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OWNER: Engineering	PROC-DE-0705	REVISION: 2
SUBJECT MATTER AREA: Design Drawings	PREPARER: Teresa Pierce	Page 1 of 28
PROCEDURE TYPE: Administrative <input checked="" type="checkbox"/> Emergency <input type="checkbox"/> Alarm Response <input type="checkbox"/>	CONCURRENCE/DATE: A. J. Reed 2/21/19 [Approval Signature on File]	
TITLE: DESIGN DRAWINGS	APPROVED BY/DATE: Randy Fadeley 2/21/19 [Approval Signature on File]	
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This document is approved for public release per review by:
Don Xiques for Teresa Fancher 2/20/19
 UCOR ETPP Classification & Date
 Information Control Office

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REVISION LOG			
Revision	Effective Date	Description of Changes	Pages Affected
2	2/28/19	This revision is a complete rewrite of the previous revision. Updated procedure for name change and changes to reflect current engineering practices, including use of new engineering "Vault" software. This revision incorporates steps from PROC-OR-1014, so that PROC-OR-1014 can be deleted. This revision also addresses IF-2018-0813.	All
1	3/3/16	Non-intent change to update organization name, and reference titles/numbers.	All
0	1/30/12	Initial release. Replaces DE-0705, Rev. 5, <i>Project Drawings</i> .	All

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PURPOSE

This procedure provides the requirements for the preparation, review, approval, and control of drawings and other engineering graphic presentations prepared by and for URS | CH2M Oak Ridge LLC (UCOR, an AECOM-led partnership with Jacobs) Engineering.

SCOPE

This procedure applies to all drawings, sketches, illustrations, figures, charts, pictures, tables, presentations, slides, graphics, and graphic representations prepared and controlled by UCOR Engineering. This procedure also applies to subcontractor drawings prepared in a staff augmentation role, and drawings prepared for UCOR by a subcontractor in a non-staff-augmentation role.

NOTE: A Subcontractor may need to contact their UCOR Subcontract Coordinator/Site Technical Representative (SCC/STR) for assistance in understanding and/or complying with this procedure.

OTHER DOCUMENTS NEEDED

- PPD-DE-1035, *Engineering Program Description*
- PROC-DE-1008, *Design Change Notices (DCNs), Engineering Instructions (EIs) and Equivalency Evaluations (EEs)*
- PROC-OS-1004, *Document Numbering and Issuance*
- PROC-OS-1005, *Management of Subcontractor/Vendor Submittals*
- Form-141, Document Review Request
- Form-1174, Comment Resolution Form
- Vault Desktop Instructions
- G1E-000000-E959, UCOR Drafting Legend & Symbols

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WHAT TO DO

A. Sketches, Figures, Graphics, Charts, Tables, Presentations, Slides, Illustrations, and Graphical Representation of Pictures or Maps

NOTE 1: Sketches, Figures, Graphics, Charts, Tables, Presentations, Slides, Illustrations, or Graphical Representation of Pictures or Maps are not required to have document numbers or border files, as they are included in a base document.

NOTE 2: Sketches, Figures, Graphics, Charts, Tables, Presentations, Slides, Illustrations, or Graphical Representation of Pictures or Maps are not considered to be design drawings and are not to be used for fabrication or construction.

Engineer/
Designer

1. Prepare Sketches, Figures, Graphics, Charts, Tables, Presentations, Slides, Illustrations, or Graphical Representation of Pictures or Maps to be used for illustrations, as required.
2. Ensure Sketches, Figures, Graphics, Charts, Tables, Presentations, Slides, Illustrations, or Graphical Representation of Pictures or Maps that are included in a base document undergo review and approval along with the parent document in accordance with PPD-DE-1035, *Engineering Program Description*.

B. UCOR Developed Design Drawings

This section covers drawings prepared by UCOR (including UCOR staff augmentation personnel)

NOTE 1: The Project Engineer shall determine the personnel who will serve as Preparer, Checker, and Reviewers for each new drawing.

NOTE 2: If a block of numbers needs to be reserved for a project/task, the UCOR Document Management Center (DMC) can be contacted by e-mail to coordinate the reservation rather than entering each individual drawing as a separate request in the DNR system.

NOTE 3: If an ORNL or Y-12 drawing number needs to be requested, the UCOR DMC will contact Oak Ridge National Laboratory (ORNL) or Y-12 to obtain the drawing number from their respective systems.

Preparer

1. Before developing a new drawing, SEARCH the following to verify if there are existing drawings, that have background information or may need to be referenced when developing a new drawing:
 - Vault,
 - UCOR DMC,
 - Other archive storage (e.g., red-lines in project files, microfilm, or manual hard copy drawings in UCOR archive records).

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NOTE: A Registered Professional Engineer of the appropriate discipline can seal only those drawings for which he/she has been in responsible charge.

Preparer

2. **IF** required by the State of Tennessee, federal law, or the contract, **THEN** the UCOR Registered Professional Engineer(s) shall seal, sign, and date the design drawings.
3. Request drawing number through electronic Document Numbering Request (DNR) system in accordance with PROC-OS-1004, *Document Numbering and Issuance*.
4. Create a new subfolder in Vault under an existing area, building, or project for the new design work in accordance with Vault Desktop Instructions.
5. Develop and maintain working files for the drawing in the associated Vault folder.
6. Prepare and format drawings in accordance with Attachment B, Drawing Format and Standards Guidelines; G1E-000000-E959, UCOR Drafting Legend & Symbols; and in a manner to convey a clear interpretation of the design concept.

NOTE 1: Cancelled or superseded drawing numbers are not to be used.

NOTE 2: The design drawing log should include, the drawing number, drawing title, preparer, originating engineer, checker, approver, drawing status and date.

UCOR DMC

7. Maintain a log of all Engineering Prepared drawings. Use Attachment E, Example Engineering Standard Drawing Title Block Format, to format the drawing numbers.

NOTE: Preliminary drawing may be marked as “PRELIMINARY - NOT TO BE USED FOR CONSTRUCTION.”

Preparer

8. Mark prints or drawings, as applicable, to indicate the purpose or restrictions on release of the drawings.
9. Ensure that any drawings partially prepared by a Vendor or Subcontractor, with additional drafting work added by UCOR, have a disclaimer note describing limits of UCOR responsibility and liability for UCOR-added items prior to being issued.

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Preparer

10. IF plots of design drawings are issued for reference purposes or provided for review to any external agency, client, vendor, or party other than the project for which they were intended, **THEN**

- Obtain permission of the appropriate Project Engineer or Chief Engineer to verify the requester's requirements or restrictions on release of such information.
- Mark drawings “FOR REFERENCE ONLY” or “INFORMATION ONLY”, if required, and indicate any additional appropriate disclaimers(s).
- Ensure the document has been reviewed by the UCOR Classification and Information Control Office (CICO) for public release or for limited distribution as appropriate.

NOTE 1: All design drawings shall be checked.

NOTE 2: The Checker shall be a separate person from the Preparer. The Checker shall be chosen by the Project Engineer and shall possess technical skills commensurate with the Preparer.

NOTE 3: When checking drawings, the following colors may be used to indicate the intent of the checker’s comments on the check prints:

Yellow - indicates an item has been checked

Red - indicates an item to be added

Green - indicates an item to be removed

Checker

11. Perform a check of the drawing by performing the following:

- a. Check the drawing for conformance with Attachment B, Drawing Format and Standards Guidelines, completeness and accuracy. Review any supporting documentation (e.g., vendor information, calculations).
- b. Review the drawing title blocks for accuracy and completeness (e.g., cross references to drawing numbers, change notices, revision numbers).
- c. Ensure that calculations supporting the drawings have been approved and issued.

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- Checker
- d. Check the drawings for technical adequacy and feasibility of design, including, as applicable:
- Personnel Safety,
 - General quality,
 - Completeness and accuracy,
 - Compliance with contract requirements,
 - Access for inspection,
 - Operability and Maintainability,
 - Human factors,
 - As Low As Reasonably Achievable (ALARA) principles,
 - Waste minimization and pollution prevention.
12. Provide comments to the Preparer.
- Preparer
13. Resolve the Checker's comments.
14. Use Form-141, Document Review Request; Form-1174, Comment Resolution Form; or other alternative process acceptable to the Project Engineer to formally document reviewers, their comments, and comment resolution including off-project review or review by State or Regulatory Agency.
15. Maintain Comment Resolution forms in engineering working files if the design drawings do not include credited Systems, Structures or Components (SSC).
- a. **IF** the drawings do include credited SSC, **THEN** the comment forms shall be maintained as records.
- Preparer/
Responsible Engineer/
Project Engineer
16. In coordination with Project Engineer, determine additional required reviews, including any off-project reviews. Consider reviews by other engineering disciplines and other functional departments, and include appropriate subject matter experts in the review process. Provide the drawing to the reviewer(s) for review.
17. **IF** the new drawing potentially affects the Safety Basis or involves a safety system, **THEN** ensure that Nuclear Safety is included as a Reviewer of new draft design drawings so that impacts to/from existing safety basis documents can be considered during the review cycle and prior to finalizing the drawing.
- Preparer
18. Resolve the Reviewers comments on the drawing. Preparer shall work with Project Engineer to resolve any conflicting comments.
- Checker
19. Check any changes made as a result of Reviewer/Project Engineer comments.

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Preparer/Checker/
Reviewer and Project
Engineer Approver

20. **WHEN** comments have been satisfactorily resolved, **THEN** indicate acceptance by signature on the title block.
- a. Electronic/Digital signatures are preferred and shall be used unless determined by Project Engineer that hard-copy “inked” signatures are acceptable.
 - b. After the drawing has all of its signatures, and has been approved by the Project Engineer or Chief Engineer, it is considered “issued.”

Project Engineer or
Designee

21. Prior to distribution of the issued drawing, ensure the document has been reviewed by the CICO or other acceptable reviewers for public release or for limited distribution.

NOTE 1: The majority of the time, new drawings issued as Rev. 0 will not be required to be issued with a Design Change Notice (DCN) or Engineering Instructions (EI) (e.g., new drawing issued as Rev. 0 to document existing field conditions where no previous drawing existed; new drawing issued Rev. 0 for new work to be performed as part of a UCOR procurement action [Purchase Order, Subcontract, etc.]).

NOTE 2: There are cases where a new drawing issued Rev. 0 would need to be issued with a DCN or EI (e.g., Rev. 0 drawing that describes a design change where the field work will be self-performed by UCOR).

Project Engineer

22. Determine if a DCN or EI is needed to accompany the Rev. 0 issuance of a drawing(s).

NOTE: The Project Engineer may choose to combine the drawing(s) into the DCN/EI .pdf file for convenience, but is not required because each drawing is maintained as a separate record by the UCOR DMC.

23. **IF** a DCN or EI is needed, **THEN** follow PROC-DE-1008, *Design Change Notices (DCNs), Engineering Instructions (EIs) and Equivalency Evaluations (EEs)*, to develop and issue the DCN or EI.

24. **IF** a DCN or EI is NOT needed, **THEN** distribute the Rev. 0 issued drawing(s) to interested parties by e-mail or other acceptable method as determined by the Project Engineer.

Preparer

25. Verify that the final version of CAD files and the issued .pdf drawing are in the Vault folder. Mark the state of the .pdf drawing in the Vault software program as “Issued” and automatic notification will be sent to the UCOR DMC.

UCOR DMC

26. Copy the .pdf issued drawing(s) from Vault and place in the UCOR DMC as the Record Copy.

27. Maintain .pdf signed/issued design drawings, and update the drawing log to indicate the issued status of the drawings.

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C. Subcontractor Developed Design Drawings

NOTE 1: If the subcontractor creates a CAD drawing for UCOR, the CAD drawing should use the UCOR border and title block. The drawing numbers will be issued by UCOR DMC through the electronic DNR system similar to a UCOR design drawing.

NOTE 2: The Project Engineer may determine on a case-by-case basis when it is acceptable for Subcontractor/Vendor drawings to be submitted on their own border (e.g., standard tank and pump drawings) and subsequently have a UCOR border and drawing number added by UCOR after receipt or to just manage the information as a statused submittal.

NOTE 3: **IF** a drawing(s) has been prepared by a subcontractor without direct supervision by a UCOR Engineer, **THEN DO NOT** sign the drawings. UCOR may use the drawing for self-performed or subcontracted work, but the Subcontractor that prepared the drawing retains responsibility and liability for accuracy and completeness of the drawing.

NOTE 4: **IF** required by the State of Tennessee, federal law, or the contract, **THEN** the Subcontractor's Registered Professional Engineer(s) shall seal, sign, and date the design drawings. A Registered Professional Engineer of the appropriate discipline can seal only those drawings for which he/she has been in responsible charge.

NOTE 5: If a block of numbers needs to be reserved for a project/task, the UCOR DMC can be contacted by e-mail to coordinate the reservation rather than entering each individual drawing as a separate request in the DNR system.

NOTE 6: If an ORNL or Y-12 drawing number needs to be requested, the UCOR DMC will contact ORNL or Y-12 to obtain the drawing number from their respective systems.

UCOR Project
Engineer or Designee

1. Reserve drawing numbers through the electronic DNR system.
2. Receive drawings prepared by Subcontractor.
3. Assign the appropriate reviewers in accordance with PPD-DE-1035 and the applicable subcontract requirements.

NOTE 1: Subcontractor-prepared drawings will typically be received as submittals and be processed in accordance with PROC-OS-1005. The UCOR STR/SCC will typically serve as the Lead Reviewer for the submittals.

NOTE 2: It is recommended that Form-1174, Comment Resolution Form, or an acceptable alternative means approved by the Project Engineer be used to document comments and their resolution. **IF** the subcontractor-prepared drawing is for a credited System, Structure, or Component, **THEN** maintenance of reviewer comments and resolution is required to be maintained as a Record.

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- Project Engineer or Designee
4. In coordination with the UCOR SCC/STR for the subcontracted design service being performed, determine additional required reviews, including any off-project reviews. Consider reviews by all engineering disciplines and other functional departments, and include appropriate subject matter experts in the review process.
- Reviewers/
Project Engineer
5. Review the drawings for matters pertinent to disciplines or functional areas of responsibility, providing comments back to the UCOR SCC/STR along with recommended status of drawing submittal per PROC-OS-1005, *Management of Subcontractor/Vendor Submittals*. Work with UCOR SCC/STR to consolidate comments and resolve any conflicting comments.
- UCOR Project Engineer or Designee
6. Resolve comments in conjunction with the UCOR SCC/STR and Subcontractor.
- NOTE:** It may be necessary to incorporate information from Subcontractor/Vendor drawings (e.g., equipment layout, aerial survey, civil survey, etc.) into new or existing UCOR design drawings. Ensure that these UCOR design drawings reference the source of the information and are reviewed, approved, and issued in accordance with Sections B and D of this procedure.
- UCOR Project Engineer or Designee
7. **WHEN** all UCOR comments have been resolved; contractual requirements have been met; and the drawing(s) has been finalized by the Subcontractor; and received in electronic format, **THEN** ensure that drawing(s) has been signed by the Subcontractor's Preparer, Checker/Reviewer, and Approver.
8. Verify that the final version of CAD files and the issued .pdf drawing are in the Vault folder. Mark the state of the .pdf drawing in the Vault software program as "Issued" and automatic notification will be sent to the UCOR DMC.
9. Prior to distribution of the issued Subcontractor drawing, ensure the document has been reviewed by the CICO or other acceptable reviewers for public release or for limited distribution

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D. UCOR Developed Design Drawing Revisions

This section covers drawing revisions prepared by UCOR (including UCOR staff augmentation personnel).

NOTE 1: Drawing revisions (after issuance of Rev. 0 version) may be needed for a variety of reasons (e.g., design changes required based on different field conditions; Subcontractor Request for Information; incorporation of vendor information; documenting as-constructed or as-built conditions or other methods/processes.)

NOTE 2: Drawing revisions (i.e., Rev. 1 or higher) may only be issued along with a new approved Design Change Notice (DCN), Engineering Instruction (EI), or issued as part of closure for an existing DCN in accordance with PROC-DE-1008, *Design Change Notices (DCNs), Engineering Instructions (EIs) and Equivalency Evaluations (EEs)*.

Preparer

1. Revise previously issued drawings as a formal revision in accordance with Attachment B, Drawing Format and Standards Guidelines.
2. Provide a concise description of the changes in the drawing title block (e.g., adding details, revising selected drawing sections, and/or noting per the DCN, EI, or other document indicating a need for the revision).

NOTE: The Project Engineer determines when clouding is not appropriate (e.g., global change to the drawing, etc.)

Preparer

3. Designate the areas changed with a cloud and a triangle containing the revision number.
4. Ensure that the changes can be clearly depicted without taking away from other details on the drawing.
5. Confirm latest drawing revision that UCOR DMC has in their record files and Drawing Log. Older/ historical drawings may not be in the UCOR DMC or in Vault. These older/historical drawings may reside in UCOR record archives as microfilm or manual hard copy drawing files only.
6. Determine with Project Engineer concurrence how historical drawings not in CAD format will be revised.
7. **IF** the drawing was CAD-produced, **THEN**
 - a. Check the CAD drawing out from the Vault folder.
 - b. Create a new subfolder in Vault for the new DCN/EI in accordance with Vault Desktop Instructions and use the new folder for the working files.
 - c. Ensure that all previous revision sign-off blocks have the initials typed in, including the date, whenever possible and include assigned initials for current revision if available.

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- | | |
|---|--|
| Preparer | <p>8. Search Vault to see if there are any existing DCNs/EIs/EEs tied to the drawing being revised.</p> <p>9. Incorporate any design changes into the current revision that were indicated on the DCNs/EIs/EEs and were not previously addressed.</p> <p>10. Mark “VOID” or “SUPERSEDED,” respectively, clearly and boldly on the face of cancelled or superseded drawings, sign off and reissue them with a revision notation in the title block (e.g., “THIS DRAWING IS VOID,” “THIS DRAWING IS SUPERSEDED BY DWG NO. xyz.”).</p> |
| Preparer/ Checker/
Reviewer /Project
Engineer | <p>11. Review, approve, and issue revisions to drawings following the process steps outlined in Section B, UCOR Developed Design Drawings.</p> <ul style="list-style-type: none"> • IF the revision potentially affects the Safety Basis OR involves a safety system, THEN
ensure that Nuclear Safety is included as a Reviewer of revised design drawings so that impacts to/from existing safety basis documents can be considered during the review cycle and prior to finalizing the drawing. • IF the revision impacts a key element of the design that was previously reviewed as part of an off-project design review, THEN
perform an additional off-project design review, as required. <p>12. IF a revision requires signing and sealing by a registered Professional Engineer and cannot be sealed, signed, and dated by the original registered Professional Engineer, THEN
ensure that it is sealed, signed, and dated by another Registered Professional Engineer in responsible charge of the revision.</p> <p>13. Verify that the final version of CAD files and the issued .pdf drawing revision are in the Vault folder. Mark the state of the .pdf drawing revision in the Vault software program as “Issued” and automatic notification will be sent to the UCOR DMC.</p> <p>14. Prior to distribution of the issued drawing revision, ensure the document has been reviewed by the CICO or other acceptable reviewers for public release or for limited distribution</p> |
| UCOR DMC | <p>15. Copy the .pdf issued drawing revision from Vault and place in the UCOR DMC as the Record Copy.</p> <p>16. Maintain all signed/issued design drawings revisions, and update the drawing log to indicate issued status of drawing revisions.</p> |

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E. Subcontractor Developed Design Drawings Revisions

Project Engineer or Designee

1. Review, approve, and issue revisions to drawings following the process steps outlined in Sections C and D.

F. Redrawn Vendor Drawings

NOTE: UCOR personnel may redraw or reformat vendor supplied drawings that require modification as required, but if UCOR changes substantive details (details other than cosmetic or title block details), then UCOR assumes responsibility for the portion of the design that is redrawn.

Preparer

1. Redraw or reformat vendor supplied drawings that require modification for UCOR use, as required. Typical modifications may include adding identification numbers and symbols.
2. **IF** the “redrawn” portion of the vendor’s drawing requires sealing by a Registered Professional Engineer, **THEN**
 - Identify and exempt from the Professional Engineer seal, those sections derived from supplier information that have not changed, and seal the changed portions as required.
 - Identify the area of exemption by clouding or otherwise designating the affected area and labeling the area as “EXEMPT from P.E. Seal” to ensure the vendor retains design responsibility.

Preparer/Checker/Reviewer/ Project Engineer

3. Prepare, review, approve, and issue the redrawn Vendor drawing as a UCOR drawing following the process steps outlined in Section B and D.

G. Other Types of Drawings

NOTE: UCOR maintains an electronic ETPP Site Base Map that is updated on a regular basis (e.g., weekly, if not daily) showing cultural features (e.g., building locations, building numbers, road configurations and names) that reflects the changing site conditions at the ETPP site.

The ETPP Site Base Map is not a drawing in itself, but is used as a reference file when creating new ETPP site drawings and drawing revisions. The latest available ETPP Site Base Map is referenced into many new drawings and drawing revisions.

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Preparer

1. Use of ETTP Site Base Map

WHEN creating new site drawings or annual updates to site drawings for ETTP regulatory governed permits, the currently available ETTP Site Base Map shall be used as a reference file. Consider including the following note on the drawing:

- For New Site drawing for Permits:
 “This drawing was issued on the date noted for regulatory permit reporting only. This drawing, or portions of it, was originated for the specific purpose of obtaining and maintaining a regulatory permit. Its use other than for its intended purpose shall be the sole responsibility of the user.”
- For Annual Updates for Site drawings for Permits:
 “Approval is only for the changes to this drawing by this revision, other portions of this drawing may not be ‘as-built.’”

NOTE 1: Existing electronic drawings that are in a CAD format, that are unacceptable per Attachment B, may require conversion to an acceptable format as part of the updating process.

NOTE 2: If manual drawings are chosen for conversion to CAD drawings, they will receive new project drawing numbers with a cross-reference to the old document number on the title block.

Preparer/Project Engineer

2. Creating new CAD drawings from historic manual drawings or older CAD format.

On a case-by-case basis, the Preparer in conjunction with the Project Engineer shall determine the extent of formatting and updating needed to meet an acceptable standard for CAD formatting and symbology for the new drawing.

Checker/Reviewers/
Project Engineer

3. Review and approve Other Types of Drawings following the same process steps outlined in Sections B and D.

Project Engineer/
Chief Engineer

4. Drawings developed for other DOE Contractors.

UCOR may be requested to develop a drawing or drawing revision for ORNL or Y-12 following their respective guidelines for CAD work and additional required signature approvals (e.g., Discipline Manager/Facility Engineering Manager). In this case, the Project Engineer shall work with the Chief Engineer to get agreement on the specific process to be followed for drawing development and signature approvals in lieu of the steps outlined in this procedure.

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RECORDS

Records generated by this procedure and listed below shall be dispositioned in accordance with PROC-OS-1001, *Records Management, Including Document Control*.

Documents to be maintained as records include the following:

- Issued approved engineering drawings (issued as Revision 0)
- Revised engineering drawings (issued as Rev. 1, Rev. 2 , etc. and above)
- Redrawn vendor drawings
- Engineering drawings prepared by Subcontractors
- Form-141, Document Review Request, Form-1174, Comment Resolution Form, or Project Engineer approved equivalent comment resolution method (Drawing comments and resolution ONLY required to be maintained as Records if drawings include credited Systems, Structures or Components.)

SOURCE DOCUMENTS

- ANSI/ISA S5.1, Instrumentation Symbols and Identification
- IEC-60617, Graphical symbols for use in electro-technical diagrams
- IEEE 315/315A, Graphic Symbols for Electrical and Electronics Diagrams
- ISO 14617-6, Graphical Symbols for Diagrams
- ISO 5807:1985, Information Processing – Documentation
- UCOR-4122, *Configuration Management Program Description for URS | CH2M Oak Ridge LLC, Oak Ridge, Tennessee*
- UCOR-4141, *URS | CH2M Oak Ridge LLC Quality Assurance Program Plan, Oak Ridge, Tennessee*
- PPD-DE-1035, *Engineering Program Description*
- PROC-DE-1008, *Design Change Notices (DCNs), Engineering Instructions (EIs) and Equivalency Evaluations (EEs)*
- PROC-DE-0704, *Project Calculations*
- ES-6.6-15, CNS Engineering Standard, CAD Drafting Requirements
- MPO-DM-330, MPO Design Management CAD Manual (ORNL)
- National Electrical Manufacturers Association (NEMA) Standards Publication ICS
- STD-342-300, Los Alamos National Laboratory CAD Standards Manual
- WPS CS-1004-5, UCOR AWS D1.1 Prequalified Welding Procedure

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Attachment A
DEFINITIONS/ACRONYMS
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Base Map – A special type of a site drawing. This is a drawing of a site feature that because of design and intended use is scheduled to change over time (e.g., landfill where the site changes as materials are placed in the landfill). Each new version becomes the base for the next drawing update/revision, which may be done annually.

CAD – Computer Aided Design

Check Prints – Copies of original drawings in a form (sometimes a PDF form) that allows for checker or reviewer review.

CICO – Classification and Information Control Office

Committed Calculations – Calculations which form the basis of drawings, specifications, or other design documents which are used to procure, construct, or operate a facility, or provide the design basis for change to an existing facility. These calculations may be revised due to changes in design criteria, methods, or for other reasons.

DCN – Design Change Notice

Design Drawing – Graphically depicted engineering documents that include detailed and precise technical information for the purpose of design, fabrication, construction, and/or demolition, and are created and revised following sections of this procedure.

DMC – Document Management Center

DNRS – Document Numbering Request System

EI – Engineering Instructions

Engineering Sketch – A drawing category that presents design concepts, but is not a design drawing. A sketch is reviewed and approved automatically when the entire document is reviewed in accordance with the document review process. No separate review is necessary for a sketch. Sketches shall not be used for fabrication or construction purposes. Sketch numbers may be unique within a document, but are not controlled and are not assigned from the UCOR Document Numbering Request System (DNRS).

Figure – A drawing category that consists of illustrations, graphs, charts, pictures, tables, slides presentations, and graphic representations of pictures or maps used for illustrations or demonstration purposes. A figure is reviewed and approved automatically when the entire document is reviewed in accordance with the document review process. No separate review is necessary for a figure. Figures shall not be used for fabrication or construction purposes. Figure numbers may be unique within a document, but are not controlled.

Final Design Drawing – A subcategory of design drawings that are ready for construction or procurement.

Non-Staff Augmentation – Subcontractor engineering personnel that prepare drawings/sketches under direct supervision of the Subcontractor’s Engineering Management.

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Attachment A
DEFINITIONS/ACRONYMS
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Preliminary Design Drawing – A subcategory of project drawings that are not ready for construction or procurement. Preliminary Design Drawings are “Issued for Internal Coordination,” “Issued for Information Only,” and “Issued for Design Review” (e.g., 30%, 60%, or 90% Design Review). When a preliminary design drawing has completed the review cycle and is ready to issue for use, it will be considered a final design drawing at Revision 0, and all alphabetical revision data shall be removed from the revision block.

Site Drawing – A drawing category that consists of existing drawings of facilities and areas that are managed by UCOR. These drawings may not be current and often can be used only for general information. In general, such drawings are only to be updated as necessary for protecting workers, property, and the environment, and for making necessary changes. The Project Engineer, with the Area Project Manager’s concurrence, shall determine which site drawings are to be converted to UCOR design drawings to support ongoing activities, and to develop a schedule to provide those updates.

Staff Augmentation – Subcontractor engineering personnel that prepare drawings/sketches under direct supervision of UCOR Engineering Management.

UCD – Unreviewed Change Determination

UCOR – URS | CH2M Oak Ridge LLC

USQD – Unreviewed Safety Question Determination

Vault – An Engineering software program that manages and controls issued drawings as well as other engineering documents. The Vault software allows the user to check-out a drawing from the storage location, make changes, review changes, approve changes, and issue the drawing.

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Attachment B
DRAWING FORMAT AND STANDARDS GUIDELINES
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- A. Drawing Software Standard** – The UCOR CAD software standards are MicroStation and AutoCAD. Choice of drafting software shall be made on a case-by-case basis with concurrence by the Project Engineer.
- B. Standard Drawing Sizes**
1. Standard drawing sizes are shown on Attachment C.
 2. For original, signed, and stamped drawings, the preferred size is either D (22 in. × 34 in.) or E (34 in. × 44 in.) sheets.
 3. The use of “C” size (17 in. × 22 in.) or B (11 in. × 17 in.) is acceptable for working files and drafts of drawings provided for review prior to issue for use.
 4. The Project Engineer can determine if a drawing size other than D or E is preferred for a specific drawing task.
- C. Drawing Title Block Format** – Use a uniform drawing title block format as shown in Attachment E.
- D. Notes, Abbreviations, and Symbols**
1. Ensure that the general drawing arrangement conforms to Attachment D, except for fabrication drawings requiring a parts list or Bill of Material (BOM).
 2. If a drawing requires a parts list or BOM, then place the table in the upper right hand corner of the drawing, if possible.
 3. Refer to drawing G1E-000000-E959, *UCOR Drafting Legend & Symbols*, for general guidance regarding symbology and drawing legend.
 4. If a series of related drawings covers a single subject, the first sheet in the series shall be a lead sheet containing the general notes, symbols and legends. Include the list of associated list of drawings on the first sheet, if possible.
 5. Each sheet shall have a separate and unique drawing number. Do not use sheet 1 of X in place of drawing numbers
- E. General Drafting Practices**
1. Ensure that all letters are in upper case “Arial” font unless other standard conventions apply (e.g., abbreviation, units) with a minimum text height that is legible on the border size used (recommend not less than 1/10 inch, plotted).
 2. End all dimensional lines with an arrowhead. The preferred convention is using filled arrows. All terminators on the drawing shall be consistent and of the same type and size.
 3. Show all dimensions in English (foot-inch) or (decimal) units, unless otherwise specified.

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Attachment B
DRAWING FORMAT AND STANDARDS GUIDELINES
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4. Ensure that leader lines are straight and angled. Draw leader lines from the beginning or end of a note, and ensure that they are short and cross as few lines as practicable.
5. Guidelines for sections within drawings:
 - Identify sections in alphabetical sequence.
 - Identify details of sections in numerical sequence.
 - Cut sections shall show essential details to the best advantage.
 - Arrange section and details clearly to show work in relation to a plan view, column line, or coordinate grid orientation.
 - Ensure that section cuts, detail marks, north arrow, and all general cells are located in the cell libraries.
6. Orient drawings with north at the top of the sheet or to the left of the sheet if top orientation is impractical.
7. **IF** the drawing is a plan and profile sheet, **THEN** ensure stationing in profile matches stationing in plan.
8. Place revision triangles at the location within the drawing that is receiving the revision status. Size this triangle to be approximately 3/8 in., plotted, and place the appropriate number designation within. Surround the area of the revision with a cloud, or otherwise designate the revision area per direction from Project Engineer.
9. When a drawing is revised, remove the existing cloud and revision triangle from the previous revision and designate the new revision area with a cloud and include revision triangles at new revised areas with next sequence number.
10. As an example, the following conventional scales are consistent with the sheet size unless otherwise directed by the person responsible for the technical content of the drawing: English: 1/8" = 1'-0", 1/4" = 1'-0", 1" = 10', 1" = 20', etc. It is preferable to show as much details as is practical.
11. When issuing new Piping and Instrumentation Diagrams and Process Flow Diagrams, ANSI/ISA S5.1 and ISO 14617-6-compliant symbols shall be used. When issuing a revision to an existing drawing, upgrading the entire drawing to the standard is not required but should be considered at the discretion of the Project Engineer.
12. When issuing new Mechanical and piping drawings involving welds, welding symbols shown in WPS CS-1004-5, UCOR AWS D1.1, *Prequalified Welding Procedure*, shall be used. When issuing a revision to an existing drawing, upgrading the drawing to the standard is not required but should be considered at the discretion of the Project Engineer.

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13. When issuing new Electrical schematics, National Electrical Manufacturers Association (NEMA) Standards Publication ICS 19-2002, Diagrams, Device Designations, and Symbols for Industrial Control and Systems, *IEEE 315/315A Graphic Symbols for Electrical and Electronics Diagrams*, and *IEC-60617 Graphical symbols for use in electro-technical diagrams*, shall be used. When issuing a revision to an existing drawing, upgrading the drawing to the standard is not required but should be considered at the discretion of the Project Engineer.
14. In addition to accurate as-built P&ID/PFD schematics, true three dimensional isometric drawings are generally appropriate for operating process systems that represent Active Safety Systems and Design Features of Category 2 and 3 nuclear facilities. Three dimensional drawings have been proven to eliminate errors overlooked in plan/profile 2-D drawings.
15. When issuing new Logic schematics and diagrams for custom applications designated as Safety Software, ISO 5807:1985, *Information Processing, Documentation*, symbols and conventions for data, program and system flowcharts, program network charts, and system resources charts shall be used. When issuing a revision to an existing drawing, upgrading the drawing to the standard is not required but should be considered at the discretion of the Project Engineer.
16. As additional CAD resources, there are standards and symbols available from ORNL/MPO Design Management CAD Manual (MPO-DM-330), CNS Engineering Standard CAD Drafting Requirements (ES-6.6-15) and the *Los Alamos National Laboratory CAD Standards Manual* (STD-342-300) that can be considered for use if information is not available in other sources.

F. Record Copies, Native Files, CAD Archival, CAD Retrieval, and Incorporation of DCNs/EIs

1. The official record copy of issued drawings (normally signed .pdfs) are located in the UCOR DMC. Native file drawings (MicroStation and AutoCAD files) which have been issued revision 0 and higher are stored in Vault.
2. Request copies of official record drawings from the UCOR DMC. (NOTE: Older/historical drawing may not be in the UCOR DMC. These older/historical drawings may reside in UCOR record archives as microfilm or manual hard copy drawing files only. Remember to check UCOR record archives when searching for older issued drawings.)
3. Follow Vault Desktop Instructions for creating, revising, and issuing new drawings and drawing revisions.
4. DCNs/EIs shall be incorporated into the design drawings in a timely manner. In accordance with PROC-DE-1008, drawings marked as a “priority” in the DCN’s Affected Documents section shall be updated and issued before closure of the DCN.

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G. Drawing Issuance

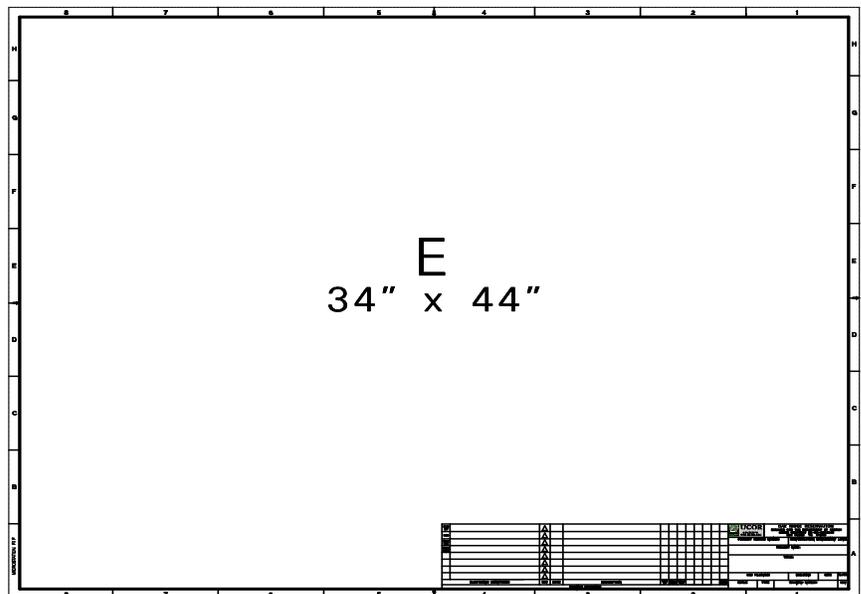
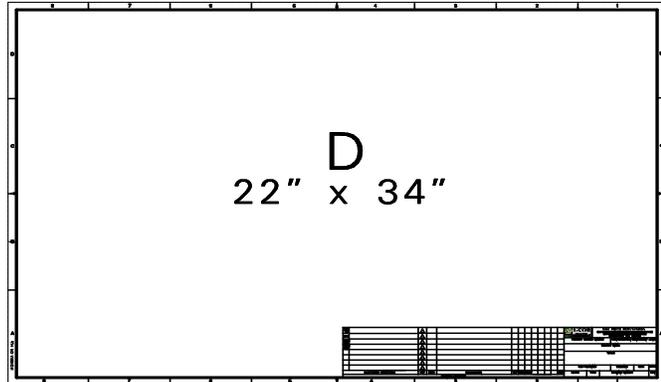
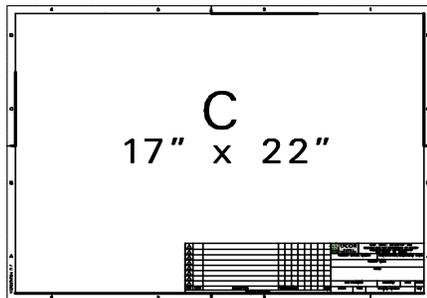
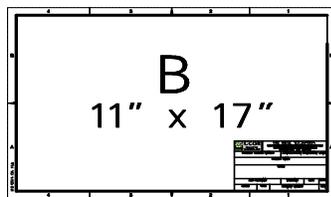
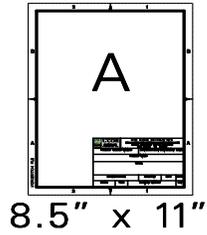
1. Ensure drawing has description in the revision box of the title block defining the reason for the drawing whether new or revised and include the DCN or EI number as appropriate.
2. Ensure appropriate preparer, checker, and approver signatures are on the drawing prior to issue.
3. Remove any PRELIMINARY type electronic stamps from drawing.
4. Ensure the appropriate revision information is in the title block.
5. Produce a .pdf version of the drawing for RECORD COPY (RC) and submit to required distribution, Vault, and UCOR DMC.
6. Ensure the document has been reviewed by the CICO or other acceptable reviewers for public release or for limited distribution.

H. Base Map Creation

1. Base maps are electronic files available on the CAD system that are created using layers in generating new drawings containing the information in the base file. The base file may contain a variety of inter-disciplinary information such as, but not limited to: surface features (topographic plans), monitoring locations, building floor plans, equipment layout, utility plans, and block plans.)
2. Create base maps as required for the project. Place base maps in a designated Vault directory.

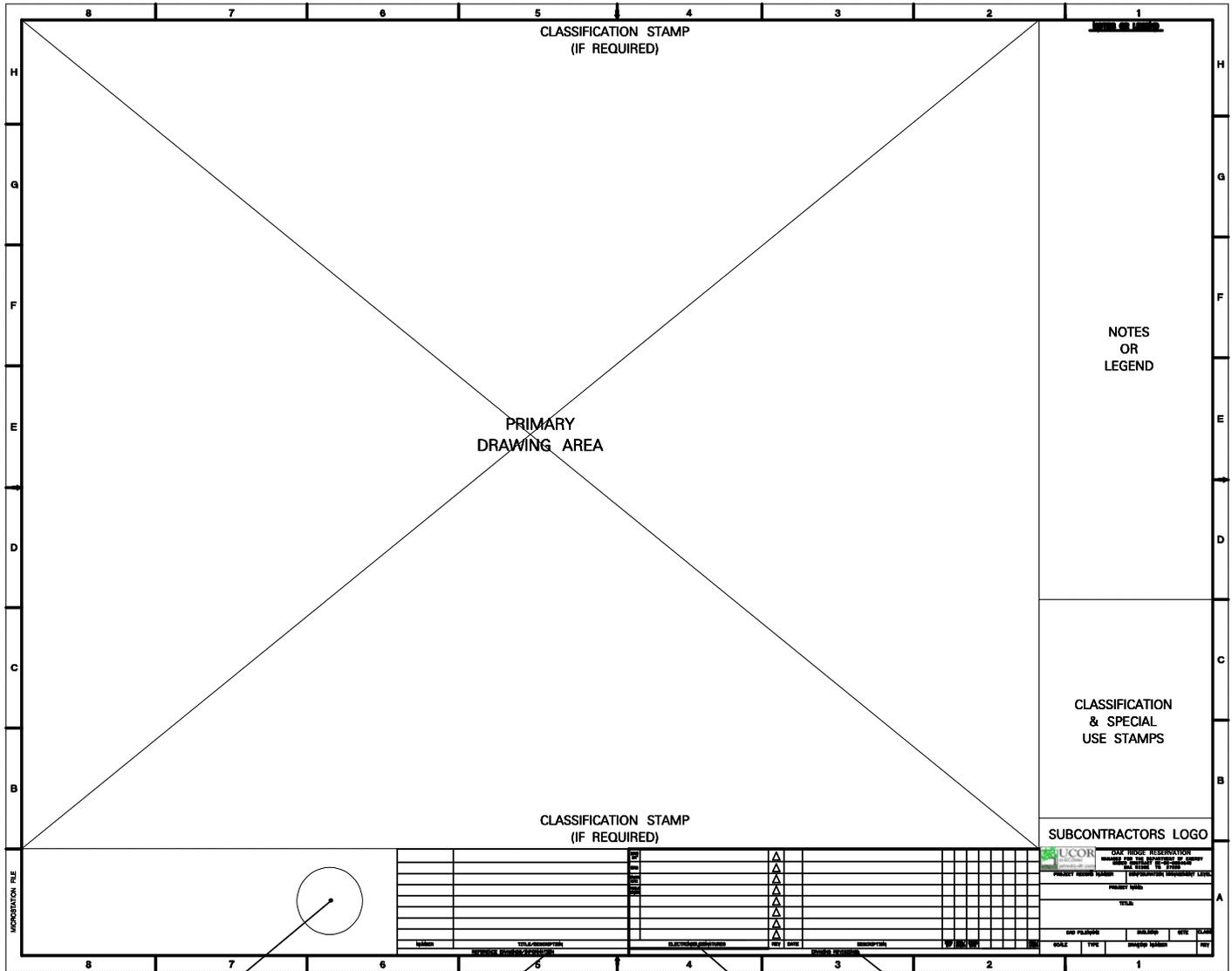
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Attachment C
STANDARD DRAWING SHEET SIZES
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**Attachment D
EXAMPLE DRAWING LAYOUT
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P.E. STAMP (IF REQUIRED) REFERENCE DRAWINGS ELECTRONIC SIGNATURES REVISIONS

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Attachment E
EXAMPLE ENGINEERING STANDARD DRAWING TITLE BLOCK FORMAT
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- Block 1:** Project Record Number: This number is provided by UT-B or ETPP for certain historical drawings. If no number is provided by UT-B or ETPP, then insert N/A in this block.
- Block 2:** Project Name: The Project Name inserted here is defined by the subject of the drawing. In many cases the project name is defined by the charge code. In other cases, the project name is a short description given to the UCOR Project, such as “MSRE RGRS design project”, or “WDO building redesign.”
- Block 3:** Drawing Title: Three line spaces are allotted for the title of the drawing. The title should include key words about the Subject of the drawing, allowing for logical search of the drawing in a search program.
- Block 4:** CAD File Name: The CAD file name should be inserted in this block. The full file name should have an extension associated with it. For example: I3E020794A131.dwg or I3E020794A131.dgn.
- Block 5:** Scale: The physical scale of the drawing should be contained in this block. Example: 1” : 10’. The words “AS SHOWN” shall be placed here when more than one scale appears on the sheet. The words “NOT TO SCALE” shall be used when a scale is not applicable (e.g. flow diagram, schematics).
- Block 6:** Type: The Type identifies the status of the drawing. Drawing types are as follows:
- | | |
|----|------------------------|
| AB | AS-BUILT |
| AC | AS CONSTRUCTED |
| AR | AS-BUILT REQUIRED |
| ID | INTERIM DESIGN DRAWING |
| IN | INFORMATION |
- Block 7:** Drawing Number: The drawing number, as issued by UCOR DMC, should be entered into this block. All design drawings shall have a preassigned drawing number that complies with the adopted convention. Drawing numbers are formatted as follows:
- M 1 E 702500 A 001
- M - (Mechanical Equipment) represents the drawing discipline (Mechanical in this example). Examples of other discipline types include: A – Architectural, C – Civil, E – Electrical, I - Instrumentation, J – Process, P– Piping, S – Structural.
- 1 - represents ETPP. Examples of other Sites include: 2 – Y-12, 3 – ORNL, and 6 – Multi-site (Special Projects).
- E - represents drawing size. Examples of drawing sizes include A, B, C, D, and E.
- 702500 – represents the EJN number (Building K-25 at ETPP Area or Building Designator Number) where bbbb is building number. Examples of other Sites include 4bbbb0 – ORO Work, 7bbbb0 - ETPP Work, 02bbbb – ORNL Work, and 9bbbb0 – Y-12 Work. For building with only 2 digits (i.e., K-25), the format will be bbbb building number will be 0250. For building with only 3 digits (i.e., K-711), the format will be bbbb building number will be 0711.

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Attachment E
EXAMPLE ENGINEERING STANDARD DRAWING TITLE BLOCK FORMAT
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In order to obtain a new drawing number from UCOR DMC, the following information needs to be communicated to UCOR DMC through the electronic Document Number Request (DNR) system:

- Date (of drawing reservation)
- Site (K, X, Y, ORO)
- Facility number or Area Name/Number
- Classification
- Drawing Title
- Discipline (Architectural, Structural, Electrical, etc.)
- Drawing size (A – E)
- Document Type (Design drawing, Master Drawing, Sketch , etc.)
- Requester/Reserver name, phone, company, email address and user ID

Block 8: Drawing Revision Number: The revision number as issued by UCOR DMC should be entered into this block.

Preliminary Drawings: Letter revision designations, i.e. A, B, C, etc., should be used on all preliminary drawings prior to issue, including drawings routed for checking and reviews.

Initial Issue: The initial issue of a drawing will be revision “0”.

Drawing Revisions: Drawings being revised shall be designated with a numerical revision. Once the drawing has been checked and approved for the next issue, the next number shall be placed in Block 8 of the revision block.

Block 9: Building Number: The building number most appropriate to the subject of the drawing should be contained in this block. If the drawing pertains to information outside the perimeter of the facility, then make a determination of whether the facility number applies or if an area designation should be used.

Block 10: Site: Identify the site in which the drawing pertains. Example: ORNL, ETTP, Y-12.

Block 11: Class: The Security Classification of the drawing should be entered into this block. The project seed file configures this field as “U”. Other classifications which may be applied are as follows:

- | | |
|---|--|
| B | Business Sensitive |
| C | Confidential |
| N | UCNI (Unclassified Controlled Nuclear Information) |
| O | Official Use Only (OUO) |
| R | Restricted |
| S | Secret |
| U | Unclassified |

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Attachment E
EXAMPLE ENGINEERING STANDARD DRAWING TITLE BLOCK FORMAT
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- Block 12:** Configuration Management Level: The highest Configuration Management (CM) level of the items being depicted, should be captured in this Block. There are three CM Levels as described in UCOR-4122. CM Level 1 is the highest level, with CM Level 2 as the next highest, and CM Level 3 as the lowest level. If several items of different CM Levels are depicted, then record the highest level from amongst the items. UCOR-4781 and UCOR-4104 list the CM Level 1 and 2 items for UCOR.
- Block 13:** Project Engineers' Initials: The Drawing Preparer should type the Project Engineer's initials in this block before digital signatures are completed.
- Block 14:** Other Reviewer's Initials: The Drawing Preparer should type the Reviewers' initials in this block before the digital signatures are completed. The reviewers in this block are reviewers other than the Checker or Project Engineer.
- Block 15:** Drawn By/Originating Engineer/Checker Engineer: The Drawing Preparer should type the Preparer's initials, the Originating Engineer's initials, and the Checker's initials in their respective blocks before the digital signatures are completed.
- Block 16:** Description: The DCN or EI number, should be entered into this block. If the DCN or EI number is not available or not appropriate, then insert a short description of the subject of the drawing.
- Block 17:** Date of Revision: The Drawing Preparer shall enter the date of approval using the following format: MM/DD/YY, which should be the same date as the Project Engineers' signing date.
- Block 18:** Revision number: This block contains the revision history of the drawing up to the current revision. The appropriate revision numbers should be inserted in the appropriate revision triangles.
- Block 19:** Signatures Block: Digital signatures are preferred for this block, and shall appear within the pdf version of the drawing only. The shown digital signatures apply only to the most recent revision. (The pdf version of the drawing becomes the record copy and is on file with UCOR DMC.)
- Block 20:** Additional Signatures: If the drawing was reviewed by other personnel, other than the Preparer, the Originating Engineer, the Checker or the Project Engineer, and the Project Engineer determines that their signatures are required for the drawing, then then those additional signatures should be recorded in this block.
- Block 21:** Required signatures: The Preparer's, the Originating Engineer's, the Checker's, and the Project Engineer's signatures are required in this block. Electronic/Digital signatures are preferred on the pdf copy of the drawing and shall be used unless determined by the Project Engineer that hard-copy "inked" signatures are acceptable.

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Attachment F
TYPICAL GENERAL CELL AND SYMBOLOGY FORMAT
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