

APPENDIX J  
TACTICAL EQUIPMENT MAINTENANCE FACILITIES**\8\ Modified by Change 8 dated 31 August 2001 /8/**

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APPENDIX J  
TACTICAL EQUIPMENT MAINTENANCE FACILITIES

1. GENERAL AND SPECIFIC CRITERIA. The specific criteria contained in this appendix shall be used with the general criteria contained in the preceding chapters of this TI. The criteria in this appendix are applicable to the design of facilities for deployable maintenance organizations and garrison maintenance organizations including public works centers.

a. Standardization. The Center of Standardization (COS) for Tactical Equipment Maintenance Facilities (TEMF) is the U.S. Army Engineer District, Savannah (CESAS). This appendix has been rewritten and coordinated with the 1996 revision of the standard design for TEMF. The DA Standard Design Package numbered DEF 214-10-03 (reference J-1), is available from the U.S. Army Engineering and Support Center, Huntsville and will be used when developing designs for maintenance facilities. In accordance with ER 1110-3-113 (reference J-2), the COS (CESAS) maintains lessons-learned and CADD files of completed designs and should be consulted when starting a project.

b. Space Planning Criteria. The maximum gross areas for TEMF, including space for mechanical equipment, can be calculated utilizing TOE and TDA information contained in the Facilities Planning Support System (FPS) with the sizing algorithms. ~~18~~This system is available through **the internet at [www.rkeng.com](http://www.rkeng.com)/ downloads and demos**. Calculations generated using TOE or TDA information and the algorithms described in paragraph 3 are used with administrative core, maintenance bay, **and warehouse modules** of the standard designs to develop projects of varying sizes.~~8~~

c. Applicability. The standard design and the criteria of this appendix are applicable to Category Codes 214-10 through 214-17, 218-35 through 218-87, and 219-10 through 219-25 as defined by AR 415-28 (reference J-3). The areas shown in table J-2 provide for scheduled and unscheduled maintenance of vehicles, administration and shop control, break and training areas, electronics and small parts testing and repair, parts storage and exchange, showers, toilet facilities, and tool storage. These areas also include, where authorized, space for welding, painting, and exchange of batteries.

2. LEVELS OF MAINTENANCE. Facilities for deployable maintenance organizations are sized from Tables of Organization and Equipment (TOE). Garrison maintenance facilities are sized based on Tables of Distribution and Allowances (TDA). TOE maintenance includes organizational, direct, and general support levels. TDA maintenance includes Directorates of Logistics (DOL), Directorates of Engineering and Housing (DEH), and Directorates of Public Works (DPW). Maintenance is also described in terms of the following levels.

a. Organizational (ORG). Organizational maintenance includes preventive maintenance functions such as inspections and servicing. The cause of equipment and system malfunctions is determined using applicable technical manuals, trouble-shooting instructions, built-in test equipment or diagnostic and fault isolation devices. Worn or damaged modules and components that do not require complex adjustments or system alignment are replaced at this level. This level is always TOE maintenance.

b. Direct Support (DS). This level of maintenance includes inspections, trouble-shooting, testing, diagnosis, repair, adjustment, and calibration; alignment of components, equipment, and systems; and replacement and repair of items. This level is generally TOE maintenance. DS maintenance organizations have an organizational maintenance component to perform maintenance on their integral equipment.

c. General Support (GS). This level of maintenance includes repair of components and repairable exchange items and printed circuit boards. This level of maintenance may be either TOE or TDA maintenance depending on the mission of the organization. DOL and DPW maintenance functions should be considered as general support maintenance.

**Space added**

d. Depot Maintenance (Category Codes 214-35 and 214-40). This level of maintenance includes overhaul, rebuild, modification, calibration, analytical and non-destructive testing and inspection, and cannibalization and fabrication of items. Depot level facilities are heavy industrial facilities and should be designed to accommodate specific remanufacturing processes. The criteria contained in this appendix are not applicable to these facilities.

3. BUILDING FUNCTIONAL AREAS. TEMF are composed of functional areas located in the core areas, repair and scheduled maintenance bays, and warehouse bays. To these areas are added a factor for non-assignable spaces to convert these net areas into a gross building area. Vehicle operators are not to be considered as building occupants when calculating the size of TEMF.

a. Repair and Scheduled Maintenance Bays. Repair and scheduled maintenance bays are intended for the repair of wheeled vehicles, tracked vehicles, construction equipment, missile launchers, towed howitzers, self-propelled artillery, and power generation equipment. TDA organizations (DOL and DPW) will also perform glass repair, front-end alignment, and painting in repair bays. Provide repair bays based on the number of mechanics working in the maintenance bays. For purpose of calculating the number of bays distribute mechanics in accordance with table J-1.

TABLE J-1 MECHANICS PER BAY	
NUMBER OF MECHANICS PER STRUCTURAL BAY	UNIT TYPE
4	TDA organizations (DOL/DPW)
9	Organizational Maintenance - Non-Engineer & General Support Level
12	Organizational Maintenance - All Other & Direct Support Level
16	Organizational Maintenance - Light Engineer

(1) Scheduled Maintenance Bays. Scheduled Maintenance Bays are included in the total number of bays provided. They are the same size as maintenance bays (9800 mm x 19 600 mm, 192 m<sup>2</sup>) but are equipped with a maintenance pit for undercarriage inspection, greasing, and oil changing. Normally, one scheduled maintenance bay is provided per building. The user may request a second bay be configured for scheduled maintenance if the unit occupying the building has more than 40 vehicles. Scheduled maintenance bays are also equipped with hose bibs to perform minor washing. Space added

(2) Circulation Bays. Groups of three structural bays on each side of the core area are to be separated by a circulation bay 2400 mm by 19 600 mm (48 m<sup>2</sup>) with a personnel door at each outside wall.

(3) Cold Regions Variation. A vehicle corridor equal to 30% of the maintenance bay area is allowed for cold regions (Weather Regions 1-4) to permit central feeding of maintenance bays in lieu of drive through bays. A maintenance ready area is also permitted equivalent to 30% of maintenance bay space for vehicle warm up vestibule prior to entry to the maintenance bays. POL storage, normally provided as a separate structure, is also allowed heat and direct access to maintenance bays.

## b. Core Areas.

(1) Administration and Shop Control. Administration and shop control are office spaces to accommodate foremen, production control, and clerical personnel. Space is assigned at 8 m<sup>2</sup> for each worker with an additional allowance of 4 m<sup>2</sup> per worker for common support and circulation.

(2) General Item Repair. General item repair shops provide space for repair of fabric, small generators, fuel and electrical systems, quartermaster and chemical equipment. General item repair also includes machining small items and printing and binding. In DOL and DPW organizations general item repair also includes locksmith, small item painting, tire repair, radiator repair, appliance repair, battery charging and filling, woodworking, furniture repair and leather repair. Provide general item repair space at the rate of 10.22 m<sup>2</sup> per mechanic with an allowance of 5 m<sup>2</sup> per mechanic for common support and circulation.

(3) Compact Item Repair. Compact item repair shops provide space for organizational level maintenance of radios, telephones, small switchboards, and personal computers. This area also provides for organizational level maintenance of medical equipment including optical, mechanical, electrical, plumbing, pneumatic, refrigeration, and low level X-ray equipment. In DPW organizations this area provides for maintenance of audio-visual equipment, diagnostic equipment, and instruments (e.g., thermostats, meters, monitors). This area is not planned in DOL organizations; see special environment repair. Provide compact item repair space at the rate of 6.4 m<sup>2</sup> per mechanic with an allowance of 3.2 m<sup>2</sup> per mechanic for common support and circulation.

(4) Special Environment Repair. Special environment repair shops provide for repair of the equipment listed below. Provide space at the rate of 9.3 m<sup>2</sup> per repair person with an additional 4.65 m<sup>2</sup> for common support and circulation. Special environment space is not to be planned for organizational level maintenance or DPW facilities.

(a) Audio-visual Equipment (e.g., televisions, overhead projectors, sound systems).

(b) Communications: Radios, telecommunications terminals, communications central switch equipment, communications security equipment, wire communications systems.

(c) Tactical and strategic electronic warfare and intelligence equipment.

(d) Tactical Equipment: Anti-aircraft missiles, MLRS, automated test equipment, small arms, artillery fire control, weather prediction equipment, land combat support system test equipment for anti-tank missiles, surveillance radar.

(e) Calibration of equipment using test measurement and diagnostic equipment (TMDE).

(f) Eyeglass fabrication.

(5) Tool Room. The tool room is for issue and secure storage of common tool kits shared by shop personnel. This area shares a room with **8\toolbox/8/** storage, see next paragraph, and is separated from it by a metal mesh partition so that it can be separately secured. Tool room space is provided at the rate of 9 m<sup>2</sup> for each unit common tool kit, and 4 m<sup>2</sup> for each unit supplemental tool kit. In TDA organizations this area is sized based on 9 m<sup>2</sup> for each tool room keeper.

(6) **8\Toolbox Storage. Toolbox/8/** storage provides for issue and secure storage of individual tool kits used in the repair bays and shops at the rate of .3 m<sup>2</sup> per mechanic. Tool kits storage space is provided for persons working outside the facility (contact teams) at the rate of 2 m<sup>2</sup> for each contact team mechanic.

(7) Repairable Exchange and Technical Supply (RX/TS). RX/TS is the organizational component of a maintenance shop that provides for temporary storage of items and components which do not function but which are repairable, and will be exchanged for replacement items. This area is also used to store parts ordered on an as-needed basis from the supporting DS activity. Space is provided based on the number of equipment records and parts specialists. The first specialist receives 27.9 m<sup>2</sup>, and each additional specialist receives 11.9 m<sup>2</sup>. The allowance may not exceed one specialist per company.

(8) Prescribed Load List (PLL) and Miscellaneous Storage. PLL items are parts that are kept in stock at all times based on demand and management policy. The PLL area is sized based on .19 m<sup>2</sup> per building occupant.

(9) Toilets, Showers and Lockers. Toilet facilities shown in the seven cores are sized in accordance with Chapter 13 of these AEI. For design purposes, the ratio of men to women is nine to one. Showers and lockers are provided for maintenance workers who are exposed to hot and dirty work. For sizing purposes lockers and showers are provided for 60% of the occupants of non-administrative areas.

(10) Break, Training, and Conference Room. The break, training, and conference room provides space for employee breaks as well as a multipurpose space for meetings, training, and conferences. The space is provided at the rate of 1.4 m<sup>2</sup> for half the building population. Regardless of the number of employees, no break training and conference room should be less than 18.6 m<sup>2</sup>.

(11) Weapons and COMSEC Vaults. This area is intended for the storage of vehicular mounted weapons, not personal arms. This area can also be used alternatively for the secure storage of cryptology equipment (COMSEC). A 28 m<sup>2</sup> vault is authorized for buildings of 1000 m<sup>2</sup> or less. Two vaults are authorized for buildings over 1000 m<sup>2</sup>.

c. Warehouse Bays. Warehouse and supply modules are authorized for DS, GS, and TDA units having a technical supply mission. This module is the sum of three sub areas.

(1) Warehouse. Warehouse space is authorized at the rate of 71 m<sup>2</sup> for each material-handling specialist. If this calculated area falls below 10% of the total of administration and shop control, repair bays, and maintenance shops, then use 30% of the sum of these areas as the warehouse space.

(2) Supply Administration. Supply administration is authorized only if the warehouse is authorized. Area is provided at the rate of 8 m<sup>2</sup> for the sum of supply administration, warehouse stock control, and accounting personnel. A layout factor of 4 m<sup>2</sup> per person is also authorized. If this area is less than 33% of the warehouse use the calculated figure. If the area exceeds 33% of the warehouse it is limited to 7% of the total of administration and shop control, repair bays, and maintenance shops.

(3) Direct Exchange and Technical Supply (DX/TS). This area provides space for the turn-in and issue of repairable Direct Exchange (DX) items, as well as supporting storage requirements for Technical Supply (TS) items. DX/TS personnel are identified as equipment receiving and parts specialists. The allowance for TOE units is 28 m<sup>2</sup> for the first equipment receiving and parts specialist, and 12 m<sup>2</sup> for each subsequent specialist. Allowances may not exceed one specialist per company. For TDA units this area is fixed at 110 m<sup>2</sup>, and is not dependent on the number of specialists.

d. Non-Assignable Spaces and Gross Area. Non-assignable area includes stairwells, common circulation corridors, janitorial spaces, columns, exterior wall thickness, and area for HVAC, electrical, and communications equipment. To determine gross allowable area of the facility total the net areas: maintenance bays, warehouse bays, administration and shop control, repair shops, tool and tool box storage, RX/TS, PLL storage, toilet and locker room, break and training room, and vaults. The conversion from net to gross area should be made using the factors

in table J-2. Table J-2 also summarizes the sizes, characteristics, components, and options associated with each standard design core.

TABLE J-2 STANDARD DESIGN CORE SIZES, CHARACTERISTICS, COMPONENTS, AND OPTIONS							
Core Number <sup>1</sup>	1	2	3	4	5	6	7
Core Size <sup>2</sup>	0298	0490	0835	1152	1536	1920	2688
Core Work Station Capacity	5	11	25	42	62	79	113
STANDARD DESIGN SHOWS THIS CONFIGURATION							
Maintenance Bays Shown	2	4	6	7	8	6	12
Configuration	1 Floor Linear	1 Floor Linear	2 Floor Linear	2 Floor Linear	2 Floor T	2 Floor X	2 Floor X
Warehouse Bays <sup>4</sup>	N/A	N/A	2	4	5	6	8
Total Area <sup>2</sup> (Gross)	758	1394	2578	3535	4365	4493	6967
Code Capacity <sup>3</sup> (Workers)	29	58	93	136	180	221	312
OPTIONS							
Maximum Maintenance Bays <sup>4</sup>	3	6	8	8	16	16	16
Net to Gross Conversion Factor <sup>5</sup>	1.21	1.18	1.18	1.16	1.18	1.18	1.17

Note<sup>1</sup>: Cores 1-5 are appropriate for organizational maintenance. Cores 3-7 are appropriate for use with DS, GS, DOL, and DPW maintenance.

Note<sup>2</sup>: Areas shown are in m<sup>2</sup>. Core areas do not include the area of the elevator, which is required for accessibility when civilians are assigned. See paragraph 4.a.

Note<sup>3</sup>: Code capacity is area dependent and is determined by **International Building Code 2000/8/** or NFPA 101, whichever is more stringent. Adding bays increases capacity.

Note<sup>4</sup>: Maximum number of maintenance bays is limited by functional requirement not to exceed 85 600 mm (8 repair bays + 3 circulation bays) from the core. The number of warehouse bays is not limited.

**Note<sup>5</sup>: Use a net to gross conversion of 1.21 in shops with three or less bays. Use a factor of 1.18 for all other maintenance shops/8/**

#### 4. SITE FUNCTIONAL AREAS.

a. **Optional Dock.** A multi-purpose dock may be provided for units having a requirement for operations vans or maintenance support vans. Docks are constructed 900 mm or 1200 mm high to correspond to bumper height on the vans to be supported, **may be covered/** or uncovered, and provide power and equipment grounding. They are typically attached to the primary building adjacent to the core or warehouse area.

b. **Shop Hardstand.** A standard access apron of 14 000 mm is required along both sides and 6000 mm along both ends of the maintenance building described above. A circulation lane 9140 mm in width surrounds this area and is required for vehicular circulation routes. When a warehouse is provided, a 20 000 mm apron is required on the side with the loading dock.

c. **Vehicle Parking.**

(1) **Organizational.** Parking allowance is determined by FPS based on the number and size of organizational vehicles. Parking stalls are back to back with access lane widths of 9140 mm for vehicles of 5500 mm or less in length. Where parked vehicles are longer than 5500 mm, that access aisle should be widened to 13 720 mm. Circulation aisle widths are to remain 9140 mm. Side clearances in spaces are to be 1000 mm. End clearances in spaces are to be 600 mm. Unit integrity should be maintained at the company level whenever possible.

(2) **POL.** POL vehicles are to be parked at least 15 240 mm from other vehicles or permanent structures. POL parking spaces are 5800 mm wide by 12 200 mm to 16 800 mm, depending on the length of the vehicle. Maintain 3000 mm spacing between vehicles. Provide one additional space as a fuel dispensing point for minor day to day fueling of organizational vehicles. Provide a 15 000 mm access apron on the access side of this parking area for maneuvering.

(3) **Dead-Line.** Provide three dead-line vehicle parking spaces 3660 mm by 9140 mm for each DS, GS or DOL repair bay provided. Size of spaces may be increased if the DS unit supports larger vehicles.

(4) **Privately Owned Vehicles (POV).** Provide POV parking at the rate of 38% of assigned military personnel plus 100% of civilian employees. Spaces are to be 2700 mm by 4900 mm where vehicle overhang occurs, and 2700 mm by 5500 mm where no overhang occurs. Aisles are to be 7300 mm wide.

d. **Site Storage.**

(1) **POL Storage Building.** Provide a building for the storage of oil, lubricants, and flammable solvents for daily use at the rate of 5.5 m<sup>2</sup> for each 25 vehicles maintained. Provide a minimum of 11 m<sup>2</sup>. Provide an access apron at the entry of this building 7000 mm by 8000 mm. Maintain 15 300 mm from other site structures to avoid the need for sprinkling this facility.

(2) **Deployment Equipment Storage Building.** Deployment Equipment Storage (Category Code 442-24) is shown on the site plans of the standard design. This area is a separate line item, independent of building and pavement areas. It should be programmed as an integral part of the maintenance facility. Provide for storage of deployment equipment at the rate of 65 m<sup>2</sup> for each company sized unit and battalion headquarters. Provide an access apron 8000 mm wide along one side of this building.

(3) **Hazardous Waste Storage Area.** This hardstand area is to be provided for the short term storage of waste fuels, spent solvents, cleaning compounds, and similar hazardous waste. Provide hardstand and access apron in the same quantity as POL Storage Building above.

(4) Secured Open Storage. Provide secured open storage at the rate of 30 m<sup>2</sup> for the first repair bay and 10 m<sup>2</sup> for each additional repair bay.

(5) Open Storage. This hardstand area is provided at the rate of 20% of the warehouse allocation for DS, GS, DOL, and DPW organizations.

e. Not Authorized.

(1) Wash Rack. Vehicle wash facilities should not be provided within the maintenance facility. Vehicle washing is to be accomplished at the centralized vehicle wash facility. These facilities will be designed in accordance with TM-5-814-9 (reference J-4). Where central vehicle wash facilities are not available a waiver may be requested through the MACOM for wash facilities. Approved wash facilities must be shown as a separate line item on the programming documents. Minor component washing may be done in the scheduled maintenance bay.

(2) Fueling Island. Fueling should be performed at a centralized bulk fueling station. Fueling islands and underground tanks will not be provided in maintenance facilities. Minor daily fueling for organizational needs may be performed using a designated POL vehicle.

~~18~~ (3) Sentry Booth. Sentry booths **should be provided at the primary entrance to the complex to control entry to the site. /8/**

## 5. SITE DESIGN.

a. Hardstand. Hardstand areas will be rigid pavement. Pavement for organizational vehicle areas should be designed for the heaviest vehicle at the installation.

b. ~~18~~**Antiterrorism and Force Protection.** Each project should be evaluated for security requirements in accordance with TM 5-853-1, (reference J-5). Minimum requirement is a perimeter fence consisting of a 2000 mm chain link fabric with 3-strand barbed wire anti-climber designed in accordance with STD 872-90-03 (reference J-6). A 3000 mm wide zone clear of trees and shrubs is required on each side of the fence. The clear zone should require minimal maintenance, and the area 500 mm each side of the fence should be provided with gravel and treated to discourage vegetation growth. Vehicular gates, approximately 8000 mm wide overall, should be provided at the vehicle entrances. **Minimum Interim Department of Defense Antiterrorism/Force Protection Construction Standards (reference J-5a). Construction upgrades, fencing upgrades, increased clear zone requirements, sentry stations, access control systems, and security systems required to meet these requirements should be itemized on the programming documents. /8/**

c. Exterior Lighting. Exterior area lighting systems will be provided for facility aprons, open storage areas, and parking areas. Exterior area lighting systems should consist of color corrected ~~18~~**high intensity discharge/8/** lighting units mounted on poles and located within the clear zone and on the primary facility. Illumination levels will be 54 lx for areas adjacent to the primary facility and 5.4 lx for parking areas.

d. Perimeter Security Lighting. Protective lighting systems will be provided in response to project specific requirements to deter trespassers and make them visible to guards. Levels of exterior lighting for protected areas will conform to the requirements in TM 5-811-1, (reference J-7). Lighting circuits will be controlled by a photoelectric cell with manual override.

e. Storm Water Management. ~~18~~**Site storm water management/8/** may require controls on the peak flow that can be discharged. Installations are required to have a storm water pollution prevention plan. Implement the applicable portions of this plan using best management practices. Segregate drainage from areas likely to be

contaminated (e.g., fueling area). Provide treatment for contaminated water prior to its discharge. Maintenance should not be performed outside the primary facility.

f. Oil/Water Separator. One or more oil/water separators are required to remove, oil, lubricants, floatables, and grit from contaminated water sources (e.g., maintenance bays, POL storage). Oil/water separators will be designed in accordance with ETL 1110-3-466, (reference J-8) for the specific waste stream to be treated. Minimize maintenance requirements and locate oil/water separators to minimize pipe runs, provide vehicular access, and be out of circulation areas.

g. Waste Oil, Antifreeze, Solvents, Cleaning Compounds, and Hazardous Materials. Hazardous materials generated in the course of maintenance operations will be classified in accordance with 40 CFR 261 (reference J-9). Criteria for short term storage (less than 90 days) of hazardous materials is provided in 40 CFR 262 (reference J-10). **Short-term** storage of hazardous materials requires a Resources Recovery Conservation Act permit. Long term storage of hazardous materials is governed by 40 CFR 264 (reference J-11). The installation Defense Resources Management Office has responsibility for long term storage. **Long-term** storage is not authorized as part of maintenance facilities.

## 6. ARCHITECTURE.

a. Accommodation of the Physically Handicapped. Core elements of the standard design have toilets, corridors, and door clearances designed to accommodate the physically handicapped. Handicapped accessibility is not required for facilities used solely by able-bodied military personnel. Facilities employing civilians are required to be fully handicapped accessible. This means the second floor facilities will require the elevator, shown as an option in the standard design. See Chapter 7 for additional requirements. Civilians, who are subject to deployment, and must be able bodied as a condition of employment, will be considered the same as able-bodied military.

### b. General Considerations.

(1) Exterior Materials. Exterior materials will be selected to provide attractive, economical, and durable low maintenance materials. Pre-engineered metal building systems are preferred for their factory finished metal siding and roof panels. Masonry walls are preferred at the ground floor level.

(2) Floors. Concrete floors in maintenance bays will be provided with a crown in the center of the bay and sloped to the exterior. Provide a continuous trench drain located on the interior side of the overhead doors. Trench drain should be sloped toward the scheduled maintenance bays where component washing will occur.

(3) Natural Lighting. Clerestory lighting will be provided over the service bay doors. Vision panels in overhead doors are also recommended. Provide windows for natural lighting and ventilation in administration, shop control, and shop spaces.

(4) Partitions. Masonry walls are required to separate maintenance bays from the core areas, at first floor corridors, at warehouse separation, and surrounding fixed areas such as toilets, vaults, storage areas and shops. Shops and storage areas may be subdivided with metal mesh partitions. Second floor walls should be gypsum board on steel studs, except toilets. A 1600 mm high wall may be provided to separate the a welding bay, generator repair bay, or scheduled maintenance bay from the other repair bays.

(5) Maintenance Bay Doors. Maintenance bay doors 7400 mm wide by 4300 mm high will be provided at each end of each maintenance bay. Provide 3000 mm by 3000 mm doors at warehouse loading docks and when required for general item repair shop. Doors may be steel of rolling, sectional, or telescoping design. Doors should be electrically operated with a provision for manual operation by a chain.

(a) Locking. Doors will be operable from the interior only. Overhead doors will be provided with a positive locking mechanism that will allow the door to remain open approximately 300 mm (1 ft) above the floor, engine exhaust position. Door locking requirements will be coordinated with the using service.

(b) Specifications. The project specification will require the overhead service bay doors to meet the loads anticipated by the design analysis. The project specifications will include provisions for testing of deflection and operation of the doors prior to acceptance during construction. Overhead doors will be provided and installed by a commercial door company having not less than five years of experience in manufacturing, installing, and servicing the size and type of doors installed. A preventive maintenance program, including a periodic maintenance program, instructions for minor repairs not requiring the company's service, and a list of spare parts to be stocked by the DPW will be provided by the door manufacturer.

(c) Insulated Doors. Where justified by an economic analysis, insulated vertical lift doors should be provided. The economic analysis will consider initial cost, life cycle cost, operating and maintenance costs, and energy costs. Insulated vertical lift doors are authorized at installations in Alaska without an economic analysis.

(7) Personnel Doors. Provide exterior personnel doors in the ends of maintenance bays as shown in the standard design. Provide steel doors with vision panels, except at storage and toilet areas. Primary building entrance may be aluminum curtain wall construction. Minimum size for personnel doors is 900 mm wide by 2100 mm high.

(8) Special Requirements by Functional Area. Special requirements related to functional areas are delineated in the standard design.

7. FIRE PROTECTION. Fire protection for the facilities will be in accordance with Military Handbook 1008 (reference J-12). The construction type will be Type II-N as defined in Uniform Building Code (reference J-13). Automatic sprinkler protection will be provided throughout the primary building. .

8. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC) SYSTEMS.

**18\ a. System Selection. All viable alternative systems meeting the functional requirements of the facility shall be considered for each of the areas. Packaged equipment, split systems or systems utilizing chilled/heating water from either a central plant or decentralized sources may be considered for the core spaces. Heating & ventilating units, radiant heating or some combination may be considered for maintenance and warehouse bays. In colder climates, supplemental heating at the floor level of maintenance bays shall be considered. System selection shall be coordinated with the installation and shall be based on energy usage and life cycle cost, reliability and operating considerations, and the maintenance capabilities and resources of the user./8/**

b. Building Exhaust Systems. Exhaust systems will be provided at repair bay pits, heat sources, and contamination sources. Scheduled maintenance bay pit exhaust system will be ducted exhaust system with explosion proof fans. Exhaust systems will operate continuously while the building is occupied. If contaminant sensors are used, air quantities may vary down to a minimum of four air changes per hour.

c. Vehicle Exhaust Systems. Vehicle exhaust evacuation systems will be provided at each repair bay. Systems will consist of reel exhaust tubing connected to exhaust fans. The exhaust lines will be sized and located as required to service vehicles and equipment to be repaired within the repair and scheduled maintenance bays. Lines will not interfere with maintenance operations or obstruct equipment such as the traveling bridge crane. The using service is responsible for providing the transition connectors between the vehicle exhaust and the vehicle

exhaust system installed in the building.

#### 9. PLUMBING.

a. Trench Drains. **18A continuous trench drain located along the exterior wall will collect drainage from repair bays./8/** Trench drain design should facilitate cleaning. Provide basket strainers to facilitate trash removal where trench drains discharge to piping systems. Convey waste to exterior oil/water separator prior to discharge to the sanitary sewer system. When a dedicated, walled welding bay is provided, provide a solid cover to the trench drain where it runs through the welding bay.

b. Emergency Showers and Eye Washes. Provide emergency eye wash stations in maintenance bays. Provide emergency showers and eye washes in general item and/or compact item repair shops when the equipment being serviced or solvents being used generate this requirement.

#### 10. ELECTRICAL AND COMMUNICATIONS.

a. Power. Power service to the buildings will be fed underground from the base electrical distribution system to a pad-mounted transformer located near the primary building. Power service to buildings will be fed underground from the transformer to building service entrance equipment, located in the electrical equipment room.

b. Special Power Requirements. Electrical power outlets for special power should be coordinated with workbench locations in shops, and provided in the maintenance bays. Both low voltage (for example, 70 V) and high frequency (for example, 400 Hz) power may be required. These requirements are unit specific, and the using service must identify these special power requirements and provide the O&MA or OPA funding for the purchase of equipment to support these needs. Although these requirements may be included in the construction contract, they cannot be provided from MCA funds.

c. Receptacles. Receptacles and devices in repair bays, except inspection pit, will be located a minimum of 500 mm above finished floor. Equipment located in inspection pits will be suitable for installation in a class 1, division 1, hazardous location.

d. Grounding. Each maintenance building will have a ground grid around the building perimeter for grounding incoming service, building steel, telephone service, piping, and internal grounding requirements. Ground straps will be provided where required by function and will be connected to the building grounding system. A grounding point will be provided in each repair and scheduled maintenance bay. Grounding points will be provided in vehicle and equipment parking areas on 10 000 mm centers. Additional grounding may be provided based on project requirements.

e. Lighting. Lighting designs will incorporate the necessary hazardous area requirements of the latest edition of NFPA 70, National Electrical Code (reference J-14). Illumination of the service bays **18/should consider super T8 fluorescent lighting or/8/** High Intensity Discharge (HID) color corrected metal halide fixtures. The fixture layout must be coordinated with the traveling bridge crane requirements. Fluorescent fixtures will be used in other areas. Illumination levels will be in accordance with the IESNA Lighting Handbook (reference J-15). Maintained illumination levels will be in accordance with table J-3.

TABLE J-3 LIGHTING LEVELS	
FUNCTIONAL AREA	LEVEL IN LUX

TABLE J-3 LIGHTING LEVELS	
FUNCTIONAL AREA	LEVEL IN LUX
Administration and Shop Control	540
Warehouse and Storage	160
Latrines, Showers, and Lockers	160
Break, Training, and Conference	325
Repair and Scheduled Maintenance Bays	325
Weapons Storage and COMSEC Vaults	160
Repair Shops (General Item, Compact Item, Special Environment, Battery, etc.)	325

f. Telephone and Data Outlets. Communications and data lines will be underground from the base communications system to the main distribution equipment located in the communications room of the primary building. Telephone and data outlets will be provided in core areas and supply administration areas. Provide a minimum of one data and one telephone outlet in each space requiring outlets. In administration and shop control areas provide a telephone and a data outlet for each 7.5 m<sup>2</sup> of floor area. Every work station should have a telephone and data outlet. In mechanical and electrical rooms and corridors provide outlets for wall mounted equipment. For controlled access facilities, provide outlets for wall mounted equipment at primary entrance. Additional locations may be provided based on coordination with the facility user.

g. Paging Systems. A paging system will be provided for the maintenance bay areas with the microphone located in the administration and shop control area.

h. Intrusion Detection Systems. Intrusion detection systems are required for arms and COMSEC vaults. Provide an empty raceway or conduit. System requirements will be coordinated with the user.

11. EQUIPMENT AND FURNITURE. Equipment and furniture are necessary to make TEMF ready for daily operations. Some items are provided as integral parts of the building construction. Most furniture and equipment must be provided by the using activity. Table J-4 shows typical equipment and furniture **that** is needed to make TEMF ready for operations.

TABLE J-4 EQUIPMENT AND FURNISHINGS		
Area	Equipment Class <sup>1</sup>	Equipment/Furniture Item
Repair Bays	IBE <sup>2</sup>	Exhaust System (See para. 8.c.)
	IBE	Bridge Crane (See para. 11.a.)
	IBE	Compressed Air (See para 11.b.)
	PPF <sup>3</sup>	Dispensing/Disposal Systems <sup>5</sup>
	PPM	Engine Hopping Dollies

TABLE J-4 EQUIPMENT AND FURNISHINGS		
Area	Equipment Class <sup>1</sup>	Equipment/Furniture Item
Scheduled Maintenance Bays	IBE <sup>2</sup> IBE IBE IBE PPM <sup>4</sup>	Exhaust System (See para. 8.d.) Bridge Crane (See para. 11.a) Inspection Pit Compressed Air (See para 11.b.) Dispensing/Disposal Systems <sup>5</sup>
Administration and Shop Control	IBE <sup>2</sup> PPF <sup>3</sup>  PPM <sup>4</sup> PPM	Window/Reception Counter <b>\8\Furniture Systems/8/</b> (See para. 11.c.) Storage Units, Chairs, Tables, Desks, Partitions
General Item Repair Compact Item Repair Special Environment	IBE <sup>2</sup> PPF <sup>3</sup>  PPM <sup>4</sup>	Compressed Air Industrial <b>\8\Furniture Systems/8/</b> (See para. 11.c.) Storage Units, Chairs
Tool Room Tool Box Storage	PPM <sup>4</sup>	Storage Racks and Bins
Repairable Exchange / Technical Supply	PPM <sup>4</sup>	Shelving, Chair, Desk
PLL & Misc. Storage	PPM <sup>4</sup>	Shelving, Chair, Desk
Toilets, Showers & Lockers	IBE <sup>2</sup>	Lockers and Benches
Break, Training, Conference Room	IBE <sup>2</sup> PPM <sup>4</sup>	Counter with Sink Chairs, Tables, Visual Aids
Weapons & Comsec Vaults	IBE <sup>2</sup> PPM <sup>4</sup>	Vault Door Storage Units
Warehouse	PPM <sup>4</sup>	Storage Racks and Shelving
Supply Administration	PPM <sup>4</sup>	Storage Units, Chairs, Tables, Desks, Counters
Direct Exchange / Technical Supply	PPM <sup>4</sup>	Storage Bins and Shelving

Note<sup>1</sup>: Equipment class is as shown in AR 415-15, Appendix H (reference J-16).

Note<sup>2</sup>: IBE is installed building equipment. This equipment is always MCA funded and is part of the construction contract.

Note<sup>3</sup>: PPF is personal property fixed. Although not MCA funded, PPF can be provided as part of construction when programmed and identified as a line item

TABLE J-4 EQUIPMENT AND FURNISHINGS		
Area	Equipment Class <sup>1</sup>	Equipment/Furniture Item

on the DD Form 1391.

Note<sup>4</sup>: PPM is personal property movable. It is always funded by the user, normally with O&MA (Operations and Maintenance Army) funds. The user may purchase these items or request USACE to provide them through a separate procurement.

Note<sup>5</sup>: Dispensing/Disposal systems are optional. They may be installed through the construction contract when this need has been identified and funded by the user. Maintenance of the installed system is the user's responsibility.

a. Traveling Bridge Cranes. Full width, under running, traveling bridge cranes will be provided in maintenance and scheduled maintenance bays. Provide 7 metric ton capacity in organizational and direct support maintenance. A top running, 35 metric ton, bridge crane may be provided for one wing of maintenance bays in general support and DOL maintenance. The 35 metric ton bridge crane must be identified in the programming documents. The 35 metric ton bridge crane will be supported by a structure independent of the building structure. ~~18~~ Hook height on **7 metric ton** bridge cranes will be 6000 mm to the cradle of the hook. **Hook height on 35 metric ton bridge cranes will be 7600 mm to the cradle of the hook.** Hydraulic lifts are not authorized. ~~18~~

b. Compressed Air. Compressed air outlets with quick disconnect couplings will be provided in all service bays. The air compressor should be provided as installed building equipment and should be sized to support 60 percent of the outlets operating at one time.

~~18~~ c. **Furniture Systems.** Furniture systems may be provided with the building when programmed by the using activity. Administrative furniture systems should be considered for administration and shop control areas. Industrial furniture systems should be considered for general item, compact item, and special environment shops. Industrial furniture systems may be installed equipped electrical, gas, water, and/or compressed air when required. ER 110-345-122 (reference J-17) provides additional information on building interior design and how to program furniture systems. ~~18~~

## 12. REFERENCES.

J-1 DEF 214-10-03, Standard Design for Tactical Equipment Maintenance Facilities (TOE and TDA), December 1996

J-2 ER 1110-3-113, Department of the Army Facilities Standardization Program, 27 September 1993

J-3 AR 415-28, Facility Classes and Construction Categories, February 1995

J-4 TM-5-814-9, Centralized Vehicle Wash Facilities, 2 February 1992

J-5 TM 5-853-1, Security Engineering Project Development, May 1994 (FOUO)

~~18~~ J-5a Interim Department of Defense Antiterrorism/Force Protection Construction Standards, December 16, 1999. (Final standards are to be used when issued.) ~~18~~

J-6 STD 872-90-03, Standard Design FE6 Chain-Link Security Fence Details, May 1992

- J-7 TM 5-811-1, Electrical Power Supply and Distribution, Chapter 11, ~~18~~Security/8/ Lighting, February 1995
- J-8 ETL 1110-3-466, Selection and Design of Oil/Water Separators at Army Facilities, 26 August 1994
- J-9 40 CFR 261, Identification and Listing of Hazardous Waste
- J-10 40 CFR 262, Standards Applicable to Generators of Hazardous Waste
- J-11 40 CFR 264, Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
- J-12 Military Handbook 1008C, Fire Protection for Facilities Engineering, Design, and Construction, or later edition
- J-13 Uniform Building Code (UBC) published by the International Conference of Building Officials, 5360 South Workman Mill Road, Whittier CA 90601
- J-14 NFPA 70, National Electric Code, National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
- J-15 Lighting Handbook, Illuminating Engineering Society of North America, 120 Wall Street, 17th floor, New York, NY 10005
- J-16 AR 415-15, Army Military Construction Program Development and Execution, 30 August 1994
- ~~18~~J-17 ER 1110-345-122, Interior Design, 22 March 1999/8/