

TECHNICAL MANUAL

PREVENTIVE MAINTENANCE

**FACILITIES ENGINEERING**

**BUILDINGS AND STRUCTURES**

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HEADQUARTERS, DEPARTMENT OF THE ARMY

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# PREVENTIVE MAINTENANCE FACILITIES ENGINEERING BUILDINGS AND STRUCTURES

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# CHAPTER 1

## INTRODUCTION

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**1-1 Purpose** This manual provides operational techniques, practices and procedures for preventive maintenance of buildings and structures to assure the following-

- a. Efficient operation and maximum utilization of available resources and manpower;
- b. Adequate care to avoid expensive and untimely repair or replacement;
- c. Elimination of hazards to life and property;
- d. Development of a system to evaluate the effectiveness of the PM program.

**1-2 Scope** This manual is a guide for Facilities Engineering and other personnel responsible for the PM of buildings and structures. It outlines basic procedures used to manage, implement, and evaluate systematic PM programs. The guidelines are not intended to cover utility systems and other specialized equipment contained in buildings and structures.

**1-3. Explanation of Terms** For the purposes of this manual, the following definitions apply—

a. *Preventive maintenance.* Preventive maintenance (PM) is the systematic and cyclic check, inspection, and correction of minor deficiencies, as well as reporting of deficiencies beyond the scope of preventive maintenances. PM includes the accomplishment of minor maintenance and repair.

b. *Buildings.* Buildings are defined to include facilities used for training, maintenance, production, research, development, testing, storage, health care, administration, bachelor and family housing, food services, community services, and museums.

c. *Structures.* Structures are defined to include such facilities as docks, piers, wharves, swimming pools, towers (except communication), hutments, historical monuments, permanent grandstands and bleachers, tanks, and underground storage facilities (igloos).

d. *Self-help.* Self-help involves military personnel and occupants of family and troop housing in accomplishing minor maintenance and repair. Family housing self-help includes limited types of improvements.

**1-4. Objectives of Preventive Maintenance** The following objectives are achieved through effective PM:

a. The useable life of buildings and structures are prolonged through cost-effective maintenance and repair.

b. Emphasis is placed on cyclic and seasonal inspection and systematic, minor maintenance and repair rather than replacement.

c. PM is a means for encouraging personnel to be constantly aware of energy conservation measures being implemented.

**1-5. Related Publications** In addition to the guidelines provided in this technical manual, those responsible for PM should familiarize themselves with related Department of the Army publications included in Appendix A.

**1-6. Illustrations** Illustrations to be used for local reproduction and/or modification are provided at the end of appropriate chapters.



## CHAPTER 2

### ORGANIZATIONAL GUIDELINES

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**2-1 General** This chapter is intended to provide the basic organization for PM programs. Its Sections describe the responsibilities, roles, and interrelationships of installation personnel and their

contributions to the maintenance of buildings and structures. Figure 2-1 outlines a typical organization for PM at an army installation.

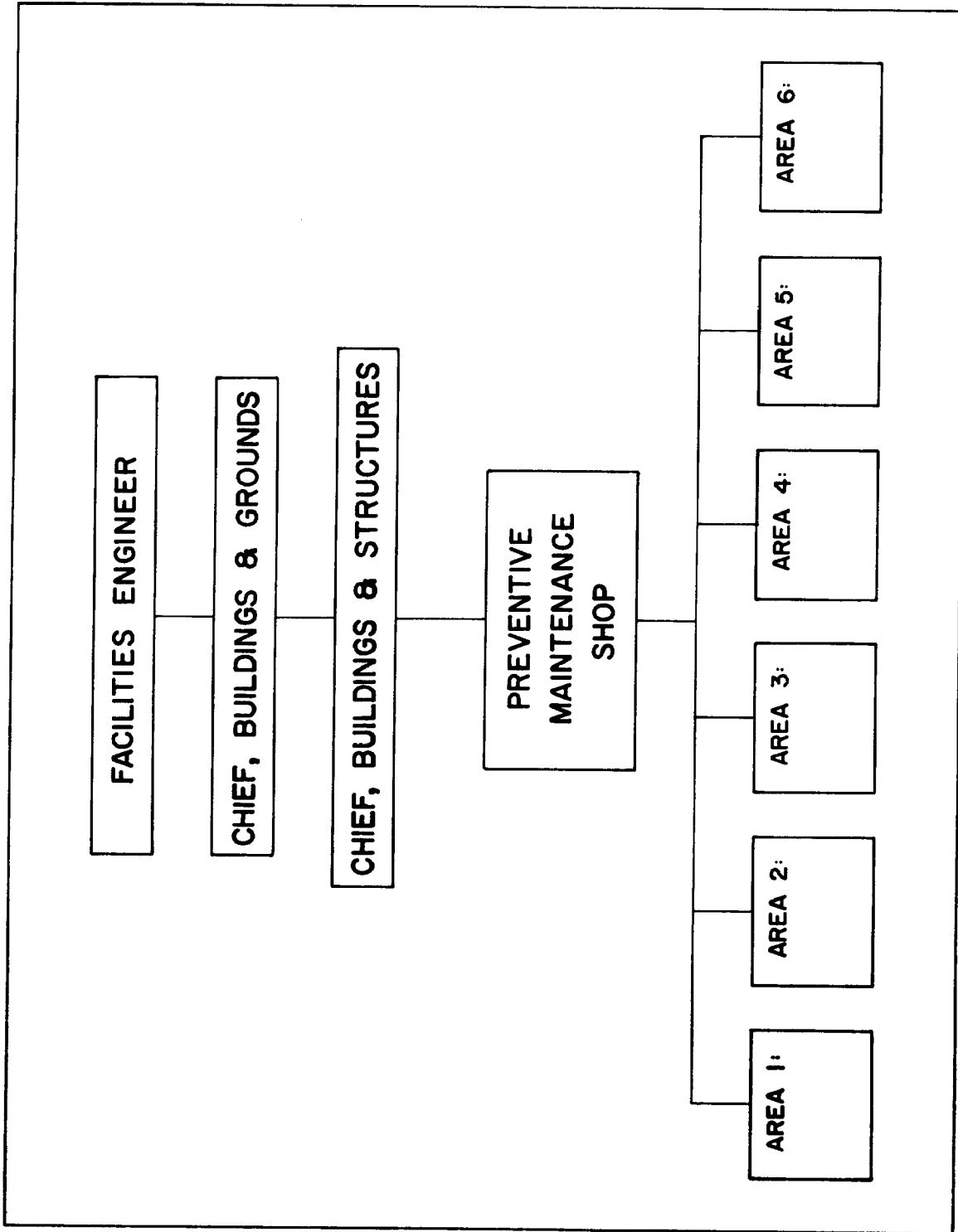


Figure 2-1. Preventive Maintenance Organization At The Installation Level

**2-2. Responsibilities and Relationships** The following are descriptions of the responsibilities of key members of the Facilities Engineer, and Family Housing and occupants.

*a. Facilities Engineer.* The Facilities Engineer is responsible for managing the PM and self-help programs. The responsibilities include:

- (1) Providing appropriate training.
- (2) Providing PM instructions to Facilities Engineering personnel and non-Facilities Engineering users of equipment.
- (3) Providing necessary supplies and equipment.
- (4) Supervising and inspecting work accomplished under the PM program.

*b. Chief, Buildings and Grounds.* The Chief of Buildings and Grounds Division plans and accomplishes PM of buildings and structures. The responsibilities include:

- (1) Establishing and continually executing effective PM programs, including family housing.
- (2) Providing assistance to self-help programs.
- (3) Establishing training programs.
- (4) Supervising and maintaining prescribed reports and records.
- (5) Reviewing procedures and methods to assure the most economical and efficient use of funds and manpower.
- (6) Coordinating PM cycles with Engineer Resources Management Division staff.

*c. Chief, Buildings and Structures.* The Chief of Buildings and Structures plans, schedules, coordinates, assigns, and accomplishes work necessary for an effective PM program, including:

- (1) Maintaining necessary records.
- (2) Conducting field inspections.

*d. Foreman, Preventive Maintenance Shop.* The foreman of the Preventive Maintenance Shop supervises a comprehensive PM program to include:

- (1) Maintaining accurate day-to-day records.
- (2) Furnishing technical guidance and training to PM workers.
- (3) Reporting maintenance and repair items beyond the scope of PM and self-help to the work receptionist.

*e. Preventive Maintenance Unit.* The PM unit is a skilled and versatile operating unit which accomplishes routine inspection, minor maintenance, repair, and reporting on a day-to-day basis.

*f. Preventive Maintenance Unit Leader.* The PM Unit Leader is responsible for the timely and efficient accomplishment of work by the unit. General responsibilities include:

- (1) Determining maintenance and repairs necessary and the extent to which work requirements are to be corrected by the team.

- (2) Reporting deficiencies that are self-help items to the occupant.

- (3) Reporting deficiencies beyond the scope of PM to the PM Foreman.

- (4) Planning work to provide the greatest possible coverage and maximum efficiency within time allotted.

- (5) Preparing records of work accomplished by the PM team.

- (6) Ensuring adequate supplies and equipment.

*g. Preventive Maintenance Worker.* The PM worker is a craftsman or mechanic who performs minor maintenance and repair work as directed by the unit leader.

*h. Preventive Maintenance Helper.* The PM helper is a general assistant who is selected and trained to substitute for or advance into the worker position.

*i. Family Housing Manager.* The Family Housing Manager informs the Chief of Buildings and Grounds Division prior to pretermination when quarters are to be vacated and assists in coordinating scheduled PM visits.

*j. Occupant.* Occupants of bachelor housing and family housing note and record deficiencies beyond the scope of self-help for reporting to the PM unit during its next scheduled visit.

**2-3. Preventive Maintenance Unit Concept.** PM needs vary among Army installations and can most effectively be met by using a unit approach. Unit composition is largely dictated by the type of facilities receiving PM service and varies from installation to installation. Typically, the PM working force is made up of the required number of two-man units. This section describes variations within the unit concept of PM.

*a. One-Man Unit.* The one-man unit is recommended for standardized and repetitive, minor maintenance and repair work.

*b. Two-Man Unit.* The two-Man unit is the most common approach for meeting the requirements of PM. This unit is comprised of the unit leader who is a versatile PM mechanic, and a trades helper.

*c. Augmented Units.* A three-man unit may be used to accomplish systematic PM. It consists of the two-man unit augmented by a leader-inspector. Within a PM area, the leader-inspector enters each building prior to the workers for the purposes of inspecting to see what PM work is required. When the workers enter the building, the leader-inspector informs them of required work and special supplies.

*d. Special Unit.* If volume of work or other factors warrant, special PM units may be established, if they are properly documented by the Facilities Engineer.

## CHAPTER 3

## GUIDELINES FOR A PREVENTIVE MAINTENANCE PROGRAM

**3-1 General** This chapter outlines basic procedures used to manage, implement, and evaluate systematic PM programs. The scope includes planning, scheduling, and daily operations to maintain a consistent level of maintenance and reduce the costs of repair in buildings and structures.

*a. Purpose of Program.* The goal of the PM program is to reduce the number of service orders to a point where buildings and structures are being maintained by scheduled work as much as possible.

*b. Developing a Management Plan.* The management plan is a tool which enables the Facilities Engineer to systematize PM and orient personnel working within the system toward results. Management plans encompass policy, planning, accomplishment of work, and evaluation of effectiveness. Guidelines provided in this chapter address each of these in the development of a management plan for PM. Facilities Engineers should adopt those guidelines which apply to their own programs' needs.

**3-2. Directions and Regulations** Directions and Regulations relating to PM in buildings and structures are drawn from a number of sources, including Army regulations, pamphlets and other technical manuals of the 600 series. Each source provides valuable guidance for establishing programs, and should be reviewed to develop a PM program from the broadest possible range of information.

*a. Regulations.* Department of the Army regulations, orders, and pamphlets applicable to the establishment and operation of PM program are listed in Appendix A.

*b. Standard Operating Plan for Preventive Maintenance.* The Facilities Engineer should develop, document, and maintain a standard operating plan for PM. This procedural plan should be developed along guidelines found in this technical manual, adapting to meet local needs.

**3-3. Planning a Preventive Maintenance Program** PM is most effective when the work is accomplished on a cyclic basis. The length of the cycle must be determined, PM Areas must be properly sized, similar facilities grouped accordingly, and adequate manpower levels calculated. Each factor is important in planning to achieve cyclic PM and is dealt with separately here.

*a. Basic Requirements to Maintain the Cycle.* Selecting an appropriate cycle length is important; however, planning, priorities, procedures, and standards should also be considered.

(1) *Priorities.* Cyclic PM should be accomplished according to the following priorities:

(a) Priority 1: Family Quarters

(b) Priority 2: Other Permanent Facilities

(c) Priority 3: Temporary Facilities

(2) *Performance Cycles.* PM cycles vary among facilities and should be performed as follows:

(a) Family housing: scheduled cycle and/or between occupancies

(b) Other Permanent Facilities: scheduled cycle

(c) Temporary facilities: scheduled cycle

(3) *Length of Preventive Maintenance Cycle.* The recommended length of an effective PM cycle is between 90 and 180 days. Under 90 days is considered uneconomical; over 180 days is considered inefficient and significantly less effective.

*(a) Optimum Cycle.* In the absence of specific installation requirements and experience which dictate length of PM cycles, a 120-day cycle should be adopted. This length has been proven to be effective by experience.

*(b) Cycle Determination for New Programs.* Installations establishing cyclic PM programs in Areas where regular maintenance or PM has not previously been accomplished will probably not be able to complete all required work in 120-day cycles initially, due to the backlog of maintenance and the volume of additional Service Order Requests being generated. A longer initial cycle may have to be used and shortened as the backlog is reduced.

*(c) Cycle Variance.* The cycle is expected to vary for each team and each repetition since time is of secondary importance to accomplishment of all identified work.

(4) *Structuring Preventive Maintenance Areas.* Planning to accomplish PM at most Army installations, because of physical size, type and location of buildings, can be simplified by subdividing into Areas. Figure 3-1 shows an Army installation subdivided into PM Areas.

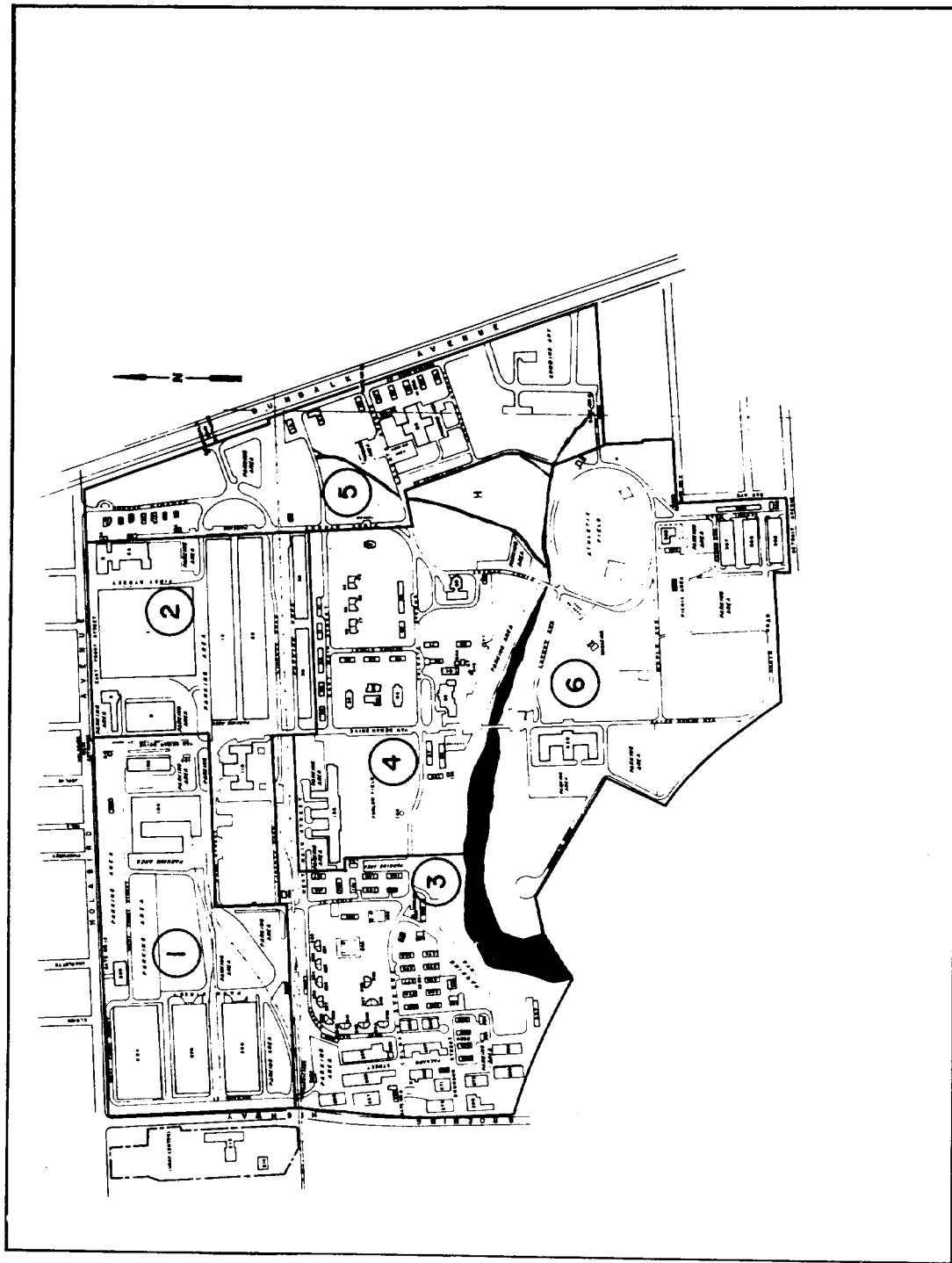


Figure 3-1. Army Installation Sub-divided into PM Areas

(a) *Geographic Closeness.* Travel distances are important in establishing PM Areas on installations. Excessive travel distances within the same PM area should be avoided. For example, training buildings, located at opposite ends of an installation would not normally be included in the same area.

(b) *Similar Buildings.* Buildings and structures with similar maintenance requirements should be located in common Areas, unless other factors such as travel distance would make establishment of the area inadvisable. If possible, Family Housing should constitute a separate PM area.

(5) *Diverting Preventive Maintenance Workers to other Duties.* Diverting workers assigned to PM to other duties disrupts planning and scheduling to maintain the cycle and is not recommended.

(6) *Manpower Requirements.* Adequate manpower is essential to accomplish work and maintain PM cycles. To ensure that manpower requirements for PM are accurately identified and properly documented, the following procedures should be followed:

(a) *Calculation of Standard Hours.* Using the PM performance standards in Figure 3-2 calculate the standard hours required for the total square footage of all facilities in each building category by PM area. MI elements of work, including travel, are accounted for in these performance standards, expressed in manhours. The local adjustment factor(L.A.F.) should be expressed as a decimal, such as 1.1 or 0.92. Its use must be fully substantiated by the results of a work sampling study or other acceptable technique.

Item	Unit	PM Performance Standards (Ref DA PAM 420-5)	L.A.F.	Local Standard
Type of building				
Training	1,000 sq. ft.	1.116		
Maintenance and production	1,000 sq. ft.	0.900		
Research, development and test	1,000 sq. ft.	0.966		
Storage	1,000 sq. ft.	0.750		
Hospital and medical	1,000 sq. ft.	2.000		
Administration	1,000 sq. ft.	1.116		
Family housing	1,000 sq. ft.	1.666		
Troop	1,000 sq. ft.	1.116		
Other	1,000 sq. ft.	1.333		

Figure 3-2. Building PM Performance Standards

Figure 3-3 is a sample calculation of standard hours using square footage found on an Army installation.

A simple illustration format, illustration 3-1, is included at the end of this chapter.

Type of Buildings	Size of Building In Square Feet	PM Performance Standards by hour, per 1000 sq. ft. (REF DA PAM 420-5)	Hours Required for Yearly Cycle	Hours Required for Quarterly Cycle
Training	143,000	1.116	159.59	638.35
Maintenance and Production	83,000	0.900	74.70	298.80
Research, Development and Testing	63,000	0.996	60.86	243.43
Storage	127,000	0.750	95.25	381
Hospital and Medical	627,000	2.000	1,254.00	5,016
Administration	255,000	1.116	284.58	1,138.32
Family Housing	448,000	1.666	746.37	2,985.47
Troop Housing	396,000	1.116	441.94	1,767.74
Other	413,000	1.333	550.53	2,202.12
<b>Total</b>	<b>2,555,000</b>		<b>3,667.82</b>	<b>14,671.23</b>

Personnel Required	$\frac{14,672 \text{ hours per year}}{1,760 \text{ manhours, employee per year}^*}$
	= 8.34 required personnel

\*This Figure will vary from installation to installation depending on the local adjustment factor.

Figure 3-3. Sample Calculation of Standard Hours

(b) *Hours for Between-Occupancy Preventive Maintenance of Family Housing Units.* Using past performance or the best possible initial estimate, identify the hours required, including travel, to provide between-occupancy PM to family housing units. This work must be documented for each housing unit visited and should cover a period equivalent to the selected cycle. Travel time must be documented and standards developed.

(c) *Determination of Manpower Requirements for Off-Post Facilities.* Manpower requirements for providing PM to off-post facilities, such as reserve centers, should be determined separately. In some cases excessive travel time is involved and the requirement may exist for personnel to remain at the station full time. Documentation must be provided to support the need for this work and the associated manpower. At some sites, studies may indicate economic justification for contracting out maintenance services including PM.

(d) *Calculation of Required Manpower for Each Preventive Maintenance Area Per Cycle.* Using the standard hours calculated using paragraph (6) (a) above, determine the number of personnel required to complete a cycle in each PM area. First, divided the total hours above by the number of available work hours during the cycle. Second, multiply this figure by the leave factor for the installation and round up to the nearest whole number.

(e) *Preparation of an Individual Job Order (I.J.O.) for Preventive Maintenance Areas.* An Individual Job Order should be written for each area that will identify the hours required to provide services as determined in the above paragraphs. As each I.J.O. is completed, the actual expended hours should be documented. In addition, the standard hours and actual hours should be noted on the PM Checklist/Record for each facility. (The Checklist/Record is discussed later in this chapter.) Work accomplished under an I.J.O. for family housing, between occupancies, must reflect maintenance and repair costs separately.

(f) *Automatic Costing of PM Under I.F.S.* Installations operating under the Integrated Facilities System (I.F.S.) may use the automated technique, to assign document (work order) numbers to work designated as PM. This eliminates the cumbersome task of preparing lengthy I.J.O's and the necessity for recording work performed against the proper cost accounting code.

b. *Scheduling Work and Notification of Visits.* Work scheduling is based on building-by-building time requirements calculated from established maintenance standards for types of buildings and known square footage. An example of this calculation is provided in Figure 3-4. Also see Illustration 3-2.

Building Number	Square Feet	Building Use	PM Performance Standards (Ref DA PAM 420-5)	Allocated Man Hours
4000	11,500	Storage	.750	8.6 hours
4001	16,000	Administration	1.116	17.8 hours
4002	40,000	Training	1.116	44.6 hours
5000	7,500	Housing, Bach.	1.116	8.4 hours
5001	15,000	Utility	1.333	20 hours

Figure 3-4. Calculation of allocated PM per building.

Effective scheduling to complete PM cycles requires full cooperation and assistance from building occupants. Meeting schedules will depend on prior notification of regular visits by the PM Unit. The following methods are recommended for notifying personnel of upcoming visits:

(1) announcements placed in the installation newspaper or bulletin.

(2) notices delivered to buildings in advance of the visit (Illustration 3-3).

(3) schedules available from work receptionist.

(4) use of community and command organizations.

**3-4. Work Reception Desk Control System** The general responsibilities of the Work Receptionist as they relate to PM activities as follows:



a. *Preventive Maintenance Visit Schedules.* Prior to issuing a Service Order, the Work Receptionist should determine the priority of each request and check the schedule of PM visits. If a request is determined to be routine and a visit is scheduled within the next 30 days, the Work Receptionist should inform the requestor to note the work requirement on the Preventive Maintenance Reminder Sheet.

b. *Self-Help.* The request should be reviewed to determine if the work should be accomplished by the requestor as self-help. Authorized self-help work lists should be available from the Work Receptionist. (See DA PAM 210-2)

### 3-5. Daily Operation of the Preventive Maintenance Unit

a. *Job Preparation.* The unit leader should obtain the current "Building & Structures PM Checklist"Record" (Illustration 3-5) from the shop files for each building to be serviced in the area assigned for that day. The unit leader should make certain that the unit has the proper supplies and equipment. Basic supply and equipment lists are provided in Chapter 5 of this Technical Manual; these may be modified to suit the needs of specific facilities. The unit leader should also check the service order file for service orders located within the assigned area that can be routinely accomplished.

b. *Inspector—Team Concept of Operations.* A system using an inspector who operates in advance of the PM Unit has been found to be effective in reducing the actual time spent to accomplish PM, particularly for 3-man units or larger. This allows building condition to be readily determined, maintenance needs outlined, and work identified.

(1) Each area leader inspector has a master list of buildings for the assigned area. It contains the building number, the designated use of the building, the size of the building and the allocated time for PM. A sample master list is shown in illustration 3-4, at the end of this chapter.

(2) The inspector enters each building or quarters prior to the PM workers to determine what PM work is needed. The inspector prepares a list of individual work requirements and breaks them down into one of 3 categories: PM, self-help, or work request (when the maintenance work falls beyond the scope of PM).

(3) After receiving the list, the PM workers should begin the actual maintenance work. Supplies used are shown on the list. Upon completion of PM in the given building or quarters, the actual time spent in each building is shown on the list, along with the workers name. The completed list is returned to the inspector and the workers move to the next assigned buildings or quarters.

### 3-6. Work Guidelines for Preventive Maintenance

PM work is accomplished in two ways: by PM units operating on scheduled visits and by occupants performing self-help.

a. *Preventive Maintenance Unit.* PM units accomplish a series of basic tasks in every building visited. Performance of these tasks ensures that PM needs are being fully met. The procedures in this section outline the basic tasks.

(1) *Question Occupant/User.* A member of the PM unit will review the building occupant's Preventive Maintenance Reminder Sheet and ask the occupant about possible maintenance problems.

(2) *Inspect.* The senior member of the PM unit will inspect the building or structure using the Preventive Maintenance Checklist Record. References are made on the checklist to inspection guides included in Chapter 8 of this technical manual.

(3) *Work Guides.* Detailed inspection/work guides contained in Chapter 8 of this manual describe typical PM requirements found in buildings and structures. As a guide, it is recommended that, in the initial establishment of a PM program, a detailed list of all specific building components and elements listed in sub-paragraphs of Chapter 8 be prepared and utilized for the first few cycles in addition to the PM checklist/record described in paragraph 3-7b below. Thereafter, only the PM checklist/record need be maintained.

(4) *Repair of Minor Work Requirements.* PM units will repair any maintenance requirements discovered during inspections and accomplish all work within their capabilities. The Unit Leader will determine which requirements fall within the scope of PM.

(5) *Reporting of work requirements beyond the Scope of Preventive Maintenance.* In order to complete the scheduled cycle within a reasonable time frame, PM units should not undertake any maintenance or repair tasks beyond their capability. Work beyond the scope of PM should be reported to the PM Foreman. (Note: Primary objective is to accomplish all work within PM capability; time is of secondary importance.)

(6) *Self-Help Items.* PM units should refer minor maintenance and repair items to the Occupant for accomplishment by self-help.

b. *Self-Help.* Guidelines for accomplishing minor maintenance and repair by self-help are contained in Chapter 4. Self-help is a valuable and essential supplement to preventive maintenance and should be given full command support.

### 3-7. Formats, Records, and Costs Accounting

This section describes the administrative aspects of

PM programs, including flow of documents, recording of work requirements, and accounting for costs.

a. *General Principles.* One principle for a successful PM program is to minimize documentation, but still fully document PM work for all labor, materials and expenses. Accurate accounting, will allow the Facilities Engineer to analyze the costs and results of his program and substantiate manpower requirements.

b. *Buildings and Structures PM Checklist/Record.* One main tool available to the PM unit in the performance of its duties is the Buildings and Structures PM Checklist/Record. Use of the "Buildings & Structures PM Checklist/Record Format" (Illustration 3-5) is recommended. It is both a guide to work performance and a record of its accomplishment.

(1) The checklist/record lists building components, applicable inspection items, date, coded action-taken symbols, remarks, and number of man hours used for the building.

(2) This format should be used in conjunction with inspection/work guides in Chapter 8, which is a training guide for PM personnel. For example, personnel assigned to the electrical component in a particular building may use a list of work guides in paragraph 8-13 for inspection. Designated in-

spection items would include conservation of energy, lighting and sockets, lamps, security alarms, wiring, electric heaters, motors, fans, fuse boxes, ductwork, switches and outlets and general electric safety items.

(3) Minor maintenance and repair tasks, as well as major items, that are corrected or reported, should be documented under the action column using one of the five symbols shown.

(4) The PM unit uses the checklist/record each time it visits a building or structure. Completed forms are filed in the PM shop at the end of the day, when all job order requests have been submitted. The format covers three visits 50 PM units can insure that follow-up actions have been taken and continuity is maintained.

(5) Installations may modify this format to suit local conditions.

c. *Preventive Maintenance Reminder Sheet.* Repair requirements discovered by the occupant between regularly scheduled PM visits other than emergencies or self-help should be listed on the Preventive Maintenance Reminder Sheet (Figure 3-5) and given to the PM Team upon arrival at the building or quarters. This record will enable the PM unit to expedite the required service. A sample illustration format, illustration 3-6, is included at the end of this chapter.

<b>Preventive Maintenance Reminder Sheet</b>		<b>Building No.</b>		
<b>Date</b>	<b>Deficiency</b>	<b>Occupant</b>	<b>P.M. Worker</b>	<b>Action Taken</b>

Figure 3-5. Preventive Maintenance Reminder Sheet

The spaces of the Preventive Maintenance Reminder Sheet will be identified by the titles as shown on Figure 3-5 and data will be entered as follows:

(1) "Building Number." Enter number of building for which sheet is prepared.

(2) "Date." Responsible building occupants will enter the date when they first observe any particular deficiencies.

(3) "Deficiency." Enter a brief description of the deficiency.

(4) "Occupant." Occupant to enter his/her initials or apt./office number.

(5) "P.M. Worker." PM worker to enter his/her initials.

(6) "Action Taken." Enter the date and the type of action taken.

d. *Typical Flow of Documents.* This technical manual provides a system to collect information on building requirements and account for the allocation of manpower and resources to meet

those requirements. Figure 3-6 shows the basic flow of information between the Occupant, PM Shop, and Work Coordinating Office.

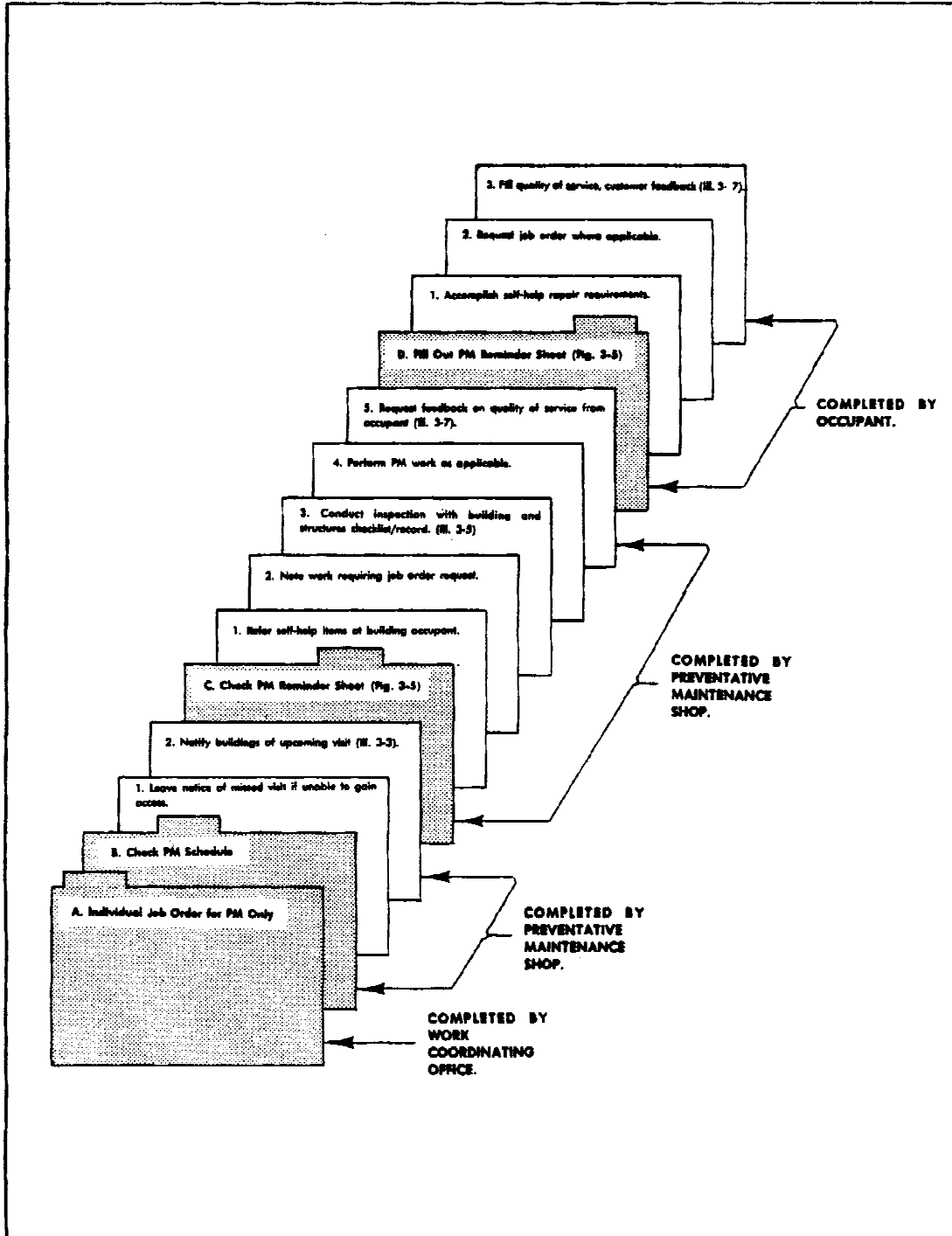


Figure 3-6. Flow of Information in PM

e. *Cost Accounting and Budgeting.* Individual job orders are written for each PM area to cover each cycle. All workers' time and materials are charged against the appropriate work order as defined above.

**3-8. Evaluation of Preventive Maintenance Programs.** A major advantage of documented PM programs is the availability of data. This data includes facts concerning Service Order levels, actual manhours expended, occupant feedback, and amount of scheduled vs. unscheduled work. It allows the Facilities Engineer to provide the Installation Commander with objective reports on the physical condition of buildings and structures and the use of manpower and resources. Periodic evaluation of PM programs using available data will indicate whether desired system performance is being achieved, and if not, where changes should be made.

a. *Standards of Maintenance.* AR 420-70 prescribes criteria, standards, and procedures in connection with Facilities Engineering responsibilities for buildings and structures. PM programs are directed toward achieving these standards, and inspections should be made at random intervals to ascertain building conditions.

b. *Calculation of Actual vs. Projected Performance.* Use of manpower in productive work is the most essential evaluation standard in PM. It indicates manpower shortages or surpluses which have occurred because initial manpower determinations did not match work requirements. Facilities Engineers should compare actual vs. estimated manhours of effort for a 120-day PM cycle. (Figure 3-7) The figures are representative for installations where established PM programs have been operating for some time. In this example, an actual surplus of over 1.387 manhours was registered.

Area No.	Calculated Man-Hours <sup>1</sup> for 120-day Cycle	<sup>2</sup> Actual Man-Hours avg. (1st Cycle)	Man-hours per quarter or Building (DA Pam 420-5)	Actual Man/Hr. per qtr/bldg worked
			Avg. Man/Hr. per sta. (DA Pam 420-5)	
1	1027	763	2.28	2.26
2	733	675	3.48	3.80
3	587	543	2.22	2.32
4	733	660	3.9	4.9
5	733	631	5.0	5.7
6	733	512	29.7	29.2
7	587	484	33.7	32.1
8	587	543	5.13	5.80
9	<u>587</u>	<u>587</u>	1.93	1.20
	6307	5456		
	<u>440<sup>3</sup></u>			
	6747			

<sup>1</sup>Man-Hours based on 1760 hours per employee year. This Figure will vary from installation to installation depending on the local adjustment factor.  
<sup>2</sup>Difference from calculated due to sick leave, annual leave, retirement, hire lag, etc.  
<sup>3</sup>Added to compensate for workers on leave pending retirement, etc.

Figure 3-7. Comparison of Actual vs. Calculated Performance

c. *Shortages in Manpower.* Calculations required to establish manpower levels are shown in figure 3-3. A comparison of allocated PM hours vs. Actual PM hours is shown in Figure 3-7. These provide documentation to be used as support for current or additional manpower requests.

d. *Volume of Service Orders.* Reduction of Service Orders is a primary goal of the PM program, and by comparing levels of Service Orders before and after PM will provide information for determining the effectiveness of the PM program.

e. *Occupant Feedback.* Effectiveness of PM may be measured by customer satisfaction. Facilities Engineers should encourage positive feedback by establishing simple methods for occupants to provide this information directly. Methods of soliciting customer feedback include the following:

(1) *Customer Checklists.* Comments regarding PM performance may be solicited via checklists or standard questionnaires distributed and collected by P.M. personnel. Illustration 3-7 shows a typical customer feedback request used to monitor FE Service, including PM.

(2) *Non-Commissioned Officer (NCO) Meetings.* Minutes of NCO meetings are another source of feedback on PM performance and should be reviewed by the Facilities Engineer.

(3) *Community Development Councils.* Community development councils may be approached to assist in providing feedback on PM in family

housing and community facilities.

f. *Performance of New Programs vs. Upgraded Programs.* PM work in some cases is accomplished too infrequently to affect the number of Service Order requests and major maintenance failures frequently occur. Long cycles contribute to the backlog of maintenance and repair since many building maintenance repair requirements go undetected over long periods. The conditions created by irregular maintenance have predictable effects on systematic, cyclic PM programs. Facilities Engineers instituting programs where effective maintenance has not been accomplished previously should expect an initial response which might include the following:

(1) *Initial Cycle Length.* Longer initial cycles should be expected and must be planned for.

(2) *Increase in Service Orders.* The backlog in maintenance and repair uncovered by initial cycles will be accompanied by an increase in Service Orders. While this increase appears to contradict the goals of the program in reducing Service Orders, it is a necessary program effect and will diminish during successive cycles.

(3) *Succeeding Cycles.* PM cycles should generate fewer Service Orders as the work becomes systematized and long-standing maintenance requirements are reduced. Eventually, the number of service orders should follow a fairly constant pattern.

Type of Buildings	Size of Building In Square Feet	Labor Standards by hour, per 1000 sq. ft.	Hours Required for Yearly Cycle	Hours Required for Quarterly Cycle
<b>TOTAL</b>				

*Illustration 3-1. Calculation for Standard PM Hours (Format)*

Building Number	Square Feet	Building Use	PM Performance Standards (Ref. DA PAM 420-5)	Allocated Man Hours

*Illustration 3-2. Calculation for Allocated PM Per Building (Format)*

**Office of the Director of Facilities Engineering**

A unit of Engineer Preventive Maintenance personnel will visit your quarters on \_\_\_\_\_ to perform scheduled building maintenance. Team members may be identified by a special Government Identification Card which they will present upon your request.

Your cooperation will be appreciated in assuring that an adult person is home to grant these workers access. Request that you list those items needing repair on your Preventive Maintenance Reminder Sheet to expedite the visit for our personnel and to minimize your inconvenience. If an item of work is beyond the scope of this team, it will be referred to the appropriate shop for repair at a later time. Further, personnel of this team will advise you on any questions you may have on self-help maintenance in your quarters.

It is our intent through this scheduled maintenance to correct small deficiencies before major repairs develop and to provide better service for the occupant. Any questions or suggestions you may have to improve this service may be referred to the Preventive Maintenance Foreman. Extension \_\_\_\_\_.

*Illustration 3-3. Sample Notification of Visit (Format)*



Master Building List			P.M. Area
Building Number	Building Usage	Building Size (sq. ft.)	Allocated P.M. Time (man hours)

*Illustration 3-4. Master Building List (Format)*

Buildings & Structures PM Checklist / Record		Key to Symbols				Referred to Occupant as Self-help Adjusted as Required Repaired Replaced Part Forward Job Order Request	
		SH: A: R: RP: J:	Remarks	Date Action	Remarks	Date Action	Remarks
Component	Work Guide References (TM5-610)	Date Action	Remarks	Date Action	Remarks	Date Action	Remarks
Roofing	8-5						
Structural	8-6						
Floor Cover	8-7						
Ext. Paint	8-8						
Int. Paint	8-9						
Heating	8-10						
Air Cond.	8-11						
Plumbing	8-12						
Electrical	8-13						
Equipment	8-14						
Structures	8-15 through 8-19						
Area: Bldg: Unit:			Time In: Time Out: Total Man-Hr:		Time In: Time Out: Total Man-Hr:		Time In: Time Out: Total Man-Hr:
			Unit Leader		Unit Leader		Unit Leader

Illustration 3-5. Buildings and Structures PM Checklist/Record (Format)

Preventive Maintenance Reminder Sheet		Building No.		
Date	Deficiency	Occupant	P.M. Worker	Action Taken

*Illustration 3-6. PM Reminder Sheet(Format)*

Quality of Service, Customer Feedback Format

TO FE Customer                      FROM FE                      DATE

1. The Facilities Engineering organization desires to provide quality service to the troops and their dependents. You can help by giving us your evaluation of our performance on work which we recently performed for you. The lower portion of this form is provided for this purpose.

2. Please be specific if you desire to make a comment or to express appreciation to certain employees.

(FE Signature Block)

---

TO FE                      FROM                      DATE

Type of Work:

Preventive Maintenance Carpentry Pest Control	Contractor Air Conditioning Heating	Plumbing Electrical Other
---	---	---------------------------------

Bldg. No: \_\_\_\_\_ Date Performed: \_\_\_\_\_

Time Arrived \_\_\_\_\_ Time Completed: \_\_\_\_\_

Work Performed: \_\_\_\_\_

(Comments/Recommendations on Service, if any): \_\_\_\_\_

\_\_\_\_\_  
Signature (not valid unless signed)

Illustration 3-7. Quality of Service, Customer Feedback Format

## CHAPTER 4

### SELF-HELP PROGRAM

**4-1. General** The Self-Help Program is a means of attaining maximum use of available resources to improve living conditions and the general appearance of facilities.

*a.* Work accomplished within this program should only include those jobs that military personnel and family housing occupants can realistically be expected to perform.

(1) Furnish written and verbal instructions to personnel upon their assignment to housing (includes bachelor housing and family housing).

(2) Develop and publish standing operating procedures.

(3) Support troop units at remote locations.

(4) Establish necessary training program.

*b.* Work under the self-help program should be accomplished in accordance with the guidance furnished in AR 420-22 and other publications listed in Appendix A.

*c.* Occupants may accomplish self-help work by individual or group effort. Family housing occupants may also be authorized by the installation commander to perform minor improvements under the Self-Help Program.

#### 4-2. Responsibilities

*a. Facilities Engineer.* The Facilities Engineer is responsible for providing a self-help program. These responsibilities include:

(1) Providing appropriate training.

(2) Providing instructions to users of equipment.

(3) Providing necessary supplies, equipment and tools.

(4) Supervising and inspecting self-help accomplished under this program.

(5) Appointing a Self-Help Coordinator to organize the program.

*b. Chief, Buildings and Grounds.* The Chief of Buildings and Grounds Division will have management responsibility for the Self-Help Program. Direct supervision of the program will be by the PM Foreman.

*c. Supply and Storage Division.* This division normally will be responsible for the issue of self-help supplies, tools and equipment.

*d. Troop Commanders.* Troop commanders are responsible for accomplishing the self-help program in troop housing areas and at remote locations. This responsibility includes:

(1) Adherence to appropriate prescribed procedures.

(2) Assuring that no unauthorized work is performed.

(3) Assignment of self-help work to individuals consistent with their experience or aptitude for the work to be accomplished.

(4) Proper use of supplies, equipment and tools.

(5) Proper training of personnel.

*e. Occupants.* Occupants of bachelor housing and family housing will perform self-help work which they can realistically be expected to perform.

*f. Family Housing Manager* The FH Manager should encourage occupants to attend self-help classes.

**4-3. Implementing the Self-Help Program** AR-420-22 Section 1, paragraph 1, establishes criteria for initiating and accomplishing self-help programs. Conformance to these criteria will ensure that PM self-help programs operate effectively.

*a. Command Support.* Installation commanders are responsible for the programming and accomplishment of self-help programs at installations under their jurisdictions. While this responsibility is delegated to the Facilities Engineer, full and visible command support for self-help is of positive value and will insure the installation personnel become involved in the program.

*b. Administration.* Responsibility for administering the PM self-help program rests with the PM Shop Foreman, who will organize and schedule self-help training, oversee the supply system, and disseminate information. Accurate records should be maintained to allow the Foreman to evaluate the self-help program and improve performance.

*c. Self-Help Instructions.* The FE, will establish and conduct regularly scheduled self-help classes for occupants of barracks, BOQ's and other quarters.

*d. Facilities Engineering Support.* Self-help coordinators may request training and other assistance from the FE. Suggestions to improve self-help performance should be routinely forwarded to the FE from occupants.

**4-4. Guidelines for Self-Help.** The PM self-help program should encompass family housing quarters and bachelor housing. The program may include other areas and facilities. This section contains broad guidelines for establishing such a program.

*a. Family Housing Occupants' Self-Help Program.* The family housing self-help program is a management tool whereby the manpower resources of occupants of quarters are used for the accomplishment of limited maintenance and repair work. These tasks are those which would normally be performed by homeowners to conserve funds and to preserve their homes. Controls, procedures and work standards should be established to assure that occupants desiring to perform self-help are aware of the authorized self-help work (see paragraph (1), below) and are capable of satisfactorily performing the work.

(1) *Authorized Self-Help Work.* Examples of maintenance and repair which may be accomplished by occupants are: replacing faucet washers and window glass; repairing insect screens and storm sashes; controlling ants, roaches, silverfish, bed-bugs and other household pests; tightening and replacing builders' hardware items; replacing light bulbs and fuses; cleaning and replacing air filters; and other similar work to maintain facilities in a proper state of repair and appearance. A comprehensive list of authorized and unauthorized, self-help repair items is included in Figure 4-1.

<b>Sample Family Housing Authorized/Unauthorized Self-Help Work List</b>	
<p><b><u>AUTHORIZED WORK</u></b></p> <p><b><u>Carpentry &amp; Hardware:</u></b></p> <ol style="list-style-type: none"> <li>1. Reset nails protruding from woodwork and other surfaces and fill holes with materials compatible with surrounding surfaces.</li> <li>2. Tighten and replace builder's hardware such as belts, screws, door hinges, doorknobs, window lifts, door stops, and door closers.</li> <li>3. Lubricate builder's hardware items to provide quiet and satisfactory operation.</li> <li>4. Repair small holes in door and window screens and ensure that all screens are properly attached and secured to building.</li> <li>5. Repair blinds and tighten brackets.</li> <li>6. Repair or replace window shades.</li> <li>7. Refasten damaged coat hooks, clothes poles, and closet shelves.</li> <li>8. Tighten bolts and screws on soap dishes and tissue holders.</li> <li>9. Adjust or repair/replace kitchen cabinet hardware.</li> </ol> <p><b><u>Electrical:</u></b></p> <p>Replace light bulbs, light globes, wall receptacle plates, and ensure that proper wattage light bulbs are used.</p> <p><b><u>Plumbing:</u></b></p> <ol style="list-style-type: none"> <li>1. Clean and unstop water closets.</li> <li>2. Perform simple maintenance and repair of bathroom fixtures.</li> <li>3. Replace shower heads.</li> <li>4. Replace faucet washers and broken or missing faucet handles.</li> <li>5. Replace caulking around bathtubs and ceramic tile.</li> </ol> <p><b><u>General Housekeeping:</u></b></p> <ol style="list-style-type: none"> <li>1. Perform minor phases of insect and rodent control.</li> <li>2. Clean quarters to maintain sanitary conditions to keep insects from breeding.</li> <li>3. Clean appliances and kitchen equipment.</li> <li>4. Replace HVAC filters.</li> </ol> <p><b><u>Miscellaneous:</u></b></p> <ol style="list-style-type: none"> <li>1. Observe utilities conservation measures.</li> <li>2. Maintain splash blocks in the proper position under downspouts to deflect water away from the building and prevent erosion.</li> </ol>	<p><b><u>UNAUTHORIZED WORK</u></b></p> <p>Repairing leaking pipes Residual spraying for insect control Moving installed equipment from one location to another Replacing venetian blinds Altering locking devices on exterior doors Adjusting gas burners or any part of heating equipment Altering oil burner adjustments Adjusting thermostats (other than setting by external means) Caulking around window and door frames or other miscellaneous areas</p>

Figure 4-1. Sample Family Housing Authorized/Unauthorized Self-Help Worklist

(2) *Issue of Family Housing Self-Help Supplies, Tools and Equipment.* Every effort must be made to make the process of obtaining self-help supplies as easy and simple as possible for the occupant: one stop shopping is preferred.

(a) Self-Help supply stores should stock and issue those supplies, equipment and tools as authorized on the Self-Help Supply List (Figure 5-6). This list with the work order, covering appropriate dates, is the authorization for issue.

Warehousing is accomplished in a manner where all authorized self-help supplies are readily accessible to the counter area to expedite issue.

(b) Required tools and equipment on the Authorized/Unauthorized Self-Help Supply List (Figure 5-6) are obtained by the FE supply and storage division and issued to occupants on Request for Issue or Turn-In (DD Form 1150).

(c) Tools and equipment required on an occasional basis are issued on a loan basis using a temporary hand receipt.

(d) A record of all supplies issued to occupants should be maintained, by quarters, cost and date issued.

(3) *Operation of Self-Help Supply Stores.* The hours of operation of self-help supply stores should be consistent with the needs of occupants. For example, supply stores might operate after duty hours one or more days per week and one half day on Saturday.

(4) *Self-Help Classes.* Family Housing Managers should encourage occupants to attend self-help training classes. Classes should be scheduled regularly to meet the population turnover of the installation.

(a) Training should include building care and maintenance and should qualify the occupant to perform all authorized and self-help work on the Authorized/Unauthorized Work List, (Figure 4-1).

(b) Training should include, occupant responsibility for fire prevention, energy conservation, and good housekeeping.

(c) During the training, occupants should be given copies of the local Self-Help Work List (Figure 4-1) and Supply List (figure 5-6). The Work Reception Desk should also keep an adequate supply of Self-Help Work and Supply Lists.

*b. Troop Self-Help Program.* Self-help is a valuable adjunct to regular PM in buildings occupied by Army personnel other than family housing. The many advantages of this means of accomplishing PM should be considered by Troop Commanders and Facilities Engineers.

(1) *Buildings Covered by the Program.* The troop self-help program may be extended to cover all on-post facilities, including Bachelor Quarters and Troop Support Buildings such as

administrative, training, operations, maintenance, production and other facilities.

(2) *Role of the Self-Help Coordinator.* The Self-Help Coordinator organizes a troop self-help program encompassing the occupants of all facilities other than family housing. The Self-Help Coordinator is responsible for seeing that all units, activities, school commands, etc., organize self-help maintenance teams. In addition, the Coordinator has the following duties:

(a) Establish a written SOP for operation of the troop self-help program.

(b) Develop training classes for self-help teams.

(c) Develop authorized self-help supply and work lists.

(d) Approve unit requests for material.

(e) Oversee periodic inspection of self-help work.

(f) Promote the Self-Help Program.

(3) After initial training, classes should be scheduled by the Coordinator to meet troop turnover.

(4) Requests for material are submitted to the Self-Help Coordinator. An adequate description of the work must be included. The Self-Help Coordinator should be given authority to approve normal self-help material requests.

(5) Units obtain all tools from the Self-Help Service Supply Center

(6) A record of all supplies issued to troop self-help teams is maintained by the unit and the Self Service Supply Center.

*c. Customer Information and the Self-Help Program.* The FE and Family Housing Manager must continually educate customers and sell the self-help program. Publicity through community organizations, newsletters, daily bulletins and post newspaper is effective in keeping the customer aware of what can be expected from the PM Program and the responsibilities the customer has been assigned. To maximize the benefits of the Self-Help Program, Work Reception personnel should use the PM schedule and the self-help work list to establish work priorities. This procedure will allow them to ascertain if a particular work request can be delayed until a regularly scheduled visit or if the work is self-help.



## CHAPTER 5

EQUIPMENT, SUPPLIES AND TRAINING GUIDELINES

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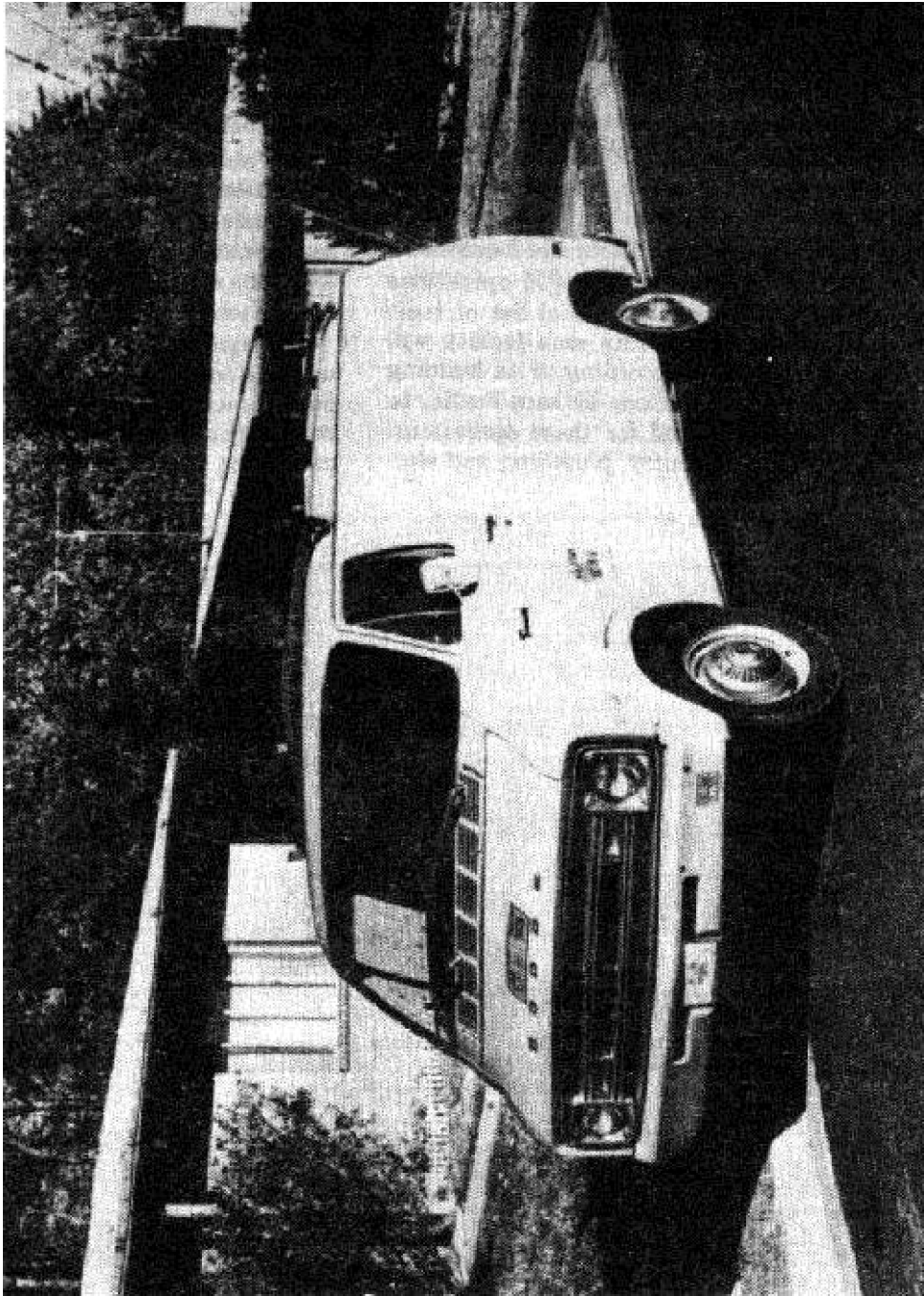
**5-1. General** Effective execution of a PM program requires equipment suited to the work, supplies, and proper training of PM workers. The Facilities Engineer is responsible for providing appropriate training and material support for PM to assure uniform performance of work.

**5-2. Preventive Maintenance Tools and Equipment** Tools and equipment necessary for PM operations must be available for use. No general list of tools will apply to all installations as each facility will have certain requirements according to its building types. Review the PM operations for each facility to determine the tools required for these operations. While basic tools for carpentry, plumbing and electrical work should

suffice for most minor maintenance and repair tasks, a record should be kept of facilities requiring special tools.

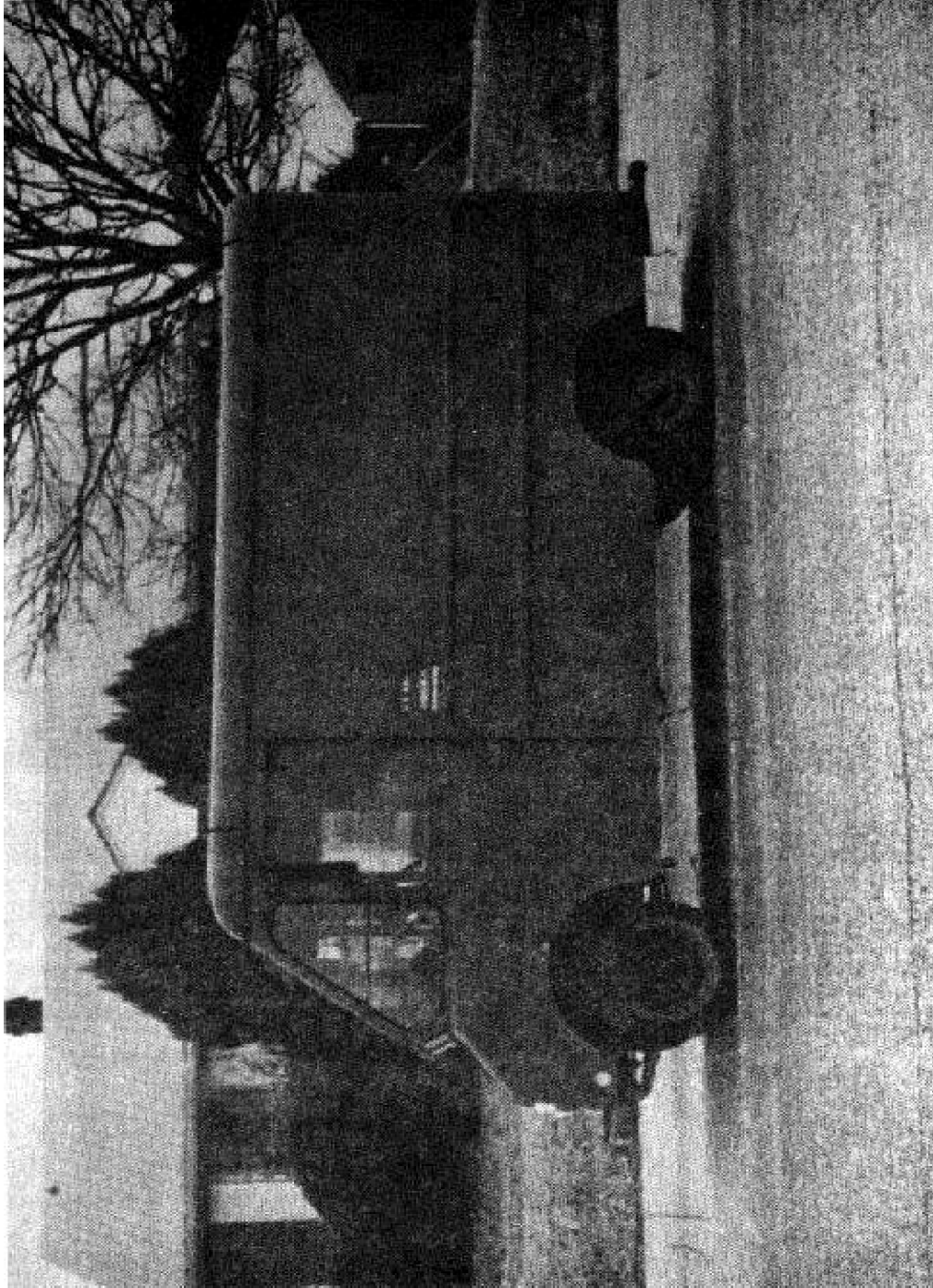
**5-3. Vehicles** Vehicle choice is an important consideration to transport personnel, supplies, and equipment, and to allow the maximum amount of maintenance and repair work to be performed away from the shop. The following types of vehicles are recommended for PM use.

a. *Econoline Vans*. These provide space for workers to perform minor maintenance under cover during inclement weather, have adequate room for supplies and equipment, and are best suited for two-man units. (Figure 5-1).



*Figure 5-1. Econoline Vans*

*b. Step Vans.* These are useful for larger PM units requiring more work space i.e. repairing doors. (Figure 5-2)



*Figure 5-2. Step Van*

c. *Mobile Shop Van.* Use of this vehicle allows repair work that is normally accomplished at the shop to be done in the PM area. The van is

provided with electrical hookup and power tools and equipment. Its use is limited to those areas where power is available (Figures 5-3 and 5-4).

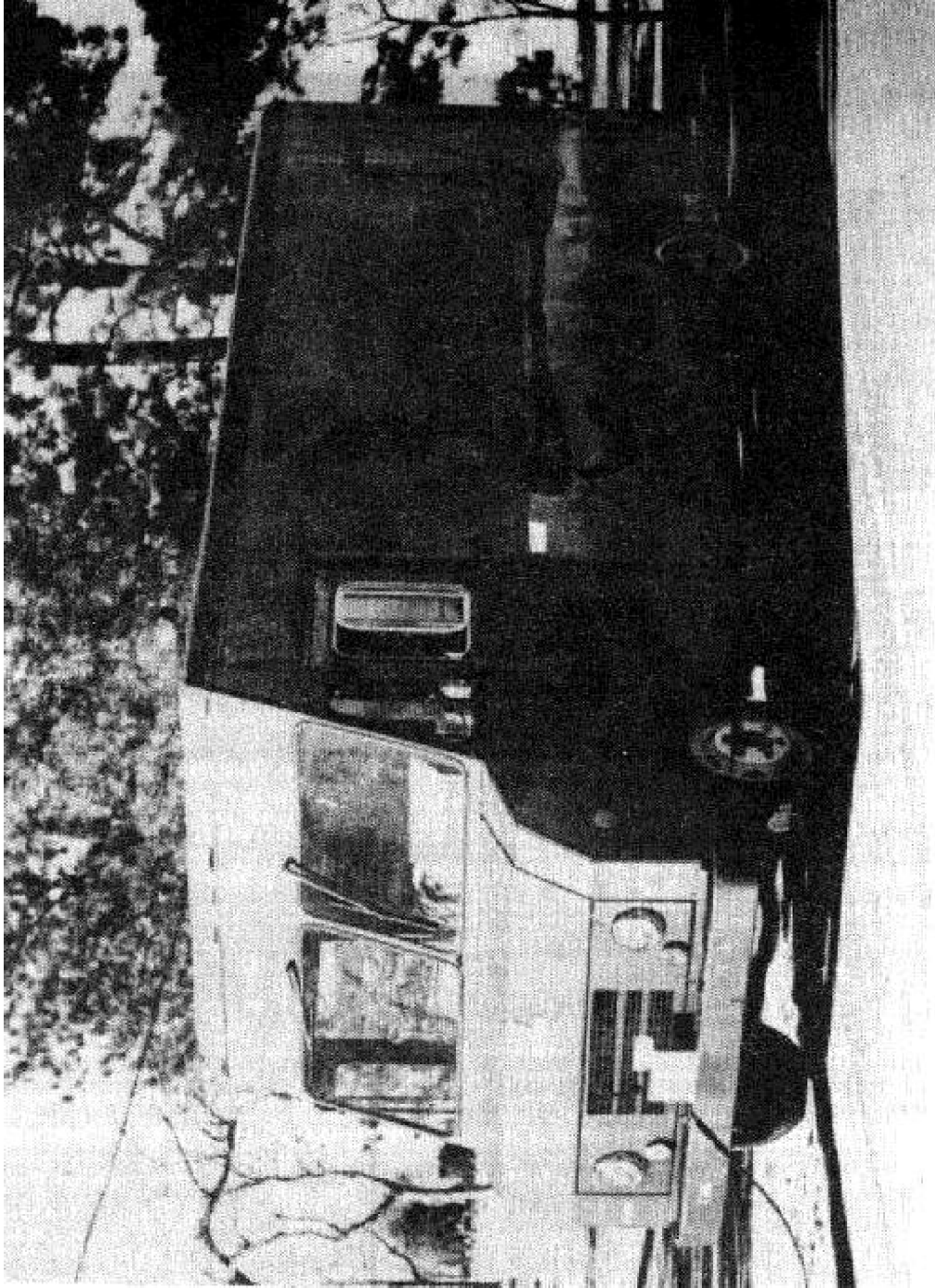


Figure 5-3. *Mobile Shop Van*

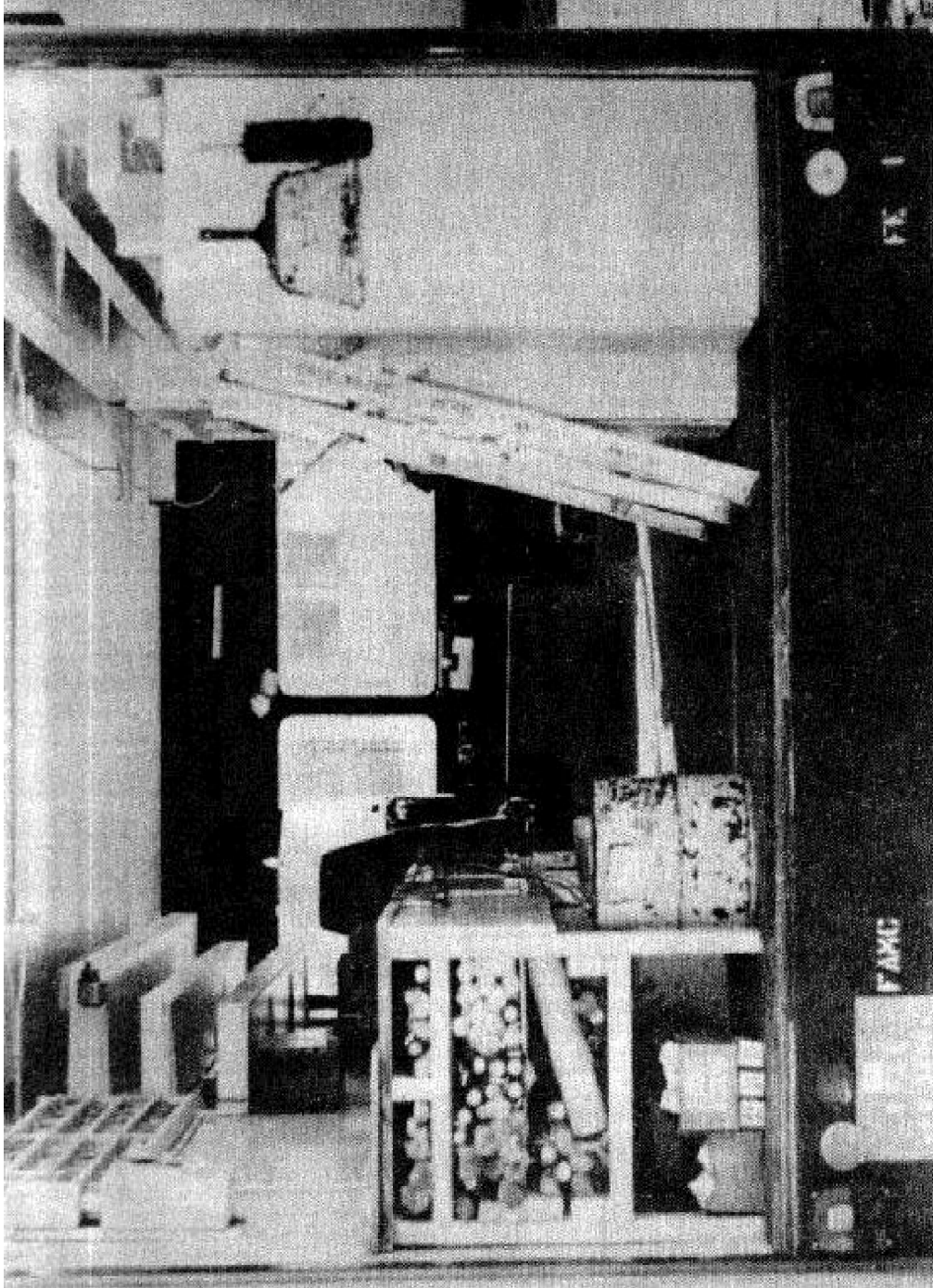


Figure 5-4. Interior of Mobile Shop Van



d. *Mobile Shop Units (Towed)*. These sheds are towed to areas where there is a relatively long term requirement for storage of tools and supplies (Figure 5-5).

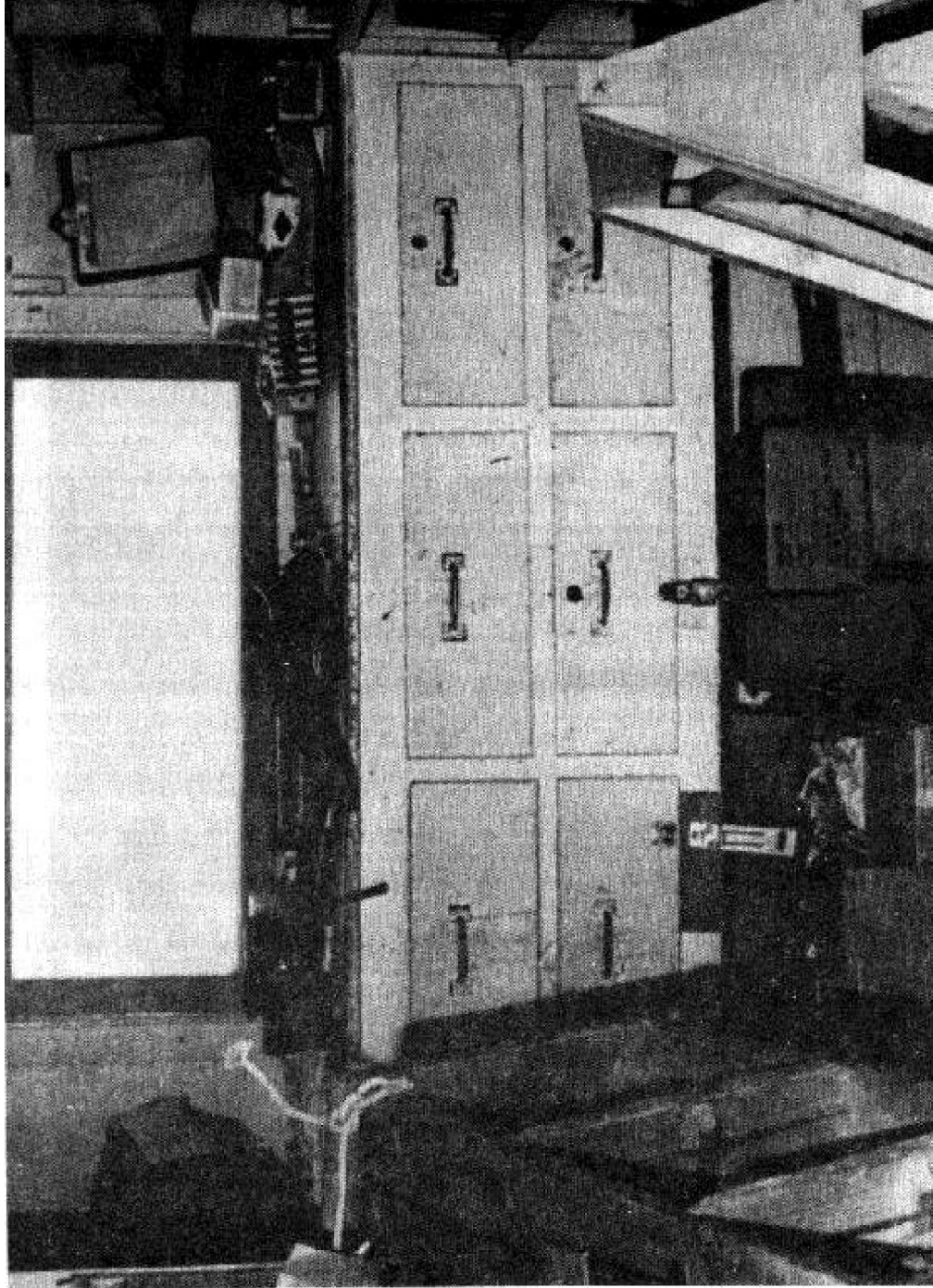


Figure 5-5. Interior of Mobile Shop Unit

*e. Scooters.* Scooters are used extensively by one man performing repetitive PM or covering large interior areas such as warehouses.

*f. Modified Push Carts.* These may be used in hospitals and multi-story buildings such as high-rise bachelor quarters.

**5-4. Materials and Supplies** Supplies must be readily available if the work is to be accomplished economically. Each unit should have required supplies in a specific place, preferably in individual vehicles with bins and compartments.

*a. Preventive Maintenance Supplies.* Prepare a master supply list of materials required in each PM area. Keep a fifteen-day supply of parts and materials in the PM vehicle, in accordance with this master supply list. The list should be kept in accordance with AR 420-17, Paragraph 7-24 "Shop/Truck Stock," and updated every three months.

*b. Self-Help Supplies.* Supplies will be made available to program participants.

(1) Maximum use should be made of the Self-Service Supply Center (SSSC) and/or Facilities Engineering Self-Service Section as a supply source for authorized personnel. These supply sources should be readily available to occupants of

family housing and bachelor housing. Additional supply facilities may be provided to serve isolated or remote areas.

(2) At remote locations, operating personnel should be provided with service stocks and authorized to use small purchase procedures to obtain supplies not normally stocked. (This can be accomplished within the framework of small purchase procedures as prescribed in Section III, Part 6, Army Procurement Procedures.)

(3) Supplies obtained, issued, or furnished for use by program participants will be costed to the applicable Army Management Structure Account (AR 37-100-XX) as prescribed in AR 37-108. The DFAE will be reimbursed by family housing funds for the issue of all items of supplies, material, and tools used in family housing areas.

(4) *Family Housing Authorized/Unauthorized Self-Help Supply List.* Self-Help Supply Centers will stock and issue supplies, equipment and tools authorized on the Family Housing Authorized Unauthorized Self-Help Supply List. This list and appropriate work orders are the authorization for issue. Figure 5-6 shows a sample Self-Help Supply List, which may be used by Facilities Engineers.

<u>Sample Family Housing Authorized/Unauthorized Self-Help Supply List</u>		
<p><b><u>AUTHORIZED ITEMS</u></b></p> <p><b><u>Electrical:</u></b>                      Adapter, electric                      Fluorescent starters                      Fuses/fusestats                      Miscellaneous gloves                      Wall plates/receptacle                      Wall plates/switch                      *Fluorescent tubes</p> <p><b><u>Door/Window Hardware Items:</u></b>                      Cabinet (catches, pulls, hinges)                      Closet door knobs                      Door stops                      Glass (misc. sizes)                      Glazing clips                      Glazing points                      Glazing putty                      Screen door (springs, catches, closers, pulls)                      Screen wire and screen retaining moulding                      Weatherstripping                      Window locks                      Window screen hangers</p> <p><b><u>Plumbing Items:</u></b>                      Aerators                      Ball (water closet tank)                      Basin stopper                      Beaded stopper chains                      Faucet (washers, screws, handles)                      Flush tank valve unit                      Liftwire (toilet tank)                      Plumbers force cup                      Shower head                      Sink spray head                      Sink spray hose                      Sink strainer                      Soap holders                      Toilet paper dispensers                      Toilet seat                      Towel bars                      Tub and tile caulking                      Water hose washers</p>	<p><b><u>Miscellaneous</u></b>                      Approved insecticides                      Clothesline wire                      *Curtain rods                      Fasteners (nails, screws, etc.) required for authorized work                      Fertilizer, lime mulch                      *Garbage cans                      Grass seed                      HVAC filters                      Spackling powder                      Spackling putty                      Venetian blind repair kits                      *Window shades</p> <p><b><u>Unauthorized Items</u></b>                      Decorative exterior lighting                      Drapes and curtains                      Fasteners (other than authorized work)                      Fencing materials                      Flood or spot lights                      Gasoline                      Hanger devices (for wall hung items)                      Intercoms                      Lawn ornaments                      Light bulbs                      Locksets                      Padlocks                      Paint                      Patio covers                      Patio lights                      Planters/flower boxes                      Play enclosures                      Sandpaper                      Shelving (for personal effect)                      Shower curtains                      Tarps                      Tools (all hand and power types)                      Traverse rods                      Venetian blind units</p>	<p>Wall hangers                      Wastepaper containers                      Wheelbarrows                      Window screen units</p> <p><b><u>Expendable Items</u></b>                      (included in quarters inventory)                      **Cutter, weed, swing blade                      Garden hoe                      Garden hoses                      Garden rake                      Garden shears                      Garden spade                      **Grass shears                      **Hedge shears                      Lawn rake                      Lawn sprinkler                      **Pruning shear</p> <p>*Direct exchange items                      **Where applicable</p>

Figure 5-6. Sample Family Housing Authorized/Unauthorized Self-Help Supply Lists



**5 5. Training of Personnel** PM personnel should have broad general knowledge of building construction and maintenance. They must be familiar with building fixtures and appurtenances and have experience with the performance standards established for all building trades. Training should be conducted in regularly scheduled sessions with a definite plan of instruction, including record keeping, obtaining cooperation of occupants, and all other details required for properly accomplishing the work. Signed evidence of satisfactory com-

pletion of training should be furnished to the unit leader. Training in the basic crafts normally is the responsibility of the foremen of appropriate sections or shops. Methods which may be used for training personnel:

(a) *Shop Training.* Training by job rotation among specialty shops within the FE organization.

(b) *On-The-Job Training.* Training received on the job with an active PM unit.

## CHAPTER 6

### PREVENTIVE MAINTENANCE FOR FAMILY HOUSING

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#### 6-1. General

a. The objectives of PM in family housing units are as follows:

(1) To protect all family housing facilities from deterioration.

(2) To perform necessary minor maintenance and repair promptly while quarters are occupied.

(3) To schedule and perform necessary maintenance and repair between occupancies in a timely and expeditious manner to minimize down time.

b. Family housing facilities should be operated and maintained to a standard providing decent and liveable accommodations in good condition.

c. Funding for PM will be provided by the housing manager based upon the family housing program.

d. The Family Housing Manager should receive a copy of all customer feedback related to the completed work.

**6-2. Family Housing Preventive Maintenance Program** Recommend family housing be a separate PM program and be given highest priority in service response. Close coordination is required between the FE and Family Housing Manager to establish the program, priorities and funding.

a. *Purpose of Cyclic, Scheduled Visits.* Twenty-four hour occupancy and the nature and demands made on family housing units by their occupants require that PM service be accomplished on a regularly-scheduled cyclic basis. This type of program in family housing has the following advantages:

(1) Family housing occupants are aware of PM and keep records of problems for upcoming visits.

(2) The special needs of family housing units are routinely met.

(3) Self-help items are noted and referred to occupants without special follow-up inspections.

b. *Role of Occupant.* Occupants of family housing units observe building problems as they occur and are a valuable source of information and

assistance to the PM unit. They are responsible for recording of known and suspected work requirements on the "Building Occupant's Preventive Maintenance Reminder Sheet" and to perform self-help.

c. *Role of the Preventive Maintenance Team.* The responsibilities of the PM team in family housing include:

(1) To perform and document work within the scope of PM.

(2) To advise occupants on matters relating to self-help.

(3) To document building maintenance and repair requirements beyond the scope of PM.

#### 6-3. Planning for Effective Accomplishment

a. *Preventive Maintenance Scheduling.* Family housing units have specific work requirements and should be handled differently than other facilities.

(1) All units, except short-term occupancy units such as student quarters should receive scheduled, cyclic, PM.

(2) As appropriate, units may receive only between occupancy PM based on local limitations. The optimum is between occupancy PM in addition to cyclic PM.

(3) Short-term occupancy and student quarters may require only between occupancy PM.

(4) A unit should not receive cyclic service if between-occupancy PM was performed during the previous three (3) months.

b. *Preventive Maintenance Operating Procedures.*

(1) A projected current-cycle schedule of PM visits is established and updated bi-weekly. The schedule is kept at the Work Reception Desk and also transmitted to housing occupants through daily bulletins, newsletters or post newspapers. Figure 6-1 shows a typical public announcement of scheduled visits.

The approximate schedule for PM for the next few weeks is as follows	
Dates	Bldgs.
22 Mar - 26 Mar	5412-5417
29 Mar - 2 Apr	5425-5437
5 Apr - 9 Apr	5439-5455
12 Apr - 16 Apr	5458-5484
19 Apr - 23 Apr	5483-5558

Figure 6-1. Advance Notice of PM Visits

(2) The building and structures PM Checklist Record, Illustration 3-5 serves as a record for visits performed. Cards for each quarters visited should be completed by the PM Unit daily and filed numerically by the quarters number at the PM Shop.

(3) At the start of the visit, PM personnel should check the PM Reminder Sheet (Figure 3-5). The occupant lists minor work requirements which occur between visits and are not Emergency or Self-Help on this form. PM workers should not accept work items which are self-help responsibility.

(4) Upon completing required PM work, the worker will present a "Quality of Service Customer Feedback Request, Illustration 3-7, to the occupant for preparation and submission.

*c. Preparing an I.J.O. for Family Housing Preventive Maintenance.* Planning for cyclic PM in family housing areas is accomplished under Individual Job Orders. Instructions for preparing I.J.O.'s for family housing are included in Paragraph 3.4. These instructions include:

- (1) Estimating required manpower distributors by area.
- (2) Typical performance standards.
- (3) Evaluation of effectiveness.

**6-4. Use of Preventive Maintenance Checklist and Work Guides in a Family Housing Quarter**

*a.* The Buildings and Structures PM Checklist/Record format used in family housing areas is outlined in Chapter 3.

*b.* Sample work guides are outlined in Chapter 8.

## CHAPTER 7

# PREVENTIVE MAINTENANCE FOR BUILDINGS AND STRUCTURES OTHER THAN FAMILY HOUSING

### 7-1. General

a. The objectives of PM in all Army buildings and structures are stated in paragraph 1-4. Additionally, cyclic PM is important --

- (1) To protect facilities from deterioration.
- (2) To ensure that buildings and structures adequately support their assigned missions.

b. This chapter includes specific instructions for applying PM guidelines to buildings other than family housing. These buildings include training, maintenance and production, research, development and test, storage, hospital and medical, administrative, and troop housing.

c. Due to the many types of Army buildings and structures, PM priorities, performance cycles, and manpower requirements will vary with the levels of use and wear. The guidelines stated in this chapter should be applied to various types of buildings and structures where appropriate.

### 7-2. Preventive Maintenance Guidelines

Facilities Engineers should document their program accurately, adhering to as closely as possible, the PM guidelines in Chapter 3.

a. *Building Use and Cycles.* Some buildings are occupied twenty-four hours a day by large numbers of personnel. Others, such as storage facilities are used less frequently. Residential spaces, including troop quarters, are used heavily and must be serviced frequently. PM requirements should be scheduled on the level of use and the mission being performed in the particular building.

b. *Planning and Scheduling.* The Facilities Engineer and departments occupying buildings should cooperate in planning for PM. PM is a support function and should not be scheduled to interfere with the designated mission of any given building.

c. *Recommended Cycles for Building Mission Types.* The optimum cycle for PM of an entire installation is approximately 120 days. It is anticipated that installations will choose cycles between 90 and 180 days, depending on local requirements. Figure 7-1 is a list of recommended inspection frequencies for buildings with varying missions. Buildings with recommended inspection frequencies longer than the established PM cycle—will not necessarily be inspected every cycle.

"Recommended Inspection/Service Frequencies by Buildings Mission"	
<u>Type of Facility</u>	<u>Inspection Frequency (days)</u>
Hospitals and Medical Facilities	90 - 120
Training Facilities	120 - 180
Dining Facilities	90 - 120
Troop Housing	90 - 120
Administrative	120 - 180
Recreational Facilities	90 - 180
Maintenance & Production	180
Research & Development	90 - 120
Storage	180

Figure 7-1. Recommended Inspection/Service Frequencies by Buildings Mission

**7-3. Hospitals and Medical Buildings**

*a. General* Due to the critical mission of hospitals, PM units must avoid any undue interference or disruption during their scheduled daily operation. The work must be performed in an orderly and efficient manner and immediate response work requests should not be handled by PM personnel unless personnel regularly assigned for this purpose are unavailable.

*b. Organization* Guidelines found below should be followed to develop and maintain effective PM programs in hospitals and medical buildings. Normally, either the Utilities Division or a Hospital Support Division is responsible for maintenance in these buildings. PM may be assigned to the hospital maintenance division or incorporated into the base-wide PM program, depending on the size of facility.

(1) *Calculation of Manpower.* A calculation should be made to determine whether the size of hospital facilities warrants assignment of full-time PM personnel to the Hospital Maintenance Division. Using the standards for hospitals found in Chapter 3 (Figure 3-2) calculate the number of man-hours required to complete PM during any chosen cycle. Shorter cycles will require more manpower. As a general rule, hospitals requiring less than one team assigned full time to PM should be incorporated into a PM area as a regularly scheduled stop. Where the size of hospitals in a PM area requires more than one full-time team, PM personnel may be permanently assigned to the Hospital Maintenance Division or the hospital may be treated as other buildings and incorporated into a PM area. A sample calculation of this type is provided in figure 7-2.

Hospital	Sized Building (sq. ft.)	Labor Standard (man-hour/1000 sq. ft.)	Man-Hours Req'd per cycle	Personnel Req'd. Per Year
A 90 day cycle 120 day cycle	627,000	2,000	1254	2.85
B 90 day cycle 120 day cycle	62,700	2,000	125.4 125.4	.285 <sup>1</sup> .213 <sup>1</sup>
<p><sup>1</sup>Note that this annual manpower requirement would necessitate the use of preventive maintenance personnel for other duties if assigned permanently to the hospital maintenance division. Therefore, Hospital B should simply be incorporated into the base-wide program of scheduled visits.</p>				

Figure 7-2. Calculation of Manpower Requirements

(2) *Organization of PM in Medical Buildings other than Hospitals.* The PM requirements of medical buildings other than hospitals are not distinctly different from other facilities. These buildings should be incorporated into the base-wide PM cycle using guidelines provided in Chapter 3.

*c. Preventive Maintenance of Utilities.* PM of equipment and utility Systems in hospitals and medical buildings is the responsibility of maintenance personnel operating within the Utilities Division.

**7-4. Bachelor Quarters**

*a.* The objectives of PM in bachelor quarters are as follows:

- (1) To protect quarters from deterioration.

(2) To perform necessary minor maintenance and repair promptly while quarters are occupied and to schedule and perform necessary minor maintenance and repair between occupancies in a timely and expeditious manner.

*b.* PM of BOQ/VOQ facilities should be accomplished according to guidelines provided in Chapter 3, with the additional requirement that occupants will be requested at check-in to report any deficiencies observed during their stay on the BOQ/VOQ Service Card (Illustration 7-1). Cooperation between the Billeting Manager and the PM Shop Foreman is necessary to insure regularly scheduled, cyclic maintenance is accomplished

without inconveniencing short term occupants of these quarters.

*c. Enlisted Men's Quarters.* When the EMQ is visited by the PM Unit, the leader-inspector should be accompanied on the inspection tour of the building by the NCO -in-charge to point out any work requirements that are the responsibilities of self-help or should be reported by work order request. The leader-inspector should also check to see that the NCO-in-Charge has the current authorized self-help work list.

#### 7-5. Troop Areas and Other Installation Buildings

Generally, all buildings and structures other than family housing, bachelor quarters, and hospitals will be included in the installation-wide program and receive scheduled, cyclic PM. Differences in level of use and special requirements are reflected in the performance standards in Chapter 3. Inspection frequencies also vary, and are given in figure 7-1.

*a. Preventive Maintenance Reminder Sheet.* All buildings covered by the installation-wide PM program should have a copy of the PM Reminder Sheet (Illustration 3-6) posted in a place designated by the Facilities Engineer. When an occupant discovers work requirements, he/she should note the problem on the record along with his/her name and the date. Since the PM unit is responsible for correcting work requirements, referring it to the appropriate shop for correction or referring it to the NCO in charge of the building as self-help, the occupant can confirm that the deficiency has been acted on by checking to see that the record has been countersigned.

*b. Self-help Support.* To support Cyclic PM, self-help should be accomplished in any building by appropriately qualified personnel with the permission of the Facilities Engineer, according to guidelines provided in Chapter 4.

#### 7-6. Structures

*a. Locations.* All structures will automatically be included in PM areas since the entire installation is subdivided geographically. PM of these structures should not be overlooked by units assigned to each area.

*b. Planning.* PM workers operating in areas with structures should document time and materials required for future planning. PM checklists should be developed for each unique structure.

*c. Reporting.* The NCOIC of the nearest building should be made responsible for reporting maintenance problems discovered in structures by one of two means:

(1) By making an entry on the PM Reminder Sheet in the building nearest to the structure.

(2) By reporting the item to the Work Reception Desk.

#### 7-7. Off-Post Facilities

Figure 3-4 provides information on calculating manpower for off-post facilities and reserve centers. PM of off-post facilities should be planned and scheduled to minimize travel time. In some cases, Facilities Engineers may be justified in contracting out maintenance of these facilities because the cost of providing FE service is greater than that of contractor performance.

#### 7-8. Use of a Preventive Maintenance Checklist and Work Guides in Buildings other Than Family Housing.

*a.* One Standard Buildings and Structures PM Checklist/Record format is used by PM units in all buildings. Instructions for completing and handling this format are given in Chapter 3.

*b.* Sample Work Guides are outlined in Chapter 8.

**BOQ/VOQ Service Card**

In order to provide better service to BOQ/VOQ occupants, this card is being provided to all occupants. Please be specific when writing the nature of your comment, problem or suggestion.

Deliver this card to the main desk when you have filled it out. Prompt action will be taken.

NATURE OF PROBLEM/COMMENT \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

SUGGESTIONS FOR IMPROVED SERVICE \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Name \_\_\_\_\_  
Bldg. \_\_\_\_\_ Room \_\_\_\_\_

*Illustration 7-1. BOQ/VOQ Service Card (FORMAT)*

## CHAPTER 8

## INSPECTION/WORK GUIDES FOR PREVENTIVE MAINTENANCE

## Section I INTRODUCTION

**8-1. General** This chapter describes typical defects frequently found in buildings and structures which require correction by PM units. For some of these, responsibility for maintenance or repair may be beyond the scope of PM and therefore must be assigned to an appropriate shop. Such assignment does not relieve the PM unit of the responsibility to detect and report any obvious work requirements. The list is comprehensive but does not include all defects which properly come within the purview of the PM program. Additions and deletions to the list should be made as appropriate. Corrections of hazards should be a constant objective of all personnel. Conditions contributing to or causing wasteful use of energy should also be corrected or reported.

**8-2. Purpose of the Work Guides.** The inspection/work guides provided in this chapter are meant to be guides only, and must be adapted to local conditions. It is intended that appropriate personnel will utilize the guides in this chapter as well

as manufacturer's instructions in developing local maintenance inspection/work requirements. The guides are also a training tool for new PM personnel who can prepare a local work guide list from the master work guide list.

**8-3. Scope of the Work Guides.** Actions to be taken to correct defects are not covered in this chapter. Other technical manuals in the 5-600 series provide such detailed information. A list of pertinent references is included in Appendix A. Inspection frequencies are not given for each item listed because these requirements may vary greatly from building to building and installation to installation. The frequencies selected by Facilities Engineering personnel should be based on manufacturer's recommendations, maintenance manual's recommendations, function of item, use of operation, history of service requirements, overhaul schedules, relationship of item to essential operation of the facility, etc.

## Section II BUILDING COMPONENTS

**8-4. General** This section of the inspection/work guides contains major building components and detailed lists of elements found in each. Use of these guides will enable PM to inspect and repair the interior and exterior of buildings systematically. The coverage of the guides also assures supervisors that consistent standards of performance are being met.

**8-5. Roofing Elements**

- a. *State and Tile Roofs*
  - (1) missing
  - (2) flashing failures
  - (3) loose or broken
  - (4) deteriorated fasteners
- b. *Metal Roofs*
  - (1) holes, looseness, punctures, broken seams
  - (2) rust or corrosion
  - (3) inadequate side or end lap (corrugated roofing)
  - (4) inadequate expansion joints

- (5) damage resulting from contact between dissimilar metals
- (6) needs painting
- (7) inadequate or improper fastening
- c. *Asphalt Strips and Roll Roofing*
  - (1) loss of granules and coating asphalt
  - (2) bare areas with exposed and deteriorating felt
  - (3) tabs curled, clawed or missing
  - (4) shingles or roll roofing brittle
  - (5) laps of roll roofing not cemented adequately
- d. *Cement Asbestos*
  - (1) missing shingles
  - (2) loose, broken, or cracked shingles
  - (3) insufficient side or end lap of corrugated sheets
- e. *Built-Up Roofs*
  - (1) bituminous coating exposed due to loss of gravel



- (2) coating weathered, felts exposed
- (3) felts disintegrated and disbonded
- (4) blisters, splits
- (5) wet insulation
- f. *Flashings*
  - (1) deteriorated, rust, corrosion
  - (2) insecurely fastened, damaged
  - (3) open joints
- g. *Roof Decking*
  - (1) deteriorated
  - (2) improper drainage
- h. *Parapets and Copings*
  - (1) cracks, spalling, damaged, missing
  - (2) open joints
- i. *Lighting Rods and Grounds*
  - (1) broken, corroded
  - (2) insecurely fastened
  - (3) missing components
- j. *Roof Vents*
  - (1) insecurely fastened
  - (2) corrosion, deterioration, damaged
  - (3) lack of weathertightness of seams and joints
- k. *Installed Equipment on Roof*
  - (1) rust, corrosion
  - (2) loose or worn guy wires, braces, roof supports and flashings
- l. *Gutters and Downspouts*
  - (1) clogged gutters and outlets
  - (2) sections missing or damaged
  - (3) rust or corrosion
  - (4) improper slope

**8-6. Structural**

- a. *Foundations and Exterior Walls*
  - (1) concrete, masonry
    - (a) spalling, breaks, salt attack
    - (b) leaking, moisture penetration
    - (c) movement due to frost heaves and differential settlement
    - (d) binding of door and windows
    - (e) wall or slab separated from footing
    - (f) exposed reinforcing
    - (g) out-of-plumb
  - (2) timber
    - (a) warped, checked, split, bowed
    - (b) sagging, broken members
    - (c) rotting, fungus growth
    - (d) termite or other insect infestation
    - (e) dampness
    - (f) bolts missing, loose or faulty
    - (g) split rings, other connections
  - (3) vents
    - (a) damaged screens; missing
    - (b) wooden parts rotten, broken
    - (c) hardware damage
    - (d) vent openings obstructed

- (4) drainage
  - (a) failure to connect downspouts to available storm sewers
  - (b) failure to terminate on properly installed splash blocks
  - (c) improper surface grading around structure
  - (d) trash, debris, or other accumulations resulting in water ponding
- (5) stucco
  - (a) deterioration or disintegration
  - (b) alligator cracks
  - (c) water stains
  - (d) broken areas
- (6) cement-asbestos
  - (a) missing or broken sheets
  - (b) stains
  - (c) loose fastenings
  - (d) broken sheets or shingles
- (7) aluminum and sheet steel siding
  - (a) scars, scuffs
  - (b) rust, corrosion
  - (c) breaks in protective coating
  - (d) puncture of metal
  - (e) loose, missing or broken fastenings
- (8) exterior trim
  - (a) deterioration of protective coating
  - (b) loose, warped, cracked, checked, or broken boards
  - (c) swelling of joints
  - (d) rotting
  - (e) fungus or termite infestation
  - (f) evidence of continued dampness
- b. *Interior Walls and Ceilings*
  - (1) wood
    - (a) damaged condition
    - (b) support failure
    - (c) rot
    - (d) termite or other insect, or fungus infestation
    - (e) abrasion, scuff marks
    - (f) loose or missing fixtures
    - (g) leaks or stains
  - (2) wallboard, plasterboard, and fiberboard
    - (a) open joints
    - (b) cracked, buckling, sagging
    - (c) support failure
    - (d) abrasions, breaks, holes
    - (e) discoloration from utility leaks
  - (3) plaster
    - (a) cracking, buckling, support failure
    - (b) spalling, moisture absorption
    - (c) discoloration from leaks
  - (4) ceramic tile
    - (a) chipped, cracked, loose, missing, holes, defective joints

(b) etched, pitted, or dull surfaces caused by use of abrasive cleaners

(5) synthetic coverings and wallpaper

(a) elements missing

(b) insecurely fastened, adhesive failure

(c) curling, abrasions, indentations, punctures, tears

(d) etched, pitted, or dull surface caused by use of abrasive cleanser

(6) wainscots

(a) loose nails

(b) cracked or missing

(c) paint deterioration

(7) metal grills

(a) corrosion, other damage

(b) deterioration of protective coating

(c) insecurely fastened

*c. Chimneys and Stacks*

(1) masonry and concrete

(a) spalling, weathering and cracking

(b) deteriorated paint

(c) damage from gases

(d) cracks from expansion and contraction

(e) eroded or sandy mortar joints

(2) linings and baffles

(a) cracks, spalling

(b) damaged from gases

(3) ladders

(a) insecure rungs, poor anchorage

(b) rust

(c) paint scaling

*d. Porches and Decks*

(1) columns

(a) deterioration

(b) settling

(c) faulty understructures

(d) paint deterioration

(2) fire escapes

(a) settling

(b) broken railings and steps

(c) hazards

(d) paint deterioration

(3) rails-wood and metal

(a) broken

(b) missing parts

(c) deterioration

(d) insecurely fastened

(e) paint deterioration

(4) decking and steps

(a) deteriorated, termites, fungus

(b) sagging

(c) cracked

(d) paint deterioration

(e) broken

*e. Doors*

(1) wood

(a) rotting, splitting

(b) missing

(c) loose, poor fit

(d) cracking

(e) lack of weathertightness

(2) metal

(a) rust, corrosion

(b) warping, binding

(c) lack of weathertightness

(d) poor fit

(3) storm

(a) binding, jamming

(b) poor frame fit

(c) corrosion and rust of metal parts

(d) rotting and damage of wood parts

(e) lack of weathertightness

(4) frames and jambs

(a) loose fitting, broken

(b) warped, cracked

(c) paint deterioration

(5) door hardware

(a) missing, missing or loose screws and bolts

(b) broken, poorly functioning

(c) rust deterioration

(d) improper installation or adjustment

(e) lack of lubricating, misalignment

(f) loss of finish coating

(6) casings, baseboards and moldings

(a) loose

(b) water and wax damage

(c) paint deterioration

(d) scratches, indentations

(7) doorstops

(a) missing

(b) broken

*f. Structural Elements.* X-Trusses, roof framing and other structural members will be inspected by a qualified engineer to assure structural adequacy (AR 420-70, para. 2-23).

(1) timber trusses

(a) twisted and bowed members

(b) dry rot

(c) checks and splits in ends at web members

(d) sag, overloading

(e) separation or slippage at joints

(f) damaged splice plates

(2) Steel trusses

(a) twisted, bowed, deformed, broken

(b) loose bolts, rivets, defective welds

(c) rust, corrosion

(d) rupture, shearing or crushing of steel plates, members, bolts and rivets

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- (3) bar joists
    - (a) corrosion, welding defects
    - (b) bends, deflection, overloading
  - (4) timber members
    - (a) loose, warped, cracked or broken
    - (b) support failure
    - (c) rot
    - (d) termite, insect or fungus infestation
    - (e) excessive deflection
  - (5) steel members
    - (a) loose bolts, rivets
    - (b) rust, corrosion
    - (c) defective welds, connection failure
    - (d) bends, deflection
  - (6) concrete members
    - (a) exposed reinforcement
    - (b) moisture penetration
    - (c) cracks, spalling, breaks
    - (d) expansion joint deterioration
  - (7) posts
    - (a) insecure foundation
    - (b) deterioration, rotted or corroded
    - (c) paint deterioration
    - (d) out-of-plumb
  - (8) girders
    - (a) splits, cracks, rot
    - (b) insufficient bearing or fastening
    - (c) bends, deflection
    - (d) welds-failure
    - (e) rust, corrosion
  - (9) floor joists
    - (a) loose bridging
    - (b) deterioration
    - (c) excessive deflection
    - (d) insecure nailing
    - (e) insect damage
  - (10) roof rafters and purlins
    - (a) loose bolts and nails
    - (b) cracked, split and broken
    - (c) open joints
    - (d) loose boards
    - (e) insect damage
    - (f) sag of members
- g. Loading Ramps and Platforms*
- (1) warehouse platforms
    - (a) cracks, breakage (Figure 8-1)
    - (b) sunken platform slabs
    - (c) hazards



*Figure 8-1. Deteriorating Loading Platform*

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- (2) retaining walls
  - (a) out-of-plumb, settled
  - (b) spalling
- h. Exterior and Interior Stairs*
  - (1) no obstructions
  - (2) wood
    - (a) sagging, rotted, splintered, loose, warped
    - (b) stains, moisture
  - (3) concrete
    - (a) wear, pitting, roughness
    - (b) lack of steel nosing
    - (c) settlement, shrinkage cracks
    - (d) absence of treatment or waxing that would prevent surface dusting
  - (4) steel
    - (a) rusted, loose, bent
    - (b) support damage
    - (c) missing, loose or damaged bolts, rivets, screws, broken welds
  - (5) finish
    - (a) absence of protective coatings
    - (b) insect infestation in finish and sub-flooring
    - (c) dampness-fungus growth
    - (d) lack of nonslip finish
  - (6) railings and balustrades
    - (a) insecurely fastened
    - (b) splits, chips, broken
    - (c) paint deterioration
    - (d) rot, termite damage
- i. Sub floors*
  - (1) loadings
    - (a) deflection, warping, cracking
    - (b) lack of conformance to posted loadings
  - (2) wood
    - (a) sagging, splintered, loose, warped, rotted, moisture, insect damage
    - (c) faulty connections-nails, screws
    - (d) protruding nails
  - (3) concrete
    - (a) wear, pitting, roughness
    - (b) settlement, shrinkage cracks
  - (4) steel
    - (a) wear, rusted, loose, bent surface
    - (b) damage to structural supports
    - (c) broken welds, missing, loose or damaged bolts, nuts, rivets and screws
- j. Windows*
  - (1) woodsash
    - (a) lack of weathertightness
    - (b) loose or missing caulking
    - (c) splitting, rotting, cracking
    - (d) loose, poor fit
    - (e) binding, missing
- (2) metal sash
  - (a) rust, corrosion
  - (b) warping, binding, poor fit
  - (c) non-weathertightness
- (3) storm windows
  - (a) binding, jamming
  - (b) poor frame fit
  - (c) rust and corrosion of metal parts
  - (d) termite rotting of wood parts
- (4) shutters, awnings and canopies
  - (a) splitting, rotting, cracking
  - (b) loose, missing
  - (c) freedom of swing
  - (d) damage to supports
  - (e) misalignment damage
- (5) insect screens
  - (a) loose, broken, missing
  - (b) missing hardware
  - (c) binding, jamming
  - (d) holes in screening material
  - (e) rust, corrosion of metal parts
  - (f) rotting, stain, damage to wooden parts
- (6) louvres and venetian blinds
  - (a) loose, missing, broken
  - (b) misalignment
  - (c) improper installation
  - (d) corrosion, abrasion
  - (e) lack of lubrication
- (7) shades
  - (a) operation, improper fit
  - (b) tears, broken, missing
- (8) window hardware
  - (a) loose, missing, broken parts
  - (b) rust, corrosion, abrasion
  - (c) loss of finish coating
  - (d) binding, misalignment
  - (e) improper installation or adjustment
  - (f) lack of lubrication
- (9) glass
  - (a) broken, chipped panes, missing
  - (b) putty missing or disintegrated
- (10) weather stripping (seasonal)
  - (a) tightness of fit
  - (b) broken, missing
  - (c) moisture, rot
- k. Glazing*
  - (1) fixed single and double glazing, insulating glass
    - (a) weathertightness
    - (b) cleaning and maintenance
    - (c) cracks, breaks
    - (d) missing panes
  - (2) interior glass panels
    - (a) cleaning, maintenance

- (b) chips, breaks, cracks
- (c) fit, connections
- (3) roof lights
  - (a) leaks, weathertightness
  - (b) cleaning, maintenance

**8-7. Floor Covering**

- a. *Wood Flooring*
  - (1) abrasion, indentations, scuffmarks
  - (2) absence of protective coatings
  - (3) insect infestations
  - (4) overloading
  - (5) dampness, fungus growth
  - (6) knots, sagging, stains, discolorations, scratches, warped
- b. *Concrete*
  - (1) stains, discolorations
  - (2) shrinkage cracks, settlement
  - (3) absence of treatment or waxing that would prevent surface dusting
  - (4) wear, pitting, roughness
- c. *Oxychloride/Cementitious*
  - (1) moisture
  - (2) abrasion resistance
  - (3) protection against chemical damage
  - (4) chips, cracks, pitting, roughness
- d. *Terrazzo*
  - (1) pitting, roughness
  - (2) discolorations
  - (3) settlement cracks, loose or broken segment
- e. *Clay and Masonry Tile*
  - (1) broken, chipped or loose resulting in uneven surfaces
  - (2) stains, discolorations
  - (3) sandy and eroded joints
- f. *Vinyl-asbestos Tile*
  - (1) loose at seams
  - (2) tears, indentations
  - (3) chipping, breaking, cracking
  - (4) furniture supports to prevent indentations
  - (5) damage from solvents or excessive water in cleaning
  - (6) metal protection strips
- g. *Asphalt Tile*
  - (1) missing, loose or broken tiles
  - (2) indentations, furniture supports to prevent indentations
  - (3) loose edged
  - (4) damaged from solvents or excessive water in cleaning
  - (5) improper wax
- h. *Resilient Floor Covering*
  - (1) wear, cracking, chipping, breaking
  - (2) scratches, tears, indentations
  - (3) lack of bonding and unevenness of underlayment

- (4) damage from solvents or excessive water in cleaning
- (5) absence of protective wax coatings
- i. *Mastic*
  - (1) depressions, indentations
  - (2) absence of protective wax coatings
- j. *Carpets and Rugs*
  - (1) wear, tear, cuts, raveling
  - (2) discolorations, fading
  - (3) beetle or moth damage
  - (4) wear, damage, failure of binding or anchoring strips
  - (5) wear or missing tractive substance on backing of small rugs or carpet on polished floors

**8-8. Exterior Painting**

- a. peeling, efflorescence
- b. Rust, Corrosion, Absence of Paint
- c. Weather Damage
- d. Deterioration
- e. Excessive Chalking or mildew

**8-9. Interior Painting**

- a. Scuffs, Abrasions
- b. Deterioration
- c. Absence of Paint

**8-10. Heating**

- a. *Hot Air Furnaces*
  - (1) operation
    - (a) complaints of operators
    - (b) improper cleaning
    - (c) poor flue connections
  - (2) filters
    - (a) dust, grease deposits
    - (b) missing, improper fit
    - (c) replacement of throwaway types
    - (d) washing of permanent types
  - (3) electrical controls
    - (a) loose connections
    - (b) charred, frayed, broken or wet insulation
    - (c) low voltage
  - (4) combustion chambers and smoke pipes
    - (a) deposits, dirt
    - (b) abrasions, wear, misalignment
    - (c) breaks in thermal insulation casings
    - (d) leakage of gases
    - (e) lack of weathertightness of seams and joints
  - (5) adjustments and connections
    - (a) missing or damaged connections
    - (b) clogged jets, valves, fuel supply lines
    - (c) insufficient oil or gas pressures
    - (d) misalignment, nonuniform flame or heat spread
    - (e) wrong fuel-air mixture
    - (f) incorrect position of pilot light

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(g) improper baffle adjustment causing impingement

(h) defects in multiple-step heating device

*b. Steam and Hot Water Furnaces*

(1) complaints of operators

(2) improper cleaning

(3) dust, scaling, corrosion, other deposits, clogging

(4) leaks, air-binding or water hammer

(5) misalignment and improper slope of units resulting in inadequate drainage and heating efficiency

*c. Hot Water Tanks*

(1) corroded surfaces

(2) leaks

(3) open seams

(4) insufficient, improper or damaged insulation

(5) improperly set aquastat

*d. Air Handlers, Pumps, and Hot Air Blowers*

(1) dust, dirt, other accumulations

(2) defective operation, indicated from observation through operating cycle

(3) loose, missing or damaged connections and connectors

(4) bent blades, worn or loose belts

(5) misalignment, imbalance

(6) excessive noise and vibration

(7) excessive end play of shaft

(8) ineffective sound isolators

*e. Space Heaters*

(1) lack of wall and floor protection (2) incorrect firing

*f. Air Ducts*

(1) soot, dust and other deposits, clogging

(2) deformations, broken, loose or missing

parts

(3) loose seams and joints

(4) breaks in vapor barriers

(5) improper air distribution at branch ducts

(6) improper seasonal damper or register settings

tings

*g. Radiators*

(1) broken parts

(2) leaking valves and connections, condensations, clogging

(3) vibrations, excessive noise

(4) corrosion, metal defects

*h. Piping*

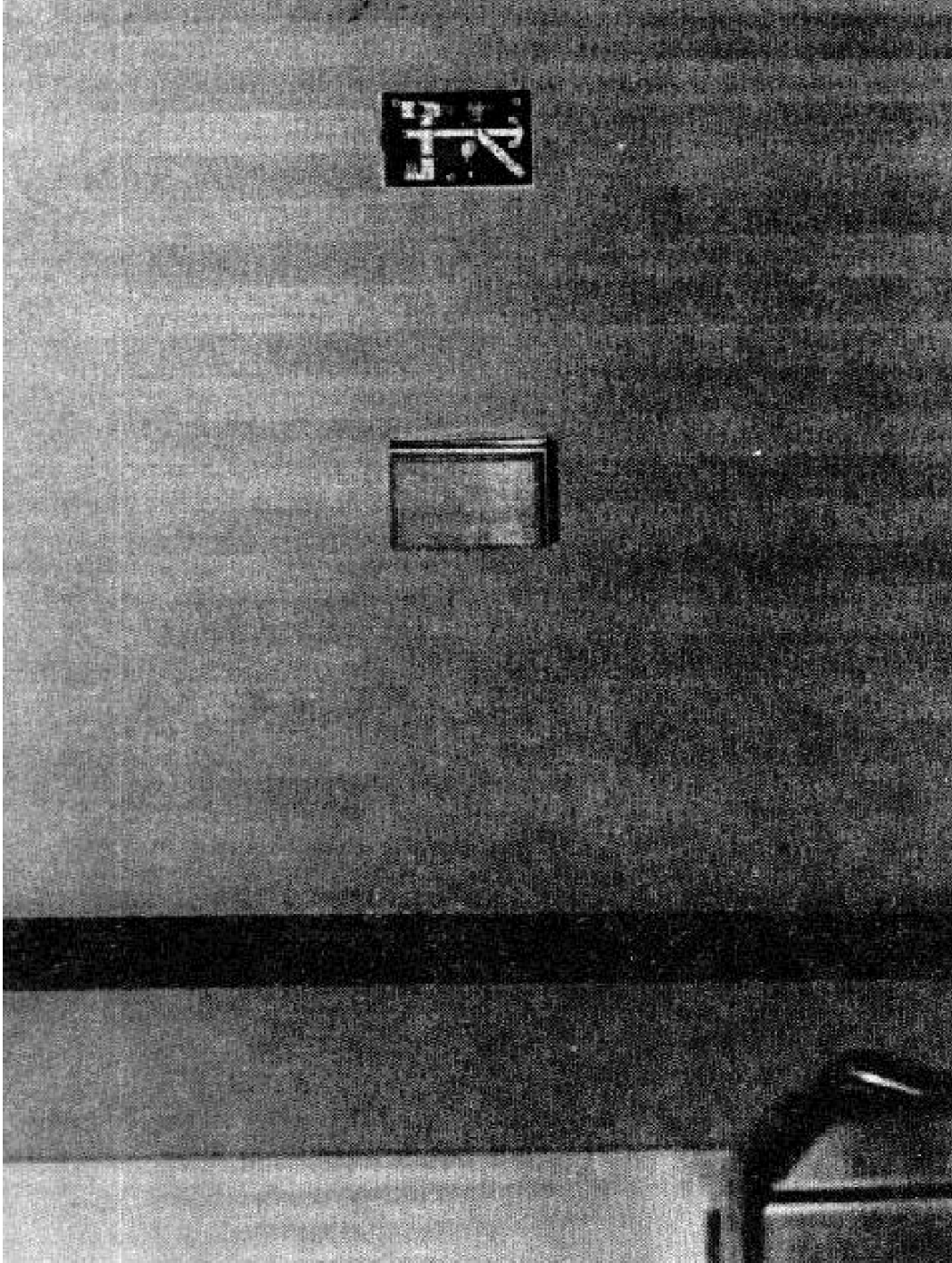
(1) defective operation

(2) leaks, clogging

(3) moisture

(4) vibration

*i. Thermostats and Controls (Figure 8-2)*



*Figure 8-2. Missing Thermostat Cover*



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- (1) complaints of operators
- (2) partially or fully inoperable
- (3) improper "on" and "off" operation

### *j. Ventilating Fans*

- (1) dirty
- (2) lack of lubrication
- (3) noisy, excessive vibration
- (4) defective
- (5) bent blades
- (6) imbalance

## 8-11. Air Conditioning

### *a. Wiring and Electrical Controls*

- (1) loose connections
- (2) charred, broken or wet insulation
- (3) short circuits

### *b. Temperature and Humidity Controls*

- (1) improper setting
- (2) loose connections
- (3) defective operation noted in observing operation through complete cycle

### *c. Air Ducts, Dampers, Registers, Grills, Louvres and Bird and Insect Screens*

- (1) soot, dirt, dust and other deposit
- (2) leaks, broken, loose or missing connections and parts
- (3) excessive vibration
- (4) material defects
- (5) defective operation of moveable parts
- (6) improper seasonal or operating settings of dampers

### *d. Thermal Insulation and Vapor Barriers*

- (1) wet, damaged or missing
- (2) broken tie wires
- (3) loose bands
- (4) torn canvas jackets

### *e. Air Filters*

- (1) dust, grease, other deposits
- (2) missing

- (3) improper fit

### *f. Piping*

- (1) leaks, corrosion
- (2) material defects of fittings, copper tubing, steel piping

## 8-12. Plumbing

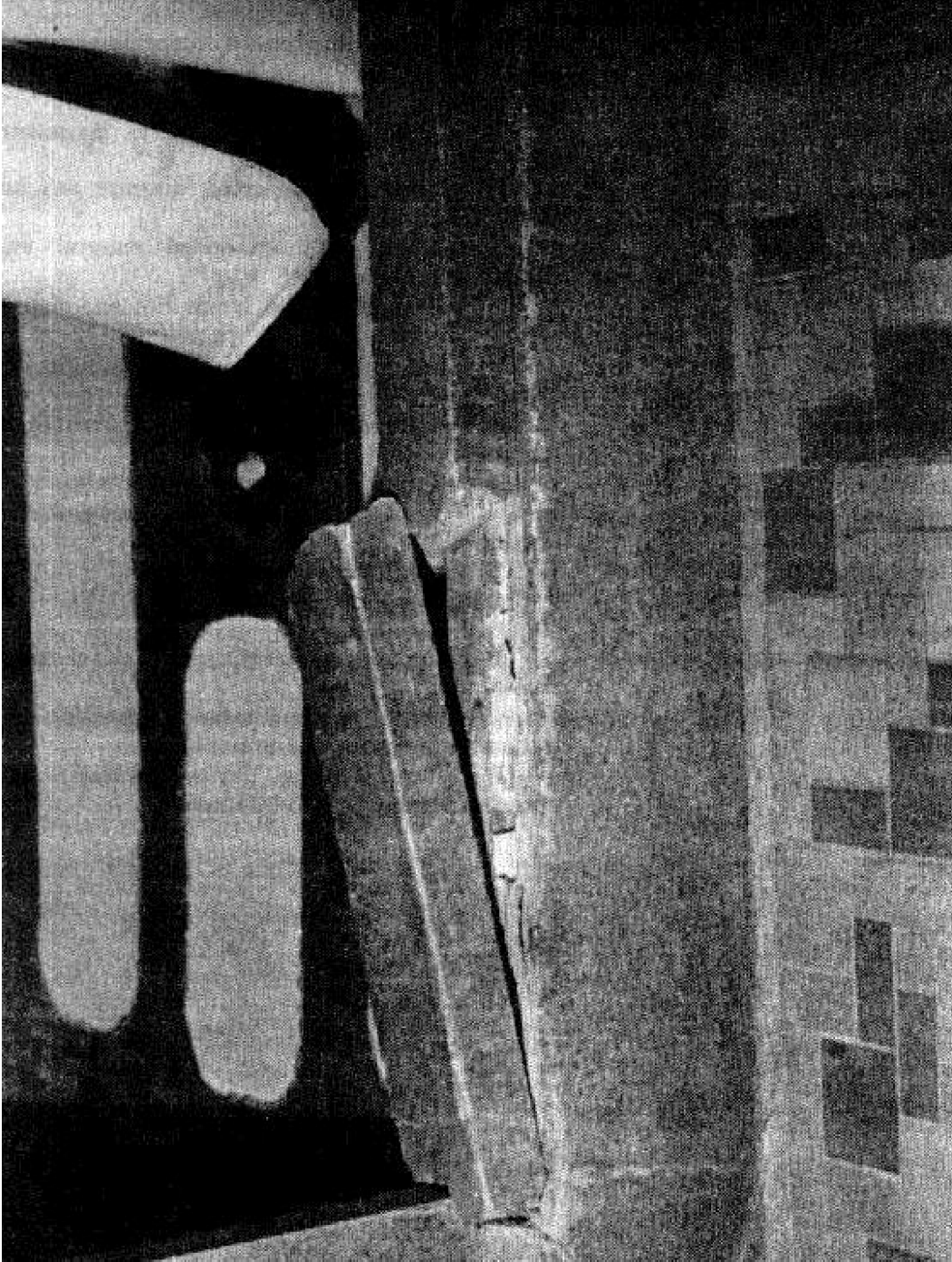
### *a. Lavatory Services*

- (1) bowl
  - (a) unsanitary
  - (b) broken, leaks, material defects
  - (c) insecurely fastened
- (2) seat
  - (a) unsanitary
  - (b) broken, missing, insecurely fastened
  - (c) splintered (if applicable)
  - (d) paint or protective coating
- (3) fixtures, flush valves and parts
  - (a) improper functioning
  - (b) leaks, broken or insecurely fastened
  - (c) missing

### *b. Sinks and Basins*

- (1) bowl
  - (a) unsanitary, odors
  - (b) broken, insecurely fastened
  - (c) leaks, material defects
- (2) faucet
  - (a) worn washers
  - (b) loose, leaking, broken
- (3) traps and drains
  - (a) dirty, clogged
  - (b) corrosion
  - (c) grease
  - (d) leaks
- (4) stopper
  - (a) missing or deteriorated
  - (b) inoperative

### *c. Bathtubs and Showers (Figure 8-3)*

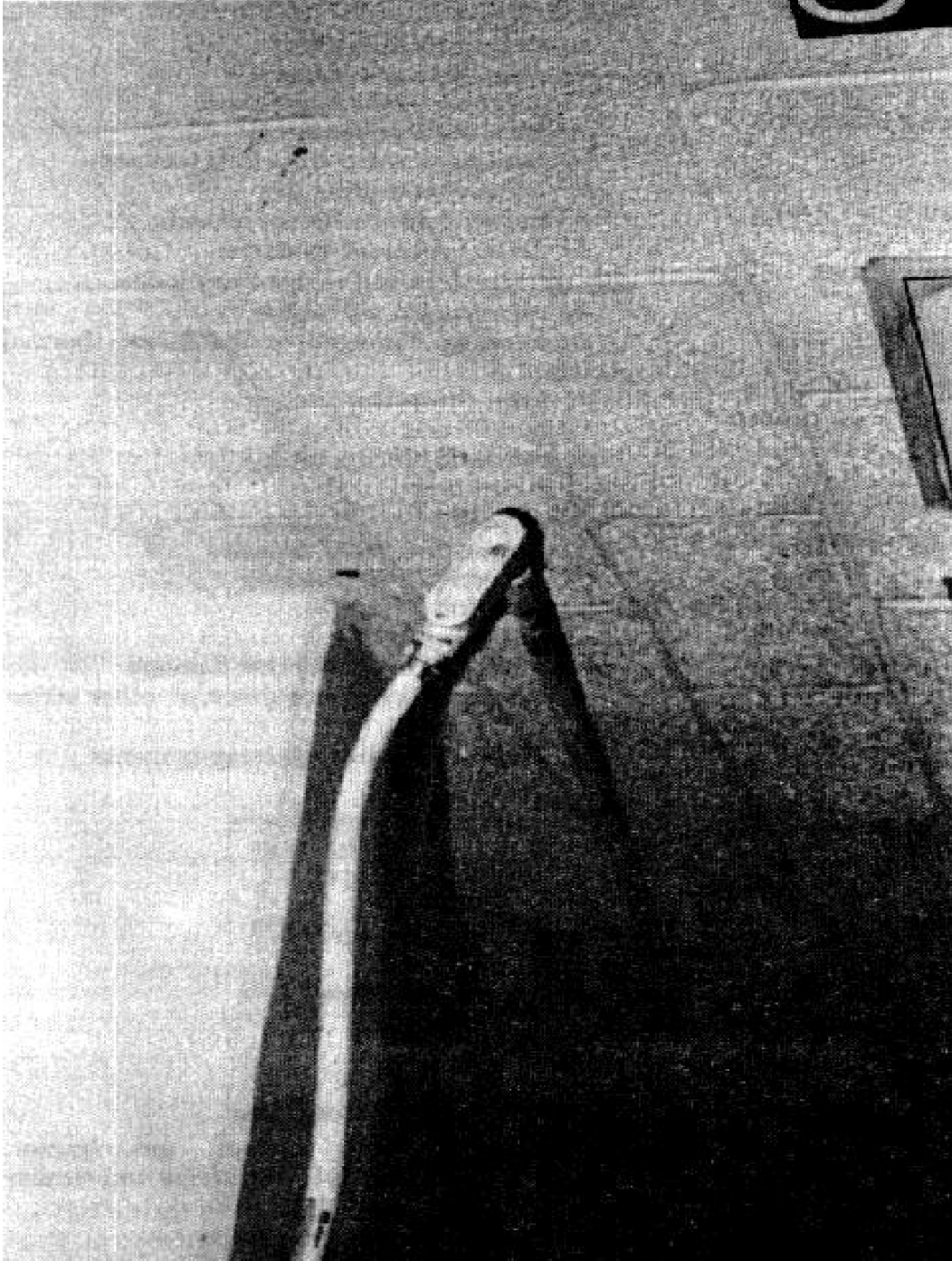


*Figure 8-3. Broken Shower Threshold*

- (1) general
  - (a) hazards
  - (b) unsanitary conditions
- (2) showerhead
  - (a) insecurely fastened
  - (b) leaking
- d. *Urinals*
  - (1) bowl
    - (a) unsanitary
    - (b) broken, insecurely fastened
    - (c) leaks
    - (d) missing strainer
  - (2) fixtures, flush valves and parts
    - (a) improper functioning
    - (b) broken, damaged
- e. *Piping*
  - (1) water piping
    - (a) external rust
    - (b) leakage, clogging, loose connections
    - (c) insufficient water flow
    - (d) water hammer
  - (2) sanitary and drain
    - (a) solid accumulation in strainers
    - (b) slow drainage
    - (c) odors and sewer gas from loss of water seal in traps
    - (d) back pressure caused by clogging
    - (e) ground water through leaky joint or broken pipe
- f. *Drinking Fountains*
  - (1) bowl
    - (a) cracked
    - (b) clogged
  - (2) valve
    - (a) worn washer
    - (b) leaking

### 8-13. Electrical

- a. *Conservation of Energy*
  - (1) unnecessary lights, excessively high lighting levels
  - (2) unnecessarily high-wattage bulbs
  - (3) unoccupied areas lighted
  - (4) signs posted to remind occupants to turn off lights
- b. *Lighting, Including Sockets*
  - (1) improper lamps installed in hazardous locations
  - (2) inadequately supported, insecure and improperly located
  - (3) evidence of unauthorized removal and relocation
  - (4) cracked or broken luminaries and fixture parts
  - (5) missing pullcords, metal pullchains not provided with insulating links
  - (6) indications of objects being supported from, hung on or stored in fixtures
  - (7) evidence of overheating, under-sized or other damage to socket, exposed or damaged connecting wiring
- c. *Wiring and Cable*
  - (1) dirty, poor ventilation
  - (2) broken conduit
  - (3) presence of moisture, grease, oil, chemical fumes
  - (4) improper or unauthorized connection and dangerous temporary connections
  - (5) damaged wiring devices, defective insulators, damaged support (Figure 8-4)



*Figure 8-4. Poorly Connected Conduit*

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- (6) broken or missing parts or exposed live parts
- (7) excessive cable sag and vibration
- (8) crowded cable spacing
- (9) evidence of overheating, ground and short circuits
- (10) overheated splices, damaged or defective insulation
- d. *Electric Heaters*
  - (1) unauthorized location
  - (2) evidence of overheating
  - (3) exposed or damaged connecting wiring
- e. *Motors and Fans*
  - (1) excessive vibration and noise
  - (2) lack of or excessive lubrication
  - (3) evidence of overheating
  - (4) exposed or damaged connecting wiring
- f. *Fuseboxes*
  - (1) dirty, corroded
  - (2) evidence of overheating
  - (3) unposted or illegible instructions, identification charts, circuit diagrams, and feeder schedules
  - (4) loose or inadequate connections
  - (5) lack of lubrication for switches
  - (6) knife switches and fuse clips improperly aligned
  - (7) dangerous temporary connections
- g. *Distribution Ducting*
  - (1) torn, insecure, hazardous
  - (2) insulation damage
- h. *Switches*
  - (1) defective operation
  - (2) broken or missing parts
  - (3) loose wires
- i. *Convenience Outlets*
  - (1) dirty, defective contacts
  - (2) missing or damaged cover plates
  - (3) difficult plugging
  - (4) overheating
  - (5) evidence of overloading on multiple sockets servicing lamps or appliances
  - (6) lack of grounding terminal
- j. *Cords, Cord Extensions, and Plugs*
  - (1) inadequate
  - (2) unsafe
  - (3) incorrect types being used
  - (4) lengths excessive
  - (5) poor insulation
  - (6) twisted, spliced
  - (7) exposed to damage underfoot
  - (8) laying on floor or across heated surfaces or lamps
  - (9) cracks, breaks, loose connection wires improperly attached and in danger of pulling away from plug when removing from outlet
  - (10) missing protective cover on male ends

- (11) no grounding terminal or ground wire with clamp
- (12) cable clamps missing or loose on power plugs

## 8-14. Equipment

### a. *Food Service Systems*

- (1) ranges
    - (a) dirty or loose canopy
    - (b) poor flue connections
    - (c) improper operation of doors
    - (d) loose units or bolts
    - (e) slanting or warped cooking surfaces
    - (f) evidence of leaking gas
    - (g) burner grills broken or missing
    - (h) defects reported by users
  - (2) refrigerators and cold storage lockers
    - (a) excess noise, vibration
    - (b) missing, damaged or inefficient thermal insulation
    - (c) paint chipped or peeling
    - (d) insufficient cooling
    - (e) complaints of operator
  - (3) exhaust fans
    - (a) excess noise, vibration
    - (b) grease, dirt, other deposits
    - (c) protective grille missing
    - (d) loose connections
  - (4) counter tops
    - (a) scratched, stained, other damage
    - (b) pulling away from cabinet or other structure
  - (5) cupboards and storage compartments
    - (a) sagging doors
    - (b) broken or missing hinges
    - (c) broken or missing locks
    - (d) insufficient supports
    - (e) broken glass
    - (f) combustible materials
  - (6) sinks
    - (a) insecurely fastened
    - (b) slow drainage
    - (c) leaking faucets
    - (d) chipped enamel
  - (7) steam and hot water tables
    - (a) defective water valves, gas burner, heating units, switches and pilot lamps and similar equipment
    - (b) dented, scratched surfaces
- ### b. *Laundry Facilities*
- (1) washing machines
    - (a) leaking door
    - (b) malfunctioning hinges
    - (c) loose or faulty electrical and plumbing connections

- (d) evidence of imbalance
- (e) excess noise, vibration
- (2) dryers
  - (a) loose, damaged or missing vent ductwork
  - (b) insufficient clearance between dryer and wall
  - (c) faulty electrical connection
- (3) ducting
  - (a) loose, damaged or missing
  - (b) located in areas prone to damage
- (4) exhaust fans
  - (a) inoperable, disfunctioning
  - (b) dirt, grease, other deposits'
  - (c) excessive noise, vibration
  - (d) operation hazards, i.e. opportunity for electric shock, injuries from rotating blade
- (5) tubs, trays
  - (a) damaged, missing, leaking
  - (b) insecurely fastened
  - (c) cabinetry
- (1) cupboards and cabinets
  - (a) sagging doors
  - (b) missing hinges or locks
  - (c) insufficient supports
- (2) chalkboards, bulletin boards
  - (a) cracked, broken, other damage
  - (b) insecurely attached
- (3) shelving
  - (a) hazards
  - (b) insufficient supports
  - (c) sagging
- (4) counters
  - (a) insecurely fastened
  - (b) slivers
  - (c) loose nails
  - (d) warped surface covering
- (5) butcher block surfaces
  - (a) chipped, slivers
  - (b) wood in need of oiling or other refinishing
  - (c) laminated pieces pulling apart
  - (d) insecurely fastened
- d. Smoke alarms—test operation

### Section III. STRUCTURES COMPONENTS

**8-15. General** This section of the inspection/work guides contains special components of structures. PM, personnel will find that use of these guides will enable them to cover most structures not addressed in Section II.

#### 8-16 Special Structures

- a. *Storage Bins and Tanks*
  - (1) foundations
    - (a) settling, movement, upheaving
    - (b) inadequate soil coverage
    - (c) cracking
  - (2) exterior concrete surfaces
    - (a) spalling, cracking and leakage
    - (b) exposed reinforcing
  - (3) exterior steel surfaces
    - (a) rust, corrosion
    - (b) distortion or other structural failure
    - (c) leakage
    - (d) deteriorated paint
  - (4) roofs
    - (a) defects in weatherproofing, heat-reflecting coatings, coverings
    - (b) rust, corrosion
    - (c) deteriorated paint
    - (d) structural or mechanical damage caused by freezing weather conditions
  - (5) structural supports
    - (a) rust, corrosion, rot
    - (b) broken, cracked, distorted
    - (c) loose, missing
    - (d) deteriorated paint
  - (6) vents
    - (a) rust, corrosion
    - (b) dirty, damaged or missing screens
  - (7) relief valves
    - (a) defective operation
    - (b) leakage
    - (c) improper adjustment
  - (8) ladders and stairs
    - (a) rust, corrosion, rot
    - (b) broken, cracked, loose, missing members or connections
    - (c) deteriorated paint
  - (9) leakage
    - (a) evidence of fuel loss
    - (b) water infiltration
- b. *Storage Sheds*
  - (1) metal
    - (a) rust, corrosion
    - (b) dents, punctures
    - (c) loose connections
    - (d) improperly functioning doors and hinges
  - (2) wood
    - (a) rot, deterioration
    - (b) insect infestation
    - (c) leaks

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- c. *Towers*
  - (1) general defects
    - (a) out of plumb
    - (b) paint deterioration
    - (c) deficient support or guys
    - (d) rust, corrosion, loose, missing, twisted, bowed, bent or broken members
    - (e) termite or other insect infestation
    - (f) corroded, loose or missing conduits, terminals, cables
  - d. *Grandstands, Bleachers*
    - (1) structural supports
      - (a) corrosion, rot
      - (b) damaged, loose or missing members
    - (2) seats
      - (a) splintered, chipped
      - (b) insecurely fastened
      - (c) peeling, cracking paint
    - (3) steps
      - (a) sagging, bowed
      - (b) insecurely fastened, missing
      - (c) improperly or illegibly identified
    - (4) wooden
      - (a) termite or other insect infestation
      - (b) splinters, splinters, chipped, rotten
      - (c) damaged, loose or missing members
      - (d) peeling, cracked paint
    - (5) steel
      - (a) corrosion, rust
      - (b) damaged, loose or missing members
      - (c) peeling, cracked paint
    - (6) concrete
      - (a) cracking, spalling, settling
      - (b) exposed reinforcing rods
      - (c) paint deterioration
  - e. *Playground Structures*
    - (1) structural supports
      - (a) corrosion, rot
      - (b) damaged, loose or missing members
      - (c) abrasive edges
      - (d) instability
    - (2) climbing apparatuses
      - (a) splinters
      - (b) rust or abrasive surfaces
      - (c) sharp edges
      - (d) missing rungs or supports
    - (3) seats and benches
      - (a) splinters, chipped
      - (b) chain supports damaged or fouled
      - (c) cloth seats frayed or torn
      - (d) sharp edges
      - (e) insecurely fastened
    - (4) paint
      - (a) cracked, peeling, chipped
      - (b) weathered

- (c) vandalized
- (d) blistered
- (5) hazards
  - (a) loose members
  - (b) dangerous edges
  - (c) rough surfaces
  - (d) damaged retaining fences

### 8-17. Swimming Pools

- a. *Walls and Floor.*
  - (1) Cracked
  - (2) Leaks
  - (3) Dirt and Stains
- b. *Scum Gutters and Drains*
  - (1) Broken
  - (2) Sluggish and Clogged
  - (3) Corrosion
- c. *Gratings*
  - (1) Cracked
  - (2) Broken
  - (3) Paint Deterioration
- d. *Spring Boards, Diving Towers and Platforms*
  - (1) Insecurely fastened
  - (2) Metal-Rust or Corrosion
  - (3) Wood-Cracked, Broken or other Damage
  - (4) Absence of Non-Slip Coverings
- e. *Concrete*
  - (1) Settling
  - (2) Cracks, Breaks and Spalling
  - (3) Exposed Reinforcing Steel
- f. *Tile*
  - (1) Chipped and Cracked
  - (2) Loose and Missing Pieces
  - (3) Defective mortar joints
- g. *Expansion Joints*
  - (1) Leakage
- h. *Depth Markers and Lane Stripes*
  - (1) Illegible
  - (2) Deteriorating

### 8-18. Docks, Piers and Wharves

- a. *Concrete Members*
  - (1) cracks, breaks, spalling, settling
  - (2) exposure of reinforcing steel
- b. *Timber Members*
  - (1) infestation
  - (2) loose, missing, broken, split, warped
  - (3) rotted bolt holes
- c. *Pilings*
  - (1) holes, abrasions
  - (2) infestation
  - (3) mechanical damage
  - (4) loose or missing wedges
- d. *Bracings*
  - (1) loose, missing, broken, split
  - (2) warped, decay

(3) termite and other pest infestation

*e. Steel Members*

- (1) rust, corrosion
- (2) loose, missing, bent, broken
- (3) defective connections

*f. Bollards, cleats*

- (1) broken or loose hardware
- (2) paint deterioration

*g. Stringers*

- (1) loose, cracked or broken
- (2) loose hardware
- (3) deterioration
- (4) infestation

*h. Decking*

- (1) cracked or broken
- (2) deterioration

(3) infestation

**8-19. Mechanical Movers**

*a. Elevators*

- (1) paint deterioration
- (2) loose or broken hardware
- (3) excessive wear of floor covering
- (4) broken, insufficient or missing lighting

*b. Escalators*

- (1) paint deterioration
- (2) loose or broken hardware
- (3) excessive wear of treated material
- (4) broken, insufficient or missing lightning
- (5) deteriorated hand rail
- (6) hazards



## APPENDIX A

## PUBLICATIONS APPLICABLE TO PREVENTIVE MAINTENANCE PERSONNEL

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<b>1. Regulations</b>		TM 5-608	Contracting for Custodial Services at Army Facilities Other Than Medical and Industrial Facilities
AR 37-108	Financial Administration-General Accounting and Reporting for Finance and Accounting Offices		
AR 210-50	Installations-Family Housing Management	TM 5-609	Military Custodial Services Manual
AR 415-35	Construction-Minor Construction	TM 5-611	Post Engineer Shops
AR 420-10	Facilities Engineering-General Provisions	TM 5-615	Concrete and Masonry
AR 420-16	Facilities Engineering-Real Property and Resource Management	TM 5-617	Maintenance and Repair of Roofs
AR 420-22	Facilities Engineering-Preventive Maintenance Self-Help Programs	TM 5-618	Paints and Protective Coatings
AR 420-41	Facilities Engineering-Utilities Contracts	TM5-620	Calking and Glazing
AR 420-43	Facilities Engineering-Electric Services	TM 5-621	Lathing and Plastering
AR 420-70	Facilities Engineering-Buildings and Structures	TM 5-622	Wharves and Shore Structures
AR 420-76	Facilities Engineering-Pest Control Services	TM 5-637	Inspection and Preventive Maintenance Services for Kitchen Equipment
AR 420-81	Facilities Engineering-Custodial Services	TM 5-662	Swimming Pool Operation and Maintenance
AR 420-83	Facilities Engineering-Maintenance and Services Equipment	TM 5-680	Electrical Facilities, General Engineering Data and Practices, Tools and Equipment, and Safety Practices
AR 420-90	Facilities Engineering-Fire Prevention and Protection	TM 5-681	Preventive Maintenance for Electrical Facilities
<b>2. Technical Manuals and Miscellaneous Publications</b>		TM 5-682	Safety, Electrical Facilities
DA Pam 210-2	Handbook for Family Housing Occupants	TM 5-683	Electrical Interior Facilities
DA Pam 420-6	Resources Management System	TM 5-684	Electrical Exterior Facilities
		TM 5-687	Fire Protection Equipment and Appliances, Inspections, Operations, and Preventive Maintenance
		TM 5-696	Automatic and Manual Fire Alarm Systems, Inspection, and Preventive Maintenance
		TM 5-760	Interior Wiring

By Order of the Secretary of the Army:

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*The Adjutant General*

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