LPR 7320.1
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Expiration Date: February 2, 2015

Langley Research Center

Engineering Drawing System

National Aeronautics and Space Administration

Responsible Office: Engineering Directorate

PREFACE

P.1 PURPOSE

a. The engineering drawing practices and procedures set forth in this directive are based on established Government-industry standards, supplemented where necessary by a minimum of requirements peculiar to the NASA Langley Research Center.

b. The purpose of this directive is to provide a uniform but flexible system of drawing preparation, use, and interpretation. A standard drawing numbering system, Engineering Drawing Files (EDF), and drawing and documentation control system are included. This directive will be maintained by the Engineering Drawing System Committee with representatives from selected organizations.

c. Unless otherwise noted herein, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

P.2 APPLICABILITY

This directive is applicable to all engineering drawings generated by LaRC personnel and their supporting service contractors.

P.3 AUTHORITY

ASME-Y14.100, “Engineering Drawings Practices”

P.4 APPLICABLE DOCUMENTS AND FORMS

a. The standards listed below, in addition to those listed in ASME-Y14.100, are requirements for generating engineering drawings:

b. MIL-STD-403, “Preparation for and Installation of Rivets and Screws, Rockets, and Missile Structures”

c. USAS B4.1-1967, “Preferred Limits and Fits for Cylindrical Parts”

d. NAS 523, “Fastener Code”

e. AWS A1.1-2001, “Metric Practice Guide for the Welding Industry”

f. AWS A2.4-1998, “Symbols for Welding and Non-Destructive Testing”

g. Unless identified by date, the edition including addenda and code cases in effect at the start of the design, shall apply.

h. DoD 5220.22M, “National Industrial Security Program Operating Manual”

i. NPR 1600.1, “NASA Security Program Procedural Requirements”

j. LAPD 1150.2, “Councils, Boards, Panels, Committees, Teams, and Groups”

k. LPR 1740.4, “Facility System Safety Analysis and Configuration Management”

l. LPR 5300.1, “Product Assurance Plan"

m. LF 33, “Drawing Record Card”

P.5 MEASUREMENT/VERIFICATION

None

P.6 CANCELLATION

This LPR cancels LPR 7320.1 dated July 18, 2004.

Original signed on file, February 2, 2010

Cynthia C. Lee
Associate Director

Distribution:
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TABLE OF CONTENTS

1 ADMINISTRATIVE PROCEDURES

1.1 Scope

a. The Engineering Drawing System Procedural Requirement establishes the procedural requirements and practices to be followed in the preparation, maintenance, control, and utilization of engineering drawings. It applies to all engineering drawings generated by Langley Research Center (LaRC) personnel and their supporting services contractors. An engineering drawing is defined as a document, which discloses by means of pictorial and/or textual presentations, the form and function of an item, is assigned a LaRC drawing number, and contains proper approvals. This procedural requirement is not applicable to any sketches, diagrams, informal schematics, or other instructions.

b. This procedural requirement is authorized for use in establishing engineering drawing format and procedures for all research, design, development, fabrication, and installation activities.

1.2 Maintenance of Engineering Drawing Directive

a. The Director of the Engineering Directorate has the functional responsibility for this procedural requirement and its approval, application, and implementation. The Engineering Drawing System Committee (EDSC) will have the responsibility for making revisions or adding supplements to this procedural requirement.

b. The EDSC will consist of the following:

Discipline Area	Number of Representatives
Flight Design Engineer	4
Facility Design Engineer,	2
Model Design Engineer	1
Engineering Drawing Files	1

c. The Director of the Engineering Directorate appoints the Chairperson. (See LAPD 1150.2, “Councils, Boards, Panels, Committees, Teams, and Groups.)

d. Requests for revisions or supplements to the procedural requirement shall be addressed to the committee chairperson. Supplements and revisions will be posted on the NASA Langley Management System Web site.

1.3 Engineering Drawing Files

The Engineering Drawing Files (EDF) office is responsible for assigning drawing numbers, publishing an index, and filing drawings, aperture cards, and X-rays.

1.3.1 Drawing Numbering System

A using organization may request initial assignment of drawing numbers by telephone or letter to EDF. The EDF clerk shall enter all available information on the log including the type of drawing, revision letter, title, size, organization code, name of requester, date assigned, and notify the requester of the assigned drawing number(s). A block of numbers may be issued to organizations as required.

1.3.2 Preparation of Drawing Record Card, LF 33

Upon completion of the new or revised drawing, the originator shall prepare LF 33, “Drawing Record Card” (Electronic form obtained from Informed Filler), by entering data listed in the LF 33 instructions.

1. Size	2. Drawing No.	3. No. of Sheets	4. Rev. Let. | Doc. Chg. No.	5a. Project Title
6. EDF Roll ID	7. Organization *(Competency/Office, Branch, Section)*			5b. Drawing Title
8. Access Control ☐ CCD ☐ Proprietary ☐ Limited ☐ Other	9. Security Classification N - Unclassified C - Confidential O - Other:			
10. Draftsman (Gov. Draftsman or Contractor Name)				11. Original or Rev. Drawing Date / 12. Cognizant Project Engineer
13. Contractor Drawing No. | Sheet Number | Rev. Letter				14. Bldg. No. / 15. Facility Name
16. Should drawing be retained? ☐ Yes If no, complete Item 17 or 18. ☐ No	Control Activity			19. Remarks
17. Destroy drawing after Year	18. Review Date Year	Frame No.		

NASA Langley Form 33 (Rev. Apr. 2002) Previous editions are usable. Prescribing Document LAPG 7320.1

Drawing Record Card ► TO BE SUBMITTED TO THE ENGINEERING DRAWING FILES (EDF) AT MS 203 WITH EACH DRAWING

E-mail complete record card(s) to c.r.herbert@larc.nasa.gov.
Forward printed copy with Drawing to MS 203/EDF.

INSTRUCTIONS

1. Size - Designated size of drawing (i.e., A, B, C, etc.). If multiple size sheets, record largest size and both in the remarks section.
2. Drawing Number - LaRC number as issued by EDF, or Engineering Sections with a block of numbers assigned
3. Number of Sheets - Number of last sheet in LaRC drawing number
4. Revision Letter - Indicate letter or if unrevised, use dash. Indicate document change notice number, if applicable.

5a. Title - Complete as written in title block. Use uniform description for entire project.
5b. Drawing TItle:" Enter Drawing Title. Limit abbreviations to those specified in MIL-STD-100.

6. EDF Roll ID - TO BE COMPLETED BY EDF ONLY.
7. Organization - Competency/Office, Branch, Section - Abbreviation may be used.
8. Access Control - Check appropriate block. Explain other.
9. Security Classification - Indicate appropriate classification. Explain other.
10. Draftsman - **Gov. Drawing** - Insert initial and last name of NASA draftsman; Drafting Service Contractors are carried as government drawings but the company name is input in this area. **Contractor Drawing** - Company name will be used. **Redrawn Drawing** - Maintain same information as shown on original Langley Form 33, "Drawing Record Card."
11. Date - Date drawn or date of latest revision; Use original drawing date or original revision date in this field.
12. Cognizant Project Engineer - List name and initial of person responsible for
13. Contractor Drawing Number/Sheet Number/Revision Letter - Complete if available.
14. Building Number - Fill in this area only if drawing applies to a facility. (The building number should appear in title block.)
15. Facility Name - If drawing refers to specific lab or facility name. This is not the location of draftsman or engineer.
16. Should Drawing be retained? - "Yes" indicates permanent retention. "No" indicates drawing may be destroyed by date
17. Destroy Drawing After - Indicate year. indicated in Item 17.
18. Review Date - Use this block if retention is uncertain at time of input.
19. Remarks - Any additional information such as project number, contract number, or code identification number. Effort code (EC) number for configuration control drawings (CCD's) should be identified in this area. Identify revision sheets of multiple sheet drawings.

1.3.3 Submittal of Drawings to EDF

After the initial release of prints by the originating organization's approving official, the originator shall remove the Section copy (1) of LF 33, attach the EDF copy (2) to the drawing, and forward drawing and LF 33 to EDF. If using the electronic version of the LF 33, the originator shall print a copy of the LF 33 to attach to the drawing to be filed, and the originator shall e-mail a copy to EDF as per the instructions on the electronic form.

1.3.4 Verification of Drawings

1.3.4.1 The EDF clerk shall check the drawing for the following:

a. Drawing submittal – All incoming drawings shall be routed through the EDF receiving area for processing. The clerk shall determine if the drawings are being submitted for the first time or if they are previously filed drawings being returned to EDF. New and revised drawings are to be processed and made ready for electronic storage. For drawings, which have not been revised, the clerk shall log in the date returned on the LF 33, and return the drawing to the files.

b. Valid drawing number – The drawing number shall be checked for duplication. EDF shall notify and return the drawing to the originating organization if required.

c. LaRC administrative standards – Drawings must meet LaRC requirements, with the correctly assigned drawing numbers, properly assigned revision letter, and properly identified configurations (see ASME-Y14.100). The drawing shall be returned to originator if incorrect. When the drawing is verified, the EDF clerk shall stamp "FILE" on the drawing and process for electronic storage.

1.3.5 Distribution of Aperture Cards

1.3.5.1 Three silver halide original aperture cards are produced and distributed as follows:

a. Security File - This file has a copy of all revisions submitted to EDF.

b. EDF Working File - Latest revision of drawing is maintained in EDF.

c. Engineering Copy - Organization identified on LF 33 shall receive aperture card if requested. If mail stop changes, please notify EDF.

1.3.6 Filing of Drawings and Drawing Record Card

a. The drawings shall be indexed by size and drawing number and placed in files.

b. Information obtained on LF 33 shall be indexed into the computer.

c. EDF copy (2) or the electronic printed copy shall be filed in a card file in drawing number sequence.

1.3.7 Retrieval and Return of Previously Filed Drawings

a. The EDF clerk will sign and date EDF copy (2) of LF 33 or the electronic printed copy with name and organization of the individual obtaining the original drawing.

b. The card will be filed in drawing number sequence until the drawing is returned. If the original drawing is under configuration control, it cannot be removed from EDF without proper authority.

c. When the revised drawing is returned to EDF, the EDF clerk takes the same actions as for the original drawing as stated in paragraph 1.3.4. On multisheet drawings, revisions must be indicated on the first sheet and each affected sheet of the drawing or the entire drawing will be rejected by EDF.

1.4 Drawing Changes

1.4.1 Changes to the engineering drawings must be made by one of three methods:

a. Drawing revision

b. Document Change Notice (DCN) (LaRC Form 178) – Excluding facility drawings. All changes made after formal release of drawings must be authorized in the same manner and processed through EDF for recording and electronic storage.

c. Redline Changes

1.4.2 It is the responsibility of the design activity to assure that changes and revisions to engineering drawings do not violate configuration control documents (CCD's).

1.4.3 Drawing Revisions

The procedures described in ASME-Y14.100 apply to LaRC generated drawings. Original drawings or other reproducibles may be withdrawn from EDF for revision and are to be returned to EDF. Revision blocks will be filled out as illustrated in Figure 1. The zone column is optional but helpful in locating the change.

ZONE	LTR	DESCRIPTION	DATE	APPROVAL
E9	A	MATERIAL WAS QQ-S-633 FOR.-001 PART INCORPORATES DCN NO. 123456	Jan. 5 1965	John Doe
E9 B3	B	(1) WAS 1.12, (2) ADDED 1.85,(3) ADDED TERMINAL TO PT. 9, (4) DELETED C2, (5) RELOCATED POSTS AND TAPPED HOLES DELINEATION, (6) DELETED NOTE: "TEST IN ACCORDANCE WITH A7812622	Feb. 3 1966	John Doe

Figure 1. Sample Revision Block

1.4.4 Document Change Notice (DCN)

A DCN is an interim method of changing the information contained on an engineering drawing or associated document. Such changes are to be incorporated into the drawing by formal revision unless otherwise specified on the DCN. DCN's will remain active until incorporated by revision and so noted in the revision block. The incorporated DCN shall then be retired to the historical files. Not more than three DCN's may be outstanding against any one drawing at any one time.

1.4.5 Drawing Redline Changes for Hardware Fabricated in LaRC Facilities

1.4.5.1 Only under critical schedule conditions where the delivery milestone will be missed, the design activity may temporarily modify drawings in the fabrication process, using redlines to reflect changes that must be enacted immediately. Redline changes are not required to be immediately submitted for review and approval of the drawing approvers. Therefore, the personnel implementing the redline changes must be aware that the changes may be disapproved, resulting in scrap or rework and ultimately cost and/or schedule impact.

1.4.5.2 The redline requestor shall inform the original drawing approvers and Project Manager after initiation of the redline change. To implement redline changes for hardware built in LaRC facilities, the design engineer or a Project approved designee shall do the following:

a. Redline the production control copy of the affected drawing that shall be the stand-alone master copy of the change until a DCN is submitted or the drawing is revised.

b. Identify each set of redlines with a circled sequential number, starting with number one. A set of redlines is defined as all redline changes made at a single point in time.

c. Place the circled numbers near each redline in the set.

d. Place the circled number at the bottom of the drawing, just to the left of the title block along with the design engineer or a Project approved designee's LaRC Badge number, signature, and the date and time of the change.

e. Make a copy of the redlined drawing for the redline requestor to take back to engineering personnel for incorporation into a revised drawing per paragraph 1.4.3 or a DCN per paragraph 1.4.4.

f. Notify by email, all project personnel who approved the original drawing and the Project Manager within 1 hour of the redline change.

g. The fabrication organization is responsible for reproducing the master redline copy for fabrication uses.

h. Incorporate the redline changes into an approved revised drawing per paragraph 1.4.3 or a DCN per paragraph 1.4.4 prior to the hardware's quality assurance inspection and release from fabrication using the approved drawing prior to redline changes and the approved DCN, or the revised approved drawing. The quality inspection shall be executed using the "as-built and approved" drawings per paragraphs 1.4.3 or 1.4.4.

NOTE: The project has the responsibility to maintain configuration control of all hardware affected by the redline process.

1.5 Drawing Cancellation Procedure

Drawing cancellation will be done in accordance with ASME-Y14.100.

1.6 Security Classification

a. DD Form 254, "DOD Contract Security Classification Specification," prepared in accordance with DOD 5220.22M, "Industrial Security Manual for Safeguarding Classified Information," shall be used by LaRC to provide specific security classification guidance to contractors who originate drawings.

b. Specific classification and marking guidance shall be provided by the LaRC Security Classification Officer for drawings originated by NASA, LaRC. The classification of the drawings shall be determined by an appropriate security classification guide or other source document and marked in accordance with NPR 1600.1, "NASA Security Program Procedural Requirements."

2 ENGINEERING DRAWING REQUIREMENTS

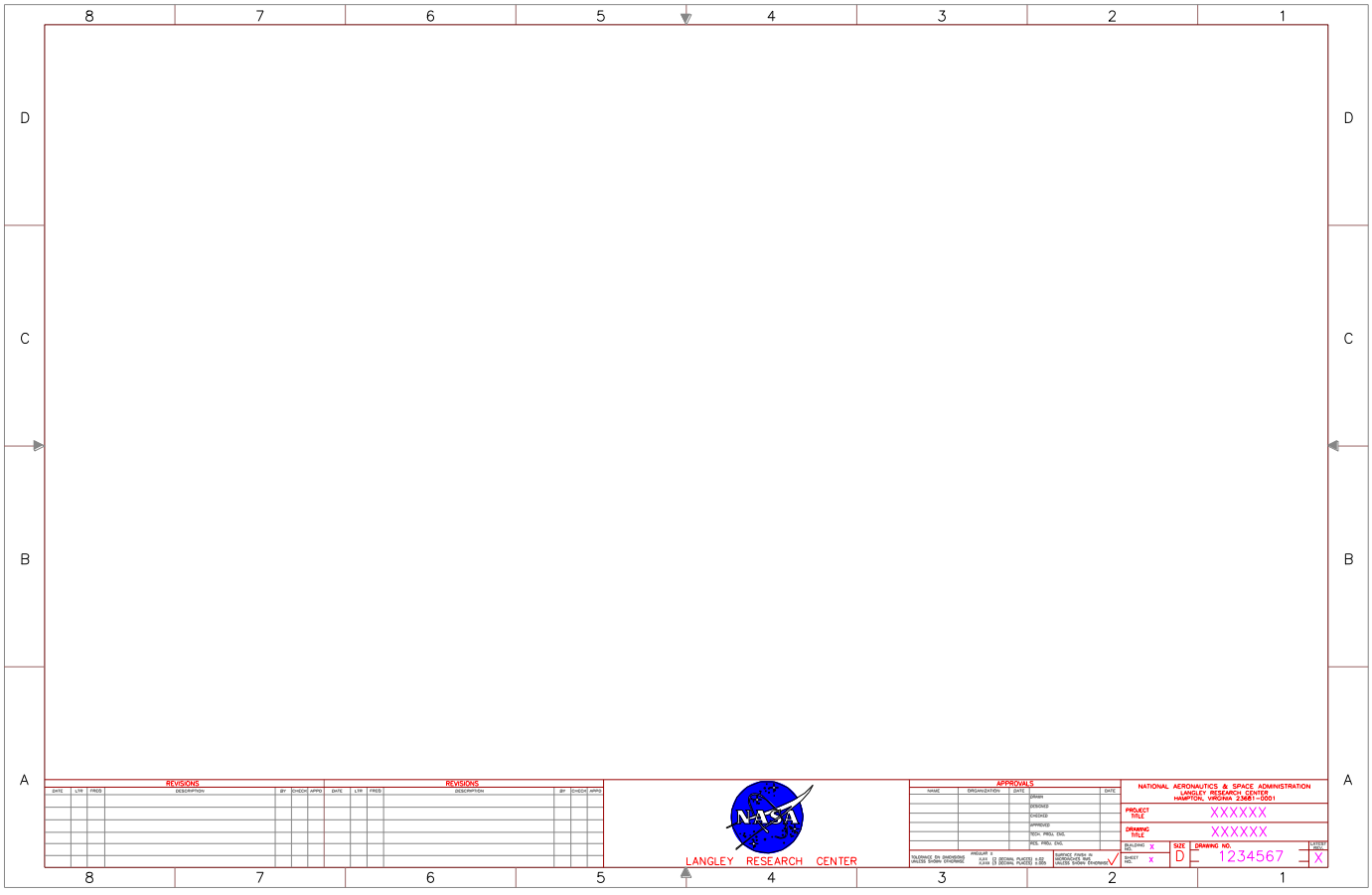
2.1 Size and Format

2.1.1 Drawing Sizes

Finished sheet format sizes and the size-designated letter are those listed in ASME-Y14.100 (ASME Y14.1). Multiple sheet drawings are permissible.

2.1.2 Basic Sheet Format

The general format and arrangement of data on drawings shall be in accordance with ASME-Y14.100 (ASME Y14.1). An alternate basic sheet is authorized for facility drawings of D size only and is shown below.



2.1.3 Title Block

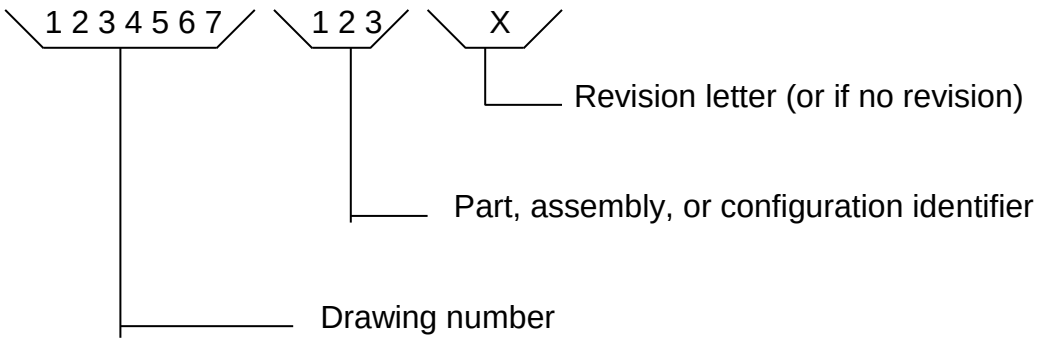
The basic drawing title block in the lower right-hand corner of each drawing shall be in accordance with ASME-Y14.100 (ASME Y14.1). An alternate title block is authorized for use with facility drawings of D size only.

2.1.4 Drawing Titles

Drawing titles shall conform to the procedures for creating title block nomenclature entries for drawings and for parts detailed thereon as specified in ASME-Y14.100 (ASME Y14.1).

2.1.5 Numbering of Drawings and Parts

The LaRC standard numbering system provides for a seven-digit (maximum) drawing number, centrally controlled and issued by the Engineering Drawing Files, a three-digit (maximum) dash number identifier for parts, subassemblies, assemblies, or configurations of assemblies as determined by the design activity, and a revision letter. The desired method of marking and identification of parts must be specified on the drawing and shall conform to LPR 5300.1, " Product Assurance Plan."



2.1.6 Auxiliary Blocks

Auxiliary blocks are authorized as set forth in ASME-Y14.100.

2.1.7 Drawing Notes

Drawing notes shall be in accordance with ASME-Y14.100.

2.1.8 CAGE CODE

The official CAGE CODE Number for NASA LaRC is 25305. This number shall be reflected in the Drawing Title Block under the CAGE CODE entry block.

2.2 Basic Requirements

2.2.1 Purpose of Drawings

The purpose of drawings is to convey sufficient engineering requirements, characteristics, and information to manufacture or procure an item or to procure materials or services. Drawings shall be complete for the purpose intended. Good drafting technique is essential; however, drawings have no artistic value and drafting technique is not an end in itself. A good drawing is one, which can be easily and completely understood by craftsmen, production planners, buyers, and others who must use the drawing.

2.2.2 Legibility

a. All line-work shall be sharply defined and of uniform density.

b. Lettering shall be clear and adequately spaced.

c. All line-work and lettering shall be sufficiently opaque to be legible in full size copies prepared by any generally accepted method of reproduction.

2.2.3 Mechanical and Photographic Processes

a. Mechanical and photographic processes may be used to reduce preparation time.

b. Printed material shall be typewritten in lieu of hand lettering, whenever possible.

c. When making new drawings, which are similar to existing drawings, use photographic or other reproduction techniques to obtain a permanent, reproducible copy of the existing drawings and then revise to produce the new drawings, which shall be renumbered and released as a new drawing.

d. When a number of drawings or sheets of a drawing are required, which are similar in most respects, draw one sheet containing all common data, print permanent reproducibles, then add the remaining data to each.

2.2.4 General Drawing Practice

General drawing practice shall be in accordance with ASME-Y14.100.

2.2.5 Dimensions and Tolerances

ASME-Y14.100 (ASME Y14.5M) shall be used to establish uniform practices for stating and interpreting requirements shown on drawings.

3 DRAWING AND DOCUMENTATION CONTROL

3.1 Definition

Drawing and documentation control as used herein as provides assurance that all released drawings reflect the current design status or after fabrication, the as-built status of all hardware.

3.2 Applicability

The procedures outlined in this section shall be applied to all drawings and/or electronic files produced at LaRC for the fabrication, construction, and maintenance of component hardware and facilities, except that the existing LaRC Research Facilities Configuration Management Program as defined by LPR 1740.4, “Facility System Safety Analysis and Configuration Management,” and the existing subsurface utility drawings program will remain unchanged.

3.3 Drawing Media Types

3.3.1 Three types of drawings are recognized as being produced at LaRC and affected by this procedural requirement:

a. Type 1 is the hand drawn print where only the original exists and all changes are made to that original.

b. Type 2 is an electronically generated original drawing, where changes are made in the data file and a new original is generated.

c. Type 3 is a totally electronic drawing where a paper original does not exist.

3.4 Release Approval

a. Only the Organizational Head or designee(s) of each organizational unit responsible for the generation of drawings, either in-house or on contract, is authorized to approve drawings for release. It is the responsibility of these individuals to assure conformance with the provisions contained within this procedural requirement. The “release approval” of drawings in no way relieves the individual engineer, designer, draftsman, Contracting Officer’s Technical Representative (COTR), and others who generated the design from the responsibility of assuring the structural integrity and/or mission suitability.

b. A project office has authority to designate the set of required signatures based solely on their specific requirements. This set of signatures can be designated by the project office as required for the release of all project drawings, whether flight or non-flight.

3.5 Approval Process

It is the responsibility of the LaRC cognizant engineer, designer, draftsman, COTR, and others to assure that no drawings are released without proper approvals.

3.5.1 Type 1 Drawings

a. Upon completion of any drawing, the Organizational Head or designee(s) within the cognizant organization shall review and sign the original, listing name and date. No construction or fabrication activity shall be performed from any engineering drawing not containing proper approval.

b. Upon revision to an original drawing, the Organizational Head or designee shall sign or initial in the approval space of the revision block. If a DCN is used to make a change, the responsible person shall sign in the appropriate approval block and the original approval signatures shall be typed in the appropriate spaces. It is the responsibility of the Organizational Head or designee(s) to assure that the drawing is properly marked with a revision notice, and that an updated drawing record card is provided to EDF at the time of approval.

c. At any time that revisions are extensive enough to require redrawing of an existing part, the original drawing shall be marked as being obsolete, superseded by a new drawing. The new drawing shall indicate which drawing it supersedes. It is the responsibility of the Organizational Head or designee(s) to assure that both drawings are properly marked before signing the new drawing.

d. It is the responsibility of the cognizant engineer, designer, draftsman, or COTR, to ensure that all recipient organizations of the original drawings also receive copies of the revision.

e. As a part of the project records, a log of all drawings and their recipient organization shall be maintained. It is the responsibility of the cognizant engineer, designer, draftsman, or COTR, to ensure that this record is up to date and available for notifying organization of revisions to drawings.

3.5.2 Type 2 Drawings

a. The permanent storage medium for this type of drawing shall be the electronically generated and plotted paper original drawing.

b. Upon completion of any drawing the Organizational Head or designee(s) shall review and sign the original, listing name and date. No construction or fabrication activity will be performed from any engineering drawing not containing proper approval.

c. Upon revision to a drawing, the responsible person shall sign or initial in the approval space of the revision block on the newly revised original, and the original approval signatures shall be typed in the appropriate spaces. The Organizational Head or designee(s) shall mark and initial the previous edition of the drawing as obsolete prior to approving the newly revised original. It is the responsibility of the Organizational Head or designee(s) to assure that the drawing is properly marked with a revision notice, and that an updated drawing record card is provided to EDF.

    1. Example: [For drawings that necessitate revision before the original is filed in EDF] Drawing Number 768B needs to be changed. The cognizant engineer stamps 768B as obsolete and the Organizational Head or designee initials the drawing. The Organizational Head or designee then reviews and approves 768C. The cognizant engineer completes a new drawing card for 768C, and delivers 768B and 768C along with 768C's drawing card to EDF for filing.

    2. Example: [For Configuration Controlled Drawings (CCD) drawings and drawings previously filed in EDF] Drawing Number 768B needs to be changed. The cognizant engineer retrieves the drawing from EDF by signing and dating the back of the filed EDF drawing card. The cognizant engineer stamps 768B as obsolete and the Organizational Head or designee initials the drawing. NOTE: The 768B must be returned to EDF in the same state as it left EDF. A working copy of 768B can be reproduced to generate red-lines if necessary. The Organizational Head then reviews and approves 768C. The cognizant engineer completes a new drawing card for 768C, and delivers 768B and 768C along with 768C's drawing card to EDF for filing.

d. If a DCN is used to make a change, the original approval signatures shall be typed in the appropriate spaces and the responsible person shall sign in the appropriate approval block.

e. It is the responsibility of the cognizant engineer, designer, draftsman, COTR, and so forth to assure that all recipient organizations of the original drawings also receive copies of the revision.

3.5.3 Type 3 Drawings

The permanent storage medium for this type of drawing shall be an electronic storage file. If a paper or Mylar original exists, then it shall be treated as a Type 2.

NOTE: THIS SECTION WILL BE COMPLETED AT SUCH TIME THAT APPROPRIATE SOFTWARE AND STORAGE MEDIUM BECOME AVAILABLE AT LARC TO FILE SIGNED COPIES WHICH CAN BE CONTROLLED BY EDF FOR FURTHER USE IN COMPUTER AIDED DESIGN SOFTWARE PROGRAMS.