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Technical Procedures Writer's Guide

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ABSTRACT

Technical procedures systematically describe a series of steps for the operation, maintenance, or testing of systems or components. They are widely used as a method for ensuring consistency, reducing human error, and improving the quality of the end-product. This guide provides specific guidance to procedure writers to help them generate high-quality technical procedures. The guidance is aimed at reducing confusion or ambiguity on the part of the operator, thereby increasing efficiency and reducing errors and rework. The appendices to this document define key terms associated with the creation of technical procedures, list common error traps, and define a set of action verbs that should be used in technical procedures.

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ACRONYMS AND DEFINITIONS

Abbreviation	Definition
DOE	Department of Energy
HF	Human Factors
ND	Nuclear deterrence
PPA	Procedure Professionals Association
SME	Subject matter expert

1. INTRODUCTION

In early 2019, staff members in the Human Factors (HF) Department were asked to help improve the technical procedures being developed for a high impact/high consequence project. The project team needed assistance standardizing and finalizing their technical procedures but could not locate a Sandia or Department of Energy (DOE) specific procedure writing guide or even a procedure template that completely met the project's needs. The HF staff members working on the project combined guidance and examples from a variety of different documents for the project team and also created a technical procedure template to streamline the standardization effort. Since that time, they have been refined and generalized for a larger audience; the original writer's guide has evolved into this SAND report.

1.1. What is a procedure?

This guide uses specific terms to describe the organization and elements of a **procedure**. Figure 1-1 introduces these elements and how they relate to one another. In short, a **procedure** prescribes performance of a **process** to achieve a defined **outcome**. The **process** is broken down into individual **activities**. Each **activity** consists of a series of **action steps**. Key terms associated with technical procedures are defined in the Glossary of this report (Appendix A).

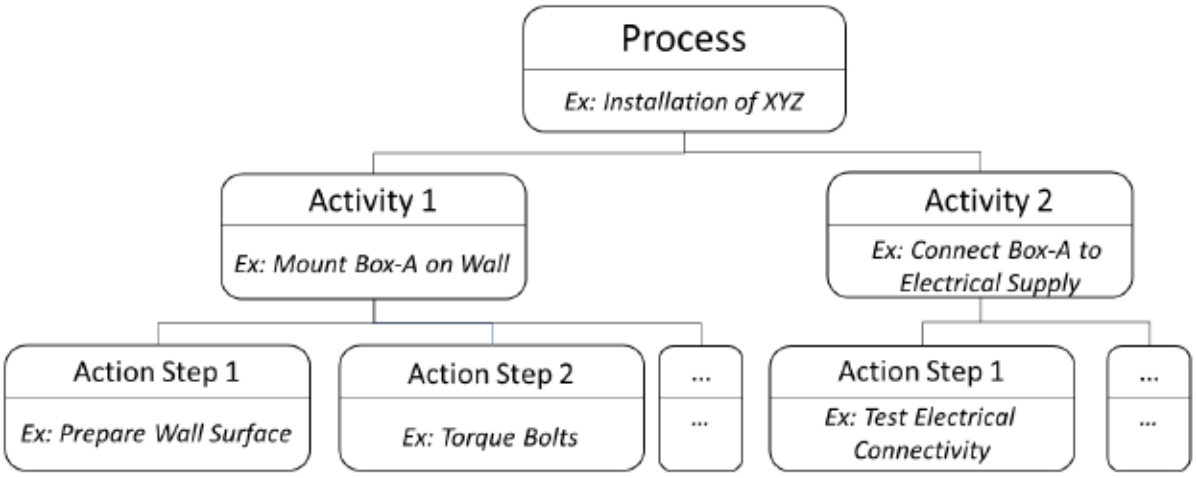


Figure 1-1. An overview of the lexicon used in this guide.

1.2. When do I need a procedure?

Procedure use and adherence is one of several error-reductions tool for work performance [1]. Consistent and effective use of these tools during work performance reduces the probability that an error may cause an accident or serious event. When a task or process is complex, a high degree of standardization is needed, and/or the consequence of an error is high, a procedure can aid in reducing the likelihood of human error. A decision tree is available in "PPA AP-907-001 Rev 2, Procedure Process Description" (2016) which may help determine whether a technical procedure is appropriate for a given situation.

This is not to say that all procedures should be identical in the level of detail and amount of content—these considerations are addressed later. Instead, we recommend the use of a procedure format that is tailored to the needs of the situation and the worker.

1.3. Technical Procedure Template

To accompany this writer's guide, we created a technical procedure template, using the Nuclear Deterrence (ND) community's Specification Template as the basis. An overview of the template can be found in Appendix B. An editable version of the template (in .docx format) can be provided by the HF Department upon request.

1.4. Living Document

This guide and its included procedure template are living documents. If you have feedback or suggestions for improvements to either, please contact the manager of the HF Department.

2. THE PROCESS

The overall process of writing a new technical procedure or revising an existing technical procedure is depicted in Figure 2-1.

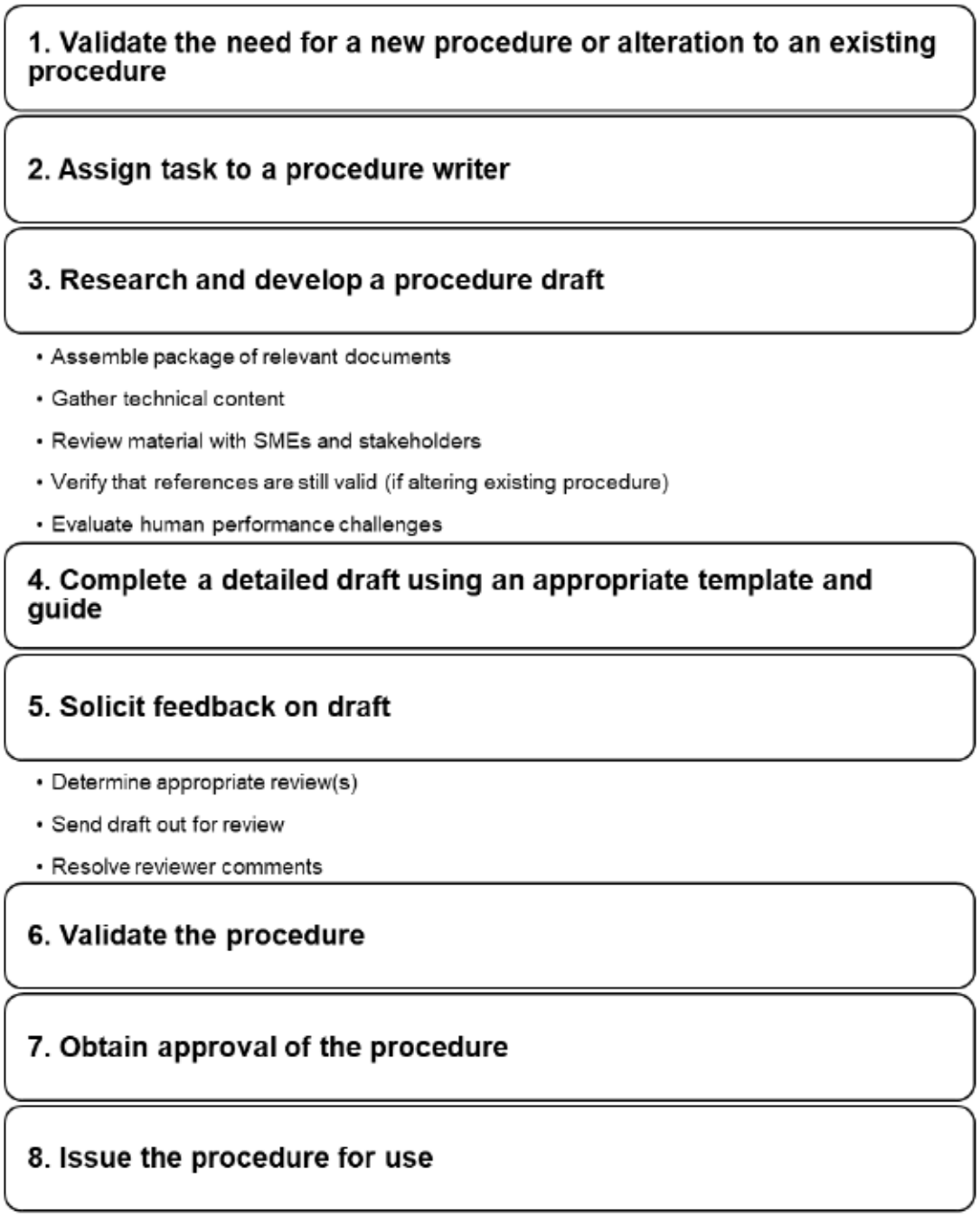


Figure 2-1. The process for creating and issuing procedures (or alterations to procedures).

The first step is to validate the need for a new procedure or revision to an existing one. Organizations have different ways of collecting and prioritizing these requests, but this part of the process will not be discussed in detail in this document. The interested reader can find guidance in "PPA AP-907-001 Rev 2, Procedure Process Description" [2].

The next step in the process is to assign the task of writing or revising to a procedure writer. The procedure writer should assemble the documents necessary for developing the procedure. These documents may include administrative documents, requirements documents, and safety documents. The writer also needs to gather the technical content for the procedure. When developing the technical content, the writer should identify things such as:

- performance objectives
- necessary activities
- necessary level of detail
- impact of critical steps
- job hazards
- the environment and location where the work will be performed

The list above is not exhaustive—there may be other technical content that the procedure writer needs in order to generate a draft procedure. More information can be found in "PPA AP-907-001 Rev 2, Procedure Process Description" [3]. If a new procedure is being developed, the writer should determine whether a **task analysis** or **process map** are needed.

The procedure writer should then review all the material with subject matter experts (SMEs) and stakeholders to ensure completeness and accuracy. If altering an existing procedure, the documents referenced in that procedure need to be reviewed to determine whether revisions have been made to them. The writer must then identify any challenges to human performance and determine how they will be overcome. Appendix C lists some of the most common error traps that writers should avoid when developing technical procedures.

Using the information gathered in the previous steps, the writer then creates a draft that will be used for the review process. To do this, the writer first needs to determine the correct template and guide to use. The procedure template provided in Appendix B may be a good starting point, but it should be tailored to the specific needs of each project. The goal of the following sections of this document are to provide the writer with the guidelines for writing this draft.

Upon completion, the draft should first be reviewed by the individual or individuals who requested it. Other reviews should follow, possibly including security, safety, engineering or human factors reviews. Once all reviewers' comments are resolved, the procedure still needs to be validated. Validation methods include:

- performance on a mock-up or spare equipment
- simulator scenario
- walkthrough
- comparison (if revising an existing procedure)
- table top

Once validated, the procedure should be submitted to the approval authority for final approval. Finally, once approved, the procedure should be distributed as appropriate, making it available to users.

3. PROCEDURE CONTENT AND FORMAT

The primary reference for this section is DOE-STD-1029-92, a Department of Energy (DOE) writer's guide that was last updated in 1998 [4]. Although the guide was canceled in 2015 by DOE, [1] we selected it due to its level of detail and the ease with which the content could be tailored to project needs. Much of the text and examples contained hereafter are taken verbatim from DOE-STD-1029-92 Change 1. Other technical procedure guides were used to provide additional examples or additional context or rationale.

3.1. General Content and Format Guidelines

This section provides guidance on the content and organization of a procedure. It defines the format of procedure pages, headers and other elements. Writers should exercise discretion when applying the guidance presented as some types of procedures may fall outside the scope of this document. Additionally, the writers of this guide have assumed that the format of the final procedure will be produced in paper format, not used on an electronic device like a tablet or laptop. For that reason, we have not included any guidelines for hyperlinks or electronic bookmarks.

3.1.1. Level of Detail

The key to successful communication with procedure users is writing at the appropriate level of detail. Only include information in the procedure that *directly relates to completing the task* to reduce distraction and ensure ease of use.

[1] Procedures should be written at a level that matches the training and experience level of the expected users. If you are unsure, write to the lowest level.

[2] When choosing a level of detail, take into account the factors listed in Table 3-1.

Table 3-1. Factors that affect a procedure's necessary level of detail

Factor	Description
Complexity of the task	As task complexity increases, the level of detail should increase.
Frequency of task performance	As task frequency increases, the level of detail can decrease.
Experience and qualification level of the user	As user qualification level increases, the level of detail can decrease on tasks that are relatively simple and frequently performed.
Degree of standardization desired	The more standardized the process needs to be, the more detailed the process needs to be.
Skill of the craft	Step by step instructions may not be needed for activities determined to be skill of the craft for the discipline that will be performing the procedure.
Consequence of error	The level of detail should increase as the risk of personal injury, equipment damage, reduction in effectiveness of safety-related systems and potential regulatory challenge increases.

[1] According to the cancellation notice dated December 2014, the "purpose of DOE-STD-1029-92 is adequately fulfilled by the Procedure Professionals Association (PPA) voluntary consensus standards PPA AP-907-005 Rev I, September 2011, Procedure Writers' Manual, and PPA-907-00 I Revision I, September 2011, Procedure Process Description." The cancellation notice is available online at: https://www.standards.doe.gov/related-items/cancellation-notice-for-department-of-energy-standard-1029-1992-writers-guide-for-technical-procedures

[3] Ask the following questions to ensure that the amount and kind of information provided are adequate:

- Can the procedure be performed in the sequence as it is written?
- Can the user locate and identify all equipment listed in the procedure?
- Can every user explain in detail how to perform general instructions?
- Can the user perform the procedure without obtaining any additional information from people or procedures not referenced in the procedure in question?
- Can the user perform the procedure without obtaining direct assistance from someone not specified in the procedure?

[4] Ensure that the user's qualifications are consistent with the decision making required by the procedure. This ensures that tasks can be performed by the user with minimum supervision.

[5] Exclude information that is pertinent only to reviewers or other people not involved in the performance of the procedure.

3.1.2. Consistency

Consistency is one of the most important principles in writing effective technical procedures. When procedure style, format and organization are inconsistent, either within or between procedures, users may assume differences in meaning that the writer never intended. Consistency facilitates rapid comprehension and allows users to concentrate solely on the content.

3.1.3. Writing Style and Language

Procedures should be written so that each user can quickly and easily grasp the intended meaning. Adhere to the following suggestions to ensure procedures are easy to follow.

[1] Communicate instruction using simple and concise language, but do not sacrifice comprehensibility.

[2] Use the imperative mood (action statements) to communicate procedure instructions to users.

> **Use:** Hand-tighten the bolts.
> **Don't use:** The user should hand-tighten the bolts.
> **Don't use:** The bolts should be hand-tightened.

[3] Be consistent with language and format across instrument labeling, procedures and training.

[4] Use words and phrases consistently throughout procedures. Do not use synonyms unless required for clarity.

> **Example,** If you first identify a part as a "plate," do not later describe it as a "cover." If you use 'select' in an action step, do not use 'pick' later if it means the same thing.

[5] Write instructions clearly. Users should never have to infer meaning.

[6] Select vocabulary carefully, with a consideration for the training that users receive. Avoid using technical terms except when there is no other wording to convey the same meaning, or the terminology is commonly used by the user.

[7] Adhere to standard American English grammatical conventions and punctuation rules unless an exception would improve understanding or readability. [2]

[a] Use brackets ([ ]) to avoid a double set of parentheses (Figure 3-1).

[b] Do not break words, component numbers, or procedure numbers with hyphens from one line to another (Figure 3-2).

3.	Updated Final Safety Analysis Report [includes QA Program Manual (UFSAR Chapter 17)]	_____

Figure 3-1. Example of proper use of brackets and parentheses together.

Incorrect:

2.	In Cubicle 3, **INSTALL** jumper from LN-01 (wire #11) to LN-02 (wire #21).	_____

Correct:

2.	In Cubicle 3, **INSTALL** jumper from LN-01 (wire #11) to LN-02 (wire #21).	_____

Figure 3-2. Adjust line breaks to avoid hyphenation.

[c] Do not use periods in acronyms, units and listed items (Figure 3-3).

Acronyms:	Incorrect:	A.T.W.A.S.
	Correct:	ATWAS
Units:	Incorrect:	lbm.
	Correct:	lbm

Figure 3-3. Leave periods out of acronyms, units and listed items.

[d] Avoid semicolons in actions steps as they promote long sentences and multiple actions within a single step (Figure 3-4).

[2] We suggest two references to help with this: the Chicago Manual of Style and the Sandia Technical Writing Style Guide.

Incorrect:

5. **STOP** permit process; **NOTIFY** Chemistry. _____

_____ _____

Person Contacted Date

Correct:

5. **STOP** permit process. _____

6. **NOTIFY** Chemistry. _____

_____ _____

Person Contacted Date

Figure 3-4. Do not use semicolons in actions steps.

[8] If necessary, rewrite sentences to avoid excessive punctuation.

[9] Avoid ambiguous words and phrases (e.g., 'as needed,' 'if necessary').

Use: "Take photographs from the front, the top and the rear."
Don't use: "Photograph from multiple vantage points."

Use: "If not already accomplished, replace dust covers on Tank Vent valves (V1 and V2) with new dust covers."
Don't use: "If necessary, replace dust covers on Tank Vent valves (V1 and V2)."

[10] Avoid vague terms which are open to interpretation or require judgment on the part of the user. Specify quantities or rates whenever possible.

Use: "Drain the liquid at a rate of 1 gallon/minute."
Don't use: "Drain the liquid slowly."

Don't use: approximately, slowly, often, frequently, gradually, quickly, equivalent to, as/if required, as/if applicable, as/if needed, as/if desired.

[11] Limit the use of abbreviations and acronyms.

[a] When an acronym must be used, ensure that it is initially spelled out in each section. this guideline can be relaxed if the acronym is a common part of the English language.

[b] Ensure each abbreviation and acronym is associated with only a single term. Do not use the same abbreviation or acronym for two different meanings.

[12] Develop a restrictive list of words and use only those on the list. Users should be familiar with them without having to refer to a list.

[14] When referencing figures or tables, do not use "refer to" or "see."

> **Use:** "Visually inspect the bracket (Figure 5-3) using the specified criteria (Table 5-1)."
> **Don't use:** "Visually inspect the bracket using the specified criteria. See Figure 5-3 and Table 5-1."

3.1.4. Numerical Information

[1] Maintain consistent use of Arabic numbers (e.g. 0, 1, 2) and spelled-out numbers (e.g., zero, one, two).

[2] Use spelled-out numbers when a number without a specified unit of measure directly precedes a number with a unit of measure.

> **Use:** "Prepare four 20 mL samples" or "Prepare 4 samples that are 20 mL each."
> **Don't use:** "Prepare 4 20 mL samples."

[3] Use spelled-out numbers when a number, typically a single digit number, is emphasized.

> **Use:** "Use one of the following."
> **Don't use:** "Use 1 of the following."

[4] Otherwise, use Arabic numbers to present numerical information.

> **Use:** "Decrease the level of the tank by 15 inches."
> **Don't use:** "Decrease the level of the tank by fifteen inches."

3.1.5. Instrumentation, Tool and Component Information

[1] Refer to instruments, tools and components using both their name and number. Use names that would be most familiar to the user. Ideally there should only be a single name for any piece of equipment. Set the numeric identifier apart from the name using a set of braces.

> **Use:** "Remove the cover from the Tank Vent valve (V2)."

[2] Avoid requiring users to interpret ambiguous descriptors, such as "approximately" and "slowly" when referring to instrument information.

[3] Specify numbers in procedures at the same precision and the same units of measure that they are presented on instrument panel displays.

[5] Eliminate mental calculation on the user's part by expressing consecutive acceptable values as a range instead of in terms of tolerance bands.

Use: "Torque the bolt to 40 foot-pounds (acceptable range is 35 to 45 foot-pounds)."
Don't use: "Torque the bolt to 40 foot-pounds ± 5 foot-pounds."

Use: 400 psig (392 to 408 psig)
Don't use: 400 psig ± 2%

3.1.6. Typeface

Text readability is affected by both the font (typeface, size, and weight) and the case (capitalized versus uncapitalized).

[1] Ensure that your selected font and size are appropriate for the worst conditions anticipated. Be sure to take into consideration the lighting and other environmental conditions.

[2] Use a mixture of upper and lower-case letters. Avoid using capital letters for an entire block of text.

[3] When choosing a font, be consistent throughout the document. Do not use so many different fonts that it becomes distracting to the user. And do not use fonts that are difficult to read.

3.1.7. Page Headers and Numbering

Each page of the procedure should include a page header that clearly distinguishes it from other procedures. Include a unique name or number to identify the procedure.

[1] Place the header at the top of every procedure page.

[2] Use sufficient margins so that no information is lost during duplication.

[3] On the front page header, include the following:

- Procedure title
- Procedure number (if used)
- Revision number
- Revision date

[4] Successive pages should include enough information to identify the procedure to which it belongs (either unique name or number).

[5] Number pages consecutively and in such a way that it will be apparent if a page is missing.

Use: "Pg. 3 of 75"
Don't use: "Pg. 3"

3.1.9. Procedure Titles

Procedure titles should be:

[1] concise, clear and descriptive of the system, equipment, process or activity;

[2] short and descriptive enough to permit the user to quickly identify the procedure and activity to which it applies; and

[3] unique enough to assist the user in identifying the correct procedure.

3.1.10. Headings

Headings are used to break the text of the procedure into sections by grouping related action steps. Think of headings as a summary statement of the process or activity that follows. They help users locate information, break up long series of actions into manageable chunks, and track their progress through the procedure. For an example of how headings should be formatted, see Figure 3-5.

1 FIRST LEVEL HEADING	("INSTRUCTIONS")
1.1 Second-Level Heading	("Installing the box")
1.1.1 Third-Level Heading	("Prepare the surface")

Figure 3-5. Example of proper heading formats.

[1] Give each major activity in the main body of the procedure a unique and descriptive heading.

[2] If possible, limit the number of heading levels to three (e.g., 1, 1.1, 1.1.1). Exceeding three levels results in section numbers that are too complex.

[3] Begin all headings at the left margin of the text block.

[4] Consider adding a page break before first-level headings to emphasize a change in focus.

[5] Identify first-level headings with all capital letters and bold type. These are the sections of the document; these include things like "INTRODUCTION," "PRECAUTIONS AND LIMITATIONS," and "INSTRUCTIONS."

[6] Identify second- and third-level headings with initial capital letters and bold type.

[7] If second-level headings are used to organize activities, start the heading with the "ing" form of action verbs and complete the heading with the objects of the action verbs (e.g., "Attaching the Conduit").

[8] If third-level headings under a second-level heading are used to organize actions steps, start the headings with action verbs and complete the heading with the objects of the action verbs (e.g., "Attach the Conduit").

[9] If they aren't used to organize action steps, then use topics for second- and third-level headings (e.g., "Responsibilities").

[10] Use a list to organize material other than action steps under headings and action steps.

[11] Designate listed items with indented upper-case letters.

[12] If it is necessary to continue a section on subsequent pages, the writer may want to repeat the relevant heading on subsequent pages with an indication that the page is a continuation (Figure 3-6).

6.4.1 (continued)

c. **RECORD** M&TE information on Attachment 1, Tracking Form. _____

d. **RECORD** Stopwatch ID Number on Attachment 2, Instrument Datasheet. _____

Figure 3-6. Example of a section continuation header. Source: [3].

3.1.11. Action Step Numbering

Action steps reduce a task or activity to a discrete set of instructions. The numbering identifies the individual steps and their sequence.

[1] Make action steps readily distinguishable by the user.

[2] Identify first-level action steps with bold typefaces bracketed numbers (Figure 3-7).

[3] Identify second-level action steps with bold typeface bracketed lower-case letters.

[4] Limit the number of action step levels to a maximum of two.

[3] Prepare compressed gas cylinders as follows:

[a] Select compressed gas cylinders with current in-service dated gas certification. ____

[b] Verify that each cylinder regulator will maintain 35 psig (30 to 40 psig). ____

Figure 3-7. An action step with two substeps. Source: [4].

3.1.12. Illustrations/Figures

Illustrations and figures can dramatically enhance the usability of procedures, but caution should be used when including them. It is imperative that they are presented clearly and do not inadvertently confuse the user.

[1] Identify figures with two Arabic numbers separated by a hyphen. The number preceding the hyphen refers to the section of the publication while the second number indicates the number of the figure within the section. The figures in this document are formatted in this manner.

[2] Identify appendix figures with letter, number, hyphen and number.

Example, Figure B2-4 refers to the fourth figure in the second section of Appendix B.

[3] Figure descriptions should clearly and succinctly indicate what the figure portrays by naming the function, process illustrated or other pertinent identification.

[4] Center the caption and description below the figure.

[5] When possible, locate figures on the same page as the related text or on the facing page. Do not place on the same page as text if the figure, including the caption, takes up more than one-half the page. Place the figure on its own page.

[6] Line art should be used whenever possible to clearly portray the necessary pictorial details. Photographs should be used sparingly as they are often harder to interpret or aren't reproduced well in printed procedures.

[7] Ensure that all graphical depictions are clear to the user in the format expected to be used during the operation.

[8] When referring to a figure in the text of your document, refer to it by number, not by its relative position to the text.

Use: "See Figure 3-5 for a detailed schematic."
Don't use: "See the figure below for a detailed schematic."

3.1.13. Tables

Tables are the preferred means of presenting large amounts of information.

[1] Tables should be as simple as possible. Sufficient explanation must be given to make them easily understood and used.

[2] Table numbers and titles should be included at the top of each table. Like figures, they should be numbered consecutively within each section of the document.

Example, Table 2-4 refers to the fourth figure in the second section of the document.
Example, Table C1-3 refers to the third figure in the first section of Appendix C.

[3] If a table is small and will not be referenced except from adjacent text, it does not necessarily need to be formally numbered and titled.

[4] When possible, locate tables on the same page as the related text or on the facing page. Do not place on the same page as text if the table, including the caption, takes up more than one-half the page. Place the table on its own page.

[5] When referring to a table in the text of your document, refer to it by number, not by its relative position to the text.

Use: "See Table 1-1 for a detailed list of supplies."
Don't use: "See the table below for a detailed list of supplies."

3.2. Procedure Organization

A technical procedure is organized such that the user is provided with all the needed information to accomplish an activity. It can include the following elements or sections:

- Coversheet
- Revision status
- Table of Contents[3]
- Acronyms and abbreviations
- Introduction
- Precautions and limitations
- Prerequisite actions
- Instructions
- Acceptance criteria
- Post-performance activity
- Source requirements
- Appendices

Not all procedures will require each of these elements; if an element isn't necessary, do not include it.

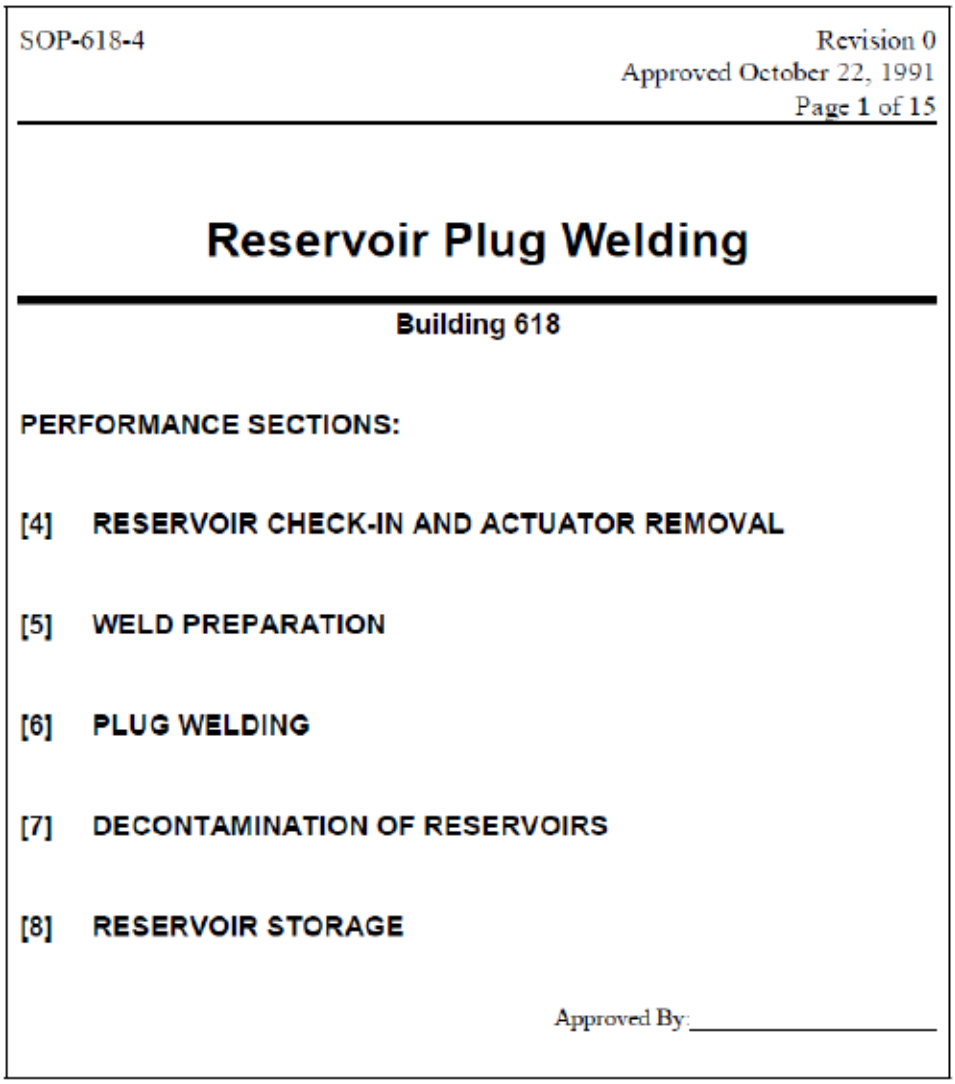
3.2.1. Coversheet

The coversheet provides a way for the user to verify that the procedure is right for the task at hand.

[1] Provide a simple descriptive title that identifies the system, equipment, process or activity that is described in the procedure.

[2] Consider providing other information in the coversheet to aid in differentiating it from other procedures. This additional information could be specific conditions or activities that the procedure controls. Figure 3-8 shows a sample coversheet.

[3] A *tables of figures* or *list of tables* can be included as well, following the table of contents.



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Reservoir Plug Welding

Building 618

PERFORMANCE SECTIONS:

[4] RESERVOIR CHECK-IN AND ACTUATOR REMOVAL

[5] WELD PREPARATION

[6] PLUG WELDING

[7] DECONTAMINATION OF RESERVOIRS

[8] RESERVOIR STORAGE

Approved By:_____

Figure 3-8. Sample coversheet. Source: [4].

3.2.2. Revision Status

It is essential that users follow the most current version of a procedure. Include the version number on each page of the procedure.

If revisions have been made, use this section to list changes. Additionally, draw the user's attention to changes (additions, deletions, or corrections) made in the procedure since the last version. One suggested way to do this is to mark the changes with vertical lines in the page margin. Only include marks for the most recent revision, not all those that came before it. This alerts the user to the fact that a change has been made since the last revision, although it does not indicate the nature of the change.

3.2.4. *Table of Contents*

A table of contents is highly recommended. It allows the user to quickly locate the portions of the procedure they need for a specific operation and is also helpful for locating appendices. This guide's table of contents is formatted in a manner that is consistent with the following recommendations.

[1] List the procedure section and sub-section headings and the titles of appendices exactly as they appear in the procedure.

[2] Listing third-level headings is optional; include them when required by the length and complexity of the procedure.

[3] At the right margin of the table of contents, identify the page number where the heading or title first appears.

[4] Format the table of contents consistently.

3.2.5. *Terms, Definitions, Acronyms and Abbreviations*

This section may not be necessary since acronyms and abbreviations should be defined when they first appear in each section. Do not rely solely on this section to introduce the user to acronyms, abbreviations or potentially unfamiliar terms. All users should be appropriately trained and familiar with the terms used in the procedure. If the writer decides that amplification is needed, include that in a note preceding the affected action step or incorporate it into the action step.

3.3. Introduction

The introduction should address the purpose, scope and applicability of the procedure.

[1] The purpose statement should be a clear description of the goal to be achieved by performing the procedure. Avoid simply restating the procedure title and headings of the table of contents. See below for an example.

Purpose
This procedure provides instructions for reservoir plug welding and storage of plug welded reservoirs.

OR

This procedure describes the disassembly, inspection, rework, and reassembly of the auxiliary feedwater pump turbines in support of 18 month turbine preventative maintenance routines.

[3] The statement of scope should describe the activities the procedure covers. If applicable, the statement may also address the limitations of the procedure (i.e. what the procedure does not cover). See below for an example.

> **Scope**
> This procedure addresses the actions necessary to plug weld reservoirs, to decontaminate them, and to store them. It does not include receipt and unpackaging of reservoirs, nor does it address rework of improperly welded reservoirs.
>
> OR
>
> This procedure verifies the opening capability of check valves in the Emergency Core Cooling System (ECCS) identified on attachments 1 and 2, thus demonstrating their operational readiness as required by AP-ZZ-003, Pump and Valve In-service Testing Program.

[4] Finally, specify the conditions that require procedure use in the applicability statement. For example, the procedure may be applicable to only a subset of all locations where the system is to be installed.

> **Applicability**
> This procedure is applicable to reservoir Types 1A and 1A with rings.

3.4. Precautions and Limitations

Precaution and limitation statements within the procedure can help prevent severe injury to, or death of, the procedure user and/or serious damage to equipment. This section delineates precautions that affect the *entire* procedure or that occur at *more than one point* in the procedure. Precautions affecting only portions of the procedure or only one point in a procedure are covered in 4.13.1, Warnings and Cautions.

[1] Write precautions and limitations to inform users of hazardous conditions and their potential effects. Figure 3-9 and Figure 3-10 are examples. Precautions accomplish two things: they 1) alert users to actions and conditions that represent potential hazards to personnel or possible damage to equipment or 2) describe abnormal conditions.

> **3.0 PRECAUTIONS**
> [1] Charged circuit breaker springs can lead to a pinch hazard.

Figure 3-9. Example precaution statement. Source: [3].

> **4.0 LIMITATIONS**
>
> 1. Maximum differential temperature between cylinders is 200°F with D/G loaded greater than 1000 KW.
> 2. Maximum turbocharger speed is 15,000 rpm.

Figure 3-10. Example limitation statement. Source: [3].

[2] Limitations define boundaries that are not to be exceeded.

[3] Do not present user actions in this section.

[4] Avoid generic precautions that are part of a job description or inherent in the task.

[5] If the user must act to respond to the precaution or limitation, include that action step at the appropriate location in the procedure and use a conditional action step to define the conditions that require an action. See 4.2,

[6] Conditional Action Steps for additional information on writing this kind of action step.

[7] Address the following in precautions and limitations as appropriate.

[a] Identify and address potential exposure of personnel or the environment to

- Radiation and contamination;
- High temperature or high pressure fluids;
- Hazardous substances;
- Electrical shocks;
- Excessive noise levels;
- Confined space hazards;
- Falls;
- Moving equipment or parts of equipment; or
- Fire hazards.

[b] Identify and address the protection of equipment and material from

- Inadvertent, incorrect, or omitted actions that may cause facility shutdowns;
- Inadvertent, incorrect, or omitted actions that may result in limiting conditions for operation as defined in the technical safety requirements;
- Limitations identified in approved vendor information;
- Limitations identified in applicable design documents;
- Unusual alarms affecting facility availability (e.g., fire) that may occur or are expected to occur as a result of performing the procedure;
- Electrical and mechanical interlocks involved in performing the procedure;
- Actions resulting in emergency response or automatic incident response; or
- Undesirable consequences of violating each precaution or limitation statement.

Hazardous conditions that apply to individual action steps are written as warnings or cautions. They are placed just before and on the same page as the affected action step. A more detailed discussion of warnings and cautions can be found in 4.13.1, Warnings and Cautions.

3.6. Prerequisite Actions

This section identifies the actions that must be completed by the user and any requirements that must be met (and possibly signed off) before the user continues with the procedure. This section should immediately precede the Instructions section.

[1] Include the following subsections as applicable:

- Planning and coordination
- Performance documents
- Special tools, equipment, parts and supplies
- Field preparations
- Approvals and notifications
- Responsibilities
- Pre-job briefs

[2] Alter the order of these subsections as appropriate, based on the sequence in which they should be performed. For example, an approval might need to be obtained before field preparations can take place.

[3] Include provisions for recording data, signoffs and remarks as needed (discussed further below).

3.6.1. Planning and Coordination

This section includes information on activities that must be undertaken to plan and coordinate the performance of the procedure. These actions may include the following:

[1] If training or qualifications specific to the procedure are required, list personnel requirements.

[2] As appropriate, include instructions for a pre-job planning meeting with the participants. This meeting could include coordinating activities at several locations, planned detailed measurements to be taken by several persons, or other aspects of performing a complex procedure.

[3] Provide administrative requirements to ensure the user has the latest revision of the procedure.

[4] Provide action steps to ensure needed information is obtained and recorded. These steps may involve:

[a] Identifying the principal personnel involved by functional responsibility.

[b] Recording the facility condition at the start and end of the procedures and the date and time the procedure is started.

[c] Justifying and identifying portions of the procedure that are used.

[5] Address any special system conditions and hold orders required to perform the work.

3.6.2. Performance Documents

Direct the user to any other documents needed to perform the procedure. These could include drawings, vendor manuals or another procedure referenced in the base procedure. When possible, however, include this material in the base procedure to reduce the number of references the user needs to gather.

3.6.3. Special Tools and Equipment, Parts and Supplies

[1] List special tools, measuring and test equipment, parts and supplies required to perform the procedure. Strict attention to the completeness and correctness of this section is extremely important. For example, failure to specify a necessary item could result in downtime or delays. Using a substitute for a specialized tool could damage equipment. It may be best to include this information in tables. Lists of material may be placed in an appendix instead of this section.

[2] Identify certified or qualified parts and equipment needed for the activities.

[3] Provide guidelines for selecting and assembling special tools, measuring and test equipment, parts and supplies.

[4] Provide separate action steps for the different categories such as parts, supplies or measuring and test equipment.

[5] Specify alternative tools and equipment if applicable.

[6] Identify specific equipment necessary to perform a procedure. Figure 3-11 shows an example of how to include this as an action step.

[3] Obtain the following parts:

Description	Part Number	TIIC No.	Quantity	Class
Gasket	3	XX-XX-XX	1	EQ
Piston	5	YY-YY-YY	1	EQ
Nut	6	ZZ-ZZ-ZZ	2	NA

Figure 3-11. Example parts list. Source: [4].

[7] Avoid using the statement 'or equivalent' when specifying equipment.

[8] Do not specify ordinary craft tools such as standard pliers and wrenches.

[9] If the procedure has a generic application, do not include instrument-specific information such as serial number or calibration date. This information is included in application-specific procedures.

[10] Provide clear specifications for verifying the adequacy of test equipment. Specifications include ranges, accuracies and compliance with calibration standards.

[11] Ensure that range and accuracy of measuring equipment are consistent with the expected values to be measured.

[12] Determine when data concerning test equipment (for example, serial numbers or calibration dates) must be recorded. Provide space in the procedure or in an appendix to record the data before the user encounters action steps which use the test equipment for critical measurements (Figure 3-12).

[13] Specify verification and performance checks or special controls required before the equipment is used. If the performance check is done just before use, include the check in the body of the procedure rather than in the prerequisite actions section.

[3] Obtain two stopwatches (calibrated and approved by Quality Assurance Lab), and complete Table 4-2.

TABLE 4-2

M&TE No.	Expiration Date	Performer Initials
		_____
		_____

Figure 3-12. Identification of measuring and test equipment. Source: [4].

3.6.4. Field Preparations

Provide instructions for preparatory activities that must be completed before continuing with the procedure (Figure 3-13). These activities may include:

- Lock-out/tag out of equipment
- Unlocking valves or rooms
- Recording the as-is condition of the structure, system or component
- Verifying if systems and components are in use before removal from service
- Confirming the correct system or equipment configuration
- Establishing system or equipment alignment and power supply
- Identifying actions to cope with potential hazards such as fire, radioactive spills or exposure to radiation
- Installing portable communications equipment and preparing special test equipment
- Identifying needed support services
- Verifying availability of performance documents before continuing with the procedure
- Providing specifications and tolerances that determine whether the results of the prerequisite action steps are acceptable
- Obtaining required permits such as radiation work, electrical work or confined space work permits. Ensure appropriate signoffs and approvals are obtained.

[4] Verify that the halon fire protection system is in service for each GM Diesel room. ___

[5] Ensure that the following tests have been completed on the GM Diesel to be tested:

A. SP-EG-100 series. ___
B. SP-EG-1. ___

Figure 3-13. Example field preparation actions. Source: [4].

3.6.5. Approvals and Notifications

This section identifies the approvals and notifications required before beginning any of the actions in the procedure. If there are required approvals or notifications that only apply to a certain step, they should be placed adjacent to that step.

[1] Provide instructions to ensure that all necessary approvals are obtained and all required notifications are made before initiating the procedure (Figure 3-14). Individuals involved may include:

- Shift manager
- Control room operator
- System or equipment engineer
- Support, quality control, regulatory or audit personnel

[2] Include any required instructions related to permits required to begin work.

[3] Provide instructions for notifications related to unexpected delays in beginning or completing work.

3.3 Approvals

[1] Consult with, and obtain permission from, your supervisor before beginning performing this procedure

_____
Supervisor Initials

Figure 3-14. Example of approval needed to begin a procedure. Source: [4].

3.6.6. Responsibilities

A separate responsibilities section is rarely required since responsibilities are implicit in the action steps. This section should be a high-level summary and should not repeat procedural requirements. Steps within the procedure that involve personnel in addition to the user must specify the person responsible for its completion.

3.6.7. Pre-job Briefs

The purpose of a pre-job brief is to ensure that the workers and the person in charge understand the scope of work to be performed. The briefing includes a discussion of the tasks involved in the work. The hazards and related safety, security and environmental controls should also be discussed.

This section, if included, should describe what is to be covered in the pre-job briefing and who must be in attendance.

Questions that should be asked during a pre-job briefing include:

[1] Do you, the worker, understand your roles and responsibilities and your work scope?

[2] What are our personal protective equipment requirements, permit limits, bounding conditions, and possible error precursors?

[3] Do you know the critical steps in this activity as they relate to your assignment?

[4] What is the worst thing that can go wrong and how should we respond?

[5] Are you aware of any co-located activities and/or hazards?

[6] What errors/lessons learned have you observed in past, similar tasks?

3.7. Instructions

This section contains the action steps that prescribe the principal tasks and subtasks of the procedure.

[1] Organize activities in the order that they will be performed.

[2] Divide the performance sections into subsections that logically group related activities as established in the procedure basis outline.

[3] Use headings for each subsection that reflect the activity rather than a generic title.

Use: "Removing the Actuator"
Don't use: "Actuator"

[4] Write the specific action steps within the performance sections in accordance with Section 4 of this guide.

3.8. Post-performance Activity

This section contains the actions necessary to close out the activity including testing, restoration and compiling results.

3.8.1. Testing

If operability equipment has been affected while performing a procedure and operability has to be verified before returning the equipment to service, include action steps that specify those tests.

3.8.3. *Restoration*

[1] Provide action steps to specify and record the return of all affected structures, systems or equipment to the desired configuration.

[2] Include instructions for the following:

[a] Required restoration adjustments, storage, or maintenance of laboratory and process equipment.

[b] The return of tools and equipment

[c] The proper disposal or storage of consumables such as test samples or chemicals not used in the process.

[3] Provide space for recording the notification of appropriate personnel that the system has (or has not) been returned to service (Figure 3-15).

[4] Include provisions for close out of any permits (such as confined entry permits) that were required to perform the procedure.

[5] Provide for verification of appropriate restoration action steps.

6.7 **Restoration**

1. **NOTIFY** SM overspeed trip maintenance was performed and trip valve was left tripped.

Maintenance Signature _____ Date _____

2. **SIGN OFF** equipment clearance.

Maintenance Signature _____ Date _____

Figure 3-15. Example of restoration activities. Source: [3].

3.8.4. *Results*

[1] Provide instructions to summarize the results of the procedure including:

[a] Listings of facility conditions

[b] Date and time of test start and test completion

[c] Participants

[d] Reasons for the test

[2] Provide instructions to state whether

[a] Problems or delays were encountered;

[b] Corrective action(s) were performed; and/or

[c] Authorization signatures were obtained.

[3] Provide instructions to state whether acceptance criteria were satisfied, a nonconformance report was initiated and/or a limited condition for operation was exceeded.

[4] Provide an action step to review the entire procedure for completion and to review and approve test results.

3.9. Records

Records generated by a procedure are maintained to document the tasks completed by performing the procedure. Administrative controls establish requirements for, and control of, records. Post-task analyses of the procedure require that the conditions of performance and the personnel involved are clearly recorded so lessons can be learned if adverse consequences occur.

[1] Identify the records generated as a result of performing the procedure in the performance section. These may include:

[a] forms;

[b] data sheets;

[c] checklists; and/or

[d] documentation of as-found conditions.

[2] Classify the records generated as appropriate to facility records control and indicate the appropriate filing or transmittal of the records.

[3] If no records are generated, state this in the procedure.

3.10. Source Requirements

Source requirements are requirements referenced by the procedure. There should be a cross-reference between these requirements and the parts of the procedure which reference them (Figure 3-16). Source requirements are identified in this way to alert users who are making an expedited procedure change.

1.	**ASSEMBLE** rebuild valve disc assembly as follows:		
	a.	**ASSEMBLE** disc and disc arm.	_____
	b.	**INSTALL** washer and disc nut.	_____
	c.	**INSTALL** new locking device. [PER 257317]	_____

Figure 3-16. Example of a reference to a source document at the action step level. Source: [3].

[1] Identify within the procedure the parts of the procedure which reference a source requirement. Use terms such as: refer to, per, see or use.

[2] List the DOE rules and orders, technical safety requirements, safety analysis reports, and other requirements and commitments directly referenced by the procedure (for example, industry codes and standards). Source requirements are identified when the basis for the procedure is established.

[3] Do not include broad, programmatic documents unless there is a specific purpose for the reference.

[4] Identify the specific requirements (and their locations) within the source requirements documents of the requirements that are referenced by the procedure.

[5] Ensure that the authorized versions of the source requirement documents are listed. For example, the codes and standards in effect when the facility was designed, not the most recent versions, normally apply unless a modification, commitment, or technical safety requirement change invokes a more current version.

[6] Do not include documents listed as performance documents.

[7] If there is more than one type of source requirement document, use subheadings to list them. For example,

- **[a]** DOE rules and orders
- **[b]** Technical safety requirements and safety analysis reports
- **[c]** Industry codes and standards.

3.11. Appendices

Provide appendices when the material and function of the procedure require them. Appendices are part of the procedure; number pages to show they are a continuation of the main body of the procedures. In addition, number appendices independently to ensure all pages are available if the appendix is detached from the main body of the procedure.

Examples of items that may be placed in an appendix are forms, tables, figures, graphs, and some checklists that are too large to incorporate in the sequence of action steps.

[1] Reference appendices within the text of the procedure.

[2] Include in appendices information more conveniently located outside the main body of a procedure.

[3] Avoid using vendor information as appendices.

- **[a]** Integrate approved vendor information into procedures, when possible, rather than referencing the information.
- **[b]** Refer to administrative requirements for processing and using vendor information.

4. WRITING ACTION STEPS

The basic element of an action step is an imperative sentence—a command to perform a specific action. An action step answers the question "what is to be done?" Additional elements, such as cautions and condition statements, add precision to instructions.

In the following sections, thirteen different types of action steps are described. A procedure will not necessarily each type of step. Use Table 4-1 to navigate within this section.

Table 4-1. Index of guidance in the Writing Action Steps section

Heading Number	Heading Text	Page Number
4.1	Writing Basic Action Steps	35
4.2	Conditional Action Steps	39
4.4	Nonsequential Action Steps	41
4.6	Equally Acceptable Alternative Action Steps	41
4.7	Time-dependent Action Steps	41
4.8	Concurrent Action Steps	43
4.10	Continuous Action Steps	43
4.11	Repeated Action Steps	43
4.12	Action Steps Containing Verifications, Checks, Notifications and Data Recording	44
4.13	Action Steps with Warnings, Cautions and Notes	46
4.14	Action Steps Directing Users Elsewhere—Branching and Referencing	49
4.15	Action Steps with Acceptance Criteria	50
4.16	Action Steps with Placekeeping or Sign Offs	51

4.1. Writing Basic Action Steps

In its simplest form, an action step contains an action verb and one or more objects of the action verb (Table 4-2). An action step describes what task is to be performed and how it should be performed. The question of who should perform it is usually implied (the user) but can sometimes be specified as someone else.

Table 4-2. Examples of basic action steps.

Action verb	Object of the verb	Supporting information (optional)
Label	the actuator disposal can	with Identification Tag Form 45.
Remove	Identification Tag Form 45	from the actuator disposal can.
Locate	the actuator disposal can.	

[1] Start the basic action step with a singular present tense action verb such as open. **Appendix D** includes a list of suggested action verbs.

[2] Describe the direct object of the verb.

[a] Identify equipment precisely as it is in the facility.

[b] If the equipment is not labeled within the facility, use equipment nomenclature precisely as it appears in the procedure basis documentation.

[c] Avoid using acronyms and abbreviations when writing action steps, particularly for short, simple words and terms. If an acronym or abbreviation is used it must (a) be easily understood by the users and (b) have a standardized and unique meaning for the users.

[3] Complete the basic action step with supporting information about the action verb and the direct object (Table 4-2). Supporting information includes further description of the object and the recipient of the object. Acceptance criteria, referencing and branching are other types of supporting information that are described later in this section.

[4] Identify each action step and action substep with a special identifier as established in 3.1.11, Action Step Numbering to distinguish the action steps from each other and from topical heading sand explanations (Figure 4-1).

[3] Prepare compressed gas cylinders as follows:

[a] Select compressed gas cylinders with current in-service dated gas certification. ____

[b] Verify that each cylinder regulator will maintain 35 psig (30 to 40 psig). ____

Figure 4-1. Example first-level action step with two second-level action steps. Source: [4].

[5] Write action steps using words that are easily understandable by the users. Where a word is used that requires a definition, include the definition as (a) part of that action step or (b) as a note that immediately precedes the action step. In some instances, an illustration may be needed to convey clear meaning to the user.

Use: Torque the bolts to … using a crossing pattern (Figure 2-1).

Don't use: Torque the bolts to … in a diametrically opposing pattern.

[6] Restructure the actions as needed to avoid using action sub-substeps. Break one section into two or more sections to simplify the action step structure if necessary.

[7] Place three or more objects of the verb in a separate table or listing with appropriate checkoff boxes or signoff blanks.

[1] Tighten the following to 40 foot-pounds (acceptable range is 35 to 45 foot-pounds):

V1 _____

V2 _____

V4 _____

V5 _____

[8] Consider combining multiple verbs with the same object in a single action statement.

Example, Sign, date and transmit completed forms to Records Management.

Example, Depress and hold until the valve is fully open.

[9] If someone other than the primary procedure user is responsible for performing an action step, identify the person to perform the task directly above the affected action step (Figure 4-2).

[2] Torque head bolts with torque wrench set at 90 foot-pounds. ____

QA Inspector

[3] Verify that head bolts are torqued to 90-foot pounds. ____

Figure 4-2. Example of identification of performer of action step. Source: [4].

[10] Use emphasis techniques (**bold**, *italics* and underlining) to highlight important information, with the following constraints:

[a] Do not use all capital letters for blocks of text.

[b] Do not capitalize the first letter of any words unless they are formal, proper nouns in accordance with standard American English usage or they are the first word of a sentence.

[c] Avoid the overuse of multiple emphasis techniques. Be consistent throughout the document.

[11] Specify numbers in the procedures at the same precision that can be read from the instruments.

[12] Avoid requiring users to make conversion from one unit of measure to another whenever possible. Provide an aid for the user if conversions are essential. Do not require mental calculations.

[14] Use consistent vocabulary, syntax and punctuation.

[a] Include articles (a, an, the) when referring to a general item; omit the article when referring to specific items.

Example, "Open the door" or "Open door DW-9"

[b] Use punctuation in accordance with standard American English.

[c] Present action steps, including associated action substeps and lists, with a minimum of interruption (for example, page breaks).

[d] Follow standard grammatical principles.

[e] Use words consistently within and among procedures.

[f] Use short, simple words.

[g] Avoid ambiguous or vague adverbs.

[15] Use main action steps to allow users to quickly comprehend the purpose of the action step. Use action substeps to provide specific details for performance (Figure 4-3). Both main action steps and action substeps use the same basic action step form.

[1] Complete Check Sheet/Data Sheet (Appendix A) for each received and unpackaged reservoir in the hood. ☐

[a] Record the serial number of the reservoirs ☐

[b] Record the reservoir type ☐

[c] Verify that reservoir is unloaded and mark verification on check sheet ☐

[d] Verify that reservoirs are acceptable to bury by ensuring that the status is "NRR" or "NWR" in the computer system. ☐

Figure 4-3. Example of how to use action substeps to provide details not included in the main action step. Source: [4].

[16] Avoid formatting an action step so that it continues onto the next page.

[17] Present numerical information in Arabic numbers (as opposed to Roman numerals). Use spelled-out numbers only when one number without a specified unity of measure is followed directly by one with a unit of measure or when a number, typically a single digit number, is emphasized.

Example, Attach one 2-inch piece of conduit to….

4.3. Conditional Action Steps

These action steps are used when a decision is based upon the occurrence of a condition or a combination of conditions. The use of conditional action steps in technical procedures is extremely important as they structure the decisions required by the procedure user. Conditional action steps use the following logic terms:

IF or WHEN to present the condition to the user.
THEN to present the action.
OR or AND to present more complex conditions.
NOT to negate the condition.

Other words (for example, "except", "unless", "but", "only") should NOT be used to present conditional information.

[1] Describe the condition first and then the action to be taken if that condition applies (Figure 4-4).

[2] Emphasize conditional terms in procedures. By convention, conditional terms are usually capitalized and underlined. The emphasis techniques used for conditional terms should be applied uniquely to conditional terms. Additionally, white space can be used to add emphasis in conditional statements, for instance, by starting each new conditional term on a new line. Figure 4-4 and

[3] Figure 4-5 show examples of how this should be formatted.

[6]	IF the plug piece is not clean, THEN wipe the cone base off with an alcohol moistened cotton swab.	☐

Figure 4-4. Example of a conditional action step. Source: [4].

4.	**REMOVE** X Relay Trip Lever Window.	_____
5.	**MEASURE** and **RECORD** as-found thickness of the lower section of X Relay Trip Lever Window.	
	As-found thickness:	_____
6.	**IF** as-found thickness is less than 0.180 inches, **THEN REPLACE** X Relay Lever per 0-MNT-005, Relay Replacement.	_____

Figure 4-5. Example of a combination of basic and conditional action steps. Source: [3].

[4] If two conditions are required and both conditions must be met, then place the conditional term AND between the conditions. Begin a new line when presenting the second condition and begin a new line with THEN and the action.

IF the valve cover (V1) has come loose
AND there is debris present on the threads
THEN remove the cover and use an alcohol wipe to clean the threads.

[5] If two conditions are involved and one or both conditions must be met before the action is taken, place the conditional term OR in underlined capital letters between the conditions. Begin a new line when presenting the second condition and begin a new line with THEN and the action.

[6] If three or more conditions are described, consider using a decision table or a listing format (Figure 4-6).

[7] Avoid using AND and OR in the same conditional statement as the resulting logic can be ambiguous and difficult to understand (Figure 4-7).

[6] IF all of the following conditions exist,

A. Condition 1

B. Condition 2

C. Condition 3

THEN open CWS-HMOV-290, ECW pump discharge valve.

Figure 4-6. Example of the list format for three or more conditions. Source: [4].

Do not use:	[8]	IF condition A OR condition B AND condition C, THEN open valve D.
Use:	[8]	IF condition A OR condition B, AND condition C, THEN open valve D.

Figure 4-7. Examples of what to avoid when using AND and OR in the same conditional statement. Source: [4].

[8] Use only AND and OR to join conditions that include both a subject and a predicate. If two subjects apply to the same predicate (for example, ".") or one subject takes two predicates (for example, "IF level is stable or falling, ...") use the un-emphasized conjunctions "and" or "or" rather than the special emphasized logic terms.

IF temperature and pressure are stable, …	(note that 'and' is not emphasized)
IF level is stable or falling, …	(note that 'or' is not emphasized)

[9] For a negative condition, use the conditional term NOT. Avoid using NOT if a single word can be used and the condition can be stated in a positive manner.

Use "IF the valve is open, ..."

Don't use "IF the valve is NOT closed, ..."

4.5. Nonsequential Action Steps

Procedure users should perform the action steps in the order they are written unless they are specifically directed to perform action steps in another order. When the objectives of the action steps will be met regardless of the sequence they are performed, then:

[1] Sequence the action steps according to usability criteria, such as according to equipment or control board layout, to reduce opportunities for error.

[2] Identify in a consistent fashion that a series of action steps can be performed nonsequentially. Place a note before the sequence of actions steps that can be performed nonsequentially, as shown below.

NOTE The activities in Action Steps [1] through [7] may be performed in any order.

[3] Provide a checkoff box or signoff line for every action in a series of nonsequential action steps to ensure that actions steps are not omitted.

4.6. Equally Acceptable Alternative Action Steps

These steps are used when it is beneficial for users to be provided with more than one option. It is important to ensure that only one alternative is performed.

[1] Format this kind of step as follows (Figure 4-8):

[a] Present alternative actions as items in a list within a single action step.

[b] Use the word one in lower case underlined to introduce the list of alternatives.

[c] Provide a checkoff line for every action as a series of alternative action steps to ensure that action steps are not omitted and that redundant actions are not performed.

[d] Specify that users only check off those action steps performed.

[1] Perform one of the following actions: Check action taken

- Set Switch S-7 to "ON" ____
- Set Switch S-9 to "ON" ____

Figure 4-8. Example of two equally acceptable action steps. Source: [4].

4.7. Time-dependent Action Steps

Some action steps contain actions that impose time requirements on the user by specifying the duration of actions or actions that must be completed within a specific period.

[1] Refer to Figure 4-9 for an example of how to format this kind of step.

[a] Place a note before the action steps to be timed to alert the user.

[b] Begin the action steps with instructions for the user to record critical time information and provide the user with a place to record this information. Typically,

this information will be the time that "starts the clock," and the time by which some action step or action must be completed.

[c] Include guidance to identify the actions to take if the time-dependent action step cannot be performed within the specified time.

[2] A note advising of time-dependent actions and instructions to record the time information are not required when the time requirement is an inherent part of the action step and misunderstanding is unlikely (Figure 4-10).

NOTE *The following action step starts a time-limited sequence. Action steps [2] through [5] are to be performed within 20 minutes.*

[1] Calculate the time by which action step [5] is to be completed by the following steps:

- **[a]** Record the time that action step [2] is to be started. _____
- **[b]** Add 20 minutes. + 20 minutes
- **[c]** Record the time that action step [5] is to be completed. _____ Complete by

[2] Place the Incident Action switch to TEST. ____

[3] Verify the amber *ALARM TEST* light on the AIA graphic panel is LIT. ____ IV

[4] Place the *Incident Action* switch to OFF. ____

[5] Push the *RESET* pushbutton on the AIA logic tester and record the time. _____

[6] IF the time recorded in action step [5] is later the time recorded in action step [1] [c], THEN REPEAT action steps [1] through [5].

Figure 4-9. Time-dependent actions steps. Source: [4].

[1] Push *Generator Start* pushbutton, and verify that the Generator started within 12 seconds.

_____ Time to Start _____ Initial ____ IV

Figure 4-10. Time-dependent action step that doesn't require a note. Source: [4].

4.9. Concurrent Action Steps

These action steps contain actions that must be accomplished at the same time. Two performers in different locations may need to execute actions simultaneously or a user may need to monitor parameters while performing another action.

[1] If the steps are to be performed by one person, place them in one action step that precisely describes the relationship between the action steps.

[2] If concurrent action steps are to be performed by more than one person, place a note before the first action step, as appropriate, identifying

[a] Concurrent action steps

[b] Personnel needed to perform each concurrent action step

[c] Locations where the action steps are performed

[d] Means of communication between locations.

4.10. Continuous Action Steps

These are conditional action steps where the conditions they describe must be monitored throughout a procedure or a portion of a procedure. For example, a user may need to monitor a gauge and take specific action if the gauge, at any point during the procedure, indicates a reading above or below a specific level.

[1] Place continuous action steps in the procedure at the point at which they first apply. Repeat the action steps periodically, as appropriate.

[2] Format continuous action steps as conditional action steps and state the portion of the procedure during which they are applicable (Figure 4-11).

[3] Notify the user when continuous action steps are to be discontinued.

[7] IF at any time while performing Action steps [9] through [17] condition X exists, THEN take action Y.

Figure 4-11. Example of a continuous action step. Source: [4].

4.11. Repeated Action Steps

These are simple action steps that must be performed more than once during the execution of a procedure.

[1] If an action step must be repeated an indefinite number of times to achieve an objective, specify that the action step is to be repeated until the expected results are achieved. Only a single signoff line is provided for this action step regardless of the number of times the action step is performed (Figure 4-12).

[8] Vary input signal until switch SW-1-7 trips. ___

Figure 4-12. Example of a repeated action step. Source: [4].

[2] If it is important to know the number of times the sequence is repeated, provide for placekeeping (see 4.16.1, Placekeeping).

[3] If an action must be performed repeatedly at timed intervals, place instructions in the procedure and provide suitable space to record the times that the action step is performed.

[4] If an action step is to be performed periodically throughout a procedure or a portion of a procedure (but not at specific timed intervals), place reminders as action steps in the body of the procedure.

[5] If a large group of repetitive actions is required and becomes cumbersome, address the actions in action steps that reference a table, a list, or an appendix (an example of a large group of repetitive actions is a series of valve alignments).

[6] Notify the performer when repeated action steps are to be discontinued.

4.12. Action Steps Containing Verifications, Checks, Notifications and Data Recording

Verification action steps assure that a specific activity has occurred or that a stated condition exists. Manipulation by the user may be required. *Check action steps* call for a comparison with stated requirements; and no manipulation by the user occurs. *Notification action steps* require reporting when given criteria are met. *Data recording action steps* assure that desired data are recorded.

[1] Provide appropriate space or tables for entering data either in the procedure or in data sheets (Figure 4-13).

[2] If the condition to be verified or checked is not found, provide the appropriate actions to take.

[3] Include labeled lines in action steps as necessary for users to record required information (Figure 4-14 and Figure 4-15).

4. **ADJUST** input to AEFT0510 as listed below and **RECORD** AEFT0510 output (as read on DMM) in the As Found column.

Input (psig)	Required (VDC)	As Found (VDC)	As Left (VDC)
0.0	0.980 to 1.020		
14.62	1.980 to 2.020		
29.24	2.990 to 3.010		
43.85	3.990 to 4.010		
58.47	4.980 to 5.020		
43.58	3.990 to 4.010		
29.24	2.990 to 3.010		
14.62	1.980 to 2.020		
0.0	0.980 to 1.020		

Figure 4-13. Example data collection table. Source: [3].

[10]	Record cooling water flow to Cylinder 12 Cooling Jacket.		
	_____ Required GPM	_____ Actual GPM	_____ Initials and date

Figure 4-14. Format for data recording of individual action step showing sign off by initials. Source: [4].

		1	2	3
1.	**APPLY** input equal to minimum element range.	____	____	____
2.	**POSITION** pointer for minimum reading using zero adjustment.	____	____	____
3.	**APPLY** input equal to maximum element range.	____	____	____
4.	**IF** pointer does not read correctly, **THEN ADJUST** span adjustment to reposition pointer about halfway toward correct reading.	____	____	____
5.	**REPEAT** steps 6.4.1 through 6.4.4 until zero and span readings are correct OR three iterations have been completed.	____	____	____

Figure 4-15. Format for data recording for repeated action steps. Source: [3].

[4] Specify required independent verification and inspection action steps (the number of independent verification and inspection action steps increase as the consequences of performance error increase).

[5] Include directions for notifying other personnel as discrete action steps. Actions requiring notifications of others often include:

[a] System alignments to be performed.

[b] Systems to be removed from or returned to service.

[c] Alarms and alarm setpoints that may annunciate as a result of performing the procedure.

[d] Equipment actuations that are expected to occur during performance of the procedure.

[e] Actions with electrical or mechanical interlocks involved (e.g. interlocks to be honored or overridden).

[f] The effects of precautions and limitations on the operating conditions, noting which equipment will be inoperative and which lights, alarms, or annunciators will react.

[g] Changes or special conditions established by the procedure that could affect or appear to affect other equipment or systems. For example, performing the procedure could involve mechanical or electrical bypass (lifted leads, inhibits, jumpers, and fuse removals) or other functional restrictions.

[h] Methods and instructions for communication among multiple persons required to perform an action.

[i] Inspection for degradation of qualified equipment (for example, environmentally qualified or seismically qualified equipment).

[6] Identify parameters and acceptable ranges needed to perform the procedure.

[a] Use the same units of measure in the procedure that users will read from the instrumentation they will be using.

[b] If there is an acceptable range for a parameter, include the acceptable range rather than a point value.

4.13. Action Steps with Warnings, Cautions and Notes

Warnings alert users to potential hazards to personnel. *Cautions* alert users to potential hazards to products or equipment. *Notes* call attention to important supplemental information.

4.13.1. Warnings and Cautions

Warnings and cautions attract attention to information that is essential to safe performance; they usually consist of the conditions, design limitations, practices, and procedures to be complied with to avoid loss of life, personal injury, health hazards, or damage to equipment. An industry study of significant events attributed one-fourth of all human performance events to a failure to provide proper warnings and cautions.

[1] Avoid overusing warnings and cautions.

[2] Review potential hazards with facility technical specialists to determine warnings or cautions that need to be included.

[3] Determine those parts of the procedure where the addition of information is necessary.

[4] Review each action step and list the potential hazards in warning or caution format.

[5] Position warnings and cautions so they are complete on one page and appear immediately before and on the same page as the action step(s) to which they apply.

[6] Place warnings ahead of cautions whenever more than one type is used at the same point in a procedure (Figure 4-16).

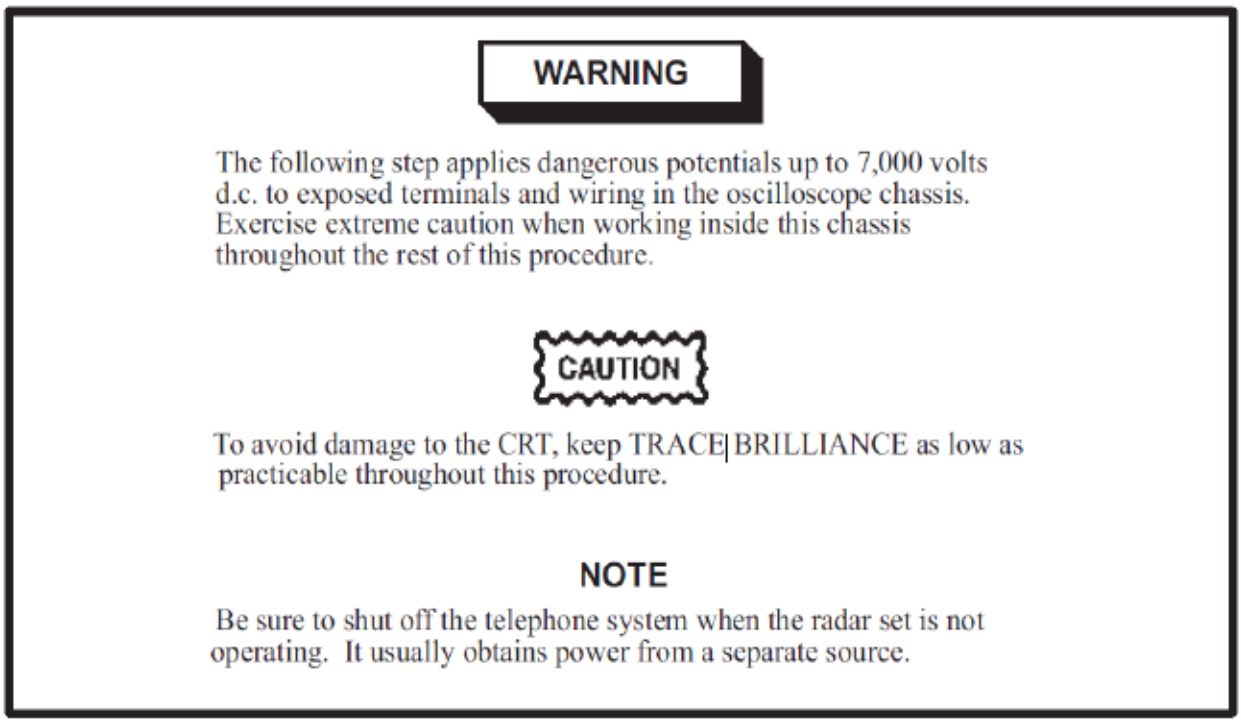

Figure 4-16. An example of a warning, caution and note placed sequentially. Source: [5].

[7] Do not include action steps in warnings and cautions.

[8] Write warnings and cautions as short, concise statements. Write warnings and cautions as statements rather than as commands to distinguish them from action steps.

Use, "Touching this wire will electrocute you!"

[9] Do not embed an action step in a warning format

Do not rewrite the *action step* "Shut the valve" into the *warning* "The valve should be shut."

[10] Ensure that cautions and warnings provide:

[a] a description of the hazardous condition,

[b] the consequences of failing to heed the warning or caution, and

[c] critical time considerations.

[11] Present the text of warnings and cautions using appropriate techniques to ensure visual identification, such as borders around the text and titles in all capital letters. Do not use all capital letters in the text, however, because they are hard for users to read.

[12] Include only one topic in each warning or caution.

[13] Number each warning or caution when more than one exists (Figure 4-17).

CAUTION 1

Operating the generator system at speeds less than 700 rpm for longer than 10 minutes with the exciter regulator in operation may cause damage to the exciter regulator field.

CAUTION 2

In the event of a power failure, emergency equipment will start and overload the diesel if the diesel is isolated on the emergency bus during testing.

Figure 4-17. Numbered Caution statements. Source: [4].

[14] If the danger is present during the entire procedure, place the warning or caution in the precautions and limitations section.

[15] Repeat the information in precautions as separate cautions or warnings within the body of the procedure as it applies to individual action steps.

4.13.2. Notes

Notes call attention to important supplemental information. The information can be a reminder of preparatory information needed to perform the activities of a procedure or action step.

[1] Avoid overusing notes.

[2] Use notes to present information that assists the user in making decisions or improving task performance.

[3] Position notes so they are complete on one page and appear immediately before and on the same page as the action step(s) to which they apply.

[4] Place warnings and cautions ahead of notes whenever more than one type is used at the same point in a procedure.

[5] Do not include action steps in notes. Embedded actions should be removed from the note and written as action steps (Figure 4-18).

[6] Number the notes if more than one note is entered at the same location in a section or subsection (Figure 4-19).

- Wrong form: contains a hidden command

  NOTE *A timed duration starts when fluid collection begins. Time is measured and fluid is collected from the end of the test hose (at the floor drain) into a graduated cylinder.*

- Correct form: rewritten to remove embedded action step

  NOTE *A timed duration starts when fluid collection begins in Action step [12] below.*

[12] Collect fluid from the end of the test hose (at the floor drain) into a graduated cylinder.

Figure 4-18. Note presentation. Source: [4].

NOTE 1 *The following action step closes generator breaker G-1 and starts diesel DL-I.*

NOTE 2 *The following action step requires a time measurement starting at the initiation signal.*

Figure 4-19. Numbered Notes. Source: [4].

[7] Write notes as short, concise statements. Write notes as statements rather than as commands to distinguish them from action steps.

Example, "The following action step starts a timed duration."

[8] Use appropriate emphasis techniques (for example, italics) to distinguish notes from cautions or warnings.

[9] Include only one topic in each note.

4.14. Action Steps Directing Users Elsewhere—Branching and Referencing

To perform a task, sometimes users must branch or reference another procedure, section, or appendix. Branching routes the procedure user to other action steps or sections within the procedure or to other procedures, and the user does not return to the original position. Referencing routes the procedure user to other action steps or sections within the procedure or to other procedures and then back to the original position in the base procedure.

Referencing and branching increase the potential for error with attendant safety and administrative consequences. Therefore, branching and referencing are highly discouraged. Use referencing and branching only when it is necessary to direct the user to information that is vital to the performance of the activity and it is not appropriate to incorporate that information into the base procedure.

[1] Evaluate the following criteria to determine if referencing or branching is appropriate. If the answer to all of the following questions is "No," then referencing or branching may be appropriate.

- **[a]** Can action steps be readily incorporated rather than referenced?
- **[b]** Will branching and referencing decrease user comprehension and ease of use?
- **[c]** Will users be directed to small, isolated sections, rather than whole procedures or appendices?
- **[d]** Will branching and referencing cause users to bypass prerequisites that affect the section to which they are being directed?
- **[e]** Will branching and referencing cause users to bypass precautions and limitations that affect the section to which they are being directed?

[2] If referencing or branching is appropriate, then use the following methods for referencing and branching:

- **[a]** Make it clear to the users that they are being directed to other material. Do not expect them to know implicitly that other material is being referenced.
- **[b]** Fully specify the location the user is to go when cross-referencing. If the user is being sent to another procedure, identify the procedure number, title, and section of

the procedure. If the user is being sent to another location in the base procedure, identify the specific location in the procedure.

[c] Use a consistent format for presenting cross-references. Emphasize key words consistently so that users can identify a cross-referenced action step. Use a term such as GO TO presented in all capital letters to indicate departure from the base procedure (Figure 4-20).

[d] If referencing, use the term RETURN TO in all capital letters to indicate the reentry point into the base procedure.

[e] If referencing, use the terms GO TO and RETURN TO in the same action step.

[f] Ensure that a reference or branch directs the user to all material needed as a prerequisite to the identified material. For example, ensure that in executing a reference or branch, the user does not bypass an applicable caution or prerequisite action step.

3.	**GO TO** OP 2305, Filling Safety Injection Accumulators, to fill 1A Safety Injection Accumulator.	_____

Figure 4-20. Example of branching terminology. Source: [3].

Data sheets are used exclusively for recording information, not prescribing how action steps are to be completed. Therefore, the referencing and branching techniques of this section are *not applicable* to data sheets.

4.15. Action Steps with Acceptance Criteria

Acceptance criteria provide a basis for determining the success or failure of an activity. Acceptance criteria may be qualitative (specify a given event that does or does not occur) or quantitative (specify a value or value range).

[1] Determine where specific acceptance criteria are to be presented in the procedure. Either or both of the following methods can be used.

[a] State the location of acceptance criteria, whether located at individual action steps (used when criteria are satisfied at the time of performance) or located in data sheets or other procedures (Figure 4-21). When acceptance criteria are located in other procedures, link procedures using referencing techniques if the information cannot be included in the procedure.

[b] Provide a summary of the acceptance criteria in a table or a list as an appendix.

[2] Include instructions for notifications to be made or actions to be taken immediately by the user, in the event that specified acceptance criteria are not met (Figure 4-22).

[a] Place these instructions or actions in the body of the procedure.

[b] Ensure that these actions are consistent with administrative instructions.

Summary of Acceptance Criteria
Specific quantitative or qualitative requirements that are intended to be verified by this procedure are noted in the action step(s) where the verifying action is performed and recorded.

Figure 4-21. Statement regarding the location of acceptance criteria. Source: [4].

[14]	IF specific acceptance criteria stated in action steps [15] through [19] are not met, THEN notify the shift manager as soon as practical after observing the nonconformance.

Figure 4-22. Notification of failure to meet acceptance criteria. Source: [4].

[3] Include subsequent notifications and actions, such as those to be taken by reviewers, with the acceptance criteria.

[4] Use acceptance criteria that consist of nominal values and, if available from the procedure basis, allowable ranges.

4.16. Action Steps with Placekeeping or Sign Offs

4.16.1. Placekeeping

Placekeeping helps procedure users keep track of their progress in a procedure and reduces the probability of omitting or duplicating action steps. The placekeeping mechanism typically consists of checkoff boxes.

[1] If initials or signatures are not required, provide a placekeeping checkoff box near the right margin of the page or the right side of a table (Figure 4-23).

[8]	Turn the transformer test switch to the TEST position.	☑

Figure 4-23. Checkoff box for placekeeping at the action step. Source: [4].

[2] If placekeeping must be performed on a separate checklist, arrange the placekeeping items in the order the actions are to be performed and reference the associated action steps in the procedure on the checklist.

4.16.2. Sign Offs

Written responses for action steps that require independent verification, inspection, data recording, or documentation of completion can also be placekeeping devices. The use of signatures, initials, check marks, and "N/A" should be defined in site-specific administrative procedures. A sign off action step includes one or more of the following elements:

- A blank line for verification, notification, or inspection signatures or initials
- A blank line for sign off by a person other than the user
- Blanks for recording data and the initials or signatures of persons recording the data.

[1] If procedures require that action steps be signed off, provide space for the sign off of the action step (Figure 4-24).

[14] Verify ISV Pump A discharge valve (ISV-A-D2) CLOSED. ____

Figure 4-24. Verification by the user showing sign off by initials. Source: [4].

[2] Provide a space for the date and/or time of a sign off where such information is determined to be useful.

[3] Position a blank signature or initial line (for entering initials that identify the persons signing off the action step) immediately following the affected action step, or on a separate data sheet or checklist, if necessary.

[4] If the sign off is located in one procedure and the action to be signed off is located in a referenced procedure, indicate in the base procedure action step that documentation occurs in the referenced procedure sign off space.

[5] Use the following methods to differentiate between sign offs required of the user and those required of other personnel.

[a] If the action step is to be signed off by someone other than the principal user, place the title or function of the responsible person under the blank line.

[b] If the action step is to be signed off by the user, place no identifying title or function under the blank line.

[6] Do not combine two closely related actions each requiring a sign off into a single action step. Make two separate action steps with individual sign offs.

[7] If an independent witness or other second sign off is needed, provide an additional space for initials and identify that an IV (independent verification) sign off or other specified signature is required (Figure 4-25).

[8] Identify action steps requiring a hold point (action steps that require inspection of the actions performed). Inspections of the results of an action step before initiating successive action steps are normally designated as hold points. Hold points may involve quality assurance, health physics, engineering, or other inspectors (Figure 4-26).

[9] Include places for entering initials or signatures to identify persons recording data when presenting action steps in tables (Figure 4-27).

[13] Verify safety system pneumatic valve (ISV-P-2) CLOSED. ____ ____ IV

Figure 4-25. Independent verification or second sign off of same action step showing sign off by initials. Source: [4].

Hold Point:
[3] Torque head bolts with torque wrench set at 90 foot-pounds.

_____
QA Inspector

Figure 4-26. Action and hold point verification sign off in the same action step. Source: [4]

Parameter	Tolerance	As Found	As Left	Initials
Pressure	290 psig (285 to 295)			___ ___ IV
Temperature	350•F (345 to 355)			___ ___ IV
Level	20 ft (19.5 to 20.5)			___ ___ IV

Figure 4-27. Sign off of a series of data points. Source: [4].

4.16.3. Sign Off or Check Off of Conditional Action Steps

In some instances, performing an action depends on a condition or combination of conditions. Conditional action steps are introduced by the words IF or WHEN and are followed by an action.

[1] Provide a space for the user to mark conditional action steps where a sign off or check off is desired (Figure 4-28). Typical entries indicating the appropriate action was taken are "N/A" if the condition does not occur or a check mark or initial if the condition does occur. Direct the user what to place in the space.

[4] IF outside temperature is less than or equal to 39•F
AND heated air is required,
THEN place coils in service.
____
Enter N/A or Initials

Figure 4-28. Conditional action step with a sign off. Source: [4].

5. FINALIZING PROCEDURES

An important final step of the procedure development process is to finalize a procedure. Previous work from Sandia has shown that one source of error was the difference between how writers and their intended audience interpreted the same set of instructions [6]. To mitigate this source of error, written procedures should be reviewed by at least one person other than the writer; ideally, this reviewer should be from the procedure's intended audience [7].

[1] This review should focus on finding any areas of the procedure that could be interpreted in more than one way.

[2] The reviewer should write down his/her interpretation of the procedure steps, so that the procedure writer can ensure that they match the intent of the instructions.

6. REFERENCES

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APPENDIX A. GLOSSARY

The definitions of key terms associated with technical procedures are provided in the table below. They were mainly sourced from "PPA AP-907-001 Rev 2, Procedure Process Description," "DOE-HDBK-1028-2009, Human Performance Improvement Handbook, Vol. 1" and "DOE-STD-1029-92 Change Notice 1, Writer's Guide for Technical Procedures."

Term	Definition
Acceptance criteria	Quantitative or qualitative criteria against which the success or failure of an activity will be judged.
Action step	A procedure element that provides instruction for performing a specific action or task.
Action substep	Detailed actions that follow upper-level action steps. Performing all action substeps of an action step results in the action step being performed.
Activities	Groups of related tasks performed to accomplish a goal.
Appendix	Supplementary material at the end of a procedure. Appendices include information more conveniently located after the main body of a procedure including forms, tables, figures and graphs.
Base procedure	The original procedure from which a user may be branched or referenced.
Caution	Cautions alert users to conditions, practices, or procedures that must be observed to avoid potential hazards involving products, equipment, and conditions adversely affecting site operations.
Check	An action step that directs operators to see if a parameter has assumed a specified value or to see if a specific action has been carried out, and, if it has not, to take the next action specified (for example, notify supervisor).
Check off	To check mark a box or line to indicate that the action step has been successfully accomplished.
Concurrent action steps	Two or more action steps that are performed at the same time.
Conditional action steps	An action step based on a condition or combination of conditions to be satisfied prior to the performance of an action.
Conditions of performance	The actual conditions under which the procedural performance activities are performed, including actual equipment location, lighting, ventilation, protective gear required, and temperature.
Content	Subjects, topics, and technical information in a procedure.
Continuous action steps	Steps continuously performed during a specific task or time period. The performer continues with the procedure while these steps are being performed. Typically, continuous action steps begin with the words 'WHILE' or 'IF AT ANY TIME'.
Data recording	Writing down data points to obtain a written record of conditions at a given time. Data may be recorded for QA purposes or for use in further calculations or verifications.
Decision tables	A format for presenting algorithms in tables.
Equally acceptable action steps	Action steps that specify a number of equally acceptable alternative actions.

Term	Definition
Facing page	Either side of a two-page spread of a procedure.
Headings	Words or short phrases that introduce a section. Not to be confused with a page header.
Hold point	A pre-selected step in a procedure that identifies a point beyond which work may not proceed until the required action is performed.
Independent verification	A series of actions by two individuals working independently to confirm the condition of a component after the original act that placed it in that condition.
Level of detail	The technical detail necessary within a procedure step to successfully interface the individual user's knowledge to the technology being used or task being performed.
Logic term	One of the six words used in conditional action steps to structure the condition and relate it to the action: IF, WHEN, THEN, AND, OR, and NOT.
Note	Statements that provide explanatory information to support a procedure step or series of steps.
Placekeeping	The process used to help users track performance of steps within a procedure by physically marking steps in a procedure that have been completed or are not applicable.
Procedure	A procedure prescribes a process (a sequence of actions) to be performed to achieve a defined outcome.
Process	A series of actions organized to produce a product or service; tangible structures established to direct the behavior of individuals in a predictable, repeatable fashion as they perform various tasks.
Process map	A representation of the workflow of a process or several parallel processes, generated to illustrate a process; a process map can improve effectiveness by helping to identify improvement opportunities.
Referencing/references	A step that directs the user to other steps, sections, supplemental information within the same procedure or to another document and the user returns to the original step.
Repeated action steps	Action steps that are performed repeatedly at various times.
Rigor	Completeness and accuracy in a behavior or process; cautiously accurate, meticulous, exhibiting strict precision during the performance of an action.
Sign off	A sign off is a set of initials or a signature that indicates that the responsible person has successfully accomplished the action step. Sign offs may also be required of inspectors or other independent verification.
Skill of the Craft	The knowledge, skills, and abilities possessed by individuals as a result of training or experience. Activities related to certain aspects of a task or job that an individual knows without needing written instructions.
Source requirements	A uniquely identified requirement that ensures future alterations do not inadvertently remove the requirement.
Task	A well-defined unit of work having an identifiable beginning and end which is a measurable component of the duties and responsibilities of a specific job.

Term	Definition
Task analysis	A family of analytical techniques that detail how a task is accomplished. A task analysis may include both the manual and mental activities, task and element durations, task frequency, task allocation, task complexity, environmental conditions, necessary clothing and equipment, and any other unique factors involved in or required for one or more people to perform a given task.
Technical basis	The technical background and information, and the documentation of the background and information, needed as a basis for all technical content of a procedure.
User	The person(s) performing the procedure.
Verification	Verification involves action steps that direct users to see if a parameter has assumed a specified value or to see if a specific action has been carried out, and, if it has not, to take actions to make it so.
Warning	A statement placed immediately before applicable steps to warn users of potential for personnel injury, loss of life, or health hazards.

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APPENDIX B. PROCEDURE TEMPLATE

If you would like a copy of this template in an editable form, including the unique styles described here in yellow, please contact the HF Department and they will provide you with the .docx file.

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ENGINEER (PA) ORG. #
ENGINEER (DA) ORG. #
TECH WRITER ORG. #

(U) TECHNICAL PROCEDURE TEMPLATE

CHANGE HISTORY

CONTROL NUMBER	ISSUE	RELEASE/CHANGE NO.	DATE
XXXXXX-	A	N/A REV 0	3/24/2020

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To update these tables, select all the text in the document (Ctl + A), then press F9. Choose update entire table and click Ok (this may happen several times).

1. SCOPE

Provide a description of the activities that this WI applies to.

2. WORK PLANNING

Prior to beginning any work, complete the following activities:

1. **Safety** – ensure a Safety Package in the Electronic Work Package Agreement System (EWP) has been completed and approved. Conduct all work activities in accordance with the EWP and any additional Work Planning and Control (WP&C) documents.
2. **Training** – All MOWs (Members of the Workforce) performing activity level work (ALW) shall have completed all required training.
3. **Read** this entire work instruction before starting any work.
4. **Documentation** – ensure documents listed in Table 1 are available and that work is completed per the latest revisions and any ACOs or transmittals in effect.
5. **Hardware** – check inventory to ensure that all hardware needed are on hand.
6. **Equipment** – check that all required tools, test equipment, and calibrated equipment is on hand and calibrations are current.

NOTE: If you have any questions or concerns, consult engineering before conducting any work.

3. INSPECTIONS AND SIGN-OFFS

These may not be necessary for all procedures, but they should be considered.

All processes require self-inspection by the assembly technician to verify that hardware was assembled and installed per the work instruction and applicable documents. Assembly steps that require inspections by additional personal include a sign-off box. Sign-off boxes are to be marked as follows:

1. **Technician Sign-Off** – When sign-off by a technician is required, the technician who completed the assembly step should mark their initials and date in the provided box.
2. **Engineering Sign-Off** – When sign-off by Engineering is required, an authorized engineer should mark their initials and date in the provided box after the assembly step is completed correctly.
3. **Quality Sign-Off** – When sign-off by Quality is required, an authorized quality representative should their initials and date in the provided box after the assembly step is completed correctly.

4. REFERENCE DOCUMENTS

Table 1. Reference Documents

Document ID	Document Title

5. REQUIRED PARTS, MATERIALS, AND TOOLS

This table could also be split into individual tables at the beginning of each section.

Table 2. Required Parts, Materials, and Tools

Identification	Description	BOM #

6. PREREQUISITE ACTIONS

What work needs to be done before beginning this procedure?

7. PROCEDURE (HEADING 1)

Include some information here if some of these steps can be done out of the order they're written. Give a brief description of the process that is covered below.

7.1. First heading (Heading 2)

1. First action step.
2. Action step with placekeeping box to check off. ☐

To add a checkbox, finish writing your action step then press tab once. The cursor should move to nearly the right margin. Then go to Insert -> QuickParts and choose Checkbox.

7.1.1. Sub-heading (Heading 3)

1. Action step with signoff line. _____

To add a Signoff line, finish writing your action step then press tab once. The cursor should move to nearly the right margin. Then go to Insert -> QuickParts and choose Sign-off line.

The style for the figure is 'Figure placement.' After inserting the image, press enter and then insert the caption. The style for the caption is 'FIGURE CAPTION.'

Figure 1. Figure caption

The style for the whole note is 'NOTE.' Use bold and all caps for the title, then press tab once and start writing the body of the note.
The style for the heading is 'WARNING.' Then press enter and change the style to WARNING TEXT. The borders are added automatically.
The style for the heading is 'CAUTION.' Then press enter and change the style to CAUTION TEXT. The borders are added automatically.

NOTE: Notes call attention to important supplemental information. See the writer's guide for more information about how to write these statements.

WARNING

Warnings alert users to potential hazards to personnel. See ___ of the writer's guide for more information about how to write these statements.

CAUTION

Cautions alert users to potential hazards to products or equipment. See ___ of the writer's guide for more information about how to write these statements.

Table 3. Torque specifications.

Item	Torque specification

Information like torque specifications may be best organized in tables or lists.

8. TESTING

9. QUALITY ASSURANCE

10. AS-BUILT RECORD

11. REWORK

These additional sections may not be necessary for all technical procedures. There may be other sections that are necessary, depending on the nature of the process. The Human Factors Department is available to help you generate technical procedures that minimize operator confusion and help reduce the likelihood of human error.

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APPENDIX C. ERROR TRAPS

The table below contains the most common error inducers related to technical procedures. These are reproduced from "PPA AP-907-005 Rev 2, Procedure Writer's Manual."

Error Trap	Description
In-field decisions without clear guidance	Terms such as if necessary and if applicable shift the worker to the knowledge-based performance mode and a higher error rate. Instead, provide sufficient detail to support consistently good decisions.
Excessive in-field decisions	Too many well-written decisions can fatigue and confuse the worker, resulting in error. This is usually the result of too much job scope or poor document design.
Decisions without conditional step structure	Atypical or inconsistently written conditional steps can inhibit proper decision making. Always use a conditional structure (e.g., **IF**…**THEN**, **WHEN**…**THEN**) when making a decision.
Vague steps or steps missing critical detail	Vague steps or inadequate detail can put the worker in knowledge-based performance mode with its corresponding high error rate. Overall, the level of detail should be suitable for an inexperienced, qualified user with no direct supervision. This includes the necessary detail to successfully implement steps that are contrary to normal convention (e.g., left-handed threads).
Multiple actions in the same step	Including more than one action in the same step increases the probability that the worker will miss the additional action(s). Steps with one action verb and two objects affecting configuration are also an error trap. However, two actions in one step are acceptable if they are functionally related and **HAVE TO** be performed simultaneously to obtain a single result. Unrelated actions are never acceptable.
Atypical action steps	Action steps not written as short active voice imperative sentences can be difficult to understand and consistently implement. The use of passive voice is especially problematic.
Negative statements	Negative statements in action steps and conditional logic can be difficult to understand and implement. Double negatives are especially problematic. Also, they can result in knowledge-based errors when a worker attempts to determine the possible positive responses. Whenever possible, use positive statements.
Inadequate defense-in-depth, termination criteria not specified	Ensure risk is understood and appropriate defenses are established. Plan for both success and possible failure – what if the desired results are not obtained?
Actions or acceptance criteria in Precautions, Limitations, notes, cautions, and warnings	Embedding actions or acceptance criteria in content not normally having this information increases the probability of actions being missed. Precautions, Limitations, notes, cautions, and warnings **NEVER** have actions, explicit or implicit.
Excessive branching and referencing	Branching and referencing is an administrative burden for the worker that might lead to error if used excessively.
Inappropriate use of verifications	Low value verifications can dilute the meaning and importance of the more important ones. There should be a regulatory, risk, or performance-based reason for every verification.

Error Trap	Description
Complex calculations without verification	Experience has shown that complex calculations should be separately verified by a second person so that any errors are caught before they affect the asset.
Excessive physical challenges	The selected components or sequence of steps may not be the most convenient or practical for the worker. What looks good on a diagram or at a desk may not look so appealing at the job site. Use validation to flesh out any issues.
Inconsistent placekeeping methods	A consistently applied placekeeping standard should be used for both Continuous Use and Reference Use documents. In turn, design each document to support this standard, including the choice to use initial blanks or checkboxes.
Time constraints	Avoid any words that could unnecessarily cause perceived time pressure. If time is of the essence (e.g., regulatory limit, time critical operator action), clearly communicate both the reason for the time constraint and the method for meeting it. Use validation to ensure that the time limit can easily be met.
Atypical terms	Using slang, uncommon words, or two different words to mean the same thing can make the document harder to understand, which can lead to error. Consistency in writing and terminology is key to success.
Inconsistent format, layout, and writing style	Inconsistent format, layout, or writing style is a user and writer burden and a precursor for error. In particular, a proper and consistent use of attributes such as fonts, emphasis, step numbering, association, abbreviations, acronyms, numbers, and action verbs have been proven to reduce error.
Non-value added information in Precautions, Prerequisites, notes, cautions, warnings, and steps	The cumulative effect of including boiler plate and redundant technical and administrative information in a document results in what is called bloat. Workers tend to just skim this information and can miss important task-specific details. A better, more sustainable solution is to use worker pre-job checklists.

APPENDIX D. ACTION VERBS

The table below contains an extensive list of action verbs and their definitions. Technical procedures should use a consistent set of carefully selected action verbs. These are reproduced from "DOE-STD-1029-92 Change Notice 1, Writer's Guide for Technical Procedures."

Verb	Definition
Actuate	Place into a specific state of functional performance.
Add	Increase the size or quantity.
Adjust	Make an incremental change or series of changes to arrive at a desired condition.
Align	Arrange equipment into a specific configuration to permit a specific operation.
Allow	Permit the completion of a specific action.
Announce	To make known publicly.
Assemble	Put together what is required to provide an operational or functional capability.
Attach	To fasten one thing to another.
Balance	Adjust several parameters at the same time at certain points in a system to specified values.
Barricade	To shut in or keep out with an obstruction.
Begin	Start an action or activity.
Bleed	Remove fluid from a piece of equipment at a restricted flow rate.
Block	Inhibit a capability of a specific system or piece of equipment.
Bolt	To attach or fasten with bolts.
Bypass	To circumvent a safety circuit (unless a single device provides for bypassing, such as a bypass switch, identify specific actions to bypass).
Calculate	To determine by computation (computation method should also be identified).
Change	To make different in some particular.
Charge	To load or fill (specific actions to charge should be included).
Check	Perform a comparison with stated requirements. No manipulation of equipment by the checker is involved.
Circle	To draw a circle around.
Clean	To rid of dirt, impurities, or extraneous matter.
Clear	To move people and/or objects away from.
Close	Manipulate a device to allow the flow of electricity or to prevent the flow of fluids, other materials, or light.
Collect	Cause the assembly of something in a fixed location or container.

Verb	Definition
Compare	Determine the relationship of the characteristics or values of different items, parameters, or conditions.
Complete	Fulfill or accomplish an instruction totally.
Consult	To ask for advice, to take counsel; to refer to.
Connect	Join, fasten, or fit to permit a desired capability.
Continue	Maintain or resume the performance of an activity or condition.
Cool	Lower the temperature of equipment or an environment.
Coordinate	Arrange for activity involving other personnel.
Correct	Alter to reestablish a desired activity or condition.
Count	To add together.
Cover	Protect or shelter equipment.
Cycle	Cause repetition of an action or activity.
Declare	To make known formally.
Decrease	Produce a smaller value.
Deenergize	Remove the supply of electrical power to equipment.
Depress	Manipulate to affect a specific position of a device.
Depressurize	To release gas or fluid pressure from.
Determine	To find out; to ascertain.
Discharge	To give outlet or vent to a fluid or other contents.
Disconnect	Separate or detach.
Discontinue	To cease to operate, administer, use, produce, or take.
Dispose	Remove from a specific location.
Don	To put on an article of wear.
Drain	Remove liquid from an enclosure or part of an enclosure, usually to empty.
Draw	To bring, take or pull out, as from a receptacle.
Energize	Provide equipment with electrical power.
Ensure	Confirm that an activity or condition has occurred in conformance with specified requirements (by action if necessary).
Enter	To make report of, set foot in.
Equalize	To make equal or uniform.

Verb	Definition
Establish	Bring about. Take necessary actions to cause a specified set of conditions to exist.
Estimate	Approximate the size, extent, or nature of a variable.
Evacuate	Vacate.
Evaluate	To assess; to determine the importance, size, or nature of; to appraise; to give a value to based on collected data.
Exit	To leave or withdraw.
Expedite	To accelerate the process or progress of.
Fill	Add fluid to a system or equipment to a prescribed point.
Filter	Pass fluid through a sized medium to stop the passage of unwanted material in the effluent.
Flush	Remove or clean with a washing action of a liquid.
Follow	Comply with an instruction.
Go to	Depart from a position in a procedure and resume at a different location in the procedure or in a different procedure.
Jumper	To make a connection between two circuit points not normally connected.
Label	To mark or identify.
Latch	To close or fasten.
Lift	Elevate to a higher level or remove, as in removing electrical leads or restrictions.
Limit	Restrict or impose bounds.
Locate	Determine or establish place or position.
Lock	Securely fasten, to prevent capability to function.
Log	To enter into a record of operations or progress.
Lower	Cause to move down or decrease position or value.
Lubricate	To apply a lubricant to.
Maintain	To hold or keep in any particular state or condition, especially in a state of efficiency or validity.
Minimize	To reduce to the smallest amount or degree.
Mix	Intermingle ingredients uniformly.
Monitor	Observe an activity, parameter value, or condition (usually on a continuous basis) to meet an instruction requirement.
Notify	Contact, advise, or communicate to make someone aware of an impending or completed activity, parameter value, or condition.
Observe	To watch carefully.

Verb	Definition
Obtain	To get or attain.
Open	Manipulate a device to prevent the flow of electricity or to allow the flow of fluids, other materials, or light.
Operate	Cause equipment or system to perform designed functions.
Pass	To go by; move by.
Perform	Carry out specified actions or action steps.
Place	To put or set in a desired location or position.
Plot	To represent graphically.
Plug	To connect or become connected, as in electrical plug; to stop or insert something.
Press	To act upon through thrusting force exerted in contact; to push.
Pressurize	To apply pressure within by filling with gas or liquid.
Prevent	To keep from happening.
Proceed	To go on in an orderly, regulated way.
Pull	To exert force upon so as to cause or tend to cause motion toward the force.
Purge	To make free of unwanted substance such as an impurity or foreign material.
Push	To press against.
Pump	Move a fluid in a piping system by the use of suction, pressure, or both.
Rack in	Insert a circuit breaker into its operating position.
Rack out	Withdraw a circuit breaker into its nonoperating position.
Raise	Cause to move up or increase position or value.
Read	Obtain information visually.
Recirculate	Cause repetitive motion of a fluid in a system.
Reduce	Decrease a variable to meet a procedure requirement.
Refer to	Use specified information that is in another location or procedure.
Release	To set free from restraint or confinement.
Remove	To take off, move away, or eliminate.
Repair	To restore to a sound state.
Repeat	Do again.
Replace	Install an equivalent part or component.
Request	Ask.

Verb	Definition
Reset	Reestablish a piece of equipment, part, or component to a previous condition, parameter value, instrument set point, or mechanical position.
Resume	To begin again after cessation or interruption.
Return to	To go back to a previous action step in the procedure in effect.
Review	Examine with deliberation for confirmation or compliance to an instruction.
Rotate	Cause to turn on an axis.
Sample	Take a representative portion for the purpose of examination.
Secure	Fasten or make safe.
Select	To take by preference of fitness from a number or group; to pick out; to choose.
Send	Dispatch.
Separate	Move apart or detach.
Set	Adjust equipment to a specified value
Shake	To agitate.
Shut down	Remove from operational status.
Silence	To stop from making noise.
Sound	To order, signal, or indicate by a sound.
Stabilize	To become stable, firm, steady.
Start	Originate the motion or function of an electrical or mechanical device.
Station	To assign a person to stand and remain at a certain place.
Stop	To halt movement or progress; to hold back; to halt.
Store	To place in reserve, to hold for later use.
Stroke	Operate a valve over its full travel. The travel time may be measured.
Subtract	To perform a subtraction.
Tag	Identify with a prescribed label.
Throttle	Adjust a valve to an intermediate position to obtain a desired parameter value.
Torque	To cause to twist or turn, as about an axis.
Transfer	To cause to pass from one to another.
Transport	To transfer or convey from one place to another.
Trip	To manually activate a semiautomatic feature; to cause to fail or stop.
Turn	Adjust with a force on an actuator that positions form a circular movement.

Verb	Definition
Unlock	To unfasten the lock of.
Unplug	To remove from a socket or receptacle.
Update	To revise to include latest information or data.
Use	To avail oneself of; to employ; to utilize.
Vent	Release a gas or liquid confined under pressure.
Verify	Confirm, substantiate, and assure that a specific activity has occurred or that a stated condition exists.
Walk	To move along on foot.
Weigh	To measure the heaviness of as by a scale.
Withdraw	To remove.
Work	To perform a task.

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