AUTOMATION INDUSTRIES, INC.
VITRO LABORATORIES DIVISION

JOB QUALITY ASSURANCE PLAN

Rev. __D__ Date __11/2/79__

JOB __02915__

Customer __The Babcock & Wilcox Company__   Contract No. __032852LC__   Date __03/17/78__

QA Spec. __09-1212-01__ Rev. __01__ Date __1/16/74__ Proposal No. __N04368.26018(1)__ Date __02/17/78__

Dwg. No. __---------__ Rev. __--__ Date __---__   Design or __08-1018000002-09__ Perf. Spec. with CIAs* Rev. __--__ Date __---__

Description of function, quantity of equipment, documentation, certifications and services to be delivered:

Design and test Calculating Module (CM) software in accordance with the applicable specifications. This software will include the functional specification, overall software test plan, programs for the MCS-4 of the CM, software design document, CM emulator for software simulation test plan, conduct of simulation tests, CM hardware/software integration test plan, conduct of integration tests, test results and reports, and coding of ROMS.

*88-4646-00, 88-4740-00, 88-4819-00, 88-4840-00, 88-4853-00, 88-4938-00, 88-4939-00, 88-4952-00, and 88-5018-00.

Applicable Vitro HDM QA Standards and Administrative Procedures (of current issue):

☐ HDM A 2.3.1.1 (MIL-Q-9858A) ☒ HDM A 2.3.1.2 (10CFR50 App B/ ANSI N45.2) ☐ HDM A 2.3.1.3 (MIL-I-45208A/ Commercial) ☐ Other (See Special Requirements)

Special QA Requirements   ☒ Attached Rev. __D__ Date __11/2/79__

Attachments (1) and (2)   ☒ Attached Rev. __A__ Date __11/2/79__
                                          ____ Date 11/13/78

Schedule of Events   ☒ See Job Plan

		Initials	Date
☐ Preliminary ☒ Final	Prepared by:	JJT	11/2/79
Distribution for Preliminary			
Contracts Office Proposal File	Reviewed and Approved by:		
Distribution for Final			
EB Branch Manager Shipping & Receiving	Project	RVC	11/2/79
Division QA Officer B&W	Department	CES	11/2/79
QC Supervisor DPC	QC	WCC	11/2/79
Project Manager	EB Branch	JJT	11/2/79
DM Department Head			
Manufacturing Supervisor			
Chief Draftsman			
Purchasing Supervisor			

8000020485

JOB QA PLAN SPECIAL REQUIREMENTS

JOB __02915__

In addition to the requirements of 10 CFR 50, Appendix B, covered by the HDM Manuals, the following apply:

1.0 **Quality Assurance Program**

1.1 General Specifications

    a. B&W Specification 09-1212-01
    b. Title 10, CFR 50, Appendix B

1.2 This plan, along with the HDM Manuals, will comprise the Q.A. Program.

2.0 **Organization**

2.1 Project Manager - R. V. Clark

3.0 **Design Control**

3.1 Design Specification - The following items specify the requirements and constraints to which the software must be designed:

    a. B&W Spec 08-1018000002-09 with CI/A 88-4646-00, CI/A 88-4740-00, 88-4819-00, 88-4840-00, 88-4858-00, 88-4938-00, 88-4939-00, 88-4952-00, and 88-5018-00.

    b. Display Card Schematic, Bailey Meter Co. drawing F8051693C, dated 9-22-76.

    c. Switch Card Schematic, Bailey Meter Co. drawing D8051694D, dated 9-22-76.

    d. Processor Card Schematic, Bailey Meter Co. drawing F8051690F, dated 4-27-77.

    e. Auxiliary "A" Card Schematic, Bailey Meter Co. drawing F8051692F, dated 4-27-77.

    f. Auxiliary "B" Card Schematic, Bailey Meter Co. drawing F8051691D, dated 9-22-76.

JOB QA PLAN SPECIAL REQUIREMENTS

JOB 02915

3.1 Design Specification - Continued

g. I/O "A" Card Schematic, Bailey Meter Co. drawing F8051688G, dated 9-28-77.

h. I/O "B" Card Schematic, Bailey Meter Co. drawing F8051689F, dated 9-22-76.

i. Calculating Module Wire List, Backplate to Connector 6628588G1, Bailey Meter Co. drawing A8052050F, dated 1-18-78,

j. Calculating Module Wire List, Backplate 6628588G1, Bailey Meter Co. drawing A8052049F, dated 1-18-78.

k. Analogue Adjust Schematic, Bailey Meter Co. drawing B8051958F, dated 8-26-77.

l. Front Plate Assembly Wiring Diagram, Bailey Meter Co. drawing D8051672E, dated 2-21-78.

m. Connector Board Schematic, Bailey Meter Co. drawing D8051695C, dated 3-25-76.

3.2 Engineering Design Assurance

a. The System Description will be defined by the Software Functional Specification.

b. Development of CM Software Functional Specification. Responsiveness to contract requirements will be verified by review and approval of the Project Manager.

c. The CM Software Functional Specification is to receive review and approval by B&W.

d. The CM Software Functional Specification will be maintained under formal document control. Changes will be authorized only through approval of Project Manager and B&W.

JOB QA PLAN SPECIAL REQUIREMENTS

JOB __02915__

3.2 Engineering Design Assurance - Continued

e. Completed CM Software (contained in the design document) prepared by Data Processing Department, will be reviewed for functional adequacy by Project staff. Formal Design Review per HDM 3.4.1 will not be conducted. Detailed design verification will be by Simulation and Integration testing, plus analysis to verify that the test parameters utilized cover the full range of design requirements.

f. CM Software documentation, including the Software Design Document, will be approved by the Project Manager and maintained under formal document control. Changes authorized only by approval of the Project Manager.

g. Figure 1 illustrates the sequence of document preparation, review, and approval required to be followed. Also shown are the documents required to serve as the basis for review and approval of any document.

h. Coding will be verified by review of coding against the approved Design Document.

3.3 Design Documentation

a. Software Functional Specification

b. Software Design Document (includes code listings)

3.4 Drawing and Change Control

Drawing and change control will be in accordance with Section C 3.7 of the HDM C Manual with the following changes:

Paragraph II.A. Delete and replace by "This standard includes methods and procedures to be used by DME, DPC, and Q.C.".

JOB QA PLAN SPECIAL REQUIREMENTS

JOB __02915__

3.4 Drawing and Change Control - Continued

Paragraph IV.A. Delete and replace by "Released drawings may only be revised by a properly prepared Engineering Order (E.O.)."

Paragraph IV.B. Line 2 - Delete "on shop floor"
Line 7 - Change "Shop" to "Section"

Paragraph V. Subsections D and F only are applicable.

Paragraph VII. Subsection C only is applicable. Delete C7, C8, C9, C10, and replace with "Drawing and E.O. distribution shall be 2 copies to DME and 2 copies to DPC marked "ENGINEERING", and 1 copy to Q.C. marked "INSPECTION"."

Upon completion of the design, design documentation will be approved by the Project Manager and will subsequently be controlled by C 3.7 as modified.

Every print-out shall have a header that identifies it by name, number, revision level, and date.

5.0 Instructions, Procedures, and Drawings

5.1 An Overall Software Test Plan will be prepared and submitted to B&W.

5.2 A Simulation Test Plan will be prepared and submitted to B&W.

5.3 An Integration Test Plan will be prepared and submitted to B&W.

5.4 A log of SW calculational errors will be maintained.

5.5 A ROM Object Tape Inspection Procedure will be prepared.

NOTE: SEE FIGURE 1 FOR REVIEW AND APPROVAL REQUIREMENTS. ANY PROCEDURES THAT WILL BE PREPARED MUST BE WRITTEN AND APPROVED PRIOR TO ANY ACTION CONTROLLED BY THIS PROCEDURE.

JOB QA PLAN SPECIAL REQUIREMENTS

JOB 02915

6.0 Document Control

Specifications and documentation will be assigned a drawing number controlled within the Drawing Change Control System as modified (see 3.4) at the time and with the relationship indicated in Figure 1.

7.0 Control of Purchased Material, Equipment, and Services

7.1 Electronic Components - Inspect per Quality Control Instruction (Q.C.I.) 501.8 dated 7-15-77. Test procedure for received PROMS will be prepared, utilizing PROLOG M920 programmer.

8.0 Identification and Control of Materials

8.1 ROMS will be serialized to identify their program and location.

9.0 Control of Special Processes

Not Applicable.

10.0 Inspection

See Attachment (2), Job QA Plan 2915.

11.0 Test Control

11.1 A Simulation Test Plan, conforming to the Overall Software Test Plan (OTP), will be prepared for approval by B&W.

11.2 An Integration Test Plan, conforming to the OTP, will be prepared for approval by B&W.

11.3 Test report format will be developed to certify that test criteria have been satisfied.

JOB QA PLAN SPECIAL REQUIREMENTS

JOB __02915__

11.0 <u>Test Control</u> - **Continued**

    11.4 An Overall Software Test Plan will be prepared and submitted to B&W.

NOTE: SEE FIGURE 1 FOR REVIEW AND APPROVAL REQUIREMENTS.

12.0 <u>Control of Measuring and Test Equipment</u>

    12.1 Emulator software will be documented. Flowcharts, listings, and print-outs will be given drawing numbers and controlled within the Drawing Change Control System.

    12.2 Emulator software validation methods and results will be included in the Emulator documentation.

    12.3 An instruction for calibration and operation of the CM for integration testing will be prepared and incorporated in the Integration Test Plan.

13.0 <u>Handling, Storage, and Shipping</u>

    13.1 ROMs only - CMOS handling procedures, ANSI N45.2.2, Level A; or hand-carry with CMOS handling procedures.

15.0 <u>Nonconforming Items</u>

ROM Object Tape and ROM discrepancies will be handled in accordance with Attachment 1, Job QA Plan 2915.

16.0 <u>Corrective Action</u>

Corrective action procedures will be in accordance with Attachment (1), Job QA Plan 2915.

17.0 <u>Quality Assurance Records</u>

Any documentation related to Quality Assurance will be retained as part of the Q.A. Documentation Package.

JOB QA PLAN SPECIAL REQUIREMENTS

JOB 02915

18.0 Audits

Audits will be conducted in accordance with Section A 4. 0 of the HDM
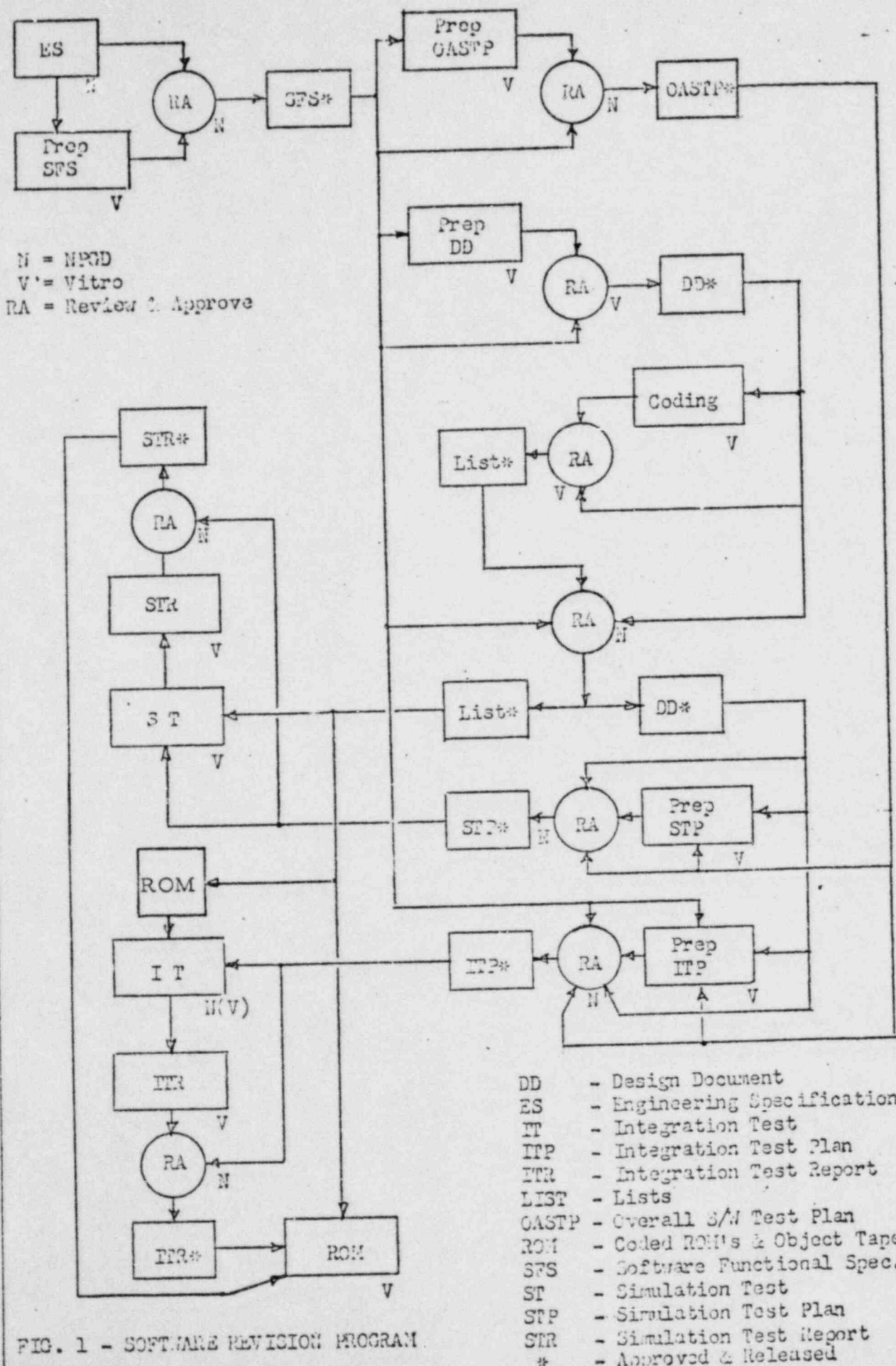Manuals.

N = NPGD
V = Vitro
RA = Review & Approve

FIG. 1 - SOFTWARE REVISION PROGRAM

DD   - Design Document
ES   - Engineering Specification
IT   - Integration Test
ITP   - Integration Test Plan
ITR   - Integration Test Report
LIST - Lists
OASTP - Overall S/W Test Plan
ROM   - Coded ROM's & Object Tapes
SFS   - Software Functional Spec.
ST   - Simulation Test
STP   - Simulation Test Plan
STR   - Simulation Test Report
*   - Approved & Released

AUTOMATION INDUSTRIES, INC.
VITRO LABORATORIES DIVISION

Attachment (1)

QUALITY ASSURANCE PROCEDURES FOR
NONCONFORMING SOFTWARE - JOB 2915

I. GENERAL

This special procedure shall be utilized for the identification, control, and correction of software which does not conform to design requirements.

II. DEFINITIONS

For purposes of this procedure, software design requirements are specified by the Software Functional Specification, SP 2915-0100, and, in greater detail, by the descriptions and flow charts of the Calculating Module Software Design Document, DD 2915-0100.

The Calculating Module Software is defined as the Assembly or equivalent Machine Language program listing (contained in Section 9 of the Design Document and reproduced in the specified PROM devices.)

III. SOFTWARE IDENTIFICATION

Calculating Module Software will be organized by PROM. Program code residing in each PROM will be identified by a unique serial number which contains information defining the CM PROM location and the issue date of the code assigned to that PROM. The specific code listing and associated serial number for each PROM will be documented in DD 2915-0100, Section 9.

IV. NONCONFORMING SOFTWARE PROCEDURE

A. Nonconforming Software Review

Software found to be deficient as a result of Simulation or Integration testing, or subsequent to delivery by Vitro, shall be analyzed by the Vitro Project organization to determine the specific software elements causing the performance deficiency. The analysis effort shall result in specific recommendations for disposition of the nonconformance with proposed corrective action where applicable. Documentation of the nonconformance and subsequent actions shall be as described in the following paragraphs.

B. Simulation and Integration Test Errors

Maintenance of a log of all errors detected as a result of Simulation and Integration Test programs is required and specified in the ST and IT Plan documents. The log shall be formatted so that the following information is recorded for each error:

1. Description of error
2. Test Conditions, Input Data, etc.
3. Corrective Action (Reference E. O.)
4. Retest certification by Project Manager
5. Identification of corrected software
   (From PROM Serial No. to New Serial No.)

Existing Engineering Change Order procedures (HDM C3. 7) require approval of E. O. 's (proposed corrective action) by the Project Manager. Corrective action which involves change to B&W approved design documents (excluding DD 2915. 0100 Section 9) shall be submitted for B&W approval in the form of proposed revised document pages. Interim authority for implementing such changes pending receipt of written B&W approval shall be noted on the E. O.

In the event that an error is considered acceptable, B&W approval will be required to "use-as-is". Project Manager certification (item 4. above) shall indicate receipt of written approval.

C. Nonconforming Software (Delivered)

Software which has been delivered for Verification Testing or use in operational CM equipment, and which is found deficient with respect to design requirements, shall be reviewed and analyzed as in A. above. The error log and procedures specified in B. shall be maintained subsequent to software delivery as a permanent record of software nonconformances and consequent changes.

Following completion of Verification Testing and any resulting revisions to the CM Software design, documentation and reporting of deficiencies shall also follow the procedures of HDM G11. 1 to assure adherence to the requirements of 10CFR21 as specified in the Purchase Order.

AUTOMATION INDUSTRIES, INC.
VITRO LABORATORIES DIVISION

D. Control of Nonconforming Software

Drawing and change control procedures (HDM C3. 7 as modified by Job ?A Plan 2915) will be utilized to control the master software listings (DD 2915-0100 Section 9) and these documents will serve as the reference for final inspection of programmed PROM's. DD 2915-0100 pages issued within Vitro and which are superseded by software or software design changes will be destroyed.

AUTOMATION INDUSTRIES, INC.
VITRO LABORATORIES DIVISION

Attachment (2)
INSPECTION PROCEDURE FOR
PROM OBJECT TAPES AND PROMS - JOB 2915

I. GENERAL

Under Job 2915, PROM Object Tapes and Programmed PROMS are deliverable items. In accordance with Vitro Quality Assurance requirements, these items shall be inspected by QC to verify conformance to the approved software design. The following inspection points are specified:

A. Prior to Integration Testing - Programmed PROMS

B. Prior to Delivery - PROM Object Tapes and Programmed PROMS

II. SOFTWARE IDENTIFICATION

Calculating Module Software will be organized by PROM. Program code residing in each PROM will be identified by a unique serial number which contains information defining the CM PROM location and the issue date of the code assigned to that PROM. The specific code listing and associated serial number for each PROM will be documented in DD 2915-0100, Section 9.

III. PROM PROGRAMMING PROCESS

The Software production process utilized for preparation of PROM Object Tapes and PROM's is depicted in Figure 1.

AUTOMATION INDUSTRIES, INC.
VITRO LABORATORIES DIVISION

FIGURE 1
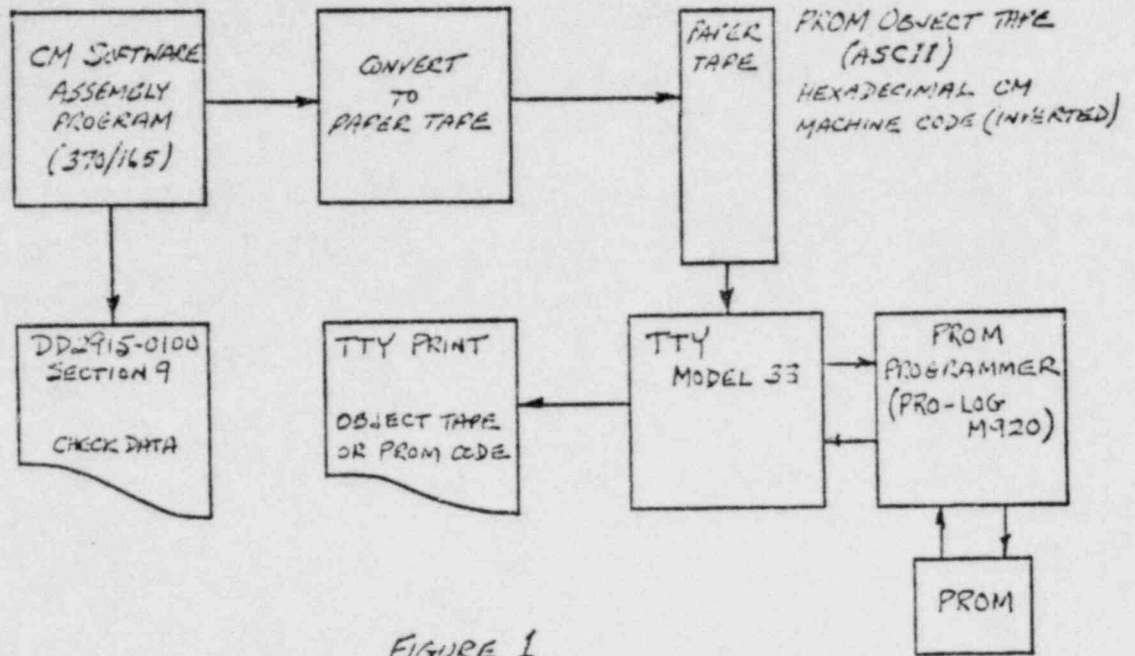
IV. INSPECTION PROCEDURES

A. Object Tapes and Programmed PROMS submitted for inspection shall be labelled to identify CM location (CPU and PROM number) and will include the unique serial number assigned for that location and software revision date.

B. An Inspection Instruction (Form R&D 48) shall be prepared based on this procedure, and will serve as the permanent record of item inspection.

C. Master code listings (DD 2915-0100 Section 9) will be the source document for all inspections. Code listings for each PROM location will include the proper serial number for that PROM and code issue. The listing for each PROM will also appear in "check data" format, that is, in identical format to that provided by the Teletypewriter print-out, (See Figure 1). Validity of "check data" incorporated in DD 2915-0100 Section 9 will be certified by others based on hand check.

IV.   INSPECTION PROCEDURES (continued)

D.   The inspector shall verify the following:

1.   Object Tape and/or PROM serial number agrees with the serial number for that PROM listed in DD 2915-0100 Section 9.

2.   The Teletypewriter print-out resulting from reading the Object Tape or PROM is identical to the "check data" for that PROM listed in DD 2915-0100 Section 9.

E.   Acceptance of the inspected items shall be indicated by affixing the inspector's stamp on the item label and on the Inspection Instruction. Rejected items shall be identified with a REWORK tag and returned to Project. The REWORK tag number shall be noted on the Inspection Instruction.

V.   EQUIPMENT CALIBRATION

As indicated in Figure 1, PROM Programming equipment and associated Teletypewriter are utilized to translate software code as part of the code verification process. Calibration of these equipment in accordance with documented procedures is required.