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| <b>NCSX</b>   |  | <b><u>NATIONAL COMPACT STELLARATOR EXPERIMENT</u></b>            |                     |
|   |  | <b>PROCEDURE: NCSX-PROC-007 Revision 3</b>                       | <b>Page 1 of 16</b> |
| <b>Title</b><br>NCSX Electronic Model and Drawing/INTRALINK Processes           | <b>Initiated by:</b><br><br>NCSX Systems Engineering Support Manager | <b>Effective Date:</b><br><br>11/15/2006                         |                     |
| <b>Concurrence by:</b><br><br>NCSX Quality Assurance Manager                    | <b>Concurrence by:</b><br><br>NCSX Design Integration Manager        | <b>Concurrence by:</b><br><br>PPPL Mechanical Design Branch Head |                     |
| <b>Concurrence by:</b><br><br>PPPL Head, Engineering & Technical Infrastructure | <b>Approved by:</b><br><br>NCSX Engineering Manager                  | <b>Supersedes:</b><br><br>Revision 2<br>May 5, 2006              |                     |

**Record of Revisions**

| <b>Revision</b> | <b>Date</b>       | <b>Description of Changes</b>  |
|-----------------|-------------------|--|
| <b>0</b>        | <b>5/4/2005</b>   | <b>Initial Issue</b>   |
| <b>1</b>        | <b>6/12/2005</b>  | <b>Clarified Fabrication Designation for Pro/E and Non-Pro/E Files.</b>  |
| <b>2</b>        | <b>5/5/2006</b>   | <b>Modified Section D (Annotation of Drawings with RFD or NCR Identification) to reflect new “stamp” process which permits modifying pdf drawing to post a “stamp” identifying the change approved by RFD or NCR).</b>   |
| <b>3</b>        | <b>11/15/2006</b> | <b>General re-write of this procedure to</b> <ul style="list-style-type: none"> <li><b>• Clarify that only the Systems Engineering Support Engineer (or his designee) can request an ECN Number for NCSX drawings to ensure that the proper reviews are provided.</b></li> <li><b>• Clarify the review and approval processes for all electronic drawing files.</b></li> <li><b>• Distinguish when a RFD stamp process will require an update to a drawing.</b></li> </ul> |

**Applicability**

This procedure is applicable to the entire NCSX Project and only addresses electronic files and drawings. Hard copy legacy drawings are not addressed.

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## Introduction

The NCSX Pro/E/INTRALINK Users Guide provides the processes by which an electronic 3D Computer Aided Design and Drafting (CADD) model, assembly, part, or drawing is promoted from a “conceptual design” status through a “release for fabrication” status. Once a drawing is “released for fabrication”, it is placed under configuration control and revisions are controlled by ECPs per NCSX-PROC-002. INTRALINK provides both a storage capability that is utilized for both Pro/Engineer (Pro/E) models and drawings (mechanical) and non-Pro/E files and drawings (e.g., AUTOCAD electrical drawings, files utilized for numerical control (NC) fabrication (e.g., .dxf, IGES and .STEP files), and other non-Pro/E files such as adobe acrobat format (.pdf) and text (.txt) files .

Electronic models are the basic building block of the Pro/E CAD system. From these 3D mechanical models all the associated parts and assemblies with the exception of standard or “library” parts such as fasteners, washers, etc and 2D mechanical drawings are derived. Pro/E 3D models and 2D drawings are reviewed and approved within INTRALINK and a pdf representation contains a final electronic signature. The Pro/E/INTRALINK database also provides configuration control processes for mechanical 3D models, parts, assemblies, and 2D drawings. This will also include data curves if they are needed or skeleton parts (used for making port cuts). In AUTOCAD 2D electrical drawings, the INTRALINK review and approval process is not utilized so electronic signatures of reviewers and approvers is done on the pdf representation. NCSX Electronic Signature Procedure, PROC-005, describes the electronic signature process.

For suppliers not having Pro/E as their CADD system and utilizing numerical control fabrication techniques, the NCSX Project converts the approved Pro/E models and Pro/E or AUTOCAD drawings to .dxf (based on 2D drawings) or IGES or STEP files (based on 3D models) for transfer to the suppliers. These files (.dxf, IGES, or STEP) are not stored in the promotion process since they are directly obtained from the approved Pro/E data files that are in the INTRALINK promotion and approval process.. Conversion of approved AUTOCAD drawings to non-native .dxf files can be done utilizing the approved drawing files. Configuration control of these non-native translations from approved Pro/E and AUTOCAD files is maintained by the Design Integration group; when a model and/or drawing is updated, the Design Integration group creates an updated .dxf, IGES, STEP, or .txt file for transmittal to the supplier. In addition, the approved drawings and the associated “read me” file that accompanies these models and drawings is updated and recorded on the Supplier FTP site per NCSX Procedure PROC-006.

It is essential that vendors and in-house fabricators have a means by which to identify those files and drawings promoted to the “release for fabrication” status. Pro/E files are those designated with the .prt (parts and models), .asm (assemblies) and .drw (drawing). For these Pro/E drawings, until the drawing is promoted and approved for “release for fabrication,” the title block will not have a revision number. Within INTRALINK, a “work in progress” (WIP) drawing is tracked with a unique INTRALINK “revision” number (will be Rev 0 prior to the initial release for fab) and a version number. Once initially approved, a Rev 0 will be placed in

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the drawing title block. The revision number in the title block is then advanced (e.g., 1, 2, etc.) as the file is updated and approved with a “release for fabrication” status.

While it is important to clearly identify those files that have been promoted to “release for fabrication” status, it is equally important to provide this information to suppliers and to in-house fabricators. For suppliers, the Supplier FTP Site provides the most recent the product specification, approved (but not yet incorporated) Requests for Deviation (RFDs), and models and drawings provides a ready reference to those files released for fabrication. The product specification becomes part of the contract documentation and any subsequent updates are included as part of contract modifications. The product specification also lists the most recent versions of the drawing files and Requests for Deviations (RFDs). In addition, the Supplier FTP contains a “read me” file to clearly explain what is contained in these packages. Out-of-date or superseded drawing files are removed from this site and archived in INTRALINK. Electronic data files are also removed from the FTP site to preclude confusion.

It has been noted, especially for the MCWF and VVSA procurements, that we are processing and approving RFDs and NCRs that have an impact on existing “release for fabrication” drawings. At this time, NCRs are not normally incorporated into drawings since the NCRs documents an “as-built” condition that varies from the design and is applicable only to a specific part/component. However, it is likely that the approved deviation from the design approved in the NCR may also likely impact follow-on parts or components in which case a RFD will be processed per PROC-009. Formally revising a drawing each time (via ECN) is both time consuming and has created real cost and schedule issues. Accordingly, the RLM has the authority to delay or not incorporate the revision into the drawings. If it is decided to defer or never incorporate the request for deviation into the impacted drawings, it is permissible to utilize the “Stamp Tool” in Adobe Acrobat to annotate the drawing with a stamp which describes the deviation from the design. Only the Design Integration Manager, Design Supervisor, or the Systems Engineering Support Manager – ***these are the only three*** -- are authorized to make a change to a “released for fabrication” pdf drawing using the “Stamp Tool” without changing the full revision of the drawing or requiring a full review and approval cycle within INTRALINK to change the ProE models and drawings. ***NOTE: the “Stamp” will only reference the RFD or ECN. However, in keeping with the requirements of PPPL Procedure ENG-010, once three “stamps” are accumulated against a drawing, the next “stamp” will require a formal drawing revision in a timely manner. The exception to this rule will be certain RFDs that are judged to never require a drawing revision and this category of RFD “stamps” will not be included in the “3 stamp” requirement – Section D of this procedure addresses this category.***

***If a “stamp” process is authorized, it is imperative that the impacted parties (suppliers or internal PPPL personnel) be notified. Accordingly, the NCSX Systems Engineering Support Manager is responsible for providing a copy of the approved RFD (per PROC-009) or ECN to the appropriate project personnel or to the PPPL Procurement Representative to ensure that the impacted parties receive timely notification.***

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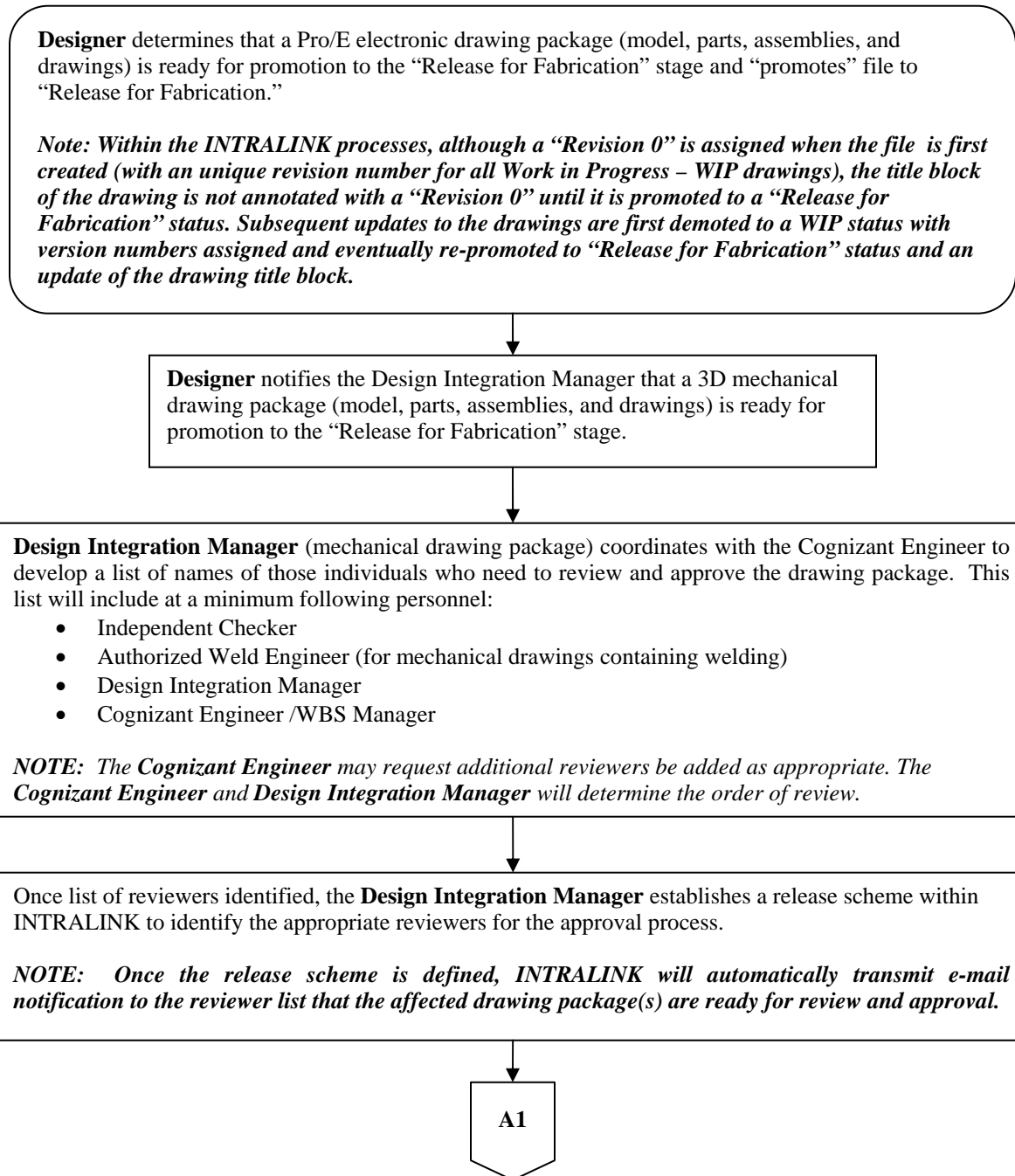
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**Referenced Documents**

| Document Number                | Document Title  |
|--------------------------------|---|
| NCSX-PLAN-CMP                  | Configuration Management Plan                                 |
| NCSX-GUID-PRO/INTR             | Pro/INTRALINK Users Guide                                     |
| NCSX-PROC-002                  | Configuration Control   |
| NCSX-PROC-005                  | Electronic Signatures   |
| NCSX-PROC-006                  | Control of NCSX Supplier and In-House Fabrication Information |
| NCSX-PROC-009                  | Requests for Deviations                                       |
| PPPL Engineering Procedure 010 | Control of Drawings, Software, and Firmware                   |
| PPPL-DRFT-001                  | PPPL Engineering Drafting Standard                            |
| PPPL QA Procedure 005          | Control of Non-Conformances                                   |

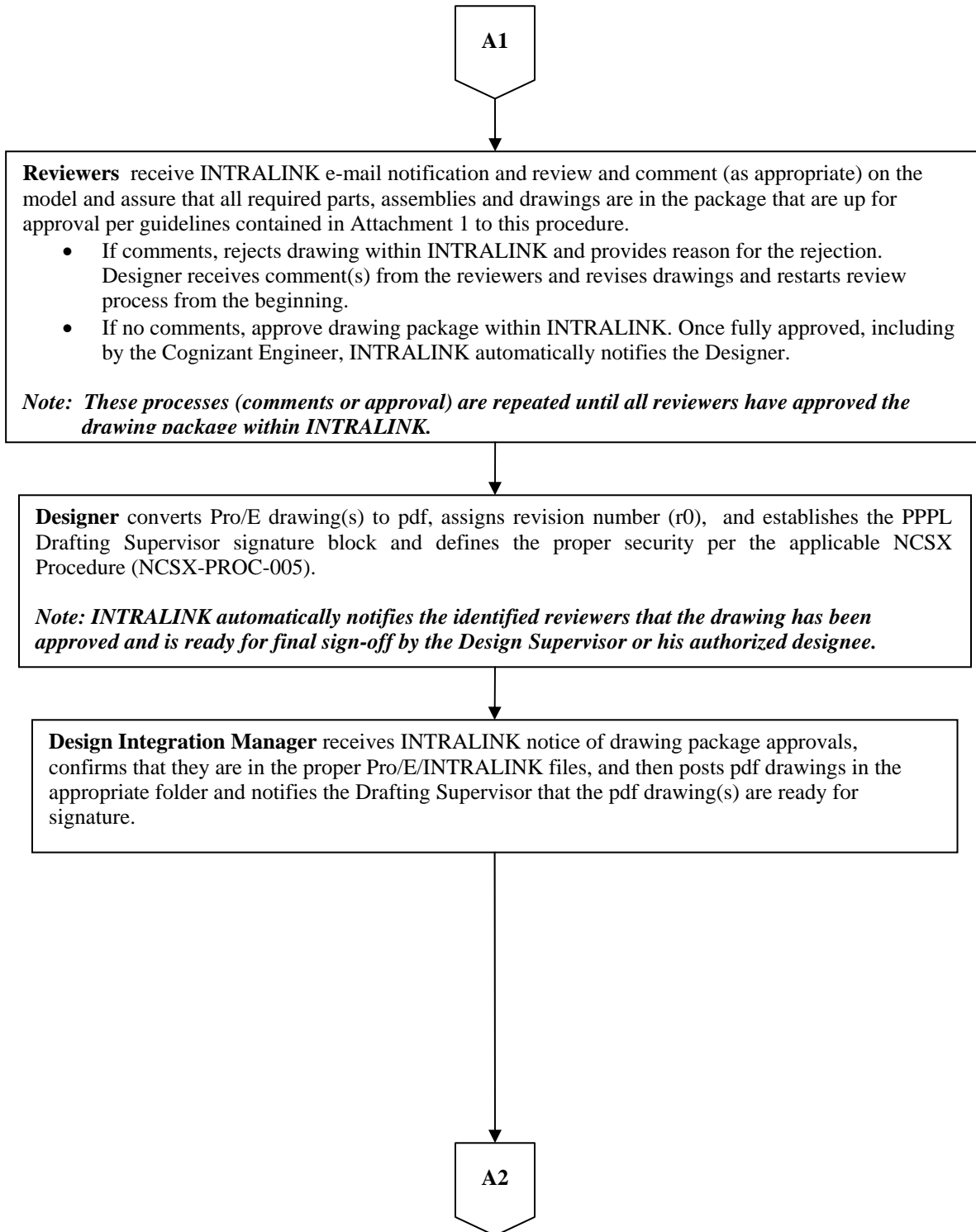
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**Procedure****A. Final Review and Approvals (Release for Fabrication) of Electronic Mechanical Model and Drawing Files Created in Pro/E**

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A2

**Drafting Supervisor** (or designee) verifies that the appropriate drawing standards were followed and that the drawing package was approved within INTRALINK.

- If not correct, notifies the Design Integration Manager and Designer and rejects the drawing. Designer will then have to correct drawing package and restart the review and approval cycle again.
- If INTRALINK documentation is complete and appropriate:
  - Places the “Release for Fabrication/Installation” stamp on the drawing(s) and signs the drawing(s) in the signature block area of the stamp as per NCSX-PROC-005;
  - Places the approved pdf drawings into the Released Drawing folder in INTRALINK; and
  - Notifies the Design Integration Supervisor that the drawing(s) is approved.

Supplier Fabrication

Supplier or In-House Fabrication?

In-House Fabrication

**Design Integration Manager:**

- Relocates superseded drawings and electronic files from the Supplier FTP Site to an archive folder in INTRALINK;
- Converts drawings and/or models to the appropriate NC format (.dxf, IGES, STEP, or .txf) as needed.
- Notifies the NCSX Systems Engineering Support Manager and Cognizant Engineer of the most recent drawings and electronic zip file designators such that the affected Product Specification can be updated; and
- Posts latest approved drawings and electronic files (including any NC format files - .dxf, IGES, or STEP as needed) on the Supplier FTP Site per NCSX-PROC-006 and notifies the Procurement Technical Representative and PPPL Procurement Representative that they are posted and that a contract modification should be processed.

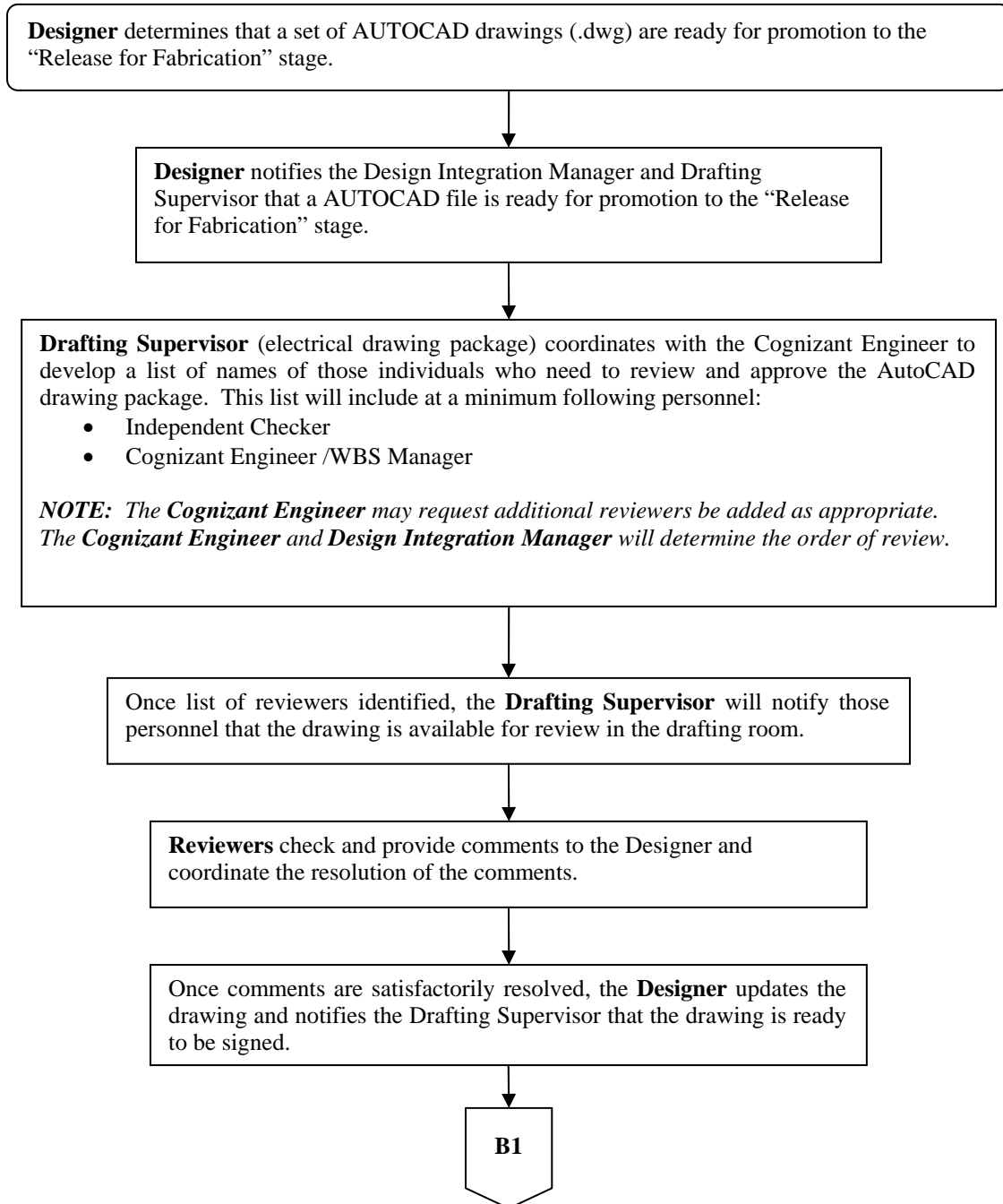
**END**

**Design Integration Manager:**

- Relocates superseded drawings to an archive folder;
- Ensures that latest drawings are posted in the Released Drawing folder;
- Converts drawings and/or models to the appropriate NC format (.dxf, IGES, STEP, or .txf) as needed.
- Informs Cognizant Engineer that drawings needed for fabrication are posted in Released Drawing folder and are available via *FroTools* utility or INTRALINK.

**END**

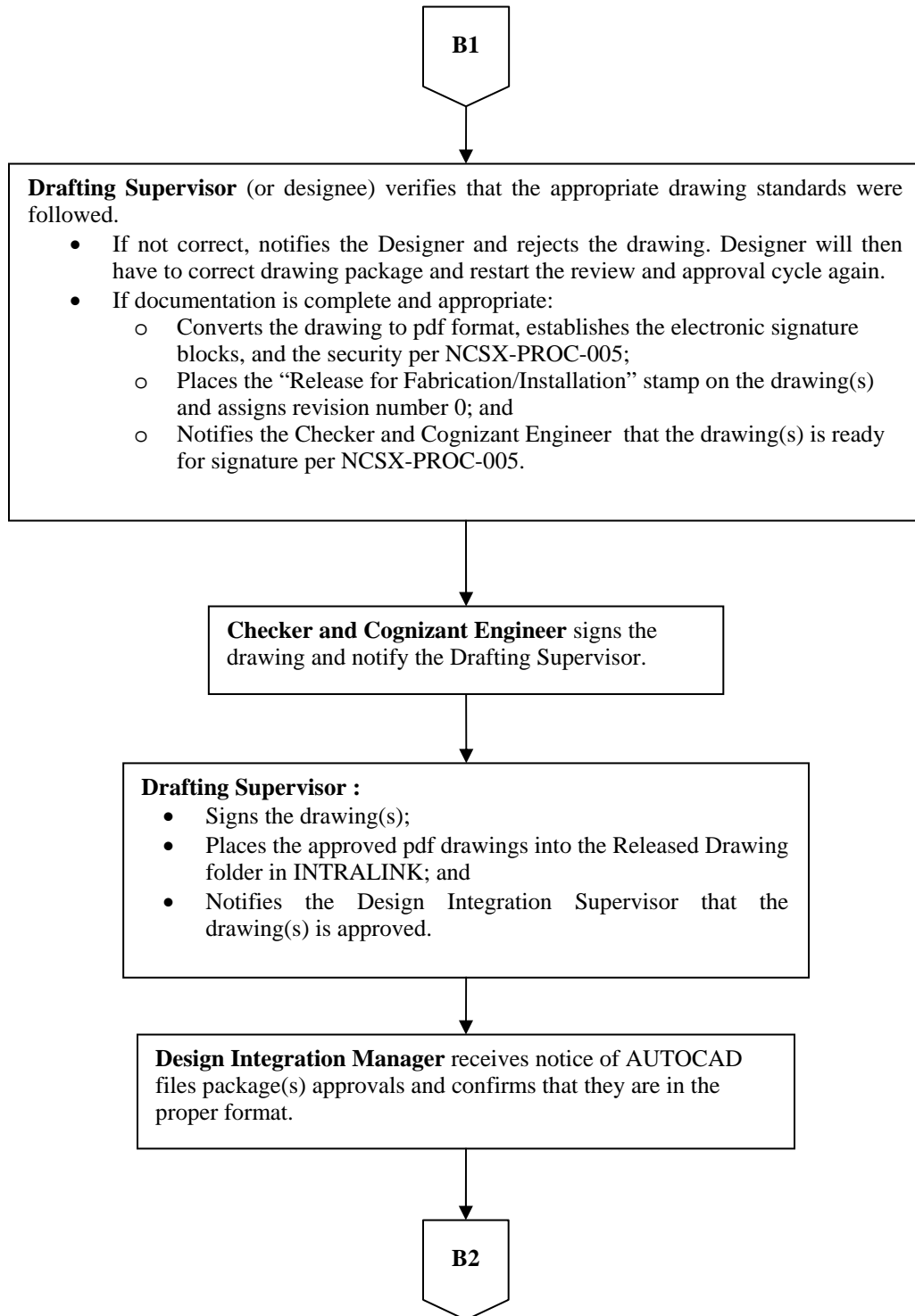
## B. Final Review and Approvals (Release for Fabrication) of Electronic Electrical Drawing Files Created in AUTOCAD



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**B2**

**Drafting Supervisor** (or designee) verifies that the appropriate drawing standards were followed and that the drawing package was approved within INTRALINK.

- If not correct, notifies the Design Integration Manager and Designer and rejects the drawing. Designer will then have to correct drawing package and restart the review and approval cycle again.
- If INTRALINK documentation is complete and appropriate:
  - Places the “Release for Fabrication/Installation” stamp on the drawing(s) and signs the drawing(s) in the signature block area of the stamp as per NCSX-PROC-005;
  - Places the approved pdf drawings into the Released Drawing folder in INTRALINK; and
  - Notifies the Design Integration Supervisor that the drawing(s) is approved.

Supplier Fabrication

Supplier or In-House Fabrication?

In-House Fabrication

**Design Integration Manager:**

- Relocates superseded drawings and electronic files from the Supplier FTP Site to an archive folder in INTRALINK;
- Converts drawings and/or models to the appropriate NC format (.dxf, IGES, STEP, or .txt) as needed.
- Notifies the NCSX Systems Engineering Support Manager and Cognizant Engineer of the most recent drawings and electronic zip file designators such that the affected Product Specification can be updated; and
- Posts latest approved drawings and electronic files (including any NC format files - .dxf, IGES, or STEP as needed) on the Supplier FTP Site per NCSX-PROC-006 and notifies the Procurement Technical Representative and PPPL Procurement Representative that they are posted and that a contract modification should be processed.

**END**

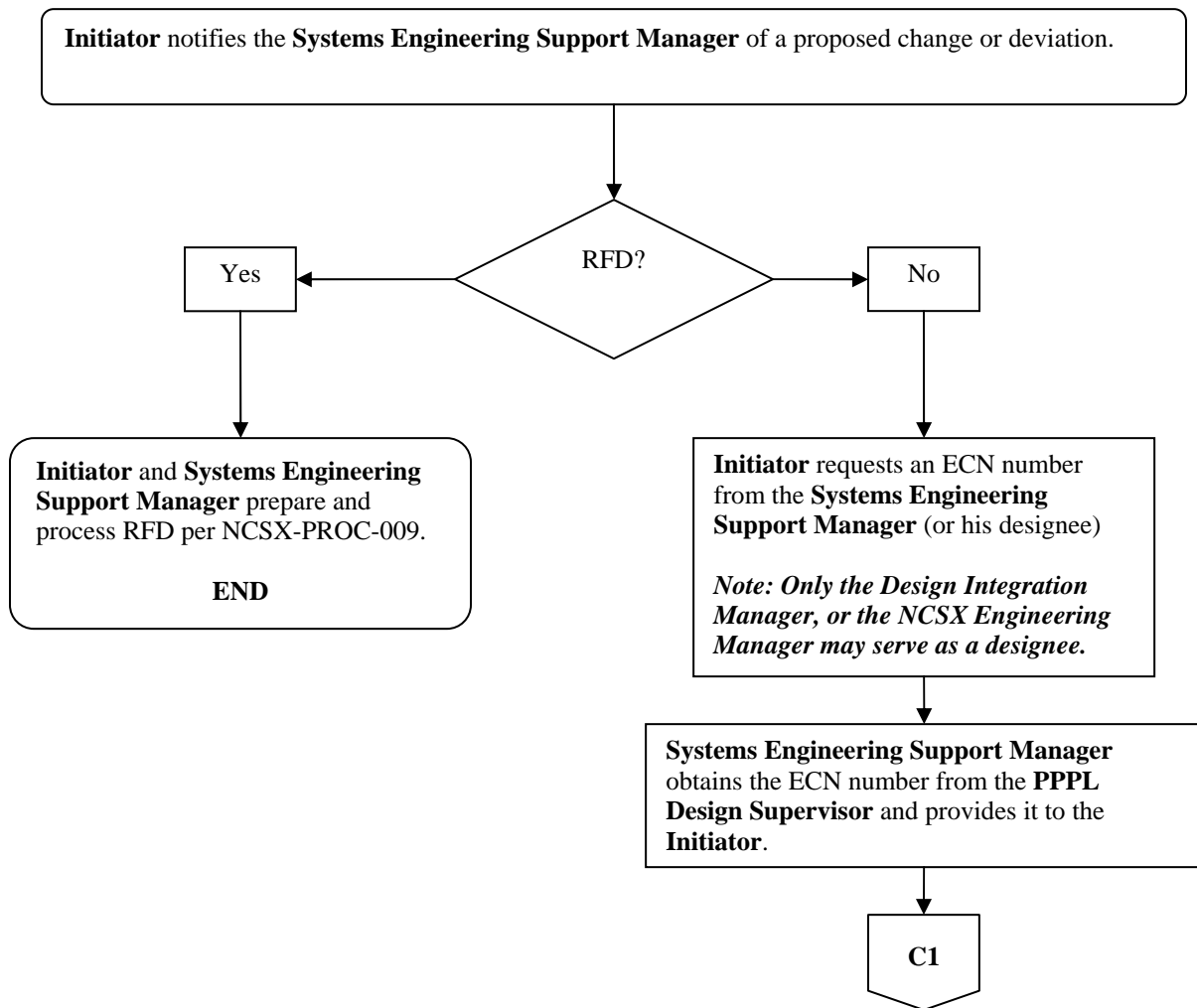
**Design Integration Manager:**

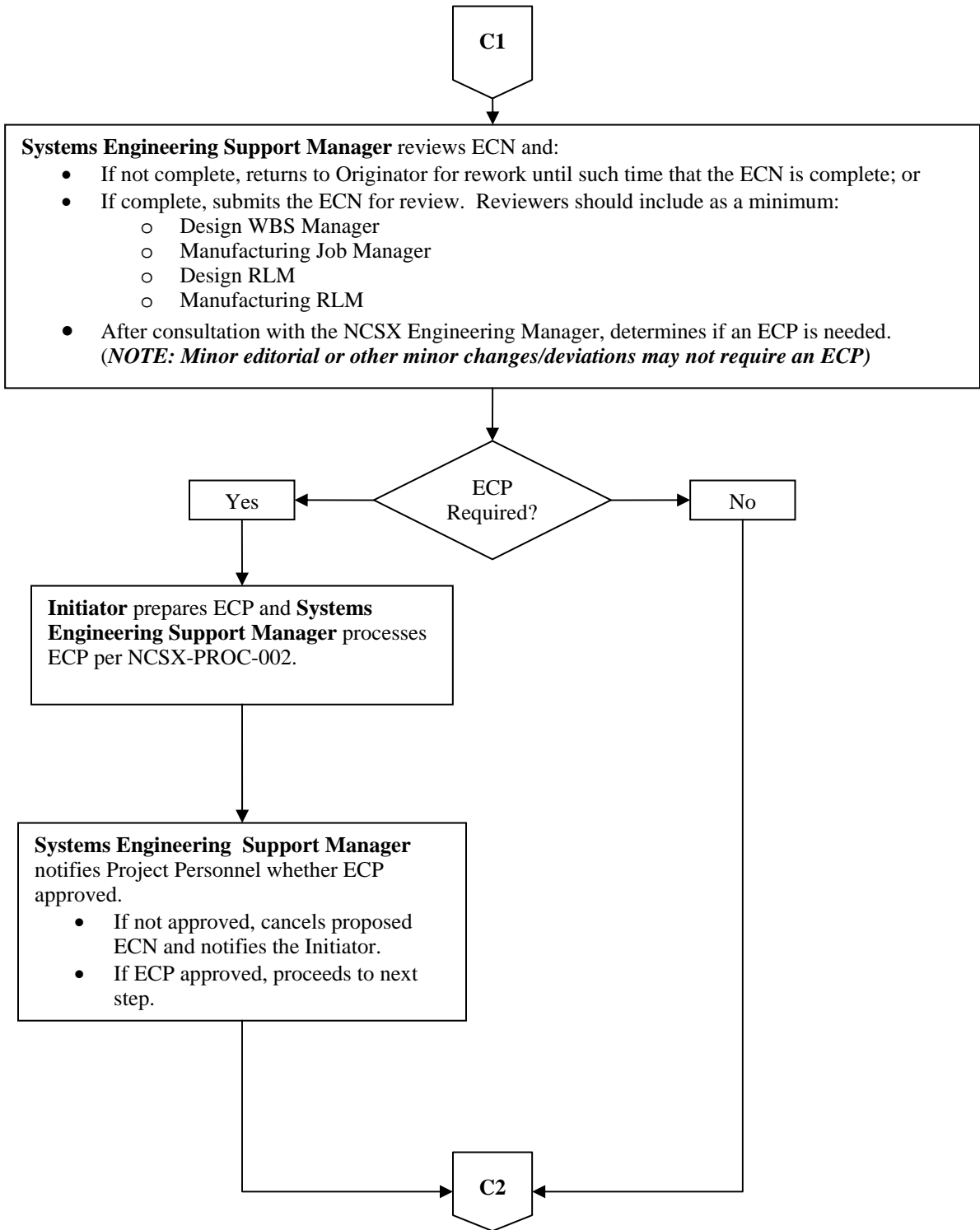
- Relocates superseded drawings to an archive folder;
- Ensures that latest drawings are posted in the Released Drawing folder;
- Converts drawings and/or models to the appropriate NC format (.dxf, IGES, STEP, or .txt) as needed.
- Informs Cognizant Engineer that drawings needed for fabrication are posted in Released Drawing folder and are available via *FroTools* utility or INTRALINK.

**END**

**C. Revision of “Release for Fabrication” Drawings and Electronic Files**

Once a drawing/electronic file is promoted and approved in a “Release for Fabrication” status, the drawing/electronic file comes under configuration control. In accordance with the NCSX Configuration Control process outlined in the NCSX Configuration Management Plan (NCSX-PLAN-CMP) and its accompanying NCSX Procedure (NCSX-PROC-002), once any document is under configuration control, an Engineering Change Proposal (ECP) per NCSX-PROC-002 is required to initiate and authorize a change or deviation (NCSX-PROC-009), unless the NCSX Systems Engineering Manager, after consultation with the NCSX Engineering Manager, specifically authorizes a change without an ECP (generally only limited to editorial and minor changes/deviations). Per the applicable PPPL Engineering Procedure (ENG-010), an Engineering Change Notice (ECN) is also required to document and authorize changes to drawings already in a “Release for Fabrication” status and/or add new drawings needed to fully implement and document the authorized change. When a drawing or file that has already been “released for fabrication” is updated, the revision number will be advanced (e.g., r1, r2, etc.) The procedure that follows provides the step-by-step process.





C2

**Systems Engineering Support Manager** incorporates comments from ECN reviewers and approved ECP (if ECP required), converts ECN to pdf format, and obtains Cog Engineer and RLM signature approvals per NCSX-PROC-005. Notes RLM recommendation as to whether or not a drawing revision is immediately needed. When ECN fully signed:

- Forwards completed ECN to the Drafting Supervisor for his records along with a copy of the implementing ECP (if ECP required).
- Also notifies Drafting Supervisor whether drawing(s) will be updated immediately or whether the ECN “stamp” process outlined in ENG-010 will be utilized. If ECN “stamp” to be utilized, proceed to Section D of this procedure, otherwise continue to next step.
- Notifies the Designer, Design Integration Manager, and impacted ATI(s) and RLM(s) that the ECN has been approved; and
- Posts the approved ECP (as appropriate) and ECN on the NCSX Engineering Web.

**Designer/Design Integration Manager** updates drawing(s) impacted by the ECN using the review and approval processes outlined in Section A or B of this procedure. reflect the ECP and ECN, including revision number (e.g., r1, r2, etc.) and processes per the review and approval procedures found in Section A or B of this Procedure. Iterates this drawing package until fully approved and posted in the appropriate INTRALINK folders.

**Design Integration Manager** Converts drawings and models to the appropriate NC format (.dxf, IGES, STEP, or .txt) as needed and posts them. Updates the “read me” file and posts the updated models and drawings on the Supplier FTP site. Finally notifies the PPPL Procurement Representative that the updated files are posted so that the Supplier can be notified.

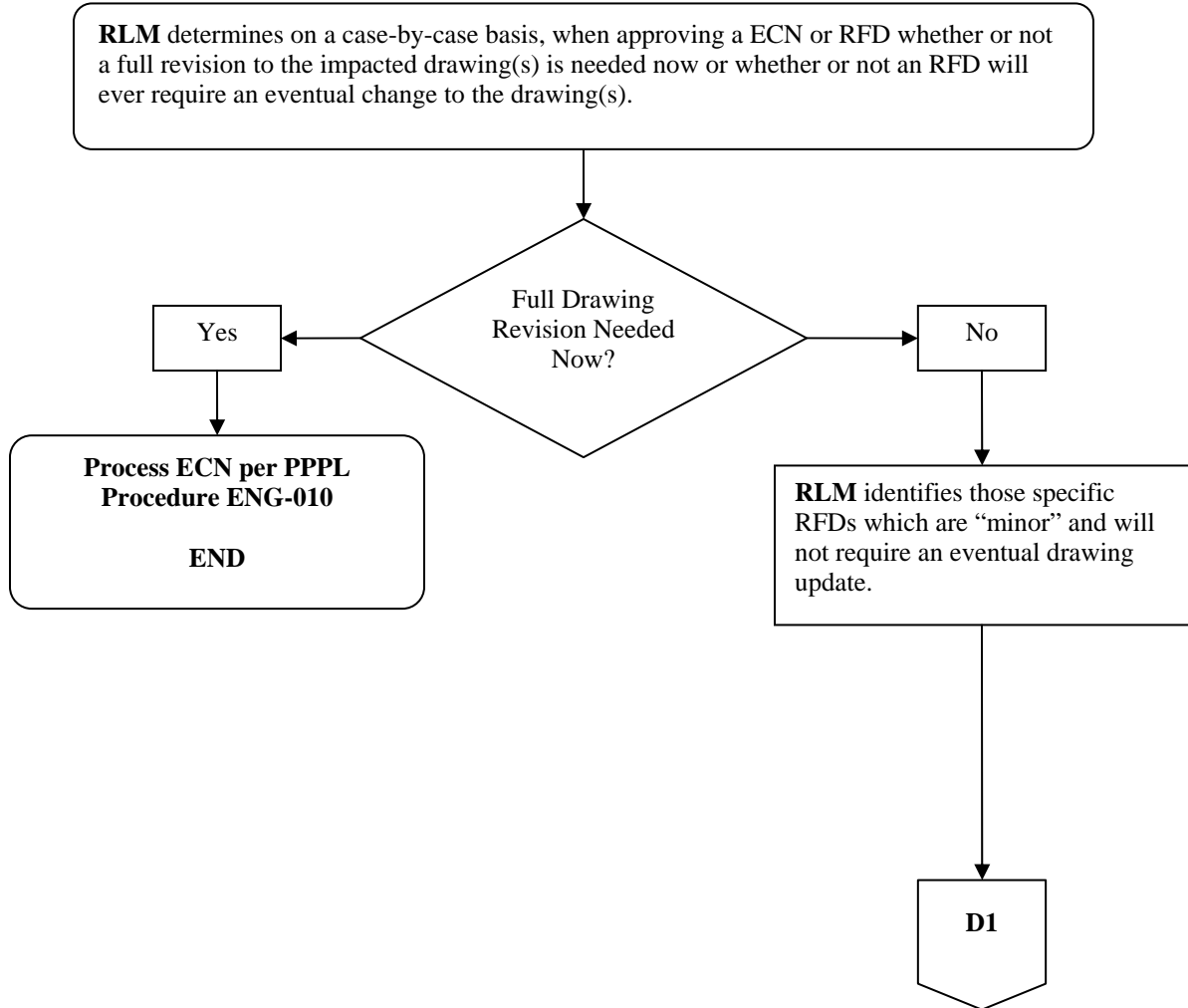
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**D. Annotation of Drawings with ECN or RFD Identification**

As per PPPL ENG-010 the Engineering Change Notice (ECN) is the vehicle by which a drawing that has been released for fabrication may be revised. Because of limited NCSX resources and time constraints on formally revising drawings, the use of the “Stamp Tool” in Adobe Acrobat can be used to update a “Release for Fab” pdf drawing to reflect an approved ECN or RFD.



D1

**Design Integration Manager or Systems Engineering Support Manager (NO OTHERS):**

- Make a copy of the impacted PDF drawing(s) and label them as a letter update (e.g., Rev 1-a, b, c, etc.) and save it to their desktop. Annotate the drawing revision as 1-a, 1-b, etc. to reflect the current revision approved and the letter update.
- Delete the Drafting Supervisor's signature from the "Release from Fabrication" to permit adding of notes using the PDF "Stamp Tool".
- Adds/revises drawing security to "Password Protected" with the allowance for "High Resolution" printing and "Commenting, Form Filling and Signing" options if not already established.
- Using the "Stamp Tool" creates a unique stamp for each approved RFD or NCR with the following details included in the note:
  - Identification of the implementing document (e.g, RFD-14-019 or NCR XXXXX.).
  - Brief description of the changes – if the content of the document cannot be clearly described, a hard copy of the implementing document will need to be provided to the Supplier or ATI. Also identifies whether an eventual drawing update will be required.
  - Applicability of the change (e.g., for RFD-14-019, only applicable to C6 and all Type A and Type B castings, etc.)

**NOTE: Unless an RFD is specifically exempted by the RLM, per ENG-010 only three (3) "stamps" (ECNs or RFDs) are permitted to accumulate against a drawing -- the next "stamp" will require an ECN and the drawing MUST be formally revised in a timely manner.**

- Ensures that the "stamp" is highlighted in yellow with a thick border to stand out.
- **NOTE: If RFD is exempted from an eventual drawing update by the RLM, the text of the RFD "stamp" should clearly identify that no update is ever required.**
- Save the drawing and send to the Drafting Supervisor for his signature in the "Release for Fabrication" stamp block

**Drafting Supervisor** re-signs the "Release for Fabrication" stamp block and sends the pdf drawing to the Design Integration Manager for posting.

**Design Integration Manager** posts the impacted drawings on the NCSX Manufacturing Web and the INTRALINK data base and also notifies impacted project personnel to ascertain whether they desire a copy of the revised drawing. Ensures that the PPPL Procurement Representative is notified to enable the Supplier to also be notified.

**NOTE: At the next full revision of the drawing the RLM, Design Integration Support Manager, and the Systems Engineering Support Manager ensures that the letter updates are incorporated. For those RFD stamps determined to never need an update, the RFD stamp will remain on the updated drawing.**

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**Attachments**

- 1 – Guidelines for Reviewing/Checking Electronic Models and Drawings**
- 2 – NCSX ECN Forms**

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The PPPL Engineering Drafting/CAD Guidelines and Standards (ES-DRFT-001) contains guidelines and standards for electronic models and drawings. Section 6 of that new PPPL Engineering Standard contains general guidelines for reviewing/checking models and drawings. The NCSX Project has developed the following NCSX-specific guidelines to assist reviewers/checkers in performing these tasks:

### **General Responsibilities of a Checker**

An individual shall be assigned as checker to review the models and drawing relating to quality, accuracy, manufacturability and conformance to standards. These guidelines and responsibilities apply to mechanical Pro/E models and drawings as well as for electrical AUTOCAD drawings. The checker must be familiar with the function and criteria of the model and drawings to be checked, but should not have been an active participant in preparing this material. Responsibilities include:

- Ensuring the accuracy and completeness of the drawings submitted to him/her, taking into account the design requirements, and assuring compliance with PPPL Drafting/ CAD Process and Standards plus other applicable standards.
- Examining detail, layout, assembly and installation model and drawings for practicality of design; accuracy and conformity to the design criteria and/or existing specification & standards.
- Applying knowledge of mechanical and/or electrical design methods; of manufacture/assembly; and drafting techniques/procedures in performing this review and check.
- Identifying inconsistencies or needed changes (if any) in the models and drawings. The checker shall discuss required changes with Cognizant Individual and/or Designer and shall coordinate and check corrections.

### **Additional Responsibilities for Checking Mechanical Pro/E Models and Drawings**

In addition to the general reviewing and checking responsibilities identified previously, the following specific additional checks need to be made by a reviewer/checker of electronic Pro/Engineer Models and Drawings:

- All Intralink released objects must have a description. The description should all be in caps.

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## Attachment 1

## Guidelines for Reviewing/Checking Electronic Models and Drawings

- All objects should have a number – no names. The number should be of the form: se123-115, where “s” represents the NCSX Project, “e” represents the drawing size, 123 represents the WBS number (either 3 or 4 place WBS), and 115 is a sequential part/drawing number within this WBS. A vendor part number or legitimate library part number may also be used. It should be noted that concepts numbers such as smc123-115 (mc represents your initials) must be converted to se123-115 before the model is moved to the fabrication release level.
- Models should be moved out of our sketch areas and moved to the correct WBS INTRALINK folder if the model represents the final released part.
- All parts should have a density specified.
- All parts and assemblies should have the analysis, model analysis, model mass properties calculated based on the master rep.
- Make sure the “Insert Here” is located after the last feature or component in the model.
- Layers / Features should be placed on one layer only. Layers should be blanked and the status saved.
- Models should be check to assure that there are no warnings; frozen features, circular references, etc.
- Assembly models – Parts/components/subassemblies should not be placed on layers. Simplified reps should be used to control the display.
- Geometric datum(s) should be placed on a layer called 9\_GEO.

**Note:** Any components that are suppressed should be removed from the model. If the component or feature needs to be suppressed the Project should understand why and try to work in the direction of removing the suppressed features/models.

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| <b>PROCEDURE: NCSX-PROC-007 Revision 3</b><br><b>Attachment 2</b><br><b>NCSX ECN Forms</b> | <b>Page: 1 of 3</b> |
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**Forms are located at:** <http://engineering/EngForms.html> .

The NCSX ECN form is a slightly modified form of the one shown on ENG-010. The NCSX ECN forms are located at:

[http://ncsx.pppl.gov/SystemsEngineering/Config\\_Mgmt/ECPs/ECP\\_StatusIndex.htm](http://ncsx.pppl.gov/SystemsEngineering/Config_Mgmt/ECPs/ECP_StatusIndex.htm)

A sample of the NCSX ECN form (slightly modified) is contained below:

**NCSX ENGINEERING CHANGE NOTICE (ECN) ECN # \_\_\_\_\_**

|                              |                              |
|------------------------------|------------------------------|
| <b>COGNIZANT INDIVIDUAL:</b> |                              |
| <b>ECN TITLE:</b>            |                              |
| <b>CC/WP/Job:</b>            | <b>AREA OR PROJECT: NCSX</b> |

**LIMITATION OF SCOPE - NOTE:** A Work Planning Form is NOT required if the total change to be accomplished (ENG-032):

- Is not large or complex or does not represent a new installation into a usable space
- Does not have a significant ES&H impact
- Does not involve tritium or other radioactive contaminated or activated equipment
- Does not impact multiple projects, systems, or groups

OR does not change the scope or intent of the original design.

Responsible Line Manager CONCURRENCE: \_\_\_\_\_  
 (Signature indicates that no Work Planning form is required.)

If non-concurrence or associated with a work planning form, enter the WP number: \_\_\_\_\_

| <b>DRAWING(S)<br/>AFFECTED NUMBER:</b> | <b>Current<br/>Revision</b> | <b>TITLE</b> |
|--|-----------------------------|--------------|
|  |                             |              |
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