes have been re-organized to simplify and make category codes more consistent with magazine construction design. 421-22 High Explosive Magazine becomes the primary category code. The following category codes have been eliminated and rolled up under 421-22 High Explosive Magazine:

- **421 12 Fuse and Detonator Magazine**
- **421 52 Smokeless Powder and Projectile Magazine**
- **421 72 Missile Magazine**
- **421 83 High Performance Magazine**

Code 423 Ammunition Storage -Liquid Propellants (Tables 420-20 thru 420-25)
Code 424 Weapon-Related Battery Storage
Code 425 Open Ammunition Storage

NOTE: All planners developing magazine BFRs must have current certification through AMMO-36 Explosives Safety for Naval Facility Planning offered by the Defense Ammunition Center.

420-2 GENERAL STORAGE REQUIREMENTS

Ammunition and bulk explosives should be stored in magazines of approved design, sited and designated for specific purposes. The type and amount of material that may be stored in any magazine is dependent on the quantity-distance requirements and permissible storages as established by the Department of Defense Explosives Safety Board (DDESB) and as approved by the Naval Sea Systems Command. These safety distance requirements are designed to provide the inhabitants of nearby communities, military personnel, and adjacent public and private property reasonable safety from injury or destruction from possible fires or explosions, and to keep to a minimum the loss of valuable ammunition stores through fire or explosions.

420-3 MAGAZINE AREA

The magazine area is the area surrounding a magazine or group of magazines, where personnel movements are restricted in the interest of safety. Magazines must be sufficiently remote from inhabited buildings, passenger railroads, and public highways, including navigable waters, so that the dangers and risks involved in storing explosives and ammunition are confined primarily to the magazine area. In order to insure this safety zone the DDESB has spacing criteria for magazines, based on the type of hazard involved and the quantity of explosives stored. See Naval Sea Systems Command Publication NAVSEA OP-5 Volume 1 (current revision) for Quantity-Distance Requirements. In the case of existing facilities, spacing criteria may limit the amount of explosives stored in a magazine to less than full capacity. In addition, limits have been set on the maximum amount of explosives that can be stored in certain types of magazines. This information is listed in the category code descriptions.

420-4 ORDNANCE HANDLING, LOADING AND OFFLOADING AREA

For new construction of Earth Covered Magazines (ECM), a concrete area will be required in front of the ECM for handling, staging, inspection, loading and offloading ordnance. This paved area will ensure adequate space is available to handle ordnance in accordance with the safety principles and tenets outlined in NAVSEA OP 5 Volume 1, Ammunition and Explosives Safety Ashore. This paved area provides safe turning distances for Material Handling Equipment (MHE) transporting ordnance and for ordnance transportation conveyances while allowing spotters and safety observers a clear view of the operation from a safe distance. The area provides critical space and clearances for ordnance staging, set-down, and maneuvering containerized weapons and pallets to/from flat bed and enclosed commercial conveyances.

For Box Types C, D, G, H, and Containerized Long Weapons Storage (CLWS) Double Bay magazines, the paved area must be approximately 175’ wide centered in front of the magazine and extend 85’ outward from the magazine. For Box Type Modular Storage Magazines (MSM) and CLWS Single Bay magazines, the paved area must be approximately 100’ wide centered in front of the magazine and extent 85’ outward from the magazine.

The paved area must drain away from the ECM in a single continuous plane and the grade must be 0.5 % min with a 2.0 % max slope from the magazine.

The paved area must not be part of an adjacent road, but must connect with the adjacent road with an adequate turning radius or short access road. The paved area must be measured from the face of either, the ECM headwall where there is no loading dock or from the face of the ECM loading dock.

Where the above paved area is not available in front of the ECM, the planner must coordinate with the Local Ordnance Handling Activity and their respective Echelon III command to review and assess the impacts to ordnance handling safety. If the appropriate area is not provided, the Echelon III command must provide written (via email) concurrence of the proposed alternative to ensure all risk management concerns have been addressed or mitigated.

The ordnance handling, loading and offloading area will be recorded under Category Code 852-40.

420-5 SEGREGATION OF MATERIALS

The dangers or hazards involved in the storage of ammunition or explosives are not measured solely by the quantity of explosives stored, but also by its sensitivity - explosives that present similar hazards may generally be stored together. Tables showing compatibility relationships can be found in the NAVSEA OP-5, Vol. I (current revision).

420-6 WEIGHT MEASUREMENT

Net Explosive Weight (hereafter referred to as NEW). This is the weight of explosive material, and is measured in pounds. In items of ammunition with a high explosive main charge, fuses containing ignition explosives, and a propelling charge of smokeless powder, the NEW is calculated in accordance with NAVSEA OP-5 Vol. I, Chapter 5. It is the NEW of ammunition or bulk explosives that is used in application of explosive safety quantity-distance (ESQD) tables.

420-7 SITING REQUIREMENTS

To ensure the prevention of unacceptable damage or injuries in the event of an accidental explosion, siting criteria have been established to define minimum required separation distances between a Potential Explosion Site (PES) and other facilities. Minimum separation distances have also been established to prevent sympathetic detonation between two PESs, and to prevent prompt propagation of an explosives event between two PES's. ESQD minimum separation distances are based upon several factors including, but not limited to:

- The level of protection mandated by the applicable explosive safety standard
- The Exposed Site (ES) type and classification
- The NEW
- The hazard classification of the ammunition and explosives at a PES
- The physical orientation between the PES and the ES
- The presence of effective barricading

Minimum ESQDs are defined in the applicable DoD and service specific explosive safety standards for various applications. These ESQDs are based on maximum levels of risk considered acceptable for various types of ES. Separation distances are not absolute safe distances, but are relative protective or safe distances.

Use greater distances than those shown in the explosive safety standards whenever practicable.

Explosives safety site plans are required for construction projects involving new PESs, new facilities (explosive or non-explosive) within the ESQD arc of existing PES, as well as for the upgrading or renovation of existing facilities (explosive or non-explosive) that might impact the explosives safety criteria applied to these facilities (e.g., removal of hardening for fragmentation that previously allowed the facility to be a lesser distance, change of mission that requires the facility to now be at a greater distance). These site plans are reviewed to ensure explosives safety criteria are being met by the proposed work. DoD requires most explosives safety site plans to be forwarded to the DDESB for review and approval. See NAVSEA explosives safety criteria for more detail on when a site plan is required and what level of site plan review and approval must be accomplished prior to commencing projects.

Table 420-1
CCNs Requiring Site Approval

116-55	148-35	216-10	226-25	226-66	421-22	425-11
116-56	148-40	216-20	226-30	226-70	421-35	
143-20	148-45	216-30	226-35	226-80	421-42	
143-21	151-10	216-40	226-40	226-81	421-48	
143-60	151-70	216-50	226-45	226-82	421-62	
148-20	212-10	216-55	226-50	226-85	421-82	
148-25	212-30	216-77	226-55	226-86	425-10	
148-30	212-50	222-10	226-56	226-88	425-30	

Explosives safety site approvals are required for facilities of the CCNs of Table 420-1. See NAVSEA explosives safety criteria, OP-5 and NAVFACINST 11010.45 (latest rev) for more detail. **The planner preparing the site approval must have current certification through AMMO-36 Explosives Safety for Naval Facility Planning offered by the Defense Ammunition Center**.

420-8 AMMUNITION LOADING

The first step in preparing requirements for ammunition storage is obtaining the authorized ammunition load plan for the installation or command for which the requirement is being prepared. To obtain the authorized load plan, the planner should contact the local or regional representative from Naval Munitions Command (NMC). When an NMC load plan is not available, the planner should contact the tenant command for which the requirement is being developed and request a copy of the Arms, Ammunition, and Explosives (AA&E) loading.

The load plan could be the Global Requirements Based Load Plan (GRBLP) or another site-specific requirement such as the tenant command's N4 shop providing the Navy Ammunition Logistics Code (NALC) items and the quantity being used, averaged over a

one year period. The GRBLP is developed and maintained by Naval Supply Systems Command, Global Logistics Support in Mechanicsburg, PA. The GRBLP will be obtained by NMC from Ordnance Information System (OIS). NMC should adjust the data to properly reflect the added ammunition maintenance load as well as a reduction factor to account for the percentage of the items that need to be stored ashore versus the items deployed afloat. Fleet Commanders Ordnance staff should be consulted for fleet ordnance download requirements from ships. NMC will provide this "adjusted" GRBLP to the planner for use.

420-9 TYPES OF MAGAZINES

The next step the planner should take is to determine the number of existing magazine assets for the installation or command and the exact type and size of each by design. This is contrary to typical requirement calculations made independent of existing facilities. A key component of the updated criteria is an accurate determination of the physical construction type of each magazine.

Earth-Covered Magazines (ECM) typically fall within one of the following categories. Details for these magazine types can be found in DDESB Technical Paper Number 15 (TP 15) Approved Protective Construction and UFC 4-420-01.

- Small "Keyport" or "Fuse & Detonator" magazines – typically smaller than 20' x 20'
- Arch magazines – typically 25' wide and varying in depth between 20' and 80' (can be standalone or one of three in a triple arch magazine facility).
- Legacy box magazines – Smokeless Powder and Projectile (SP&P), Standard Missile Magazines, Box Types A and B
- Modern box magazines – Box Types C, D, E, F and M
- Modular Storage Magazines (MSM) – 25' wide and varying in depth between 20' and 80'

Installations can commonly have several magazines that are modified versions of the types listed above. Both TP 15 and UFC 4-420-01 define magazine designs that are authorized for future construction. For new construction, the following magazines are recommended: Box Type C/D, Modular Storage Magazine (Navy), Modular Storage Magazine (European), Containerized Long Weapons Storage (32' Single Bay, 50' Double Bay). The CLWS magazine is currently under development and shall be ready 4th quarter of FY20. If a different magazine than the recommended designs listed above is being considered, the planner shall contact NOSSA to obtain approval for use.

The planner should contact the local NMC Detachment or Naval Ordnance Safety and Security Activity (NOSSA) for information on existing facilities. If this data does not exist, a detailed asset evaluation of the magazines should be conducted to identify the design of each ammunition storage facility. In addition, the planner shall consult the Magazine Design Type Identification Guide, which provides technical and detailed information on the various magazine design types (both legacy, and approved for new construction) used by the Navy and Marine Corps. The magazine type is an identifying

feature on the iNFADS Property Record Card. The Magazine Design Type Identification Guide is available on the NAVFAC Criteria Management Portal page: Magazine Guide

420-9.1 MAGAZINE ASSET EVALUATION

When conducting an asset evaluation survey of an ammunition storage magazine, the planner should work with the NMC Detachment representative and have access to the installation's latest Explosives Safety Siting *(*ESS*)* software program. Planners should use the "Magazine Construction Assessment Report" (MCAR) to record the magazine physical characteristics while in the field (link to downloadable form is referenced below).

The planner should physically inspect and record the following data of each magazine:

- Interior Length - The interior measurement (to the nearest inch) of the distance from headwall to back wall.
- Interior Width - The interior measurement (to the nearest inch) of one side to the other. For arch magazines, this measurement is taken at the base of the wall.
- Interior Height - The vertical distance measured from the ground inside to the ceiling (to the nearest linear foot). For box type magazines the ceiling is sloped and the height will vary. The height should be measured at the high and low points.
- Exterior Length – The exterior measurement (to the nearest inch) of the magazine. For earth covered magazines, refer to the Magazine Design Type Identification Guide for specifications.
- Exterior Width – The exterior measurement (to the nearest inch) of the magazine. For earth covered magazines, refer to the Magazine Design Type Identification Guide for specifications.
- Doors - The number of doors, height and width (to the nearest inch), and thickness (to the nearest inch) of the door panel as well as the clear opening and location from center of headwall. Record if the door is single or double leaf design and whether the door is designed to swing open or slide open. If the door has more than one steel plate in thickness (i.e., is the door a built-up section), record details of the various plates and the channels/beams/bracing used to construct the door. Note the bracing and bearing surfaces supporting the door. Specifically, note any corbels on the ceiling or pull-up door stops in the floor.
- Headwall – Measure the thickness (to the nearest inch) of the thinnest part of the head wall. This may not be directly measurable at the door opening. Record any window or other opening in the headwall that is not concrete.
- Columns – Number, width, height and distance between (to the nearest linear half-foot) each column. Note the type and dimensions (width and height to the nearest inch) of the column header at the ceiling. Note if there are multiple

column rows and the number in each row as well as the distance between (side to side).
- Bays – Number of and distance between (front to rear) column bays.
- Miscellaneous – Indicate presence of loading dock, wing walls, IDS, revetment/berm/barricade, mechanical room and crane. Measure the loading dock length, width and total area (square feet). Measure the revetment distance from the headwall (feet). Identify IDS type and access type (rail, pallets, forklift, small missile, large missile, etc.).
- Photographs of each building, facility and structure. Photographs of the interior of the magazine, the head wall from the outside and inside, and the door from the outside and the inside. (NOTE: photographs are subject to security restrictions).
- Note any other structural feature such as HVAC openings, rails in the floor, added walls or racks

This data should be compared against known designs in the Magazine Design Type Identification Guide, available on the NAVFAC Criteria Management portal page to determine the magazine type. Both the MCAR and the Magazine Design Type Identification Guide are available on the Criteria Management portal page (located HERE). Because variations to the standard magazine types do exist at many installations, capturing the key structural features of each facility is essential. In these cases, the planner should consult with structural engineers from NAVFAC Capital Improvements or NOSSA. The CODEX is a 10-digit code which describes magazine type (including variants of the main types), strength (7 Bar, 3 Bar, and Undefined, as well as Flat Roof downgrade, and types of Above Ground Magazines (AGMs)), and exterior features such as barricades, access in/out of the magazine, and if there is or is not Intrusion Detection System (IDS) protection, and the level of security provided by the magazine. The CODEX coupled with the Magazine Construction Assessment Report (MCAR) provides the definition of a magazine which sites physical capabilities, strength and security requirements of ammunition stored. The CODEX consists of a ten-digit number represented by eight data fields in iNFADS. These fields are:

- Facility Type – 1st and 2nd digit
- Facility Sub Type – 3rd and 4th digit
- Strength Designator – 5th digit
- Barrier – 6th digit
- Access Type – 7th digit
- Intrusion Detection System (IDS) – 8th digit
- Mechanical Room – 9th digit
- Bridge Cranes/Monorails – 10th digit

Upon completion of the CODEX for each magazine, the planner shall validate the CODEX with the Installation Explosive Safety Officer (ESO). Once approved, the final MCAR shall be signed by the ESO and uploaded as an attachment to the property record card. In addition to uploading the signed MCAR, the magazine type must be entered for each facility via the “MCAR” tab located under the physical level tab of the

iNFADS Facility Module (at the utilization level). The information entered will subsequently appear on the Property Record Card.

Additional data that should be captured includes:

- Maintenance Responsibility UIC
- User UIC
- Presence of a front loading dock or apron. Loading docks shall be classified as a utilization within the magazine's property record card under Category Code 85115 "Load/Unload Ramp."
- Presence of front wing walls. These are concrete walls at ECMs that flank both sides of the headwall.
- Presence of a mechanical room. Mechanical rooms shall be classified as a utilization within the magazine's property record card under Category Code 89009 "Miscellaneous Utility Building."
- Presence of an adjacent, earthen berm or engineered revetment or barricade (typically either a steel or concrete structure). This structure should be recorded under Category Code 14910 "Protective Barricade/Revetment" and each non-contiguous asset should be counted separately on the property record card.
- Where there are multiple Hazard Class/Divisions (HC/D) in a magazine, the utilization of the magazine will be determined by siting the most restrictive HC/D.
- Where there are multiple tenant commands in a magazine, the utilization of the magazine shall be determined by the most restrictive HC/D material being held by the group of tenants.
- NOTE: Prior to changing the utilization Category Code of a magazine, the planner shall contact the Installation Explosive Safety Office and discuss/verify the action is acceptable.
- NOTE: Verify that the "Predominate Design" field in iNFADS aligns with the ESO's Safety Site Approval designation for the facility. This field shall only be changed with ESO approval.

420-10 PLANNING METHOD

A facility requirement is established by comparing the required load plan to the available existing facilities to determine if sufficient space exists or if a deficit exists. The load plan could be the GRBLP or another site-specific requirement. The list of existing facilities is based on the list of explosive storage facilities with current approved site plans.

The methodology used for the comparison and the required level of detail is a factor of the relative size of the installation or area being considered. Two generic size categories are described here. These categories are not rigid and judgment should be used to determine the most effective analysis method.

- Small scenario (manual)–
    - Fewer than 5 storage magazines, or

  - Storage of less than 4 item types, or
  - Storage of a small load plan (less than 100 pallets/footprints) in which the number of pallets/footprints is already defined
- Large scenario –
  - Any scenario with 5 or greater storage magazines, or
  - Storage of 4 or greater item types, or
  - Storage of a large load plan with greater than 100 pallets/footprints, or
  - Any complex load plan of unknown characteristics

NOTE: All planners developing magazine BFRs must have current certification through AMMO-36 Explosives Safety for Naval Facility Planning offered by the Defense Ammunition Center.

The Magazine Storage and Requirements Calculator (MSRC) has been developed to facilitate the planning process. The planner has the option to use the MSRC for either scenario described above, as deemed fit. But the small scenario allows the planner to handle small/simple scenarios without using the MSRC. This tool can be obtained from the NAVFAC Criteria Management portal page along with an instruction manual for its use. The direct link to the tool and all supporting resources is located here, and requires Common Access Card (CAC) access:

Magazine Storage & Requirements Resources

420-10.1 **PLANNING METHODOLOGY**. The general planning process follows the same steps regardless of the approach used. Each of the following steps is described in more detail for each scenario size. Instances in which the MSRC can or should be used are identified.

1. Characterize the load plan.
2. Define the list of existing magazines.
3. Perform a stowage analysis.
4. (Optional in the event of a deficit of magazine space) Identify the preferred magazine type for hypothetical additional magazines and then optimize the storage of the remaining load plan items into this magazine type.
5. Magazines facilities are pre-approved, non-deviation, construction designs. The MSRC will provide the required number of magazines in whole units and if the planner is developing the requirement by hand calculation, the final requirement shall also be in whole units.

420-10.2 **CHARACTERIZE THE LOAD PLAN**. This step translates a load plan of individual items (e.g., bullets and bombs) into a defined number of stowage footprints (e.g., 46 pallets and 12 large bombs) as defined in Table 420-1. The load plan is obtained from NMC or other tenant command and has been previously adjusted by NMC to properly reflect the added maintenance load as well as a reduction factor to

account for the percentage of the items that need to be stored ashore. NMC will provide this “adjusted” GRBLP to the NAVFAC planner or contractor for use.

At a minimum, the GRBLP will contain the Navy Ammunition Logistics Code (NALC) and a quantity of individual items for each NALC. The GRBLP may also include an “owner” or other designator, though this is not necessarily required.

The planning process (either using the MSRC or any “manual” process) will translate the load plan into an equivalent number of generalized footprints. The generalized footprint types used in this process are (with nominal storage Length x Width x Height provided in inches):

- Standard Pallet (48x40x34)
- Oversized Pallet (53x47x43)
- Small Bomb (65x36x32)
- Large Bomb (107x41x24)
- Small Missile (127x43x24)
- Medium Missile (159x36x49)
- Large Missile (241x40x41)
- Extra Large Missile (308x40x40)

If the MSRC is used (for either a small or large scenario), the GRBLP is entered into the spreadsheet and the equivalent number of various footprints can be output as a report.

Additional factors including Hazard Class/Division (HC/D), storage Compatibility Group (CG) and NEW of each item are also gathered for each item. If the MSRC is used, these values are obtained automatically from the technical data obtained from OIS based on the NALC for each item.

Where there are multiple Hazard Class/Division (HC/D) ordnance in the load plan, the BFR CCN will be determined by siting the most restrictive HC/D.

420-10.3 **DEFINE THE LIST OF EXISTING MAGAZINES**. In this step, magazines that are acceptable for storage of the load plan are identified with sited NEW quantities. This list should be correlated with iNFADS, NMC and NOSSA for agreement. Magazines typically fall within one of the following categories. Details for these magazine types can be found in TP 15.

- Small “Keyport” or “Fuse & Detonator” magazines – typically smaller than 20’ x 20’
- Arch magazines – typically 25’ wide and varying in depth between 20’ and 80’
- Legacy box magazines – Smokeless Powder and Projectile (SP&P), Standard Missile Magazines, Box Types A and B
- Modern box magazines – Box Types C, D, E, F and M
- Modular Storage Magazines (MSM) – 25’ wide and varying in depth between 20’ and 80’

The NAVFAC planner or contractor obtains the list of magazines from iNFADS and verifies with the local installation. Sited NEW values are obtained from the local Explosives Safety Officer, Installation Planner or NOSSA. The MSRC includes the capability to import a list of magazines generated from the ESS software. See the MSRC User's Manual for details.

Each of the magazines other than the small Keyport and Fuse & Detonator types can be modeled in the MSRC as a standard type. Other types can be modeled as user-defined magazine types in the MSRC.

420-10.4 **ANALYSIS PROCESS**. In this step, the load plan is systematically allocated throughout the existing magazines. This process may be very direct for small scenarios. For larger scenarios, the MSRC has been developed to facilitate this process using methods and requirements approved by NAVFAC, NMC, Fleet and NOSSA. The intended outcome of this step is to show that all munitions in the load plan can be stowed within the list of available magazines while satisfying CG rules, sited NEW limitations and spatial constraints.

The maximum number of footprints within a specific type of magazine can be obtained using the MSRC stowage matrix shown in Table 420-1. Small Keyport and Fuse & Detonator magazines are not accounted for in this table.

This table assumes that all items are stacked 3 containers high. If a given NALC has a different maximum allowable stack height, the values in Table 420-1 would be scaled accordingly. If the number of footprints to be stowed does not entirely fill one or more stacks, empty spaces must be accounted.
Fractions are used to account for mixing of various footprint types. As an example of this, if an 80' Arch contains 58 large bombs (50% of its capacity for large bombs), it could only accept 49 standard pallets (50% of its theoretical max capacity of standard pallets) before it is considered completely full.

The values in this table have been determined by NMC, NAVFAC and NOSSA, and NAVSEAINST 8024.2 (latest revision) and account for all rows and other wall standoff requirements.

Table 420-2
MSRC Stowage Matrix

Magazine Type (depth)	Standard Pallet	Oversized Pallet	Small Bomb	Large Bomb	Small Missile	Medium Missile	Large Missile	Extra Large Missile
Arch (20')	20	--	--	--	--	-	--	--
Arch (25')	26	--	--	--	--	--	--	--
Arch (40')	48	--	--	--	--	--	--	--
Arch (50')	65	30	109	68	--	--	--	--
Arch (80')	98	48	153	116	--	--	--	--

Magazine Type (depth)	Standard Pallet	Oversized Pallet	Small Bomb	Large Bomb	Small Missile	Medium Missile	Large Missile	Extra Large Missile
Triple Arch	294	144	459	348	--	--	--	--
SP&P I	432	216	288	144	192	144	--	--
SP&P IIA	480	396	480	240	264	198	60	--
SP&P IIB	426	276	303	198	224	114	30	--
Box A	426	276	303	198	224	114	30	--
Box B	468	306	338	212	192		36	--
Box C	450	288	324	216	240	126	36	36
Box D	750	432	525	360	400	198	90	60
Box E	450	288	324	216	240	126	36	36
Box F	750	432	525	360	400	198	90	60
Box M *	--	--	--	--	--	--	153	108
Std Missile Mag I	408	286	305	198	182	--	--	--
Std Missile Mag II	430	302	324	225	120	--	--	--
MSM (20')	30					--	--	--
MSM (40')	78	72	108	60	72	15	--	--
MSM (60')	129	108	162	90	108	22	--	--
MSM (80')	180	144	207	120	144	30	--	--
CLWS 32’ x 93.5					84	60	48	36
CLWS 32’ x 117					168	126	60	48
CLWS 50’ x 117 Double Bay					504	336	210	168

* Box M has not been considered for any application other than Large and Extra Large Missiles

420-10.5 **SMALL SCENARIO ANALYSIS**. For a small scenario, it is not necessary to use the MSRC. If the number of equivalent footprints within the load plan has been determined (see Section 420-10.2) and the magazine types have been defined (see Section 420-10.3), the NAVFAC planner or contractor can distribute the load plan throughout the magazines manually. CG mixing rules, sited NEW quantities, as well as any other physical constraints must be considered.

The planner can directly compare the number of generalized footprints to the values shown in Table 420-2 for the available magazine types. Magazines can be filled with a mix of footprint types if necessary. In this case, fractions of a full magazine would be used as described in Section 420-10.4.

The output from this analysis would be a listing of all load plan items stowed, and if applicable, a listing of load plan items not stowed. The magazine(s) used for stowage should be listed for each load plan item. These outputs can be used to populate the BFR report.

420-10.6 **LARGE SCENARIO ANALYSIS**. These scenarios should be analyzed using the MSRC. An iterative process is used to optimize the allocation of the load plan throughout the list of available magazines. The MSRC allows the user to systematically work through the load plan to ensure that required storage constraints are met, and if desired, specific munitions are stowed in compatible magazines. Examples of this include items requiring Intrusion Detection Systems (IDS) are stowed in magazines equipped with IDS, or particular items may be required to be stowed in a specific area of the installation, depending on local guidance and discretion.

Detailed instructions for the use of the MSRC are provided in the MSRC Users' Manual provided with the tool. Here is a direct link to the user manual. Common Access Card (CAC) access is required.

MSRC User's Manual

The MSRC provides many options for output from the analysis beyond generating the BFR. Some of these options include a listing all load plan items stowed. If applicable, a listing of load plan items not stowed and a theoretically stowed items listing in each magazine are also included.

420-10.7 **ESTIMATING FUTURE MAGAZINES**. This section describes the additional magazines planning process, whether they are planned as part of a new installation or to meet an existing storage capacity deficit.

In the event that the load plan cannot be completely stowed within the existing magazines, or in the event that a potential future scenario is being studied, the MSRC can be used to estimate the number of magazines required to store this material. In this scenario, the proposed magazines' sited NEW must be determined or estimated (see Section 420-10.2) to ensure a proper required magazines quantity. The proposed sited NEW estimates may be used in the tool, but must be verified by the Explosive Safety Software (ESS) Planning Tool option prior to using the information in a BFR. To use this methodology, check with the local Explosives Safety Officer, Installation Explosive Safety Planner or NOSSA.

Where multiple magazines are proposed at less than 500,000 pounds NEW, if possible, increase the Intermagazine Distance (IMD) separation distance to 100 ft. both “Side to Side” and “Rear to Rear” and 160 ft. “Front to Rear.” This will support a temporary waiver to increase the magazine’s allowed NEW storage up to 500,000 pounds when events dictate such a waiver.

Where magazines are proposed at a “restrictive land available site” and continuous earth cover is considered, as part of the siting criteria, the following must be met:

a) the Intermagazine Distance (IMD) separation distance both Side to Side, Rear to Rear, Front to Rear and;
b) the two earth covers intersect at or below a point ½ the height of the two structures – i.e. H/2 where H is the height of the structure (at structures highest point).
    a. Example: two Box Type D magazines – 15’-8” (height of interior roof at front of magazine) + 1’6” (roof thickness) = 17’-2”, 17’-2” divided by 2 = 8’-7”. The low point of the earth cover must at or below 8’-7” as measured from finished grade.

If only one or two types of munitions need to be stowed, the MSRC Stowage Matrix can be used directly to estimate the number of required magazines. Compatibility Group mixing rules as well as sited NEW quantities and any other physical constraints must be considered.

The MSRC can be used to estimate required magazines to stow any remaining load plan for an analysis or theoretical scenarios. When using the MSRC, the user will select the preferred magazine type to be constructed. By default, Box Types C, D, CLWS Single Bay, CLWS Double Bay or any size of MSM should be selected for the analysis. Other magazine types are not permitted for new construction.

The following table is from the Whole Building Design Guide:

“Ammunition and Explosive Storage Magazines: ECM Approved For New Construction”

https://www.wbdg.org/building-types/ammunition-explosive-magazines/ecm-approved-new-construction

Table 420-3
Magazine Type and Gross Square Footage

Magazines Approved for New Construction per Department of Defense Explosive Safety Board (DDESB) Test Paper (TP)-15, “Approved Protective Construction”			

Magazine Type	Drawing Number	Number of Doors/"Bays"	Gross Square Footage (GSF)
RC Box Type "C"	14004689-14004720 Rev. 1 (Without Platform)	3	5,920
RC Box Type "C"	14005091-14005122 Rev 1 (With Platform)	3	5,920
RC Box Type "D"	18232899-18232936 (Without Platform)	5	10,057
RC Box Type "D"	18232899-18232978 (With Platform)	5	10,057
Modular Storage Magazine:	Army:421-80-07	1	2,124.22
Modular Storage Magazine:	**NAVY**:14063806-14063858 **ARMY**:421-80-08, 421-80-13	1	
25' w x 20' depth variant		1	894
25' w x 40' depth variant		1	1,438
25' w x 60' depth variant		1	1,978
25' w x 80' depth variant			2,518
CLWS, Single Bay, 32' w x 93'-6" depth	TBD	1	3,706
CLWS, Single Bay, 32' w x 117' depth	TBD	1	4,552
CLWS, Double Bay, 50' w x 117' depth per bay	TBD	2	13,254

Notes:

1. Army ECM, Concrete Oval-Arch, dwg. No. 421-80-09, 25' width x 90' depth is approved for new construction but door width of 8' limits the use of the magazine to Small Bombs, Oversized and Standard Pallets.
2. Army RC Box, Dwg No. 421-80-07, 24' width x 80' depth, are approved for construction but in lieu of sliding doors have two steel doors that are manually opened and there is a 4" lip at base of opening for doors to rest against, causing loading/unloading issues.

3. Army RC Box, Dwg No. 421-80-13, 25’ width x 80 depth is approved for European construction but NOSSA will required modifications to the design drawings to support Lightning and Electrical.
4. Munitionslagerhause (German Deign) magazines, although shown as approved for new construction, will require a review and design update before being avail for NOSSA/DDESB approval for construction.

420-11 CONTAINERIZED AMMUNITION

Implementation of directives for containerizing ammunition for shipment is now underway at certain ordnance activities, initially at coastal POE's. For these activities, category codes and planning factors have been developed to facilitate proper identification and sizing of the facilities that are in support of containerized ammunition shipments. The following category codes and planning factors are established for handling of ammunition by containers. As warranted, additional category codes and planning factors will be developed.

148 35	Container Holding Yard (Loaded)
148 40	Container Transfer Facility
148 45	Rail/Truck Receiving Station
151 70	Ordnance Container Handling Pier
152 70	Ordnance Container Handling Wharf
156 20	Container Operations Building
218 10	Container Repair and Test Building
425 20	Container Holding Yard (Empty)
860 20	Explosive Barricade for Suspect Trucks and Railroad Cars

421 AMMUNITION STORAGE DEPOT AND INSTALLATION

421-1 DEFINITION

Ammunition storage utilizes magazines or other suitable containers to store ammunition for the ultimate user's logistic flexibility at an activity. Planning methods are provided for the following types of ammunition storage facilities:

421 22	High Explosive Magazine
421 32	Inert Storehouse
421 35	Ready Magazine
421 42	Smokedrum Storehouse
421 48	Small Arms/Pyrotechnic Magazine
421 62	Special Weapons Magazine

421 12 FUSE AND DETONATOR MAGAZINE (SF)

FAC: 4211

BFR Required: Y

This category code is no longer in use. Please use 421 22 High Explosive Magazine or 421 48 Small Arms/Pyrotechnic Magazine as appropriate.

421 22 HIGH EXPLOSIVE MAGAZINE (SF)

FAC: 4211
BFR Required: Y

42122-1 **DEFINITION.** A high-explosive magazine is used for the storage of mass- detonating explosives. Bomb, warheads, missiles, naval mines, demolition charges are examples of munitions generally stored in high explosive magazines. Refer to the Magazine Design Type Guide for types of magazines commonly found on installations.

Please refer to Section 420-8 TYPES OF MAGAZINES for details on how to survey existing magazines and DDESB Technical Paper Number 15 (TP 15) Approved Protective Construction and UFC 4-420-01 for descriptions of magazines and those authorized for construction.

Note: The following category codes have been eliminated and rolled up under 421-22 High Explosive Magazine:

- **421 12 Fuse and Detonator Magazine**
- **421 52 Smokeless Powder Projectile Magazine**
- **421 72 Missile Magazine**
- **421 83 High Performance Magazine**

421 32 INERT STOREHOUSE (SF)

FAC: 4211
BFR Required: Y

42132-1 **DEFINITION.** Storehouses for inert material are usually 50 x 200 ft. or 106 x 204 ft. or multiples of these basic dimensions, and are similar to commercial warehouses. These storehouses are used for the storage of such non-explosive items as bomb tails, machine gun links, empty cartridge cases, and packing materials.

Although the height of stowage in these storehouses depends on the type materials, the average stacking height is about 10 feet. Storage space available for storage will meet a minimum criteria of 60 percent of net storage space used for storage operations. The net storage capacity of the 50 x 200 ft. storehouse is approximately 60,000 cubic feet. For planning of installation inert storehouses use only the 50 x 200 ft. storehouse.

421 35 READY MAGAZINE (SF)

FAC: 4221
BFR Required: Y

42135-1 **DEFINITION.** This category code and nomenclature encompasses two specific types of magazines whose requirements are determined by the function performed. The three types of magazines within this category code are identified as:

(a) **Ready Service Magazine.** When shore establishments require certain types of ammunition to be stored in a ready service condition, in order to reduce the arming time, the ammunition may be stored in designated Ready Service Magazines. A 12' x 17' box-type magazine is suitable for performing this function. This facility is usually located at an air station and is used to hold ammunition and/or weapons that are built up from a storage configuration ready for arming an aircraft, or to receive for temporary storage, ammunition and/or weapons from aborted aircraft. These paved areas for loading or unloading ordnance from an aircraft are typically captured under CCN 11656 “Combat Aircraft Loading Area (CALA)”.

(b) **Special Service Magazine**. This type of magazine is provided in or near such facilities as loading plants, filling houses, weapon assembly buildings, ammunition maintenance buildings and Weapon Quality Evaluation Laboratories. The magazine can be a special size and construction, depending upon the material(s) stored therein. However, a 6' x 8' Keyport magazine has been found to be most suitable for this application. The need to provide segregation of non-compatible, open explosives frequently gives rise to a requirement for separate magazine structures, irrespective of any loading factor. Historical data should be used to determine the number of these facilities required which is dependent upon both the amount of explosives stored and the compatibility of the explosives themselves.

Note: Ready Service Lockers (i.e. RSLs, GOLANs, RMAG, NABCOs, CONEXs, etc.) are not Class 2 Real Property and shall not be entered into iNFADS. NAVFAC HQ instruction on RSLs as equipment/non-RP can be found here: NAVFAC HQ RSL Instruction. Concrete pads supporting RSLs shall be recorded under Category Code 425 11. The Pad should be sited for RSL’s NEW limit.

421 42 SMOKEDRUM STOREHOUSE (SF)

FAC: 4211
BFR Required: Y

42142-1 **DEFINITION.** Chemical and smoke mixtures are stored separately in fire- hazard type magazines or in buildings especially designed for such storage. Drums of smoke mixture may be stored in surface buildings with special racks for

support, and overhead equipment for handling. Smokedrum storehouses are of the sizes and capacities shown in Table 42142-1.

Table 42142-1
Smokedrum Storehouses

Size Number	Capacity (Drum)	Approximate Bldg Dimensions In Feet				
		W		L		H
1	120	25	x	17	x	14
2	240	25	x	34	x	14
3	360	25	x	51	x	14
4	480	25	x	58	x	14

For more than 480 drums, two or more buildings should be provided.

421 48 SMALL ARMS/PYROTECHNICS MAGAZINE (SF)

FAC: 4211
BFR Required: Y

42148-1 **DEFINITION.** This structure may be used to store Class 1 Division 3 and 4 ammunition. This type of magazine may vary considerably in size and description. The standard earth-covered concrete arch magazine without barricade and the non-earth covered two compartment magazine are commonly used for this purpose. If the land area is limited and there is a large requirement for small arms/pyrotechnics storage space, the large triple arch magazine maybe used. See section 420-9 PLANNING METHOD to calculate requirements. For ammunition class descriptions, see OPNAVINST 8020.8.

421 52 SMOKELESS POWDER PROJECTILE MAGAZINE (SF)

FAC: 4211
BFR Required: Y

This category code is no longer in use. Please use 421 22 High Explosive Magazine or 421 48 Small Arms/Pyrotechnic Magazine as appropriate.

421 62 SPECIAL WEAPONS MAGAZINE (SF)

FAC: 4211
BFR Required: Y

42162-1 **DEFINITION.** The special weapons magazine is the same type of structure as the high explosive magazine and differs only in that it is used for the

storage of nuclear weapons. Magazines used for the storage of special weapons are subject to quantity-distance requirements and are limited to the maximum amount of nuclear material that can be stored in any one magazine. This information, along with the sizes and weights of nuclear weapons and security requirements can be obtained from:

- (S) SWOP 20-7, NUCLEAR SAFETY CRITERIA (U)
- (S) SWOP 50-1, NUCLEAR ORDNANCE GENERAL INFORMATION (U)
- (C) OPNAVINST C5510.83 SERIES, CRITERIA AND STANDARDS FOR SAFEGUARDING NUCLEAR WEAPONS (U)

Planning data for Category Code 421 62 related to specific locations will be classified in accordance with cognizant Navy directive.

421 72 MISSILE MAGAZINE (SF)

FAC: 4211
BFR Required: Y

This category code is no longer in use. Please use 421 22 High Explosive Magazine.

421 82 SUBMARINE LAUNCHED BALLISTIC MISSILE STORAGE FACILITY (SF)

FAC: 4211
BFR Required: Y

42182-1 No criteria are currently available for this Category Code.

421 83 HIGH PERFORMANCE MAGAZINE (SF)

FAC: 4212
BFR Required: Y

This category code is no longer in use. Please use 421 22 High Explosive Magazine or 421 48 Small Arms/Pyrotechnic Magazine as appropriate.

423 AMMUNITION STORAGE – LIQUID PROPELLANTS

423-1 DEFINITION

The siting of liquid propellant (energetic liquids) storage facilities and the amount of propellant that can be stored are subject to strict safety criteria due to the fire and/or detonation hazards involved. Factors such as the degree of hazard and the compatibility of propellants stored in close proximity to each other affect the spacing of storage facilities and the amount of propellant that can be stored. NAVSEA OP-5 Vol. 1,

Ammunition and Explosives Ashore provides criteria on hazard classification, quantity-distance tables, storage compatibility, and explosive equivalents.

423 10 LIQUID PROPELLANT STORAGE (GA)

FAC: 4231
BFR Required: Y

42310-1 **DEFINITION.** Storage vessel dimensions along with relevant siting requirements can be used to develop facility requirements.

423 20 LIQUID PROPELLANT DISPENSING FACILITY (GM)

FAC: 1221
BFR Required: Y

42320-1 **DEFINITION.** Liquid propellant storage and dispensing facilities shall satisfy the operational requirements of the particular command within whose jurisdiction the facilities are located.

424 WEAPON-RELATED BATTERY STORAGE

424-1 DEFINITION

Weapon-related storage utilizes refrigerated warehouses that are capable of maintaining at least subfreezing temperatures. This code is not to be used for other cold storage facilities.

424 10 WEAPON-RELATED BATTERY STORAGE (SF)

FAC: 4241
BFR Required: Y

42410-1 **DEFINITION.** Storage requirements can be determined from the quantity to be stored and the types of equipment used to rack and stack the batteries.

425 OPEN AMMUNITION STORAGE

425-1 **DEFINITION.** Provides open hardstands (pavements or prepared/stabilized surfaces) for ammunition storage and excludes all other hardstands.

425 10 OPEN AMMUNITION STORAGE PAD (SY)

FAC: 8526
BFR Required: Y

42510-1 **DEFINITION.** Refer to NAVSEAOP-5 Vol. 1 for regulations governing open storage of explosive material. Ordnance open storage is undesirable.

42510-2 **EXPLOSIVE SAFETY SITE APPROVAL.** Explosives safety site approvals are required for facilities of this category code. See NAVSEA explosives safety criteria for more detail. The planner preparing the site approval must have current certification through AMMO-36 Explosives Safety for Naval Facility Planning offered by the Defense Ammunition Center.

425 11 EXPLOSIVE STORAGE SITE PAD (SY)

FAC: 8526
BFR Required: N

42511-1 **DEFINITION.** This category code covers the pad, which must be made of concrete or asphalt, that Ready Service Lockers or reduced Quantity Distance (QD) equipment (i.e. RSLs, GOLANs, RMAG, NABCOs, CONEXs, etc.) are placed on. The site pad must be marked with a permanent facility marker (i.e. concrete monument, bollard, or placard) in accordance with the Installation Appearance Plan. The marker must be of the same level of permanent construction as the site pad.

For a newly constructed site pad, the edges must be constructed such that there is a minimum 1’ offset from any point along the perimeter of the storage equipment. The intent is to provide a 1’ offset on all four sides of rectilinear equipment, or a minimum of a 1’ offset at any point along the perimeter of non-rectilinear equipment.

For site pad areas obtained from existing paved surfaces such as aircraft aprons, etc., the dimensional rules for new pads still apply. In these cases, the dimensional area must be delineated by permanent markings such as road striping, permanent corner markers, or similar permanent markings, such that the dimensions of the site pad area can be validated at any point in the future.

The site pad must be sited for the equipment’s NEW limit and the site pad’s NFA number shall be incorporated into the site approval process, (i.e. NFA 0001, RSL 0001-1 RO 0001-1). The equipment number shall be a follow on number of the structure (i.e. 0001-1 or 0001-A).

The tenant command is responsible for maintenance (i.e. grounding and bonding test, etc.) of the storage equipment (i.e. RSL or other reduced QD equipment) on the site pad. The Installation’s Public Works Department is responsible for maintenance of the site pad (as it is real property).

If the planner is establishing a site pad area on an existing and approved contiguous surface, the planner must subtract the area of the site pad from the property record card of the existing contiguous surface.

42511-2 **EXPLOSIVE SAFETY SITE APPROVAL.** This structure is required to support equipment that stores explosive material. Therefore, explosive safety site approvals are required for equipment placed on this structure. In accordance with NAVSEA OP 5 Volume 1 (latest revision), the facility number for the site approval must reference the structure (site pad). See NOSAAINST 8020.22 (latest revision), NAVSEA OP 5, Volume 1 (latest revision), and NAVFAC Instruction 11010.45 for more detail. The planner preparing the site approval must have current certification through AMMO-36 Explosives Safety for Naval Facility Planning offered by the Defense Ammunition Center.

Note: Ready Service Lockers (i.e. RSLs, GOLANs, RMAG, NABCOs, CONEXs, etc.) are not Class 2 Real Property and shall not be entered into iNFADS. NAVFAC HQ instruction on RSLs as equipment/non-RP can be found here: NAVFAC HQ RSL Instruction. The Pad shall be sited for RSL's NEW limit.

425 20 CONTAINER HOLDING YARD (EMPTY) (SY)

FAC: 4251
BFR Required: Y

42520-1 **DEFINITION.** An empty ISO container-holding yard should be capable of storing at least one full container shipload plus 1/3 more. As the pipeline becomes full of containers, each container ship will discharge one container for each one loaded. Additionally, empty containers awaiting testing, repairs, stuffing or shipment to inland points will be on hand. Assuming a single berth pier/wharf for a 750 container ship, planning for an empty container-holding yard should be for 1,000 empty containers. See Figure 42520.1 for a typical 1,000-container yard layout. Total area of the holding yard is 19,180 SY. Size is predicated on 8' x 8' x 20' containers stacked three high. Containers are handled with container handling equipment or straddle carriers.

Figure 42520.1-Typical 1,000 Container Yard Layout

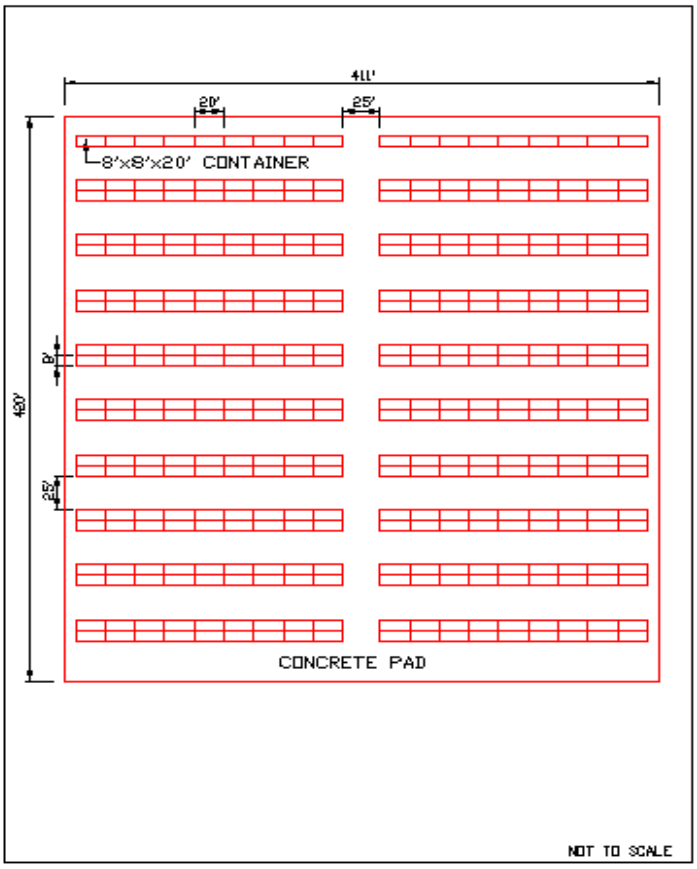

FIGURE 425-E0
CONTAINER HOLDING YARD (EMPTY)

425 30 BARRICADED MODULE (SY)

FAC: 4251
BFR Required: Y

42530-1 **DEFINITION.** A barricaded module is a barricaded area comprising of a series of connected cells with hard surface storage pads separated from each other by barricades. A light shed-type metal roof or fire retardant tarpaulin installed in a manner to provide sufficient ventilation between the tarpaulin and the stored ammunition may be used to cover the individual cells. Heavy structures or flammable materials will not be used for this purpose.

The maximum net weight of explosives permitted to be stored within each cell is 250,000 pounds. Storage pads should be hard surfaced, if possible, in order to minimize the effects of earth shock from an accidental explosion. No restrictions are imposed upon the arrangement of cells within a module or upon the arrangement of groups of modules, except that all cell openings will not be faced toward each other unless they are barricaded or meet the standard quantity-distance criteria for un-barricaded above ground magazines. See Figure 42530.1 for typical module layout. See NAVSEA OP-5 for site restrictions and facility design requirements.

Figure 42530.1 Typical Module Layout

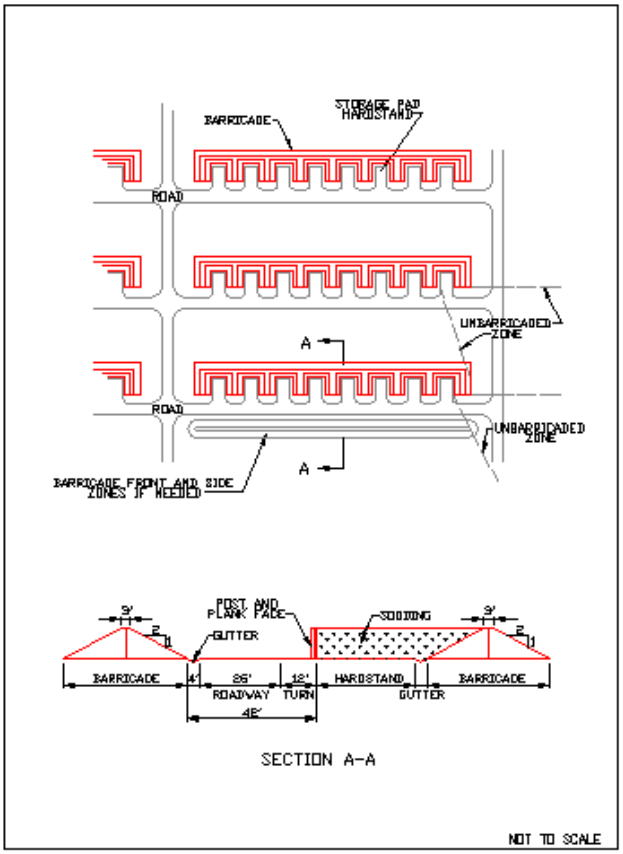

FIGURE 425-30
TYPICAL ARRANGEMENT OF EIGHT-CELL MODULES

42530-2 **EXPLOSIVE SAFETY SITE APPROVAL.** Explosives safety site approvals are required for facilities of this category code. See NAVSEA explosives safety criteria for more detail. The planner preparing the site approval must have current certification through AMMO-36 Explosives Safety for Naval Facility Planning offered by the Defense Ammunition Center.

430 COLD STORAGE

430-1 DEFINITION

Cold storage is planned to provide refrigerated warehouses for storage of General Supply Materials which require temperatures ranging from -10°F to 60°F in the following categories:

- Perishable Substances
- Photosensitized Material

- General Supply Batteries
- Medical and Dental Supplies

430-2 EXCLUSION

Excluded from this category group are cold storage for weapons-related batteries (use Category Code 424 10) and cold storage spaces that are a functional part of another facility such as an open mess, club, hospital, commissary or exchange. These cold storage spaces are planned as part of their respective main facilities and are accommodated within its space allowances.

430-3 OTHER APPLICABLE REQUIREMENTS

In most CONUS locations, Cold Storage Facility requirements have been all but eliminated through changes in supply business processes. Direct Vendor Delivery contracts provide such materials directly to end users in an as needed frequency required to effectively transfer the related warehousing from the public to the private sector vendors. These requirements guidelines are provided for those missions who do require an installation or area storage facility to hold some measure of items requiring cold storage.

430-4 STORAGE OF FARINACEOUS AND HIGH ACID FOOD PRODUCTS

These food products are properly stored in an environment where the temperature is between 50 and 70 degrees Fahrenheit. A cold storage warehouse will be required to provide chill storage at those activities where climatic conditions preclude the use of a general purpose warehouse.

431 10 COLD STORAGE WAREHOUSE (SF)

FAC: 4311
BFR Required: Y

43110-1 **DEFINITION.** A cold storage warehouse is planned to preserve the quality of perishable foods and general supply materials that require refrigeration. The warehouse will include freeze and chill space and normal processing facilities and mechanical areas. The space requirements are applicable to cold storage facilities of all sizes whether built as separate structures or in conjunction with other buildings and are determined by using the criteria furnished in the BFR guidance above. For installations with such requirements, correlated to loading, Table 43110-1 provides a means of estimating cubic feet. The facility requirements are based upon the cubic foot space required per man per 30 days. This method utilizes subsistence consumption requirements for shore facilities and provides for two types of storage requirements.

For additional information, see MIL-HKBK 1032/2.

Table 43110-1
TCF Allowances for Refrigerated
Warehouse Facilities per Man per Month

Total Cu. Ft. (TCF) Allowances for Category Code 431-10:

Type I Requirement: Allows 4 cubic feet (CF) of perishable subsistence per man per month when fresh milk and bread are received monthly.

Type II Requirement: Allows 3 CF of perishable subsistence per man per month when fresh milk and bread are received at least every other day.

Type	Net Cubic Feet Per Man Per Month	Universal Factor**	TCF Allowances Per Man Per Month*		
			Total	Chill	Freeze
I	4	1.96	7.84	4.12	3.72
II	3	1.96	5.88	4.12	1.76

* All allowances represent average values. If historical data are available that differ from these allowances, such data may be used for requirements planning if fully justified/documented.

** See derivation of "Universal Factor" in appendix P 80X. This factor states, “1.96 TCF are required per cubic foot of material to be stored or 78.4 TCF are required per M/T of material to be stored.”

440 GENERAL SUPPLY BUILDING

440-1 DESCRIPTION

This category group consists of supply-oriented covered storage and/or storage support facilities that are assigned to the Supply/Material Department or assigned for storage of operational mount-out stocks. Requirements allowance guidance can be found in the General Supply Planning Guidance under Requirements Determination.

440-2 DETERMINING GENERAL SUPPLY REQUIREMENTS

This section provides information regarding the general methods used to calculate Basic Facilities Requirements (BFRs) for supply facilities.

440-2.1 **Definitions.**

440-2.1.1 **Cubic vs. Square Feet.** Requirements for supply operations and logistics facilities planning are first found in volume and then in the associated area, as opposed to area alone. This initial measure of volume is more commonly in cubic feet (CF) or measurement tons (MT). A MT is a logistics term that is often convenient to express a palletized or material unit load - and is equal to 40 cubic feet. The second general phase of a logistics requirement calculation is the translation of a given volume into area or square feet of facility required. This second phase is wholly dependent on an assumption of facility and storage system configuration as it interjects an available height or stacking height (SH). This is the height available to the storage function. The accommodation of a given volume requirement can vary with that of different stacking heights. That is, a given volume or cubic foot requirement translates into SF – X with SH – X and translates to SF – Y with SH – Y. This height is either that of an existing or planned building and/or system.

440-2.1.2 **BFR Qualification - Existing vs. Planned Facilities.** Supply operations' dependence on available stacking height requires a BFR to carry an assumption of SH that is either based on an existing building and system (status quo), an existing building with system upgrades (modernization) or a new building. It is, therefore, important that the BFR be qualified with the assumptions related to the respective SH (used to translate cubic feet to square feet of facility required).

440-2.2 **Calculation Methods.** BFRs may be calculated using either the analytical/4-step method or an operational space analysis method as the situation dictates.

440-2.2.1 **Analytical or 4-Step Method.** There are four steps required for determining storage space requirements by this method. This method is thought to be the preferred and most practical for use in planning up to and including the activity 1391 level or as needed to feed strategic planning.

Step 1 - Total Cubic Feet. Determine the total cubic feet (TCF) required for the CF or MT of material to be stored.

The first factor in the two part equation is determining a cubic feet (CF) or MT required by the user or user group. This cubic measure can be provided by the user (e.g., via records or expert knowledge of business forecast) or determined via a survey of existing operations coupled with an interview aimed at validating observations and forecasting any changes (i.e., survey observes 1 CF, interview relates 20% forecasted increase, requirement is 1.2 CF). A normal desired forecast for requirements is five years.

The second part of this two-part equation translates the raw volumetric measurement of required material into a CF requirement of the accommodating system or facility. This adjustment or translation accounts for the inherent losses in a storage system due to normal operations (various system and operational space losses). A universal factor has been derived and found to be 1.96 for CF and 78.4 for MT. That means that for 1 CF equates to 1.96 TCF required and 1 MT equates to 78.4 TCF required. This universal loss factor, 1.96, adjusts the raw material cubic measurement for various system and operational space losses. For example, 100 CF of raw material required translates to 196 TCF storage space required.

Step 2 – Stacking Height. Determine a stacking height (SH = available stacking height) value. For an existing facility use the current SH value. For a planned facility suggested SH's are shown in Table 440-1.

Table 440-1 Suggested Stacking Heights for Planned Facilities

Type of Storage	Stacking Height (FT)
Open Storage	4 – 10
MTIS, ILO, Outfitting Facilities	4 (without racks) Up to 12 (if racks are planned)
SERVMARTS	4 feet for display gondolas 7 feet for bin shelving
Covered Storage Facilities (other than above)	12
High-Rise Facility (planned available storage height above 12 feet)	Use the planned available storage height.

Step 3 – Net Square Feet. Determine the projected net square feet or NSF requirement by dividing the projected TCF required by the SH value determined in Steps 1 and 2 above.

Step 4 – Gross Square Feet. A NSF to gross square feet (GSF) multiplier of 2.5 or 2.0 should be applied to adjust for aisle, operational, handling and all spaces within the outer portion of the exterior walls defining the notional facility. Use 2.5 with the more common, large aisle operations that normally utilize sit-down, rider counter-balance material handling equipment and are characterized by the related ten to twelve

feet maneuvering aisles. Recommend using 2.0 in facilities with more dense, modern systems referred to as very-narrow aisle. These will be characterized by aisles of less than seven feet and often outfitted with vehicle guidance such as electronic wire or mechanical rail. Where this very-narrow aisle system cannot be verified or confirmed, 2.5 should be used.

Alternative GSF Multiplier. Alternatively to the net to gross factors described above, a more accurate SF to GSF multiplier can be calculated, through a notional facility layout that depicts actual floor space required for the rack or storage footprint (i.e., no aisles or collateral areas) and the resulting total facility. The ratio of total space to racked space is the SF per NSF multiplier. For additional assistance please contact the criteria manager.

Additional Support Space. The net to gross factors listed in this step are intended to accommodate some nominal area for material receiving, processing, staging and shipping areas associated with the operation. As such required support areas can vary widely, additional space may be added to the requirement 'bottom-line' to allow for a more active receipt and shipping operation. This additional space should be supported by and documented from operator input. If such additional processing space is expected to exceed fifteen percent of the total facility, the planner should consider it a separate category code as it may begin to address a transshipment operation that is related to, but additive to, the related storage requirement calculation. In any case it would be a separate and additive calculation to that arrived using the net to gross above. Such transshipment category codes would include 156-10 and 143-55.

440-2.2.2 **Operational Space Analysis Method.** This method for determining the BFR is prescribed as a more accurate process than that developed using the 4-step method. This Operational Space Analysis Method is expected for any BFR project support beyond the activity 1391 level.

440-2.2.2.1 **Total Cubic Feet.** The TCF for the operation would be determined as described in step one of the 4-step method above (paragraph 440-2.2.1.1).

440-2.2.2.2 **Operational Analysis Mapping.** An operational analysis that maps the planned operation within an existing or planned facility should then be used to determine the facility requirements. Using input from the operator, the space analysis should identify and quantify the key operational components such as: administrative,

receiving, shipping, storage, aisles. etc. It is expected that the material storage or staging portion of this analysis will include consideration and identification of storage and material handling systems. Note that each of these areas may be comprised of distinguishable components (i.e., storage can be bulk, palletized, rackable and binnable). As actual or planned SH's, aisle spacing, mechanical and miscellaneous spaces are used in this method, no related estimating metrics are required.

440-2.2.2.3 **Gross Area Requirement.** The sum of the planned areas (i.e., areas comprising the operation) form the gross area requirement - the BFR. It is expected that such an analysis would be supported by narrative and graphical documentation sufficient to convey the planned operational construct that has been coordinated with and approved by the user.

440 - 2.3 DISCUSSION OF CUBE RELATIONSHIPS.

440 – 2.3.1 **Material Cube and the Measurement Ton**. The cube of material may be expressed in terms of several units of measure. However, cubic feet and Measurement Tons are the most commonly used in the Navy. A Measurement Ton (M/T) is a volumetric unit of measure defined as 40 cubic feet. An M/T of material can be configured in any shape. It can be visualized, for example, as 40 cubes of material measuring one cubic foot each. The cube of material in bin, rack and bulk storage areas is normally quantified in terms of cubic feet of material or M/Ts of material. The M/T is the preferred unit of measure in the Navy since it is the standard unit of measure used for shipboard cargo.

The following information may prove useful in estimating M/Ts of material in storage when no other data are available. A M/T of material is the appropriate average cube of pallet load of Navy shipment cargo on a standard Navy/DoD 40" x 48" pallet with a load height averaging 36", including pallet. The cube of an average Navy pallet load in storage is typically 0.8 M/Ts or 40" x 48" with a load height averaging 30", including pallet. The maximum pallet load height specified by Military Standard 147 is 54" (including pallet). A pallet load measuring 40" x 48" x 54" high (including pallet) equals 60 cubic feet or 1.5 M/Ts of material. The maximum cargo load size specified by Military Standard 147 on a 40" x 48" pallet (with material overhanging on pallet) is 43" x 52" x 54" high (including pallet). A load measuring 43" x 52"x 30.9" high (including pallet) equals 40 cubic feet or one M/T.

440-2.3.2 **Total Cubic Feet and the Universal Factor.** The Universal Factor provides for the determination of Total Cubic Feet required based on the cubic feet or M/Ts of the material to be stored. The Universal Factor allows 1.96 cubic feet of space for every cubic foot of material that is to be stored, i.e., a ratio factor of 1.96 to 1 applies. This can also be stated as a ratio factor of 78.4 to 40 if both the "1.96" and the "1" are multiplied by 40. The Universal Factor can thus be stated in either one of two ways, i.e., "1.96 TCF are allowed per M/T of material to be stored" or "78.4 TCF are allowed per M/T of material to be stored." The term Universal Factor is used because it applies equally to bin, rack and bulk storage areas. That is, it applies to all TCF in SA Facilities. This is an extremely convenient factor for determining storage space requirements since it means that TCF can be determined, on the basis of M/Ts or cubic feet of material to be stored, without regard to whether bin, rack or bulk facilities are or will be used to satisfy the requirement. Thus, the function of determining the BFR for TCF can be completely separated from the function of facility layout, equipment select ion, comparative cost analysis and integrated systems development.

440-2.4 **References.**

440-2.4.1 **NAVSUP Publication 529 – Warehouse Modernization & Layout Guide.** This reference is somewhat dated, but the guidance is valid regarding the layout planning related to modernization or new construction of warehousing facilities. This remains a significant publication to that end, but should be used in conjunction with some professional logistics engineering input for any purpose beyond initial activity level 1391 preparation.

440-2.4.2 **DLAM 4145.12 – Joint Services Manual (JSM) for Storage and Materials Handling.** This manual provides detailed guidance on storage and handling of material at DoD installations, by material type. While geared towards operations guidance, this information is critical to some correct planning by providing storage assumptions that impact spatial requirements.

440-2.4.3 **UFC 4-442-01N & MIL-HDBK-1032/2.** The developing UFC and the MIL HDBK which is its primary text, provide guidance on the design of covered storage facilities. It is of particular interest to planners as it provides information that is relevant to any plans (scope) for modernization or construction, including facility and site layout guidance.

440-3 REGIONAL PLANNING FOR SUPPLY

The application of requirements guidance in a regional planning perspective is meant to identify and exploit opportunities for optimizing facility use. This optimization goal of planning analysis is implied in regionalization (i.e. seeking regional economies of scale) and requires the planner to view the sum of all available assets in their aggregate, wherever practical. It is in this aggregate view of assets that a requirements summary in cubic feet is best translated into an optimal configuration in square feet. In other words, the question of a regional planning exercise is: “What is the most efficient accommodation of my cubic foot requirement within the existing or planned square footage (facilities & systems)?” For additional information on applying this criteria in a regional perspective, contact the criteria manager via e-mail.

441 10 GENERAL PURPOSE WAREHOUSE (SF)

FAC: 4421
BFR Required: Y

44110-1 **DESCRIPTION.** This code includes general warehouses with the following characteristics: heated or unheated and with/without heavy-duty (overhead crane) capability, sprinkler systems and/or alarm systems. The purpose of related missions is to provide all or some combination of materials staging or storage, handling and processing, receipt and shipping.

44110-2 **REQUIREMENT.** The general warehouse provides covered space for bulk and in storage, aisle space, space for receiving, packing and crating, office space for direct warehouse supervision (non-administrative) and toilet facilities.

441 11 GENERAL PURPOSE WAREHOUSE, MARINE CORPS DSSC (SF)

FAC: 4421
BFR Required: Y

44111-1 **DESCRIPTION.** This category code includes requirements for Marine Corps ground activities which have been designated by Marine Corps Orders as Direct Support Stock Control activities or which have specialized DSSC functions.

44111-2 **REQUIREMENT.** For new activities, Table 44111-1 may be used for requirements development. The guidance related to 440 series requirements development found in General Supply Planning Guidance under Requirements Determination, is otherwise recommended. If the 10-foot stacking height (SH) used in Table 44111-1 is not applicable, you may reduce the SF proportionate to the increase in SH as a conservative approximation (e.g., if SH is 20 feet vs. 10 feet, 330,000 SF would translate to 165,000 SF). For DSSC mission, include military strength of the base in question plus the military strength of other locally supported units. Non-DSSC activities use only the military strength of the base at which located.

Table 44111-1 Storage Space for DSSC Functions

Installation Military Strength	SF Allowed with SH of 10 feet
Up to 500	7,500
501 to 1,000	14,000
1,001 to 3,000	36,000
3,001 to 5,000	64,000
5,001 to 7,000	96,000
7,001 to 10,000	125,000
10,001 to 15,000	182,000
15,001 to 20,000	216,000
20,001 to 25,000	286,000
25,001 to 30,000	304,400
30,001 to 35,000	333,000

441 12 STORAGE OF AIR OR GROUND ORGANIC UNITS FOR MARINE CORPS (SF)

FAC: 4421
BFR Required: Y

44112-1 **DESCRIPTION.** This category code includes general purpose storage facilities assigned to Marine Corps bases, air installations and Fleet Marine Force (FMF) units for organic requirements to include Division/Wing, Battalion/Group and Company/Squadron storage areas, Special Service storerooms, base shipping and receiving functions and any other organic storage requirements.

441 13 SPECIFIC PURPOSE WAREHOUSE, MARINE CORPS LOGISTICS SUPPORT BASE (SF)

FAC: 4411
BFR Required: Y

44113-1 **DESCRIPTION.** This facility includes general-purpose warehouses designated as storage areas for Marine Corps owned material in support of logistic

support base mission as Integrated Material Managers. Also included is the space utilized in support of pre-positioned war reserve stocks.

441 14 SPECIFIC PURPOSE WAREHOUSE, MARINE CORPS SUPPORTED ACTIVITY SUPPLY SYSTEM (SASSY) MANAGEMENT UNIT (SF)

FAC: 4411
BFR Required: Y

44114-1 **DESCRIPTION.** This facility includes general-purpose warehouses designated for support of the Supported Activity Supply System (SASSY) management units to include general and mount out accounts and consolidated issue point assets.

441 20 CONTROLLED HUMIDITY WAREHOUSE (SF)

FAC: 4424
BFR Required: Y

44120-1 **DESCRIPTION.** A Controlled Humidity Warehouse is similar to a General Warehouse (441 10) in every respect except that it is constructed with appropriate vapor barriers and contains humidity control equipment to maintain humidity at desired levels. This warehouse may be a separate building or contiguous with a General Warehouse. See Figure 44120-1 for some examples of requirements that justify a controlled humidity warehouse.

Figure 44120-1. Examples of Justifying Requirements

1. Readiness and immediate issue requirements dictate a low humidity environment for moisture sensitive material.
2. A low humidity environment is required to maintain the condition of material being held in temporary storage while awaiting repair, disposition, preservation or assembly of components.
3. A low humidity environment is required to allow a reduction in reactivation time and/or reactivation cost of moisture sensitive material in storage.

441 30 HAZARDOUS AND FLAMMABLES STOREHOUSE

FAC: 4423
BFR Required: Y

44130-1 **DESCRIPTION.** A hazardous materials warehouse is required for the storage and handling of materials such as flammable and combustible liquids, acids,

oxidizers, poisons, water reactive materials, caustics and organic peroxides. As safe storage of such materials lies in their separation from incompatible materials, a hazardous and flammables storehouse is required as much for adequate material separation as for their storage and handling. Such separations are normally accommodated via separate rooms. Incompatible material separation accommodations will also extend to the planning and design of containment of affluent run-off basins (i.e., in case of sprinkler event). A hazardous materials warehouse will also be equipped with fire protection and ventilation (i.e., harmful or flammable gases) in accordance with National Fire Protection Association (NFPA) standards. Site evaluation of a proposed or existing hazardous materials storehouse should be done in careful consideration to compatibility with adjacent properties, facilities or operations. Due to the compartmentalized layout of such facilities, their proper planning or planning related evaluation is sensitive to a working understanding of proper facility layout and design. Information on warehouse design and sample storage segregation layouts can be obtained from UFC 4-440-01 Warehouses and Storage Facilities.

44130-2 **STORAGE OF GAS BOTTLE CYLINDERS AND DRUMMED POL.** Storage of bottle gas cylinders and drummed petroleum, oils and lubricants (POL) are not planned for storage in flammables/hazardous warehouses and should be included in shed space, category code 441 35.

441 35 GENERAL STORAGE SHED

FAC: 4422
BFR Required: Y

44135-1 **DESCRIPTION.** The general shed is a roofed structure without complete side and/or end walls and with or without sprinkler and/or alarm systems. Examples of material stored in sheds include gas cylinders, vehicles, unfinished lumber and other construction material. Considerations for the applicability of such facilities are based on the relative need for protection from expected area weather conditions.

441 40 UNDERGROUND STORAGE (SF)

FAC: 4421
BFR Required: Y

44140-1 **DESCRIPTION.** Where it is necessary, because of potential sabotage or enemy action to protect supplies either by dispersal or protective construction, instead of programming new protective construction, existing mines may be used. Suitable mines for this purpose include: limestone, marble, quartzite, granite, gold, silver, uranium, lead, zinc and copper.

44140-2 **REQUIREMENT.** Only draft-type entries should be considered. Rooms should not be less than 30 feet wide or less than 12 feet high. Optimum dimensions are 500 feet wide and 18 feet high.

441 70 DISPOSAL SALVAGE SCRAP BUILDING (SF)

FAC: 4421
BFR Required: Y

44170-1 **DESCRIPTION.** This facility is primarily to provide covered space for the receipt, processing, staging and issue of material that has been deemed excess to Navy needs and is awaiting some resale or final disposal. To the extent practical, such operations are expected to use efficient storage practice as with a ready issue material warehouse. Where the warehousing analogy is accurate, the requirements development for this category should follow those of 441 10.

441 71 INTEGRATED LOGISTICS OVERHAUL (ILO) AND OUTFITTING BUILDING (SF)

FAC: 4421
BFR Required: Y

44171-1 **DESCRIPTION.** This facility provides covered supply space used for processing materials offloaded from or assembled for loading aboard ships. It includes space required for receiving, sorting, identifying and processing materials off-loaded as well as processing and assembly of outfitting materials to be loaded aboard fleet units.

44171-2 **REQUIREMENT.** Since the performance of this operation is primarily a function of facility floor space and not stacking height (SH), the determination of requirements is not first one of cubic feet. This operation is not characterized by a significant storage requirement and is not, therefore, dependent on a facility height. These operations are, however, dependent on a case specific estimate of peak and average operational tempo, processing times, and the related summary of material and operational floor layout requirements. A requirement should be developed using a related space analysis. If an existing operation is present, its floor space can be used as a ‘baseline’ measure from which to determine requirements through documented interview with the operators. This interview would be designed to forecast operational needs and adjust the baseline accordingly.

441 72 SERVMART (SF)

FAC: 4421
BFR Required: Y

44172-1 **DESCRIPTION.** A SERVMART provides covered supply facilities used for display and sale of supply systems materials for self-service requisitioning by end users. It includes areas used to display items on shelves or gondolas, checkout counters and

administrative functions. This category excludes back-up storage areas; requirements for such areas must be based on SH values and are carried under other basic category 441 codes.

44172-2 **REQUIREMENT.** Since the performance of this operation is primarily a function of facility floor space and not stacking height (SH), the determination of requirements is not first one of cubic feet. These operations are, however, dependent on an analysis that accounts for stocked items (i.e. number & type), their stock depth and their retail shelving floor layout. A requirement should be developed using a related space analysis. If an existing operation is present, its floor space can be used as a 'baseline' measure from which to determine requirements through documented interview with the operators. This interview would be designed to forecast operational needs and adjust the baseline accordingly.

441 73 MTIS BUILDING (SF)

FAC: 4421
BFR Required: Y

44173-1 **DESCRIPTION.** A Material Turned Into Store (MTIS) Facility provides covered supply space used for processing materials turned into supply for redistribution or disposal. It includes space used for receipt, screening, identification, assembly and staging for return to storage areas.

44173-2 **REQUIREMENT.** Since the performance of this operation is primarily a function of facility floor space and not stacking height (SH), the determination of requirements is not first one of cubic feet. This operation is not characterized by a significant storage requirement and is not, therefore, dependant on a facility height. These operations are, however, dependent on a case specific estimate of peak and average operational tempo, processing times, and the related summary of material and operational floor layout requirements. A requirement should be developed using a related space analysis. If an existing operation is present, its floor space can be used as a 'baseline' measure from which to determine requirements through documented interview with the operators. This interview would be designed to forecast operational needs and adjust the baseline accordingly.

451 10 OPEN STORAGE AREA (SY)

FAC: 4521
BFR Required: Y

45110-1 **DESCRIPTION.** This category group consists of non-covered storage areas, paved or otherwise established, for storage of General Supply Materials. Several of the excluded types of functions include miscellaneous materials coded under other

basic category codes (e.g., ammunition on open pad coded under 425-10 and open storage areas for non-supply oriented functions coded under 425 11).

45110-2 **REQUIREMENT.** Unless known to be otherwise, a stacking height (SH) of 4 feet should be used in accordance with the Basic Facilities Requirement (BFR) 4-step method described in the requirements section of this guidance. An estimation of material requirements, likely lay-down scenario (i.e., how material is stowed on area) and material handling equipment access is also acceptable as a means of determining square foot (SF) requirements via a space analysis.

451 70 EXTRAORDINARY SUPPORT – DISPOSAL - STORAGE AREA (SY)

FAC: 4521
BFR Required: Y

45170-1 **DESCRIPTION.** This code refers to open areas primarily to provide space for the receipt, processing, staging and issue of material that has been deemed excess to Navy needs and is awaiting some resale or final disposal and whose value is not significantly impacted by uncovered exposure to the environment. This code may also be used for such open yards required for staging or storage of items being held for their scrap value to ongoing missions or systems.

45170-2 **REQUIREMENT.** To the extent practical, such operations are expected to use efficient storage practice as with a ready issue operation. There are no metrics that can serve to guide an allowance for this operational requirement. A SH of 4 feet should be used in accordance with the BFR 4-step method described in the requirements section of this guidance. Otherwise, an estimation of material requirements, likely lay-down scenario (i.e., how material is stowed on area) and material handling equipment access may also be used in a space analysis to determine requirements.