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## Standard

# Drawing Requirements Standard


The INL is a U.S. Department of Energy National Laboratory
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**Idaho National Laboratory**

| **DRAWING REQUIREMENTS STANDARD** | Identifier: STD-10011<br>Revision: 1<br>Effective Date: 06/29/07 Page: 1 of **164** |
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| Engineering, Design, and Drafting | Standard | **Use Type 3** | DAR Number: 516638 |
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Manual: Applied Engineering Management System

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# 1. PURPOSE

This standard provides specific information and reference data for standardization of drafting practices and uniform interpretation of all drawings produced by the Idaho National Laboratory (INL). Specifically it establishes minimum requirements, provides guidance, and defines responsibilities for development, review and approval, revision, maintenance, and control of INL drawings per LWP-1201, "Document Management."

This standard is based on established INL procedures and interpretation of industry and government drafting practices. Many nationally-recognized standards are cited as references in this standard. These widely-available standards provide the supplemental information essential for producing the many varieties of drawings originated by the INL.

All personnel involved in the generation of drawings are to familiarize themselves with the contents of this standard and its referenced documents. Drafting examples and drawings shown in this standard are complete only to the extent necessary to illustrate a particular drafting practice. Actual drawings shall conform to applicable requirements explained either in the text or in referenced documents. A departure from the thus-established practices requires concurrence from the Drafting Supervisor.

The INL Electronic Document Management System (EDMS) documents all drawing index code information. Questions, comments, additions, or corrections to the Index Code Numbering System should be directed to the Drafting Supervisor.

# 2. SCOPE

This standard covers the preparation, review, and approval of engineering drawings; periodic and pre-use verification of drawing accuracy; and continued maintenance of those drawings. This standard also addresses identifying and controlling essential drawings and master facility drawings (MFD). The engineering drawing categories covered by this standard include:

A. General engineering drawing

B. Architectural engineering (AE) drawings

C. Non-company drawings (subcontractor- and vendor-supplied drawings)

D. Interim drawings.

This standard also covers development and use of engineering sketches (reference Subsection 4.11).

Additional detail is provided for applying instructions contained in LWP-1201 and other EDMS-Controlled Documents, as those instructions pertain to drawings.

Drawing field changes are made using LWP-10400, "Design Control."

This standard applies to all personnel who prepare, review, or approve drawings that are to be entered into the company EDMS or other company-approved document control system. This standard does **not** apply to those work-for-others customers who have requested specific drawing formats or drawing development and control processes for use on those projects.

# 3. RESPONSIBILITIES/PREREQUISITES

## 3.1 Responsibilities

**NOTE:** *The performer designations called out in this procedure are based on function rather than organization. As such, performer responsibilities may be assigned to individuals with titles other than those specified below.*

| Performer | Responsibilities |
|---|---|
| Requester | Initiates new and revised drawings. |
| Drafter | Prepares and revise drawings. |
| System Engineer/Complex Engineer | Coordinates drawing development and revision, including:<br>A. Reviewing drawings to determine that the technical information is accurately depicted<br>B. Resolving review comments<br>C. Assigning engineering drawing designations (essential, master facility, and general)<br>D. *As-building* (see def.) drawings<br>E. Developing engineering sketches (see Subsection 4.11). |
| Drafting Checker | Independently reviews engineering drawings and authorizes their release. |
| Engineering Work Organization Manager | Determines extent of technical check and assign technical checker. |
| Technical Checker | Reviews drawings for technical accuracy. |
| Design Engineer | Resolves technical checker's comments, particularly those that have resulted in a design change. |
| Program, Project, or Facility Manager | Approves new and revised drawings. |
| *Registered Professional Engineer* (RPE; see def.) | Provides RPE signature and seal approval as required on drawings. |

| Performer | Responsibilities |
|---|---|
| Facility/Complex Manager | Approves engineering drawing designations.<br><br>Reviews facility drawing lists.<br><br>(See program, project, or facility manager responsibilities.) |
| Configuration Management (CM) Subject Matter Expert (SME) | Verifies engineering drawing designations and enters designations into EDMS. |

### 3.2 Prerequisites

3.2.1 Program, project, or facility management has defined the minimum review, approval, signature, and distribution requirements for their drawings.

3.2.2 Program, project, or facility management has defined any facility-specific criteria for selecting and establishing a list of essential and master facility drawing.

## 4. INSTRUCTIONS

### 4.1 Preparing New or Revised Drawings

4.1.1 Requester: Initiate a request for a new or revised drawing.

4.1.1.1 Enter Electronic Document and Content Management (eDOCs) system (LWP-1250) and proceed through process, obtaining authorization from the structure, system, or component (SSC) primary owner to initiate preparation to "create" a new drawing or "revise" an existing drawing and obtain an *Electronic Change Request* (eCR see def) number.

4.1.1.2 Determine the type of drawing that is needed (AE or ED) with consultation and concurrence of the drafting supervisor.

4.1.1.3 Furnish the drafting organization with drawing preparation guidance through:

A. Preliminary sketches

B. Layouts

C. Information to be included in the drawing notes (such as inspection and test criteria applicable to the items depicted on the drawing)

D. Other information necessary to prepare the drawing (such as project title and assembly titles).

4.1.1.4 If the drawing requires the seal of a *registered professional engineer* (RPE; see def), request that an electronic reproduction of the engineer's seal be placed on the drawing or that space be left where the engineer's manual seal can be placed (reference LWP-10100, "Code Definitions, Interpretation, and Variance Professional Engineers").

4.1.2 Drafter: Drawing Preparation

4.1.2.1 Prepare the drawing in accordance with the information provided by the requester.

4.1.2.2 All drawings shall include a stamp indicating a Not Approved status until the drawing is released to EDMS. The only Approved for Construction stamped drawings shall come from EDMS

4.1.2.3 Follow the formatting instructions contained in Section 6, Drawing Requirements Standard, and any program-, project-, or facility-specific requirements.

4.1.3 System Engineer: Review the drawing to confirm that the technical information is accurately depicted.

4.1.4 System Engineer: If the drawing is a new engineering drawing, assign a drawing designation of essential drawing, master facility drawing, or general drawing per Subsection 4.9.

## 4.2 Drafting Check of New and Revised Drawings

4.2.1 Drafting Checker: Provide an independent review of the drawing.

4.2.1.1 Check the drawing per Section 11.

4.2.1.2 Resolve checking-related design or drafting issues with the requester, system engineer, and drafter.

## 4.3 Technical Checking New and Revised Drawings

**NOTE:** *Technical checking is performed on design-related drawings as part of the design control process directed in LWP-10400, "Design Control," or in MCP-3630, "I&C Computer System Management."*

4.3.1 Engineering Work Organization Manager: Determine the extent of technical check and select a competent technical checker from the appropriate discipline. Base extent of review and selection of technical checker on:

A. Design safety function

B. Design complexity

C. Degree of standardization

D. State of the art

E. Similarity of previously approved designs

F. Requirements of the affected program, project, or facility.

**NOTE:** *Normally, technical checking is limited to one technical checker, who may solicit input from other disciplines as needed.*

4.3.2 Engineering Work Organization Manager: Select a technical checker who:

A. Is not involved in designing the engineered item depicted in the drawing(s)

B. Has demonstrated technical expertise relevant to the topic being reviewed or technical experience on similar work sufficient to assess the technical adequacy of the drawing and compliance with design inputs.

4.3.3 Engineering Work Organization Manager: If the drawing(s) is for a spent nuclear fuel structure, system or component (SSC), ensure that:

A. Documentation exists to verify the technical checker's education and experience are commensurate with scope, complexity, and nature of the work

B. Supervisors of personnel directly involved in developing the design are not performing the technical check.

4.3.4 Engineering Work Organization Manager: Provide the technical checker with:

A. Design input documents, such as technical and functional requirements (T&FRs)

B. Drawing(s) to be reviewed

C. Sufficient pertinent information for the reviewer to perform the review (such as Form 431.52, "Design Review Checklist").

4.3.5 Technical Checker: Review the drawing(s) and associated documents to determine if:

A. Drawing(s) meets design input requirements

B. Design inputs were correctly selected and incorporated into the drawing(s)

C. Design output is reasonable compared to design inputs

D. Interfaces with related SSCs and drawings have been considered

E. Suitable materials, parts, processes, and inspection and testing criteria have been specified.

**NOTE:** *Review assistance may be solicited from other disciplines, and Form 431.400G, "Design Verification Review Checklist", may be used as needed.*

4.3.6 Technical Checker: Provide the design engineer with comments on a marked print of the drawing(s) or on Form 412.13, "DMCS Review Comments and Resolutions."

4.3.7 Design Engineer: Resolve technical checker's comments, particularly those that have resulted in a design change.

4.3.8 Design Engineer: Provide the drafter with a marked print or other clear identification of changes required as a result of the drawing review.

4.3.9 Drafter: Incorporate the requested changes, working with the design engineer to ensure accurate interpretation of the change information.

4.3.10 Drafting Checker: Perform a final check of the drawing to ensure that any changes made subsequent to the drafting check are consistent with the direction contained in Step 4.2.1.

## 4.4 Approving New and Revised Drawings

4.4.1 Requester: Complete appropriate sections of the eCR.

4.4.1.1 Document the technical checker and obtain their signature approval in Reviewers Section of the eCR.

4.4.2 Program, Project, or Facility Manager: Sign the eCR (in Reviewer Section) to signify program, project, or facility acceptance.

4.4.3 Requester: Deliver the signed eCR to the drafting organization.

4.4.4 Drafter: Complete the drawing title block or revision history block as applicable.

4.4.5 Drafter: Prepare a hardcopy plot of the final drawing for drawings requiring a PE seal.

4.4.6 RPE: If the drawing requires the seal of an RPE, sign the PE seal placed electronically on the drawing or place and sign the manual seal (reference Step 4.1.1.4).

4.4.7 Drafter: If the drawing contains the seal of an RPE, revise the electronic file of the drawing by adding the following adjacent to the seal:

Revision: _____

Original Signed by: _____

Date Original Signed: _____

Seal Number: _____

Original Stored at: _____

4.4.8 Drafter: Provide the eCR and an 11 × 17 print, full size pdf file and the electronic drawing file of the final drawing to the drafting checker for release authorization (reference Subsection 4.5).

## 4.5 Authorizing Release of New and Revised Drawings

4.5.1 Drafting Checker: Sign and date the eCR in the Drawing Checker Section to indicate the drawing is authorized for release.

4.5.2 Drafting Checker: Deliver the signed eCR, final plot of the drawing, an electronic file copy of the final drawing, and the AE specification (if applicable) to the appropriate *Document Records Service Center (DRSC)*

*location* (see def.) for release per MCP-9395, "Releasing and Distributing DMCS Controlled Documents."

**NOTE:** *Direct drawing changes are added directly to an original drawing rather than through the use of an interim drawing.*

## 4.6 Revising Drawings by Direct Drawing Change

4.6.1 Requester: Process eCR form and obtain system or complex engineer authorization to initiate the drawing change as a direct drawing change.

4.6.2 Requester: Provide information to the drafting organization through preliminary sketches, layouts, marked prints, or other forms of communication that will facilitate preparation of the drawing revision.

4.6.3 Drafter: Revise the drawing.

4.6.3.1 Obtain access to the drawing from the appropriate EDMS location.

4.6.3.2 Revise the drawing in accordance with the information provided by the requester.

4.6.4 Check, review, approve, and authorize the revised drawing for release per Subsections 4.2 through 4.5.

**NOTE:** *When making modifications to existing systems documented on essential drawings, interim drawings shall be used to document the change; for master facility drawings, interim or direct drawing changes may be used (see Subsections 5.1.3 and 5.1.4). The SSC may be operated using the interim drawing with the related essential or master facility drawing while the interim drawing is being incorporated into its affected drawing.*

## 4.7 Revising Drawings Using Interim Drawings

4.7.1 Requester: Initiate an interim drawing to revise an existing drawing.

4.7.1.1 Process eCR and obtain system or complex engineer authorization to initiate the drawing change.

4.7.1.2 Provide information to the drafting organization through preliminary sketches, layouts, or other forms of communication that will facilitate preparation of the interim drawing.

4.7.2 Drafter: Prepare an interim drawing.

4.7.2.1 Prepare the interim drawing against the affected drawing in accordance with the information provided by the requester.

4.7.2.2 Place status notes on the affected drawing and on the interim drawing to provide a cross-reference between the two drawings in accordance with Subsection 6.5.

4.7.3 Check, review, approve, and authorize the interim drawing for release per Subsections 4.2 through 4.5.

4.7.4 System Engineer: After the applicable SSC is modified in accordance with the interim drawing, provide the drafting organization with the information required to as-build the affected drawing.

4.7.5 Drafter: Revise the interim and affected drawings.

4.7.5.1 Revise the affected drawing in accordance with the *as-built* (see def.) information provided by the system engineer.

4.7.5.2 Revise the interim and affected drawings to accurately reflect the final status (such as indicating "superseded" or "canceled" for the interim drawing and removing the reference to the interim drawing from the affected drawing) in accordance with Subsection 10.5.12.

4.7.6 Check, review, approve, and authorize the revised affected drawing and interim drawing for release per Subsections 4.2 through 4.5.

## 4.8 Preparing Non-INL Drawings for Release

4.8.1 Requester: If it is anticipated that the INL will be making changes to non-INL, vendor-supplied drawings or if the drawings affect facility configuration, initiate the release of the drawings to the appropriate DRSC location through preparation of a eCR (reference LWP-7203, "Vendor Data Process," for instructions on the selection process).

4.8.2 Requester: Deliver the non-INL drawings that are to be retained in the EDMS to the drafting organization.

4.8.3 Drafter: Ensure proper format of non-INL drawings provided by the system engineer.

4.8.3.1 If the drawings do not meet the electronic file structure requirements of this document, jointly determine with the

system or complex engineer the appropriate action to be taken prior to release.

4.8.3.2 Restructure electronic files as required.

4.8.3.3 Add the INL index codes and serial number in accordance with Subsection 5.3

4.8.4 Check, review, approve, and authorize the vendor-supplied drawing for release per Sections 4.2 through 4.5.

## 4.9 Identifying Essential and Master Facility Drawings

4.9.1 Facility/Complex Manager: Select essential and master facility drawings (reference Subsections 5.1.3 and 5.1.4) based on the consequences of using a drawing that is not an *as-built drawing* (see def.) for operating or for maintaining the subject SSC. Use Appendix A, Drawing Designation Selection Criteria, to make the selection.

4.9.2 Facility/Complex Manager: Provide drawing designation information to the assigned Configuration Management SME.

4.9.3 Configuration Management SME: Verify:

A. Facility manager has concurred with essential and master facility drawing designations

B. Drawings are active

C. Essential drawings are identified to be as-built utilizing the interim drawing process to maintain a continuous as-built configuration.

D. Master facility drawings are identified As-Built after modifications are complete utilizing the interim drawing process or direct drawing change process.

4.9.4 Configuration Management SME: Enter the appropriate drawing designations into EDMS through the drawing data entry screen.

**NOTE:** *There is no need to retain a formal, documented record of input, concurrence, or verification.*

4.9.5 CM SME: To group drawings in subsequent drawing lists, select the applicable “Special Code” from the EDMS pick list.

**NOTE:** *EDMS search and report tools will group essential and master facility drawings based on the special codes assigned to the individual drawings. New or revised special codes may be added by contacting the DRSC.*

4.9.6 Facility Manager: At least annually, review the list of essential and master facility drawings and notify SE and/or CM SME of needed corrections.

## 4.10 As-Building Drawings

4.10.1 Facility/Complex Manager: Perform *as-building* (see def.) and drawing assessment tasks on essential drawings as follows and using the guidance in Appendix B, As-Buildings Drawings.

4.10.1.1 Before "operations turnover," complete as-building tasks per:

A. LWP-10400, "Design Control"

B. MCP-3630, "I&C Computer System Management"

C. LWP-7460, "Project Turnover and Acceptance."

4.10.1.2 If drawing accuracy is questioned during the course of operations, evaluate the risk of continued operation.

4.10.1.2.1 If the risk is acceptable, complete as-building as soon as possible.

4.10.1.2.2 If the risk is not acceptable, take appropriate mitigative actions to minimize risks.

4.10.1.3 Before initiating maintenance or operational activities where utilized drawings have not been otherwise verified accurate, as-build at least the portion of the drawing being used.

4.10.1.4 Establish a 5-year periodic review program to assess and document drawing accuracy and integrity.

4.10.1.5 Perform periodic assessments.

4.10.1.5.1 Evaluate the need to maintain the drawing(s) as essential drawings.

4.10.1.5.2 Review documents (such as EJNs) and work orders) that may have directed a change.

4.10.1.5.3 Perform a physical inspection of the system to identify obvious changes.

4.10.1.5.4 If drawing accuracy or integrity is questioned, repeat as-building tasks per Step 4.10.1.

4.10.2 Facility/Complex Manager: Perform as-building and drawing verification tasks on master facility drawings as follows and using the guidance in Appendix B, As-Buildings Drawings.

4.10.2.1 Complete as-building tasks to meet operational needs.

4.10.2.2 For all ongoing maintenance and operational activities where utilized drawings have not been otherwise verified accurate, as-build at least the portion of the drawing being used.

4.10.3 Facility/Complex Manager: Perform as-building and drawing verification tasks on general drawings as needed to support facility operating and maintenance needs.

4.10.4 Facility/Complex Manager: Perform as-built drawing reconciliation and review.

4.10.4.1 For drawing deficiencies, determine if the deficiency is a design or document problem using Form 431.400B, or LWP-10400, "Design Control."

4.10.4.2 Resolve all design deficiencies through the process directed in LWP-10400 or in MCP-3630, "I&C Computer System Management."

4.10.4.3 For drawings without design-related deficiencies, prepare and submit a eCR to document "as-built as of (date)."

4.10.4.4 Complete and document on the eCR an engineering review that verifies the drawing is consistent with the applicable *design requirements* (see def.).

4.10.4.4.1 Review the following documents as needed and as available:

A. System design description (SDD)

B. Safety analysis report (SAR)

C. Technical safety requirements (TSRs)

D. Design reports, which may include analyses of overpressure protection, stress, seismic, safety, design basis, single failure, or over-current protection.

4.10.4.4.2 Review operational performance and surveillance records and experience.

4.10.4.5 Obtain drawing approval per Subsection 4.4.

4.10.4.6 Document appropriate design information in the applicable SDD per TEM-10400-2, "Design Description."

## 4.11 Developing and Using Engineering Sketches

**NOTE 1:** *No records are generated through performance of this section. When an* engineering sketch *(see def.) is developed, it becomes part of the associated work control documentation and controlled per applicable work control process, such as in LWP-6200, "Maintenance Integrated Work Control Process*."

**NOTE 2:** *Sketches shall not be developed with an INL drawing format.*

4.11.1 Requester: Apply the following limitations to engineering sketches.

4.11.1.1 Revise engineering sketches to become Company drawings as needed.

4.11.1.2 Do not use engineering sketches in place of required company drawings or designs.

4.11.1.3 Do not allow engineering sketches to be stored in the Electronic Document Management System (EDMS; reference Step 4.11.2.1).

4.11.2 System Engineer, Design Engineer, or Project Engineer: Develop legible, technically-accurate engineering sketches as needed to support work control processes, such as maintenance.

4.11.2.1 Document on each sketch the name and title of the requester and date of the sketch.

4.11.2.2 Deliver completed sketches to the performing organization for incorporation into the subject work control document (such as a work order).

# 5. ENGINEERING DRAWINGS

Engineering Drawings disclose (directly or by reference) by means of graphic and/or textual presentations the physical and functional requirements of structures, systems, or components. These drawings are documents that contain necessary information to facilitate the design, fabrication, procurement, installation, testing, operation, inspection, troubleshooting, etc. of the depicted structure, system, or component (SSC).

This section defines the types of engineering drawings most frequently used to establish engineering requirements. It describes typical applications and minimum content/requirements.

## 5.1 General Drawing Requirements

5.1.1 All drawings in the INL EDMS require review, approval, release, and change control in accordance with this standard.

**NOTE:** *Sketches, illustrations, pictorials, etc. are not included in the controlled drawing system*.

5.1.2 Specific requirements for Engineering Drawings include:

5.1.2.1 Preparation on Engineering Drawing format in accordance with this standard (reference Section 6).

5.1.2.2 Drawings shall be prepared in accordance with this standard and instructions contained in ASME 14.24M.

5.1.2.3 Drawings shall include a drawing number and an index code, in accordance with this standard (reference Section 7)

5.1.2.4 Drawings shall be revised in accordance with this standard and LWP-1201.

5.1.3 *Essential drawings* are identified by the program, project, or facility manager as necessary for the safe operation and maintenance of facilities, structures, systems, and components. Essential drawings are as-built prior to placing the SSC they describe into operation. These drawings typically describe system-level information related to SSCs whose failure could have significant worker, public, or environmental consequences (reference Appendix A for more information).

5.1.4 *Master facility drawings (MFD)* are identified by the program, project, or facility manager for the routine operation, maintenance, safety analysis, and engineering of the facility equipment and systems that depict the as-built condition after modifications to a facility or SSC are complete (reference Appendix A and Subsection 4.10 for more information)

**NOTE 1:** *Interim Drawings may be used to document new designs, however after fabrication of the depicted structure, system, or component, the Interim Drawing shall be upgraded to or incorporated into an Engineering Drawing*.

**NOTE 2:** *Architectural Engineering Drawings may be used as Interim Drawings when they meet the requirements stated in this section. When an Architectural Engineering Drawing is being used as an Interim Drawing, the Architectural Engineering Drawing format shall be retained*.

5.1.5 *Interim (temporary) Drawings* are used to portray proposed or in process changes to existing structures, systems, or components under configuration control. The Interim Drawing in either a new drawing or a modified copy of the original drawing (with a different drawing number). Interim Drawings are used to maintain Essential Drawings in the as-built condition and may be used to maintain Master Facility Drawings, if directed by the cognizant engineer during a system modification process.

## 5.2 Architectural Engineering Drawings

5.2.1 In general the intent of Architectural Engineering Drawings is to convey sufficient information, along with a technical specification, for the subcontractors to estimate cost, bid on, and construct the depicted structure, system, or component. In order to allow the subcontractor flexibility for cost-effective equipment selection and construction methods, sufficient detail shall be provided. Technical specification should identify performance or code requirements which the subcontractor is responsible to implement through his own shop drawings or other controls; technical specifications may be shown on the drawing. Thus, tolerances are not normally used on Architectural Engineering Drawings and details are left to the subcontractor to draw (e.g., structural steel shop drawings, spool drawings).

5.2.2 Architectural Engineering Drawings shall consist of a complete set of individual drawings which graphically describe the required construction work for a given project. For modifications to existing facilities, the AE may be required to show the new construction using existing as-built drawings.

5.2.3 Architectural Engineering Drawings are used for construction contractor activities and are not intended to be operation and maintenance documents. Thus, at the completion of the depicted project, any Architectural Engineering Drawing information which is needed for operation and maintenance shall be incorporated into Engineering Drawings with sufficient detail to allow facility personnel to perform operation and maintenance activities prior to their being released into EDMS for this purpose.

5.2.3.1 Architectural Engineering drawings are generally prepared through the following four (4) design phases:

A. Conceptual Design: — Conceptual design drawings provide general layouts of structures, systems and site areas that may include simple electrical schematics, piping flow diagrams, and heating and ventilating flow diagrams. Detail should be sufficient to support development of a budget-level project estimate.

B. Preliminary Design — Preliminary drawings provide sufficient information to show arrangements, locations, size, and process and utility systems.

C. Final Design — Final drawings provide a complete construction package ready for final review, prior to final approval for construction.

D. Approval for Construction (AFC) Design — AFC drawings form the complete drawing package including all required approval signatures and are ready to be issued for construction.

5.2.4 Additional requirements for Architectural Engineering Drawings include:

5.2.4.1 Preparation on Architectural Engineering Drawing format in accordance with this standard (reference Section 6).

5.2.4.2 Drawings shall be prepared in accordance with this standard and the INL Architectural Engineering Standards.

A. Parts Lists are not normally used on Architectural Engineering Drawings.

B. Materials and components are identified on the field of the drawing and in related specifications.

5.2.4.3 Drawings shall include a drawing number and an index code, in accordance with this standard (reference Section 7).

5.2.4.4 Drawings shall be revised in accordance with this standard (reference Section 10).

5.2.4.5 The AE shall use nationally recognized standards (e.g., ANSI, IEEE, ASME, MIL-STD). Where possible, drawings should be developed and grouped to support anticipated bid packages. Unless they are part of a design-build package, the construction drawings, in conjunction with the specifications, shall be of sufficient detail that, no further design engineering is required by the specifications. They shall not be so detailed as to be overly restrictive or to eliminate planning functions normally performed by the specifications, such as material takeoff, job layout, shop detailing, etc. Examples of the detail information generally required on drawings are:

A. Location and details for concrete embedments, blockouts, and penetrations.

B. Location and details for absorbers and HEPA filters.

C. Location of piping, including details for piping support, expansion, etc.

D. Location and details for building vents and drains.

E. Location and installation details for all mechanical and electrical equipment, including identification of all equipment in conformance with the existing plant identification systems as provided in the design criteria.

F. Details for demolition of existing equipment (when applicable).

G. Location of electrical outlets, junction boxes, conduit stub ups, communication conduits, alarms, etc.

H. Complete wiring diagrams for controls and instrument connections.

I. Complete P&IDs and one-line electrical drawings.

J. Piping spool or isometric drawings. These may be supplied by the AE as per the specification requirements.

K. Loop diagrams. These may be supplied by the AE as per the specification requirements and shall be drawn according to ISA S5.1.

L. Clear identification of interface point/changes in construction materials (e.g., carbon steel to stainless steel) or conditions (e.g., new or existing).

5.2.5 Cover Sheet Drawing

5.2.5.1 Unless otherwise directed, drawings for each construction project shall include a cover sheet drawing(s). The cover sheet drawing shall be the first sheet of the set and shall be properly titled and numbered in the same manner as the other drawings in the set. The following information shall be given on the cover sheet drawing or drawings:

A. An index giving a list of all the drawings in the set, including the cover sheet drawing itself. In cases where drawings for separate and distinct projects are combined into a single set for the purpose of bidding as a single construction package, the cover sheet drawing index shall designate the various projects by subcontract division number. The project and subcontract division numbers will be provided by the INL.

B. The INL site map (or other appropriate map) showing the various INL areas and pointing out the location of the construction area. An electronic copy of the INL site map will be furnished to the AE upon request. Where further orientation is desirable or necessary, the AE should consider including an area plot plan (on this same cover sheet drawing) to show the specific construction site.

## 5.3 Non-INL Drawings

5.3.1 Non-INL drawings transferred into the INL EDMS presents a unique numbering situation. Each of these drawings normally bears an identifying drawing number assigned by the originating company. That number shall be retained unchanged. In addition, an INL assigned index code number and drawing number shall be assigned per Subsection 6.2.1.3 and placed on the drawing near the title block (reference Subsection 10.5.10.

5.3.1.1 Future modification/revisions to these drawings shall be handled the same as other INL drawings (reference Subsection 10.5.

5.3.1.2 If the drawing contains any proprietary or copyright statements, then the original Title Block shall be retained unchanged when modifications/revisions are made to the drawing.

5.3.1.3 Use the assigned INL drawing number when these drawings are referenced on other INL drawings.

## 5.4 Record Release Drawings

5.4.1 “Record Release” is a term applied to and noted on a completed or uncompleted drawing or layout released into the controlled drawing system for historical purposes, rather than for use in fabrication or operations. The notation “RELEASED FOR RECORD ONLY DO NOT FABRICATE” (reference Figure 5-1), is placed above, or as close as possible to, the Title Block.

5.4.1.1 Enter REC REL in the Special Code Block.

5.4.1.2 An authorized checker shall verify that the drawing has a valid drawing number, index code, and descriptive title.

5.4.1.3 The minimum required review/approval signatures on the eCR form shall be an authorized checker and the document owner. Additionally, the eCR shall denote that the drawing is being “released for record only”.

5.4.2 Record Release Drawings may be revised or upgraded to Engineering Drawings, Architectural Engineering Drawings, or Interim Drawings. See Subsection 10.5.13. If the drawing is upgraded, then it shall be checked, reviewed, and approved per this document following the requirement for the release of new drawings.

5.4.3 If the Record Release Drawing is not upgraded or replaced within five (5) years from the date of issue, it may be removed from the Drawing Control System at the discretion of the document owner.

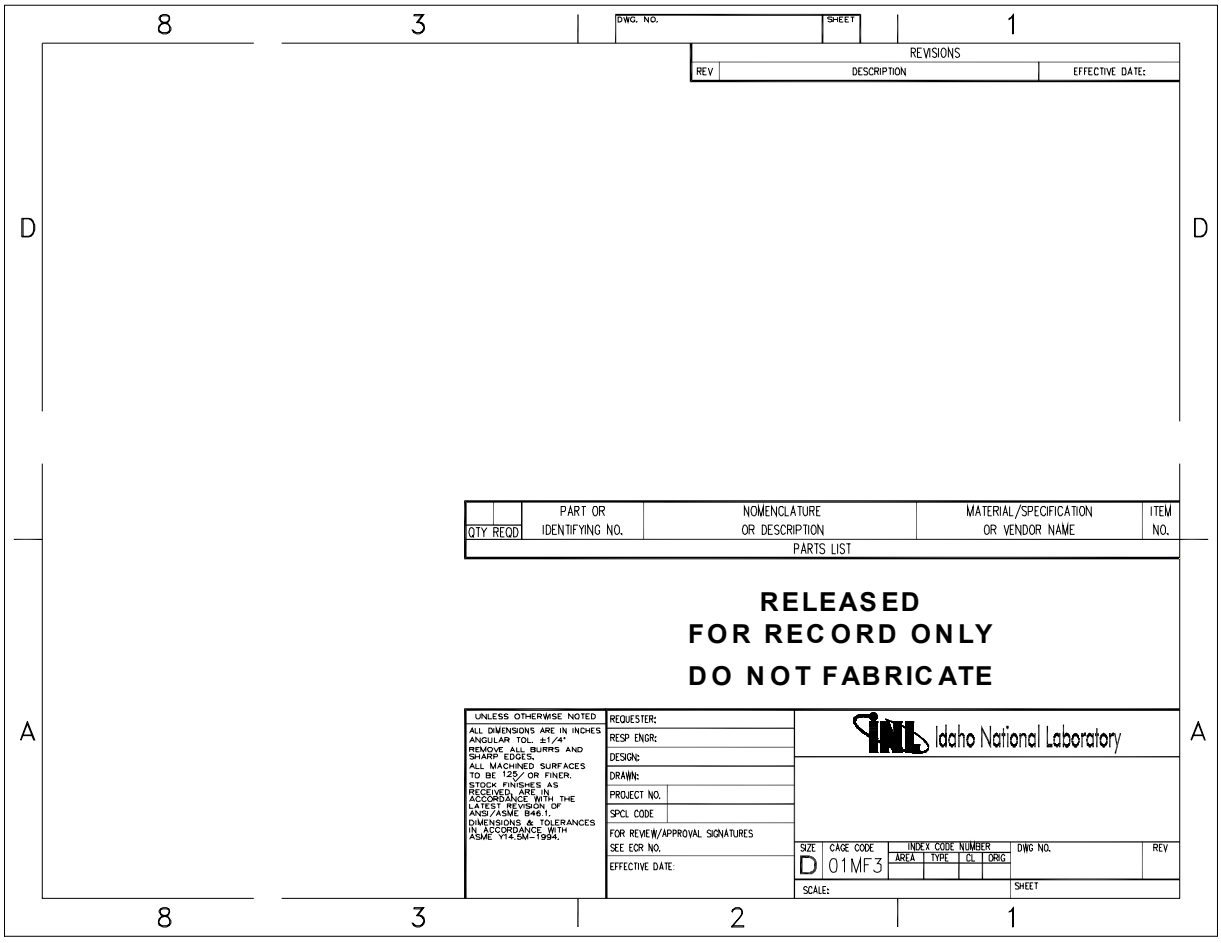


Figure 5-1. Record release drawing.

# 6. DRAWING FORMAT

## 6.1 General Requirements

6.1.1 New General Engineering Drawings and Architectural Engineering Drawings are prepared on the respective drawing formats described in this standard. These drawing formats are prepared and controlled by the Design/Drafting Group. Location of parts lists, supplementary data blocks, revision column, and general notes are shown in Figure 6-1.

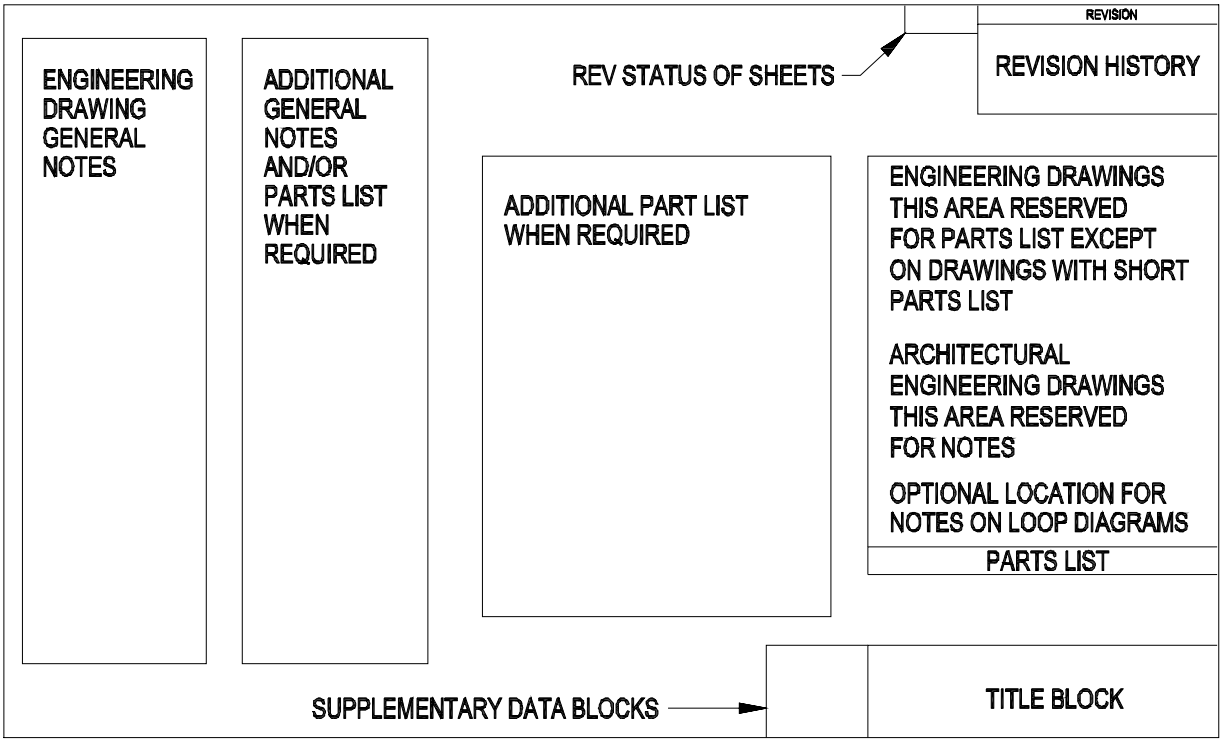


Figure 6-1. Location of parts list, general notes, revision history column on general engineering drawing format.

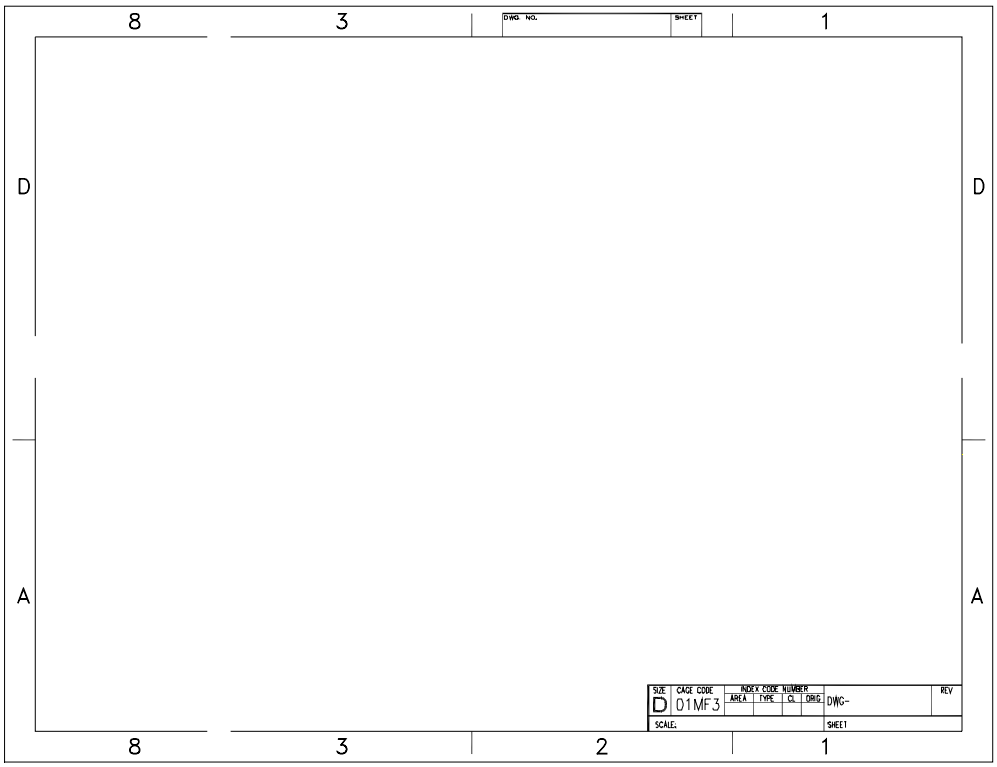


Figure 6-2. General engineering drawing continuation sheet.

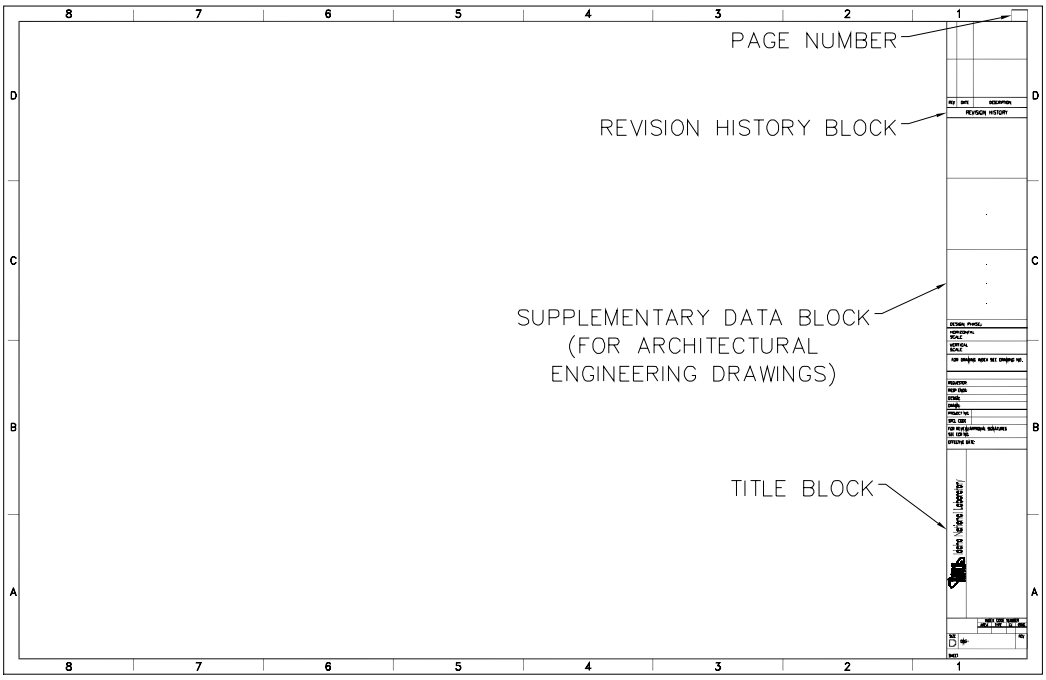


Figure 6-3. Architectural engineering drawing format.

6.1.2 Drawing sheet sizes shall conform to the following:

| Drawing Size | Paper Width | Paper Length | Vertical Margin | Horizontal Margin |
|---|---|---|---|---|
| A | 8.5 | 11 | .375 | .375 |
| B | 11 | 17 | .375 | .375 |
| C | 17 | 22 | .500 | .500 |
| D | 22 | 34 | .500 | .500 |
| E | 34 | 44 | .500 | .500 |

6.1.3 The preferred drawing size for Engineering and Architectural Engineering Drawings used within the INL is D except for logic diagrams which will typically be prepared on C size formats. D size formats are preferred for handling, storage, and reproduction.

6.1.4 Security marking information, if required, shall be placed between the Title Block and Parts List.

6.1.5 Drawing release shall be indicated by the addition of the effective date in the drawing title block or in the case of drawing revisions, by the addition of the effective date in the revision history column.

6.1.6 A quality level is assigned to each part of a system or structure per LWP-13014 “Determining Quality Levels” and are not indicated on the drawing.

6.1.6.1 Quality Level Safety/Category information shall be removed from all existing drawings submitted for revision from engineering.

6.1.7 Multi-sheet drawings consist of two or more sheets (normally D or E size) that are treated as a single drawing. Each sheet is identified by the same drawing number. All sheets of multi-sheet drawings are the same size.

6.1.7.1 General notes and the parts list are placed on the first sheet. Extensive general notes and/or parts lists may be continued on subsequent sheets (reference Figure 6-1).

6.1.7.2 The first sheet is prepared on a standard format. The remaining sheets are prepared on continuation sheet formats (reference Figure 6-2).

6.1.7.3 Multi-sheet drawings should be limited to the following types of drawings:

A. Assembly, weldments, details, or installation drawings, which cannot be adequately defined, complete with general notes and parts lists on a single sheet.

B. Diagrammatic drawings (i.e., schematics, P&IDs, flow sheets, wiring diagrams) which will not fit on one drawing sheet.

6.1.8 Rectangular zones across the face of the drawing provide a useful means of identifying the location of specific drawing features (e.g., sections, views). These zones are described through use of the numbers and letters in the margins. See Figures 6-1, 6-2, and 6-3.

## 6.2 Title Block

6.2.1 The following information shall be entered in the title block as applicable, reference Figures 6-4 and 6-5.

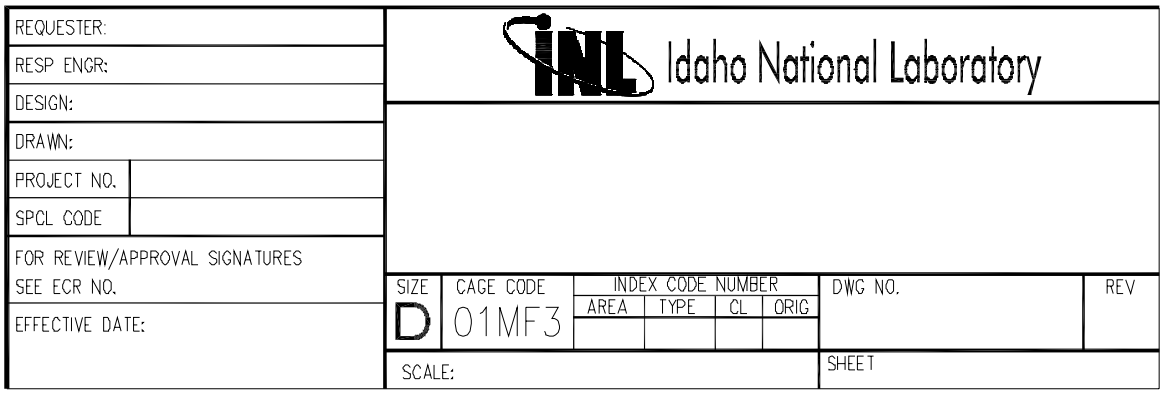


Figure 6-4. INL general engineering title block.

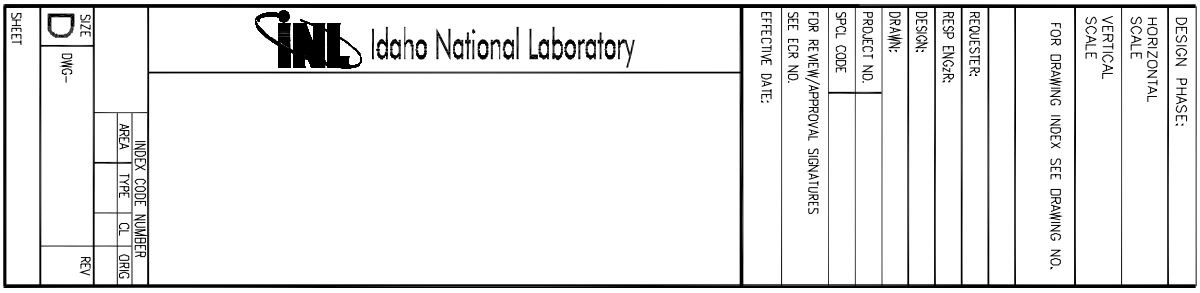


Figure 6-5. INL architectural engineering title block. (Rotated to conserve space.)

6.2.1.1 "DRAWING TITLE" — Drawing titles identify the location and application of the depicted structure, system, or component in order to facilitate drawing search and retrieval efforts. No abbreviations, except for approved INL acronyms, are used in the title block and as many or as few lines as apply are used. Following are guidelines for drawing titles (this assumes a five-line title arrangement):

| | |
|---|---|
| Line 1 | Area acronym-building number centered |
| Line 2: | Project title (derived from official project title) |
| Line 3: | Item name (first part) including basic name, and modifying phrase Component (Engineering Drawings only) |
| Line 4: | Item name (second part) |
| Line 5: | Drawing subject (Assembly, Installation, Details, Sections, Floor Plan, Ripout, Wiring Diagram, etc.) |

Following are two (2) examples of a drawing title:

**EXAMPLE 1:**

ATR-670
CENTER FLUX TRAP BAFFLE
BACKUP CLAMP
LOWER RIGHT HAND
ASSEMBLY

**EXAMPLE 2:**

MFC-768
POWER PLANT BUILDING
INSTRUMENT AIR SYSTEM

PROCESS AND INSTRUMENTATION DIAGRAM

**EXAMPLE 3:**

MFC-765
FFTF PRODUCTION ELEMENT CHOPPER
PIN, GUIDE
IN-CELL GRAPPLE

6.2.1.2 "INDEX CODE NUMBER" — The index code number is placed on all drawings, prior to release, for the purpose of classifying drawings within one common numbering system. The index code consists of a twelve (12) digit number in four sub-numbered units (reference Subsection 7.8).

6.2.1.3 "DRAWING NO." — The drawing number is placed on all drawings, prior to release. The drawing number consists of a six (6) digit number assigned by the INL EDMS (reference Section 7).

6.2.1.4 "REV" — The revision indicator shall be numeric beginning with 1. Initial issue of a drawing does not constitute the need for a revision number and may be indicated by the use of a dash (-). (reference Section 10.)

6.2.1.5 "SCALE" General Engineering Drawing — The scale used on each drawing sheet shall be entered in the scale block (for multi-sheet drawings, the scale noted in the scale block does not have to be the same for all sheets). When the scale is constant throughout a drawing sheet, the entry is of the form shown in Example A (reference Scale of Drawings in Subsection 8.5). If, however, more than one scale is used on a drawing sheet, the notation NOTED shall be placed in the scale block as shown in Example B (the different scales shall be shown under the applicable assembly, detail, view, section, etc.). Drawings with no specific scale, such as schematics, wiring diagrams, perspectives, etc., have the notation NONE in the scale block as in Example C.

| | |
|---|---|
| Example A: | SCALE 1/1 |
| | SCALE 1/8″ = 1′ – 0″ |
| Example B: | SCALE NOTED |
| Example C: | SCALE NONE |

6.2.1.6 "SCALE" — Architectural Engineering Drawings shall include a graphic bar scale for each scale used on the drawing. The graphic bar scale shall be located in the supplementary data block next to the Title Block (reference figure 6-3) and/or on the field of the drawing as applicable.

6.2.1.7 "SHEET" — General Engineering Drawing

A. Single Sheet Drawing — When the drawing is a single sheet drawing, the entry is of the form as shown in Example A.

B. Multi-sheet Drawing — When the drawing is a multi-sheet drawing, the entry on the first sheet shall contain the sheet number and total number of drawing sheets as shown in Example B. The entry on the continuation sheets shall contain the sheet number only, as shown in Example C.

| | |
|---|---|
| Example A: | SHEET 1 OF 1 |
| Example B: | SHEET 1 OF 3 |
| Example C: | SHEET 2 |

6.2.1.8 "SHEET" — General Architectural Engineering Drawing

A. Enter an alphanumeric sheet number made up of an assigned letter followed by a dash number. The dash number identifies the consecutive order of the drawing sheet in its related series. Examples:

| | |
|---|---|
| Architectural | A-1, A-2, A-3, etc. |
| Civil | C-1, C-2, C-3, etc. |

B. Assigned letter identifiers:

T — Cover/Title Sheet Drawing

C — Civil

U — Utilities (outside systems, piping, waste and electrical)

A — Architectural

S — Structural

P — Piping and Plumbing

FP — Fire Protection

M — Mechanical

H — Heating

HV — Heating and Ventilating

V — Ventilating

E — Electrical (including alarms and communications)

IN — Instrumentation

LSS — Life Safety Systems

TLCM — Telecommunications

FA — Fire Alarms

D — Demolition

**NOTE:** *Other letter identifiers may be used if approved by the Drafting Manager*.

6.2.1.9 "REQUESTER" — Enter the name of the requester.

6.2.1.10 "RESPONSIBLE ENGINEER" — Enter the name of the responsible engineer.

6.2.1.11 "DESIGN" — Enter the name of the design engineer.

6.2.1.12 "DRAWN" — Enter the name (initial[s] and last name) of the drafter who prepared the drawing. Do not use nicknames.

6.2.1.13 "PROJECT NO." — Enter the project number if applicable.

6.2.1.14 "SPEC CODE" — Enter the special code identifier if applicable.

6.2.1.15 "eCR NO." — Enter the eCR number that contains the review/approval signatures.

6.2.1.16 "EFFECTIVE DATE" — Enter the date indicating when the drawing was approved for release. EDMS will match the effective date with the effective date noted on the drawing.

## 6.3 Engineering Drawing Supplementary Data

6.3.1 See figure 6-1 for an example of an Engineering Drawing format.

6.3.2 "STANDARD TOLERANCE" block (optional). The standard tolerance block specifies the tolerances that apply to the linear and angular dimensions on the field of the drawing. The tolerances in this block do not apply to commercial item sizes, basic dimensions, welding symbols, and screw thread or similar dimensions that are otherwise controlled. Reference Figure 6-6.

6.3.2.1 Altering the Standard Tolerance block. The standard tolerance block shall not be altered unless a larger tolerance is required for the majority of the dimensions shown on the drawing. For an altered tolerance block reference Figure 6-7.

6.3.3 "METRIC TOLERANCE" block (optional). When a drawing is prepared using IS metric units, the metric tolerance block shall be used on the drawing format. All application requirements that apply to the standard tolerance block also apply to the metric tolerance block. See Figure 6-6.

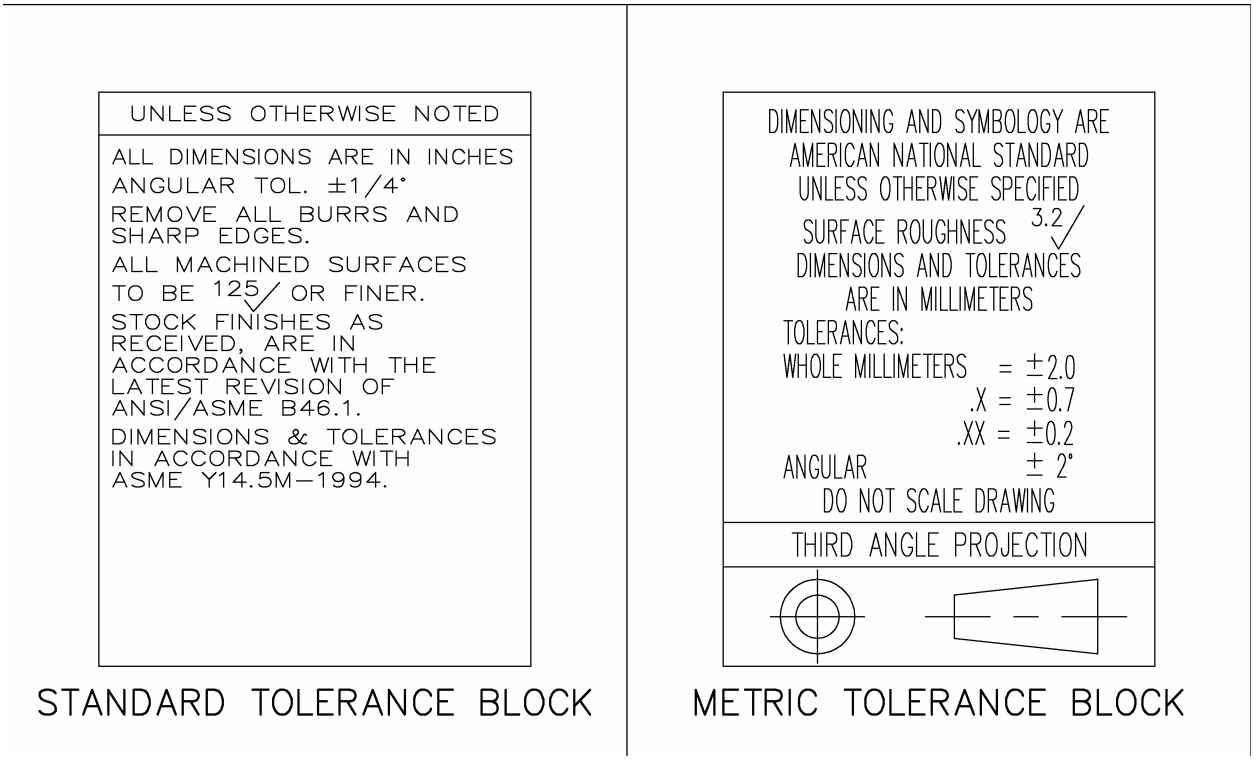


Figure 6-6. Standard and metric tolerance blocks.

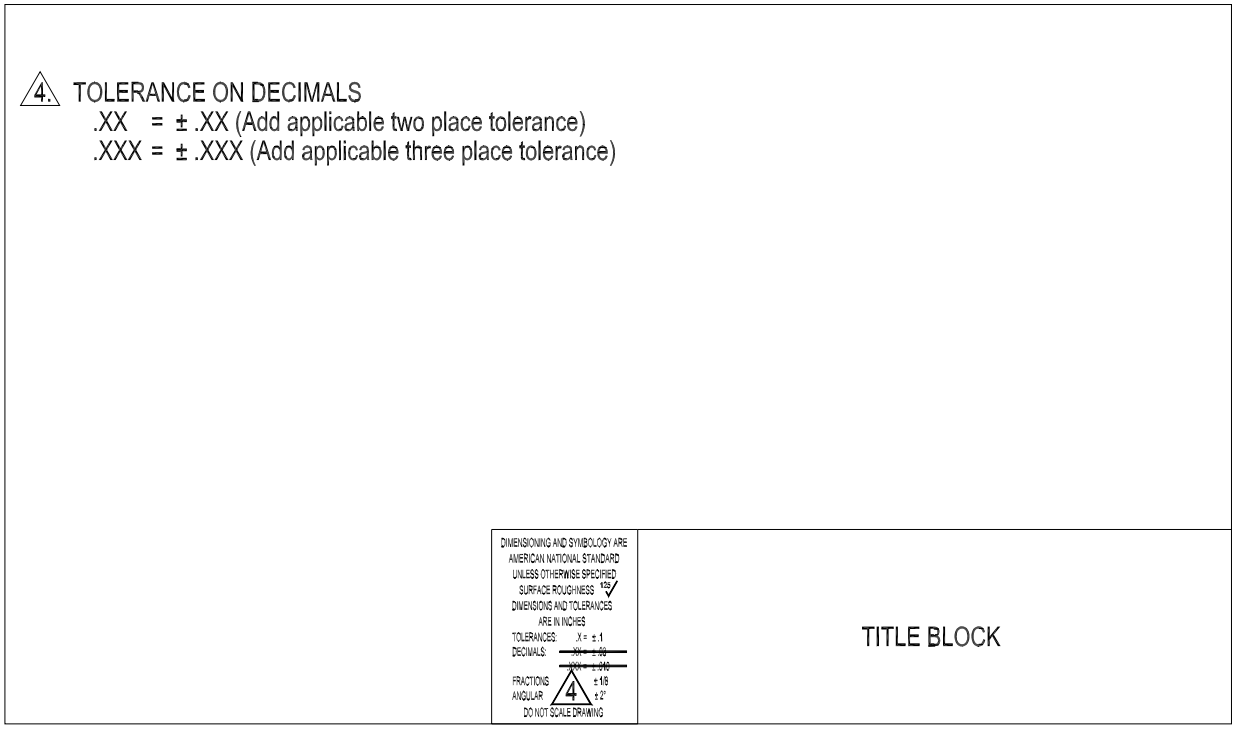


Figure 6-7. Altered tolerance block.

6.3.4 "APPLICATION" block (optional).

6.3.4.1 "ITEM NO." Column — Enter the Parts List Item number that is used on another drawing. The item number is repeated for each next assembly drawing application.

6.3.4.2 "NEXT ASSY" Column — Enter drawing number(s) for the next assembly(ies) to which the drawing applies. Only next assembly drawings shall be listed or referred to in the next assembly block. Next assembly drawings are those where the item(s) depicted would be used and normally appear in a parts list. On end item assembly drawings, the word "FINAL" is entered.

**NOTE 1:** *When the drawing is used in conjunction with other drawings (e.g., wiring diagram, schematic diagram), the reference drawings shall be listed in the general note. No delta note will be shown in the next assembly block for reference drawings*.

**NOTE 2:** *"REV STATUS OF SHEETS" block shall not be used on Pro-Engineer drawings.*

6.3.4.3 "REV STATUS OF SHEETS" block. The Revision Status of Sheets block is added to the left of the Revision History block on the first sheet of multi-sheet drawings before initial release. Sheet numbers are added in sequence. The REV row carries a dash (-) for unrevised sheets and the revision indicator for each revised sheet. A diagonal line is drawn through the space when revision makes the sheet canceled (reference Figure 6-8).

| 4 | 3 | 2 | 1 | SHEET | REV STATUS OF SHEETS |
|---|---|---|---|---|---|
| — | 2 | | 4 | REV | |

Figure 6-8. Rev status of sheets.

6.3.4.4 "PARTS LIST". A parts list will normally be added to the drawing to facilitate identification of materials and/or components used in the depicted structure, system, or component.

6.3.4.5 "REVISION" History block. The revision history column shall be used to identify revisions as described in this standard (reference Section 10).

## 6.4 Architectural Engineering Drawing Supplementary Data

6.4.1 See Figure 6-3 for an example of an Architectural Engineering Drawing format.

6.4.2 In the supplementary data block, enter the following information:

6.4.2.1 Enter the drawing number of the index sheet on all drawings included in a contract-related series, with the exception of the cover sheet itself.

6.4.2.2 "DESIGN PHASE" as described in Step 5.2.3.1.

6.4.3 Each drawing sheet in a contract related series is given an individual page number, which is located at the upper right-hand corner of the sheet in the margin outside of the border. These page numbers are assigned in a sequential order to include all drawings in the contract-related series.

6.4.4 A parts list (such as that used on an Engineering Drawing) is not normally used on Architectural Engineering Drawings. Instead, materials and components are identified on the field of the drawing and in related specifications.

6.4.5 "REVISION" History block. The revision history column shall be used to identify revisions as described in this standard.

## 6.5 Interim Drawings

6.5.1 See Figure 6-9 for an example of an Interim Drawing format.

6.5.2 The notation INTERIM DRAWING shall appear above the title block in a minimum of 0.25 in. high letters.

6.5.3 The notation INTERIM shall be entered in the special code block in the title block.

6.5.4 Interim Drawings shall be cross-referenced to related affected drawings.

6.5.5 "REVISION" History block. The revision history column shall be used to identify revisions as described in this standard.

6.5.6 The Interim Drawings shall contain the following statement (See Figure 6-9).

EJN No.:
MADE FROM (DRAWING XXXXXX or N/A if new)

6.5.7 The affected drawing shall contain the following statement (reference Figure 6-10).

THIS DRAWING AFFECTED BY

EJN No. _____

RIPOUT DWG NO. _____

INSTALL DWG NO. _____

6.5.7.1 Numbering, including an index code, in accordance with this standard.

6.5.7.2 Show necessary details to complete the fieldwork and to incorporate the information on the parent drawing at the completion of the modification.

6.5.7.3 May show the areas of change ballooned (clouded), with the notations “RIPOUT”, “INSTALL” or with the notation “DARK LINES INDICATE (installation or removal)”

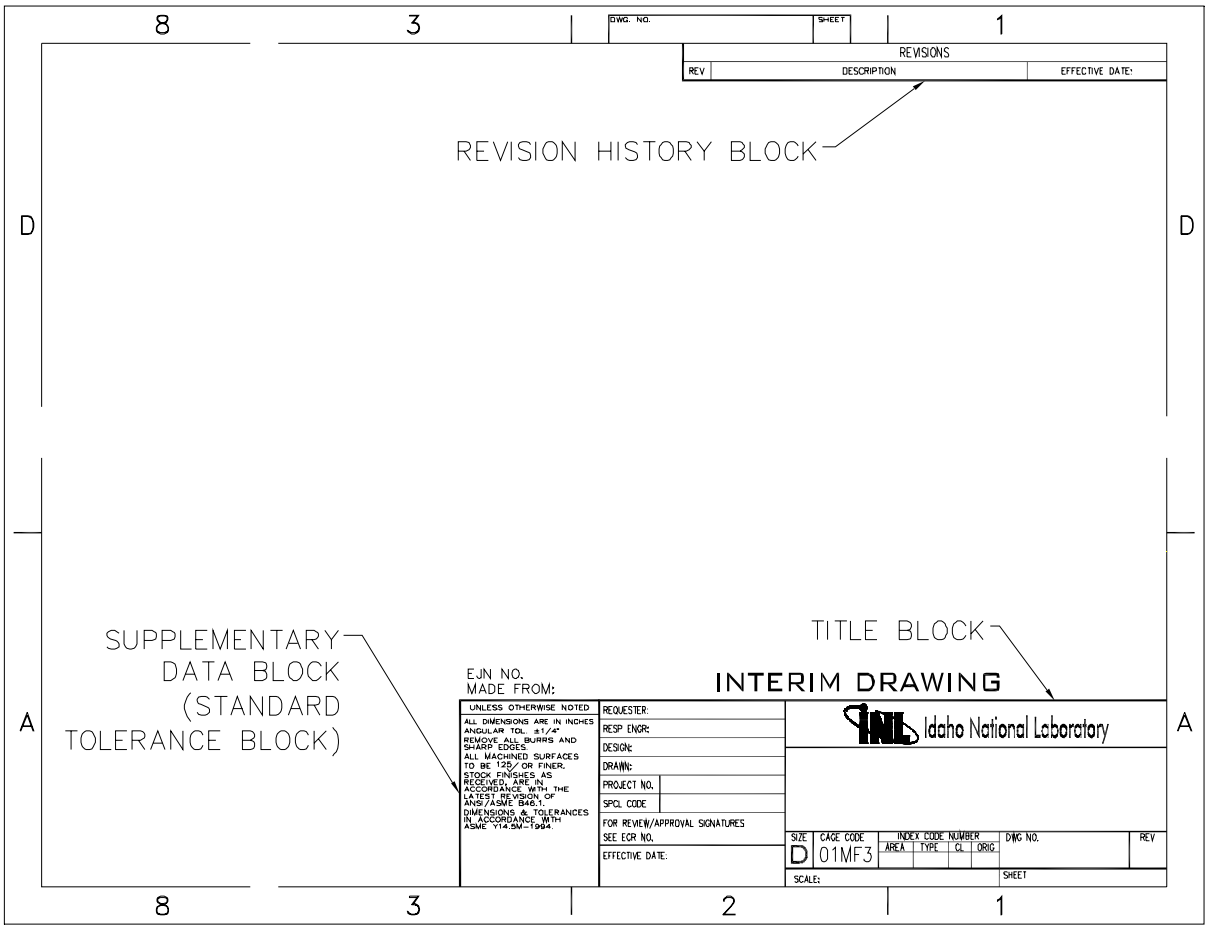


Figure 6-9. Interim drawing format.

## 6.6 Continuation Sheet

6.6.1 See Figure 6-2 for an example of a continuation sheet.

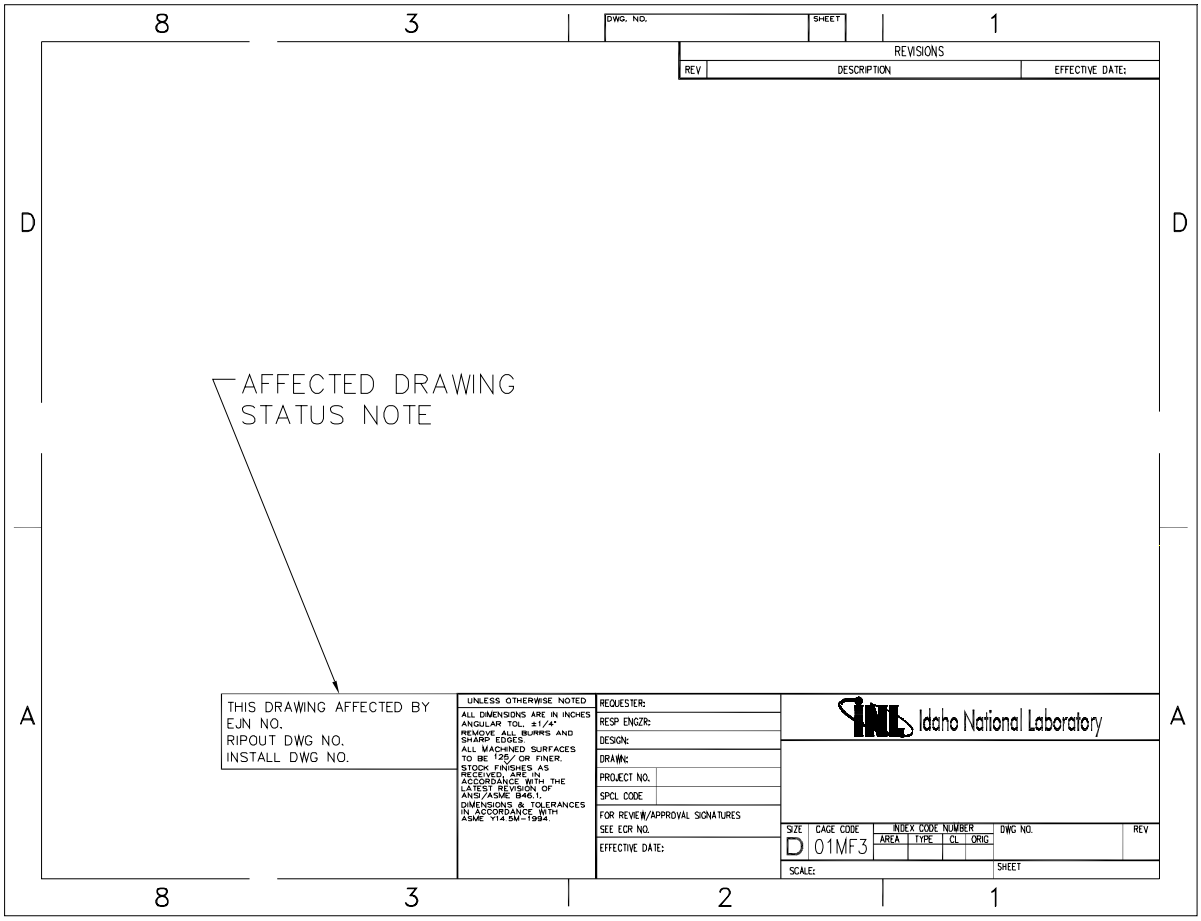


Figure 6-10. Affected drawing status note location.

# 7. DRAWING AND PART NUMBERING SYSTEMS

## 7.1 General Requirements

7.1.1 New or redrawn drawings to be released into the Drawing Control System are assigned drawing and index code numbers per the requirements contained in this section as assigned by EDMS per LWP-1201.

7.1.2 Architectural Engineering Drawings are assigned drawing numbers after completion of the Title II design phase and prior to approving the drawings for construction.

7.1.2.1 Before the drawing number is assigned, electronic drawing files shall have filenames based upon function.

7.1.2.2 The electronic drawing file name will show in the date stamp area on the drawing outside the border. All hard copies of the drawing shall have the filename visible.

7.1.2.3 All electronic drawing file names are to remain the same for the life of the project. The drawing filename shall change only when the file is to be Issued “Approved for Construction,” then it changes to the six digit drawing number from EDMS.

**NOTE 1:** *When a multi-sheet drawing is created with software that is capable of creating a multi-sheet drawing with one file name then naming the electronic file shall follow the requirements for a single sheet drawing.*

**NOTE 2:** *When a multi-sheet drawing is revised that was created as a single file name, all sheets shall have the same revision indicator.*

**NOTE 3:** *Do not make a multi-sheet drawing with one file name from a released drawing with multiple file names.*

**NOTE 4:** *For Pro-Engineer electronic drawing file names see Section 12.3.*

## 7.2 Electronic Drawing File Names

7.2.1 Single Sheet Drawing File Names

7.2.1.1 Single sheet drawing file names shall consist of the six character drawing number (e.g., 123456, 123457, 123458).

7.2.1.2 When the drawing file is a revision to an existing drawing, the file name shall consist of the six character drawing number, an "R", and numeric revision indicator (e.g., 123456R1, 123456R2, 123456R3).

7.2.2 Multi-Sheet Drawing File Names

7.2.2.1 Multi-sheet file names shall consist of the six character drawing number and a two character sheet number with the exception of sheet 1 which will not include the two character sheet number (e.g., 123456, 12345602, 12345603).

7.2.2.2 When the drawing file is a revision to an existing drawing, the file name shall consist of the six character drawing number, a two character sheet number with the exception of sheet 1 which will not include the two character sheet number, an "R", and a numeric revision indicator (e.g., 123456R1, 123456R2, 123456R3).

## 7.3 Part Numbers

7.3.1 Assigned part numbers are used on an Engineering Drawing to identify a part, subassembly, assembly, unit, or system.

7.3.2 Each part number consists of a six digit drawing number and a dash number, (e.g., 123456-1).

7.3.3 The dash number is a numerical identification, which identifies an individual part or assembly.

7.3.3.1 Dash numbers are assigned to detail parts and assemblies and coincide with the item number in the parts list.

7.3.3.2 Dash numbers are assigned on the field of the drawing in the region at which the part is detailed or otherwise defined.

7.3.4 Revision indicators are not a portion of the part number.

7.3.5 Dash numbers in the parts list of the drawing are cross referenced on the field of the drawing by corresponding item numbers.

7.3.6 When design, procurement, or inspection conditions require physical identification of parts, assemblies, or subassemblies, the drawing specifies a method of marking, in accordance with STD-13122 or other appropriate standard.

7.3.6.1 A required permanent identification marking is normally located by a phantom line block placed on the part or assembly. The block is drawn to indicate the approximate region for the marking, but is not dimensionally located unless design conditions require precise location control. To the extent practicable, identify marking locations that will not be hidden by subsequent surface coatings or by installation configurations. A note of the following form specifies the marking information. This note is normally placed on the field of the drawing, with a leader arrow pointing to the phantom line block, but may be given as a delta note.

MARK PER (applicable standard) WITH (drawing number) AND APPLICABLE ITEM NUMBER.

7.3.6.2 Temporary markings are normally specified in a general note, but may be specified on the field of drawing when necessary for clarity. In either case the note gives the following information:

TEMPORARY MARKING PER (applicable standard) WITH (drawing number) AND APPLICABLE ITEM NUMBER.

7.3.6.3 Certain manufacturing and assembly situations require more than one permanently marked number to appear on an individual part in an overall assembly. In such cases, distinguishing suffixes become useful. A case in point is a casting with, for example, machined ends, that is subsequently assembled to one or more machined parts. The casting, initially distinguished as XXXXXX-1 CSTG, would, after machining, be given the additional machined part number XXXXXX-1, also on the cast surface. Finally, the assembly number, XXXXXX-1 ASSY, is also marked on the cast surface. The suffixes CSTG and ASSY are useful identifiers that are readily distinguished from the -1 machined part number.

## 7.4 Serial Numbered Parts

7.4.1 When design, procurement, or inspection requires part serialization for record traceability, drawings will specify this requirement.

7.4.2 Serial numbers are alphanumeric numbers, assigned to a part, which differentiate that part from all others having the same part number.

7.4.3 When hardware requires a serial number, the requirement is specified by the addition of "AND ASSIGNED SERIAL NUMBER," as follows, to the marking note.

MARK PER (applicable standard) WITH (drawing number) AND APPLICABLE ITEM NUMBER AND ASSIGNED SERIAL NUMBER.

7.4.4 Carry-over serialization is used when a machined part or an inseparable assembly is made from, or contains, a serialized component. Selection is made of the component whose serial number is to be carried over and a notation is made, in the parts list or elsewhere on the drawing, that designates the identifying marking of the component by its respective part number and serial number.

7.4.5 Matched parts are normally serialized to identify each component separately.

## 7.5 Item Numbers

7.5.1 Item numbers are assigned to each line entry in the parts list. Item numbers are entered in numerically ascending order beginning with number 1, and no item number shall be omitted.

7.5.2 The corresponding items are identified on the field of the drawing by the item number enclosed in a 1/2 in. × 45 degree ellipse and a leader line pointing to the applicable part. An acceptable alternate is a 1/2 in. diameter circle if the application software uses this as its standard item bubble. See Figure 7-1.

7.5.2.1 It is preferred to group item numbers in numerical sequence or order of assembly. See Figure 7-2.

7.5.2.2 The word ITEM is combined with the relevant number for use in general and local notes. For example:

PRIME ALL EXPOSED SURFACES WITH 2 COATS OF ITEM XX AND PAINT WITH 1 COAT OF ITEM XX.

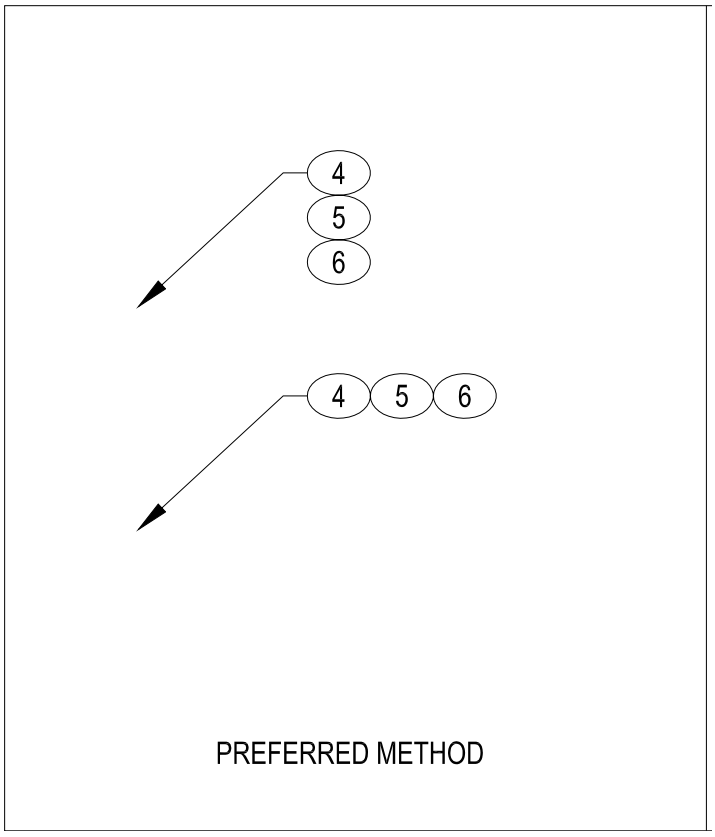


Figure 7-1. Item balloons.

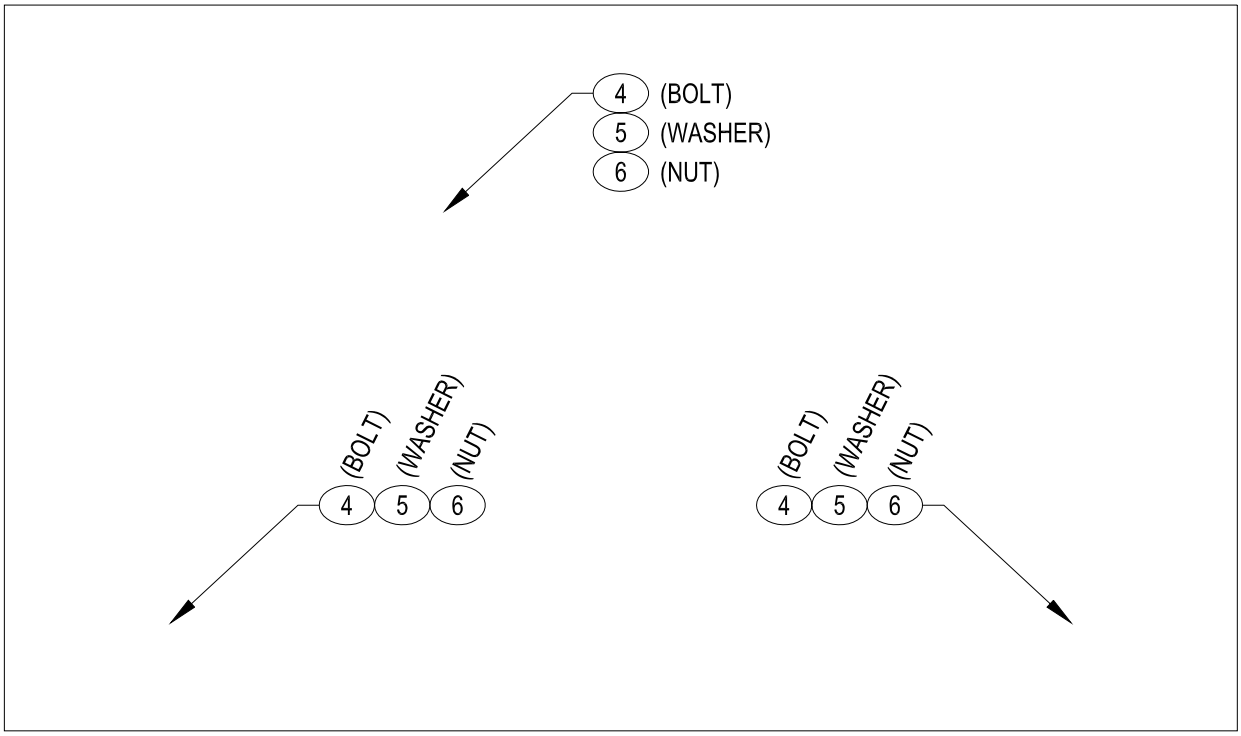


Figure 7-2. Item number groupings.

7.5.3 When an item number appears more than once on the face of a drawing to indicate the same part in different views, all but one of the item numbers carry the notation REF. The use of REF designated item numbers is discouraged, unless such use promotes clarity.

7.5.4 The item number and dash number are identical on the drawing on which the part is detailed.

7.5.5 Supplemental information may be added to the item numbers on the face of drawing in situations cited in the following paragraphs.

7.5.5.1 On multiple assembly drawings that specify the use of different detail parts on specific assemblies, the assembly's dash number may be used to supplement the item number, as shown in Figure 7-3.

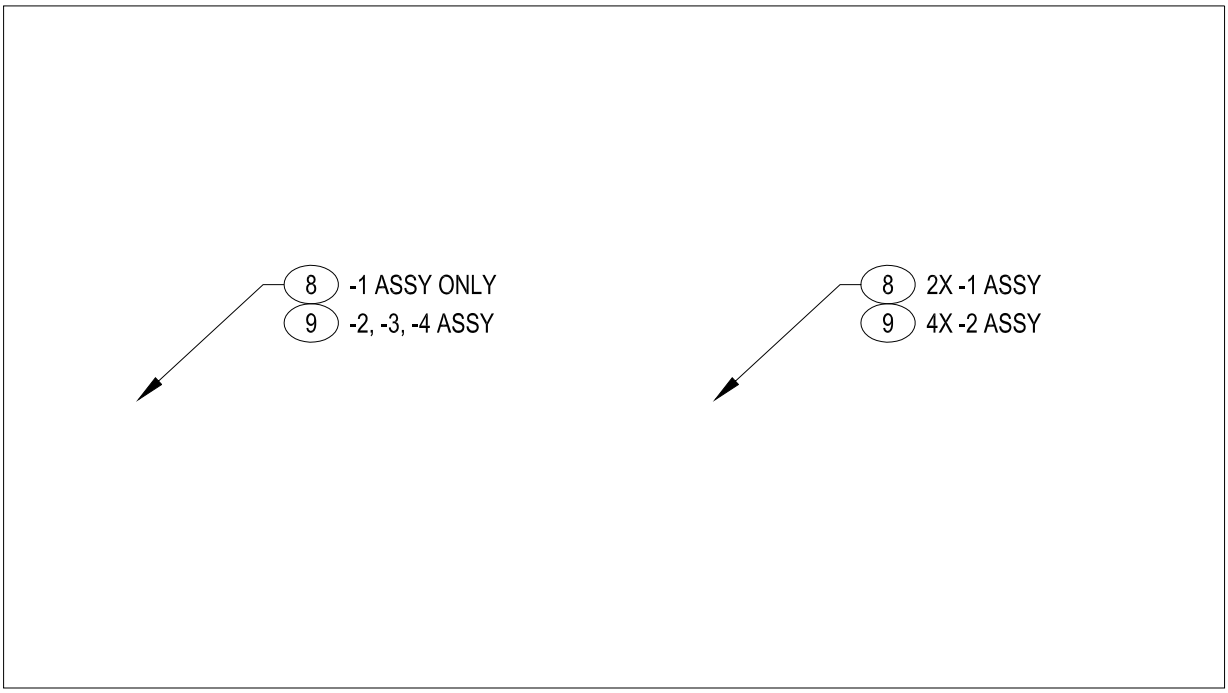


Figure 7-3. Assembly dash numbers qualifiers.

7.5.5.2 On multiple assembly drawings, the assembly's dash number instead of the item number identifies the assembly view on the drawing, reference Figure 7-4.

7.5.5.3 When a part is detailed on the same drawing as its next assembly, the notation SEE DETAIL or SEE ASSY is added to the item number call out, reference Figure 7-4, also reference Figure 7-5 for a multi-sheet application.

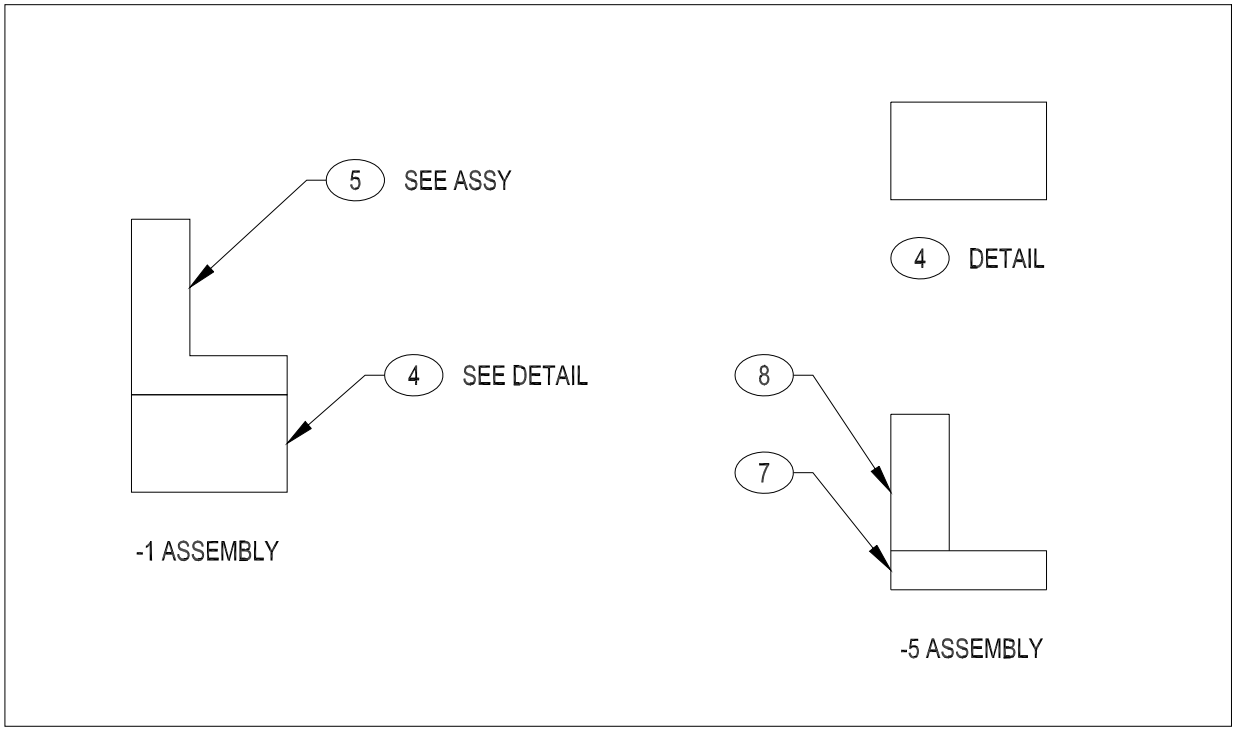


Figure 7-4. Dash number on multiple assembly views.

## 7.6 Facility Identification Numbering Systems

7.6.1 The facility identification numbering system assigns a unique identifier (numbers and letters) to specific equipment, such as each of the lines on a Piping & Instrument Diagram (P&ID) or a physical piping drawing and each item of equipment on an arrangement drawing.

7.6.2 The responsibility for generation and assignment of these facility identifiers are the responsibility of the applicable project or program.

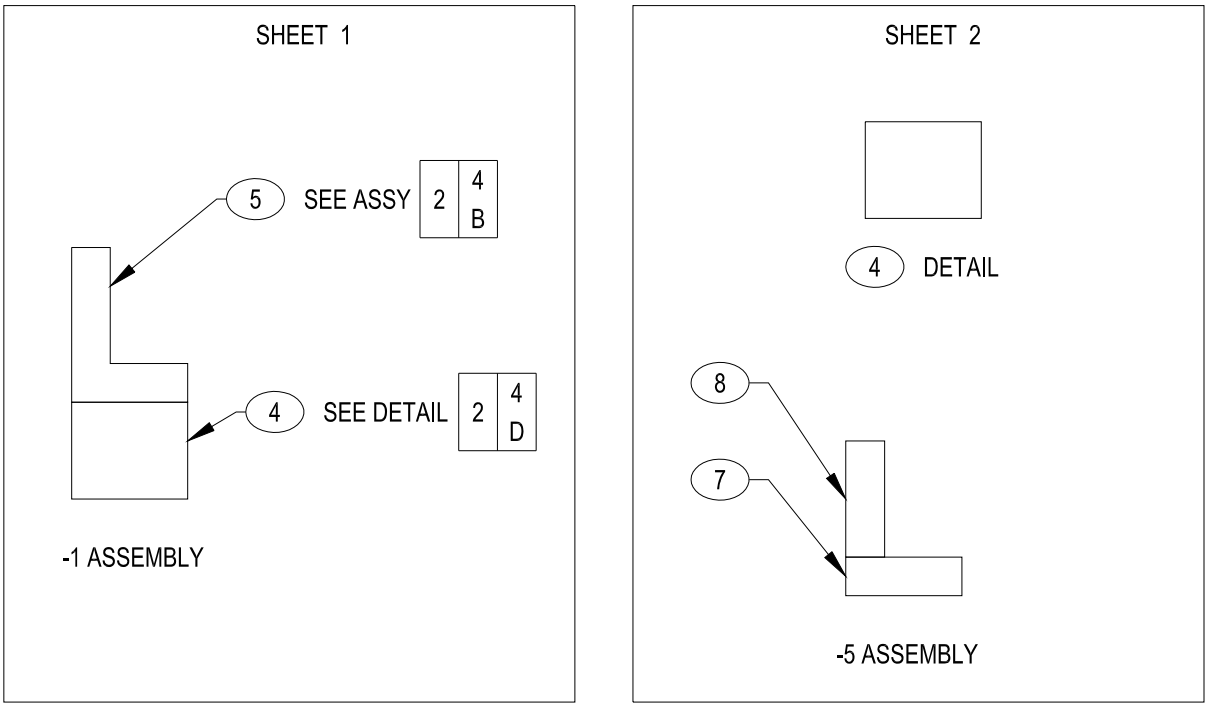


Figure 7-5. Application of zone blocks on multi sheet drawings.

## 7.7 Weld Joint Numbers

7.7.1 Weld joint numbers may be assigned on welded parts (e.g., piping, vessels, and structures) or on a separate weld map drawing to provide specific joint identification for cross reference in welding specifications, inspection procedures, and associated records.

7.7.2 Each weld joint is identified on the field of the drawing by a “W”, a dash, and a numerically ascending number beginning with “1” and limited to three digits. This identifier is enclosed in the weld joint symbol per the requirement contained in the Drafting Practices section (Section 9) of this standard. A leader arrow extends from the symbol to the weld joint. Reference Figure 9-1.

## 7.8 Drawing Index Codes

### 7.8.1 Index Code Number System

7.8.1.1 INL drawings have been generated by a variety of companies and cover a variety of subject matter. A numbering system was needed that identified and categorized drawings in a common way. The numbering system translates all drawing numbers into predetermined standard index code categories and permits full utilization of automated data handling systems. All additions or changes are controlled by EDMS.

7.8.1.2 All INL drawing formats contain the Index Code block as an integral part of the title block as shown in Figures 6-4 and 6-5.

A. Drawings requiring multiple index codes or vendor drawings received without an index code block shall have the index code block and code numbers added before they can be released into the controlled drawing system.

B. The location of the supplemental index code block should not interfere with the drawing areas reserved for revisions, parts list, notes, etc., but should be placed as near the title block as possible.

7.8.1.3 Drawings pertaining to more than one Area Location, Drawing Type, or Class of Work should be assigned as many additional index codes and supplemental index code blocks as may be required to describe the different index code categories present on the drawing. Regardless of the number of index codes assigned to the drawing, the drawing number is always the same.

### 7.8.2 Index Code Number Description

7.8.2.1 The index code number system divides drawing numbers into four significant categories describing

A. Area Location (area or facility assigned number) reference LST-215

B. Drawing Type (subject or location within the site, e.g., building number, structure number) reference LST-216

C. Class of Work (drawing content) reference LST-217

D. Drawing Originator reference LST-218

### 7.8.3 Drawing (Serial) Numbers Index Code Description

7.8.3.1 The six-digit field of the Drawing (Serial) Number provides 999,999 numbers for index code serialization or drawing numbering. The INL Document Control Center maintains Drawing Number control by assigning numbers or blocks of numbers from the master record to authorized individuals or organizations originating drawings to be included in the EDMS.

**NOTE:** *Drawing numbers will be assigned per SMC-MCP-1.2409 for the Specific Manufacturing Capability (SMC) project.*

### 7.8.4 Special Index Programs Description

7.8.4.1 In addition to the drawing indexing capabilities offered by the index code, special drawing index programs have been developed to further classify certain unique groups of drawings. For information on the Special Index Programs contact the INL Document Control Center.

A. INTEC In-plant Code Systems

B. RTC Experiment Drawing List

C. Telecommunications

D. Life Safety Systems

E. Electronic Documents Control System (EDMS)

F. SMC-LST-026, "Master Data Set"

# 8. DRAFTING PRACTICES

## 8.1 General Requirements

8.1.1 Most of the standards listed in Section 15.2, Applicable Documents, are nationally recognized. These standards are valuable sources of information for drafting practices. These standards are accepted by the INL as the overall guidelines for the preparation of the wide varieties of Engineering Drawings and Architectural Engineering Drawings. Copies of these standards are maintained by the INL Technical Library.

8.1.2 The standards listed in Section 15.2, Applicable Documents, and the specific drafting practices subsequently set forth in this section, as well as the requirements given in the other sections of this standard, are in conformance with nationally-recognized standards. Deviations from this standard or listed nationally-recognized standards require concurrence from the Drafting Supervisor or an appointed designee. In the event of conflicts between this standard and listed national-recognized standards, this standard shall take precedence.

8.1.3 The Drafting organization promotes the practice of functional, simplified drafting. Functional drafting methodology provides the minimum of delineation and lettering needed to fully convey the intent of a particular drawing and the means for properly maintaining the drawing as an active record of the end product. Most INL produced drawings provide fabrication and inspection information. Some are intended for use in plant operating documents. Simplified drafting serves these end use purposes in a cost-effective manner. Specific requirements are given in the following paragraphs.

**NOTE:** *Care must be taken to provide the customer with a product that meets his needs. If artistic flourishes, extensive detailing, etc. are required for the end product, then this may be provided, but not at the expense of compromising drafting practices.*

8.1.3.1 Avoid artistic flourishes, unnecessary frills, shading, etc.

8.1.3.2 Omit excess detailing, nonproductive views, and unnecessary sections that do not contribute to the intent of the drawing

8.1.3.3 Except for a small isometric view to aid in interpretation avoid views that show information that can be clearly shown in existing portions of the drawing.

8.1.3.4 Avoid hidden lines unless they clarify the drawing.

8.1.3.5 Omit showing flutes, knurls, and details of standard parts.

8.1.3.6 On features that are repeated on a drawing, such as grill openings, louvers, etc., provide the detailed information at one location and enough detail at the other locations to identify the item.

8.1.3.7 Symbolic detail rather than actual detail shall be used when an article is common and familiar or when the detail is adequately described on another drawing or view. Screw threads, for example, are shown simplified in accordance with ASME Y14.6.

8.1.3.8 Normally, the necessary detail is shown at the detail drawing level. Omit unnecessary detail at the assembly and installation level.

8.1.3.9 On new drawings showing plan views of areas, buildings, structures, etc., the preferred orientation of the information depicted on the drawing should be the north direction arrow points towards the top or left hand margin of the drawing sheet. The direction of the north arrow symbol within a drawing package should remain consistent, to prevent confusion between drawings and views.

8.1.4 Table 8-1 lists the minimum text height for text used on drawings. The text style requirements are given in Section 10.

Table 8-1. Minimum text heights.

| Use | Minimum Text Height (in inches) |
|---|---|
| • Section letters (A-A)<br>• View letters (A)<br>• Tabulation letters (A, B, etc.)<br>• Word "SECTION"<br>• Word "VIEW" | 0.250 |
| • Dimensions<br>• Tolerances<br>• Notes<br>• Zone letters on field of drawing<br>• Subtitles for special views<br>• Parts lists | 0.125 |
| • Process and instrumentation diagrams (P&ID)<br>• Process flow diagrams (PFD) | 0.094 |

## 8.2 Rounding of Linear Units

8.2.1 When a figure is to be rounded to fewer digits than the total number available, the procedure shall be as follows.

8.2.1.1 When the first digit discarded is less than 5, then the last digit retained shall not be changed. For example 3.46325, if rounded to four (4) digits, would be 3.463; if rounded to three (3) digits, 3.46.

8.2.1.2 When the first digit discarded is greater than 5 or if it is a 5 followed by at least one (1) digit other than 0, then the last digit retained shall be increased by one. For example 8.37652, if rounded to four (4) digits, would be 8.377; if rounded to three (3) digits, 8.38.

8.2.1.3 When the first digit discarded is exactly 5, followed only by zeros, then the last digit retained should be rounded upward if it is an odd number, but no adjustment made if it is an even number. For example 4.365, when rounded to three (3) digits, becomes 4.36. The number 4.355 would also round to the same value, 4.36, if rounded to three (3) digits.

## 8.3 Drawing Notes

8.3.1 Notes are used on drawings for a variety of purposes. In some cases, they supplement the graphics, dimensions, and symbols with concise statements that complete the necessary fabrication information. Such a notation may apply to special treatment processes, to inspection requirements, to assembly procedures, or to any instruction more effectively conveyed by words than by delineation. A note may also be very generalized and invoke a requirement given in a national code for an entire circuit or system that comprises many components.

8.3.2 Notes shall be composed clearly and avoid vague and ambiguous terms and be written in the present tense. Notes given as examples in this standard are approved by the Design Drafting organization, and they may be used directly, when they properly apply, or as a guide for composing a note for a particular application.

### 8.3.3 Local Notes

8.3.3.1 Local notes are placed on the field of the drawing, outside the outline of the affected object, and as near as practicable to the affected region of the object. Information presented in these notes normally applies to a particular portion of the overall drawing.

8.3.3.2 Local notes are punctuated as necessary for clarity; however, only the longer notes that form complete sentences terminate with a period.

8.3.3.3 Fabrication operations such as drill, ream, tap, punch, or bore are not called out on drawings. The configuration, surface finish, and tolerance will permit the manufacturer to establish the type of operation required.

8.3.3.4 Spotface (SF), counterbore (CBORE), counterdrill (CDRILL), countersink (CSK), THREAD, and UNDERCUT are considered as descriptive terms, not as types of operations, and my be used in notes.

### 8.3.4 General Notes

8.3.4.1 The preferred location for general notes are located in the upper left-hand corner on General Engineering Drawings or on the bottom right of Architectural Engineering Drawings. A general note may serve any of several purposes; it may be a note that would become repetitive if placed at each point of application, a note that applies to the drawing in general, or a lengthy note that would occupy excessive space on the field of the drawing.

8.3.4.2 The general notes normally are presented in a sequence that corresponds to the sequence of the affected fabrication or processing steps.

8.3.4.3 On multi-sheet Engineering Drawings, the general notes begin on sheet 1.

8.3.4.4 On Engineering Drawings, a general note with a number enclosed in a delta symbol is cross referenced to another delta symbol with the same enclosed number, which is located at the note's point of application. This point of application may be the parts list, application block, tolerance block, field of the drawing, etc. The purpose of this methodology is to remove a space-consuming note from an otherwise congested area on the drawing. The general note may also have several points of application on the drawing, each cross referenced back to the general note by the same delta enclosed number, to thus save drafting time, repetition, and drawing space.

8.3.4.5 On Architectural Engineering Drawings, the general notes are located on the first drawing of a discipline (e.g., Civil, Piping, Electrical) often on a legend drawing. General notes list the information that is consistent for all drawings of that discipline.

8.3.4.6 A general note may specify a process or operation that affects only a portion of a part. In such a case, extension lines or dimension lines may be used in conjunction with a delta symbol on the face of the drawing to show the application of the note. Figure 8-1 provides an example in which three general notes are cross referenced to their applicable location by means of delta symbols.

8.3.4.7 Examples of commonly used notes:

8.3.4.7.1 Notes of the following forms are used frequently on electrical drawings and may serve either local note or general note applications.

A. FIELD ROUTE AND SUPPORT CONDUIT PER NATIONAL ELECTRICAL CODE.

B. RESISTANCE IN OHMS UNLESS OTHERWISE NOTED.

C. CAPACITANCE IN MICROFARADS UNLESS OTHERWISE NOTED.

D. ALL RESISTANCE VALUES ARE IN OHMS ±____% AND ARE ____WATT, UNLESS OTHERWISE NOTED.

E. ALL CAPACITANCE VALUES ARE IN MICROFARADS AND ARE ____WVDC, UNLESS OTHERWISE NOTED.

8.3.4.7.2 The following notes have specified application for casting and forging drawings; the first four are normally used as general notes, and the fifth note may be either a general or local note in accordance with the particular application.

A. REMOVE ALL BURRS, GATES, FINS, ETC., FLUSH WITH CONTOUR WITHIN .XX.

B. EXCEPT FOR DIMENSIONS MARKED (FORGING or CASTING) THE CONTOUR OF THE (FORGING or CASTING) IS NOT RESTRICTED BY THE ENVELOPE SHOWN IN PHANTOM.

C. THIS (FORGING or CASTING) TO BE SUBSEQUENTLY MACHINED ALL OVER.

D. SURFACES INDICATED TO BE SUBSEQUENTLY MACHINED.

E. ANGULAR RELATIONSHIP TO OTHER FEATURES IS NOT REQUIRED.

8.3.4.7.3 The following notes have wide application as general notes on mechanical equipment drawings; some may also be used as local notes.

A. ALL CORNER AND FILLET RADII .XX UNLESS OTHERWISE NOTED.

B. MARK PER (applicable standard) WITH (drawing number and applicable dash number with serial number if applicable).

C. WELD (or BRAZE, or GTAW, or GMAW, etc.) PER (applicable standard).

D. FABRICATE PER (applicable standard).

E. ASSEMBLE PER (applicable standard).

F. CLEANLINESS PER (applicable standard) LEVEL____.

**NOTE:** *When multiple drawings of like type are listed, sufficient modifiers shall be used in the title to allow the user to distinguish application differences. For example:*
*XXXXXX UNIT A WIRING DIAGRAM*
*XXXXXX UNIT B WIRING DIAGRAM*

G. THIS DRAWING USED IN CONJUNCTION WITH:
XXXXXX PIPING AND INSTRUMENT DIAGRAM
XXXXXX WIRING DIAGRAM

H. LOCKWIRE PER (applicable standard).

I. INSTALL ITEM____ PER MANUFACTURER'S INSTRUCTIONS.

J. PRIME ALL (SURFACES or EXPOSED SURFACES WITH____ COATS OF ITEM____ AND PAINT WITH ____COATS OF ITEM____.

K. HEAT TREAT TO CONDITION____ PER (applicable standard).

L. CHROME PLATE PER (applicable standard).

8.3.4.7.4 Additional general notes may be developed and standardized for an individual project. A specification may provide requirements and options that need to be stated as notes on a drawing.

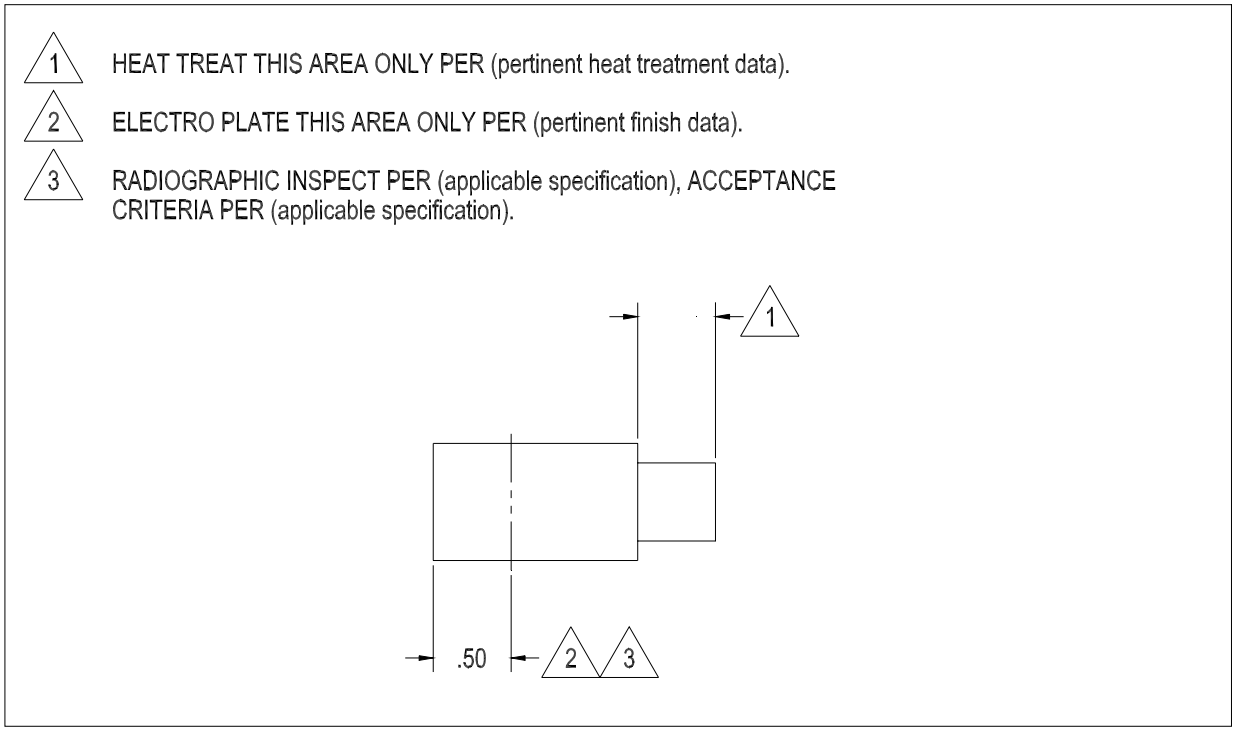


Figure 8-1. Examples of cross referencing a general note.

## 8.4 Dimensions and Tolerances

8.4.1 INL produced Engineering Drawings that require dimensioning normally expresses those dimensions in either United States (U.S.) customary units, the International System of Units (SI units), or “soft” metric units. Normally, only one of the three systems of dimensional units is used on any one drawing.

8.4.2 INL produced Architectural Engineering Drawings that require dimensioning normally express those dimensions in United States (U.S.) customary units of dimensions in feet, inches, and fractions of inches.

8.4.3 Civil engineering drawings normally express U.S. customary units of dimensions in feet and tenths of feet.

8.4.4 Engineering Drawings (mechanical or electromechanical) normally express U.S. customary units of dimensions in inches and decimals or inches and fractions of an inch.

8.4.4.1 If the dimension is 120 inches or more, then a reference dimension will normally be given in feet and inches. For example:

130.12
(10 FT – 10.12 IN)
or
(10' – 10.12")

8.4.5 The dimensioning and tolerancing practices covered in ASME Y14.5M, along with the applied symbology, shall be used on all INL produced Engineering Drawings.

8.4.6 On Engineering Drawings to be dimensioned in SI metric units, the format shall be altered by adding a metric tolerance block, reference Figure 6-6. The metric tolerance block includes the symbol indicating the application of third angle projection, which is the orthographic projection method widely accepted in the United States (further information on first angle and third angle projection is presented in ASME Y14.3). The Engineering Drawing format is further modified to identify the metric application by adding the notation SI METRIC, with a letter height of 10 mm, in the top left hand corner of the sheet, above the space for general notes.

8.4.6.1 The SI metric dimensioning and tolerancing practices covered in ASME Y14.5M shall be used on INL produced Engineering Drawings to be dimensioned in SI metric units.

8.4.6.2 In addition to the practices contained in ASME Y14.5M, the following fundamental rules for dimensioning and tolerancing shall apply to Engineering Drawings generated by the INL.

A. Dimension, extension, and leader lines shall not cross each other unless absolutely necessary. A dimension line shall not be broken, except for insertion of the dimension. Extension or leader lines shall not run through a dimension nor shall they be broken, except where they pass through or are adjacent to arrowheads.

B. Dimensions shall be shown in the view that most clearly represents the form of the feature.

C. Sufficient dimensions shall be given to clearly define the size, shape, and position of each feature.

D. A dimension shall be marked as reference ( ) when it is repeated on the same drawing, specified on a subordinate document, an accumulation of other dimensions, or shown for information purposes.

E. Dimensions shall be placed outside the outline of the part unless clarity is impaired.

F. Dimensions shall be selected and arranged to minimize the accumulation of tolerances between related features.

G. Dimensioning to hidden lines shall be avoided.

H. Dimensions shall be so given as to minimize the need to calculate, scale, or assume any dimension during the fabrication process.

I. Dimensions applying to two adjacent views are normally placed between the views.

J. Extension lines shall not connect two views.

K. Geometric tolerancing shall be used per ASME Y14.5M.

## 8.5 Scale of Drawings

8.5.1 Commonly used scales for Engineering Drawings. Other scales may be used for drawing clarification.

| Scale | Designation |
|---|---|
| Full size | 1/1 |
| Enlarged | 10/1, 4/1, 2/1 |
| Reduced | 1/2, 1/4, 1/8, 1/10, 1/20, 1/30, 1/40, 1/50, 1/60, 1/100 |

8.5.2 Commonly used scales for Architectural Engineering Drawings. Other scales may be used for drawing clarification.

| Scale | Designation |
|---|---|
| Full size | FULL |
| Enlarged | 10/1, 4/1, 2/1 |
| Reduced | HALF |
| | 3″ = 1′-0″ |
| | 1 1/2″ = 1′-0″ |
| | 1″ = 1′-0″ |
| | 3/4″ = 1′-0″ |
| | 1/2″ = 1′-0″ |
| | 3/8″ = 1′-0″ |
| | 1/4″ = 1′-0″ |
| | 3/16″ = 1′-0″ |
| | 1/8″ = 1′-0″ |
| | 3/32″ = 1′-0″ |
| | 1″ = 20.0′ |
| | 1″ = 30.0′ |
| | 1″ = 40.0′ |
| | 1″ = 50.0′ |
| | 1″ = 60.0′ |
| | 1″ = 100.0′ |
| | 1″ = 200.0′ |

8.5.3 New drawings shall be drawn to scale. However, when a dimensional change is made on a released general Engineering drawing and it is not practical to change the detail to agree with the new dimension, the dimension is underscored with a straight line to indicate the out-of-scale condition. When a dimensional change is made on a released Architectural Engineering Drawing and it is not practical to change the detail to agree with the new dimension, a line is added beneath the dimension to indicate the out-of-scale condition.

## 8.6 Parts List

8.6.1 A parts list is used on Engineering Drawings where parts and/or materials are required to fabricate or procure the item(s) shown on the drawing. See Figures 8-2 through 8-10.

8.6.1.1 Each part or material callout is entered only once in the parts list. Parts or materials referenced from another drawing are not entered.

8.6.1.2 Bulk items such as weld filler metal, solder, paint, primer, etc., are entered in the parts list and the quantity required is specified as "As-Required" (AR). The application method is specified in a general note.

8.6.1.3 Surface protection material such as electroplating, anodizing, etc., is not entered in the parts list. The callout by local or general note identifies the process, appropriate specification, and materials. For example:

ANODIZE PER (applicable specification), TYPE _____, CLASS _____.

NICKEL PLATE PER (applicable specification), FINISH NO. _____ ITEM 5 ONLY.

CHROME PLATE PER (applicable specification).

8.6.1.4 Material used in conjunction with protective coating applications such as thinning, reducing, cleaning, etc., are not entered in the parts list.

8.6.1.5 Alternate parts or materials may be used when they possess physical and functional interchangeable characteristics. Alternates should be kept to a minimum. Only the alternates listed on the drawing shall be used without changing the drawing.

8.6.1.6 Alternate parts are specified on the drawing in any of the following formats as applicable:

A. When there is no preference between two or more items, they are entered together in a single space in the parts list. For example:

**NOTE:** *Do not use a slash ( / ) to separate entries in the Parts List, use the word "or" so there is no confusion as to the intent.*

| PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MATERIAL / SPECIFICATION OR VENDOR NAME | |
|---|---|---|---|
| 123456-1<br>OR<br>123457-1 | VALVE | | |
| -1 | BRACKET | PLATE OR BAR, 1/4 THK<br>304 OR 304L SST | ASTM A 167 OR A 276 |

B. Two or more alternate items are specified in a tabulation block and qualified by a delta note. See Figure 8-10.

C. Single alternates are specified in a general note and delta referenced to the preferred item in the parts list. For example:

PERMISSIBLE TO USE (alternate part number and applicable vendor identification) IN PLACE OF ITEM XX.

| QTY REQD | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MATERIAL/SPECIFICATION OR VENDOR NAME | ITEM NO. |
|---|---|---|---|---|
| | -1 | | PLATE, ¼ THK 304 SST ASTM A 167 | 1 |

PARTS LIST

Figure 8-2. Detail drawing parts list.

| | | | | | |
|---|---|---|---|---|---|
| | | -3 | BRACKET | PLATE, ¼ THK CS — ASTM A 36 | 3 |
| | | -2 | BRACKET | PLATE, ¼ THK 304L SST — ASTM A 167 | 2 |
| | | -1 | BRACKET | PLATE, ¼ THK 304 SST — ASTM A 167 | 1 |
| QTY REQD | | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MATERIAL/SPECIFICATION OR VENDOR NAME | ITEM NO. |
| PARTS LIST | | | | | |

Figure 8-3. Tabulated detail drawing parts list.

| | | | | | |
|---|---|---|---|---|---|
| | AR | | WELD FILLER METAL | E60 OR E70 SERIES — AWS A5.1 | 15 |
| | | | | | 14 |
| | AR | | LOCK WIRE, ø.035 | 302 SST — ASTM A 580 COND A | 13 |
| | | | | | 12 |
| | 1 | E0360-058-1750 | EXTENSION SPRING | ASSOCIATED SPRINGS | 11 |
| | | | | | 10 |
| | 2 | | NUT, HEX ½-13 UNC-2B | CS — ASTM A 563 | 9 |
| | 2 | | BOLT, HEX HD ½-13 UNC-2A X 1 ½ LG | CS — ASTM A 325 | 8 |
| | | | | | 7 |
| | AR | | | PLATE, ¼ THK CS — ASTM A 36 | 6 |
| | | | | | 5 |
| | 1 | 543211-1 | HOUSING | | 4 |
| | | | | | 3 |
| | 1 | -2 | BRACKET | PLATE, ⅜ THK CS — ASTM A 36 | 2 |
| | | -1 | ASSEMBLY | | 1 |
| QTY REQD | -1 | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MATERIAL/SPECIFICATION OR VENDOR NAME | ITEM NO. |
| PARTS LIST | | | | | |

Figure 8-4. Assembly drawing parts list.

| -3 | -2 | -1 | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MATERIAL/SPECIFICATION OR VENDOR NAME | ITEM NO. |
|---|---|---|---|---|---|---|
| | | 15 | | NUT, HEX ½-13 UNC-2B | CS ASTM A 194 GR 2H | 9 |
| | | 15 | | BOLT, HEX HD ½-13 UNC-2A X 1 ½ LG | CS ASTM A 193 GR B7 | 8 |
| 1 | | | 403999-1 | MOTOR ASSEMBLY | | 7 |
| 3 | | | -6 | TAB | BAR, 2 X ½ CS ASTM A 36 | 6 |
| | 1 | | -5 | BRACKET | PLATE, ⅜ THK CS ASTM A 36 | 5 |
| | 2 | | -4 | BRACE | PIPE, 2 SCHED 40 CS BLACK FINISH ASTM A 53 GR B | 4 |
| | | 1 | -3 | HOUSING ASSEMBLY | | 3 |
| | | 1 | -2 | BRACKET ASSEMBLY | | 2 |
| | | | -1 | ASSEMBLY | | 1 |

QTY REQD

PARTS LIST

Figure 8-5. Multiple assembly drawing parts list.

| -2 | -1 | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MATERIAL/SPECIFICATION OR VENDOR NAME | ITEM NO. |
|---|---|---|---|---|---|
| 2 | | 256781-2 | HOUSING | | 5 |
| | 2 | 256781-1 | HOUSING | | 4 |
| 2 | 2 | 256780-1 | PLUNGER ASSEMBLY | | 3 |
| | | -2 | ASSEMBLY, OPPOSITE | | 2 |
| | | -1 | ASSEMBLY, SHOWN | | 1 |

QTY REQD

PARTS LIST

Figure 8-6. Shown and opposite assembly drawing parts list.

| | | | | | |
|---|---|---|---|---|---|
| | 2 | | TEE, BW<br>2 SCHED 40 | CS ASTM A 234 GR WPB | 20 |
| | 2 | | REDUCING TEE, BW<br>2 X 2 X 1 SCHED 40 | | 19 |
| | 2 | | ELBOW, BW<br>90° 2 SCHED 40 LR | | 18 |
| | 2 | | ELBOW, BW<br>45° 2 SCHED 40 LR | | 17 |
| | 2 | | CONCENTRIC REDUCER, BW<br>2 X 1 SCHED 40 | | 16 |
| | 2 | | ECCENTRIC REDUCER, BW<br>2 X 1 SCHED 40 | | 15 |
| | 2 | | HALF COUPLING, THREADED<br>1 3000# | CS ASTM A 105 | 14 |
| | 1 | | COUPLING, THREADED<br>1 3000# | | 13 |
| | 64 | | NUT, HEAVY HEX<br>5/8-11 UNC-2B | CS ASTM A 194 GR 2H | 12 |
| | 32 | | BOLT, STUD<br>5/8-11 UNC-2A X 3 3/4 LG | CS ASTM A 193 GR B7 | 11 |
| | 2 | | SLIP ON FLANGE<br>2 150# RF | CS ASTM A 181 GR 1 | 10 |
| | 2 | | SOCKET WELD FLANGE<br>2 150# RF | | 9 |
| | 2 | | BLIND FLANGE<br>2 150# RF | | 8 |
| | 2 | | WELD NECK FLANGE<br>2 150# RF | | 7 |
| | 3 | | GASKET, 1/16 THK<br>2 #150 RF FLANGE | FLEXIBLE GRAPHITE | 6 |
| | | | | | 5 |
| | AR | | | PIPE, 2 SCHED 40<br>CS ASTM A 120 | 4 |
| | AR | | | TUBING, 1/4 OD X .035 WALL<br>304 SST ASTM A 269 | 3 |
| | | | | | 2 |
| | | -1 | INSTALLATION | | 1 |
| | -1 | PART OR | NOMENCLATURE | MATERIAL/SPECIFICATION | ITEM |
| QTY REQD | | IDENTIFYING NO. | OR DESCRIPTION | OR VENDOR NAME | NO. |

PARTS LIST

Figure 8-7. Piping drawing parts list.

| | | | | | |
|---|---|---|---|---|---|
| | 2 | | SHOULDER SCREW, HEX SCH<br>¾ X 2 LG | CS ASTM A 325 | 20 |
| | 2 | | SHEET METAL SCREW, PAN HD SLOTTED<br>#10 X 12 LG | CADMIUM PLATED STEEL | 19 |
| | 2 | | SET SCREW, HEX SCH<br>¼-20 UNC-2A X ½ LG CUP POINT | CS ASTM A 325 | 18 |
| | 2 | | NUT, HEX<br>½-13 UNC-2B | CS ASTM A 563 | 17 |
| | 2 | | SPLIT LOCK WASHER<br>1/2 | CADMIUM PLATED STEEL | 16 |
| | 2 | | BOLT, HEX HD<br>½-13 UNC-2A X 1 ½ LG | CS ASTM A 325 | 15 |
| | 2 | | NUT, HEX<br>#5-40 UNC-2B | CADMIUM PLATED STEEL | 14 |
| | 2 | | PLAIN WASHER<br>#5 TYPE A | | 13 |
| | 2 | | MACHINE SCREW, HEX HD<br>#5-40 UC-2A X ¾ LG | | 12 |
| | | | | | 11 |
| | | | | | 10 |
| | 1 | 256781-2 | HOUSING | | 9 |
| | 1 | 256781-1 | HOUSING | | 8 |
| | | | | | 7 |
| | 1 | -6 | CAPTIVE BOLT | FLEXIBLE GRAPHITE ASTM A 120 | 6 |
| | 1 | -5 | BRACKET | PIPE, 2 SCHED 40 CS ASTM A 120 | 5 |
| | 1 | -4 | BRACE | PIPE, 2 SCHED 40 CS ASTM A 120 | 4 |
| | 1 | -3 | HOUSING | PIPE, 2 SCHED 40 CS ASTM A 120 | 3 |
| | | | | | 2 |
| | | -1 | INSTALLATION | | 1 |
| QTY REQD | -1 | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MATERIAL/SPECIFICATION OR VENDOR NAME | ITEM NO. |

PARTS LIST

Figure 8-8. Structural drawing parts list.

| | | | | | |
|---|---|---|---|---|---|
| | AR | | SOLDER | SN 60CS QQ-S-571 | 15 |
| | | | | | 14 |
| | AR | | PLAIN WASHER<br>#5 TYPE A | CLEAR VINYL | 13 |
| | AR | | WIRE, NO. 18 AWG<br>COATED, TYPE S | COPPER | 12 |
| | | | | | 11 |
| | 1 | 5MA4 | DIODE | INTERNATIONAL RECTIFIER CO | 10 |
| | 1 | HA12A6 | TIME RELAY | EAGLE SIGNAL CO | 9 |
| | 5 | 01121 | RESISTOR, 5K, ½ W, 5% | MASTER RESISTOR CO | 8 |
| | 5 | BBR-20-150 | CAPACITOR, 30 MFD, 120 VAC | CORNELL-DUBLIER CORP | 7 |
| | | | | | 6 |
| | 1 | -5 | EQUIPMENT TAG | PLASTIC ENGRAVING STOCK<br>1/16 THK, BLACK WITH WHITE CORE | 5 |
| | | | | | 4 |
| | 1 | 123456-1 | MOUNTING PLATE | | 3 |
| | | | | | 2 |
| | | -1 | ASSEMBLY | | 1 |
| | -1 | PART OR | NOMENCLATURE | MATERIAL/SPECIFICATION | ITEM |
| QTY REQD | | IDENTIFYING NO. | OR DESCRIPTION | OR VENDOR NAME | NO. |

PARTS LIST

Figure 8-9. Electrical drawing parts list.

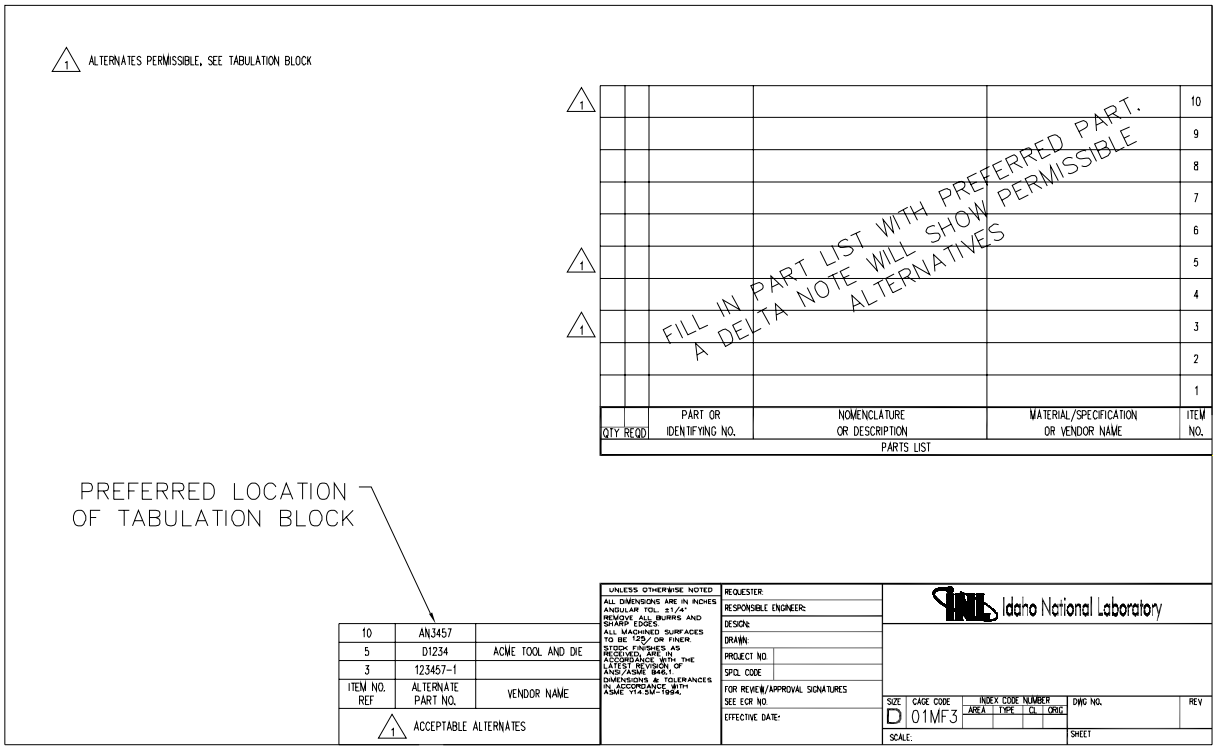


Figure 8-10. Parts list with permissible alternates.

# 9. GRAPHIC SYMBOLS

## 9.1 General Requirements

9.1.1 Graphic symbols provide an effective means for conveying certain engineering information on drawings in an abbreviated, space-saving manner. The nationally recognized standards listed herein have promoted the increasing uniformity of applied symbology throughout industry. These standards are accepted generally by the INL as the overall symbology guidelines for drawing preparation.

9.1.2 Graphic symbols that originate from a nationally recognized standard and that are used on a specific type of drawing (e.g., a piping and instrumentation diagram) may be referenced to their source document by a drawing note for definition. The symbols may also be defined in a legend placed on the drawing. A legend is normally required for definition of non-standard symbols.

9.1.3 INL developed graphic symbols discussed and illustrated in this section supplement the symbols provided in the nationally recognized standards.

These supplementary symbols have been adapted to specific needs and conventions that have evolved within the INL.

## 9.2 Identifying Sections and Views

9.2.1 To relate the viewing plane or cutting plane to its removed section or view, capital letters such as A, B, C, etc., are placed near each arrowhead (reference Subsection 9.4 for requirements for Architectural Engineering Drawings). The corresponding removed section or view are identified as SECTION A-A, SECTION B-B, VIEW C, etc. Section and View letters should be used in alpha order excluding I, O, Q, S, X and Z. If the alphabet is exhausted, additional removed sections and views shall be indicated by double letters in alpha order, as in AA-AA, AB-AB, AC-AC, etc.

## 9.3 Supplementary Engineering Drawing Symbols

9.3.1 Figure 9-1 illustrates several INL generated and adopted graphic symbols used on drawings. These supplement the symbols provided in the nationally recognized standards sited in this section.

9.3.1.1 Example A illustrates the delta symbol used to cross-reference a general note to a point of application elsewhere on the drawing. The same symbol enclosed number at the point of application refers back to the general note.

9.3.1.2 Example B illustrates the zone symbol used frequently on multi-sheet drawings and to cross-reference to a different drawing. Adaptations of the symbol for the single and multiple cross-references are shown.

9.3.1.3 Example C illustrates the elliptical symbol used on the field of the drawing to enclose an item number. The ellipse provides a visual aid in locating the item. Also reference Figure 7-1.

9.3.1.4 Example D gives the weld joint symbol commonly used on weld maps to identify each of the numerous weld joints. This identity facilitates traceability of the fabrication and inspection records to each individual weld.

9.3.1.5 Example E illustrates the circular symbol used to enclose the revision number. The revision identifier may be used on the field of the drawing to locate the area of a revision.

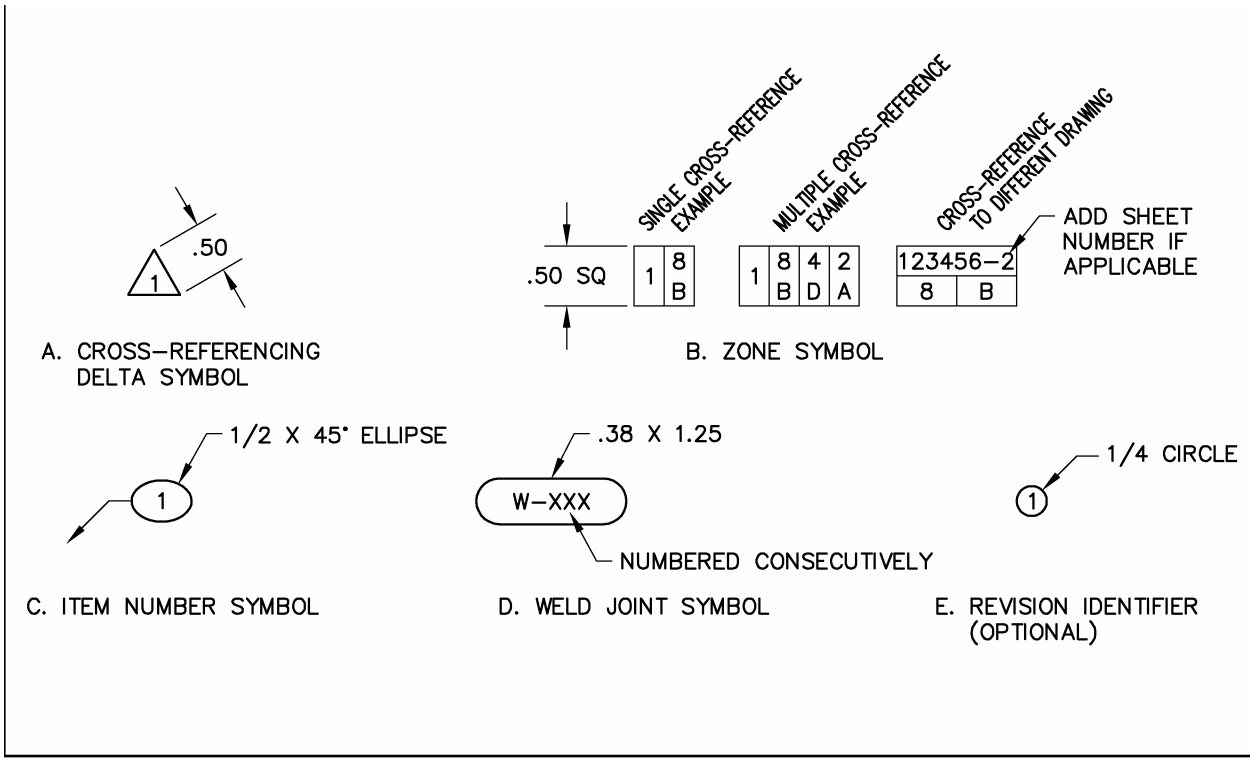


Figure 9-1. Supplementary drawing symbols.

## 9.4 Supplementary Architectural Engineering Drawing Symbols

9.4.1 Most of the graphic symbols used on INL produced Architectural Engineering Drawings are provided in the nationally recognized standards cited in this section. Those that provide symbology for architecture, steel members, maps, electrical diagrams, fluid systems, heating and ventilation systems, and welds are particularly useful in the architectural engineering applications.

9.4.2 The practices for presenting sections and details on Architectural Engineering Drawings are adapted to conventions that have evolved within the INL. While these overall practices are generally in accordance with the nationally recognized practices, some of the elements are unique and have become standardized for uniformity within the Architectural Engineering Drawing category.

9.4.2.1 On INL produced Architectural Engineering Drawings, the viewing plane for a section or view is normally identified by a circle (or balloon) with an integral arrow point on one end of the plane-indication line and an arrow point with no balloon on the other end. See Figure 9-3.

**NOTE:** *If the section and the viewing plane appear on different drawings, those drawings are cross-referenced in the lower halves of the balloons. If both the section and the viewing plane appear on the same drawing, a dash is placed in the lower part of each balloon*.

9.4.2.2 Frequent use of details is made to supplement information for certain components and features on produced Architectural Engineering Drawings. This practice avoids overcrowding in particular drawing locations and provides essential detail information. The local notation at the region to be detailed refers to the identifying number assigned to the detail. See Figure 9-4 through 9-8.

**NOTE:** *For cases in which the region of origin and the detail are placed on separate drawings, those drawings are cross-referenced in the lower part of the identifying balloons. If both the region of origin and the detail appear on the same drawing, a dash is placed in the lower part of the balloon*.

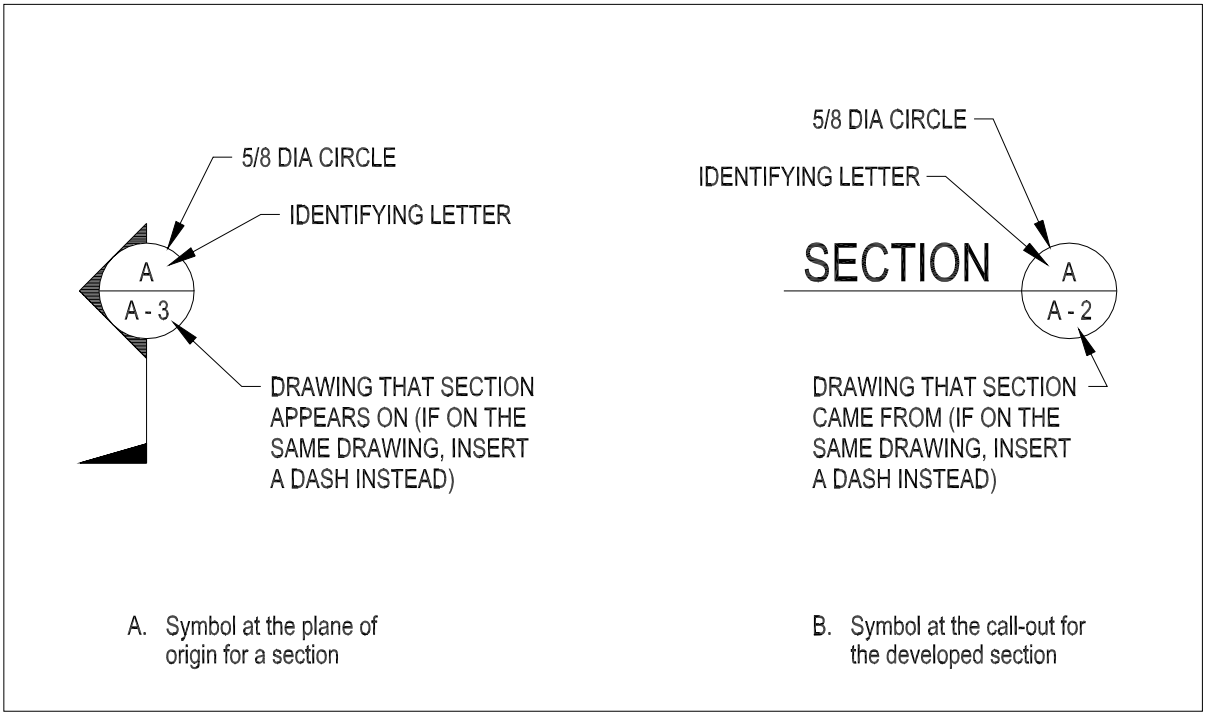


Figure 9-3. Architectural engineering drawing symbols.

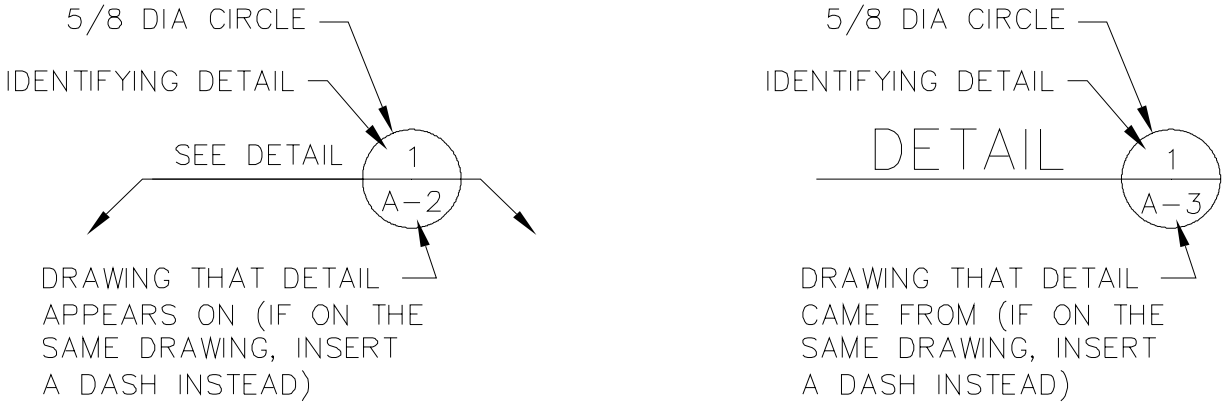


Figure 9-4. Architectural engineering drawing symbols.

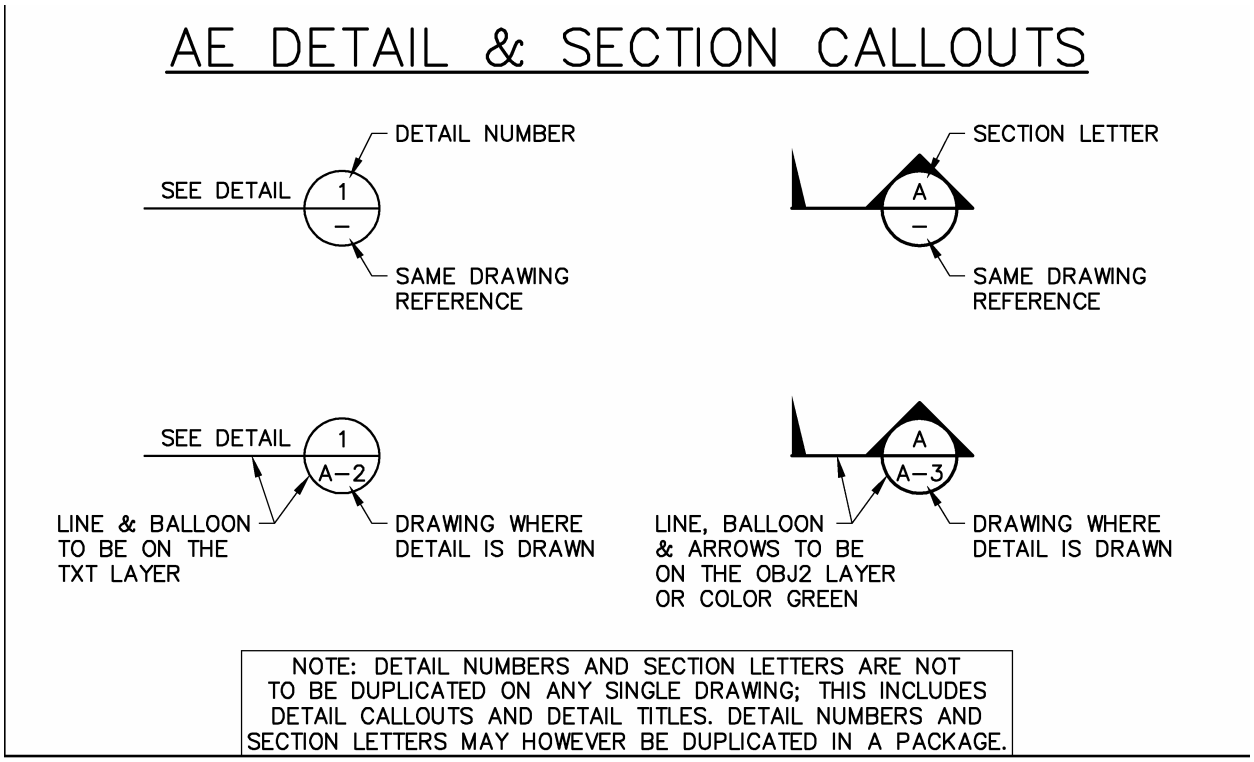


Figure 9-5. Architectural engineering drawing symbols.

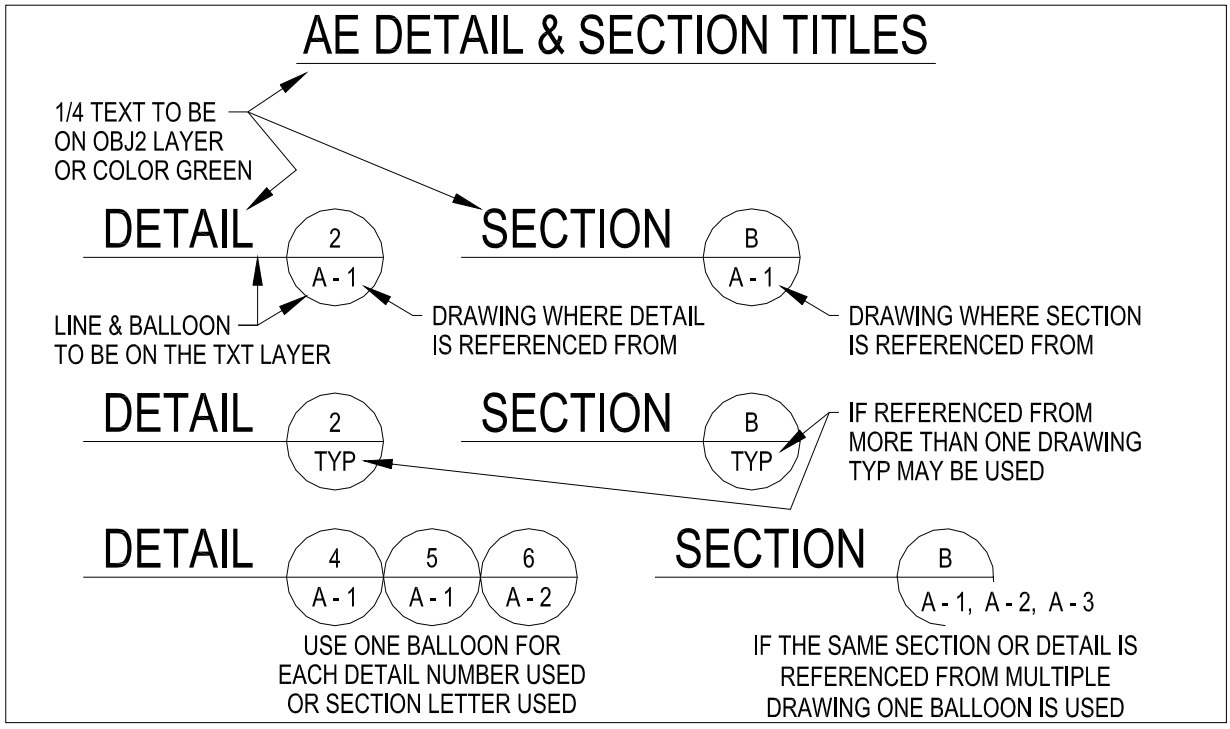


Figure 9-6. Architectural engineering drawing symbols.

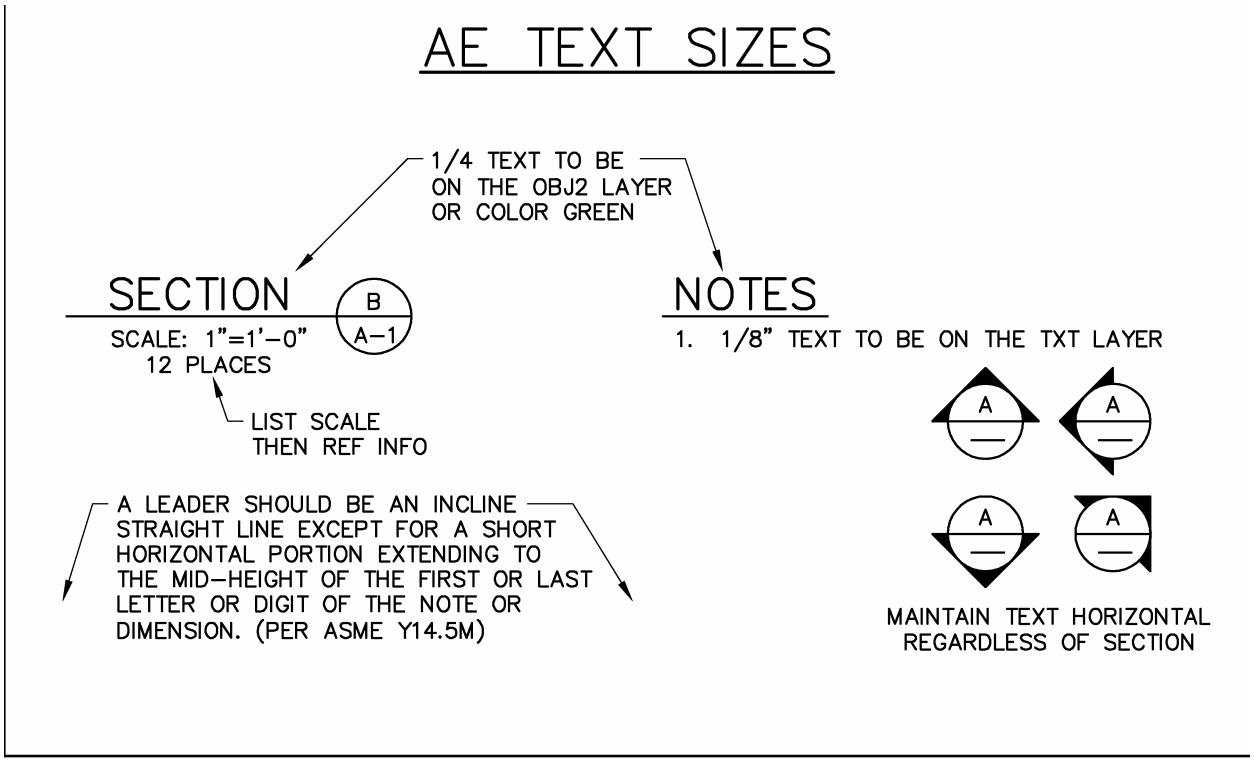


Figure 9-7. Architectural engineering drawing symbols.

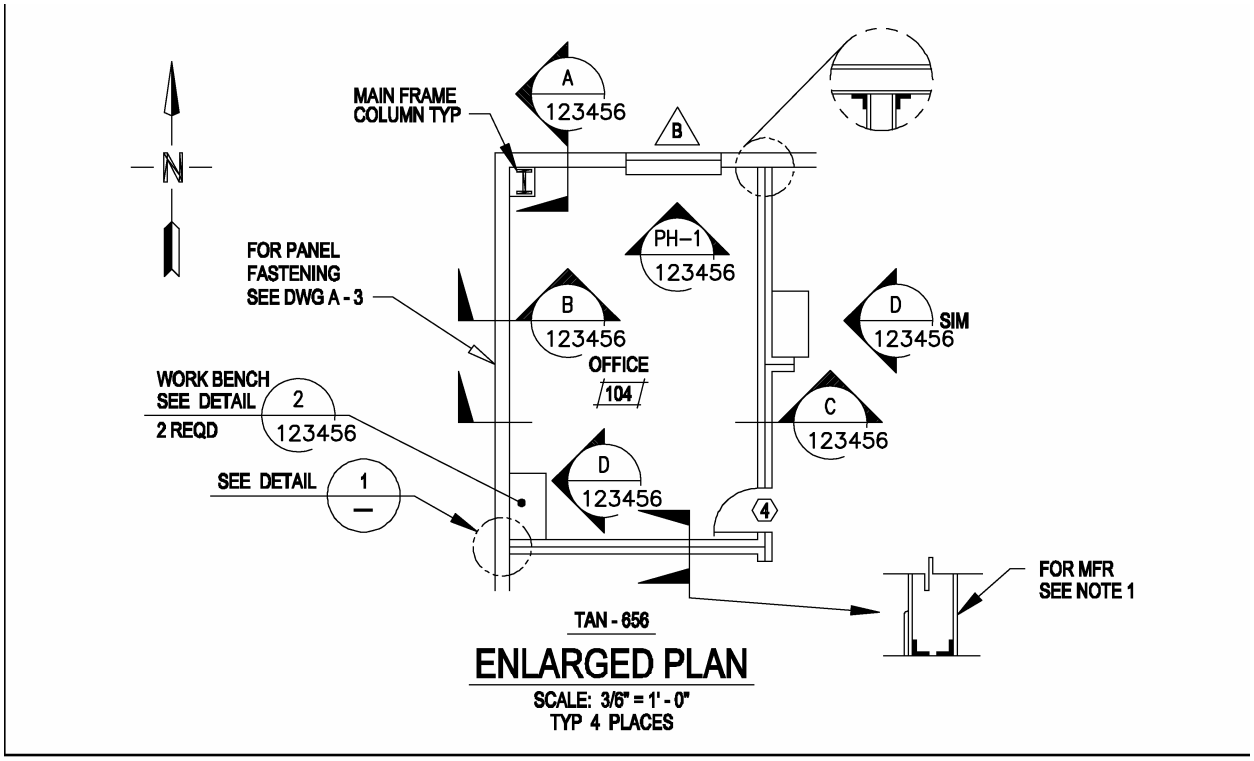


Figure 9-8. Architectural engineering drawing symbols.

9.4.3 Figure 9-9 shows the symbology on INL produced Architectural Engineering Drawings for designating photos typically used on demolition drawings.

9.4.3.1 Example A illustrates the symbol used at the point of origin of photo.

9.4.3.2 Example B is used in the caption for displaying the photo.

9.4.4 Electrical symbols of protective devices such as fuses and circuit breakers shall have the rating of that device adjacent to the symbol on the drawing. For breakers in electrical distribution panels the ratings may be incorporated into a standard detail of the panel. Other devices such as disconnect switch ratings, current transformer ratios, potential transformer ratios, and switchgear devices shall have their appropriate descriptive rating/American Standard function number similarly on or near the symbol. Transformer voltage ratings for primary and secondary voltages shall also be shown along with the applicable delta-Y, Y-delta, or other configuration of the transformer.

9.4.5 All photos or drawings shall be black and white or gray tone.

9.4.6 Drawings with photos shall be e-transmitted to a directory for release to provide EDMS with a single zipped file.

9.4.7 Photos shall be named with the drawing number, a dash, and a two character number, (e.g., 123456-01, 123456-02, 123456-03). The photo name shall be placed on the defpoints layer on the lower right corner of the drawing. This will allow the name to be turned off when printing.

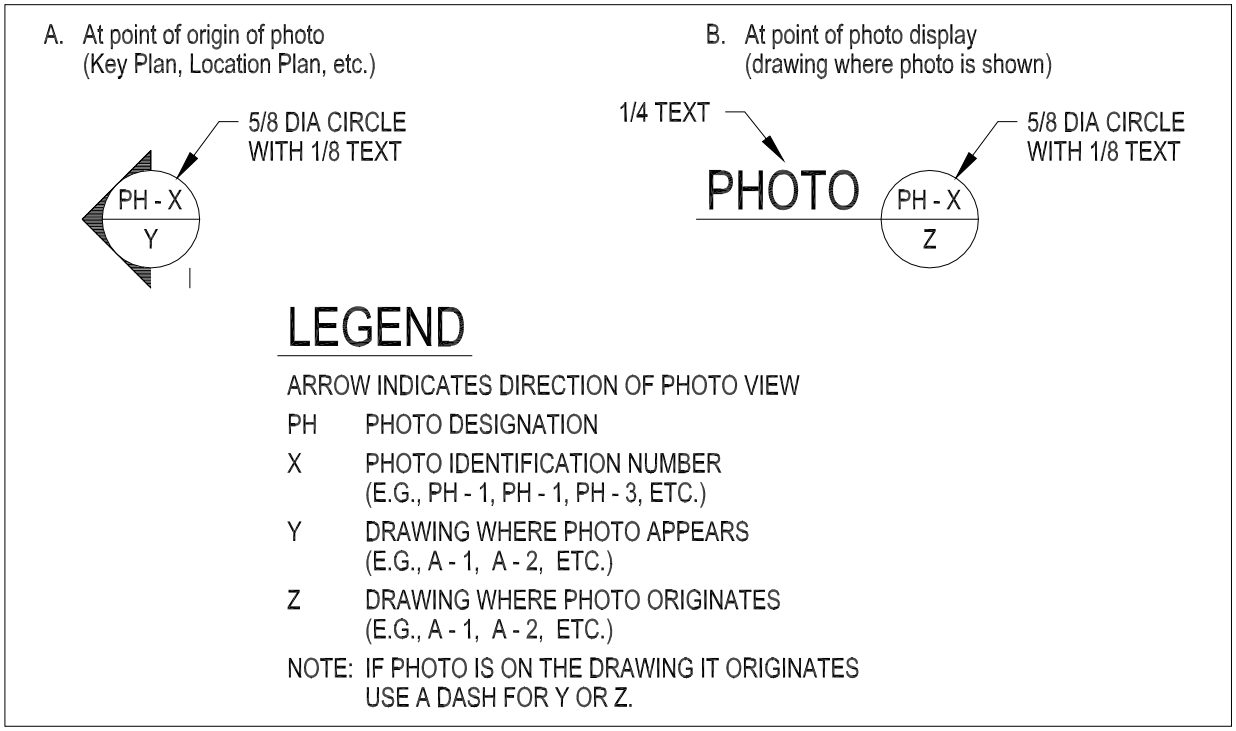


Figure 9-9. Architectural engineering drawing photo symbols.

# 10. DRAWING REVISIONS

## 10.1 General Requirements

10.1.1 A drawing revision is any change to a drawing that has been released into the controlled drawing system. The revision shall be properly authorized, identified and recorded, reviewed, and approved before it is released into the controlled drawing system.

10.1.2 The eCR shall be used to describe changes being made to the drawing and to record review and approval signatures.

10.1.2.1 A drawing revision shall be made by adding, deleting, or crossing out the information or by redrawing the drawing.

10.1.2.2 The crossing out method shall only be used when it is essential to retain the information on the drawing. It should be noted that prior revisions of drawings can be obtained through the drawing document control centers.

10.1.3 Revision status is identified by a numeric revision designator beginning with 1 and used in sequential order (e.g., 1, 2, 3). Certain INL and non-INL drawings have been revised using alpha revision designators. When these drawing are subsequently revised, the new revision designator shall be numeric and shall be determined using Table 10-1. For example, if a drawing to be revised was designated as a revision B, then the subsequent revision shall be revision 2.

## 10.2 Incorporation of Revision on Drawings

10.2.1 Revisions incorporated on drawings shall be authorized per the requirements contained in this standard and Subsection 10.5.

10.2.2 When substantive drawing changes authorized by a change authorization form are being incorporated on a drawing, minor changes may also be made without being recorded (all changes are subjected to a drafting check, verified by an authorized checker). (See LWP-1201.)

10.2.3 Revisions to drawings shall be consistent with the original workmanship and shall comply with the Drafting Practices Section (Section 8) of this standard.

10.2.4 Deletions required by changes to a drawing are made by removal or crossing out certain information. The crossing out of data shall be by a double line through each line of text, or by a series of diagonal parallel lines at a uniform spacing through the entire deleted detail. The cross-out method is used only when there is a distinct advantage to retain the deleted information.

10.2.5 Dimensional changes are made to scale. However, it is permissible to leave the delineation unchanged when the revised portion is not appreciably different. See Section 8.5.3 and the requirement contained in ASME Y14.35M.

10.2.6 When a general note is removed, the word REMOVED shall be inserted in its place. The note number remains on the drawing.

10.2.6.1 When a delta note is removed, revise as stated above and also remove the associated delta symbol from the note number in the drawing notes and the delta symbol and note number from the field of the drawing.

10.2.7 On drawings that have been revised or redrawn, the general notes are listed in their original numerical order and must be the same subject or application.

10.2.8 When a part identified by a dash (-) number is deleted from the face of the drawing and, consequently, from the parts list, the word REMOVED is inserted in the description column of the parts list. The dash number is left in the part number column and is not used again for another part. The item number is left in the item number column and not reused. All other information on the line entry is deleted.

10.2.9 AE drawing revisions beyond the as-built condition shall have the current change clouded.

10.2.10 Master facility and Essential drawings shall have the current change clouded or identified with a revision balloon (reference Figure 10-1). All other drawings may have the current change clouded or identified with a revision balloon.

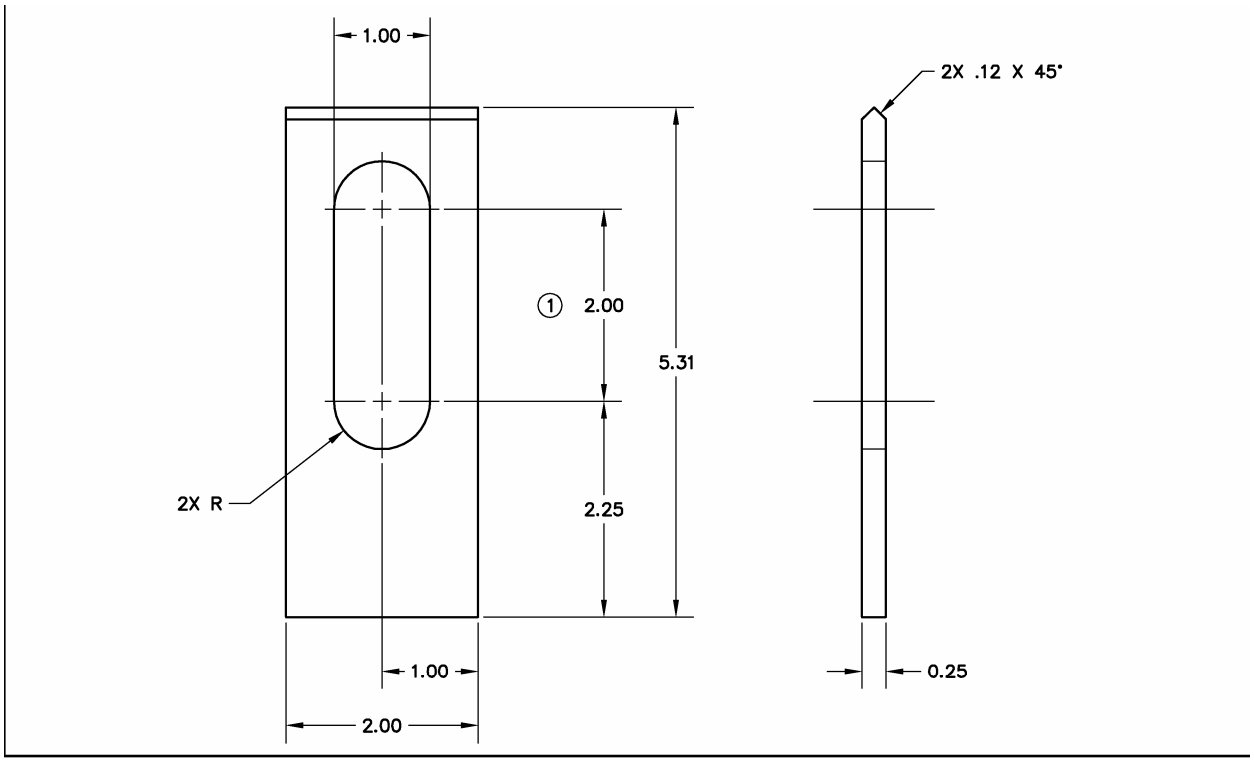


Figure 10-1. Revision.

## 10.3 Revision Block Entries

10.3.1 The revision block provides the designated space for maintaining a record of drawing revisions. Subsection 10.5 provide examples of revision block entries for a variety of change conditions applied to single-sheet and multi-sheet drawings.

10.3.1.1 Record changes made to a drawing by one of the following methods:

A. If the eCR form describes the specific drawing change(s), then enter the eCR number (no additional description required) in the Description Column.

B. When changes resulting from one or more revision authorization documents are so extensive or complicated as to make a clear description impracticable, the entry in the Description Column may be limited to the eCR number(s) and a clearly phrased general description. For example, "COMPLETELY REVISED FOR RELOCATION OF OXYGEN SYSTEM" or "GENERAL CHANGE ZONES 1A, 3B, AND 4C".

C. Enter the description of change and the eCR number in the Description Column.

10.3.2 The revision block shall display the previous revision and latest current entry.

10.3.3 If a Program's/Project's document, e.g., Engineering Job Number, Work Order (WO), is used to request a revision, the authorizing document may be listed in the description column of the revision block with the eCR number.

## 10.4 Revisions to Multi-Sheet Drawings

10.4.1 Concurrent revisions affecting any or all sheets of a multi-sheet drawing are identified by the same revision designator on only those sheets that require change and on sheet 1. The revision designator on sheet 1 applies to the drawing as a whole and not to individual sheets. A REVISION STATUS OF SHEETS block (reference Subsection 6.3.4.3) shall be included on sheet 1 when this typical method is used. Examples of revision block and revision status of sheet block entries for multi-sheet drawings are given in Subsection 10.5.

10.4.1.1 An optional multi-sheet method, for multi-sheet drawings that are contained in one file, advances the revision number on all sheets (even though some sheets require no change) and may forgo the addition of the REVISION STATUS OF SHEETS block. This method shall only be used to satisfy program/project documentation requirements with Drafting supervision approval.

Table 10-1. Alpha to numeric revision indicator conversion chart.

| Alpha | Numeric | | Alpha | Numeric | | Alpha | Numeric | | Alpha | Numeric |
|---|---|---|---|---|---|---|---|---|---|---|
| A | 1 | | AA | 23 | | BA | 45 | | CA | 67 |
| B | 2 | | AB | 24 | | BB | 46 | | CB | 68 |
| C | 3 | | AC | 25 | | BC | 47 | | CC | 69 |
| D | 4 | | AD | 26 | | BD | 48 | | CD | 70 |
| E | 5 | | AE | 27 | | BE | 49 | | CE | 71 |
| F | 6 | | AF | 28 | | BF | 50 | | CF | 72 |
| G | 7 | | AG | 29 | | BG | 51 | | CG | 73 |
| H | 8 | | AH | 30 | | BH | 52 | | CH | 74 |
| J | 9 | | AJ | 31 | | BJ | 53 | | CJ | 75 |
| K | 10 | | AK | 32 | | BK | 54 | | CK | 76 |
| L | 11 | | AL | 33 | | BL | 55 | | CL | 77 |
| M | 12 | | AM | 34 | | BM | 56 | | CM | 78 |
| N | 13 | | AN | 35 | | BN | 57 | | CN | 79 |
| P | 14 | | AP | 36 | | BP | 58 | | CP | 80 |
| R | 15 | | AR | 37 | | BR | 59 | | CR | 81 |
| S | 16 | | AS | 38 | | BS | 60 | | CS | 82 |
| T | 17 | | AT | 39 | | BT | 61 | | CT | 83 |
| U | 18 | | AU | 40 | | BU | 62 | | CU | 84 |
| V | 19 | | AV | 41 | | BV | 63 | | CV | 85 |
| W | 20 | | AW | 42 | | BW | 64 | | CW | 86 |
| Y | 21 | | AY | 43 | | BY | 65 | | CY | 87 |
| Z | 22 | | AZ | 44 | | BZ | 66 | | CZ | 88 |

Table 10-1. (continued).

| Alpha | Numeric | | Alpha | Numeric | | Alpha | Numeric | | Alpha | Numeric |
|---|---|---|---|---|---|---|---|---|---|---|
| DA | 89 | | EA | 111 | | FA | 133 | | GA | 155 |
| DB | 90 | | EB | 112 | | FB | 134 | | GB | 156 |
| DC | 91 | | EC | 113 | | FC | 135 | | GC | 157 |
| DD | 92 | | ED | 114 | | FD | 136 | | GD | 158 |
| DE | 93 | | EE | 115 | | FE | 137 | | GE | 159 |
| DF | 94 | | EF | 116 | | FF | 138 | | GF | 160 |
| DG | 95 | | EG | 117 | | FG | 139 | | GG | 161 |
| DH | 96 | | EH | 118 | | FH | 140 | | GH | 162 |
| DJ | 97 | | EJ | 119 | | FJ | 141 | | GJ | 163 |
| DK | 98 | | EK | 120 | | FK | 142 | | GK | 164 |
| DL | 99 | | EL | 121 | | FL | 143 | | GL | 165 |
| DM | 100 | | EM | 121 | | FM | 144 | | GM | 166 |
| DN | 101 | | EN | 123 | | FN | 145 | | GN | 167 |
| DP | 102 | | EP | 124 | | FP | 146 | | GP | 168 |
| DR | 103 | | ER | 125 | | FR | 147 | | GR | 169 |
| DS | 104 | | ES | 126 | | FS | 148 | | GS | 170 |
| DT | 105 | | ET | 127 | | FT | 149 | | GT | 171 |
| DU | 106 | | EU | 128 | | FU | 150 | | GU | 172 |
| DV | 107 | | EV | 129 | | FV | 151 | | GV | 173 |
| DW | 108 | | EW | 130 | | FW | 152 | | GW | 174 |
| DY | 109 | | EY | 131 | | FY | 153 | | GY | 175 |
| DZ | 110 | | EZ | 132 | | FZ | 154 | | GZ | 176 |

## 10.5 Revision Block Entries

### 10.5.1 Change Condition #1, Direct Drawing Change to Revise a Released Drawing

**EXAMPLE:**

| REV | DESCRIPTION | EFFECTIVE DATE |
|---|---|---|
| 3 | SEE eCR-XXXXXX | 3/29/07 |

**NOTE:** *Multiple eCR numbers can be listed in the Revision History block on the drawing.*

Remarks:

A. A eCR form is issued.

B. The required review/approval signatures on the eCR form shall be per LWP-1250.

**NOTE:** *If the only change to the drawing is to add or remove the Interim Drawing cross referencing note (reference Subsection 6.5), then reference Subsection 10.5.12 Change Condition #12.*

C. The drawing advances to the next revision number.

D. Drawing revisions shall be marked on the face of the drawing per the requirements in Subsection 10.2.

E. If an INL Title block will be added to a drawing that has a non-INL Title block, then follow Subsection 10.5.4 for Change Condition #4.

F. If the drawing title and/or index code changes, note change in Revision History block, DO NOT cloud changes in Title block or Index Code block.

Example of title block and index code revisions:

**EXAMPLE:**

| REV | DESCRIPTION | EFFECTIVE DATE |
|---|---|---|
| 3 | REVISED TITLE BLOCK AND INDEX CODE<br>SEE eCR-XXXXXX | 3/29/07 |

### 10.5.2 Change Condition #2 Direct Drawing Change to Incorporate a Field Change without Additional Changes

**EXAMPLE:**

| REV | DESCRIPTION | EFFECTIVE DATE |
|---|---|---|
| 3 | SEE eCR-XXXXXX | 3/29/07 |

Remarks:

A. A eCR form is issued (the eCR form used to initiate the Field Change shall be used).

B. The required review/approval signatures on the eCR form shall be per LWP-1201.

C. The drawing advances to the next revision number.

### 10.5.3 Change Condition #3 Direct Drawing Change to Incorporate a Field Change with Additional Changes

**EXAMPLE:**

| REV | DESCRIPTION | EFFECTIVE DATE |
|---|---|---|
| 3 | SEE eCR-XXXXXX | 3/29/07 |

Remarks:

A. Drawing shall be processed as a direct drawing change, Change Condition #1.

B. The required review/approval signatures on the eCR form shall be per LWP-1201.

### 10.5.4 Change Condition #4 Redraw Drawing with or without Additional Changes

**EXAMPLE:**

| REV | DESCRIPTION | EFFECTIVE DATE |
|---|---|---|
| 5 | REDRAWN (WITH/WITHOUT) CHANGE<br>eCR-XXXXXX | 3/29/07 |

Remarks:

A. A eCR form is issued.

B. The minimum required review/approval signatures on the eCR form shall be as follows:

1. If the drawing is redrawn without change, except for the addition of an INL title block, then an authorized checker and document owner approval is required.

2. If the drawing is redrawn with changes to the field of the drawing for a drawing revision per LWP-1201.

C. An INL format shall be used and the original index code and drawing number shall be retained (the originator code shall denote who created the original drawing, therefore it shall remain unchanged).

D. The drawing advances to the next revision letter.

E. The drafter enters his/her name in the title block and all applicable title block information as it appears on the replaced drawing.

F. Previous revision history is not carried forward to the redrawn drawing.

G. An authorized checker makes a comparison check.

### 10.5.5 Change Condition #5 Canceled Drawing

**EXAMPLE:**

| REV | DESCRIPTION | EFFECTIVE DATE |
|---|---|---|
| 3 | DRAWING CANCELED<br>SEE eCR-XXXXXX | 3/29/07 |

Remarks:

A. A eCR form is issued.

B. The minimum required review/approval signatures on the eCR form:

1. If the drawing is canceled without change then an authorized checker and document owner approval is required.

2. If drawing is canceled with change then process per the requirements contained in Section 4 for a drawing revision.

C. Process as a direct drawing change (Change Condition #1) in addition to the requirements contained here.

1. Enter CANCELED in the Special Code Block.

2. Add the canceled statement as near to the title block as possible. See Figure 10-4.

3. If one or more sheets of a multi-sheet drawing are being canceled, then see example in Subsection 10.5.17 for additional requirements.

D. Document control changes drawing status from “active” to “canceled”.

### 10.5.6 Change Condition #6 Superseded Drawing Replace a Drawing with a Superseding New Drawing Number

Entry on superseded drawing:

**EXAMPLE:**

| REV | DESCRIPTION | EFFECTIVE DATE |
|---|---|---|
| 3 | DRAWING SUPERSEDED BY DRAWING XXXXXX<br>SEE eCR-XXXXXX | 3/29/07 |

Remarks:

A. A eCR form is issued.

B. The minimum required review/approval signatures on the eCR form:

1. If the drawing is superseded without change, then an authorized checker and document owner approval is required.

2. If the drawing is superseded with change, then process per the requirements contained in Section 4.

C. Process as a direct drawing change (Change Condition #1) in addition to the requirements contained here.

1. Enter SUPERSEDED in the Special Code Block.

2. Add the superseded statement as near to the title block as possible. See Figure 10-5.

3. If one or more sheets of a multi-sheet drawing are being superseded, then see example in Subsection 10.5.17 for additional requirements.

D. Document control changes drawing status from “active” to “superseded”.

Entry on superseding drawing (drawing revision):

**EXAMPLE:**

| REV | DESCRIPTION | EFFECTIVE DATE |
|---|---|---|
| 1 | REPLACES DRAWING XXXXXX REV 3<br>SEE eCR-XXXXXX | 3/29/07 |

Remarks:

A. A eCR form is issued.

B. The required review/approval signatures on the eCR form shall be per LWP-1201.

C. Drawing shall be processed as a direct drawing change (reference Change Condition #1).

Entry on superseding drawing (new drawing):

**EXAMPLE:**

| REV | DESCRIPTION | EFFECTIVE DATE |
|---|---|---|
| — | REPLACES DRAWING XXXXXX REV 3 | |

Remarks:

A. A eCR form is issued.

B. The required review/approval signatures on the eCR form shall be per LWP-1201.

### 10.5.7 Change Condition #7 Reinstate A Canceled or Superseded Drawing with or without Change

**EXAMPLE:**

| REV | DESCRIPTION | EFFECTIVE DATE |
|---|---|---|
| 3 | DRAWING REINSTATED<br>SEE eCR-XXXXXX | 3/29/07 |

Remarks:

A. A eCR form is issued.

B. The minimum required review/approval signatures on the eCR form:

1. If the drawing is reinstated without change then an authorized checker and document owner approval is required.

2. If the drawing is reinstated with change, then process per the requirements contained in Section 4 for a drawing revision.

C. Process as a direct drawing change (Change Condition #1) in addition to the requirements contained here.

1. Remove CANCELED or SUPERSEDED from the Special Code Block, if applicable.

2. Remove the canceled or superseded statement near the title block, if applicable.

3. If one or more sheets of a multi-sheet drawing are being reinstated, then see example in Subsection 10.5.18 for additional requirements.

D. Document control changes drawing status from “canceled” or “superseded” to “active”.

### 10.5.8 Change Condition #8 As-Built Revisions General Engineering Drawings

**EXAMPLE:**

| REV | DESCRIPTION | EFFECTIVE DATE |
|---|---|---|
| 3 | AS-BUILT AS OF (date)<br>SEE eCR-XXXXXX | 3/29/07 |

Remarks:

A. A eCR form is issued.

B. The minimum required review/approval signatures on the eCR form shall be an authorized checker, the document owner, and the individual who performed the as-build field verification.

C. The drawing advances to the next revision number.

**NOTE 1:** *Before a drawing can be considered as-built (AS-BUILT AS OF (date) noted in the revision history block) the requirements contained in Section 4 for as-building drawings, shall be met. Also, see definitions for As-Built, As-built drawing, As-found, Physical configuration, and Walkdown in Section 17.*

**NOTE 2:** *PE stamps are removed when drawings are as-built.*

**NOTE 3:** *If an Essential Drawing is being revised to document the completion of an assessment of the drawing's accuracy and integrity then enter "ASSESSED AND VERIFIED AS-BUILT AS OF (date)" in the revision history block.*

### 10.5.9 Change Condition #9 As-Built Revisions Architectural Engineering Drawings (as-built condition of a project at the conclusion of construction)

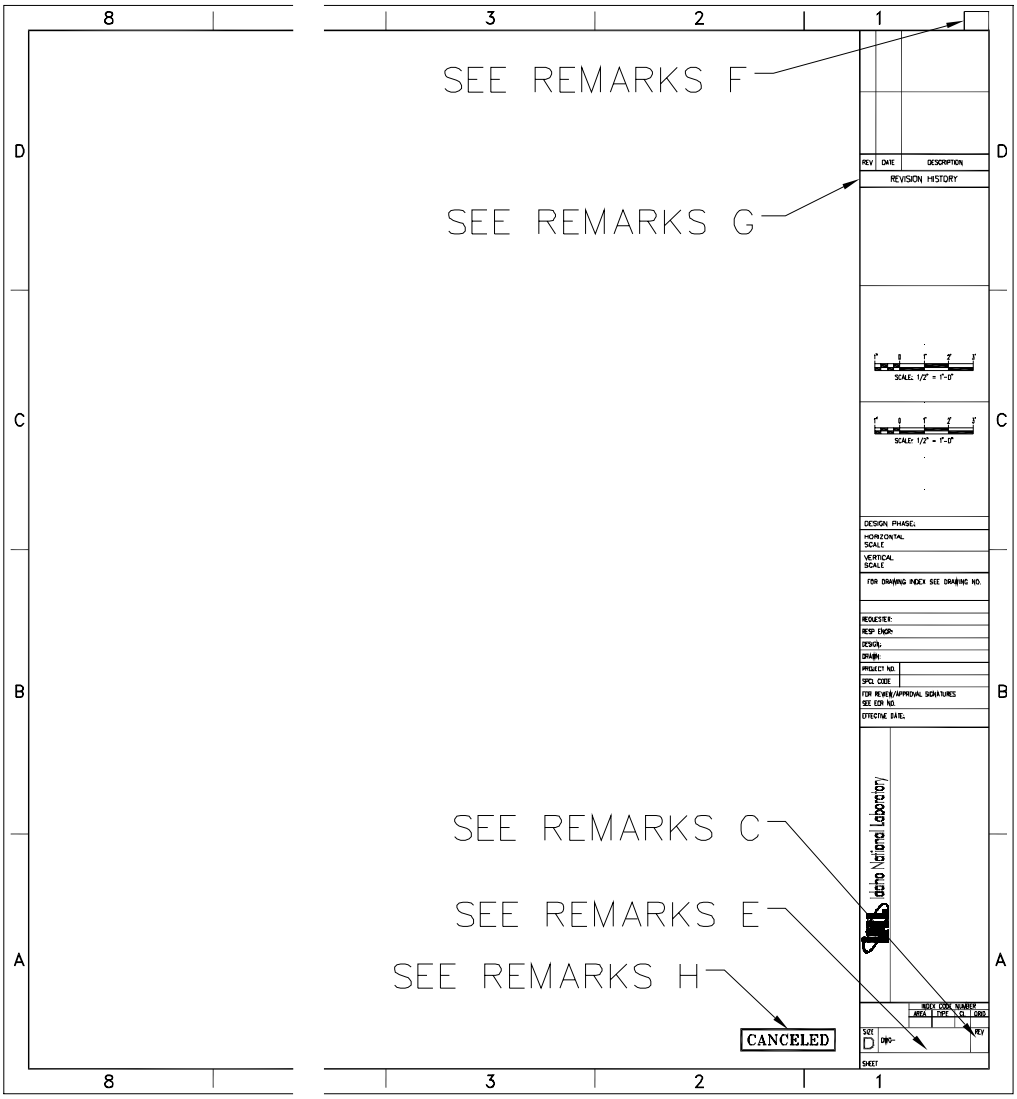


Figure 10-2. As-building architectural engineering drawings.

Remarks:

A. A eCR form is issued.

B. The minimum required review/approval signatures on the eCR form shall be an authorized checker and the document owner.

C. The drawing advances to the next revision number.

D. DO NOT indicate location of revision(s) on the face of the drawing by clouding. Remove any previous clouds

E. If the drawing is to be maintained as an operation and maintenance drawing (or applicable non operation and maintenance drawing), do the following:

Field of drawing:

1. Change the "HAND" font to "SIMPLEX" font as applicable.

2. Remove all construction notes and renumber notes (DO NOT enter "REMOVED" when removing a construction note).

3. Change all Architectural Engineering drawing call outs on the field of the drawing (i.e., P-1, P-2, S-1, S-2, E-1, E-2) to the applicable six digit drawing number. Do not reference canceled drawings.

Title Block:

1. Change the sheet number to 1 OF 1. If applicable, some drawings may be changed to multi-sheet drawings.

2. Remove the design phase call out (normally AFC).

3. Retain drawing index sheet drawing number if applicable.

4. Retain scale bar if applicable.

F. Remove page number.

G. Add applicable description call out in the revision history block.

H. If the drawing is no longer needed (i.e., Title Sheets, Demolition Drawings, drawing information was incorporated into existing operation and maintenance drawings), the drawing shall be CANCELED. See Subsection 10.5.5 for Change Condition #5. When the Architectural Engineering (construction) Drawing information is incorporated onto existing operation and maintenance drawings, the applicable operation and maintenance drawing number may be added to the cancellation statement, reference Subsection 10.5.11 for Change Condition #11.

**NOTE:** *Before a drawing can be considered as-built (AS-BUILT AS OF (date) noted in the revision history block) the requirements contained in Section 4 for as-building drawings, shall be met. Also, see definitions for As-Built, As-built drawing, As-found, Physical configuration, and Walkdown*.

### 10.5.10 Change Condition #10 Transfer Drawing(s) From Non-INL to INL

**EXAMPLE:**

| REV | DESCRIPTION | EFFECTIVE DATE |
|---|---|---|
| \ | RELEASED BY INL<br>SEE eCR-XXXXXX | 3/29/07 |

Remarks:

A. Verify file structure and modify as required.

B. Add an INL index code and drawing number (serial number) to the drawing near the title block.

C. Place a diagonal line in the REV column in the Revision History Block. The drawing revision indicator shall not advance.

D. Document Control shall enter the drawing into the controlled drawing system at its current revision level (the drawing shall be controlled by a drawing control center prior to any changes being made with the exception of the addition of an index code, drawing number, and assigned safety category). This will facilitate controlling the drawing in the condition it was received from the vendor (baseline).

**NOTE:** *It is the intent that all drawings being transferred into the INL drawing control center shall be controlled at the revision they were received. However, if for any reason, changes are made to the drawing, other than the addition of an index code and, drawing number then the drawing revision indicator shall be advanced*.

E. Subsequent changes shall be processed as a direct drawing change, reference Subsection 10.5.1 for Change Condition #1.

### 10.5.11 Change Condition #11 Incorporation of Interim Drawing on Affected Drawing

**NOTE:** *When information is incorporated from Interim Drawings onto their respective Master Facility Drawing or Essential Drawing (or other affected drawings as applicable).*

Entry on interim drawing:

**EXAMPLE:**

| REV | DESCRIPTION | EFFECTIVE DATE |
|---|---|---|
| 1 | DRAWING CANCELED AND INFORMATION INCORPORATED ON DRAWING (affected drawing number)<br>SEE eCR-XXXXXX | 3/29/07 |

Remarks:

A. A eCR form is issued.

B. The Interim Drawing shall be canceled, reference Subsection 10.5.5 for Change Condition #5 Canceled Drawing.

C. The required review/approval signatures on the eCR form shall be per LWP-1201.

D. The drawing advances to the next revision number.

Entry on affected drawing:

**EXAMPLE:**

| REV | DESCRIPTION | EFFECTIVE DATE |
|---|---|---|
| 1 | INCORPORATED INFORMATION FROM INTERIM DRAWING (Interim Drawing number)<br>AS-BUILT AS OF (date) (see remark D)<br>SEE eCR-XXXXXX | 3/29/07 |

Remarks:

A. A eCR form is issued.

B. The required review/approval signatures on the eCR form shall be per LWP-1201.

C. The drawing advances to the next revision number.

D. Add the statement "AS-BUILT AS OF (date)" in the revision history block only if the drawing is in an as-built condition.

### 10.5.12 Change Condition #12 Adding or Removing Interim Drawing Cross-referencing Note on Affected Drawing

**NOTE:** *Also reference Subsections 10.5.1 and 10.5.11 for Change Conditions # 1 and 11, respectively.*

Entry on affected drawing to add cross-referencing note:

**EXAMPLE:**

| REV | DESCRIPTION | EFFECTIVE DATE |
|---|---|---|
| 1 | ADDED DRAWING AFFECTED BY STATEMENT FOR EJN 2345<br>AS-BUILT AS OF (date) (reference remark D)<br>SEE eCR-XXXXXX | 3/29/07 |

Remarks:

A. A eCR form is issued.

B. If the only change is to add the Interim Drawing cross-referencing note, then the minimum required review/approval signatures on the eCR form shall be an Authorized Checker.

C. The drawing advances to the next revision number.

D. Add the statement "AS-BUILT AS OF (date)" in the revision history block only if the drawing is in an as-built condition. Normally, the as-built date will be the as-built date shown in the previous revision.

Entry on affected drawing to remove cross-referencing note:

**EXAMPLE:**

| REV | DESCRIPTION | EFFECTIVE DATE |
|---|---|---|
| 2 | REMOVED DRAWING AFFECTED BY STATEMENT<br>AS-BUILT AS OF (date) (reference remark D)<br>SEE eCR-XXXXXX | 3/29/07 |

Remarks:

A. A eCR form is issued.

B. If the only change is to remove the Interim Drawing cross-referencing note, then the minimum required review/approval signatures on the eCR form shall be an Authorized Checker.

C. The drawing advances to the next revision number.

D. Add the statement "AS-BUILT AS OF (date)" in the revision history block only if the drawing is in an as-built condition. Normally, the as-built date will be the as-built date shown in the previous revision.

### 10.5.13 Change Condition #13 Revising or Upgrading Record Release Drawings

Entry for a revision of a Record Release Drawing:

**EXAMPLE:**

| REV | DESCRIPTION | EFFECTIVE DATE |
|---|---|---|
| 1 | SEE eCR-XXXXXX | 3/29/07 |

Remarks:

A. A eCR form is issued.

B. Clouding of revisions is not required.

C. The drawing advances to the next revision number.

D. The minimum required review/approval signatures on the eCR form shall be an authorized checker and the document owner.

Entry for an upgrade of a Record Release Drawing:

**EXAMPLE:**

| REV | DESCRIPTION | EFFECTIVE DATE |
|---|---|---|
| 2 | UPGRADED TO (General Engineering, AE, or IM) STATUS REMOVED RELEASED FOR RECORD ONLY NOTATION SEE eCR-XXXXXX | 3/29/07 |

Remarks:

A. A eCR form is issued.

B. Clouding of revisions to upgrade a Record Release Drawing is not required.

C. The drawing advances to the next revision number.

D. Prior to release of an upgrade to a Record Release Drawing, an authorized checker shall check the complete drawing.

E. The required review/approval signatures on the eCR form shall be per LWP-1201.

### 10.5.14 Change Condition #14 Direct Drawing Change Drawing Revisions Made to Sheets 1, 2, & 4

Entry on sheet 1 of a multi-sheet drawing:

**EXAMPLE:**

| REV | DESCRIPTION | EFFECTIVE DATE |
|---|---|---|
| 1 | SEE eCR-XXXXXX | 3/29/07 |

| 4 | 3 | 2 | 1 | SHEET | REV STATUS OF SHEETS |
|---|---|---|---|---|---|
| 1 | — | 1 | 1 | REV | |

### 10.5.15 Change Condition #15 Direct Drawing Change, Drawing Revisions Made to Sheet 2, Revision to Sheet 4 was Made by a Previous Revision

Entry on sheet 1 of a multi-sheet drawing:

**EXAMPLE:**

| REV | DESCRIPTION | EFFECTIVE DATE |
|---|---|---|
| 2 | SEE eCR-XXXXXX | 3/29/07 |

| 4 | 3 | 2 | 1 | SHEET | REV STATUS OF SHEETS |
|---|---|---|---|---|---|
| 1 | — | 2 | 2 | REV | |

### 10.5.16 Change Condition #16 Redraw Drawing with or without Additional Changes

Entry on sheet 1 of a multi-sheet drawing:

**EXAMPLE:**

| REV | DESCRIPTION | EFFECTIVE DATE |
|---|---|---|
| 2 | REPLACES REV 1<br>SEE eCR-XXXXXX | 3/29/07 |

| 4 | 3 | 2 | 1 | SHEET | REV STATUS OF SHEETS |
|---|---|---|---|---|---|
| 2 | 2 | 2 | 2 | REV | |

Drawing revision indicator advances on all drawing sheets

### 10.5.17 Change Condition #17 Canceling Or Superseding Drawing Sheet and Adding Drawing Sheet, Cancel or Supersede Sheets 2 and 3, Add Sheet 4

Entry on sheet 1 of a multi-sheet drawing when drawing sheets are canceled and/or added:

**EXAMPLE:**

| REV | DESCRIPTION | EFFECTIVE DATE |
|---|---|---|
| 3 | SHEETS 2 AND 3 CANCELED<br>ADDED SHEET 4<br>SEE eCR-XXXXXX | 3/29/07 |

Entry on sheet 1 of a multi-sheet drawing when drawing sheets are superseded and/or added:

**EXAMPLE:**

| REV | DESCRIPTION | EFFECTIVE DATE |
|---|---|---|
| 3 | SHEETS 2 AND 3 REPLACED BY DRAWING XXXXXX<br>ADDED SHEET 4<br>SEE eCR-XXXXXX | 3/29/07 |

Entry on Rev Status of Sheets block for both examples (canceling or superseding drawing sheets):

**EXAMPLE:**

| 4 | 3 | 2 | 1 | SHEET | REV STATUS OF SHEETS |
|---|---|---|---|---|---|
| 3 | | | 3 | REV | |

### 10.5.18 Change Condition #18 Reinstate A Canceled Or Superseded Drawing Sheet

Entry on sheet 1 of a multi-sheet drawing:

**EXAMPLE:**

| REV | DESCRIPTION | EFFECTIVE DATE |
|---|---|---|
| 4 | REINSTATED SHEET 3<br>SEE eCR-XXXXXX | 3/29/07 |

| 4 | 3 | 2 | 1 | SHEET | REV STATUS OF SHEETS |
|---|---|---|---|---|---|
| 3 | 4 | | 4 | REV | |

**NOTE:** *Remove the canceled or superseded statement near the title block of sheet 3.*


Figure 10-4. Canceled statement.


Figure 10-5. Superseded statement.

# 11. CHECKING OF DRAWINGS AND DRAWING REVISIONS

## 11.1 General Requirements

11.1.1 An authorized drafting checker shall perform checking of drawings and drawing revisions. A list of authorized checkers shall be issued to EDMS by the drafting supervisor. The authorized checker list shall be reviewed by the drafting supervisors annually.

**NOTE:** *Other qualified personnel may be assigned to perform checking functions by the Drafting Supervisor or an appointed designee. However, release authorization of drawings and drawing revisions (reference Subsection 4.2) shall be by an authorized checker.*

11.1.2 The drawing and/or drawing revision package submitted to checking shall be as complete as possible to allow for drawing verification.

11.1.2.1 A complete check package shall include the following items, when applicable:

A. Change authorization documentation, for example, eCR, Engineering Job Number (EJN), Engineering Work Request.

B. When a drawing revision is made, include a print of the drawing before changes were made.

C. Sketches (information received from the requester to prepare drawings or drawing revisions)

D. Review prints (see Subsection 11.1.3)

E. Vendor data and catalog cuts

F. All other information used in the preparation of drawings or drawing revisions.

11.1.3 Drawings or drawing revisions submitted to checking shall be stamped with an applicable stamp designating the print as a CHECK PRINT.

11.1.3.1 The first check print shall be reduced to 11 × 17 unless otherwise requested by the authorized checker.

11.1.4 Once drawings or drawing revisions are submitted to checking, changes shall not be made without checker concurrence.

11.1.4.1 In the case of CAD drawings, any changes that are authorized to be made to the drawing plot shall also be made to the CAD file, and the checker shall verify both changes.

11.1.5 The following marking standard for CHECK PRINTS shall be followed.

**NOTE:** *A comment in blue but circled in red requires resolution*.

| Color | Function | Color Code Definition |
|---|---|---|
| Yellow | Checker | Correct as shown |
| Blue | Checker | Questions, comments, or suggestions for requester or drafter |
| Red | Checker | Incorrect data or required change/verification |
| Green | Engineer | Resolution of comments or additional changes that may be required |
| All others | Drafter | Comments or notes for general use |

11.1.6 All CHECK PRINTS shall be returned to the checker after incorporation of checker comments by drafting.

## 11.2 Specific Checking Requirements

### 11.2.1 All Drawings

11.2.1.1 The checker shall verify the following, as applicable, for all drawings and/or drawing revisions:

A. Drawing meets all applicable requirements contained in this standard.

B. Drawing is prepared with appropriate format and title block.

C. Drawing contains a unique drawing number that is not duplicated within EDMS.

D. Index Code is consistent with the content of the drawing and follows the requirements contained in Subsection 7.8.

E. Drawing review and approval concur with Section 9.

F. Drawing contains sufficient information for its end use. Drawings used for Operation and Maintenance include sufficient information.

G. Special or unique operating conditions or cautions, as specified by the design engineer, are identified.

H. Weld procedures, inspection methods, and acceptance criteria are defined.

I. Standards are compatible with materials used.

J. Dimensions are accurate and in accordance with INL and ANSI/ASME drafting standards.

K. Views, sections, and details exist on drawings and are oriented per standard drafting practices.

L. System diagram and physical installation drawings are adequate and compatible (e.g., P&ID agrees with physical, schematic diagram agrees with wiring diagram).

M. Drawing arrangement complies with standard drafting practices, including symbology and format.

N. Views are scaled properly and appropriately.

O. There is sufficient information on the drawing to facilitate fabrication.

P. Specialized processes or assembly methods are noted.

Q. Interfacing components are compatible.

R. Applications of tolerances are compatible with fabrication methods. Tolerances should be as large as possible within the limits for assembly and required component function.

S. Standard vendor supplied items are fully documented in the part list or on the field of the drawing to facilitate procurement.

T. Design features allow the most simplified method of manufacturing.

U. Result of the fabrication, not the method used, is shown.

V. Fasteners, which hold assemblies together, or weld joints, are accessible to perform assembly function and required maintenance activities.

W. Finishes are standard size and to the largest value possible, considering end use of item and fabrication procedure.

X. General notes are numbered consecutively and in the approximate sequence of fabrication or processing.

Y. All notes are clear, concise, and apply to only one subject. They are written in the present tense, and punctuated grammatically. Words/abbreviations are spelled correctly and used properly.

Z. Method of calling out general notes on drawings is consistent with type of drawing format being utilized.

AA. Drawing scale is appropriately noted in the title block and field of drawing, if applicable.

BB. Dimensioning practices allow for component interchangeability.

CC. Drawings contain appropriate references to applicable national codes/standards.

DD. Drawings contain appropriate inspection criteria/quality/functional testing requirements.

EE. All existing drawings affected by the new design configuration shall reference the new drawing at point of design change to satisfy program/project documentation requirements.

FF. Drawings contain proper cross-referencing between drawings.

GG. All documents referenced on the drawing (i.e., drawings, specifications, standards, codes) are released and available.

HH. Reference packages with markups are returned to the engineer.

### 11.2.2 Engineering Drawings

11.2.2.1 The checker shall verify the following for Engineering Drawings and other drawings and/or drawing revisions with similar format/end use:

A. Drawings contain a parts list of components which are specified on the field of the drawing. Consistent methodology shall be applied to the entire drawing. An exception to this requirement is that the components may be called out on the field of the drawing, however, a parts list is the preferred method.

B. Parts list item numbers are in agreement with the item numbers on the field of the drawing.

C. Quantity required agrees with the design shown.

D. Titles of components in the parts list agrees with subassembly/detail component drawing title.

E. Each part or material call out is entered only once in the parts list.

F. If applicable, the application block is completed correctly.

G. National standards are interpreted and applied correctly to the drawing.

H. All sheets of a multi-sheet drawing utilize the same index code, drawing number, and sheet size.

I. Multi-sheet drawings have a REV STATUS OF SHEETS block near the revision history block on sheet one.

J. Parts list and notes for multi-sheet drawings are shown on sheet one or location is noted on sheet one.

K. The addition of zone locator symbol is applied correctly to details and sections of multi-sheet drawings.

L. When a weld identification table is used, the numbers on the field of drawing and weld identification table agree.

M. Alternate parts or materials are noted and identified.

### 11.2.3 Architectural Engineering Drawings

11.2.3.1 The checker shall verify the following for Architectural Engineering Drawings:

A. Cover sheet (Title sheet) is part of the Architectural Engineering package and includes a drawing index of package drawing contents.

B. Drawing numbers, sheet numbers, and page numbers on drawings agree with cover sheet.

C. The primary drawing title is the official project title and agrees on all drawings in the package.

D. The secondary drawing title adequately describes the information shown on the drawing and agrees with the cover sheet.

E. Drawing package is assembled to match the order as shown in Subsection 6.2.1.8.B with proper discipline designation. All related drawings are grouped such that the subcontractors will know their area of responsibility.

F. Assigned safety category should be removed.

G. Call outs of common features/components on interdisciplinary drawings are in agreement.

H. When the drawing call out states “See Specification” the information indicated exists within the associated specification.

I. Specification schedule of drawings agrees with cover sheet.

J. Assigned equipment identification numbers agree on drawings and specification.

K. Current drawing status is indicated in the drawing title block.

L. Physical design features/locations are consistent between package disciplines and do not interfere with identified existing known/planned facilities/equipment.

M. Material and components are identified in the specification or on the field of the drawing (drawings normally do not contain a parts list).

N. Drawings within a discipline indicate the appropriate location of any legend and general notes.

O. Any new utility line services connect to appropriate existing utility lines in active service.

### 11.2.4 Drawing Revisions

11.2.4.1 The checker shall verify the following for drawing revisions:

A. Drawing(s) meets all applicable requirements contained in this standard.

B. The change is consistent with the presentation of views, projections, etc. already shown on the drawing.

C. Method of revising drawings meets program/project needs.

D. Existing drawings affected by the revision are identified/revised to provide a consistent documentation loop.

E. Drawing revision workmanship is consistent with that shown on the existing drawing.

F. Revision level of sheets on a multi-sheet drawing may vary, but the latest revision shall always apply to sheet one and be shown in the REV STATUS OF SHEETS block. Advancement of the revision level of all sheets is permissible to satisfy program/project documentation requirements.

G. Appropriate change authorization documentation is supplied in the check package.

H. Revision does/does not affect function/interchangeability of components for anticipated future use.

I. Changes on the field of the drawing may be indicated by clouding or a revision identifier (Subsection 9.3.1.5) in the area of change.

J. When a general note is removed from a released drawing the word “REMOVED” shall be inserted in its place and the note number retained.

K. When a delta note is removed, the associated delta symbol is removed from the note number in the drawing notes and the delta symbol and note number are removed from the field of drawing.

L. When an item and/or dash numbered component is deleted from a parts list, the following apply: (a) the item and/or dash number remains in the parts list item and/or dash number column, (b) all other existing information on that part is removed from the parts list, (c) the notation “REMOVED” shall be placed in the parts list nomenclature or description column, (d) the item and/or dash number shall not be used for another part, and (e) all field of drawing call outs, views, and notes referring to the deleted component shall be deleted from the drawing.

M. Safety category indication has been removed per LWP-13014.

### 11.3 Authorizing Drawing Release

11.3.1 Authorizing drawing release by an Authorized Checker shall follow the requirements contained in Section 4. The signed eCR form and electronic files are then sent to EDMS for processing. See Figure 11-1 for process flow.

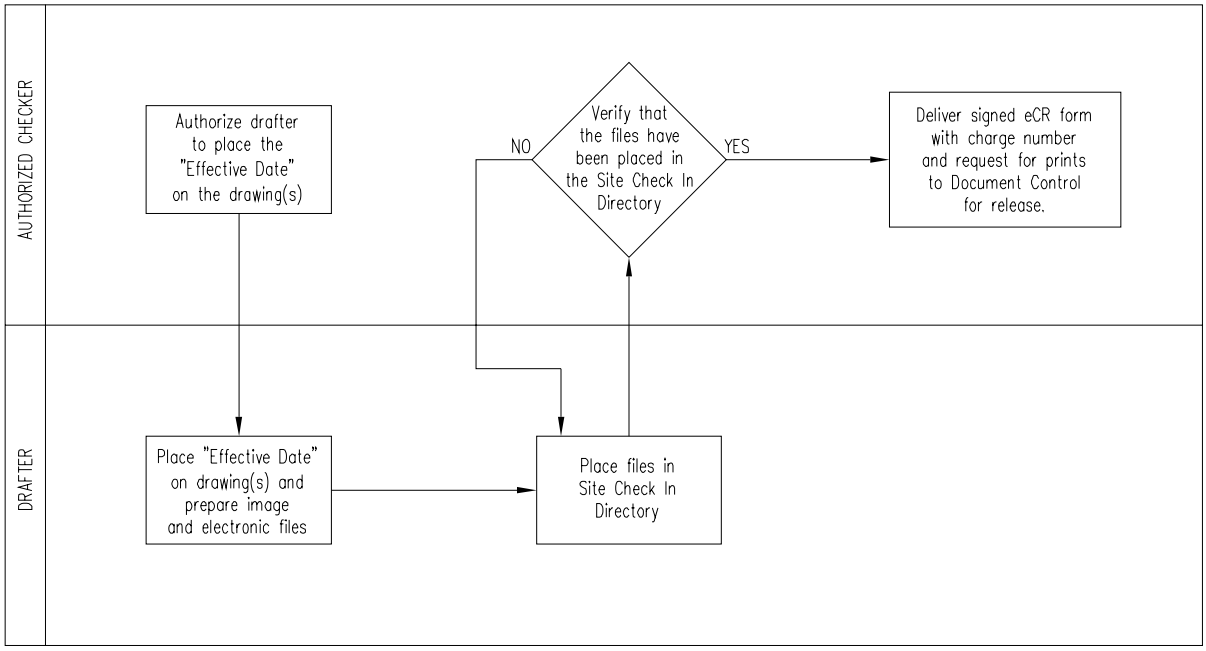


Figure 11-1. Drawing release process flow diagram.

## 12. CAD DRAFTING PRACTICES

### 12.1 General Requirements

12.1.1 Save CAD files every half-hour.

12.1.2 Make daily backup copies of all CAD files on applicable drafting server.

## 12.2 AutoCAD Requirements

### 12.2.1 Software Requirements

The .dwg AutoCAD file type shall be used for release of drawings into EDMS when a zip file is necessary, the zip file will be .exe and shall include the .dwg file.

12.2.1.1 Establish the environment to which the drawings are prepared by using AutoCAD SETUP command to set LIMITS, SCALE, and FORMAT SIZE. Drawings using Paper space shall set the scale to FULL (reference Subsection 12.5).

12.2.1.2 Use only approved drawing formats.

12.2.1.3 Set the bottom left corner of the drawings to coordinates 0,0, unless otherwise approved by the Drafting Manager or an appointed designee.

12.2.1.4 Create drawings not reliant on a scale factor, i.e., electrical schematics, wiring diagrams, loop diagrams, piping and instrument diagrams, at a scale of 1/1.

12.2.1.5 Use precise endpoint location techniques to ensure closed corners and precision line work. The use of SNAP and OSNAP can facilitate this process.

12.2.1.6 Generally, symbols shall be created on layer “0” to enable the symbol to be moved from one layer to another and take on the characteristics of each layer it is placed on.

12.2.1.7 Purge all unused blocks, non-standard layers, line types, non-standard text styles, etc. from drawing files before release.

### 12.2.2 Standard Layering Assignments

12.2.2.1 The standard layering assignments shown in Table 12-1 and/or as defined below shall be used for the preparation of new drawings and/or drawing revisions. Deviation from this standard layering assignments requires prior approval from the Drafting Supervisor or an appointed designee.

Table 12-1. Standard layering assignments.

| Name | Color | Line Width | Line Type | Layer Use |
|---|---|---|---|---|
| 0 | 7 (white) | 0.008 | Continuous | Symbol generation |
| CL | 5 (blue) | 0.008 | Center | Center lines |
| DIM | 1 (red) | 0.008 | Continuous | Dimensions, leader lines |
| FMT | 6 (magenta) | 0.021 | Continuous | Format |
| HALF | 11 | 0.013 | Continuous | Halftone |
| HATCH | 4 (cyan) | 0.008 | Continuous | Hatching |
| HCL | 11 | 0.013 | Center | Halftone - Center lines |
| HHID | 11 | 0.013 | Hidden | Halftone - Hidden lines |
| HID | 5 (blue) | 0.008 | Hidden | Hidden lines |
| HPHM | 11 | 0.013 | Phantom | Halftone - phantom lines |
| HTXT | 14 | 0.004 | Continuous | Halftone text |
| OBJ1 | 7 (white) | 0.008 | Continuous | Thin object line |
| OBJ2 | 3 (green) | 0.021 | Continuous | Wide object line |
| OBJ3 | 2 (yellow) | 0.013 | Continuous | Medium object line |
| PHM | 5 (blue) | 0.008 | Phantom | Phantom lines |
| SECT | 3 (green) | 0.021 | Phantom | Section lines |
| TXT | 2 (yellow) | 0.013 | Continuous | Text |
| CLOUD | 4 (cyan) | 0.008 | Continuous | Indicating drawing revisions |

12.2.2.1.1 Use only color numbers 1 through 256. Deviation from the standard color assignment requires prior approval from the Drafting Manager or an appointed designee.

### 12.2.3 Text

12.2.3.1 Use vertical Simplex text style for the preparation of all new drawings and/or drawing revisions.

12.2.3.2 Minimum text height shall conform to the requirements contained in Subsection 8.1.4.

12.2.3.3 Make fraction call outs as follows: 13/16, 1/8, 1/4, etc.

12.2.3.4 Do not use blocks that may need to be exploded for editing.

12.2.3.5 Do not use attribute text for general notes or material call outs.

### 12.2.4 Plotting

12.2.4.1 See system administrator for printer/plotter configuration files.

### 12.2.5 Paper Space

12.2.5.1 Drawings shall utilize the capabilities of Model space/Paper space allowing the ease of plotting full size drawing details at different scale factors.

12.2.5.2 Setup the drawing environment such as LIMITS, SCALE, and FORMAT SIZE to FULL SIZE in paper space using the AutoCAD SETUP command.

12.2.5.3 In paper space, set the limits to the desired sheet size with the lower left limit set to 0,0.

12.2.5.4 In model space, set the limits to the extents of the object within the drawing.

12.2.5.5 Draw all entities in model space to FULL SCALE. Place all text, dimensioning, and drawing formats in paper space.

### 12.2.6 Externally Referenced Files (x-ref)

12.2.6.1 The use of externally referenced files (x-refs) may be used to limit errors and rework of objects (floor plans, civil plans, assembly drawings, etc.) that are used repetitively through out the drawing package.

12.2.6.2 In setting up the x-ref files refer to Subsection 12.2 for layering guidelines.

12.2.6.3 Set VISRETAIN system variable to 1.

12.2.6.4 Set PSLTSCALE system variable to 1.

**NOTE:** *AE packages may be excluded from displaying offspring drawing lists.*

### 12.2.7 Releasing Externally Referenced (x-ref) Files to Document Control

12.2.7.1 To facilitate change control, all x-ref drawing shall be released to document control as follows:

12.2.7.1.1 Insert a standard INL format.

12.2.7.1.2 The drawing Title Block, line 4 or 5, shall read: MASTER X-REF.

12.2.7.1.3 Assign a 6-digit drawing number.

12.2.7.1.4 List all offspring drawings on the master x-ref drawings above or directly to the left of the Title Block. See Figure 12-1.

12.2.7.1.5 List all x-ref drawings on the offspring drawings, above or directly to the left of the Title Block. See Figure 12-1.

12.2.7.1.6 A eCR form is required to release the x-ref drawing by document control. Only signature required for drawing review and approval shall be an authorized checker.

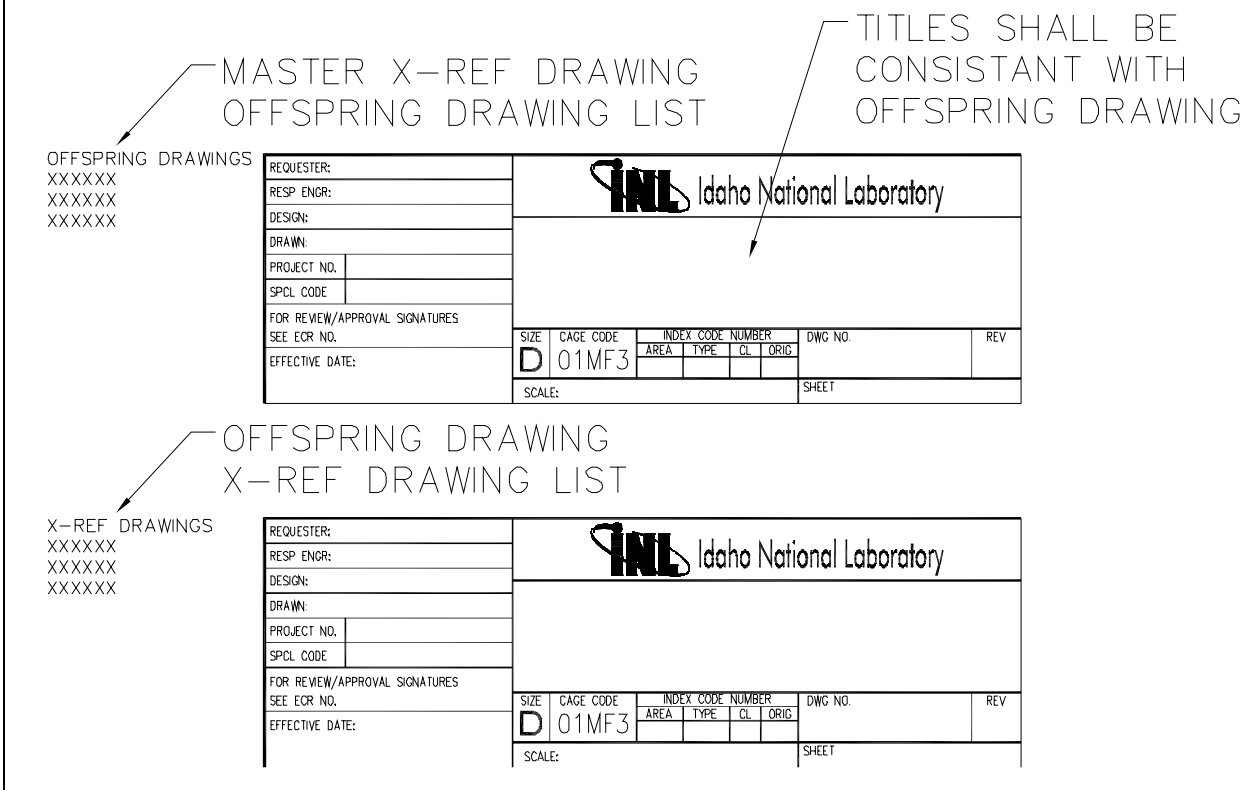


Figure 12-1. X-ref cross referencing.

## 12.3 Pro-Engineer Requirements

### 12.3.1 Software requirements

The following Pro/Engineer software modules are currently utilized at INL:

Behavioral Modeler

Collaboration

Design Animation

Interactive Surface Design

Mechanism Design

Mechanism Dynamics

Pro/ASSEMBLY

Pro/CABLING

Pro/CDT

Pro/DETAIL

Pro/FEATURE

Pro/HARNESS-MFG

Pro/NOTEBOOK

Pro/PHOTORENDER

Pro/PIPING

Pro/PROCESS_ASM

Pro/REPORT

Pro/SHEETMETAL-DES

Pro/SURFACE

Pro/WELDING

### 12.3.2 Drawing Size and Formats

Drawing sizes and supplied formats are as follows:

| Drawing Size | Format Name |
|---|---|
| A size 8-1/2 × 11 | inl_a_assy<br>inl_a_det |
| B size 11 × 17 | inl_b_assy<br>inl_b_det |
| C size 17 × 22 | inl_c_assy<br>inl_c_det |
| D size 22 × 34 | inl_d_assy<br>inl_d_det<br>inl_d_shtz |
| E size 34 × 44 | inl_e_assy<br>inl_e_det<br>inl_e_shtz |

### 12.3.3 Layers and Colors

Layers listed below shall be used for all models and drawings. Colors used in drawings are default Pro/Engineer colors. Additional layers may be used as deemed appropriate with approval by the Drafting Supervisor.

| Layer Name | Description | Where Used |
|---|---|---|
| DATUM | Datum planes | Parts, assemblies |
| EXTRA | Automatically added but unneeded text, etc. | Drawings |

### 12.3.4 Text

#### 12.3.4.1 Text Height

Text height shall be 1/8 in. (after plotting) on all general text within the borders of the format Larger text heights may be used for titles, or wherever needed for clarity.

#### 12.3.4.2 Text Styles/Fonts

Only text styles supplied with Pro/ENGINEER will be acceptable. Vendor-created, or third party text styles and fonts are not to be used.

### 12.3.5 Model Environment

#### 12.3.5.1 General Requirements

12.3.5.1.1 Models shall be created in such a way that cosmetic dimensions on the drawings are minimized.

12.3.5.1.2 Relations shall be adequately explained with comments (/* comment).

#### 12.3.5.2 Weldments

12.3.5.2.1 Depending on complexity, weldments may be either a single part with multiple features or they may be assemblies of features. Whenever it is necessary to show the weld seam an assembly is the preferred method. If an assembly drawing is made, the parts ellipse and a parts lists are not needed.

12.3.5.2.2 If assembly weldments are created, the individual parts will not have a drawing number of their own. Instead, they will have a number derived from the weldment drawing number, substituting a unique part identifier for the document type (reference Section 10). For example, a bracket and a sleeve that are part of the weldment 123456 could have the file names 123456-BRKT and 123456-SLV, respectively.

12.3.5.2.3 Weldments created as assemblies shall have the word “WELDMENT” included as part of the title.

#### 12.3.5.3 Library Parts

When commercially obtainable parts such as fasteners are used, the models for such parts may come from the Pro/ENGINEER LIBRARY.

### 12.3.6 Drawing Environment

#### 12.3.6.1 Review Prior to Drawing Creation

Models of design shall be submitted for engineering review prior to creation of drawings.

### 12.3.6.2 General Requirements

12.3.6.2.1 Local and leader notes and cosmetic features shall be attached to the views in which they are found.

12.3.6.2.2 Leader notes and other dimensional information given in note form must be parametric whenever possible.

12.3.6.2.3 In addition to the views required to adequately depict the object, a trimetric (general) view at a reduced scale is to be shown on the drawing.

12.3.6.2.4 All parts and assemblies will have materials assigned to them from the Pro/ENGINEER materials directory.

12.3.6.2.5 Family tables may be used for vendor parts, nuts, bolts, etc. They are not to be used for part development.

### 12.3.6.3 Assembly Drawings

12.3.6.3.1 Part and assembly files must have parameters defined (reference Section 1.1.1).

12.3.6.3.2 After views of assembly have been added to drawing, ellipse numbering to match the parts list.

12.3.6.3.3 Prior to release the bill of materials (BOM) shall be fixed to freeze the order of parts.

#### 12.3.6.4 Parts List/BOM Revisions

12.3.6.4.1 Part numbers assigned to drawings and purchased parts may only be replaced with similar parts or removed.

12.3.6.4.2 For every part deleted from an assembly, a null assembly named REMOVED1, REMOVED2, etc., shall be created and added to the assembly without placement constraints (packaged).

12.3.6.4.3 Null assembly (REMOVED1) shall be added to BOM in assembly drawing and parts list and fixed to same part number as deleted part.

### 12.3.7 Document Numbers

#### 12.3.7.1 Drawing Numbers

Drawing numbers are assigned by EDMS per LWP-1201.

**NOTE:** *The revision number is not an integral part of the drawing number*.

#### 12.3.7.2 Electronic File Numbers

The electronic file number matches the drawing number (see Subsection 7.2).

# 13. ELECTRICAL DRAWING DOCUMENTATION REQUIREMENTS AT MATERIALS AND FUELS COMPLEX (MFC)

## 13.1 Purpose

Electrical drawing documentation requirements are used to ensure clarity and consistency in identifying modifications on drawing prints and sketches associated with installation documents. This document provides guidance in the uniformity and diagrammatic information required for accurate and consistent drawing documentation of facilities and systems at MFC. Available resources to assist in generating and locating drawing information are also contained.

## 13.2 Scope

This document applies to all MFC organizations and personnel who are responsible for generating or reviewing installation documents which install new and/or modify existing electrical equipment at MFC.

## 13.3 Responsibilities

13.3.1 The Lead Engineer is responsible for providing schematic diagrams, associated sketches, and marked drawings to the Electrical Configuration Control Coordinator (ECCC).

13.3.2 The ECCC is responsible for ensuring the documentation of authorized modifications to the electrical system at MFC.

## 13.4 Procedure

13.4.1 Each installation document shall contain interim drawing prints which are clearly marked and adequately depict specifically what the installation document is installing and/or removing.

13.4.2 Before the final review, each installation document shall include all associated schematics and sketches. Modifications made to existing wiring diagrams and other associated drawings may be included at this time, but may also be added by the ECCC during the review process.

13.4.3 Interim Drawings should be generated by the Design Drafting Department, per Subsection 6.5.

13.4.3.1 Modifications to existing systems shall be enclosed within a thick border and identified as being involved in a specific installation document.

13.4.3.2 A configuration control signature block will be added.

| | Signature | Printed Name | Date |
|---|---|---|---|
| ECCC | | | |
| Technician | | | |

13.4.3.3 The ECCC will log the work package and related drawings into the appropriate database, prepare a revised drawing list (RDL), and sign the configuration control signature block.

13.4.3.4 The MFC Configuration Control Coordinator will stamp the drawing "RECORD COPY" and add the drawing to the work package for completion.

13.4.3.5 The technician will sign the supplemental signature block when the work is complete and the drawing is marked with "AS BUILT" changes.

13.4.3.6 At the completion of the work package the Configuration Control Coordinator will return the "RECORD COPY" drawings and RDL to the ECCC for As-Built review/incorporation into EDMS.

### 13.5 Records

13.5.1 The MFC ECCC maintains records as required to assure maximum traceability of all electrical changes issued for installation.

Field changes shall be available in the EDMS system on the interim drawing.

## 14. DRAWING REQUIREMENTS FOR SUBCONTRACTED PROJECTS

Drawings shall consist of a complete set of individual drawings which graphically describe the required work for a given project.

### 14.1 Standards

Drawing format, drawing numbering schemes, and layering shall be defined by the subcontractors drawing standards based on nationally recognized standard guidelines (e.g., ANSI, IEEE, ASME, MIL-STD).

### 14.2 Deliverables

14.2.1 Approved drawings shall be provided to the drafting supervisor by the project manager upon the completion of a project for inclusion into EDMS as a non-INL vendor drawing.

14.2.2 The subcontractor shall provide the following items for each drawing.

14.2.2.1 Drawings signed off shall have all signatures and dates added to the electronic files before final submittal to INL.

14.2.2.2 Electronic drawing files in .dwg or .08F Pro-B, .drw, .prt, or .asm format including all electronic attachments. For Inventor drawings provide a pack-n-go of the .idw file (.idw, .ipt, iam, and .ipj)

14.2.2.3 11 × 17 hard copy or a full size copy if a PE stamp was required.

14.2.2.4 Files shall be transmitted electronically from vendor to INL via an approved transfer medium (i.e., CD, email, USB drive).

14.2.2.5 Files created with data management links such as those created with Pro/PDM, Pro/INTRALINK, etc., shall have those links removed prior to submission to INL.

14.2.2.6 If files are compressed (ZIPPED) for submittal, the decompression utility must be included with the files.

# 15. APPLICABLE DOCUMENTS

## 15.1 General Requirements

15.1.1 Standardization of many terms and abbreviations used on drawings has been promoted by prominent, nationally-recognized technical societies and organizations. The standard terms and abbreviations complying with national and/or international interpretation are acceptable for use on drawings.

15.1.2 Certain terms and acronyms have acquired frequent use within the more localized aspects of work performed at the INL. Such terms and acronyms are either defined within the text of this document or in other referenced INL documents (see LST-2 and ASME Y14.38).

## 15.2 Applicable Documents

AIA, “Architectural Graphic Standards” (Ramsey and Sleeper)

AISC, *Manual of Steel Construction*

ANSI Y14.5-66, “Electrical & Electronic Diagrams”

ANSI Y23.2, “Graphic Symbols for Electrical and Electronic Diagrams”

ASME Y14.1, “Decimal Inch Drawing Sheet Size and Format”

ASME Y14.2M, “Line Conventions and Lettering”

ASME Y14.3M, “Multiview and Sectional View Drawings”

ASME Y14.4M, “Pictorial Drawing”

ASME Y14.5M, "Dimensioning and Tolerancing"

ASME Y14.6, "Screw Thread Representation"

ASME Y14.6AM, "Screw Thread Representation Metric Supplement to ASME Y14.6"

ASME Y14.7.1, "Gear Drawing Standards – Part 1 for Spur, Helical, Double Helical and Rack"

ASME Y14.7.2, "Gear and Spline Drawing Standards Part 2 – Bevel and Hypoid Gears"

ASME Y14.8M, "Castings and Forgings"

ASME Y14.13M, "Mechanical Spring Representation"

ASME Y14.24M, "Types and Applications of Engineering Drawings"

ASME Y14.34M, "Associated Lists"

ASME Y14.35M, "Revision of Engineering Drawings and Associated Documents"

ASME Y14.36M, "Surface Texture Symbols"

ASME Y14.38, "Abbreviations and Acronyms"

ASME Y14.41-2003 "Digital Product Definition Data Practices"

ASME Y14.100M, "Engineering Drawing Practices"

ASME Y32.4, "Graphic Symbols for Plumbing Fixtures for Diagrams Used in Architecture and Building Construction"

ASME Y32.7, "Graphic Symbols for Railroad Maps and Profiles"

ASME Y32.18, "Symbols for Mechanical and Acoustical Elements as Used in Schematic Diagrams"

AWS A2.4, "Standard Symbols for Welding, Brazing And Nondestructive Examination"

DOE-ID "Architectural Engineering Standards"

*Drawing Requirements Manual — Current Edition* (Global Professional Publications)

*Facility and Land Use Plan*, INL intranet address — http://eris04.inel.gov/

Form 412.13, "DMCS Review Comments and Resolutions"

Form 431.47, "Change Process Selection (CPS)"

Form 431.400B, "Engineering Job File Cover Form"

Form 431.500G, "Design Verification Review Checklist"

IEEE Y32.9, "Graphic Symbols for Electrical and Wiring Diagrams Used in Architecture and Building Construction"

IEEE-100, "The IEEE Standard Dictionary of Electrical and Electronics Terms Sixth Edition"

IEEE/ASTM-SI-10, "Standard for Use of the International System of Units (SI): The Modern Metric System"

ISA S5.1, "Instrumentation Symbols and Identification"

ISA S5.3, "Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic and Computer Systems"

ISA S5.4, "Instrument Loop Diagrams"

ISA S5.5, "Graphic Symbols for Process Displays"

LST-2, "Acronyms and Abbreviations"

LST-9, "INL Records Schedule Matrix"

LST-215, "Area Location Index Code List"

LST-216, "Drawing Type Index Code List"

LST-217, "Class of Work Index Code List"

LST-218, "Drawing Originator Index Code List"

LWP-1201, "Document Management"

LWP-1250, "Electronic Document and Content Management (eDOCs)"

LWP-6200, "Maintenance Integrated Work Control Process"

LWP-7001, "Management of Projects"

LWP-7203, “Vendor Data Process”

LWP-7460, “Project Turnover and Acceptance”

LWP-10010, “Use of Registered Professional Engineers”

LWP-10400, “Design Control”

LWP-10400-2C1, “Perform Field Change

MCP-3630, “I&C Computer System Management”

MCP-9395, “Releasing and Distributing DMCS Controlled Documents”

NFPA 13, “Standard for the Installation of Sprinkler Systems”

NFPA 170, “Standard for Fire Safety Symbols”

STD-7026, “Numbers Assignments for INEL Buildings, Structures and Roads”

TEM-10400-2, “System Design Description”

# 16. RECORDS

**NOTE:** *SMC uses approved controlled document and records systems and processes that meet the intent of the EDMS and document control processes as referenced in this procedure.*

| Records Description | Uniform File Code | Disposition Authority | Retention Period |
|---|---|---|---|
| Released drawing (in-process record) master, electronic file of document, and associated case file contents (such as eCRs) are in-process records until the drawing is released per TEM-10400-5. | Varies based on document type (see note 1). | Establish disposition authority based on the document type of the document master (see note 2). | Establish retention period based on the document type. |
| Form 412.13, EDMS Review Comment and Resolution form used to document a periodic review. | Varies based on document type (see note 1). | Establish disposition authority based on the document type to which the form applies (see note 2). | Document control: Incorporate into the applicable document's case file and retain based on the document's assigned retention period. |

**NOTE 1:** *Uniform file codes for controlled documents are contained in the INL Records Schedule Matrix. (http://edms.inel.gov/inl_index.html)*

**NOTE 2:** *The above records may be either quality-affecting or nonquality-affecting records. If they are quality-affecting records, they may be either lifetime or nonpermanent. Determination of record type is the responsibility of the document owner, who may consult with the appropriate records coordinator, with the company records management organization, or with Quality Assurance personnel.*

# 17. DEFINITIONS

*As-built*. Documentation (such as piping and instrument diagrams and database records) verified by physical inspection as depicting the actual *physical configuration* (see def.) and verified as consistent with the design requirements by the USQ process, environmental screening, and engineering review.

*As-built drawing.* A drawing (such as piping and instrument diagrams and flow diagrams) verified by *walkdown* (see def.) as depicting the actual *physical configuration* (see def.) and verified as consistent with the design requirements by the USQ process, environmental screening, and engineering review. Drawings that are as-built will have the following words in the revision block of the drawing: "As-built as of (date)."

*As-building.* The process of determining the *as-found* (see def.) condition by *walkdown* (see def.), resolving discrepancies with the *facility document* (see def.), obtaining approval to revise the document, and producing the as-built documentation.

*As-found.* Information, often in the form of marked-up documents that reflects the actual *physical configuration* (see def.) and identifies any discrepancies with currently approved *facility documents* (see def.).

*Configuration management.* An integrated management process that ensures facility configuration is established and maintained in conformance with reviewed and approved design requirements as changes evolve over the life of the facility. In addition, the Configuration Management Program ensures that the design requirements and *physical configuration* (see def.) are accurately reflected on the facility operating and design documentation.

*Design requirements.* Those structure, system, or component engineering requirements that are reflected in design output documents (such as drawings and specifications) and define factors specified by design engineering such as:

A. Form, fit, and function(s)

B. Capabilities, capacities, physical sizes, and dimensions

C. Limits and setpoints.

The design requirements provide the results of the design process.

*EDMS location.* An organization and facility that is identified and recognized as having responsibility and authority for the control of released documents through a system that imposes appropriate controls on the change, distribution, receipt, and recall of the documents. Authorized document control centers are listed on the EDMS homepage.

*Electronic Change Request (eCR)*. The online process to make changes, deletions and begin new drawings. (Documentation has previously been tracked with Document Action Requests [DAR], Document Change Notice [DCN], and Advanced Drawing Change Notice [ADCN])

*Electrical Configuration Control Coordinator (ECCC)*. Person responsible for the accounting of and processing of electrical changes to MFC drawings.

*Physical configuration.* The actual physical location, arrangement, and material condition of structures, systems, and components within a facility.

*Registered professional engineer.* A person who has been duly registered or licensed as a professional engineer or professional land surveyor by the applicable state licensing board. For the purpose of this procedure, this definition includes registered architects.

*Released drawing.* A drawing that has been reviewed, approved, and issued for use in accordance with the approved company procedure, and is under the control of a DMCS location.

*Walkdown.* A visual inspection of a facility SSC to identify the *as-found* (see def.) *physical configuration* (see def.) and any discrepancies with currently-approved *facility documents* (see def.).

## 18. REFERENCES

Form 412.11, “INL Document Action Request (eCR)”

Form 412.13, “DMCS Review Comments and Resolutions”

Form 431.47, “Change Process Selection (CPS)”

Form 431.400.B, “Facility Change Form”

Form 431.400.G, “Design Review Check List”

LWP-1201, “Document Management”

LWP-1250, “Electronic Document and Content Management (eDOCs)”

LWP-6200, “Maintenance Integrated Work Control Process”

LWP-7001, “Management of Projects”

LWP-7203, “Vendor Data Process”

LWP-7460, “Project Turnover and Acceptance”

LWP-10100, “Code Definition, Interpretation and Variance”

LWP-10400, “Design Control”

LWP-10400-2C1, “Perform Field Change”

MCP-3630, “I&C Computer System Management”

MCP-9395, “Releasing and Distributing DMCS Controlled Documents”

TEM-10400-2, “Design Descriptions”

## 19. APPENDIXES

Appendix A, Drawing Designation Selection Criteria

Appendix B, As-Building Drawings

Appendix C, Procedure Basis

## Appendix A

## Drawing Designation Selection Criteria

Designate drawings that are used for any of the following purposes as essential drawings:

A. The drawing describes the critical operational characteristics, system interfaces, and control features of a system included in the authorization basis (safety class or safety significant SSCs; reference NS-18302, Vital Safety Systems at INL Nuclear Facilities List). The authorization basis may include environmental protection regulatory permits and compliance agreements.

B. The drawing is included in materials maintained in the emergency response facility (such as the command post or emergency control center) and could be relied upon for event mitigation.

C. The drawing is used for operating the SSC. The drawing could be included in the operating instructions or could simply be recognized as an established source of relevant information (such as in drawing files maintained in the operations area). Normal, abnormal, and emergency operating modes are included.

Use the following guidance to determine the designation of specific types of drawings.

| Drawing Types | Essential | Master Facility | General |
|---|---|---|---|
| Plant Design | | | |
| Site Location Drawings | | X | |
| General Arrangements | | X | |
| Equipment & Duct Work Arrangement | | X | |
| Combination Arrangements | | X | |
| 3D Model | | X | |
| Equipment Locations | | X | |
| Machine Design Drawings | | | X |
| Weld Details | | | X |
| Fire Protection Drawings | | X | |
| Piping Isometrics | | X | |
| Area Piping Drawings | | X | |
| Piping & Equipment Details | | X | |
| HVAC Layout Drawings | | X | |

| Drawing Types | Essential | Master Facility | General |
|---|---|---|---|
| Plant Design (continued) | | | |
| Jumper Design Drawings | | | X |
| Plumbing Drawings | | | X |
| Floor Drain Drawings | | | X |
| Sewer Drain Drawings | | | X |
| Roof Drain Drawings | | | X |
| General & Miscellaneous | | | X |
| Mechanical/Process | | | |
| Flow Diagrams | | X | |
| Piping & Instrument Diagrams (P&ID) (used to respond to plant events, determine compensatory actions, and clarify technical requirements) | X | | |
| Other P&IDs | | X | |
| Fire Suppression System Design | | X | |
| Equipment Requirements Drawing (Vendor) | | X | |
| Dimensional Record Drawings | | | X |
| System Integration Diagrams | | X | |
| Equipment Details | | X | |
| Piping Details | | X | |
| Piping Flexibility | | | X |
| General & Miscellaneous | | | X |
| Civil | | | |
| Site and Plot Plans | | | X |
| Building Plan | | X | |
| Survey Drawing | | X | |
| Roads/Railroads Drawings | | | X |
| Erosion Control Drawings | | | X |
| Profiles Drawings | | X | |
| Landscaping Drawing | | | X |

| Drawing Types | Essential | Master Facility | General |
|---|---|---|---|
| Civil (continued) | | | |
| Fencing/Parking/Laydown | | | X |
| Grading | | | X |
| Yard Utilities Drawings | | X | |
| Wells | | | X |
| Sanitary/Storm Sewers Drawings | | X | |
| Ductbanks | | X | |
| Manholes | | | X |
| Settling Basins | | | X |
| Shoring Drawings | | | X |
| Structural | | | |
| Structural Concrete Plans | | X | |
| Structural Concrete Sections & Details | | X | |
| Structural Masonry | | X | |
| Structural Steel Drawings | | X | |
| Fabrication Details | | | X |
| Miscellaneous Steel, Plans, Sections, Details | | X | |
| Miscellaneous Steel Grating, Handrails, Plate Drawings | | | X |
| Foundation Drawings | | X | |
| Pipe Supports/Pipe Racks Drawings | | | X |
| Equipment Supports Drawings | | | X |
| Tray and Conduit Supports Drawings | | | X |
| Instrumentation Supports Drawings | | | X |
| HVAC Support Drawing | | | X |
| Architectural | | | |
| Architectural Plans and Elevations | | | X |
| Architectural Renderings & Models | | | X |
| Architectural Sections | | | X |
| Architectural Schedules & Index | | | X |

| Drawing Types | Essential | Master Facility | General |
|---|---|---|---|
| Architectural (continued) | | | |
| Architectural Details | | | X |
| Radiological Zone Drawings | | X | |
| Fire Area Boundary Drawings | | X | |
| Fencing & Site Security Drawings | | X | |
| Penetration Seals | | | X |
| Electrical | | | |
| Single Line or One Line Diagrams (used to respond to plant events, determine compensatory actions, and clarify technical requirements) | X | | |
| Other Single Line or One Line Diagrams | | X | |
| Three Line Meter & Relay Diagrams | | X | |
| Area Classification Drawings | | X | |
| Raceway Layout Drawings | | X | |
| Schematic Diagrams | | X | |
| Lighting Drawings | | X | |
| Grounding Drawings | | X | |
| Cathodic Protection Drawings | | X | |
| Underground Utilities Ductbanks/Manholes | | X | |
| Cable Schedule | | X | |
| Conduit Schedule | | X | |
| Interconnection/Wiring Diagrams | | X | |
| Communication Drawings | | X | |
| Heat Tracing Drawings | | X | |
| Fire Detection Drawings | | X | |
| Demolition & Removal Drawings | | | X |
| Overhead Pole Line Drawings | | | X |
| Coordination Study Drawings | | X | |

| Drawing Types | Essential | Master Facility | General |
|---|---|---|---|
| Instrumentation & Controls | | | |
| Control Room Layout | | X | |
| System Block Diagram | | | X |
| Logic Diagram | | X | |
| Control Panel Layout | | | X |
| Instrument Diagrams | | X | |
| Instrument Data Sheets | | X | |
| Instrument Location Drawing | | | X |
| Instrument Index | | X | |
| Input/Output Summary | | X | |
| Instrument Installation Detail | | | X |
| Instrument Rack Drawing | | | X |
| Level Setting Diagram | | X | |
| Setpoint Index | | X | |
| Loop Diagram | | X | |
| System Process Graphics Layout | | X | |
| General & Miscellaneous | | | X |

**Appendix B**

**As-Buildings Drawings**

# 1. GENERAL AS-BUILDING GUIDELINES

Accurate as-building information is key to the effective performance of configuration management; emergency response; operations; maintenance; environment, safety, and health (ES&H); facilities management; and planning. The following defines the processes to generate verified as-built information to ensure that the depicted configuration agrees with the actual configuration found in the field and verified consistent with the design requirements. The success of an as-built program will, to a large degree, depend on the rigor applied to review, approval, implementation, and verification of changes throughout the life of the equipment or facility.

## 1.1 Graded Approach to As-Building

A graded approach should be used for the generation of as-built information for systems important to safety, environment, and mission. The organization responsible for the equipment that is depicted on the drawing should determine the level of detail and accuracy and the methods used to develop as-built information. The level of detail and accuracy is dependent on specific systems within facilities, the use of a facility, the integrity of a structure, and system priorities. Field verification should be conducted to the fullest extent possible. Suggested methods include walkdown, use of video cameras, close-range photogrammetry, and other means available. Because of the complexity or configuration of many facility systems, structures, and components, a 100% field verification is not always possible. Every reasonable attempt to field-verify SSCs should be made.

## 1.2 Personnel Training and Qualification Necessary to Perform As-Building

Those responsible for the as-building effort should determine the training and minimum qualifications for personnel performing specific as-building functions (site and utility plans, architectural and structural plans, mechanical, electrical, and instrumentation), including:

A. Knowledge of Site ES&H policies

B. Necessary combination of education and experience

C. Working knowledge of engineering drawings and documentation, and applicable local, state and national codes and standards

D. Functional knowledge and understanding of systems (such as mechanical, electrical, instrumentation and controls, civil and structural, industrial electronics, and under- and above-ground utilities) to be verified.

### 1.3 Identification of an As-Built Drawing

A drawing that has been as-built will have the words "As-built as of (date)" in the revision block of the drawing.

### 1.4 Information on a Drawing to be as-Built

A drawing may be a combination of different types of information such as equipment layout, block diagram, one-line diagram, wiring diagram, parts list, and fabrication information. Not all drawing information is necessary and clutter should be removed from configuration managed drawings. Because all information on all drawings cannot be field verified, those items not field verified should be annotated (such as ballooning).

Drawings that are required to be as-built must be as-built in their entirety and have the "As-built as of (date)" noted in the revision block of the drawing. Once a drawing has been as-built, the next consecutive revision to the drawing does not require the entire drawing to be as-built, only those portions of the drawing that were revised. For example, an essential drawing must first be as-built in its entirety and the statement "As-built as of (date)" entered into the revision block of the drawing. If the next change to the drawing was the result of a modification, only that area of the drawing that was modified needs to be as-built. The remainder of the drawing is to be assessed per Subsection 1.1 (even though the drawing may not be an essential drawing) and the statement "As-built as of (date)" entered into the revision block of the drawing. The drawing has now been maintained in the as-built condition. However, if the previous revision did not have the statement "As-built as of (date)," the entire drawing is to be as-built.

## 2. AS-BUILDING GUIDELINES FOR DRAWINGS

Information provided on a drawing may cross disciplines that would require using different as-building guidelines below for the drawing to be properly as-built.

### 2.1 Site and Utility Plans

Site and utility plans describe surface and subsurface information adjacent to facilities. This section is not intended as guidance for Site-wide mapping efforts.

### 2.1.1 Site Plans

Suggested features include, but are not limited to:

- Brass caps and other permanent survey monuments (Survey control benchmarks used should be referenced in a note on the plan.)
- Building footprints with building numbers
- Roads, parking lots, sidewalks, curbs, catch basins, culverts, permanent signs, and lighting
- Fences (Use different symbols to depict industrial, security, three-strand barbed wire, and other types of fencing.)
- Retaining walls and other non-utility structures
- Contours with appropriate intervals
- Surface drainage direction arrows and culverts, including culvert size and other applicable information, as necessary.

### 2.1.2 Utility Plans

All utilities on the Site should be shown to the building line in plan view. This section is not intended as guidance for Site-wide mapping efforts. Suggested features include, but are not limited to:

- Appropriate site information (refer to Subsection 1.1 above)
- Line sizes, services, and material types, where necessary
- All utility features and locations (such as valves normally open or closed, manholes, lift stations, clean outs, pumper connections, fire hydrants, telephone boxes, poles, transformers, and high voltage switch positioning NO & NC).

## 2.2 Architectural and Structural Plans

### 2.2.1 Floor Plans

Accurate floor plans are used for space and site planning, emergency response drawings, emergency evacuation and hazard maps, and as a base drawing for further as-built efforts (such as electrical and mechanical plans). Suggested features include, but are not limited to:

- Wall width, construction materials, fire rating, and wall openings
- Room numbers
- Door and window locations, including fire ratings and door swings
- Interior and exterior ramps, ladders, stairs, docks, and rails
- Utility chases, elevator shafts, and wall louvers
- Interior fence enclosures and associated doors
- Columns and column tags
- Concrete or hard-surfaced pads at exterior doorways
- Exterior dimensions
- Floor pits, grating, and trenches
- Permanent utility fixtures and counters
- Mezzanines
- Vaults and screen rooms
- Square footage (building gross and net, room, and utility chase)
- Other features as necessary.

### 2.2.2 Structural Documentation (such as Uniform Building Code and seismic)

At visible portions of the structure verify that the drawing reflects the original as-built features, correct errors to as-built, and verify dimensions of features and components affected by modifications. Note on the drawing that original dimensions were not verified by actual measurement during this as-building.

- Connection details
- Equipment bases
- Floor loading
- Snow loading
- Other.

## 2.3 Mechanical Plans

### 2.3.1 Heating, Ventilating, and Air Conditioning (HVAC) Systems

As-built HVAC drawings may be in many forms, including one-line air flow diagrams, ducting plans, process flow diagrams, sequence of operations diagrams, isometrics, and/or scale drawings. Verify that flow, flow routing, components, component locations, and controls are accurately reflected. Correct errors and incorporate modification. For buried or imbedded ducting, verify identification and sizes at entrance and exit points. Note on the drawing that original dimensions were not verified to actual measurement.

2.3.1.1 For one-line airflow diagrams, suggested features to be included, but are not limited to:

- Dampers, registers, grilles, and diffusers
- HVAC equipment
- Transitions with sizes called out
- Flow rates and pressure differentials

- Air flow arrows
- Special equipment (such as fume hoods and HEPA filters).

2.3.1.2 For ducting plans, the suggested features to be included, but are not limited to:

- HVAC equipment and dampers
- Diffusers, registers, and grilles
- Transitions with sizes noted
- Ducting runs for supply, return, and exhaust air
- Fume hoods and HEPA filters
- Type of exhaust.

### 2.3.2 Piping Systems

As-built piping drawings may be in the form of piping and instrumentation diagrams, isometrics, and drawings.

2.3.2.1 **Underground or Imbedded Piping and Plumbing.** Verify by checking identification and lines sizes at entrance and exit points, at valve standpipes, and at manholes. Verify branch lines at any visible locations. Verify indicated service by line identification, flow, operational data, etc.

2.3.2.2 **Visible Piping and Plumbing.** Verify line sizes, line locations, location of components such as pumps, valves, flow orifices, and thermowells. Include branch piping and sample and impulse lines. Correct errors and incorporate modifications.

2.3.2.3 **Pipe labeling.** Pipe should be labeled in accordance with Conduct of Operations requirements.

2.3.2.4 **Gas and Liquid Systems** (such as for oils, acids, solvents, or water). Suggested features to be included, but are not limited to:

- Tanks, compressors, valves, gages, drains, and vents
- Type of gas or liquid (labeling)
- Meters and pressure-reducing valves
- Lines, including size, service, and material type.

2.3.2.5 **Water Systems** (such as domestic, non-potable, heating, or chilled). Suggested features to be included, but are not limited to:

- Supply and return lines, including size, service, and material type
- Flow measurement devices
- Plumbing fixtures (such as sinks, lavatories, water coolers, and emergency showers)
- Gauges, valves, and back-flow preventives
- Boilers, chillers, and similar types of equipment
- Flow direction arrows.

2.3.2.6 **Building Drain Systems** (such as for sanitary sewer, rain water, hazardous liquid waste, and radioactive liquid waste). As-built drain system drawings may be in forms such as schematic drawings, isometrics, plans, shop drawings, and database files. Suggested features to be included, but not limited to:

- Line size, service, and material type
- Manholes and cleanouts
- Drainage system inputs (such as floor drains and sink drains)

- Wyes, valves, tees, and elbows
- Holding tanks, septic tanks, leach fields, and similar equipment.

### 2.3.3 Mechanical General

Ensure drawings correctly reflect critical dimensions and features, identify errors, and show corrections necessary for as-building. The cognizant engineering organization will identify critical dimensions and features on a case-by-case basis.

A. Remote handling equipment

B. Plant machinery and mechanical equipment

C. Storage and shipping equipment

D. Tools, gauges, special research, or analytical equipment

E. Piping systems, tanks, and vessels.

## 2.4 Electrical Systems

Electrical systems include power, lighting, alarms, and other specialized Site systems. Electrical as-built drawings may consist of one-line drawings, plan views, schedules, or other supporting details necessary to describe these systems. Accurate electrical drawings are required to facilitate lockout and tagout programs.

### 2.4.1 Power System One-Line Diagrams

An initial one-line diagram, starting at the incoming power supply and showing major system components, should be developed. Suggested features include, but are not limited to:

- Power sources (voltage, capacity in volt-amperes, and short-circuit currents)
- Incoming lines (number, gauge, type, and amperage limits)
- In-plant generation
- Incoming main fuses, sizes, potheads, cutouts, switches, main, and tie-breaker settings

- Power transformers (rating, winding connections, impedance, and grounding means)
- Feeder breaker settings and fuse switches (size)
- Relays (function, use and type, and settings)
- Potential transformers (size, type, and ratio)
- Current transformers (size, type, and ratio)
- Control transformers (size, type, and ratio)
- Surge arresters (type and rating)
- Capacitors (type and rating)
- Automatic transfer switches.

Additional downstream, one-line diagrams should be developed to represent all feeders. All significant loads and panelboards should be depicted down to, but not including, branch circuits. One-line diagrams should also be developed for emergency power, standby power, and uninterruptible power supply (UPS) systems where applicable. Circuit directories or panel schedules may be used in lieu of one-line diagrams for 480-V and lower voltages if all information is included.

2.4.1.1 Items are to be correctly identified.

2.4.1.2 Items will be shown in the proper sequence.

2.4.1.3 Load capacities will be verified.

2.4.1.4 System accuracy will be determined by requesting operations to turn on and off (or vice versa) each system.

2.4.1.5 Identify motor starters and their sizes.

### 2.4.2 Equipment Location Plan

Suggested features include, but are not limited to:

- Panelboards
- Disconnects
- Utilization devices (such as motors and chillers)

- Conduit routing
- Labeling with power sources.

### 2.4.3 Circuit Directories and Panel Schedule

Suggested features include, but are not limited to:

- Breaker size and identification
- Identification of each circuit
- Panel and bus information (such as labeling, source, phase, and voltage).

### 2.4.4 Schematic Diagrams

2.4.4.1 Items are to be correctly identified.

2.4.4.2 Fuses, breakers, and other protective devices are identified as to size, type, and model if appropriate.

2.4.4.3 Items will be shown in the proper sequence.

2.4.4.4 When specific terminal points are identified on the drawing, verification of these points is required. A work order will be generated to control end-to-end checks when reasonable doubt exists as to the drawing accuracy or when the affected system does not operate properly. Engineering judgment will be used.

### 2.4.5 Supporting Documentation

Supporting documentation should be included as needed to accurately describe the power systems. Supporting information should be cross-referenced to the one-line or plan files for ease of retrieval and archiving. Suggested features include, but are not limited to:

- Elevations
- Details
- Wiring schematics
- Control diagrams
- Schedules.

### 2.4.6 Lighting

2.4.6.1 **Indoor Lighting.** Suggested features to be included, but are not limited to:

- Reflected ceiling plan and grid layout, where possible
- Location of fixtures
- Identification of fixtures (normal, emergency, and exit lighting)
- Associated controls
- Fixture labeling with source and controlling switch
- Special fixture types and locations.

2.4.6.2 **Outdoor Lighting.** Suggested features to be included, but are not limited to:

- Plan location (building perimeter, parking lot, and area lighting should be shown on a site or plot plan)
- Location of fixtures
- Identification of fixtures (such as normal or emergency)
- Associated controls
- Fixture labeling with source
- Special fixtures types and location.

### 2.4.7 Alarms and Other Systems

These electrical systems may include public address, telephone, data, fire, security, cathodic protection, and lightning protection.

2.4.7.1 **One-Line Diagram.** Suggested features to be included, but are not limited to:

- Primary system elements
- Labeling, as applicable.

2.4.7.2 **Equipment Location Plan Drawings.** Suggested features to be included, but are not limited to:

- Device location
- Identification and labeling of devices
- Identification of sources, as necessary.

2.4.7.3 **Supporting Documentation.** Supporting documentation should be included as needed to accurately describe the alarm and other systems. Supporting information should be cross-referenced to the one-line or plan files for ease of retrieval and archiving. Documentation may include, but is not limited to:

- Elevations
- Details
- Wiring schematics
- Control diagrams
- Schedules
- Sequence of operations.

## 2.5 Instrumentation and Controls

As-built for instrumentation and control systems should consist of flow diagrams, sequence of operation sheets, schematics, and component location plans.

### 2.5.1 Instrumentation and Control Plans (such as pneumatic electric and electronic)

Suggested features include, but are not limited to:

- Interconnection diagrams
- Remote terminal units
- HVAC equipment such as fans, pumps, chillers, boilers, control components (such as relays), thermostats, controllers, and sensors

- Control dampers and control valves
- Computerized control systems.

### 2.5.2 Process Piping and Instrumentation Diagrams (P&IDs)

2.5.2.1 All major components and piping will be shown.

2.5.2.2 Control elements, instrument tap points, sensors, etc., will be shown in their proper flow sequence.

2.5.2.3 Identity of instruments, valves, piping, tubing, and sensing elements will be verified as tagged.

2.5.2.4 Components will be shown in their relative locations to other hardware, but no dimensions, other than pipe sizes, will be shown.

2.5.2.5 Unused systems and the partial remainders of removed systems will be identified as out-of-service (OOS) and will be shown on the drawing.

2.5.2.6 Component nomenclature will be verified on item tags (such as valve and tubing line numbers).

2.5.2.7 Engineering judgment will be used in as-building drawings of inaccessible areas. As-build only hardware that is accessible without altering any equipment or facilities for access.

2.5.2.8 Items that are not intended to be shown on drawings are to be addressed by note or reference.

### 2.5.3 Block Diagrams

2.5.3.1 Components are to be correctly identified.

2.5.3.2 Components will be shown in the proper sequence.

### 2.5.4 Wiring Diagrams

2.5.4.1 Terminal blocks, wiring, cables, relays, etc, will be correctly depicted on the drawings.

2.5.4.2 Fuses, breakers, and other protective devices will be identified as to size, type, and model.

2.5.4.3 Wire and cable tags will be checked for accuracy according to the tagging method used in the affected area.

2.5.4.4 End-to-end checks will be performed by work order when reasonable doubt exists as to the drawing accuracy or when the affected system does not operate properly. Engineering judgment will be used.

2.5.4.5 The size and location of underground and imbedded electrical wiring will be given.

## Appendix C

## Procedure Basis

| Step | Basis | Source | Citation |
|---|---|---|---|
| 4.1.1.3, 4.3.4, 4.3.5 | Drawings shall contain appropriate inspection and testing acceptance criteria. | PRD-5074 | 4.1.1.6 |
| All | Design documents shall adequately support facility design, fabrication, construction, and operation. | PRD-5074 | 4.1.4.2 |
| 4.3.4 | Design documents shall be sufficiently detailed…such that a person technically qualified in the subject can understand the documents and verify their adequacy without recourse to the originator. | PRD-5074 | 4.1.4.6 |
| 4.3.7 | If the design is modified to resolve verification findings, the modified design shall be verified prior to release for use. | PRD-5074 | 4.1.6.6 |
| 4.3.4, 4.3.5, Form 431.52 | The final design including drawings shall:<br>A. Be relatable to the design input<br>B. Specify required inspections and tests<br>C. Identify assemblies and/or components<br><br>When such an assembly or component part is a commercial grade item characteristics of the item to be verified shall be documented. | PRD-5074 | 4.1.4.7 |
| | Design reviews shall be controlled and performed to ensure that:<br>A. The design inputs were correctly selected<br>B. Appropriate design methods and computer programs were used<br>C. The design output is reasonable compared to design inputs.<br>D. The necessary design inputs for interfacing organizations are specified<br>E. Suitable materials, parts, processes, and inspection and testing criteria have been specified. | | 4.1.7.1 |

| Step | Basis | Source | Citation |
|---|---|---|---|
| 4.3.4, 4.3.5, Form 431.52 | Interface controls shall include the integration of activities of organizations that can affect the approved configuration. | | 4.1.11.5 |
| 5. | All records designated in implementing documents as quality assurance records shall be controlled. | PRD-5074 | 4.1.14.1 |
| All | Interface controls shall include the assignment of responsibility and the establishment of implementing documents among participating design organizations and groups for the review, approval, release, distribution, and revision of documents involving design interfaces. | PRD-5074 | 4.2.1.1 |
| 4.3.2, 4.3.3 | Design verification shall be performed by competent individuals or groups other than those who performed the original design, but may be from the same organization. If necessary, this verification may be performed by the originator's supervisor provided. | PRD-5074 | 4.2.3.3 |
| All | Activities affecting quality shall be prescribed by and performed in accordance with documented instructions, procedures, or drawings that include appropriate quantitative or qualitative acceptance criteria for determining that prescribed results have been satisfactorily attained. | PRD-5076 | 4.1.1.1 |
| All | Activities affecting quality shall be described to a level of detail commensurate with the complexity of the activity and the need to assure consistent and acceptable results. | PRD-5076 | 4.1.1.2 |
| All | The need for and the level of detail in written procedures or instructions shall be determined based on the complexity of the task, the significance or the item or activity, work environment, and worker proficiency and capability (education, training, experience). | PRD-5076 | 4.1.1.3 |
| All | The type of document to be used to perform work shall be appropriate to the nature and circumstances of the work being performed. | PRD-5076 | 4.1.2.2 |

| Step | Basis | Source | Citation |
|---|---|---|---|
| Entire MCP & related forms per MCP-135 | Implementing documents shall include the following information as appropriate to the work to be performed:<br>A. Responsibilities and organizational interfaces<br>B. Technical and regulatory requirements<br>C. A sequential description of the work to be performed<br>D. Quantitative or qualitative acceptance criteria<br>E. Prerequisites, limits, precautions, process parameters, and environmental conditions<br>F. Quality verification points<br>G. Methods for demonstrating that the work was performed as required<br>H. Identification ofQA records<br>I. Identification of associated items and activities. | PRD-5076 | 4.1.3.1 |
| | Implementing documents shall be reviewed, approved, and controlled in accordance with PRD-5077, 6.1 Document Control. | | 4.1.4.1 |
| 5. | All records designated in implementing documents as quality assurance records shall be controlled in accordance with PRD-5088, Quality Assurance Records. | PRD-5076 | 4.1.6.1 |
| 4.11 | Activities affecting quality shall be described to a level of detail commensurate with the complexity of the activity and the need to assure consistent and acceptable results. | PRD-5076 | 4.1.1.2 |
| | The need for and the level of detail in written procedures or instructions shall be determined based on the complexity of the task, the significance or the item or activity, work environment, and worker proficiency and capability. | | 4.1.1.3 |
| | The type of document to be used to perform work shall be appropriate to the nature and circumstances of the work being performed. | | 4.1.2.2 |

| Step | Basis | Source | Citation |
|---|---|---|---|
| General | For each document within the CM Program, the following information shall be readily available:<br><br>Revision level<br>Current Status<br>Document Owner<br>Information regarding pending changes<br>Storage location<br>Outstanding document action requests. | PRD-115 | 3.3.3.6 |
| 4.1.1.4,<br>4.4.6,<br>4.4.7 | If the drawing contains the seal of a professional engineer, revise the electronic file of the drawing by adding the name of the professional engineer, date signed, and document storage location adjacent to the seal. | Idaho Code | Title 54-1215 |
| 4. | Interface controls shall be established and include assignment of key roles and responsibilities for performing CM activities | PRD-115 | 3.1.3.2 |
| 4. | Revisions to documents within the CM Program shall be completed in a timely manner. | PRD-115 | 3.3.3.1 |
| 4.4.2 | Document owners shall be responsible for the technical content of assigned documents. | PRD-115 | 3.3.1.4 |
| 4.6,<br>4.7 | Document owners shall establish priorities for revision and retrieval of documents that have been entered into the Records Management System. | PRD-115 | 3.3.1.3 |
| 4.5 | Only the currently approved revisions of documents within the CM Program shall be used. | PRD-115 | 3.3.3.5 |
| 4.6.1,<br>4.7,<br>4.9,<br>4.10 | Drawings or other configuration controlling documents, or equivalent electronic media, that are necessary to the safe operation of a nuclear facility or to ensure its safety following an off-normal event shall be maintained in the as-built condition. | PRD-115 | 3.3.3.7 (These drawings are interpreted to be “essential drawings.”) |
| 4.8 | CM interfaces shall be identified, both external and internal to the organization, including direction and criteria for the control of vendor activities and information. | PRD-115 | 3.1.3.1 |

| Step | Basis | Source | Citation |
|---|---|---|---|
| 4.10 | In accordance with the approved project plan (PLN-485) and site area recovery plans, physical configuration assessments or walkdowns shall be performed. | PRD-115 | 3.5.2.1 |
| 4.10 | Discrepancies shall be evaluated to determine whether the physical configuration or the documentation is correct. | PRD-115 | 3.5.2.4 |
| 4.10 | The change process shall generate accurate as-built information. | PRD-115 | 3.4.5.4 |
| 4.9.1, 4.10.2 | As-building expectations for general documents and Documentation Designation Selection Criteria table. | * | |

* Engineering Instruction Letter No. 1 — HWM-03-99, Herbert W. Mumford III