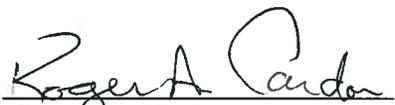




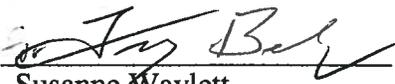
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TITLE: O&M CRITERION WRITER'S GUIDE

SIGNATURES

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Reviewed Classification

 (Reviewed by)	<u>120106</u> (Z#)	<u>12/22/09</u> (Date)	<u>Unclassified</u> (Classification)
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RECORD OF REVISIONS

Revision No.	Date	Description
0	08/27/98	Initial issue
1	03/01/00	This revision reflects the conversion from WordPerfect into Microsoft Word with additional clarification on how to develop the criteria.
2	03/06/01	This revision includes: <ul style="list-style-type: none"> • Addition of Table of Contents • The use of Basis Statements in Sections 6, 7, and 9 • References to "Lessons Learned" in Section 6, "Requirements" • Section 9, "Required Documents" • Further clarification is needed in the use of references
3	01/09/02	Requested changes made by the Maintenance Subcommittee.
	04/03/02	Changes to Section 4.0 reflects O& M Criterion written by groups other than MSS-MSE
	07/12/02	Editorial change in Section 4.3.2
4	6/25/03	Change to reflect Division reorganization, with the new group of MSS-MSE positions. Change all references to DOE O 4330.4B with the replacement DOE Order - DOE O 433.1. Formatting changes made to add uniformity. Addition of Authority Having Jurisdiction (AHJ) in Section 4.0 Responsibilities.
5	4/30/07	This revision incorporates organizational changes, reference updates, and document revision reference updates.
6	12/22/09	Changes reflect Division reorganization Change references to reflect P950, <i>Conduct of Maintenance</i> Remove DOE 430.1B references from Section 1

CRITERION 101

O&M CRITERION WRITER'S GUIDE

This document provides the standard format and style guide for use in developing Functional Series documents that define Criterion and comprise the LANL Operations and Maintenance (O&M) Manual for Structures, Systems, and Components (SSCs) as required by P 950 *Conduct of Maintenance*. Format and examples of the type of technical content are defined and shall be adhered to by all organizations in the development of assigned Criterion. Examples appear just as they would in the actual Criterion (i.e., font, paragraph numbering, style, etc.)

RECORD OF REVISIONS

Revision numbering begins with 0 (original document) and then proceeds numerically (e.g., 1, 2, etc.) for each revision.

The revision date shall be recorded in the "date column."

Under "description" include range of dates for the entry, if applicable. For additional revisions, include pertinent information describing why the document was revised.

Example - Record of Revisions

Revision No.	Date	Description
0	03/07/00	Initial Issue - Incorporates a review of ORPS & NRC lessons learned from 1/1/95 to 2/1/2000.
1	11/14/00	Added requirement 7.2.4 and reviewed lessons learned from 2/00 to 10/00 for additional relevant information.

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Figures

When generating a list of figures in a document, number them sequentially within a section (e.g., Figure 6-1, Figure 6-2, etc. for figures in Section 6) and place the title at the bottom of the figure.

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Tables

When generating a list of tables in a document, number them sequentially within the section (e.g., Table 6-1, Table 6-2, etc. for tables in Section 6, and place the title at the top of the table.

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This page SHOULD be deleted if there are no figures and/or tables in the O&M Criterion.

	<p style="text-align: center;"><i>Conduct of Maintenance (P 950)</i> Operations and Maintenance Manual O&M Criterion Writer's Guide</p>	<p style="text-align: center;">Criterion 101, R6 Page 5 of 20</p>
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CRITERION XXX

TITLE

1.0 PURPOSE

This section should clearly and concisely state the purpose of the criteria and why it has been issued. Additional information to clarify any special aspects regarding the specific need for the document and its implementation at Los Alamos National Laboratory (LANL) may be included.

In all cases, include the following statement:

This document addresses the requirements of P 315, *Conduct of Operations Manual*, and P 950, *Conduct of Maintenance*, by defining the minimum operations and maintenance criteria for structures, systems, and components that it covers. The criterion lists requirements that are based on codes, standards, contract commitments, lessons learned, or business case. It also lists recommendations based on industry practices, operational experience, or business case. Guidance for implementation of the requirements and recommendations is also provided.

Example – Purpose

The purpose of this Criterion is to establish the minimum requirements and best practices for operation and maintenance of Electrical Motors ranging from 5 Hp. to 200 Hp. at LANL. This document addresses the requirements of P 315, *Conduct of Operations Manual*, and P 950, *Conduct of Maintenance*, by defining the minimum operations and maintenance criteria for structures, systems, and components that it covers. The criterion lists requirements that are based on codes, standards, contract commitments, lessons learned, or business case. It also lists recommendations based on industry practices, operational experience, or business case. Guidance for implementation of the requirements and recommendations is also provided.

2.0 SCOPE

Provide a concise description of the types of activities, facilities, systems, or equipment to which this document applies. Where applicable, state in this section what size and type of equipment, facility, and applicability to real property and/or programmatic Structures, Systems, and Components (SSCs) that are within the scope of this Criterion. To ensure clarity, the author may also specify SSCs that fall outside the scope of this Criterion.

Author must set the boundaries for the document. Review related criterion scope sections to determine if they may include parts of a system that would fall under the criterion currently being developed. For example, filters, motors, and refrigeration systems do not need to be covered in the Air Handling System criterion; however, it is helpful to refer

the reader to them. When in doubt as to where something is to be covered, contact the criterion author or the MSS-MP Group Leader for clarification.

Example – Scope

The scope of this Criterion includes the routine inspection, testing and preventive and predictive maintenance of Electrical Motors with horsepower ratings from 2 Hp to 200 Hp, single phase and three-phase power source, all frame types, at all nuclear and non-nuclear LANL facilities. Lubrication is not addressed; see Criterion 427, Lubrication. This Criterion does not address corrective maintenance actions required to repair or replace equipment.

3.0 ACRONYMS AND DEFINITIONS

3.1 Acronyms

State that “Acronyms are defined in their first use.” For documents exceeding 15 pages, alphabetically list all acronyms used in the body of the Criterion.

Example – Acronym List

AHJ	Authority Having Jurisdiction
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
CFR	Code of Federal Regulations
LIP	LANL Institutional Procedure
LPS	Lightning Protection System
MM	Maintenance Manager
O&M	Operations and Maintenance

3.2 Definitions

Define any terms, in alphabetical order, that are used in the criterion that may not be obvious to the reader or may be subject to interpretation. For terms that are not unique to the Criterion, but need to be restated, reference the original source of the definition in detail. Strive for consistent terminology across documents; follow DOE usage to the maximum extent.

Example – List of Definitions

Air Terminal - A strike termination device that is essentially a point receptor for attachment of flashes to the lightning protection system and is listed for the purpose. Typical air terminals are formed of a tube or solid rod. Air terminals are some times called lightning rods (NFPA 780).

 <p>Los Alamos NATIONAL LABORATORY EST. 1943</p>	<p><i>Conduct of Maintenance (P 950)</i> Operations and Maintenance Manual O&M Criterion Writer's Guide</p>	<p>Criterion 101, R6 Page 7 of 20</p>
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Insulation Resistance Test - (meggering) A test for measuring the electrical resistance between two conductors separated by an insulating material (McGraw-Hill Dictionary of Scientific and Technical Terms 5th Edition).

4.0 RESPONSIBILITIES

Clearly define the responsibilities associated with implementing and maintaining the subject Criterion alphabetically. Include responsibilities for MSS-MP, the SME organization (if different from MSS-MP), the Maintenance Manager, Group Leaders, and others as applicable.

When the Criterion is authored by MSS-MP or an SME, include the following statement of responsibility:

MSS-MP is responsible for the technical content, monitoring the applicability and the implementation status of this Criterion. MSS-MP will assist organizations that are not applying or meeting implementation expectations or will elevate concerns to the appropriate level of LANL management.

Criteria authored by organizations other than MSS-MP shall include the following statement of responsibility:

MSS-MP is responsible for the administrative content, and for monitoring applicability and implementation status of this Criterion. MSS-MP will assist organizations that are not applying or meeting the implementation expectations contained herein or will elevate their concerns to the appropriate level of LANL management.

Criteria could include the specific Authority Having Jurisdiction (AHJ) position and shall include the following statement defining the AHJ:

The AHJ is responsible for providing decisions on specific technical questions regarding this criterion.

Example – Responsibilities List

4.1 MSS-Division Leader

Receives and approves or rejects, in conjunction with the AHJ, requests for variances from this criterion. Maintains the record of decision for all variance requests.

4.2 MSS- Maintenance Programs (MP)

Responsible for administrative content and for monitoring applicability and implementation status of this Criterion. MSS-MP will assist organizations that are not applying or meeting the implementation expectations contained herein or will elevate their concerns to the appropriate level of LANL management.

4.3 Facility Operations Director (FOD)

Responsible for implementation of this O&M Criterion for identified systems/equipment within their facility boundaries.

4.4 Operations Manager (OM)

Responsible to the FOD for implementing operation portions of this Criterion and for coordinating transfer of systems/equipment to the Maintenance Manager for maintenance activities. The OM with concurrence of the FOD will prioritize implementation within budget allocations.

4.5 Maintenance Manager (MM)

Responsible to the FOD and the MSS-Division Leader for implementing the maintenance portions of this Criterion and for coordinating the transfer of systems/equipment to the Operations Manager at the conclusion of maintenance activities. The MM with concurrence of the FOD will prioritize implementation within budget allocations.

4.3 Authority Having Jurisdiction (AHJ)

The AHJ (Point of Contact for (Insert Chapter) of the LANL Engineering Manual) is responsible for providing a decision on specific technical questions regarding the systems or equipment relevant to this criterion.

5.0 PRECAUTIONS AND LIMITATIONS

5.1 Precautions

List any unique precautions that may be required to ensure the safety of personnel, the environment, or equipment being discussed. If an existing LANL document, (i.e., AP, P, or PD), specifically addresses the hardware-related safety concerns (i.e., not general program information) for the process under discussion, reference it in this section (refer the reader to the document, do not restate its content). It is important to note that the intent of this section is not to restate all applicable precautions (the existing LANL work control and safe work practice programs are intended to identify all applicable hazards). Only list those unique precautions requiring special attention in this section.

In all cases, include the following paragraph:

This section is not intended to identify all applicable precautions necessary for implementation of this Criterion. However, all applicable precautions should be contained in the implementing procedure(s) or work control authorization documents. The following precautions are intended only to assist the author of a procedure or work control document in the identification of hazards and precautions that may not be immediately obvious.

Example – Precaution

Ensure electric motor units are electrically grounded and electrical installation wiring and controls are used consistent with NEC and NFPA electrical code requirements. (NEC Article 430 and 250)

5.2 Limitations

Identify limitations associated with this Criterion. Note that limitations in applicability should be placed in Section 2.0 Scope, not in this section.

In all cases, include the following three paragraphs:

The intent of this Criterion is to identify the minimum requirements and recommendations for SSC operation and maintenance across the Laboratory. Each user is responsible for the identification and implementation of additional facility specific requirements and recommendations based on their authorization basis and unique equipment and conditions, (e.g., equipment history, manufacturer warranties, operating environment, vendor O&M requirements and guidance, etc.).

Nuclear facilities and moderate to high hazard non-nuclear facilities will typically have additional facility-specific requirements beyond those presented in this Criterion. Nuclear facilities should implement the requirements of DOE Order 433.1 as the minimum programmatic requirements for a maintenance program. Additional requirements and recommendations for SSC operation and maintenance may be

necessary to fully comply with the current DOE Order or the Code of Federal Regulations (CFR) identified above.

Nuclear facilities and certain high hazard facilities (e.g. high explosive operations) may have additional facility specific requirements beyond those presented in this Criterion which are contained in the Safety Analysis Report (SAR), Technical Safety Requirements (TSR), or facility safety plans, as applicable.

6.0 REQUIREMENTS

This section shall clearly define or describe the specific requirements for the equipment or process covered. In this section concisely state what minimum O&M related activities are required for the subject equipment or system.

Perform a thorough search of *all* applicable DOE Orders, codes or standards committed to in the LANL Contract. Identify those O&M requirements that the LANL *must* meet to satisfy the Contract.

Required activities must be driven by:

1. Formal commitments made to the DOE or other regulatory agencies

Identify and review any additional formal commitments made to the DOE or other regulatory agencies. These commitments may be found through access to the LANL Issues Management (LIMTS) system, Requirements Management System (RMS), regulatory consent orders, and records of decision (RAD) from regulatory agencies. Consent orders and RAD commitments are typically associated with ESH&Q Division requirements.

2. Operating experience, the DOE/LANL Lessons Learned program, and/or good engineering practices

Operating experience and lessons learned should also be researched for additional requirements that the institution deems appropriate. Requirements derived from lesson learned must be justified based on risk and/or cost/benefit analysis. Lessons Learned reports should be researched back five years from the date that the Criterion is being developed or revised. Lessons Learned data is available through the DOE Occurrence Reporting Program and its data system, the Occurrence Reporting and Processing Systems (ORPS) located at the following Web address:

<http://www.hss.energy.gov/CSA/analysis/orps/orps.html>. A copy of ORPS reports researched by the Criterion author shall be provided to MSS-MP for retention in the official file.

Professional operating experience, engineering judgment, manufacturer's recommendations and requirements, and system/equipment historical analysis form a basis for a requirement when implementation is proven to enhance safety, increase longevity of the SSC, ensure availability for intended service, or positively impacts cost

of maintenance and/or operations. The author must justify the requirement based on risk and cost/benefit analysis. Analysis results, a statement of the operating experience basis and research documentation shall be provided and in the official file.

In development of the Criterion, internal Laboratory requirements should be referred to *but not restated*. However, the requirements may be restated when taken from DOE orders, codes, standards, Lessons Learned information, etc. that are not readily available to the user. Where this is not possible, a summary or paraphrase of the requirement may be provided.

A “basis” statement *shall* be provided after each requirement listed. The basis statement *shall* clearly list the source document, where applicable and if appropriate, the driver for the document. If the basis is the author’s judgment, manufacturer requirements, or operational experience, a justification *shall* be provided. The phrase “Engineering judgment” should not be used as a stand-alone basis. The author *shall* include (succinctly, in less than one paragraph, preferably in a sentence or two) a defensible justification describing why the subject requirement is necessary. Bear in mind contractual requirements to sustain the SSCs for intended and planned use when formulating basis statements. Sections 6.1 s and 6.2 *shall* always be included. When there are no requirements identified simply state “No requirements beyond those stated in section 5.2, Limitations.”

In all cases, include the following statement immediately after the Section 6.0 heading:

Minimum requirements for all users are specified in this section. Requested variances to these requirements shall be prepared and submitted to MSS-MP for review and approval. The MSS Division Leader approves or denies variances. The Criterion users are responsible for analysis of operational performance and SSC replacement or refurbishment based on this analysis. Laws, codes, contractual requirements, engineering judgment, safety matters, and operations and maintenance experience drive the requirements contained in this section.

6.1 Operations Requirements

List all operations-related requirements that *shall* be followed. Examples of potential requirements include special qualification or certification requirements for operators. The author is strongly encouraged to grade requirements based on Management Level (ML).

Example – Operations Requirements

Inspect the floor area directly under and on the sides of the door for tripping hazards. Inspect the areas affected by the operation of the door for obstructions that may interfere with normal operation . These inspections should be performed every time the door is opened or closed. NOTE: Documentation supporting execution of this requirement may be required for ML-1 and ML-2 door systems or as defined by the facility Authorization Basis (AB). As a minimum, personnel that operate roll-up/overhead doors should be able to demonstrate knowledge of this requirement.

Basis: These inspections are required to assure personnel safety and are based, in part, on DOE Lessons Learned ALO-LA-FIRNGHELAB-1995-0002. Wear of obsolete floor guides and other surrounding structures and obstructions that may interfere with the normal operation may cause damage and personnel injuries. Point-to-point testing of all zones within a Fire Alarm Control Panel should be performed as post-maintenance verification of the operability of the system.

Basis: NFPA 72-7-3.21(1). Compliance with NFPA code is required per the LANL Prime Contract.

6.2 Maintenance Requirements

List all maintenance-related requirements that shall be followed. Examples of potential requirements include the following:

- Special qualification or certification requirements for personnel doing preventive maintenance activities.
- Preventive maintenance activities by frequency or type (including inspections, lubrications, routine part replacements, calibrations, functional tests, predictive maintenance, and surveillance's).

The author is strongly encouraged to grade requirements based on the Management Level (ML). The author may divide these requirements into subsections as deemed appropriate. These subsections can be organized by maintenance frequency or equipment/component type, or any combination of the two. It is acceptable to organize this section to level five subsections, if necessary. Use an alphabetical list rather than bullets when itemizing requirements. A basis statement shall be used for each numbered section and address any lettered lists within the section. Each item on the lettered list does not require a separate basis statement if the basis for all the elements on the list is the same. Basis statements can be combined to address several items on the list. The use of tables in this section is encouraged.

Example 1 – Maintenance Requirements

Semi-Annual Intervals

Visually inspect critical welds between the curtain or panel support shaft and end-plates for damage or cracking.

Basis: This inspection is required to assure personnel safety and is based on DOE Lessons Learned ALO-LS-LANL-PHYSCOMPLX-1997-0003. Damaged welds can lead to failure and allow the door to fall uncontrollably. Several DOE locations have experienced near-miss accidents that could have been prevented by performing this inspection.

Inspect labels on the door control switches. Verify that the labels provide clear guidance for the operation of the door and cannot be confused with other equipment in close proximity to the operating door such as a dock leveler.

Basis: This inspection is required to ensure personnel safety and is based on Lessons Learned 1998-LA-LANL-ESH7-0009 (Ref. 10.5) and vendor instruction, e.g., Overhead Door Company; Recommended Preventive Maintenance – Rolling Doors 1994.

Example 2 – Maintenance Requirements

Freeze protection systems should be inspected and verified to be fully operational and placed in service not later than 15th of each month.

Example 3 – Maintenance Requirements

Check the sensitivity of each smoke detector within one-year of installation and every two years thereafter in accordance with manufacturer's instructions. Use only manufacturer approved equipment to conduct tests.

Basis: NFPA 72-7-2.2. Compliance with this NFPA code is required per the LANL contract.

7.0 RECOMMENDED AND GOOD PRACTICES

Clearly state in this section what the Criterion user should consider in the development of the O&M program. State concisely what O&M related activities are recommended for the subject equipment/system.

Recommended activities shall be driven by one or more of the following:

1. **Industry standards and practices.** Review generally accepted industry standards and guidelines to identify best practices in operations and maintenance for the subject SSCs.

2. **Industry codes and standards.** Review accepted industry codes to identify code recommendations for operations and maintenance for the subject SSCs.
3. **Manufacturer's recommendations.** The primary guide to maintenance and operational requirements can be obtained from the manufacturer of the structure, system, or component. These manufacturer recommendations should be used when the failure to perform the recommended actions could void the manufacturer's warranty or it is demonstrated that failure to perform the maintenance/operations actions could cause the SSC to fail to meet the requirement to be "available for intended use."

A "basis" statement shall be provided after each recommendation listed. The basis statement shall clearly list the source document (including reference number, revision, section and/or page number) and if appropriate, the driver for the document. If the basis is the author's judgment, manufacturer recommendations, or operational experience, a justification shall be provided. The phrase "engineering judgment" should not be used as a stand-alone basis, the author shall include (succinctly, in less than one paragraph) a defensible justification describing why the subject recommendation has been made.

In all cases: The following paragraph should appear in each O&M Criterion.

The information provided in this section is recommended based on acceptable industry practices and should be implemented by each user based on the unique application and operating history of the subject systems/equipment.

Example – Operations Recommendations

7.1 Operations Recommendations

Motors are designed to operate at or below any maximum surface temperature stated on the nameplate. Failure to operate the motor properly can cause this maximum surface temperature to be exceeded. If applied in a hazardous area, this excessive temperature may cause ignition of hazardous materials. Operating motors at any of the following conditions can cause nameplate temperatures to be exceeded:

- A. Motor load exceeding service factor value
- B. Ambient temperatures above nameplate value
- C. Voltages above or below nameplate value
- D. Unbalanced voltages
- E. Loss of proper ventilation
- F. Variable frequency operation
- G. Altitude above 3000 ft.
- H. Severe duty cycles – repeated starts
- I. Motor stalls, motor reversing, or single phase operation

Basis: Recommendations provided by DOE Motor Challenge Program

Example – Maintenance Recommendations

7.2 Maintenance Recommendations

Careful and regular maintenance and inspections are required to detect and clear any faults as early as possible before major damage can develop. Only general inspection intervals for trouble-free operation can be recommended because of the widely differing operating conditions. The inspection intervals should therefore be matched to the prevailing circumstances (dirt, deposits, frequent starts, loading, temperature, etc.). Special information provided by motor manufactures should also be followed. The following Maintenance Recommended Frequency Matrix is provided as a general guide.

Table 7-1 Recommendations Frequency Matrix

Chart Legend	I = Inspect, T = Test, M = Monitor, P = Perform		
	Qtr (3mo)	6 mo	1yr
COMPONENT - MOTOR			
<i>Monitor of Operating Conditions</i>			
Power			T
Power Factor			T
<i>Monitor Thermal, Vibration, Acoustics</i>			
Thermographic/Temperature Assessments			M
Vibration Monitoring			M
Acoustics			M
<i>Electrical Motors in Storage</i>			
Lubrication			P
Start/Run (when available)	P		
Shaft Rotations	P		

8.0 GUIDANCE

This section provides guidance on how to implement the requirements and recommendations delineated in Sections 6.0 and 7.0 above. The intent is to provide guidance for the development and implementation of the program and to encourage consistency in implementation. Where possible, the guidance should track to the section numbers for each respective Requirement or Recommendation. For example, guidance on how to implement Requirement 6.2 should be provided in Section 8.2. Where no guidance is provided for a specific section or statement, simply state: "No implementing guidance is available."

As a minimum (and if available), reference implementing LANL operations/maintenance procedures or job standards by number and title that have been reviewed and approved by MSS-MP and meet the expectations of the Criterion. In the majority of cases, MSS-MP has lead responsibility for these implementing procedures. For each reference to an existing LANL procedure, include the following pre-fix statement: "Provided it has been reviewed and approved by MSS-MP..." Include web hyperlinks to any referenced internal documents.

Identify and discuss any preferred methods or techniques that should be used in implementing the requirements and recommendations. Where applicable, list additional technical reports, white papers, Lessons-Learned, and Energy Facility Contractors Group (EFCOG) presentations that would be helpful to the user.

	<p style="text-align: center;"><i>Conduct of Maintenance (P 950)</i> Operations and Maintenance Manual O&M Criterion Writer's Guide</p>	<p style="text-align: right;">Criterion 101, R6 Page 17 of 20</p>
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8.1 Operations Guidance

Example – Operations Guidance

Crane operator licenses are obtained by completing form 1486, *Crane Operator and Rigging License Application*, which defines training requirements. This form may be found at the following URL: <http://enterprise.lanl.gov/forms/1486.pdf>

8.2 Maintenance Guidance

Example 1 – Maintenance Guidance

A discussion of water chemistry issues unique to northern New Mexico and how to best develop and apply chemical addition is provided in Attachment A, “Water Chemistry issues unique to Northern New Mexico.”

Example 2 – Maintenance Guidance

PMI 40-40-001, Air Conditioning and Refrigeration Systems provide guidance for chiller maintenance programs.

9.0 REQUIRED DOCUMENTATION

Clearly define SSC-specific documentation that is required to comply with; DOE Orders, regulation, or law committed to in the LANL Prime Contract and/or codes, or standards accepted as best business practice.; Include documentation requirements found in the LANL Issues Management (LIMTS) system, Requirements Management Program (RMP), regulatory consent orders, and records of decisions (RAD) from regulatory agencies. Documentation resulting from defensible engineering judgment shall have approval by MSS-MP. The author shall provide samples of the required documentation as an Appendix to the subject criteria when specific formats are required.

Identify the required documentation of data, the types of required documentation, content, format necessary to maintain auditable records for all maintenance, repairs, tests, and inspections and the basis for taking the data. If none is required, simply state “None required.” Maintenance history shall be maintained in the CMMS system. The author must clearly define responsibility for other required documentation including document control expectations.

A “basis” statement shall be provided after each requirement listed. The basis statement shall clearly list the source document, where applicable, and if appropriate, the driver for the document. If the basis is the author’s judgment, manufacturer requirements, or operational experience, a justification shall be provided. The phrase “engineering judgment” should not be used as a stand-alone basis, the author shall include (succinctly, in less than one paragraph, preferably in a sentence or two) a defensible justification

describing why the subject requirement is necessary. Maintenance history shall be maintained for all maintenance activities performed on structures, systems or components addressed by this document as required by AP-MNT-010, Maintenance History. The procedure states, in Section 2.1:

“A maintenance history and trending program will be maintained to document data, provide historical information (maintenance planning), and support maintenance and performance trending of SSCs.”

Example – Required Documentation

Maintenance history should be maintained for electric motors to include, as a minimum, the parameters listed in the following table:

Table 9-1 Documentation Parameters

MAINTENANCE HISTORY DOCUMENTATION PARAMETERS				
Parameter	ML 1	ML 2	ML 3	ML 4
Maintenance Activities				
Repair / Adjustments	X	X	X	X
Motor Replacement	X	X	X	X
Lubrication Evolutions	X	X	X	
Equipment Problems				
Failure Dates	X	X	X	
Failure Root Cause	X	X	X	
Inspection Results				
Inboard Bearing Temperature	X	X		
Outboard Bearing Temperature	X	X		
Vibration Analysis Data	X	X		
Leg Voltage	X			
Start-Up Current per Leg	X			

Basis: Documentation of the parameters listed in Table 9-1 above satisfies the requirements of AP-MNT-010, Maintenance History.

	<p style="text-align: center;"><i>Conduct of Maintenance (P 950)</i> Operations and Maintenance Manual O&M Criterion Writer's Guide</p>	<p style="text-align: right;">Criterion 101, R6 Page 19 of 20</p>
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10.0 REFERENCES

List all documents that are directly noted in the body of the Criterion. Do not include a blanket listing of additional references that were not directly referenced in the body of the Criterion. Include dates and/or revision numbers in references.

Example – Reference List

The following references, and associated revisions, were used in the development of this document:

- 10.1 P 950, Conduct of Maintenance.
- 10.2 DOE O 430.1B, *Real Property Asset Management*.
- 10.3 DOE Order 433.1, *Maintenance Management Program for DOE Nuclear Facilities*.
- 10.4 OSHA 1910.212, *Occupational Safety & Health Administration* “General Requirements for all machines,” subpart title, “Machinery and Machine Guarding.”
- 10.5 AP-MNT-010, *Maintenance History*.

11.0 APPENDICES

List any additional appendices in this section that are referenced in the body of the Criterion. Appendices may be used to include such items as recommended data sheet formats/forms, special instructions, excerpts of requirements/codes/laws, recommended maintenance program, or any other supplemental information, which will aid in the implementation of the Criterion.

Example – Appendix List

Appendix A, Reliance Proper Motor Lubrication White Paper – B5021 Appendix B, Reliance RPM AC Finned Frame Inverter Duty Motor Data Sheet



Example – Appendix A

APPENDIX A

Reliance Proper Motor Lubrication White Paper – B-5021

White Paper: AC Motors Proper Motor Lubrication

|Open Bearing | Sealed Bearing | Shielded Bearing | Lubrication Techniques | Over-greasing |

The service life of most motors is dependent on a little bit of good grease at the right times. This report discusses the pros and cons of different types of bearings, under- or-over-lubrication problems, and proper lubrication techniques.

Most motor failures are related to bearing failures. However, most bearing failures are not the result of bearing fatigue but improper lubrication. Bearing fatigue life calculations are commonly referred to as L-10 life (previously B-10). These calculations, expressed in thousands of hours of bearing life, give a good indication if a specific bearing can handle a specific load; but they cannot and should not be used to predict bearing life. Why? Because it all comes back to taking care of that bearing with good lubrication practice.

Before we can discuss good lubrication practices we need to understand the basic types of bearings that motor manufacturers generally use, along with their advantages and disadvantages.

[Intermediate pages deleted for this guide example]