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C-A OPERATIONS PROCEDURES MANUAL

13.6.1 Preparation & Issuance of Engineering Drawing/Specifications

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Attachments

Hand Processed Changes

<u>HPC No.</u>	<u>Date</u>	<u>Page Nos.</u>	<u>Initials</u>
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Approved: _____ *Signature on File* _____
 Collider-Accelerator Department Chairman Date

D. Passarello

13.6.1 Preparation & Issuance of Engineering Drawing/Specifications

1. Purpose

This document defines a process for the preparation and release of C-A drawings and specifications (excluding architectural). This process supplements the BNL Standard Based Management System (SBMS) Design Subject Area and has been prepared in consultation with the C-A Mechanical and Electrical Design Rooms.

Drawings, dated prior to 1989, which define items intended for use in the production or procurement of new research apparatus/equipment, shall, when revised, comply with the requirements of this document. Drawings released after 1989 shall comply with the requirements of this and applicable reference documents.

2. Responsibilities

C-A staff shall plan, develop, define and control the design of the C-A facilities and its components in a manner that will assure the consistent achievement of the producibility, performance, safety, reliability, maintainability, and availability objectives.

3. Prerequisites

Implementation of the requirements set forth in this document necessitates user recognition of either C-A-ESD-001, Design Room Work Procedures, Electrical Systems Design or C-A-MSD-001, Design Room Work Procedures, Mechanical Systems Design, and the [Engineering Design](#) SBMS subject area.

4. Precautions

None

5. Procedure

5.1 Design Process

The design criteria shall define, as required, the performance objectives, operating conditions, and requirements for safety, environmental protection, reliability, maintainability, and availability, as well as the requirements for materials, fabrication, construction, and testing.

A graded approach will be employed to emphasize those items that could have the greatest effect upon personnel, environmental safety, performance, cost and schedule. The cognizant engineer or scientist (CE/CS) shall determine the proper QA Classification for the item/material defined by the drawing/specification. Refer to [Graded Approach for Quality Requirements](#) SBMS subject area.

- 5.1.1 Design reviews permit an exchange of ideas among concerned individuals with expertise in required fields. These reviews will determine that design interfaces are compatible, that the design meets all of its criteria, that the delineation is complete, unambiguous, and readily producible, and that the important parameters can be verified by inspection and/or test. Design reviews shall be summarized and documented. The degree of documentation shall be commensurate with the level of detail provided during the design review.
- 5.1.2 The following criteria determines whether a given project and/or procurement generated by such a project need be the subject of a formal design review.
- 5.1.2.1 Engineering or construction work, which results in the generation of a single purchase order, change order, or CS RFW, or PE ILR, with a dollar value in excess of \$50,000.
- For those items in 5.1.2.1 which are not for replacement in kind, consideration shall be given to performing calculations by C-A or appropriate BNL experts and to review independent calculations performed by vendor
- 5.1.2.2 New system designated with a A1 Quality Classification.
- 5.1.2.3 Additions or modifications to existing A1 level systems, which involve changes of performance or mission. Specifically exempted from formal review requirements are changes, which relate to adding or deleting unit of like kind to those already in existence.
- 5.1.2.4 Projects which will result in the procurement of more than 25 modules/boards or more than 500 non-laboratory stock components with a dollar value in excess of \$ 50,000.
- 5.1.2.5 AIP and CIP project with at least \$350,000 in funding must have a review before detailed design begins. Projects with \$1,000,000 or more of funding must also be reviewed, by the appropriate C-A Division Head and the Chief Mechanical and Electrical Engineer, at nine-month intervals after the initial review.
- 5.1.2.6 Proposal for new departmental electronic/electrical or mechanical standards must be reviewed by the Chief Mechanical and/or Electrical Engineer.
- 5.1.2.7 Development effort, design, or project, which has a manpower component greater than five full time employees.

5.1.2.8 Proposals generated outside the C-A Department whose implementation would impact the operation, safety, or performance of the C-A complex.

5.1.2.9 Systems which could impact the radiation burden of the accelerator complex; all electronics items which operate in radiations field exceeding 100 mrad/hr; all mechanical or electro-mechanical items which must operate in radiation fields exceeding 1 rad/hr.

5.1.3 The various phases of the design review process are described below.

Preliminary Design Phase

- Preliminary Safety and Environmental Impact Assessment (If Required)
- Preliminary Review - (Cost and Scheduling; Code Compliance, Outline of Design, Safety Considerations, QA Requirements, and Potential Impact on Other Systems)

Design Validation Phase

- Prototype Design Approval - (Cost and Scheduling, Layout of Prototype, Qualification, and Testing Proposal)

Detail Design Phase

- Safety and Environmental Analysis
- ESH Committee Review
- Design Review -(Cost, QA Requirements, Code Requirements, Safety Requirements, Engineering Considerations, Compare to Preliminary Review Documents)
- Specification/Drawing Approval

Construction Phase (Configuration Control)

- Perform Periodic Design Reviews (as required)
- CE/CS Initiates/Reviews Engineering Change Notices (ECN's)

5.1.4 It is the responsibility of the Chief Mechanical or Electrical Engineer to notify C-A management that an element of a given project and/or procurement generated by such a project will trigger the design review process.

- For those items listed in 5.1.2.1, which exceed \$50,000 but are less than \$100,000, the C-A Chief ME/EE may determine that a formal design review is not required. The decision to forgo a design review shall be documented and copies distributed to the Accelerator or Experimental Support & Facilities Division Head and the ESHQ Division Head.

- For those items listed in 5.1.2.1, which exceed \$100,000, the decision to waive the design review process must be approved by the C-A Department Chairman

5.1.5 The division management is responsible for final acceptance or rejection of proposals up to A2 and to recommend acceptance or rejection of the proposal to the Department Chairman for A1 proposals.

5.2 Drawing Preparation Process

Production drawings shall contain all of the detailed requirements necessary to manufacture, purchase, inspect/test parts, subassemblies, assemblies, modules, or units.

5.2.1 The CE/CS shall provide the Design Group with the information necessary to prepare the drawing. Design criteria approved by the Chief Mechanical/Electrical Engineer should include as applicable: performance objectives; operating conditions; and requirements for safety, environmental impact, reliability, maintainability, availability, ease of manufacture, inspection, special handling, age control requirements, etc.

5.2.2 Appropriate codes, standards and practices for material, fabrication, construction, testing, and process shall be defined in the design documentation. Where feasible, nationally recognized codes, standards and practices should be used. When these documents fall short of defining the requirements, they are to be modified, supplemented, or replaced with BNL specifications.

5.2.3 The Design Room Technical Supervisor shall review the drawing to verify that the descriptions and notes are unambiguous, correct and complete, and that the drawing conforms to the proper format and design standards.

5.3 Drawing Numbering System

5.3.1 The C-A drawing system shall use a variable length (due to tabulation), alpha-numeric numbering system for drawings and parts lists.

5.3.1.1 When feasible tabulated drawings depicting similar items (which as a group, have constant & variable characteristics) will be utilized. The use of tabulated drawings precludes the preparation of an individual drawing for each item tabulated.

5.3.2 Drawing numbers are issued by the C-A Documentation Control Center

5.3.3 If a number has been assigned to a drawing, and the item represented by that drawing is not used, then that particular number can not be reassigned to another drawing.

5.3.4 The appropriate drawing revision is entered in the revision column/box. Upper case drawing revision letters shall be used in alphabetical sequence. The letters "I", "O", "Q", "S", "X", and "Z" shall not be used. When revisions are numerous enough to exhaust the alphabet, the revision following "Y" shall be "AA", then "AB", etc.

5.3.5 For prototype drawings preface the drawing numbers with the letters "RD". When approved for production, the "RD" preface will be removed from the drawing. Refer to paragraph 5.6.3 for revision level assignment.

5.4 Parts Lists

A parts list is a tabulation of parts and materials required to fabricate the assembly shown on a drawing. All assembly drawings will have a parts list which is integral/separate to the drawing.

5.5 Drawing Format

5.5.1 All C-A production drawings will be guided by the latest revisions of ASME Y14.24M, Types and Applications of Engineering Drawings and associated standards.

5.5.2 Cross-reference information is added to the drawing title block on sheet one. The "Used On Drawing No." column contains the drawing number(s) of the assembly(s) to which the detail or assembly pertains.

5.5.2.1 A "Qty. Per Assy." column contains the quantity/amount required to complete a single article. The symbol "AR" (as required) may be used in lieu of exact quantity of a bulk material. Symbols other than "AR" may be used, provided they are explained by an appropriate note or reference document. This information may also be recorded on the parts list.

5.5.3 Examples of General Notes

- Applicable documents, standards, and/or specifications.
- All items listed with part number and manufacturer can be substituted with a BNL approved equivalent part.

5.6 Release process for New Drawing

5.6.1 The CE/CS will, after resolution of any outstanding issues, authorize the Design Group to obtain drawing approval signatures.

5.6.2 Based on the QA Classification assigned to the drawing, the following approvals are required. At the discretion of the Chief ME/EE, additional review/approvals may be required. Required individuals shall review the drawing for completeness, technical content, technical accuracy, impact, and validity.

QA LEVEL A3	QA LEVEL A2 (Requires A3 signatures).	QA LEVEL A1 (Requires A3 and A2 signatures)
<ul style="list-style-type: none"> • Designer • Checker • Design Group Supervisor • Cognizant Engineer • Group Leader or Chief ME/EE • Cognizant Physicist (required for Primary Area Enclosure changes) 	<ul style="list-style-type: none"> • Chief Mechanical/Electrical Engineer • Division/Deputy Division Head, or designee 	<ul style="list-style-type: none"> • Quality Assurance • Radiation Safety Committee Chairman, or designee • Chairman/Deputy Department Chairman, or designee

5.6.3 The revision level assigned to the initial release of baselined engineering drawings and parts lists is at the discretion of the cognizant design room. Revisions may be the same as the prototype (RD) revision, be one greater than the prototype (RD) revision, or revert to an “A” revision. The revision history box on the drawing must clearly indicate at what revision the drawing was officially released.

5.6.4 The Documentation Control Center will provide copies of released drawings upon request.

5.7 Computerized Drawing Databases

5.7.1 Drawings, describing equipment to be placed in or necessary for the operation of C-A facilities, shall be created by Computer Aided Design (CAD) programs. It is the responsibility of the Design Room Supervisor to ensure that the design databases, including equipment required to read the data bases, are maintained.

5.7.2 Drawing databases shall be secured to prevent unauthorized changes. Access to these databases is controlled by the design room technical supervisors.

5.7.3 Drawing files will be archived prior to implementation of an approved ECN. This will insure that previous revisions are retrievable without modifications. All drawing revisions will be incorporated by the C-A Design Groups.

5.7.4 Backup files, tapes or drives shall be located in at least one other location other than where the databases are generated or changed.

5.7.5 The Design Room shall maintain electronic copies of the engineering drawings and parts lists. The Design Group shall assure that traceability to approval signatures on initial release or to approved ECN's for subsequent releases shall be is maintained.

5.8 Specification Preparation

5.8.1 Specifications required for the procurement of items and/or materials, should describe the item/material, performance objectives (when applicable), and acceptance criteria.

5.8.2 The CE/CS is responsible for the preparation, review, approval, and distribution of C-A specifications. The responsible individual shall forward the approved original specification to the C-A Documentation Control Center.

5.8.3 As a minimum, the document cover page should contain a title/subject, unique number, a means of identifying the current revision, QA Category, and the authorization/concurrence (as appropriate) of the CE/CS, Supervisor/Group Leader, Division Head or designee, Chief Mechanical/Electrical Engineer, ESH, and QA. Subsequent pages shall contain the document number and a method for tracking revision, e.g. date and/or letter.

5.8.3.1 Specification numbers are issued by the C-A Documentation Control Center.

5.8.4 The general arrangement or layout of C-A specifications should include the major sections defined below. Section headings may be altered as necessary to accommodate the subject matter.

1. Scope
2. Applicable Documents
3. Requirements - Includes requirements for Design, including reviews of proposed designs, Preproduction (Qualification), Parts, Materials, Processes, Construction and Workmanship.
4. Quality Assurance Provisions - Includes requirements for identifying responsibility for Inspection/Tests, defines the procedures and acceptance criteria for Preproduction (qualification), Acceptance (Production) and Special Inspections and/or Tests
5. Preparation for Delivery
6. Notes - Includes information pertaining to Intended Use of item, Ordering Data, Precedence of Documents, Performance Objectives, Definitions, Testing Ground Rules, Seller's Article Uniformity, and a list of Associated Equipment.

6. Documentation

None

7. References

7.1 [C-A-OPM 13.6.2, Configuration Management.](#)

7.2 C-A-EDG-001, Design Room Work Procedures, Electrical Systems Design

7.3 C-A-MDG-001, Design Room Work Procedures, Mechanical Systems Design

7.2 ASME Y14.24M-1989, Types and Applications of Engineering Drawings

7.3 [SBMS, Engineering Design](#)

7.4 [SBMS, Graded Approach for Quality Requirements](#)

8. Attachments

None