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QUALITY ASSURANCE PROGRAM PLAN
FAILED FUEL MOCKUP TEST STAND
(LMFBR PROGRAM)

C. K. McGlothlan

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ORNL-TM-2884

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REACTOR DIVISION

QUALITY ASSURANCE PROGRAM PLAN
FAILED FUEL MOCKUP TEST STAND
(LMFBR PROGRAM)

C. K. McGlothlan

APRIL 1970

Engineering Document M-10351-RM-100-A-0

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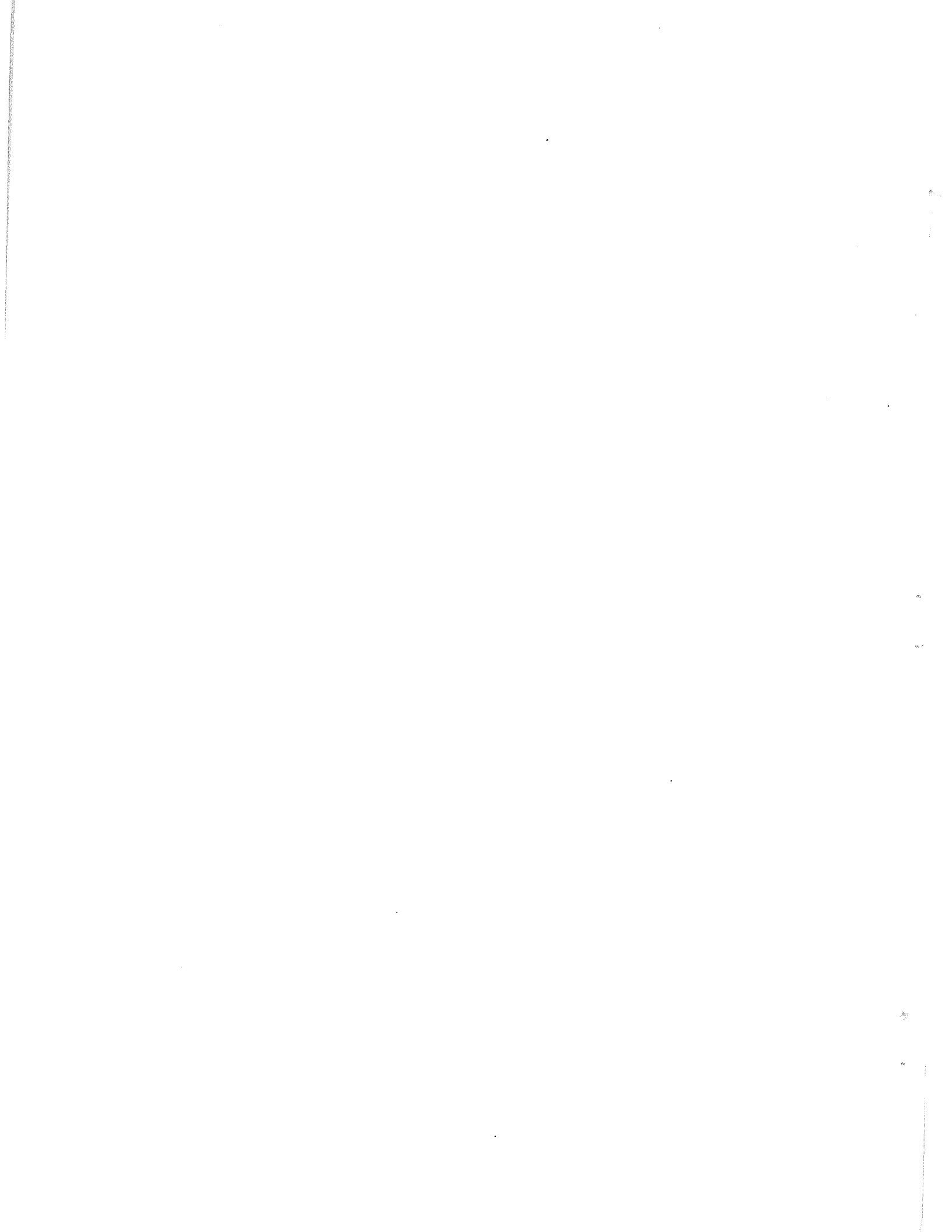


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ABSTRACT

A Quality Assurance Program Plan is presented for use by the Reactor Division of the Oak Ridge National Laboratory in the design, construction, and operation of the Failed Fuel Mockup Test Stand in support of the Liquid Metal Fast Breeder Reactor Program.

The Quality Assurance Program Plan sets forth requirements, policies, and procedures for planning, managing, conducting, and evaluating processes, structures, components, and systems.

Quality Assurance Procedures covering Management and Planning, Design and Development, Procurement, Fabrication and Assembly, Installation, Operation, Maintenance, Modifications and Audit are included. These procedures are based on proven practices at ORNL.

Implementation of these procedures provides the means of control and verification whereby those responsible for project management can assure that the quality required for safe, reliable, and economical operation will be achieved.

Keywords: quality assurance levels, responsibility and authority, project engineer, qualified personnel, designee, codes, standards and specifications, procedures, documentation, review, evaluation, calibration, material identification, change control, inspections and tests, nonconformance, records, audit.

REACTOR DIVISION

Quality Assurance Program Plan

INTRODUCTION
(Interim Use)

C. K. McGlothlan

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1. INTRODUCTION

1.1 Scope

This document defines the Quality Assurance Program Plan to be used by the Reactor Division of Oak Ridge National Laboratory (ORNL) in performing research and development work for the Atomic Energy Commission - Division of Reactor Development and Technology (AEC-DRDT). It describes the Quality Assurance Program Plan for the project described in Section 2 of this document. It is based on the "Quality Assurance Program Requirements" of RDT Standard F 2-2T, June 1969, and other RDT guidelines.^{1,2} Paragraph numbers in this document relate to corresponding paragraph numbers in RDT F 2-2T.

This document sets forth requirements, policies and procedures for planning, managing, conducting, and evaluating processes, structures, components, and systems. These quality assurance requirements, policies, and procedures are based on successful practices at ORNL and are the method of control and verification whereby those responsible for project management can be assured that the quality required for safe, reliable, and economical operation will be achieved. The objective of this document is to assure that structures, components, systems, and facilities are designed, developed, manufactured, constructed, operated, and maintained in compliance with established engineering criteria. To achieve this objective, quality assurance controls are established and implemented at predetermined points, and necessary action taken to prevent, detect, and correct any deficiencies.

The requirements, policies, and procedures have been arranged into the following sections:

1. Introduction
2. Management and Planning
3. Design and Development
4. Procurement
5. Fabrication and Assembly
6. Construction and Installation
7. Operation, Maintenance, and Modification
8. Activity Audit

Sections 1, 3, 4, 5, 6, and 8 describe the Reactor Division's requirements, policies, and procedures that are applicable to all AEC-DRDT research and development jobs. In Section 2, "Management and Planning" and Section 7, "Operation, Maintenance, and Modifications," specific requirements of the Quality Assurance Program Plan are stated for the experiment or test stand.

1.2 Definitions

1. Contractor. The individual, company, or "in house" Union Carbide Corporation - Nuclear Division (UCC-ND) plant entering into a contract, subcontract, purchase order, or work order issued by the purchaser. In addition, the Reactor Division of ORNL is the "contractor" to AEC within the meaning and intent of the design and operation sections of this document.

2. Engineering Services Department. The service department in the Reactor Division that processes and coordinates procurement, fabrication, installation and storage activities for the various operating departments in the Reactor Division.

3. Management. Program Director, and/or Reactor Division Director, and/or Operating Department Head.

4. Operating Department. Any department in the Reactor Division that has overall responsibility for conducting an experiment.

5. Project Engineer. The engineer usually assigned by the Operating Department of the Reactor Division to manage and coordinate all activities necessary to build the experiment or test stand. He is responsible for performing and/or requesting the services of specialists to perform the necessary design, procurement, fabrication, and installation activities.

6. Purchaser. The Reactor Division of ORNL is the agency responsible to the AEC and the purchaser for issuance and administration of contracts, subcontracts, and purchase orders imposing the requirements, policies, and procedures of this document. In a like manner the Reactor Division, as the purchaser, issues and administrates work orders to other "in house" UCC-ND plants in the Oak Ridge Operations (ORO) area.

7. Quality Assurance. The planned and systematic actions necessary to provide adequate confidence that a material, component, system or facility will perform satisfactorily in service.

8. Quality Control. The quality assurance activities, i.e., mensuration, inspections, tests, etc., that control the attributes of the material, process, component, system, or facility in accordance with predetermined quality requirements.

9. Test Stand. Materials, parts, components, and subsystems assembled into a complete system capable of being operated to obtain data and information.

1.3 Applicability

This document applies to all activities that affect the quality of any essential portion of the test facility and an experiment from initial design concept through fabrication, construction, and operation. The extent to which these policies and procedures apply are defined in this document.

1.4 Responsibility

Responsibility for establishing, implementing, and maintaining the requirements of the Quality Assurance Program is vested with the purchaser and the contractor. The purchaser has the responsibility and the authority to impose requirements on the contractor by contract, purchase order, or work order.

The contractor is responsible for conducting all activities affecting quality in accordance with the specified requirements, policies, and procedures of this document and other applicable criteria, codes, standards, and successful practices.

1.5 Relation to Other Requirements

The requirements, policies, and practices of this document and the plans, procedures, and documents resulting from its implementation shall be satisfied in addition to quality assurance requirements contained in other applicable codes, standards, and specifications. The requirements,

policies, and practices of this document are not to be interpreted by the contractor in a manner that would result in a duplication or derogation of work effort.

1.6 Purchaser Actions

The Quality Assurance Program of the contractor and of his subcontractors and suppliers shall be subject to surveillance, inspection, evaluation, and audit by the purchaser or by his designated representative at any time during the course of the program. Such actions by or on behalf of the purchaser shall not relieve the contractor of his responsibility for compliance with contract requirements.

Upon request, the contractor shall furnish, or provide access to, contract-related quality assurance information, documents, records, material samples, and other items required by the purchaser or his designated representative. Representatives of the purchaser shall have access to the contractor's plant, facilities, and equipment for the purpose of inspection of work and materials.

REACTOR DIVISION

Quality Assurance Procedure 2

MANAGEMENT AND PLANNING
FAILED FUEL MOCKUP TEST STAND
(LMFBR PROGRAM)

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2. MANAGEMENT AND PLANNING

2.1 Scope

This procedure defines the general management and planning actions for the Failed Fuel Mockup (FFM) Test Stand to satisfy the Quality Assurance Program requirements of this document and other specific program requirements.^{3,4,6} Reactor Division-Quality Assurance Procedures are presented as Sections 1, 3, 4, 5, 6, and 8 of this document and are applicable as stated. Sections 2 and 7 of this document have been written specifically for the FFM test stand.

2.2 Quality Assurance Program

2.2.1 Planning

Planning includes all project activities affecting quality and provides for controls, special equipment, capable personnel and specific inspection, testing, surveillance and audit efforts necessary for verification of quality.

The FFM has been assigned an Engineering Job Number (EJN) 10351 for use as an identifying or serial number. This number shall be placed on all documents associated with the FFM and shall be used to identify and store records.

2.2.2 Quality Assurance Program Plan

The Quality Assurance Program Plan sets forth the quality assurance requirements, policies, practices, procedures, and quality assurance audit. It delineates responsibilities for design, procurement of materials, procurement of components manufactured by subcontractors, fabrication of components by UCC-ND shops, construction, operation, maintenance, and modifications of the test stand.

It is the policy of the Reactor Division of Oak Ridge National Laboratory (ORNL) to achieve quality control objectives through utilization of personnel in existing "in house" Union Carbide Corporation-Nuclear Division (UCC-ND) plant groups rather than through establishment of a large, centralized quality control organization. Written procedures

provide standardization, and a small quality assurance staff is responsible for technical quality assurance coordination and audit. This is consistent with assignment of quality responsibilities to individual plant groups and permits the most efficient use of the specialists available within those groups.

2.2.3 Designation of Quality Assurance Effort for the FFM

The FFM, a nonradioactive test loop, contains both high quality, Level 2, and standard quality, Level 3, items and services as defined in Appendix I of this procedure. In general, the sodium containing system has been designated Quality Level 2 with the remainder of the test loop designated Quality Level 3. During design it shall be the responsibility of the designers and the project engineer to determine the appropriate quality level of each system and principal component with concurrence of the Division Quality Assurance Coordinator of the Reactor Division (DQAC-RD).

Codes, standards, and practices selected to accomplish these quality levels are given in Appendix A of this document.

2.3 Organization

2.3.1 Responsibility and Authority

Responsibility and authority for implementation of the Quality Assurance Program shall reside with the project engineer. He shall be supported by management, designers, personnel performing procurement, fabrication, and installation activities, and the DQAC-RD. The designation of functional responsibilities for the FFM is summarized in Figure 1.

The Experimental Engineering Department of the Reactor Division has been designated the Operating Department for the FFM test stand.

LMFBR program coordination with the Fast Flux Test Facility (FFTF) and Argonne National Laboratory (ANL) shall be the responsibility of the FFM Program Director and the ORNL Liquid Metal Fast Breeder Reactor (LMFBR) Program Coordinator.

2.3.1.1 Quality Assurance Responsibility and Authority. The DQAC-RD performs and coordinates quality assurance activities to assure that the

QA Program Activity	Organization					
	Management ^a	Design	Procurement Fabrication	Installation	Project Engineer	Quality Assurance
Preparation of QA Program Plan	A	S	S	S	P	A
Perform QA Program Audit	R	S	S	S	S	P
Provide Design Criteria & Requirements	P	R			S	R
Establish Design Standards		P			A	A
Design Drawings & Specifications ^b		P			A	R
Design Review Meetings	R	S			P	R
Specify Supporting Development Tests & Design	R	P			S	R
Supporting Development Tests	A	S			P	
Prepare Procurement Documents & Specifications	A	S	R		P	R
Conduct Supplier Evaluation & Selection		S	S		P	R
Provide Material Control			S	S	P	R
Control of Nonconforming Items	A	R	S	S	P	A
Prepare Procedures & Conduct Acceptance Testing	A	R		S	P	R
Prepare Operating & Maintenance Procedures	A	R			P	R

^aProgram Director, and/or Reactor Division Director, and/or Operating Department Head.

^bThe Reactor Division Design Department shall prepare assembly, test and operating procedures on request.

Fig. 1. Designation of Quality Assurance Functional Responsibility

Quality Assurance Program is accomplished. He is responsible to the ORNL Quality Assurance Director. The quality assurance functions are shown on the FFM Project Organization Chart, Fig. 2.

The DQAC-RD shall review, and accept the Quality Assurance Program Plan if it meets the quality assurance requirements of ORNL and RDT Standard F 2-2T. In addition, he shall perform auditing activities to determine if quality assurance activities required in the Quality Assurance Program Plan are being followed.

Acceptance by the DQAC-RD of the Quality Assurance Program Plan should be interpreted to mean that in his opinion the test equipment will perform as planned. The responsibility for ultimate success or failure of the test rests with the project engineer. The responsibility for the success of the test in meeting program objectives rests with the Program Director.

The design criteria are given in the Program Plan,⁵ AEC-DRDT program letters^{4,6} and supplementary information.

2.3.1.2 Appeal of Quality Assurance Requirements. In case of disagreement between the DQAC-RD and the project engineer, the problem shall be presented to the Operating Department Head and the ORNL Quality Assurance Director's office. If the disagreement is not resolved, a review board including the ORNL Quality Assurance Director, Reactor Division Director, and Program Director shall make the decision.

In the event that a decision can not be resolved at this level a final appeal can be made to the ORNL Deputy Director.

Any decision affecting quality, including justifications, shall be documented by the review board. Copies shall be sent the DQAC-RD, ORNL QA office, and other appropriate organizations, and placed in the permanent project file.

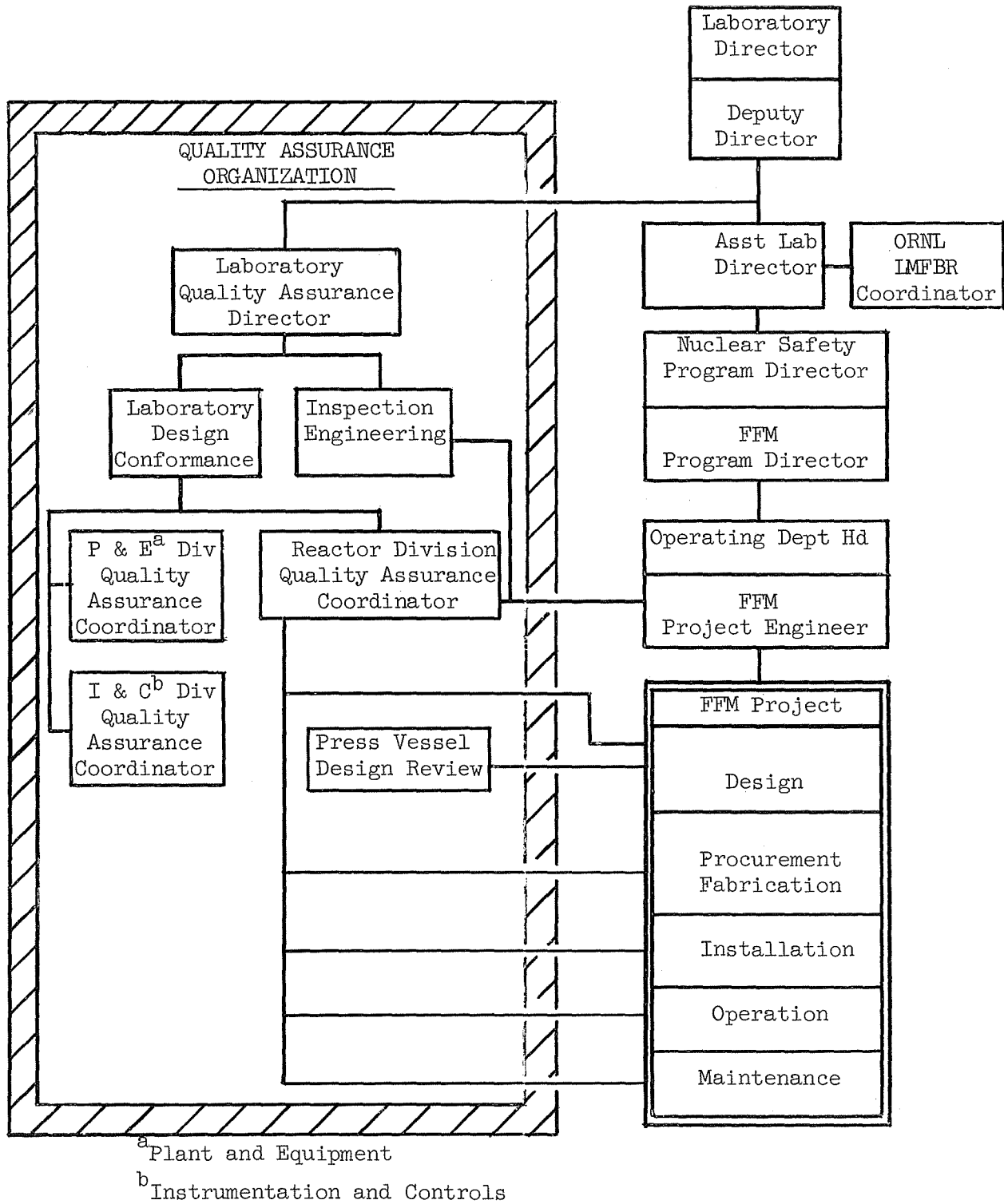


Fig. 2. Quality Assurance Organization for the FFM Project

APPENDIX I

DEFINITIONS OF QUALITY LEVELS

Quality Level I is normally assigned to a component or system that cannot be easily inspected while in-service because of radioactive contamination and/or high radiation fields and in which failure could (1) cause an extended delay in the completion of the project or in the program supporting the project, (2) cause serious or costly damage to a significant portion of the system or the facility in which it is located, or (3) create a hazardous condition.

Normally, Quality Level I is associated with components of the reactor primary system, with some components of in-pile circulating loops, with certain fueled and nonfueled irradiation capsules, and with those components of a nuclear fuel processing plant that are in contact with the main processing stream. Operation of the project is normally expected to continue for an extended period of time in fields of intense neutron flux and/or at high levels of radioactivity

Quality Level II is normally assigned to a component or system with or without the presence of radioactivity, in which failure could (1) cause an extended delay in the project or in the program supporting the project, (2) cause serious or costly damage to a significant portion of the system or the facility in which it is located, or (3) create a hazardous condition.

Normally, Quality Level II is associated with engineering-scale experiments operating outside of a reactor system that are designed to operate at high pressure and/or high temperature, with noncritical components of an in-pile loop, with a reactor secondary system, and with some reactor facilities and experiments that are not in-core.

Quality Level III is normally assigned to a component or system in which failure will (1) not cause an extended delay in the completion of the project, or (2) not cause costly destruction of the project.

Normally, Quality Level III is associated with laboratory-scale experiments, with noncritical components or systems of engineering-scale experiments, and with electrical, structural, and piping systems that are under the jurisdiction of the various industrial codes.

Quality Level IV is normally assigned to components or systems that are associated with bench-scale low-cost experiments operating at low pressure and which contain either nonhazardous materials or small quantities of toxic materials that are suitably contained. Laboratory service systems not governed by Quality Level III requirements may be assigned to Quality Level IV.

Note 1: Some components purchased to a Quality Level III from reliable vendors who have a long well-documented history for high-quality products may under certain circumstances be used in a Quality Level II system.

Note 2: The replacement of a minor component or a minor section of an existing system may be performed to the standards used in the original design of the system, however, if a significant component or section of the system is replaced, it must be designed and installed in accordance with this quality level guide.

Note 3: Redundant circuit designs using components from reliable vendors may qualify for Levels I and II application.

REACTOR DIVISION

Quality Assurance Procedure 3
(Interim Use)

DESIGN AND DEVELOPMENT

C. K. McGlothlan

February 1970

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3. DESIGN AND DEVELOPMENT

3.1 Scope

This procedure describes the quality assurance requirements, policies, and controls to be implemented during the design and development phase (development work supporting design) of research and development projects for the Atomic Energy Commission-Division of Reactor Development & Technology (AEC-DRDT).

The paragraphs of this procedure are applicable for Levels 1, 2, 3, and 4 quality work as indicated in the following Table. See Appendix I of this procedure for definition of quality assurance levels.

<u>Paragraphs</u>	<u>Quality Level</u>			
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
3.1 Scope	X	X	X	NA
3.2 Design Planning	X	X	X	NA
3.3 Design Definition & Control	X	X	O	NA
3.4 Document Review & Control	X	X	O	NA
3.5 Design Reviews	X	X	X	NA
3.6 Development Supporting Design	X	X	X	NA
3.7 Failure Reporting	X	X	X	NA
3.8 Quality Records	X	X	X	NA
3.9 Quality Audit	X	X	X	NA

X - Applicable in its entirety.

O - Applicable with noted exceptions.

NA - Not applicable.

3.2 Design Planning

Formulation of criteria for the overall design shall be the joint responsibility of the Program Director, members of the Operating Department and other appropriate personnel or groups.

The project engineer shall provide guidance to the various design groups in translating the criteria into engineering drawings and documents.

It shall be the responsibility of the Reactor Division Design Department to schedule and to supply or obtain the required thermal, hydraulic, mechanical, electrical, and instrumentation design calculations, and to design or obtain design and to specify or obtain specifications for all equipment, instruments, systems, and controls in accordance with established criteria and standards. The Reactor Division Design Department may request design assistance, as appropriate, from other design groups in the K-25, ORNL, Paducah or Y-12 plants of Union Carbide Corporation-Nuclear Division (UCC-ND).

The lead design engineer, appointed by the Reactor Division Design Department Head, shall be delegated responsibility for coordinating the design effort, including interface coordination of the design groups. Interfaces between electrical, mechanical, instrumentation, chemical, civil, metallurgical, and other design activities shall be established early in the design period and performance to these interfaces shall be monitored by the project engineer and reviewed in regularly scheduled design review meetings. See Figure 3-1 and Paragraph 3.5.

Reactor Division design assistance shall be requested by the project engineer on Form UCN-5158, "Request for Design Services." A sample of this form is included in Appendix II of this procedure.

When needed, design consultants shall be employed by the Reactor Division Design Department. Consultants shall be obtained in accordance with UCC-ND Standard Practice Procedure D-2-8, "Consultant and Special Services."

3.3 Design Definition and Control

The following methods shall be utilized for control of design activities to assure that applicable design criteria, codes, standards, practices, and requirements for materials, structures, components, systems, and processes are defined and correctly translated into specifications, drawings, procedures, and instructions.

3.3.1 Design Criteria

The design criteria shall be developed utilizing programmatic guidance from AEC-DRDT.

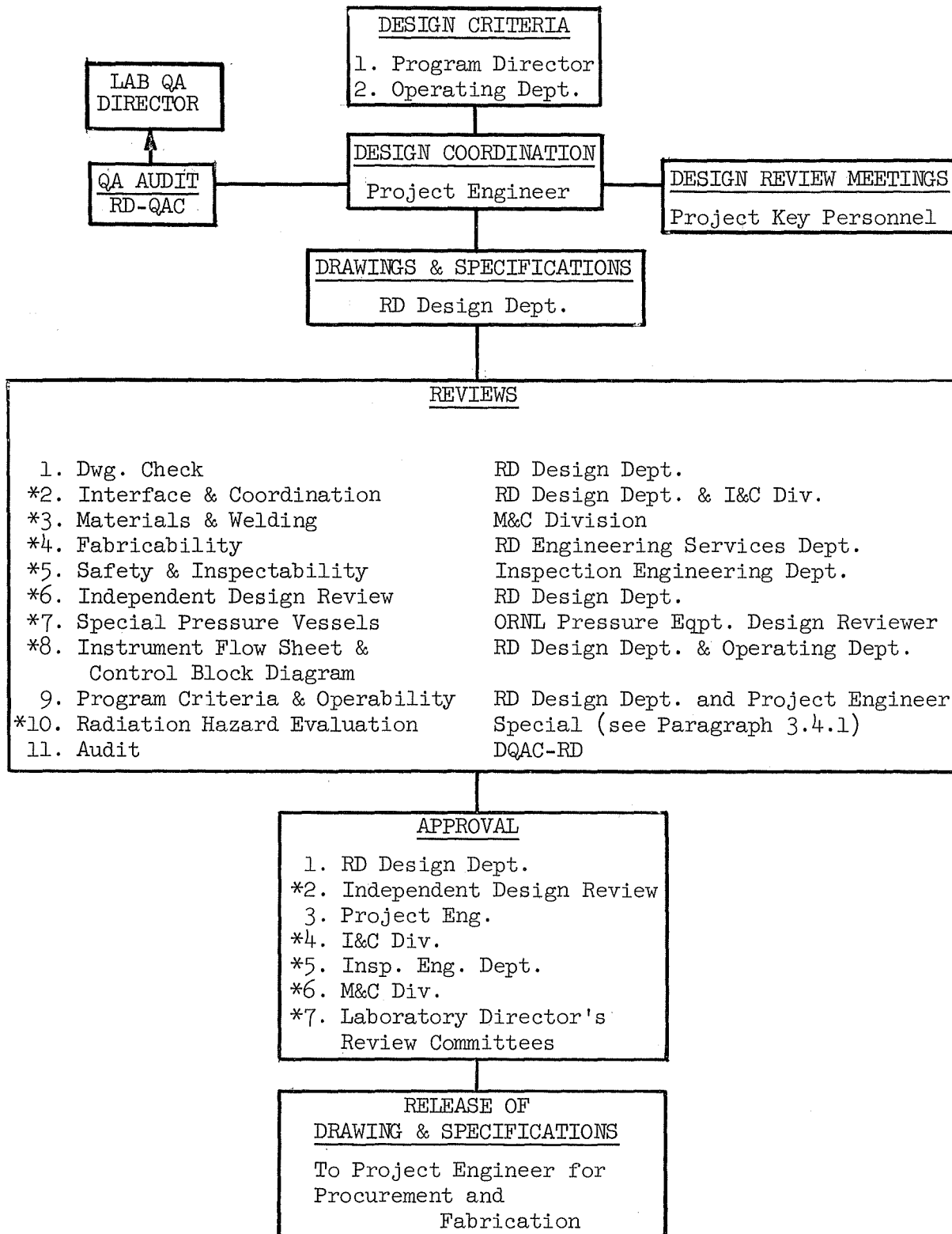


FIG. 3-1

*When Applicable

CHART OF DESIGN ACTIVITY AND RESPONSIBILITY

The criteria shall be described in the Conceptual Systems Design Description (CSDD) or the Program Plan together with supplemental written information. See Paragraph 3.3.5.

3.3.2 Codes, Standards, and Practices

For Level 1 or 2 quality, mandatory codes, standards, and practices in Appendix A of the QA Program Plan shall be used.

For Level 3 quality, recognized codes, standards and practices in Appendix A of the QA Program Plan shall be used as applicable.

All codes, standards, quality levels, and practices used shall be clearly identified and referenced in design criteria, analyses, description, plans, specifications, drawings and other engineering documents as applicable.

3.3.3 Engineering Studies

Designers shall make engineering studies sufficient to establish that the design meets appropriate codes, standards and criteria, that it is based on proven practices and that it is adequate for the intended service, for safety, and for maintainability. For Level 1 and 2 quality this information shall be documented in the form of calculations and reports, in sufficient detail for review by other qualified designers. (See Section 3.4 for review.)

3.3.4 Parts, Materials, and Processes

The designers and the project engineer shall select parts, materials, and processes on the basis of satisfactory past experience or qualification for the intended service.

If existing equipment and material, qualified under previous programs, are to be used for Quality Level 1, 2, and 3 applications and they do not conform to requirements established for new equipment and material, additional inspections, as appropriate and practical, shall be utilized. The additional inspections shall establish that the equipment and material are adequate, reliable, and safe even though the risks may be higher than for conforming equipment. When non-conforming equipment and material are used it shall be documented by the project engineer and distributed for review and approval by the Program Director, Reactor Division Management and the DQAC-RD. The discussions shall include problems and reasons for the use of non-conforming equipment and material.

3.3.5 Design Description

When requested by AEC-DRDT, a series of Design Description reports shall be prepared in accordance with Appendix III of this procedure, "Outline for System Design Descriptions," and/or "Instructions for Design Descriptions Preparation."⁷

A series of two or three System Design Description reports will be adequate for small and medium size jobs, but for large jobs, additional Design Description reports may be needed for each large complex component.

The basic objective of preparing Design Descriptions is to provide description of the system, component or facility design at appropriate points in conceptual, preliminary, and final design as a firm point of departure for subsequent design effort.

Design descriptions should provide a means to define and integrate the various technical, operational, and safety considerations involved; maximize application of past experience; relate research, development, test, and backup design efforts; identify interfaces; and serve as a common technical basis for other project activities. Design descriptions should provide a technical reference for detail component specifications, operational test procedures, and safety analysis reports.

The Conceptual Design Description (CDD) should present the conceptual design and indicate the extent of engineering and development necessary to arrive at a firm design. This report is usually required for AEC-DRDT programmatic approval. The Preliminary Design Description (PDD) should present a firm design which is developed during the preliminary design phase (Title I). The Final Design Description (FDD) should be developed in greater design detail during final design (Title II) and, as issued should be a full description of the "as built" system or component. It should be issued after construction is complete and prior to beginning operation. For small, well defined jobs, the Conceptual and Preliminary Design Description may be combined into one report.

3.3.6 Specifications, Drawings and Instructions

3.3.6.1 Scope. Specifications, drawings, instructions and other engineering documents necessary to define specific procurement, fabrication and assembly requirements shall be prepared.

These documents shall include, as applicable, information on requirements for materials, fabrication, construction, installation, testing, inspection, maintenance, cleaning, packaging, shipping, storage, operations, and quality assurance.

3.3.6.2 Preparation of Specifications and Drawings.

1. The Reactor Division Design Department shall be responsible for all design and assignment of an "Engineering Job Number" to the job.

2. Drawings and Specifications - The Reactor Division Design Department shall identify and use appropriate codes and standards, prepare all drawings, specifications, and other design documents except those documents prepared by other designated groups.

3. When delegated design responsibility by the Reactor Division Design Department, the designated design groups shall prepare or supervise the preparation of drawings and specifications according to appropriate codes and standards listed in Appendix A of the QA Program Plan.

4. Detail design, drawings, and specifications may be prepared by any qualified person or UCC-ND design group outside the Reactor Division Design Department. However, the design calculations, drawings, and specification shall be submitted to the Reactor Division Design Department Head for appropriate review and approval before procurement and construction are initiated. For minor jobs, the tracings may be approved by the Reactor Division Design Department Head or his designee without obtaining formal reviews and approvals.

3.3.6.3 Preparation of Special Engineering Documents. The project engineer shall coordinate the preparation of special specifications, instructions, and other engineering documents.

The applicable existing and proposed special engineering documents shall be listed in Appendix B of the QA Program Plan.

3.3.7 Classification of Items

All components, structures, systems, facilities and systems, facilities and services shall be classified, with respect to function, relative importance, and contribution to achieving project objectives. The quality level for each of these items shall be selected by the designers in cooperation with the project engineer and concurrence of the DQAC-RD.

3.3.8 Identification

The design departments shall note the quality level of all parts, materials, components, and processes on drawings, specifications and other engineering documents. For Level 1 or 2 equipment and systems, the identification system shall allow for material traceability between engineering documents and products, through the use of component titles, material heat numbers, Inspection Request (IR) numbers, weld joint numbers, part numbers and serial numbers. For Level 3 quality systems and equipment, material traceability between engineering document and end products will be optional as determined by the project engineer.

The weld inspection schedules (weld quality levels) A, B, C, D, E, or F of ORNL Weld Inspection Procedures in Appendix B of the QA Program Plan shall be selected by the lead design engineer in cooperation with the project engineer and the assigned metallurgist.

Reactor Division Design Department procedures in Appendix A of the QA Program Plan shall be used for drawing identification and assignment of an "Engineering Job Number."

3.3.9 Interface Control

The lead design engineer shall be informed immediately of any design interface problems and he shall take action to resolve the problem. Definition of design interface problems between the mechanical, electrical and instrument control designs shall be done by the lead design engineer or his designee and the other design engineers involved.

3.4 Document Review and Controls

3.4.1 Document Review

It shall be the responsibility of the Design Department of the Reactor Division to review or request the review of their engineering documents. The reviews shall be performed as follows:

(1) All drawings shall be checked for workability, completeness, interferences, tolerances, materials, and drafting errors by a checker in the Reactor Division Design Department or delegated design group.

(2) The instrumentation and controls design engineer shall review all drawings as applicable, for instrument application problems, operability and interface connections and interactions.

(3) The electrical design engineer shall check all drawings and specifications, as applicable, for interface connection with the electrical drawings.

(4) A metallurgist from the Metals & Ceramics Division shall review all drawings, as applicable, for material application, weld joint design, and material and weld joint inspection requirements.

(5) The project engineer and personnel in the Engineering Services Department shall review all drawings, as applicable, for fabricability.

(6) The ORNL Inspection Engineering Department shall review all pressure equipment and layout drawings for conformance to the safety requirements of ORNL Standard Practice Procedure-12 B, testing and inspectability of the equipment.

(7) A radiation hazard evaluation and review shall be conducted on all nuclear reactors, test loops in nuclear reactors and experiments containing or coming in contact with radioactive materials. This evaluation and review shall be conducted as described in Procedures 1.3, "Safeguard Requirements in the Design of Operations and Experiments" and Procedure 1.5, "Radiation Safety Review and Authorization of Operations and Experiments" contained in the ORNL Health Physics Procedure Manual. The responsibility for requesting this review and supplying the necessary information to the review committees is usually vested with the project engineer and the Operating Department of the Reactor Division.

(8) All drawings, specifications, analyses, and other significant engineering documents used to define Quality Level 1 or 2 items and services, as described in Appendix A of this document, shall be reviewed and evaluated by a qualified design engineer who did not participate in the preparation of the original documents. The independent design review shall be conducted systematically to verify completeness and adequacy with respect to engineering standards, design practices and intended application.

The independent design review shall be conducted to determine if the proposed design is adequate. The reviewer shall either approve the design

as presented or recommend modifications in areas that are deficient. The reviewer shall not propose or investigate alternate designs.

(9) Special and unusual pressure vessel and piping systems shall be reviewed independently by an ORNL Pressure Equipment Design Reviewer when requested by the Reactor Division Design Department Head.

(10) An independent design review of the Instrument Flow Sheet and Control Block Diagram shall be made for all jobs. This review shall be based on the requirement that the instrument application, the type instruments used, the control functions shown, and the alarms and interlocks shown are adequate for the safe operation of the system. These items shall be evaluated to assure that the instrument and controls system and application will include protection against overheating, freezing, overpressure, and that the design of controls and alarms will protect the system against severe consequences of equipment and component failures. Items which fall into Quality Level 1 or 2 categories shall be listed.

This review may disclose that review of other drawings is necessary. If so, these drawings shall be listed by the reviewer and they shall be given the independent review before they are issued.

In addition, the Instrument Flow Sheet and a Control Block Diagram for all jobs shall be distributed for review to the program director, project engineer, and the Operating Department.

(11) The lead design engineer and project engineer shall review all drawings and specifications for conformance to program criteria and operability.

3.4.2 Document Control

3.4.2.1 Approval of Documents. The checker, project engineer and the Reactor Division Design Department Head shall sign all drawings, and the mechanical, electrical, instrument designers, and the lead design engineer shall sign all drawings, as applicable, to indicate that the drawings are complete and satisfactory. The independent design reviewer, including the ORNL pressure equipment design reviewer, radiation hazard evaluation reviewer and the Inspection Engineering Department reviewer shall indicate by letter to the Reactor Division Design Department Head that the design is adequate for the intended use. Copies of the letter shall be sent to the project engineer, Program Director, and the DQAC-RD.

3.4.2.2 Issuing of Documents. Drawings, specifications, bills of material, and other design documents shall be issued by the Design Department of the Reactor Division for material procurement, component fabrication, and installation after all necessary approval signatures and approval letters have been obtained. All approved drawings shall be stamped by the Reactor Division Design Department, "Certified for Construction" and dated. Prints of each design document shall be distributed as designated by the project engineer. These design documents shall be distributed by the Design Department of the Reactor Division on Form UCN-2094, "Information Transmittal." (See Appendix V of this procedure.)

3.4.2.3 Significant Changes to Design Documents. Significant changes to approved design documents shall be reviewed, approved, and documented by the Reactor Division Design Department. These changes shall be requested by the project engineer on a "Request for Design Services," form UCN-5158. (See Appendix II of this procedure.)

3.4.2.4 Minor Changes to Design Documents. Minor field changes to approved drawings may be authorized by the project engineer. Each change shall be described in detail and forwarded for approval to the Reactor Division Design Department Head on a "Message Form." (See Appendix VI of this procedure.) The Reactor Division Design Department Head shall return a copy of the message form to the project engineer. It shall indicate approval or disapproval (with comments) concerning the change. The project engineer may make the field change before receiving approval, however, the change shall be subject to final approval by the Reactor Division Design Department.

3.5 Design Review Meetings

Design review meetings shall be held to discuss and resolve technical problems concerning design adequacy. Design review meetings shall be scheduled, as appropriate, (approximately one per month) by the project engineer or Program Director. These reviews shall provide assurance that electrical, mechanical, thermal hydraulic, safety, and similar type studies are in line with project objectives, budget and schedule; that research and development programs and tests associated with the design provide

optimal benefits to the design effort; that maximum use is made of qualified, standard, or approved parts, materials, components, and processes; that accessibility for in-service inspection, maintenance, or repair is adequate; and that acceptance criteria for inspections and tests are delineated, that interface problems have been adequately resolved, and that equipment can be safely operated. Participation in design review meetings shall be inter-departmental, including key personnel having responsibility for design, fabrication, test, quality assurance, operation, maintenance, safety, project management, and consultants as appropriate. Special design review meetings with other participants in the same project shall be held when design interfaces are being resolved. Each design review meeting shall be documented by the project engineer to include a synopsis of significant problems, decisions, action items, and indicate any significant deviation from established program objectives. Reports of design review meetings shall be reviewed by the management of the project, by the Program Director, by the DQAC-RD, and by the ORNL Quality Assurance Director.

3.6 Development Supporting Design

Items in the design which require development or tests to establish their workability and reliability shall be called to the attention of the project engineer and Operating Department by the Reactor Division Design Department. A test or development program, if appropriate, shall be proposed for each of these items.

The project engineer and the Operating Department shall be responsible for obtaining the requisite design assistance and for scheduling and conducting the test and development programs.

3.7 Failure Reporting

Equipment failures^a and/or system inadequacies shall be reported to project and division management on the form entitled, "Incident Report." (See Appendix VII of this procedure.)

^aThe inability of an item to perform within specified limits.

3.8 Quality Records

The Design Department of the Reactor Division shall compile and maintain design records. Records shall be filed according to Engineering Job Number and Title and shall include all design description reports, all tracings including those produced by subcontractors, a complete master drawing list on Form UCN-7043A, (see Appendix VIII of this procedure) all design data and studies, all design review and failure reports, all specifications, all bills of material and copies of all other design documents. Tracings produced by UCC-ND design groups other than the Reactor Division may be retained by that design group, however as a minimum requirement, a complete set of all drawing prints shall be sent to the Reactor Division Design Department for the permanent file. The records shall be readily accessible and shall be retained for the life of the project with which the experiment is supporting.

3.9 Quality Audit

The ORNL Quality Assurance Organization shall regularly audit the design effort in accordance with applicable requirements of the Reactor Division-Quality Assurance Procedure No. 8, "Activity Audit."

APPENDIX I

DEFINITIONS OF QUALITY LEVELS

Quality Level I is normally assigned to a component or system that cannot be easily inspected while in-service because of radioactive contamination and/or high radiation fields and in which failure could (1) cause an extended delay in the completion of the project or in the program supporting the project, (2) cause serious or costly damage to a significant portion of the system or the facility in which it is located, or (3) create a hazardous condition.

Normally, Quality Level I is associated with components of the reactor primary system, with some components of in-pile circulating loops, with certain fueled and nonfueled irradiation capsules, and with those components of a nuclear fuel processing plant that are in contact with the main processing stream. Operation of the project is normally expected to continue for an extended period of time in fields of intense neutron flux and/or at high levels of radioactivity.

Quality Level II is normally assigned to a component or system with or without the presence of radioactivity, in which failure could (1) cause an extended delay in the project or in the program supporting the project, (2) cause serious or costly damage to a significant portion of the system or the facility in which it is located, or (3) create a hazardous condition.

Normally, Quality Level II is associated with engineering-scale experiments operating outside of a reactor system that are designed to operate at high pressure and/or high temperature, with noncritical components of an in-pile loop, with a reactor secondary system, and with some reactor facilities and experiments that are not in-core.

Quality Level III is normally assigned to a component or system in which failure will (1) not cause an extended delay in the completion of the project, or (2) not cause costly destruction of the project.

Normally, Quality Level III is associated with laboratory-scale experiments, with noncritical components or systems of engineering-scale experiments, and with electrical, structural, and piping systems that are under the jurisdiction of the various industrial codes.

Quality Level IV is normally assigned to components or systems that are associated with bench-scale low-cost experiments operating at low pressure and which contain either nonhazardous materials or small quantities of toxic materials that are suitably contained. Laboratory service systems not governed by Quality Level III requirements may be assigned to Quality Level IV.

Note 1: Some components purchased to a Quality Level III from reliable vendors who have a long well-documented history for high-quality products may under certain circumstances be used in a Quality Level II system.

Note 2: The replacement of a minor component or a minor section of an existing system may be performed to the standards used in the original design of the system; however, if a significant component or section of the system is replaced, it must be designed and installed in accordance with this quality level guide.

Note 3: Redundant circuit designs using components from reliable vendors may qualify for Levels I and II application.

APPENDIX III

INSTRUCTIONS FOR PREPARATION OF SYSTEM DESIGN DESCRIPTIONS

Division of Reactor Development and Technology

February 1966

1. Summary

System Design Descriptions are working technical reference documents which describe specifically the design of individual systems of a nuclear power plant and facility. Normally there are three submissions of a System Design Description: Conceptual, Preliminary and Final. These submissions occur during the engineering design and development phases of a nuclear power plant, and form the basic technical reference for the existing reporting requirements for Conceptual Design, Preliminary Design (Title I), Final Design (Title II), Safety Analysis Reports and Power Plant Operating Manual.

2. Objectives of System Design Descriptions

The objective of System Design Descriptions is to provide a technical reference for detailed component specifications, for operational procedures, and for test procedures. Further, they provide an official, technical reference document, describing a reactor system, on which to base technical comments and recommendations for changes by all organizations involved in the nuclear power plant development program. Their evolution, including the formal technical justifications for changes, provides detailed documentation of the technical development history and the design philosophy leading to the final plant configuration.

System Design Descriptions provide technical design information for management planning and control of cost, schedule and resources. In particular, they provide the bases for identification of the requirements in certain areas, such as:

- a. research and development,
- b. parallel or backup development efforts,
- c. development and proof testing, facilities and resources,
- d. personnel and training,
- e. quality assurance,
- f. maintenance, availability and reliability,
- g. special tools and spares provisioning,
- h. cost and schedule priorities.

System Design Descriptions form the technical basis for and can be directly incorporated into the Conceptual Design Report, Preliminary Design Report (Title I), Final Design documents (Title II), Safety Analysis Reports, and the Power Plant Operating Manual. The content of the System Design Descriptions is discussed in the next section.

3. Content of System Design Descriptions

The System Design Description is a formal technical document that represents the official reference design and design philosophies of a system. All System Design Descriptions contain the following basic outline:

- Section 1. Introduction
 - 1.1 System Function
 - 1.2 Summary Description of the System
 - 1.3 System Design Requirements
- Section 2. Detailed Description of System
- Section 3. Principles of Operation
- Section 4. Safety Precautions
- Section 5. Maintenance
- Appendices
- Schematic Diagram
- Forwarding Letter

A detailed presentation of what is contained in each of the headings of a typical Final System Design Description is shown in Appendix IV to these instructions. The content varies during the various phases of design development, and these distinctions in each phase are presented in the next Section.

The content of a System Design Description may be amplified in the forwarding letter which transmits the document to RDT. It should include any information not appropriately part of the System Design Description, but which is necessary for proper consideration of the information presented therein. The forwarding letter should include specific information as discussed in Appendix IV.

4. Development of System Design Descriptions

Appendix IV contains an outline of a System Design Description which is intended for use as a guide by a system designer. The content of the outline is based on a Final System Design Description. The different characteristics of earlier issues are detailed in the following sections.

4.1 Conceptual System Design Description

The Conceptual System Design Description presents the conceptual design and indicates the extent of engineering and development necessary to arrive at a firm system design. The outline in Appendix IV should be used as a guide for this conceptual design phase. Introduction, Detailed Description of System and the Schematic Diagram will be the sections stressed during this phase. The content of the Conceptual System Design Description should be sufficient to serve the following purposes:

- a. To reach agreement on a conceptual system design at the earliest possible date,

- b. To indicate what considerations have led to the contractor's selection of the proposed system, including analyses of trade-offs and alternatives,
- c. To form the basis for preparation of preliminary equipment arrangements,
- d. To define the courses of action necessary to arrive at an engineered system recommended by the contractor,
- e. To identify areas in which R&D and/or parallel or backup development efforts may be required.

Each Conceptual System Design Description should be prepared early in the conceptual design phase and submitted to RDT for approval in sufficient time so that comments may be resolved prior to issuing the Conceptual Design Report. The Conceptual System Design Descriptions may be incorporated as an integral part of the Conceptual Design Report to minimize the technical reporting requirements.

The first Conceptual System Design Description submitted should be for the over-all Reactor Plant and should include a list of all System Design Descriptions and major design studies together with scheduled dates for their submission. Systems should be chosen on the basis of providing only a single function.

The forwarding letter for the Conceptual System Design Description should contain the appropriate information as listed in Appendix IV. In addition, it should contain a discussion of the extent of work that must be performed before the submission of the Preliminary System Design Description (i.e., model tests, simulator studies, experiments, sizing calculations, etc.), including a scheduled date for its submission.

4.2 Preliminary System Design Description

The Preliminary System Design Description presents a firm system design which is developed during the preliminary design phase (Title I). Its content follows the same format as the outline in Appendix IV. However, certain areas of design are highlighted in this phase of development and the content of the System Design Description should be sufficient to satisfy the purposes of this submission as follows:

- a. To present a description of the system the contractor recommends for RDT approval,
- b. To present the various operational concepts, including normal, abnormal, emergency and infrequent modes of operation,
- c. To present a system schematic diagram to provide for exchange of information between the contractor and the Architect-Engineer and to aid in equipment arrangement work,
- d. To provide technical justification of the need for R&D programs and/or parallel or backup development efforts,
- e. To define the courses of action necessary to arrive at the final system design,
- f. To serve as a basis for outline specifications for system components,

- g. To indicate any features in the proposed system that may affect or limit system performance.

Each Preliminary System Design Description should be submitted to RDT for approval when a firm system design is reached. The approved description constitutes a technical reference for the Preliminary Design (Title I) and Preliminary Safety Analysis Reports. During this phase, a System Design Description will be reissued if significant system design changes are made.

In addition to the requirements listed in Appendix IV, the forwarding letter for this submission should identify deviations from previously established specifications (such as a change in the material of construction of a component), and indicate the status of the component specifications.

4.3 Final System Design Description

The System Design Description is developed in greater design detail during final design (Title II) and is issued as a Final System Design Description. The content of this submission should follow the format as outlined in Appendix IV. This document should be submitted to RDT for information and approval of any features not previously agreed to by official correspondence. All areas of uncertainty in the design should be resolved when this document is submitted. Revised issues may be required incorporating design changes made during the construction (Title III) phase.

The Final System Design Description will serve as the technical reference for the Final Design Report (if required), the Final Safety Analysis Report, and the Power Plant Operating Manual. It may be incorporated directly into these documents.

APPENDIX IV

OUTLINE FOR SYSTEM DESIGN DESCRIPTIONS*

SECTION 1. INTRODUCTION1.1 System Functions

This section should state the purpose of the system by listing the basic functional requirements of the system. These requirements should define what the system does.

1.2 Summary Description of the System

This section should give a brief description of the system to acquaint the reader with the general nature of the system, the system components and the basic operating principles of the system. It should provide background information to aid in the understanding of Section 2, Detailed Description of System, and Section 3, Principles of System Operation.

1.3 System Design Requirements

The design basis for the system should be described in this section. The applicable codes and standards to which the system is designed should be referenced. A statement of specific system requirements and considerations additional to the basic system functional requirements listed in Section 1.1 should be included. These requirements and considerations are imposed by the required system functions and by interface relationships with other systems. Other system design requirements may be generated by the need to satisfy test, operational and maintenance considerations. The above information should be followed by a tabulation (where possible) of system characteristics, i.e., coolant flow rate, coolant temperature rate of change limitations, instrument error, etc., established by the designer as necessary to satisfy all requirements placed on the system. These characteristics should be justified, as necessary, by information appended to the system description. General requirements such as environmental conditions should be stated here rather than repeated for each component under Section 2.1.

SECTION 2. DETAILED DESCRIPTION OF SYSTEM2.1 Components

This section should provide a description of each major component in the system. The description should list the principal characteristics necessary to fulfill the system requirements. The functional location of

*The content of this outline is based on a Final System Design Description that is prepared after completion of the detailed design of the system.

the component and the intended and incidental effects of the component on the system should be clearly indicated. It should not give construction details except those special features which are required for clarity. Special requirements, such as those imposed by a dual function with another system, should be given.

The description of each component should be complete to the extent of forming the foundation of an equipment specification. In the preliminary design phase, this section would form the basis for writing a new specification where no previous component specification can be used. When an equipment specification is available for a component, it should be referenced along with any important modifications necessary to fit individual cases.

Following the descriptive paragraph for each major component outlined above, the design requirements and performance data for the component should be listed (in tabular form if possible).

Non-major components of the system such as special valves and relays should be listed in tabular form with information similar to the following:

- a. Component number corresponding to the schematic diagram,
- b. Size, type and material of construction,
- c. Functional name (brief) such as containment stop valve, D/P isolation valve, scram relay, etc.,
- d. Normal and fail position of valves and relays,
- e. Specification number and commercial equivalent, if any,
- f. Type of connections (welded, brazed, threaded, etc.),
- g. Pressure, temperature, voltage and current ratings, as applicable,
- h. Special requirements such as position indicators, set pressures on relief valves, etc.

2.2 Instruments, Controls, Alarms and Protective Devices

These sections should describe operating instruments, indicating instruments, controls, alarms and protective devices (i.e., circuit breakers, interlocks, etc.) associated with the system operation. It is expected that a portion of the information can be presented in tabular form which would include for each device information such as:

- a. Instrument number corresponding to the schematic diagram (this number should indicate the system to which the device belongs),
- b. Type and purpose (briefly),
- c. Installed spares,
- d. Range of measurement, set point, accuracy, etc.,
- e. Location of remote indication, control devices and alarms,
- f. Specification number.

It may be desirable to describe instrument or control functions in narrative form (e.g., 3-way boiler level control). Also, description of protective devices may be better suited in narrative form. A summary of

the effects of instrument errors and instrument-to-instrument errors on system design should be appended.

SECTION 3. PRINCIPLES OF OPERATION

This section should provide a complete discussion of the principles of system operation under various conditions. (Note: This section should not give detailed operating procedures.) Effects of maximum heat-up and cool-down rates, power transients, etc., and status of standby components should be included where applicable. The section should be divided as follows for most of the systems:

3.1 Startup

This section should describe the startup operation with particular reference to those features of plant operation that vary from normal operational procedures.

3.2 Normal Operation

This section applies to the operation of the system during normal plant operation. However, if the system does not operate during normal plant operation, a statement to this effect should be included here and the specific system-operation described instead. This section should discuss the sequence of flow (i.e., fluid, electrical, information, etc.) in this system and the function of each of the various components with regard to this flow. The first part of this description should be general in nature and should not be restricted to any particular operating level of the reactor plant. However, subsequent discussions should cover the function of the system with respect to the various operating levels of the plant. Reference should be made to the system schematic diagram (component name and number) and to such appended tabular summaries and graphs of calculated operating conditions as may be required. Related parts of the system which are supplementary in nature should be discussed herein. Typical of this category are continuously operating vents and drains, purification circuits, etc. Systems which are covered elsewhere by separate descriptions should be referenced and should not be repeated in this section.

3.3 Shutdown

This section should describe shutdown operations with particular reference to those features of plant operation that vary from normal operation that vary from normal operational procedures.

3.4 Special or Infrequent Operation

This section should describe operation of the system during special or infrequent operating conditions (such as partial shutdown for maintenance).

3.5 Emergency

This section should describe emergency operations which follow failures such as loss of power and feed pump failure.

SECTION 4. SAFETY PRECAUTIONS

4.1 Hazards

This section should identify the features of the system that might create hazardous conditions to the reactor plant. This section will be supported by formal casualty studies.

4.2 Precautions

This section should indicate the precautions that must be followed for safe operation of the system and the reactor plant.

SECTION 5. MAINTENANCE

5.1 Preventive Maintenance

This section should describe the periodic system and component checks inspections that are required to assure reliable operation and acceptable performance of the system. Periodic system adjustments and cleaning operations that are required for maintaining system performance within acceptable limits should also be included.

5.2 Trouble Shooting

This section should contain a list of probable trouble symptoms, corresponding indications and probable causes arising from malfunction of the system or components.

APPENDICES

1. Tabulation of component data (including valves and instruments) when more desirable here than in text of System Design Description.
2. Graphs, charts, calculations, as applicable, for clarity and to substantiate system or component design. Examples are curves of pressure drop versus flow for components and piping in the Reactor Primary Coolant System, sizing criteria for components, etc.
3. A summary of the effects of instrument errors on system design and operation.
4. List of references made in the text of the System Design Description. All references made should be available to those using the system design description. Earlier issues of System Design Descriptions will contain extensive reference to such detailed reports as Topical Design Reports, design studies, test reports, etc.

SCHEMATIC DIAGRAM

1. Symbols should comply with standards accepted by RDT.
2. A legend of symbols used should be included.
3. A number should be assigned in accordance with an approved numbering system to each piece of equipment indicated. This number should identify each piece of equipment either with the subject system or with a related system or part of system shown.
4. Interfaces with other systems should be clearly indicated by notes on the schematic. Other systems or parts of systems indicated for clarity should be shown in phantom.
5. Normal position of valves should be indicated; also, fail positions where applicable.
6. Packing side of globe valves and flow direction of check valves should be indicated.
7. Type of capping (weld, screw, etc.) for valves and piping should be shown.
8. Pipe sizes should be indicated.
9. Operational vents, drains, flush and fill lines should be indicated.
10. The location and types of any transition welds where pipes, components or fittings are to be of different basic metals should be indicated.
11. All instruments, with numbers, should be indicated.
12. The schematic should indicate roughly where each component is located within the plant spaces.
13. All contact positions should be indicated schematically for multiple position switches.
14. A method of showing local or remote indication and/or alarm for each instrument should be provided on the schematic.

FORWARDING LETTER

The forwarding letter transmitting the System Design Descriptions to RDT should include at least the following information as appropriate:

- a. A discussion of the areas of uncertainty in the recommended System Design Description together with a plan of action for resolving these uncertainties.
- b. Resolutions of questions or comments on the preceding submittal.
- c. Identification of changes made in the proposed design since the preceding submittal with reasons for the changes.
- d. Identification of major differences of special interest between the proposed system and the systems approved for other reactor plants.

APPENDIX VI

INSTRUCTIONS TO SENDER

- 1. DETACH YELLOW COPY
- 2. SEND WHITE AND PINK PARTS WITH CARBON TO PERSON ADDRESSED.

50006

INSTRUCTIONS TO RECIPIENT

- 1. WRITE REPLY AT BOTTOM.
- 2. DETACH STUB, RETAIN WHITE COPY AND RETURN PINK COPY TO SENDER

To:

SUBJECT

DATE

Reply Message

FOLD Y

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SIGNED

DATE OF REPLY

REPLY TO

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SIGNED

RECIPIENT

DETACH AND FILE FOR FOLLOW-UP

APPENDIX VII

OAK RIDGE NATIONAL LABORATORY

INCIDENT REPORT

(Format)

Facility: _____ Date of Incident: _____

Report No.: _____ Time of Incident: _____

Subject:

1. Description of Incident and General Designation of Apparent Cause:

(Design _____ Mat'l _____ Personnel _____ Procedure _____ Other _____)

2. Operating Conditions of the Facility at Time of Incident:

3. Immediate Evaluation, Corrective Action Taken, and Results:

4. Is Further Evaluation or Corrective Action Necessary?

If Yes: Before Further Operation?

By Whom?

5. Evaluation:

6. Temporary Corrective Action Taken:

7. Permanent Corrective Action Taken or Recommended:

8. Similar Incidents:

Originated by: _____ Date Reported _____

Approved by: _____ Date _____

Director

Division

Approved by: _____ Date _____

Director

Quality Assurance,
ORNL

4-1

REACTOR DIVISION

Quality Assurance Procedure 4
(Interim Use)

PROCUREMENT

C. K. McGlothlan

February 1970

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4. PROCUREMENT

4.1 Scope

This procedure presents quality assurance requirements, policies, and controls to be implemented by the Reactor Division during the procurement phase of research and development projects for the Atomic Energy Commission-Division of Reactor Development and Technology (AEC-DRDT). The paragraphs of this procedure are applicable for Levels 1, 2, 3, and 4 quality work as indicated in the following Table. See Appendix I of this procedure for definitions of quality assurance levels.

<u>Paragraphs</u>	<u>Quality Level</u>			
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
4.1 Scope	X	X	X	X
4.2 Procurement Planning	X	X	X	X
4.3 Procurement Requirements	X	X	X	NA
4.4 Procurement Document Review	X	X	O	O
4.5 Selection of Procurement Sources	X	X	O	NA
4.6 Control of Configuration	X	X	O	NA
4.7 Personnel Training & Control	X	X	X	NA
4.8 Equipment Calibration	X	X	O	NA
4.9 Source Surveillance & Inspection	X	X	O	NA
4.10 Receiving Inspection	X	X	O	O
4.11 Control of Non-conforming Items	X	X	X	NA
4.12 Control of Received Items	X	X	X	NA
4.13 Quality Records	X	X	X	NA
4.14 Quality Audits	X	X	X	NA

X - Applicable in its entirety.

O - Applicable with noted exceptions.

NA - Not applicable.

4.2 Procurement Planning

The project engineer, supported by key personnel from the Engineering Services Department of the Reactor Division, and the Purchasing Division of Union Carbide Corporation-Nuclear Division (UCC-ND), shall be responsible for meeting the procurement requirements of the Quality Assurance Plan.

The project engineer may delegate the performance of many procurement activities to qualified personnel from the Inspection Engineering Department, and Instrumentation and Controls Division of ORNL, and the Operating Department of the Reactor Division, as applicable, and from other appropriate groups.

The project engineer or his designated representative shall initiate procurement action and he shall be responsible for final acceptance of all procured items and services. Procurement shall be initiated on "Request for Work or for Requisition," Form UCN-3898 or "Purchase Requisition," Form UCN 3324. (See Appendices II and III of this procedure.) The Engineering Services Department shall prepare a "Purchase Requisition," Form UCN 3324 (Appendix III of this procedure), when necessary, attach drawings and specifications, obtain necessary approvals, and deliver the procurement package to the UCC-ND Purchasing Division.

Procurement of items shall be accomplished in accordance with AEC regulations and UCC-ND corporate Standard Practice Procedure D-2-1, Part I. The appropriate group in the Purchasing Division shall make all formal contacts with suppliers. After initiation of formal procurement activities, the Purchasing Division shall be informed of technical contacts between the project engineer and the supplier.

Personnel in the ORNL Inspection Engineering Department shall assist in evaluating vendor quality assurance programs and provide inspection services as requested by the Engineering Services Department and/or project engineer. This assistance shall be requested according to ORNL Inspection Engineering Department's QA Procedure, Section 1, "Inspection of Purchased Material."

Procurement activities and responsibilities, including quality assurance, are shown on Fig. 4-1.

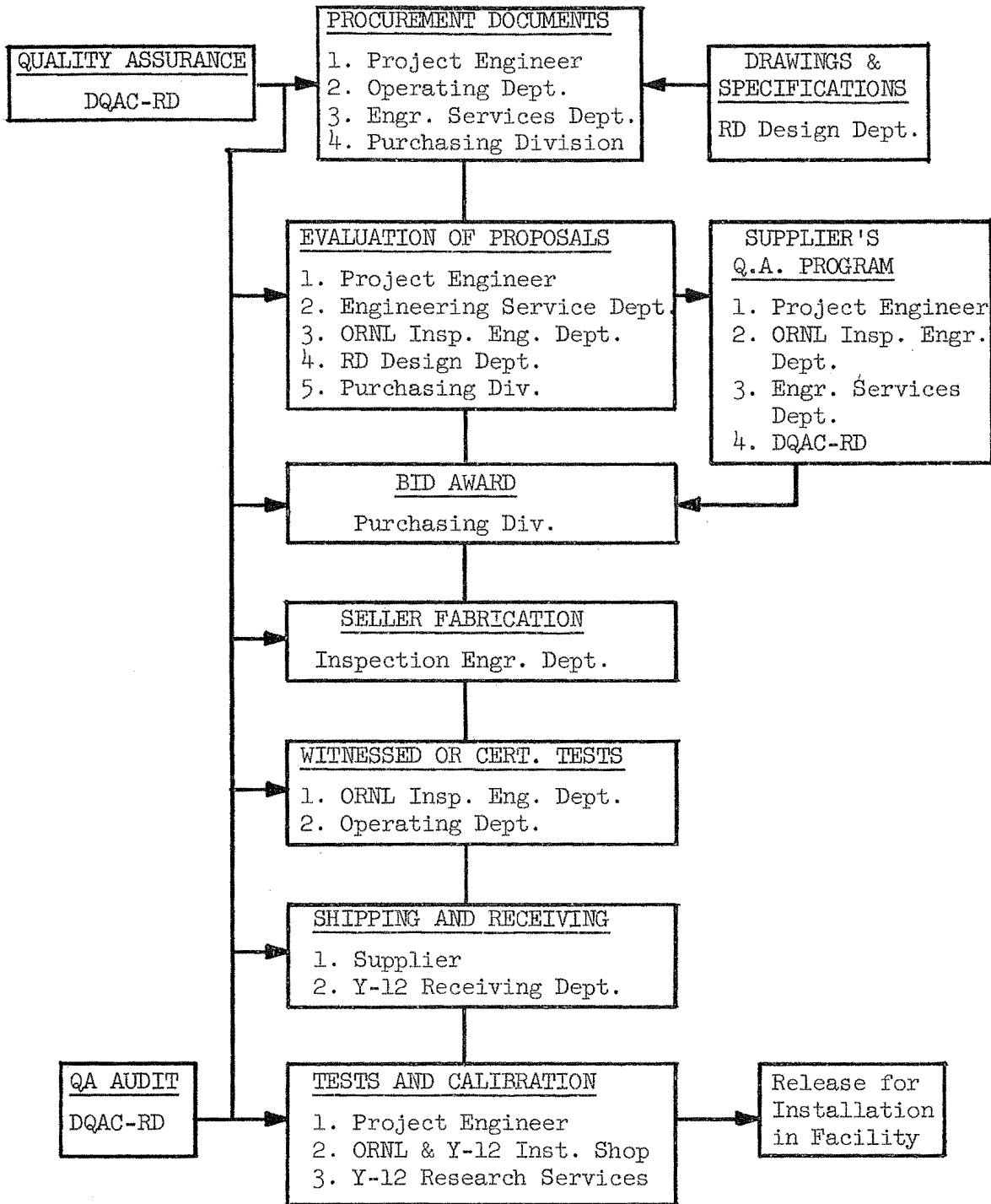


FIG. 4-1

PROCUREMENT ACTIVITIES AND RESPONSIBILITIES

4.3 Procurement Requirements

Procurement action shall not be initiated until suitable QA requirements, policies, and procedures have been established and drawings and specifications have been properly signed and documented as specified in Paragraph 3.4 of this document. These drawings and specifications, including the QA requirements, shall become an integral part of purchase orders placed with suppliers.

4.4 Procurement-Document Review

Procurement documents shall be reviewed by personnel designated below to assure that technical and quality assurance requirements are complete and appropriate.

<u>Documents</u>	<u>Reviewer</u>	<u>Review Function</u>
<u>For Engineering Services Dept.</u>		
Request for Requisition (Form UCN-3898) or Purchase Requisition (Form UCN-3324) and applicable drawings & specifications	1. Project Engineer	a) Required Approvals
	2. Operating Department Head	a) Need for Item b) Proper Description c) Charge Account
	3. Department Head Engineering Services	a) Approval by Dept. Head or authorized signature b) Review for Procurement Action and Assignment of Work
<u>For Purchasing Division</u>		
Purchase Requisition (Form UCN-3324)	1. Department Head Engineering Services	a) Proper Description b) Support Documents Attached c) Charge Account d) Review for Procurement Action and Assignment of Work

Before purchase orders are placed for Quality Level 1 or 2 items, the project engineer shall send a copy of each "Request for Requisition or Purchase Requisition" with support documents, to the Division Quality Assurance Coordinator-Reactor Division (DQAC-RD) for review of quality assurance requirements.

4.5 Evaluation and Selection of Procurement Sources

4.5.1 General Requirements

Suppliers' bid proposals shall be evaluated on the basis of conformance to design drawings and specifications, supplier competence, delivery date, and cost.

4.5.2 Acceptable Source List (not used)

4.5.3 Pre-award Evaluation

The project engineer and the mechanical, electrical, instrument and lead design engineers, as appropriate, shall review bid proposals for conformance to the design drawings or specifications and the supplier's ability to meet the functional requirements. When required in the bid invitation, the supplier shall submit his quality assurance program plan and procedures along with his bid package to meet the quality assurance requirements of this document and/or RDT Standards F 2-2T or F 2-4T. The supplier's quality assurance program plan shall be reviewed by the project engineer, DQAC-RD, and the ORNL Inspection Engineering Department for conformance to the requirements of the purchase requisition.

The project engineer, Engineering Services Department, ORNL Inspection Engineering Department, and DQAC-RD, when appropriate, shall review the supplier's quality control and inspection procedures, and when necessary, inspect the supplier's quality control and plant facilities.

The project engineer, ORNL Inspection Engineering Department, DQAC-RD, and UCC-ND Purchasing Division shall resolve any deviations between the supplier's quality assurance plan and the requirements of the purchase requisition.

The project engineer and the Engineering Services Department shall determine if the equipment delivery meets the schedule requirements or make adjustments as necessary to see that schedule conflicts are rectified.

The purchasing agent shall determine if all contractual requirements have been fulfilled according to UCC-ND policies and Standard Practice Procedure as related for procurement (See Appendix A of the QA Program Plan for applicable UCC-ND procurement procedures).

The Purchasing Division, where applicable, shall call a conference with the supplier, project engineer, Engineering Services Department, DQAC-RD where appropriate, and other project personnel prior to the release of the purchase order to assure that the supplier understands the requirements of the specifications and drawings, including those associated with quality assurance.

Should the supplier request waivers or changes to the drawings or specifications, the Engineering Services Department shall advise the project engineer. Changes to approved design documents shall be done in accordance with Paragraph 4.5.4.

4.5.4 Changes to Approved Drawings

Significant changes or waivers to approved design documents shall be reviewed, approved, documented and reissued by the Reactor Division Design Department in the manner used to prepare the original documents. These changes shall be requested by the project engineer on a "Request for Design Service," Form UCN-5158. (See Appendix IV of this procedure.)

Minor field changes to approved drawings may be authorized by the project engineer. Each change shall be described in detail including Engineering Job Number and forwarded for approval to the Reactor Division Design Department Head on a three copy, "Message Form." See Appendix V of this procedure. The Reactor Division Design Department Head shall return a copy of the message form to the project engineer. It shall indicate approval or disapproval (with comments) concerning the change. The project engineer may make the field change before receiving approval, however, the change shall be subject to final approval by the Reactor Division Design Department. It shall be the responsibility of the project engineer to notify the DQAC-RD of any change which alters the quality assurance requirements.

The Purchasing Division shall be requested to send all bid proposals for Quality Level 1 and 2 items and each bid proposal that is not in accordance with the purchase requisition to the Engineering Services Department for review and approval by the project engineer. Unless specifically requested otherwise the Purchasing Division may award a purchase order subcontract to the low bidder for Quality Level 3 and 4 items without

project approval if the low bid proposal is in accordance with the purchase requisition. The release to purchase by the project engineer may be made verbally through the Engineering Services Department to the Purchasing Division if the purchase is to be made in accordance with the bid proposal. Where exceptions to the drawings or specifications are requested by the supplier, the release shall be accomplished by letter from the project engineer to the Engineering Services Department with copies to all ORNL persons involved, including the Reactor Division Design Department and DQAC-RD.

4.6 Control of Configuration

4.6.1 Contract Change Control

Project scope changes resulting in revised drawings, specifications, and schedule of items and services after the purchase contract has been awarded shall originate with the project engineer. The request for change shall be directed to the Engineering Services Department for handling in a manner similar to the original request. Supplier proposals and counter proposals, problems, and price adjustments shall be evaluated by personnel in the manner used to award the original purchase order contract. See Section 4.5 of this document.

4.6.2 As-Built Verification

The supplier shall be required to furnish as-built drawings and specifications to reflect the as-built configuration of Quality Level 1 and 2 items when received. As built verification for Quality Level 3 items shall be optional with the project engineer. As built verification shall not be required from the Seller when items are fabricated in accordance with UCC-ND drawings and specifications.

4.7 Personnel Training and Certification

Contractor (ORNL) personnel who perform surveillance inspection of supplier special processes such as welding, radiography, magnetic particle, dye-penetrant, dimensional, and ultrasonic examination shall be competent in these fields. ORNL nondestructive testing personnel shall be qualified

and certified in accordance with ORNL Inspection Engineering Department's QA Procedure Manual, Section 2, "Certification of NDT Personnel." Records of personnel qualifications shall be available for examination in the ORNL Inspection Engineering Department.

Personnel from the Reactor and the ORNL Instrumentation and Controls Divisions who perform surveillance inspection of instrumentation and electrical items shall be competent in this field. These inspectors shall be selected by the head of the cognizant department and approved by the Operating Department Head and/or project engineer.

4.8 Equipment Calibration and Standards

Each supplier's inspection agency shall be responsible for inspecting and evaluating their measuring and test equipment. This evaluation shall be done before and during use to determine equipment capability, accuracy, and tolerance against standards having known valid relationships to national standards.

Requirements covering the calibration of supplier's inspection equipment for Quality Level 1 and 2 items shall be included as part of the bid package. The results of supplier's inspection equipment calibration activities may be checked by UCC-ND Inspectors at the supplier's factory and/or at the job site. UCC-ND measuring instruments shall be checked and inspected according to applicable UCC-ND procedures in Appendix B of the QA Program Plan.

4.9 Source Surveillance and Inspection

4.9.1 General Requirements

ORNL inspectors, selected in accordance with paragraph 4.7, shall visit supplier's plants, as required, to verify that Quality Level 1 and 2 items are being manufactured according to QA requirements, drawings, and specifications. When necessary, resident ORNL inspectors shall be assigned to suppliers' plants. The project engineer shall specify critical points or stages for inspections which will determine when visits are necessary.

4.9.2 Shipment Authorization

Items requiring tests at the factory shall not be authorized for shipment by the Purchasing Division until the necessary supplier test and inspection reports have been reviewed by the ORNL Inspection Engineering Department and/or inspectors responsible for inspection of instruments and electrical items. The project engineer shall notify the Purchasing Division through the Engineering Services Department to authorize shipment when the inspectors indicate (in writing) that the items meet the requirements of the purchase order documents.

4.10 Receiving Inspection

4.10.1 Planning and Inspection of Items

All items from suppliers shall be received and given a routine inspection by the Y-12 Plant Receiving Department for 1) quantity, 2) shipping damage, and 3) conformance of the item received to the item described in the purchase order. Inspections shall be performed in accordance with UCC-ND Standard Practice Procedure D-2-12 "Inspection of Materials." The Y-12 Receiving Department shall notify the Engineering Services Department who shall notify the project engineer of any damage or error. The handling of damaged or defective material shall be performed in accordance with UCC-ND Standard Practice Procedure D-2-6, "The Handling of Damaged or Defective Material."

Items received subject to special inspection (specified on the purchase requisition) shall be forwarded through Engineering Services Department to the project engineer after the routine inspection is completed.

All Quality Level 1 and 2 items, except instruments and electrical items, shall be inspected by the ORNL Inspection Engineering Department for item conformance, reidentification, and special inspection activities except dimensional, when requested by the project engineer. These inspection activities shall be requested by the project engineer on an Inspection Request (IR) Form UCN-2335. (See Appendix VI of this procedure.) The inspection results shall be given on this form. Reidentification shall consist of electroetching the referenced Inspection Request (IR) Number on the part or by tagging.

Quality Level 1 and 2 instruments and electrical items shall be inspected by competent inspectors, as stated in Paragraph 4.7, for item conformance, reidentification, and any special inspection activities requested by the project engineer.

Dimensional inspection for conformance to drawings shall be performed by the Y-12 General Machine Shop Inspection Department when requested by the project engineer.

Required functional tests shall be the responsibility of the project engineer on all purchased equipment, (whether suspected of shipping damage or not) as soon as practical after the equipment is received.

4.10.2 Documentation

The resident inspector from the ORNL Inspection Engineering Department shall review supplier-generated documents, such as drawings, manuals, certifications, test results and inspection data for all Quality Level 1 and 2 items (except instruments and electrical items). The inspector shall review the documents for completeness and conformance to contract requirements as described in Paragraphs 4.9.1 and 4.10.1.

His findings, including any deviations, shall be documented on IR Form, UCN-2335 and/or letter to the project engineer with a copy to the Engineering Services Department.

Inspectors that inspect instruments and electrical items (see Paragraph 4.7) shall review and evaluate seller-generated documents, such as drawings, and test reports, and notify the project engineer in writing of conformance to the specifications and drawings. Conformance and deviations for Quality 1 and 2 items shall be documented on appropriate forms and/or letters showing the Engineering Job Number, and sent to the project engineer.

Nonconforming items shall be processed as stated in Paragraph 4.11.

4.10.3 Disposition of Received Items

If errors or shipping damage are apparent to the Y-12 Receiving Department during routine inspection the Reactor Division's Engineering Services Department shall be notified by the Receiving Department. The Engineering Services Department shall investigate the case and discuss

the problem with the project engineer and the ORNL Inspection Engineering Department, when appropriate. Final action by Engineering Services shall be based on outcome of the discussion with concurrence of the project engineer. Functional checks shall be performed by the project engineer or his designee as required to determine the extent of damage.

4.10.4 Supplier Payment Authorization

Payment to suppliers, who furnish items subject to routine inspection only, shall be made automatically by Accounts Payable Department when routine inspection is satisfactorily completed. Payment to suppliers, who furnish items subject to routine and special inspections, shall be authorized by the project engineer after all routine and special inspection operations indicate that the items meet purchase order requirements, including receipt of quality assurance documents, and a letter of compliance for Quality Level 1 and 2 items, has been received from the ORNL Inspection Engineering Department and/or the inspectors responsible for inspection of instruments and electrical items. Payment shall be authorized by the project engineer to the Engineering Services Department. When possible, inspections shall be performed promptly to take advantage of available price discounts.

A special "Inspection Report" Form UCN-3611 (Appendix VII of this procedure), shall be issued to the Y-12 Receiving Department by the Engineering Services Department after all special inspection activities have been completed. It shall indicate the acceptance or the reasons for rejection of the items. Payment to suppliers shall be made by the Accounts Payable Department if the items are accepted.

The Y-12 Plant Receiving Department shall issue a Receiving Report, Form UCN-3324 (modified) to the Engineering Services Department for each item received. (See Appendix VIII of this procedure.) It shall show the final disposition of each item.

4.11 Control of Nonconforming^a Items

Damaged and/or nonconforming items shall be returned to the supplier

^aA characteristic of an item that does not conform to a specified requirement.

for repair,^b rework,^c replacement, or rejection, as determined by the project engineer. The project engineer may, in special cases, determine that it is more economical to repair the items in UCC-ND shops. His action, including justification shall be done in accordance with Paragraph 4.5.4, "Changes to Approved Drawings," and shall be in writing to the Engineering Services Department with copies to the ORNL Inspection Engineering Department and to the DQAC-RD. Copies of reports of damaged or nonconforming items that may affect the schedule of the program shall be sent to the Program Director and Operating Department Head.

4.12 Control of Received Items

Items received and accepted shall be stored by Engineering Services Department in a special storage area until needed at the job site. Items shall be received, accepted, stored and released under the control of the Engineering Services Department. The resident inspector of the ORNL Inspection Engineering Department shall assist in identification as related to traceability. The stored items shall be properly marked for rapid traceability to pertinent records.

4.13 Quality Records

The Reactor Division Engineering Services Department shall maintain a file of procurement documents, and it shall include the following, as applicable, for each purchased item: 1) Request for Purchase, 2) Purchase Requisition, 3) Purchase Order, 4) Bid Proposals, 5) Drawings, 6) Specification, 7) all supplier-generated correspondence and documents, 8) Receiving Reports, and 9) Special Inspection Reports (Form UCN-3611). They shall be filed according to purchase requisition number with cross reference to purchase order number, supplier, type material, and Engineering Job Number.

^bThe process of restoring a nonconforming characteristic of an item to an acceptable condition, although it does not conform to a specified requirement.

^cThe process by which a nonconforming item is made to conform to specified requirements.

The ORNL Inspection Engineering Department's resident inspector shall maintain a complete file of all quality assurance, test, and inspection records. They shall be filed by Engineering Job Number and title and shall reference the purchase requisition number and IR number, where used.

The files shall be maintained, as a minimum, for the life of the project with which the experiment is supporting. No files shall be destroyed without the written authorization of the Operating Department Head.

4.14 Quality Audits

The quality assurance functions related to procurement shall be audited in accordance with applicable requirements of the Reactor Division's- Quality Assurance Procedure, No. 8, "Activity Audit."

APPENDIX I

DEFINITIONS OF QUALITY LEVELS

Quality Level I is normally assigned to a component or system that cannot be easily inspected while in-service because of radioactive contamination and/or high radiation fields and in which failure could (1) cause an extended delay in the completion of the project or in the program supporting the project, (2) cause serious or costly damage to a significant portion of the system or the facility in which it is located, or (3) create a hazardous condition.

Normally, Quality Level I is associated with components of the reactor primary system, with some components of in-pile circulating loops, with certain fueled and nonfueled irradiation capsules, and with those components of a nuclear fuel processing plant that are in contact with the main processing stream. Operation of the project is normally expected to continue for an extended period of time in fields of intense neutron flux and/or at high levels of radioactivity.

Quality Level II is normally assigned to a component or system with or without the presence of radioactivity, in which failure could (1) cause an extended delay in the project or in the program supporting the project, (2) cause serious or costly damage to a significant portion of the system or the facility in which it is located, or (3) create a hazardous condition.

Normally, Quality Level II is associated with engineering-scale experiments operating outside of a reactor system that are designed to operate at high pressure and/or high temperature, with noncritical components of an in-pile loop, with a reactor secondary system, and with some reactor facilities and experiments that are not in-core.

Quality Level III is normally assigned to a component or system in which failure will (1) not cause an extended delay in the completion of the project, or (2) not cause costly destruction of the project.

Normally, Quality Level III is associated with laboratory-scale experiments, with noncritical components or systems of engineering-scale experiments, and with electrical, structural, and piping systems that are under the jurisdiction of the various industrial codes.

Quality Level IV is normally assigned to components or systems that are associated with bench-scale low-cost experiments operating at low pressure and which contain either nonhazardous materials or small quantities of toxic materials that are suitably contained. Laboratory service systems not governed by Quality Level III requirements may be assigned to Quality Level IV.

Note 1: Some components purchased to a Quality Level III from reliable vendors who have a long well-documented history for high-quality products may under certain circumstances be used in a Quality Level II system.

Note 2: The replacement of a minor component or a minor section of an existing system may be performed to the standards used in the original design of the system; however, if a significant component or section of the system is replaced, it must be designed and installed in accordance with this quality level guide.

Note 3: Redundant circuit designs using components from reliable vendors may qualify for Levels I and II application.

APPENDIX III



UNION CARBIDE CORPORATION
NUCLEAR DIVISION
 OAK RIDGE, TENNESSEE 37830
 Acting Under U.S. Government Contract W7405 eng 26 With the U.S. Atomic Energy Commission

PURCHASE REQUISITION

- TELEPHONE RELEASE
- LETTER RELEASE
- PURCHASE ORDER

REQUISITION NO.	DELIVER BY	WANTED BY	REFER QUESTIONS TO P.O. BOX M, ATTENTION:	PLANT	ORDER NUMBER	RELEASE NO.	CH. NO.	PROCUREMENT DATE	R. A. NO.	
SHIP TO: U.S. Atomic Energy Commission, c/o Union Carbide Corporation, Nuclear Division							F.O.B. (As Coded)			
Motor Freight, Air Express, or Railway Express to Oak Ridge, Tenn.; Air Freight to Knoxville, Tennessee							ABOVE ORDER AND RELEASE NO. MUST APPEAR ON ALL PACKAGES, B/L, AND FREIGHT BILLS			
Parcel Post or United Parcel Serv. To:		Rail Freight via and To Destination (As Coded)		SHIPPING POINT						
Post Office Box 37830 Oak Ridge, Tenn.		1. Southern Railway To Blair, Tennessee 2. Louisville and Nashville Railway To Oak Ridge, Tennessee		TRANSPORTATION TERMS: (As Coded) 1. Account of Government. Do Not Insure. Declare Value So As To Obtain Lowest Possible Transportation Rate. 2. Account of Seller-Prepaid. 3. Other (See Below)			SHIP VIA (As Coded) A. Motor Freight B. Rail Freight C. Rail Express D. Air Freight* E. Air Express F. Parcel Post G. Air Parcel Post H. Seller's Truck I. Seller's Option J. Knoxville Cont. Carrier K. Bus L. As Shown M. UCN Truck N. 0-30a Parcel Post O. 31-45a Rail Express Over 45a Motor Freight P. United Parcel Service *Excludes Air Freight Forwarders			
VENDOR PAYEE CODE				DISCOUNT (As Coded) 5 - 1/2% 0 - Net 6 - 5% 1 - 1% 7 - 6% 2 - 2% 8 - 10% 3 - 3% 4 - 1/4% 9 -			PAYMENT TERMS		DISCOUNT PERIOD Discounts are taken in accordance with Standard Policy (See Payments Article of Terms and Conditions) unless Noted Below:	
ATTENTION: SUGGESTED VENDORS				OTHER DISCOUNT PERIODS						

FURNISH THE FOLLOWING ITEMS IN ACCORDANCE WITH TERMS AND CONDITIONS DESIGNATED ATTACHED HERETO AND WITH SPECIFICATIONS AND/OR DRAWINGS REFERRED TO HEREIN AND MADE A PART HEREOF.

ITEM NO.	WORK ORDER			CATALOG NUMBER	DESCRIPTION	ORDERED QUANTITY	UNIT	UNIT PRICE			TOTAL PRICE		
	ACCT.	T/E	SUB NO.					\$	e	c	\$	e	c

THE BLOCK CHECKED BELOW IS APPLICABLE TO THIS ORDER. IF BLOCK "A" IS CHECKED, THE SELLER SHALL SIGN & COMPLETE IN THE SPACE PROVIDED.

<input type="checkbox"/> A. TO THE SELLER: PLEASE SIGN & RETURN ONE COPY AS ACCEPTANCE OF THIS ORDER AT ONCE TO THE ABOVE ADDRESS, P.O. BOX M. ALL OF THE AGREEMENTS OF THE PARTIES RELATING TO THE SUBJECT MATTER ARE CONTAINED IN THIS PURCHASE ORDER.			<input type="checkbox"/> B. TO THE SELLER: THIS PURCHASE ORDER IS ISSUED TO ACCEPT SELLER'S PROPOSAL DATED _____		
ACCEPTED (FIRM NAME)			BY (NAME & TITLE)		DATE
REQUEST NO. _____ AND CONSTITUTES THE SOLE CONTRACTUAL AGREEMENT BETWEEN THE PARTIES.					
BILLING INSTRUCTIONS (REFER TO PURCHASE ORDER TERMS AND CONDITIONS)			You are required to follow the provisions of DHS Regulation I and all other applicable regulations and orders of BDSA in obtaining controlled materials and other products and materials needed to fill this order. DO E-2 (CERTIFIED FOR NATIONAL DEFENSE USE UNDER DHS REGULATION 1) DMS ALLOTMENT NO. E-2 (CERTIFIED FOR NATIONAL DEFENSE USE UNDER DHS REGULATION 1)		
1 <input type="checkbox"/> INVOICE NOT REQUIRED - DO NOT MAIL 2 <input type="checkbox"/> FURNISH ORIGINAL INVOICE TO: UNION CARBIDE CORPORATION - NUCLEAR DIVISION ACCOUNTS PAYABLE DEPARTMENT P.O. BOX P, OAK RIDGE, TENNESSEE 37830			NO TENNESSEE SALES OR USE TAX IS PAYABLE BY THE SELLER ON MATERIAL COVERED BY THIS ORDER BY REASON OF EXEMPTION CERTIFICATE AUTHORIZED FOR USE BY THE BUYER BY THE DEPARTMENT OF REVENUE, STATE OF TENNESSEE.		
INITIAL OF BUYER			INSPECTION REQUIRED (1) ROUTINE (2) SPECIAL		REQUISITIONER (Signature)
REFER TECHNICAL QUESTIONS TO			PHONE		INSTALLATION HEAD (Auth. Rep. Signature)
SUP SO			COMM CODE		TYP TRM
PLT			FP CST		NO. OF ITEMS
PRD TYP			TYP REQ		TOTAL AMOUNT OF ORDER
INC. DEC.			\$		c

UNION CARBIDE CORPORATION
 NUCLEAR DIVISION
 PURCHASING

QUARTER, 19__

MATERIAL CONTROL DEPT. (Signature) DATE

DELIVER TO BUILDING

UCM-3226 (235, 7-88)

APPENDIX V

INSTRUCTIONS TO SENDER

- 1. DETACH YELLOW COPY
- 2. SEND WHITE AND PINK PARTS WITH CARBON TO PERSON ADDRESSED.

50008

INSTRUCTIONS TO RECIPIENT

- 1. WRITE REPLY AT BOTTOM.
- 2. DETACH STUB, RETAIN WHITE COPY AND RETURN PINK COPY TO SENDER

<i>To:</i>		
SUBJECT	DATE	<i>Reply Message</i>
FOLD Y		

M
E
S
S
A
G
E

	SIGNED	
R E P L Y	DATE OF REPLY	REPLY TO
	SIGNED	

RECIPIENT

DETACH AND FILE FOR FOLLOW-UP

APPENDIX VI

INSPECTION REQUEST

Nº 11148

TO	DATE ISSUED
TASK ENGINEER	DATE REQUIRED
REQUESTER	ACCOUNT NO.
TASK PROGRAM	WORK ORDER
DWG. NO.	REQUISITION
ITEM NO.	PURCHASE ORDER
DWG. TITLE	

ITEM	TYPE/OR SPECIF.	QUANTITY	SIZE	DESCRIPTION OF ITEM

MATERIAL SOURCE <input type="checkbox"/> Y-12 STORES <input type="checkbox"/> ORNL STORES <input type="checkbox"/> ORGDP STORES <input type="checkbox"/> DIRECT P. O. _____ R. R. # _____ REMARKS: _____		MILL CERTIFICATE DATA REQUIRED: <input type="checkbox"/> AVAILABLE <input type="checkbox"/> COPY ATTACHED <input type="checkbox"/> YES HEAT NO. _____ <input type="checkbox"/> NO MFG. CO. _____	
---	--	---	--

INSTRUCTIONS:

INSPECTION REPORT

TYPE INSPECTION REQUIRED: VISUAL DIMENSIONAL
 DYE PENETRANT ULTRASONIC
 EDDY CURRENT RADIOGRAPHY

DISPOSITION

REJECTED FOR INTENDED USE ACCEPTED FOR INTENDED USE

COMMENTS:

DISPOSITION BY	DATE	COPY TO
WAIVER ACCEPTED BY	DATE	COPY TO

APPENDIX VII

INSPECTION REPORT

VENDOR
ORDER NO.
REC. REPORT NO.

Material does does not meet specifications.

REMARKS:

SIGNED

This material cannot be paid for nor returned until inspection has been completed. Prompt processing frequently earns a cash discount for UCNC. Inspector may keep copy No. 4 (pink). Forward remaining copies to the Receiving Department, Building 9720-8.

APPENDIX VIII



UNION CARBIDE CORPORATION
NUCLEAR DIVISION

OAK RIDGE, TENNESSEE 37830
 Acting Under U.S. Government Contract W7405 eng 26 With the U.S. Atomic Energy Commission

RECEIVING REPORT

REQUISITION NO.	DELIVER BY	WANTED BY	REFER QUESTIONS TO P.O. BOX M, ATTENTION:	PLANT	ORDER NUMBER	RELEASE NO.	CH. NO.	PROCUREMENT DATE	R. R. NO.	
SHIP TO: U.S. Atomic Energy Commission, c/o Union Carbide Corporation, Nuclear Division				ABOVE ORDER AND RELEASE NO. MUST APPEAR ON ALL PACKAGES, B/L, AND FREIGHT BILLS				F.O.B. (As Coded)		
Parcel Post or United Parcel Serv. To: <input type="checkbox"/> Motor Freight, Air Express, or Railway Express to Oak Ridge, Tenn.; Air Freight to Knoxville, Tennessee								SHIPPING POINT		1. Destination 2. Shipping Point 3. Shipping Point - Fit. Allowed 4.
Post Office Box Oak Ridge, Tenn. 37830		Rail Freight via and To Destination (As Coded) 1. Southern Railway To Blair, Tennessee 2. Louisville and Nashville Railway To Oak Ridge, Tennessee		TRANSPORTATION TERMS: (As Coded) 1. Account of Government. Do Not Insure. Declare Value So As To Obtain Lowest Possible Transportation Rate. 2. Account of Seller-Prepaid. 3. Other (See Below)		SHIP VIA (As Coded) A. Motor Freight B. Rail Freight C. Rail Express D. Air Freight* E. Air Express F. Parcel Post G. Air Parcel Post H. Seller's Truck I. Seller's Option J. Knoxville Contr. Carrier K. Bus L. As Shown M. UCN Truck N. 0-300 Parcel Post O. 31-450 Rail Express P. United Parcel Service * Excludes Air Freight Forwarders				
VENDOR PAYEE CODE				DISCOUNT (As Coded) 5 - 1/2% 0 - Net 6 - 5% 1 - 1% 7 - 6% 2 - 2% 8 - 10% 3 - 3% 9 - 4 - 1/4%		PAYMENT TERMS		DISCOUNT PERIOD Discounts are taken in accordance with Standard Policy (See Payments Article of Terms and Conditions) unless Noted Below:		
ATTENTION: SUGGESTED VENDORS				OTHER		OTHER DISCOUNT PERIOD				
STATUS CODE LEGEND: A. ACCEPTABLE OVERAGE C. FINAL SHIPMENT D. DAMAGED MATERIAL				I. REQUIRES INSPECTION K. ACCEPTABLE SUBSTITUTION SHIPMENT APPLIES.		P. SHIPMENT APPLIES R. REJECTED, SPECIFICATIONS NOT MET S. ACCEPTABLE SUBSTITUTIONS, FINAL SHIPMENT.		U. UNACCEPTABLE OVERAGE X. NEITHER OF FOREGOING APPLIES OR MORE THAN ONE OF THEM APPLY.		
ITEM NO.	WORK ORDER			CATALOG NUMBER	DESCRIPTION	TAX CODE	ORDERED QUANTITY	UNIT	UNIT PRICE \$	QUANTITY RECEIVED
	ACCT.	T/E	SUB NO.							
TRANS. COST \$	TRANS. ADJ.	INSURED OR EXTRA VALUATION 1. YES 2. NO		CHANGE OF SHIPPING POINT 1. YES 2. NO		SHIPPED VIA (As Coded) AND CARRIER'S NAME				
INV. NO., PACKING LIST NO., SHIPMENT DATE, OR DATE RECEIVED	RECEIVED FROM (If Different from Vendor)			NO. & KIND OF CONTAINERS		GROSS WEIGHT	TRANS. BILL OR REGISTRY NO.		CAR NUMBER	
REMARKS:				P. D. REC. REPORT PREPARED BY (Initial) DATE RECEIVED		RECEIVING OFFICER (Signature)				
INITIAL	PAGE	INSPECTION REQUIRED (1) ROUTINE (2) SPECIAL		REQUISITIONER (Signature)		DATE	MATERIAL CONTROL DEPT. (Signature)		DATE	
REFER TECHNICAL QUESTIONS TO				PHONE	INSTALLATION HEAD (Auth. Rep. Signature)	REQUISITION DATE	DELIVER TO		BUILDING	

REACTOR DIVISION

Quality Assurance Procedure 5
(Interim Use)

FABRICATION AND ASSEMBLY

C. K. McGlothlan

February 1970

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5. FABRICATION AND ASSEMBLY

5.1 Scope

This procedure provides for quality assurance requirements, policies, and controls to be implemented by the Reactor Division of Oak Ridge National Laboratory (ORNL) during fabrication and assembly phases of research and development projects for the Atomic Energy Commission-Division of Reactor Development and Technology (AEC-DRDT).

The paragraphs of this procedure are applicable for Levels 1, 2, 3, and 4 quality work as indicated in the following table. See Appendix I of this procedure for definitions of quality levels.

<u>Paragraphs</u>	Quality Level			
	1	2	3	4
5.1 Scope	X	X	X	NA
5.2 Planning	X	X	X	NA
5.3 Inspection & Test Plan	X	X	O	NA
5.4 Material Identification and Control	X	X	O	NA
5.5 Control of Processes	X	X	O	NA
5.6 Inspection and Tests	X	X	O	NA
5.7 Document Control	X	X	X	NA
5.8 Equipment Calibration	X	X	X	NA
5.9 Statistical Quality Control	NA	NA	NA	NA
5.10 Control of Nonconforming Items	X	X	X	NA
5.11 Corrective Actions	X	X	X	NA
5.12 Packaging and Storage	X	X	O	NA
5.13 Quality Records	X	X	X	NA
5.14 Quality Audits	X	X	X	NA

X - Applicable in its entirety.

O - Applicable with noted exceptions.

NA - Not applicable.

5.2 Planning

5.2.1 Fabrication in UCC-ND Shops

The project engineer shall be responsible for meeting the fabrication and assembly requirements of the Quality Assurance Plan. He may delegate the performance of many fabrication activities to qualified personnel from the Engineering Services and Operating Departments of the Reactor Division, Instrumentation and Controls Division, Inspection Engineering Department of ORNL, as applicable, and other appropriate groups.

Fabrication shall not be initiated until drawings and specifications have been properly signed and documented.

The project engineer or his designee shall initiate all requests for fabrication, and he is responsible for final acceptance of all completed items in conjunction with ORNL Inspection Engineering and other designated inspectors, where applicable. The project engineer or his designee shall request fabrication on "Request for Work or for Requisition" Form UCN-3898 or "Cross Order" Form UCN-2211 (see Appendix II and V of this procedure).

Fabrication and assembly operations shall be performed in various shops in ORNL, Y-12, K-25, and Paducah Plants of Union Carbide Corporation-Nuclear Division (UCC-ND) except as stated in Paragraph 5.2.2.

Key personnel in the Engineering Services Department shall determine which shops are competent and are interested in doing the work and may request cost estimates from one or more of the selected UCC-ND Shops. The shop proposals shall include cost and time estimates and the applicable fabrication procedures that will be used to implement the Quality Assurance Program requirements.

UCC-ND Shop proposals shall be evaluated and approved as described in Paragraph 5.2.4 of this report. Jobs shall be placed by the Engineering Services Department in the Y-12 Shops on "General Shops Work Request" Form UCN-3245 and "Maintenance Work Request" Form UCN-2546, in the ORNL Shops on "Cross Order" Form UCN-2211 (for jobs over \$1,000) and "Blanket Work Order Request" Form UCN-1685 and in the K-25 and Paducah Shops on "Cross Order Form UCN-2211. (See Appendices III, IV, V, and VI of this procedure.)

The Engineering Services Department shall be responsible for transmitting the latest quality assurance, design documents, and procedures to the shop, the independent plant inspection agency (see Paragraph 5.3) and the resident inspector of the ORNL Inspection Engineering Department, when applicable.

Key personnel in the ORNL Inspection Engineering Department shall assist in evaluating UCC-ND shop quality assurance programs and provide inspection services as specified by the project engineer.

5.2.2 Fabrication in Outside Shops

Fabrication and assembly work procured from outside shops (other than UCC-ND shops) shall be processed according to the Reactor Division's QA Procedure, No. 4, "Procurement" and other appropriate procedures in Appendix B of the QA Program Plan.

5.2.3 Fabrication Document Review

All fabrication documents shall be reviewed by personnel designated below to assure that technical and quality assurance requirements are complete and appropriate.

<u>Documents</u>	<u>Reviewer</u>	<u>Review Function</u>
<u>For Engineering Services Dept.</u>		
Request for Work (Form UCN-3898) or Cross Order (Form UCN-2211) and Supporting Drawings and Specifications	1. Project Engineer 2. Operating Department Head 3. Department Head Engineering Services	a) Required Approvals a) Need for Item b) Proper Description c) Charge Account a) Approval by Operating Department Head or Authorized Signature b) Review for Fabrication Action and Assignment of Work c) Support Documents Attached

Before each job is placed for Quality Level 1 or 2 fabricated items, the project engineer shall send a copy of each request for fabrication with supporting documents to the Division Quality Assurance Coordinator-Reactor Division (DQAC-RD) for review of quality assurance requirements.

5.2.4 Evaluation of Company UCC-ND Shops

UCC-ND shops shall be evaluated on the basis of shop competence, estimated cost, and delivery date.

The project engineer shall review the shops' ability to meet the functional requirements.

The project engineer and the Engineering Services Department shall determine if the proposed equipment delivery meets the cost and schedule requirements or make adjustments as necessary to see that conflicts are rectified.

The Engineering Services Department, and ORNL Inspection Engineering Department, DQAC-RD, and appropriate plant QA representative, where applicable, and the project engineer or his designee, where applicable, shall call a conference with the shop prior to release of the fabrication order to assure that the shop understands the quality assurance requirements.

If a shop requests waivers or changes to the drawings or specifications, the Engineering Services Department shall advise the project engineer. Changes to approved design documents shall be done in accordance with Paragraph 5.2.5.

5.2.5 Changes to Approved Drawings

Significant changes or waivers to approved design documents shall be reviewed, approved, documented and reissued by the Reactor Division Design Department in the manner used to prepare the original documents. These changes shall be requested by the project engineer on a "Request for Design Service" Form UCN-5158. (See Appendix VII of this procedure.)

Minor field changes to approved drawings may be authorized by the project engineer. Each change shall be described in detail, including Engineering Job Number, and forwarded for approval to the Reactor Division Design Department Head on a three copy "Message Form." (See Appendix VIII of this procedure.) The Reactor Division Design Department Head shall return a copy of the message form to the project engineer. It shall indicate approval or disapproval (with comments) concerning the change. The project engineer may make the field change before receiving approval, however, the change shall be subject to final approval by the

Reactor Division Design Department. It shall be the responsibility of the project engineer to notify the DQAC-RD of any change which alters the quality assurance requirements of the job.

The Engineering Services Department shall notify the shop to begin work after evaluation of the shop is completed and approved by the project engineer. The release to fabricate by the project engineer can be made verbally to the Engineering Services Department if the fabrication is to be made in accordance with the drawings or specifications. Where minor exceptions or changes to the drawings or specifications are granted, the release shall be accomplished by letter from the project engineer to the Engineering Services Department with copies to all involved, including the Reactor Division Design Department and the DQAC-RD.

5.2.6 Change Control

UCC-ND shops shall be authorized to do only fabrication work that is shown on drawings stamped "Certified for Construction" by the Reactor Division Design Department and approved procedures or as instructed by the project engineer.

The use of sketches for minor items may be authorized by the project engineer. This shall be done only for special cases and the sketches shall be approved by the Reactor Division Design Department Head or his designee before procurement and/or fabrication of the item are initiated.

When necessary, minor field changes to approved drawings, specifications, and procedures shall be handled by the project engineer in the following manner: (1) The changes shall be made and signed by the project engineer; the changes shall be documented as stated in Paragraph 5.2.5. (2) The design documents shall be revised and reissued by the Design Department of the Reactor Division prior to initial operation of the test stand.

Requests for significant changes in drawings, procedures, and specifications, after approved documents have been issued, shall originate with the project engineer as specified in Paragraph 5.2.5.

Revised design documents and procedures shall be forwarded to the UCC-ND shops and inspection agencies by the Engineering Services Department. It shall be the responsibility of the inspector from the independent

plant inspection agency (see Paragraph 5.3), where applicable, to check and verify that the shop craftsmen have received and are using the latest revised design documents and procedures.

5.3 Inspection and Test Plan

An inspection and test plan has been established to identify those inspection and test points from raw materials through fabrication, and assembly at which conformance of parts, components, and subsystems to design requirements can be verified. Figure 5-1 and 5-2 show the planned inspection activities and the inspection agencies responsible for inspecting fabricated items in shops of the four UCC-ND plants.

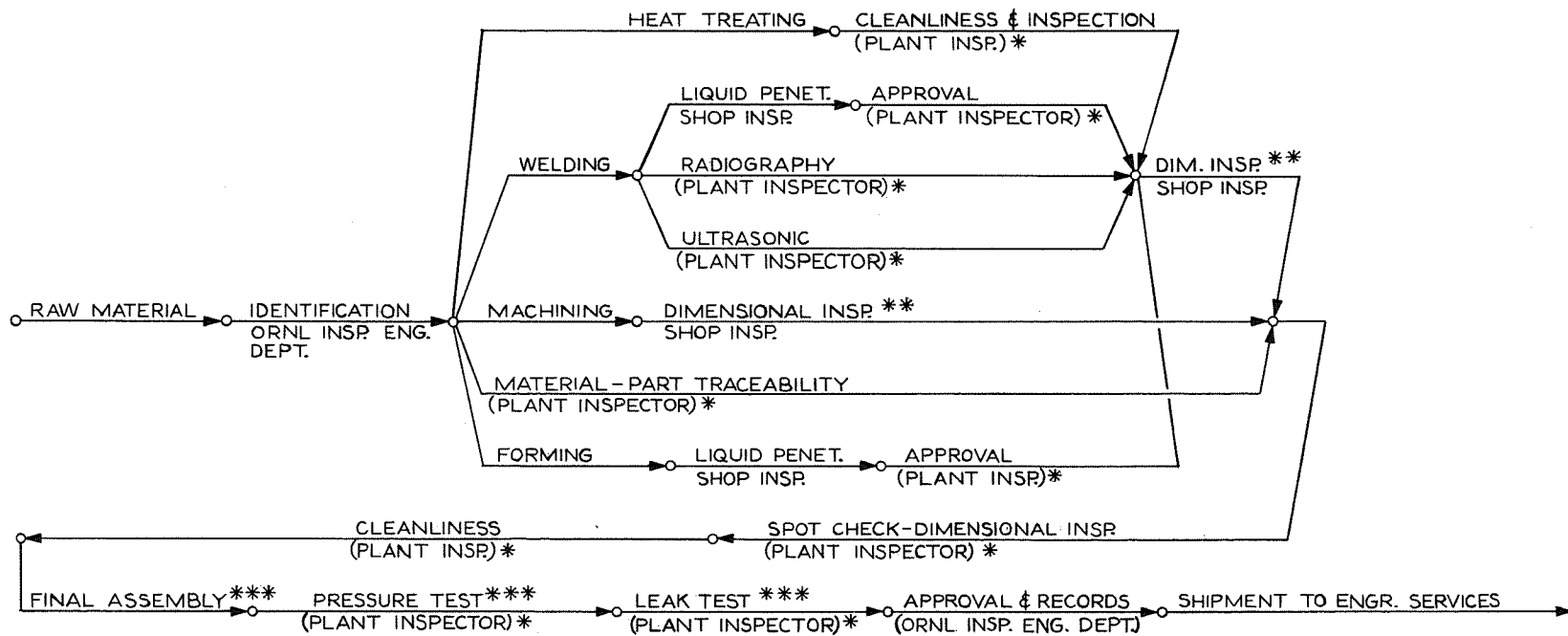
Management of inspection agencies who perform most inspection activities in the UCC-ND shops is independent^a from shop management. Fabrication personnel and inspectors who perform dimensional and liquid penetrant inspection activities in some UCC-ND shops are under the same management.

When Quality Level 1 and 2 items are being fabricated in any UCC-ND shop, the ORNL Inspection Engineering Department shall check and approve inspection procedures and inspectors qualifications. In addition, an inspector from the ORNL Inspection Engineering Department, who is certified to Level II requirements according to Inspection Engineering Department's QA Procedure Manual, Section 2, "Certification of NDT Personnel" shall be used to monitor inspection activities required in Quality Level 1 and 2 work.

Acceptance criteria shall be stated in applicable "Codes, Standards, Specifications, and Procedures," and/or detail drawings, specifications, and procedures.

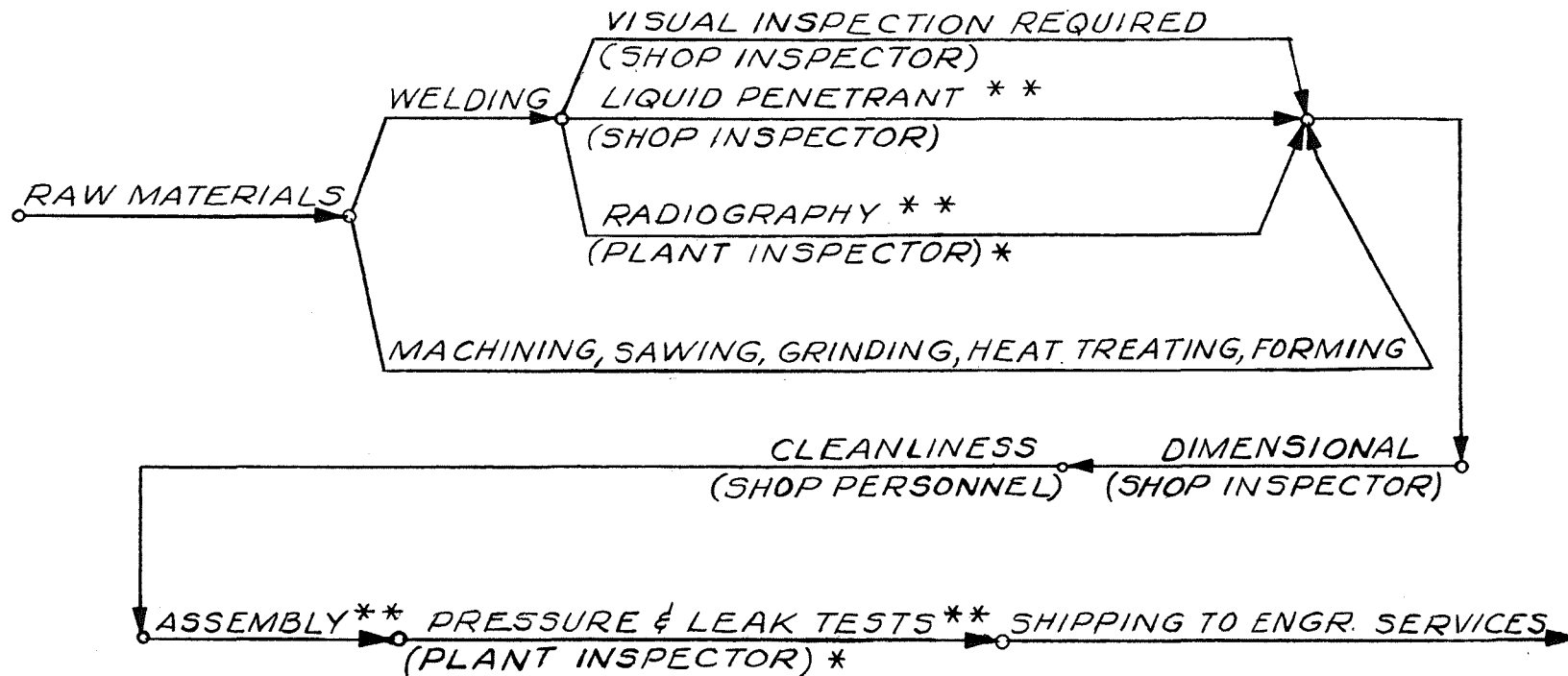
^aIndependent UCC-ND Inspection Agencies

K-25 Plant - Plant Inspection Department
 ORNL - Inspection Engineering Department
 Paducah Plant - Plant Inspection Department
 Y-12 Plant - Mechanical Inspection Department



- * INDEPENDENT PLANT INSPECTION AGENCIES(SEE PARAGRAPH 5.3 FOR DEFINITION).
- ** AS REQUIRED FOR SHOP FIT UP OR WHEN REQUESTED.
- *** AS REQUIRED.

Fig. 5-1 UCC-ND Shop Inspection Activities
Quality Level 1 and 2



** - WHEN REQUIRED
 * - INSPECTION AGENCIES
 (SEE PARAGRAPH 5.3
 FOR DEFINITION)

Fig. 5-2 UCC-ND Shops Inspection Activities
 Quality Level 3

5.4 Material Identification and Control - Quality Level 1 and 2 Fabrication

5.4.1 Raw Material

All raw materials shall be procured and released to Company Shops by the Engineering Services Department. Only material that has been inspected and bears an IR "Inspection Request" number or other approved identification shall be used.

5.4.2 Raw Material Identification for Individual Parts

Material for each part shall be selected by the Engineering Services Department prior to sending the material to the shops. The material shall be selected in accordance with the requirements specified on the drawings. Only drawings stamped "Certified for Construction" shall be used. See Figure 5-3 for an example. The resident inspector from the ORNL Inspection Engineering Department, in cooperation with the Engineering Services Department, shall identify the material selected for each part on a record set of drawings with the material information indicated in Fig. 5-5 and as shown on Fig. 5-4. The record set of drawings shall be retained for the permanent file by the resident inspector from the ORNL Inspection Engineering Department.

CRITICAL MATERIAL
DO NOT SUBSTITUTE

Raw Stock	Material - Part
Ht No.	Verification
IR No.	Inspector
Type	Date

Fig. 5-5 Material Identification Stamps

All material destined for UCC-ND shops shall be prepared and identified as follows:

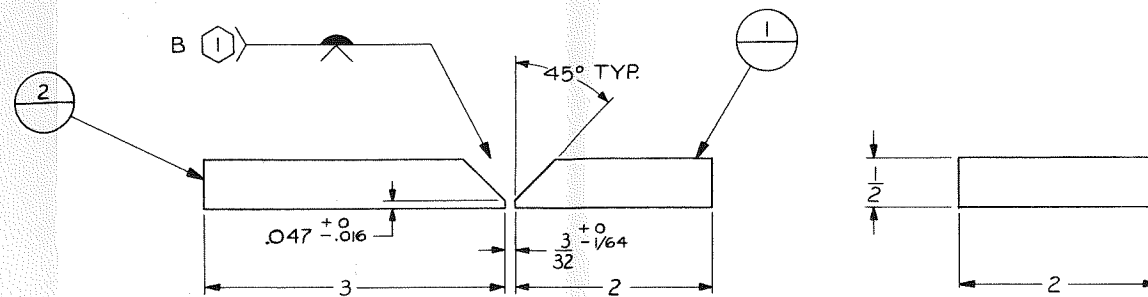
1. If a partial plate, rod or pipe is required to make a part, the raw stock shall be cut to a size approved by the shop selected to do the fabrication. If an entire plate, rod or pipe is required to make one or more parts, the raw stock may be sent to the shop without cutting.

PARTS LIST					
PART	DWG NO.	REQD	DESCRIPTION	STOCK SIZE	MATERIAL
1		1	PLATE	1/2 X 2 X 2	TYPE 304SS RDT-M5-IT
2		1	PLATE	1/2 X 2 X 3	TYPE 304SS RDT-M5-IT

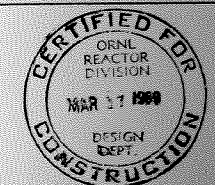
GENERAL NOTES:

1. ASTM MATERIAL WITHOUT CERTIFIED CHEMICAL & MECHANICAL PROPERTIES WILL NORMALLY BE USED FOR LEVEL 3 QUALITY FABRICATION.
2. (1) WELD SERIAL NO. (NOT REQ'D. FOR LEVEL 3 QUALITY FABRICATION).
3. "B" IS WELD INSPECTION SCHEDULE (OR QUALITY) SEE INSPECTION PROCEDURE, LISTED BELOW, FOR DESCRIPTION
4. WELD PREPARATION WILL NOT NORMALLY BE DIMENSIONED ON LEVEL 3 QUALITY FABRICATED ITEMS.

* THE DESIRED OPTIONAL REQUIREMENTS WILL BE LISTED ON THIS DWG.



QUALITY LEVEL 1



WPS 302	MET-WR 201	B	MET-WR-1	MET-WS-3
WELDING INSPECTION	INSPECTION SCHEDULE	WELDING & INSPECTION	OTHER REFERENCES	
INTERNAL FABRICATION		EXTERNAL FABRICATION		

SEE SECTION 3.4 FOR DRAWING APPROVALS

GENERAL SPECIFICATIONS		TOLERANCES UNLESS OTHERWISE SPECIFIED:	
UNLESS OTHERWISE SPECIFIED:		FRACTIONS ± 1/64	
1. BREAK ALL SHARP EDGES		DECIMALS ±	
2. TYPE, GRADE, OR FINISH OF MATERIAL MAY BE CHOSEN BY FABRICATOR.		ANGLES ± 0°-30'	
3. MACHINED SURFACE FINISH SHALL NOT EXCEED: (ASA B46.1-1962) ✓		SCALE: FULL	

NO.	REVISIONS				DATE	APPD	APPD
	DRAWN	DATE	SUBMITTED	DATE			
	DESIGNED	DATE	APPROVED	DATE	APPROVED	DATE	
	CHECKED	DATE	APPROVED	DATE	APPROVED	DATE	

REFERENCE DRAWINGS	NUMBER	
OAK RIDGE NATIONAL LABORATORY OPERATED BY UNION CARBIDE CORPORATION OAK RIDGE, TENNESSEE		
BLDG. NO. _____		
PLATE TO PLATE		
SUBMITTED	ACCEPTED	APPROVED
M	10534	RM 001 C
		REV.

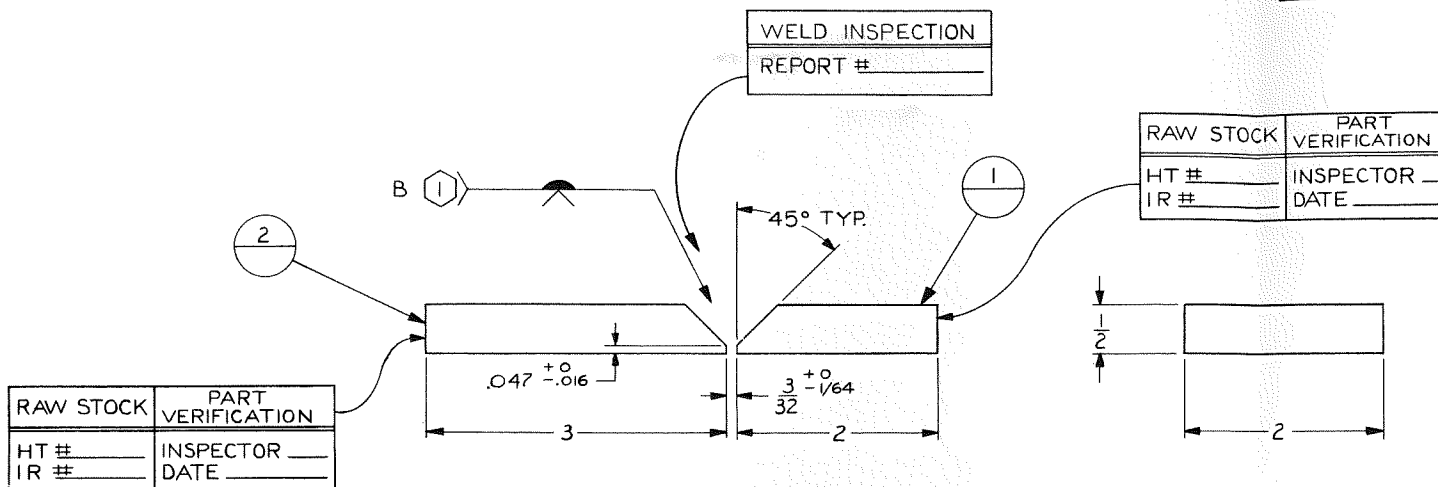
NO REPRESENTATION OR WARRANTY, EXPRESSED OR IMPLIED, IS MADE THAT THE USE OR DISCLOSURE OF ANY INFORMATION, APPARATUS, METHOD OR PROCESS DISCLOSED IN THESE DRAWINGS MAY NOT INFRINGE PRIVATE RIGHTS OF OTHERS. NO LIABILITY IS ASSUMED WITH RESPECT TO THE USE OF, OR FOR DAMAGES RESULTING FROM THE USE OF, ANY INFORMATION, APPARATUS, METHOD OR PROCESS DISCLOSED IN THESE DRAWINGS. THE DRAWINGS ARE BEING MADE AVAILABLE FOR INFORMATION TO BIDDER AND ARE NOT TO BE USED FOR OTHER PURPOSES, AND ARE TO BE RETURNED UPON REQUEST OF THE FORWARDING CONTRACTOR.

Fig. 5-3 Typical Dwg. "Approved for Construction"

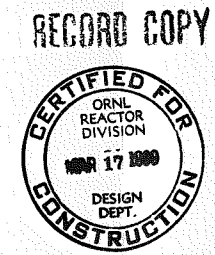
PARTS LIST					
PART	DWG NO.	REQD	DESCRIPTION	STOCK SIZE	MATERIAL
1		1	PLATE	1/2 X 2 X 2	TYPE 304SS. RDT-M5-IT
2		1	PLATE	1/2 X 2 X 3	TYPE 304SS. RDT-M5-IT

GENERAL NOTES:

1. (1) WELD SERIAL NO. (NOT REQ'D. FOR LEVEL 3 QUALITY FABRICATION.)
2. "B" IS WELD INSPECTION SCHEDULE (OR QUALITY) SEE INSPECTION PROCEDURE, LISTED BELOW, FOR DESCRIPTION.



QUALITY LEVEL 1
CRITICAL MATERIAL
DO NOT SUBSTITUTE



RAW STOCK	PART VERIFICATION
HT # _____	INSPECTOR _____
IR # _____	DATE _____

RAW STOCK	PART VERIFICATION
HT # _____	INSPECTOR _____
IR # _____	DATE _____

WPS	MET-WR	B	MET-WR-1	MET-WS-3
302	201			
WELDING	INSPECTION	INSPECTION	WELDING	OTHER
	SCHEDULE	SCHEDULE	INSPECTION	REFERENCES
INTERNAL FABRICATION		EXTERNAL FABRICATION		
WELDING & INSPECTION PROCEDURE				

SEE SECTION 3.4 FOR DRAWING APPROVALS

NO REPRESENTATION OR WARRANTY, EXPRESSED OR IMPLIED, IS MADE THAT THE USE OR DISCLOSURE OF ANY INFORMATION, APPARATUS, METHOD OR PROCESS DISCLOSED IN THESE DRAWINGS MAY NOT INFRINGE PRIVATE RIGHTS OF OTHERS. NO LIABILITY IS ASSUMED WITH RESPECT TO THE USE OF, OR FOR DAMAGES RESULTING FROM THE USE OF, ANY INFORMATION, APPARATUS, METHOD OR PROCESS DISCLOSED IN THESE DRAWINGS. THE DRAWINGS ARE BEING MADE AVAILABLE FOR INFORMATION TO BIDDER AND ARE NOT TO BE USED FOR OTHER PURPOSES, AND ARE TO BE RETURNED UPON REQUEST OF THE FORWARDING CONTRACTOR.

GENERAL SPECIFICATIONS	TOLERANCES UNLESS OTHERWISE SPECIFIED:
1. BREAK ALL SHARP EDGES	FRACTIONS ± 1/64
2. WELD GRADUATION	DECIMALS ± ~
3. MACHINED SURFACE FINISH SHALL NOT EXCEED: (ASA B46.1-1962) ✓	ANGLES ± 0°-30'
	SCALE: FULL

NO.	REVISIONS	DATE	APPD	APPD
DRAWN	DATE	SUBMITTED	DATE	APPROVED
DESIGNED	DATE	APPROVED	DATE	APPROVED
CHECKED	DATE	APPROVED	DATE	APPROVED

REFERENCE DRAWINGS	NUMBER
OAK RIDGE NATIONAL LABORATORY OPERATED BY UNION CARBIDE CORPORATION OAK RIDGE, TENNESSEE	
BLDG. NO. _____	
PLATE TO PLATE	
SUBMITTED	ACCEPTED
M	10534 RM 001 C REV.

Fig. 5-4 Record Copy of Component Drawing

2. One or more cardboard tags with the following information shall be taped or attached in an appropriate manner to every piece of raw stock by the resident inspector of the ORNL Inspection Engineering Department.

PART IDENTIFICATION TAG

Engineering Job No. _____

Dwg. No. _____

Part No. _____

Heat No. _____

IR No. _____

Part Accepted _____

Part Rejected _____

Inspector _____

Fig. 5-6 Part Identification Tag

3. A tag shall be prepared for every part except where there are two or more small parts (such as screws, etc.) of identical design made from the same piece of raw material. In this case the parts shall be bagged and the tag attached to the outside of the bag.

The Engineering Services Department shall be responsible for shipping all materials to the shop.

After the material is received at the shop it shall be stored by shop personnel in a special segregated area inside the shop until it is needed for fabrication. Nonconforming material shall be controlled in accordance with Paragraph 5.10.

5.4.3 Part Identification in Fabrication Cycle

The part identification tag shall be retained on each part during the fabrication cycle and until the part is welded or attached to a component. If for any reason the part identification tag has to be removed during the fabrication cycle (cutting, machining, rolling, heat treating, etc.), it shall be the responsibility of the inspector from the independent

plant inspection agency (Paragraph 5.3) to verify that the part identification tag has been reattached to the proper part.

After individual parts have been fabricated, and immediately prior to assembly or welding, the inspector from the independent plant inspection agency shall check and verify that parts have been made from material specified on the drawings. This verification shall be entered on the Weld Inspection Reports, Form UCN-1149A (Appendix IX of this procedure), for welded items and on the inspector's drawings for non-welded items. (See Fig. 5-4.) When fabrication is completed the inspector shall forward the drawings to the Engineering Services Department for review, final approval, entering of inspection results on the record set of drawings, and storage by the resident inspector from the ORNL Inspection Engineering Department.

If material identification is removed during fabrication and cannot be identified by the inspector, the inspector shall reject the part, note it on a "Part Identification Tag" (Fig. 5-6), and follow instructions in Paragraph 5.10, "Control of Nonconforming Items."

5.4.4 Identification of Welds

5.4.4.1 Drawing Identification. Drawings of parts shall have details for machining weld preparation, American Welding Society (AWS) weld symbols, serial numbers and inspection schedules for all welds, welding and weld inspection procedures, and other general welding information. An example of this identifying information is shown on Fig. 5-3.

5.4.4.2 Shop Identification. The inspector from the independent plant inspection agency (Paragraph 5.3) shall check the base and filler metal,^a inspect, and fill out a weld inspection report, UCN Form 1149A, as each weld is made. Base metal verification shall be made as stated in Paragraph 5.4.3. The weld inspection report shall have a serial number and this serial number shall be stamped on the inspector's copy of the applicable component drawing at the weld symbol by the inspector from the independent plant inspection agency. See Fig. 5-4.

^aWeld filler metal with certified chemical and physical properties shall be furnished by Engineering Services Department and/or ORNL Inspection Engineering Department.

Cleanliness and/or Heat Treating Reports, Form TX-3245, or other appropriate forms shall have a serial number and this serial number shall be stamped on the inspector's copy of the applicable drawing.

The radiographs associated with each weld report shall be identified by Engineering Job Number, drawing number, weld serial number, and weld report number. When each weld or group of welds is completed, the inspector shall forward the weld inspection report, radiographs, ultrasonic reports, and cleaning and heat treating reports (as applicable) to the Engineering Services Department. The Engineering Services Department shall forward the reports to the resident inspector of the ORNL Inspection Engineering Department for review, approval, entering of inspection results on the record set of drawings, and filing.

5.4.5 Quality Level 3 Fabrication

Material for Level 3 quality jobs shall be furnished by Engineering Services Department or procured by the shop selected to do the fabrication. It shall be procured in accordance with requirements specified on approved drawings.

Material identity shall not be documented during the various fabrication activities unless specifically requested on drawings or special instructions. However, normal good shop practices shall be exercised to maintain correct material identity and control.

5.5 Control of Processes

5.5.1 Fabrication and Assembly Processes

5.5.1.1 Machining and Forming. Shop management shall be responsible for the quality of the work their forces produce by the use of qualified shop personnel, proper machine tools, planning, and scheduling. In addition, shop management shall be responsible for determining the need for the design and fabrication of all tools and fixtures required during the fabrication processes. The Engineering Services Department and/or project engineer shall give approval of the design of all special tools and fixtures.

When special machining and forming procedures are needed, the procedures shall be written by the project engineer or his designee in cooperation with shop personnel.

5.5.1.2 Welding. All welding for Quality Level 1 and 2 items shall be performed by qualified welders using detailed procedures qualified by ORNL except as follows. When work is performed in Y-12, K-25 or Paducah Plants, their welding procedures may be used if submitted in advance to the Engineering Services Department for approval by ORNL Inspection Engineering Department and the project engineer.

All welding procedures to be employed, regardless of origin, together with their qualification test results, and records of performance qualification tests of welders qualified to those procedures shall be examined and approved by the ORNL Inspection Engineering Department before any welding is done. See applicable welding procedures in Appendix B of the QA Program Plan.

Welding on Quality Level 3 items shall be performed by qualified welders using qualified procedures except that approval by ORNL Inspection Engineering Department of procedures and welder qualification test results is not required.

5.5.1.3 Heat Treating. Stress relieving or other forms of heat treatment shall be performed only when and by the method specified in Appendix B of the QA Program Plan or drawings and procedures with the following exception. The project engineer may approve additional stress relieving operations when the shop requests it for dimensional control of parts during fabrication.

Annealing shall be performed on parts receiving severe cold working and/or as specified on drawings and procedures. Parts shall be cleaned before heat treating according to Section 5.5.4, "Cleaning." After cleaning in the shop, each part shall be inserted in an appropriate bag before it is sent to the furnace.

It shall be the responsibility of the independent plant inspection agency (Paragraph 5.3) to check Quality Level 1 and 2 items for cleanliness before they are inserted in an appropriate bag in the shop, again just before they go in the heat-treating furnace, and after they come out

of the furnace. Material identification, and heat treating procedures shall be checked for compliance with specifications.

For Quality Level 1 and 2 items, the independent plant inspection agency shall be responsible for reporting the results on Form TX-3245, "Cleanliness and Heat Treating Report," (See Appendix X of this procedure.) or other appropriate forms. A time-temperature recorder chart shall be provided for each furnace cycle and shall become a part of the "Cleanliness and Heat Treating Report."

No environment that might cause a deleterious effect to the material shall be used in the heat-treating furnace.

All Quality Level 1 and 2 parts shall be liquid penetrant inspected after annealing, according to the applicable liquid penetrant procedure in Appendix B of the QA Program Plan.

Surface oxide formed during heat treating in atmospheres of air, helium, and argon must be removed before a satisfactory liquid penetrant inspection can be performed.

5.5.2 Fabrication Process Qualification

Requests for qualification or verification of new or special fabrication processes shall originate with the project engineer. When special or new fabrication processes are required during fabrication the shop shall qualify the process by fabricating one or more test pieces and presenting them to the Engineering Services Department for review, evaluation and approval by the project engineer.

5.5.3 Nondestructive Examination

All nondestructive examinations in ORNL shall be performed using the ORNL Inspection Engineering Department's procedures based on RDT Standards. The applicable procedures are listed in Appendix B of the QA Program Plan.

When fabrication work is performed in Y-12, K-25 or Paducah Plants, their nondestructive procedures may be used if submitted in advance to the Engineering Services Department and approved by Inspection Engineering Department and the project engineer.

5.5.4 Cleaning

Cleaning of items, when required, shall be performed and reported in accordance with applicable procedures in Appendix B of the QA Program Plan, drawings, and specifications.

5.5.5 Personnel Training and Certification

Nondestructive testing personnel at ORNL shall be formally qualified and certified in accordance with the ORNL Inspection Engineering Department's QA Procedure Manual, Section 2, "Certification of NDT Personnel." Y-12 Plant personnel at the Y-12 Shops and the Y-12 job site performing radiography and applying penetrant shall be qualified but conversely to ORNL-personnel may not be formally certified. Inspection personnel at K-25 and Paducah plants shall be qualified but may not be certified to RDT Standard F 3-6T. In these cases an ORNL inspector qualified and certified as a Level II inspector in accordance with ORNL Inspection Engineering Department's QA Procedure Manual, Section 2, "Certification of NDT Personnel" shall be responsible for the interpretation of the results of radiographic and penetrant inspections for Quality Level 1 and 2 items.

5.6 Inspection and Tests

5.6.1 General Requirements

Weld inspection activities shall be performed by inspectors in accordance with Paragraph 5.3. Routine dimensional inspection activities shall be performed by qualified inspectors. No report of dimensional inspection shall be made unless requested by the project engineer. The qualifications and certifications of all inspectors and inspection and test operations shall be audited, reviewed, and approved by a qualified and certified Level II inspector from the ORNL Inspection Engineering Department.

Quality Level 3 fabricated items and services shall be inspected by shop inspectors, or by an independent plant inspection agency if requested by the shop or the project engineer. Routine inspection reports shall not be made and no proof or functional tests shall be performed unless they are requested by the project engineer.

5.6.2 Procedures

5.6.2.1 Welding. The "ORNL Welding Inspection and Fitup Procedures" listed in Appendix B of the QA Program Plan shall be used for all Quality Level 1 and 2 fabrication. They are not required for Quality Level 3 fabrication unless specified on drawings and other design documents.

5.6.2.2 Dimensional. Standard shop practices and procedures, as determined by shop management, shall be used to inspect all dimensions on fabrication drawings to assure correct part configuration and fitup. No formal inspection procedures and check lists shall be used unless specifically requested by the project engineer.

Detailed "as built inspection dimensional" reports for a specific part shall be completed by the shop inspector when it is requested by the project engineer or when the part is out of drawing tolerance. A detailed "as-built" dimensional inspection of parts by an independent inspection agency (Paragraph 5.3) may be requested by the project engineer. Results of detailed inspections shall be reported on record drawings, inspection forms UCN 6679, (Appendix XI of this procedure) or other appropriate forms.

5.6.2.3 Inspection Procedures for Instruments and Electrical Items. The project engineer or his designee shall prepare all the necessary quality assurance procedures and shall supervise the training of inspection personnel. Detailed checkout and testing procedures shall be prepared for Quality Level 1 and 2 items and for Quality Level 3 items as determined by the project engineer.

Each procedure for Quality Level 1 and 2 items shall be reviewed by the DQAC-RD and/or the DQAC-I & C.

The project engineer or his designated inspector, as applicable, shall inspect the equipment during fabrication and after final fabrication to assure that all the requirements of the procedures, specifications, and drawings are met satisfactorily. An inspection report for Quality Level 1 and 2 items shall be prepared and filed according to Paragraph 5.13.

5.6.2.4 Special. Special inspection procedures and check lists for Quality Level 1 and 2 fabricated items shall be written by the project engineer or his designee, and for Quality Level 3 items when considered necessary by the project engineer. See applicable procedures in Appendix B of the QA Program Plan. The procedures shall be reviewed and accepted by the ORNL Inspection Engineering Department and/or a recognized authority in the particular inspection activity. Each procedure must receive final acceptance by the DQAC-RD.

5.6.3 Completed Item Inspection and Test

5.6.3.1 Functional Testing of Mechanical Items. The required functional test shall be performed by shop personnel under the direction of the project engineer and the Engineering Services Department. The project engineer or his designee shall prepare the necessary procedures and check lists to accomplish the functional tests. See applicable procedures in Appendix B of the QA Program Plan. The test results shall be documented and filed according to Paragraph 5.13.

5.6.3.2 Functional Testing of Instruments and Electrical Items. The required functional tests of UCC-ND fabricated instrumentation and controls shall be performed under the direction of the project engineer or his designated inspector. He or his designee shall prepare the necessary procedures and check lists to accomplish the functional tests.

The project engineer or his designee shall be responsible for witnessing and/or auditing the tests and/or for the acceptance of fabricated equipment. All tests shall be conducted by shop personnel. The results of tests shall be documented and filed according to Paragraph 5.13.

5.6.3.3 Hydrostatic and Pneumatic Tests. Hydrostatic and/or pneumatic testing shall be performed and reported in accordance with the ORNL Inspection Engineering Department's QA Procedure Manual, Section 8, "Hydrostatic & Pneumatic Testing" or other applicable procedures on drawings or in Appendix B of the QA Program Plan. The reports shall be filed in accordance with Paragraph 5.13.

5.6.3.4 Leak Test. Leak tests, when required, shall be performed and reported in accordance with the ORNL Inspection Engineering Department's QA Procedure Manual, Section 7, "Leak Testing" or other applicable procedures on drawings or in Appendix B of the QA Program Plan. The reports shall be filed in accordance with Paragraph 5.13.

5.6.5 Certification

5.6.5.1 Certification of Mechanical Items. The ORNL Inspection Engineering Department shall notify the project engineer by letter or other appropriate forms that all Quality Level 1 and 2 components have been fabricated in accordance with drawings, specifications and procedures. If any component has not been fabricated according to all fabrication documents the exceptions and limitations shall be listed.

The letter shall be written for each component, or groups of components, after fabrication is complete and after the completed record copy of drawings, inspection, and test reports have been received by the ORNL Inspection Engineering Department. Copies of the letter shall be sent to the Engineering Services Department and the DQAC-RD.

5.6.5.2 Certification of Instruments and Electrical Items. The designated inspectors shall certify by letter to the project engineer, Engineering Services Department, the DQAC-RD and the DQAC-I&C that all Quality Level 1 and 2 instruments and electrical items have been fabricated in accordance with fabrication documents. If any item has not been fabricated according to the fabrication documents the exceptions and limitations shall be listed and disposition of the item shall be indicated.

5.7 Document Control

Refer to Paragraphs 5.2.1 and 5.2.5 and 5.2.6.

5.8 Equipment Calibration and Standards

5.8.1 Equipment Evaluation

Inspection agencies in each UCC-ND plant shall be responsible for inspecting and evaluating their own inspection measuring and test equipment. This evaluation shall be done before and during use to determine

equipment capability, accuracy and tolerance against standards having known valid relationships to national standards where such standards exist. Acceptable UCC-ND plant procedures relating to inspection and evaluation of shop inspection equipment are given in Appendix B of the QA Program Plan.

If approved by the project engineer, instruments may be calibrated by any qualified UCC-ND instrument shop in the Oak Ridge Operations area. The calibration shall be performed by qualified personnel using written procedures that have been approved by the engineer responsible for instrument design of the test or experiment.

5.9 Statistical Quality Control and Analysis

Will not be used.

5.10 Control of Nonconforming^a Items

It is the responsibility of the inspector from the independent plant inspection agency (Paragraph 5.3) and/or ORNL Inspection Engineering Department to detect and inform the project engineer, through the Engineering Services Department of the existence of any nonconforming material and fabrication activity, except for instruments and electrical items. Nonconforming instruments and electrical items shall be detected and reported to the project engineer by the designated inspectors responsible for the inspection of these items.

The project engineer shall determine if the nonconforming items should be rejected, repaired,^b reworked,^c or accepted. His determination, including reasons shall be reported in accordance with Paragraph 5.2.5 "Changes to Approved Drawings," in a letter to the Engineering Services Department with copies to the ORNL Inspection Engineering Department and

^aA characteristic of an item that does not conform to a specified requirement.

^bThe process of restoring a nonconforming characteristic of an item to an acceptable condition, although it does not conform to a specified requirement.

^cThe process by which a nonconforming item is made to conform to specified requirements.

to the DQAC-RD. Copies of reports of damaged or nonconforming items that may affect the schedule of the program shall be sent to the Program Director and the Operating Department Head.

Nonconforming items shall be identified on the "Part Identification Tag" or other appropriate means and segregated from conforming items. Final disposition of items shall be indicated on the inspection report.

5.11 Corrective Action

See Paragraph 5.10.

5.12 Packaging and Storage

5.12.1 Handling

Each UCC-ND shop shall be responsible for the safe handling and storage of parts during fabrication to prevent damage.

5.12.2 Packaging and Storage

All completed fabricated items shall be packaged, as appropriate, to prevent damage during shipment to the job site.

The Engineering Services Department shall receive, identify, and store all equipment in a special storage area until it is released for use at the job site.

5.12.3 Shipping

Items shall not be shipped from UCC-ND shops until authorized by the Engineering Services Department. The Engineering Services Department shall not authorize shipment until the requirements in Paragraph 5.6.5, "Certification" have been met.

Items that have been fabricated in UCC-ND shops usually will be shipped to the Engineering Services Department utilizing UCC-ND trucks and personnel. Special instructions for the shipping and storage of delicate or critical items shall be supplied to the Engineering Services Department by the project engineer or his designee.

Items that have been fabricated in the UCC-ND shop in Paducah may be shipped to the Y-12 Plant by common carrier or as specified and they shall be forwarded by the Y-12 Receiving Department directly to the Engineering Services Department.

5.13 Quality Records

All quality records for fabricated items, except instruments and electrical items, shall be forwarded by the independent plant inspection agency (Paragraph 5.3) through Engineering Services to the resident inspector of the ORNL Inspection Engineering Department. The Quality Assurance records shall include, as applicable, all record drawings, cleanliness and heat treating records, welding inspection records, records of personnel training and certifications, welding procedure and qualification, test results, welder performance test results, inspection and test records, and results of the disposition of rejected or nonconforming material or components. These records shall be filed according to Engineering Job Number, Component Title, and/or Drawing Number for easy retrieval.

Quality records for fabricated instruments and electrical items shall be forwarded to the project engineer by the designated inspectors responsible for inspection of fabricated instruments and electrical items. The project engineer shall review and forward these records for filing to the resident inspector of the ORNL Inspection Engineering Department.

These records shall be filed according to Engineering Job Number, Component Title, and/or Drawing Title for easy retrieval.

The files shall be maintained, as a minimum, for the life of the project with which the experiment is supporting.

No files shall be destroyed without the written authorization of the Operating Department Head.

5.14 Quality Audits

The Quality Assurance functions related to fabrication shall be audited in accordance with the Reactor Division's Quality Assurance Procedure, No. 8, "Activity Audit."

APPENDIX I

DEFINITIONS OF QUALITY LEVELS

Quality Level I is normally assigned to a component or system that cannot be easily inspected while in-service because of radioactive contamination and/or high radiation fields and in which failure could (1) cause an extended delay in the completion of the project or in the program supporting the project, (2) cause serious or costly damage to a significant portion of the system of the facility in which it is located, or (3) create a hazardous condition.

Normally, Quality Level I is associated with components of the reactor primary system, with some components of in-pile circulating loops, with certain fueled and nonfueled irradiation capsules, and with those components of a nuclear fuel processing plant that are in contact with the main processing stream. Operation of the project is normally expected to continue for an extended period of time in fields of intense neutron flux and/or at high levels of radioactivity.

Quality Level II is normally assigned to a component or system with or without the presence of radioactivity, in which failure could (1) cause an extended delay in the project or in the program supporting the project, (2) cause serious or costly damage to a significant portion of the system or the facility in which it is located, or (3) create a hazardous condition.

Normally, Quality Level II is associated with engineering-scale experiments operating outside of a reactor system that are designed to operate at high pressure and/or high temperature, with noncritical components of an in-pile loop, with a reactor secondary system, and with some reactor facilities and experiments that are not in-core.

Quality Level III is normally assigned to a component or system in which failure will (1) not cause an extended delay in the completion of the project, or (2) not cause costly destruction of the project.

Normally, Quality Level III is associated with laboratory-scale experiments, with noncritical components or systems of engineering-scale experiments, and with electrical, structural, and piping systems that are under the jurisdiction of the various industrial codes.

Quality Level IV is normally assigned to components or systems that are associated with bench-scale low-cost experiments operating at low pressure and which contain either nonhazardous materials or small quantities of toxic materials that are suitably contained. Laboratory service systems not governed by Quality Level III requirements may be assigned to Quality Level IV.

Note 1: Some components purchased to a Quality Level III from reliable vendors who have a long well-documented history for high-quality products may under certain circumstances be used in a Quality Level II system.

Note 2: The replacement of a minor component or a minor section of an existing system may be performed to the standards used in the original design of the system; however, if a significant component or section of the system is replaced, it must be designed and installed in accordance with this quality level guide.

Note 3: Redundant circuit designs using components from reliable vendors may qualify for Levels I and II application.

APPENDIX IV

TEAR OFF THIS STRIP TO REMOVE ORIGINATOR (CANARY) COPY

MAINTENANCE WORK REQUEST				WORK ORDER NO. X		JOB NUMBER 08034											
UCN 2546 (2-10-65)				DISTRIBUTION: Originator retains Canary Copy and forwards remaining copies to maintenance.		WCC NO.	DEPT. NO.	SLOT	BIN	FOREMAN BADGE							
REQUESTER - USE THIS SPACE				RELATIVE IMPORTANCE (Circle) H L													
DATE				JOB DESCRIPTION													
WORK LOCATION	EQUIPMENT NAME	PROPERTY OR M NUMBER	APPROVAL	CRAFT NO. EST. HOURS													
				TYPE EST													
				TYPE JOB													
				P. E. NO.		JOB CLASS OR PLAN			PROPERTY OR M NUMBER								
				REQUESTER				SAFETY PERMIT REQUIRED		REGULAR		NUCLEAR		ORIGINATING W.C.C. NO.		SCHEDULED COMPLETION	
				BLDG.		PHONE		REQUESTED COMPLETION		TYPE JOB (CIRCLE)		SCHEDULE START		COORDINATOR			
SHIP TO		BLDG.		DEL. STA.		PHONE		3 5		CROSS ORDER ISSUED TO		DATE ISSUED					
JOB NUMBER		WORK ORDER NO.		JOB TITLE				REQUESTER		REQ. COMPLETION							
X 08034								DATE REC'D.		SCHED. COMPLETION							

THIS IS A FOUR PART FORM - WRITE FIRM AND LEGIBLE

APPENDIX VIII

INSTRUCTIONS TO SENDER

- 1. DETACH **YELLOW** COPY
- 2. SEND **WHITE** AND **PINK** PARTS WITH **CARBON** TO PERSON ADDRESSED.

50020

INSTRUCTIONS TO RECIPIENT

- 1. WRITE REPLY AT BOTTOM.
- 2. DETACH STUB, RETAIN **WHITE** COPY AND RETURN **PINK** COPY TO SENDER

<i>To:</i>		
SUBJECT	DATE	<i>Reply Message</i>
FOLD ∇		

M
E
S
S
A
G
E

	SIGNED	
R E P L Y	DATE OF REPLY	REPLY TO
SIGNED		

RECIPIENT

DETACH AND FILE FOR FOLLOW-UP

APPENDIX IX

WELD INSPECTION REPORT

DISTRIBUTION:				Report No.	
				DRAWING NUMBER	
				WORK ORDER NUMBER	
				DATE	
COMPONENT TITLE				WELD NUMBER	
WELDING SPECIFICATION		WELDING PROCESS		TYPE JOINT	
INSPECTION SPECIFICATION			INSPECTION SCHEDULE		
BASE MATERIALS			FILLER METAL		
TYPE			TYPE		
IR			IR		
HEAT			HEAT		
MFG.			MFG.		
LOT NO.			ITEM		
FORM			SIZE		
ITEM					
PIECE					
SIZE					
WELDER					
WELDER'S NAME			BACK-UP GAS		
			A He		
FITTER'S NAME			COVER GAS		
			A He		
INSPECTION					
		DISPOSITION		APPROVED	
CLEANLINESS					
FIT-UP					
ROOT PASS					
PENETRANT: DEFECTS					
INTERMEDIATE PASSES					
PENETRANT: DEFECTS					
FINAL PASSES					
PENETRANT: DEFECTS					
RADIOGRAPHY					
ULTRASONIC					
WELDING VARIABLES		VOLTS	AMPS	INTER PASS TEMP.	
REMARKS:					
INSPECTOR'S SIGNATURE			DATE	FINAL ACCEPTANCE	DATE

APPENDIX X

CLEANLINESS AND HEAT TREATING REPORT

REPORT NO. _____

Distribution: _____

Date _____

Part Description _____ Drawing No. _____

Material:

Type
Heat
IR
Lot

Item
Piece
Size

Cleanliness:	Yes	No	Disposition	Inspector	Date
Part Free of Dust, Dirt, Fillings, etc.					
Part Free of Grease					
Part Free of Internal Blockage					
Part Free of Internal Oxide					
Part Free of External Oxide					

Method of Degreasing _____ Solvent Temperature _____
 Cleaning Solvent _____

Heat Treating:

Type Equipment _____ Location _____
 Canned Retort: Yes _____ No _____ Equipment Operator _____
 Date Part Canned _____
 Atmosphere of Part Interior _____ Gas Flow Rate _____
 Atmosphere of Part Exterior _____ Gas Flow Rate _____
 Part Temperature _____ Time at Temperature _____ Date _____

	Yes	No	Disposition	Inspector
Material Identification of Part Reestablished After Heat Treating				
Part Free of Internal Oxide				
Part Free of External Oxide				
Structural Damage				
Time-Temperature Graph Attached				

Remarks:

Inspector's Signature _____ Date _____
 Final Acceptance _____ Date _____

REACTOR DIVISION

Quality Assurance Procedure 6
(Interim Use)

CONSTRUCTION AND INSTALLATION

C. K. McGlothlan

February 1970

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6. CONSTRUCTION AND INSTALLATION

6.1 Scope

This procedure presents the quality assurance requirements, policies, and controls to be implemented by the Reactor Division of Oak Ridge National Laboratory (ORNL) during the installation phase of research and development projects for the Atomic Energy Commission-Division of Reactor Development and Technology (AEC-DRDT). These requirements, policies, and procedures are intended to assure that structures, components, and systems essential to safety, operability, and reliability are installed, constructed, and tested at the job site in the Y-12 Plant area in conformance with drawings and specifications. This procedure applied to Union Carbide Corporation-Nuclear Division (UCC-ND) and Cost Plus Fixed Fee Contractor (CPFF) participation.

The paragraphs of this procedure are applicable for Quality Levels 1, 2, 3, and 4 as indicated in the following table. See Appendix I of this procedure for definitions of quality assurance levels.

<u>Paragraphs</u>	<u>Quality Levels</u>			
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
6.1 Scope	X	X	X	NA
6.2 Organization	X	X	X	NA
6.3 Installation Document Review	X	X	O	NA
6.4 Construction Planning	X	X	X	NA
6.5 Control of Configuration	X	X	O	NA
6.6 Construction Procurement	X	X	O	NA
6.7 Construction and Installation Control	X	X	O	NA
6.8 Inspection	X	X	O	NA
6.9 Preoperational Testing	X	X	X	NA
6.10 Quality Control Records	X	X	X	NA
6.11 Quality Audits	X	X	X	NA

X - Applicable in its entirety.

O - Applicable with noted exceptions.

NA - Not applicable.

6.2 Organization

The project engineer shall be responsible for meeting the construction and installation requirements of the quality assurance plan. He may delegate the performance of many construction and installation activities to qualified personnel from the Engineering Services and Operating Departments of the Reactor Division, Instrumentation and Controls Division, Inspection Engineering Department of ORNL, as applicable, and other appropriate groups. The personnel from these groups that are performing quality control functions shall be independent of direct control by the Y-12 Research Services Department or the CPFF contractor, the installing organizations. Quality assurance functions and the organizations responsible for performing these functions are shown on Fig. 6-1.

All government-funded work estimated to cost \$2,000 or more is covered by the Davis-Bacon Labor Act,^a and it shall be reviewed by the Atomic Energy Commission-Oak Ridge Operations (AEC-ORO) Davis-Bacon Committee.^b This review shall determine if the proposed UCC-ND and CPFF contractor participation is in accordance with the guide lines given in Appendix II. Management shall request this review in writing and forward it to the Engineering Services Department. The Engineering Services Department and the Y-12 Facilities Engineering Department shall procure the necessary documents and present them to the Davis-Bacon Review Committee.

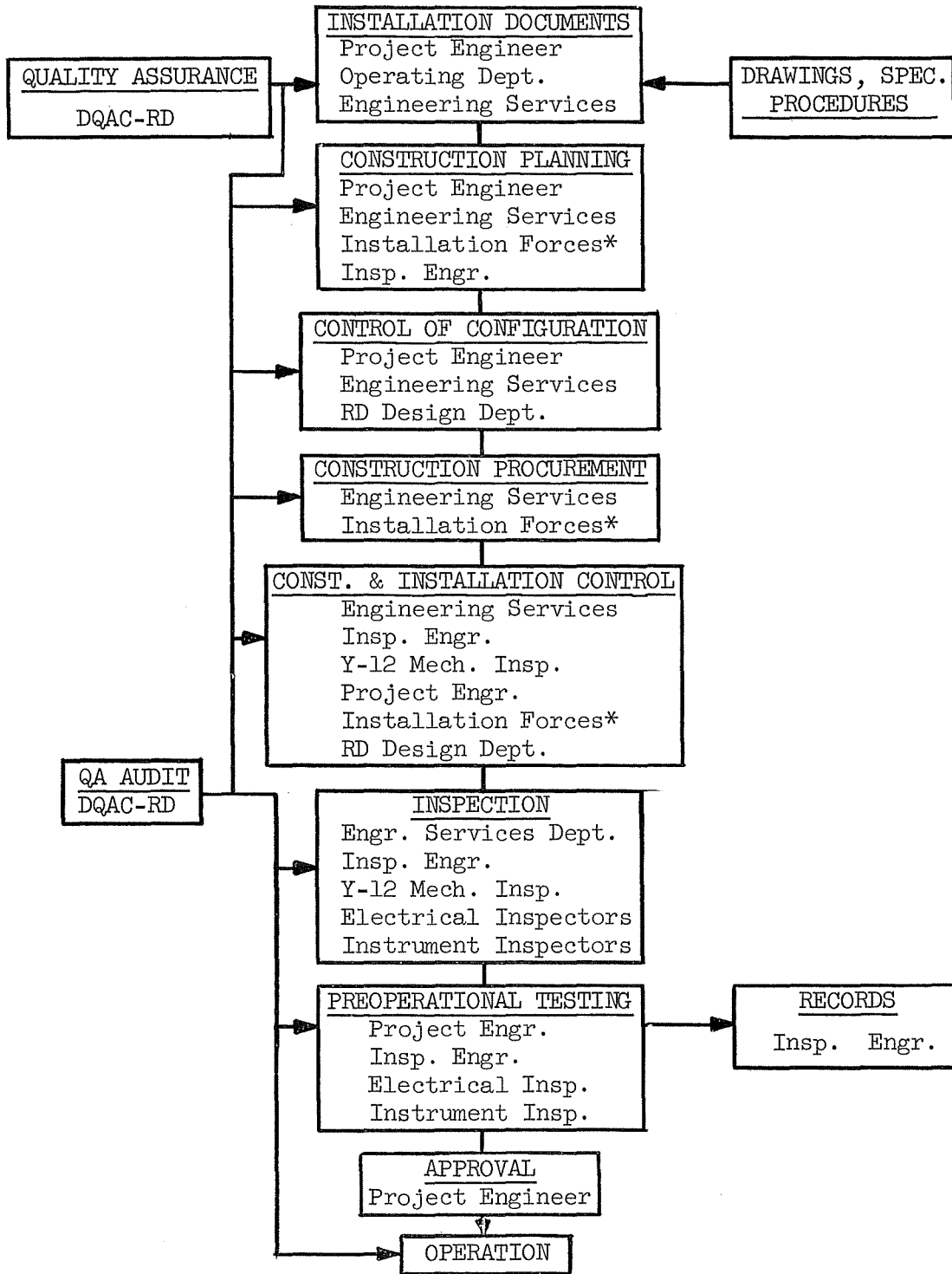
6.3 Installation-Document Review

Requests for installation shall not be initiated until drawings and specifications have been properly signed and documented.

Installation documents shall be reviewed by personnel designated below to assure that technical and quality assurance requirements are complete and appropriate.

^aThe labor law requiring that prevailing area construction wages be paid for construction work.

^bDavis-Bacon Committee-Oak Ridge Area - AEC employees representing the Labor Department.



*Installation Forces -
Y-12 Research Services
Dept. or CPFF Contractor

FIG. 6-1
INSTALLATION QUALITY
ASSURANCE ACTIVITIES
RESPONSIBILITIES

<u>Documents</u>	<u>Reviewer</u>	<u>Review Function</u>
<u>For Engineering Services Dept.</u>		
Request for Work (Form UCN-3898) or Work Request (Form UCN 2546) with Supplementary Drawings and Specifications	1. Project Engineer 2. Operating Department Head 3. Department Head Engineering Services	a) Required Approvals a) Need for Item b) Proper Description c) Charge Account a) Approval by Operating Department Head b) Support Documents Attached c) Review for Installation Action and Assignment of Work

Before installation is started for Quality Level 1 and 2 items and services, the project engineer shall send a copy of each request for installation and the support documents to the Division Quality Assurance Coordinator-Reactor Division (DQAC-RD) for review of quality assurance requirements.

6.4 Construction Planning

6.4.1 Initiating Requests for Construction and Installation Work

Request for assembly, installation, and construction shall be initiated by the project engineer or his designee. He shall determine that each piece of equipment, and all the construction drawings and documents meet the requirements of the Quality Assurance Program for design, procurement, and fabrication prior to initiating construction. In addition he shall be responsible for determining that the documentation contains all the information needed by the field forces to do the work according to the design. Installation work shall be requested on Work Request, Form UCN-2546 or "Request for Work or for Requisition Form" UCN-3898, as appropriate. (See Appendices III and IV in this procedure.) After document review and approval have been completed as stated in Paragraph 6.3, the installation documents shall be sent to the Engineering Services Department for placement of work.

The Engineering Services Department shall release the construction drawings to the installation forces on "Work Request Form" UCN-2546 or

other appropriate forms. The Engineering Services Department shall also send construction drawings and other necessary documents to the Y-12 Mechanical Inspection Department and ORNL Inspection Engineering Department, as applicable.

6.4.2 Quality Control Evaluation

An evaluation of the quality control program and procedures of the installation forces shall be conducted jointly by the project engineer, Engineering Services Department, DQAC-RD, and ORNL Inspection Engineering Department (when applicable). All applicable groups shall concur that the installation forces understand and meet the requirements of the Quality Assurance Program.

6.5 Control of Configuration

The installation forces shall be authorized to do only construction and installation work that is shown on drawings, stamped "Certified for Construction" by the Reactor Division Design Department and approved procedures or as instructed by the project engineer.

The use of sketches for minor items may be authorized by the project engineer. This shall be done only in special cases and the sketches shall be approved by the Reactor Division Design Department Head or his designee before procurement and construction are initiated.

When necessary, minor field changes to approved drawings, specifications, and procedures shall be handled by the project engineer in the following manner: (1) The change shall be made and signed by the project engineer. In addition, the change shall be documented as stated in Paragraph 6.5.1, "Changes to Approved Drawings." (2) The design documents shall be revised by the Design Department of the Reactor Division prior to initial operation of the test stand.

It shall be the responsibility of the project engineer to notify the DQAC-RD of any change which alters the quality assurance requirements of the job.

Requests for changes in drawings, procedures, and specifications, after approved documents have been issued, shall originate with the project engineer as specified in Paragraph 6.5.1.

Revised design documents and procedures shall be reissued to the installation forces and inspection agencies in the manner used to issue the original documents; see Paragraphs 6.3 and 6.4.

It shall be the responsibility of the inspector from the Y-12 Mechanical Inspection Department or the ORNL Inspection Engineering Department, as applicable, to check and verify that the installation personnel have received and are using the latest revised documents for all pressure vessels and Quality Level 1 and 2 equipment and systems.

6.5.1 Changes to Approved Installation Drawings

Significant changes or waivers to approved design documents shall be reviewed, approved, documented and reissued by the Reactor Division Design Department in the manner used to prepare the original documents. These changes shall be requested by the project engineer on a "Request for Design Service," Form UCN-5158. (See Appendix V of this procedure.)

Minor field changes to approved drawings may be authorized by the project engineer. Each change shall be described in detail including Engineering Job Number, and forwarded for approval to the Reactor Division Design Department on a three-copy "Message Form." (See Appendix VI of this procedure.) The Reactor Division Design Department Head shall return a copy of the message form to the project engineer. It shall indicate approval or disapproval (with comments) concerning the change. The project engineer may make the field change before receiving approval, however, the change shall be subject to final approval by the Reactor Division Design Department.

6.6 Construction Procurement

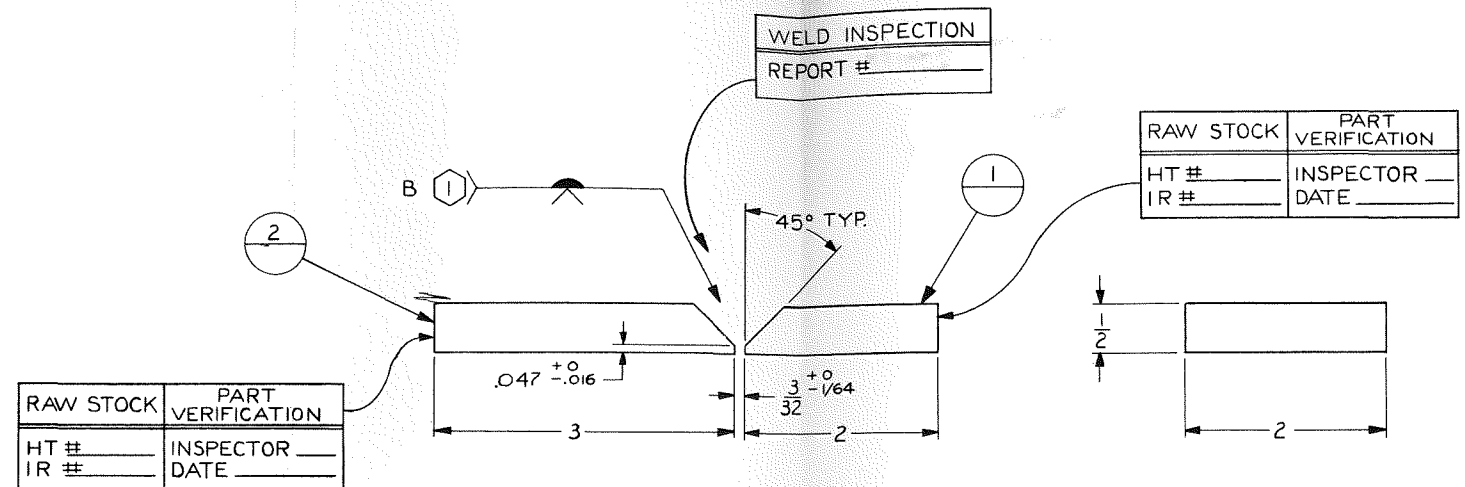
All Quality Level 1 and 2 items shall be procured according to the "Procurement" procedure of the QA Program Plan and furnished to the installation forces by the Engineering Services Department. Quality Level 3 items may be furnished by Engineering Services Department or procured by the installation forces.

All items fabricated in UCC-ND shops shall be fabricated according to the Reactor Division's Quality Assurance Procedure, Number 5, "Fabrication" and furnished to the installation forces by the Engineering Services Department.

PARTS LIST					
PART	DWG NO.	REQD	DESCRIPTION	STOCK SIZE	MATERIAL
1		1	PLATE	1/2 X 2 X 2	TYPE 304S.ST. RDT-M5-IT
2		1	PLATE	1/2 X 2 X 3	TYPE 304S.ST. RDT-M5-IT

GENERAL NOTES:

1. 1 WELD SERIAL NO. (NOT REQ'D. FOR LEVEL 3 QUALITY FABRICATION.)
2. "B" IS WELD INSPECTION SCHEDULE (OR QUALITY) SEE INSPECTION PROCEDURE, LISTED BELOW, FOR DESCRIPTION.



QUALITY LEVEL 1

CRITICAL MATERIAL
DO NOT SUBSTITUTE

RECORD COPY



WPS 302	MET-WR 201	B	MET-WR-1	MET-WS-3
WELDING	INSPECTION	INSPECTION	WELDING	OTHER
	SCHEDULE	SCHEDULE	INSPECTION	REFERENCES
INTERNAL FABRICATION		EXTERNAL FABRICATION		
WELDING & INSPECTION PROCEDURE				

SEE SECTION 3.4 FOR DRAWING APPROVALS

REFERENCE DRAWINGS	NUMBER
OAK RIDGE NATIONAL LABORATORY OPERATED BY UNION CARBIDE CORPORATION OAK RIDGE, TENNESSEE	
BLDG. NO. _____	
PLATE TO PLATE	
SUBMITTED	ACCEPTED
_____ M 10534 RM 001 C REV.	_____ APPROVED

NO REPRESENTATION OR WARRANTY, EXPRESSED OR IMPLIED, IS MADE THAT THE USE OR DISCLOSURE OF ANY INFORMATION, APPARATUS, METHOD OR PROCESS DISCLOSED IN THESE DRAWINGS MAY NOT INFRINGE PRIVATE RIGHTS OF OTHERS. NO LIABILITY IS ASSUMED WITH RESPECT TO THE USE OF, OR FOR DAMAGES RESULTING FROM THE USE OF, ANY INFORMATION, APPARATUS, METHOD OR PROCESS DISCLOSED IN THESE DRAWINGS. THE DRAWINGS ARE BEING MADE AVAILABLE FOR INFORMATION TO BIDDER AND ARE NOT TO BE USED FOR OTHER PURPOSES, AND ARE TO BE RETURNED UPON REQUEST OF THE FORWARDING CONTRACTOR.

GENERAL SPECIFICATIONS UNLESS OTHERWISE SPECIFIED: 1. BREAK ALL SHARP EDGES 2. SEE SECTION 3.4 FOR DRAWING APPROVALS 3. MACHINED SURFACE FINISH SHALL NOT EXCEED: (ASA B46.1-1962) <input checked="" type="checkbox"/>	TOLERANCES UNLESS OTHERWISE SPECIFIED: FRACTIONS ± 1/64 DECIMALS ± _____ ANGLES ± 0°-30' SCALE: FULL
---	--

NO.	REVISIONS	DATE	APPD	APPD
	DRAWN	DATE	SUBMITTED	DATE
	DESIGNED	DATE	APPROVED	DATE
	CHECKED	DATE	APPROVED	DATE

Fig. 6.2 Typical Dwg. "Approved for Construction"

6.7 Construction and Installation Control

6.7.1 Material Handling and Cleaning Control - Quality Levels 1 and 2

6.7.1.1 Raw Material. All raw materials shall be procured and released to the installation forces by the Engineering Services Department. Only material that has been inspected and bears an "Inspection Request" (IR) Number shall be used.

6.7.1.2 Raw Material Identification for Individual Parts. Material for each part shall be selected by the Engineering Services Department prior to sending the material to the installation forces. The material shall be selected in accordance with requirements specified on drawings. Only drawings stamped "Certified for Construction" and approved as stated in Paragraph 6.5 shall be used. See Fig. 6-2 for an example. The resident inspector from the ORNL Inspection Engineering Department, in cooperation with the Engineering Services Department, shall identify the material selected for each part on a record set of drawings with the material information indicated in Fig. 6-3 and as shown on Fig. 6-4. The record set of drawings shall be retained for the permanent file by the resident inspector from the ORNL Inspection Engineering Department.

CRITICAL MATERIAL
DO NOT SUBSTITUTE

<u>Raw Stock</u>	Material - Part
<u>Ht No.</u>	Verification
<u>IR No.</u>	Inspector
<u>Type</u>	Date

Fig. 6-3 Material Identification Stamps

All material destined for the installation forces shall be prepared and identified as follows:

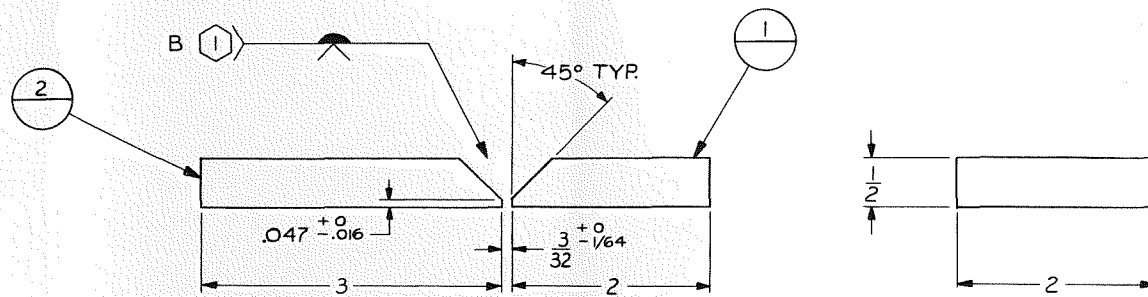
1. If a partial plate, rod or pipe is required to make a part, the raw stock shall be cut to a size approved by the installation forces. If an entire plate, rod or pipe is required to make one or more parts, the raw stock may be sent to the installation forces without cutting.

PARTS LIST					
PART	DWG NO.	REQD	DESCRIPTION	STOCK SIZE	MATERIAL
1		1	PLATE	1/2 X 2 X 2	TYPE 304 SST RDT-M5-IT
2		1	PLATE	1/2 X 2 X 3	TYPE 304 SST RDT-M5-IT

GENERAL NOTES:

1. ASTM MATERIAL WITHOUT CERTIFIED CHEMICAL & MECHANICAL PROPERTIES WILL NORMALLY BE USED FOR LEVEL 3 QUALITY FABRICATION.
2. ① WELD SERIAL NO. (NOT REQ'D. FOR LEVEL 3 QUALITY FABRICATION.)
3. "B" IS WELD INSPECTION SCHEDULE (OR QUALITY) SEE INSPECTION PROCEDURE, LISTED BELOW, FOR DESCRIPTION
4. WELD PREPARATION WILL NOT NORMALLY BE DIMENSIONED ON LEVEL 3 QUALITY FABRICATED ITEMS.

* THE DESIRED OPTIONAL REQUIREMENTS WILL BE LISTED ON THIS DWG.



QUALITY LEVEL 1



WPS 302	MET-WR 201	B	MET-WR-1	MET-WS-3
WELDING	INSPECTION	INSPECTION SCHEDULE	WELDING & INSPECTION	OTHER REFERENCES
INTERNAL FABRICATION		EXTERNAL FABRICATION		

SEE SECTION 3.4 FOR DRAWING APPROVALS

REFERENCE DRAWINGS	NUMBER
Oak Ridge National Laboratory OPERATED BY Union Carbide Corporation OAK RIDGE, TENNESSEE	
BLDG. NO. _____	

NO REPRESENTATION OR WARRANTY, EXPRESSED OR IMPLIED, IS MADE THAT THE USE OR DISCLOSURE OF ANY INFORMATION, APPARATUS, METHOD OR PROCESS DISCLOSED IN THESE DRAWINGS MAY NOT INFRINGE PRIVATE RIGHTS OF OTHERS. NO LIABILITY IS ASSUMED WITH RESPECT TO THE USE OF, OR FOR DAMAGES RESULTING FROM THE USE OF, ANY INFORMATION, APPARATUS, METHOD OR PROCESS DISCLOSED IN THESE DRAWINGS. THE DRAWINGS ARE BEING MADE AVAILABLE FOR INFORMATION TO BIDDER AND ARE NOT TO BE USED FOR OTHER PURPOSES, AND ARE TO BE RETURNED UPON REQUEST OF THE FORWARDING CONTRACTOR.

GENERAL SPECIFICATIONS	TOLERANCES UNLESS OTHERWISE SPECIFIED:
UNLESS OTHERWISE SPECIFIED:	FRACTIONS ± 1/64
1. BREAK ALL SHARP EDGES	DECIMALS ± _____
2. TYPE, GRADE, OR FINISH OF MATERIAL MAY BE CHOSEN BY FABRICATOR.	ANGLES ± 0°-30°
3. MACHINED SURFACE FINISH SHALL NOT EXCEED: (ASA B46.1-1962) ✓	SCALE: FULL

NO.	REVISIONS				DATE	APPD	APPD
	DRAWN	DATE	SUBMITTED	DATE			
	DESIGNED	DATE	APPROVED	DATE	APPROVED	DATE	
	CHECKED	DATE	APPROVED	DATE	APPROVED	DATE	

PLATE TO PLATE					
SUBMITTED		ACCEPTED		APPROVED	
M	10534	RM	001	C	REV.

Fig. 6-4 Record Copy of Component Drawing

2. One or more cardboard tags with the following information shall be taped or attached in an appropriate manner to every piece of raw stock by the resident inspector from the ORNL Inspection Engineering Department.

PART IDENTIFICATION TAG

Engineering Job No. _____

Dwg. No. _____

Part No. _____

Heat No. _____

IR No. _____

Part Accepted _____

Part Rejected _____

Inspector _____

Date _____

Fig. 6-5 Part Identification Tag

3. A tag shall be prepared for every part except where there are two or more small parts (such as screws, etc.) of identical design made from the same piece of raw material. In this case the parts shall be bagged and the tag attached to the outside of the bag.

The Engineering Services Department shall be responsible for shipping all Quality Level 1 and 2 materials to the installation forces.

6.7.1.3 Part Identification in Installation Cycle. The part identification tag shall be retained on each part during the installation cycle and until the part is welded or attached to a component. If for any reason the part identification tag has to be removed during the installation cycle, it shall be the responsibility of the inspector from the Y-12 Mechanical Inspection Department to verify that the part identification tag has been reattached to the proper part.

Immediately prior to assembly or welding, the inspector from the Y-12 Mechanical Inspection Department shall check and verify that parts

have been made from material specified on the drawings. This verification shall be entered on the Weld Inspection Reports, Form UCN-1149A (Appendix VII of this section) for welded items and on the inspector's drawings for nonwelded items. See Figure 6-4. When installation is completed the inspector shall forward the drawings to the Engineering Services Department for review, final approval, entering of inspection results on the record set of drawings, and storage by the ORNL Inspection Engineering Department.

If material identification is removed during installation and cannot be identified by the inspector, the inspector shall reject the part, note it on a "Part Identification Tag," (Fig. 6-5) and follow instructions in Paragraph 6.7.6, "Control of Nonconforming Items."

6.7.1.4 Identification of Welds. Drawings of parts shall have details for weld preparations, American Welding Society (AWS) weld symbols, serial numbers and inspection schedules for all welds, welding and weld inspection procedures and other general welding information. An example of this identifying information is shown on Fig. 6-2.

The inspector from the Y-12 Mechanical Inspection Department shall check the base and filler metal,^a inspect, and fill out a weld inspection report, UCN Form 1149A, as each weld is made. Base metal verification shall be made as stated in Paragraph 6.7.1.3. The weld inspection report shall have a serial number and this serial number shall be stamped on the inspector's copy of the applicable component drawing at the weld symbol by the inspector from the Y-12 Mechanical Inspection Department. See Fig. 6-4.

Cleanliness and/or Heat Treating Reports, Form TX-3245, or other appropriate forms shall have a serial number, and this serial number shall be stamped on the inspector's copy of the applicable component drawing. Nonconforming items will be processed according to Paragraph 6.7.6.

The radiographs associated with each weld report shall be identified by Engineering Job Number, drawing number, weld serial number, and weld report number. When each weld or group of welds is completed, the inspector shall forward the weld inspection report, radiographs, ultrasonic

^aWeld filler metal with certified chemical and physical properties shall be furnished by Engineering Services Department and/or ORNL Inspection Engineering Department.

reports, and cleaning and heat treating reports (as applicable) to the Engineering Services Department. The Engineering Services Department shall forward the reports to the resident inspector of the ORNL Inspection Engineering Department for review, approval, entering of inspection results on the record set of drawings, approval, and filing.

6.7.1.5 Material Control-Quality Level 3. Material for Quality Level 3 jobs shall be furnished by Engineering Services Department or procured by the CPFF contractor or obtained from UCC-ND stores by the Y-12 Research Services Department. It shall be procured in accordance with requirements specified on approved drawings.

Material identity shall not be documented during the various installation activities. However, normal good practices shall be exercised to maintain correct material identity and control.

6.7.1.6 Cleaning. Cleaning of items, when required, shall be performed and reported in accordance with applicable procedures on drawings and in Appendix B of the QA Program Plan.

6.7.2 Special Process Control

Requests for qualification or verification of new or special processes shall originate with the project engineer. When special or new processes are required the installation forces shall qualify the process by fabricating one or more test pieces and presenting them to the Engineering Services Department for review, evaluation, and approval by the project engineer.

6.7.3 Training and Certification

Management of the installation forces shall be responsible for the quality of the work their forces produce by providing qualified personnel, proper tools, and planning to perform the construction, assembly, and installation work.

All welding shall be performed by qualified welders using detailed procedures qualified by ORNL except as follows. When work is performed by Y-12 forces, their welding procedures may be used if submitted in advance to the Engineering Services Department for approval by the ORNL Inspection Engineering Department and the project engineer.

All welding procedures to be employed, regardless of origin, together with their qualification test results, and records of performance qualification tests of welders qualified to those procedures shall be examined and approved by the ORNL Inspection Engineering Department before any welding is done. See applicable welding procedures in Appendix B of the QA Program Plan.

Nondestructive testing personnel at ORNL shall be formally qualified and certified in accordance with RDT Standard F 3-6 T. Y-12 Plant personnel at the Y-12 job site performing radiography and applying penetrant shall be qualified but conversely to ORNL - personnel may not be formally certified. In this case an ORNL inspector qualified and certified as a Level II inspector to the ORNL Inspection Engineering Department's QA Procedure Manual, Section 2, "Certification of NDT Personnel" shall be responsible for the interpretation of the results of radiographic and penetrant inspections for Quality Level 1 and 2 items.

All nondestructive examinations in ORNL shall be performed using detailed procedures qualified by ORNL and based on RDT Standard F 3-6 T. The applicable procedures are listed in Appendix B of the QA Program Plan.

When installation work is performed by Y-12 Plant installation forces, their nondestructive procedures may be used if submitted in advance to the Engineering Services Department and approved by the ORNL Inspection Engineering Department and the project engineer.

6.7.4 Interface Control

The installation forces shall coordinate all construction and installation interface activities.

6.7.5 Equipment Calibration and Standards

All instruments designated Quality Level 1 or 2 shall be calibrated and alarm and action set points checked prior to installation in and/or prior to operation of the test stand. Instruments designated Quality Level 3 shall be calibrated when requested by the project engineer. The calibrations, using applicable testing procedures in Appendix B of the QA Program Plan, shall be performed by the Y-12 Gage Certification Laboratory and the Y-12 Physical and Electrical Standards Laboratory or by

qualified personnel in the installation organization using test equipment calibrated according to Y-12 Plant procedures in Appendix B of the QA Program Plan. Special calibration procedures shall be prepared by the instrument design engineer or his designee, when calibration is determined to be necessary by the instrument design engineer or project engineer.

If approved by the project engineer, instruments may be calibrated by any qualified UCC-ND instrument shop in the Oak Ridge Operations area. The calibration shall be performed by qualified personnel using written procedures that have been approved by the engineer responsible for instrument design of the test or experiment.

A curve, chart or data sheet shall be made for each calibration and sent to the project engineer. A listing of calibration and test frequency for each device shall be furnished the project engineer by the instrument designer.

6.7.6 Control of Nonconforming^a Items

It shall be the responsibility of the inspector from the Y-12 Mechanical Inspection Department to determine and inform the project engineer, by way of the Engineering Services Department, of the existence of any nonconforming construction and installation activities except electrical and instrumentation. Nonconforming instrumentation and electrical items and systems shall be detected and the existence reported to the project engineer by the designated inspectors responsible for the inspection of the items.

The project engineer shall determine if the nonconforming work should be rejected, repaired,^b reworked,^c or accepted. His action, including reasons, shall be reported in accordance with Paragraph 6.5.1, "Changes to Approved Drawings" in a letter to the Engineering Services Department

^aA characteristic of an item that does not conform to a specified requirement.

^bThe process of restoring a nonconforming characteristic of an item to an acceptable condition, although it does not conform to a specified requirement.

^cThe process by which a nonconforming item is made to conform to specified requirements.

with copies to the ORNL Inspection Engineering Department, the DQAC-I & C, if applicable, and to the DQAC-RD. Copies of reports of damaged or non-conforming items that may affect the schedule of the program shall be sent to the program director.

Nonconforming items shall be identified on the "Part Identification Tag" or other appropriate means and segregated from conforming items until final disposition is made. Final disposition of items shall be indicated on the inspection reports.

6.8 Inspection

6.8.1 Source Inspection

Not applicable.

6.8.2 Receiving Inspection

6.8.2.1 Procured Items. Items procured by Engineering Services Department shall be inspected according to applicable paragraphs of the "Procurement" procedure of the QA Program Plan before delivery to the job site.

6.8.2.2 Company Fabricated Items. Items fabricated in UCC-ND shops shall be inspected according to applicable paragraphs of the "Fabrication and Assembly" procedure of the QA Program Plan before delivery to the job site.

6.8.2.3 Existing Items. If existing equipment and material, qualified under previous programs are to be used for Quality Levels 1, 2, and 3 applications and they do not conform to requirements established for new equipment and material, additional inspections, as appropriate and practical, shall be utilized. The additional inspections shall establish that the equipment and material are adequate, reliable, and safe even though the risks may be higher than for conforming equipment. When such nonconforming equipment and material are used it shall be documented by the project engineer and distributed for review and approval by the Program Director, Reactor Division Management, and the DQAC-RD. The discussions shall include problems and reasons for the use of such nonconforming equipment and material.

Special step-by-step inspection procedures and check lists shall be prepared by the project engineer or his designee for all Quality Level 1 and 2 items, and they shall be independently reviewed and approved by one or more persons qualified in the planned inspection activity. In addition, the DQAC-RD shall review and accept all Quality Level 1 and 2 procedures before they are used. See applicable special procedures in Appendix B of the QA Program Plan.

The need for preparation and independent review of special inspection procedures for Quality Level 3 item shall be determined by the project engineer.

6.8.3 Site Inspection

The inspector from the Y-12 Mechanical Inspection Department or ORNL Inspection Engineering Department shall be responsible for performing and documenting all inspection and testing activities, except for instrumentation and electrical items and systems, during construction and installation at the job site. Inspection activities shall include welding, nondestructive testing, cleanliness, and dimensional checks. The results of these inspection activities shall be interpreted according to drawing requirements and applicable procedures in Appendix B of the QA Program Plan.

The project engineer or his designee shall inspect the installed electrical items and instrumentation.

The inspectors shall be authorized only to accept items and systems that meet the minimum inspection and test requirements specified in this document, on drawings, specifications and procedures.

6.8.4 Installation Inspection

Inspections and tests shall be performed after installing assemblies, subsystems and systems to verify that installation has been accomplished in accordance with design drawings, specifications, and codes. These inspections and tests shall include pressure and leak tests, cleanliness, electrical continuity and function, and visual examination for completeness and configuration. Nonconforming items shall be processed according to Paragraph 6.7.6.

6.8.4.1 Inspection of Installed Mechanical Systems. These inspection activities shall include checks for completeness, configuration, cleanliness, and pressure and leak testing.

Procedures as appropriate shall be prepared by the project engineer for all Quality Level 1 and 2 systems, and they shall be independently reviewed and approved by one or more persons qualified in the planned inspection activity. In addition the DQAC-RD shall review and accept all Quality Level 1 and 2 procedures before they are used. The procedures shall include a step-by-step outline of the inspection requirements and a check list with appropriate signature spaces to assure that each inspection is accomplished. The project engineer shall determine the need for the preparation and independent review of special inspection procedures for Quality Level 3 items.

6.8.4.2 Inspection of Installed Instrumentation and Electrical Systems. Installation of instrumentation shall be inspected and documented by the project engineer or the instrument design engineer when designated by the project engineer. Electrical construction and installation work shall be inspected and documented by the project engineer or the electrical engineer in the Engineering Services Department when designated by the project engineer. The tests shall consist of performing terminal-to-terminal wire checks and functional tests on all circuitry. The results shall be recorded by the inspector initialing a record set of instrument and electrical schematic drawings. Initials shall be applied only after the operation of every contact or device indicates that the equipment will perform as intended. The correct position of the contacts for all relays shall be checked for the normal, operate and emergency position. The Y-12 Research Services Department shall assist in performing the tests.

Procedures, as appropriate, shall be prepared by the project engineer or his designee for all Quality Level 1 and 2 and instrumentation and electrical items. These procedures shall be reviewed as specified in Paragraph 6.8.4.1. All sets of record drawings and special inspection results shall be forwarded to the project engineer after all circuits have been checked and verified that they are operating as shown on drawings. After preoperational testing is completed the project engineer

shall forward the record documents to the resident inspector of the ORNL Inspection Engineering Department for filing. It shall be determined by the project engineer at this time that all appropriate instrumentation has received a recent calibration.

6.9 Preoperational Testing

The project engineer or his designee shall be responsible for the preoperational testing (shakedown) of the test stand. It shall consist of operating each subsystem and finally the entire system, but without the test fluid, if practical, to verify that all subsystems, individually and collectively, are functioning properly. The project engineer shall provide all the procedures, check lists, and necessary documentation.

The shakedown shall consist of operating all mechanical equipment and systems. Instrumentation shall be checked for proper response. The alarm and safety systems shall be checked for proper set points and responses.

Operational tests of all electrical equipment, including controls and alarms shall be made to assure that the equipment has been wired properly and that the correct control actions are initiated. Electric preheaters shall be energized and their corresponding thermocouples checked for proper response.

6.9.1 Acceptance for Operation

Final acceptance of the test stand for operation shall be made by the project engineer acting as a delegate of the Program Director and reviewed by the DQAC-RD. It shall not be accepted until all requirements of the Quality Assurance Program, including the preoperational tests, have been met satisfactorily and written notification has been received from the ORNL Inspection Engineering Department and designated inspectors indicating that requirements of the mechanical, electrical, and instrumentation quality assurance programs have been met satisfactorily.

6.10 Quality Control Records

Quality control records for items and systems that have been installed at the job site shall be forwarded by the Y-12 Mechanical Inspection Department and the project engineer to the resident inspector of the ORNL Inspection Engineering Department for permanent filing. The quality control records shall include, as applicable, all record drawings, welding inspection records, personnel and procedure qualifications, inspection and test records, and results of the disposition of rejected or nonconforming items and systems. These records shall have the Engineering Job Number on each document, and they shall be filed according to Engineering Job Number, Component Title and/or Drawing Number.

The files shall be maintained, as a minimum, for the life of the project with which the experiment is associated. The files shall not be destroyed without the written approval of the Operating Department Head.

6.11 Quality Audits

The quality assurance functions related to installation shall be audited in accordance with the Reactor Division's Quality Assurance Procedure, Number 8, Activity Audit.

APPENDIX I

DEFINITIONS OF QUALITY LEVELS

Quality Level I is normally assigned to a component or system that cannot be easily inspected while in-service because of radioactive contamination and/or high radiation fields and in which failure could (1) cause an extended delay in the completion of the project or in the program supporting the project, (2) cause serious or costly damage to a significant portion of the system or the facility in which it is located, or (3) create a hazardous condition.

Normally, Quality Level I is associated with components of the reactor primary system, with some components of in-pile circulating loops, with certain fueled and nonfueled irradiation capsules, and with those components of a nuclear fuel processing plant that are in contact with the main processing stream. Operation of the project is normally expected to continue for an extended period of time in fields of intense neutron flux and/or at high levels of radioactivity.

Quality Level II is normally assigned to a component or system with or without the presence of radioactivity, in which failure could (1) cause an extended delay in the project or in the program supporting the project, (2) cause serious or costly damage to a significant portion of the system or the facility in which it is located, or (3) create a hazardous condition.

Normally, Quality Level II is associated with engineering-scale experiments operating outside of a reactor system that are designed to operate at high pressure and/or high temperature, with noncritical components of an in-pile loop, with a reactor secondary system, and with some reactor facilities and experiments that are not in-core.

Quality Level III is normally assigned to a component or system in which failure will (1) not cause an extended delay in the completion of the project, or (2) not cause costly destruction of the project.

Normally, Quality Level III is associated with laboratory-scale experiments, with noncritical components or systems of engineering-scale experiments, and with electrical, structural, and piping systems that are under the jurisdiction of the various industrial codes.

Quality Level IV is normally assigned to components or systems that are associated with bench-scale low-cost experiments operating at low pressure and which contain either nonhazardous materials or small quantities of toxic materials that are suitably contained. Laboratory service systems not governed by Quality Level III requirements may be assigned to Quality Level IV.

Note 1: Some components purchased to a Quality Level III from reliable vendors who have a long well-documented history for high-quality products may under certain circumstances be used in a Quality Level II system.

Note 2: The replacement of a minor component or a minor section of an existing system may be performed to the standards used in the original design of the system, however, if a significant component or section of the system is replaced, it must be designed and installed in accordance with this quality level guide.

Note 3: Redundant circuit designs using components from reliable vendors may qualify for Levels I and II application.

APPENDIX II

APPENDIX II

GUIDE FOR CONSTRUCTION CONTRACTOR AND Y-12 MAINTENANCE PARTICIPATION IN WORK ORDERS

Basis: All Government funded work estimated to cost \$2,000 or more is covered by the Davis-Bacon Act. The Act requires that prevailing area construction wages be paid for construction work.

OPERATING CONTRACTOR	CONSTRUCTION CONTRACTORS							
<p style="text-align: center;">Y-12 MAINTENANCE PARTICIPATION</p> <p>(Reference: AEC Manual, Chapter 9116, Labor Laws)</p> <p>Operational Activities Excluded From Davis-Bacon</p> <p><u>Group I Activities:</u></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">1. Engineering</td> <td style="width: 50%;">4. Maintenance</td> </tr> <tr> <td>2. Procurement</td> <td>5. Production</td> </tr> <tr> <td>3. Shop Fabrication</td> <td>6. Research & Development</td> </tr> </table> <p><u>Group II Activities:</u></p> <ol style="list-style-type: none"> 1. Risk to protection of life and property or to continuity of operations. 2. Installation not involving substantial construction. 3. Adjustments or improvements in machining or equipment. 4. Overhaul and reworking component parts. 5. Minor modifications including tie-ins. 6. Movements and reinstallation of equipment. 7. Process Advancements. 8. Development of models and pilot-type equipment. 9. Decontamination. <p>Group II activities must not involve a temporary increase and subsequent decrease in Y-12's force of mechanics and/or laborers.</p>	1. Engineering	4. Maintenance	2. Procurement	5. Production	3. Shop Fabrication	6. Research & Development	<p style="text-align: center;">FIXED FEE CONTRACTOR PARTICIPATION (CPFF)</p> <p>(Reference: AEC, ORO Policy)</p> <p><u>Job Conditions:</u></p> <ol style="list-style-type: none"> 1. Construction is located in an operating area of a building and is of such a nature that the complete scope cannot be developed until the demolition is completed and the condition of the existing material determined. 2. Construction is located in a congested production area of a building. The work will have to be very closely coordinated with operations and accomplished with a minimum of interference. The construction schedule will be subject to interruptions when necessary to meet production requirements. 3. Construction is located in a production area of a building which is subject to temporary contamination from time to time. The construction schedule may be interrupted by contamination or production commitments. 4. Construction is urgently needed to accelerate a specific program. There is not sufficient time to prepare complete engineering, plans and specifications necessary to accomplish the work by lump-sum contract without delaying this program. 5. Adequate plans and specifications are not available for the construction project and none will be prepared. The work will be field directed. 6. The amount of time and cost involved to prepare complete engineering, plans and specifications necessary to accomplish the construction (less than \$5,000) by lump-sum contract cannot be justified. 	<p style="text-align: center;">LUMP-SUM CONTRACTOR PARTICIPATION</p> <p>(Reference: AEC, ORO Policy)</p> <p>All construction activities that can be described adequately for bid and pricing purposes.</p>
1. Engineering	4. Maintenance							
2. Procurement	5. Production							
3. Shop Fabrication	6. Research & Development							
<p><u>CONCLUSION:</u> Field work activities that can be defined as items of Group I or Group II above may be recommended for Y-12.</p>	<p><u>CONCLUSION:</u> Construction having one or more of the conditions listed above may be recommended for a fixed fee contractor (CPFF).</p>	<p><u>CONCLUSION:</u> All construction, when possible, should be recommended for lump-sum contractor participation.</p>						

APPENDIX VI

INSTRUCTIONS TO SENDER

- 1. DETACH YELLOW COPY
- 2. SEND WHITE AND PINK PARTS WITH CARBON TO PERSON ADDRESSED.

50012

INSTRUCTIONS TO RECIPIENT

- 1. WRITE REPLY AT BOTTOM.
- 2. DETACH STUB, RETAIN WHITE COPY AND RETURN PINK COPY TO SENDER.

To:

SUBJECT

DATE

Reply Message

FOLD Y

M
E
S
S
A
G
E

SIGNED

DATE OF REPLY

REPLY TO

R
E
P
L
Y

SIGNED

RECIPIENT

DETACH AND FILE FOR FOLLOW-UP

APPENDIX VII

WELD INSPECTION REPORT

DISTRIBUTION:				Report No.	
				DRAWING NUMBER	
				WORK ORDER NUMBER	
				DATE	
COMPONENT TITLE				WELD NUMBER	
WELDING SPECIFICATION		WELDING PROCESS		TYPE JOINT	
INSPECTION SPECIFICATION			INSPECTION SCHEDULE		
BASE MATERIALS			FILLER METAL		
TYPE			TYPE		
IR			IR		
HEAT			HEAT		
MFG.			MFG.		
LOT NO.			ITEM		
FORM			SIZE		
ITEM					
PIECE					
SIZE					
WELDER					
WELDER'S NAME			BACK-UP GAS		
			A He		
FITTER'S NAME			COVER GAS		
			A He		
INSPECTION					
		DISPOSITION		APPROVED	
CLEANLINESS					
FIT-UP					
ROOT PASS					
PENETRANT: DEFECTS					
INTERMEDIATE PASSES					
PENETRANT: DEFECTS					
FINAL PASSES					
PENETRANT: DEFECTS					
RADIOGRAPHY					
ULTRASONIC					
WELDING VARIABLES		VOLTS	AMPS	INTER PASS TEMP.	
REMARKS:					
INSPECTOR'S SIGNATURE			DATE	FINAL ACCEPTANCE	DATE



REACTOR DIVISION

Quality Assurance Procedure 7

OPERATION, MAINTENANCE, AND MODIFICATION

FAILED FUEL MOCKUP (FFM) TEST STAND
(IMFBR PROGRAM)

C. K. McGlothlan

February 1970

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7. OPERATION, MAINTENANCE, AND MODIFICATIONS

7.1 Scope

This procedure provides for the quality assurance program requirements, policies and controls to be invoked and satisfied by the Reactor Division of the Oak Ridge National Laboratory (ORNL) during the operation and maintenance phases of the Failed Fuel Mockup (FFM) test stand. The requirements, policies, and procedures include: planning for operation and maintenance of the test stand, equipment, and facilities; control of operating modes or conditions and maintenance of systems and components; training of personnel; control of modifications, preparation of records, and the auditing of methods and activities. These requirements, policies, and procedures are intended to assure that controls are established and test stand and equipment are operated, maintained, and modified in accordance with FFM program plans,^{4,5,6} the Quality Assurance Program Plan, the applicable codes, standards, drawings, specifications, and predetermined safety restrictions.

7.2 Planning

Planning for operation, maintenance, and modifications is outlined in Sections 2 and 4 of the FFM Program Plan,⁵ and detailed in subsequent paragraphs of this section.

7.3 Organizations

7.3.1 Responsibility and Authority

The project engineer - test operator^a is responsible for the startup, normal, upset and shutdown operations of the test stand. The test stand shall be operated during the day shift by the project engineer with the assistance of support help within the Operating Department. It shall be operated on off shifts by property trained shift personnel. In addition,

^aFor small and medium size jobs the project engineer, usually, is responsible for operating the test stand and for collecting and reporting data.

the project engineer or his designee shall be responsible for determining the need and requesting all necessary preventive, failure and overhaul maintenance activities.

The Y-12 Research Services Department shall provide qualified maintenance personnel to perform all maintenance activities done in the Y-12 Plant. An electrical engineer from the Engineering Services Department and an instrument engineer from the Instrumentation and Controls Division shall assist the project engineer and the Y-12 Research Services Department in the maintenance activities. Inspectors from the Y-12 Mechanical Inspection Department and the ORNL Inspection Engineering Department shall assist, as requested by the project engineer. Special maintenance activities may be done in other UCC-ND plants when appropriate and approved by the project engineer.

7.3.2 Training and Certification

The project engineer shall be responsible for the training of all test stand operators. When possible, the training shall include participation in the design, fabrication, installation, and shakedown activities of the test stand and a review of the operating and test procedures and emergency shut down procedures. Shift personnel monitoring test stand operation shall be similarly trained but may not participate in activities prior to shakedown operations. Trained personnel from the Reactor Division and special fire fighting equipment shall be provided to fight sodium fires in case of an accident.

Management of the Y-12 Research Services Department shall be responsible for the quality of the maintenance work their forces produce by providing qualified personnel, proper tools and planning.

All welding shall be performed by welders qualified and certified according to ORNL Welding Procedures in Appendix B of the QA Program Plan.

Nondestructive testing personnel at ORNL shall be formally qualified and certified in accordance with RDT Standard F 3-6 T and ORNL "Inspection Engineering Quality Assurance Policies and Procedure Manual" Section 2, Certification of NDT personnel. Y-12 Plant personnel at the Y-12 shops and the Y-12 job site performing radiography, applying penetrant and

performing other nondestructive testing operations shall be qualified but may not be formally certified. However, in this case an ORNL inspector qualified and certified as a Level II inspector according to ORNL Inspection Engineering Department Procedure Manual, Section 2, "Certification of NDT Personnel" shall be responsible for the interpretation of the results of radiographic and penetrant inspections for Quality Level 1 and 2 work.

7.4 Operation Control

7.4.1 Operating Objectives

The operating objectives of the FFM test stand are given in Sections 1 and 2 of the FFM Program Plan⁵ and in subsequent detailed test program proposals.

7.4.2 Procedures

The project engineer and/or his designee shall prepare an operating manual for the test stand. The manual shall be based on Section 4 of the FFM Program Plan,⁵ "as-built" design documents, and Section 7 of this document.

Included in the manual shall be procedures to describe actions required for startup, normal and upset operations, emergencies and for shutdown. Emergency procedures shall be posted in clear view on the control panels. A simplified isometric diagram shall be posted at the control panel which shall indicate the location of thermocouples, electric heaters and their controllers. A simplified flow diagram shall also be available at the control panel.

Data sheets shall be prepared, as appropriate, to record the required test program information from the operation of the test stand and the test piece.

Instructions to shift personnel shall be in writing on Forms UCN 1507 (see Appendix I in this procedure).

7.4.3 As-Built Verification

The project engineer shall determine that objectives and performances defined during the design phase have not been degraded during procurement,

fabrication and installation of the test stand. The project engineer shall be responsible for requesting that all drawings and other design documents needed for operation and maintenance be revised and reissued to show as-built conditions before placing the test stand in operation. A set of drawings marked to show "as-built" changes shall be filed by the project engineer until the changes have been incorporated on revised drawings.

7.4.4 Technical Specifications

Descriptions of the operating capabilities of the test stand, its systems, and equipment shall be given in the operating manual. See Paragraph 7.4.2 of this document. These descriptions shall identify design features and establish operating limits, safeguards, and requirements for the systems and equipment to be operated. Procedures shall be prepared to implement this feature of the Quality Assurance Plan.

7.4.5 Document Control

The project engineer shall be responsible for the preparation, approval, and release of documents required for operation. These documents including procedures, specifications and analyses shall be reviewed by the Operating Department Head before they are used. The designers shall review operating documents if considered necessary by the project engineer.

7.4.6 Operation Review

Reviews of operating objectives, and safety and test methods, procedures and test methods shall be conducted as appropriate but not less than once per month during operation of the test stand or experiment. The review shall be attended by the Program Director, Operating Department Head, project engineer, and other appropriate personnel. Significant changes in policies and objectives shall be documented by the project engineer and distributed to appropriate personnel.

7.5 Maintenance Control

This section covers the quality assurance requirements, policies, and procedures to be invoked by the Reactor Division during preventive and replacement maintenance.

7.5.1 Maintenance Policy

The maintenance quality assurance requirements, policies, and procedures are intended to assure that the maintenance program is conducted in accordance with planned methods and controls that assure that equipment, systems, and facilities are maintained reliably safely and in accordance with project objectives. The project engineer shall initiate or approve the start of all maintenance work and he shall accept all installed or repaired items, systems, and services after maintenance.

Qualified personnel from the Y-12 Mechanical Inspection Department, Y-12 Safety Department, the ORNL Inspection Engineering Department, ORNL Instrumentation and Controls Division, and the Engineering Services Department, as applicable, shall assist the project engineer in maintaining quality control. The personnel from these groups that are performing quality control functions are independent of direct control by the Y-12 Research Services Department, the organization performing maintenance.

7.5.2 Work Instructions

Requests for maintenance shall be initiated by the project engineer or his designee. The project engineer or his designee shall be responsible for determining that the documentation contains all the information needed by the maintenance forces to do the work. Minor routine and preventative maintenance shall be requested on "Maintenance Work Request," Form UCN-2546. Major maintenance work shall be requested on "Request for Work or for Requisition," Form UCN-3898. See Appendices III and IV in this procedure.

A "Safety Work Permit," Form UCN-3694, (Appendix V in this procedure) shall be issued to the maintenance personnel. It shall be issued by the project engineer whenever necessary. It shall indicate the safety precautions that have been completed prior to starting work and the protective equipment required to perform the maintenance work in a safe manner.

Maintenance supervision shall be responsible for providing maintenance craftsmen with complete information relating to the maintenance work and the information shall include all detailed instructions, procedures, and drawings provided by the project engineer or his designee.

Preventive and replacement maintenance activities shall be accomplished as follows:

Preventive Maintenance

1. Special instructions shall be prepared, as necessary, to detail maintenance procedures, schedules, and step-by-step actions required to accomplish the maintenance. The project engineer or his designee from the Instrumentation and Controls Division, the Y-12 Research Services Department, and the Engineering Services Department shall prepare the special procedures.
2. Procedures in the Y-12 Research Services Department "Maintenance Manual" shall be used, as applicable, for maintenance operations.

Replacement Maintenance

The replacement of a sodium system component in the test stand shall be performed in accordance with Procurement, Fabrication, Construction, and Installation sections of the QA Program Plan.

7.5.3 Special Processes

The project engineer shall review and approve all special processes, tools and devices required for maintenance activities.

7.5.4 Parts and Materials

The project engineer or his designee shall be responsible for requesting the procurement of all spare parts and materials. The Engineering Services Department shall be responsible for identifying, storing, issuing and keeping records for spare parts and materials. These activities shall be performed in accordance with quality assurance requirements of the original Design and Procurement sections of the QA Program Plan.

7.5.5 Documents

The project engineer or his designee shall be responsible for the preparation, approval, and release of documents required for maintenance. These documents including procedures, specifications and instructions shall be reviewed before they are used.

7.5.6 Maintenance Review

Requests for major maintenance work shall be reviewed by personnel designated below to assure that technical and quality assurance requirements are complete and appropriate.

<u>Documents</u>	<u>Reviewer</u>	<u>Review Function</u>
<u>For Engineering Services Dept.</u>		
Request for Work (Form UCN-3898) with Supplementary Drawings, Specifications, and Instructions	1. Project Engineer	a) Required Approvals
	2. Operating Department Head	a) Need for Item b) Proper Description c) Charge Account
	3. Department Head Engineering Services	a) Approval by Operating Department Head b) Support Documents Attached c) Review for Installation Action and Assignment

Maintenance Work Requests, Form UCN-2546, for minor routine and preventative maintenance shall be issued by the operating technician directly to the maintenance personnel.

The project engineer or his designee from the ORNL Instrumentation and Controls Division, the Engineering Services Department, the Operating Department, and the DQAC-RD shall monitor the preventive maintenance operations to determine the effectiveness.

7.6 Modification

Major modification to the test stand shall be performed in accordance with the Design, Procurement, Fabrication, Construction, and Installation Sections of the QA Program Plan.

7.7 Surveillance

An operating log shall be kept by the operating technicians for the purpose of documenting the chronological history of events pertaining to operation, maintenance, and modification or repair. This log and the shift log, Form UCN-1508 (Appendix VI in this procedure) shall be checked daily by the project engineer to assist in the detection and prevention of failures and the improvement of test stand availability.

7.8 Inspection and Testing

The project engineer shall be responsible for requesting that all instruments used for operation and data collection be calibrated before initial operation and as necessary during operation but not less frequent than each six months.

The Y-12 Research Services Department shall be responsible for calibrating these instruments using test equipment that has been routinely checked and verified as having known valid relationship to the National Bureau of Standards, the Y-12 Gage Certification Laboratory, and the Y-12 Physical and Electrical Standards Laboratory.

The instruments shall be calibrated according to "Procedure for Calibration of Measuring and Test Equipment in the Y-12 Plant" listed in Appendix B of the QA Program Plan or according to special procedures prepared by the project engineer or his designee. If approved by the project engineer, instruments may be calibrated by any qualified UCC-ND instrument shops in the Oak Ridge Operations area. The calibration shall be performed by qualified personnel using written procedures that have been approved by the engineer responsible for instrument design of the test stand or experiment.

Certificates of calibration in the form of data sheets, curves, or charts shall be provided and forwarded to the project engineer by the appropriate instrument shop each time an instrument is calibrated. The project engineer shall collect and file these certifications with other operating documents.

7.9 Test Equipment Calibration and Standards

The Y-12 Research Services Department shall be responsible for having their test equipment such as potentiometer and pressure testing devices scheduled in the Y-12 Plant Instrument Certification Program. See "Procedures for Calibration of Measuring and Test Equipment and Equipment in the Y-12 Plant" in Appendix B of the QA Program Plan.

7.10 Incident^a Reporting and Corrective Action

Incidents as defined by Laboratory Management shall be reported by the project engineer using the format in Appendix II of this section, approved by the Reactor Division Director, and forwarded to the ORNL Quality Assurance Director for approval and distribution to USAEC.

7.11 Quality Assurance Records

Operating records shall be maintained by the project engineer throughout the operation, maintenance, and modification phases of the test stand. They shall be filed according to Engineering Job Number and Title. The records shall include operating logs, instrument calibration history, operational reviews, maintenance data, inspection and test results, incident reports with corrective action status, and quality assurance audits. After termination of test stand operation the records, excluding test data, shall be forwarded to the resident inspector of the ORNL Inspection Engineering Department for permanent filing according to Engineering Job Number, Component Title and/or Drawing Number.

The files shall be maintained, as a minimum, for the life of the project with which the experiment is associated. The files shall not be destroyed without the written approval of the Operating Department Head.

^aAn unusual or unplanned occurrence affecting or potentially affecting the performance, reliability or safety of a reactor or test facility, or personnel safety, which requires or may require special evaluation, and corrective or preventive action to be taken.

7.12 Quality Audit

The quality assurance functions related to operation, maintenance and modifications shall be audited in accordance with the Reactor Division's Quality Assurance Procedure, No. 8, "Activity Audit."

APPENDIX I

OPERATING ORDER SHEET

Equipment Identification	
Work Order No.	Account No.
Date	Responsible Engineer
	Phone: Home
	Office
Control Conditions to Maintain:	

Operators to Initial on Noting:

APPENDIX II

OAK RIDGE NATIONAL LABORATORY

INCIDENT REPORT
(Format)

Facility: _____ Date of Incident: _____

Report No.: _____ Time of Incident: _____

Subject:

1. Description of Incident and General Designation of Apparent Cause:
(Design _____ Mat'l _____ Personnel _____ Procedure _____ Other _____)

2. Operating Conditions of the Facility at Time of Incident:

3. Immediate Evaluation, Corrective Action Taken, and Results:

4. Is Further Evaluation or Corrective Action Necessary?

If Yes: Before Further Operation?

By Whom?

5. Evaluation:

6. Temporary Corrective Action Taken:

7. Permanent Corrective Action Taken or Recommended:

8. Similar Incidents:

Originated by: _____ Date Reported _____

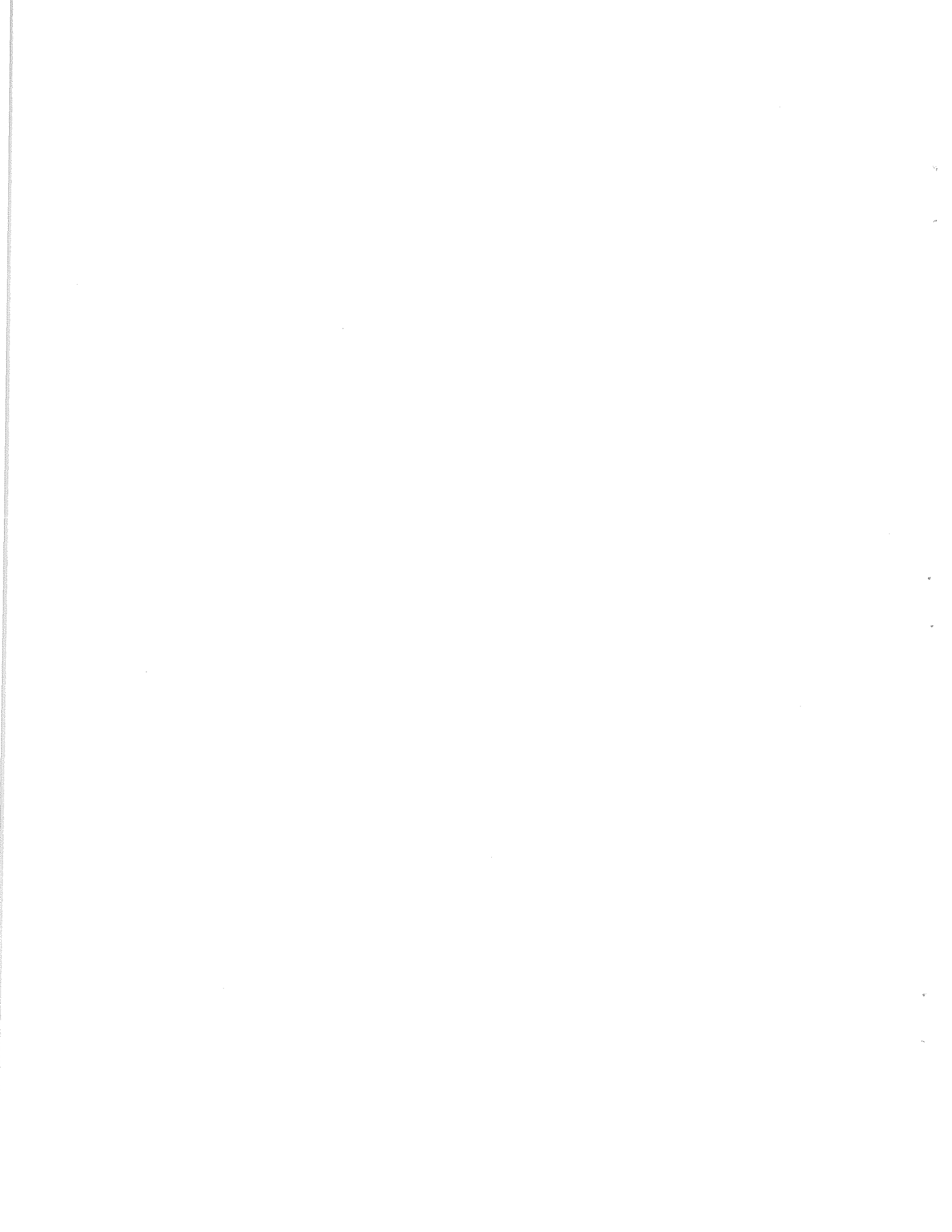
Approved by: _____ Date _____

Director

Division

Approved by: _____ Date _____

Director
Quality Assurance,
ORNL



REACTOR DIVISION

Quality Assurance Procedure 8
(Interim Use)

ACTIVITY AUDIT

C. K. McGlothlan

February 1970

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8.3 Nondestructive Examination Audit.	8-3
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8. QUALITY ASSURANCE AUDITS

8.1 Activity Audit

The Division Quality Assurance Coordinator-Reactor Division (DQAC-RD) or his qualified designee shall conduct audits of activities affecting quality. Such activities shall include designing, procurement, fabricating, assembling, handling, cleaning, storing, shipping, inspecting, testing, installing, operating, maintaining, repairing and modifying. Activities shall be audited to determine the status of compliance with requirements of the Quality Assurance Program Plan, established Quality Assurance procedures and instructions, and applicable codes and standards.

8.2 Product Audit

The DQAC-RD or his qualified designee shall periodically audit inspection areas and reinspect randomly selected materials, products, or processing that has already been inspected, accepted, and appropriately identified as accepted by inspection personnel.

Results of these audits shall be sent to the ORNL Quality Assurance Director with copies to the Reactor Division Director, the project engineer, and the Program Director.

8.3 Nondestructive Examination Audit

The DQAC-RD or his qualified designee shall periodically audit non-destructive examination and personnel certification procedures to verify that applicable specifications, standards, and codes set forth in the Quality Assurance Program Plan and design documents have been implemented, and their requirements are being met.

The certification process shall be audited to assure that personnel certified to perform special processes have satisfactorily passed tests indicating their competence in accordance with the requirements of applicable specifications and standards.

Nondestructive examination results, such as test data, readouts, and film shall be periodically audited to verify accuracy of equipment and adequacy of interpretation of examination results.

8.4 Records Audit

Results of inspection, tests, and nondestructive examinations shall be audited by the DQAC-RD or his qualified designee to assure adequacy and availability.

8.5 Reporting and Corrective Action

The results of the audits shall be documented in the form of a letter with supplemental forms as required. The letter shall list all deficiencies and recommended corrective action. The letter shall be sent to the ORNL Quality Assurance Director with copies to the program director, the project engineer, and Reactor Division management.

The DQAC-RD shall maintain a list of locations of all permanent files.

ACKNOWLEDGMENT

This report represents the collective efforts of many persons other than the author.

P. A. Gnadt and A. G. Grindell of the Reactor Division assisted in writing and checking portions of the report.

D. L. Aubuchon and R. M. Fuller of the Inspection Engineering Department contributed to the sections on nondestructive testing.

S. E. Beall, M. H. Fontana, M. I. Lundin, R. E. MacPherson, and W. R. Osborn of the Reactor Division; A. H. Anderson, A. E. G. Bates, and H. J. Metz of the Instrumentation and Controls Division for assistance in reviewing the document.

A. L. Boch and F. H. Neill of the Directors Division and J. W. Anderson of the RDT Standards Office for assistance in reviewing the contents.

REFERENCES

1. Milton Shaw, USAEC Letter of July 25, 1969, Subject: "Quality Assurance Program Requirements," to S. R. Sapirie, USAEC-ORO.
2. H. M. Roth, USAEC-ORO, Letter of July 31, 1969, Subject: "Quality Assurance Program Requirements," to A. M. Weinberg, Oak Ridge National Laboratory.
3. M. E. Langston, USAEC, Draft of "Guide for Preparation of Quality Assurance Program Plans," September 11, 1969 (one of several sections proposed for inclusion in RDT Standard F 2-5T).
4. Milton Shaw, USAEC, Nuclear Safety Program Letter Number 16 of December 26, 1968, to F. L. Culler, Jr., Oak Ridge National Laboratory.
5. R. E. MacPherson and M. H. Fontana, Fuel-Failure Mockup Program Plan, USAEC Report ORNL-TM-2529, Oak Ridge National Laboratory, June 1969.
6. A. J. Pressesky, USAEC Letter of June 11, 1969, Subject: "Comments on FFM Program Plan," ORNL-TM-2529, to F. L. Culler, Jr., Oak Ridge National Laboratory.
7. R. V. Dulin, Instructions for Design Description Preparation, USAEC Report, BNWL-592, Pacific Northwest Laboratory, October 1967.

APPENDIX A-1

MANDATORY CODES, STANDARDS, SPECIFICATIONS, AND PROCEDURES
FOR
QUALITY LEVEL 2 LIQUID METAL AND MOLTEN SALT TEST SYSTEMS^a
(Interim Use)

I. Design

- A. Vessels - ASME^b Boiler and Pressure Vessel Code, Section III, for Class C Nuclear Vessels with full penetration TIG welds required.^c
- B. Piping - ANSI (USAS)^d B 31.1.0, Power Piping Code with full penetration TIG welds required.^{c,e} In addition, a complete piping flexibility analysis shall be performed to assure that excessively high thermal expansion stresses do not develop. Use "Piping Flexibility Analysis Program MEL 21"^f or equivalent.

II. Materials and Equipment

- A. Materials - Use RDT^g material standards with all the additional requirements as defined therein made mandatory whenever practical.^h Use of the additional requirements will result in obtaining essentially MET-RM¹ quality material. The optional RDT requirements shall be specified if they are considered necessary by the Project Engineer. Small quantities of ASTM material with certified mill chemical check analysis and mechanical properties shall be upgraded to RDT material standards at ORNL if material to RDT standards cannot be easily procured. For equipment operated above 1000°F, the minimum carbon content of stainless steels shall be 0.04 percent unless it can be shown analytically that the high temperature strength is not needed. Material procured to ASTM standards with mill certified chemical and physical properties or ORNL chemical check analysis may be used for non-containment applications. Welding rod with certified chemical and mechanical properties shall be used.
- B. Existing Equipment - Documents shall be produced to establish that existing equipment, qualified under previous programs, conforms to MET or RDT material and fabrication requirements. If existing equipment does not meet MET or RDT requirements, other inspections, as appropriate and practical, shall be utilized to establish that the equipment is adequate, reliable, and safe even though the risk is higher than for conforming equipment. When such nonconforming equipment is used it shall be documented by the project engineer and distributed for review and approval by the Program Director, Reactor Division Management, and the Reactor Division Quality Assurance Coordinator. The discussion shall include problems and reasons for the use of such nonconforming equipment. A material vendor's (mill) detailed and certified chemical analysis on the particular piece of material or ORNL chemical check analysis shall

be specified as a minimum requirement. Material conformance statements by jobbers shall not be accepted.

- C. Purchased Equipment - Purchase new equipment to ORNL Job Specifications and to RDT Standards where practical.^h

III. Fabrication

All vessels, piping, pumps, and valves^h shall be fabricated using full penetration welds and require 100% liquid penetrant and radiography inspection.^j Welds and welders shall be qualified in accordance with WPS or PS^k welding procedure (or procedures based on RDT standards when available).

IV. Inspection

Materials and Welding at ORNL - Use ORNL nondestructive testing procedures (based on RDTⁱ Inspection Standard RDT F 3-6 T). Use ORNL inspectors qualified to Level II requirements of RDT Standard 3-6 T and ASME Code, Section III, Appendix IX.

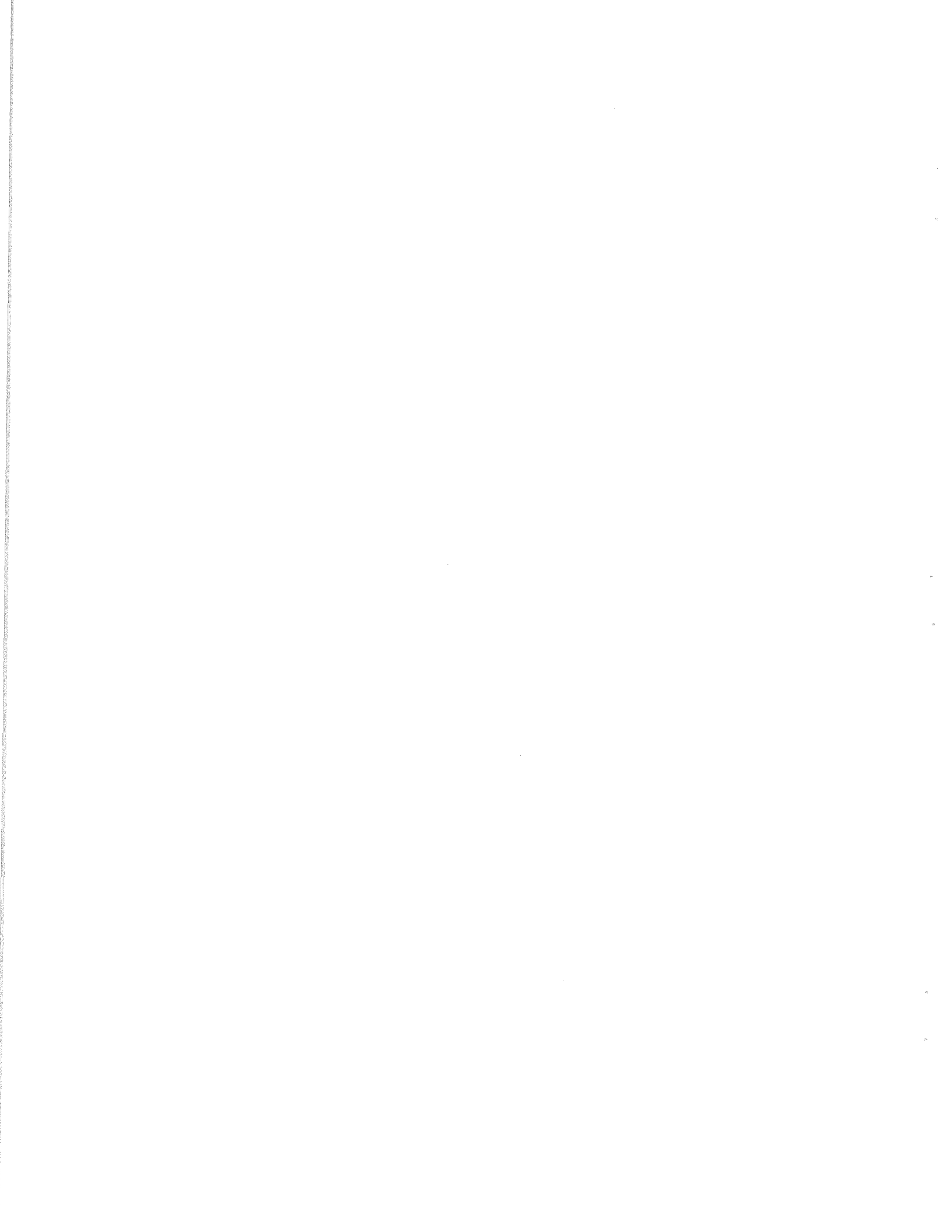
Welding at Y-12 - Use the MET-NDT^l nondestructive testing procedures and Y-12 inspection personnel to perform liquid penetrant and radiography operations. Spot check of liquid penetrant operations and interpretation of all x-ray films shall be made by an inspector from the ORNL Inspection Engineering Department. This inspector shall be qualified to the Level II requirements of RDT Standard F 3-6 T and ASME Code, Section III, Appendix IX.

FOOTNOTES

- a. Pressure vessels, piping, pumps, and valves containing or coming in contact with liquid metal or molten salt.
- b. American Society of Mechanical Engineers.
- c. RDT F 6-1 T, Welding, Part II and Appendix C as it pertains to weld joint design.
- d. American National Standards Institute - (replacing) - United States of America Standard.
- e. ASME Section III, Nuclear Vessels, Article 5 (Fabrication).
- f. Developed by San Francisco Bay Naval Shipyard.
- g. RDT Material Standards - Reactor material specifications prepared for the Division of Reactor Development and Technology of the AEC.
- h. Due to the tentative status and the limited application of RDT standards, it is expected that suppliers will take exception to some of their requirements. Until industry has worked to RDT standards for a reasonable period of time, it is expected that some exceptions will

be granted. The exceptions should not reduce the quality below the quality level obtained with existing ORNL MET and Job Specifications.

- i. MET-RM Specifications - Reactor material specifications prepared by the Metals & Ceramics Division of ORNL.
- j. See Reference c as it pertains to fabrication.
- k. WPS or PS Specification - Welding procedures prepared by the Metals & Ceramics Division of ORNL.
- l. MET-NDT Specifications - Nondestructive testing procedures prepared by the Metals & Ceramics Division of ORNL.



APPENDIX A-2

RECOGNIZED CODES, STANDARDS, AND PROCEDURES
(AS APPLICABLE)

1. National Electrical Code, 1968
USAS Standard CI - 1968
2. National Electrical Code Handbook
3. Institute of Electronic and Electrical Engineers (IEEE) Standards
4. National Electrical Manufacturers Association Standards
5. Union Carbide Corporation - Nuclear Division
Standard Practice Procedure
12-B Design and Inspection of Pressure Containing Equipment
16 Safety Standards
6. ORNL Plant Safety Manual
Health Physics and Procedure Manual
7. ORNL Reactor Division Design Department
Operating Procedures
8. ORNL General Engineering & Construction Division Design Department
Operating Procedure Number 3 - Numbering Engineering
Drawings and Documents
9. ORNL Instrumentation and Controls Division
 - a. Electrical Design Standards and Graphic Symbols
ORNL Report CF-60-10-62, Rev. 2
 - b. Symbols for Instruments, Flowsheets and Drawings
ORNL Report CF-57-2-1, Rev. 1
 - c. Engineers Manual
 - Part I - Instrument Specifications
 - Part II - Test and Evaluation Reports and Inspection
 - Part III - Test and Evaluation Reports and Inspection
 - Part IV - Engineering Standards
10. Y-12 Plant
Engineering Standards, Volumes 1, 2, and 3
Safety and Fire Protection Standard

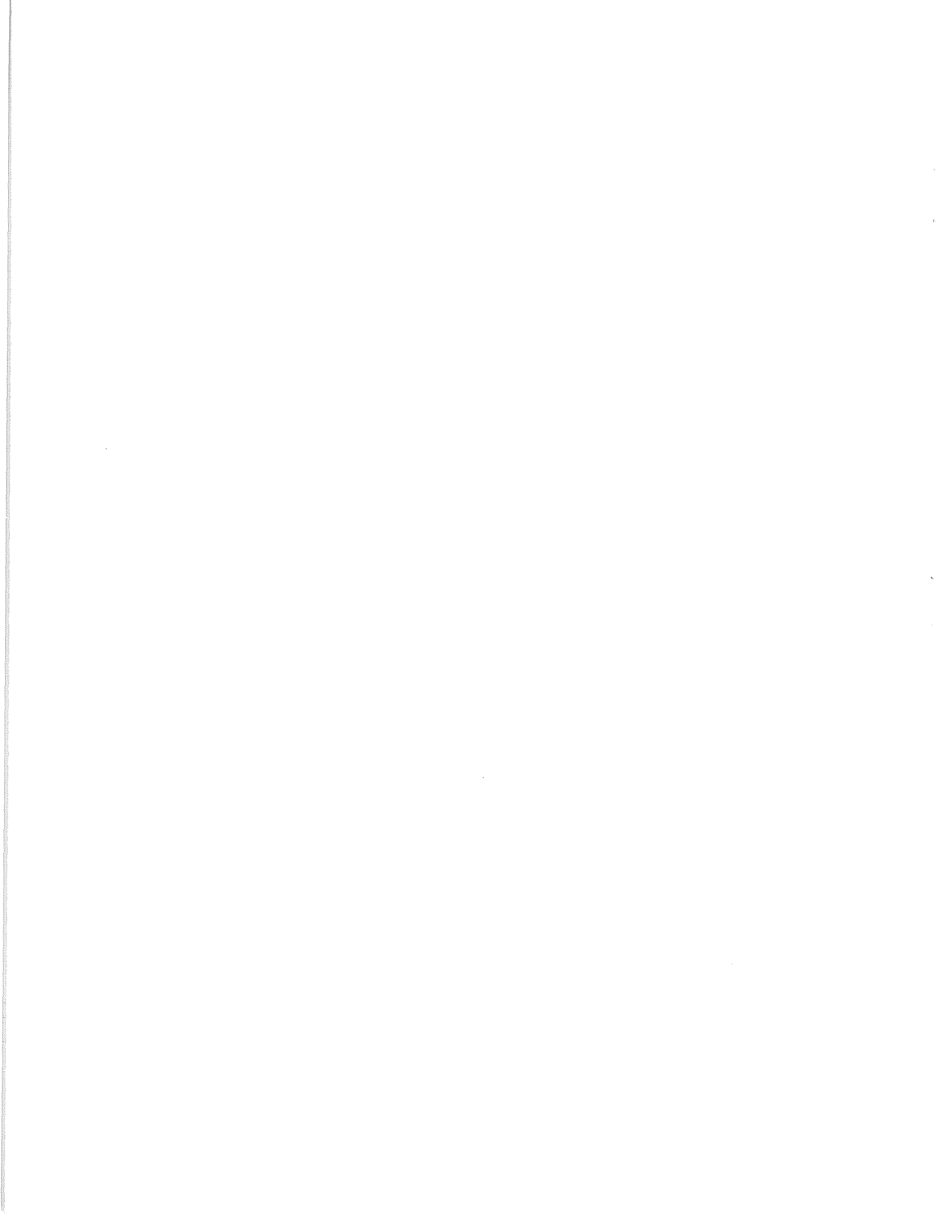
11. UCC-ND Procurement Procedures
 Union Carbide Corporation-Nuclear Division
 Standard Practice Procedure
 D-2-1 Procurement of Materials
 D-2-6 The Handling of Damaged or Defective Material
 D-2-8 Consultant and Special Services
 D-2-12 Inspection of Materials

12. ORNL Inspection Engineering Department^a
 Quality Assurance Policies and Procedures Manual

Section No.	Contents
1	Inspection of Purchased Material
2	Certification of NDT Personnel
3	Radiographic Inspection
4	Penetrant Inspection
5	Ultrasonic Inspection
6	Magnetic Particle Inspection
7	Leak Testing
8	Hydrostatic and Pneumatic Test (in preparation)
9	Visual Inspection
10	Upgrading Materials to Comply with RDT Materials Standards (in preparation)
11	Shop Inspection of Pressure Vessels
12	
13	Pressure Vessel and Pressure Piping Inspection (in preparation)
14	Inspection and Testing of Hoisting Equipment
15	Inspection and Testing of Activated Carbon Filter Systems (in preparation)

^aThese Quality Assurance Standards are intended primarily for the use and guidance of personnel in the ORNL Inspection Engineering Department. They are detail procedures showing the implementation of the quality requirements of ASME Section III and RDT Specifications. Included are qualifications of inspection procedures, equipment, and personnel, and the criteria for approval or rejection of material. Also included are procedures for compliance with AEC regulations as outlined in ORNL Standard Practice Procedure Number 16 for maintaining standards of safety by the inspection of pressure equipment, hoisting equipment, backflow preventers, and high efficiency filters.

Section No.	Contents
16	Inspecting and Testing High Efficiency Particulate Filter Systems (in preparation)
17	Inspection and Testing of Backflow Preventers (in preparation)
18	
19	Gauge and Tool Control



APPENDIX A-3

SPECIAL FFM ENGINEERING DOCUMENTS

1. Oxide Removal and Measuring System for Liquid Metal Service
ORNL Job Specification, JS-174-233
2. High Temperature Bellows Sealed Valve
ORNL Job Specification, JS-177-195



APPENDIX B-1

INTERIM PROCEDURE FOR PROCUREMENT OF "LEVEL 2 QUALITY"
MACHINE WORK IN OAK RIDGE AND KNOXVILLE SHOPS

Raw Material

All raw material shall be procured and released to the shops by the Engineering Services Department. Only material that has been inspected and bearing an IR number shall be used.

Raw Material Identification for Individual Parts

Material for each part shall be selected by the Engineering Services Department prior to sending the material to the shops. The material selected shall be in accordance with requirements specified on drawings. Only drawings stamped "Approved for Construction" shall be used. The resident ORNL Inspection Engineering inspector, in cooperation with the Engineering Services Department, shall identify the material selected for each part on a record set of drawings with the material information indicated below.

CRITICAL MATERIAL
DO NOT SUBSTITUTE

Raw Stock	Material -
Ht No.	Part
IR No.	Verification
Type	Inspector
	Date

All material shall be prepared and identified before it leaves the plant as follows:

1. If a partial plate, rod or pipe is required to make a part, the raw stock shall be cut to a size approved by the shop selected to do the fabrication. If an entire plate, rod or pipe is required to make one or more parts, the raw stock shall be sent to the shop without cutting.
2. One or more paper tags with the following information shall be taped or attached in an appropriate manner to every piece or raw stock by the resident inspector from the ORNL Inspection Engineering Department.

PART IDENTIFICATION TAG

Engineering Job No. _____
 Dwg. No. _____
 Part No. _____
 Heat No. _____
 IR No. _____
 Part Accepted _____
 Part Rejected _____
 Inspector _____
 Date _____

3. A tag shall be prepared for every part except where there are two or more small parts of identical design made from the same piece of raw material.

The Engineering Services Department shall be responsible for shipping all materials to the shop.

After the material is received at the shop it shall be stored in a special segregated area inside the shop until it is needed for fabrication.

Part Identification in Fabrication Cycle

The part identification tag shall be retained on each part at all times, including shipping, except during the time required for machining and inspection. The tag shall immediately be attached after machining and inspection are completed.

Shop management and craft personnel shall be responsible for maintaining material identify and making dimensional inspections in the shop.

Source Inspection

The resident inspector from the ORNL Inspection Engineering Department shall make unannounced visits, not less than two per week, to the shop where the work is being done for the purpose of spot checking material identity and dimensions of parts during machining. His findings shall be marked on record drawings and/or IR Form UCN-2335. He shall report his findings on nonconforming parts to shop management, the Engineering Services Department, and the project engineer. The project engineer shall determine if the item may be used, modified, or rejected, and he shall notify the Engineering Services Department. The notification shall be in writing with copies to the resident inspector from the ORNL Inspection Engineering Department and the Reactor Division Quality Assurance Coordinator.

Site Inspection and Part Identification

When requested by the project engineer, each completed part, after receipt by ORNL, shall be dimensionally inspected by the resident inspector from the ORNL Inspection Engineering Department and the results recorded on a new IR form.

If parts are dimensionally inspected, the new IR Number, Drawing Number, Part Number, Unit Number, and material type shall be electro etched on each part. Reference to the original material IR Number shall be made in the new IR report. If parts are not dimensionally inspected, the original material IR Number, Drawing Number, Part Number, Unit Number, and type material shall be electro etched on each part by the resident inspector from the ORNL Inspection Engineering Department.

Material Verification

The resident inspector from the ORNL Inspection Engineering Department shall verify that the completed part was made from the material furnished. He shall compare the information on the part identification tag with the raw material information entered on the record drawing. If the information checks, the inspector shall sign the record drawing.



APPENDIX B-2

Welding and Inspection Procedures^a for the FFM Test Stand

MET-NDT-4	Penetrant Inspection of Metal Parts
MET-NDT-5	Radiographic Inspection Testing
MET-NDT-6	Ultrasonic Inspection of Welded Joints

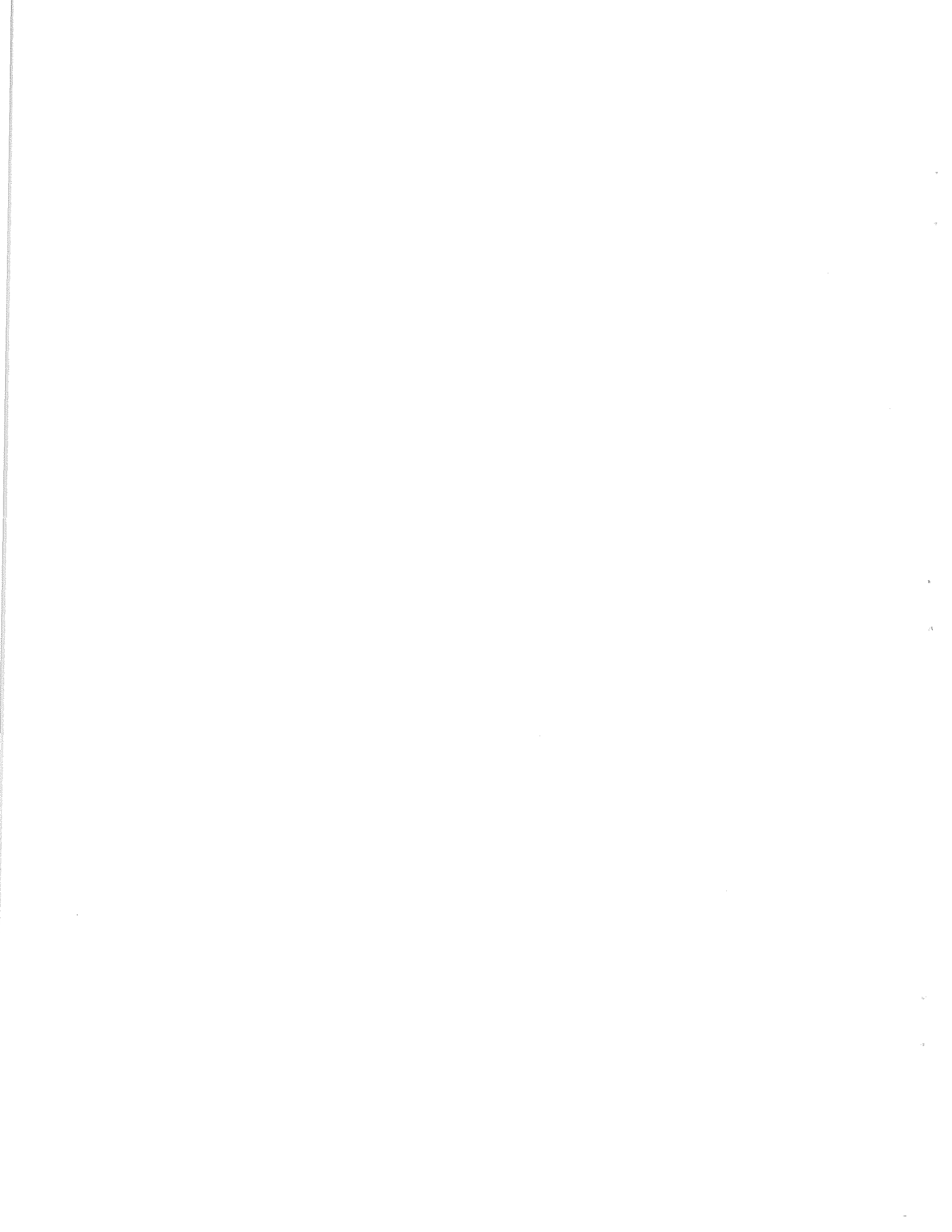
Internal Welding Inspection and Fitup Procedures^a

MET-WS-2	Machining Details for Matching Single-Welded Joints
MET-WR-200	Procedure for Inspection of Welding of High Nickel Alloys
MET-WR-201	Procedure for Inspection of Welding of Austenitic Steel
MET-WR-202	Procedure for Inspection of Welding of Carbon and Alloy Steel

Internal Welding Procedures^a

PS-19	Gas Tungsten-Arc Welding of Chromium-Nickel Stainless Steel
PS-36	Gas Tungsten-Arc Welding of Steel to Chromium-Nickel Stainless Steel
PS-40	Coated Electrode Welding of Steel
WPS-302	Gas Tungsten-Arc Welding of Chromium-Nickel Stainless Steel
WPS-1303	Gas Tungsten-Arc Welding of Nickel-Chromium-Iron (Inconel)
WPS-2603	Gas Tungsten-Arc Welding of Chromium-Nickel Stainless Steel to Nickel-Chromium-Iron (Inconel)

^aProcedures developed by the Metals and Ceramics Division of ORNL for use by UCC-ND Shops in fabricating and installing high quality equipment and services.



APPENDIX B-3

LMFBR-FUEL FAILURE MOCKUP LOOP

Job No. 10531

INDEX OF SPECIAL EQUIPMENT QUALITY ASSURANCE
PROCEDURES AND CHECK LISTS

	<u>Equip. Status</u>	<u>Procedure Status</u>
I. PKA-2 Pump (Dwg. No. F-2974)		
A. Pump Bowl Assembly	Used-OH-NC	Cp
B. Rotary Element Assembly	New-OH-NC	Cp
II. Pressure Transmitter (I&C)	Used-OH-NC	IP
III. Magnetic Flowmeter, 3 1/2 in. pipe (GE Cat. No. 173D637G1).	Used-OH-NC	IP
IV. Filter (Dwg. No. E-025)	New-P-C	*
V. Magnetic Flowmeter, 2 in. pipe (GE Cat. No. 173D623G1)	New-OH-NC	IP
VI. Test Section Assembly (Dwg. No. E-033)	New-F-C	IP
VII. Heat Exchanger (Dwg. No. E-019)	New-OH-NC	Cp
VIII. Mixing Tee (Dwg. No. E-020)	New-F-C	*
IX. Dump Tank (Dwg. No. E-021)	New-F-C	*
X. Valves, 2 1/2 in. "Y" Type K Vapor Valve, Mason-Neilan 316 SS	New-OH-NC	*
XI. Sampler Assembly (Dwg. No. E-023)	New-F-C	*
XII. Oxide Control Indicator Package	New-P-C	*
XIII. Valves, 1/2 in.	New-P-NC	IP
XIV. Reflux Condenser (Dwg. No. E-020)	New-F-C	*
XV. Tank Sampler - Portable (Dwg. No. E-024)	New-F-C	*
XVI. Lubrication Stand	New-F-C	*

*Listed on Drawing

OH - On Hand

IP - In Preparation

NS - Not Started

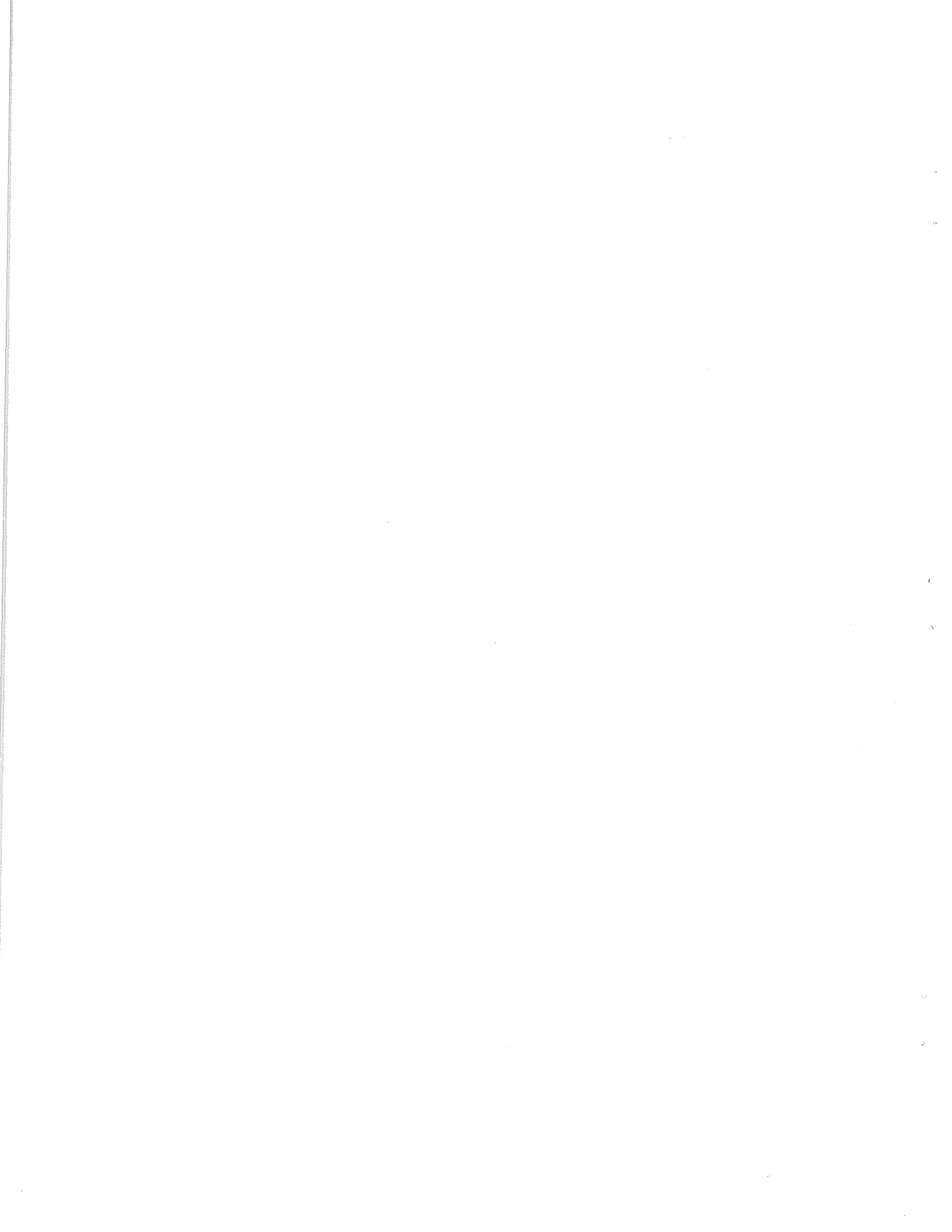
P - Purchase Item

F - UCC-ND-Fabricated Item

NC - Nonconforming

C - Conforming

Cp - Complete



APPENDIX B-4

PROCEDURES FOR CALIBRATION OF MEASURING AND TEST EQUIPMENT
IN THE Y-12 PLANT

Procedures have been prepared to establish and maintain a calibration system to control the accuracy of measuring and test equipment in the Y-12 Plant. The procedures are based on measurement standards assigned by the National Bureau of Standards, the Y-12 Gage Certification Laboratory, and the Y-12 Physical and Electrical Standards Laboratory.

These Y-12 Plant procedures meet or exceed the requirements of RDT Standard F 3-2 T "Calibration System Requirements," and shall be used as applicable.

MA	3-5.3	Product Quality Acceptance Equipment Identification
MA	3-5.6	Punched Card Control System for Instrument Certification Program
MJP	0010-01	Field Calibration of Assay Gauges - Neutron Activation Analysis Type
MJP	3291-01	Calibration of Unsaturated Cadmium Standard Cells
MJP	3864-01	Stop Watch Calibration
MJP	3940-01	Calibration of Conventional Dial Platform Scales
MJP	5700-01	Calibration of AC-DC Console
MJP	5721-01	Calibration of DC Voltmeters
MJP	5722-01	Calibration of DC Ammeters
MJP	5722-02	Calibration of Direct Current Milliammeters
MJP	5722-03	Calibration of Direct Current Microammeters
MJP	5727-01	Calibration of DC Shunts
MJP	5727-02	Calibration of Resistors
MJP	5727-03	Calibration of Resistance Standards
MJP	5731-01	Calibration of Pressure Gauges - 0 to 50 PSIG Range
MJP	5741-01	Calibration of Gas Flow Rotameters
MJP	5751-01	Calibration of Accelerometer Systems
MJP	5757-01	Calibration of Frequency and Time Standard
MJP	5959-01	Linear Variable Differential Transformer Calibration
MJP	5797-01	Calibration of Standard Volume
MJP	5797-02	Calibration of Standard Leak Station
MJP	5797-03	Calibration of Standard Leak

MJP 5797-04 Standard Leak Calibration - Mass Spectrometer Method
MJP 5799-04 Foxboro Model 40 "Stabilog" Controller Alignment
MJP 5861-01 Calibration of Analytical Balances
MJP 7600-01 Calibration of Dry Room Vacuum Relief Valves

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