PART 4

PREVENTIVE MAINTENANCE

CHAPTER 1 - OVERVIEW

1-1 INTRODUCTION

A. The purpose of this document is to establish standard procedures in organizing, implementing, and controlling a cyclic inspection, detection and repair system for non-clinical personal property and building service equipment. Preventive maintenance is that work performed on a facility or equipment to eliminate failures and/or breakdowns or to keep such failures and/or breakdowns within predetermined economic limits. It is an obvious fact, but one which is often ignored, that a preventive maintenance program should be established solely on the basis or a cost-benefit analysis. It is the responsibility of the Facilities Manager to evaluate and implement a program so as to ensure maximum economy for the facility. The key factor to be stressed in any consideration of a preventive maintenance program is that it must pay for itself. The effective Facilities Manager will balance the total cost of preventive maintenance against the total cost of "breakdown" maintenance and establish an economical program of preventive maintenance consistent with the benefits derived form it. Any well designed program will yield benefits far in excess of the cost. There is no question that downtime will be less with preventive maintenance than without it. The concepts presented in this chapter, particularly those on documentation and maintenance scheduling, can be accomplished through conventional means by completing forms or through the use of a computer and maintenance software.

B. Much effort has been expended to develop a standard cookbook that could be used to implement a similar program at any given facility and accomplish similar objectives. Over the years this has proved to be infeasible, because of variables encountered at any given facility. Since any kind of maintenance requires the services performed by human beings, the human factor must be taken into account in program design and implementation. Program implementation is always easier at a new facility than at one where the habits have been established and ingrained. Since the implementation of a preventive maintenance program is not limited to a new facility, one must be prepared to exert the necessary energy to change the procedure from a "break-down-fix up" method to that of a standard procedure to conserve the efforts of individuals and downtime of the facility. The success of the program is solely dependent on the cooperation of all concerned. The very best maintenance system will not eliminate breakdowns completely, but a good system has been proven to categorically reduce the number of outages. It is evident that correction of deficiencies at any early stage will save considerable resources and stretch the maintenance expense to cover other requirements.

C. The idea of planning maintenance is simple. It means doing certain planned and scheduled maintenance on equipment and facilities to extend their life, reduce costly failures, or

simply attain more efficiency and effectiveness. The full support of top management is essential to an effective preventive maintenance program. A written policy statement at the Area level should clearly describe the importance of preventive maintenance to non-clinical personal property equipment, building service equipment and structures of the real property. It should clearly show how preventive maintenance affects the strength and support of the facility. A preventive maintenance program must be established before a facility is activated for use. Failure to start a program correctly can impact on the entire life of the site. It is essential that a commitment be initiated before the facility opens for business.

1-2 SCOPE

The preventive maintenance program prescribed by this handbook encompasses real property and personal property (exclusive of clinical equipment). The goal is to establish consistent practices designed to improve the performance and safety of property used in a health care facility. The key factor to consider is the degree of risk that property used under normal conditions could start fires, cause physical injury from mechanical, structural, or electrical failure or otherwise threaten patients, staff, or visitors.

1-3 BENEFITS OF PREVENTIVE MAINTENANCE

A. Preventive maintenance programs are based on employee involvement and rely on knowledge, ideas, and contributions from all maintenance personnel. The program must tap into the ideas and expertise of every member of the maintenance staff. When people become involved in change, they accept ownership for the rebuilding process. Employees need to be encouraged to participate in improvements.

Important aspects of managing a program include:

(1) Building trust

(2) Providing recognition for improvements made

(3) Providing the opportunity to be creative

(4) Being willing to listen and act on employee suggestions

B. Acceptance of the challenge to start or improve a planned maintenance program is no longer optional but essential. Everyone involved must believe in the program and the program must relate to the facility and to the maintenance department.

The following objectives will ensure a successful program:

(1) Perform maintenance at a level that will keep the facility and equipment safe and in an acceptable condition without over maintaining or under maintaining.

(2) Inspect and detect items which require continuing attention or which may impact adversely on the operation of the facility.

(3) Promote the most effective and efficient use of staffing and resources.

(4) Provide a more accurate means of estimating the number of operations and maintenance personnel needed.

(5) Establish a basis for determining budgetary requirements and long-range planning projections.

(6) Provide a means of evaluating the maintenance effort and control of the standard of operation at each facility.

(7) Provide a method for instruction and training in proper maintenance procedures by operators and users of equipment.

(8) Establish the workload and schedule for an effective preventive maintenance program.

(9) Establish the components that require contractor performed maintenance due to lack of in-house expertise or staffing.

(10) Prolong longer equipment life.

(11) Reduce the number of repairs.

(12) Require less standby equipment.

(13) Reduce equipment downtime.

C. The returns shown above do not come automatically and quickly; they take time to develop as the preventive maintenances program develops. Since this program usually involves gradual build-up, truly visible results may not show up for 18 - 24 months after the program is implemented. Some progress, however, will be seen after several months.

1-4 CONVINCING MANAGEMENT

A. Since preventive maintenance is a cost reduction program, the first and most important step is to convince management that cost reduction will take place. Management must be shown that lower unit output costs, greater output and reduced capital investment will result from investment in preventive maintenance. A good place to start is with breakdown costs. Analyze the costs of past breakdowns; loss of patient care, staff idle time,

medication or supply spoilage, cost of injuries, operating overhead, labor and material costs involved. Then estimate what repairs and inspections would have cost if they would have been scheduled before the breakdown instead of after the breakdown. The difference between breakdown costs and repair/inspection cost is the potential savings. Time spent in gaining management's support will spare you many headaches later.

B. Lets review an example of an analysis to justify preventive maintenance:

(1) The analysis of maintenance records of a pump operating a 24 hour operation 7 days a week application shows cost of repairs to the pump over the last 3 years to be $1200 labor, $1800 material, and 18 hours downtime at $500/hour = $9000.

(2) The pump is not included in the preventive maintenance program thus it gets no attention unless it is down or the system is down. It cannot be lubricated or inspected unless the system is down. Because of the high shut-down cost ($500/hour) this would not be cost effective.

(3) Analysis of the operation shows that the system could be changed to include a back-up pump, allowing the pumps to be maintained and virtually eliminating all down time due to pump failure. This would cost $1000 for the pump and $500 for installation. The preventive maintenance cost for inspection and repairs is $900/year.

Present Maintenance
cost/year = $1200/3 + $1800/3 = $1000
(labor) + (material)

Present cost of down time = $9000/3 = $3000/year

Maintenance expense savings = $1000 - $900 = $100/year

Savings/year Down time = $3000

Total Savings/year = $3000 + $100 = $3100

$$\text{Payback} = \frac{\text{Investment}}{\text{Savings}} = \frac{1500}{3100} = .48 \text{ years}$$

"IN LESS THAN 6 MONTHS YOU HAVE RECOVERED THE COSTS."

CHAPTER 2 - CRITERIA FOR ESTABLISHING A PROGRAM

2-1 ACCREDITATION REQUIREMENTS

The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) gives installations the opportunity to derive the requirements of a preventive maintenance program based on their owned assessment of the risk involved. Equipment maintenance history may indicate that more or less maintenance than indicated by the manufacturer's recommendations is needed for a particular type of equipment; service history may show a pattern of breakdowns that could be countered by adjusting the preventive maintenance interval; or the effects of the aging process may suggest a need to arrange the preventive maintenance intervals. It is important however, that all proposed arrangements go through the service unit safety committee. A mechanism whereby users will be informed of any changes in the frequency of preventive maintenance of their equipment is required by accreditation. Informing users of any proposed internal changes gives the using department the opportunity to understand the reasons for the changes and to voice concerns to the committee.

2-2 FLEXIBILITY

The determination of maintenance intervals is a dynamic process which is to be designed so that adjustments can be made when necessary. By establishing a proper interval, a facility can conserve manpower and direct maintenance and best efforts to overcome problems with the greatest need. It would be foolish to continue to perform preventive maintenance at a determined frequency when it could be changed to conserve manpower and still maintain acceptable standards. A rule of thumb to consider is that maintenance can be reasonable if at least three consecutive service intervals are found to be acceptable. Then a recommendation can be made to reduce the frequency to another appropriate interval (e.g. monthly to quarterly, semi-annual to annual). Under no circumstances will preventive maintenance intervals exceed one year.

2-3 EQUIPMENT TO BE INCLUDED IN THE INVENTORY

A. To many Facilities Managers a preventive maintenance program is merely a whole lot of forms, inspection schedules and the maintenance employees and the calendar do the rest. This is not the right attitude to think about the program. If a preventive maintenance program is to succeed you must learn to use economic decisions. It must be dynamic and flexible when describing what and how often to perform maintenance functions. This emphasis on economics may seem strange to many, but a preventive maintenance program hinges solely on economics. Is it worth the expense to

invest in maintenance, or are the downtime related expenses equal to or lower than the maintenance? In short do not adopt paperwork used elsewhere successfully to dictate what you should do at your particular location.

B. In deciding what to inspect take into consideration:

(1) How critical is the equipment?

(2) Does the normal size of the equipment without preventive maintenance exceed operating needs?

(3) Is standby equipment available in case of failure?

(4) Does the cost of preventive maintenance exceed the cost of repair or replacement?

(5) Will failure to maintain equipment harm patients, staff or visitors?

C. A health care facility uses numerous types of patient care and non-patient care equipment that affect the overall quality of care. The Joint Commission believes that the proper management of this equipment is a complex and costly task that can be accomplished through careful and systematic risk assessment regarding various types of equipment. The identified risks can then be used as a basis for structuring and operating an equipment management program. Once the initial assessment is made, an organization can develop programs of preventive maintenance based on the risk involved. A methodology is now needed to determine the equipment that should be included in the preventive maintenance inventory. We will now establish the criteria to use in assisting you in making that judgement.

D. Risk Categories

All equipment is evaluated for inclusion in the preventive maintenance inventory based upon three risk assessment factors.

(1) Risk Category I

Equipment Functional Areas (A) - Defines various environmental areas in which equipment is used in the facility.

(2) Risk Category II

Impact of Failure or Malfunction (I) - Defines potential impact scenarios that may result due to failure or malfunction of the equipment.

(3) Risk Category III

Preventive Maintenance Frequency (F) - Defines the level and frequency of preventive maintenance required.

E. Each risk category includes specific sub-categories that are assigned points which when added together according to the formula listed below, yield a score. The score then determines whether the equipment will be maintained or not. Equipment with a total score of twelve (12) or higher is included in the equipment management program and added to the preventive maintenance inventory. Equipment with a score below 12 is not included in the preventive maintenance program. Equipment with scores below 12 is only maintained when it breaks down. No funds are expended towards prolonging its useful life.

This is may be a result of:

(1) Lack of in-house staffing to perform the preventive maintenance.

(2) Lack of funds to perform the preventive maintenance by contract.

(3) Equipment is solid state and therefore does not require preventive maintenance.

(4) Spares are available to cover the downtime when one of the items breaks down.

or

(5) The replacement cost of the equipment when compared with the investment cost of preventive maintenance over the life expectancy of the equipment does not make the investment profitable.

F. Equipment that scores below twelve (12) may be added to the program inventory at the discretion of the Facilities Manager. Exceptions require approval by the service unit safety committee.

G. The formula used to calculate the score for determining inclusion in the preventive maintenance is:

Total = A + I + F

(See Exhibit 2-3-A)

H. The following risk criteria is established for evaluating equipment for inclusion in the preventive maintenance program:

EXHIBIT 2-3-A

PREVENTIVE MAINTENANCE EVALUATION CRITERIA

A. RISK CATEGORY I

Equipment Functional Area (A)	Points
Anesthetizing Areas (O.R., E.R., Ob Gyn.,)	10
Critical Care Areas, Recovery Room,	9
Dialysis, Dental, Radiology, Inpatient Areas, Blood Bank	8
Outpatient Clinics	7
Diagnostic Services (Clinical Laboratory, Radiology)	6
Support and Therapeutic Services (Pharmacy, PT)	5
Central Computer, and Telephone Room	4
Mental Health	3
Administrative Areas	2
Employee Quarters	1

B. RISK CATEGORY II

Impact of Failure or Malfunction - (I)	Points
Potential patient death	5
Potential patient or staff injury	4
Potential patient or staff health problem	3
Discomfort or Inconvenience	2
No significant risk	1

C. RISK CATEGORY III

Preventive Maintenance Frequency - (F)	Points
Monthly	5
Quarterly	4
Semi-annually	3
Annually	2
Not Required	1

I. Whenever new equipment is received by the facility, it is must be evaluated for inclusion into the equipment management program within 30 days of its arrival at the facility.

CHAPTER 3 - SETTING UP THE PROGRAM

3-1 HOW TO START A PROGRAM

A. Do not lose sight of some requirements of laws, regulations, codes, and accreditation which are not preventive maintenance requirements. For the purposes of this handbook we have broken down our preventive maintenance program into two categories:

(1) Preventive Maintenance - Traditional (Lubricate, visual inspection, adjust, check parameters (temperature, pressure, vibration, tension).

(2) Tests and Inspections - Tests and/or inspections verify the performance of the equipment (e.g., testing of emergency generator under load, internal boiler inspection, elevator inspection)). Their purpose is to assure that the equipment is capable of functioning in its design parameters.

B. The best way to start a program is to divide the health care facility into installations. Within the installations tackle the one department at a time. In doing so, consider your efforts in the following categories:

REAL PROPERTY (BUILDING SERVICE EQUIPMENT)

HEATING/INCINERATION

Boilers (Steam/Hydronic/Electric)
Boiler Safeties
Boiler Water Treatment
Boiler Controls
Boiler Safety Pressure Valves
Condensate Return Pumps
Flame Guard
Convectors/Radiators
Steam Traps
Air Handlers
Re-Heat Coils
Humidifiers
Heat Exchanger
Hot Water Recirculating Pumps
Hot Water Zone Valves
Air Handler Belts
Natural Gas/Propane Valves
Fuel Oil Sampling
Incinerator Safeties
Incinerator Controls

AIR CONDITIONING/VENTILATION

Air Handlers
Exhaust Hoods
Air Handler Belts
Air Handler Interlocks
Cooling Coils
Air Balancing
Packaged Units
Filters
Condensers
Pneumatic/Electrical Controls
Control Air Compressor
Energy Management Computer
Cooling Tower
Cooling Tower Sump Pump
Cooling Tower Fans
Chillers
Chiller Tube Cleaning
Chiller Water Zone Valves
Chiller Water Pumps
Chiller Oil Sampling
Fan Coil Units
Control Air Dryer

HORIZONTAL/VERTICAL TRANSPORT

Pneumatic Tube
Elevators
Lifts

POTABLE WATER/PLUMBING

Lift Stations
Irrigation Backflow Devices

Water Hardness
Potable Water Zone Valves
Backflow Devices
Potable Water Pumps

FIRE PROTECTION

Water Supply Storage
Jockey Pump
Fire Pump
Sprinkler Heads
Tamper Switches
Flow Switches
Sprinkler Zone Valves
Tamper Switches
Dry Sprinkler/Air Compressor
Post Indicator Valves
Siamese Connection
Auto. Extinguishing System
Fire Alarm Panels
Pull Boxes/Bells/Horns
Smoke Detectors
Duct Detectors
Smoke Detectors
Fire Dampers
Smoke Dampers
Fire Doors (Sliding)
Hydrants

MEDICAL GASES

Medical Air Alarm Panels
Medical Air Outlets
Medical Air Zone Valves
Oxygen Alarm Panels
Oxygen Zone Valves
Nitrous Oxide Alarm Panels
Nitrous Oxide Outlets
Nitrous Oxide Zone Valves
Oxygen Outlets

MEDICAL/SURGICAL VACUUM

Medical Vacuum Zone Valves
Medical Vacuum Alarm Panels
Medical Vacuum Outlets
Surgical Vacuum Zone Valve
Surgical Vacuum Outlets
Dental Vacuum Zone Valves
Dental Vacuum Alarm Panels
Dental Vacuum Outlets
Surgical/Vac. Alarm Panels

ELECTRICAL

Emergency Generator
Generator Transfer Switch
Switchgear
Transformers
Line Isolation Monitors
Electrical Grounding
Electrical Receptacles
Ground Fault Interrupters (GFI)
Main Breakers
Parking Lot Car Block Heaters
Air Handler Motors
Chiller Motors
Potable Water Pump Motors
Chiller Pump Motors
Cooling Tower Fan Motors
Cooling Tower Pump Motors
Street Lighting
Ambulance Sign
Photo Electric Cells
Emergency Lighting (Battery)

POLLUTION ABATEMENT

Incinerator Emissions
Boiler Emissions
Spray Paint Booth Emissions
Emergency Generator Emissions

GROUNDS

Paved Parking Areas
Signage

Sidewalks
Parking Striping
Curb Printing
Erosion Assessment
Ramps
Fencing
Cattle Guard

STRUCTURAL

Door Closers
Automatic Doors
Dock Leveler
Roofing
Roof Penetrations
Roof Drains
Roof Flashing
Gutters/Downspouts

PERSONAL PROPERTY (Non-Clinical)

DIETETICS

Dishwasher
Steam Table
Steam Booster
Ovens
Griddles
Coffee Maker
Toasters
Food Carts
Refrigerators
Walk-in Refrigerator

ADMINISTRATIVE

Lektrievers
Typewriters
Security Alarms
Paging System
Telephone
Computers
Conveyors

VENTILATION/AIR CONDITIONING

Window Air Conditioners
Swamp Coolers

MEDICAL/SURGICAL/DENTAL

Medical Air Compressor
Dialysis Water System
Nurse Call
Vacuum Pumps
De-ionized Water System

PHARMACY/LABORATORY

Steam Sterilizers
Laminar Flow Hoods
Biological Hoods
De-Ionized Water
Blood Bank Alarm
Bottle Washer
Dental Air Compressor
Dental Air Dryer
ETO Sterilizers
Bedpan Washers

LAUNDRY

Dryer
Washer
Ironer
Folder
Hoists

GROUNDS

Parking Gate	Leaf Blower
Lawn Mowers	Weed Wackers
Snow Blowers	Tractors

INSTRUMENTS/TOOLS (CALIBRATION)

Freon Detector	**Asbestos Air Sampling Pump**
Volt Meter	**Light Meter**
Ohm Meter	**Sound Meter**
Tachometer	**Velometer**
Flame Guard Tester	

INDUSTRIAL HYGIENE (MONITORING)

Asbestos	**Radiation (Radiology)**
Noise	**Lead**
Formaldehyde	**Hard Metals (Dental)**
Ethylene Oxide (ETO)	**Waste Anesthetic Gases**
Radon	**Nitrous Oxide**
Antineoplastic	**Ventilation (Pressure)**

NOTE - BOLD Type indicates that the item requires inspection and/or testing in addition to preventive maintenance.

3-2 INSPECTORS

A. A PM inspector is a craftsman with good skills, who has been trained to test, replace some components, and make small repairs and adjustments as he/she inspects. The length of time allowed for repairs, changes and adjustments can be as little as 15 minutes or as much as a couple of hours. Regardless of the time involved, the inspector should stick as close to the schedule as possible so that inspections do not fall behind.

B. Inspections and tests may be separate from the preventive maintenance tasks or they may be accomplished simultaneously. Maintenance duties could be assigned and rotated among the workers. Not all PM duties require a journeyman worker. It is up to the Facilities Manager to determine what level of skills that are needed for each PM task. It would not be logical to assign PM duties on the switchgear equipment to an electrician helper. It could be possible to assign PM duties for filter replacements or lubrication of a motor, fans and pumps to a helper. The key is the level of skills needed to perform the task. Training is the key to diversifying your staff to perform preventive maintenance.

3-3 CHECKLISTS

A. Preventive maintenance should be conducted through means of checklists. Documentation needs to be kept of any recommendations or corrections made by the inspector. Any repairs required as a result of the inspection should be initiated by a work order. If too many repairs on the same piece of equipment are occurring, then the inspection process needs to be reviewed.

(1) Is the problem encountered covered by the preventive maintenance tasks?

(2) Are inspection intervals adequate?

(3) Is the inspector being thorough in his duties?

(4) Does the inspector need training?

Repetitive equipment failures are a clue to material failure problems which may require design changes. Repetitive failures can also indicate operational overloading or misapplication.

B. Inspections should neither be overdone nor underdone. It is extremely important that a follow up on the preventive maintenance program be conducted to ensure that it is enough to eliminate breakdowns but not often enough to make the inspection formidable and too costly. A good rule of thumb is that inspections should be often enough to produce repairs every third or fourth inspection on average; they should not be so infrequent that breakdowns are occurring. Cost needs to be monitored for repairs to each piece of equipment. Sometimes it does not pay to do preventive maintenance.

C. To ensure complete and uniform maintenance, all points to be checked must be itemized on the preventive maintenance guideline form. Criteria must be specific enough that variables to check such as operating pressures, temperatures, belt slack, and type of lubricant to use are clearly spelled out in the inspection form. Inspection tasks and variables for each piece of equipment are found in guide books, manufacturer's catalogues, maintenance manuals and trade magazines. Checklists must reflect the complexity and location of preventive maintenance points for each piece of equipment as well as its condition, load and the environment within which it operates. In IHS we use Form HRSA 427, "Preventive Maintenance Guide and Checklist". The example in Exhibit 3-3-A is shown to illustrate the type of information that is required in the preventive maintenance checklist.

3-4 STAFFING FOR PREVENTIVE MAINTENANCE

A. A successful preventive maintenance program must be staffed with sufficient number of individuals whose abilities and skill in the

various trades is appropriate. To staff with anything less will jeopardize the success of the program and the effectiveness of the department. Skills can be taught and assimilated. However, one cannot staff a maintenance program without qualified help. More bodies will not suffice. The only recourse under such constraints is to contract out the total preventive maintenance program until the staff acquires the skills and knowledge. This is a very expensive undertaking. It does no good whatsoever (in fact, it does more harm) to start a preventive maintenance program on a part time basis using maintenance personnel whose prime responsibility is renovations and repairs and, only secondarily, in their spare time, preventive maintenance. Staff who work in this manner will only lose faith in what preventive maintenance can really do.

B. To obtain qualified staff it is necessary to raise pay levels in order to attract more competent personnel who are willing to undergo the constant training necessary to keep up with today's sophisticated equipment.

C. In order to staff a preventive maintenance program it is necessary to complete individual guidelines for each item to be included in the preventive maintenance program. The appropriate staff hours to accomplish each maintenance task will be defined in this document. This allows you to obtain the sum total of staff hours necessary to accomplish the required preventive maintenance. The total staff hours in the schedule is then divided by 1760 hours (hours equivalent to one employee per year) to arrive at the preventive maintenance staffing level in full time equivalent employee (FTE). Remember that preventive maintenance performed under contract must be deducted from this calculation, as the contractor furnishes the staffing.

EXHIBIT 3-3-A

PREVENTIVE MAINTENANCE GUIDE AND CHECKLIST

Installation: _____ Building No. _____
Description: _____ PM No. M-018
_____ Cycle: S
_____
Location: _____

PREVENTIVE MAINTENANCE TASK

1. Check the pressure drop across filter bank. Replace filters if pressure drop exceeds 20 psi.

2. Clean unit, inspect for oil leaks.

3. Check oil level. If lower than third mark from bottom of dipstick add SAE 40 oil.

4. Check the pressure relief valve. Head pressure should relieve each time the compressor stops.

5. Check belt tension for 1/4" gap, adjust tension as needed.

6. Record amperage (10-14 A), voltage (106-124 V), surface temperature (160-180 F). Take action as needed.

7. Check motor and compressor pulley for tightness and correct alignment (1/16")

8. Record compressor cut-in (30 psi) and cut-off (80 psi) pressures. Adjust as necessary.

9. Release safety valve manually.

10. Check alternator operation by switching control to standby unit. Leave compressor in alternate unit.

11. Remove, clean, and reinstall compressor valves. Inspect cylinders for wear.

12. Date and initial the PM task on the guidelist.

CHAPTER 4 - PROGRAM INSTALLATION

4-1 MOBILIZATION

Initiating a preventive maintenance program is no easy undertaking and cannot be done in haste. The whole maintenance staff should get involved, especially the most skilled workers. The program should be developed in a specific and logical sequence. Skipping over or moving on before one phase is completed will result in difficulties later on. However, a program may be completed on less than the whole of the facility, providing that any omission is adequately defined and programmed for future completion. The forms specified in this handbook must be used exclusively. There is a space requirement that needs to be met. Preventive maintenance systems mean paperwork. Office space for the laying out and development of a program is considerable. When completed, the program must be housed in the facilities area in a convenient and accessible (but considerably smaller) space. There is a psychological value in making the program schedule, books, files, etc., the "centerpiece" of the maintenance office. This in effect says, "We think this is the most important thing in this office!"

A. Step 1 - Staging Area

(1) Assemble the following documents and forms.

* Facilities Engineering Operations Manual, Part 2, Technical Elements.
* Facilities Engineering Operations Manual, Part 4, Preventive Maintenance
* Facilities Engineering Operations Manual, Part 13, Program Procedures
* Form HSA-T-50, Building Record
* Form HSA-427, Preventive Maintenance Guide and Checklist
* Form HSA-431, Equipment Card
* Form PM-1, Preventive Maintenance
* Engineering Drawings (Architectural, Electrical, Mechanical, Plumbing, Site Plan)
* NFPA Codes (10, 13, 14, 17, 20, 22, 24, 72A, 80, 90A, 99, 101)
* Service Unit Facilities Policies and Procedures
* Manufacturer's catalogue and shop drawings.

(2) Set aside an area to be used while developing the program. Equipment needed will include:

* Filing Cabinet (5 Drawers)

* Index File Cabinet (5 x 8 Cards)

* Work Surface (Tables or Desks) for staging 4'x 8'

* Typewriter or computer.

* Equipment Labels (Stickers)

* Three Ring Binders (3")

Brief the staff on the contents of this handbook and discuss appropriate information and conduct training.

B. Step 2 - Inventory

A complete and accurate inventory is the cornerstone of a successful preventive maintenance program. Perform a complete inventory of each installation, its buildings, their component parts, systems, and non-clinical personal property. Begin the inventory by working progressively through each building, each floor, each area. You must have engineering drawings with you to assist you in identifying systems by numbers used in the drawings (e.g., air handler in surgery and ICU, AH-3). The completed inventory will provide a detailed abstract of each facility and its contents. Remember that each building will have to receive a unique number. Consult your real property management staff to ensure you both use the same number. Use chapter 5 of this Part of the manual to assist you in determining what equipment is to be included in the preventive maintenance program. The list is only a guide to the equipment that you need to identify.

C. Step 3 - Determine the Equipment in the PM Program

This step now requires that you score each individual equipment item (or equipment system) against the risk criteria to determine if the equipment will be included in the preventive maintenance inventory. Remember that you need to:

(1) Keep personal non-clinical property equipment separate from utilities equipment as required by accreditation. They must be two separate inventories that are separate or can be separated (if you use a computer).

(2) You need to keep an inventory of all equipment in the facility whether you (or a contractor) perform preventive maintenance on the equipment or not. In addition you need to document to the accreditation bodies that you rated and ranked all the equipment to determine if it would be included in the preventive maintenance inventory. This documentation must be maintained for the life of the

equipment and filed with the Equipment Record Card, HSA - 431.

D. Step 4 - Complete Equipment Cards

You are required to maintain an Equipment Record Card, HSA - 431 for each piece of equipment that you inventory. Separate the items that the rating criteria dictated that you perform preventive maintenance. Remember to include the equipment cards for the equipment that you will be contracting out. Use the manufacturers manuals, nameplate data, location, and other facts to determine the guidelist preventive maintenance tasks that are required for each item of equipment.

(1) The inventory file of the automated computer software shall be used by facilities engineering to develop and record in a uniform manner information regarding items of equipment and component parts of systems.

(2) Information for the non-clinical personal property equipment portion of the database shall be supplied by the supply management department. Upon acceptance of such equipment, the property management clerk shall direct HSA - 431, Equipment Record Card, for each item to facilities engineering for evaluation and inclusion in the preventive maintenance inventory.

(3) Facilities engineering shall be responsible for entering information regarding building service equipment into the inventory.

E. Step 5 - Maintenance Manuals

Maintenance manuals received with equipment shall be located in the facilities department or area designated by the Facilities Manager. The location of the maintenance manuals shall be annotated in the Preventive Maintenance Guide and Checklist, HRSA - 427 for each item.

F. Step 6 - PM Procedures

The actual preventive maintenance is accomplished following the facilities department's written procedures which are based on recommendations from equipment manufacturers, the American Society of Hospital Engineers, laws, regulations, codes, IHS guidelines in the Technical handbook series for Health Facilities and equipment operation, maintenance and repair history.

G. Step 7 - Schedule

When the above steps are completed the PM schedules can finally be generated. The following document will need to be generated: Preventive Maintenance Master Schedule. This schedule is a series of listings for equipment to be maintained by:

a. Location - This identifies the service unit and installation by name.

b. Classification - This classifies the listing by mechanical, plumbing, electrical, grounds, structural, personal property.

c. Equipment Number - This identifies each individual piece of equipment (i.e., M -083, E - 116, PP - 034).

d. Description - This documents a brief description of the piece of equipment (i.e., Air handler AH -4, Buffalo Forge, 12000 cfm, 2.3" sp).

e. Frequency - This identifies the code depicting the frequency or frequencies that the item is scheduled for PM (i.e., Q, A; quarterly and annually).

f. Assigned Month(s) - This outlines the month(s) of the year that this item will be scheduled for maintenance (i.e., 3-6-9-12). The months are designated by a numeric identification corresponding to the calendar year where 2 is February, 5 is may etc.

4-2 IMPLEMENTATION

A. SCHEDULING

(1) Approximately 2 weeks prior to the first of the month, the facilities manager will generate a PM list for the facility. This list shall be generated from the facilities computer or from the manual list for the schedule month. PM work order numbers are automatically generated using a computer. If using a manual system the facilities manager will assign monthly blanket work orders by trade and by individual facilities employee.

(2) The facilities manager or designee will contact the immediate supervisor of the area scheduled for preventive maintenance the day before the facilities employee is scheduled to perform the work. This will ensure that the department is aware of the scheduling and can accommodate the facilities employee. In some instances it may be necessary to schedule the preventive maintenance on overtime or change the facilities employee's tour of duty to allow the work to be accomplished without disrupting the operation of the department.

(3) The PM list shall be assigned to the mechanic scheduled to perform the skill required for the preventive maintenance involved in the list that month.

(4) Mechanics shall complete the PM and report completion in accordance with the preventive maintenance procedure in Part 4, Preventive Maintenance. Mechanics will report to the immediate supervisor of the department before and after completing the preventive maintenance. Mechanics will not leave an area without informing the supervisor of the area of any equipment not found during the inspection. Mechanics will not spend more than 5 minutes looking for equipment to be maintained. It is department responsibility to locate the equipment assigned to them by property management.

(5) No later than one week following the end of each month, the mechanics shall submit the completed PM sheets to the Facilities Manager. Each mechanic will enter the PM status adjacent to each item entry in the manual list or in the computer printout and initial each page of entries. The codes to use in documentation of the maintenance are as follows:

a. Pass (P) - Self explanatory.

b. Corrective Action Taken © - Equipment maintained required corrective action (i.e., adjustment) which was accomplished. Equipment passed and is fully operational.

c. Deferred (D) - Equipment was not located and was therefore not maintained. Supervisor of the area was notified and could not locate the equipment.

d. In Use (I) - Equipment was in use and could not be released by supervisor for maintenance. Maintenance was deferred.

e. Out of Service (O) - Equipment was not in use and could not be put in use by the supervisor of the area. Maintenance was deferred.

B. EVALUATION

(1) After all assigned PM for the month has been completed by the mechanic he/she will assess the work accomplished by compiling the following data on a pre-printed form obtained from the Facilities Manager. If a facility has a computerized preventive maintenance software package this can be accomplished by a search in the computer.

* Number of items assigned

* Number of items completed-passed

* Number of items completed requiring corrective action.

* Hours assigned (total of the guidelist for the work assigned)

* Hours completed
* Number of items in use
* Number of items not located
* Number of items out of service
* Number of items deferred due to lack of time to complete

(2) The Facilities Manager shall forward each department head a memorandum outlining the following:

a. Number of items scheduled

b. Number of items completed

c. Number of items not located (requesting that the department locate the items for PM)

d. Number of items in use (requesting that the department notify the Facilities Manager when the item is available for PM)

e. Number of items turned in (requesting that the department inform facilities engineering if the item is still at the installation)

f. Number of items in storage (requesting the department to notify facilities engineering for an inspection prior to activation)

g. Number of items not completed due to a shortage of time/manpower (notifying service of next scheduled inspection)

The memos shall be sent to each affected department by the fifteenth of the month.

(3) If the department notifies the Facilities Manager or designee, of the correct location of an equipment item, he/she shall initiate a work order for the PM of the item and shall update the location of the item in the preventive maintenance inventory.

(4) After forwarding the memos to the departments, the Facilities Manager or designee, shall make any corrections to the inventory that were provided by mechanics. This includes updating location, equipment category, etc. If any changes to the PM scheduling frequency or time were proposed by the mechanic, they shall be discussed and approved by the service unit safety committee through the Facilities Manager prior to changes to the schedule. These memos shall be used

in the analysis of the PM program in the internal controls report.

(5) The PM schedule shall be submitted to the Facilities Manager for the official record.

C. Completion

Each month, the Facilities Manager or designee shall document preventive maintenance completion by closing out the PM work orders as follows:

(1) PM work orders shall be closed out in the computer and a copy maintained with the equipment history card.

(2) Department Heads shall be notified monthly of the items scheduled and completed in their department. Any problems or recommendations for replacement shall also be reported.

(3) A manual system for the PM system will be maintained in the same manner.

CHAPTER 5 - INSPECTIONS

5-1 OVERVIEW

A. Inspections, as provided for in jurisdictional regulations, will be made at the time of installation and at regular periods thereafter. It is essential that inspections be thorough and complete. To accomplish this it is imperative that inspections and tests be conducted by qualified inspectors and in accordance with the most restrictive applicable law, regulation, or code. Where the inspection guide may appear only to recommend that certain steps be taken, jurisdictional regulations may make them mandatory. In addition, regulations may make provisions for different requirements. The inspector should have a thorough knowledge of all the regulations. The inspectors should be conscientious and extremely careful in his/her observations, taking sufficient time to make the examination thorough in every way. The inspectors should never take a statement as final as to conditions not observed by him/her and, in the event that a thorough inspection cannot be made, he/she should note this in his/her report and not accept the statements of others.

B. The purpose of inspections and tests required by codes, laws, regulations and accrediting bodies is to assure that equipment continuously conforms to the requirements in effect at the time of installation or alteration. The requirements have to be repeated at specified intervals to regularly assure that the equipment continues to perform within acceptable parameters. Inspections and tests are mandatory. The frequency cannot be reduced nor the extent of the test diminished under any circumstances. This is quite a different outlook as compared to preventive maintenance which is a recommended practice for economic reasons only. In health care a factor of liability is also introduced which mandates the testing of equipment to ensure the welfare of patients as much as employees in the health care environment.

5-2 REQUIREMENTS

A. The following is a listing of tests and inspections required in a typical health care facility. The list is not inclusive. It is intended to generate a summary listing of the major requirements. You are requested to contact the Facilities Engineering Branch, Division of Facilities Management, Office of Environmental Health and Engineering in Headquarters with any information that will enhance the listing found in this chapter.

B. You should never request inspections by merely requesting that the contractor perform the work in accordance with applicable codes. It is your responsibility as a Facilities Manager to be aware of the codes, laws and regulations applicable to your operation. It is imperative that your specification for bidding

the services clearly state the requirements that you extract from the inspection guides for your unique situation. Inspection guides are often written in such a manner that the individual using the guide needs to make certain decisions regarding the interpretation of the guide and or applicable decisions that affect the manner in which the inspections is to be conducted. For this reason it is not possible for a requisition for inspection services merely to state "in accordance with NFPA 99". You must extract the edited applicable sections of the code that are specific to your equipment.

C. In addition you must also attach any required form that will be used to report information regarding the test and/or inspection. Make sure that the specification requires that the data be interpreted by the inspector. For example stating that a pressure reading was 34 psi means nothing unless the inspector is required to state if that reading is acceptable or not.

(1) Boilers - National Board Inspection Code (NBC), A Manual for Boiler and Pressure Vessel inspectors, ANSI/NB-23.

a. Steam - Internal annually and external semi-annually.

b. Hydronic - Internal biennially and external semi-annually.

(2) Incinerators - Safeties annually and emissions quarterly.

(3) Backflow Devices - Annually.

(4) Fire Protection Systems - National Fire Protection Association, Inspection, Test and Maintenance Manual, NFPA catalog No. SPP-83.

(5) Medical Air System - National Fire Protection Association, NFPA 99, Health Care Facilities, Chapter 4 and 12, 13, 14, or 15 as applicable.

(6) Electrical Systems - National Fire Protection Association, NFPA 99, Health Care Facilities, Chapter 3, 7 and 12, 13, 14, or 15 as applicable.

(7) Dialysis Water Equipment - Annual test of output water quality.

(8) Laminar Flow, Biological, and Exhaust Hoods - Annual certification.

National Fire Protection Association, NFPA 45, Chapter 6, Fire Protection for Laboratories Using Chemicals.

National Sanitation Foundation Standard No. 49

Federal Standard No. 209B

Occupational Safety & Health Act (OSHA) 1910.1000(e)

(9) Industrial Hygiene Monitoring - Minimum annual monitoring.

(10) Chiller Oil - Annual analysis.

(11) Fuel Oil - Annual analysis.

(12) Control Valves and Breakers - Exercise annually.