this document downloaded from

vulcanhammer.net

Since 1997, your complete online resource for information geotecnical engineering and deep foundations:

The Wave Equation Page for Piling

The historical site for Vulcan Iron Works Inc.

Online books on all aspects of soil mechanics, foundations and marine construction

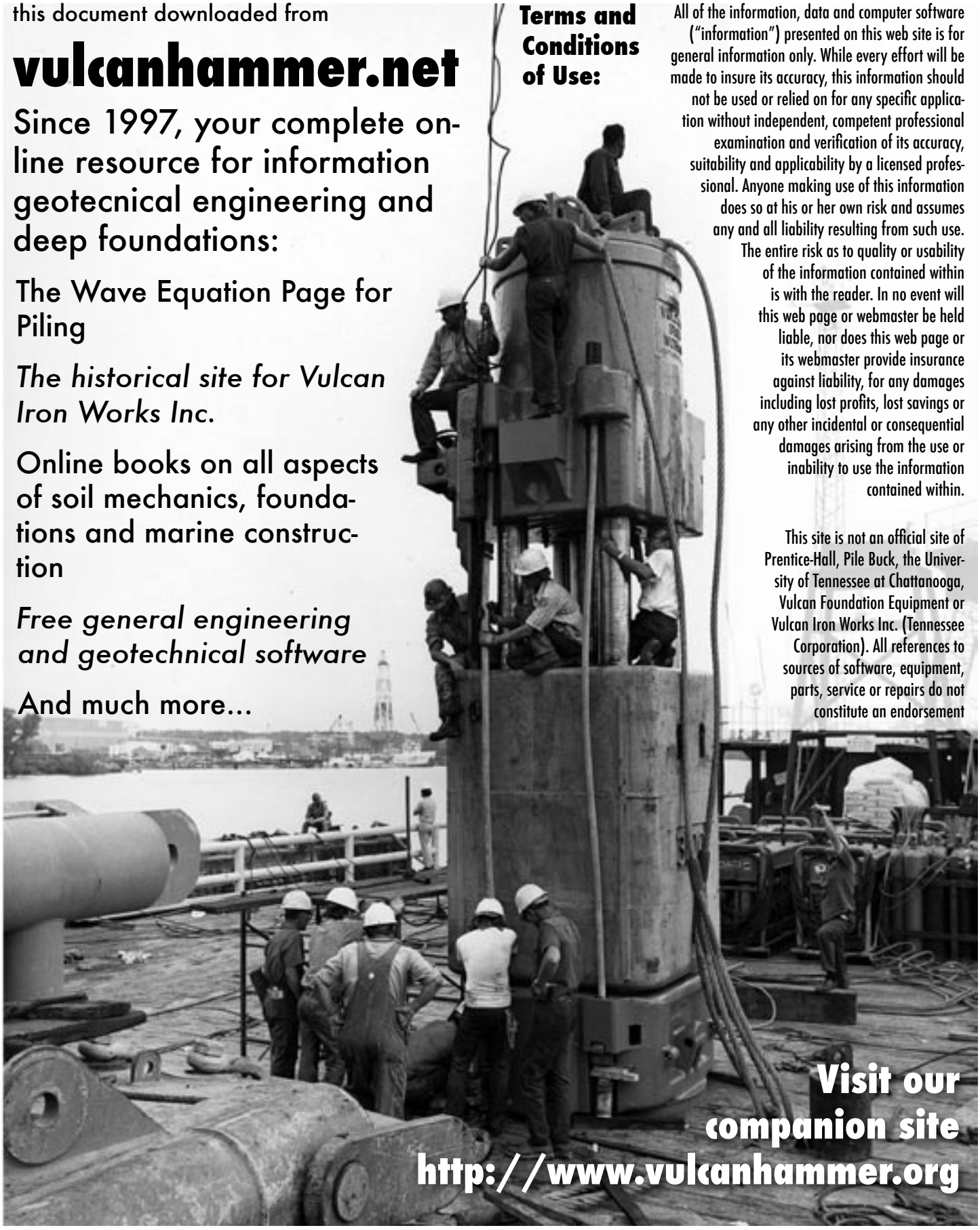
Free general engineering and geotechnical software

And much more...

Terms and Conditions of Use:

All of the information, data and computer software ("information") presented on this web site is for general information only. While every effort will be made to insure its accuracy, this information should not be used or relied on for any specific application without independent, competent professional examination and verification of its accuracy, suitability and applicability by a licensed professional. Anyone making use of this information does so at his or her own risk and assumes any and all liability resulting from such use. The entire risk as to quality or usability of the information contained within is with the reader. In no event will this web page or webmaster be held liable, nor does this web page or its webmaster provide insurance against liability, for any damages including lost profits, lost savings or any other incidental or consequential damages arising from the use or inability to use the information contained within.

This site is not an official site of Prentice-Hall, Pile Buck, the University of Tennessee at Chattanooga, Vulcan Foundation Equipment or Vulcan Iron Works Inc. (Tennessee Corporation). All references to sources of software, equipment, parts, service or repairs do not constitute an endorsement



Visit our companion site http://www.vulcanhammer.org

Naval Facilities Engineering Command
200 Stovall Street
Alexandria, Virginia 22332-2300

APPROVED FOR PUBLIC RELEASE

Inspection Of Shore Facilities

NAVFAC MO-322
Volume I
March 1993

SN 0525LP-608-7500

SNDL DISTRIBUTION

(25 Copies each):

FKA1C COMNAVFACENGCOM

FKN1 EFDs

(10 Copies each):

FA46 PWCLANT
FB54 PWCPAC

FKP7 NAVSHIPYDs
FT104 PWCCNET

HQ U.S. AIR FORCE
Engineering And Services Center
Tyndall AFB, FL 32403

U.S. ARMY
Office Chief of Engineers
Washington, D.C. 20314 (DAEN-MPO)

(2 Copies each):

E3A LABONR
FA6 NASLANT
FA7 NAVSTALANT
FA10 SUBASELANT
FA18 NAVPHIBASEIANT
FA24 COMNAVBASELANT
FA47 HOSPLANT
FB7 NASPAC
FB10 NAVSTAPAC
FB13 SUBASEPAC
FB21 NAVPHIBASEPAC
FB28 COMNAVBASEPAC
FB30 NAVSHIPREPFAC
FB36 NAVFACPAC
FB45 TRIREFFACPAC
FB58 HOSPPAC
FC3 COMNAVACTEUR
FC5 NAVSUPACTEUR
FC7 NAVSTAEUR
FC14 NASEUR
FC17 NAVALHOSP
FD4 OCEANCEN
FF1 COMNAVDIST Washington, DC
FF3 NAVSTACNO
FF6 NAVOBSY
FF32 FLDSUPPACT
FF38 USNA
FF42 NAVPGSCOL
FG2 NAVCOMMSTA
FG3 COMMUNICATIONUNIT
FJA4 NAVAL HOME
FKA8F5 SUBASE
FKM9 NSC
FKM12 NAVPETOFF
FKM13 SPCC
FKM15 ASO
FKN2 CBCs
FKN3 OICCs
FKN7 NEESA
FKN10 NAVSUPPFAC
FKN11 NAVCIVENGRLAB
FKP1B WPNSTAs
FKP1J NAVORDSTAs
FKP16 NAVSSES
FKQ6A NAVAIRDEVCEN
FKQ6G NUSC
FKR1A NAS
FKR1B NAVAVNDEPOT
FKR3A NAVAIRENGCEN
FKR5 NAVAVIONICCEN
FR3 NASRFSFOR
FR4 NAF
FT6 NASCNET
FT9 NAVAVMUSEUM
FT13 NATTC
FT28 NETC
FT31 NTC
FT37 NAVSCOLCECOFF
FT38 NAVSUBTRACENPAC
FT39 NAVTECHTRACEN
FT55 NAVSCSCOL
FT108 NAVALHOSP
V3 COMCAB
V4 MCAF
V5 MCAS
V16 CG MCB
V23 CG MCLB

Additional Copies may be obtained from:
Naval Publications and Forms Center
5801 Tabor Avenue
Philadelphia, PA 19120

FOREWORD

A major problem facing Facility Managers is the physical condition of the shore establishment. Advancing deterioration frequently threatens operational readiness. In times of declining resources there is a tendency to condone breakdown maintenance versus planned maintenance and to reduce or curtail Facility inspections. This results in poorly defined and understated maintenance and repair resource requirements and condition. Facility Managers are always in a position of justifying resource needs to decision makers. At higher levels, programs are evaluated not only on need, but on mission readiness impact while recognizing available resources cannot fully fund all programs. Documentation of real property condition and its effect on operational readiness is critical in justifying budget requests. Facility condition is determined by accurate facility inspection. It is both the cornerstone of a sound Facility Management System and the bedrock on which it is built. Without good facility condition information and a common sense approach to Facilities Management it is difficult to exercise good stewardship over assigned assets and supporting resources.

This manual contains policy and criteria for inspection and condition assessment of shore facilities and preventive maintenance of equipment. It provides guidance to implement and maintain an inspection/assessment system. Comprehensive inspection by technically qualified personnel is the key to helping protect Real Property investment. An effective facilities management program avoids over/under maintenance. It fosters timely corrective action before advancing deterioration causes major repairs, or impacts mission.

Application of maintenance standards will effectively and efficiently protect personnel and property at a cost commensurate with facility functional requirements. Use of this guidance will assure economical maintenance and maximum reliability of facilities and equipment. Additional information or suggestions to improve this publication are invited and should be submitted through appropriate channels to the Naval Facilities Engineering Command (Attention: Code 163), 200 Stovall Street, Alexandria, VA 22332-2300. This publication supersedes **NAVFAC MO-322 Vol I of July 1977.**

This publication has been reviewed in accordance with the Secretary of the Navy Instruction 5600.16A and is certified as an official publication of the Naval Facilities Engineering Command.

E. R. HAMM
CAPTAIN, CEC, U.S. Navy
Assistant Commander for
Public Works Centers and Departments

ABSTRACT

This publication establishes the Continuous Inspection Program for Real Property facilities and equipment. Practices and procedures are recommended to ensure facility and equipment safety, reliability and readiness at optimum cost.

The contents of this manual contain definitions and recommended standards for the Shore Facilities Inspection/Assessment System; inspection frequency and times, procedures and types; suggested guidelines for records and reports; procedures for condition assessments; discussions of the Annual Inspection Summary and facility maintenance planning.

CHANGE CONTROL SHEET

Document all changes, page replacements, and pen and ink alterations posted in this manual.

AMENDMENT NUMBER	AMENDMENT DATE	POST DATE	POSTED BY (LAST NAME)

Table of Contents

1. **INTRODUCTION** 1-1

1.1 PURPOSE 1-1
1.2 OBJECTIVE 1-1
1.3 DISCUSSION 1-1
1.4 SCOPE 1-1
1.4.1 Volume 1-Inspection/Assessment System 1-2
1.4.2 Volume 2-Control Inspection Checklist 1-2
1.4.3 Volume 3-Instructor's Manual for Control Inspector Training 1-2
1.5 RESPONSIBILITIES 1-2
1.5.1 Activity Responsibility 1-2
1.5.1.1 Facilities Management Program 1-2
1.5.1.2 Facility and Equipment Inventories 1-3
1.5.1.3 Safety 1-4
1.5.1.4 Organization 1-4
1.5.1.5 Control Inspector's Duties 1-4
1.5.1.6 PMI Inspector Duties 1-5
1.5.1.7 Supervisor's Duties 1-5
1.5.1.8 Operator Inspection 1-5
1.5.1.9 Management's Appraisal Responsibility 1-5
1.5.1.10 Shore Base Readiness Report (BASEREP) 1-6
1.5.2 Claimant Responsibilities 1-6
1.5.3 Naval Facilities Engineering Command (NAVFACENGCOM) Responsibilities 1-8

2. **SYSTEM DESCRIPTION** 2-1

2.1 PURPOSE 2-1
2.2 INVENTORIES 2-1
2.2.1 Real Property Inventory 2-1

2.2.1.1 Utility Systems Inventories 2-1
2.2.2 Systems Inventory 2-2
2.2.3 Preventive Maintenance Inspection (PMI) Inventory 2-2
2.2.4 Replacement Items Inventory 2-2
2.2.5 Real Property Baseline Inventory 2-3
2.3 INSPECTION TYPES 2-3
2.3.1 Control Inspection (CI) 2-3
2.3.1.1 Specialized Inspection 2-3
2.3.1.2 Engineering Investigation 2-4
2.3.2 Preventive Maintenance Inspection (PMI) 2-4
2.3.3 Operator Inspection 2-4
2.3.4 Certification Inspections 2-4
2.4 STANDARDS AND TECHNICAL ASSISTANCE 2-5
2.4.1 Inspection Guides 2-5
2.4.1.1 Control Inspection Checkpoints 2-5
2.4.1.2 PMI Checkpoints 2-5
2.4.2 Maintenance Standards 2-5
2.4.2.1 Level of Maintenance Classification (LMC) Codes 2-5
2.4.2.2 Condition Evaluation Standards 2-6
2.4.2.3 Regulatory Standards and Safety Codes 2-7
2.4.3 Technical Sources 2-7
2.4.3.1 Manuals and New Technology 2-7
2.4.3.2 Technical Assistance 2-7
2.4.3.3 Engineered Performance Standards (EPS) 2-7
2.5 FORMS AND RECORDS 2-10
2.6 RELATED PROGRAMS AND AGREEMENTS 2-10
2.6.1 Maintenance Service Agreements (MSA) 2-10
2.6.2 Intra/Inter-Services Support Agreements (ISSA) 2-11
2.6.3 Engineering Evaluation (EE) of Existing Assets 2-11
2.6.4 Family Housing Programs 2-11

3. CONTROL INSPECTION PROCEDURES 3-1

3.1 PURPOSE 3-1
3.2 OBJECTIVES 3-1
3.3 INSPECTOR QUALIFICATIONS 3-2
3.4 SCHEDULING CONTROL INSPECTIONS 3-2
3.4.1 Frequencies 3-2
3.4.2 Scheduling Considerations 3-2
3.4.3 Control Inspection Times 3-3
3.5 PREPARING TO INSPECT 3-4
3.6 ADDITIONAL DUTIES OF MECHANICAL AND ELECTRICAL INSPECTORS 3-5
3.7 CORRECTING NON-DEFERRABLE (CRITICAL) AND DEFERRABLE DEFICIENCIES 3-5
3.8 CONTRACTOR ASSISTANCE 3-5

4. CONTROL INSPECTION REPORTS AND RECORDS 4-1

4.1 REPORT DESCRIPTIONS 4-1
4.1.1 Facility Inspection Checklist 4-1
4.1.2 Facility Condition Summary Report Sheet 4-1
4.1.3 Facility Condition Report Detailed Deficiency List 4-1
4.2 REPORT PREPARATION 4-5
4.2.1 Preparation of “Detailed Deficiency List” 4-6
4.2.1.1 Report Accuracy 4-6
4.2.2 Work Packaging 4-7
4.2.3 Inspection Report Numbering 4-7
4.2.4 Deficiency Cost Estimates 4-8
4.2.5 Special Projects Program 4-8
4.2.6 Inspection Report Use 4-8
4.3 TYPES OF RECORDS 4-9
4.3.1 Facility History Files 4-9
4.3.1.1 Warranty Program 4-9

4.3.2 Cyclic Maintenance Planning Files 4-14
4.3.3 Completed Job Order Files 4-14
4.3.4 Completed E/S Work Files 4-14
4.4 MANAGEMENT REVIEW AND APPRAISAL 4-15
4.5 FACILITY MAINTENANCE PLANNING 4-15

5. **PREVENTIVE MAINTENANCE INSPECTION/SERVICE (PMI) PROCEDURES** **5-1**

5.1 OBJECTIVE 5-1
5.1.1 Discussion 5-1
5.1.2 Management Prerequisite 5-2
5.2 PMI INSPECTOR QUALIFICATIONS 5-2
5.3 ESTABLISHING A PMI PROGRAM 5-2
5.3.1 PMI Inventory 5-2
5.3.2 PMI Contractor Assistance 5-2
5.3.3 PMI Guides and Frequency 5-3
5.3.4 Inspection Record 5-5
5.4 SCHEDULING INSPECTIONS 5-5
5.4.1 PMI Frequencies 5-5
5.4.2 PMI Times 5-5
5.4.3 PMI Scheduling Considerations 5-6
5.5 HANDLING MAJOR DEFICIENCIES 5-6
5.6 SUPPORT REQUIREMENTS 5-6
5.7 PROGRAM ANALYSIS 5-6

6. **OPERATOR INSPECTION PROCEDURES** **6-1**

6.1 OBJECTIVE 6-1
6.2 RESPONSIBILITY 6-1
6.3 QUALIFICATIONS 6-1
6.4 SCHEDULING INSPECTIONS 6-1
6.5 PERFORMING OPERATOR INSPECTIONS 6-1

7. **ANNUAL INSPECTION SUMMARY (AIS)** **7-1**

7.1 PURPOSE 7-1
7.2 OBJECTIVE 7-1
7.3 AIS FUNDING RELATIONSHIP 7-1
7.4 PREPARATION OF THE AIS 7-2
7.4.1 Type "B" Annual Inspection Summary 7-3
7.4.2 Type "C" Annual Inspection Summary 7-9

8. **THE BASE ENGINEERING SUPPORT, TECHNICAL (BEST) SYSTEM** **8-1**

8.1 OBJECTIVE 8-1
8.2 DISCUSSION 8-1
8.3 THE SFI MODULE 8-1
8.3.1 Inventory 8-1
8.3.2 Inspection Frequencies And Standard Hours 8-2
8.3.2.1 CI Frequencies and Standard Hours 8-2
8.3.2.2 PMI Frequencies and Standard Hours 8-2

References Reference- 1

APPENDIX A Sample Guides For Developing Utility Systems Pseudofacility Numbers A-1
APPENDIX B Minimum Recommended Frequencies for Control Inspection B-1
APPENDIX C Control Inspection Times C-1
APPENDIX D Facility Inspection Checklist D-1
APPENDIX E Work Packaging E-1
APPENDIX F Maintenance Planning (Maintenance Action Plan-MAP) F-1
APPENDIX G Long Range Maintenance Planning (LRMP) G-1

Index Index- 1

FIGURES

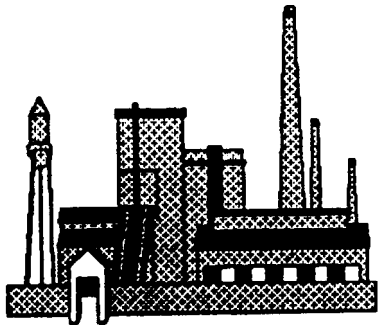
Figure No.	Title	Page
1-1	Shore Base Readiness Report (BASEREP)	1-7
4-1	Facility Inspection Checklist	4-2
4-2	Facility Condition Summary Report	4-3
4-3	Facility Condition Report Detailed Deficiency List	4-4
4-4	Facility Condition Report - Coded Floor Plan	4-5
4-5	Control Inspection Report Flow	4-10
4-6	Historical Record Built-up Roof	4-11
5-1	PM Inspection Record Card	5-3
5-2	PMI Inventory and Tracking Record	5-4
7-1	Form for Type “B” AIS	7-4
7-2	Form for Type “B AIS	7-5
7-3	Type “C” Annual Inspection Summary Form Summary-1	7-10
7-4	Type “C” Annual Inspection Summary Form Summary-2	7-11
7-5	Example of Completed Form Summary-1	7-14
7-6	Example of Completed Form Summary-2	7-15

TABLES

Table No.	Title	Page
2-1	Level of Maintenance Classification (LMC) Codes	2-6
2-2	Selected Listing of Maintenance & Operations Manuals	2-8

CHAPTER 1. INTRODUCTION

1.1 PURPOSE. This manual is a guide for personnel who operate, inspect, test, certify, assess the condition of, and maintain shore facilities and equipment. It provides criteria, standards and procedures for development and implementation of a comprehensive Inspection/Assessment System.



1.2 OBJECTIVE. The objectives are to:

(1) systematically identify deficiencies,

(2) recommend action that will correct deficiencies and/or impede advancing deterioration, and

(3) maintain facilities and systems at a level consistent with mission.

1.3 DISCUSSION. Facility acquisition costs are minuscule in comparison to life cycle maintenance costs associated with facility ownership. While design and construction are challenging and rewarding from the aspect of satisfying a real facility need, there is little glamour for the facility manager who must make the difficult daily funding decisions that keep the same facilities operational. There is little awareness of cost of ownership and various maintenance strategies which need to be coupled to establish and achieve facility life extension goals. Knowledge of facility condition is critical to an effective facility manager and this knowledge can only be attained by facility inspection. A dedicated inspection effort is vital to properly identify Real Property maintenance and repair deficiencies which will potentially impact mission or degrade plant investment. This manual outlines methods to identify and quantify deficiencies and their mission impact. Inspection by-products are: (1) an accurate assessment of facility condition and the potential impact on readiness by Investment Category/Base Readiness Mission Category (BASEREP) and (2) identification of resource needs for budget planning purposes. Chief of Naval Operations (CNO) requires each major claimant to provide a facility condition assessment (BASEREP), OPNAVINST 3501.167 (series) and Annual Inspection Summary (AIS), OPNAV 11010.34 (series) annually. Overall Navy assessments are then prepared by OPNAV which portray the long-term impact of resource allocation decisions. Assessments and resource allocation decisions are adjusted annually for a six-year projection (Future Years Defense Plan - FYDP).

1.4 SCOPE. This is the first of three volumes which describes investigations and evaluations needed to effectively manage facilities and equipment (excluding transportation) for which Public Works is responsible. These volumes contain no instant magical solution to Facility Management and condition problems. They do, however, provide a

logical systematic approach providing Facility Managers with information needed to make sound decisions based on economics and mission support.

1.4.1 Volume l-Inspection/Assessment System. Chapter 1 assigns responsibilities for the maintenance of shore facilities. Chapter 2 describes the Inspection/Assessment system. The remaining chapters (3 through 8) provide detailed inspection guidance.

1.4.2 Volume 2-Control Inspection Checklist. This volume provides inspection checklists for use by technical Control Inspectors.

1.4.3 Volume 3-Instructor's Manual for Control Inspector Training Course. This volume provides a training plan for conducting an Inspector Training course to teach Control Inspectors how to assess, evaluate and document facility deficiencies.

1.5 RESPONSIBILITIES. OPNAV Instructions 11010.23 (series) and 11000.16 (series) contain CNO's management concepts for Real Property Maintenance Activities (RPMA). These instructions convey CNO policy for facility inspections and condition assessments and assign organizational responsibilities. Embedded in this policy and guidance is an attempt to achieve a state of equilibrium between the functional value of facilities to mission and the financial resources available to support the shore establishment.

1.5.1 Activity Responsibility. Commanders, Commanding Officers and Officers-in-Charge of Shore Activities having plant account custody of land or facilities (Class I and II Real Property) respectively are responsible to the CNO through their major claimant for prudent planning and plant maintenance. This includes identifying and reporting resource requirements, material condition, safety, environmental and appearance deficiencies as well as efficient and effective utilization of assigned assets including funds. Without explicit well defined, well organized knowledge of facility condition, it is impossible to successfully plan, fund and execute a Facility Management Strategy.

1.5.1.1 Facilities Management Program. The Commanding Officer is responsible for establishing and maintaining an effective facilities management program such as that specified in NAVFAC MO-321, "Facilities Management" (for Public Works Departments). Performance Standards shall be incorporated into work planning and estimating procedures and variance analyses shall be performed. The cornerstone of a sound facilities management system is a good facilities inspection program. Activities served by a Public Works Center (PWC) or Department (PWD) of another activity are responsible for all functions except execution of work. They are still responsible for accepting the work performed by others.

The Facilities Management Program includes as a minimum:

- Conducting a continuous, comprehensive inspection of Real Property Assets to identify and quantify condition. Maintenance and Repair work generated from continuous inspection shall constitute a minimum of 65% of the nonrecurring work programmed for accomplishment. The Continuous Inspection Program is comprised of 3 types of inspection: Control, Preventive Maintenance and Operator. These are discussed in this volume.
- Training personnel to conduct accurate inspections using approved guidance.
- Establishing and maintaining a Preventive Maintenance Inspection (PMI) program for dynamic equipment.
- Establishing and conducting an Operator Inspection program for equipment and facilities requiring a full time operator.
- Initiating proper and responsive action to correct deficiencies.
- Preparing and submitting an AIS and required assessments to higher authority which accurately reflects facility condition.
- Preparing, maintaining and using maintenance plans developed from a budget based on requirements identified via a comprehensive Continuous Inspection Program.
- Ensuring that Minor Construction/Alteration work, including planning and design, does not interfere with or consume resources needed to plan, estimate or accomplish Maintenance and Repair work. OPNAV Instruction 11000.16 states that expenditures for Minor Construction and Alteration (less Equipment Installation) shall not normally exceed 10% of the total claimant expenditures for Maintenance of Real Property (MRP) without prior approval of CNO (OP-44).
- Reducing the level of maintenance on facilities to be demolished, renovated, replaced or not fully utilized. Maintenance standards, including safety, shall be appropriate to use.
- Making inspectors aware of environmental and energy/utilities conservation program goals and instructing them to document deficiencies accordingly.

1.5.1.2 Facility and Equipment Inventories. Accurate inventories are critical. Essential Class I and II property inventory, including items of dynamic equipment, must be accurately maintained. A facilities manager must know which assets require maintenance, their location, amount of maintenance needed and relative importance of the asset to mission.

1.5.1.3 Safety. Equipment such as safety glasses, shoes, hard hats, gloves, respirators, and belts shall be provided to inspectors as required. Guidance shall be given concerning protective equipment requirements, maintenance and use of equipment, and safety precautions to be observed. Inspections of electric and steam distribution systems, elevators, etc. may require a helper to minimize danger. Inspectors shall observe safety precautions and be familiar with safety instructions. Safety Inspectors and Industrial Hygienists should augment the Control Inspection effort and maintain a dialogue to determine the proper course of corrective action, etc. If these personnel are unavailable, required services should be purchased from other sources (PWC, contract, etc.)

1.5.1.4 Organization. NAVFAC P-318, "Organization and Functions for Public Works Departments," recommends a Work Generation Branch in the Facility Management Engineering Division (FMED). Responsibilities include scheduling and performing facility inspections, preparing inspection reports, and planning and estimating functions.

1.5.1.5 Control Inspector's Duties. Control Inspectors shall:

- Carefully review facility files for reported problems, historical trends and status of planned work prior to a field inspection.
- Be familiar with current space utilization assignments, warranties, inter/intra service support and/or lease agreements.
- Consult with facility occupants regarding known problems prior to inspection.
- Conduct thorough inspections and produce an accurate report with reliable data. Incomplete examinations should be reported. Corrective actions shall be recommended based on personal observation and/or tests or engineering investigations by qualified personnel.
- Recommend other tests or investigations if required.
- Attempt to determine and report the true cause of a problem rather than reporting cosmetic deficiencies.
- Be alert to deficiencies affecting entire systems. Recommend repair by replacement of the system rather than piecemeal, temporary solutions to problems when practical. Indicate when Special Projects should be developed.
- Appraise the effectiveness and quality of repairs to previously reported problems. Report inferior quality work or ineffective fixes. Note failure to perform specified work.

- Evaluate Preventive Maintenance and Operator Inspection Program effectiveness . Recommend changes when needed.
- Prepare cost estimates, by craft, to correct deficiencies.
- Classify deficiencies as Deferrable or Critical (OPNAV Instruction 11010.34 provides guidance.)
- Report changes in space usage.

1.5.1.6 PMI Inspector Duties. Maintenance and Utilities shop personnel are responsible for conducting PMI of dynamic equipment in accordance with specifications provided by the FMED. The FMED is responsible for PMI Program administration. The Maintenance Division and Utilities Division personnel should assist the FME Division in developing inventories, identifying checkpoints, assigning inspection frequencies, planning, scheduling, and appraising PMI effectiveness. Once the Program has been defined, it is the FMED responsibility to issue work authorizations for PMI accomplishment and monitor PMI execution.

1.5.1.7 Supervisor's Duties. The Work Generation Branch Supervisor must assure that each Control Inspector is properly instructed and trained. The Supervisor should review each incoming Customer Work Request to ensure the work is not duplicated on an Inspection Report. If so, the customer should be notified of work status and the Work Request returned. An effectively administered Control Inspection Program will substantially reduce Customer Work Requests for Maintenance and Repair. The Work Generation Branch Supervisor shall conduct random inspections to assure quality. Major unexplained discrepancies between previous and current Inspection Reports are to be resolved with inspectors, including site visits, to evaluate problem areas and ensure the inspector is adequately trained. The FMED Director should randomly review Inspection Reports for completeness, accuracy and validity of reported deficiencies and recommended corrective actions. The Shop Supervisor responsible for executing operator inspection or PMI Work is responsible for training workers, maintaining work quality, promptly reporting out-of-scope PMI deficiencies and suggestions for over/under maintenance.

1.5.1.8 Operator Inspection. Operator Inspection is conducted by the person assigned to operate the equipment or system. It includes examination, lubrication and minor adjustments. Standard Operating Procedures (SOPs) shall be developed and posted on the equipment or facilities, or written in a watch log. During the watch, the operator should note what was done and indicate if major repair or overhaul is needed. Work beyond operator's capability or authority should be reported to the supervisor. Breakdowns should be reported immediately.

1.5.1.9 Management's Appraisal Responsibility. Management shall monitor the "health" of the operation. Indicators exist for continuing appraisal. For ex-

ample, if the percentage of Specific Maintenance and Repair Work generated from Continuous Inspection is less than 65%, the Inspection Program may be ineffective or inspection generated work is not being programmed for accomplishment. Note the level of Emergency work. An increase in Emergency work and a decrease in PMI work may indicate dynamic equipment inspections are not being worked as planned or PMI specifications and frequency may need adjustment. It may also indicate that an item of equipment needs to be replaced versus continual repair. Management indicators and targets are included in the "Management Guide, Maintenance Subsystem, Base Engineering Support, Technical (BEST)" and NAVFAC MO-321 Chapters 10 and 11. These will assist in measuring and monitoring overall program effectiveness. Manual data collection for appraisal is tedious, but simplified with automation.

1.5.1.10 Shore Base Readiness Report (BASEREP). OPNAV Instruction 3501.167 (series) establishes procedures for assessing the readiness of Navy shore activities. Readiness data helps justify resources for shore establishment. The BASEREP (Figure 1-1) is an operator's assessment of base readiness. Commanding Officers evaluate readiness of assets (personnel, facilities, and equipment) by Mission Category. Rating factors are used to assess readiness capability by mission area. These are:

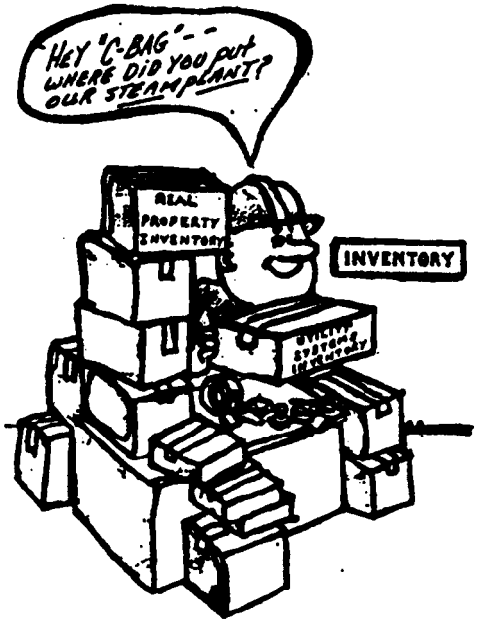
- C1 - Asset has fully met all demands in the Mission Category throughout the reporting period;
- C2 - Asset has substantially met all demands of the Mission Category throughout the reporting period with only minor difficulty;
- C3 - Asset has only marginally met demands of the Mission Category throughout the reporting period, but with major difficulty;
- C4 - Asset has not met vital demands of the Mission Category.

BASEREP ratings for "Condition" of facilities must be supported by Facility Inspection Reports. Inspection Reports also provide repair solutions required by CNO for BASEREP ratings of C3 and/or C4.

1.5.2 Claimant Responsibilities. A synopsis of Claimant RPMA responsibilities outlined in OPNAV Instruction 11000.16 follows:

- Issue guidance and instructions for administration and management of assigned land and facilities.
- Maintain a qualified staff to administer land and facilities matters. Utilize Naval Facilities Engineering Command (NAVFACENGCOM) technical assistance.
- Provide training for personnel whose decisions affect land and facilities or the resources to acquire, maintain or dispose of them.

CHAPTER 2. SYSTEM DESCRIPTION



2.1 PURPOSE. This chapter describes an Inspection/Assessment System designed to determine facility and equipment condition and proper corrective measures to obtain maximum utilization and readiness at minimum cost. It discusses the continuous inspection program, types of inspections, inventories, standards and inter-relationship of inspection programs. The procedures provide systematic methods for identifying and reporting maintenance and repair work on a continuous basis and arrangement of data for management decisions based on priority.

2.2 INVENTORIES. Inventory data is basic to effective maintenance planning. Inventories should be verified and updated during inspections.

2.2.1 Real Property Inventory. Real Property Inventory for Class I and Class II property owners is contained in NAVFAC Manual P-164, "Detailed Inventory of Naval Shore Facilities." It is the basic reference for Control Inspection. Facility usage should be reviewed during inspection and the activity Facility Planner notified of changes. Real Property Inventories are the responsibility of activity Facility Planners. Changes to property record cards shall be reported to the geographic EFD's/EFA's Facilities Planning and Real Estate Department. The EFD/EFA will make revisions to the Navy Facilities Assets Data Base (NFADB) which will be reflected in revised NAVFAC P-164 publications.

2.2.1.1 Utility Systems Inventories. Utility systems and components are difficult to identify because facility numbers are not usually assigned. Pseudo facility numbers may be assigned. Utility pseudo facility numbers should be composed of at least two factors: (1) utility service code and (2) descriptive type service. Appendix A provides a pseudo facility numbering guide. Inventories of systems and components are the basis for developing preventive maintenance inspection and service of equipment. Inventories should be sorted so frequency of inspection, priority data, replacement information, etc. can readily be determined.

Listings should indicate systems or components that, if disabled, would:

- Disrupt essential mission-related operations.
- Endanger life and/or property.

- Impair quality of life.
- Cause environmental problems.
- Require a long lead-time for replacement.

2.2.2 Systems Inventory. A systems inventory shows all vents, pipes, anodes, rectifiers, valves, inspection access, motors, traps, filters, and other components for a single system. Within each system a separate sublist may indicate components requiring preventive maintenance and those that are repaired by replacement. Each system requires inspection and is the responsibility of both Control Inspectors and Preventive Maintenance Inspectors depending on the type inspection performed.

2.2.3 Preventive Maintenance Inspection (PMI) Inventory. A PMI inventory is a listing of items of dynamic equipment requiring periodic lubrication, adjustment and/or inspection. PMI of equipment with an assigned operator is generally part of the operator's SOPs, especially if failure would have serious consequences. If the operator does not have time or training to perform the work, it should be included in the PMI program. PM Inspection is particularly applicable to unattended:

- Water supply, treatment, and distribution systems.
- Sewage collection and treatment systems.
- Fuel storage and handling facilities.
- Compressed air and industrial gas generating and distribution systems.
- Electric generating and distribution systems.
- Appurtenants to cathodic protection equipment systems.
- Heating, ventilating, refrigeration, air conditioning equipment and systems.
- Bakery, food preparation and service, and dish washing equipment.
- Weight-handling equipment.
- Public Works shop equipment.

2.2.4 Replacement Items Inventory. Small items such as fractional horsepower motors, water coolers, self-lubricating fans, window unit air conditioners, automatic door closers and other sealed units do not normally require preventive maintenance unless critical to a mission essential operation. These items are replaced when they break down. Control Inspection of systems and user complaints (numerous E/S calls) also identify the need to replace items. An inventory of such items, with replacement dates, including stock or availability data should be maintained.

2.2.5 Real Property Baseline Inventory. The Baseline Inventory expands upon the Real Property Inventory and gives detailed information on components or sub-components. It is used to identify unique/special inspection, certification, or maintenance requirements for use in Facilities Support Contracts or work scheduling. It should contain such items as the number and kind of piles supporting a pier, the total number of railway ties in the system and number in the replacement program. Square feet of roofing by type and facility, length of a distribution system section according to size and type of pipe (including cathodic protection and rectifiers), and other detailed information should also be included.

2.3 INSPECTION TYPES. The Continuous Inspection Program is comprised of three types of inspection: (1) Operator, (2) Preventive Maintenance, and (3) Control. Effective planning and execution of these inspections ensures a comprehensive examination of all facilities and equipment.

2.3.1 Control Inspection (CI). Control Inspection is a scheduled structural, mechanical and electrical examination of facilities conducted throughout the year to determine physical condition. CI is the cornerstone of the Continuous Inspection Program. Other types of inspections such as command, safety inspections and user inspections can supplement and support Control Inspections. It is advantageous to encourage informal reports from Master-at-Arms, building "monitors," and facility occupants. Booklets or written instructions on the care and operation of components of a facility for occupant use are also helpful. Feedback from the users' perspective enables Public Works to monitor the "health" of a facility between scheduled inspections. Supplemental inspection input should be reviewed prior to the scheduled CI and appropriate information included in the CI Report. Control Inspection is the primary source of work generation. It should produce the majority of shop and contract maintenance and repair workload. AIS and budget base data is a natural by-product of effective CI.

2.3.1.1 Specialized Inspection. Specialized Inspections are investigations, tests or observations that require special skill or equipment. Specialized inspections include: Waterfront, Electrical Systems, Automated Control Systems, Elevators, Fleet Moorings, Roofing, Surfaced Areas/Airfield Pavements, Coatings/Composite Materials, Mechanical Systems, Underground Utilities, Petroleum Fuel Facilities, Trackage, Bridges/Trestles, Underground Structures, Corrosion Control/Cathodic Protection, Pest Management Programs, Antenna Towers. Inspections in general are performed by EFDs/EFAs on a reimbursable basis. Certain EFDsEFAs are tasked to provide specialized expertise and act as the "lead" in specific technical areas. The objectives of this are to:

- Develop and maintain recognized experts in specific areas.
- Concentrate on technical provisions and standards.

- Support activities, other EFDs/EFAs and **NAVFACENGCOM** in highly technical matters.

Specialized Inspections are part of Control Inspection for areas where special expertise is required, but unavailable. These inspections are normally conducted on facilities and equipment which impact safety or mission. They provide feeder information to the Control Inspector and indicate if detailed engineering investigations and designs are required.

2.3.1.2 Engineering Investigation. Engineering Investigations are one time highly technical studies requested by Control Inspectors based on a need. They may be conducted to determine the cause of a defect, extent of damage, ability of a facility to function, safety limitations, or condition of the facility or component. In addition, they may provide background information to supplement or support other programs and studies. A dialogue should be established between Engineering and FMED to review previous, current and proposed studies and other pertinent information.

2.3.2 Preventive Maintenance Inspection (PMI). PMI consists of examination, lubrication, minor adjustments and/or minor repair of dynamic equipment to which a specific operator is not assigned. The Work Generation Branch of the FMED determines what to inspect and the job specifications. The Shore Facilities Inspection (SFI) Module of Public Works Management Automation/Base Engineering Support, Technical (PWMA/BEST) will be helpful in facilitating the implementation and administration of a PMI Program. (See Chapter 8 for more information on PWMA/BEST.)

2.3.3 Operator Inspection. This includes examination, lubrication, and minor adjustments of equipment and systems for which the PWD is responsible and to which an operator is assigned. Safety and maintenance checks shall be included in Standard Operating Procedures (SOPs) and shall be conducted as listed in activity regulations and manufacturers' literature. Continuous observations shall be made when equipment is operating.

2.3.4 Certification Inspections. The intent of Certification Inspections is to ensure functional reliability and safety and to prevent property damage or personal injury. Certification of certain type facilities, components or sub-components is recommended and is sometimes mandatory. Elevators, Graving Drydocks, Crane and Railroad Trackage, Boilers and Unfired Pressure Vessels, Hyperbaric Facilities require certification. Information regarding certification requirements of these areas is in respective NAVFAC Maintenance and Operations (MO) Manuals or instructions. The Certification program is designed to identify and classify defects according to hazard or

risk. When prescribed limits are exceeded, the facility or component shall be placed out of service until repaired.

2.4 STANDARDS AND TECHNICAL ASSISTANCE. Technical information sources, standards, criteria and checklists for inspections are defined as follows:

2.4.1 Inspection Guides. Checklists, inspection points and other references include:

2.4.1.1 Control Inspection Checkpoints. MO-322, Volume 2 contains inspection checklists for Buildings, Mechanical/Electrical, Utility Plants and Distribution Systems and Miscellaneous Equipment, Structures and Systems. NAVFAC MO manuals covering maintenance, operations and inspection for a specific type facility are also available.

2.4.1.2 PMI Checkpoints. PMI checkpoints may be obtained from manufacturer's manuals, facility/equipment history files and NAVFAC MO manuals. Manufacturer's manuals for similar equipment may also be useful. Many new facilities may have Operation and Maintenance Support Information (OMSI) manuals of essential facility and equipment data. OMSI manuals may be a part of the construction contractor's delivery requirements. Warranty data is also included.

2.4.2 Maintenance Standards. The description of condition of plant and property must measurably relate to maintenance standards. Application of standards permit decisions on maintenance necessity, extent and frequency of maintenance, and effectiveness of the results of prior maintenance efforts. Application of standards permit comparison between conditions observed and the standard. The level of maintenance must be related to the Facilities Requirements Plan and the applicable Level of Maintenance Classification Code (Section 2.4.2.1.). For example, a warehouse in excess of requirement, or scheduled for removal within five years should not be maintained at the same level as one to be retained twenty-five years.

2.4.2.1 Level of Maintenance Classification (LMC) Codes. All facilities may not contribute equally to mission. Relating facility maintenance to mission, can result in more maintenance to facilities that are the most vital to mission. This can be don,: by assigning levels of maintenance classification (LMC) codes. The LMC code is not a priority system for work. Work on a Class C facility may be needed ahead of a Class A facility for safety reasons or protection of property. Parts of a single facility can also have different LMCs.

For example, some sections of roads or railroads serving an ammunition depot may be more vital to mission than other sections. Multi-classification may be justified for some facilities; however, it should be minimized. LMC codes for each facility should appear

on inspection records. Inspectors, Planner/Estimators, and Shop Supervisors should know its use and intent. Inspectors should relate deficiencies to LMC Codes when classifying deficiencies as Critical or Deferrable. It should also be used in work control to determine priorities for job accomplishment. LMC Codes are defined in Table 2-1.

Table 2-1
LEVEL OF MAINTENANCE CLASSIFICATION CODES
(LMC Codes)

Code	Classification Characteristics	Level of Maintenance
A	o Vital to mission o Active future of over 10 years	o Maintain economically to assure full safe and efficient support for an indefinite period
B	o Important to mission o Active future use of 3-10 years	o Maintain economically to fulfill mission for the duration of facility life or mission
C	o Limited importance to mission o Substandard construction or future active life of less than 3 years o Infrequently or only partially used	o Limited maintenance on basis of planned remaining useful life o Eliminate fire, health and safety hazards o Patch and reinforce instead of replacing wherever economical o Consider breakdown maintenance
D	o Inactive facilities (required during mobilization)	o Limited maintenance to assure weather tightness, structural stability, protection from fire or erosion o Eliminate safety or health hazards o Minimal maintenance to permit reactivation within the period prescribed under mobilization plans
E	o Surplus Facilities	o Eliminate fire, safety and health hazards o Prevent pilferage effecting final disposal action

2.4.2.2 Condition Evaluation Standards. Condition evaluation standards are prescribed ratings for various defect classifications. Condition evaluation ratings provide uniformity in assessing the condition of components or sub-components of a facility. Evaluation procedures may be standardized by assigning numerical ratings to specific conditions shown pictorially in respective condition evaluation standards handbooks. The concept behind a handbook is for inspectors with different backgrounds to be able to select the same rating from the handbook, thus providing a uniform rating system throughout the shore establishment. Facility condition standards are contained in selective MO manuals, such as, MO-102.1, MO-102.2, MO-102.3, MO-102.4, MO-102.6, MO-103.9 and MO-210.9.

2.4.2.3 Regulatory Standards and Safety Codes. Inspectors and Facility Managers should be familiar with these standards and know how they apply. These include:

- National Building Codes:
  - Corrosion
  - Electrical
  - Elevator
  - Plumbing
  - FRA Track Safety Standards
  - OSHA Requirements
- Design Criteria (Applicable to repair):
  - Design Manuals, NAVFAC DM Series and MIL-HDBKs
  - Industrial or Association Standards
  - Standard Engineering Texts and References
  - Military Standards
  - Type Specifications
- Environmental Regulations

2.4.3 Technical Sources. Sources of information include:

2.4.3.1 Manuals and New Technology. Inspectors should actively seek and be familiar with NAVFAC MO Manuals, especially in their craft areas, and with applicable technical manuals, NCEL Tech Data Bulletins, inspection guides, and manufacturer's instructions. A complete list of NAVFAC Manuals and Publications is included in NAVFAC P-349, "NAVFAC Documentation Index." Table 2-2 contains an excerpt listing of manuals with which Control Inspectors need to be familiar. Indepth guidance for such topics as corrosion control, surfaced areas and roofing are a few examples.

2.4.3.2 Technical Assistance. Inspectors should seek advice and assistance when needed or in doubt. Assistance is available from their supervisor, or Engineering Field Division/Engineering Field Activity (EFD/EFA), Public Works Centers and NCEL via the EFD/EFA.

2.4.3.3 Engineered Performance Standards (EPS). Industrial standards are rigidly defined for the exact performance of work throughout the production process where the work place is constant and method of work performance is carefully prepared. In maintenance, however, the same task may be performed at different times

Table 2-2
Selected Listing of Maintenance and Operations Manuals
(Source: NORTHNAVFACENGCOM Code 164 Data Base, October 1992)

Publication Number	Publication Date	Title
MO-102	3/1/77	Maintenance and Repair of Surfaced Areas (Tri-Service)
MO-102.1	11/1/88	Maint & Rpr of Asphalt Surfaced Airfields
MO-102.2	11/1/88	Maint & Rpr of Jointed Concrete Roads & Parking Lots
MO-102.3	6/1/89	Maint & Rpr of Asphalt Surfaced Airfields
MO-102.4	6/1/87	Maint & Rpr of Jointed Concrete Airfields
MO-102.6	5/1/90	Asphalt Crack Repair Field Manual
MO-103	1/1/80	Maintenance of Trackage
MO-104	10/1/87	Maintenance of Waterfront Facilities
MO-104.1	9/1/90	Maintenance of Fender Systems and Camels
MO-104.2	9/1/89	Specialized Underwater Waterfront Facilities Inspections
MO-110	6/1/81	Paints and Protective Coatings (Tri-Service)
MO-111	9/1/63	Building Maintenance; Structures
MO-113	1/1/74	Fac. Engineering Main. and Repair of Roofs (Tri-Service)
MIL-HDBK -1114/2	12/31/91	Maintenance & Operations of Heating Systems
MO-114 Vo1 3	2/1/89	Maintenance & Operations of Ventilation Systems
MO-116	3/1/72	Facilities Engineering; Electrical Interior Facilities
MO-117	9/1/89	Maintenance Fire Protection Systems
MO-118	10/1/88	Inspection of Vertical Transportation Equipment
MIL-HDBK -1119	8/31/91	Food Service Equipment
MO-124	8/1/87	Mooring Maintenance
MO-126	10/1/91	Inspection of Bridges and Trestles
MO-200	4/1/79	Facilities Engineering-Electrical Exterior Facilities
MO-201	4/1/90	Operation of Electric Power Distribution Systems
MO-204	5/1/74	Electric Power Systems Analysis
MO-205	6/1/64	Central Boiler Plants (Being updated as MIL-HDBK-1125)
MO-206	1/1/89	Operation and Maintenance of Air Compressor Plants
MO-207	12/1/75	Operation and Main. of Internal Combustion Engines
MO-209	1/1/89	Maintenance of Steam, Hot Water Distribution Systems
MO-210	8/30/84	M&O of Water Supply, Treatment & Distribution Systems
MO-210.9	8/1/90	Inspection of Elevated Water Tanks
MO-212	1/1/82	Sewage and Industrial Waste Disposal System
MO-213	5/1/90	Solid Waste Management
MO-220	11/1/70	Maintenance and Operation of Gas Systems (Tri-Service)

Table 2-2 (Continued)
Selected Listing of Maintenance and Operations Manuals
(Source: NORTHNAVFACENGCOM Code 164 Data Base, October 1992)

Publication Number	Publication Date	Title
MO-221	11/1/88	Utilities Metering
MO-225	8/1/90	Industrial Water Treatment
MO-230	8/1/90	Maintenance & Operation of Petroleum Fuel Facilities
MIL-HDBK -1130	12/31/91	Inactivation Caretaker Maintenance and Reactivation of Shore Facilities
MO-303	5/1/72	Utility Targets Manual (Being Updated)
MO-306	7/1/92	M&O Cathodic Protection Systems
MO-307	9/1/92	Corrosion Control
MO-310	12/1/71	Military Entomology Operational Handbook (Being Updated)
MO-312	5/1/90	Wood Protection
MO-312.1	2/1/91	Inspection, Maintenance, Procurement Procedures for CDAA Wood Components Handbook
MO-312.2	4/1/91	Field Guide for Receipt & Inspection of Treated Wood Products
MO-312.3	9/1/92	Insp., Maint, and Procure. Procedures for Wood Poles
MO-312.4	3/1/92	Wood Protection Instructor's Training Manual
MO-314	5/24/89	Weed Control and Plant Growth Regulation
MO-315	10/1/91	Pest Control Quality Assurance Evaluator Handbook
MO-321	9/1/85	Facilities Management
MO-323	4/1/86	Inspection, Main., & Operations Manual for Naval Reserve Centers (NRC) (Being updated as MIL-HDBK- 1151)
MO-324	3/1/92	Inspection & Certification of Boilers & Unfired Pressure Vessels
MO-327	6/1/90	Facility Support Contract Quality Mgmt Manual
MO-330	8/17/87	Materials Testing
MO-340	7/1/80	Ship to Shore Hose Handling Operations Manual
MO-350	12/1/79	Standards Operational Manual For Waste Oil Raft
MO-405	7/1/90	Maint. and Operation of Active Solar Energy Systems
MO-406	7/1/90	Maintenance of Hyperbaric Facilities
MO-909	8/1/79	Oil Shop Off Load Barge (SWOB)
MO-910	7/1/81	Sewage Ship Waste Off Load Barge (SWOB)
MO-911	8/1/90	Utilization of Navy Generated Waste Oils as Burner Fuel
MO-913	9/1/91	Historic Structures Preservation Manual

to obtain identical results, but rarely is the method of work performance identical in all respects. Work sites, tools, materials and methods may vary between two performances of the task. Engineered Performance Standards are developed by observing maintenance personnel at work and by measuring their work through the application of approved Industrial Engineering techniques. This provides the Planner and Estimator and shops with estimating standards that truly represent the specific type of work (maintenance) to be done. Time standards for many maintenance and repair tasks are available in the NAVFAC P-700 Manual (series), "Engineered Performance Standards." These standards are also incorporated in the Facilities Engineering Job Estimating (FEJE) module of BEST. Application of EPS is facilitated by use of the BEST Automation Tool.

2.5 FORMS AND RECORDS. Only forms needed to effectively manage the Shore Facilities Inspection/Assessment System should be used. Records must permit appraisal of the planning and execution of the inspection effort; preparation of required reports; identification of future funding requirements; and maintenance of accurate historical data. Specific reports, forms and records are discussed in Chapter 4, Control Inspection Reports and Records and Chapter 5, Preventive Maintenance Inspection/Service (PMI) Procedures.

2.6 RELATED PROGRAMS AND AGREEMENTS. Specific agreements and programs are an important part of the Inspection/Assessment System. They are:

2.6.1 Maintenance Service Agreements (MSA). Formal agreements for recurring services on specific equipment and facilities. The scope of work must be defined in a written specification and the work quality and quantity specified in a contractual-like agreement between the customer and Public Works. MSA's are used primarily by PWC's. MSA's should be reviewed, renegotiated and updated annually. Basic elements of the agreement are:

- **Level of Maintenance. The** level to which equipment or facilities are to be maintained.
- **Unplanned Corrective Maintenance.** Provisions for a breakdown or malfunction requiring unscheduled service.
- **Planned Corrective Maintenance or PMI.** A scheduled shutdown of equipment for planned maintenance or cyclic checks, adjustments, and service to keep equipment at a prescribed level of operating performance.
- **Planner/Estimator Inspection.** Provisions for on-site evaluation of work to finalize the job plan and estimate.
- **Quality Assurance Evaluation (QAE).** Ongoing evaluation of work (by shop supervision, and/or full-time Quality Control Technicians) to assess quality and quantity of work performed.

2.6.2 Intra/Inter-Services Support Agreements (ISSA). Formal Agreements to provide support in a contractual-like manner by or between DOD components or another federal agency/department. Intra denotes agreements between Navy components, Inter denotes external Navy sources. The content of ISSAs should address the same basic elements as MSA, as a minimum.

2.6.3 Engineering Evaluation (EE) of Existing Assets. Engineering Evaluation is part of the Shore Facilities Planning System (SFPS) and is described in the "Shore Facilities Planning Manual", NAVFACINST 11010.44 (series). SFPS planners rely on information provided by on-site inspections, Control Inspection Reports, AIS, engineering investigations, and other technical studies. To assure high quality Shore Facilities Planning documentation, Planner/Estimators and/or Control Inspectors should be assigned to assist EFD planners in on-site, visual inspections. Control Inspector backgrounds and experience provide invaluable assistance to planners by:

- Identifying undocumented facility use/users.
- Defining user and host-tenant relationships.
- Indicating adequacy of facilities for current use.
- Determining siting adequacy for current use based on safety criteria.
- Evaluating suitability of facilities for other uses.
- Assessing facility condition (functional and physical) and citing major deficiencies.

2.6.4 Family Housing Programs. Family Housing inspections include:

- **Maintenance and Repair Inspection Program (MARIP).** Its purpose is to identify family housing maintenance and repair deficiencies. Program responsibility lies with the EFD's Housing Division. Direction is established in NAVFACINST 11101.94 (series).
- **Occupancy Inspection Program (OIP). The** program includes four vital inspections: make-ready, check-in, pre-termination, and termination. They identify Command and occupant responsibilities, determine condition of quarters, initiate good occupant relations, orient and instruct the occupant on equipment operation, and ensure occupants understand

procedures for obtaining Emergency/Service. This program is discussed in the Navy Family Housing Manual, NAVFAC P-930.

CHAPTER 3. CONTROL INSPECTION PROCEDURES

3.1 PURPOSE. The purpose of Control Inspection is to conduct a complete visual inspection of all facility components, items and systems to determine physical condition. The inspector shall address the need for repair, replacement versus repair of selected items, or replacement in total. The Inspector's Report is the single most important document in the process and is the inspectors "only" product. The inspector is the direct link between the facility's health and the funding process. The Inspection Report must answer:

- What is wrong (description & scope)?
- Where is the problem (location)?
- How big is the problem (quantity)?
- How to correct the problem (solution)?
- How much does it cost to fix ($)?
- Who should fix it (craft/contract)?
- When should it be fixed (priority)?

3.2 OBJECTIVES. Control Inspection is a scheduled facility inspection designed to:

- Provide a thorough examination of each facility and its components and make uniform assessment of condition.
- Appraise the adequacy of Operator and Preventive Maintenance Inspections.
- Assure adequate, consistent levels of maintenance by detecting over or under maintenance.
- Minimize system breakdowns and repair costs.
- Regulate the input of work for PW shops or contract.
- Provide AIS/BASEREP reporting data.

- Identify facility maintenance and repair resource requirements and provide a basis for developing a meaningful, executable resource plan.

3.3 INSPECTOR QUALIFICATIONS. Inspectors should have a technical trade background in electrical, mechanical or structural disciplines. Formal education in theory is desirable. They should have the ability to write clear, concise, detailed descriptive reports of facility condition. They need to be experienced in maintenance and repair operations and skilled in inspection techniques, planning and estimating, maintenance standards, safety, health and building codes. It is usually cost effective for inspectors at small activities to possess a craftsman rate in one discipline with experience and/or knowledge of the others. Working knowledge may be obtained from on-site training, EFD/EFA or PWC training, correspondence courses, or instruction from schools or industrial facilities. A basic understanding of micro computers and the ability to become proficient in their use is recommended. Training and experience requirements are contained in Office of Personnel Management Standards. Basic Control Inspection Program Training can be attained by completing two-phased training offered by EFDs/EFAs: Phase 1 (Control Inspector Training) and NTTC-160 Correspondence course (Phase II) available from NAVFAC Code 161,8530 La Mesa Boulevard, La Mesa, CA 92041. Control Inspection can be performed by engineers, Inspection Branch or contractor personnel.

3.4 SCHEDULING CONTROL INSPECTIONS. Control Inspection workload should be balanced with available capability and scheduled annually. This provides the most effective method of identifying and processing deficiencies. Facility inspection scheduling documentation should be administered and maintained by the Work Generation Branch. Where PWMA/BEST is installed, the Shore Facilities Inspection (SFI) module can perform this function (see Chapter 8).

3.4.1 Frequencies. Recommended Control Inspection frequencies are contained in Appendix B. Available resources may not permit inspecting at this frequency; however, the frequencies in Appendix B have been established by CNO as a baseline for consistent reporting purposes and as a desirable Navy goal. Activity Inspection frequencies must, however, be based on available resources, facility mission, experience and engineering judgment.

3.4.2 Scheduling Considerations. When developing inspection schedules, certain variables to consider are:

- Activity resources available for Control Inspection.
- Time for each discipline to inspect a facility (See Section 3.4.3).
- Team size. When possible, Inspection teams should be formed. Teams offer complementary experience and training, provide safety backup and maximize transportation utilization. This permits technical discussions

for problem resolution and insures the presence of another person during the inspection of attics, crawl spaces, roofs and fire escapes. Facilities requiring only a single discipline can be used to smooth resource "peaks" and "valleys" in the scheduling process.

- Climatic conditions (rainy season, severe winters, dry season, storm season, and tides) impact planned scheduling. Extra inspections may be necessary after storms.
- Special requirements such as special equipment, tools, security clearance, etc.
- Inadequate Inspection Resources. If all facilities cannot be inspected at the CNO recommended frequency (Appendix B), an alternative plan is needed. One alternative is to use the LMC as the basis for scheduling by grouping facilities into 3 categories: Group 1 containing LMC "A", Group 2 containing LMC "B", and Group 3 containing LMC "C", "D" and "E", i.e., mission essential, mission support and non-mission related. Depending on resources available, inspect all Group 1, 1/2 of Group 2 and 1/3 of the Group 3 facilities each year. Note - AIS facility inspection status must still be reported based on CNO baseline standards (Appendix B) and not alternative frequencies.
- Overtime.
- Utilizing an A&E contractor or PWC to inspect all or selected facilities.
- Augmenting the Inspection force with qualified shop personnel on a temporary basis.

A key to successful scheduling execution is to send a memo to the Facility occupant advising of the scheduled inspection and requesting their input prior to the actual visit. The memo may contain space for feedback of their problems and experiences for analysis beforehand.

3.4.3 Control Inspection Times. Inspection time is the amount of time normally required to examine the facility with appropriate tools or equipment. Appendix C provides inspection time guides to help prepare initial schedules. Time must be added to make sketches, report writing, cost estimating, travel and delay time. It is important to give inspectors adequate time to make careful inspections. Intangible factors that may affect inspection time allocation are: inspector undergoing on-the-job training, scope of deficiencies, age of facility, type of construction, and site conditions. Initial inspections will generally require more time because the size and scope of deficiencies found are usually greater. Recording actual inspection time is critical to the success of future schedule development. Time spent on inspection preparation, on-site inspection, travel and report writing should be recorded separately. After a series of inspections

has been made, better time values are available for adjusting schedules. Activities using PWMA/BEST may use the SFI module to generate and refine inspection times.

3.5 PREPARING TO INSPECT Prior to on-site inspection the inspector should analyze work control files including E/S files to determine if major deficiencies exist or are developing. The status of work planned or in progress should be considered and addressed in the Inspection Report. Work on the current shop load plan should be included on the Inspection Report and noted that Job Order "X" will correct a specific deficiency. New deficiencies with a significant impact on currently planned or authorized work should be noted on the Inspection Report and brought to management's attention. This allows management to modify job orders thus reducing or preventing costly delays during work accomplishment. Jobs on the Shop Load Plan should be modified to include correction of appropriate newly discovered deficiencies, if prudent. Review of E/S work can reveal potential problems or highlight intermittent, cyclic or seasonal occurrences. Additional items that should be included on the inspection planning and preparation checklist are to:

- Be familiar with Activity's Master Plan for Facility use and general development.
- Obtain facility floor plans.
- Obtain listings, status and appropriate documentation for major alteration and maintenance projects.
- Determine craft codes and labor rates.
- Determine maintenance cycles with respect to painting schedules, long-range maintenance plans, etc.
- Obtain a list of pertinent contracts and warranties.
- Obtain lists of building tenants and maintenance persons.
- Establish Facility priority (LMC).
- Arrange security clearance for the inspection.
- Determine special safety precautions that must be observed: radioactivity, asbestos, confined spaces air sampling, hard hat/safety glasses/safety shoe requirements, weak roof areas, inspector physical exams, etc.
- Resolve any interference with other inspections or audits scheduled for accomplishment: energy audit, asbestos, roofs, security or fire protection.
- Determine special tool and test equipment requirements, and define the depth of diagnostics intended during the conduct of the inspection.
- Notify the building manager/user of the planned inspection and request preliminary user feedback of known trouble areas.

3.6 ADDITIONAL DUTIES OF MECHANICAL AND ELECTRICAL INSPECTORS. Mechanical and Electrical Control Inspectors must monitor PMI program effectiveness and recommend changes where needed. To do this, they must be familiar with the scope and frequencies of Preventive Maintenance Inspections. Inspectors should also be involved in review of PMI feedback reports and E/S analysis. There is seldom need for structural PMI.

3.7 CORRECTING NON-DEFERRABLE (CRITICAL) AND DEFERRABLE DEFICIENCIES. A deficiency is considered to be Critical if: (1) it must be corrected within 12 months and (2) it will impact mission, affects quality of life or has safety or environmental hazard potential. Deficiencies not meeting these two (2) criteria (time and type) are Deferrable. A critical deficiency that has existed for more than four (4) years is to be classified as deferrable. Processing and programming deficiencies for correction is a Work Generation Branch function within the FME Division. This requires FME Division Management to ensure that:

- The deficiency scope and year of correction be defined.
- The deficiency be included in a maintenance action plan. If it is Special Project scope, it should be submitted to the major claimant for programming or in the case of NIF activities, approved for inclusion in the NIF overhead budget for recapture.

NOTE: Activities utilizing the PWMA/BEST Work Input Control (WIC) module can track deficiencies from inception to Facility history files.

3.8 CONTRACTOR ASSISTANCE. An activity may determine that contractor assistance is required for Control Inspections. They can examine facilities/systems to determine physical condition and provide reports identifying deficiencies and estimated costs. In addition, they can develop Step I Special Project documentation for deficiencies exceeding the Commanding Officer's funding authority. Input of deficiency data (as job packages) into the activity's ADP system can also be made part of the contractor's responsibility.

Assistance in obtaining contractor support is available by submitting an Engineering Services Request (ESR) to the EFD/EFA, The EFD/EFA will prepare an Engineering Services contract for award to a qualified A-E firm. Pre-negotiation and on-site "kickoff" meetings with EFD/EFA, activity, and contractor personnel is an essential step. They ensure all parties understand contract requirements and quality of expected products. To help ensure a successful product, activity involvement throughout the contract is essential. Initially, the activity should provide the contractor with facilities and location maps, units of measure, Facility History Files, drawings, and Service Call history. The activity should randomly conduct comparison inspections to ensure "product satisfaction." Specification packages are available from NAVFAC EFDs/EFAs to assure a

quality product is received and the contract is properly administered.

There are advantages and disadvantages to contractor inspections. Advantages include:

- Obtaining a one-time comprehensive inspection to supplement in-house effort.
- A more liberal approach and identification of long-range Special Project scope repairs.
- Obtaining an outsider's view of facility conditions and incorporation of repair by replacement philosophy vice the potential for a "scrape, patch and paint" approach.

Disadvantages include:

- Lengthy contract processing time.
- Assigning work tasks to administer and monitor the contract.
- Dependency on contractor inspections for AIS data.
- Abandoning the Control Inspection Program as a means to generate work on a continuous basis for shop/contract accomplishment.
- Loss of corporate facility knowledge and familiarity.
- Public Works/Customer relationships may suffer as a result of less frequent interface.
- The volume of one-time inspection data is often overwhelming causing the product to not be properly used.
- Delegation of responsibility for classifying deficiencies as Critical or Deferrable to the contractor.
- The expense of contractor assistance is normally three to five times in-house cost.
- Difficulty of monitoring thoroughness of crawl space and attic inspections.

An alternative to total contract inspection is contract inspection of selected facilities with remaining inspections done in-house. This enables the activity to select mission essential and/or facilities which are difficult to inspect for contract inspection thus ensuring comprehensive coverage overall. Examples might be: infra-red inspection of electrical panels; infra-red roof inspection by aircraft.

Contract inspection should be viewed as an alternative only if there is insufficient in-house inspection personnel or expertise is limited in certain areas.

CHAPTER 4. CONTROL INSPECTION REPORTS AND RECORDS

4.1 REPORT DESCRIPTIONS. The Control Inspection Report Package consists of: A "Facility Condition Summary Report" and a "Facility Condition Report Detailed Deficiency List." The Report package enables Inspectors to systematically report deficiencies, urgency, and provide preliminary labor hour and material estimates by trade. The Report identifies "packages of work" that can be planned, estimated, and programmed into a work control system as a single undertaking. It can also be used to provide budget-oriented resource requirements data and is the basis for the Annual Inspection Summary (AIS) and BASEREP assessment. Priorities assigned by Inspectors highlight urgent items requiring immediate correction differentiating from long-range requirements for maintenance planning purposes. A "Facility Inspection Checklist" may also be added to the Report package to reflect facility components examined and not examined during the Inspection. Figures 4-1, 4-2 and 4-3 portray the CI Report package documents and format.

4.1.1 Facility Inspection Checklist. The cover sheet of the completed Inspection Report package may be a "Facility Inspection Checklist," Appendix D. It tells management at a glance what facility components were inspected (structurally, electrically, mechanically) and if it received a roof inspection. It lists items to be inspected. Its use ensures all major items in a facility are considered by the Inspector and provides a summary of what was inspected. Figure 4-1 portrays a typical checklist.

4.1.2 Facility Condition Summary Report Sheet. The "Facility Condition Summary Report," Figure 4-2, provides a summary of labor hours and cost by craft and material or contract necessary to restore the facility to an acceptable condition. Management can quickly view craft areas involved for workload programming and cost of restoration for budget and operating plan purposes.

4.1.3 Facility Condition Report Detailed Deficiency List. The "Facility Condition Report Detailed Deficiency List," Figure 4-3, provides information necessary for day-to-day management, i.e., what is wrong, cost of correction and urgency. Management should immediately evaluate each item checked "Immediate" or in the "One-Year" columns and plan or initiate corrective action. Deficiencies remaining unfunded on 30 September comprise the activity's Critical Maintenance and Repair backlog on the AIS. Deficiencies checked in the "Two Years and Beyond" column provide a relative degree of urgency and are included on the AIS backlog as Deferrable Maintenance and Repair

items. The value of the detailed deficiency listing of deficiencies is further enhanced when accompanied by afloor plan (Figure 4-4) coded to denote the exact location of

DATE: _____

FACILITY INSPECTION CHECKLIST

FACILITY NUMBER: _____ REPORT NO: _____

INSPECTOR(S): _____ INSP. HOURS: _____

ENTER: (S) = SATISFACTORY or (U) = UNSATISFACTORY

ELECTRICAL		MECHANICAL	
INCOMING SERVICE		PLUMBLING	
MAIN DISTRIBUTION PANELS		HEATING	
POWER/LIGHTING PANELS		COOLING	
ELECTRICAL DEVICES		EXHAUST/VENTILATION	
ELECT. WIRING NETWORK		TEMPERATURE CONTROLS	
_____		_____	
_____		_____	
EXTERIOR		INTERIOR	
ROOF		FLOORS	
WALLS		WALLS	
FOUNDATON		CEILINGS	
WINDOWS		DOORS	
GENERAL		STAIRWAYS	
_____		_____	
_____		_____	
SAFETY/HEALTH		SITE	
EMERGENCY LIGHTS		SIDEWALKS	
EXIT LIGHTS		AREAWAYS	
DETECTION DEVICES.		DRAINAGE	
PROTECTION SYSTEMS		ROADS	
WATER TREATMENT		PARKING LOTS	
SEWAGE TREATMENT		_____	
FOOD SERVICE		_____	
_____		_____	
_____		_____	

NOTES:

_____

_____

_____

_____

_____

Figure 4-1
Facility Inspection Checklist

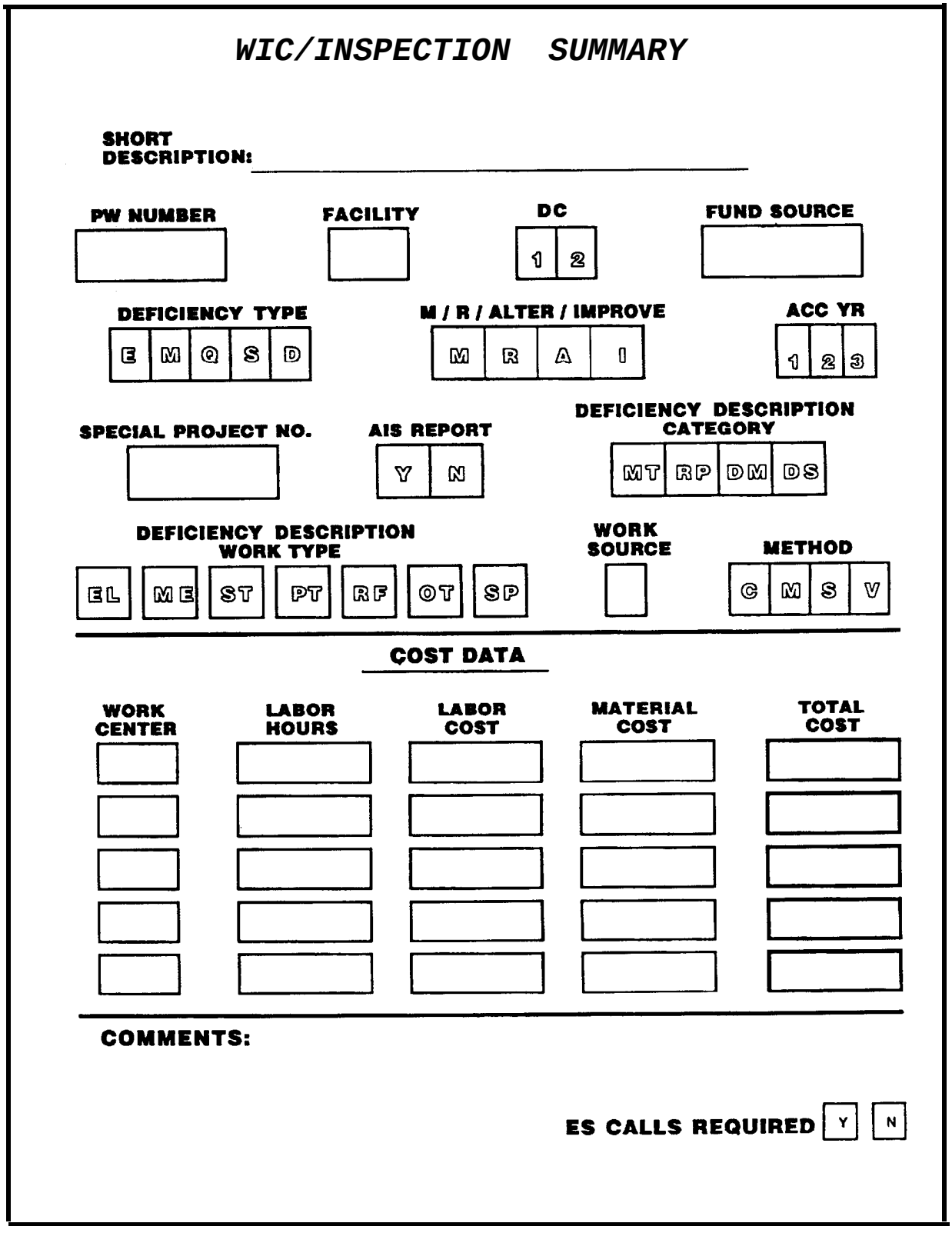


Figure 4-2
Facility Condition Summary Report

FACILITY CONDITION REPORT DETAILED DEFICIENCY LISTINGS

Page ___ of ___

Date _____ **Inspection Time** _____

Facility Number _____ **Type Inspection:** S E M O

Inspector _____

PKG	E	1	2	3	4	5	DEFICIENCY DESCRIPTION	W/C	LAB HRS.	LAB COST	MATL COST	TOTAL COST

Figure 4-3
Facility Condition Report Detailed Deficiency List

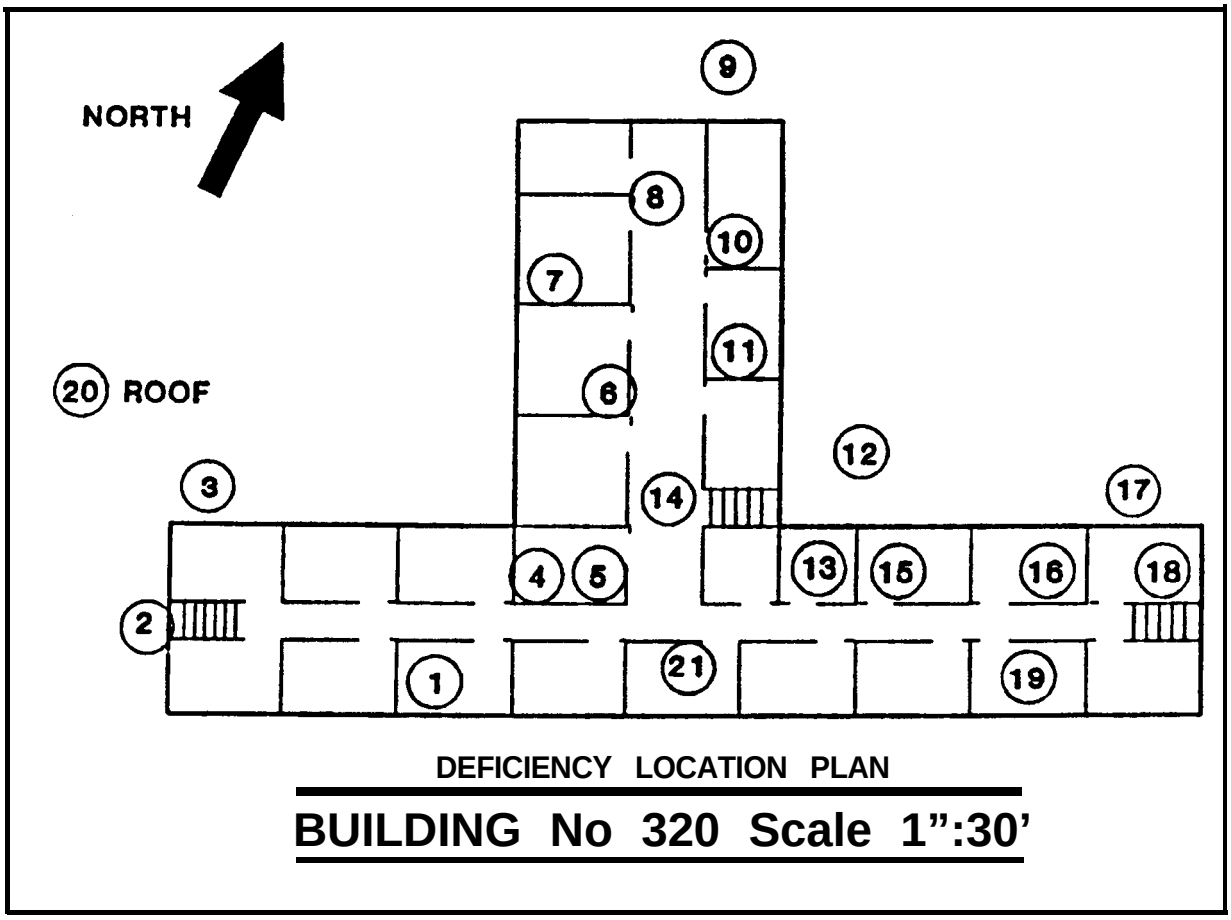


Figure 4-4
Facility Condition Report - Coded Floor Plan

reported deficiencies within the Facility.

4.2 REPORT PREPARATION. A complete Facility Condition Report package is comprised of three (3) essential documents. These documents reflect the results of inspections for structural, electrical, mechanical and roofing disciplines. Most facilities require all four (4) disciplines. A complete Inspection Report package will include individual "Facility Condition Detailed Deficiency List" and "Facility Inspection Checklists" for each facility accompanied by a "Facility Condition Summary Sheet." The Detailed Deficiency List depicts findings by discipline. The Summary sheet combines all disciplines depicting overall condition and craft area workload on a single sheet of paper. Floor plans, etc. may be attached as part of the package. The Detailed Deficiency List form may also be used to report PMI work that is beyond the scope of the PMI work authorization. These reports are made a part of the Facility File.

Facility Files should contain complete data on all facility deficiencies. It is the central reference point for all Inspection Reports, customer Work Requests, and Emergency/ Service work authorizations.

4.2.1 Preparation of "Detailed Deficiency List". The Inspection Report is the key to the Shore Facilities Inspection/Assessment System. Incomplete, inaccurate reports result in confusion, extra paper work, avoidable cost, and may endanger life and property. Inspectors should be instructed in inspection report preparation. Inspectors should describe deficiencies on the "Detailed Deficiency List" (Figure 4-3). Attempt to record the true cause of a problem. A separate sketch may describe work more clearly and be attached as a supplement. Inspectors should concisely describe each deficiency and recommend corrective action. Inspectors shall designate each deficiency as Deferrable or Critical using guidelines in OPNAVINST 11010.34. They should prepare a preliminary cost estimate (labor and material or contract costs) to correct each deficiency (see paragraph 4.2.4). Although Control Inspectors generally do not make adjustments to equipment, it is permissible at small activities if Inspectors are qualified and authorized. The report should contain enough detail to enable a job order to be written without revisiting the job site. Inspectors should ask these questions before releasing the report: (1) Could a final estimate for labor and material costs be made from my description? (2) Is there enough information for FMED personnel to make intelligent decisions concerning priorities and funding? (3) Could the deficiency be corrected from the information on my report? The report form is designed for deficiencies of Specific Work scope; however, Emergency/Service and Minor Work deficiencies can also be recorded and processed. Inspection reports will reflect three types of findings:

- **New finds.** Original, first time deficiencies not previously documented.
- **Known deficiencies.** A known problem that has not been corrected. The cost estimate and scope of work may require revision because of deterioration (or partial correction of the problem).
- **No deficiency finds.** This should be recorded and kept on file.

4.2.1.1 Report Accuracy. Thorough reporting is important. Inspectors sometimes ask: "Why keep reporting the same deficiencies? They never get corrected." There will never be resources to correct everything so deficiencies will continue to exist. In fact, they will get worse due to deterioration and Deferrable deficiencies will, eventually, become Critical. Thorough reporting is essential, especially during austere times, because:

- Scope and cost requirements must be updated. This is needed in the budget process. It provides justification for the current level of funding and is the only hope for increasing funding.
- Routine updating and comparative analysis permits an accurate annual facility condition assessment. This is also a factor considered in higher level resource decisions.
- Complete reporting enables management to intelligently prioritize all work, giving consideration to deficiencies which migrate from Deferrable to Critical.

- It provides information for a continuing review of workload with respect to in-house/contract decisions.
- Updating of scope and costs for Special Projects helps the claimant reevaluate project priorities.

As a minimum, each deficiency reported should:

- Reflect a correction action verb - repair, replace, prepare, etc.
- Define the problem - leaking valve, broken switch plate.
- Location - exact - Bldg. E, Room 307, South wall.
- Quantify costs - + 25% accuracy for budget and planning purposes.
- Be noted on a floor plan - shops must be able to easily locate.

4.2.2 Work Packaging. Work identified by inspection is used for AIS, budget, contract and shop loading decisions. It can fill these roles best, however, when it can be viewed in the way it will eventually be authorized for accomplishment. Work packaging is a technique that "packages" deficiencies together the way it makes sense to do the job. This should be done by the inspector at the time of report preparation. The inspector should ask which deficiencies should logically be worked together as a single undertaking and then group those items on the Inspection Report. The letters A, B, C, etc. on the left side of the Inspection Report can denote items that can be worked together. Note the blocks on Figure 4-3. The package should then be assigned a Work Request (P.W.) number and entered in the Work Control Program or Work Input Control (WIC) module. A breakdown by Work Center should be shown in the Work Center Summary Section of WIC. Summarization into packages can reduce the number of entries in a manual or automated system by 40-60 percent. This technique is illustrated in Appendix E. This appendix also provides a sample input for a Public Works Management Automation (PWMA), BEST, WIC Module data entry.

4.2.3 Inspection Report Numbering. Each Detailed Deficiency List or Work package should be numbered. The number should be shown on all Job Orders correcting a deficiency. One system consisting of four components which can be used for Inspection Report Numbering is:

Bldg. No.	Month	Year (last digit)	Discipline (M,E,S,R)

Example: Bldg. 320; Mechanical Inspection for the facility conducted in April of 1992.

Detailed Deficiency List number:	320-4-2-M
Summary Sheet and Checklist number:	320-4-2

4.2.4 Deficiency Cost Estimates. Inspectors will prepare only preliminary cost estimates. NAVFAC P-716, "Unit Price Standards" (UPS), MEANS, Richardson Dodge, etc. are recommended as useful tools. Estimates should show labor and material by craft regardless of whether the work will be done in-house or by contract. Final estimates with material take offs may be generated for deficiencies designated as critical only if they will be funded and worked within 12 months. Inspectors should not recommend the method of work accomplishment, e.g., PWD or contract forces (unless obvious). Costs may be adjusted if a decision to contract is made. Cost data must be provided for all deficiencies. If information is incorrect or missing, reports generated from deficiency data will not be accurate.

4.2.5 Special Projects Program. Special projects are work which is beyond the Commanding Officer's approval authority. OPNAVINST 11010.20 series provides guidance. Control Inspectors should be the primary source of input for the Special Projects Program. If a Special Project requirement is identified, inspectors should:

- Prepare a scoping estimate (see paragraph 4.2.4).
- Annotate the item as a potential Special Project to alert management.
- Forward the Inspection Report to Engineering/Planning via the FMED for evaluation and preparation of project documentation.

It is critical that Engineering personnel perform an on-site validation of the Special Projects technical requirement, scope, cost and ensure inclusion of all major related work required for that facility. This validation process prevents overloading shops with project scope work, permits economies of construction and causes minimum disruption to facility occupants. Phased projects should be considered if the total cost is too high for funding in a single year or if operational constraints prohibit single year funding. Total project requirement (scope) should be identified to the claimant with phased work accomplished by several contracts. Activities should take full advantage of claimant funding to correct major deficiencies that would deplete activity resources. To enable proper claimant programming, Special Projects should be prepared and submitted throughout the year as inspections are completed and requirements identified.

4.2.6 Inspection Report Use. The inspection and subsequent report are a waste of resources if management fails to use the product to effectively manage facilities. The number of ways the product can be used is limited only by the imagination and initiative of management. In addition to the routine uses as a shop/contract loading, budget and AIS tool there are other "spin-offs" of data that can assist the manager in decision making. A few examples are craft summaries (staffing); backlog reduction plans;

Facility Condition Index by facility, cost account or investment category; priority listing by facility, customer, etc; type deficiency (roofing/paint) listing; condition assessment by facility age; etc. The FMED Director, or designee, shall review, coordinate and process all Inspection Reports. If funding is not available, deficiencies should be placed in backlog as a valid critical or deferrable requirement. If it is more important than a planned and funded job, it should be processed and the less important item relegated to backlog status. A Control Inspection Report flow is shown in Figure 4-5.

4.3 TYPES OF RECORDS. An effective inspection records system, whether manual or automated, consists of:

4.3.1 Facility History Files. A current Inspection Report should be on file for each facility. The Facility History Files should include copies of work in process and completed work. Accurate facility history is critical to the decision making process involving economics of repair, repair versus replacement, effectiveness of maintenance methods, techniques, etc. Figure 4-6 shows an example of Historical Records for built-up and asphalt-shingled roofs. Other examples may be found in literature from trade groups or other NAVFAC MO Manuals. Accurate Historical Records are also the best means of gathering data to arrive at a meaningful evaluation of completed jobs to determine methods of improvement or cost reduction on future jobs. These records should be used to:

- Determine product effectiveness under varying environments or on different surfaces.
- Compare different products under similar conditions.
- Compare different equipment for product application.
- Determine labor efficiency under varying conditions.
- Judge better (or lower) quality products on planned jobs.
- Better determine frequency of application of a product.

The proper use of Historical Records replaces guesswork with purposeful direction and planning. Goals can be established realistically and with confidence based on recorded experience. The ultimate result is a refined maintenance program which provides an economical and efficient means of prolonging facility life and protecting investments.

4.3.1.1 Warranty Program. This program is vital to a cost conscious organization, especially one under a Station Operations and Maintenance Contract. It is easy to have work covered by warranty erroneously accomplished by another means. This is minimized if warranties are recorded and work monitored and tracked to avoid in-house accomplishment. The success of this program is directly related to feedback from Contract Surveillance personnel (for a contract operation). It also helps manage-

Figure 4-5
Control Inspection Report Flow

CONTROL INSPECTION FUNCTION

1. Review previous inspection report from Facility File

2. Review pending/completed work requests

3. Note programmed work from Shop Load plan6

4. Review work included in contract6

5. Check Special Projects funding status

6. Inspect facilities as scheduled

7. Conduct a complete inspection

8. Obtain a Control Inspection number for each report

9. Consult with Work Reception Section personnel to expedite issuance of Emergency/Service chits for items requiring urgent repairs under 16 hours. Record E/S chit number on the Inspection Report and vice versa

10. Prepare a comprehensive Inspection Report

11. Forward the completed Report with cover sheet to the Facility Management Engineering Division Director

FACILITY MANAGEMENT ENGINEERING DIVISION DIRECTOR

1. Receive Inspection Report

2. Review each item with respect to the:
   (a) criticality of each deficiency
   (b) Level of Maintenance Classification for the facility
   (c) funds and shop capability

3. Make an initial decision on each item with respect to:
   (a) whether the item should be programmed, and if so, the desired month
   (b) whether the item should be deferred or contracted
   NOTE: The Inspection Report provides space for noting nondeferrability

4. Make appropriate additions/ deletions to Maintenance Action Plan

5. Forward the Inspection Report and annotated cover sheet to the Work reception Section

WORK RECEPTION SECTION (WORK PROGRAMMER)

1. Receive Inspection Report and cover sheet with instruction6

2. Note instructions of FMED regarding item by item disposition as depicted on the cover sheet

3. Prepare tab strips in accordance with instruction6 and post to the appropriate Shop Load Plan (short, long range), contract board or suspense file or input into Best/PWMA systems, if installed

4. update the work center labor hour totals as well as financial commitments

5. Advise the FMED when a month has been over-programmed and adjust the Plan in accordance with instructions

6. Post the job order number to the tab strip when the job order has been prepared. Insure that the Inspection Report number is noted on every applicable job order

7. Insure that previous Inspection Reports of the same facility do not contain the same deficiencies to avoid duplication of total requirements

8. File the annotated inspection Report in the Facility File

NOTE:

1. All Inspection Reports must be numbered for identifying the Report and facility.
2. Unscheduled inspections should be conducted only when unavoidable. These inspections disrupt the Control Inspection program and often duplicate work previously disclosed by a Control Inspection. To avoid duplication, the inspector should always review the Facility Pile prior to conducting inspection.

HISTORICAL RECORD-BUILT-UP ROOFS

BUILDING NO. 1 USED FOR Reserve Activities
Permanent X Semi-permanent ____ Temporary ____ Year Roof was Applied 1980
Slope of Roof: Flat ____ In. per foot 1 in 20
Area of Roof: Squares 122 (one square equals 100 sq ft)
Roof Deck (Type, thickness or gauge, coating or treatments, method of attachment, side lap fastening, lap requirements, span, etc.):
Wood ____ Concrete slab ____ Concrete plank ____
Gypsum slab ____ Gypsum plank ____ Steel X Other ____
Additional information: ____

Type of Built-Up Roof:
Asphalt: Aggregate Surfaced X Smooth Surfaced ____ Cold Process ____
Coal-Tar Pitch ____
Kind of Surfacing: Slag ____ Gravel X Crushed Stone ____
Promenade tile ____ Slate slabs ____ Mineral-surfaced cap sheet ____
Smooth-Surfaced cap sheet ____ Other surfacing (name) ____

Number of Plies of Felt: 2 ____ 3 X 4 ____ 5 ____
Kind of Felt: Organic (Rag) X Coated ____ Uncoated ____
Glass Fiber ____ Asbestos ____ Coated ____
Uncoated ____
Kind of Base Sheet: ____
Insulation (List all trade names, thickness and type of each layer, define published 'R' values, method of attachment to substrate and layer to layer. Identify code numbers, U.D. or F.M. labels, method of breaking joints, etc.):
Composite
2" Urethane R-14
1" Mineral Board R-2.8

Vapor Barrier (When used, identify trade names, mil thickness, how sealed at ends and side laps, penetrations, describe quantity of adhesive and method of application. Describe edge seals if used.):
None

Flashings (Describe base flashing materials such as cant strips, types of films or felts used, priming of walls, trade names and description or thickness, specified fasteners and frequency, surfacing, list flashing spec numbers and manufacturer's details):
Base flashings: Metal ____ Kind of metal ____
Composition 376 LF Kind Felt
Cant strip: Yes X No ____
Other (describe) ____
Counter or cap flashings: Yes X No ____
Through wall: Yes ____ No X Metal ____
Kind of metal Galv. Composition ____ Kind Painted
Other (describe) Wall 156 LF Felt
Reglet (describe) ____
Additional information: Edge Metal 155 LF Galv Counter 48 LF Galv

Figure 4-6
Historical Record Build-Up Roof

HISTORICAL RECORD - BUILT-UP ROOFS

Drainage System: (include use of crickets, scuppers, drains set in sumps, etc):

Roof drains: 3"

Scuppers:

Gutters: 153 LF Galv

Downspouts: 90 LF Galv

Other: Slope East to West

Previous Maintenance: (Describe briefly with dates; attach additional sheets if necessary):

Roof membrane:

Flashings:

Weather conditions: (Weather during installion)

Guarantees:

Roof Guarantees by:	Expiration Date:
ABC Company	4/1990

Additional Information:

Contacts:

	FIRM	CONTRACT	TELEPHONE
Architect		79-C-11XX	
General Contractor		79-C-01XX	
Roofing Contractor			
Roof Consultant			
Test Laboratory			
Roofing Mat'ls. Manufacturer	ABC Company		
Deck Contractor			
Decking Mat'ls. Manufacturer			

Others

1 Curb Mounted Rooftop HVAC Unit

2 Pitch Pans (ELEC)

3 Exhaust Vents Galv/Paint

4 Plumbing Vents Flashed w/lead sleeves

Figure 4-6 Cont'd
Historical Record Build-Up Roof

HISTORICAL RECORD-ASPHALT-SHINGLE

BUILDING NO. 2 USED FOR NCO Club
Permanent X Semi-permanent ____ Temporary ____ Year Roof was Applied 1980
Kind of Roof Deck: Sheathing boards X Thickness, in. 1"
S.S. ____ T&G X Plywood ____ Thickness, in. ____
Underlayment: None ____ Saturated felt 15# Paper ____
Asphalt shingles ____ Wood shingles ____ Other ____
Slope of Roof, in. per ft: 5" Area of roof, squares 100
Type of Shingles:
Square butt strip shingles: Exposure, in. 5 Weight 240 psf,
per square Thick-butt ____ Uniform thickness ____
Fire protection class: ____
Tabs cemented: Factory applied adhesive ____
Field applied cement ____
Other: (describe) Class C
Color of Roofing Granules: White
Flashings:
Valley flashings: Roll roofing X Asphalt shingles ____
Metal ____ Kind of metal ____
Drip edge: Roll roofing ____ Asphalt shingles ____ Metal ____
Kind of metal Aluminum
Vent flashings: (Describe) ____
Chimney and wall flashings: Roll roofing 55 Metal X
Kind of metal Aluminum
Previous Maintenance: (Describe briefly with dates)
Asphalt shingles: ____
Flashings: ____

Gutters and Downspouts
Type Metal ____ Guage ____ Thickness ____ Weight ____
Guarantees:
Roof Guarantees by: Expiration Date:

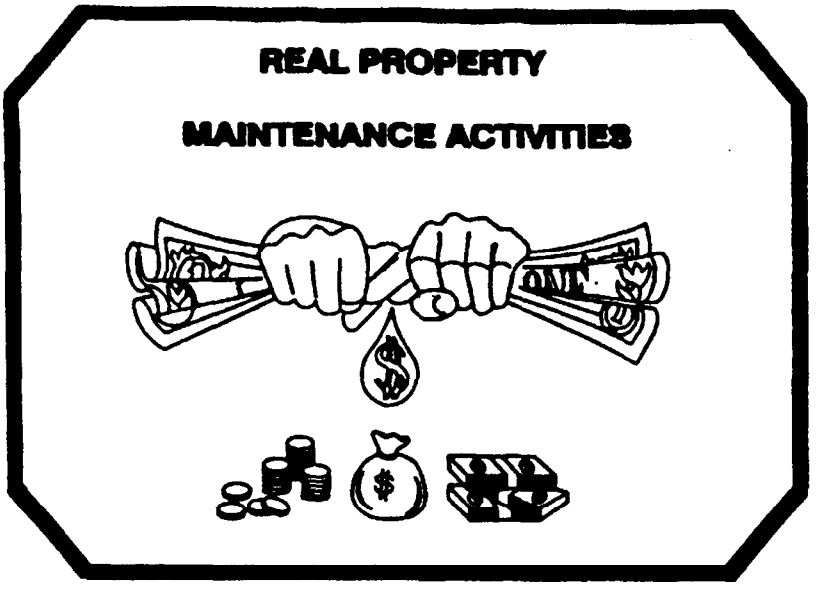
Figure 4-6 Cont'd
Historical Record Asphalt-Shingles

ment to establish life cycle data for replacement equipment and predict future replacement. Automation is recommended to track warranty information.

4.3.2 Cyclic Maintenance Planning Files. Programmed Maintenance in the areas of roofing, painting, flooring, overhauls, is recommended. As an illustration, a five year cycle for exterior painting would mean that 1/5th of the total exterior area should be painted each year. Individual structures are identified as they require painting and are prioritized on the applicable Maintenance Action Plan (see paragraph 4.5).

4.3.3 Completed Job Order Files. Completed Work Authorizations are filed in two ways: (1) in sequence of issue by number by year of issue in the Completed Job Order File, and (2) in sequence of issue by facility or Property Record Card Number in the Facility File.

4.3.4 Completed E/S Work Files. Completed E/S work authorizations are also filed in two ways: (1) in sequence by number by year of issue and (2) in sequence by facility or Property Record Card Number. Files should be purged at least annually after analysis and extraction of data to assist in decisions made concerning equipment/facility component replacement, vandalism problems, etc. Automated E/S operations can be purged to history for longer term retention. Extracts of annual E/S effort by type work by Facility is recommended for inclusion in the Facility File.



4.4 MANAGEMENT REVIEW AND APPRAISAL, See Chapter 1 Paragraph 1.5.1.9 for discussion of Facilities Management Program appraisal responsibilities. With respect to the Control Inspection process, the FMED should be concerned with whether inspections are conducted as planned; if inspections are thorough and accurate; if recommendations are technically sound; and if cost estimates are accurate within acceptable limits. The FMED should conduct random follow-up inspections to verify effectiveness. Cost effectiveness can be compared to the actual cost of correcting comparable items.

4.5 FACILITY MAINTENANCE PLANNING. Congressional interest in the use of Maintenance of Real Property (MRP) funds, especially the portion used to reduce maintenance and repair backlog reported on the AIS, established the need to develop a Maintenance Action Plan (MAP) comprised of AIS items to be accomplished with Maintenance and Repair (M&R) funds. The MAP is the activity's plan for spending MRP funds available for Minor and Specific work (LCC 06 and 07). This generally approximates 30% + 5% of M&R funding available. NAVFAC MO-321 provides clarification of Labor Class Codes. The MAP is a list of individual line items selected from the latest AIS (Code 1 deficiencies) which are the most critical, mission essential deficiencies. It should be prepared concurrent with the NAVCOMPT Budget and provide a firm spending plan for the Current Year portion of the Budget. Execution against the MAP must be continuously tracked to be effective. Some major claimants require submission of the MAP as part of the Navy Comptroller Budget package. Claimants may establish varying target amounts for MAP development, e.g. 75% of Minor and Specific "resource availability" as a MAP target. Procedural guidelines for developing a MAP are contained in Appendix F. Maintenance planning uses the results of the inspection program for multi-year programming. It also relies on accurate facility and equipment historical records. A longer plating horizon (normally five years) permits more efficient resource allocation and contract execution. This usually is more economical and permits better prioritization of deficiencies adversely affecting mission and readiness. If a five-year plan is desired, an estimated "Plan-Year" should be assigned to Deferrable deficiencies to enable programming in the appropriate year. Out-year planning must consider anticipated funding. The Detailed Deficiency List Inspection Report format is ideal for indicating "Plan-Year" at the time of deficiency identification. Public Works Centers have established a Long Range Maintenance Planning (LRMP) Program which is a service available on a reimbursable basis. Training of activity personnel and installation of the LRMP Program is also available from the Centers.

More details, including inspection times, are in Appendix G or obtained by contacting the nearest Public Works Center. LRMP provides the activity with systematic, in-depth documentation of maintenance and repair requirements forecasted over a multi-year planning cycle. This information is used to formulate funding strategies and to allocate resource dollars to critical mission needs and to predict future facility requirements.

CHAPTER 5. PREVENTIVE MAINTENANCE INSPECTION/SERVICE (PMI) PROCEDURES

5.1 OBJECTIVE. The primary objective of PMI is to ensure the continued reliability of dynamic equipment. PMI is a systematic approach to protect vital operating equipment from premature breakdown or replacement. A second objective is to assure efficient operation by providing systematic examination of equipment and systems and correcting minor deficiencies before they expand into major items for repair or replacement.

51.1 Discussion. PMI consists of examination, lubrication, minor adjustment, and minor repair. It is concerned primarily with items that, if disabled, would interfere with essential operations, endanger life and/or property, or involve high cost or long lead time for replacement. A viable and effective PMI program will assist in providing the command with the tools to avoid breakdown maintenance situations and is a cost effective vehicle for "protective maintenance." PMI alerts management to upcoming maintenance deficiencies in time for systematic planning and scheduling of repair work. This philosophy is in contrast to "breakdown maintenance" where the majority of repairs are done on an "emergency" basis. The system is used to schedule periodic inspections and servicing, monitor equipment repairs including labor and materials, and maintain inventory data including spare parts numbers, spare parts stocked, and set-up requirements where necessary. Some advantages of an effective PM program are:

- Reduced equipment downtime.
- More effective maintenance scheduling.
- Reduced emergency maintenance costs.
- Longer equipment life and better capital expenditure decisions.
- Reduced inventory shortages and overstocks.

Cost savings from PMI will not be immediate. Maintenance costs may rise initially, largely because previously hidden deficiencies will be uncovered. After the program is in operation for one or two years cost savings will result from reduced E/S work and efficiencies gained through planned and scheduled maintenance versus fire drill breakdown maintenance. PMI is highly repetitive work that can be planned, estimated and scheduled. Therefore, it should be issued as an estimated Standing Job Order, Labor Class Code (LCC) 03 and charged to the appropriate PMI Cost Account Number (CAN).

5.1.2 Management Prerequisite. If a PMI program is to function properly, full management support is essential. Many programs of this nature falter shortly after a vigorous beginning. Management must assign priority to this program to ensure its development, implementation, and continued accomplishment, with dynamic follow-up to ensure acceptable performance.

5.2 PMI INSPECTOR QUALIFICATIONS. PM Inspectors should hold a craftsman rate in their respective trades. They should be able to execute written instructions contained in the work authorization containing checkpoints and frequency of work to be performed. They should be able to detect abnormal equipment conditions and communicate needs in clear, concise, details to supervision and FMED via PM feedback reports.

5.3 ESTABLISHING A PMI PROGRAM. The following guidelines are needed to establish a PMI Program.

5.3.1 PMI Inventory. An inventory of all dynamic equipment needs to be developed. Formal record keeping, either manual or automated, is essential. When establishing the inventory, facilities and systems should be subdivided based on their relationship to mission, i.e., direct mission, indirect mission and non-mission related. Identify each piece of critical equipment and its components. Research these to determine the number of different procedures involved with each component that must be scheduled and performed and at what frequency. Once the number of components and procedures has been determined, inspection guides, checkpoints and frequencies will be needed for each procedure. A sample PMI record card for a manual system is shown in Figure 5-1. Equipment History Files should be set up for each piece of equipment. These files should contain manufacturers' literature, parts lists, drawings, etc., as well as completed PM cards. When establishing a PMI Program, it is important to involve Maintenance and Utilities Division personnel. Their corporate knowledge is critical in developing inventories, establishing checkpoints, and assigning priorities. The mechanic is the most important person in determining the job to be done as well as the most effective and efficient way to get it done. A PMI Inventory Record sheet, Figure 5-2 provides an example of procedures, decision points and necessary implementation actions.

Equipment of marginal mission importance should be excluded from the program. Overstatement of requirements can cause loss of interest by shop personnel if they see work authorized that is not critical to activity needs. The inventory should contain a spare parts catalog frequently needed by the mechanics.

5.3.2 PMI Contractor Assistance. Contractor assistance may be obtained to establish inventories and perform other functions to establish a PMI Program. Commercial firms can conduct inventories, label equipment, establish checkpoints and inspection guides, determine frequencies and generate PMI schedules. The activity

should not rely solely on contractor input but should carefully review the contractor's submission and make revisions based on detailed knowledge of their physical plant.

5.3.3 PMI Guides and Frequency. Inspection guides, checkpoints and frequency of inspection should be developed for each type of equipment in inventory. Determine:

- Appropriate inspection guidance. Detailed maintenance and servicing information can usually be found in the equipment manufacturer's manuals, and NAVFAC MO Manuals.
- Checkpoints and frequency of inspection for all inspection guides applicable to the work to be performed. Do not overstate frequencies or assign needless checkpoints.
- Actual time to inspect the checkpoint. This should be the actual on-site time to the tenth of an hour. Travel time, write-up, delay time, etc. will be added on the actual work authorization.

PREVENTIVE MAINTENANCE INSPECTION RECORD
NAVFACENGCOM

EQUIPMENT DESCRIPTION	PROPERTY NO.	LOCATION		CARD NO.
EQUIPMENT DATA			FREQ.	STD. HRS.
MANUFACTURER		MODEL NO.	GUIDE NO.	CHECK POINTS
SERIAL NUMBER	FRAME NO.	VOLTAGE	H.P.	
TYPE / BELT(S)		FILTER (S)		
OTHER				

PREVENTIVE MAINTENANCE INSPECTION RECORD

DATE	CHECK POINTS	ACTUAL INSP. HRS.	DEFICIENCY REPORT MADE YES	DEFICIENCY REPORT MADE NO	INSPECTOR' MECHANIC INITIALS	DATE	CHECK POINTS	ACTUAL INSP. HRS.	DEFICIENCY REPORT MADE YES	DEFICIENCY REPORT MADE NO	INSPECTOR' MECHANIC INITIALS

Figure 5-1
PM Inspection Record Card

PREVENTIVE MAINTENANCE INSPECTION
CHECK–OFF CARD

Use Inspection Guide:	CODES:			Work Center:	Charge to Job Order #:
	NI – Not Inspected	X – Adjustment Required	XX – Repairs Required		
	✓ – Satisfactory	(X) – Adjustment Accomplished	(XX) – Repairs Accomplished		
	– Not Applicable				

FACTORS AFFECTING INSPECTION

KEYS: TOOLS:

DATE INSPECTED	FREQ	CHECK POINTS SCHEDULED FOR INSPECTION	CHECKPOINTS 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	INSPECTOR'S INITIALS	INSPECTION HOURS STD.	USED	DEFICIENCY REPORT MADE? YES	NO
			17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32					
			33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48					

PROPERTY NO.:	DESCRIPTION:	CATEGORY CODE:	LOCATION:

Figure 5-2
PMI Inventory and Tracking Record

5.3.4 Inspection Record. A PMI Record Card should be developed for each item of inventory. Include data in subparagraph 5.3.3 as well as:

- Item identification including property number, nomenclature, make, model, and other pertinent information.
- Location - Building number, floor, room number, etc.

The PMI Record Card should be used during inspection and updated to reflect:

- Checkpoint inspected.
- Description of deficiencies corrected or reported. If the equipment is part of a building system, copies should be placed in the Facility File.
- Actual time spent on-site (tenths of an hour). After several PMIs of the item of equipment, the actual times should be averaged and compared to the estimate, differences reconciled and estimates revised. This gives more accurate data for planning and scheduling shop workload.
- Date of Inspection.
- Inspector's Initials - Inspectors should be rotated so different views on equipment and component condition may be obtained.

5.4 SCHEDULING INSPECTIONS. A 52 week schedule for each shop should be developed, spreading the work equally if possible. Work scheduling should consider location, type, frequency, and shop.

5.4.1 PMI Frequencies. Initial PMI frequencies should be based on manufacturers' guidelines. Experience and analysis of actual maintenance records will indicate the need to revise frequencies.

5.4.2 PMI Times. Time allowed to perform each PMI should be based on time needed to perform specific checklist items plus time for travel, delay, site access, etc. Time allowed should permit the inspector to complete service with tools, parts, and materials available in a hand-carried preplanned Inspection/Service kit. When circumstances require more than one hour per piece of equipment and the inspector does not have to return to the shop for additional tools, parts or materials, the effort should be completed. An Emergency/Service Work Authorization should be issued to account for time expended and the Inspection Record noted accordingly. NAVFAC P-717.0 "Preventive/Recurring Maintenance Handbook" contains Inspection/Service time standards for some items of dynamic equipment.

5.4.3 PMI Scheduling Considerations. It is not usually economical for all items to receive PMI. Annual operation and maintenance costs for these items should be monitored and required services analyzed. Perhaps some services could be performed as cyclic maintenance on Specific Job Orders issued at predetermined intervals, thus

eliminating need for PMI. Certain types of low cost, non-mission equipment such as fractional horsepower motors, window unit air conditioners (except for filter changes), water coolers, household refrigerators with sealed units, and automatic door closers may be replaced or repaired at time of breakdown more economically than under the PMI Program. Replacement items which are part of "vital" operating equipment should be stocked, or readily available at breakdown. Self Help programs, particularly in Family Housing and barracks, should be used to the fullest extent for PMI type work. It is imperative, however, that Public Works coordinate all work. The decision to PM one piece of equipment does not mean all like items require PMI. Environmental conditions, equipment age and usage vary between common equipment at the same activity and among activities. Proper scheduling permits orderly and efficient accomplishment of PMI. Similar equipment in the same general area of the base should be scheduled for PM consecutively. A single master schedule can be used if all PMI is performed by one Work Center. If more than one Work Center performs PMI, it is advantageous to prepare a schedule for each Work Center, to permit labor requirements leveling.

5.5 HANDLING MAJOR DEFICIENCIES. Equipment breakdowns discovered during PMI should be reported immediately to the supervisor or Work Reception Desk. Work beyond the scope of the PMI work authorization (usually major repairs and overhauls) should be recorded on a Control Inspection Report (Detailed Deficiency List) and forwarded to the Work Generation Branch via the Inspector's Supervisor (and Utilities Division if utilities equipment). The craftsman should include a priority, i.e., immediate, one year, etc. for correction of major deficiencies.

5.6 SUPPORT REQUIREMENTS. When management commits to establishing a PMI Program they must also commit resources to install and operate the Program. Initial PMI planning and estimating (P&E) requires approximately 12 P&E hours for each piece of major equipment of which 4 hours is for writing work orders and preparing the PMI schedule. Maintaining the PMI function requires approximately 1 P&E hour per 150 shop hours of PMI work authorized (or contract equivalent). This is needed to update work authorizations annually. In addition, a minimum of 160 hours are needed to review PMI program effectiveness, 1 hour per 50 items of PMI inventory to update inventory and adjust PMI requirements, and 1 hour per 50 PMI Reports to review Reports and coordinate actions needed to correct reported deficiencies.

5.7 **PROGRAM ANALYSIS.** Analysis of the PMI Program should be conducted routinely and especially prior to renewing work authorization. The analysis must question:

- Is all key equipment covered under PMI and is the level of service effective?
- Can the PMI frequency be reduced without impact?
- How does equipment replacement cost compare to annual PMI cost?

- Is PMI justified based on economics, mission, or both?
- Would it be more cost-efficient to not inspect and repair or replace when failure occurs?

CHAPTER 6. OPERATOR INSPECTION PROCEDURES

6.1 OBJECTIVE. The objective of Operator Inspection is to provide and assure efficient operation of mission essential equipment and systems which require the assignment and attendance of an operator.

6.2 RESPONSIBILITY. Operator Inspection is the responsibility of the person assigned to operate the equipment or system. Standard Operating Procedures (SOPs) should be developed and posted on the equipment or facilities, or written in the watch log. Deficiencies beyond the scope of the operator's assigned responsibilities should be immediately reported to the Work Generation Branch's Work Receptionist via the shop supervisor. During operation and equipment servicing, operators should be alert to symptoms, the need for diagnostic technical inspections and the potential need for major repair or overhaul. Although Operator Inspections may generate some Specific Work requirements as a result of routine examination, lubrication and minor adjustments of equipment to which they are assigned, their primary responsibility is to assure continuous operation of critical equipment and systems. Operator Inspection Program effectiveness should be evaluated during Control Inspection. Operators should continually monitor the PMI Program whether performed as part of their SOP or by shop forces and recommend adjustments when needed.

6.3 QUALIFICATIONS. Operators must be thoroughly familiar with the equipment or systems to which assigned. They require a complete knowledge of operational and safety requirements and a full understanding of SOPs. Independent assignment should not be made until the supervisor or lead operator has certified that the required skills and knowledge have been demonstrated. They should be able to detect abnormal operating conditions and take necessary corrective actions to avoid disruption, damage to property or hazard to personnel.

6.4 SCHEDULING INSPECTIONS. Operator inspections do not require scheduling since a specific operator is generally permanently assigned to the equipment or system.

6.5 PERFORMING OPERATOR INSPECTIONS. Operators should perform procedures outlined on assigned Preventive Maintenance Inspection/Service work authorizations and approved standard operating procedures.

CHAPTER 7. ANNUAL INSPECTION SUMMARY (AIS)

7.1 PURPOSE. The purpose of the Annual Inspection Summary (AIS) is to report the condition of Navy owned and operated real property, including temporary in-grants not out-leased or declared surplus.

7.2 OBJECTIVE. The objective of the AIS is to provide an annual assessment of facility condition and report the impact of condition on mission readiness. A secondary objective is to provide a means for the command chain to present unfunded facility condition problems to higher authority for programming consideration. Although the AIS is not a request for funds, it provides solid supporting justification for additional resources to correct facility problems. The AIS also provides:

- An assessment of the overall facility inspection program and inspection coverage.
- An assessment of individual facility condition.
- A budget-oriented report of facility resource requirements.
- The data needed to develop an executable Maintenance Action Plan (MAP) within resource constraints.
- Data needed to make an assessment of Base Readiness (BASEREP).

7.3 AIS FUNDING RELATIONSHIP. High interest in the deteriorating condition of Navy Real Property and severe reductions in facility repair funds prompted the Chief of Naval Operations (CNO), to institute procedures to identify, report and analyze facility deficiencies. These procedures:

- Emphasize inspection of facilities with direct bearing on activity readiness.
- Emphasize inspection of facilities with high economic impact on operations.
- Identify facility condition deficiencies by Investment Category.
- Prioritize facility problems as critical or deferrable.
- Require major claimants to review and verify AIS Reports.
- Synchronize facility condition reporting with the budget request programming cycle.
- Include Real Property Maintenance Activities (RPMA) program requirements as an agenda item for the Military Construction Review Board (MCRB) and require major claimants to defend their RPMA program before the MCRB based on AIS data.

- Permit CNO to view the MCON and RPMA Program as related requirements by Investment Category addressing both current and future needs jointly.
- Use the AIS and BASEREP as tools to help CNO formulate programming guidelines and define the direction of MCON and RPMA through the Future Years Defense Plan (FYDP).

7.4 PREPARATION OF THE AIS. There are three (3) different types of Annual Inspection Summaries depending on the types of property involved. Preparation instructions as well as reporting formats differ with each type. Specific guidance for preparation and reporting is contained in instructions promulgated by the commands involved. Only the Type "A" report is required by CNO. The three (3) types are:

TYPE "A". Navy owned and operated property, including facilities operated by contractor for research and development, not out-leased or declared surplus. OPNAVINST 11010.34 (series) contains forms and instructions for annual preparation. The majority of Navy activities are in this category and therefore subject to OPNAVINST 11010.34 series reporting requirements.

TYPE "B". Navy property, except industrial facilities, out-leased, declared surplus, or sold with a recapture provision. Para. 7.4.1 provides information for preparation of Type "B" AIS Reports.

TYPE "C". Industrial facilities not Navy operated. Reporting instructions for applicable activities will be issued by the requesting command. Para. 7.4.2 provides information for preparation of Type "C" AIS Reports.

7.4.1 Type "B" Annual Inspection Summary

1. **TYPE OF PROPERTY.** Type "B" Annual Inspection Summary (Figures 7-1 and 7-2) shall be used to report conditions for the following types of property:

a. Naval Property, not including Industrial Facilities, which is outleased, or outpermitted, to others.

b. Naval Property, not including Industrial Facilities, which has been declared excess or surplus and is pending lease, transfer or sale, and for which the Navy is responsible for protection, maintenance and repair until such time that this responsibility is transferred to the disposal agency. Also included is property of activities which have been disestablished and which are not covered under reports for other types of property.

c. Naval Property, not including Industrial Facilities, which has been sold or transferred with a provision for recapture in event of a national emergency.

2. **INSPECTION.**

a. **Category of Inspection. The** data for preparing a Type "B" Annual Inspection Summary are usually obtained from a one-time comprehensive inspection, as opposed to regular inspections.

b. **Inspection Party.** It is desirable that the inspector be accompanied by a representative of the lessee, or owner, so the lessee or owner will be more conversant with the deficiencies listed.

c. **Inspector's Recommendations.** The Inspector's Recommendations, as shown in the summary, shall be in consonance with facilities categorization code levels for Naval installations; the terms of the lease, permit, or sales contract; and the Condition Report for Leased Property, if one was prepared.

d. **Facilities Categorization Codes.** In general, the facilities categorization codes for outleased Naval property shall be the same as those for Naval installations in an active status. The lease, permit or sales contract will specify the lessee's, permittees' or owners' responsibility for maintenance and may modify the required amount of maintenance. Copies of such documents should be reviewed prior to each inspection. When a Condition Report for Leased Property has been made the maintenance required of the lessee cannot be more than that required to return the property to the condition shown in the report, unless the lease specifically states otherwise.

Type B ANNUAL INSPECTION SUMMARY NAVFAC 9-11014/48 (9-69) Supersedes NAVDOCKS 2711	Instructions for completing form are contained in NAVFAC MO-322	REPORT NAVFAC 11014.2
1 FROM Date By Direction	2 TO 3 VIA	4 PROPERTY 5 FOR YEAR ENDING
9 FIRST ENDORSEMENT FROM: 1. FORWARDED 2. COMMENTS ATTACHED Date By Direction	10 COPIES TO	6 SHEET OF 7 LEASE OR CONTRACT NO. 8 INSPECTED BY
11 ☐ LESSEE ☐ OWNER		12 EST. REACTIVATION COST $_____
13 FIELD REPRESENTATIVE OF GOVERNMENT		
14 MAINTENANCE RESPONSIBILITY		
15 MAINTENANCE ACTION		

DEFICIENCIES

CATEGORY CODE 16	DESCRIPTION 17	ESTIMATED COST LESSEE OROWNER 18	NAVY 19	PRIORITY 20

Figure 7-l
Form for Type "B" AIS

Type B ANNUAL INSPECTION SUMMARY CONTINUATION SHEET NAVFAC 9-11014/48A (9-69)				REPORT NAVFAC 11014-2
1. PROPERTY				6 SHEET Of
CATEGORY CODE 16	DESCRIPTION 17	ESTIMATED COST LESSEE OR OWNER 18	 NAVY 19	 PRIORITY 20

Figure 7-2
Form for Type "B" AIS

e. **Inspection Scheduling.** Inspections shall be scheduled no later than 12 months after the previous inspection.

3. **WHEN TO SUBMIT.** Submit upon request of the cognizant Major Claimant, or its field representative.

a. Who. For Naval property, not including Industrial Facilities, which is outleased or outpermitted to others, the Type "B" Annual Inspection Summary shall be prepared and forwarded to the Major Claimant as follows:

(1) For the above described property which is located on an active Naval activity having a Public Works Department, the Public Works Officer shall prepare and forward the Type "B" Annual Inspection Summary to the Major Claimant, via the EFD.

(2) For property in the custody of the Naval Facilities Engineering Command, the summary shall be prepared and forwarded to the NAVFACENGCOM by the EFD. For property not in the custody of the NAVFACENGCOM, and for property which has been sold or transferred with a provision for recapture the summary shall be prepared and forwarded by the EFD to the requesting Major Claimant and activity with one copy to the Commander, Naval Facilities Engineering Command.

4. **COMPOSITION.** The Type "B" Annual Inspection Summary shall be prepared on Form NAVFAC 9-11014/48 (9-69), Type "B" Annual Inspection Summary, and Form NAVFAC 9-11014/48A (9-69), Type "B" Annual Inspection Summary Continuation Sheet. No forwarding letter is required. Report symbol NAVFAC 11014-2 applies.

a. **Information Source.** This type of summary shall show all deficiencies, except those of a housekeeping nature (for example, items costing less than $1,000 to correct), together with estimated correction costs. When correction action on any deficiency has been initiated, but not completed, notation shall be made to that effect. The property subject to inclusion in the Type "B" Annual Inspection Summary includes not only that classified by Category Codes, but also shop cranes and hoists and Public Works shop equipment for maintenance and production facilities.

5. **INSTRUCTIONS FOR COMPLETING FORMS NAVFAC 9-11014/48 (9-69) AND 11014/48A (9-69), TYPE "B" ANNUAL INSPECTION SUMMARY AND TYPE "B" ANNUAL INSPECTION SUMMARY CONTINUATION SHEET.**

a. **Action-Activity.** The submitting activity shall provide appropriate entries in Blocks 1 through 5, 8 and 9, and Columns 10 through 13. (If the summary is prepared by the EFD, this action will be completed by the EFD.)

b. **Action-EFD.** The EFD shall provide appropriate entries in Blocks 7 and 14.

c. **Subparagraph Numbers.** Refer to Numbered Blocks or Columns on Forms NAVFAC 9-11014/48 and 9-11014/48A.

(1) **From.** Insert abbreviated title of Command and Activity forwarding report. If "By Direction" is not applicable, xxx it out. Indicate date report was forwarded.

(2) **To.** Insert title of Command or Office to whom report is to be sent, i.e., "Commander, NAVFAC (16)."

(3) **Via.** Insert title of the appropriate Command or Commands through which the Summary will be forwarded.

(4) **Property.** Identify the property or facility being reported, for example, "NAD Underground," "Former MCAS Eagle Mtn. Lake."

(5) **For Year Ending.** Show date for end of period covered by this report.

(6) **Sheet.** Show sheet number and total number of sheets in report.

(7) **Lease or Contract** No. Show lease or contract number, if applicable. If none, insert "None." For purpose of this report, licenses or permits are considered leases.

(8) **Inspection By.** Indicate the activity which performed the inspection, such as EFD, MCBC, etc.

(9) **First Endorsement.** To be completed by the first Command shown in Block 3 Indicate date report was forwarded. If "By Direction" is not applicable, cross it out. Comments may be added on either Form NAVFAC 9-11014/48 (9-69), or 9-11014/48A (9-69), if space is available, otherwise use attached sheets. If comments are not applicable, cross out item 2, "Comments attached." Additional endorsements, if required, may be made at the end of the summary.

(10) **Copies To.** Indicate by abbreviated titles those Commands or offices to whom copies of this report are to be forwarded.

(11) **Lessee, Owner.** Check appropriate box and provide name and address of lessee or owner.

(12) **Estimated Reactivation Cost.** Indicate the estimated current dollar cost that would be required to restore this property to an active operational status.

(13) **Field Representative of Government.** Insert the title of the Government's field representative designated in the lease.

(14) **Maintenance Responsibility.** Insert the clause number(s) in the lease, or the National Security Clause, which delineate(s) the maintenance responsibility of the lessee or owner. Provide a brief description of this clause.

(15) **Maintenance Action.** Cross out "(is)" or "(is not)" and cross out "(lease)" or "(contract)" in the printed statement as appropriate. If "(is)" is crossed out, describe briefly the action taken by the Government field representative to obtain effective lessee maintenance.

(16) thru (20) **Deficiencies.** The deficiencies discovered during the inspection are to be listed in Columns 16 through 20, except that deficiencies of a housekeeping nature (for example, items costing less than $1,000 to correct are not to be shown). When corrective action on any deficiency has been initiated, but not completed, the deficiency should be listed and notation "started" placed in Column 18 or 19.

(16) **Category Code.** The appropriate category code is to be taken from NAVFAC P-72, Category Codes for Navy Facilities Assets. Leave this column blank when deficiencies for Class III Plant Account items, or non-plant account items, are shown. For each deficiency listed, show in Column 16 the applicable Navy Category Code (5-digits).

(17) **Description.** List separately in Column 17 each deficiency to be included in the summary, including the apparent cause and the effect on the property, if the deficiency is not promptly corrected.

(18 & 19) **Estimated Cost.** For each deficiency listed, enter the estimated deficiency correction cost. Place the entry in Column 18 if the lessee or owner is responsible for correcting the deficiency. When there is a divided responsibility for correcting the deficiency, indicate the appropriate portion of the estimated cost in each of the columns. Provide a total for each column at the end of the summary.

(20) **Priority.** This Column is to be used only to classify the deficiencies that should be corrected by the Navy. Those items that are considered necessary to protect the Government's interest, and to maintain readiness of the property, are to be indicated as N1, N2, N3, etc.; the lower the figure representing highest urgency or priority. The remaining items that, while desirable, do not appear immediately essential to main-

tain readiness of the property, are to be indicated D1, D2, D3, etc.; the lower figures representing the most desirable.

7.4.2 Type "C" Annual Inspection Summary

1. **TYPE OF PROPERTY. A** Type "C" Annual Inspection Summary (Figure 7-3, 7-4) shall be used to report conditions for the following types of property:

a. Navy-owned Industrial Facilities which, during peacetime are leased, with termination provisions, for civilian operations; are maintained as an unused standby; or are being operated under a facilities contract.

b. Privately-owned Industrial Plants (Part of the Departmental Plant Reserve) in which the Navy has a legal right, through the National Security Clause or similar provisions, to occupancy, use or priority for production, if needed.

c. National Industrial Plant Reserve Plants.

2. **INSPECTION. The** data for preparing a Type "C" Annual Inspection Summary are obtained from a one-time comprehensive inspection, rather than a result of regular inspections. The summary shall provide a detailed report for use of the major claimant. Generally, the inspection scope should be sufficient to determine the general maintenance level attained and to indicate major deficiencies. Where a National Security Clause is contained in the sales document, the inspection should be sufficiently detailed to ensure that the owner fulfills his maintenance obligations.

a. **Inspection Party.** It is desirable that the inspector be accompanied by a representative of the lessee or owner, and a representative of the major claimant. In those instances where the property, lease, permit, license or sales contract is under the cognizance of the General Services Administration (GSA), an authorized GSA representative should accompany the inspector. In those instances where the maintenance obligation responsibility between the lessee, or owner, and the Navy may be difficult to ascertain, the inspector should be accompanied by a representative of the EFD, Real Estate Division, who shall provide, or obtain, prompt interpretation of maintenance responsibilities.

b. **Inspector's Recommendations.** The inspector's recommendations, as shown in the summary, shall be made in accordance with maintenance levels for industrial plants; terms of the lease, permit, license or sales contract; and condition report for leased property, if one was prepared. When a deficiency is noted, it is desirable that the parties concerned agree as to deficiency correction responsibility. If the parties concerned cannot agree as to deficiency correction responsibilities, all pertinent facts shall be noted in

TYPE C ANNUAL INSPECTION SUMMARY - 1
NAVFAC 8-11014/48 (9-69)
Supersedes NAVDOCKS 2713
S/N 0105-004-0060

Instructions for completing form are contained in NAVFAC MO-322

REPORT NAVFAC 11014-3

1. FROM
Date By Direction

2. TO

3. DATE OF INSPECTION

4. COPIES TO

5. SHEET 1 OF

6. ☐ OWNER ☐ LESSEE ☐ CONTRACTOR

7. LEASE OR CONTRACT NO.

8. TYPE OF PLANT ☐ DRP ☐ NIRP

9. INSPECTION PARTY
NAME TITLE REPRESENTING

10. DOD PLANT NUMBER

11. PLANNED MOBILIZATION PRODUCT

12. OVERALL CONDITION OF FACILITIES

	PREVIOUS REPORT	*THIS REPORT*
☐	EXCELLENT	☐
☐	GOOD	☐
☐	FAIR	☐
☐	POOR	☐

13. REACTIVATION
COST $ _____
TIME _____ MANDAYS

14. USE - *Production similar to planned mobilization product.*
☐ YES ☐ NO

15. SPONSORING COMMAND ☐ ☐ ☐

16. CORRECTIVE MEASURES TAKEN SINCE LAST REPORT

SUMMARY OF DEFICIENCIES

METHOD OF ACCOMPLISHMENT	MARK	ESTIMATED COST (TO BE CORRECTED WITHIN)			
		PREVIOUS REPORT		THIS REPORT	
		12 MONTHS 17	24 MONTHS 18	12 MONTHS 19	24 MONTHS 20
DEFICIENCIES TO BE CORRECTED BY LESSEE UNDER TERMS OF THE LEASE.	A				
DEFICIENCIES TO BE CORRECTED FROM MAINTENANCE FUNDS PROVIDED BY THE LESSEE.	B				
DEFICIENCIES TO BE CORRECTED FROM FUNDS PROVIDED BY THE SPONSORING COMMAND.	C				
DEFICIENCIES TO BE CORRECTED BY GSA.	D				
DEFICIENCIES TO BE CORRECTED BY OWNER UNDER TERMS OF THE SALES CONTRACT.	E				
TOTALS					

A-7253

Figure 7-3
Type "C" Annual Inspection Summary Form
Summary- 1

TYPE C ANNUAL INSPECTION SUMMARY - 2

NAVFAC 9-11014/88 (9-88)
Supersedes NAVDOCKS 2714
S/N 0109-004-0065

REPORT NAVFAC 11014-9

5. SHEET OF

6. OWNER. LESSEE. CONTRACTOR

7. LEASE OR CONTRACT NO.

21	DESCRIPTION 22	QUANTITY 23	MARK 24	ESTIMATED COST			
				12 MONTHS	24 MONTHS	AT REACTIVATION	
				COST $ 25	COST $ 26	TIME MANDAYS 27	COST $ 28

Figure 7-4
Type “C” Annual Inspection Summary Form
Summary-2

the summary in order that appropriate action may be taken at Departmental level. In the case of deficiencies at plants of the National Industrial Plant Reserve, it is most desirable that the EFD representative, and the authorized GSA field representative, agree on interpretation of the lease or sales contract, and the estimated deficiency costs that are the responsibility of the lessee or purchaser. In the case of plants that have been sold, the inspector's judgment must reflect the owner's responsibility contingent upon his use of the facility and seriousness of the deficiency. One-time comprehensive inspections providing rehabilitation estimates need not be made each year, provided significant changes have not occurred since the previous report.

c. **Maintenance Levels.** Maintenance levels for industrial plants are provided by the responsible major claimant. The lease, permit, license or sales contract, or the National Security Clause of such document, will specify lessees', permittees' or owners' responsibility for maintenance; and may modify the maintenance level required. Where copies of applicable leases, permits, licenses, or sales contracts are not available in the EFD, they should be reviewed at the office of the major claimant's field representative prior to each inspection. Where a Condition Report for Leased Property has been made, the maintenance required of the lessee cannot be more than that required to return the property to the condition shown in the report, unless the lease specifically states otherwise.

d. **Inspection Scheduling.** Industrial Plant inspections shall be scheduled by the EFD so summaries will reach the major claimant prior to 1 December of each year.

3. **WHEN TO SUBMIT.** Submit annually, at no later than 12-month intervals. Submit upon request of the cognizant major claimant, or its field representative, for all other property. When a cognizant major claimant, or its field representative, has previously requested that a property inspection be made, and the request is not limited to a one-time comprehensive inspection, the EFD shall submit summaries at no later than 12-month intervals. Summaries shall be forwarded to reach the cognizant major claimant prior to 1 December each year.

4. **WHO.** The summary shall be prepared by the geographical EFD in which the property is located. Following will be their responsibilities:

(1) Establishing inspection dates,

(2) Facilities inspection to determine their physical condition,

(3) Providing technical recommendations for deficiencies correction,

(4) Providing cost estimates for deficiencies correction, and

(5) Preparing the Type "C" Annual Inspection Summary.

5. **DISTRIBUTION.** Semi-annual summaries are made only at the request of the cognizant Major Claimant. Copies of the report will be submitted to the Major Claimant only.

6. **COMPOSITION.** The Type "C" Annual Inspection Summary shall be prepared on Form NAVFAC 9-11014/49 (9-69) Type "C" Annual Inspection Summary-1 and Form NAVFAC 9-11014/50 (9-69) Type "C" Annual Inspection Summary-2. Figure 7-5 and Figure 7-6 are sample completed forms of a Type "C" Annual Inspection Summary.

a. **Information Source.** This type of summary shall include all deficiencies, except those of a housekeeping nature (for example, items costing less than $1,000 to correct), together with an estimated correction cost. When corrective action on any deficiency has been initiated, but not completed, notation shall be made to that effect. The property subject to inclusion in the Type "C" Annual Inspection Summary also includes the following:

(1) Public works shop equipment for maintenance and production facilities.

(2) Fire extinguisher systems.

(3) Locomotives, railroad rolling stock, materials-handling equipment and weight-handling equipment.

(4) Production equipment only if requested by the cognizant major claimant or its field representative.

b. **Instructions for Completing Forms NAVFAC 9-11014/49 (9-69) Type** "C' **Annual Inspection Summary-l and NAVFAC 9-11014/50 (6-69) Type "C" Annual Inspection Summary-2.** Subparagraph numbers, following, refer to numbered Blocks or Columns on Forms NAVFAC 9-11014/49 and 9-11014/50:

(1) **From.** Insert abbreviated title of Command and Activity forwarding report. Signature of Commander/Commanding Officer, EFD, or other person authorized to forward report. If "By Direction" is not applicable, cross it out. Indicate date report was forwarded.

(2) **To.** Insert title of Command or Office to whom report is to be sent.

(3) **Date of Inspection.** Show date inspection was completed.

NAVFAC 9-11014/48 (REV.9/88)
S/N 0108-004-0060

REPORT NAVFAC 11014-2
REPORT NAVFAC 11014-3

ANNUAL INSPECTION SUMMARY

AIS TYPE "B" ☐ "C" ☒ OR — FOR YEAR ENDING

1. FROM NAVAIRSYSCOM
DATE 20 MAR
BY DIRECTION Judithanne P. Hire

2. TO TELEDYNE CAE

3. DATE OF INSPECTION 28-31 JANUARY 1991

4. VIA

5. SHEET 1 OF 12

6. ☐ OWNER ☒ LESSEE TELEDYNE CAE ☐ CONTR.

7. COPIES TO
NAVAIRSYSCOM
RDNAVFACENGCOM(CODE RD06)

8. LEASE/CONTRACT NO.
N00019-90-E- 9006

10. INSPECTION PARTY

NAME	TITLE	REPRESENTING
SEE ATTACHED LIST		

9. TYPE OF PLANT
☐ DRP ☐ NIRP ☐ NIROP ☒ NWRP

11. DOD PLANT NUMBER N/A

12. PLAN MOBILIZATION PRODUCT
MISSLE GAS TURBINE ENGINES

14. REACTIVATION
COST _____
TIME ____LABOR DAYS

15. USE PRODUCTION SIMILAR TO ITEM 12
☐ YES ☐ NO

16. SPONSORING COMMAND
☐ NAVSEA
☒ NAVAIR
☐ _____

13. OVERALL CONDITION OF FACILITIES

	PREVIOUS AIS	THIS AIS
EXCELLENT	☐	☐
GOOD	☒	☒
FAIR	☐	☐
POOR	☐	☐

17. CORRECTIVE MEASURES TAKEN SINCE LAST AIS
SEE ATTACHED SHEETS

18. MAINTENANCE PROGRAM ASSESSMENT/ SPECIAL REQUIREMENTS
SEE ATTACHED SHEETS

19.-22. SUMMARY OF DEFICIENCIES (TYPE "C" ONLY)

METHOD OF ACCOMPLISHMENT CODE (MAC) DESCRIPTION	MAC	ESTIMATE COST (TO BE CORRECTED WITHIN) PREVIOUS AIS 12 MONTHS 19.	PREVIOUS AIS 24 MONTHS 20.	THIS AIS 12 MONTHS 21.	THIS AIS 24 MONTHS 22.
DEFICIENCIES TO BE CORRECTED BY LESSEE UNDER THE TERMS OF THE LEASE.	A	N/A	N/A	N/A	N/A
DEFICIENCIES TO BE CORRECTED FROM MAINT. FUNDS PROVIDED BY THE LESSEE.	B				
DEFICIENCIES TO BE CORRECTED FROM FUNDS PROVIDED BY THE SPONSORING COMMAND.	C	2,572,000	10,882,000	8,136,000	15,791,000
DEFICIENCIES TO BE CORRECTED BY GSA.	D				
DEFICIENCIES TO BE CORRECTED BY OWNER UNDER TERMS OF THE SALES CONTRACT.	E				
TOTALS		2,572,000	10,882,000	8,136,000	15,791,000

Figure 7-5
Example of Completed Form
Summary-l

TYPE C ANNUAL INSPECTION SUMMARY - 2

REPORT NAVFAC 11014-3

NAVFAC 9-11014/90 (9-80)
Supersedes NAVDOCKS 1734
S/N 0109-004-0065

SHEET 4 OF 12

6. OWNER, LESSEE, CONTRACTOR
Teledyne CAE, Toledo, OH

7. LEASE OR CONTRACT NO.
N00019-90-E-9006

21	DESCRIPTION 22						
	Building:						
001	Replace one 500 KVA, 7,200/480 Volt electrical transformer in Substation 4.	LS	C	X			
002	Replace non-energy efficient window.	LS	C	X			
003	Rehabilitate hydraulic press pit.	LS	C	X			
004	R&lace ceiling in Metallurgical Lab.	LS	C		X		
005	Replace oil filled circuit breaker in Substation 1.	LS	C	X			
006	Remove asbestos, in air conditioning room. (Environmental compliance)	LS	C	X			
007	Replace creosote-block floor.	LS	C	X			
008	Replace office lighting fixtures.	LS	C	X			
009	Reduce cromic acid mist and other emissions in material cleaning, coating and plating area.	LS	C	X			
010	Replace flooring material that contains asbestos.	LS	c		X		
011	Repair major blisters and east/west expansion joints. Recoat main roof with fibrated aluminum coating.	LS	C	X			
012	Install fire wall in manufacturing area from north to south walls.	LS	C	X			
013	Consolidate office area air conditioning systems into one energy efficient system.	LS	C	X			
014	Insulate attics over office areas.	LS	C	X			
015	Rehabilitate steam heating delivery system to provide additional steam	LS	C	X			

Figure 7-6
Example of Completed Form
Summary-2

(4) **Copies To.** Indicate by abbreviated titles those Commands, or Offices to whom copies of this report are to be forwarded.

(5) **Sheet.** Show sheet number and total number of sheets in report.

(6) **Owner, Lessee or Contractor.** Check appropriate box and provide name and address of owner, lessee or contractor.

(7) **Lease or Contract** No. Show lease or contract number, if applicable. If none, insert "None." For purpose of this report, licenses and permits are considered leases.

(8) **Type of Plant.** Check appropriate box.

(9) **Inspection Party.** List members of inspection party by name, title and the organization they represent.

(10) **DOD Plant Number.** If this property has been assigned a DOD plant number, show that number. If none, insert "None."

(11) **Planned Mobilization Product.** Indicate the product planned for production in this plant when mobilization occurs.

(12) **Overall Condition of Facilities.** Check the appropriate box for this report and also check the appropriate box for the condition reported in the previous report.

(13) **Reactivation.** Show the estimated dollar cost and mandays necessary to place the facilities, not including production equipment, in the proper condition to produce the planned mobilization product. These entries should be the same as the sum total of Columns 27 and 28. If these estimates for reactivation have been repeated from the previous reports, notation shall be made to that effect.

(14) **Use.** If the plant is being used for its intended purpose, that is, the production of a product similar to the planned mobilization product, place a check mark in the YES box. If not, place a check mark in the NO box.

(15) **Sponsoring Command.** Check the appropriate box. If necessary, insert the brief title of the major claimant.

(16) **Corrective Measures Taken Since Last Report.** Provide a brief statement as to corrective measures taken and maintenance accomplished since the previous inspection. Discrepancies from the requirements of the lease or sales contract

shall be noted with an indication as to the cause of these discrepancies and the measures taken to correct them, including recommendations to higher authority. If necessary, continue on blank sheets.

(17 thru (20) **Summary of Deficiencies.** This part provides a summary of estimated deficiency costs discovered during the inspection, classified by the method for accomplishing the deficiencies correction. Data for Columns 19 and 20 are taken from Columns 25 and 26, classified by the mark in Column 24. Data for Columns 17 and 18 shall be taken from Columns 19 and 20 of the previous report.

(21) thru (28) **Deficiencies.** The deficiencies discovered during the inspection are to be listed in Columns 21 through 28, except that deficiencies of a housekeeping nature (for example, items costing less than $1,000 to correct) are not to be shown. When corrective action on any deficiency has been initiated, but not completed, the deficiency should be listed and a notation "Started" placed in Column 25 or 26. Deficiencies corrected before the inspection is completed should not be listed. Data is required for three classifications of deficiencies: (a) those requiring corrective action within the ensuing twelve months, (b) those requiring corrective action within the ensuing twenty-four months, and (c) those requiring corrective action only when the property is reactivated for mobilization production.

(22) **Description.** List separately each deficiency to be included in the summary, including the apparent cause and effect on the property if the deficiency is not promptly corrected.

(23) **Quantity.** For each deficiency listed in Column 22, indicate where appropriate, the quantity involved in correcting the deficiency. For example for paving, 1000 SY; for concrete work, 20 CY; for pipe replacement, 1275 LF.

(24) **Mark.** Each deficiency which should be corrected within the ensuing 12 or 24 month period shall be identified to indicate correction responsibility. The mark to be applied shall be determined by the Major Claimant's field representative as follows:

(a) For those deficiencies in outleased Departmental Reserve Plants, or outleased plants of the National Industrial Plant Reserve, in the custody of GSA, that should normally be corrected by the lessee at his own expense under the terms of the lease.

(b) For those deficiencies in outleased Departmental Reserve Plants that should be corrected from maintenance funds provided by the lessee in lieu of cash rental under the terms of the lease, and as directed by government representative for

the lease.

(c) For those deficiencies in outleased Departmental Reserve Plants that should be corrected from funds provided by the cognizant primary support authority.

(d) For those deficiencies in outleased plants of the National Industrial Plant Reserve, in the custody of GSA, that should be corrected by GSA with its appropriated funds. Indicate whether the deficiency is serious enough to recommend that GSA request an appropriation for correction in its next budget submission.

(e) For those deficiencies in Departmental Plants, or plants of the National Industrial Plant Reserve, which have been sold; that should be corrected by the purchaser (owner) under the terms of the sales contract.

(25) and (26) **Estimated Cost.** Provide a cost estimate for each deficiency correction listed in Column 22. If the deficiency should be corrected in the ensuing 12 months, list the cost estimate in Column 25. If the deficiency should be corrected within 13 to 24 months, list the cost estimate in Column 26.

(27) and (28) **Estimated Cost at Reactivation.** This covers the rehabilitation required to reactivate the plant, not including production equipment, for planned peak production, and includes the number of mandays required, Column 27. The dollar figure, Column 28, for reactivation rehabilitation is in addition to the cost for deficiencies correction within the 12 month and 24 month periods.

CHAPTER 8. THE BASE ENGINEERING SUPPORT, TECHNICAL (BEST) SYSTEM

8.1 OBJECTIVE. The objective of BEST is to provide Public Works personnel with a simple, flexible, interactive ADP system to track workload that is easy to operate.

8.2 DISCUSSION. BEST is a "tool" that automates the Navy's facilities management system. It consists of standard user-friendly software and features independent functional modules. There are separate equipment suites for maintenance, housing and transportation functional areas. The Maintenance/Utilities subsystem consists of five modules:

- Emergency Service (E/S)
- Shore Facilities Inspection (SFI)
- Work Input Control (WIC)
- Facilities Engineering Job Estimating (FEJE)
- Utilities (UT)

Central processing unit and storage device sizes and the number of work stations and printers will vary among activities. The modular system is flexible and versatile enough to accommodate most Public Works Department needs. A microcomputer version is available as well as the Honeywell mini version. Other functions are automated or being developed to complement the BEST system as part of a Public Works Management Automation (PWMA) micro initiative. BEST is a large portion of the PWMA pie. More detailed information concerning BEST and the five Maintenance/Utilities modules can be found in the "Management Guide, Maintenance/Utilities Subsystem, Base Engineering Support, Technical" and the user's manuals for the individual modules.

8.3 THE SFI MODULE. The SFI Module automates the Shore Facility Inspection/Assessment System. The SFI Module automates the normal clerical functions and scheduling operations associated with management of both the Control Inspection (CI) program for facilities and the Preventive Maintenance Inspection (PMI) programs for dynamic equipment. The SFI module contains two (2) sub-modules, CI and PMI.

8.3.1 Inventory. An effective use of the SFI Module is an accurate facilities and dynamic equipment inventory. This is essential for CI and PMI programs whether managed through the SFI Module or manually. It includes such items as facility number and name, priority, inspection frequency, map grid, and zone. PMI equipment inventories include equipment name, number and inventory code. After initial data input and start-up, a procedure for inventory update must be established to maintain accurate inventories. The FME Division is the focal point for gathering changes to data elements

and input of revisions into the system.

8.3.2 Inspection Frequencies And Standard Hours. CI and PMI require different methods of putting in inspection frequencies and standard hours.

8.3.2.1 CI Frequencies and Standard Hours. Frequencies and hours are entered directly into the CI sub-module. Type inspection, frequency, and standard hours are entered for each facility. Each inspection-can then be scheduled. After the final schedule is approved, the system generates inspection work orders. Upon completion, actual labor hours expended can be matched to the schedule for performance reports and unaccomplished inspections.

8.3.2.2 PMI Frequencies and Standard Hours. Frequencies and hours are estimated in the FEJE Module. A job order for a particular type of equipment is written, one phase per frequency. Appropriate checkpoints and pertinent equipment are attached. The job order is then sent from FEJE to SFI, ready for each phase to be scheduled.

8.3.3 Scheduling. The SFI module allows the user to decide which week of the fiscal year each inspection should take place and when the phases should be scheduled. In this manner total hours per quarter, month, or week can be obtained. This report helps the scheduler develop the Work Plan Summary for the Shop Load Plan in the WIC module.

8.3.4 Management Reports On Facility/Equipment Condition. The System can be queried at any time and management reports generated. This flexibility provides an effective tool to the PW manager to ascertain the current condition of any facility or piece of equipment. Overall, this leads to better work scheduling, project selection, and maintenance. A detailed description of management reports and indicators can be found in the BEST "Management Guide."

REFERENCES

Directives

1. DOD 4165.2, DOD Real Property Maintenance Activities Program

2. NAVFACINST 11010.44D, Shore Facilities Planning Manual

3. NAVFACINST 11012.139, Facility Post-Occupancy Evaluation Program

4. OPNAVINST 3501.167B, Shore Base Readiness Report (BASEREP)

5. OPNAVINST 11000.16A Command Responsibility for Shore Activity Land and Facilities

6. OPNAVINST 11010.23D, Management of Real Property Maintenance Activities

7. OPNAVINST 11010.34B, Annual Inspection Summary; Instructions for Preparation and Submission of

Manuals

1. OPNAVINST 11010.20E, Facilities Projects Manual

2. NAVMAT P-5100, Safety Precautions for Shore Activities

3. BEST Users' Manuals and Management Guide

4. NAVFAC MO-104, Maintenance of Waterfront Facilities

5. NAVFAC MO-110, Paints and Protective Coatings

6. NAVFAC MO-111, Building Maintenance; Structures

7. NAVFAC MO-113, Maintenance & Repair of Roofs

8. MIL-HDBK-1114/2, Maintenance & Operation of Heating Systems

9. NAVFAC MO-114, Vo1 3, Maintenance & Operation of Ventilation Systems

10. NAVFAC MO-116, Electrical Interior Facilities

11. NAVFAC MO-117, Maintenance of Fire Protection Systems

12. NAVFAC MO-124, Mooring Maintenance

13. NAVFAC MO-200, Facilities Engineering -- Electrical Exterior Facilities

14. NAVFAC MO-205, Central Heating & Steam Electric Generating Plants

15. NAVFAC MO-206, Operation and Maintenance of Air Compressor Plants

16. NAVFAC MO-209, Maintenance of Steam, Hot Water and Compressed Air Distribution Systems

17. NAVFAC MO-210, Maintenance & Operation of Water Supply System, Treatment & Distribution Systems

18. NAVFAC MO-230, Maintenance & Operation of Petroleum Fuel Facilities

19. MIL-HDBK-1130, Inactivation, Caretaker Maintenance and Reactivation of Shore Facilities

20. NAVFAC MO-312, Wood Protection

21. NAVFAC MO-321, Facilities Management

22. NAVFAC MO-322, Inspection of Shore Facilities Volumes 2 and 3.

23. NAVFAC P-68, Contracting Manual

24. NAVFAC P-72, Department of the Navy Facility Category Codes

25. NAVFAC P-164, Detailed Inventory of Naval Shore Facilities

26. NAVFAC P-318, Organization and Functions for Public Works Departments

27. NAVFAC P-349, NAVFAC Documentation Index

28. NAVFAC P-700, (Series), Engineered Performance Standards

29. NAVFAC P-716, Unit Price Standards Handbook

30. NAVFAC P-930, Navy Family Housing Manual

APPENDIX A
Sample Guides For Developing Utility Systems Pseudofacility Numbers

PSEUDOFACILITY NUMBERS
(UTILITY SYSTEMS)

Pseudofacility numbers for activity utility systems are composed of two parts as follows:

Utility Service Code	**Utility Description Code**
(Numeric)	(One alpha character and one or two numeric characters)

TABLE 1
Utility Service Codes: (Choose One)

Codes	Utility Service
11	AC Electricity
12	DC Electricity
15	Fresh Water
16	Salt Water
21	Steam
23	Small Plants
24	Heating Systems
25	Sewage
26	Industrial Waste
31	Natural Gas
35	Compressed Air
36	Oxygen Distribution
37	Condensate

TABLE 2
Utility Description Codes: (Choose One)

	Description	Codes
1.	Electrical Cable = Circuit Numbers = Emergency Circuit	A (Add to circuit; i.e. Al) 1...89 Select one Number for each circuit 90-99
2.	Electrical Duct 3" and Under = Number of Holes =	B (Add to holes; i.e., B-4) l...l5 Select one number for each duct
3.	Electrical Duct Over 3" = Number of Holes =	C (Add to holes; i.e., C2) 1...15
4.	Transformers = 500KV and Under = Over 500KV =	D 1...50/ number each transformer 51...99/ as appropriate
5.	Transformer Pads = 500KV and Under = Over 500KV =	E 1...50/ number each pad 51...99/ as appropriate
6.	Transformer Vaults 500KV and Under = Over 500KV =	F 1...50/ number each vault 51...99/ as appropriate
7.	Transformer Manholes 500KV and Under = Over 500KV =	G 1...50/ number each manhole 51...99/ as appropriate
8.	Street Lighting = 500KV and Under = Over 500KV =	H 1...50/ number each circuit/section 51...99/ as appropriate

TABLE 2 (Continued)
Utility Description Codes: (Choose One)

	Description	Codes
9.	Electrical Sub-station =	1...99 For last two digits use assigned substation number or serialization beginning with 01 and ending with 99
10.	Telephone Duct 3" and under = Number of Holes =	L (Add to holes; i e., L5) 1...15 Select one number for each duct
11.	Telephone Duct over 3" = Number of Holes =	M (Add to holes; i.e., M3) 1...15 Select one number for each duct
12.	Piping = Less than 2" = From 2" to 4 1/2" = 5" to 10" = Over 12" =	P (Add to size: i.e., P4) 1 Choose one number for each 2 type of pipe 3 4
13.	Steam Manholes =	R (Stand-alone Code)
14.	Sewer Manholes =	S (Stand-alone Code)
15.	Sewer Lines =	T (Stand-alone Code
16.	Gas/Air/Oxygen Lines	V (Stand-alone Code)

APPENDIX B
Minimum Recommended Frequencies
for
Control Inspection

Use of minimum Control Inspection frequencies is not mandatory. They will however be the basis for AIS Reporting to insure Navy-wide consistency in inspection coverage determination. They are also provided as a reasonable basis for Control Inspection scheduling. Activities may wish to accelerate frequencies based on special mission requirements.

CONTROL INSPECTION FREQUENCIES
(YEARS)

LMC[1]	Mission Relationship[2]	TYPE OF INSPECTION[3] Structural*	Electrical	Mechanical	Roofing
A	Direct Mission Support	2	2	2	1
B	Indirect Mission Support	3	3	3	1
C	Non-Mission Support	4	4	4	2
D&E	Inactive or Excess	5	5	5	3

*Inspect camels in group LMCs A&B annually and LMCs C&D bi-annually

NOTE 1. - Level of Maintenance Classification

NOTE 2. - Example. Active aircraft hangar = direct mission; admin, BEQ, BOQ = indirect mission support; recreational pavilion = non-mission support. Group designation is an individual activity decision based on common sense.

NOTE 3. - Specialized inspections of elevators, boilers, etc. are to be inspected at mandated frequencies as directed.

APPENDIX C
Control Inspection Times

These tables include times for physical inspection only. Initial data collection and analysis, travel, cost estimating and report writing are add-ons to times reflected. The tables are provided as a guide for preparing initial inspection schedules. During inspection performance, inspectors should record actual times for use in revising schedules.

Appendix C-1

STRUCTURAL INSPECTIONS	CONTROL INSPECTION FUNCTION Total Estimated Inspection Hours Per Facility																
CATEGORY CODE/ FACILITY TYPE	FACILITY SQUARE FOOTAGE (in thousands)																
	1	1.5	2	2.5	3	3.5	4	4.5	5	6	7	8	9	10	15	20	25
12xxx – Liquid Fueling/Dispensing	1.5	1.6	2.2	2.5	2.8	3.1	3.4	3.7	4.0	4.7	5.3	5.9	6.5	7.2	10.3	13.4	16.5
13xxx – Communications	1.7	2.1	2.4	2.8	3.1	3.5	3.9	4.2	4.6	5.3	6.0	6.7	7.4	8.1	11.7	15.3	18.9
14xxx – Land Operations Facilities	1.3	1.6	1.8	2.1	2.3	2.6	2.8	3.1	3.3	3.6	4.3	4.8	5.3	5.8	8.3	10.8	13.3
16xxx – Harbor & Coastal Facilities	4.5	5.6	6.6	7.7	8.8	9.9	11.0	12.1	13.2	15.3	17.5	19.7	21.9	24.0	34.9	45.8	56.6
17xxx – Training Facilities	0.9	1.2	1.5	1.8	2.1	2.4	2.7	2.9	3.2	3.8	4.4	5.0	5.6	6.2	9.1	12.1	15.0
21xxx – Maintenance Facilities	2.4	2.6	2.7	2.8	2.9	3.1	3.2	3.3	3.4	3.7	3.9	4.2	4.4	4.6	5.9	7.1	8.3
31xxx – Science Laboratories	2.3	2.7	3.1	3.5	3.9	4.3	4.7	5.1	5.5	6.3	7.1	7.9	8.7	9.5	13.5	17.5	21.5
41xxx – Liquid Fuel Storage, Bulk	2.0	2.0	2.0	2.0	2.0	2	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
42xxx – Ammunition Storage	2.0	2.0	2.0	2.0	2.0	2	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
44xxx – General Supply Buildings	3.6	3.7	3.8	3.9	3.9	4	4.1	4.2	4.2	4.4	4.5	4.7	4.8	5.0	5.7	6.5	7.2
61xxx – Administration Buildings	1.3	1.5	1.7	1.9	2.2	2.4	2.8	2.8	3.1	3.5	4.0	4.4	4.9	5.3	7.6	9.9	12.2
69xxx – Administrative Structures	1.0	1.0	1.0	1.0	1.0	1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
71xxx – Family Housing	1.2	1.6	1.9	2.3	3.0	3	3.4	3.7	4.1	4.8	5.5	6.2	6.9	7.6	11.2	14.8	18.4
72xxx – Unaccompanied Personnel Hsg	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.8	3.9	4.1	4.3	4.5	4.7	4.9	5.8	6.8	7.7
73xxx – Community Facility – Personnel	1.9	2.0	2.1	2.2	2.3	2.3	2.4	2.5	2.6	2.8	3.0	3.2	3.4	3.6	4.5	5.4	6.3
74xxx – Community Facility – Moralc	2.6	2.7	2.9	3.0	3.3	3.3	3.4	3.6	3.7	4.0	4.3	4.6	4.9	5.2	6.6	8.0	9.4
81xxx – Electrical Power	2.7	3.0	3.3	3.5	4.0	4	4.3	4.6	4.8	5.4	5.9	6.4	6.9	7.5	10.1	12.7	15.4
8xxxx – Utilities & Grounds (excludes Roads)	2.1	2.3	2.5	2.6	3.0	3	3.1	3.3	3.5	3.8	4.1	4.5	4.8	5.1	6.8	8.5	10.1

ELECTRICAL INSPECTIONS	CONTROL INSPECTION FUNCTION Total Estimated Inspection Hours Per Facility																
CATEGORY CODE/ FACILITY TYPE	FACILITY SQUARE FOOTAGE (in thousands)																
	1	1.5	2	2.5	3	3.5	4	4.5	5	6	7	8	9	10	15	20	25
12xxx – Liquid Fueling/Dispensing	1.5	1.6	1.7	1.9	2.0	2.1	2.3	2.4	2.6	2.8	3.1	3.4	3.6	3.9	5.3	6.6	8.0
13xxx – Communications	2.9	3.1	3.4	3.6	3.8	4.1	4.3	4.5	4.8	5.3	5.7	6.2	6.7	7.2	9.5	11.9	14.3
14xxx – Land Operations Facilities	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.4	3.8	4.2	4.6	5.0	7.0	9.0	11.0
17xxx – Training Facilities	3.0	3.4	3.7	4.1	4.4	4.8	5.2	5.5	5.9	6.6	7.3	8.0	8.7	9.4	13.0	16.6	20.2
21xxx – Maintenance Facilities	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.6	1.9	2.1	2.3	2.5	2.7	2.9	4.0	5.0	6.0
31xxx – Science Laboratories	7.0	7.6	8.3	8.9	9.5	10.2	10.8	11.5	12.1	13.4	14.7	16.0	17.2	18.5	24.9	31.3	37.8
41xxx – Liquid Fuel Storage, Bulk	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
42xxx – Ammunition Storage	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
44xxx – General Supply Buildings	1.4	1.4	1.5	1.5	1.5	1.6	1.6	1.7	1.7	1.8	1.8	1.9	2.0	2.1	2.5	2.9	3.3
61xxx – Administration Buildings	2.7	3.1	3.6	4.0	4.4	4.8	5.2	5.6	6.1	6.9	7.7	8.6	9.4	10.2	14.4	18.6	22.7
71xxx – Family Housing	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
72xxx – Unaccompanied Personnel Hsg	3.8	3.9	3.9	4.0	4.0	4.1	4.1	4.2	4.2	4.3	4.4	4.5	4.6	4.7	5.2	5.8	6.3
73xxx – Community Facility – Personnel	2.0	2.2	2.4	2.6	2.9	3.1	3.3	3.5	3.8	4.2	4.7	5.1	5.6	6.0	8.3	10.6	12.9
74xxx – Community Facility – Morale	3.6	3.8	3.9	4.0	4.1	4.3	4.4	4.5	4.6	4.9	5.1	5.4	5.6	5.8	7.1	8.3	9.5
81xxx – Electrical Power	1.7	2.2	2.8	3.3	3.8	4.4	4.9	5.4	6.0	7.1	5.1	9.2	10.3	11.4	16.7	22.1	27.5
8xxxx – Utilities & Grounds (excludes Roads)	4.9	5.0	5.1	5.3	5.4	5.5	5.7	5.8	5.9	6.2	6.4	6.7	7.0	7.2	8.5	9.9	11.2

MECHANICAL INSPECTIONS	CONTROL INSPECTION FUNCTION Total Estimated Inspection Hours Per Facility																
CATEGORY CODE/ FACILITY TYPE	FACILITY SQUARE FOOTAGE (in thousands)																
	1	1.5	2	2.5	3	3.5	4	4.5	5	6	7	8	9	10	15	20	25
12xxx – Liquid Fueling/Dispensing	4.8	6.8	8.8	10.8	12.8	14.8	16.8	18.8	20.8	24.8	28.8	32.8	36.8	40.8	60.8	80.0	100.8
13xxx – Communications	1.7	1.9	2.2	2.4	2.6	2.9	3.1	3.3	3.6	4.1	4.5	5.0	5.5	6.0	8.3	10.7	13.1
14xxx – Land Operations Facilities	1.2	1.4	1.6	1.7	1.9	2.1	2.2	2.4	2.6	2.9	3.2	3.6	3.9	4.2	5.9	7.6	9.2
17xxx – Training Facilities	2.6	2.7	2.7	2.8	2.8	2.9	2.9	3.0	3.0	3.2	3.3	3.4	3.5	3.6	4.1	4.7	5.2
21xxx – Maintenance Facilities	1.6	1.7	1.7	1.8	1.8	1.9	1.9	2.0	2.0	2.1	2.2	2.3	2.4	2.5	3.0	3.5	4.1
31xxx – Science Laboratories	3.5	4.1	4.6	5.1	5.6	6.1	6.7	7.2	7.7	8.8	9.5	10.8	11.9	12.9	18.1	23.3	28.5
41xxx – Liquid Fuel Storage, Bulk	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
42xxx – Ammunition Storage	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
44xxx – General Supply Buildings	0.9	0.9	0.9	1.0	1.0	1.1	1.1	1.1	1.2	1.2	1.3	1.4	1.5	1.5	1.9	2.3	2.7
61xxx – Administration Buildings	1.3	1.7	2.1	2.5	3.0	3.4	3.8	4.2	4.7	5.5	6.4	7.2	8.1	8.9	13.2	17.4	21.7
71xxx – Family Housing	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
72xxx – Unaccompanied Personnel Hsg	3.6	3.7	3.8	3.8	3.9	4.0	4.1	4.1	4.2	4.3	4.5	4.6	4.8	4.9	5.6	6.3	7.0
73xxx – Community Facility – Personnel	2.5	2.5	2.6	2.7	2.8	2.9	3.0	3.0	3.1	3.3	3.4	3.6	3.8	3.9	4.8	5.6	6.4
74xxx – Community Facility – Morale	2.7	2.8	2.9	3.0	3.2	3.3	3.4	3.6	3.7	3.9	4.2	4.5	4.7	5.0	6.2	7.5	8.8
81xxx – Electrical Power	2.0	2.3	2.7	3.0	3.3	3.6	3.9	4.2	4.5	5.2	5.8	6.4	7.0	7.7	10.8	13.9	17.0
8xxxx – Utilities & Grounds (excludes Roads)	2.2	2.3	2.5	2.6	2.8	2.9	3.0	3.2	3.3	3.6	3.9	4.2	4.5	4.8	6.2	7.6	9.0

ASPHALT SHINGLE ROOF INSPECTIONS	CONTROL INSPECTION FUNCTION Total Estimated Inspection Hours Per Facility																
CATEGORY CODE/ FACILITY TYPE	FACILITY SQUARE FOOTAGE (in thousands)																
	1	1.5	2	2.5	3	3.5	4	4.5	5	6	7	8	9	10	15	20	25
12xxx – Liquid Fueling/Dispensing	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7	1.0	1.3	1.7
13xxx – Communications	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.6	0.7	0.7	0.8	1.2	1.5	1.9
14xxx – Land Operations Facilities	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.8	1.1	1.3
16xxx – Harbor & Coastal Facilities	0.4	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.5	1.8	2.0	2.2	2.4	3.5	4.6	5.7
17xxx – Training Facilities	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.5	0.6	0.6	0.9	1.2	1.5
21xxx – Maintenance Facilities	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.5	0.6	0.7	0.8
31xxx – Science Laboratories	0.2	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.8	0.9	1.0	1.4	1.8	2.2
41xxx – Liquid Fuel Storage, Bulk	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
42xxx – Ammunition Storage	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
44xxx – General Supply Buildings	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.6	0.6	0.7
61xxx – Administration Buildings	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.8	1.0	1.2
69xxx – Administrative Structures	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
71xxx – Family Housing	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.5	0.6	0.6	0.7	0.8	1.1	1.5	1.8
72xxx – Unaccompanied Personnel Hsg	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.7	0.8
73xxx – Community Facility – Personnel	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.5	0.6
74xxx – Community Facility – Morale	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.7	0.8	0.9
81xxx – Electrical Power	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.7	0.6	0.7	0.7	1.0	1.3	1.5
8xxxx – Utilities & Grounds (excludes Roads)	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.7	0.8	1.0

BUILT–UP & STANDING SEAM METAL ROOF INSPECTIONS	CONTROL INSPECTION FUNCTION Total Estimated Inspection Hours Per Facility																
CATEGORY CODE/ FACILITY TYPE	FACILITY SQUARE FOOTAGE (in thousands)																
	1	1.5	2	2.5	3	3.5	4	4.5	5	6	7	8	9	10	15	20	25
12xxx – Liquid Fueling/Dispensing	0.4	0.5	0.5	0.6	0.7	0.8	0.9	0.9	1.0	1.2	1.3	1.5	1.6	1.8	2.6	3.4	4.1
13xxx – Communications	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.1	1.3	1.5	1.7	1.9	2.0	2.9	3.8	4.7
14xxx – Land Operations Facilities	0.3	0.4	0.5	0.5	0.6	0.6	0.7	0.8	0.8	1.0	1.1	1.2	1.3	1.5	2.1	2.7	3.3
16xxx – Harbor & Coastal Facilities	1.1	1.4	1.7	1.9	2.2	2.5	2.7	3.0	3.3	3.8	4.4	4.9	5.5	6.0	8.7	11.4	14.2
17xxx – Training Facilities	0.2	0.3	0.4	0.4	0.5	0.6	0.7	0.7	0.8	1.0	1.1	1.3	1.4	1.5	2.3	3.0	3.8
21xxx – Maintenance Facilities	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.2	1.5	1.8	2.1
31xxx – Science Laboratories	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.6	1.8	2.0	2.2	2.4	3.4	4.4	5.4
41xxx – Liquid Fuel Storage, Bulk	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
42xxx – Ammunition Storage	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
44xxx – General Supply Buildings	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.2	1.2	1.2	1.4	1.6	1.8
61xxx – Administration Buildings	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.9	2.5	3.0
69xxx – Administrative Structures	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
71xxx – Family Housing	0.3	0.4	0.5	0.6	0.7	0.8	0.8	0.9	1.0	1.2	1.4	1.6	1.7	1.9	2.8	3.7	4.6
72xxx – Unaccompanied Personnel Hsg	0.8	0.8	0.8	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.1	1.1	1.2	1.2	1.5	1.7	1.9
73xxx – Community Facility – Personnel	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.9	1.1	1.4	1.6
74xxx – Community Facility – Morale	0.6	0.7	0.7	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.1	1.1	1.2	1.3	1.6	2.0	2.4
81xxx – Electrical Power	0.7	0.7	0.8	0.9	0.9	1.0	1.1	1.1	1.2	1.3	1.5	1.6	1.7	1.9	2.5	3.2	3.8
8xxxx – Utilities & Grounds (excludes Roads)	0.5	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.9	1.0	1.0	1.1	1.2	1.3	1.7	2.1	2.5

NON-BUILDING CONTROL INSPECTION TIMES

CAN	DESCRIPTION	UNIT OF MEASURE	INSPECTION TIME STR	ELEC	MECH	SPEC
7270	Breakwaters/Causeways	1000 LF	0.3			
7280	Graving Docks & Drydocks	Each	14.3	8.8	9.1	
7290	Marine Railways	100 LF	3.2	0.4	0.5	
72A0	Shipbuilding Ways	Each	12.0	4.0	8.0	
	Fleet Moorings	Each	0.6			0.6
7300	Surfaced Areas	1000 SY	0.2			
	Expansion Joints	1000 LF	0.2			
	Traffic Markings	1000 LF	0.2			
7400	Grounds	Acre	0.3			
7450	Drainage	1000 LF	0.4			
75N0	Family Housing Trailer	10000 SY	0.5			
7510	Railroad & Crane Trackage (2RL)	1000 LF	0.5			
	Trestles	100 LF	1.9			
	Trestles – Concrete Ties	100 LF				1.3
7520	Liquid Fuel Dispensing FAC	1000 gpm	0.2	0.3	0.5	
7530	Communication, Navigation and					
	Traffic Aid Facilities	Each	0.5	0.3	0.3	
7540	Communication Lines (Non–Tele)	Mile		2.6		
7550	Airfield Lighting	1000 LF		0.3		
75A0	Bulk Liquid Fuel Staorage Tanks	<1000 bbl	3.6		1.8	
	Bulk Liquid Fuel Storage Tanks	>1000 bbl	5.4		2.7	
75D0	Other Administrative Structure	Each	0.1			
75J0	Installed Refrig. Equip. In Walk–In					
	Refrigerators – Over 25 ton cap.	Each				1.5
75k0	Installed Cooling or Refrig. Equip.					
	– Under 3 ton cap.	Each		0.3	0.5	
	– From 3 to 5 ton cap.	Each		0.5	0.9	
	– From 15 to 100 ton cap.	Each		0.6	1.3	
	– From 100 to 800 ton cap.	Each		0.9	2.0	
75L0	Fences, Walls and Gates	1000 LF	0.3			
75M0	Antennas & Antenna Systems	Each	0.3	0.2		
	Swimming Pools	Each	0.6	0.6	1.1	
7610	Electrical Plants/Electrical					
	Power Generation Equipment	Each	2.0	0.2	0.5	
	Generation & Drive Unit	Each		1.8	1.4	
	Auxiliaries	All		1.4	0.8	
	Switchboard	Each		2.0	2.0	
	Heating Plant/Boilers:					
	<30 Hp	Each				2.7
	30 to 50 Hp	Each				8.0
	50 to 105 Hp	Each				12.0
7620	Heating Plants over 3,500K BTU/Hr	Each	1.0	0.7	1.0	
7630	Heating Plants					
	750,000 to 3,500,000 BTU/Hr	Each	1.0	0.7	1.0	
7640	Steam Plants	Each	1.0	0.7	1.0	
7650	Water Treatment Facilities	1000 LF			0.5	

CAN	DESCRIPTION	UNIT OF MEASURE	INSPECTION TIME STR	ELEC	MECH	SPEC
76F0	Liquid Storage Facilities					
	Tanks – Elevated:					
	<10,000 gal	Each	2.7	0.5	2.2	
	>10,000 gal	Each	4.0	0.8	3.3	
	Tanks – Ground Level:					
	<10,000 gal	Each	1.9	0.5	1.5	
	>10,000 gal	Each	2.9	0.8	2.3	
7670	Sewage Plants/Pumping & Treatment	100K gal/day	0.8	1.2	1.5	
	Pumps	Each		0.2	0.3	
7690	Compressed Air Plants & Systems					
	(Pneumatic Power)	1000 LF	2.3	1.5	1.0	
76C0	Ice Mfg. Equip. Installed in Facilities					
	Class 210 & 220 (CAN 7120)	Each			1.5	
76D0	Cooling & Refrig. Equip. Installed on					
	Fac. Class 430 (Storage – Cold)	Each			1.5	
76E0	Hot Water Heaters					
	<30 gal	Each			0.2	
	30 to 300 gal	Each			0.5	
	>300 gal	Each			0.8	
7710	Electrical Power & Lighting: *					
	Distribution –					
	Overhead	1000 LF		0.5		
	Underground	1000 LF		0.7		
	Manholes –					
	Distribution Lines	Each		0.7		
	Street Lighting	Each		0.5		
	Transformers –					
	Poles	Each		0.3		
	Substations	Each		1.0		
	Stations & Vaults	Each		0.5		
	Steam & Hot Water: *					
	Above Ground	1000 LF			0.6	
	Tunnels & Covered Trenches	1000 LF	1.4			
	Manholes	Each			0.4	
	Condensate Pumps	Each			0.3	
7720	Steam & Hot Water for Plants					
	>3,500,000 BTU/Hr	1000 LF			0.5	
	750,000 to 3,500,000 BTU/Hr	1000 LF			0.5	
7730	Potable Water	1000 LF			0.4	
7740	Nonpotable Water	1000 LF			0.4	
7750	Fire Protection Water	1000 LF			0.4	
7760	Sewage & Waste Collection	1000 LF			0.5	
7770	Gas Distribution *					
	Piping	1000 LF			0.2	
	Gages & Meters	Each			0.2	
	Regulators	Each			0.2	

• Safety Requirement - 2 Persons

CAN	DESCRIPTION	UNIT OF MEASURE	INSPECTION TIME STR	ELEC	MECH	SPEC
7770	Gas Distribution (Cont'd) *					
	Valves	Each			0.1	
7780	Communication Sys. – Admin. Tele. *					
	Overhead	1000 LF		0.5		
	Underground	1000 LF		0.3		
	Telephone Handholes	Each		0.4		
	Switchboard & Centrals	Each		8.0		
7790	Fire Alarms					
	Overhead	1000 LF		0.5	1.0	
	Underground	1000 LF		0.5		
	Boxes	Each		0.1		
	Sewage & Storm Drainage *					
	Piping	1000 LF			0.5	
	Manholes	Each			0.5	
	Sump Pumps	Each		0.3	0.3	
	Bridges	1000 LF	0.2			
	Cathodic Protection System	Each		5.2		
	Cathodic Protection Test System	Each		0.3		
	Chimneys & Stacks (Boiler Plants)	Each	3.7			
	Gangways & Brows	Each	0.5			
	Unfired Pressure Vessels					
	<500 cubic feet	Each				0.5
	500 to 1000 cubic feet	Each				1.0
	1000 to 2000 cubic feet	Each				1.5
	>2000 cubic feet	Each				2.0
	Internal (Boroscope)	Each				2.0
	Crane					
	IET Bridge 3 to 10 tons	Each	0.5		0.7	
	OET Bridge 10 to 30 tons	Each	0.5		1.0	
	OET Bridge 30 to 50 tons	Each	0.5	0.5	1.7	
	OET Wall	Each	0.5		0.9	
	Jib and Pillar	Each			0.7	
	Monorail System	1000 LF	0.3	0.2	1.7	
	Single Hoist	Each			0.5	
	Floating 100 to 200 tons	Each	0.5	0.5	3.3	
	Locomotive 30 to 40 tons	Each	0.7	0.3	2.0	
	Truck and Wagon 10 to 20 tons	Each	0.7	0.7	2.0	
	Gantry 10 to 40 tons	Each			2.2	
	Tower 30 to 50 tons	Each			2.9	
	Hammerhead 50 to 100 tons	Each			3.4	
	Tractor–Crawler 3 to 5 tons	Each			0.8	
	Forklift	Each			0.6	
	Elevators					
	Cable	Each				2.5
	Hydraulic	Each				1.5
	Hand Operated	Each				0.5

* Safety Requirement – 2 Persons

NON-BUILDING CONTROL INSPECTION TIMES

CAN DESCRIPTION	UNIT OF MEASURE	INSPECTION TIME STR	ELEC	MECH	SPEC
7790 (Cont'd):					
Elevators (Cont'd):					
<2000 lbs *	Each				2.5
2,000 to 4,000 lbs *	Each				6.0
4,000 to 8,000 lbs *	Each				8.0
>8,000 lbs *	Each				10.0
Platform Lifts and Dumbwaiters	Each			0.2	0.5
Escalators	Each				1.1
Galley Hood and Ducts	Each			0.3	
Towers	100 ft of				
	Vertical Height				2.0
High Pressure Air System > 3,000 psig			0.5	3.0	
Heating Systems	Each			4.0	
Water Treatment & Pumping Plants	100K gal/day	0.8	0.4	1.5	1.5
Fire Sprinkler System – Deluge	Each			2.0	
Air Traffic Aids	Each		0.2		
Wells	Each		0.1	0.1	
Windbreaks	1,000 LF	0.5			

• Safety Requirement - 2 Persons

CONTROL INSPECTION TIME TABLES (EXAMPLE)

Times are for inspection only. After inspection times are selected, add the following labor hours per facility.

	Structural/Roofing	Mechanical	Electrical
Cost Estimate	1.9 hrs/est	1.9 hrs/est	1.9 hrs/est

Travel (based on travel zone in which the facility is located)

It must be noted, the Inspection times determined are average times and may differ due to differences in the way facilities are arranged and the variety of uses within each facility.

In determining the total square feet of a facility, look at all category codes for that facility and add them together. Use the dominant category code when determining the inspection time. Additional time should be added if security clearances or escorts are required.

Example: How much time will be required to accomplish a complete inspection with cost estimates in Category 61XXX? The facility is a single story facility located in Travel Zone 5 and the sum of all Cat. Code Sq. footage is 25000 SF. Facility has built-up roof. No abnormal conditions or facility layout problem exist.

		Inspection Package Time			
		Structural	Electrical	Mechanical	Roofing
1.	From tables	12.20	22.70	21.70	3.0
2.	Cost Estimate Prep.	1.90	1.90	1.90	1.9
3.	Travel				
	a. Trips*	2	3	3	1
	b. Time/Trip	.55	.55	.55	.55
	c. Travel Time	1.10	1.65	1.65	.55
4.	Total (1 + 2 + 3c)	15.20	26.25	25.25	5.45
				or 72.15 Hours	

*Inspection time divided by 8 hrs/day.

APPENDIX D
Facility Inspection Checklist

This form is used as a cover sheet for the completed Inspection Report package. It tells management at a glance what facility components were inspected. It lists items to be inspected.

DATE: _____

FACILITY INSPECTION CHECKLIST

FACILITYNUMBER: _____ **REPORT NO:** _____

INSPECTOR(S): _____ **INSP. HOURS:** _____

_____

ENTER: (S) = SATISFACTORY or (U) = UNSATISFACTORY

ELECTRICAL
INCOMING SERVICE
MAIN DISTRIBUTION PANELS
POWER/LIGHTING PANELS
ELECTRICAL DEVICES
ELECT. WIRING NETWORK
_____
_____

MECHANICAL
PLUMBLING
HEATING
COOLING
EXHAUST/VENTILATION
TEMPERATURE CONTROLS
_____
_____

EXTERIOR
ROOF
WALLS
FOUNDATON
WINDOWS
GENERAL
_____
_____

INTERIOR
FLOORS
WALLS
CEILINGS
DOORS
STAIRWAYS
_____
_____

SAFETY/HEALTH
EMERGENCY LIGHTS
EXIT LIGHTS
DETECTION DEVICES
PROTECTION SYSTEMS
WATER TREATMENT
SEWAGE TREATMENT
FOOD SERVICE
_____
_____

SITE
SIDEWALKS
AREAWAYS
DRAINAGE
ROADS
PARKING LOTS
_____
_____
_____
_____

NOTES:

_____
_____
_____
_____
_____

APPENDIX E

WORK PACKAGING

Work identified by inspection is used for AIS, budget, contract and shop loading decisions. This Appendix is one technique for “packaging” deficiencies together the way it makes sense to do the job.

WORK PACKAGING

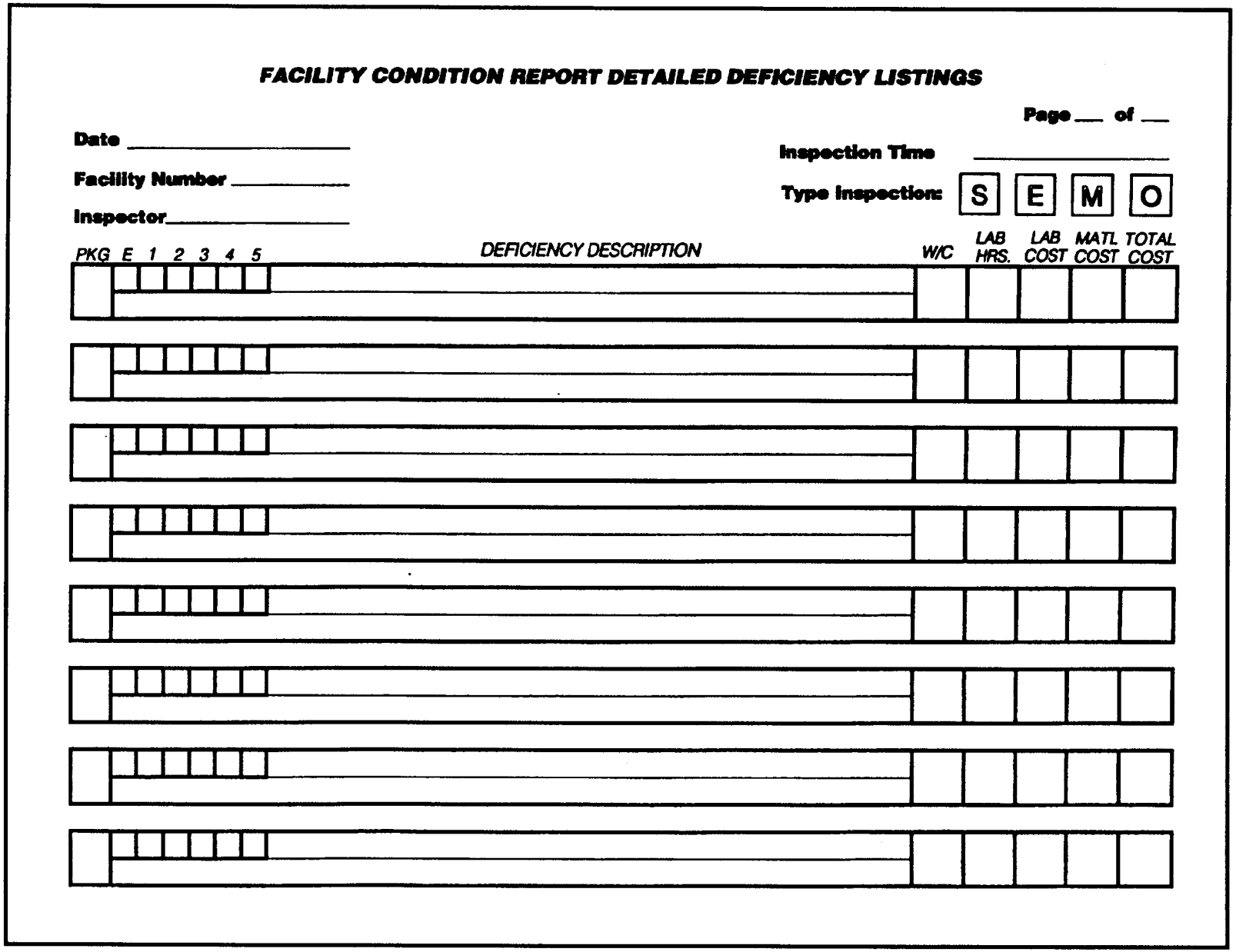
I. INTRODUCTION

Inspection reports, properly formatted, can enhance the effectiveness of the maintenance management system to execute work. Effectiveness is greatly improved by a Work Packaging Technique. The idea is to package or collect deficiencies together into workable jobs ready for accomplishment. If followed, the packaging technique can minimize data entries for manual or automated maintenance management systems. The reduction of the number of entries in a work control system allows Facility Managers to concentrate on fewer jobs and places emphasis on correction of problems. It reduces the number of resource management decisions and planner/estimator preparation time. Work Packaging is also a reporting technique that assists facility inspectors. The technique allows inspector latitude to prioritize, recommend, and analyze inspection deficiencies. This is critical to the preparation of the Annual Inspection Summary and Maintenance Action Plan.

DEVELOPING A PACKAGING SYSTEM

To implement the work packaging system, facility inspectors must complete the Facility Condition Report Detailed Listing (Exhibit-1) listing deficiencies found during the on-site inspection. Inspection reports should be prepared for each discipline e.g., structural, electrical, and mechanical. Completed inspection reports are then analyzed by the inspection team to determine how the work should logically be accomplished. The team decides what deficiencies can be worked together as a package (A, B, C, D, etc.). These packages contain deficiencies that should logically be worked together as single, or multi-craft in-house or contract jobs.

The blocks in the description area of the inspection report denote individual packages. Exhibit-2 is a Work Input Control (WIC) / Inspection Summary Sheet used with the packaging technique. It is prepared by the inspection team as the work packages are developed. A separate WIC summary sheet for each package designator A, B, C is required. Individual summary sheets are needed because each represents a separate job. The packaging summary sheets are used as input to an automated data base, i.e., WIC module of “BEST’ or to update a manual system. Exhibit-3 is a sample work package demonstrating the use of the technique.



FACILITY CONDITION REPORT DETAILED DEFICIENCY LISTINGS

Page ___ of ___

Date _____

Facility Number _____

Inspector _____

Inspection Time _____

Type Inspection: S E M O

PKG	E	1	2	3	4	5	DEFICIENCY DESCRIPTION	W/C	LAB HRS.	LAB COST	MATL COST	TOTAL COST

BASIC DEFINITIONS

FACILITY CONDITION REPORT DETAILED DEFICIENCY LISTING (EXHIBIT 1)

DATE	**WHEN THE INSPECTION WAS CONDUCTED**
INSPECTION TIME	**ACTUAL TIME USED TO CONDUCT THE INSPECTION AND PREPARE THE REPORT**
FACILITY NUMBER	**THE FACILITY NUMBER ASSIGNED TO THE FACILITY**
TYPE INSPECTION	**CATEGORY OF INSPECTION STRUCTURAL, ELECTRICAL, MECHANICAL, OTHER**
INSPECTOR	**NAME OF THE PERSON CONDUCTING THE INSPECTION**
PKG	**PACKAGE IDENTIFIER (USE A, B, C, D, ETC:)**
E	**CHECK THIS BLOCK IF AN EMERGENCY/SERVICE CALL WAS SUBMITTED TO CORRECT THE DEFICIENCY (E/S CALL NUMBER SHOULD BE ANNOTATED IN THE DESCRIPTION BLOCK FOR INSPECTOR TRACKING)**
1 THRU 5	**THE YEAR CORRECTION OF THE DEFICIENCY IS REQUIRED BY.**
DEFICIENCY DESCRIPTION	**DETAILED DESCRIPTION OF THE DEFICIENCY FOUND**
W/C	**CRAFT OR WORK CENTER THAT SHOULD CORRECT THE DEFICIENCY. A "C" SHOULD BE USED WHEN CONTRACT ACCOMPLISHMENT IS RECOMMENDED**
LAB HRS	**THE ESTIMATED LABOR HOURS TO CORRECT THE DEFICIENCY, LEAVE BLANK IF W/C BLOCK IS "C"**
LAB COST	**THE LABOR COST IS THE ACTIVITY RATE X LABOR HOURS, LEAVE BLANK IF W/C BLOCK IS "C"**
MATL COST	**MATERIAL COST, LEAVE BLANK IF W/C BLOCK IS "C"**
TOTAL COST	**ENTER ESTIMATED TOTAL CONTRACT ESTIMATE.**

WIC / INSPECTION SUMMARY

SHORT DESCRIPTION: _____

PW NUMBER | **FACILITY** | **DC** (1 2) | **FUND SOURCE**

DEFICIENCY TYPE (E M Q S D) | **M / R / ALTER / IMPROVE** (M R A I) | **ACC YR** (1 2 3)

SPECIAL PROJECT NO. | **AIS REPORT** (Y N) | **DEFICIENCY DESCRIPTION CATEGORY** (MT RP DM DS)

DEFICIENCY DESCRIPTION WORK TYPE (EL ME ST PT RF OT SP) | **WORK SOURCE** | **METHOD** (C M S V)

COST DATA

WORK CENTER	LABOR HOURS	LABOR COST	MATERIAL COST	TOTAL COST

COMMENTS:

ES CALLS REQUIRED Y N

Exhibit-2

WIC / INSPECTION SUMMARY

PW NUMBER - THE ASSIGNED PUBLIC WORKS IDENTIFICATION NUMBER CREATED TO TRACK THE JOB FROM CRADLE TO GRAVE.

FACILITY - THE FACILITY NUMBER AS NOTED ON THE P-164 REAL PROPERTY INVENTORY

DEFICIENCY CODE - A SINGLE DIGIT CODE REFERRING TO THE COMMANDING OFFICER'S FUNDING LIMITATION

(1) WITHIN CO'S LIMIT
(2) ABOVE CO'S LIMIT

FUND SOURCE - A FOUR DIGIT CODE REFERRING TO THE FUND SOURCE eg: 1804 O&MN

DEFICIENCY TYPE- A SINGLE ALPHA CHARACTER DENOTING ONE OF THE FOLLOWING:

(E)CATASTROPHIC/ENVIRONMENTAL
(M)LOSS OF MISSION
(S)SAFETY
(Q)QUALITY OF LIFE
(D)DEFERRABLE

E, M, S, Q ARE CRITICAL DEFICIENCY TYPES OF SUCH SEVERITY THAT CORRECTIVE ACTION SHOULD BE INITIATED WITHIN TWELVE MONTHS.

M/R/ALTER/IMPROVE - A SINGLE ALPHA CHARACTER DENOTING ONE OF THE FOLLOWING:

(M) MAINTENANCE
(R) REPAIR
(A) ALTERATIONS
(1) IMPROVEMENTS

ACC YEAR - A DESIGNATION THAT DENOTES THE YEAR THE DEFICIENCY SHOULD BE CORRECTED:

(1) ONE YEAR
(2) Two YEARS
(3) THREE YEARS

SPECIAL PROJECT NUMBER - A SPECIAL PROJECT NUMBER IS USUALLY REQUIRED WHEN A DEFICIENCY EXCEEDS THE COMMANDING OFFICERS APPROVAL LIMIT. *E.G., IT REQUIRES FUNDING BY THE MAJOR CLAIMANT:

AIS REPORT- IF THE DEFICIENCY SHOULD BE PUT ON THE ANNUAL INSPECTION SUMMARY A (Y) YES) OR (N) NO) IS REQUIRED.

ALTERATION, IMPROVEMENTS AND CONSTRUCTION ARE NOT AIS CATEGORY OF WORK REQUIRED.

DEFICIENCY DESCRIPTION CATEGORY- A DESCRIPTION OF THE CATEGORY OF WORK REQUIRED:

(MT) MAINTENANCE
(RP) REPAIR
(DM) DEMOLITION
(DS) DESIGN

DEFICIENCY DESCRIPTION WORK TYPE - THE TYPE OF WORK INVOLVED:

(EL) ELECTRICAL
(ME) MECHANICAL
(ST) STRUCTURAL
(PT) PAINT
(RF) ROOF
(OT) OTHER
(SP) SPECIALIZED

WORKSOURCE - HOW THE WORK WAS GENERATED:

(I) INSPECTION
(W) WORK REQUEST

METHOD - THE METHOD OF ACCOMPLISHMENT.

(C) CONTRACTOR
(M) MILITARY
(S) SHOPS
(V) VENDOR

COST DATA - THIS IS A SUMMARY OF EFFORT REQUIRED TO ACCOMPLISH THE JOB. COMPLETE THIS SECTION USING THE INFORMATION FROM THE FACILITY CONDITION REPORT DETAILED DEFICIENCY LISTING (EXHIBIT 1)

COMMENTS- NOTE ANY PERTINENT INFORMATION IN THIS SECTION

E/S CALLS REQUIRED- IF EMERGENCY OR SERVICE CALLS ARE ISSUED TO CORRECT A DEFICIENCY NOTE ON THE INSPECTORS REPORT CHECK THE APPROPRIATE BLOCK:

(Y) YES
(N) NO

WIC / INSPECTION SUMMARY

SHORT DESCRIPTION: STRUCT AND MECH REPAIRS

PW NUMBER	FACILITY	DC	FUND SOURCE
	N23	[X] 1 2	1804

DEFICIENCY TYPE	M / R / ALTER / IMPROVE	ACC YR
E M [X] S D	M [X] A I	[X] 1 2 3

SPECIAL PROJECT NO.	AIS REPORT	DEFICIENCY DESCRIPTION CATEGORY
	[X] N	MT [X] DM DS

DEFICIENCY DESCRIPTION WORK TYPE: EL ME [X] ST PT RF OT SP

WORK SOURCE: I

METHOD: C M [X] S V

COST DATA

WORK CENTER	LABOR HOURS	LABOR COST	MATERIAL COST	TOTAL COST
01C	80	1600	2046	3640
12	16	320	60	380

COMMENTS:

ES CALLS REQUIRED [Y] [N]

Exhibit-3

WIC / INSPECTION SUMMARY

SHORT DESCRIPTION: ELECTRICAL REPAIRS

PW NUMBER	FACILITY	DC	FUND SOURCE
	N23	[X] 1 2	1804

DEFICIENCY TYPE	M / R / ALTER / IMPROVE	ACC YR
E M Q [X] D	M [X] A I	[X] 1 2 3

SPECIAL PROJECT NO.	AIS REPORT	DEFICIENCY DESCRIPTION CATEGORY
	[X] N	MT [X] DM DS

DEFICIENCY DESCRIPTION WORK TYPE

EL	ME	ST	PT	RF	OT	SP
[X]						

WORK SOURCE	METHOD
I	C M [X] V

COST DATA

WORK CENTER	LABOR HOURS	LABOR COST	MATERIAL COST	TOTAL COST
21	24	480	480	960

COMMENTS:

ES CALLS REQUIRED [Y] [N]

Exhibit-3

WIC / INSPECTION SUMMARY

SHORT DESCRIPTION: STRUCT, ELECT, MECH REPRS.

PW NUMBER	FACILITY	DC	FUND SOURCE
	N23	[X] 1 2	1804

DEFICIENCY TYPE	M / R / ALTER / IMPROVE	ACC YR
E M Q S [X]	M [X] A I	1 [X] 3

SPECIAL PROJECT NO.	AIS REPORT	DEFICIENCY DESCRIPTION CATEGORY
	[X] N	MT [X] DM DS

DEFICIENCY DESCRIPTION WORK TYPE							WORK SOURCE	METHOD			
EL	ME	[X] ST	PT	RF	OT	SP	I	C	M	[X] S	V

COST DATA

WORK CENTER	LABOR HOURS	LABOR COST	MATERIAL COST	TOTAL COST
01P	72	1440	220	1660
01C	8	160	200	360
21	16	320	100	420
23	32	640	1000	1640
12	24	480	240	720

COMMENTS:

ES CALLS REQUIRED [X] Y [ ] N

Exhibit-3

WIC / INSPECTION SUMMARY

SHORT DESCRIPTION: REPLACE BUILT-UP ROOF

PW NUMBER	FACILITY	DC	FUND SOURCE
	N23	1 [X] 2	1804

DEFICIENCY TYPE	M / R / ALTER / IMPROVE	ACC YR
E M [X] S D	M [X] A I	1 2 [X]

SPECIAL PROJECT NO.	AIS REPORT	DEFICIENCY DESCRIPTION CATEGORY
	[X] N	MT [X] DM DS

DEFICIENCY DESCRIPTION WORK TYPE							WORK SOURCE	METHOD			
EL	ME	[X] ST	PT	RF	OT	SP	I	[X] C	M	S	V

COST DATA

WORK CENTER	LABOR HOURS	LABOR COST	MATERIAL COST	TOTAL COST
C				250,000

COMMENTS:

* SPECIAL PROJECT REQ'D, SEND TO ENGINEERING FOR PROJECT SUBMITTAL

ES CALLS REQUIRED [Y] [N]

Exhibit-3

FACILITY CONDITION REPORT DETAILED DEFICIENCY LISTINGS

Date 11-06-91 Page 1 of 1

Facility Number N-23 Inspection Time 4.0 HRS

Inspector H. MATECKI Type Inspection: [X] E M O

PKG	E	1	2	3	4	5	DEFICIENCY DESCRIPTION	W/C	LAB HRS.	LAB COST	MATL COST	TOTAL COST
A		X					REPLACE (12) EXTERIOR WOODEN WINDOWS, BADLY DETERIORATED AT SILLS	O1C	48	960	1800	2760
C			X				PATCH APPROX 40 SF OF SPALLING PLASTER ON NORTHWEST SIDE OF BUILDING	O1P	24	480	100	580
C				X			REPLACE 800 SF OF DETERIORATED, BADLY STAINED ACCOUSTICAL CEILING TILES (2'x2') RMS 12,13,14,15	O1C	8	160	200	360
C			X				PAINT INTERIOR WALLS RMS 12,13,14,15 PAINT DISCOLORED AND BADLY FLAKING AND ALLIGATORED	O1P	48	960	120	1080
A		X					REPLACE 400 SF ASPHALT FLOOR TILES RMS 18, 20, 21, 22 WORN AND BROKEN IN VARIOUS PLACES	O1C	32	640	240	880
D						X	REPLACE BUILT-UP ROOF FLASHING INCLUDING GRAVEL STOPS, SURFACE DETERIORATION EVIDENT MANY LEAKS THROUGHOUT THE YEARS (CONTRACT REQ'D)	C	–	–	–	250K
							* SPECIAL PROJECT *					

FACILITY CONDITION REPORT DETAILED DEFICIENCY LISTINGS

Date 11-06-91

Facility Number N-23

Inspector B. WHEAT

Page 1 of 1

Inspection Time 2.5 HRS

Type Inspection: S E [X] O

PKG	E	1	2	3	4	5	DEFICIENCY DESCRIPTION	W/C	LAB HRS.	LAB COST	MATL COST	TOTAL COST
C			X				REPLACE (2) DETERIORATED CONDENSING COILS ON ROOFTOP 10 TON UNITS	23	32	640	1000	1640
B		X					REPLACE (3) EXHAUST VENTILATORS ON ROOF MISSING COVERS OVER BLOWER, FAN BLADES BENT	21	8	160	300	460
C			X				REPLACE (6) CRACKED PORCELAIN WASH BASINS MEN'S HEAD 1ST FLOOR	12	24	480	240	720
A		X					REPLACE SEWER LINE FROM HEADS TO MAIN CONNECTION UNDER BLDG, NUMEROUS STOPPAGES	12	76	320	60	380

FACILITY CONDITION REPORT DETAILED DEFICIENCY LISTINGS

Date 11-06-91

Facility Number N-23

Inspector B. WAINWRIGHT

Page 1 of 1

Inspection Time 2.0 HRS

Type Inspection: S [X] M O

PKG	E	1	2	3	4	5	DEFICIENCY DESCRIPTION	W/C	LAB HRS.	LAB COST	MATL COST	TOTAL COST
B		X					REPLACE (2) 100A, 60CYCLE, 1 PHASE PANELS IN HALL, OVERLOADED (24 CIRCUIT)	21	8	160	200	360
B			X				REPLACE (6) BROKEN PERIMETER LIGHTING FIXTURES LOCATED ON NORTH & SOUTH ENDS OF BLDG	21	8	160	240	400
C				X			REPLACE APPROX 100' OF 1/2" EMT ABOVE CEILING RMS 12, 13. RUSTY AND DETERIORATED	21	16	320	100	420

Appendix E-13

Exhibit-3

APPENDIX F

MAINTENANCE PLANNING
(MAINTENANCE ACTION PLAN - MAP)

The Maintenance Action Plan (MAP) is a list of high priority Minor and Specific type work that is to be accomplished, either in-house or by contract.

MAINTENANCE PLANNING
(MAINTENANCE ACTION PLAN - MAP)

I. INTRODUCTION

The Maintenance Action Plan (MAP) is a list of high priority Minor and Specific type work that is to be accomplished, either in-house or by contract within resources available. It is a resources execution tool that should be prepared in the spring (NAVCOMPT/APPORTIONMENT) for the following fiscal year (FY). The MAP is part of the overall MAP Maintenance Plan that includes a plan to accomplish specific high priority items of maintenance and repair (M & R) work. The MAP is comprised of individual critical maintenance and repair (CMAR) items selected from a current update of the Annual Inspection Summary (AIS). CMAR items have the highest priority and should be selected from Investment Categories (IC) of greatest importance to the Major Claimant and the activity. Detailed guidance for preparation of the AIS can be found in the OPNAV Instruction 11010.34 series.

II. DETERMINING MINOR AND SPECIFIC RESOURCES

The first step in M&R budgeting and planning is to identify FA/M1 budget "requirement." This consists of determining the amount of valid resource needs for recurring work such as Emergency/Service (E/S), Standing Job Orders (SJO), repetitive contracts, Maintenance Shop and Facilities Management Engineering Division (FMED) overhead support and non-recurring work such as Minor and Specific Jobs generated from AIS Deficiency Code (DC) - one (1) items. Part "A" of Exhibit-1 contains a format for M&R "requirements" identification.

Once determined, the next step is to carefully reduce "requirements" to what you must live with in terms of actual funds available, i.e., the assigned FA/M1 dollar control. Generally, fixed items such as E/S, SJOs, and overhead support can't be reduced below a certain acceptable level. Flexibility nearly always must come from the amount of available funds that can be realistically allotted to Minor and Specific work, i.e., DC-1 CMAR deficiencies. Note - The AIS contains deferrable DC-1 M&R deficiencies (DMAR) which are also part of "requirements" subject to funding consideration, i.e., they compete for available funds, but from a position of weakness, i.e., they're not critical. Funds remaining "after" funding fixed items is the starting point for the MAP and its development. Part "B" of Exhibit-1 contains a format for Op-plan development and final determination of that portion of Ml funds available for specific M&R items.

III. DEVELOPING A MAINTENANCE ACTION PLAN (MAP)

Once the resource amount available for Minors and Specific type M&R work has been determined, then, and only then, can a MAP be developed. Input for the MAP comes from the AIS which must first be sorted so that priority work can be quickly culled from the total AIS deficiency list.

The AIS should be sorted first by (DC) and then Investment Code (IC) and Deficiency Type (DT). This sorting process will result in all deficiencies within the Commanding Officer's funding authority being listed together in IC groupings by type of work. A sample report is provided as Exhibit-2.

The next step in MAP development is to mark the CMAR items on the AIS sorted report. This should be done within the mission essential IC's established by your Major Claimant or activity. Select the critical items within each IC that can be completed next year. The dollar value of the MAP items should equal the resources planned for Minor and Specific type work for that year unless your claimant indicates a lessor percentage is to be used. ***Some*** claimants request the MAP to be only 50% of the amount available for Minors and Specifics, reserving the balance for unplanned work that it is known will occur throughout the year, that is hopefully priority type work.

Once you have decided which maintenance and repair items to accomplish during the upcoming year (from the sorted AIS report), enter each line item onto a blank MAP report form. Exhibit-3 is a sample MAP format. Any automated spreadsheet tool may be used.

MAP items should be programmed and accomplished during the designated Fiscal Year as planned. As jobs are accomplished they should be checked off the list and a completion date and work authorization document number recorded. All MAP line items should be monitored so that their completion during the year can be assured. Try to ensure the funding allocated for specific M&R items and as many of the originally planned jobs are done. A properly executed MAP should result in CMAR backlog reduction.

Appendix F-3

Exhibit-1

M1 FY-___ BUDGET PLANNING AND EXECUTION

DESCRIPTION	PART A FY-___ TOTAL REQ'T CAN	IC	No. Units	E/S	OHD	SJO	M&S	Insp Reports CMAR	DMAR	TOT'L	PART B FY-___ OP PLAN (Annual) E/S	OHD	SJO	M&S	Insp Reports CMAR	DMAR	TOT'L
				–	–						–	–					
				–	–						–	–					
				–	–						–	–					
				–	–						–	–					
				–	–						–	–					
				–	–						–	–					
				–	–						–	–					
				–	–						–	–					
				–	–						–	–					
				–	–						–	–					
				–	–						–	–					
				–	–						–	–					
				–	–						–	–					
				–	–						–	–					
				–	–						–	–					
				–	–						–	–					
				–	–						–	–					
				–	–						–	–					
				–	–						–	–					
				–	–						–	–					
E/S Less Util	7820	19	*		–	–	–	–	–			–	–	–	–	–	
E/S Util	7830	19	*		–	–	–	–	–			–	–	–	–	–	
Dismantling	7840	19		–		–	–	–	–		–		–	–	–	–	
Main Shop OH	7910	19		–		–	–	–	–		–		–	–	–	–	
MCD	7920	19		–		–	–	–	–		–		–	–	–	–	
Cons/Grds Eq	7930	19		–		–	–	–	–		–		–	–	–	–	
TOTAL DIRECT M1																	

* – Calls

Definitions:

CAN – Cost Acount Number
E/S – Emergency/Service
OHD – Overhead
M&S – Minor & Specific Work
CMAR – Critical DC-1 M&R
DMAR – Deferrable DC-1 M&R
SJO – Standing Job Orders/ Recurring Contracts
IC – Investment Category

Appendix F-4

Exhibit-2

AIS SORTED REPORT

LINE NO.	CATEGORY M R D D S	TYPE OF WORK S R E M P SP O	FAC. NO.	PROP. REC. CARD	CAT CODE	CAN	IC	DC	DT	EST. COST	PROJ. NUM.	INSP. STATUS
12			1034M	200538	11120	7330	01	1	D	400		CXXXX
5			857M	200388	13145	71K0	02	1	D	16,000		CCCCC
3			857M	200388	13145	71K0	02	1	D	2,000		
44			857M	200388	13145	71K0	02	1	D	4,000		
15			857M	200388	13145	71K0	02	1	D	47,000		
20			857M	200388	13145	71K0	02	1	D	6,000		
4			857M	200388	13145	71K0	02	1	Q	17,000		
6			857M	200388	13145	71K0	02	1	M	3,000		
1			857M	200388	13145	71K0	02	1	Q	19,000		
22			857M	200388	13145	71K0	02	1	Q	13,000		
36			857M	200388	13145	71K0	02	1	Q	16,000		
34			SLGT	200388	13145	71K0	02	1	S	2,000		CCCCX
25			SLGT	200388	13145	71K0	02	1	S	8,000		
37			848M	200252	72112	7170	15	1	M	4,000		CCXCX
27			848M	200252	72112	7170	15	1	E	50,000		
39			848M	200252	72112	7170	15	1	M	50,000		
13			848M	200252	72112	7170	15	1	S	11,000		
2			511M	200191	74023	71J0	16	1	Q	3,000		CCCCX
42			724M	200472	74040	71J0	16	1	E	2,500		CCCCX
9			887M	200405	74043	71J0	16	1	S	4,000		CCCCX
10			887M	200405	74043	71J0	16	1	E	4,200		
18			846M	200245	74064	71J0	16	1	Q	27,000		CCCCX
31			846M	200245	74064	71J0	16	1	M	26,000		
41			847M	200333	82109	7640	17	1	D	4,500		CCCCX
16			847M	200333	82109	7640	17	1	D	1,000		
28			847M	200333	82109	7640	17	1	D	1,500		
17			513M	200192	82160	7640	17	1	D	400		NNNNX
8			514	200193	84160	7640	17	1	D	300		NNNNX
43			WDIST	200129	84110	7650	17	1	D	15,000		CNNNX
7			WDIST	200129	84110	7650	17	1	D	44,000		
11			WDIST	200129	84110	7650	17	1	D	10,000		

EXHIBIT _____ FY-___ BUDGET MAINTENANCE ACTION PLAN (MAP)

DATE _____ UIC _____

NOTE:

NON-DEFERRABLE AIS ITEMS SHOULD RECEIVE HIGHEST PRIORITY

POINT OF CONTACT _____

PHONE NUMBER _____ ORGANIZATION/COMMAND _____

PRIORITY NO.	JOB ORDER NO. /CONTRACT	AIS LINE/ INSP. RPT. NO.	FACILITY NO. or AREA	DESCRIPTION OF JOB	COST ($000.0)	COST ACCT.NO.	COMMENTS

Appendix F-5

Exhibit-3

APPENDIX G

LONG RANGE MAINTENANCE PLANNING (LRMP)

LONG RANGE MAINTENANCE PLANNING

I. INTRODUCTION

Long Range Maintenance Planning (LRMP) is a management system based on comprehensive facility inspections and accurate cost estimates. The control inspection system provides the framework for the development of the Long Range Maintenance Planning system. Both provide guidelines for systematic, in-depth documentation of maintenance and repair requirements forecasted over a multi-year planning cycle. The LRMP system of inspection not only provides for in-depth inspection but inventory of facility components and installed equipment. It also provides additional emphasis on research, summarization and analysis.

Inventory of plant and equipment is the basic foundation block of the maintenance management system. Control inspection does not emphasize the inventory phase and listing of building systems and components as LRMP does. The inventory data collected in the performance of LRMP inspections provides planning engineers with a listing of facility systems and components such as numbers of doors, windows, light fixtures, etc. The initial collection of this inventory is labor intensive.

Activities that utilize Control Inspection or Long Range Maintenance Planning inspections are in a better position to formulate funding strategies and to allocate resource dollars. The KEY is to inspect, plan, and respond to the critical mission needs and future facility requirements.

II. OBJECTIVES

A. Document unfunded deficiencies and project system failures

B. Project budget and ceiling requirements

C. Produce an Annual Inspection Summary based on valid comprehensive inspections, and a Budget plan addressing those deficiencies

D. Provide a dedicated inspection workforce

III. LRMP PROCESS

The LRMP process includes, but is not limited to, the following components:

A. Research
B. Inspection
C. Estimating
D. Analyzing
E. Summarizing
F. Evaluating
G. Prioritizing

Research is the review of facility or building folders to determine what has transpired since the last inspection. Emergency service requests, job orders, military construction and special projects including shore facility planning documents, engineering studies, and contracts are reviewed prior to inspecting the facility. Research provides the inspector with a good picture of recurring problems, and an updated status since the last inspection.

The Inspection of scheduled facilities is conducted by a team of inspectors. The inspector's on-site inspection also includes a review of installed equipment. The inspector documents equipment serial and model numbers, and notes condition and numbers of installed facility components and systems. The collection of this information is valuable when preparing special projects for equipment replacement and alteration and in preparation of preventive maintenance schedules. The initial preparation of the equipment and system inventory is time consuming. It is recommended that inspectors update facility inventories every three to five years. Planners and estimators should update equipment inventories as changes occur. Exhibit-1 provides LRMP inspection effort by type and size facility.

The Estimate to correct deficiencies is accurate within ± 10 percent. Long range maintenance planning uses estimating techniques that provide material lists and labor estimates. LRMP estimates are based on engineered performance standards.

The Inspector Analyzes inspection deficiencies using such criteria as facility age, history of repairs, existing condition and impact to mission if failure occurs. Analysis of inspection reports provides the Facility Manager a good indication of condition and helps in priority assessment. The summarization of inspection recommendations and report backup into a format for analysis provides the LINK between management and inspection.

The Evaluation of inspector recommendations are guided by repair/replacement "maintenance free" scenarios, energy efficient, and state of the art replacements.

Priority or year of accomplishment recommendations are made by the inspector using criteria compatible with published AIS guidance, i.e., OPNAV Instruction 11010.34B. Priorities assigned are:

1st year — Critical Deficiencies

Deficiencies that need to be accomplished in one year and will result in at least one of the following: loss of mission, catastrophic environmental, quality of life, or safety.

2nd and 3rd year — Deferrable Deficiencies

Deficiencies which do not display signs of imminent system failure, but rapid deterioration is evident with the system nearing the end of its life expectancy.

4th and 5th year — Deferrable Deficiencies

Deficiencies which display some deterioration. The system is functional but nearing its life expectancy within five years. Fourth and fifth year deficiencies should be re-evaluated prior to funding consideration (at least every 3 to 5 years).

IV. SYSTEM COMPARISON

A comparison of Control Inspection and Long Range Maintenance Planning is difficult because each system has it's own unique advantages. Exhibit-2, Control Inspection/Long Range Maintenance Planning Comparative Analysis, outlines significant components of each system.

V. LRMP INSTALLATION

For additional information, assistance, or installation of the Long Range Maintenance Planning system contact the nearest Public Works Center, NAVFAC Code 161, or Engineering Field Division/Engineering Field Activity (EFD/EFA).

LONG RANGE MAINTENANCE PLANNING (LRMP)
INSPECTION
TIMES

These tables include times for Physical Inspection and Report Writing. Initial Data Collection and Analyses, Travel and Cost Estimating are add-ons to times reflected. The tables are provided as a guide for preparing initial inspection schedules. During inspection performance, inspectors should record actual times for use in revising schedules.

Exhibit- 1

STRUCTURAL INSPECTIONS	LRMP FUNCTION Total Estimated Inspection Hours Per Facility																
CATEGORY CODE/ FACILITY TYPE	FACILITY SQUARE FOOTAGE (in thousands)																
	1	1.5	2	2.5	3	3.5	4	4.5	5	6	7	8	9	10	15	20	25
12xxx – Liquid Fueling/Dispensing	11.4	11.7	12.1	12.4	12.7	13.0	13.3	13.6	13.9	14.6	15.2	15.8	16.4	17.1	20.2	23.3	26.4
13xxx – Communications	11.6	12.0	12.3	12.7	13.0	13.4	13.8	14.1	14.5	15.2	15.9	16.6	17.3	18.0	21.6	25.2	28.8
14xxx – Land Operations Facilities	11.2	11.5	11.7	12.0	12.2	12.5	12.7	13.0	13.2	13.7	14.2	14.7	15.2	15.7	18.2	20.7	23.2
16xxx – Harbor & Coastal Facilities	14.4	15.5	16.5	17.6	16.7	19.8	20.9	22.0	23.1	25.2	27.4	29.6	31.8	33.9	44.8	55.7	66.5
17xxx – Training Facilities	10.8	11.1	11.4	11.7	12.0	12.3	12.6	12.8	13.1	13.7	14.3	14.9	15.5	16.1	19.0	22.0	24.9
21xxx – Maintenance Facilities	12.3	12.5	12.6	12.7	12.8	13.0	13.1	13.2	13.3	13.6	13.8	14.1	14.3	14.5	15.8	17.0	18.2
31xxx – Science Laboratories	12.2	12.6	13.0	13.4	13.8	14.2	14.6	15.0	15.4	16.2	17.0	17.8	18.6	19.4	23.4	27.4	31.4
41xxx – Liquid Fuel Storage, Bulk	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9
42xxx – Ammunition Storage	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9
44xxx – General Supply Buildings	13.5	13.6	13.7	13.8	13.8	13.9	14.0	14.1	14.1	14.3	14.4	14.6	14.7	14.9	15.6	16.4	17.1
61xxx – Administration Buildings	11.2	11.4	11.6	11.8	12.1	12.3	12.5	12.7	13.0	13.4	13.9	14.3	14.8	15.2	17.5	19.8	22.1
69xxx – Administrative Structures	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9
71xxx – Family Housing	11.1	11.5	11.8	12.2	12.5	12.9	13.3	13.6	14.0	14.7	15.4	16.1	16.8	17.5	21.1	24.7	28.3
72xxx – Unaccompanied Personnel Hsg	13.1	13.2	13.3	13.4	13.5	13.6	13.7	13.7	13.8	14.0	14.2	14.4	14.6	14.8	15.7	16.7	17.6
73xxx – Community Facility – Personnel	11.8	11.9	12.0	12.1	12.2	12.2	12.3	12.4	12.5	12.7	12.9	13.1	13.3	13.5	14.4	15.3	16.2
74xxx – Community Facility – Morale	12.5	12.6	12.8	12.9	13.1	13.2	13.3	13.5	13.6	13.9	14.2	14.5	14.8	15.1	16.5	17.9	19.3
81xxx – Electrical Power	12.6	12.9	13.2	13.4	13.7	13.9	14.2	14.5	14.7	15.3	15.8	16.3	16.8	17.4	20.0	22.6	25.3
8xxxx – Utilities & Grounds (excludes Roads)	12.0	12.2	12.4	12.5	12.7	12.9	13.0	13.2	13.4	13.7	14.0	14.4	14.7	15.0	16.7	18.4	20.0

Appendix G-6

Exhibit-1

ELECTRICAL INSPECTIONS	LRMP FUNCTION Total Estimated Inspection Hours Per Facility																
CATEGORY CODE/ FACILITY TYPE	FACILITY SQUARE FOOTAGE (in thousands)																
	1	1.5	2	2.5	3	3.5	4	4.5	5	6	7	8	9	10	15	20	25
12xxx – Liquid Fueling/Dispensing	6.2	6.3	6.4	6.6	6.7	6.8	7.0	7.1	7.3	7.5	7.8	8.1	8.3	8.6	10.0	11.3	12.7
13xxx – Communications	7.6	7.8	8.1	8.3	8.5	8.8	9.0	9.2	9.5	10.0	10.4	10.9	11.4	11.9	14.2	16.6	19.0
14xxx – Land Operations Facilities	6.1	6.3	6.5	6.7	6.9	7.1	7.3	7.5	7.7	8.1	8.5	8.9	9.3	9.7	11.7	13.7	15.7
17xxx – Training Facilities	7.7	8.1	8.4	8.8	9.1	9.5	9.9	10.2	10.6	11.3	12.0	12.7	13.4	14.1	11.7	21.3	24.9
21xxx – Maintenance Facilities	5.8	5.9	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.6	7.0	7.2	7.4	7.6	8.7	9.7	10.7
31xxx – Science Laboratories	11.7	12.3	13.0	13.6	14.2	14.9	15.5	16.2	16.8	18.1	19.4	20.7	21.9	23.2	29.6	36.0	42.5
41xxx – Liquid Fuel Storage, Bulk	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7
42xxx – Ammunition Storage	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7
44xxx – General Supply Buildings	6.1	6.1	6.2	6.2	6.2	6.3	6.3	6.4	6.4	6.5	6.5	6.6	6.7	6.8	7.2	7.6	8.0
61xxx – Administration Buildings	7.4	7.8	8.3	8.7	9.1	9.5	9.9	10.3	10.8	11.6	12.4	13.3	14.1	14.9	19.1	23.3	27.4
71xxx – Family Housing	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9
72xxx – Unaccompanied Personnel Hsg	8.5	8.6	8.6	8.7	8.7	8.8	8.8	8.9	8.9	9.0	9.1	9.2	9.3	9.4	9.9	10.5	11.0
73xxx – Community Facility – Personnel	6.7	6.9	7.1	7.3	7.6	7.8	8.0	8.2	8.5	8.9	9.4	9.8	10.3	10.7	13.0	15.3	17.6
74xxx – Community Facility – Morale	8.3	8.5	8.6	8.7	8.8	9.0	9.1	9.2	9.3	9.6	9.8	10.0	10.3	10.5	11.8	13.0	14.2
81xxx – Electrical Power	6.4	6.9	7.5	8.0	8.5	9.1	9.6	10.1	10.7	11.8	12.8	13.9	15.0	16.1	21.4	26.8	32.2
8xxxx – Utilities & Grounds (excludes Roads)	9.6	9.7	9.8	10.0	10.1	10.2	10.4	10.5	10.6	10.9	11.1	11.4	11.7	11.9	13.2	14.6	15.9

MECHANICAL INSPECTIONS	LRMP FUNCTION Total Estimated Inspection Hours Per Facility																
CATEGORY CODE/ FACILITY TYPE	FACILITY SQUARE FOOTAGE (in thousands)																
	1	1.5	2	2.5	3	3.5	4	4.5	5	6	7	8	9	10	15	20	25
12xxx – Liquid Fueling/Dispensing	11.0	13.0	15.0	17.0	19.0	21.0	93.0	25.0	27.0	31.0	35.0	39.0	43.0	47.0	67.0	87.0	107.0
13xxx – Communications	7.9	8.1	8.4	8.6	8.8	9.1	9.3	9.5	9.8	10.3	10.7	11.2	11.7	12.2	14.5	16.9	19.3
14xxx – Land Operations Facilities	7.4	7.6	7.8	7.9	8.1	8.3	8.4	8.6	8.8	9.1	9.4	9.8	10.1	10.4	12.1	13.8	15.4
17xxx – Training Facilities	8.8	8.9	8.9	9.0	9.0	9.1	9.1	9.2	9.2	9.4	9.5	9.6	9.7	9.8	10.3	10.9	11.4
21xxx – Maintenance Facilities	7.8	7.9	7.9	8.0	8.0	8.1	8.1	8.2	8.2	8.3	8.4	8.5	8.6	8.7	9.2	9.7	10.3
31xxx – Science Laboratories	9.7	10.3	10.8	11.3	11.8	12.3	12.9	13.4	13.9	15.0	16.0	17.0	18.1	19.1	24.3	29.5	34.7
41xxx – Liquid Fuel Storage, Bulk	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2
42xxx – Ammunition Storage	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2
44xxx – General Supply Buildings	7.1	7.1	7.1	7.2	7.2	7.3	7.3	7.3	7.4	7.4	7.5	7.6	7.7	7.7	8.1	8.5	8.9
61xxx – Administration Buildings	7.5	7.9	8.3	8.7	9.2	9.6	10.0	10.4	10.9	11.7	12.6	13.4	14.3	15.1	19.4	23.6	27.9
71xxx – Family Housing	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1
72xxx – Unaccompanied Personnel Hsg	9.8	9.9	10.0	10.0	10.1	10.2	10.3	10.3	10.4	10.5	10.7	10.8	11.0	11.1	11.8	12.5	13.2
73xxx – Community Facility – Personnel	8.7	8.7	8.8	8.9	9.0	9.1	9.2	9.2	9.3	9.5	9.8	9.8	10.0	10.1	11.0	11.8	12.6
74xxx – Community Facility – Morale	8.9	9.0	9.1	9.2	9.4	9.5	9.6	9.8	9.9	10.1	10.4	10.7	10.9	11.2	12.4	13.7	15.0
81xxx – Electrical Power	8.2	8.5	8.9	9.2	9.5	9.8	10.1	10.4	10.7	11.4	12.0	12.6	13.2	13.8	17.0	20.1	23.2
8xxxx – Utilities & Grounds (excludes Roads)	8.4	8.5	8.7	8.8	9.0	9.1	9.2	9.4	9.5	9.8	10.1	10.4	10.7	11.0	12.4	13.8	15.2

ASPHALT SHINGLE ROOF INSPECTIONS	LRMP FUNCTION Total Estimated Inspection Hours Per Facility																
CATEGORY CODE/ FACILITY TYPE	FACILITY SQUARE FOOTAGE (in thousands)																
	1	1.5	2	2.5	3	3.5	4	4.5	5	6	7	8	9	10	15	20	25
12xxx – Liquid Fueling/Dispensing	1.1	1.2	1.2	1.2	1.3	1.3	1.3	1.4	1.4	1.5	1.5	1.6	1.6	1.7	2.0	2.3	2.6
13xxx – Communications	1.2	1.2	1.2	1.3	1.3	1.3	1.4	1.1	1.4	1.5	1.6	1.7	1.7	1.8	2.2	2.5	2.9
14xxx – Land Operations Facilities	1.1	1.1	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.4	1.4	1.5	1.5	1.6	1.8	2.1	2.3
16xxx – Harbor & Coastal Facilities	1.4	1.5	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.5	2.7	3.0	3.2	3.4	4.5	5.6	6.7
17xxx – Training Facilities	1.1	1.1	1.1	1.2	1.2	1.2	1.3	1.3	1.3	1.4	1.4	1.5	1.5	1.6	1.9	2.2	2.5
21xxx – Maintenance Facilities	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.5	1.6	1.7	1.8
31xxx – Science Laboratories	1.2	1.3	1.3	1.3	1.4	1.4	1.5	1.5	1.5	1.6	1.7	1.8	1.9	1.9	2.3	2.7	3.1
41xxx – Liquid Fuel Storage, Bulk	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
42xxx – Ammunition Storage	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
44xxx – General Supply Buildings	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.5	1.5	1.5	1.6	1.6	1.7
61xxx – Administration Buildings	1.1	1.1	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.4	1.4	1.5	1.5	1.8	2.0	2.2
69xxx – Administrative Structures	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
71xxx – Family Housing	1.1	1.1	1.2	1.2	1.3	1.3	1.3	1.4	1.4	1.5	1.5	1.6	1.7	1.8	2.1	2.5	2.8
72xxx – Unaccompanied Personnel Hsg	1.3	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.5	1.5	1.6	1.7	1.8
73xxx – Community Facility – Personnel	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.5	1.6
74xxx – Community Facility – Morale	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.5	1.5	1.6	1.8	1.9
81xxx – Electrical Power	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.5	1.5	1.6	1.6	1.7	1.7	2.0	2.3	2.5
8xxxx – Utilities & Grounds (excludes Roads)	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.5	1.5	1.7	1.8	2.0

BUILT–UP & STANDING SEAM METAL ROOF INSPECTIONS	LRMP FUNCTION Total Estimated Inspection Hours Per Facility																
CATEGORY CODE/ FACILITY TYPE	FACILITY SQUARE FOOTAGE (in thousands)																
	1	1.5	2	2.5	3	3.5	4	4.5	5	6	7	8	9	10	15	20	25
12xxx – Liquid Fueling/Dispensing	2.9	2.9	3.0	3.1	3.2	3.2	3.3	3.4	3.5	3.6	3.8	4.0	4.1	4.3	5.0	5.8	6.6
13xxx – Communications	2.9	3.0	3.1	3.2	3.3	3.4	3.4	3.5	3.6	3.8	4.0	4.2	4.3	4.5	5.4	6.3	7.2
14xxx – Land Operations Facilities	2.8	2.9	2.9	3.0	3.1	3.1	3.2	3.2	3.3	3.4	3.6	3.7	3.8	3.9	4.6	5.2	5.8
16xxx – Harbor & Coastal Facilities	3.6	3.9	4.1	4.4	4.7	5.0	5.2	5.5	5.8	6.3	6.9	7.4	7.9	8.5	11.2	13.9	16.6
17xxx – Training Facilities	2.7	2.8	2.8	2.9	3.0	3.1	3.1	3.2	3.3	3.4	3.6	3.7	3.9	4.0	4.8	5.5	6.2
21xxx – Maintenance Facilities	3.1	3.1	3.1	3.2	3.2	3.2	3.3	3.3	3.3	3.4	3.5	3.5	3.6	3.6	3.9	4.2	4.5
31xxx – Science Laboratories	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.1	1.3	4.5	4.7	4.9	5.9	6.9	7.9
41xxx – Liquid Fuel Storage, Bulk	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
42xxx – Ammunition Storage	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
44xxx – General Supply Buildings	3.4	3.4	3.4	3.4	3.5	3.5	3.5	3.5	3.5	3.6	3.6	3.6	3.7	3.7	3.9	4.1	4.3
61xxx – Administration Buildings	2.8	2.8	2.9	3.0	3.0	3.1	3.1	3.2	3.2	3.4	3.5	3.6	3.7	3.8	4.4	4.9	5.5
69xxx – Administrative Structures	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
71xxx – Family Housing	2.8	2.9	3.0	3.0	3.1	3.2	3.3	3.4	3.5	3.7	3.9	4.0	4.2	4.4	5.3	6.2	7.1
72xxx – Unaccompanied Personnel Hsg	3.3	3.3	3.3	3.3	3.4	3.4	3.4	3.4	3.5	3.5	3.6	3.6	3.6	3.7	3.9	4.2	4.4
73xxx – Community Facility – Personnel	2.9	3.0	3.0	3.0	3.0	3.1	3.1	3.1	3.1	3.2	3.2	3.3	3.3	3.4	3.6	3.8	4.1
74xxx – Community Facility – Morale	3.1	3.2	3.2	3.2	3.3	3.3	3.3	3.4	3.4	3.5	3.6	3.6	3.7	3.8	4.1	4.5	4.8
81xxx – Electrical Power	3.2	3.2	3.3	3.4	3.4	3.5	3.6	3.6	3.7	3.8	3.9	4.1	4.2	4.3	5.0	5.7	6.3
8xxxx – Utilities & Grounds (excludes Roads)	3.0	3.1	3.1	3.1	3.2	3.2	3.3	3.3	3.3	3.4	3.5	3.6	3.7	3.8	4.2	4.6	5.0

LONG RANGE MAINTENANCE PLANNING (LRMP)
TIME TABLE
(EXAMPLE)

Times are for inspection only. After inspection times are selected, add the following labor hours per facility.

	Structural/Rooting	Mechanical	Electrical
LRMP Data Collect	2.0 hrs	1.2 hrs	1.5 hrs
Analysis	2.2 hrs	1.2 hrs	1.3 hrs
Cost Estimate	1.9 hrs/est	1.9 hrs/est	1.9 hrs/est

Travel (based on travel zone in which the facility is located)

It must be noted, the Inspection times determined are average times and may differ due to differences in the way facilities are arranged and the variety of uses within each facility.

In determining the total square feet of a facility, look at all category codes when determining the inspection time. Additional time should be added if security clearances are required and/or escorts required.

Example: How much time will be required to accomplish a complete LRMP inspection with cost estimates in Category 61XXX? The facility is a single story facility located in Travel Zone 5 and the sum of all Category Code Square footage is 25,000 SF. Facility has built-up roof. No abnormal conditions or facility layout problems exist.

	Structural	**Mechanical**	**Electrical**	**Rooting**
1. From Tables	22.1	27.9	27.4	5.5
2. LRMP Data Collection	2.0	1.2	1.5	2.0
3. Analysis	2.2	1.2	1.3	2.2
4. Cost Estimate Prep	1.9	1.9	1.9	1.9
5. Travel				
a. Trips*	3.0	4.0	4.0	1.0
b. Time/Trip	.55	.55	.55	.55
c. Travel Tie	1.65	2.2	2.2	.55
Total LRMP (1+2+3+4+5c)	29.85	34.4	34.3 or 110.7 Hours	12.15

*Inspection Time divided by 8 hrs/day.
(l-4+5c)

Exhibit-2

CONTROL INSPECTION \ LONG RANGE MAINTENANCE PLANNING
COMPARATIVE ANALYSIS

COMPONENTS	CONTROL	LRMP	REMARKS
RESEARCH	MODERATE	EXTENSIVE	INSPECTION FOLDERS PREPARED & ANALYZED
INVENTORY	MINIMAL	EXTENSIVE	LRMP COUNTS FACILITY EQUIPMENT, SYSTEMS & MODULES
INSPECTION	MODERATE	EXTENSIVE	LRMP LABOR INTENSIVE (INVENTORY)
COST ESTIMATING	PRELIMINARY + OR - 25%	DETAILED + OR - 10%	LRMP UTILIZES PWC PKGS FOR ESTIMATING, CI USES UNIT PRICE STANDARDS
ANALYSIS	MODERATE	EXTENSIVE	CI UTILIZES PACKAGING (APPENDIX E)
SUMMARIZATION	MINIMAL	EXTENSIVE	LRMP REQUIRES SUMMARIZATION INPUT REPORT
EVALUATION	MODERATE	EXTENSIVE	LRMP ALLOWS INSPECTOR EVALUATION AND REPORT
PRIORITIZATION	5 YEAR PRIORITY	5 YEAR PRIORITY	SAME
TRAINING REQUIRED	1 WEEK FORMAL. TRADE BACK-GROUND REQUIRED	6 WEEK FORMAL. TRADE BACK-GROUND REQUIRED	LRMP MORE IN-DEPTH TRAINING REQUIRED
HEALTH AND SAFETY REQUIREMENTS	ADVISORY	PHYSICAL & RESPIRATOR QUALIFIED	
WORK MANAGEMENT INTERFACE	YES	NO	LRMP DOES NOT INCLUDE WORK REQUESTS IN AIS
PRIORITY UPDATES	UPON RE-INSPECTION	AUTOMATIC PRE-PROGRAMMED	LRMP PROGRAM AUTOMATICALLY UPDATES PRIORITY, RE-INSPECTION NOT DONE
COMPUTER REQUIRED	NO, BUT CAN BE INPUT IF REQUIRED	YES	LRMP NOT INTENDED FOR MANUAL OPERATION
SOFTWARE INTERFACE	BEST/PWMA	MICRO-COMP (D) BASED STAND ALONE	LRMP INTERFACE USES COMMERCIAL PACKAGES SUCH AS WPERF, HGRAPH, TIMELINE

Exhibit-2

INDEX

A

Agreements,
  Intra/Inter-Services Support, 2-11
  Maintenance Service, 2-10
Annual Inspection Summary (AIS),
  AIS Funding Relationship, 7-1
  Objective, 7-1
  Purpose, 7-1
  Preparation of, 7-2
  Type “A”, 7-2
  Type “B”, 7-2,7-3
  Type "C" 7-2,7-9
Appraisal,
  Management’s Responsibility, 1-5

B

Base Engineering Support, Technical (BEST) System,
  Discussion, 8-1
  Objective, 8-1
Base Readiness Report (BASEREP), 1-1, 1-6

C

Checklist,
  Facility Inspection, 4-1
Checkpoints,
  Facility Inspection, 4-1
  PMI, 2-5
Codes,
  Level of Maintenance Classification (LMC), 2-5
  Safety, 2-7
Completed E/S Work Files, 4-14
Completed Job Order Files, 4-14
Condition Evaluation Standards, 2-6
Continuous Inspection Program, 1-3
Contractor Assistance, 3-5,5-2
Control Inspection Procedures,
  Objectives, 3-1
  Purpose, 3-1
  Scheduling, 3-2
  Times, 3-3
Control Inspector’s Duties, 1-4
Cost Estimates,
  Deficiency, 4-8
Cyclic Maintenance Planning Files, 4-14

D

Deficiencies,
  Deferrable, 3-5
  Non-Deferrable, 3-5
Detailed Deficiency List, 4-6
Duties,
  Control Inspector, 1-4
  PMI Inspector, 1-5
  Supervisor, 1-5

E

Engineering Evaluation (EE) of Existing Assets, 2-11
Engineered Performance Standards (EPS), 2-7

F

Facilities Evaluation and Assistance Team (FEAT) Visits, 1-8
Facility History Files, 4-9
Facility Management Program, 1-2
Facility Maintenance Planning, 4-15
Family Housing Programs,
  Occupancy Inspection, 2-11
  MARIP, 2-11
Forms, 2-10

F (Cont'd)

Future Years Defense Plan (FYDP), 1-1

I

Inspection,
- Frequencies, 8-2
- Guides, 2-5
- Operator, 1-5
- Preparing for, 3-4
- Record, 5-5
- Scheduling, 3-2,5-5
- Standard Hours, 8-2
- Technical Assistance, 2-7
- Technical Sources, 2-7

Inspection Report Numbering, 4-7
Inspection Types,
- Certification, 2-4
- Control, 2-3
- Engineering Investigation, 2-4
- Operator, 2-4
- Preventive Maintenance (PM), 2-4
- Specialized, 2-3

Inspector Qualifications, 3-2
Inventories,
- Facility & Equipment, 1-3
- PMI, 2-2
- Real Property Baseline, 2-3
- Replacement Items, 2-2
- Systems, 2-2
- Utility Systems, 2-1

L

Level of Maintenance Classification (LMC) Codes, 2-5
Long Range Maintenance Planning (LRMP) Program, 4-15

M

Maintenance Action Plan (MAP), 4-15
Maintenance Service Agreements (MSA), 2-10
Maintenance Standards, 2-5
Major Deficiencies, 5-6
Management Reports, 8-2
Management Review & Appraisal, 4-15

O

Operator Inspection, 1,5,2-4,6-1
- Objective, 6-1
- Qualifications, 6-1
- Responsibility, 6-1
- Scheduling, 6-1

Organization, 1-4

P

Preventive Maintenance Inspection (PMI),
- Frequencies, 5-3,5-5,8-2
- Guides, 5-3
- Inspector Duties, 1-5
- Inspector Qualifications, 5-2
- Inventory, 5-2
- Procedures,
  - Discussion, 5-1
  - Objective, 5-1
- Program Analysis, 5-6
- Record Card, 5-4
- Standard Hours, 8-2
- Support Requirements, 5-6
- Times, 5-5

Procedures,
- Control Inspection, 3-1
- Operator Inspection, 6-1

Public Works Management Automation (PWMA) System, 8-1

Q

Qualifications,
Inspector, 3-2

R

Rating Factors, 1-6
Readiness Report,
Shore Base, 1-6
Real Property Inventory, 2-1
Records, 2-10
Regulatory Standards, 2-7
Related Programs and Agreements, 2-10
Responsibilities,
Activity, 1-2
Claimant, 1-6
NAVFACENGCOM, 1-8
Report Accuracy, 4-6
Report Descriptions, 4-1
Report Preparation, 4-5
Reports,
Facility Condition Summary, 4-1
Facility Condition Detailed Deficiency, 4-1
Management, 8-2

S

Safety, 1-4
Safety Codes, 2-7
Scheduling Inspections, 3-2
Shore Base Readiness Report (BASEREP), 1-6
Shore Facilities Inspection System
Description, 2-1
Discussion, 1-1
Objective, 1-1
Purpose, 1-1
Scope, 1-1
Shore Facilities Inspection (SFI) Module,
Discussion, 8-1
Inspection Frequencies, 8-2
Inventory, 8-1
Management Reports, 8-2
Objective, 8-1
Scheduling, 8-2
Standard Hours, 8-2
Special Projects Program, 4-8
Standards,
Condition Evaluation, 2-6
Regulatory, 2-7

T

Times,
Control Inspection, 3-3
LRMP, 4-15
PMI, 5-5
Training,
Control Inspection Course, 1-2, 1-8

U

Utility Systems Inventories, 2-1

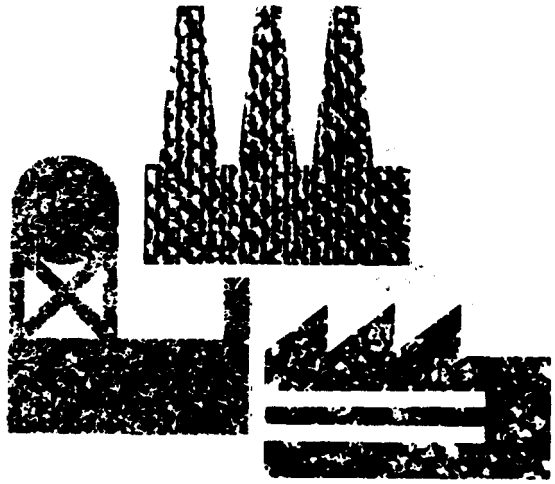
W

Warranty Program, 4-9
Work Packaging, 4-7

Naval Facilities Engineering Command
200 Stovall Street
Alexandria, Virginia 22332-2300

APPROVED FOR PUBLIC RELEASE

Inspection Of Shore Facilities



NAVFAC MO-322
Volume II
January1993

SN 0525-LP-542-8700

SNDL DISTRIBUTION

(25 Copies each):

FKA1C COMNAVFACENGCOM

FKN1 EFDs

(10 Copies each):

FA46 PWCLANT
FB54 PWCPAC

FKP7 NAVSHIPYDs
FT104 PWCCNET

HQ U.S. AIR FORCE
Engineering And Services Center
Tyndall AFB, FL 32403

U.S. ARMY
Office Chief of Engineers
Washington, D.C. 20314 (DAEN-MPO)

(2 Copies each):

E3A LABONR
FA6 NASLANT
FA7 NAVSTALANT
FA10 SUBASELANT
FA18 NAVPHIBASELANT
FA24 COMNAVBASELANT
FA47 HOSPLANT
FB7 NASPAC
FB10 NAVSTAPAC
FB13 SUBASEPAC
FB21 NAVPHIBASEPAC
FB28 COMNAVBASEPAC
FB30 NAVSHIPREPFAC
FB36 NAVFACPAC
FB45 TRIREFFACPAC
FB58 HOSPPAC
FC3 COMNAVACTEUR
FC5 NAVSUPACTEUR
FC7 NAVSTAEUR
FC14 NASEUR
FC17 NAVALHOSP
FD4 OCEANCEN
FF1 COMNAVDIST Washington, DC
FF3 NAVSTACNO
FF6 NAVOBSY
FF32 FIDSUPPACT
FF38 USNA
FF42 NAVPGSCOL
FG2 NAVCOMMSTA
FG3 COMMUNICATIONUNIT
FJA4 NAVALHOME
FKA8F5 SUBASE
FKM9 NSC
FKM12 NAVPETOFF
FKM13 SPCC
FKM15 ASO
FKN2 CBCs
FKN3 OICCS
FKN7 NEESA
FKN10 NAVSUPPFAC
FKN11 NAVCIVENGRLAB
FKP1B WPNSTAs
FKP1J NAVORDSTAs
FKP16 NAVSSES
FKQ6A NAVAIRDEVCEN
FKQ6G NUSC
FKR1A NAS
FKR1B NAVAVNDEPOT
FKR3A NAVAIRENGCEN
FKR5 NAVAVIONICCEN
FR3 NASRESFOR
FR4 NAF
FT6 NASCNET
FT9 NAVAVMUSEUM
FT13 NATTC
FT28 NETC
FT31 NTC
FT37 NAVSCOLCECOFF
FT38 NAVSUBTRACENPAC
FT39 NAVTECHTRACEN
FT55 NAVSCSCOL
FT108 NAVALHOSP
V3 COMCAB
V4 MCAF
V5 MCAs
V16 CG MCB
V23 CG MCLB

Additional Copies may be obtained from:
Naval Publications and Forms Center
5801 Tabor Avenue
Philadelphia, PA 19120

FOREWORD

The establishment of a continuous inspection program is paramount to controlling the physical condition of a shore activity. Control Inspections are a major part of a continuous inspection program. Control Inspections are scheduled examinations and/or tests of shore facilities to determine the physical condition with respect to the required level of maintenance. A well planned and scheduled implementation of a Control Inspection program will generally reduce overall maintenance costs and preserve mission readiness. Facilities kept in good condition reduce costly repairs and the resulting disruptions to planned maintenance and facility users' work schedules.

The primary goal of this publication is to provide a system and recommended procedures to permit cost effective, quality, and responsive real property inspections. Use of this guidance will assure economical maintenance and maximum reliability of facilities and equipment.

Additional information or suggestions to improve this publication are invited and should be submitted through appropriate channels to the Naval Facilities Engineering Command (Attention: Code 163), 200 Stovall Street, Alexandria, VA 22332-2300. This publication supersedes **NAVFAC MO-322 Vol II of May 1978.**

This publication has been reviewed in accordance with the Secretary of the Navy Instruction 5600.16A and is certified as an official publication of the Naval Facilities Engineering Command.

E. R. HAMM
CAPTAIN, CEC, U. S. Navy
Assistant Commander for
Public Works Centers and Departments

ABSTRACT

This publication provides procedural guidance and inspection guides needed to perform Control Inspections. A systems approach is used to facilitate inspections by trade or craft. The publication is designed to aid the facilities inspector in preparing and performing facility inspections and reporting facility deficiencies.

The contents include inspection guides for Structural, Electrical, Mechanical, and Roofing categories. Each guide is formatted into sections including a definitions section, an instructions section and a repair/replacement criteria section. The definitions section provides a listing of related terms and their meanings and scope with respect to performance of physical inspection. The instructions section is the basic trade inspection guide. The repair/replacement criteria section provides guidance to determine the best course of action to correct reported deficiencies.

CHANGE CONTROL SHEET

Document all changes, page replacements, and pen and ink alterations posted in this manual.

AMENDMENT NUMBER	AMENDMENT DATE	POST DATE	POSTED BY (LAST NAME)

Table of Contents

1. INTRODUCTION 1-1

2. APPLICATION 2-1

3. GENERAL INSPECTION INSTRUCTIONS 3-1

3.1 OVERVIEW 3-1
3.2 SCOPE 3-1
3.3 WORKLOAD PLANNING 3-1
3.4 INSPECTOR FITNESS AND INSPECTION EQUIPMENT 3-1
3.5 INSPECTOR PLANNING AND PREPARATION 3-4
3.5.1 Inspector Responsibilities 3-4
3.5.2 Inspector Scheduling 3-4
3.5.3 Research and Folder Preparation 3-4
3.6 PREVENTIVE MAINTENANCE INSPECTION (PMI) 3-4
3.7 INSPECTION PROCEDURE 3-5
3.8 ADDITIONAL INSPECTOR DUTIES 3-6
3.8.1 Emergency/Service Work 3-6
3.8.2 Safety Hazards 3-6
3.8.3 Use of Repair/Replacement Criteria 3-6
3.9 SPECIAL PROJECT CONSIDERATIONS 3-6
3.10 INCORRECT OR CONFLICTING INFORMATION HANDLING . . 3-7
3.11 INSPECTION PROGRAM QUALITY ASSURANCE 3-7

4. INSPECTION GUIDES 4-1

4.1 INSPECTION GUIDE FORMAT 4-1
4.2 INSPECTION GUIDE USE 4-1
4.3 MULTI-TRADE INSPECTIONS 4-1

5.1 DEFINITIONS 5-1
5.2 STRUCTURAL INSPECTION INSTRUCTIONS 5-3
5.2.1 Aircraft Power Check Facility 5-3
5.2.2 Ammunition Storage (Aboveground) 5-3
5.2.3 Antenna-Supporting Towers and Masts 5-5
5.2.4 Asbestos 5-7
5.2.5 Bridges and Trestles 5-8
5.2.6 Brows and Gangways 5-15
5.2.7 Ceiling 5-17
5.2.8 Chimneys and Stacks (Structural) 5-17
5.2.9 Construction 5-20
5.2.10 Doors and Gates 5-20
5.2.11 Exterior wall 5-20
5.2.12 Fencing 5-22
5.2.13 Floor 5-22
5.2.14 Foundation 5-23
5.2.15 Fresh Water Storage 5-23
5.2.16 Grounds 5-28
5.2.17 Imhoff and Septic Tanks 5-33
5.2.18 Interior wall 5-34
5.2.19 Paint 5-34
5.2.20 Railroad Trackage 5-34
5.2.21 Retaining Walls 5-38
5.2.22 Pavement 5-39
5.2.23 Stair 5-40
5.2.24 Storm Drainage System 5-41
5.2.25 Swimming Pools 5-43
5.2.26 Tunnels and Underground Structures 5-46
5.2.27 Waterfront 5-49

5.2.28 Window 5-54
5.3 REPAIR/REPLACEMENT CRITERIA 5-54
5.3.1 Asbestos 5-54
5.3.2 Ceiling. 5-54
5.3.3 Construction 5-54
5.3.4 Door 5-55
5.3.5 Exterior walls 5-56
5.3.6 Fencing 5-56
5.3.7 Floor 5-56
5.3.8 Foundation 5-56
5.3.9 Interior walls 5-56
5.3.10 Painting 5-56
5.3.11 Pavement 5-57
5.3.12 Stair 5-57
5.3.13 Waterfront 5-57
5.3.14 Window 5-57

6. MECHANICAL INSPECTION GUIDE 6-1

6.1 DEFINITIONS 6-1
6.2 MECHANICAL INSPECTION INSTRUCTION 6-3
6.2.1 Air conditioning 6-3
6.2.2 Air handlers 6-4
6.2.3 Boilers 6-4
6.2.4 Elevators 6-16
6.2.5 Emergency eyewash or shower 6-16
6.2.6 Exhaust 6-16
6.2.7 Fire Protection 6-16
6.2.8 Fuel Facilities 6-17
6.2.9 Heating 6-29
6.2.10 Incinerators 6-31

6.2.11 Piping 6-34
6.2.12 Plumbing 6-35
6.2.13 Pump (Submersible Sump) 6-36
6.2.14 Sanitary Sewage Utility System 6-36
6.2.15 Steam Utility System 6-36
6.2.16 Unfired Pressure Vessels 6-37
6.2.17 Water heater 6-43
6.2.18 Water Utility System 6-43
6.3 REPAIR/REPLACEMENT CRITERIA 6-44
6.3.1 Air conditioning 6-44
6.3.2 Airhandler 6-45
6.3.3 Eye wash/shower 6-45
6.3.4 Exhaust 6-45
6.3.5 Fire protection 6-46
6.3.6 Heating 6-46
6.3.7 Insulation 6-47
6.3.8 Piping 6-48
6.3.9 Plumbing 6-49
6.3.10 Water heaters 6-49

7. ELECTRICAL INSPECTION GUIDE **7-1**

7.1 DEFINITIONS 7-1
7.2 ELECTRICAL INSPECI'ION INSTRUCTIONS 7-3
7.2.1 Cathodic Protection Systems 7-3
7.2.2 Chimneys and Stacks (Electrical) 7-6
7.2.3 Disconnecting Switches 7-6
7.2.4 Distribution Transformer 7-9
7.2.5 Electrical Utility System 7-14
7.2.6 Fire alarm 7-15
7.2.7 Floors (Conductive Test) 7-15

7.2.8 Fresh Water Storage (Cathodic Protection System) 7-16
7.2.9 Fuses and Small Circuit Breakers (Under 600 Volts and 30 Amperes) 7-23
7.2.10 General wiring 7-24
7.2.11 Ground Test (Lightning Protection) 7-25
7.2.12 Grounds and Grounding Systems 7-26
7.2.13 Instruments 7-28
7.2.14 Lighting 7-30
7.2.15 Motors and Generators 7-30
7.2.16 Navigation Lights 7-37
7.2.17 Panels 7-38
7.2.18 Potheads 7-39
7.2.19 Power Plants 7-39
7.2.20 Rectifiers 7-42
7.2.21 Relays 7-44
7.2.22 Steel Power Poles and Structures 7-45
7.2.23 Switchgear 7-47
7.2.24 Wood Poles and Accessories 7-48
7.3 REPAIR/REPLACEMENT CRITERIA 7-52
7.3.1 Fire Alarm 7-52
7.3.2 General wiring 7-52
7.3.3 Lighting 7-53
7.3.4 Panels (Primary, Secondary, and Sub) 7-53

8. ROOFING INSPECTION GUIDE 8-1

8.1 DEFINITIONS 8-1
8.2 ROOFING INSPECTION INSTRUCTIONS 8-1
8.2.1 Asphalt strip shingled roof 8-1
8.2.2 Built-up roof 8-2
8.2.3 Metal roof 8-4
8.2.4 Slate roof 8-4

8.2.5 Trusses 8-5
8.2.6 Moisture Survey Instructions for Built-Up Roofs 8-7
8.3 REPAIR/REPLACEMENT CRITERIA 8-7
8.3.1 Asphalt strip shingles 8-7
8.3.2 Built-up Roof 8-8
8.3.3 Metal 8-9
8.3.4 Slate 8-9

INDEX Index-1

CHAPTER 1. INTRODUCTION

The Shore Facilities Inspection System includes three (3) inspection categories: Operator Inspection, Preventive Maintenance Inspection (PMI) and Control Inspection. Specialized Inspection is included within the Control Inspection category. This manual provides procedural guidance and Inspection Guides needed to perform Control Inspections.

Control Inspection is a scheduled examination and/or test of shore facilities to determine the physical condition with respect to the required level of maintenance. Control Inspection objectives are to:

- Provide a thorough examination of each facility and its components and make uniform assessment of condition,
- Appraise the adequacy of Operator and Preventive Maintenance Inspections,
- Assure adequate, consistent levels of maintenance by detecting over or under maintenance,
- Minimize system breakdowns and repair costs,
- Regulate the input of work for Public Works shops or contract,
- Provide Annual Inspection Summary (AIS)/BASEREP reporting data, and
- Identify facility maintenance and repair resource requirements and provide a basis for developing a meaningful, executable resource plan.

While this manual does not cover Specialized Inspections performed by Engineering Field Divisions, Public Works Centers, etc., results of Specialized Inspections should be integrated with findings of the Control Inspection program to determine overall facility condition.

A well planned and scheduled implementation of a Control Inspection program will generally reduce overall maintenance costs and preserve mission readiness. Facilities kept in good condition reduce costly repairs and the resulting disruptions to planned maintenance and facility users' work schedules. Control Inspections go beyond the findings of superficial, aesthetic and cosmetic imperfections. Control Inspections are framework-based inspections performed to seek and document basic deficiencies. Performance of Control Inspections will provide the following:

- Identification of existing and potential problems in a facility, for which cost estimates can be made or, when appropriate, Emergency/Service calls can be initiated,
- Assessment of facility condition,
- Reassessment of previously identified maintenance and repair work, and
- Information to maintain and update the inventory of facility components.

Control Inspections should be planned, scheduled and systematically performed by qualified Public Works inspectors. Control Inspections should be performed by personnel familiar with the facilities and equipment to be maintained, who know the accepted condition standards and guides, and who operate on a planned schedule. Inspector qualification requirements are discussed in NAVFAC MO-322, Volume I, the **Inspection of Shore Facilities** manual.

CHAPTER 2. APPLICATION

This manual is designed to aid the facilities inspector in preparing and performing facility inspections and reporting facility deficiencies. A systems approach is used to facilitate inspections by trade or craft. Generally, inspections are divided into Structural, Electrical, Mechanical, and Roofing. This manual includes inspection guides for these categories.

This manual provides generic Control Inspection guidance. It should be used as a reference only, and not a substitute for sound engineering judgement. In all cases, manufacturer's instructions and local governmental codes should be consulted and used in conjunction with Control Inspection Guides. Appropriate precautions should be exercised when inspecting hazardous material and other environmentally unsafe areas. Where replacement of parts is necessary, the materials used should be of equal or better quality.

Application of Control Inspections with regard to the overall Shore Facilities Inspection System is explained in NAVFAC MO-322, Volume I, the **Inspection of Shore Facilities** manual. Application of Control Inspections with regard to the overall Facilities Maintenance Management program is explained in NAVFAC MO-321, the **Facilities Management** manual.

CHAPTER 3. GENERAL INSPECTION INSTRUCTIONS

3.1 **OVERVIEW:** Each inspection begins with planning, scheduling, research and folder preparation. Inspections are performed by inspectors with trade expertise so the best quality inspection may be made. Each inspector must use their own trade knowledge when inspecting. The key to good facility maintenance planning is the performance of complete inspections. Considerations as to repair versus replacement, methods, materials, conditions, economics, etc. must be considered for each deficiency noted from the inspection. After inspectors finish facility inspections, they make cost estimates for the deficiencies found, prioritize the deficiencies and prepare a facility Inspection Report.

3.2 **SCOPE: A** facility inspection includes all systems and components on the facility, in the facility and within 5 feet of the outside shell of the facility. This includes piping, wiring, steps, awnings, and sidewalks.

3.3 **WORKLOAD PLANNING:** Inspector Supervisors should establish a schedule of inspections to be performed from the latest inventory of facilities. Recommended inspection frequencies and estimated times are provided in MO-322, Volume I. Inspector Supervisors should plan the total inspection workload to the extent it can be evenly distributed from fiscal year to fiscal year. This process will add stability to the amount of deficiency backlog and associated budgeting and resource use to execute corrections. Inspection workload should be evenly distributed and assigned to the inspectors. It is recommended that assignments be made on a weekly basis.

3.4 INSPECTOR FITNESS AND INSPECTION EQUIPMENT:

Have a physical - The physical must certify that you are healthy enough to:

- Wear a respirator
- Crawl in attics and crawl spaces
- Endure other daily tasks of inspectors

Have a respirator fitted for you - You must use and take care of the respirator. Whenever you are in a crawl space, an attic, or other space that might have asbestos, you must wear a respirator.

Collect other safety equipment - Along with a respirator, the following safety equipment should be assembled:

- Hard hat - to be worn in designated areas
- Safety glasses - to be worn in designated areas

- Safety shoes - to be worn during all inspections
- Coveralls - to be worn as necessary
- Asbestos coveralls & booties - to be worn in all attics, crawl spaces, and areas that might have asbestos
- Gloves - to be worn as necessary
- Ear plugs - to be worn in designated areas
- Knee pads - to be worn when crawling

Collect inspection tools - The following items will be useful during inspections:

- Group items for all trades:
  - Ladders
  - Trucks
  - Cameras
    - Polaroid
    - 35 MM
  - Sonic tape
  - Micro cassette recorder
  - Measuring wheel
- Individual items for all trades:
  - Employee Identification Card - to be worn or carried during all inspections
  - Note pad
  - Inspection Report Forms
  - Inspection instructions for your trade
  - Flashlight
  - Tape measure
  - Rule
  - Rain suit
  - Tool bag
  - Clip board
  - Screwdrivers
    - Phillips
    - Straight slot

- Structural:
  - Hammer
  - Sharp, pointed instrument - knife, etc.
  - Adjustable wrench
  - Pliers
- Mechanical:
  - Socket wrench
  - Nut driver set
  - Allen wrench
  - Adjustable wrench
  - Amp probe
- Electrical:
  - Nut driver set
  - Amp probe
  - Side cutters (9” handle recommended)
  - Crescent wrench (6” recommended)
  - Slip joint pliers
  - Knife
- Waterfront:
  - Adjustable wrench
  - Phillips head screwdriver
  - Socket wrench
  - Nut driver set
  - Boat with life preserver and/or vest
- Pavement:
  - PAVER book
  - Tape measure
  - Rule
- Utilities:
  - Manhole cover puller
  - Blower for manholes (if going in)

Note: It the inspection requires going into the manhole, a gas free test must be made before entry.

3.5 INSPECTOR PLANNING AND PREPARATION:

3.5.1 Inspector Responsibilities. For the inspector, inspections begin only after inspection assignments are made and research is completed. The inspector is assigned an individual schedule of facilities to be inspected by an assigned deadline, usually weekly. The inspector is responsible to schedule time to make sure that all facilities on the list are done on time. Completion of a facility inspection means that physical inspection, writing of inspection reports, data entry to any required data bases, cost estimates, and inventory updates have all been done.

3.5.2 Inspector Scheduling. To begin, the inspector should schedule to meet the facility point-of-contact to discuss problems about the facility prior to actual inspection. If the facility has any security restrictions, make arrangements to gain access and follow procedures as prescribed by local regulations before beginning inspection.

3.5.3 Research and Folder Preparation. Before going to the facility, inspectors should collect all information available about the area to be inspected. It is important to determine problems known and previously reported for revision and update in the scheduled inspection. Sources of this information include previous inspection reports and cost estimates, currently scheduled or in-process minor and specific (Labor Class Codes 06-07) jobs, related contract jobs and warranty data, in-process Emergency and Service jobs, Military Construction (MCON) and Special Projects. 'Much of this information can be obtained in the form of data base reports where automated systems are in use. Scaled floor plans (one line drawings) should also be obtained for marking deficiency locations. Inspection Report forms should be obtained and topical information completed. All of this information should be organized into a facility inspection folder for ready use until the job is complete.

3.6 PREVENTIVE MAINTENANCE INSPECTION (PMI) OVERSIGHT:

During inspection, inspectors should determine that equipment covered by PMI job orders are being properly maintained. Inspectors should also note in the Inspection Report whether equipment requires replacement due to age or condition.

3.7 INSPECTION PROCEDURE:

Begin inspection by talking to the facility point-of-contact and other knowledgeable facility occupants about current and past facility problems. Ask specifically about:

- Structural:
  - Safety hazards
  - Roof or other leaks - note locations of these from the inside so you know where to look for a cause of the problem from the outside
- Mechanical:
  - Safety hazards
  - Air temperature
  - Plumbing problems
- Electrical:
  - Safety hazards
  - Flickering lights or other electrical devices
  - Sparks from panels, lights, or outlets

Using Inspection Guides from Chapter 4, conduct physical inspection of the facility. As you inspect the facility, fill out Inspection Report forms with the required information. Mark the floor plans to note deficiency locations. Each system related to your trade should be checked as a whole (heating system, lighting system, window system, etc.). Start from the outside of the facility and work in.

- Walk around the outside of the facility inspecting the exterior:
- Go into the facility:
- Start at lowest floor and inspect all spaces on the floor, including all:
  - Open areas
  - Rooms
  - Areas above drop ceilings
  - Closets
  - Mechanical rooms
- Continue inspecting floors until all have been done:
- Inspect attic space (crawl in it if you can’t walk through it):
- Inspect roof:
- Inspect under the facility, crawl in crawl spaces where found:

3.8 ADDITIONAL INSPECTOR DUTIES:

3.8.1 Emergency/Service Work. For minor deficiencies (where labor is estimated to be less than 16 hours), Inspector should submit a Service call. If there could be loss or damage to government property, essential services have been disrupted or a personnel hazard exists, Inspector should submit an Emergency call. The Inspection Report should be annotated accordingly.

3.8.2 Safety Hazards. Where safety hazards are found, Inspector should immediately notify:

- Activity's Safety Office
- Inspector Supervisor
- Activity's Staff Civil Engineer or Facilities Management Engineering Division Director

3.8.3 Use of Repair/Replacement Criteria:

Repair/replacement criteria in the Inspection Guides should be used to determine if a system or component should be repaired or replaced. Inspectors should use trade knowledge along with these Guides to make repair or replacement decisions. Age alone may not be sufficient reason to replace something. Use the axiom 'If this were your house, would you replace it or repair it?'. If there is any doubt in what to do, consult the Inspection Supervisor.

3.9 SPECIAL PROJECT CONSIDERATIONS:

Note: To determine if a Special Project should be written and how to write a Step 1 and Step 2 of a Special Project, see NAVFAC INST 11010.20(Series). Anyone creating Special Projects should attend the class on Special Projects offered by Civil Engineering Corps Officer School (CECOS) or an Engineering Field Division/Engineering Field Activity (EFD)/(EFA).

Based on physical inspection, determine the following about the Special Project:

- Is the scope correct?
- Is the cost accurate?
  - Has inflation been considered?
  - Have parts or labor for the tasks increased faster than inflation?
- Is the proposed method of correction appropriate?
- Does the Project still need to be done?

- Does the Project have sufficient detail?

Based on the findings above, process Special Project as follows (provide any amendments recommended to special projects):

- Special Project looks correct, no changes are recommended - Don't do anything to the Project.
- Incorrect scope or cost - Suggest an amendment to the Project.
- Project unnecessary - Suggest cancellation of the Project.
- Lack of detail - Suggest an amendment to the Project.

3.10 INCORRECT OR CONFLICTING INFORMATION HANDLING:

During inspection, information in the facility folders may be determined to be incorrect or conflicting. When this happens, make note of these discrepancies, notify the Inspector Supervisor, and include your assessment of the situation in your Inspection Report.

3.11 INSPECTION PROGRAM QUALITYASSURANCE:

Discrepancies, omissions and understated cost estimates will negatively impact resource budgeting and workload planning. Therefore, it is important to obtain high quality inspection results. To monitor inspection quality, a team consisting of one Inspector, the Inspector Supervisor, and one Maintenance Supervisor and/or Engineer should periodically spot inspect 10% of the completed facilities inspected. By doing this, statistically tracking results, correcting problems, and training people not to make the same mistakes, the Inspection Program will yield high quality inspection results.

CHAPTER 4. INSPECTION GUIDES

4.1 INSPECTION GUIDE FORMAT:

This chapter includes Inspection Guides which are trade oriented. Each Guide is formatted into sections generally including a definitions section, an instructions section and a repair/replacement criteria section. The definitions section provides a listing of related terms and their meanings with respect to performance of physical inspection. The instructions section is the basic trade inspection guide. The repair/replacement criteria section provides guidance to determine the best course of action to correct reported deficiencies. Cost estimates should be developed using applicable criteria.

4.2 INSPECTION GUIDE USE:

Inspectors should use these Guides to supplement the General Instructions provided in Chapter 3. These Guides should be used as a reference and should be complimented with sound engineering judgement. Each facility is unique; therefore, a complete inspection may require inspection of components and systems not included in the Guides. Manufacturer's instructions and local governmental codes should be consulted and used in conjunction with these Guides.

4.3 MULTI-TRADE INSPECTIONS:

Beware of Omissions. An Inspector performing a general (i.e., a complete turn-key) inspection should know to cover all systems and components in a facility without question. Inspectors should read and become familiar with all Guides to know what is expected of each trade and to recognize what may be part of a facility not included in the Guides. When multiple Inspectors are assigned to inspect various components and systems by trade, it is important that the inspection be coordinated. In this case, the Inspector Supervisor should assign a Lead Inspector responsible to make sure the entire facility gets inspected. Any questions should be resolved by the Inspector Supervisor.

CHAPTER 5. STRUCTURAL INSPECTION GUIDE

5.1 DEFINITIONS:

Aircraft Power Check Facility - consists of aircraft securing fittings and mooring eyes anchored in concrete, tie-down chain assembly with aircraft holdback fitting and blast deflectors.

Ammunition Storage (Aboveground) - Ammunition storage facilities that are covered with earth, but aboveground.

Antenna-Supporting Towers and Masts - includes guyed radiators and guys, antenna-supporting strongbacks, strongback insulation to towers, elevating mechanisms, and obstruction and navigation lighting, but does not include inspection of antenna.

Asbestos - minerals used as a noncombustible or chemically resistant material.

Bridges and Trestles - includes those constructed of steel, timber, masonry, concrete, and composite materials. It does not cover concrete boxes with integral floor, which are classed as culverts regardless of span, and are included in Storm Drainage Systems.

Brows and Gangways - includes brows and gangways constructed of steel, wood, and aluminum.

Ceiling - what can be seen from the inside of a room

Construction - the general structure or mainframe of the facility

Doors and Gates - the door package and the interface with the facility and fence gates

Exterior walls - what can be seen from the outside of a facility

Fencing - fencing attached to a facility or as its own facility

Floor - from top of the foundation to the air in the room, including carpet, tiling, painting, etc.

Foundation - from the ground to below the floor of a facility

Fresh Water Storage - includes ground storage reservoirs and tanks and elevated

storage tanks in fresh water systems. Included also are the various accessories normally associated with fresh water tanks.

Grounds - includes lawn and turf areas, areas seeded to rough grasses, agricultural and grazing lands, woodlands, trees and shrubs, runoff and erosion control works, fill and cut slopes, gullies, irrigation systems, and weed control.

Interior Walls -what can be seen from the inside of a facility

Painting - preparing and painting or coating of an inspected surface

Pavement - concrete and asphalt roads, parking lots, sidewalks and airfields

Railroad Trackage - includes running tracks, access tracks, classification yards, sidings, and storage track

Retaining Walls - retaining walls of all kinds, including cribbing and sheet piling when used as retaining walls.

Stair - stairs go from one level to another with 8 treads or more, steps are less than 8 treads.

Storm Drainage Systems - includes catch-basins, curb inlets, pipelines, headwalls, out-falls and tide gates, drop structures and spillways, manholes, culverts, subsurface drainage, gutters, and ditches. A plan of the entire storm drainage system from inlets to outfall ditches should be used.

Swimming Pools - includes swimming pools, wading pools, and accessories, such as spring boards and diving towers.

Tunnels and Underground Structures - including ammunition storage tunnels; pipeline tunnels, vehicular tunnels, and water tunnels; also, underground structures housing utilities, service installations, and similar equipment or operations. It does not include underground tanks, or earth-covered ammunition magazines that are wholly or partly aboveground.

Waterfront - (refer to MO-104 for additional definitions)

Topside - what can be inspected by walking on the top of the structure

Underside - what can be inspected from a boat by or under the structure at mean low water

Underwater - what can be inspected by a diver during an under water inspection

Window - the window package and the interface with the facility

5.2 STRUCTURAL INSPECTION INSTRUCTIONS:

5.2.1 Aircraft Power Check Facility: Comply with all current safety precautions. Check For:

- Aircraft Securing Fittings and Mooring Eyes:
  - cracked, broken or spalled concrete
  - settlement, movement or heave in vicinity of fittings
  - rusted, loose, bent or broken anchor plates and bolts
- Chain:
  - breakage, rust, corrosion and wear between individual links and between links and fittings
  - check chain dimensions for distortion in accordance with NAVSHIPS 0901-260-0001
- Aircraft Holdback and Deck Fittings:
  - rust
  - corrosion
  - bent, worn or damaged parts
- Blast Deflectors:
  - rust
  - corrosion
  - bent, missing or damaged parts

5.2.2 Ammunition Storage (Aboveground): Comply with all current safety precautions. Check for:

- Main, Foundation, and Retaining Walls:
  - Cracks
  - Spalling
  - Broken areas
  - Settlement
  - Failure to maintain 3 ft minimum earthfill width at tops of retaining walls and minimum side slope of 1-1/2 to 1 at earth embankments
  - Drainage problems resulting in surface ponding or other evidence of subsurface draining failure

Ammunition Storage (Aboveground) -Continued

- Floors:
  - Leakage at juncture of metal wall with concrete wall
  - Improper floor slab grading resulting in poor floor drainage
- Metal Surfaces:
  - Punctures
  - Breaks
  - Bends/Bulges
  - Rust
  - Corrosion
  - Mechanical damage
- Damaged roof, wall surfaces, or waterproofing, resulting in leakage. Refer to Chapter 8, Roofing Inspection Guide:
- Painted Surfaces:
  - Rust
  - Corrosion
  - Cracking
  - Scaling
  - Peeling
  - Wrinkling
  - Alligatoring
  - Chalking
  - Fading
  - Complete loss of paint
- Doors:
  - Sagging
  - Binding
  - Broken
  - Defective, or inadequate hinges
  - Missing, broken, or other damage to locks and latches

Ammunition Storage (Aboveground) -Continued

- Sodded areas:
  - Poor condition, presence of bare spots
  - Weeds, trash, debris, or other detrimental conditions constituting a fire hazard or tending to promote erosion
- Inorganic Mulch (gravel, slag, etc.):
  - Insufficient thickness
  - Vegetation growing through
- Ventilators:
  - Rust
  - Corrosion
  - Torn or missing insect screens
  - Water leakage
- Grounding Connections: Test with earth ground tester or ohmmeter to assure electrical continuity and maximum ground impedance and a megger to assure isolation to the building. Refer to Chapter 7, Electrical Inspection Guide, Grounds and Grounding Systems. Check for:
  - Corrosion
  - Mechanical Damage

5.2.3 Antenna-Supporting Towers and Masts: Comply with all current safety precautions. Check for:

- Foundations:
  - cracked, broken, or spalled concrete
  - exposed reinforcing
  - movement or settlement
  - heaving from frost action
- Anchor Bolts and Straps:
  - rust
  - corrosion
  - loose, missing, or damaged parts

Antenna-Supporting Towers and Masts-Continued

- Structural Steel Towers, Ladders, and Safety Cages:
  - rust
  - corrosion
  - loose, missing, twisted, bowed, bent, or broken members
- Splices, Bolts, and Rivets:
  - rust
  - corrosion
  - loose, missing, other damage, broken welds
- Timber Towers and Ladders:
  - loose, missing, twisted, bowed, cracked, split, rotted
  - termite or other insect infestation of wooden members
- Guys and Anchorage:
  - cracked, split, rotted
  - loose, missing or damaged vibration dampers
  - termite or other insect infestation
  - looseness of wooden parts
  - metal parts for rust, corrosion, loose, missing, or other damage
  - frayed or broken strands or unequal tension of guys
  - inadequate deadman anchorage
  - missing or improper safety securing of hardware (i.e., mousing, double nuts)
  - broken or missing ground straps and bonding connections
- Deviations from plumb:
- Painted Surface:
  - rust
  - corrosion
  - cracking
  - scaling
  - peeling

Antenna-Supporting Towers and Masts-Continued

- wrinkling
- alligatoring
- chalking
- fading
- complete loss of paint

■ Obstruction and Navigation Lights: relamping:

■ Improper operation and lack of cleanliness of lights, shields, hoods, and receptacle fittings:

■ Sticking, binding, arcing, or burning of relay contacts; loose connections, missing parts of relays:

■ Lightning Rods and Aerial Terminals: damage from burning:

■ Conduits, Terminals, and Downleading Cables:

- corrosion
- loose or missing attachments to structures
- other damage

■ Poor or unsatisfactory mechanical bonding of joints of aerial terminals, downleading cables, and ground connections:

■ Lack of electrical continuity from aerial terminals through ground connections:

■ Dirt, dust, grease, or other deposits on insulators, or cracks, breaks, chips, or checking of the porcelain glaze or signs of arc tracking:

■ Pulleys, winches, cables, ropes, or the elevating mechanisms and gear for inadequacy or improper operating condition:

5.2.4 Asbestos: Asbestos was used before 1970 mainly for insulation purposes. Asbestos is a general term for several fibrous mineral silicates. It is difficult to detect. Technical Note N-1576 **Characterization of Asbestos Construction Products at Naval Shore Facilities** of May 1980 and Technical memorandum M-52-77-7 **Characterization of Asbestos Construction Materials at Naval Shore Facilities** of April 1977 provide extensive lists of asbestos containing materials. Do not disturb something that could contain asbestos. Asbestos is commonly found in:

Asbestos-Continued

- Friable forms: (dry material which can be crumbled or reduced to powder by hand pressure.):
  - Pipe Lagging
  - Sprayed on insulation
  - Troweled on insulation
  - Tile
    - Ceiling
    - Acoustic
    - Insulating
- Nonfriable forms: (dry material which can be dispersed into atmosphere by mechanical actions such as sawing.):
  - Floor Tile
  - Roofing
  - Sheathing
  - Piping
  - Concretes

5.2.5 Bridges and Trestles: Comply with all current safety precautions. Check for:

- Side Slopes:
  - failure to maintain slopes of 1-1/2 to 1 or more
  - soil erosion
  - inadequately protected with vegetation or mulch
  - concrete overlays (if applicable)
    - cracking
    - spalling
    - broken areas
    - other damage
    - erosion
    - settlement

Bridges and Trestles-Continued

- Bridge and Foundation Protective Structures, such as Riprap Cribbing, Bulkheads, Dolphins, Piles, or Other:
  - missing
  - broken
  - insect and other pest infestation
  - decay
  - erosion
  - undermining
  - scouring
  - other damage
- Drainage Ditches:
  - loose bottom and sides
  - improper side sloping
  - silting
  - failure to protect surrounding areas at outfalls from erosion
  - vegetation encroachment
- Roadway of Approaches:
  - cracked
  - settlement
  - broken
  - corrugated
  - and disintegrated concrete or bituminous surfaces
    - cracked
    - broken
    - other damage to curb and gutter sections
- Approach Fill: settlement, particularly at joint between fill and structure:
- Fences, Barricades, and Railings at Approaches:
  - inadequacy or structural damage
  - missing or illegible load and speed limit signs

Bridges and Trestles-Continued

- Drainage Channels:
  - erosion
  - scouring
  - accumulations of driftwood and debris above, below, and at structure
  - evidence of possible course diversion resulting from obstructions, erosion, or other
  - vegetation
- Concrete Foundation:
  - cracks, scaling
  - disintegration
  - exposed reinforcing
  - wood piling and pads
    - missing
    - broken
    - ineffective bearing
    - decay
    - termite and other pest infestation
  - all foundations
    - scouring
    - undermining
    - settlement
- Abutments and Piers:
  - cracks
  - breaks
  - scaling
  - spalling
  - disintegration
  - open joints
  - other damage
  - evidence of damage from impact and vibration

Bridges and Trestles-Continued

- failure of expansion devices
- damage from floating debris, ice, and waterborne traffic

■ Timber Framing:

- loose
- missing
- twisted
- bowed
- warped
- split
- checked
- unsound members
- deteriorated joints
- rot
- termite and other insect infestation

■ Steel Framing:

- rust
- corrosion
- loose
- missing
- bowed
- bent
- broken members

■ Concrete and Masonry Structures:

- weathering
- cracks
- spalling
- exposed reinforcing
- open, eroded, and sandy mortar joints
- broken and missing stones

Bridges and Trestles-Continued

- missing, corroded, rotted embeded support members (headers, lintel, frames, etc.)

■ All Superstructures:

- damage from floating debris, ice, and waterborne traffic
- misalignment both horizontal and vertical

■ Wood Flooring:

- loose, missing, broken, rotted pieces
- protruding nails and other fastenings
- checkered wearing plates
    - loose
    - missing
    - other damage

■ Structure Roadways:

- cracked
- broken
- corrugated
- disintegrated concrete or bituminous surfaces

■ Concrete Curbs and Gutters and/or Concrete or Masonry Handrails and Handrail Walls:

- loose, missing, and broken individual sections
- misalignment
- sandy and eroded mortar joints
- loose or missing capstones
- other damage

■ Expansion Joints:

- improper sealing
- loose or missing filler
- failure to allow movement when filled with trash or debris
- misaligned

Bridges and Trestles-Continued

- Metal Handrails:
  - rust
  - corrosion
  - loose
  - missing
  - broken
  - misalignment
  - other damage
- Bridge Seats, Bearing and Cover Plates:
  - rust
  - corrosion
  - missing
  - loose
  - other damage
  - failure to cover ranges of movement
- Rollers and Other Similar Devices:
  - rust
  - corrosion
  - inadequate lubrication
  - failure to allow movement
  - failure to cover ranges of movement
- Cables:
  - frayed, raveled, or broken strands
  - inadequate lubrication
  - defective anchorage
  - interference from over-hanging objects

Bridges and Trestles-Continued

- Splices, Bolts, Rivets, Screws, and Other Connections:
  - rust
  - corrosion
  - lose
  - missing
  - broken welds
  - other damage
- Movable Bridges:
  - rust
  - corrosion
  - wear
  - inadequate lubrication. (Examine through complete operating cycle.)
- Utility Supports:
  - rust
  - corrosion
  - loose
  - missing
  - or broken parts
- Utility Lines:
  - corrosion
  - leaks
  - sagging
  - insulation and waterproofing defects
  - mechanical damage
  - inadequate or missing protection barriers

Bridges and Trestles-Continued

- Painted Surfaces:
  - rust
  - corrosion
  - cracking
  - scaling
  - peeling
  - wrinkling
  - alligatoring
  - chalking
  - fading
  - complete loss of paint

5.2.6 Brows and Gangways: Comply with all current safety precautions. Check for:

- Abnormal deflection or side sway:
- Steel and Aluminum Structural Members:
  - rust
  - corrosion
  - loose
  - missing
  - bent
  - buckled
  - broken
- Steel and Aluminum Flooring Members:
  - mechanical damage
  - excessive wear
  - slippery walking surfaces
- Handrails (or cables) and Stanchions:
  - damaged or loose members and fittings
  - wire rope for looseness
  - frayed or broken strands

Brows and Gangways-Continued

- Rollers and Wheels:
  - hard to move
  - lack of lubrication
- Connections:
  - rust
  - corrosion
  - loose
  - missing
  - broken
  - other damage
- Wooden Structural Members:
  - loose
  - missing
  - twisted
  - bowed
  - cracked
  - split
  - broken
  - rotted members, particularly at joints
- Wooden Flooring Members:
  - mechanical damage
  - excessive wear
  - slippery walking surfaces
- Wooden Handrails:
  - loose
  - missing
  - broken

Brows and Gangways-Continued

- Painted Surfaces:
  - rust
  - corrosion
  - cracking
  - scaling
  - peeling
  - wrinkling
  - alligatoring
  - chalking
  - fading
  - complete loss of paint

5.2.7 Ceiling: Check for:

- Deflection or warping:
- Tile:
  - Missing tile
  - Damage
  - Soil
- Plaster:
  - Cracks
  - Damage
  - Loose sections
- Water stains:

5.2.8 Chimneys and Stacks (Structural): Comply with all current safety precautions. Also refer to Chimneys and Stacks (Electrical). Inspect after any severe storm. Check for:

- Foundations:
  - settlement
  - cracks due to heat, shocks, vibrations

Chimneys and Stacks (Structural)-Continued

- Brick and Concrete Walls:
  - weathering
  - cracking
  - spalling
  - eroded or sandy mortar joints
  - expansion and contraction cracks
  - deteriorated paint
  - damage from gases
  - missing, corroded, rotted embeded support members
- Caps:
  - weathering
  - cracking
  - spalling
  - loose material
- Exposed Metal Surfaces:
  - rust, corrosion, and deteriorated paint
  - broken, loose, missing, other damage to bolts, rivets, and welds
- Linings, Supporting Corbels, and Baffles:
  - cracks
  - spalling
  - damage from gases
- Guys, Anchorage, and Bands:
  - lack of tautness
  - rust
  - corrosion
  - frayed, broken, loose, missing or mechanically damaged anchorage

Chimneys and Stacks (Structural)-Continued

- Ladders:
  - rust
  - corrosion
  - paint scaling
  - poor anchorage
  - broken, loose, or missing ladder rungs
  - missing or damaged safety cages, platform railings, etc.
- Painters Trolley:
  - wear, corrosion, other damage to tiller ropes, pulleys, and pulley supports
  - poor pulley support anchorage
- Openings for Cleanout Doors, Breechings and Flues:
  - cracking or spalling of the masonry surfaces
  - metal frames for distortion, rust, corrosion
  - broken, loose, missing, other damage to bolts, rivets, and welds
- Cleanout Doors and Fastenings:
  - distortion
  - rust
  - corrosion
  - wear
  - broken
  - cracked
  - missing parts
  - other damage
- Spark Arrester Screens:
  - clogged with fly ash
  - rust, tears, and other damage
  - bolts and screws for rust, and corrosion
  - loose, broken, or missing parts

5.2.9 Construction: Check the structure for:

- Rot:
- Water damage:
- Bug infestation:
- General deterioration:
- Cracking, splitting, distortion of members:
- Proper connections of members:
- Settling:
- Corrosion/rusting:

5.2.10 Doors and Gates: Check for:

- Operation:
- Fit:
- Seal:
- Rust:
- Rot:
- Damage:
- Wear:
  - Lock sets
  - Hinges
  - Safety/panic hardware
- Cracks:

5.2.11 Exterior wall:

- Gutter and downspouts - Check for:
  - Missing sections
  - Damage
  - Rust
  - Loose sections
  - Missing splash blocks
  - Damaged splash blocks
  - Proper slope
  - Obstructions/clogging

Exterior wall-Continued

- Wall coverings - Check for:
  - Missing sections
  - Loose sections
  - Damage
  - Cracks
  - Spalls
  - Bulges
- Trim and cornices - Check for:
  - Missing Sections
  - Loose sections
  - Damage
  - Rot
- Steps, stoops, and porches - Check for:
  - Loose sections
  - Damage
  - Rot
  - Bug infestation
  - Cracks
  - Spalling
  - Separation of concrete components
  - Settlement
  - Missing members
- Water penetration - Look closely at the areas with water damage or water spots and stains. Check for:
  - Openings
    - Caulking
    - Seals
  - Exterior wall surfaces
    - Holes
    - Cracks

Exterior wall-Continued

- Mortar joints
  - Spalling
  - Cracks
- Flashing deficiencies
- Condensation
- Equipment/piping leaks

5.2.12 Fencing: Refer to Doors and Gates above for fence gates. Check for:

- Missing sections and parts:
- Damage:
- Rust:
- Tunneling and erosion:

5.2.13 Floor: Check for:

- Standing Water:
  - Grade
  - Leaks
  - Clogged drains
- Carpet:
  - Wear
  - Soil
  - Damage
- Tile:
  - Wear
  - Missing and loose tiles
  - Damage
- Deflection:

5.2.14 Foundation:

- Wood - Probe the wood frames with a sharp instrument to check for:
  - Rot
  - Water damage
  - Bug infestation
  - Deterioration
  - Settling
  - Leaks
- Concrete/masonry - Check for:
  - Settling
  - Deterioration
  - Spalling/cracking
  - Leaks

5.2.15 Fresh Water Storage: Comply with all current safety precautions. The health of personnel who enter reservoirs or tanks for inspection must be approved by the medical officer of the activity. To assure against contamination of potable water, procedures established by the Public Works Officer must be carried out. Check for:

- Concrete Foundations:
  - settlement
  - cracks
  - spalling
  - exposed reinforcing
  - insect infestation
  - erosion & undermining
- Wood Foundations and Pads:
  - checked
  - split
  - rot
  - insect infestation
  - direct soil contact of untreated wood
  - settlement

Fresh Water Storage-Continued

- Anchor Bolts and Straps:
  - loose or missing pieces
  - rust
  - corrosion
  - physical damage
- Steel Tanks:
  - rust
  - corrosion
  - leakage
  - damaged protective coatings
  - bent, bowed or broken members
  - loose scale
  - damaged or deteriorated riveted welded seams
- Concrete Tanks:
  - settlement
  - cracks
  - spalling
  - leakage
  - defective joint at juncture of floor and walls
  - exposed reinforcing
  - damaged protective coatings
- Wood Tanks:
  - leakage
  - cracked, checked, split, warped, or mechanically damaged pieces
  - rot
  - termite infestation
  - wall and base sections for vertical and horizontal misalignment
  - bands or hoops for rust, corrosion, looseness or missing

Fresh Water Storage-Continued

- Steel Tower Structure:
  - rust
  - corrosion
  - loose, missing, bowed, bent or broken members
  - loose sway bracing
  - misaligmnent of tower legs
  - evidence of unstableness
- Wood Towers:
  - loose, missing, twisted, bowed, cracked or split pieces
  - rot
  - termite infestation
  - misalignment of tower legs
  - evidence of unstableness
- Wood and/or Steel Ladders, Walkways, Guardrails, Handrails and Stairways:
  - rust corrosion
  - poor anchorage
  - loose or missing pieces
  - other damage
- Handholes, Manholes, Access Doors, Hatchways and Other Covers:
  - loose
  - missing
  - broken
  - rust
  - corrosion
  - improper fit
  - damaged or missing hardware

Fresh Water Storage-Continued

- Concrete Reservoirs:
  - settlement
  - cracks
  - spalling
  - leakage
  - exposed reinforcing
- Expansion Joints:
  - improper sealing
  - loose or missing filler
  - failure to allow movement when filled with trash and debris
  - failure to allow adequate movement
- Earth Embankments:
  - erosion resulting from lack of full sod or vegetation coverage
  - burrowing animals
  - improper drainage
  - ponding water along base
  - leakage through embankment or along outlet piping
- Improper Operation of Valve Control:
  - illegible and improper operating condition of water level indicator
- Valves, Piping, Fittings, Sleeves and Other Accessories:
  - broken
  - loose
  - missing
  - rust
  - corrosion
  - leakage
  - other damage
- Nonintegrity of riser frost casings or insulating materials:

Fresh Water Storage-Continued

- Splices, Bolts, Rivets, Screws and Other Connections:
  - loose
  - missing
  - broken welds
  - rust
  - corrosion
  - other damage
- Painted Surfaces:
  - rust
  - corrosion
  - cracking
  - scaling
  - peeling
  - wrinkling
  - alligatoring
  - chalking
  - fading
  - complete loss of paint
- Cathodic Protection Anodes:
  - defects and broken segments
  - failure to remove anodes where ice forms in freezing weather
- Accumulations of dirt:
  - trash
  - debris
  - foliage

Fresh Water Storage-Continued

- Lightning Rods, Terminals, Cables and Ground Connections:
  - rust
  - corrosion
  - loose, burned, missing or other damage to parts and connections
  - test for electrical continuity through ground connections
- Obstruction and Navigation Lights:
  - need of relamping
  - other damage
- Lights, Hoods, Shields and Receptacle Fittings:
  - missing
  - loose
  - damaged parts
  - failure to operate
- Conduit:
  - breaks
  - other damage
  - water leakage, seals
- Remove conduit inspection plates and examine internal connections for:
  - looseness and inadequacy
  - relays for loose or weak contact springs
  - worn or pitted contact
  - defective operation

5.2.16 Grounds: Check for:

- Lawn and Other Turf Areas including Borders:
  - traffic damage
  - loss of color
  - density
  - sparse and bare spots
  - weeds
  - undesirable grasses

Grounds-Continued

- diseases
- insect damage
- erosion
- silt deposits
- waterborne debris
- excessive height
- bruised or damaged ends from dull mower

■ Trees and Shrubs in Landscaped Areas:

- lack of vigor
- need of trimming
- interference with utilities or buildings
- injury from mowers
- structural weaknesses
- storm, disease or insect damage

■ Border Strips and Areas Seeded to Rough Grasses for Erosion Control:

- poisonous or noxious weeds
- seedling trees that may hinder future mowing
- erosion and siltation
- lack of vigor
- inadequacy of coverage
- evidence of burning

■ Woodlands:

- erosion
- dead, diseased, or damaged trees
- fire-lanes for being impassable
- vegetation growth that may carry ground fires
- hollow trees

Grounds-Continued

- **Earth Dams and Dikes:**
  - damage from erosion
  - burrowing animals
  - seepage
  - lack of vegetation density or vigor of growth
  - drop inlet pipes for stoppage
  - logs
  - debris
  - outlet ends for erosion
  - piping damage or failure
- Emergency Spillways of Drop Inlet Dams:
  - blockage
  - erosion damage
- Permanent Check Dams in Water Course:
  - overflow at notch section
  - bypassing at ends
  - erosion on downstream side
  - damaged and deteriorated walls and apron
- Hillside and Terrace Diversion Embankment, Channels, and Culverts:
  - silt
  - debris
  - rank vegetation
  - low and weak sections
  - overflow
  - erosion
  - gullying
  - burrowing animals

Grounds-Continued

- Valley Drainage Channels including Culverts and Lateral Drains and Tile at Entrance Points:
  - overflow
  - stoppage
  - silt
  - debris
  - bank vegetation
  - erosion
  - caving
  - sloughing
  - scour
- Vegetated Waterways:
  - inadequate vegetation fullness and cover in relation to ground surface area that should be shielded
  - erosion of waterway and along sides
  - debris
  - overflow
- Fill Slopes on Barricades, Highways, Railways, Airfield Runways, Igloos and other Soil-Covered Buildings:
  - erosion
  - burning
  - steepness
  - lack of vigor and insufficient vegetation coverage for protection against beating rain and direct sunshine
  - inadequate fill depth at top of slope wherever buildings and weather conditions necessitate variations on different slopes
  - inadequate surface runoff piping
  - insufficient thickness of organic mulch (gravel, slag, etc)

Grounds-Continued

- Cut Slopes and Diversion Channels:
  - erosion
  - scour
  - burning
  - weaknesses from past or possible overflow
  - lack of vigor or growth and insufficient vegetation coverage
  - inadequate surface runoff piping
- Gulleys including all Surface Water Entrances and Upstream Ends or Head where Mainstream Enters:
  - current rate of erosion
  - resulting pollution and sedimentation of downstream lakes
  - channels
  - damaged lands
  - impairment of bridges and other structures
  - need of erosion control such as temporary brush and wire dams and plantings
- Sprinkler System Nozzles, Sprays, Hose, Pipe and Valves:
  - rust
  - corrosion
  - clogging
  - inadequate width or pressure
  - leakage
  - defective operation
  - evidence of water usage waste indicated by metering records or computations from nozzle hours per acre per annum

Grounds-Continued

- Flood Irrigation Systems including Delivery Channels, Gates, Flow-Control and Water Turnout Works, and Border-Dikes:
  - defective operation
  - erosion
  - silting
  - scour
  - water loss
  - improper application
  - failure to supply to all parts of tract
- Windbreaks of Trees:
  - breakage
  - lack of vigor
  - dead or dying trees requiring replacement
  - disease and insect damage indicated from condition of leaves
  - branches interfering with utility lines
  - contour ridges in arid sections inadequate to prevent surface runoff and retain and cause absorption of storm waters around tree
- Weed Control:
  - vigor and rapid growths indicating need of reapplying soil sterilents
  - erosion damage where soil sterilents were used
  - check for emergence of any and all types of vegetation as an index of the efficacy of the remaining soil chemicals and a need for applying additional chemicals to the soil
  - where selective contact sprays are used, check for percentage of kill and injury to vegetation that is to be preserved
  - check vegetation on adjoining lands for damage by spray drift

5.2.17 Imhoff and Septic Tanks: Refer to NAVFAC Technical Publication DM-5 for standards.

- Visit all septic and Imhoff tanks and manholes to determine proper operation:
- Note any indication of oil, gasoline, or lubricating grease entering the system:

Imhoff and Septic Tanks-Continued

- Note the existence and location of any septic sewage or accumulation of solids in the system:
- Look for sand, mud or grit in the system:
- Note and immediately report the presence of noxious or explosive gas:
- Structural cracks:
- Look for signs of no/inadequate drainage from leach fields:

5.2.18 Interior wall: Check for:

- Bulges:
- Water intrusion of exterior walls:
- Separation of wall and floor:

5.2.19 Paint: Check paint condition of the following:

- Exterior walls:
- Interior walls:
- Floors:
- Doors:
- Windows:
- Fences:
- All other painted surfaces:

5.2.20 **Railroad Trackage:** Comply with all current safety precautions. Refer to NAVFAC MO-103 for additional information. This guide is not intended to be a complete inspection procedure. Inspectors should refer to NAVFACINST 11230.1(Series) for more complete inspection guidance. Check for:

- Tracks: Examine closely where track passes from earth fill to bridges or trestles. (Standard gage is 4’ 8-1/2” which is increased on sharp curves. Maximum gage is 4’ 9-3/4” and minimum gage is 4’ 8”:
  - Vertical and horizontal misalignment caused by heaving
  - sinking
  - churning
  - inadequate expansion
  - particularly during hot weather
  - rough spots (ask train crews)

Railroad Trackage-Continued

- Rails:
  - Breaks
  - splits
  - cracks in head, web or base
  - damage from flat wheels
  - wear
  - head wear
  - creeping or shoving, particularly at curves or ends
  - batter
  - overflow
  - chipping
  - joints
    - loose angle or splice bars
    - loose or missing bolts
    - inadequate expansion. Ends of 39 ft. rails should butt at 85°F. At lower temperatures, clearance of 1/16 inch for every 20° difference or part thereof
  - loose spikes/fasteners or failure to provide sufficient quantity per tie
  - improper tie plate seating
  - improper support of rail
  - obstructed flangeways of girder-type rails
  - obstructed flangeways and tops not flush with pavement or crossing for standard-type rails
  - Road Crossing
    - poor condition
    - roughness to road traffic
    - obstructions
- Ties:
  - Decay
  - splitting
  - general deterioration

Railroad Trackage-Continued

- rail cutting
- insufficient or improper embedment in ballast to prevent movement
- inadequate drainage

■ Ballast:

- Dirt and mud accumulations
- soft or wet spots
- grass or weeds
- washing away and settlement
- inadequate extension beyond ties
- slope to grade steeper than 2 to 1

■ Drainage:

- Obstructed drainage ditches and culverts
- erosion of side slopes and shoulders
- actual or potential slides onto or close to track
- washing or erosion at head-walls
- inlets discharge openings

■ Turnouts: Refer to NAVFACINST 11230.1(Series) to determine proper gages, for example, between frogs and flange faces and on tangents and curves:

- Lack of lubrication
- clogged with debris or dirt
- inadequately spiked
- out-of-gage
- improper operating condition of switch points, switch latches, targets, and lamps:
- loose/missing rail braces
- worn/damaged switch and frog points

■ Tank Car Unloading Tracks:

- Bonding wires across rail joints, between rails and unloading header pipelines, and connections between rails and ground rods, and insulated rail joints

Railroad Trackage-Continued

- loose connections
- corrosion
- frayed or broken strands. (Repair when one strand broken in 7-strand, or more than 3 broken in 19-strand.)

■ Protective Devices:

- Warning Signs
  - inadequate
  - improperly placed
  - illegible
  - telltales improperly placed and in poor condition
- Warning signals/gates
- inadequate and poor structural stability of bumper blocks and cattle guards.
- Guard Rails:
  - poor structural condition and improper placing at sharp curves
  - steep embankments
  - trestles, bridges, or other locations where derailment would be serious
- Retaining Walls:
  - undermining
  - misalignment
  - weephole obstructions
  - other deficiencies that would tend to endanger tracks

■ Clearances:

- Clearances at warehouses and structures less than 8’ from center line of track from rail to 22’ above rail
- Clearances of overhanging shed roof less than 5’6” from centerline of track and from rail to 15’6” above rail
- Clearances that do not conform to AREA standards and are less than those required by serving railroad

Railroad Trackage-Continued

- Presence of weeds or other obstructions blocking view, creating fire hazard, or reducing clearances

5.2.21 Retaining Walls: Check for:

- Concrete Foundations:
  - cracked
  - broken
  - scoured
  - spalling
  - exposed reinforcing
  - evidence of lateral movement, settlement, undermining and rotation
- Concrete or Masonry Walls:
  - cracked
  - broken
  - spalling
  - misplaced sections
  - general deterioration
  - exposed reinforcing
  - eroded and sandy mortar joints
  - bulging
  - vertical and horizontal misalignment
- Timber Walls and Cribbing:
  - cracked
  - broken
  - loose
  - missing
  - wearing
  - undermining
  - rotting
  - insect infestation
  - bulging

Retaining Walls-Continued

- vertical and horizontal misalignment

■ Sheet Piling and Bulkheads:

- rust
- corrosion
- bulging
- vertical and horizontal misalignment

■ Evidence of seepage resulting from obstruction in weepholes or other drainage outlets:

■ Loose or missing premolded expansion joint material allowing washout of backfill:

■ Structural inadequacy and poor physical condition of deadman anchors, other attachments and fastenings:

■ Embankment Slopes and Areas Behind Walls:

- erosion, settlement or slippage resulting from improper drainage
- lack of full sod or vegetation coverage
- damage from burrowing animals
- slopes steeper than angle of repose

5.2.22 Pavement:

■ Asphalt - Check for:

- Alligatoring
- Bleeding
- Blade cracking
- Bumps and sags
- Conjugation
- Depression
- Edge cracking
- Joint reflection
- Lane/shoulder
- Longitudinal
- Patching
- Polished

Pavement-Continued

- Potholes
- Railroad
- Rutting
- Shoving
- Slippage
- Swell
- Weathering

■ Concrete - Check for:

- Blow-up buckling
- Comer breaks
- Joint repairs
- Spalling comer or joint
- Pop-outs
- Partial slab replacement
- Full slab replacement
- Partial depth replacement
- Full depth replacement
- Linear cracking
- Shrinking
- Scaling
- Faulting
- Exposed reinforcement

5.2.23 Stair: Exterior stairs, ladders and handrails - Check for:

■ Rust:

■ Rot:

■ Damage:

■ Deterioration:

5.2.24 Storm Drainage System: Comply with all current safety precautions. Check for:

- Ascertain that invert elevation on nonsedimentation basin and pipe are same:
- Catch-Basins and Curb Inlets:
  - debris
  - obstructions
  - cracked, broken or improperly seated grating
  - settlement
  - Top elevation adequate and compatable to prevent ponding
- Pipelines: Inspect pipe smaller than 48" diameter by using a light between manholes. Crawl through pipe 48" diameter or larger. Tightness of joints may be checked by blocking off a section between manholes for 24 hours to determine amount of ground water infiltration. Use a watchman to open line in event of rain:
  - Misalignment
  - settlement
  - cracked
  - broken
  - open joints
  - sediment
  - debris
  - tree roots
  - erosion in concrete pipes
  - erosion and corrosion in corrugated metal pipes
- Headwalls:
  - cracked
  - broken
  - spalling
  - exposed reinforcing
  - settlement
  - undermining
  - improper condition of pipe joint at headwall

Storm Drainage System-Continued

- Approach Channels:
  - evidence of water channeling under and around pipe or headwall
- Outfall and Channel Beyond Headwall:
  - sediment
  - debris
  - other obstructions
  - evidence of erosion of adjoining property
- Tide Gates:
  - restricted or tight motion
  - loose closure
  - outfall line and bar screens for sediment and obstructions
- Drop Structures and Spillways:
  - silt accumulation and erosion
- Manhole Frames and Covers:
  - rust
  - corrosion
  - poor fit
  - ladder rungs for rust
  - corrosion
  - broken parts
  - damaged supports
- Manhole Walls:
  - cracking
  - spalling
  - exposed reinforcing
  - eroded or sandy mortar joints
  - loose, broken or displaced brick

Storm Drainage System-Continued

- Manhole Bottoms:
  - clogging
  - restricted flow
  - silt
  - sewer pipe fragments (indicating broken pipe)
  - invert elevation of outlet pipe not flush with bottom
- Culverts: Cracks in pavement over subsurface drainage and culverts indicate washout of soil from cracked or broken pipe. Obstructions are indicated by restricted flow after prolonged rainfall:
  - sediment
  - obstructions at inlets and outlets
  - ditch bottoms not flush with pipe inverts
  - noncompacted or previous soil resulting in channeling
- Gutters and Ditches:
  - cracked, broken, or eroded concrete surfaces
  - defective expansion joint
  - misalignment
  - obstructions
  - ponding of water
  - silting or sloughing-off of sides
  - inadequate side vegetation coverage necessary to prevent erosion
- Standing water which would permit mosquito breeding in drainage system:

5.2.25 Swimming Pools: Check for:

- Concrete:
  - cracks
  - breaks
  - spalling
  - exposed reinforcing
  - settlement

Swimming Pools-Continued

- Tile:
  - chipped
  - cracked
  - loose and missing pieces
  - defective mortar joints
- Expansion Joints:
  - leakage
- Wall and Floor Finishes:
  - roughness
  - dirty
- Depth Markers, Safety Markings, and Lane Strips:
  - illegible
- Springboards:
  - cracks
  - breaks
  - splintered
  - other damage
  - loose or missing fastenings
  - absence of nonslip coverings
- Ladders:
  - rust or corrosion of metal parts
  - loose
  - missing
  - broken
  - rot
  - other damage to wooden parts
  - misalignment of towers
- Other Metal Accessories:
  - rust
  - corrosion

Swimming Pools-Continued

- broken or missing parts
- other damage

■ Other Wooden Parts:

- cracks
- breaks
- splintered
- loose joints or fastenings
- rot
- insect
- other damage

■ Main Drains:

- sediment
- rust.

■ Gutter Drains:

- obstructions

■ Walls:

- stains from corroded fittings

■ Fences, Barricades, Dividing Walls and Footings:

- broken
- loose
- missing
- other damage

■ Painted Surfaces:

- blistering
- checking
- cracking
- scaling
- wrinkling
- flaking
- peeling

Swimming Pools-Continued

- rust
- corrosion
- complete absence of paint

5.2.26 Tunnels and Underground Structures: Comply with all current safety precautions. Check for:

- Portal Structures:
  - drainage defects
  - cracks
  - breaks
  - leaks in face and between face and tunnel lining
  - eroded slopes or undermining
- Wing and Face Walls:
  - inadequate protection to personnel
  - erosion of slopes
  - loose rocks
  - actual or potential slides
  - scouring or undermining of walls
- Door and Gate Operation and Locking Devices:
  - rust
  - corrosion
  - loose, missing or damaged parts
  - improper operation
- Concrete Floors:
  - cracks
  - breaks
  - scaling
  - other damage surface dusting
  - settlement
- Earth and Gravel Floors:
  - improper grading and drainage

Tunnels and Underground Structures-Continued

- soft and muddy areas

■ Vehicular Tunnel Floors:
- faulting at joints
- scaling
- abrasion
- depression
- buckling

■ Tracks for misalignment:
- rails for damage
- inadequate or loose connection and supports
- ties for rot or other damage

■ All Linings:
- leakage
- settlement
- displacement
- concrete
    - cracks
    - breaks
    - exposed metal
- looseness
- rust
- corrosion
- timber
    - cracks
    - breaks
    - rot

■ Unlined Tunnels:
- spalling
- disintegration
- loose or fallen rocks

Tunnels and Underground Structures-Continued

- Metal Roofs:
  - rust
  - corrosion
  - inadequate supports
- Pipeline Tunnels:
  - rust
  - corrosion
  - misalignment
  - broken
  - leakage
- Pipeline Supports and Anchors:
  - rust
  - corrosion
  - loose, missing or broken parts
- Defective drainage systems or facilities:
  - particularly in ammunition tunnels
  - indicated by dampness
  - flooding
  - ponding
- General Condition or Ventilation Equipment:
  - apparent defects in operation
  - rust
  - corrosion
  - loose, missing or other damage to related parts
- Lighting Systems and Fixtures:
  - poor operating condition
  - inadequate
  - improper type

Tunnels and Underground Structures-Continued

- Grounding Connections: Grounding of metal parts is required in ammunition tunnels. Refer to Chapter 7, Electrical Inspection Guide, Grounds and Grounding Systems:
  - electrical discontinuity
  - loose, missing, corrosion or other damage to the connections

5.2.27 Waterfront:

Topside -

- Concrete or wood structures - Check for:
  - Horizontal and vertical alignment
  - Missing or broken sections, loose connections, traffic obstructions, and other hazardous conditions of
    - Curbing
    - Handrails
    - Catwalks
  - Wear, breaks, rough or sharp surfaces or edges, and missing bolts of
    - Bollards
    - Bits
    - Cleats
    - Capstans
  - Loose, missing, or broken screws, and wear on
    - Deck drains
    - Scuppers
  - Rust, corrosion, damage, and bent or worn hinge pins of
    - Manhole covers
    - Gratings
  - Rust, cracking, spalling, and other damage of
    - Deck surface
    - Curbs
  - Cracks, holes, and other damage of asphalt coverings
  - Corroded, broken, bent, or missing ladder rungs

Waterfront-Topside-Continued

- Cracked, rotted, loose, or worn decking of wood structures only

■ Synthetic material:

- Structures - Check for
  - Cracked, worn, brittle, or deformed plastic
    - Railing
    - Stanchions
    - Gratings
    - Lighting devices
    - Piping
  - Loose or damaged
    - Fittings
    - Connections
  - Exposed fiberglass
  - Cracked, worn, or deformed rubber fender components
- Coatings, patches, and jackets - Check for
  - Pits, cracks, scars, or abrasions of coatings
  - cracked, loose, or dislodged epoxy patches
  - Punctures, brittleness, tears, abrasions, seam splitting of fabric in pile jackets
- Foam filled fenders
  - Fender-to-pier connection hardware - Check for
    - Condition
    - Proper operation
    - Corrosion
    - Proper horizontal constraint
    - Proper vertical and rotational motion allowable
  - Chain and tire net - Check for
    - Proper operation of end fittings
    - Chain symmetry on the fender
    - Proper protection of the chains by the tires

Waterfront-Topside-Continued

- Proper net tension
- End fittings - Check for
  - Proper operation
  - Corrosion
  - Cracking or separation of fender shell around end fittings

Underside -

- Elastomer shell - Note the size and location of the damage on a sketch. Check for
  - Cuts
  - Tears
  - Punctures
- Concrete:
  - Pile caps - Check for
    - Damage
    - Broken or missing members
    - Cracks
    - Spalling
    - Rust
    - Exposed steel reinforcement
  - Bearing, batter, and fender piles - Check for
    - Damage
    - Broken or missing members
    - Cracks
    - Spalling
    - Rust
    - Exposed steel reinforcement

Waterfront-Underside-Continued

- Pilings or structure - check for loose layers of concrete or hollow spots by sounding with a hammer. A sharp ring noise indicates sound concrete. A soft surface will be detected, not only by sound change, but also by a change in the rebound, or feel of the hammer. A thud or hollow sound indicates a delaminated layer of concrete, most likely from corrosion of steel reinforcement.

■ Wood:

- Stringers and pile caps - Check for
  - Damage
  - Broken or missing members
- Bearing, batter, and fender piles - Check for
  - Damage
  - Broken or missing members
- Dolphins - Check for
  - Broken, worn or corroded
    - Cables
    - Cable connections
  - Corroded, loose, broken, or missing
    - Wedge block
    - Chafing strips and bands
    - Chock bolt hangers
- Pilings - Check for
  - Rot
  - Fungi
  - Marine borer damage
- Interior rot by sounding with hammer and probing suspect areas with a sharp, thin, pointed object. If an area is in question, take a small boring for laboratory analysis using an increment borer. Once the core is extracted, seal the hole with a creosote treated plug to prevent easy access of borers to the interior of the pile

Waterfront-Underside-Continued

- Steel structures - Check for:
  - Corrosion - Corrosion may be evident during visual inspection in the H-piles and sheet piles in two areas, the splash zone and approximately two feet below mean low water. Inside steel pipe piling, anaerobic bacterial corrosion caused by sulphate-reducing bacteria may also be found to exist
  - Abrasion - Abrasion of steel structure can generally be recognized by worn smooth polished areas
  - Fatigue distress - Fatigue distress can be recognized by a series of small hairline fractures perpendicular to the line of stress in the member. Fatigue cracks are difficult to locate by visual inspection. This problem is more common in offshore platforms with welded structural connections than in standard piers and wharves
  - Overload damage - Overloading can be recognized by deformation or distortion of a structural member in the form of a sharp crimp or compression of a bearing or batter pile, deflection of steel sheet piling caused by failure of tie-backs or excessive overload of back-fill or live load
  - Loss of foundation material - Erosion may cause loss of foundation material around the piles supporting the structural element. A loss of foundation material in front of the sheet pile bulkhead may cause kick-out of the toe of the wall and result in bulkhead or pile collapse

Underwater -

A recommendation for an underwater inspection should be considered if the facility maintenance specialist suspects underwater damage. This damage, usually to the piles, may be due to unique environmental factors or marine borer damage. The check-lists above may be used when performing and evaluating an underwater inspection.

5.2.28 Window: Check for:

- Fit:
- Seal:
- Air infiltration:
- Rust:
- Rot:
- Water intrusion:
- Insect damage:
- Glazing condition:
- Broken/cracked panes:
- Missing panes:
- Sash:
  - Fit
  - Seal
- Lock condition:
- Screen condition:

5.3 REPAIR/REPLACEMENT CRITERIA:

5.3.1 Asbestos: Asbestos in good condition will be maintained in place until it must be repaired, replaced with a non-asbestos material, or removed prior to renovations and demolitions in accordance with OPNAVINST 510023C. Asbestos abatement projects should be prepared in accordance with OPNAVINST 11010.20 (Series). Abatement actions should be taken to minimize or eliminate the hazardous exposure to asbestos. These actions include:

- Operation and Maintenance (O&M) Program:
- Encapsulation or enclosure:
- Removal:

5.3.2 Ceiling: Renewal of ceiling finishes is cyclic maintenance. Each situation must be assessed by the inspector before preparing an estimate.

5.3.3 Construction: If in doubt about repairing or replacing the construction of a facility have an engineering study performed to review the situation. For wood, load bearing members use the following, criteria for repair:

- Good overall condition:

- Moderate to severe deflection:
- No deterioration:
- change in facility mission has overloaded members (installation of heavy equipment):

5.3.4 Door.

- Exterior:
  - Wood
    - Repair
      - General good condition
      - Damaged or inoperable hardware
      - Superficial damage or deterioration
    - Replacement
      - General poor condition
      - Doors and frames are rotted or deteriorated
      - Doors are warped
      - Doors are out of plumb due to glue joint failure
  - Steel
    - Repair
      - General good condition
      - Damaged or inoperable hardware
      - Superficial damage or deterioration
    - Replacement
      - General poor condition
      - Doors do not operate properly
      - Major damage or deterioration to doors or frame
- Interior
  - Repair
    - General good condition
    - Minimum damage
    - Replacement hardware easily accessible

- Replacement
    - General poor condition
    - Replacement hardware difficult to obtain

5.3.5 Exterior walls: Walls will normally only be repaired. If replacement is considered, have an engineering study performed.

5.3.6 Fencing:

- Repair:
    - Minor, spotty, or no rust (on metal fencing)
    - Minor damage or deterioration over small sections of fencing
    - General good appearance
- Replacement:
    - Severe rusting (on metal fencing)
    - Major damage or deterioration over a large part of fencing
    - General poor appearance

5.3.7 Floor: (tile, carpet, painted, etc)

Renewal of floor finishes is cyclic maintenance. Each situation must be assessed by the inspector before preparing an estimate.

5.3.8 Foundation: If in doubt about repairing or replacing the construction of a facility have an engineering study performed to review the situation.

5.3.9 Interior walls: Walls will normally only be repaired. If replacement is considered, have an engineering study performed.

5.3.10 Painting: Painting is cyclic maintenance. Normally every 5 years the interior and exterior surfaces of a facility should be repainted. Some factors to consider before specifying a paint job are the:

- Item to be painted:
- Surface type, age, and condition - old and weathered surfaces would require more frequent applications of paint:
- Time since last painting:

5.3.11 Pavement : Divide the pavement area into Branches, Sections using MO-102.5, **Pavement Maintenance Management.** This will translate inspection results into types of distress and rate the severity level. **Use NAVFAC** MO-102.1 **(Asphalt Surfaced Roads and Parking Lots), NAVFAC MO-102.2 (Jointed Concrete Roads and Pavement-Continued Parking Lots), NAVFAC** MO-102.3 **(Asphalt Surfaced Airfields), NAVFAC** MO-103.4 **(Jointed Concrete Airfields).** They contain pictures of the types of distress in asphalt and concrete pavements along with providing the inspector with a method of determining the severity rating. Record the distress types and their severity levels. Then calculate the pavement condition index (PCI). The PCI measures the pavement's structural integrity and surface operating condition on a scale from 0-100, where 0 = failed and 100 = excellent condition. Use a PCI chart to rate the pavement condition for repair or replacement.

5.3.12 Stair: Each situation must be assessed by the Inspector before preparing an estimate. Normally stairs are only repaired.

5.3.13 Waterfront: Generally the waterfront facilities should be repaired. If replacement is considered, request that an engineering evaluation be done to better assess the situation.

5.3.14 Window:

- Steel:
  - Repair
    - General good condition
    - Proper operation
    - Good fit
  - Replacement
    - Badly rusted window frame
    - Leaks evident
    - Single pane
    - Many broken, cracked, or deteriorated frames
    - Poor frame to wall connection
    - Poor operation
    - Poor fit

Window-Continued

- Wood:
  - Repair
    - General good condition
    - Good operation
    - Good fit
  - Replacement
    - Bad rot or deterioration
    - Worn tracks (opening and closing difficult)
    - Leaks evident
    - Single pane
    - Many broken, cracked, or deteriorated frames
    - Total reglazing of windows required to assure good condition

CHAPTER 6. MECHANICAL INSPECTION GUIDE

6.1 DEFINITIONS:

Air conditioning - devices that cool air including heat pumps

Air handler - devices that move heated, cooled, and untreated air and the associated ductwork

Boilers - includes boilers, expansion drums on high temperature water installations, boiler auxiliaries, and controls

Emergency eyewash/shower - all eyewashes, showers, and exposed pipe used to wash eyes or body when contaminated with hazardous materials

Exhaust - devices that cause or allow air to leave a facility (fans, vent, etc.)

Fire protection - everything from the first valve outside of the facility to the discharge point, includes sprinkler systems and hose outlets, note fire extinguishers

Fuel Facilities -

Distribution - fuel distribution facilities include piping, valves, accessories, signs and markings, ground connections, pits, tunnels, and ladders

Receiving and Issue - includes platforms and islands, small structures, fuel hose, hose connections, and adapters, hose racks and reels, grounding connections, portable ladders and steps, portable gangplanks, signs and markings, general cleanliness, and painting

Storage - includes surface and subsurface tanks, tank enclosures, and tank fittings and appurtances

Heating - devices that heat air for a facility, not heat pumps

Incinerators - includes incinerators used for refuse and garbage disposal, including special-purpose types

Piping -

Chilled/Hot Water System - from the first valve off the heat exchanger or chiller to the destination inside the facility

Compressed Air - from the first valve off of the compressor to the destination inside the facility

Natural Gas - from the first valve on the facility side of the facility water meter to the destination inside the facility

Sewage - from 5 feet outside the facility to the source inside the facility

Steam - from the first valve on the facility side of the pressure reducing station closest to the facility, to the destination inside the facility

Water - from the first valve on the facility side of the facility water meter to the destination inside the facility

Plumbing - all fixtures and exposed pipe related to the distribution and use of water in a facility

Sanitary Sewage Utility System - the sewage lines from the facilities to the sewage treatment plant

Steam Utility System - the steam distribution system piping from the steam plant to the point where the steam enters the facility

Unfired Pressure Vessels - includes all closed vessels in which internal pressure is above atmospheric pressure and the pressure is obtained from an external source except (a) cylinders for shipment of compressed or liquified gasses; (b) air tanks for brakes on vehicle; (c) unfired pressure vessels having a volume of 5 cubic feet or less; (d) unfired pressure vessels designed for a working pressure not exceeding 15 pounds per square inch gage; (e) unfired pressure vessels containing only water under pressure for domestic supply purposes, including those containing air, the compression of which serves only as a cushion; (f) unfired pressure vessels used as refrigerant receivers for refrigerating and air conditioning equipment; (g) expansion or accumulator tanks used in conjunction with high temperature water installations

Water heaters - devices that heat water for domestic purposes (including converters and storage tanks when used for domestic hot water)

Water Utility System - the water lines from the base's source (city line, well, reservoir, etc.) through any storage tanks to the destination (facility, fire line, etc.)

6.2 MECHANICAL INSPECTION INSTRUCTION:

6.2.1 Air conditioning:

- Condenser - Check for:
  - Metal cabinet condition
  - Fan and coil condition
- Evaporator - Check for:
  - Metal cabinet condition
    - Fan and coil condition
    - Proper drainage of drain pan
    - Electrical wiring condition
    - Condition and proper operation of control circuits
  - Refrigeration piping and insulation - Check for
    - Hanger system condition
    - Deteriorated piping
    - Leaking and weeping joints
    - Insulation condition and type
    - Asbestos insulation condition whether encapsulation or removal is necessary
    - Piping to ensure that piping is same throughout (copper, black, and galvanized are not mixed)
  - Fan coil units - Check for
    - Proper operation of unit
    - Cabinet damage
    - Drainage of drain pan
    - Leaks
    - Proper mounting
  - Duct system including air diffusers and return air grills - Check for
    - Cleanliness
    - Proper operation of dampers

Air conditioning-Continued

- Insulation damage and type
- Diffuser operation
- Return air grills operation and condition

- Compressors - Check for
  - Excessive noise
  - Oil on deck
  - Leaks at connections to compressors
- Pumps - Check for
  - Leaking at packing glands
  - Excessive noise
  - Leaking at connections
- Electric and pneumatic controls - check for proper operation
- Check water treatment chemicals and system
- Water cooling towers, casings, baffles, fans and tower water distribution system including piping and insulation, sump heaters (steam and electric) - check condition and operation
- Absorption chillers (centrifugal and reciprocating) - check for proper operation and condition
- Expansion tanks - check for condition and proper operation
- Vacuum pumps - check for condition and proper operation

6.2.2 Air handlers:

Check for:

- Condition and operation of
  - Fan motors
  - Squirrel cages
  - Fan belts
- Condition of flexible connection between duct and air handler
- Proper lubrication

6.2.3 Boilers: Comply with all applicable safety precautions. This procedure does not include all requirements and specifications to perform this inspection. Refer to NAVFAC MO-324, **Inspection and Certification of Boilers and Unfired Pressure**

Boilers-Continued

Vessels for more information. Inspectors must obtain and possess a valid NAVFACENGCOM Certificate of Competency and a current license issued by the geographic Engineering Field Division/Engineering Field Activity (EFD)/(EFA). Contracted inspectors must possess a state certificate and a current license issued by the EFD/EFA. Before entering the shell or drums of the boiler, make sure that they have been properly ventilated; that there is no inflammable gas present; that the blow-off and surface blow-off valve, the main and auxiliary steam valves, feed-water valves, and all other valves on connecting pipes are closed; and that a reliable method is used to safeguard these valves while anyone is inside the boiler. When electric cords are used inside a boiler they should be in good condition, well insulated, designed to withstand mechanical injury and provided with a suitable guard. **Naked lights are prohibited.** On this inspection report, indicate decrease in pressure-carrying capacity and recommendations not completed or scheduled for completion from previous inspection reports and log sheets. Check for:

EXTERNAL INSPECTION

- Safety and Relief Valves:
  - accumulated rust, scale or debris
  - obstructed drain
  - hazardous conditions created by discharge
  - try lever not free
  - gags removed
  - stems not bent
- Automatic Low-Water (Level or Flow) Fuel Cut-Off and/or Water Feeding Device:
  - rust
  - corrosion
  - deteriorated or defective parts
  - improper function
- Gages:
  - cracked, broken, missing or dirty glass
  - illegible markings
  - bent pointer

Boilers-Continued

- leaking connections
- improper function of cock between gage and boiler

■ Water Columns and Gage Glasses:

- excessive corrosion
- cracked or dirty glasses
- leakage
- improper drainage

■ Material Storage: lumber or other material on boiler or setting:

■ Lagging:

- loose or missing material
- cracks
- open seams
- evidence of vapor or water leaks

■ Casing:

- distortion
- slippage of bricks
- open seams, cracks
- looseness
- sheared bolts

■ Shell:

- corrosion
- cracks
- leaking roofs, valves, pipes
- rust streaks on covering

■ Boiler Doors:

- sagging
- warping
- cracking
- chipped or broken edges
- worn hinges

Boilers-Continued

- defective locks or latches
- improper operation
- deteriorated or damaged blast deflectors
- condition of gasket

■ Breechings:

- excessive corrosion
- cracked welds
- loose or broken connections
- separated sections

■ Overhead Machinery: loose parts or material that may drop on or strike boiler:

■ Foundation: settlement, improper level:

■ Piping:

- leakage
- strain or torsion
- excessive corrosion
- improper drainage
- misalignment
- lack of support
- inadequate provision for expansion or contraction
- excessive vibration
- water pockets at valves and connections
- loose, deteriorated, strained, inadequate connections
- settlement
- improper tension or alignment in supports

■ Stop and Check Valves:

- loose, missing, broken parts
- excessive wear or corrosion
- leakage
- obstructed drain openings

Boilers-Continued

- Pressure Reducing Valves:
  - loose, missing, broken parts
  - rust, scale, other substance preventing proper operation
- Blow-Off Tanks:
  - excessive corrosion
  - cracks
  - distortion, other weakness
  - leaks, water pockets
  - improperly placed valves
- Ladders and Runways:
  - broken, cracked, split, badly worn members
  - excessive corrosion
  - loose or missing bolts or other connections
  - broken welds
  - abnormal deflection
  - loose or warped sections
  - slippery surfaces
  - inadequate anchorage
- Electric Steam Generators: Refer to Chapter 7, Electrical Inspections Guide, Motors and Generators. Check for:
  - burnt, corroded, frayed, or broken strands in grounding cable
  - loose connections
  - broken or deteriorated screens and guards
  - missing, illegible, or improperly posted warning signs

INTERNAL INSPECTION

- Contamination:
  - connection of potable water to sewer system
  - absence of air gap between potable water and waste pipe
- Preparation for Inspection:
  - inadequate

Boilers-Continued

- incomplete
- untimely

- Steam Gage: improperly calibrated. Recalibrate:
- Boilers Secured or Stored:
  - Wet Lay-up
    - incompletely filled
    - improper pH and sulfite concentration
  - Dry Layup
    - not completely dry
    - inadequate supply of desiccant
    - improper or inadequate placement of desiccant
- Waterside Metal Surfaces:
  - evidence of oil. Report presence of oil
  - indications of scale. Report location, amount, density, degree of hardness, and age of scale
- Plates:
  - cracks
  - defective joints
  - distortion
  - erosion
  - excessive corrosion
  - grooving
  - lap seam cracks
  - cracked or severely corroded rivets
  - cracked welds
  - Determine minimum thickness and calculate new maximum allowable working pressure
- Stays and Braces:
  - cracks
  - bends
  - looseness

Boilers-Continued

- uneven tension
- excessive corrosion or erosion
- loose, cracked, broken connections

■ Reinforcing Plates:
- excessive corrosion
- worn
- cracked
- deformed
- insecurely fastened
- openings obstructed

■ Openings and Connections for Piping and External Attachments:
- obstructed
- inadequate
- excessive corrosion

■ Internal Piping and Fittings:
- loose connections
- breaks
- cracks excessive corrosion
- clogging

■ Protection for Blow-Off Connection:
- spalling
- cracking
- looseness
- missing or worn parts

■ Manholes and Handholes:
- corrosion
- leakage
- distorted
- elongated
- excessively corroded holding clamps

Boilers-Continued

- Tubes:
  - deterioration
  - excessive reduction in thickness
  - bulges
  - cracks
  - defective welds
  - erosion
  - corrosion
  - waste pockets
  - scale
  - distortion
- Ligaments: broken, cracked, leaks:
- Drumheads: cracks, deformation, excessive corrosion:
- Flanging: grooving:
- Soot Blowers:
  - worn, loose, or inadequate bearings and parts
  - incorrect alignment of nozzles
  - excessive scouring of refractory baffles
  - incorrect blowing ranges
  - inadequate traps
  - condition of packing
  - signs of direct impingement of steam on tubes
- Fireside Surfaces or Gas Passages:
  - steam pockets
  - corrosion
  - bulging
  - blistering
  - distortion
  - deformation
  - excessive burning action

Boilers-Continued

- fly ash deposits
- flame leakage
- localization of heat
- deteriorated or loose tie rods and buck stays

■ Fusible Plugs:

- poor condition
- unsound metal
- in service more than one year
- exposed to steam temperature in excess of 425°F

■ Setting:

- improper level
- tendency to settlement
- inadequate provision for expansion and contraction
- excessive corrosion
- holes
- cracks
- slippage
- distortion
- binding
- loose bricks
- improper air space
- poor insulation of steel supporting members
- excessive vibration

■ Furnaces and Baffles:

- spalling
- cracking
- settlement
- distortion
- abnormal cracks and seams
- excessive burning and corrosion

Boilers-Continued

- fly ash deposits
- inadequate expansion joints
- improper protection of mud drums
- loose, missing, deteriorated, improperly placed baffling

■ Firing Equipment and Dampers:

- Burners
  - loose, broken, or missing parts
  - excessive wear or corrosion
- Grates, Stokers and Feeders
  - loose, broken or missing parts
  - excessive wear or corrosion
- Dampers
  - loose, broken, missing, bent, warped, or binding parts
  - excessive wear or corrosion
  - improper operating condition

■ Low-Water Fuel Cut-Off and/or Water Feeding Device:

- scale or dirt deposits
- restricted moving parts
- excessive wear
- loose, broken, or missing parts
- improper function

HYDROSTATIC TEST

■ Preparation: inadequate, incomplete:

■ Inspection:

- leakage
- loose parts
- distortion
- deformations
- Report row and number of tubes requiring rolling or replacement

Boilers-Continued

- Maximum allowable Working Pressure: Recalculate:

INSPECTION OF OPERATION

- Firing Equipment: improper or inefficient operation:
- Controls:
  - inability to maintain proper steam pressure or water temperature and air-fuel ratio throughout capacity range of boiler with load swings of the rapidity encountered in operation
  - improper programming sequence and timing
  - improper cutoff of fuel supply; inability to maintain proper water level or to operate cutoff devices
  - Test flue gas for CO
  - Check air-fuel ratio with CO_2 and O_2 measuring devices
- Steam and Water Piping:
  - leakage
  - excessive vibration
  - water-hammer
  - tendency to crystallize
- Water Columns and Gage Glasses: restricted connections:
- Steam Gages:
  - stuck pointer
  - restricted movement of pointer
  - obstructed connections
- Temperature Indicating Devices: excessive temperatures indicated, particularly during and immediately after high load demands:
- Blow-Off Valves:
  - restricted openings
  - excessively worn or otherwise defective
- Stop and Check Valves:
  - excessive vibration
  - ineffective or defective operation

Boilers-Continued

- Pressure Reducing Valves: defective, inadequate, improper operation:
- Metering and Recording Devices: improper operation:
- Boiler Auxiliaries:
  - steam leakage
  - wastage to atmosphere
  - unnecessary use
  - inadequate or improper functioning
- Boiler Safety and Water-Pressure Relief Valves:
  - improper operation
  - obstructed discharge
  - does not release at required pressure
  - have qualified personnel adjust to proper setting requirements (See MO-324 for appropriate organizations/personnel authorized to perform this function)
- Feedwater Treatment:
  - Equipment: ineffective, inadequate, improper operation
  - Materials: incorrect, insufficient
- Feedwater Quality:
  - proper analyses
  - allowable ranges
  - periodic checks
- Fuel Handling Practices:
  - multiple handling
  - use of duplex equipment for small loads
  - unnecessary heating
  - improperly maintained equipment
  - insufficient operation
- Partial Loading: unnecessary use of similar equipment at part load when one unit could carry load:

6.2.4 Elevators: Check certification to ensure it is current. Record and immediately advise if certification is expired.

6.2.5 Emergency eyewash or shower: Check for:

- Proper operation:
- Condition:

6.2.6 Exhaust:

- Fans - Check for:
  - Proper rotation
  - Belts and sheaves for proper condition, alignment and tension
  - Fan inlet and outlet for system defects
  - Measure fan speed, motor speed, voltage, amperage, static pressure at the fan inlet and outlet, total flow rate at the fan inlet. Request Mechanical Engineering assistance from EFD/EFA/NEESA if inspection capability is not available at local Public Works Department. Request technical support for proper selection of fans to meet special activity requirements of temperature, corrosiveness, abrasiveness, and flammability.
- Bathroom exhaust fan - Check for:
  - Proper ventilation
  - Proper operation
  - Cleanliness of filters
  - Proper operation of dampers
- Exhaust system for clothes dryer - Check for:
  - Proper operations
  - Cleanliness of filters

6.2.7 Fire Protection:

- Sprinkler system piping - Check for:
  - Check for painted fusible elements on sprinkler heads. Painted fusible elements will cause an unwanted delay in sprinkler head operation.
  - Check for painted heat activated devices (HAD's). If heat detectors are used to activate a sprinkler system (i.e., deluge or pre-action systems) the HAD's cannot be painted.

Fire Protection- Continued

- Rusted piping
- Leaking threaded or mechanical joints
- Rusted or broken hangers
- Bent pipe

- Combustible materials above sprinkler heads - It is illegal to have flammable material above a drop ceiling without a sprinkler head to serve that area:
- Connections between fire protection and domestic water (fire water should not be allowed to flow back to the domestic water system). Backflow preventers are required on foam water sprinkler systems. Conventional wet-pipe, dry-pipe, pre-action and deluge sprinkler systems only require a check valve between the sprinkler system and the domestic water.:
- Deterioration of fusible elements on sprinkler heads especially in corrosive or exterior atmospheres. There are no fusible links on halon systems:
- Certification of all components:

6.2.8 Fuel Facilities:

Distribution -

- Above-Ground Piping:
  - leakage
  - loose connections
  - damaged or missing hangers and supports
  - misalignment causing undue stresses at pipe joints or failure to allow freedom of movement at expansion joints
  - defective gland nuts and bolts at expansion joints and clamp-type couplings
  - deteriorated or damaged paint or protective coverings. Stop leaks by takeup within limits of packing gland adjustments
  - defective packing
  - defective hangers and supports
  - defective gland nuts and bolts

Fuel Facilities-Distribution-Continued

- defective anchorage

- Underground Piping: Location of underground leaks may be determined by sectioning the pipelines and performing hydrostatic tests. See Military Fuel Operations Handbook, Office of the Assistant Secretary of Defense (Supply and Logistics):
  - leakage indicated by earth discoloration
  - dead vegetation
  - presence of odors
  - review periodic oil sampling records to determine if there is entrainment of ground water
  - review and compare fuel and replenishment records to determine if there is a loss of fuel
- Valves:
  - leaks
  - corrosion
  - visible defects in stem, operating handwheel or lever, body packing, gland, flanges, and gaskets
  - inadequate lubrication, wear, mechanical damage
  - damage to protective coatings
  - difficult operation
  - Where operational functions of the system will permit and where precautions are feasible against contamination of the fuel, the following inspections should be performed
    - Operate gate and plug-type valves to fully closed and open position, to ascertain condition of valve seats and stem threads and to test limit cutout of remote-controlled valves
    - Inspect plug valves for incorrect adjustment
    - Remove inspection covers of check valves and inspect such parts as valve seats, gates, and hinges, for wear and damage
    - Lift pressure vacuum relief valves by hand to assure against sticking; if setting is questionable, check and reset as specified by the manufacturer's instructions

Fuel Facilities-Distribution-Continued

- Check for
  - loose flanges at leaking gaskets
  - defective gaskets
  - leaking stems, within the limit of packing gland adjustment
  - defective packing
  - defective or missing bolts and nuts, handwheels, and operating levers

■ Meters and Pressure Gages:
- significant drop in pressure after 15 minutes
- leakage
- cracked dial cover glasses
- defective gaskets
- moisture behind glasses
- mechanical damage
- inaccuracy of indicating and recording mechanisms

■ Thermometers:
- inaccuracy
- mechanical damage
- loss of indicating fluid

■ Strainers: Remove obstructions. Remove and examine for wear, damage, obstructions, and replace defective screens:
- leaks
- defective operation

■ Shock Absorbers:
- leaks and mechanical damage
- liquid in U-bend of liquid-cushion type not at proper level
- tube pressure at which pneumatic-tube type operates is below normal pressure plus the amount specified by manufacturer
  - low pressure

Fuel Facilities-Distribution-Continued

- hammering sound in pipelines of bellows-type after previous satisfactory operation indicates probable damage and must be repaired or replaced
- liquid in air-chamber type

■ Vents:

- damaged screens
- dirt or other obstructions blocking discharge to atmosphere
- restricted by paint or corrosion

■ Grounding Connections:

- loose
- missing
- mechanical or corrosive damage
- failure to maintain electrical continuity

■ Grading at Pits and Tunnels: Adjacent earth surface improperly sloped and does not divert surface water away from pits and areas above tunnels:

■ Pits for Valves, Meters, and Pumps:

- defective cover gaskets, hinges, locks
- dry hinges
- trash and debris
- cracked, spalled, or broken concrete areas
- rotted, splintered, broken, and other damage to wooden parts
- rust, corrosion, and cracks in metal covers and frames
- defective gaskets, hinges, locks
- unlubricated hinges
- trash and debris in pits
- other deficiencies

■ Underground Tunnels:

- deteriorated protective coatings
- rust
- corrosion
- decay

Fuel Facilities-Receiving and Issue

- mechanical damage
- defective hinges and locks for access hatches and covers
- leakage at roof seams and caulked pipe seams in concrete walls and other locations
- settlement
- cracked or broken concrete areas

■ Ladders:

- rust
- corrosion
- broken welds
- rot
- splitting
- broken
- loose, missing, or damage to individual parts or connections
- unsafe
- deteriorated paint
- tighten or replace loose, missing, or defective bolts and rungs

■ Signs and Markings:

- inaccuracy
- illegibility

■ Wooden Platforms and Islands:

- loose
- missing
- worn
- rotted
- other damage to individual planks

■ Wood Framing, Supports, Stairs, and Guardrails:

- loose
- missing
- worn

Fuel Facilities-Receiving and Issue-Continued

- rotted
- broken parts

■ Metal Framing, Supports, Stairs, and Guardrails:

- rust
- corrosion
- loose
- missing
- twisted
- bowed
- bent
- broken parts

■ Metal Platforms:

- worn
- bent
- broken
- defective gratings and plates
- connections
- rust
- corrosion
- loose
- missing
- broken
- other damage

■ Concrete Islands:

- cracks
- breaks
- settlement that may lead to failure of pipe or valves
- damage to related equipment

Fuel Facilities-Receiving and Issue-Continued

- Small Structure Concrete Foundations:
  - cracks
  - breaks
  - settlement that may lead to structure failure
- Metal Area:
  - rust
  - corrosion
  - wear
  - other damage
- Wood Framing:
  - wear
  - rot
  - insect infestation
  - other damage
- Roofs and/or Walls:
  - leakage
  - wear
  - rot
  - insect infestation
  - other damage
- Doors and Windows:
  - sagging
  - binding
- Hardware:
  - defective hinges
  - locks
  - broken glass
- Hose Racks and Reels:
  - corrosion of metal

Fuel Facilities-Receiving and Issue-Continued

- rotting and other damage to wood
- mechanical damage
- other defects that may result in injury to stored hose

■ Portable Ladders, Steps, and Gangplanks:

- wear
- mechanical damage
- breakage
- loose, missing, or damaged bolts or connections
- other defects that may be a safety hazard

■ Signs and Markings:

- inaccurate
- illegible

■ Debris and spillage that may cause safety or fire hazard:

■ Permanent and Portable Grounding Connections for Steel Structures, Piping, and Railway Trackage at Fuel Piers and at Receiving and Issue Stands: Test permanent and portable grounding connections with megger or ohmmeter to assure electrical continuity and zero grounding. Refer to Chapter 7, Electrical Inspection Guide, Grounds and Grounding Systems:

- mechanical damage
- corrosive damage

■ Painted Surfaces:

- rust
- corrosion
- cracking
- scaling
- peeling
- wrinkling
- alligatoring
- chalking
- fading
- complete loss of paint

Fuel Facilities-Storage -

- Foundations:
  - settling movement
  - upheaving
  - inadequate soil coverage
- Exterior Concrete Surfaces:
  - spalling
  - cracking
  - exposed reinforcing
  - leakage
- Exterior Steel Surfaces:
  - rust
  - corrosion
  - distortion or other structural failure
  - leakage
  - deteriorated paint
- Roof Surfaces:
  - defects in waterproofing
  - heat-reflecting coatings, coverings
- Floating and Expansion-Type Roofs, Seals, Supports, and Support Guides:
  - rust
  - corrosion
  - improper sealing
  - deteriorated paint
  - structural or mechanical damage caused by freezing weather conditions
- Structural Supports and Connections:
  - rust
  - corrosion
  - rot

Fuel Facilities-Storage-Continued

- broken
- cracked
- distorted
- loose
- missing
- deteriorated paint

■ Tank Linings:

- loss of elasticity
- granulation
- discoloration
- cracks
- peeling
- sloughing off

■ Tank Interior:

- rust
- corrosion
- scale
- deteriorated protective coatings

■ Frames and Covers on Manholes and Hatches:

- rust
- corrosion
- cracks
- breaks
- missing or damaged bolts
- worn defective hinges and gaskets

■ Vents:

- rust
- corrosion
- dirty screens

Fuel Facilities-Storage-Continued

- Pressure and Vacuum Relief Valves:
  - defective operation
  - leakage
  - improper adjustment
- Manometers and Thermometers:
  - inaccuracy
  - mechanical damage
  - loss of fluid
- Float Gages:
  - wear
  - binding
  - apparent inaccuracy
- Cables, Sheaves, and Winch of Swing Lines:
  - wear
  - mechanical damage
  - stuffing boxes and liquid seals
  - deterioration
  - improper operation
- Stairs, Ladders, Platforms, and Walkways:
  - rust
  - corrosion
  - rot
  - broken
  - cracked
  - loose
  - missing
  - members or connections
  - deteriorated paint

Fuel Facilities-Storage-Continued

- Roof Drains and Screens:
  - missing
  - rust
  - clogging
- Ground Connections:
  - loose
  - missing
  - mechanical damage
  - corrosion interfering with electrical continuity
- Interior Heating, Inlet and Outlet Pipes, Nozzles, Supports, Sumps, and Sump Drains:
  - rust
  - corrosion
  - wear
  - loose or missing parts
  - obstructions
  - other defects
- Dikes:
  - cracks
  - breaks
  - spalling
  - rust
  - corrosion
  - settlement
  - heaving
  - soil erosion
  - water seepage
  - inadequate sod cover on outer face where earth-filled
  - inadequate treatment of inner face to prevent vegetation growth
  - access steps for settlement

Fuel Facilities-Storage-Continued

- breaks
- other damage

- Drainage Ditches, Sumps and Earth Surfaces between Ditch and Foundation:
  - improper slope to divert surface water away from foundation and berm
  - trash and debris
  - erosion
- Leakage: Locate leaks by filling completely with water and applying hydrostatic pressure of 4 ft. of water for not less than 4 hours:
  - review records to determine indication of fuel losses
  - review oil sample records to determine if water infiltration

6.2.9 Heating:

- Thermostats - Check for:
  - Proper operation (if possible)
  - Vacuum or air leaks
  - Proper location
- Coils - Check for:
  - Leaks
  - Proper vacuum breaker on condensate return for steam coils
- Zone pumps - check for proper operation:
- Radiators - Check for:
  - Radiator valves and traps condition
  - Leaks at push nipples
  - Operation of automatic air vents on hot water systems
- Baseboard radiators - Check for:
  - Leaks in fin tubes
  - Damaged cover and mounting frame
  - Leaks of radiator valves and traps on steam units
  - Leaks of automatic air vents on hot water units

Heating-Continued

- Fan coil units - Check for:
  - Proper operation
  - Damaged cabinet
  - Proper drainage of drain pan
  - Leaks
  - Proper mounting
- Duct system and components - Check for:
  - Cleanliness
  - Proper operation of dampers
  - Insulation damage and type
  - condition and operation of diffusers
- Control valves - Check for:
  - Vacuum or air leaks at connections
  - Proper operation
- Heat exchangers - Check for:
  - Casing leaks
  - Condition and proper operation of traps
  - Proper operation of associated valves and pumps
  - Proper operation and condition of vacuum breaker on condensate return
- Expansion tanks - Check for:
  - Leaks
  - Deterioration
  - Proper operation
- Boilers: Perform general inspection of boilers and unfired pressure vessels. Use ASHRAE guidelines for life expectancy. Refer to Boilers and Unfired Pressure Vessels sections in this chapter:
  - Stack - Check for:
    - Deteriorated metal
    - Proper stack cap and tension cables

Heating-Continued

- Check certification to ensure it is current
- Casings - Check for
  - Deterioration
  - Insulation deterioration and type

6.2.10 Incinerators: Comply with all current safety precautions. Before inspection, operating personnel should thoroughly clean inside of furnace. Check for:

- Refractory Linings at Throats, Roof Arches, Door Arches and Jambs, Target Wall, Charging Hole Covers, Guillotine Doors, and Combustion Chambers:
  - spalling
  - loosening
  - deterioration of areas or individual units
- Combustion Chambers:
  - deformations
  - breaks
  - wear
  - corrosion
  - soot deposits
  - clinkers
  - ashes
  - excessive slag formations indicating excessive lining deterioration
  - depositing of an excessive amount of noncombustibles
- Drying Hearths and Grates:
  - warped sections
  - burned-out areas
- Exterior Settings:
  - settlement
  - cracks
  - broken areas
  - eroded and sandy mortar joints

Incinerators-Continued

- failure to provide adequate expansion and contraction between furnace setting and building and between flue and chimney

- If leakage is suspected, make open flame test and draft gage, arch, door frames, and wall surfaces:
- Failure of furnace steel framing supports are indicated by damage to arches and roof areas, door casings, and walls:
- Cables and Rigging of Adjustable Dampers and Counterweighted Doors:
  - rust
  - corrosion
  - inadequate lubrication
  - damaged or frayed strands
  - improper operation through defective pulleys, wheels, or other parts
- Doors:
  - rust
  - corrosion
  - warped
  - loose fit
  - damaged or missing parts of latches and hinges
- Tuyeres and Tuyere Plates:
  - warped
  - burned-out areas
- Charging Chute Frames and Covers:
  - rust
  - corrosion
  - broken
  - loose
  - missing parts
- Inadequate ash-handling and ash-removal facilities:
- Portable-Type Pyrometers and Recording or Indicating Types fitted with High and Low Temperature Warning Lights:

Incinerators-Continued

- inadequate
- inaccurate

- Combustion Chamber Draft Gage:
  - improper operating condition
  - inaccuracy
- Need of supplementary fuel:
- Burner Assemblies:
  - improper fuel-air mixtures
  - leakage
  - clogged jets, orifices, petcocks, valves
  - improper positioning of pilot light
  - nonuniform flame spread
  - dirty filters
- Wiring and Controls:
  - loose connections
  - damaged insulation
  - evidence of short circuits
  - loose or weak contact springs
  - worn or pitted contacts
- Examine motor windings and brush rigging:
- Operate control mechanisms through complete cycle of operation:
- Nonavailability and poor condition of operating tools:
- All-Metal Trash Burners and Incinerators:
  - rust
  - corrosion
  - burned-through areas
  - warped and buckled surfaces

Incinerators-Continued

- Can-Washer Equipment:
  - vacuum breakers not installed in water lines
  - improper operating conditions
  - improper drainage for cleaning areas
- Painted Surfaces:
  - rust
  - corrosion
  - cracking
  - scaling
  - peeling
  - wrinkling
  - alligatoring
  - chalking
  - fading
  - complete loss of paint

6.2.11 Piping:

- Drain vent and waste - Check for:
  - Hanger system condition
  - Proper grading
  - Weeping or leaking joints
  - Deteriorated piping
- Steam and water distribution - Check for:
  - Pipe type
  - Hanger system condition
  - Deteriorated piping
  - Leaking, and weeping joints
  - Insulation condition and type - if asbestos, determine if it needs to be encapsulated or removed
  - Proper grade on condensate return
  - Type of pipe on condensate return (when applicable)

Piping-Continued

- Proper operation of steam traps
- Proper drainage, cracking, and proper venting of cooling wells
- Valves - Check for
    - Leaking flanges
    - Packing condition
    - Test operation where practical
- Expansion joints - Check for
    - Leaks at packing glands
    - Anchor points and slip guides
- Pressure reducing valves and components - Check for
    - Chattering
    - Leaking packing glands
- (Water distribution only) Check water for rust and color of water (Cold water rust may require filter where water enters building or shows signs of rusting. Hot water rust only may require hot water tank to be flushed or replaced.)

6.2.12 Plumbing:

- Sinks/tubs - Check for:
    - Cracks and wear of porcelain or other surface
    - Inoperative or leaking mixing valves
    - Pop-up waste (drain plug) operation
    - Proper installation
    - Proper drainage
- Showers - Check for:
    - Proper drainage
    - Leaking valves
    - Leaks through floor
- Water closet - Check for:
    - Proper flush cycles
    - Cracked bowls or tanks
    - Proper securing of flanges

Plumbing-Continued

- Leaks around flushometer connections

■ **Urinals -** Check for:

- Proper flush cycles
- Cracks
- Proper securing of flanges
- Deteriorated "P' traps
- Deteriorated wall connections

6.2.13 Pump (Submersible Sump): Check for water and debris in pits and drain if necessary. Check pump for proper operation.

6.2.14 Sanitary Sewage Utility System: Start the inspections at the facilities and follow the lines until they reach the water treatment facility. Obtain sanitary sewage utility system drawings before inspections. Nothing should be turned on or off and nothing should be opened or closed unless special arrangements have been made with the activity. Notify the local utility department before starting the inspections. Check for:

■ Proper operation of lift stations:

■ Proper inflow of the sewage into the treatment plant (check with the plant operator about problems):

■ Proper flow through manholes:

6.2.15 Steam Utility System: Start the inspection from the steam generating plant and follow the lines until they reach a facility or other destination. Obtain steam utility system drawings before inspections. Nothing should be turned on or off and nothing should be opened or closed unless special arrangements have been made with the activity. Coordinate any inspection with the station utility department before starting the inspections. Have operating personnel available during the inspection to provide information on conditions and to provide access to pits, mechanical rooms, and fenced enclosures. Check through a visual inspection for:

■ Leaks:

■ Proper insulation. (The insulation should meet current criteria and be serviceable:)

■ Condition of all components, including:

- Pipe
- Valves
- Flanges

Steam Utility System-Continued

- Pumps
- Expansion loops
- Expansion joints
- Steam traps
- Anchors
- Alignment of guides and roller supports
- Check trouble logs for recurring outages or areas that require continuing repairs
- Have steam pits opened and check for condition and water intrusion

■ Proper pressure drop across pressure reducing stations:

■ Hanger and support condition:

6.2.16 Unfired Pressure Vessels: Comply with all applicable safety precautions. This procedure does not include all requirements and specifications to perform this inspection. Refer to NAVFAC MO-324 "Inspection and Certification of Boilers and Unfired Pressure Vessels" for more information. Inspectors must obtain and possess a valid NAVFACENGCOM Certificate of Competency and a current license issued by the geographic Engineering Field Division/Engineering Field Activity (EFD/EFA). Contracted inspectors must possess a state certificate and a current license issued by the EFD/EFA. Before entering an unfired pressure vessel make sure that it has been properly ventilated, that there is no inflammable gas or toxic material present, that all valves on connecting pipes are closed, and that a reliable method is used to safeguard these valves while anyone is inside the vessel. When electric cords are used inside an unfired pressure vessel they should be in good condition, well insulated, designed to withstand mechanical injury, and provided with a suitable guard. **Naked lights are prohibited.** From previous inspection reports, indicate decrease in pressure-carrying capacity and note any recommendations in previous reports not completed or not scheduled for completion. Check for:

EXTERNAL INSPECTION

■ Safety and Relief Valves:

- accumulated rust, scale or other debris
- obstructed drain
- hazardous conditions created by discharge
- levers do not operate freely

Unfired Pressure Vessels-External Inspection-Continued

- stems bent

■ Rupture Disks:

- burst
- leaking
- deteriorated
- plugged vent

■ Pressure Indicating Gages:

- broken, missing or dirty glass
- illegible markings
- bent pointer
- leaking connections
- inoperative

■ Lagging:

- loose or missing material
- cracks
- open seams
- evidence of vapor or water leaks

■ Shell:

- corrosion
- leakage
- cracks
- distortion
- cracked or broken welds
- loose or cracked rivets
- loose or missing caulking

■ Supports:

- settlement
- deterioration
- lack of rigidity

Unfired Pressure Vessels-External Inspection-Continued

- cracks
- loose or dislodged material
- excessive corrosion
- cracked or broken welds
- loose or missing bolts or rivets
- warped or bent structural members

■ Piping:

- leakage
- strain or torsion
- excessive corrosion
- improper drainage
- misalignment
- lack of support
- inadequate provision for expansion or contraction
- excessive vibration
- pockets at valves and connections
- loose
- deteriorated
- strained
- inadequate connections
- settlement
- improper tension and alignment in supports

■ Stop and Check Valves:

- loose, missing or broken parts
- excessive wear or corrosion
- leakage
- obstructed drain openings

■ Pressure Reducing Valves:

- loose, missing or broken parts
- rust, scale or other substance preventing proper operation

Unfired Pressure Vessels-External Inspection-Continued

- Pressure Control Switch:
  - loose, missing or broken parts or connections
  - corrosion
  - rust or other substance preventing proper operation

INTERNAL INSPECTION

- Preparation for Inspection:
  - inadequate
  - incomplete
  - untimely
- Pressure Gage:
  - improperly calibrated. Recalibrate
- Vessels Secured or Stored:
  - not completely dry
  - inadequate supply of desiccant
  - improper or inadequate placement of desiccant
- Corrosion Resistant Lining:
  - cracks
  - corrosion behind lining
  - corrosion behind deposits on lining
- Minimum Thickness (Surfaces exposed to Corrosion from Vessels' Contents):
  - determine
- Maximum Corrosion Rate:
  - determine
- Shell Plates:
  - cracks
  - defective joints
  - distortion
  - erosion

Unfired Pressure Vessels-Internal Inspection-Continued

- corrosion
- grooving
- lap seam cracks
- cracked or severely corroded rivets
- cracked welds. Determine minimum thickness and calculate new maximum allowable working pressure

■ Heads:

- cracks
- deformation
- excessive corrosion

■ Stays and Braces:

- cracks
- bends
- looseness
- excessive tension
- excessive corrosion or erosion
- loose, cracked or broken connections

■ Nozzles:

- distortion
- excessive corrosion
- cracked welds
- loose, cracked or severely corroded rivets or bolts
- poor or ineffective threaded conditions

■ Reinforcing Plates:

- cracks
- deformations
- other weaknesses

■ Openings and Connections for Piping and External Attachments:

- obstructed
- inadequate

Unfired Pressure Vessels-Internal Inspection-Continued

- excessive corrosion

HYDROSTATIC OR PNEUMATIC TEST

- Preparation:
  - inadequate
  - incomplete
- Inspection:
  - significant drop in pressure in 15 minutes
  - leakage
  - loose parts
  - deformations
  - Maximum Allowable Working Pressure
  - Recalculated

INSPECTION OF OPERATION

- Controls:
  - inability to maintain proper pressures
  - improper adjustment for cut-out and cut-in devices
- Piping:
  - leakage
  - excessive vibration
  - tendency to crystallize
- Pressure Indicating Gages:
  - stuck pointer
  - restricted movement of pointer
  - obstructed connections
- Temperature Indicating Devices:
  - excessive temperatures indicated
  - particularly during and immediately after high load demands
- Stop and Check Valves:

Unfired Pressure Vessels-Inspection of Operation-Continued

- excessive vibration
- ineffective or defective operation

■ Pressure Reducing Valves:

- defective
- inadequate
- improper operation

■ Metering and Recording Devices:

- improper operation

■ Safety and Relief Valves:

- improper operation
- obstructed discharge
- does not release at required pressure. Have qualified personnel adjust to proper setting requirements (See MO-324 for appropriate organizations/personnel authorized to perform this function)

6.2.17 Water heater: (including convertors and storage tanks where applicable). Check for:

- Age
- Proper temperature
- Proper relief valve installation
- Capacity of each tank in the building
- Holding tank condition (rusting, weeping, or deteriorating)
- Insulation condition and type of insulation
- Type of hot water tank (steam, electric, or reclaim)
- Location of each tank
- Leaks

6.2.18 Water Utility System: **Start** the inspection from the source (water treatment plant, well, local water main, etc,) and follow it until the lines reach a facility or other destination. Obtain water utility system drawings before inspections. Nothing should be turned on or off and nothing should be opened or closed unless special arrangements have been made with the activity. Notify the local utility department before starting the inspections. Check for:

- Valve leaks

Water Utility System-Continued

- Valve box wetness
- Line leaks
- Proper operation of
  - Wells
  - Pumps
- Proper operation of chlorination plant (check with the operator about problems)

6.3 REPAIR/REPLACEMENT CRITERIA:

6.3.1 Air conditioning -

- Chillers:
  - Repair
    - General good condition
    - Only specific parts require replacement or repair
    - Parts are easy to procure
    - Replacing or repairing parts is cost effective
  - Replacement
    - Over 20 years old
    - Badly rusted, damaged, deteriorated
    - Leaking refrigerant or oil (indications of frequent or continuous leaks)
    - Many breakdowns and repairs (check activity record)
    - Parts difficult or impossible to procure
    - Replacing or repairing parts is not cost effective
- Cooling towers:
  - Repair - Only minor repairs required
  - Replacement
    - Over 15 years old
    - Many or severe leaks
    - Heavy corrosion and deterioration
- Controls (electric/pneumatic):

Air Conditioning-Continued

- Repair
  - Only minor adjustments required
  - Repair is cost effective
- Replacement
  - Old, broken, damaged, or inoperative thermostats, valves, and/or other major components
  - Uncontrollable temperature variations throughout facility

6.3.2 Air handler -

- Repair:
  - General good condition
  - Only specific parts require replacement or repair
  - Parts are easy to procure
  - Replacing or repairing parts is cost effective
- Replacement:
  - Over 12 years old
  - Badly corroded or otherwise deteriorated
  - Fan motors inoperative
  - Coil stopped up
  - Fins fall off when touched
  - Parts difficult or impossible to procure
  - Replacing or repairing parts is not cost effective

6.3.3 Eye wash/shower -

- Repair - Minor problems:
- Replacement:
  - Cracked fixtures
  - Not conforming with applicable codes

6.3.4 Exhaust -

- Repair:
  - General good condition
  - Parts are easy to procure

Exhaust -Continued

- Replacing or repairing parts is cost effective
- Minor parts required to make operable

■ Replacement:

- Over 15 years old
- Badly corroded or rusted
- Undersized
- Inoperable
- Parts difficult or impossible to procure
- Replacing or repairing parts is not cost effective

6.3.5 Fire protection : Any type of fire suppression or detection system that has not been actually tested for a long period of time should be tested by the EFD/EFA/PWC fire protection engineer. Consult with them for testing frequency of fire protection systems. Also see NAVFAC MO-117, Maintenance of Fire Protection Systems.

6.3.6 Heating :

■ Radiators/convectors (steam or hot water):

- Repair
  - General good condition
  - Only specific parts require replacement or repair
  - Parts are easy to procure
  - Replacing or repairing parts is cost effective
- Replacement
  - Over 15 years old
  - Unit doesn't work
  - Badly corroded
  - Fins fall off when touched
  - Parts difficult or impossible to procure
  - Replacing or repairing parts is not cost effective

Heating -Continued

- Boilers and related piping:
  - Repair
    - Less than 20 years old
    - Adequate output
    - Parts are easy to procure
    - Replacing or repairing parts is cost effective
    - Records show few repairs
  - Replacement
    - Over 20 years old
    - Records show many repairs
    - Related piping badly deteriorated
    - Inadequate output
    - Parts difficult or impossible to procure
    - Replacing or repairing parts is not cost effective
- Controls (electric/pneumatic):
  - Repair
    - Only minor adjustments required
    - Repair is cost effective
  - Replacement
    - Old, broken, damaged, or inoperative thermostats, valves, and/or other major components
    - Uncontrollable temperature variations throughout facility

6.3.7 Insulation: - (Fiberglass, Armaflex)

- Repair:
  - Only small areas tom or damaged
  - Repair would be cost effective
- Replacement:
  - Over 50% tom or damaged
  - Repair not cost effective

6.3.8 Piping -

- Pipe oil and lubricants (POL): Making repair/replacement recommendations for above ground POL lines is very difficult because of the many factors to consider. POL lines located near the waterfront deteriorate about 50% faster than those away from the water. This deterioration is due to the constant exposure to salt, water, and air if above ground):
    - Waterfront
        - Repair
            - Less than 10 years old
            - Random or spot corrosion or rust
            - General good condition
        - Replacement
            - Over 10 years old
            - Wall thickness reduced 50% (NDT check)
            - Evidence of numerous repairs
            - Evidence of line stress (possibly due to hangar failure)
            - Many and major leaks
            - Large areas of deterioration or rust
    - Above ground, away from waterfront
        - Repair
            - Less than 20 years old
            - Little or no loss in wall thickness (NDT check)
            - Little or no rust or deterioration
        - Replacement
            - Over 20 years old
            - Wall thickness reduced 50% (NDT check)
            - Evidence of numerous repairs
            - Evidence of line stress (possibly due to hanger failure)
            - Many and major leaks
            - Large areas of deterioration or rust

Piping-Continued

- All but pipe oil and lubricants (POL):
  - Repair
    - Less than 20 years old
    - Minor, isolated leaks
    - Little or no corrosion
    - General good condition
  - Replacement
    - Over 20 years old
    - Frequent, bad leaks (joints, other places)
    - Bad corrosion
    - Frequent repairs (check with activity records)
    - Evidence of blockages in pipe due to corrosion

6.3.9 Plumbing:

- Repair - Minor problems:
- Replacement:
  - Cracked fixtures
  - Not conforming with applicable codes

6.3.10 Water heaters:

- Repair - Minor rusting:
- Replacement:
  - Leaking water jackets
  - Leaking steam bundle
  - Replace water heater converters when over 20% of the tubes are plugged

CHAPTER 7. ELECTRICAL INSPECTION GUIDE

7.1 DEFINITIONS:

Cathodic Protection Systems - includes wood poles used to support overhead electric distribution systems and/or telephone open wire or serial cable systems and such accessories and related items as crossarms, insulators, pins, tiewires, hardware, line wires near the pole, guywires, and groundwires

Disconnecting Switches - includes manually group-operated and hook-stick-operated disconnecting switches used on transmission lines and distribution systems, including grounding switches

Distribution Transformer -

Deenergized - includes deenergized electric distribution transformers used for voltage reduction

Energized - includes energized electric distribution transformers used for voltage reduction

Electrical Utility System - the overhead and underground power transmission and distribution lines from the source (base power plant, local utility feed, etc.) to the facility or other final destination

Fire Alarm - the electronic warning system for fire. From the panel to the activating device to the alarm

Fuses and Small Circuit Breakers (Under 600 Volts and 30 Amperes) -Visual inspection only of fuses and small circuit breakers and their enclosures in electrical circuits operating at 600 volts or below and rated at 30 amperes and below

General wiring - all wiring throughout a facility including attic and crawl space wiring

Grounds and Grounding Systems - includes electrical grounds and grounding systems for all electrical equipment, apparatus, machinery, metallic conduit, and all accessories that are a part of the outdoor electrical power distribution system. It also includes grounds of structural supports, frames, towers, safety fencing, hardware, equipment enclosures, system neutrals, and buried ground cable networks and counter-poises used in substation and similar areas. In such places, good engineering practice, Bureau

specifications, and other controlling rules and regulations such as National Electric Code, National Electrical Safety Code, and United States Navy Safety Precautions for Shore Activities, NAVSO P-2455, require grounding for operational and personnel safety. Proper operation of grounding systems for Ordinance Storage Facilities is especially important

Instruments - includes electrical AC and DC indicating, recording, and portable instruments and associated equipment used for measurement of electrical power quantities

Lighting - all the devices that produce light in or around the facility, going from the panel to the light

Motors and Generators - includes AC and DC electric motors, generators, exciters, M-G sets, synchronous converters and condensers, other electrical rotating equipment

Panels - breaker boxes that have one power input and usually many distribution output lines. Panel types are:

Primary - the main power coming into a facility going into the primary panel

Secondary - the second source of power coming into a facility. This will be rated equal to or less than that of the primary panel

Sub - panels off the primary or secondary panel. Note in the comment area if these panels serve other panels

Potheads - includes electrical potheads used in power distribution systems, including potheads used as terminals of underground cables as well as those incorporated as terminals of equipment and a part thereof

Power Plants - includes electrical equipment and apparatus in electric power generating plants of the station type

Relays - Protective relays located in electrical power circuits only. It does not include relays used to protect or control utilization equipment. Inspection is limited to those aspects that relate to care rather than to the operating characteristics of relays

Steel Power Poles and Structures - Steel power poles and towers, metallic street lighting standards, A-frames, and all other steel structures used to support electric power lines or equipment, including those used for transmission lines, distribution systems, substations, and switching stations

Switchgear - includes electrical switchgear, associated apparatus, and equipment connected to distribution circuits in buildings, 600 volts and under, and not located in vaults or fire-resistant rooms. It includes, primarily, switchgear known as “metal clad”, “drawout”, “cubicle”, or “truck” type

Wood Poles and Accessories - Wood poles used to support overhead electric distribution systems and/or telephone open wire or aerial cable systems. Included are such accessories and related items as crossarms, insulators, pins, tiewires, hardware, line wires near the pole, guywires, and ground-wires. Inspection of equipment such as transformers, cutouts, lightning arresters, or terminal boxes that are mounted on wood poles is covered elsewhere

7.2 ELECTRICAL INSPECTION INSTRUCTIONS:

7.2.1 Cathodic Protection Systems: Comply with all current safety precautions. Do not bridge insulated couplings. Do not make or break electrical connections. Determine if preventive maintenance inspections are adequate. Check for:

GALVANIC OR SACRIFICIAL ANODE SYSTEMS:

- Terminals and Jumpers of Test Leads (permanently installed and accessible on underground systems):
  - rust
  - corrosion
  - broken or frayed wires
  - loose connections
  - similar deficiencies. Tighten connections
- Anode Suspensions (elevated water tanks and systems for waterfront structures):
  - rust
  - corrosion
  - bent or broken suspension members or braces
  - frayed or broken suspension lines or cables
  - loose bolts
  - loose cable connections
  - frayed or broken wiring

Cathodic Protection Systems-Continued

- Anodes (waterfront and water tank structures where visible):
  - clean corrosion product off and measure/report the diameter of anodes every three years or when significant deterioration from past inspection is noted
  - report apparent average diameter remaining so arrangements can be made for replacement or adjustment
- Bushing (supporting anode):
  - severe rust and corrosion where resistors including variable types are installed in circuit
  - examine units for corrosion
  - broken or frayed wires
  - loose connections
- Electric Wiring (hot water tanks):
  - poor insulation
  - loose connections

RECTIFIER-POWERED SYSTEMS: Record voltmeter and ammeter readings where installed.

- Exterior of Enclosure:
  - rust
  - corrosion
  - mechanical damage
- Cover Hinges and Locks:
  - inadequate lubrication
  - rust
  - other deficiencies
- Wiring and Fastenings Near Rectifier:
  - broken or damaged insulation
  - rust
  - corrosion on conduit

Cathodic Protection Systems-Continued

- Interior of Enclosure:
  - rust
  - deteriorated/damaged rubber gaskets
  - dirty insulating oil or improper oil level (oil cooled rectifiers only)
  - drops of moisture
  - loose wiring
  - signs of excessive heating. (Do not put hand or tools inside enclosure.)
- Anodes (waterfront structures where visible):
  - clean corrosion product off and measure/report the diameter of anodes every three years or when significant deterioration from past inspection is noted
  - report apparent average diameter remaining so arrangements can be made for replacement or adjustment
- Bushing (supporting anode):
  - severe rust and corrosion where resistors including variable types are installed in circuit
  - examine units for corrosion
  - broken or frayed wires
  - loose connections
- Exposed Wires and Cables:
  - insecure fastenings
  - frayed or broken insulation
- Electrical Connections (wires and cables connected to anode junction boxes and/or other equipment except rectifier enclosures):
  - poor condition
  - loose connections
  - other deficiencies

7.2.2 Chimneys and Stacks (Electrical): Comply with all current safety precautions. Also refer to Chimneys and Stacks (Structural). Check for:

- Lightning Rods, Terminals, Cables, and Ground Connections: Test for electrical continuity from aerial terminals through ground connections:
  - corrosion
  - loose
  - burned
  - missing
  - other damaged parts and connections
- Lights, Hoods, Reflectors, Shields, and Receptacle Fittings:
  - failure to operate
  - missing, loose, or damaged parts
  - moisture
  - need of relamping
- Conduit:
  - breaks and other damage
  - remove conduit inspection plates and examine internal connections
    - for lack of tightness and inadequacy
    - relays for defective operation
    - for loose or weak contact springs
    - worn or pitted contacts
    - moisture

7.2.3 Disconnecting Switches: Comply with all current safety precautions. **DO** NOT operate until tests show circuit is dead and grounding harnesses have been attached. **DO NOT operate without prior clearance from operating forces.** Inspection of pole-mounted switches requires an assistant to operate the switch from the ground. Determine if the preventive maintenance inspections are adequate. Check for:

- Group-Operated Switches:
  - rust
  - corrosion
  - loose brackets and holding bolts
  - nonrigid bearings and supports

Disconnecting Switches- Continued

- Grounding Cables, Clamps and Straps:
  - weak supports
  - broken or frayed portions of conductors
  - loose connections
- Insulating Section of Operating Rod:
  - indications of cracks or signs of flashovers
- Movable Connections:
  - inadequate lubrication
  - rust
  - corrosion
  - other conditions resulting in malfunctioning
- Switch:
  - gears stiff or adjustment needed. (Operate switch several times to determine. **DO NOT operate without prior clearance.)**
- Locking and Interlocking Devices and Mechanism:
  - functional inadequacy to prevent unauthorized operation
- Mounting and Bases:
  - rust
  - corrosion
  - twisted, bent, or warped
  - loose or missing ground wire
- Insulators:
  - cracks, breaks, chips or checking of porcelain glaze, more than thin or transparent film of dirt
  - dust
  - grease
  - other deposits on porcelain
  - damage indicated by streaks of carbon deposits from flashovers
  - loose, broken or deteriorated cement holding insulator to other parts. **(Arrange for insulator cleaning during this inspection since it is performed only when line is deenergized.)**

Disconnecting Switches- Continued

- Blades and Contacts:
  - excessive discoloration from overheating
  - roughness and pitting from arcing
  - misalignment of blades with contacts
  - Arcing Horn Contacts
    - burns
    - pits
    - failure to contact each other throughout their length when switch is opened and closed
  - inadequate tension of bolts and springs
  - inadequate blade stop
  - lack of hinge lubrication
  - insufficient nonoxide grease for blades and contacts
- Cable or Other Electrical Connections:
  - loose bolts
  - discolorations indicating excessive heating at connection points
  - corrosion particularly that resulting from atmospheric conditions
- Electrical Clearances of Cable or Other Conductor:
  - inadequate to other phases or to ground for applicable circuit voltage. (Switch both open and closed,)
- Flexible Connections:
  - frayed, broken or brittle. (Excessive discoloration indicates overheating.)
- Cable from Grounding Switch to Grounding System:
  - frayed
  - broken strands
  - loose connections

7.2.4 Distribution Transformer: Comply with all current safety precautions. Determine if preventive maintenance inspections are adequate.

Deenergized: TRANSFORMER MUST BE DEENERGIZED AND CIRCUIT SWITCHES LOCKED OUT. USE GROUNDING HARNESSES ON INPUT TERMINALS. Before inspection, make arrangements to have electricians and other required labor available. **Note: Inspections described in the Energized section are to be performed as part of this inspection.** Check for:

- Bushings and Insulators:
  - grease
  - dirt
  - other foreign materials
  - improper oil level in oil-filled bushings
- Insulators and Porcelain Parts: Report for investigation by a qualified electrical engineer any chipped glaze exceeding 1/2 inch in depth or an area exceeding one square inch on any insulator or insulator unit:
  - cracks
  - checks
  - chips
  - breaks
  - where flashover streaks are visible, reexamine for injury to glaze or for presence of cracks
  - severe cracks, chipped cement, or indications of leakage around bases of joints of metal to porcelain parts at terminal and transformer ends
- Terminal Ends:
  - mechanical deficiencies
  - looseness
  - corrosion
  - damage to cable clamps
- Connections:
  - heating evidenced by discolorations
  - looseness
  - frayed or broken strands

Distribution Transformer-Continued

- broken cable insulation
- corrosion indicated by blue, green, white, or brown corrosion products on metallic portions of all main and ground terminals, including terminal board and grounding connections inside transformer case

■ Enclosure and Cases:

- signs of moisture if case is opened
- plugged breathers
- inactive desiccant
- enclosure leakage
- weathertightness
- rust or corrosion on inside cover

■ Coils and Cores: If feasible, probe down side with glass rod, and if dirt and sludge exceed approximately 1/2 inch, arrange to change or filter insulating oil, and have coils and cores cleaned. Use low-pressure air, if available, to blow out dust from air-cooled transformers, or pull out dust with vacuum equipment:

- interior deficiencies
- dirt
- sludge

■ Gages and Alarms: ENGINEERING TESTS should be performed under supervision of qualified electrical engineer before, during, or after inspection as applicable. Assistance of inspectors and craft personnel is required, and arrangements should be made with proper authority to assure coordinated effort by everyone taking part:

- liquid Level Gage and Alarm System
  - dirty
  - not readable
  - improper frequency of calibration
- test grounding system
- test dielectric strength of insulating liquid. Refer to NAVFAC MO-200

Distribution Transformer-Continued

- test insulation resistance. Refer to NAVFAC MO-200
- measure load current with recording meter over period of time when load is likely to be at its peak
- measure peakload voltage
- make regulation tests and tests of operating temperature during peak-load-current tests
- test and calibrate thermometers or other temperature alarm systems

Energized: DO NOT CONTACT ANY PART OF THE TRANSFORMER OR ASSOCIATED EQUIPMENT. Check for:

- Concrete Foundations and Supporting Pads:
  - settling and movement
  - surface cracks exceeding 1/16 inch in width
  - breaking or crumbling within 2 inches of anchor bolts
- Anchor Bolts:
  - loose or missing parts
  - corrosion, particularly at points closest to metal base plates and concrete foundations resulting from moisture or foreign matter, and exceeding 1/8 inch in depth
- Mounting Platforms, Wooden:
  - cracks
  - breaks
  - signs of weakening around supporting members
  - rot, particularly at bolts and other fastening, holes through which bolts pass, wood contacting metal
  - burning and charring at contact points, indicating grounding deficiency
  - inadequate wood preservation treatment
- Mounting Platforms, Metallic:
  - deep pits from rust
  - corrosion
  - other signs of deterioration likely to weaken structure

Distribution Transformer-Continued

- Hangers, Brackets, Braces and Connections:
  - rust
  - corrosion
  - bent
  - distorted
  - loose
  - missing
  - broken
  - split
  - other damage
  - burning or charring at wood contact points resulting from grounding deficiency
- Enclosures, Cases and Attached Appurtenances:
  - collections of dirt and other debris close to enclosure that may interfere with radiation of heat from transformer or flashover
  - dirt, particularly around insulators, bushings, or cable entrance boxes
  - leaks of liquid-filled transformers
  - deteriorated paint
  - scaling
  - rust
  - corrosion, particularly at all attached appurtenances, such as lifting lugs, bracket connections, and metallic parts in contact with each other
- Nameplates and Warning Signs:
  - dirty
  - chipped
  - worn
  - corroded
  - illegible

Distribution Transformer-Continued

- improperly placed

■ Grounding:

- loose, missing, broken connections
- signs of burning or overheating
- corrosion
- rust
- frayed cable strands
- more than 1 strand broken in 7-strand cable
- more than 3 strands broken in 19-strand cable

■ Bushings and Insulators:

- cracked, chipped, or broken porcelain
- indication of carbon deposits
- streaks from flashovers
- dirt, dust, grease, soot, or other foreign material on porcelain parts
- signs of oil or moisture at point of insulator entrance

■ Grounding and Phase Terminals:

- overheating evidenced by excessive discolorations of copper
- loose connection bolts
- defective cable insulation
- no mechanical tension apparent as a result of temperature changes
- leads appear improper and create danger of flashovers from unsafe phase-to-phase or phase-to-ground clearances caused by deterioration of leads or expansions during temperature changes.

■ Lightning Arresters:

- where attached to or mounted on, refer to Ground Test (Lightning Protection) (Electrical)

■ Breathers:

- holes plugged with debris
- desiccant-type breathers need servicing or replacement

Distribution Transformer-Continued

- Grills and Louvers for Ventilation of Air-Cooled Transformers: Openings located near floor or ground line can be inspected with small nonmetallic framed mirror having long insulated handle, used in conjunction with light from hand flashlamp having insulated casing. Throw light beam onto mirror and reflect upward into openings:
  - plugged with debris or foreign matter, interfering with free passage of air.

7.2.5 Electrical Utility System: Start the inspections from the source (power plant, local power company feed, or where the power lines come up from the ground.) Obtain electrical utility system drawings before inspections. **Nothing should be turned on or off and nothing should be opened or closed unless special arrangements have been made with the activity. Notify the local utility department before starting the inspections.**

- Overhead - Check for:
  - Condition of all components, especially
    - Rusting of metal parts
    - Rotting of pole (knock the base of the pole with a hammer and listen to sound)
    - Broken insulators
  - Proper sag of conductors
  - Proper installation of components
  - Leaking transformers
- Underground:

The underground electrical system may only be checked by a visual inspection of opened pad mounted transformers and other devices. A maintenance representative from the activity should open the devices. **Inspector should not attempt to open or touch parts of an open device.** Check for:

- Cleanliness inside and out
- Proper gage readings
- Proper installation of all components
- Condition of all components

7.2.6 Fire alarm: Check condition of:

- Pull stations:
- Bells and horns:
- Smoke/heat detectors:
- Control panel:
  - Verify that the power is on. These are generally supplied by 120 volt AC power sources which are then transformed to 24 volt DC within the panel
  - Verify that the battery backup is fully charged
  - Verify that there are no trouble lights on. If trouble lights are illuminated, the panel or field devices need to be serviced
- Annunciator panel:
- Wiring:

7.2.7 Floors (Conductive Test):

- Specifications: Conductive floors may be made of lead, conductive rubber or plastic, conductive masonry material, or conductive composition material. Floors must comply with the following requirements:
  - The surface of the floor must be free from cracks and reasonably smooth. If washing of floors is necessary, the material as installed must be capable of withstanding repeated washing with hot water. If conductive floors are to be waxed, a conductive wax approved by Underwriters' Laboratories, Inc. shall be used
  - The material must not produce sparks when stroked briskly and firmly with a hardened steel file
  - The material must not slough off, wrinkle, or buckle under normal conditions of use
  - The electrical resistance measured between ground and a S-pound electrode in direct contact with 5 square inches of floor area must not exceed 1,000,000 ohms
  - In areas where conductive floors and conductive shoes are required, the total resistance between the ground and the wearer shall not exceed 1 megohm (1 million ohms). Where conductive floors and conductive shoes are required, table tops on which exposed explosives are handled or where explosive dust is encountered shall be covered with properly grounded, conductive, sparkproof material

Floors (Conductive Test)-Continued

- **Testing:** Ensure that conductive floors were tested at the time of installation and thereafter at least semi-annually. The tests shall determine if the floors meet the requirements above. The results of these tests should be posted in preventive maintenance records or a log and maintained on file:
- Type of Instrument: Instruments used in testing floors should be of a type specifically designed for this purpose. It is recommended that the voltage applied by the testing instrument be between 90 and 500 volts. Tests may be conducted with low voltage instruments, but if the floors show more than the maximum resistance by tests with instruments of less than 500 volts, a test with a 500-volt instrument should be made to confirm the results. The instrument used should consist of two dry electrodes, one of which should be a piece of metal which weighs 5 pounds and makes contact with 5 square inches of floor area. The other electrode should consist of a spring clip for attachment to a permanent ground:
- Use of instrument: **Instruments for testing the conductivity of floors shall be used inside the room only if the room is free of explosives;** otherwise, the test instrument shall be placed outside the room. In any case, the floor in the immediate area of electrode contact shall be thoroughly cleaned of all explosive material:

7.2.8 Fresh Water Storage (Cathodic Protection System): See paragraph 7.2.1 for the cathodic protection requirements of fresh water storage. For water tank structure inspection check for:

GALVANIC OR SACRIFICIAL ANODE SYSTEMS:

- Terminals and Jumpers of Test Leads (permanently installed and accessible on underground systems):
  - rust
  - corrosion
  - broken or frayed wires
  - loose connections
  - similar deficiencies. Tighten connections

Fresh Water Storage (Cathodic Protection System)-Continued

- Anode Suspensions (elevated water tanks and systems for waterfront structures):
  - rust
  - corrosion
  - bent or broken suspension members or braces
  - frayed or broken suspension lines or cables
  - loose bolts
  - loose cable connections
  - frayed or broken wiring
- Anodes (waterfront structures where visible):
  - when more than 3/4 spent
  - report apparent average diameter remaining so arrangements can be made for replacement or adjustment
- Bushing (supporting anode):
  - severe rust and corrosion where resistors including variable types are installed in circuit
  - examine units for corrosion
  - broken or frayed wires
  - loose connections
- Electric wiring (hot water tanks):
  - poor insulation
  - loose connections

RECTIFIER-POWERED SYSTEMS: Record voltmeter and ammeter readings where installed.

- Exterior of Enclosure:
  - rust
  - corrosion
  - mechanical damage
- Cover Hinges and Locks:
  - inadequate lubrication

Fresh Water Storage (Cathodic Protection System)-Continued

- rust
- other deficiencies

■ Wiring and Fastenings Near Rectifier:

- broken or damaged insulation
- rust
- corrosion on conduit

■ Interior of Enclosure:

- rust
- deteriorated/damaged rubber gaskets
- dirty insulating oil or improper oil level (oil cooled rectifiers only)
- drops of moisture
- loose wiring
- signs of excessive heating. **(Do not put hand or tools inside enclosure.)**

■ Exposed Wires and Cables:

- insecure fastenings
- frayed or broken insulation

■ Electrical Connections (wires and cables connected to anode junction boxes and/or other equipment except rectifier enclosures):

- poor condition
- loose connections
- other deficiencies

■ Concrete Foundations:

- settlement
- cracks
- spalling
- exposed reinforcing
- termite tubes

Fresh Water Storage (Cathodic Protection System)-Continued

- Wood Foundation and Pads:
  - checked
  - split
  - rot
  - termite infestation
  - direct soil contact of untreated wood
- Anchor Bolts and Straps:
  - loose or missing pieces
  - rust
  - corrosion
- Steel Tanks:
  - rust
  - corrosion
  - leakage
  - damaged protective coatings
  - bent, bowed or broken members
  - loose scale
  - damaged or deteriorated riveted or welded seams
- Concrete Tanks:
  - settlement
  - cracks
  - spalling
  - leakage
  - defective joint at juncture of floor and walls
  - exposed reinforcing
  - damaged protective coatings
- Wood Tanks:
  - leakage
  - cracked, checked, split, warped or mechanically damaged pieces
  - rot

Fresh Water Storage (Cathodic Protection System)-Continued

- termite infestation
- wall and base sections for vertical and horizontal misalignment
- bands or hoops for rust
- corrosion
- looseness or missing

■ Steel Tower Structure:

- rust
- corrosion
- loose, missing, bowed, bent or broken members
- loose sway bracing
- misalignment of tower legs
- evidence of unstableness

■ Wood Towers:

- loose, missing, twisted, bowed or cracked split pieces
- rot
- termite infestation
- misalignment of tower legs
- evidence of unstableness

■ Wood and/or Steel Ladders, Walkways, Guardrails, Handrails and Stairways:

- rust
- corrosion
- poor anchorage
- loose or missing pieces
- other damage

■ Handholes, Manholes, Access Doors, Hatchways and Other Covers:

- loose
- missing
- broken
- rust

Fresh Water Storage (Cathodic Protection System)-Continued

- corrosion
- improper fit
- damaged or missing hardware

■ Concrete Reservoirs:

- settlement
- cracks
- spalling
- leakage
- exposed reinforcing

■ Expansion Joints:

- improper sealing
- loose or missing filler
- failure to allow movement when filled with trash and debris

■ Earth Embankments:

- erosion resulting from lack of full sod or vegetation coverage
- burrowing animals
- improper drainage
- ponding water along base
- leakage through embankment or along outlet piping

■ Improper Operation of Valve Control:

- illegible and improper operating condition of water level indicator

■ Valves, Piping, Fittings, Sleeves and Other Accessories:

- broken
- loose
- missing
- rust
- corrosion
- leakage
- other damage

Fresh Water Storage (Cathodic Protection System)-Continued

- Nonintegrity of riser frost casings or insulating materials:
- Splices, Bolts, Rivets, Screws and Other Connections:
  - loose
  - missing
  - broken welds
  - rust
  - corrosion
  - other damage
- Painted Surfaces:
  - rust
  - corrosion
  - cracking
  - scaling
  - peeling
  - wrinkling
  - alligatoring
  - chalking
  - fading
  - complete loss of paint
- Anodic Rods:
  - defects and broken segments
  - failure to remove anodes where ice forms in freezing weather
- Accumulations of dirt, trash, debris or foliage:
- Lightning Rods, Terminals, Cables, and Ground Connections:
  - rust
  - corrosion
  - loose
  - burned
  - missing
  - other damage to parts and connections

Fresh Water Storage (Cathodic Protection System)-Continued

- test for electrical continuity through ground connections

- Obstruction and Navigation Lights:
  - need of relamping
  - other Lights
- Hoods, Shields and Receptacle Fittings:
  - missing
  - loose
  - damaged parts
  - failure to operate
- Conduit:
  - breaks
  - other damage
- Remove conduit inspection plates and examine internal connections for:
  - looseness and inadequacy
  - relays for loose or weak contact springs
  - worn or pitted contacts
  - defective operation

7.2.9 Fuses and Small Circuit Breakers (Under 600 Volts and 30 Amperes):

Comply with all current safety precautions. DO NOT **contact fuses. DO NOT remove covers. DO NOT deenergize.** Check for:

- By-passing:
  - report apparent by-passing of fuses or circuit breakers for further investigation
- Housekeeping:
  - dust
  - dirt
  - oil
  - grease
  - corrosion
  - foreign matter within enclosure
  - inadequate identification of circuits

Fuses and Small Circuit Breakers (Under 600 Volts and 30 Amperes)-Continued

- Enclosures:
  - deterioration of enclosures or connecting conduit or cable due to rust or corrosion
  - loose, corroded, or missing covers
- Connections (if visible without removing covers):
  - loose
  - corroded
  - inadequate
  - deteriorated insulation
- Capacity:
  - Check size of existing fuses or circuit breakers against system engineering drawings. Report oversized fuses and circuit breakers
- Fuses:
  - overheating indicated by discoloration of brass or copper at contact points
  - distortion
  - charring
  - deterioration of fiber cases of cartridge type cases
- Circuit Breakers:
  - distortion
  - charring
  - deterioration of molded portions of case
- Grounding:
  - loose corroded connections
  - deteriorated or abraded insulation
  - frayed or broken cables

7.2.10 General wiring: Check for:

- Broken conduit:
- Exposed wiring:
- Missing box and conduit covers missing:

General Wiring-Continued

- Deterioration of conductor insulation:
- Sagging or improperly supported conduit:
- Condition of electrical devices, receptacles, switches, electrical equipment, motors, etc.:
- Romex wiring exposed to physical damage:

7.2.11 Ground Test (Lightning Protection):

- Lightning Protection System Requirements:

The resistance of the primary and secondary system shall not exceed 10 ohms. When the primary system is installed in wet ground, its resistance shall not exceed 3 ohms. To obtain continuous and reliable protection, the systems shall be maintained to function efficiently. A higher resistance caused by any parts of the system being corroded, broken, or poorly installed may cause lightning discharged or current to take a less resistant path through the building and its contents thereby causing fires and explosions. Deterioration is most active at the places where the conductors enter the ground.

- Semiannual Inspection:

Ensure that the primary and secondary systems are visually inspected semiannually for evidence of corrosion and broken connections. Repairs for all discrepancies found during these inspections shall be made immediately.

- Annual Test:

Ensure that the lightning protection system is tested electrically annually. The results of these tests, together with the description of the defects noted and repairs made, shall be submitted to the person responsible for the efficient operation of the lightning protection systems and entered in the station records.

- Equipment Used:

Electrical tests consist of measuring the ohms resistance of the system to ground and the ohms resistance of any grounding system or individual ground connection. An instrument such as an ohmmeter or a megger should be used to measure the resistance. The procedures outlined below are based on the use of a testing instrument which is equipped with a test ground. If an instrument such as a megger is used, two instrument grounds are needed. The manufacturer's instructions for using the instrument should be followed carefully to avoid damage to the instrument and to insure valid results.

Ground Test (Lightning Protection)-Continued

- Measurement of Ground Resistance:

A copper-clad steel rod from 3/8 inch to 1 inch in diameter and long enough to be driven into the ground so it makes good contact with permanently moist soil should be used for the test ground. The diameter of the rod has little effect on the magnitude of the electrical resistance to ground.

- Method of Test:

Primary and secondary lightning protection systems shall be tested as follows:

Primary System:

One lead of the test instrument should be connected to the test ground and the second lead in turn to each of the air terminals. The resistance to ground for each air terminal shall be recorded.

Secondary System:

The resistance to ground and the electrical continuity of all grounded doors, windows, gutters, downspouts, shutters, trusses, columns, girders, reinforcing rods, and other metal objects in buildings and magazines should be tested by securing one lead of the test instrument to the part being tested and the other lead to the test ground.

- Electrical Connections:

In order to assure low contact resistance, the metallic surfaces forming each electrical contact must be carefully scraped until they are bright and shiny to remove any paint and oxide film. The teeth of terminal clips should similarly contact a bright and shiny metallic surface. If the surface film is not removed, sufficient pressure must be applied to terminal clips to cause their teeth to break through to the basic metal conductor underneath.

7.2.12 Grounds and Grounding Systems: Comply with all current safety precautions. The condition of the grounding system is important both for proper operation of the distribution system to obtain indications of improper or unsafe conditions affecting operation of the system and to protect personnel from electric shock that might result in injury or death. **Grounds and grounding systems require maintenance at much higher levels of perfection than most other facilities, to assure the required degree of safety to personnel.** Because a current as low as 5 milliamperes is considered

Grounds and Grounding Systems-Continued

dangerously high and current as low as 10 milliamperes may be fatal, extreme care must be exercised in inspecting and testing ground and grounding systems to minimize danger of electric shock and possible resulting injury or death. In general, **NEVER** open a grounding circuit connection when the equipment it is intended to protect is energized. This applies equally to grounds on structural or supporting members, to grounds on equipment enclosures, and to grounds on either primary or secondary system neutrals. The life and safety of everyone approaching, or coming in contact with, electrical facilities depends on how carefully and completely inspections of grounds and grounding systems are performed. When equipment is energized, DO NOT make inspection at bases of electrical equipment, regardless of circuit voltage. Determine if preventive maintenance inspections are adequate. Check for:

- Visual Connections:
  - loose, missing, broken connections
  - signs of burning or overheating
  - corrosion
  - rust
  - frayed cable strands, more than one strand broken in 7-strand cable, more than 3 strands broken in 19-strand cable
- Underground Connections:
  - unsatisfactory condition or defects uncovered when 4 or 5 connections are exposed to view by digging
- Electrical Resistance Tests:
  - From point of connection on structure, equipment enclosure or neutral conductor to top of ground rod, allowable resistance can be obtained from maximum permissive resistance below
  - From ground rod, mat or network to earth ground, allowable resistance can be obtained from max. permissive resistance below
  - From gates to gateposts, allowable resistance is 1/2 ohm
  - From operating rods and handles of group-operated switches to supporting structures, allowable resistance is 1/2 ohm
  - From metallic-cable sheathing to ground rod, cable, or metal structure, allowable resistance is 1/2 ohm

Grounds and Grounding Systems-Continued

- From equipment served by rigid conduit to the nearest grounding cable attachment on conduit runs of less than 25 feet, allowable resistance is 10 ohms

■ Maximum permissive resistance for grounds and grounding systems between equipment or structure being grounded and solid (earth) ground:

- For generating stations, maximum permissive resistance is 1 ohm
- For main substations, distribution substations, and switching-stations on primary distribution systems, maximum permissive resistance is 3 ohms
- For secondary distribution system (neutral) grounding, noncurrent-carrying parts of the distribution system itself, and enclosures of electrical equipment not normally within reach of other than authorized and qualified electrical operating and maintenance personnel, maximum permissive resistance is 10 ohms
- For individual transformer and lighting-arrester grounds on distribution system, maximum permissive resistance is 10 ohms

■ When total resistance in either of the above tests exceeds allowable, measure resistances of individual portions of the circuits to determine the points of excessive resistance and report:

■ Substandard resistance values resulting from poor contact between metallic portions of grounding system and earth:

■ Structural steel, piping, or conduit run exceeding 25 ft used as a current-carrying part of grounding circuit for protection of equipment:

■ Absence of ground-cable connections:

7.6.13 Instruments: Comply with all current safety precautions. Determine if preventive maintenance inspections are adequate. Check for:

■ Electrical Instruments:

- improper shielding, mounting, or enclosures when located near strong magnetic fields, subject to vibrations, extremes in temperature, moisture, metallic and other dust, and acid or corrosive vapors
- inadequately, improperly or not neatly stored in cases or cabinets that are free from dust, corrosive fumes, excessive heat, moisture, vibration, strong magnetic fields
- not clean

Instruments-Continued

- improperly marked and identified
- incorrect type and range for application
- no manufacturers' instructions for servicing
- poor physical condition of instrument cases, portable cases, handles nameplate, leads, calibrated leads, shunts, multipliers
- loose electrical connections
- dirty or corroded contact surfaces
- inadequate, poorly arranged, improperly insulated wire, cable, and leads
- broken glass
- pointer friction
- warped or dirty scale
- bent pointers
- missing parts
- moving elements not locked when instruments provided with locking devices are not in use
- inkwell not clean and dry when portable type recording instruments are in storage

■ Calibration:

- Not serviced, calibrated, or tested at appropriate intervals to accepted standards of accuracy for particular instrument
- records of tests not available

■ Watt-Hour Meters:

- nonoperative voltage (power-on) indicating lamps
- Outdoor Service Meters
  - poor physical condition
  - loose weather seals
  - moisture or dirt in enclosure
  - corrosion
  - loose connections
  - missing parts

Instruments-Continued

- DC Ammeters:
  - improperly connected in grounded leg of grounded DC circuits
- Instrument Transformers:
  - poor physical condition
  - dirty
  - inadequate connections
  - visual evidence of overloading or overheating

7.2.14 Lighting: Check condition and operation of:

- Diffusers, lens, globes:
- Broken or aging fixture:
- Proper wiring and mounting of fixtures:
- Proper operation of all emergency lighting fixtures:
- Assure that emergency lights are wired into dedicated circuits:

7.2.15 Motors and Generators: Comply with all current safety precautions. Determine if preventive maintenance inspection is adequate. When practicable, start, run, and cycle motor and generator equipment through load range. Take care in starting motors and generators. On standby or infrequently operated equipment, check rotor freedom and lubrication. At humid locations check records for evidence of regular exercise; if not found arrange for drying out windings; megger windings before starting motor. Check for:

RUNNING INSPECTION (While Equipment Operates)

- Log or Operator Records:
  - evidence of motor or generator overload
  - induction motor underload
  - low power factor of load
  - excessive variations in bearing temperature
  - operating difficulties
- Exposure:
  - unsafe accessibility for maintenance of instrumentation
  - exposed to physical or other damage from normal plant functions, processes, traffic, and radiant heat

Motors and Generators-Continued

- inadequate personnel guards, fences
- insufficient, missing, or illegible signs, identification, or operating instructions

■ Housekeeping: Identify need to remove oil and solvent cans, oil or solvent soaked rags and waste, other combustibles, particularly those near commutating machinery. Identify need to remove obstructions that may interfere with rotation or ventilation:

- dust, dirt, airborne grit, sand
- dripping oil, water, other fluids
- vapors
- rust
- corrosion
- peeling, scratches, abrasions or other damage to painted surfaces

■ Machine Operation:

- noisy
- unbalanced
- rubbing
- excessive vibration
- rattling parts

■ Structural Supports:

- inadequate
- cracks
- settlement
- defective or inadequate vibration pads, shockmounts and dampers
- loose, dirty or corroded bolts and fittings

■ Ventilation:

- dirty
- inadequate amount of air passing through machine
- dirty
- clogged

Motors and Generators-Continued

- stator-iron air slots causing excessive temperature. (Too hot to touch. Measured temperature should not exceed 80°F for open frames, or 90% for enclosed frames. Compare with manufacturer's data.)

■ Motor and Generator Leads:

- exposed bare conductors
- frayed, cracked or peeled insulation
- poor taping
- moisture
- paint
- oil or grease
- vibration
- abrasions
- breaks in insulation at entrance to conduit or machines
- arcs or burns
- overheated
- inadequate terminal connections
- lack of resiliency, lack of life or dried-out insulation
- exposure to physical damage, traffic, water, heat, for semipermanent, temporary, or emergency connections

■ Bearings:

- improper lubrication (check lubrication schedules for lubricant used and frequency)
- improper oil level in oil gages
- incorrectly reading gages
- noisy bearings
- overheated bearing caps or housings. (If bearings are too hot to touch, determine causes. A slow but continuous rise in bearing temperature after greasing indicates possible overlubrication or underlubrication, improper lubricant, or deteriorated bearings. Under normal conditions, the temperature of ball or roller bearings will vary from 10° to 60°F above the ambient temperature.)

Motors and Generators-Continued

- Collector Rings, Commutators, Brushes:
  - excessive sparking
  - surface dirt
  - grease (check cleanliness with clean canvas paddle)
  - sparking or excessive brush movement caused by eccentricity, sprung shaft, worn bearings, high bars or mica
  - surface scratches
  - roughness
  - end-play resulting from magnetic-center hunting of rotor
  - inadequate brush freedom
  - nonuniform brush wear
  - poor commutation
  - improper brushes
  - incorrect brush pressure. Brush spring pressure should be between 1-3/4 to 2-1/2 psi of brush-commutator contact area for light metallized carbon or graphite brushes; for pressure for other type brushes, check manufacturer's data. (Measure with spring scale.)
- Starters, Motor Controllers, Rheostats, Associated Switches:
  - damaged or defective insulation
  - loose laminations
  - defective heater or resistance elements
  - worn contacts
  - shorts between contacts
  - arcing
  - grounds
  - loose connections
  - burned or corroded contacts. Worn contacts and defective heater resistance elements should be replaced

Motors and Generators-Continued

- Protective Equipment:
  - dirty
  - signs of arcing
  - symptoms of faulty operation
  - improper condition of contacts
  - burned-out pilot lamps
  - burned-out fuses

SHUTDOWN INSPECTION (while equipment is not in operation and is electrically disconnected. A shutdown inspection includes a running inspection.)

- Stators:
  - dirt
  - debris
  - grease
  - coils not firmly set in slots
  - burns
  - tears
  - aging
  - embrittlement
  - moisture in insulation
  - clogged air slots
  - rubbing
  - corrosion
  - loose laminations of stator-iron
  - charred or broken slot wedges
  - abrasion of insulation or chafing in slots
  - signs of arcing or grounds
- Rotors:
  - difficult turning
  - rubbing
  - excessive bearing friction

Motors and Generators-Continued

- end play
- overheating
- looseness of windings
- charred wedges
- broken
- cracked
- loosely welded or soldered rotor bars or joints
- cracked end rings in squirrel cage motors
- loose field spools and deteriorated leads and connections in synchronous motors
- deteriorated insulation in wound rotors

■ Roto-Stator Gaps:

- Check gaps on 5 hp or larger induction motors, particularly of the sleeve bearing type
- Where practicable, measure and record gaps on the load, pulley or gear end of the motor
- Measure at 2 rotor positions, 180° apart, 4 points for each rotor position. If there is more than 10% variation in gaps, arrange for realignment

■ Mechanical Parts:

- corrosion
- improper lubrication
- misalignment
- end play
- interference
- inadequate chain or belt tension

■ Insulation Resistance:

- Test insulation resistance of motor and generator windings. Compare results with table below
- Insulation resistance values are arbitrary and should be correlated with operating conditions, exposure to moisture, metallic dust, age, length of time in service, severity of service, and maintenance levels

Motors and Generators-Continued

- Permanent records should be kept of measured insulation values on all integral hp motors
- To ascertain trends, graphs showing the long-time relationship of insulation resistance to time should be prepared on all large or critical equipment

INSULATION-RESISTANCE VALUES

Machine Rating (volts)	Insulation Resistance Minimum (Megohms)	Insulation Resistance Preferred (Megohms)
110	0.11	0.20
220	0.22	0.50
440	0.42	0.75

SYMPTOM OBSERVED/Probable Cause

NOISY BEARING (Popping or churning):
Overlubrication
Excessive moisture in lubricant

EXCESSIVE ARCING AT BRUSHES:
Incorrect brush position
Improper type, size or span of brushes
Incorrect brush pressure or contact
Loose brush rigging
Dirty or rough commutator or slip ring
High or low commutators bars
Short-circuited commutator bars
Overload or excessive vibration

NOISY BRUSHES (SINGING):
Excessive brush pressure
Brushes too hard
Holders improperly adjusted
High and low commutator bars
Loose commutator bars
High mica between commutator bars

Motors and Generators-Continued

Brushes set at improper angle

RING FIRE AND FLASHING ON COMMUTATOR:
Short or open circuit in armature coil

OVERHEATING:
Overload
Field or armature short circuit
Poor ventilation
Rotor off center
Unbalanced phase currents
Excessive field current
Line voltage too low
Bearing friction

SPEED TOO HIGH:
Weak field current
Prime mover speed too high

SPEED TOO LOW:
Overload
Low line voltage
Bearing friction
Dragging rotor
Prime mover speed too low

HUNTING ACTION:
Load variation
Variation in voltage frequency (unstable speed of prime mover)

7.2.16 Navigation Lights: Check for:

- Cable and Wiring:
  - dirty
  - poor ventilation
  - detrimental ambient conditions
  - presence of moisture, greases, oil or chemical fumes
  - damaged wiring devices

Navigation Lights-Continued

- defective insulators, cleats, and cable supports
- broken or missing parts
- exposed live parts
- evidence of overheating
- grounds and short circuits
- overheated splices
- damaged or defective insulation
- need for painting of noncurrent-carrying parts subject to corrosion
- defective operation (try manually and electrically when practicable)

■ Battery:

- Connections
  - loose
  - corroded
  - dirty
  - inadequate
- proper output voltage

7.2.17 Panels: (primary, secondary, and sub)
Check for:

■ Ground wire and buss:

■ Proper wire connections:

■ Correct circuit breaker size (Ampere):

■ Deterioration of conductor insulation:

■ Unprotected or tapped circuits:

■ Excessive heat:

■ Proper feeder and branch circuit conductors:

■ Proper load amps and feeder conductor size:

■ Unbalanced load:

■ Circuit capacity (to see if circuits could be added):

■ Age of panel (economical availability of replacement parts):

7.2.18 Potheads: Comply with all current safety precautions. **DO NOT TOUCH** when energized. Determine if preventive maintenance inspections are adequate. Check for:

- Porcelain:
  - cracks
  - breaks
  - chips
  - checking of porcelain glaze
  - streaks of carbon deposits indicating flashovers and possible damage
  - dirt, dust, grease or other deposits
  - cracks, breaks, or deterioration of cement sealing compound
  - leakage
  - signs of moisture
- Cable Clamps:
  - corrosion
  - loose bolts, solder or GROUND CONNECTION
  - poor mechanical connections. (Corrosion of lead cables and connections at potheads indicated by presence of a white, brownish, or reddish product.)
- Terminal Studs and Bolting Pads:
  - corrosion
  - loose connections
  - poor contacts evidenced by discolorations from heating.
- Mountings:
  - corrosion
  - other weakness

7.2.19 Power Plants: Comply with all current safety precautions. Check for:

- General:
  - Housekeeping: lack of cleanliness or orderliness
  - Safety Signs and Posted Instructions
    - inadequate
    - illegible

Power Plants-Continued

- improper location
- Operating Log, Plant Log, and Maintenance Records
  - failure to record pertinent readings
  - other information necessary to locate and evaluate trouble areas and trends
- Evidence of need to follow up deficiencies that may lead to breakdown

■ Generator Loading Operating Log:

- review for duration and amount of overload, ambient temperature, temperature rise. Note when rated temperature is approached or exceeded

■ Insulation:

- Make insulating test measurements of generator field, armature windings, and cable from main breaker terminals. Note evidence of electrical weakness to extent that normal operating voltage or surges may result in failure

■ Generator Excitation Systems:

- inadequate
- not serviceable
- unreliable
- poor physical condition of emergency exciters and associated equipment, including rheostats, pilot exciters, voltage regulators, motor drives
- inadequate ground indicating system in ungrounded exciter circuits

■ Plant Battery:

- Battery Room or Enclosure:
  - lack of cleanliness
  - unacceptable temperature
  - inadequate ventilation
  - unsatisfactory condition of floor
  - fire hazard from lighting and power fixtures, fittings, and cable

Power Plants-Continued

- Operating and Maintenance Records:
  - review for deficiencies in specific gravity levels
  - cell temperature
  - makeup water history
  - equalizing charge practices
  - sustained overcharges and discharges
- Connections:
  - loose
  - corroded
  - dirty
  - inadequate
- Cells:
  - oversulphated plates
  - physical erosion
  - internal shorts
  - buckled plates
  - cracked grids
  - dirty electrolyte
  - improper electrolyte level
  - excessive sedimentation
- Chargers and Controls: poor physical condition
- Instruments: inaccurate, (check frequency of calibration)

■ Buses:

- poor condition
- dirty
- structural distortion
- loose joints and connections
- evidence of overheating

Power Plants-Continued

- Control Switchboards:
  - poor physical condition
  - dirty
  - Wiring and Connections
    - lack of neatness
    - looseness
  - Fuses in Control Wiring System: improper size
  - Indicating Lamps: not operating
  - Mimic Buses
    - illegible
    - inaccurate

7.2.20 Rectifiers: Comply with all current safety precautions. Rectifier cabinets and enclosures contain energized electrical equipment. **DO NOT tighten wires, make adjustments, or disturb any valve, control, or other adjustment device.** Check for:

ENCLOSURES

- General Area Housekeeping:
  - dust
  - dirt
  - trash
  - debris
- Exterior:
  - mechanical damage
  - excessive corrosion (more than two rust spots 1/2 inch diameter)
  - corroded, binding or unlubricated hinges and latches
- Interior:
  - rust
  - corrosion
  - moisture condensation
  - indications of excessive heating

Rectifiers-Continued

- Wiring:
  - broken
  - damaged
  - deteriorated
  - missing insulation or clamps
  - corroded or mechanically damaged conduit
  - cracked or broken sleeves on floor or wall bushings

METALLICRECTIFIERS

- Electric Meters:
  - Record readings from all AC and DC ammeters and voltmeters. Report if supply voltage is more than 5% below or above nameplate rating. Report defective meters
- Temperature:
  - Record readings of water temperature indicators, if provided. On indoor installations record ambient temperature at apparent hottest point five feet from units. Report if temperature of cooling water is more than 10% above that recommended by manufacturer
- Fan:
  - dirt
  - excessive vibration
  - loose hold-down bolts
  - loose or worn bearings
  - inadequate or improper lubrication

MERCURY-ARC RECTIFIERS

- Meters and Gages:
  - illegible
  - inadequate lighting
  - cracked, broken, dirty or badly stained viewport glasses

Rectifiers-Continued

- Water Cooling Systems:
  - leaks
  - rust
  - corrosion
  - mechanical damage
  - excessive vibration
- Pumps, Fans, and Motors:
  - leaks
  - excessive vibration
  - loose or missing hold-down bolts
  - deteriorated mounting pads or shock pads
  - inadequate or improper lubrication

7.2.21 Relays: Comply with all current safety precautions. Determine if preventive maintenance inspections are adequate. Check for:

- Relays (General):
  - dirty
  - evidence of moisture
  - high temperature
  - other adverse conditions
  - visible corrosion
  - deterioration or pitting of contacts, pivots, and coils
  - broken or loose parts and connections
- Temperature and Pressure Relay:
  - settings at improper temperature and pressure limits
  - evidence of damaging temperature or pressure conditions

7.2.22 Steel Power Poles and Structures: Comply with all current safety precautions. Remember these structures are part of an Electrical system and may be conducting current. Avoid contact with line poles and structures until they have been grounded and/or deenergized. Check for:

- Ground Area:
  - trash, debris, weeds or brush one foot in height within 3 feet of pole or structure
- Concrete Bases, Pads and Anchor Bolts:
  - cracks, including surface cracks wider than 1/16 inch
  - breaks
  - chipped areas deeper than 1/2 inch
  - settlement
  - movement
  - defective paint/galvanizing
  - visible rust or corrosion to depths exceeding 1/16 inch
  - loose or missing nuts/bolts
  - where visible, inspect all metal where it enters concrete
- Street Light Standard Handholes and Bell Interiors: Visual Inspection Only, If Energized:
  - rust
  - corrosion
  - installed transformers
    - loose wires
    - excessive discolorations from heating and sparking
    - signs of insulating compound or other leakage
    - charred, burned, or missing insulation
- Poles, Structures, Crossarms and Beams: Inspection from Ground, Use Field Glasses:
  - defective paint/galvanizing
  - visible rust or corrosion, especially pitting where visible
  - inspect all metal in contact with, or entering concrete
  - loose bolts and pins

Steel Power Poles and Structures-Continued

- excessive rust and corrosion between pole and/or structure and braces, equipment supports, insulator pins, guy fastenings, and similar locations
- checking, chipping, flaking, or scaling of paint on pole and attachments
- broken or bent structural or accessory members, especially near bolts
- misalignment. (Top of unguyed pole is out of line more than 1 foot in any direction.)

■ Guys and Anchors:

- corroded, cracked or worn hardware at guy takeoffs, anchors and insulators
- cracked, broken, or dirty insulators
- missing insulators
- defective galvanizing
- corrosion
- broken strands
- battered or corroded guy shields
- excessive sag or tautness
- guy anchor movement

■ Ground Wire: Visual Inspection Only:

- failure to install at least one wire at every steel pole or structural support, including each steel column in substation or switching station
- Connections
    - lust
    - corrosion
    - looseness
    - discolorations from overheating
    - substandard conditions

7.2.23 Switchgear: Comply with all current safety precautions. Check for:

- Asbestos: Inspect ARC chutes and flash pads for friable asbestos. Vacuum to eliminate safety and health hazard using high efficiency particulate air vacuum (HEPA VAC) Do not use compressed air. Avoid dispersing asbestos. Then encapsulate and seal with insulating paint such as "Gyptal" or equivalent from any manufacturer. Use protective clothing and respirator as required. Empty HEPA VAC into plastic bag for disposal at approved asbestos disposal facility:
- Are preventive maintenance inspections adequate?
- Housekeeping:
  - dampness
  - dirty
  - inaccessibility
  - detrimental conditions such as ambient temperatures in excess of 100°F
  - humidity causing sweating of metal enclosures
  - rodents or insect infestations
  - stored combustibles
  - trash, dirt or dust accumulations
  - poor location
  - poor ventilation
  - gas, steam or water leakage
- Exterior Housing and Enclosure Ground:
  - rust
  - corrosion
  - need for painting
  - signs of abuse
  - unauthorized or improper signs
  - storage materials or dust accumulating on top of enclosures
  - missing parts or other items
  - poor condition or inadequacy of enclosure ground

Switchgear-Continued

- Interior of Compartments, Cubicles and Drawers:
  - dirty
  - condensation
  - symptoms of overheating
  - burns from ground and short circuits
  - defective insulation
  - defective operation of locks, doors, and drawers
- Air and Oil Circuit Breakers, Oilless-Type Air Blast Breakers (Deenergized/50 Amperes and above):
  - incorrect wipe of main and arcing contacts on opening and closing
  - overheating
  - lack of continuity
  - looseness of connections on all mechanisms
  - incorrectly placed pins and cotter pins
  - improper functioning of rods and moving parts and binding occurs when breaker is operated
- Tests:
  - Measure operating voltage on electrically-operated breakers
  - Measure operating voltages in switchgear control circuits
  - Make liquid dielectric strength tests. Liquid should be changed if tests under 18,000 volts
  - Measure insulation resistance and evaluate
    - minimum value or low limit recommended is 2 megohms total (after one minute at approximately 25 degrees C.) for safe operation or before making high-potential tests
    - make high-potential tests at 65 percent of initial installed value, or in accordance with manufacturer's recommendation

7.2.24 Wood Poles and Accessories: Comply with all current safety precautions. Because overhead electric distribution systems are energized almost continuous-ly, inspection of such items as poles, hardware, and associated accessories should be made from the ground using field glasses except during those periods when placed outages of the various systems will permit a climbing inspection. Ordinarily such climbing inspections will occur very infrequently and should be performed only when it is certain

Wood Poles and Accessories-Continued

that all line wires attached to the pole are deenergized and provided with safety grounding. Poles supporting only telephone open wires or telephone aerial cables should not be climbed unless an obvious defect indicates the necessity of climbing to permit a closer inspection. It is essential that questionable poles be tested and supported before the pole is subjected to the unbalanced load caused by climbing for closer inspection. Particular attention shall be given to weather conditions, power hazards, traffic warning procedures, and tree and brush cuttings. Check for:

- Ground Area:
  - water ponding at base
  - debris, trash, or weeds within 3 feet in any direction
- Poles: Visual Inspection, Except as Indicated:
  - sound-test with unpointed hammer for hollowness caused by termites, carpenter ants, and/or decay fungi. Sounding should be from groundline to the highest point reached from standing position; actual condition of questionable poles should be confirmed by drilling a 3/8” hole(s) with a wood bit to center of pole in the area under suspect. Test holes must be plugged with a 7/16” perservative treated wood dowel. Check for external decay most prevalent in the vicinity of the ground-line area, knotholes, large splits and checks, and in and around woodpecker holes
  - splits
  - lightning, bird, insect, vehicle, or other damage
  - make shallow excavation around pole and take increment boring if a faulty condition below ground is suspected. (Upon completion of boring treat hole with wood preservative, drive treated plug into hole, sterilize soil, backfill and tamp excavation.)
  - ground-line treatment of untreated poles required in addition to all poles in-service at least ten (10) years. Pole ground-line re-treatments should be conducted on a ten year cycle. Preparers of pole maintenance contracts should refer to NAVFAC Specification TS-20212 for guidance.
  - failure of originally installed protective treatment of pole

Wood Poles and Accessories-Continued

- poles should not lean except for special reasons. When lean is more than 1 foot at top, pole should be straightened and if necessary guyed. (To determine whether top of pole is out of alignment, sight the pole from those adjacent to it.)
- structural inadequacy or other deficiencies requiring stub reinforcement or complete replacement

Note: Pole plant inspectors should become familiar with NAVFAC MO-312.3, **Inspection, Maintenance and Procurement Procedures for Wood Poles.** This handbook provides detailed guidance on inspection and maintenance procedures for wood pole plants.

■ Crossarms and Buckarms: Use Field Glasses:

- splits
- bum
- decay
- twists
- weathering damage
- other defects

■ Insulators and Pins: Use Field Glasses:

- cracks
- breaks
- chips
- dirty or missing insulators
- cracked, broken or missing pins
- rust
- corrosion
- looseness of insulator bolted connections and fastenings to crossarms resulting in strains on line wires or movement of wires on insulators

Wood Poles and Accessories-Continued

- Tie-Wires and Line Wires: Use Field Glasses:
  - looseness
  - chafing
  - slippage
  - other damage within l-2 feet of insulators and corrosion at points where linewires and tie-wires come together near insulators
- Hardware Pole Steps, Crossarm Braces, Grounding Bonds, Brackets, Through Bolts or Other: Use Field Glasses:
  - signs of fire damage and rot or insect damage around all hardware in contact with pole or crossarms
  - rust
  - corrosion
  - looseness of any parts
- Ground Wires: Use Field Glasses:
  - rust
  - corrosion
  - frayed or broken strands
  - discoloration that may indicate overheating or complete failure of connections, including connection to ground rod at base of pole. **(Do not disconnect or allow contact with body if overhead lines are energized.)**
  - Protective Moldings
    - looseness
    - missing
    - broken
    - cracks
    - decay

Wood Poles and Accessories-Continued

- Guywires:
  - loose, missing, or corroded clamps, wires or holding bolts, and brackets
  - broken or cracked insulators and complete absence of insulators on circuits over 300 volts
  - excessive tautness or looseness and failure of guys and guy anchors
  - vehicle damage
  - inadequacy and nonvisibility of shields or protectors
  - corrosion
  - fraying or broken strands
- Clearances and Tree Limbs: Use Field Glasses:
  - inadequate separation from limbs, branches, and foliage
  - dead trees or limbs that may fall on line
  - brush and tree prunings have not been removed
  - inadequacy and poor condition of tree guards and attachments on insulated wire

7.3 REPAIR/REPLACEMENT CRITERIA:

7.3.1 Fire Alarm: Since the fire alarm may not be tested, it's true condition may not be determined. If replacement is considered, consult with the fire department serving the facility. An engineering evaluation may be necessary to determine the correct action.

7.3.2 General wiring:

- Repair:
  - General good condition
  - Problem area can be spliced in an accessible area
- Replacement:
  - Insulation badly cracked, damaged, deteriorated
  - Undersized conductor

7.3.3 Lighting:

- Repair:
  - Less than 20 years old
  - Replacement parts available
  - Replacing/repairing parts is cost effective
  - General good condition and appearance
- Replacement:
  - Over 20 years old
  - Badly damaged or deteriorated beyond repair
  - Parts difficult or impossible to procure
  - Replacing or repairing parts is not cost effective
  - Lighting replacement should be considered when a new suspended ceiling is to be installed.

7.3.4 Panels: (Primary, Secondary, and Sub)

- Repair:
  - General good condition
  - No overloading
  - No evidence of burning or arcing (fire or shock hazard)
- Replacement:
  - Over 20 years old
  - Badly damaged or deteriorated
  - Panel overloaded
  - Panel displays evidence of burning or arcing (fire or shock hazard)

CHAPTER 8. ROOFING INSPECTION GUIDE

8.1 DEFINITIONS:

Roofing System - an assembly of interacting components designed to weatherproof, and normally to insulate, a building's top surface. Normally from above the ceiling of the top floor or the ceiling of an attic to the top most surface of the facility

Test Cuts - destructive tests used to determine primarily the composition of the roofing system, conformance with specification, i.e., bitumen weights, and condition. Normally test cuts are limited in number and therefore are not a complete indication of the condition of a roof structure.

Infrared Thermography - is a non-destructive method of inspecting roofs. The equipment can be hand-held or used from an aircraft, to determine heat retained by wet insulation.

Nuclear moisture surveys - Nuclear moisture surveys require a minimum of core samples be taken to verify moisture content. They are non-destructive tests used to determine the condition of roof insulation. A nuclear moisture survey can detect moisture in a roof which could contribute to leaks and rapid deterioration of the roof

Trusses - includes all types of building trusses that are normally designed for the express purpose of supporting roof loads as well as ceilings where applicable. All lateral and vertical bracing and ties between trusses are included

8.2 ROOFING INSPECTION INSTRUCTIONS:

8.2.1 Asphalt strip shingled roof: Check for:

- Flashings - Pay particular attention to the flashing around penetrations or between roofs of different ages. Check for:
  - Missing sections
  - Rust
  - Damage
- Valleys:
  - Punctures
  - Weathering
  - Deterioration

Asphalt strip shingled roof-Continued

- Shingles:
  - Brittleness
  - Clawed edges
  - Absence of minerals
  - Cracking
  - Missing tabs/shingles
  - Breaking
  - Weather damage
- Penetrations:
  - Deterioration
  - Deterioration of the surrounding flashing

8.2.2 <u>Built-up roof:</u> Check for:

- Gravel Stops:
  - Missing stops
  - Loose stops
  - Rust
  - Evidence of numerous repairs
  - Problems at the creased corner which forms a 90 degree angle
- Flashings:
  - Metal
    - Check the valley, step, and cap flashings for
      - Missing sections
      - Rust
      - Punctures
      - Wind damage
    - Check the cap and step flashings for
      - Proper reglet seals
      - Separation from vertical surfaces

Built-up roof-Continued

- Bituminous
  - Splits
  - Tears
  - Punctures
  - Absence of protective coatings
  - Separation from vertical surfaces

- Bare spots - Bare spots expose the plies directly to the elements which can accelerate deterioration. Check for:
  - Cracking
  - Alligatoring
  - Deteriorated felt
- Blisters - Blisters are an indication of moisture or gas between roof plies. Do not apply enough pressure to rupture blisters as this will allow water intrusion. Blisters do not necessarily indicate roof system failure. Check for:
  - Punctures
  - Splits
  - Water - by gently touching to see if water will come out of blister
- Pitch pockets
  - Cracking
  - Shrinkage
  - Absence of bitumen
  - Deterioration of perimeter metal
- Ponding water - Ponding around roof penetrations will result in leaks. Ponding of a large area could indicate a possible structural defect. Stopped up roof drain will cause ponding. Check for:
  - Location
  - Percentage of roof surface which displays ponding
- Penetrations - The majority of roof failures begin in areas near penetrations. Check for:
  - Proper flashings
  - Ponding of water near penetration

Built-up roof-Continued

- General surface appearance:
  - Displacement of aggregate
  - Weathering
  - Debris

8.2.3 Metal roof: Check for:

- Surface:
  - Rust
  - Punctures
  - Tears
  - Wind damage
- Fasteners:
  - Loose fasteners
  - Missing fasteners
  - Deterioration
- Seams:
  - Looseness
  - Rust
- Penetrations:
  - Deterioration
  - Deterioration of surrounding flashing

8.2.4 Slate roof: (Do not walk on slate roof if possible.) Check for:

- Flashings:
  - Missing sections
  - Punctures
  - Rust
  - Separation of strip flashing from vertical surfaces
  - Reglet seals
- Valleys - Check flashing:
- Penetrations - Check flashing:

Slate Roof-Continued

- Missing slate percentage - If twenty five percent (25%) or more of the slate is missing, consider roof replacement. If this much slate is missing, the fasteners have probably failed. Reuse some of the slate if possible during roof replacement:

8.2.5 Trusses: Comply with all current safety precautions. To identify truss members for the report, use a sketch of the truss and label the panel points either numerically or alphabetically. The deficient member may then be identified by indicating the panel points between which it lies. Check for:

- Truss Sag: Examine trusses for sagging by stretching piano wire between supports and measuring vertical defections at panel points or use a surveying instrument:
- Painted Surfaces:
  - blistering
  - checking
  - cracking
  - scaling
  - wrinkling
  - flaking
  - mildew
  - bleeding
  - rust
  - corrosion
  - complete absence of paint, particularly at end of members
  - record film thickness and condition on metal surfaces

TIMBER

- From Ground: Use field glasses:
  - twisted and bowed members
  - excessive number and size of knots
  - slope of grain over one inch in ten
  - checks and splits in ends of web members
  - separation or slippage at joints

Trusses-Continued

- sag
- overloading

■ From Truss:

- loose bolts
- split rings
- shear plates
- fastening devices
- checks and splits in bracing, chord members, splice plates (scabs), web members and filler blocks
- missing filler blocks
- improper end and edge distances
- looseness of tie rods. (Bolts may be considered loose if after striking head of bolt a sharp blow with a hammer, the nuts can be taken up two full turns or more.)

■ Steel Splice Plates:

- rupture
- shearing
- crushing
- rust

■ Wooden Parts:

- dry rot
- dampness and surface moisture of long duration
- termite and other insect, and fungus infestation. Termite and fungus infestations are often detected prior to actual visual damage by probing with a sharp-pointed instrument those areas where prolonged dampness is not directly associated with rainfall or damp climate

■ Wooden Supports near or at Ground Level:

- termite tubes or tunnels
- dirt piled up to wood level

Trusses-Continued

- need of protective treatment. If removal of dirt piles is impracticable, wood in direct contact with, or less than 8 inches from ground level should be given protective treatment

STEEL

- From Ground:
  - twisted
  - bowed
  - deformed
  - broken members
- From Truss:
  - loose bolts
  - rivets
  - defective welds
- From Truss: rupture, shearing, or crushing of steel plates, members, bolts, and rivets:

8.2.6 Moisture Survey Instructions for Built-Up Roofs: Partial or total built-up roof replacement recommendations can be made using moisture survey results. NAVFAC prefers a moisture survey to be completed before any built-up roof is replaced.

- Mark out a grid on the roof:
- Using the nuclear moisture detector test and record the moisture level at each marked point:
- Map out the grid and test results:
- Draw conclusions and make recommendations from the test results:
- Prepare cost estimates based on your recommendations:

8.3 REPAIR/REPLACEMENT CRITERIA:

8.3.1 Asphalt strip shingles:

- Repair:
  - Uniform and flat shingles
  - Ample minerals
  - Pliable

Asphalt strip shingles-Continued

- No rust on valley, step, or vent flashings
- No evidence of previous repairs

■ Replacement:

- Brittle shingles -they crush and break under foot
- Clawed and turned under shingles
- Missing shingle tabs -possibly due to bad weather
- Mineral loss on shingles
- Bond deterioration
- Rusting valley, step, and vent flashings
- Frequent leaks -check with activity's records
- Many repairs evident

8.3.2 Built-up Roof:

■ Repair:

- Flashing responsible for leaks
- Generally good condition, no membrane splits, tears, etc.
- No history of major leaks
- Attic or overhead inspection indicated good condition of underside of roof
- Nondestructive testing indicates majority of insulation is dry

■ Replacement:

- Membrane is cracking, splitting or slipping
- Membrane condition is poor
- Nondestructive testing indicates majority of insulation is wet
- Roofer recommends replacement as most cost effective
- Many repairs are evident
- Frequent leaks -check with the activity records
- Leaks are interfering with the mission
- Water ponding evident and associated with leaks
- Lack of sufficient aggregate and advanced membrane deterioration such as brittle condition

8.3.3 Metal:

- Repair:
  - Repair should always be first consideration for metal roofing as it is often impractical to replace metal roofs.
  - General good appearance
  - No deep rust, only surface rust if there is any
  - No major deterioration
- Replacement:
  - Last resort, if repairs are not possible
  - Many repairs evident
  - Frequent leaks -check activity's records
  - Leaks interfering with mission
  - Deep rust
  - Deterioration on underside of roof
  - General poor appearance

8.3.4 Slate:

- Repair:
  - Few if any leaks
  - Few broken, missing, or deteriorated slates
  - Good appearance
- Replacement:
  - Many and frequent leaks
  - Many repairs evident
  - Leaks interfering with the mission
  - Missing 25% or more of slate
  - Large number of deteriorated or broken slate

INDEX

A

Abutments, 5-10
Air Conditioning, 6-1,6-3,6-44
Air Handler, 6-1,6-4,6-45
Aircraft Power Check Facility, 5-1,5-3
Alarms, 7-10
Ammunition Storage (Aboveground), 5-1,5-3
Annual Inspection Summary, 1-1
Antenna-Supporting Towers and Masts, 5-1,5-5
Application, 2-1,
Asbestos, 3-2,5-l, 5-7,5-54
Asphalt Strip Shingled Roof, 8-l
Asphalt Strip Shingles, 8-7

B

Boilers, 6-1,6-4,6-47
- Controls, 6-47
- External Inspection, 6-5
- Internal Inspection, 6-8
- Hydrostatic Test, 6-13,6-42
- Inspection of Operation, 6-14
- Repair, 6-47
- Replacement, 6-47

Bridges and Trestles, 5-1,5-8
Brows and Gangways, 5-1,5-15
Built-up Roof, 8-2,8-8

C

Cables, 5-13
Cathodic Protection Systems, 5-27,7-l, 7-3
- Galvanic or Sacrificial Anode Systems, 7-3,7-16
- Rectifier-Powered Systems, 7-17

Ceiling, 5-1,5-17,5-54
Chilled/Hot Water Sy, 6-2
Chimneys and Stacks, 5-17,7-6
Circuit Breakers, 7-23
Compressed Air, 6-2
Concrete Curbs, 5-12
Concrete Structures, 5-11
Concrete Tanks, 5-24
Conflicting Information, 3-7
Construction, 5-1,5-20,5-54
Control Inspections, l-l, l-32-1
Cooling Towers, 6-44
Criteria, 3-6,5-54,6-44,7-52
Culverts, 5-43

D

Dams & Dikes, 5-30,6-28
Definitions, 5-1,5-2,6-l, 6-2,7-1, 7-2, 7-3,8-l
Dikes, 5-30,6-28
Disconnecting Switches, 7-1,7-6
Distribution Transformer 7-1,7-9
- Deenergized, 7-1
- Energized, 7-1

Doors and Gates, 5-1,5-4,5-19,5-20, 5-55
Drainage Ditches, 5-9,5-41,6-29
Duct Systems, 6-30

E

Earth Embankments, 7-21
Electrical Utility System, 7-1,7-14
Elevators, 6-16
Emergency Eyewash or Shower, 6-1, 6-16,6-45
Emergency/Service Work, 3-6
Exhaust, 6-1,6-16,6-45
Exterior Walls, 5-1,5-20,5-56
Eye Wash, 6-45

F

Fencing, 5-1,5-9,5-22,5-56
Fenders, 5-50
Fire Alarm, 7-1,7-15,7-52
Fire Protection, 6-1,6-16,6-46
Flashings, 8-1,8-2
Flood Irrigation System, 5-33
Floors, 5-1,5-4,5-12,5-16,5-22, 5-56,7-15
Folder Preparation, 3-4
Foundation, 5-1,5-5,5-10,5-23,5-24, 5-56
Fresh Water Storage, 5-1,5-23,7-16
Fuel Facilities, 6-1,6-17
  Distribution, 6-1,6-17
  Receiving and Issue, 6-1,6-21
  Storage, 6-1,6-25
  Underground Piping, 6-18
  Valves, 6-18
Fuses and Small Circuit Breakers, 7-1, 7-17,7-23

G

General Wiring, 7-1,7-24,7-52
Ground Test, 7-25
  Lightning Protection, 7-25
Grounds, 5-1,5-28
Grounds and Grounding Systems, 5-5, 6-20,7-l, 7-26
Guide Format, 4-l
Guide Use, 4-l
Gulleys, 5-32
Guys, 5-6,5-18

H

Heat Exchangers, 6-30
Heating, 6-1,6-29,6-46
Housekeeping, 7-31
Hydrostatic Test, 6-13,6-42

I

Imhoff and Septic Tanks, 5-33
Incinerators, 6-1,6-31
Infrared Thermography, 8-l
Inspection Equipment, 3-1
Inspection Procedure, 3-5
Inspection Tools, 3-2
Inspector Duties, 3-6
Inspector Fitness, 3-l
Inspector Guide Format, 4-l
Inspector Guide Use, 4-l
Inspector Planning and Preparation, 3-4
Inspectors, l-2,3-1,3-4,3-6,3-7,4-1
Instruments, 7-2,7-28
Insulation, 6-47
Interior Wall, 5-1,5-34,5-56
Introduction, l-l

L

Ladders, 5-19,5-25,5-40,6-8, 6-21, 6-24,6-27,7-20
Lighting, 7-2,7-30,7-53
Lightning Rods, 5-7,5-28,7-22

M

Metal, 5-4
Metal Roof, 8-4,8-9
Moisture Survey, 8-7
Motors and Generators, 7-2,7-30
  Running Inspection, 7-30
  Shutdown Inspection, 7-34
Mulch, 5-5
Multi-trade Inspections, 4-l

N

Natural Gas, 6-2
Navigation Lights, 5-7,5-28,7-23,7-37
Nuclear Moisture Surveys, 8-1

0

Omissions, 3-7,4-1
Operator Records, 7-30
Overview, 3-l

P

Paint, 5-1,5-4,5-6,5-15,5-34,5-56
Painters Trolley, 5-19
Panels, 7-2,7-38,7-53
  Primary, 7-2
  Secondary, 7-2
  Sub, 7-2
Pavement, 5-1,5-39,5-57
Physical, 3-1
Piers, 5-10
Piping, 6-2,6-34,6-48
  Chilled/Hot Water System, 6-2
  Compressed Air, 6-2
  Natural Gas, 6-2
  Sewage, 6-2
  Steam, 6-2
  Water, 6-2
Pitch Pockets, 8-3
Plumbing, 6-2,6-35,6-49
Potheads, 7-2,7-39
Power Plants, 7-2,7-39
Preventive Maintenance Inspection
  Oversight, 3-4
Protective Devices, 5-37
Pump, 6-36

Q

Quality Assurance, 3-7

R

Radiators, 6-29
Railroad Trackage, 5-1,5-34
Rectifier-Powered Systems, 7-4,7-17
Rectifiers, 7-42
  Enclosures, 7-4,7-42
  Metallic Rectifiers, 7-43
  Mercury-Arc Rectifiers, 7-43
Relays, 7-2,7-44
Repair/Replacement Criteria, S-54,
6-44,7-52,8-7
Respirator, 3-l
Responsibilities, 3-4
Retaining Walls, 5-1,5-38
Roof, 5-4,6-25,8-l
  Moisture Survey, 8-7
Roofing System, 8-l

S

Sacrificial Anode Systems, 7-3,7-16
Safety Equipment, 3-l
Safety Hazards, 3-6
Sanitary Sewage Utility System, 6-2,6-36
Scheduling, 3-4
Scope, 3-l
Septic Tanks, 5-33
Service Work, 3-6
Sewage, 6-2
Slate Roof, 8-4,8-9
Sodded Areas, 5-5
Special Projects, 3-6
Specialized Inspections, l-l
Spillways, 5-30
Sprinkler System, 5-32
Stacks, 7-6
stair, 5-1,5-40,5-57
Steam, 6-2,6-5,6-8,6-9,6-11,6-14,
6-15,6-33,6-34
Steam Utility System, 6-2,6-36
Steel Framing, 5-11
Steel Power Poles and Structures, 7-2,
7-45
Steel Tanks, 5-24
Storm Drainage System, 5-1,5-41
Superstructures, 5-12
Swimming Pools, 5-1,5-43
Switchgear, 7-3,7-47

T

Tanks,
Concrete, S-24,7-19
Interior, 6-26
Linings, 6-26
Steel, 5-24,7-19
Wood, 5-24,7-19
Test Cuts, 8-l
Ties, 5-35
Timber, 8-5
Timber Framing, 5-11
Timber Towers, 5-6,5-25
Tools, 3-2
Towers, 5-25,7-20
Trees, 5-29
Trusses, 8-1,8-5
Timber, 8-5
Steel, 8-7
Tunnels and Underground Structures, 5-1,5-46,6-20

U

Unfired Pressure Vessels, 6-2,6-37
External Inspection, 6-37
Internal Inspection, 6-40
Hydrostatic or Pneumatic Test, 6-42
Inspection of Operation, 6-42
Utility Lines, 5-14
Utility Supports, 5-14

V

Ventilation,
Motors & Generators, 7-31
Ventilators,
Ammunition Storage, 5-5

W

Watt-Hour Meters, 7-29
Water, 6-2
Water Heater, 6-2,6-43,6-49
Water Utility System, 6-3,6-43
Waterfront, 3-3,5-2,5-49,5-57
Topside, 5-2
Underside , 5-2
Underwater, 5-2
Weed Control, 5-33
Window, 5-2,5-54,5-57
Wood Flooring, 5-12,5-16
Woodlands, 5-29
Wood Poles and Accessories, 7-3,7-48
Workload Planning, 3-l

Z

Zone Pumps, 6-29