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QUALITY ASSURANCE MANUAL *

Volume II

Appendices

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I N D E X VOLUME II: Appendices

APPENDIX A

Quality Assurance Policies and Standards in Mechanical Systems

Appendix A.1: Policy for Quality Review of Machine Components

1. Design projects for any of the SLAC machines (SPEAR, PEP, LINAC, Damping Rings, BSY, Arcs, and Final Focus) shall be reviewed by the Machine Operations Support Group (MOSG). A formal design review shall be held for major projects and shall include consideration of:
   A. Engineering factors - stresses, thermal problems, etc.
   B. Design factors - function, alignment, I&C interfaces, etc.
   C. Fabrication - tolerances, materials, etc.
   D. Installation plans
   E. Schedule and budget

2. All final designs of new components and major design changes that affect the function or installation must be approved by the respective MOSG area engineer and the area operations manager (Accelerator Department). Installation and assembly drawings must be signed by the area engineer.

3. All vacuum component drawings must be reviewed and approved by the Vacuum Group.

4. All magnet drawings must be reviewed and approved by the Electronics/Power Supply Group.

5. All supports must be reviewed by the Alignment Group.

6. Installation drawings are to be reviewed by the installation technician supervisor.

7. All drawings of hardware to be installed in one of the machines or tooling to fabricate hardware must be reviewed by the MOSG Design Group Supervisor before release to the MFD, Purchasing or Document Control. The review will be for overall quality, completeness, and conformance to drawing standards. Drawing revisions need not be reviewed unless they reflect major design changes as defined above.

8. During the fabrication of components, MFD will maintain a file of prints which will be marked to indicate problems found and changes made in the course of the job. All changes must be approved by the responsible design engineer. These marked prints will be returned to the respective design group supervisors. The supervisors, along with the project engineers, are responsible for insuring that "as built" changes are made to the drawings.

9. During installation of components, MOSG technicians will mark prints with "as installed" information. These prints will also be forwarded to the Design Supervisors for drawing revision.

Appendix A.2: Project Engineering Standards
General Drafting Instructions
DS-016-110-01

(This is being updated on a continuous basis)

TABLE OF CONTENTS

SCOPE

1.1 Purpose

This document describes requirements for drafting practices and shall apply to subcontract and formal project drawings.

1.2 Exceptions

SLAC Prototype Format drawings to be used by "in-house" shop services need not conform to these requirements except where specified in SLAC DS-016-110-10.

1.3 Consulting

Drafters shall consult with their supervisors when in doubt or in cases not covered by this standard.

1.4 Additional Drafting Standards

For additional drafting standards in specific deciplines, refer to the following:

1. DS-016-110-04 - Mechanical Engineering Design and Drafting
2. DS-016-110-05 - Electronics Engineering Printed Circuit Board Design and Drafting
3. DS-016-110-06 - CADD System Design and Drafting

APPLICABLE DOCUMENTS

The latest issue of the following documents shall form a part of this standard to the extent specified herein. SLAC Standards shall take precedence in event of conflict among SLAC Standards and Documents listed under paragraph 2.2 and 2.3.

2.1 SLAC Standards - Design

Document No.	Title
	ARCHITECTURE
DS-011-200-01	Building Concrete
DS-011-200-02	Building Masonry
	ELECTRICAL
	Plant Facilities
DS-013-140-01	General
DS-013-210-01	Service Voltages
DS-013-220-01	Equipment Phasing
DS-013-230-01	Wiring Identification
DS-013-230-02	Conduit Identification
DS-013-320-01	Receptacles and Plugs
DS-013-320-02	Wiring Methods - Fixed Installations
DS-013-320-04	Wiring Methods - Portable and Temporary Installations
DS-013-410-01	Motor Control Centers - Controls and Starters

DS-013-410-02	Electric Motors
DS-013-610-01	Light Intensity Values
	ELECTRONICS AND MICROWAVE
	Wiring
DS-014-110-01	Identification Coding, Insulated Hookup Wire
DS-014-110-02	Color Designation, Multi-Conductor, Paired Comm. Cable
	Equipment
DS-014-200-01	Indicator Lights
	General
DS-014-710-01	Color Code for Resistors
	MECHANICAL UTILITIES
	Plumbing
DS-015-300-02	Identification of Piping
	DOCUMENT CONTROL
AP-041-300-01	Document Control Procedures
DS-016-110-10	SLAC Prototype Format
DS-016-310-01	Engineering Document Numbering System

2.2 SLAC Fabrication and Process Standards

FP-022-110-02	Painting Standards for Buildings and Surfaces
FP-022-110-03	Minimum Requirements for Paint Finishes
FP-022-110-04	Identification and Marking of Metallic and Non-Metallic Surfaces
FP-023-100-01	Welding of Metal and Metal Alloys

FP-023-100-02	Soft Soldering for Electronics
FP-023-100-03	Welding Aluminum Vacuum Systems
FP-023-100-04	Welding of OFHC High Vacuum Systems
FP-024-100-01	General Heat Treating Standards for Steels
FP-024-100-02	Heat Treatment for Aluminum
FP-027-100-01	Plating Standard for Corrosion Protection
FP-027-100-02	Chemical Film Treatment of Aluminum
FP-027-200-01	Metal Degreasing
FP-027-200-02	Surface Cleaning of Stainless Steels
FP-027-200-03	Surface Cleaning of Aluminum
FP-027-200-04	Surface Cleaning of High Carbon Steels
FP-027-200-05	Surface Cleaning of Low Carbon Steels
FP-027-200-06	Surface Cleaning of Copper
FP-027-200-07	Surface Cleaning of Magnesium
FP-028-100-01	Mechanical Engineering Safety Inspection - Pressure and Vacuum Vessels
FP-202-631-14	Fabrication of Ultra High Vacuum Components

2.3 Industry Standards

DOD-STD-100C	Engineering Drawing Practices
ANSI-Y1.1	Abbreviations for Use on Drawings and in Text
ANSI-Y14.1	Drawing Sheet Size and Format
ANSI-Y14.2Mx	Line Conventions and Lettering
ANSI-Y14.3	Multi and Sectional View Drawings
ANSI-Y14.4	American Drafting Standards Manual - Section 4 - Pictorial Drawing

ANSI-Y14.5M	Dimensioning and Tolerancing
ANSI-Y14.6	Screw Thread Representation
ANSI-Y14.6aM	Screw Thread Representation (Metric Supplement)
ANSI-Y14.13M	Mechanical Spring Representation
ANSI-Y14.15	Electrical and Electronics Diagrams
ANSI-Y14.15a	Interconnection Diagrams Supplement
ANSI-Y14.15b	Interconnection Diagrams Supplement
ANSI-14.17	Fluid Power Diagrams
ANSI-Y14.36	Surface Texture Symbols
ANSI-Y32.2	Graphic Symbols for Electrical and Electronics Diagrams
ANSI-Y32.4	Graphic Symbols for Plumbing Fixtures for Diagrams Used in Architecture and Building Construction
ANSI-Y32.9	Graphic Symbols for Electrical Wiring and Layout Diagrams Used in Architecture and Building
ANSI-Y32.16	Reference Designations for Electrical and Electronics Parts and Equipment
ANSI-Z32.2.3	Graphical Symbols for Pipe Fittings, Valves and Piping
ANSI-Z32.2.4	Heating, Ventilating, Air Conditioning
ANSI-C37.2	Electric Power System Device Function Numbers
ANSI/NFPA-172	Fire Protection Symbols for Architectural and Engineering Drawings.

2.4 OTHER

AIA	American Institute of Architects "Architectural Graphic Standards"
AISC	American Institute of Steel Construction Publication "Manual of Steel Construction"
ACI-315	American Concrete Institute Publication "Manual of Standard Practice for Detailing Reinforced Concrete Structures"
AWS-A2.1	Standard Welding Symbols.

REQUIREMENTS

3.1 Format

1. Size - Approved sizes are "A", "B", "C", "D", "E", "F", and "R" roll. Use of "A" size and "R" size drawings is discouraged. Roll size shall not exceed 36" in width nor 12 feet in length.

2. Drawing Numbering - Numbers shall be assigned to drawings per AP-041-300-01 and DS-016-310-01. Numbers shall be stenciled in space below title block. Letter and number heights shall be 1/4" on all drawings except 5/32" on "A" and "B" sizes.

3. Titles - Titles of drawings shall be stenciled in vertical, bold face within title block. Lettering heights shall be 3/16" on all drawings except 5/32" on "A" and "B" sizes. *Minimum information shall be as follows:

Definition	Example 1	Example 2
a. Project	Beam Switchyard	Klystron Gallery
b. Associated System	AC Electric Services	Vacuum System
c. Subject	Coaxial Cable Layout	6" Valve

* Abbreviated titles shall not be used unless approved by drafting supervisors. No two drawings containing the same base

document number shall have identical titles, except in the case of multiple sheet drawings.

4. Lettering and Line Work - Lettering and Line work shall be capable of clear reproduction during microfilming per ANSI Y14.2M.

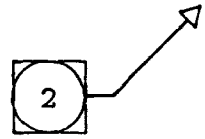
5. Notes - Drawing notes shall be indicated in the following manner:

NOTES

1. CLEAN AND DEGREASE

2. STAMP P/N XX

3. TEST PER ST-XX



See Fig. 1 for preferred locations of notes. Numbers, enclosed by a 3/8" or 1/2" dia. circle and a square, shall be used for "flagging" special notes applying to specific areas of a drawing. A corresponding symbol shall be placed near affected area. Use of arrow leader shown above is recommended.

6. Revisions - Sequential numbers enclosed by the triangular symbol 

shall be used for indicating revisions on the face of the drawing in area where the change occurred. The corresponding number shall be placed in revision box under "REV" column and change description and date inserted.

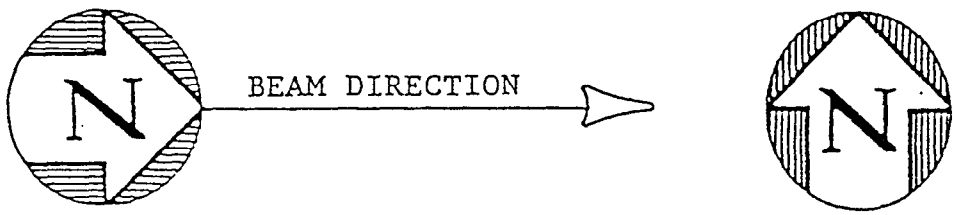
Entries shall be made in the revision block as follows:

REV	DESCRIPTION	DRN.	CHK.	APP.	DATE
3	Dim. 5/8" was 1/4"; Deleted Note 1	VP	HYI	RLF	4/13/88

7. Drawing sequence - Next assembly or next associated drawing shall be noted directly above title block, e.g., NEXT ASSEMBLY: SA-190-184-01. (Revision indicator is omitted from all referenced drawings.)

8. Orientation - All plant arrangement or installation plan views shall have "North Arrow", North direction always to top of sheet or to right side of sheet. Beam direction shall be indicated when showing portions of the Accelerator.

9. Example



10. Scale - Drawing Scales shall be per DOD-STD-100C.

11. Abbreviations - All abbreviations shall be per ANSI-Y1.1.

12. Welding Symbols - Welding Symbols shall be per AWS A2.1

13. Views and Sectioning - Views and sections shall be per ANSI-Y14.3.

3.2 Drawing List

At the beginning of a given project, a tentative drawing list shall be prepared showing assigned drawing numbers and exact titles of drawings required to complete project. Allowance should be made for insertion of additional drawings as required. Drawing list shall be up-dated at end of project and shall become a formal document with an assigned document number (See Fig. 3). Drawing List number and title shall be first item listed.

3.3 Material List

All assembly and subassembly type drawings shall include a material list. Assembly material lists shall tabulate only subassemblies, parts and fasteners that are required for final assembly. Items not required for final assembly, and previously listed on subassembly material lists shall not be repeated. Subassembly material lists shall tabulate only required parts and materials. A Material List must be placed on the 8-1/2" X 11" M.L. form (Fig.) or on the face of the drawing (Fig.). (See Fig. 4).

3.4 Checking

Drawings shall be checked by a checker designated by a drafting supervisor prior to release for review and/or approval. Checkers shall use the following colors:

1. Red - to be used for deletions.

2. Green - to be used for additions.

3. Yellow - "Leave as is".

4. When checking has been completed, check prints shall be reviewed and approved by the responsible engineer, affected drawings revised, check prints returned to checker and tracings signed off.

5. When checking has been completed on markup prints, the markups shall be reviewed and approved by the cognizant engineer, affected drawings revised and signed off, and the markups returned to the checker.

3.5 Completed Drawings

Drawings, when approved, shall be incorporated into the document control system in accordance with AP-041-300-01.

3.6 Policy for Archiving Manual and CADD Produced Drawings

1. Original Drawings

   a. No original drawing,(RO,CO) will be accepted into Document Control for storing unless it contains (1), the Designer/ Drafter's name, which may be printed; (2), the Checker's full signature; (3),the Engineer's full signature, and (4), the full signature of the responsible person in the Approval block.

2. Revised drawings

   a. For revised manually produced drawings, R1, R2, etc., the signatures will remain as is in the main title block area. The Revision Block area will require the Drafter's initials as well as the Checker's and the Approver's initials.

b. For CADD produced Original drawings (C0), there will be no pen or pencil marks on the face of the drawing, other than the signatures as described in 1a, above.

c. For CADD revised drawings (C1,C2,etc.), the only permissable pen or pencil marks on the face of the drawing will be at the Revision Block for Drafter/designer, Checker, and Approver initials. The Title Block signatures may or may not be signed but will be typed in by the CADD designer/ Drafter.

DRAFTING CATEGORIES

4.1 Machine and Electro-Mechanical

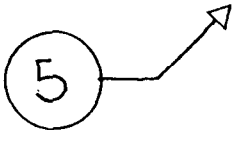
The method of drafting to be used shall be per ANSI Standards (Reference Page 1).

1. Tolerances and Dimensions - Dimensioning shall be per ANSI-Y14.5M. All assemblies and weldments shall have their overall size dimensioned for reference purpose.

2. Screw Threads - Thread and hole call outs shall be per ANSI-Y14.6.

3. Surface Roughness - Finish call out shall be per ANSI-B46.1.

4. Item Call Out - Items on the face of an assembly or subassembly shall be identified by the appropriate material list item number enclosed in a 1/2" diameter circle with an arrowed leader pointing to the item, e.g.,



4.2 Piping

1. Piping Detail Sheets (isometric) - Drawings showing piping details shall be shown on "B" size sheets and shall include a material list per Figure 6. Details shall be drawn in isometric form.

2. Piping Layout - Drawings showing installation of complete systems conform to Figure 7. Piping layouts are comparable to a mechanical top assembly drawing.

3. Piping Diagrams - See Figure 8

4. Section and Details - See Figure 9

5. Instrument Piping - See Figure 10

6. Dimensioning - Layouts and details shall be dimensioned to the nearest foot -inch, e.g., 1'-10-1/2" or 6'-9". In cases where a dimension is less than a foot, it shall be indicated as: 6" or 2-1/2".

7. Symbols - Piping symbols shall be per ANSI-Z32.2.3.

4.3 Electrical/Electronic

1. Symbols - For schematic and wiring diagrams, symbols shall be per ANSI-Y32.2. Component reference shall be per ANSI-Y32.16. For architectural type electrical drawings, symbols shall be per ANSI-Y32.9.

2. Schematic Diagrams - Drawings showing circuitry shall be arranged top to bottom, or left to right. Power or signal input shall be located at the extreme top or left on drawings, with output flowing toward or terminating at the bottom or right hand side, leaving the extreme right hand side open for notes (Fig. 11).

3. Equipment Drawings - Assembly or part drawings of equipment, chassis, or components shall conform to Paragraph 4.1.

4.4 Architectural

Drawings and symbols shall conform to American Institute of Architects "Architectural Graphic Standards".

4.5 Structural

Detail drawings shall conform to American Institute of Steel Construction "Structural Steel Detailing" and "Manual of Steel Construction" (Fig. 12a and Fig. 12b). Concrete structural drawings shall conform to American Concrete Institute "Manual of Standard Practice for Detailing Reinforced Concrete Structures" (ACI-315).

Appendix A.3: Quality Assurance Practices for the Survey and Alignment Group

Alignment at SLAC can be broken into two basic methods: that which produces coordinates with redundant observations and that which does not. In Method I observations are taken and then mathematically adjusted to produce best estimates for point coordinates. Method II entails the direct observation of calculated offsets using surveying instruments and optical tooling scales. The main aspects of quality assurance are discussed below:

1. Controlling Quality

   Method I relies on redundant and independent observations, which are reduced as a group in a least-square adjustment. The result is not only coordinates but also statistics describing the quality of the whole survey and of each individual observation. This data can be analyzed using well established statistical methods, to determine if the data conforms with the requirements.

   Method II, which will be gradually replaced by Method I, has no such statistical basis for error detection. In all cases check observations are taken to detect errors in measurements and calculations. In many cases extra reference marks are provided on instrumentation which provide independent checks. These are used whenever available.

2. Corrective Action

   In Method I, blunder detection programs are utilized which flag possible erroneous observations for further examination. If no obvious problems can be found the offending data is reobserved. If the observation procedure is flawed, steps are taken to evaluate this and implement the necessary changes.

   In Method II, calculations and observations are checked until a cause for the problem is found. After it is corrected, procedures are examined and corrected as necessary. If possible, further checking procedures are established.

   Observational, computational and checking procedures are evaluated for both methods after failure occurs. If changes are warranted they are instituted immediately, if possible.

3. Worker Motivation

   In both cases, an organized effort with clearcut goals and purposes must be maintained. The workers are motivated by not only an understanding for the need of quality assurance but more importantly by their pride in a job well done. This feeling can be fostered and maintained by a staff which approaches a project or problem in a systematic and logical manner with realistic short term and long term goals clearly stated.

4. Evaluation of Effectiveness

If the program is working, standardized methods have fewer problems with better results and less time expended, and the workload of old problems is kept to a minimum.

Alignment and surveying methods can be presented for evaluation, including computational as well as observational methods. Also, paper as well as computer records of past projects can be examined for proper form and corrections of ongoing problems.

Appendix A.4: Examples of Documentation In Production

Shop Traveler Document (1)

SLAC Metal Stores Work Order (1)

Daily Time Report - Light Fabrication Shop (1)

Vacuum Lab Traveler (1)

Vacuum Process and Testing Traveler (1)

Job Description Form - Fabrication Shop (1)

Job Card, Plating Shop - Vacuum (1)

Job Card, Plating Shop - General (1)

Overtime Request - Mechanical Fabrication Shops (1)

Transport Box Specification - Plating Shop (1)

(CIC) CARLS IN CHARGE

Page No. 2
01/20/88

JOB/TASK ROUTE SHEET
Shop Traveler Document
Tasks by Sequence Number

Job Title SLD-CENT.DRIFT CHAM.TRAY ASSY. (395) Priority 521

Cus No SLD Cus Name SLD GROUP Contact J GRANDOV x3166 Job Open 01/19/88 Job Qty 1

Job No 002472 Ref Code W.O. # 22-1376-B Coord KNIGHT Release 01/19/88 Est Start 02/02/88

Assemble into Job - No sub-assemblies 0 Due Date 02/29/88 Est Finish 02/17/88

Seq No.	Work Center	Operation Description	Task Qty	Qty To Go	U/M	Time To Go	Estimated Start Date	Comments
0150	LIGHT FAB. MACH.	PF 241-316-15-C0 AXLE,ROLLER	1	1	EA	1.5	02/08/88	GIVE PART TO REQUESTOR
0160	LIGHT FAB. MACH.	PF 241-316-16-C0 LEVER,CRIMP	1	1	EA	2.0	02/09/88	GIVE PART TO REQUESTOR
0170	LIGHT FAB. MACH.	PF 241-316-17-C0 ARM,TENSION ADJUST.	1	1	EA	1.5	02/09/88	GIVE PART TO REQUESTOR
0180	LIGHT FAB. MACH.	PF 241-316-18-C0 YOKE,CRIMP	1	1	EA	6.0	02/09/88	GIVE PART TO REQUESTOR
0190	LIGHT FAB. MACH.	PF 241-316-19-C0 AXEL,SPOOL	1	1	EA	1.0	02/10/88	GIVE PART TO REQUESTOR
0200	LIGHT FAB. MACH.	SA 241-316-20-C0 BLOCK,ROLLER	1	1	EA	1.5	02/10/88	GIVE PART TO REQUESTOR
0210	LIGHT FAB. MACH.	PF 241-316-21-C0 ROLLER	1	1	EA	1.0	02/10/88	MAT. ORDERED,GIVE PART TO REQUESTOR
0220	LIGHT FAB. MACH.	PF 241-316-22-C0 FRAME,MOUNTING	1	1	EA	3.0	02/11/88	GIVE PART TO REQUESTOR
0230	LIGHT FAB. MACH.	PF 241-316-23-C0 GUARD,SPOOL	2	2	EA	4.0	02/11/88	GIVE PART TO REQUESTOR
0240	LIGHT FAB. MACH.	PF 241-316-24-C0 CAP,ROLLER	1	1	EA	1.0	02/12/88	GIVE PART TO REQUESTOR
0250	LIGHT FAB. MACH.	PF 241-316-25-C0 BRACKET "A",MOTOR	1	1	EA	0.8	02/12/88	GIVE PART TO REQUESTOR
0260	LIGHT FAB. MACH.	PF 241-316-26-C0 BRACKET "B", MOTOR	2	2	EA	1.5	02/12/88	GIVE PARTS TO REQUESTOR
0270	LIGHT FAB. MACH.	PF 241-316-27-C0 BRACKET,MTS. PLATE	1	1	EA	3.0	02/12/88	GIVE PART TO REQUESTOR
0280	LIGHT FAB. MACH.	PF 241-316-28-C0 SLEEVE,BUSHING	1	1	EA	1.0	02/15/88	GIVE PART TO REQUESTOR

SLAC METAL STORES

ISSUE—CUTTING ORDER

Work Order _____ Account No. _____ Date _____

☐ Pickup

Requested by _____ ☐ Deliver to _____

NO. PIECES	MATERIAL	UNIT DIMENSIONS	STORES USE ONLY

Date Required _____ Received by _____

Issued by _____ Date _____ Staff No. _____ Voucher No. _____

Group No. _____

37713 10M

Metal Stores

DAILY TIME REPORT SHOP 07E DATE: _____

LIGHT FABRICATION

NAME: _____ STAFF NO.: _____

VACATION _____ SICK _____ PERSONAL _____ OTHER _____

JOB NUMBER	PRINT OR SKETCH NUMBER	ITEM NO	HOURS	% COMP.

COMMENTS: _____

_____

VACUUM GROUP
BIN 13 GROUP 09
BLDG 031 EXT. 2021

VACUUM LAB TRAVELER

TRAVELER SERIAL#

This traveler contains information about vacuum group assemblies and parts. Please fill it out completely and log the information in the traveler log book. Keep this traveler with the assy. or part while it is being processed, or when it gets placed in storage.

DESCRIPTION OF PART: _____ DATE RCVD: _____

QTY: _____ PART PRINT #: _____ PART ID#: _____

PROJECT NAME: _____ WORK ORDER#: _____

ORIGINATOR/PROJECT ENGR: _____ PH.EXT.#: _____

TECHS: _____

ASSEMBLY INFORMATION: Write in date, tech initials, information requested, etc. | SIGN-OFF:

MATERIAL: _____ MACHINED: _____

VISUAL INSPECTION: _____ QC: _____

CLEANING: _____ PRE-ASSY: _____

BRAZING: _____ WELD I: _____

LK CHK I: _____ COMPLETE ASSY: _____

WELD II: _____ LK CHK II: _____

BAKEOUT(Note temp, fragile parts, time, pressure, etc. Remember to make a plot
N2 PURGE and fill out bakeout logsheet and give it to the project engr.):

PUMPDOWN: _____ VENT: _____

OTHER SPECIAL INFORMATION TO BE NOTED:

ELECTRONIC TESTING:

CALIBRATION:

ALIGNMENT:

COMMENTS:

SUPERVISOR SIGN-OFF: _____ DATE: _____

If assy/part is complete, fill in completed assy date and description of part section of this form.

If assy/part is removed from from lab to be installed, write date removed: _____

If assy/part is stored, indicate where stored: _____

If assy/part is removed from lab to go to another shop, indicate what shop: _____

date removed: _____ removed by whom: _____
Once assy/part has been removed from lab, make a copy of this traveler, file the copy in the traveler log book and LEAVE THIS TRAVELER WITH THE assy/part! Thank You.

VACUUM GROUP
BIN 13 GRP 09
BLDG 031
EXT: 2021

PROCESS + TESTING TRAVELER

All outside groups requesting work from the vacuum group, please fill out the upper portion of this form.

DESCRIPTION OF PARTS: _____ QUANTITY: _____

PART PRINT#: _____ W.O.#: _____

PROJECT NAME: _____

REQUESTER/ORIGINATOR: _____ GROUP: _____

PHONE EXT: _____ ONCE COMPLETE DELIVER TO: _____

DATE SUBMITTED: _____ DATE REQUIRED: _____

OPERATION TO BE PERFORMED BY VACUUM GROUP: _____

INSTRUCTIONS: (Note temperature, baking time, delicate parts, acceptable leak check rates, etc.

— — — — This portion to be completed by the vacuum group — — — — — — — —

TECHNICIAN: _____ VISUAL INSPECTION: _____

DATE STARTED: _____ DATE COMPLETE: _____

SUPERVISOR SIGN-OFF: _____ DELIVER TO (PICK-UP BY): _____

NOTES: (Leak check data, weld notes, remarks for shop, problems, etc.) _____

Once processing is complete, please make a copy of this traveler for your supervisor, and leave this document with the part.

FABRICATION SHOP
JOB DESCRIPTION FORM

JOB #

FABRICATING SHOP _____ DATE REQ'D. _____

JOB SUBMITTED BY _____ EXT. _____ PAGE 1 - _____

DELIVERY TO OR NOTIFY _____ EXT. _____ PAGE 1 - _____

WORK ORDER NO. _____ DATE SUBMITTED _____

NO. REQ'D	DRAWING NUMBER	DESCRIPTION

PARTS & MATERIALS SUPPLIED BY REQUESTOR		
ABOVE DRAWING NUMBER	ITEM NO. ON DWG.	DESCRIPTION

ADDIT. INFO: _____

FOR PLATING SHOP USE ONLY	
TIME	BY

JOB CARD PLATING SHOP

TAG NO: _____

SUBMITTED BY: _____ EXT._____ DATE: _____

DELIVER TO: _____ EXT._____ BLDG: _____

ACCOUNT NO.: _____ W.O. NO. _____

EXPLANATION OF WORK:

VACUUM GROUP

a. DEGREASING ONLY _____

b. CLEAN FOR VACUUM _____

c. TYPE OF METAL TO BE CLEANED _____

d. TYPE OF BASE METAL TO BE PLATED _____

e. TYPE OF PLATING DESIRED _____

f. THICKNESS OF PLATING DESIRED _____

g. APPROXIMATE TIME REQUIRED _____

h. ADDITIONAL INSTRUCTIONS OR REMARKS _____

_____

_____

_____

_____

_____

_____

FOR PLATING SHOP USE ONLY

TIME	BY

PLATING SHOP JOB CARD

SUBMITTED BY:_____ EXT:_____ DATE:_____

DELIVERED TO:_____ EXT._____ BLDG:_____

ACCOUNT NO:_____ W.O. NO:_____

EXPLANATION OF WORK:

a. DEGREASING ONLY_____

b. CLEAN FOR VACUUM_____

c. TYPE OF METAL TO BE CLEANED_____

d. TYPE OF BASE METAL TO BE PLATED_____

e. TYPE OF PLATING DESIRED_____

f. THICKNESS OF PLATING DESIRED_____

g. APPROX. TIME REQUIRED_____

h. ADDITIONAL INSTRUCTIONS OR REMARKS_____

_____

_____

_____

_____

_____

_____

CHECK GROUP

CRYOGENICS------- ☐
ELECTRONICS------ ☐
INJECTION LAB---- ☐
MECH. ENG.------- ☐
PEL-------------- ☐
SPRL------------- ☐
SSRL------------- ☐
TUBE SHOP-------- ☐
VACUUM GROUP----- ☐
WELD SHOP-------- ☐
OTHER:
_____ ☐

MECHANICAL FABRICATION SHOPS

OVERTIME REQUEST

Employee Name	Hours To Be Worked	Charged to W.O. or Acct. No.	Job Description	Date O.T. Worked

SUPERVISOR: _____ APPROVED BY: _____

From: CLEANING AND PLATING SHOP - MFS Department

TO OUR CUSTOMERS

To prevent the possibility of damage, we would like to suggest that you transport parts to be cleaned in fiberglass tote boxes. These boxes are very durable and can easily be cleaned before loading them with your cleaned parts.

The sizes listed below will fit our storage shelves and are recommended.

LEWIS "STACK-N-NEST" TOTE BOXES

	PRICE OF BOXES (1-19 quantities)	PRICE OF COVERS (each)
Code # SN 1610-5 - 16" x 10" x 5" deep	$9.32 ea	#CO 1610-1 - $6.28 ea
Code # SN 12-6 - 18" x 12" x 6" deep	11.31 ea	#CO 1812-1 6.53 "
Code # SN 1812-8 18" x 12" x 8" deep	12.94 ea	#CO 2013-1 6.53 "
Code # SN 2217-10 22" x 17" x 10" deep	19.62 ea	#CO 2217-1 10.66 "

TOTE BOXES ARE AVAILABE FROM:

Advanced Handling Systems of Northern California
526 Laurelwood Road
Santa Clara, California 95051

Phone: (408) 988-1833

COLORS AVAILABLE ARE: GREEN, GRAY, BLUE, AND RED.

Appendix A.5: Examples of MOSG Installation and Removal Procedures

9.4' ACCELERATOR SECTION INSTALLATION PROCEDURE

Robert R. Wurster

March 10, 1986

9.4' ACCELERATOR SECTION INSTALLATION PROCEDURE MANUAL

(REFER TO DRAWING ID 238-010-59
ID 902-675-52 R0
SA 750-214-05)

1) Assemble all tools required per ACCELERATOR INSTALLATION TOOL LIST.

2) Verify that the sector is under N2 purge. (A sintered bronze exit should be provided.)

3) Verify 'Z' location of downstream accelerator support belly band. (The distance from center of welded mount to center of belly band on the light-pipe will be the same as the distance between end support centers on the 9.4' accelerator section being installed.)

4) Fit belly band to light pipe and install hardware finger-tight. (This will allow adjustment in 'Z' if necessary.) All hardware will be secured during alignment process.

5) Install alignment mounting hardware finger-tight.

6) Verify serial number and orientation of 9.4' accelerator section to be installed.

7) Place (stongback) locating tool #1 on light pipe just upstream of belly band.

8) Place (stongback) locating tool #2 on light pipe at upstream end of installation location. NOTE: GREAT CARE MUST BE TAKEN TO INSURE THAT THE LOCATING TOOLS ARE LEVEL AND CENTERED SECURELY ON THE LIGHT PIPE.

   THE FOLLOWING PROCEDURE WILL REQUIRE ULTRA-CLEAN CONDITIONS AND THE USE OF CLEAN GLOVES (WHERE NOTED).

9) With foil ready, remove upstream eyelet peel-off from accelerator section to be installed and foil over exposed vacuum.

10) Place 9.4' accelerator section on locating tools as far down-stream as possible, using accelerator lifting fixture and the large hoist. SEE NOTE.

NOTE: IT MAY BE NECESSARY TO REMOVE BLANK FLANGES FROM BOTH THE INPUT WAVEGUIDE AND THE 9.4' ACCELERATOR INPUT TRANSITION TO ALLOW THE REQUIRED AMOUNT OF 'Z' MOVEMENT. FOIL, BAG AND TAPE OPEN FLANGES.

11) Remove foil and lint-free from upstream eyelets, place engagement ring on upstream accelerator section (properly oriented with scribed arrow up and pointed downstream) and roll 9.4' accelerator section upstream as far as possible (eyelets touching). NOTE: Some rough alignment using strongback alignment tools may be required to allow engagement of ring.

12) Secure alignment hardware between 9.4 accelerator end supports and light pipe mount/belly band.

THE FOLLOWING STEPS REQUIRES THE USE OF CLEAN GLOVES.

13) While wearing clean gloves, install waveguide load with clean gasket per Waveguide Flange Assembly Procedure. NOTE: 2 BOLTS ON EACH FLANGE ADJACENT TO EACH OTHER WILL BE INSTALLED BACKWARDS TO ALLOW CLEARANCE FOR FUTURE INSTALLATIONS (SEE DRAWING * ID-902-675-52 R0 Note 2).

14) Install Waveguide load sheet metal support bracket. Safety wire load to support.

15) Align 9.4' accelerator section. (TO BE PERFORMED BY THE PRECISION ALIGNMENT TEAM.)

16) Install load transfer blocks between 9.4' accelerator section and upstream accelerator section. Brass shim washers must be inserted between load transfer blocks and accelerator end supports (on the upper bolts only).

17) Check alignment of upstream accelerator section and adjust as required. (TO BE PERFORMED BY THE PRECISION ALIGNMENT TEAM.)

18) When alignment is completed, remove all strongback locating tools.

19) Weld eyelet joining the 9.4' accelerator section with the upstream accelerator section. Inspect weld twice.

20) Remove foil from input waveguide flange and accelerator input transition flange.

PROCEED IMMEDIATELY TO NEXT STEP

21) Using hardware on the vacuum manifold 'Y' supports nearest the input waveguide pump-out, align the input waveguide flange and the accelerator input transition flange.

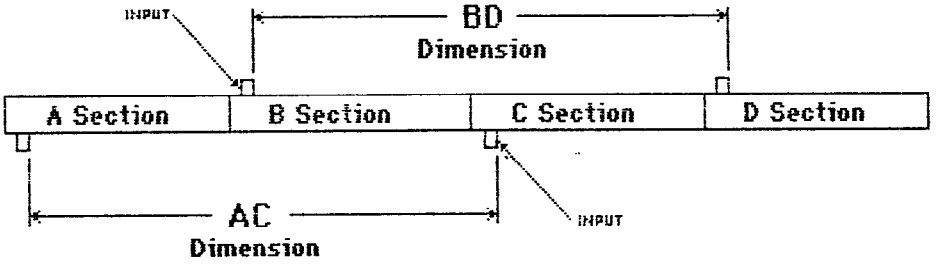
THE FOLLOWING PROCEDURE WILL REQUIRE ULTRA-CLEAN CONDITIONS AND THE USE OF CLEAN GLOVES.

22) Using clean gloves and gasket, secure Skarpaas flanges between 9.4' accelerator section and input waveguide per Waveguide Flange Assembly Procedure.

23) Fit a QE magnet support belly band at the downstream end of the 9.4' accelerator section per drawing ID 238-010-59. Install hardware finger-tight. (NOTE: Hardware will be secured during the alignment process.)

24) Downstream accelerator sections must now be realigned in 'Z' (The dimension between 'A' input and 'C' input / 'B' input and 'D' input must be returned to original settings taken during the Accelerator Removal Procedure.)

TYPICAL GIRDER



FOR QE/BPM0 INSTALLATION, REMOVE EYELET PEEL-OFF FROM DOWNSTREAM END OF 9.4' ACCELERATOR SECTION, FOIL OVER EXPOSED EYELET AND PROCEED IMMEDIATELY TO STEP 25 OF THE "SLC INTER-GIRDER BPM0/QUAD INSTALLATION PROCEDURE" AND COMPLETE THAT MANUAL.

RETURN TO STEP 25 OF THIS MANUAL AFTER COMPLETION OF THE QE/BPM0 INSTALLATION PROCEDURE MANUAL.

25) Align entire girder. (TO BE PERFORMED BY THE PRECISION ALIGNMENT TEAM.)

STATION# _____

BETA ACC. SWAP #22

Date	Tech		
_____	_____	1)	Verify that sector is vented and under purge.
_____	_____	2)	Tag, shut off H20 supply and return.
_____	_____	3)	Cut, drain H20 lines at Acc. and W/G.
_____	_____	4)	Tag, remove W/G load and blank off.
_____	_____	5)	Label, disconnect wiring.
_____	_____	6)	Measure AC / BD dimensions and record.
_____	_____	7)	Machine, deburr eyelet(s) per Procedure Manual.
_____	_____	8)	Unbolt input W/G.
_____	_____	9)	Remove Acc. section per Procedure Manual.
_____	_____	10)	Boroscope Acc. apertures.
_____	_____	11)	Install Belly-band and level.
_____	_____	12)	Verify new Acc. serial number/eyelet measurements.
_____	_____	13)	Install Acc. section.
_____	_____	14)	Install W/G load.
_____	_____	15)	Align Acc. section.
_____	_____	16)	Weld eyelet(s) and inspect twice.
_____	_____	17)	Bolt-up input W/G and top castings.
_____	_____	18)	Plumb H20 lines to Acc. and W/G.
_____	_____	19)	Turn on H20 supply and return, remove tags and check for leaks.
_____	_____	20)	Connect wiring.

AC Dimension _____ BD Dimension _____ ACC.# _____

ACCELERATOR SECTION REMOVAL PROCEDURE

Robert R. Wurster

March 12, 1986

ACCELERATOR SECTION REMOVAL PROCEDURE
(REFER TO DRAWING AD 771-001-R1)

1) Assemble all tools per ACCELERATOR REMOVAL/INSTALLATION TOOL LIST.

2) Tag demagnitizing power plug (located at the last flat rack in each sector) "OUT OF SERVICE". Date and sign tag.

3) Tag and turn off power supply to any and all magnets / beam line equipment located within the designated work area (girder, sector, etc.). NOTE: The supervisor at sector 10 (Ext. 2133) will take responsibility for this step.

4) Tag "OUT OF SERVICE" and shut off all supply cooling H20 to accelerator sections, magnets and beamline equipment to be removed. Date and sign tag.

5) Tag "OUT OF SERVICE" and shut off all return H20 from items in previous step. Date and sign tag.

6) Label all electrical leads on magnets and beamline equipment designated for removal. Disconnect leads.

7) Cut demagnitizing jumper wires between accelerator sections to be removed or modified.

THE FOLLOWING STEPS COVER THE PROCEDURE FOR EACH ACCELERATOR SECTION TO BE REMOVED.

8) Tag (with location information) and disconnect pipe union at the valve on return header. Drain H20 away from beam pipe into container for disposal. (THERE IS ONE (1) RETURN LINE FROM EVERY OTHER INPUT WAVEGUIDE AND EVERY OTHER WAVEGUIDE LOAD WITH THE ORDER OF OCCURENCE CHANGING EVERY GIRDER. eg. Input, Load, Input, Load -- Load, Input, Load, Input etc.)

9) Tube cut or hack saw return flex line at the waveguide load or input wave guide leaving a length of straight pipe and an elbow on the flex.

10) Place loose flex line in a safe storage area until time for reinstallation.

11) Tube cut or hack saw supply line at accelerator allowing enough lead-out pipe for easy solder reconnection but not so much so as to cause an inconvenient protrusion while handling accelerator section. Drain H20 away from beam pipe into container for disposal.

12) Secure supply flex line away from beam pipe.

13) Cut water jumpers between accelerator and waveguide load, and/or waveguide load and input waveguide, with the latter cut being made reasonably close to the input waveguide. (This will allow clearance when removing the accelerator section.)

14) Cork, bag and tape all open H20 lines to prevent accidental contamination of vacuum systems.

15) Verify that the sector is vented and under N2 purge. (A sintered bronze exit should be provided.)

WHERE AN 'A', 'B', OR 'C' SECTION IS TO BE REMOVED AN ACCURATE MEASUREMENT IN 'Z' MUST BE TAKEN TO INSURE THAT ACCELERATOR SECTIONS MOVED FOR THE PURPOSE OF CLEARANCE ONLY, BE RETURNED TO THEIR ORIGINAL POSITIONS.

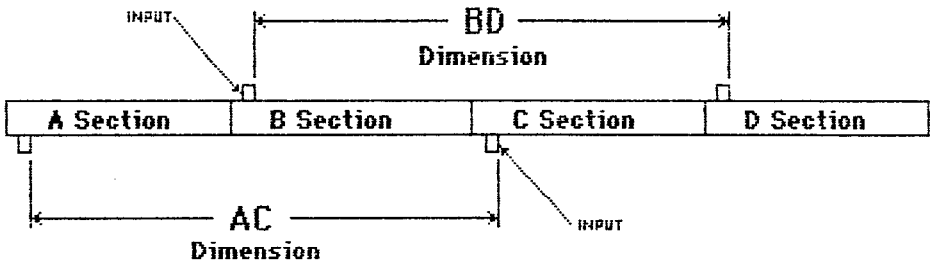
FOLLOW STEPS 16 OF THIS MANUAL.

WHERE ONLY THE 'D' SECTION IS DESIGNATED FOR REMOVAL ON A GIVEN GIRDER PROCEED TO STEP 19 OF THIS MANUAL.

(MEASUREMENT IS NOT REQUIRED).

16) Using a 100' tape, measure the distance between 'A' input and 'C' input (from side of input waveguide transition to side of input waveguide transition) and record. Repeat for 'B' input to 'D' input dimension and record. ACCURACY IS IMPORTANT TO A TOLERANCE OF +/- 1/32 inch. (SEE DRAWING BELOW.)

TYPICAL GIRDER



17) Cut the wire that secures the load to the sheet metal support bracket. Remove support and store for future installation.

18) Remove all but two (2) bolts (opposite each other) from the waveguide load to accelerator flanged connection.

THE FOLLOWING PROCEDURE WILL REQUIRE ULTRA-CLEAN CONDITIONS AND THE USE OF CLEAN GLOVES (WHERE NOTED).

19) With foil, blanking flanges and blank gaskets ready, remove the load and foil both the accelerator and the load.

PROCEED IMMEDIATELY TO THE NEXT STEP

20) While wearing clean gloves, install blank gasket and flange on both the accelerator and the waveguide load. (Refer to FLANGE ASSEMBLY PROCEDURE.)

FOR REMOVAL OF ACCELERATOR SECTIONS BEGINNING A GIRDER ('A' SECTION) OR ENDING A GIRDER ('D' SECTION), COMPLETE STEP #7 THRU #24 IN THE "SLC INTER-GIRDER BPM0 & QUAD INSTALLATION PROCEDURE." PROCEED TO STEP 21 OF THIS MANUAL UPON COMPLETION OF THE AFORE MENTIONED STEPS.

FOR REMOVAL OF ALL OTHERS ('B' & 'C' SECTIONS) PROCEED TO STEP 21 OF THIS MANUAL.

21) Wash down accelerator eyelets and surrounding area using ethyl alcohol or equivalent.

22) Cover any nearby magnets, components, etc. that metal chips could damage.

23) Remove the four (4) bolts that surround the welded eyelet, securing the accelerator end supports.

24) Remove four (4) bolts, tag and remove the top castings of the accelerator to waveguide support (to allow access).

25) Using a hand held cutting burr (pencil type), carefully machine eyelet. Cut just deep enough to separate eyelet using a degreased knife and a small ball-peen hammer to assist. (.070 inch has been set as a standard depth of cut.)

WHERE ONE (1) ACCELERATOR SECTION IS TO BE REMOVED, TWO EYELETS MUST BE CUT. WHERE TWO (2) ACCELERATOR SECTIONS IN SUCCESSION ARE TO BE REMOVED, THREE (3) EYELETS MUST BE CUT. ETC.

26) After eyelet is separated, deburr the outside edges of the eyelet using a degreased file (6-8" flat).

27) Cover each eyelet with foil after deburring to prevent accidental contamination of the vacuum system.

IN ORDER TO REMOVE AN ACCELERATOR SECTION, ALL SECTIONS LOCATED DOWNSTREAM WITHIN THAT GIRDER MUST BE SHIFTED DOWNSTREAM TO ALLOW THE DISENGAGEMENT OF THE ALIGNMENT RING LOCATED BETWEEN SECTIONS.

IF THE 'D' SECTION IS SLATED FOR REMOVAL, (BEING THE LAST SECTION ON THE GIRDER) ONLY IT WILL MOVE, ALLOWING THE REMOVAL OF THE RING BETWEEN SECTION 'D' AND SECTION 'C'.

IF THE 'B' SECTION IS SLATED FOR REMOVAL, SECTIONS 'C' & 'D' MUST BE SHIFTED DOWNSTREAM AND THE RING BETWEEN SECTIONS 'B' & 'C' REMOVED. THEN SHIFT SECTION 'B' DOWN-STREAM AND REMOVE THE RING BETWEEN SECTIONS 'A' & 'B'.

28) Place (strongback) locating tool #1 under the downstream end of the accelerator section to be removed and the downstream end of the accelerator section immediately upstream (WHERE THE 'B', 'C' OR 'D' SECTION IS TO BE REMOVED).

29) Place (strongback) locating tool #2 under the upstream end of the accelerator section to be removed and both ends of any sections located downstream within that girder.

30) Carefully align and level all locating tools before proceeding to next step. NOTE: <u>GREAT CARE MUST BE TAKEN TO INSURE THAT THE LOCATING TOOLS ARE CENTERED ON THE LIGHT PIPE</u> (30 INCH DIAMETER ALUMINUM WELDED PIPE) <u>AND FIRMLY SUPPORTING THE ACCELERATOR STRONGBACK.</u>

31) Remove alignment hardware securing the accelerator sections (to be moved and/or removed) to the light pipe. Retain hardware for reinstallation.

NO ACCELERATOR SECTIONS SHALL REMAIN ON THE LOCATING TOOLS UNATTENDED

32) Loosen four (4) each bolts securing the strongback alignment end plates (on the section to be removed) with the compression blocks located between two (2) adjacent strongbacks as follows:

'A' section - downstream end of section only.
'B' section - both ends of section.
'C' section - both ends of section.
'D' section - upstream end of section only.

DO NOT AT THIS TIME REMOVE ANY BOLTS OR BRASS SHIM WASHERS.

33) Make a foil basket under the eyelets of the accelerator section to be removed. (This is a safety measure to prevent the accidental dropping of the engagement ring located between accelerator sections within a girder.)

34) Locate a screw-jack between accelerator section to be REMOVED (downstream end) and the section(s) to be MOVED. In the case of a 'D' section, locate the screw-jack at the upstream end.

35) Remove loosened bolts and brass shim washers from compression blocks between accelerator sections. Document location of shims for future installation.

36) Remove all but the top bolt on the input waveguide to accelerator flanged connection on the section(s) to be MOVED (if any) and the section(s) to be REMOVED.

37) Wrap a large quanity of foil loosely around the flange(s) as the last bolt is removed. This will retain the gasket between the flanges and serve as a cushion during the (re)moving sequence.

THE FOLLOWING PROCEDURE REQUIRES THE USE OF CLEAN GLOVES (WHERE NOTED).

38) With one (1) person (in clean gloves) holding a degreased scribe tool, and a second person operating the screw-jack, slowly separate the eyelets (APPROXIMATELY 1/4 INCH) until the engagement ring can be seen.

39) Carefully insert the point of the scribe into one of the holes on either side of the ring while continuing to jack the accelerator sections apart. As soon as the ring can clear the step that it is resting on, stop jacking and remove the ring. NOTE: (THIS SHOULD BE NO MORE THAN A 3/4 INCH SEPARATION.)

OBSERVE AND MARK ORIENTATION, BEAM DIRECTION (AN ARROW ON TOP POINTING DOWNSTREAM) AND LOCATION OF THE RING.

40) Wrap the ring in lint-free and foil. Label with the location and place in a zip-lok plastic bag.

41) Foil over all exposed vacuum (eyelets).

IN THE CASE OF THE 'A' SECTION, A TEMPORARY ALIGNMENT SUPPORT IS INSTALLED BETWEEN THE ACCELERATOR AND THE STRONGBACK APPROXIMATELY FOUR (4) INCHES FROM THE UPSTREAM END. THE STRONGBACK IS THEN CUT JUST UPSTREAM OF THE SUPPORT. THIS ALLOWS THE LASER ALIGNMENT PLATE TO REMAIN ON THE GIRDER.

42) Place a .030 inch (approximately) sheet of stainless steel between eyelets. Lift out the accelerator section(s) slated for removal using the Accelerator Lifting fixture and a large engine hoist.

USE EXTREME CAUTION.
DO NOT BUMP EYELETS OR FLANGE FACES.

43) As soon as the accelerator section is clear of the light pipe, place in a transport tote and secure.

PROCEED IMMEDIATELY TO NEXT STEP.

44) While wearing CLEAN GLOVES, blank off the accelerator input transition flange and the input waveguide flange. (Refer to FLANGE ASSEMBLY PROCEDURE.)

45) Carefully remove the foil from the eyelet(s) to be deburred (both on and off the light pipe) and while wearing CLEAN GLOVES carefully plug the accelerator aperture(s) with lint-free.

46) Deburr accelerator eyelet(s) using a degreased file.
NOTE: TAKE CARE NOT TO SCRATCH THE COPPER FACE OF THE ACCELERATOR END OR BUMP THE LINT-FREE PLUG.

47) Cover eyelet(s) with foil.

48) Vacuum up all metal chips. THIS MUST BE A THOROUGH JOB.

49) Remove foil and while wearing CLEAN GLOVES carefully pull out the lint-free plug(s). Watch for any evidence of metal chips.

THE FOLLOWING STEP REQUIRES ULTRA-CLEAN CONDITIONS AND THE USE OF CLEAN GLOVES.

50) View apertures and 1st three (3) accelerator cavities using a clean Boroscope. NOTIFY SUPERVISOR OF ANY CONTAMINATION.

51) FOIL, BAG AND TAPE ALL EYELETS (BOTH ON AND OFF THE LIGHT PIPE).

52) Use furniture dollies to transport section(s) to a designated site for removal by crane.

53) Any sections that are remaining on the light pipe should be moved back upstream and resecured with the alignment hardware.

NO ACCELERATOR SECTION SHALL REMAIN ON THE LOCATING TOOLS UNATTENDED.

Appendix A.6: Example of a Weekly Status Report (MFD)

LINAC STATUS REPORT

SHOP WORK STATUS REPORT

ITEM NO.	PART NAME	QTY	FILE NUMBER	CHARGE NUMBER	PRIORITY	ENGINEER RESPONSIBLE	RELEASE DATE	SHOP(S) RESPONSIBLE	REQUESTED DUE DATE	COMPUTER COMPLETION DATE	ESTIMATED COMPLETION DATE	% COMP OF ESTM	LABOR COST	STATUS
01	FAST VALVE CONVERSION	8	000823	W.O. # 06-7126-0	201	C PERKINS x2970	09/16/86	UMEM	11/30/86	02/29/88		0	0	RECONSIDER AFTER DOWN
02	SHOP WORK TO SUPPORT MAINTENANCE OF LINAC AND RINGS	.1	001267	W.O. # 06-8101-0	902	AL LISIK x2322	02/20/87	TMEM EMEM RMEM RMLD UMEM FMEM	10/01/87	02/24/88	CLOSED	100	8446	CLOSED
02A	SHOP WORK TO SUPPORT MAINTENANCE OF LINAC	1	001965	ACCT # 12-0624	902	C PERKINS x2970	11/11/87	TMEM UMEM	10/01/88		10/01/88	0	0	
02B	SHOP WORK TO SUPPORT MAINTENANCE OF DAMPING RINGS	1	001967	ACCT # 12-0622	902	C PERKINS x2970	11/11/87	TMEM UMEM	10/01/88		10/01/88	0	0	
03	SHOP WORK TO SUPPORT BST	1	001969	ACCT # 12-0631	902	C PERKINS x2970	11/11/87	TMEM UMEM	10/01/88		10/01/88	0	0	
04	SHOP WORK TO SUPPORT CID	1	001971	ACCT # 12-0621	902	C PERKINS x2970	11/11/87	TMEM UMEM	10/01/88		10/01/88	0	0	
05	SEPTUM MAGNET (SUPPORTS AND INSPECTION & PROCESSING OF CONDUCTOR)	1	001457C	W.O. # 06-8165-0	203	BOB SUKIENNICKI	05/06/87	UMEM	07/17/87	12/09/87		61	5531	AT VACUUM
06	BAKEABLE FOCUSING LENS COILS	7	001947	W.O. # 06-6004-8	223	H FISCHER x2327	11/06/87	TMEM	11/17/87	01/01/88	11/17/87	0	0	

POSITRON SOURCE STATUS REPORT

07A	CAPTURE SECTION #3	1	000985	W.O. # 06-8112-0	202	AL LISIK x2322	10/31/86	EMEM UMEM	02/16/88	02/29/88	02/16/88	60	27707	WORKING / MAY HAVE INTERFERENCE WITH FURNACE DOWN
07B	VACUUM CRUSH SEAL BASKETS	12	001957	W.O. # 06-8112-0	224	B. SMITH x2638	11/10/87	EMEM	11/23/87	12/04/87	11/23/87	0	0	
08	POSITRON SOURCE GENERAL MAINTANENCE WORK	1	001539	W.O. # 06-8183-0	903	B FEERICK x3401	06/16/87	TMEM	10/01/87	11/23/87	CLOSED	100	8792	CLOSED
08A	SHOP WORK TO SUPPORT MAINTENANCE OF SLC POSITRON SOURCE	1	001973	W.O. # 06-2301-8	903	B FEERICK x3401	11/11/87	TMEM UMEM	10/01/88		10/01/88	0	0	
09	BUNCH MONITORS	3	001775	W.O. # 06-8630-0	210	B FEERICK x3401	09/14/87	EMEM UMEM	10/10/87	12/03/87	11/16/87	85	4369	IN MACHINE SHOP
10	PENETRATION PARTS, SLC-POSITRON SOURCE	1	002184	W.O. # 06-6005-8	218	B FEERICK x3401	10/26/87	TMEM	10/30/87	11/16/87	11/13/87	92	2601	ON HOLD FOR FURTHER INSTRUCTIONS
11	FLUX CONCENTRATOR, e+ SOURCE	4	002262	W.O. # 06-1403-7	221	E REUTER x2072	11/05/87	EMEM RMEM UMEM	11/16/87	02/25/88	11/16/87	0	0	

APPENDIX B

Quality Assurance Policies and Standards in Klystron & Microwave Department

Appendix B.1: Quality Assurance Procedures for Incoming Materials

a.) This section refers to general Q.C. procedures for raw materials (e.g. copper bar, stainless forgings, stainless tube and pipe, cupro nickel sheet, etc.) used for Klystron component manufacturing

b.) TRACEBILITY:

All incoming materials are assigned a lot number, used for internal traceability. This number has the form KXXXX.YY, where XXXX is an assigned number unique to the manufacturerer's heat lot number, and .YY is a number used to distinguish between separate bars, sheets, tubes, etc, of the same heat.

All pieces are stamped or labeled with the lot number upon receiving. Traceability is maintained throughout manufacturing processes and vendors return finished parts identified with appropriate lot number. Components are serialized during mechanical inspection, and at that time the lot number is recorded us.serial number along with other data on the mechanical inspection report. The lot number is also recorded on the shipping order, shop order log, receiving inspection cover sheet, and daily shipping report, which allows various cross checks in the event of error or omission.

c.) TESTING

All incoming materials are subjected to acceptance

tests. These tests vary depending upon material type and application, but usually consist of independent chemical analysis and metallographic examination. Samples for testing are cut when material is received and are identified with the assigned lot number. Test results are accumulated in a file established for each lot number along with copies of the manufacturers' test reports and certifications and copies of the purchase requisition. This file is then consulted prior to issuing material to verify acceptance.

Tests are performed on some specific materials of importance are as follows:

1.) COPPER

Copper currently being used in SLAC klystorns is purchased from Hitachi (through Copper & Brass Sales). The material is oxygen-free electronic grade certified to ASTM F68-82, Metallographic Class I.

Chemical composition must conform to ASTM F68, Table 1 (copy attached). However independent chemical analysis is not currently part of our acceptance procedure. The contaminant of most concern is oxygen. At the start of 5045 production, quantitative analysis for oxygen. was performed on many copper samples by by different labs with inconsistent results.,

We feel that metallographic examination is a reliable method for determining the presence harmful levels of oxygen. Metallographic examinations are performed on eight (8) samples taken from each copper bar. Samples are cleaned, fired at 950 degrees centigrade for twenty (20) minutes in Hydrogen, polished, etched, and examined at 100x. Samples must conform to ASTM F68, Metallographic Class I. The most common cause for rejection is porosity (usually resulting from oxygen contamination).

2.) STAINLESS STEEL: (Sheet, plate, tube, bar and forgings) is purchased from a variety of domestic and foreign mills depending on price and availability. The acceptance criteria as indicated below vary somewhat depending upon the application within the tube. Forgings or vacuum melted material is used instead of wrought forms whenever the major work direction of the wrought form could result in elongated defects which coincide with the direction of a possible leak path. In addition, vacuum melted (specifically, consumable electrode vacuum arc remelted) material is used for all stainless components near the cathode heater

which are in a more crtical position relative to potential outgassing. Type 304L is used in all locations except for the focus electrode and focus electrode support cup, which are made from 317L vacuum melted.

Samples of each piece of stainless purchased for use in klystrons (excluding some external parts, water fittings, etc.) are sent to an independent test lab for chemical analysis. Carbon and sulfur are analyzed by quantitative techniques, other elements by spectrographic analysis. Chemical composition must meet chemical requirements listed in the applicable ASTM specification and compare with chemical test reports supplied by the material manufacturer.

The material used for the focus electrode and focus electrode cup is type 317L modified. It is a non-standard grade and has the following composition.

Aluminum	(Al)	0.02%
Carbon	(C)	0.014
Chromium	(Cr)	20.43%
Cobalt	(Co)	0.14%
Columbium	(Cb)	0.11%
Copper	(Cu)	0.30%
Manganese	(Mn)	1.55%
Molybdenum	(Mo)	4.09%
Nickel	(Ni)	19.83%
Phosphorus	(P)	0.022%
Silicon	(Si)	0.26%
Sulfur	(S)	0.005%
Titanium	(Ti)	0.01%

Vanadium	(V)	0.09%
Zirconium	(Zr)	0.005%
Alloy Type		317L Modified

Also metallographic examinations are performed at SLAC of two (2) or more samples from each piece of stainless steel used in the klystron (excluding external parts). The inclusion content of the steel is rated in accordance with ASTM E45-84 method D. For the more critical klystron components such as anode housing, anode plate, cathode parts and window flanges, the maximum allowable inclusion content is as follows:

Type	A	B	C	D
Heavy	1 1/2	1	1 1/2	1
Thin	1	1 1/2	1	1 1/2

These requirements are usually met only by vacuum melted material.

For less critical parts, those exposed to vacuum but not in high temperature or high field areas, the maximum allowable inclusion content is as follows:

	A	B	C	D
Heavy	1 1/2	2	1 1/2	2
Thin	2	2 1/2	2	2 1/2

3.) CUPRO-NICKEL

A good grade of 70-30 cupro-nickel has has been purchased from Amax Special Metals Division and also from a European source through Copper & Brass Sales. Cupro-nickel is used for all the

welding eyelets.

Samples from each shipment are sent to an independent test lab for chemical analysis. The following is the chemical compostion of recent samples from copper & brass sales and Amax:

	C&B		AMAX
AL	.005	%	.001
C	.076		.025
Cb	.020		NA
CO	.005		.001
Cm	70.9		69.5
Fe	.005		NA
Pb	.005		.001
Mn	.37		NA
Ni	28.9		30.3
P	.002		.003
Si	.02		.005
S	.006		.002
Ti	.02		.001
Zn	.08		.001

Both of these chemistries are acceptable for klystron use.

Test welds and test brazes are performed on cupro-nickel samples to verify weldability and brazeability. These samples are then mounted, polished, etched and examined at 100x. Possible causes for rejection are excessive porosity or inclusions, poor braze wettability (high contact angle), porosity or cracking in weld.

Appendix B.2: Summary of QA Activities During Different Stages of Tube Manufacturing

I. MATERIALS

A. Certification required.
B. Chemistry tests performed as required.
C. Metallographic tests performed as required.
D. Materials numbered for traceability.

II. MANUFACTURING

A. Engineering drawings required.
B. Process documentation.
C. Mechanical inspection of parts with traceability numbers.
D. Travelers used.

III. TUBE ASSEMBLY

A. Detailed assembly drawings required.
B. All parts traced and logged.
C. Manufacturing parts required for assembly.
D. Travelers used.
E. Strong supervision required.

IV. BAKE PROCESSING

A. Detailed manufacturing rates required.
B. Computer controlled bake processing.
C. Equipment maintenance schedule.
D. Travelers used.

V. MECHANICAL ASSEMBLY

A. Manufacturing notes required.
B. Extensive final inspection.
C. Travelers used.
D. Strong supervision required.

Appendix B.3: Quality Assurance in Klystron Manufacturing

MANUFACTURING COMPONENTS:

a.) This section refers to general QC procedures used for all manufactured klystron components, excluding windows, HV seals, cathodes, and electromagnets.

b.) MECHANICAL INSPECTION: All incoming fabricated components must pass mechanical inspection prior to being placed in inventory. An inspection report is written for each lot of parts received and this report is retained in a permanent manufacturing and inspection history file.

Parts which have an electrical function are inspected 100%. Mechanical parts, fittings, water Jackets, etc. are sampled. If discrepancies are found in a sample the lot is inspected 100%. All descrepancies are noted on the inspection report and the affected parts are rejected. In some cases parts may be held pending possible MRB action.

c.) MATERIAL REVIEW BOARD (MRB)

If a part has a discrepancy which is judged to be minor or not affecting tube performance or life, it may be presented to the MRB committee for disposition. The committee consists of the production manager, tube engineer, manufacturing manager, and QC supervisor. The committee decides whether the parts in question will be used as is, reworked, or scrapped. Discrepant parts not

brought before MRB are either reworked or scrapped. Reworked parts are reinspected.

d.) TRACEABILITY:

All parts are given a serial number or lot number when inspected. This number is recorded on the inspection report along with material lot number and inspection data. The part serial numbers are also recorded tube number during assembly. Thus, given the tube number, complete data including component inspection reports, discrepancies, material test reports, etc., can be obtained.

Appendix B.4: Quality Assurance Procedures in Klystron Testing

Klystron Testing operations are governed by a set of Testing Notes that cover all procedures associated with klystron processing and data accumulation. All operators are familiar with these notes, and use them in processing tubes. Each tube is delivered with a travel folder from manufacturing which contains the history of the tube as it proceeded through the manufacturing process. The pulse transformer tank to which the tube is mated has undergone a set of quality assurance checks and pulse modulator testing before being delivered for use with a tube. The tube is mated to a focus magnet which has a separate quality assurance check program, is dressed with plumbing according to a written procedure, and the tank is filled with oil from a carefully monitored oil processing station. A final inspection of the completed tank-tube assembly is conducted by the mechanical group supervisor. Tank, magnet, and assembly information is added to the tube folder.

The tube assembly is installed in the 1 μsec test stand, the installation is inspected by the assigned test stand operator, and the tube processing commences according to the processing notes. On completion of initial 1 μsec processing, the tube is moved to a 3.5 μsec test stand for final processing, and a full power, 180 PPS heat run. Various data logging sheets are used to record each test, and the results. Performance of the tube as recorded by the operator is reviewed by the shift supervisor. All data sheets are kept in the tube travel folder. Any unusual or non-spec performance of a tube is brought to the attention of the shift supervisor, and then to a tube engineer. A program of additional testing is agreed on, and the new procedures are carried out. Most of these additional procedures are documented in the Testing Notes manual.

When a tube has completed all prescribed tests satisfactorily, the data is presented to a tube engineer for acceptance. The tube engineer may request additional testing, or sign off on the tube for Gallery use, sometimes with some limitations which are noted on the data card that goes with the tube. Tubes that are rejected are sent back to manufacturing for autopsy, and possible rebuilding.

The standardized data taken for each tube is entered into the SPIRES manufacturing data base, a tube card containing operating settings is attached to the tube, and the traveler folder containing all manufacturing and testing data is filed in the master klystron file. The tube is moved to a storage area and is available for Gallery use.

The overall operation of the Test Lab testing facility is summarized in the morning report which is distributed and discussed at the daily 8:30 AM management meeting, These discussions sometimes generate additional engineering and operational meetings to solve problems as they come up. On a weekly basis, a report of completed testing operations is generated, and used to update Klystron Task Force master data files.

Appendix B.5: Documentation Process for a Single Part (Anode Housing) in Klystron & Microwave Department

B.5a: Material Specifications

B.5b: Material Certification and Testing

B.5c: Part Purchase Requisition to an Outside Vendor and Machining Specifications

B.5d: Part Inspection and QC Reports

B.5e: Tube Manufacturing Reports

B.5f: Tube Assembly Reports

B.5g: Tube Bake Processing Reports

B.5h: Klystron Test Reports

B.5i: Failure Reports

B.5j: Part Non-Conformance Report

B.5k: Engineering Change Order

Appendix B.5a: Material Specifications

Specifications for Stainless Steel (2)

Other Specifications for Materials: (not included here)

Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service, ASTM A 182 (p. 93-106)

Standard Practice for Determining the Inclusion Content of Steel, ASTM E 45 (p. 61-73)

II. Stainless Steel

a.) General:

Stainless steel (sheet, plate, tube, bar & forgings) is purchased from a variety of domestic & foreign mills depending on price and availability. The acceptance criteria as indicated below vary somewhat depending upon the application within the tube. Forgings or vacuum melted material is used instead of wrought forms whenever the major work direction of the wrought form could result in elongated defects which would coincide with the direction of a possible leak path. In addition, vacuum melted (specifically, consumable electrode vacuum arc remelted) material is used for all stainless components near the cathode heater which are in a more critical position relative to potential outgassing. Type 304L is used in all locations except for the focus electrode and focus electrode support cup, which are made from 317L vacuum melted.

b.) Chemistry

Samples of each piece of stainless purchased for use in klystrons (excluding some external parts, water fittings, etc.) are sent to an independent test lab for chemical analysis. Carbon & sulfur are analyzed by quantitative techniques, other elements by spectrographic analysis. Chemical composition must meet chemical requirements listed in the applicable ASTM specification (attached) and compare with chemical test reports supplied by the material manufacturer.

The material used for the focus electrode and focus electrode cup is type 317L modified. It is a non-standard grade and has the following composition.

Aluminum	(Al)	0.02%
Carbon	(C)	0.014%
Chromium	(Cr)	20.43%
Cobalt	(Co)	0.14%
Columbium	(Cb)	0.11%
Copper	(Cu)	0.30%
Manganese	(Mn)	1.55%
Molybdenum	(Mo)	4.09%
Nickel	(Ni)	19.83%
Phosphorus	(P)	0.022%
Silicon	(Si)	0.28%
Sulfur	(S)	0.005%
Titanium	(Ti)	0.01%
Vanadium	(V)	0.09%
Zirconium	(Zr)	0.005%
Alloy Type		317L Modified

c.) Metallographic Testing

SLAC performs metallographic examinations of 2 or more samples from each piece of stainless steel used in the klystron (excluding external

parts). The inclusion content of the steel is rated in accordance with ASTM E45-84 method D (attached). For the more critical klystron components such as anode housing, anode plate, cathode parts and window flanges, the maximum allowable inclusion content is as follows:

Type A =	B	C	D
Heavy	1½	1	1½	1
Thin	1	1½	1	1½

These requirements are usually met only by vacuum melted material.

For less critical parts, those exposed to vacuum but not in high temperature or high field areas, the maximum allowable inclusion content is as follows:

	A	B	C	D
Heavy	1½	2	1½	2
Thin	2	2½	2	2½

Photo-micrographs are attached illustrating some of these conditions.

Appendix B.5b: Material Certification and Testing

Material Purchase Requisition (1)

Request for Order Shipping (1)

Laboratory Certificate - Anamet Laboratories, Inc. (1)

Materials Characterization (1)

Test Photographs (1)

Material Certification - Western Forge & Flange Co. (1)

PURCHASE REQUISITION

STANFORD UNIVERSITY
STANFORD LINEAR ACCELERATOR CENTER

Order Date | Requisition No. 74094-D

Originator	Bin No.	Phone Ext.	Group	Code
earson/LEvy	30	2433	KLY	08A

Expedite: ☐ Yes ☒ No | Inspection Required: ☐ Yes ☒ No | Attach Terms Cond.: ☐ Yes ☐ N

Authorization	Req'n. Date	Date Required
	05-08-85	10-01-85

Reporting Code

Count Title	Account No.	Work Order No.
		08-7030-6

Refer Inquires To: Buyer

Ship to: ☐ 2575 Sand Hill R ☐ Other – Specify Below

Specific Delivery Point	Object	Budget Approval	Approved By
Klys./Mfg. L. Levy			(Business Services Only)

Telephone Authorization Purchasing

A7094-A

PA

Does Requisition Involve Hazardous Material? ☐ Yes ☒ No ← Must Be Checked
Explosives ☐ Lasers ☐ Radioactive Mat'l. ☐ X-Ray Equip. ☐ Toxic, Corrosive, or Flammable Material

Equipment is a Replacement Item ☐

Special Handling or Packaging Requirement

Vendor Name	Delivery Date	Ship Via	F.O.B. Dest.	F.O.B. Ship Pt.	Confirming To	Terms	P.O. Number

Item No	Quantity	Unit	Item(s) Not Available in SLAC Stores ☐ — Complete Description of Materials	Estimated Cost	DO NOT USE
			Cross Forged 304L Vacuum Arc Remelted Cylinders, Rough Machined as follows:		
1	100	ea	8 7/8" OD x 6 3/8" ID x 6 5/8" Long @$363.00	36,300.00	
	NOTE:	1)	Certification of conformance to ASTM A182-F, and actual chemical test reports traceable to the mill heat lot number, must accompany each shipment.		
		2)	Send additional copies of certifications and test reports via US Mail; Attn: Irwin Levy, Bin 30.		
		3)	All pieces to be from the same material heat lot.		
		4)	Heat lot and billet number to be stamped on each piece.		
		5)	Final inspection and acceptance will be at the SLAC, Menlo Park, CA. Non-conforming materials will be rejected.		
		6)	All tolerances + 1/16" - 0" (OD); + 0" - 1/16" (ID).		
		7)	Maximum allowable inclusion content rating shall be:		

TYPE	THIN	HEAVY
A	1	½
B	1½	1
C	1	½
D	1½	1

as defined in ASTM E-45, Method "D".

		8)	No welding or other repair permitted.		
		9)	Recommended Vendors:		
			a) Coulter Steel, Wayne, 4-653-2512		
			b) Viking Metallugrigal, Steve, 9-800-648-3768		
			c) Western Forge & Flange, Bill, 6-727-7000		
				36,300.00	

Do not write in this section

Alt. Contract No. If Other Than "515"
☐ Suggested Vendors Below.

Remarks:
REF: Housing, Anode PF-700-867-42
T: ~~402-502~~ 298-373 / Chris Bork 6/24

PURCHASING CHOICE

Previous REQ: 9460

Requisition No. 74094-D

ACCT. NO. FOR CHGS.	DEPARTMENT	REQUISITIONER		MLU NO.
12-0871	Klystron	Bob Hoshida	Ext. 2433	84501-D

REQUEST FOR SHIPPING ORDER

RETURN THIS TO EXPEDITING - Bin 1

SHIP TO. (COMPLETE ADDRESS)	VENDOR	XX SAME AS SHIP TO
Anamet Laboratories Inc. 2827 Seventh St. Berkeley, CA 94710		

SPECIAL INSTRUCTIONS FOR ORIGINATOR:

A. CONTAINS NO HAZARDOUS MAT'L (XX STATEMENT ON REQ'N ( ) VERIFIED BY _____ UNLESS CHECKED BELOW.
( ) EXPLOSIVE ( ) LASER ( ) RADIOACTIVE ( ) FLAMABLE ( ) POISONOUS ( ) CORROSIVE ( ) X-RAY EQUIP:
( ) OTHER RESTRICTED MATERIAL NOT LISTED/SPECIFY:

B. ( ) DELICATE/FRAGILE MAT'L—SPECIFY.

C. ( ) FOR NON-GOVERNMENT USERS ONLY—AMOUNT OF INSURANCE REQUESTED.

SUBCONTRACT NO.	SHIP VIA	SHIPMENT		VENDOR RETURN AUTHORIZATION	DATE WRITTEN
US 511370-MB	Best Way	PREPAID	COLLECT	( ) SHOW ON LABEL	2-6-86
CT NO. FOR CHGS.		XX			

ITEM	QUANTITY	UNIT	DESCRIPTION / SERIAL NO. / DOE NO.	APPROX. WT & SZ.	REASON FOR SHIPMENT
1	1	lot	K911.1, 304L V.M. Forged Cyl.		Quantitative analysis for carbon and sulfur (leco) emission spectographic analysis.
2	1	lot	K911.2, " " " "		
3	1	lot	K922, 304L X-Forged Sample		
4	1	lot	K923, 1¼" DIA. 304L Stamped Disc		

Item 3. (K922) is Rush!

CT LOCATION OF MATERIAL:	FREIGHT CHGS.	SHIPMENT AUTHORIZED BY

FOR:
- [ ] Material Chemical Analysis
- [ ] CREDIT
- [ ] REPLACEMENT
- [ ] REWORK
- [ ] FABRICATION
- [ ] LOAN
- [ ] VENDOR PROPERTY
- [ ] WARRANTY

Remarks to Expediting:

LABORATORY CERTIFICATE

Anamet Laboratories, Inc.

ANALYTICAL
CHEMICAL
METALLURGICAL

2827 SEVENTH STREET • BERKELEY, CALIFORNIA 94710 • (415) 841-5771

HIGH TEMPERATURE
APPLIED RESEARCH
PHYSICAL TESTING

February 14, 1986

LABORATORY NUMBER: 286.86

P.O. No. U.S. 511370-MB
Req. No. 84501D
Acct. No. 12-0871
S.C. No. 04126

SUBJECT: Four Metal Coupons for Chemical Analysis

MARK: K911.1 & K911.2; 304L V.M. Forged Cyl., K922; 304L X-Forged Sample, K923; 1 1/4" Dia. 304L Stamping Disc.

DATE SUBMITTED: February 7, 1986

REPORT TO: Stanford Linear Accelerator Center
2575 Sand Hill Road
Menlo Park, California 94025
Attn: Bob Hoshida, Bin 30

CHEMICAL ANALYSIS

Mark:		K911.1	K911.2	K922	K923
Aluminum	(Al)	0.006%	0.006%	0.009%	0.005%
Carbon	(C)	0.009%	0.013%	0.014%	0.025%
Chromium	(Cr)	18.96%	18.90%	18.01%	18.81%
Cobalt	(Co)	0.27%	0.28%	0.05%	0.10%
Columbium	(Cb)	0.02%	0.02%	<0.005%	<0.005%
Copper	(Cu)	0.34%	0.35%	0.47%	0.16%
Manganese	(Mg)	1.21%	1.22%	1.60%	1.57%
Molybdenum	(Mb)	0.49%	0.52%	0.22%	0.24%
Nickel	(Ni)	10.65%	10.72%	10.56%	9.02%
Phosphorus	(P)	0.022%	0.024%	0.022%	0.025%
Silicon	(Si)	0.41%	0.40%	0.50%	0.29%
Sulfur	(S)	<0.002%	<0.002%	<0.002%	0.016%
Titanium	(Ti)	<0.005%	0.005%	0.007%	<0.005%
Vanadium	(V)	0.12%	0.12%	0.05%	0.05%
Zirconium	(Zr)	<0.005%	<0.005%	<0.005%	<0.005%
Alloy Type		304L	304L	304L	304L

These tests were performed in accordance with the purchase order.

Respectfully submitted,

ANAMET LABORATORIES, INCORPORATED

By E. A. Foreman

E. A. Foreman
Manager, Quality Control

(5)

304L VM Forging

MATERIALS CHARACTERIZATION

2-7-86

6

Sample _____ Date _____

Submitted by Bob Hoshida Account No. 08-R204-6 94.14.2

Phone Ext. 2433 Sample No. _____

Analysis to be performed:

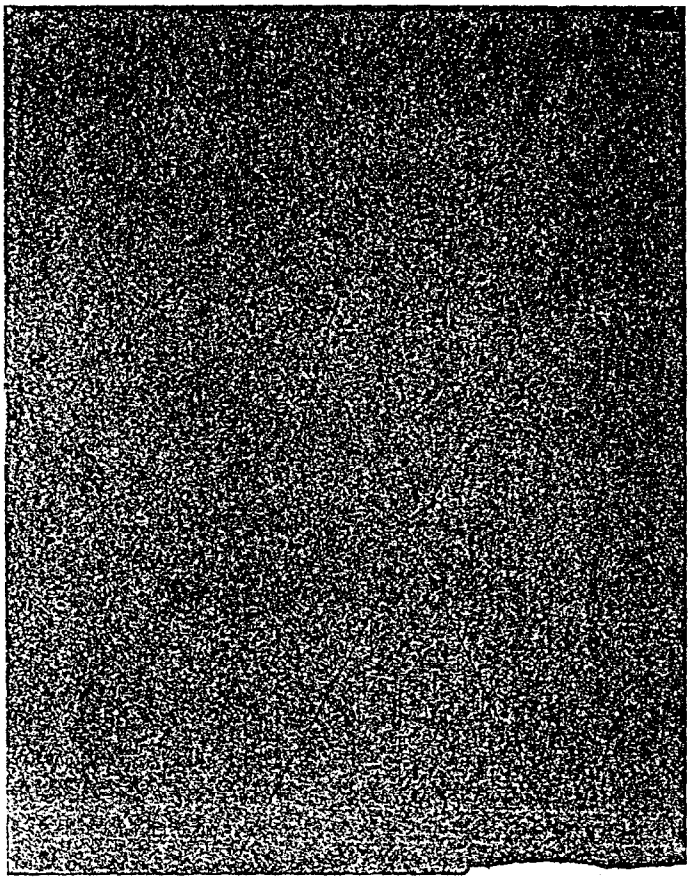
- ◯ IR
- ◯ XRD
- ◯ Emiss. Spec.
- ◯ ~~Mass.~~ Spec. ✓
- ◯ SEM
- ◯ Metallograph
  - ◯ Inclusion
  - ◯ Microporosity
- ◯ EDAX
- ◯ Auger
- ◯ μ-Probe
- ◯ RBS
- ◯ ESCA
- ◯ Other _____

Results:

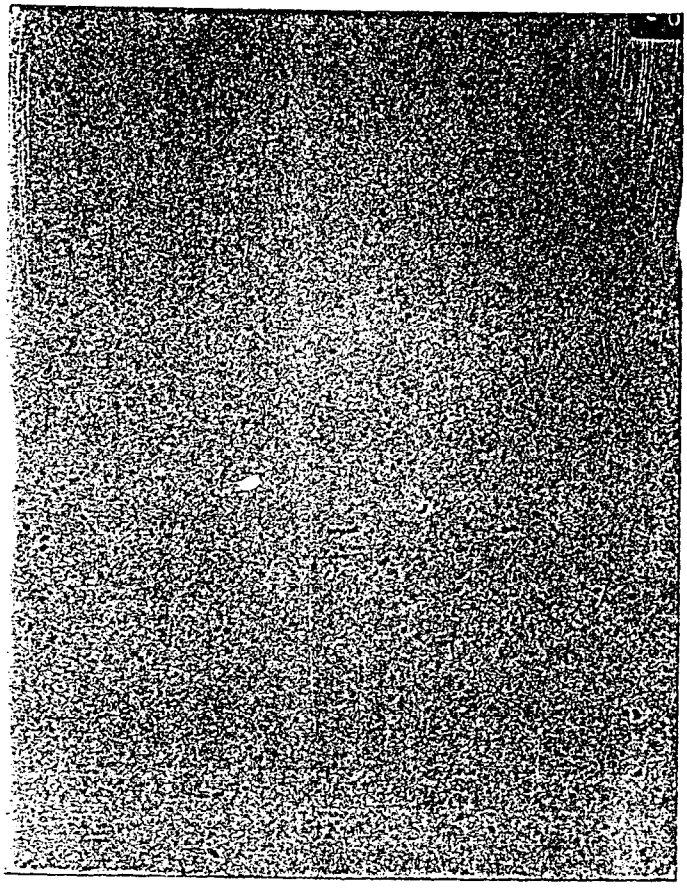
Analyst: _____ Mount No: _____

Reported: Date: _____ By _____

Channel: Phone _____ Memo _____ Other _____



D=½ AH01 911.2



D=½ AA00 911.1

WESTERN FORGE & FLANGE CO.

780 REED STREET 95050
P.O. BOX 327 95052-0327
SANTA CLARA, CALIFORNIA
T.I.N. #94-1022981

PHONE (408) 727-7000
TWX 910-338-0111
TELEX 34-6448
ELN #62819212

INVOICE DATE

INVOICE NO.

PACKING LIST

WORK ORDER NO. D 91268

CUSTOMER

Stanford Linear Accelerator Center
P.O. Box 4349
Stanford, CA 94305
Attn: Accts Payable

SHIP TO

Same
2575 Sand Hill Road
Menlo Park, CA 94025

DATE SHIPPED	DATE WANTED
1/6/86	
CARRIER: WFF Trk	FOB: Dest
CARTONS & WT.	SHIP VIA
CHEM. & PHYSICAL: W/FLANGES: 1 / W/INV.: 1	MARK NO.: RFQ 3713

CUST. P.O. NO.	DATE REC'D	REC'D BY	SALESMAN		
PO US 489950M	7/30/85	mail	BF	PARTIAL ☐ COMPLETE ☒	RESALE ☒ TAXABLE ☐ NON-TAXABLE ☐

ITEM NO.	QUANTITY	DESCRIPTION		HEAT NO.	PRICE	AMOUNT
3.	~~68~~	RINGS, CROSS FORGED & RMAO TO FIN: 8-7/8" O.D. + .060 - .000 6-3/8" I.D. + .000 - .060 6-5/8" Long + .060 - .000	A182 F-304L VAR. WITH INCLUSION RATING PER ASTM E45 METHOD D.	64278		

TERMS: NET 30 FROM DATE OF SHIPMENT

After 30 days SERVICE CHARGE is computed by a PERIODIC RATE 1½% per month which is ANNUAL PERCENTAGE RATE of 18%.

CLAIMS FOR SHORTAGE WITHIN 5 DAYS AFTER R BE MADE OF GOODS.

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Appendix B.5c: Part Purchase Requisition to an Outside Vendor and Machining Specifications

Part Purchase Requisition (1)

Specification - Machining Lubricants (1)

Specification - Machining, Polishing, Deburring (1)

Part Drawing, Anode Housing (1)

STANFORD UNIVERSITY
STANFORD LINEAR ACCELERATOR CENTER

Originator	Bin No.	Phone Ext.	Group	Code
PEARSON/BEEBE	30	3602	KLY	08A

Group Authorization | Req'n. Date: 12-02-86 | Date Required: 03-01-87

Account No.: SEE NOTES | Work Order No.: SEE NOTES

DEC 3 1 20 PM '86

Specific Delivery Point: TESTLAB KLY/MFG. | Object | Budget Approval | Approved By (Business Services Only)

Does Requisition Involve Hazardous Material? ☐ Yes ☒ No ◀ Must Be Checked
☐ Explosives ☐ Lasers ☐ Radioactive Mat'l. ☐ X-Ray Equip. ☐ Toxic, Corrosive, or Flammable Material

Special Handling or Packaging Requirements | Inspection Required ☐ Yes ☒ No | Attach Terms Cond. ☐ Yes ☐ No

Refer Inquires To | Buyer | Telephone Authorization Purchasing | Ship To: ☐ 2575 Sand Hill Rd. ☐ Other-Specify Below

	Vendor Name	Delivery Date	Ship Via	F.O.B. Dest.	F.O.B. Ship Pt.	Confirming To	Terms	P.O. Number
A	Holz Precision	2-16		X			1-30	
B						Ardythe		
C								
D								

Item No.	Quantity	Unit	Item(s) Not Available in SLAC Stores ☐ Complete Description of Materials	Estimated Cost	DO NOT USE
1	50	ea	PF-700-867-42-R0 ANODE HOUSING (1682) ~~@$370.00~~	~~$18,500.00~~	

NOTES:
1
1) SLAC will provide all materials. SLAC will also provide all stress relieving, chemical cleaning and plating if applicable. Vendor will provide material heat lot traceability for each part. Parts will be bagged and tagged with part number and applicable material heat lot number. Vendor will return residual stock with piece parts.
2) Material must be rough machined then stress relieved. Material returned for stress relieve must be free from burrs, chips and sharp edges.
3) Quantities of plus or minus five percent (±5%) will be accepted.
4) Vendor will use only SLAC approved machining lubricants and abrasives per SC-700-866-47-R4 and SC-700-866-49-R1 for machining and polishing.
5) Parts will be manufactured in strict accordance with drawing specifications. Vendor will provide a 100% general workmanship certificate of compliance. In addition vendor will provide a 100% dimensional inspection of at least 10% of the delivered parts. Parts inspected will be identified by tag traceable to individual inspection reports.
6) Material supplied by SLAC will be identified with a material heat lot number. Finished parts must be traceable to this number, i.e. if more then one heat lot number is supplied, each part must be labeled with the heat lot number of the material from which it is made.

~~98% wo# 08-7030-7 acct# 12-0878~~
2% wo# 08-7030-8 acct# 12-0877

~~TOTAL $18,500.00~~

DO NOT PLACE MORE THAN ONE REQUISITION PER ...

Do not write in this section

Gov't. Contract No. If Other Than "515"
List Suggested Vendors Below

CHAMP (6) 379-6550
M & E (6) 227-7040
HOLZ (6) 943-9204

Remarks:
~~T:429-479~~

Requisition No. 24284 -E

NO. 37700 (3-86) Jacket No. GPO 685-942

REQUESTOR (RETURN TO DEPT. AFTER ORDER PLACEMENT)

PROPRIETARY DATA OF STANFORD UNIVERSITY AND/OR U.S. DEPARTMENT OF ENERGY.
RECIPIENT SHALL NOT PUBLISH INC. WITHIN INFORMATION WITHOUT SPECIFIC
PERMISSION OF STANFORD UNIVERSITY

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B | SC-700-866-47-R4

REV.	DESCRIPTION	DRN.		APP.	DATE
R4	REVISED & REDRAWN	H.G.	10/6/86	SL	10/17/86

The following list of lubricants is approved for use in machining and fabricating components which will become part of a high vacuum system.

Relton A-9
Tap Magic
Tapmatic #1
Tapmatic #2
Rapid Tap
Trim Tap
"Pearl" Kerosene by Chevron Chem. Co.
"Tool Saver" by Do All Corp.
Cutzol EDM 220-30
Sunnen Han-852 Honing Oil
Vytron Concentrate
Rust-Lick G-25-J
Wheelmate #203
RD2-195
Dip Kool 868
Dip Kut 819H
No Sul #6871
Kool Mist #88
Cimcool 5 Star 40
Cimperial #1011
Haloform CW-40
Aqua Syn 55 (G-C Lubricants Co.)
Dip Kool 862
Trim Sol
Trim 9106 CS
CINDOL 3102
Penwalt #DP 1131
Cold Stream Coolant by Johnson Wax Co.

SCALE:	ITEM NO.	PREFIX	BASE	SUFFIX	TITLE OR DESCRIPTION	QTY.
		STOCK OR PART NO.				

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES: BREAK EDGES .005-.015
INTERNAL CORNERS .015 R MAX
FRACTIONS ±
DEC. .X
.XX
.XXX
ANGLES ± ALL SURFS. √

DO NOT SCALE DRAWING

STANFORD LINEAR ACCELERATOR CENTER
U S DEPARTMENT OF ENERGY
STANFORD UNIVERSITY STANFORD, CALIFORNIA

ENGR T. LEE
DFTS H. GREENHILL
CHK FJA 10-6-86
APPROVALS 10/17/86

NEXT ASSEMBLY:

SPECIFICATION
MACHINING LUBRICANTS
5045 KLYSTRON

SC-700-856-47-R4 | B

SH OF

M/F R4

REV.	DESCRIPTION	DRN.	CHK	APP.	DATE
R1	REVISED & REDRAWN	BB	6/2084	RTH	6/2084

Acceptable techniques and materials for use in the machining, deburring, and polishing of klystron components.

I. Scope

This specification is required for the finishing of all klystron components which have surfaces communicating with the inside vacuum areas. The specification is invoked by referring to the specification number in the drawing notes, purchase order requirements, manufacturing notes, or work instructions.

II. Techniques

a. Machining

The preferred technique for finishing is by machining only, i.e. no abrasive or polishing compounds are to be used unless approved. All commonly available cutting tools are permitted. Metal removal other than by machining, such as grinding, honing, EDM, chem milling, etc. are expressly forbidden.

b. Deburring

Deburring shall be with file, deburring knife or permitted abrasive. Deburring by abrasive vibrating or tumbling is permitted only if medium is silicon carbide in conjunction with fluids expressly permitted per SLAC Spec. SC-700-866-47-R0. Deburring by any other unspecified technique is prohibited.

c. Polishing

If the surface finish requirements cannot be met by machining alone, then polishing with approved abrasives may be permitted. Care must be taken to avoid using excessive pressure during polishing so as to preclude contamination of surfaces by imbedded abrasives. Avoid any burnishing or excessive heating. Any evidence of imbedded contamination will be cause for rejection.

III. Materials

a. Fluids - Lubricants

Cutting fluids, lubricants, wetting agents, etc. for use in machining or polishing are limited to those expressly permitted per SLAC Spec. SC-700-866-47-R0.

b. Abrasives

Abrasives for use in polishing klystron components are limited to the following:

3M Scotch Brite	Type S, Silicon Carbide (Gray Color) Type A, Aluminum Oxide (Maroon Color) Note: Type S is available in ultra fine (500 grit equiv.) while Type A is available in very fine (240 grit equiv.).
3M Wetordry Fabricut Cloth	Aluminum oxide or silicon carbide (available in 600 grit equiv.).

PROPRIETARY DATA OF STANFORD UNIVERSITY AND/OR U.S. DEPARTMENT OF ENERGY. RECIPIENT SHALL NOT PUBLISH THE WITHIN INFORMATION WITHOUT SPECIFIC PERMISSION OF STANFORD UNIVERSITY.

SCALE:	ITEM NO.	PREFIX	BASE	SUFFIX	TITLE OR DESCRIPTION	QTY.
		STOCK OR PART NO.				

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES: BREAK EDGES .005-.015
INTERNAL CORNERS .015 R MAX
FRACTIONS ±
DEC. .X
.XX
.XXX
ANGLES ± ALL SURFS. √

DO NOT SCALE DRAWING

NEXT ASSEMBLY:

STANFORD LINEAR ACCELERATOR CENTER
U.S. DEPARTMENT OF ENERGY
STANFORD UNIVERSITY STANFORD, CALIFORNIA

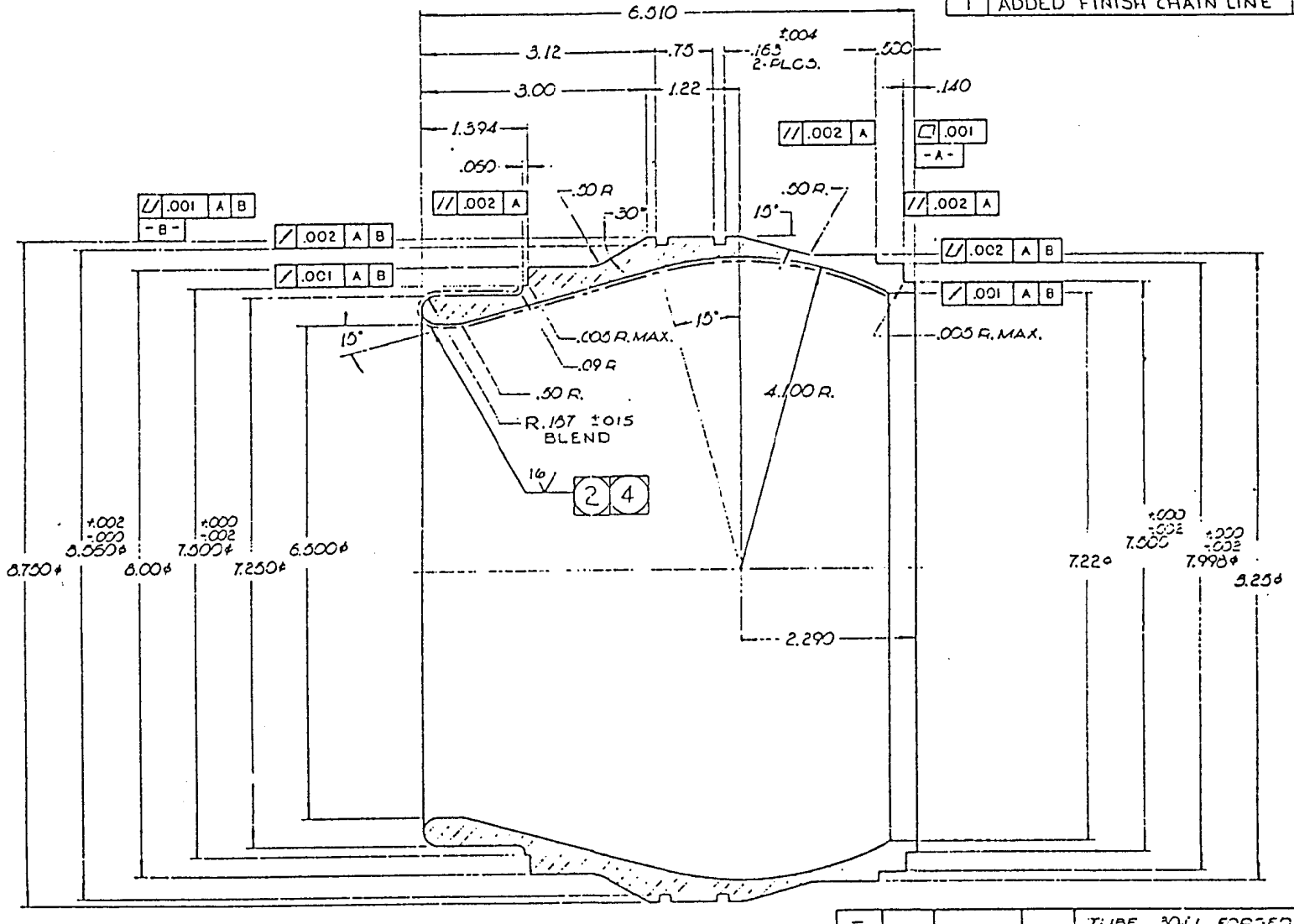
ENGR C. PEARSON
DFTS B. BOHL
CHK R. H.
APPROVALS

SPECIFICATION
MACHINING, POLISHING, DEBURRING
KLYSTRONS

SC-700-866-49-R1 B

SH OF M/F R1

REV.	DESCRIPTION	DRN.	CHK.	APP.	DATE
1	ADDED FINISH CHAIN LINE	JGS	FJA	RLV	4-19-83



NOTES:

1. STRESS RELIEVE AT 900°-1000°C FOR 10-20 MIN. WITH FAST COOL BEFORE FINAL MACHINING
2. ALL RADII MUST BE FULLY BLENDED - NO FLATS, STEPS OR TOOL MARKS PERMITTED
3. USE ONLY SLAC APPROVED MACH'G FLUIDS PER SC-700-366-47
4. SURFACES SHOWN WITH 16/ FINISH TO BE POLISHED PER SC-700-366-49

ITEM NO.	PREFIX	BASE	SUFFIX	TITLE OR DESCRIPTION	QTY.
	STOCK OR PART NO.				
—				TUBE, 304L FORGED SS	

DO NOT SCALE DRAWING

NEXT ASSEMBLY: SA-700-367-41

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.
TOLERANCES:
BREAK EDGES .003-.015
INTERNAL CORNERS .015 R MAX
FRACTIONS ±
DEC. .X
.XX .010
.XXX .005
ANGLES ±½° ALL SURFS. 32/

SCALE: 1/1

STANFORD LINEAR ACCELERATOR CENTER
U.S. DEPARTMENT OF ENERGY
STANFORD UNIVERSITY STANFORD, CALIFORNIA

PROPRIETARY DATA OF STANFORD UNIVERSITY AND/OR U.S. DEPARTMENT OF ENERGY. RECIPIENT SHALL NOT PUBLISH THE INFORMATION WITHIN UNLESS GRANTED SPECIFIC PERMISSION OF STANFORD UNIVERSITY

DWN J. LEHSOU DATE
MFR A. SOUL
CHKD R.T.H. 12-13-83
APPROVED 12/16/83

HOUSING, ANODE
5045 KLYSTRON

PF 700-367-42-R1 C

PF 700-367-42-R1 C

Appendix B.5d: Part Inspection and QC Reports

Inspection Report, Anode Housing (2)

Cover Sheet, Lot Inspection Report (1)

Master Inspection Report in Master File (1)

PART NAME HOUSING, ANODE			ASSY. 5045	PF/SA # PF-700-867-42-R0			REPORT # 0024	
REQ # 1682			BATCH/SN #	Insp'd By:	Ht. Lot		Date	Page
Qty. 28	Rej. 0	Accept 28	VENDOR HOLZ PRECISION		SEE BELOW		5-26-87	1 OF 2

SN # →	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419
Dimensions ↓																			
30° ± 1/2°																			
8.00 ± .010																			
7.250 ± .005																			
6.500 ± .005																			
HAND MEASURE																			
15° ± 1/2°																			
3.12 ± .010																			
.75 ± .010																			
3.00 ± .010																			
1.22 ± .010																			
.163 ± .004 (2X)																			
.060 ± .005																			
8.560 ± .002 .000																			
↗ .002 A B																			
.50 ± .010 R (3X)																			
1.875 FULL RADIUS 756																			

PART NAME HOUSING, ANODE			ASSY. 5045	PF/SA # PF-700-867-42-R0		REPORT # 0024
REQ #			BATCH/SN #	Insp'd By:	Ht. Lot	Date	Page
Qty.	Rej.	Accept	VENDOR				1 of 2

SN # →	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419
Dimensions ↓																			
.500 ± .005																			
// | .002 | A |																		
.140 ± .005																			
// | .002 | A |																		
6.510 ± .005																			
▱ | .001 | -A-																			
8.750 ± .005																			
↗↗ | .001 | A | B | -B-																			
15° ± 1/2°																			
8.25 ± .010																			
7.998 ± .002 / .002																			
↗↗ | .002 | A | B |																		
7.500 ± .000 / .002																			
↗ | .001 | A | B |															.0013			
7.22 ± .010																			
1.394 ± .005																			
// | .002 | A |																		
8.750 ± .005																			
↗↗ | .001 | A | B |																		

SHOP #	1682	PART #	PF-700-867-42RO
EQ. #	24284-E	DESCRIPT.	ANODE HOUSING
P.O. #	619285	HT LT #	PARTS MARKED K911, K756

VENDOR	HOLZ PRECISION	P.L. #	5-13/5-14

	RECEIVING			Q.C.		Q T Y			DATE	
	DATE	QTY	LOC	DATE	BY	ACC	REJ	RTV	RTV	
1	5-14-87	28	FLOOR	5-26-87	[signature]	28	—			
2										
3										
4										

(1) REMARKS

(2) REMARKS

(3) REMARKS

(4) REMARKS

I.R. # 0024

ENGR.: | DATE: 5-18-84 | PART II [illegible] Housing Anode | PART NO.: 700-867-42

SPECIAL INSTRUCTIONS: PLACE SERIAL NO. ON BOX

See Enclosed Q.C. Blueprint.

RED: Level "A", 100% Inspection.

YELLOW: Level "B", 10% Inspection plus 100% when any discrepancies are found.

GREEN: Level "C", Visual plus 1% Inspection.

* Asterisk indicates discrepancies must be dispositioned by full MRB. i.e. Project Engineer, Production Manager, and Q.C. Manager. Other items may be dispositioned by Production Manager or Q.C. Manager alone.

MASTER INSP. REPORT IN MASTER FILE

SPECIAL GAUGING METHODS:

1) Check all 16 finish surfaces 100% visual. Per note #2.

2) Check finish visually on all grooves.

FACSIMILE GAGE FOR 15°, .50R, 15°, 4.100R AND 2.290 IN BOX ON TOOL SHELF

CHECK ICV USING TYPE QC AMPLIMETER PROFILOMETER IF QUESTIONABLE

Validator Program G5

LOT	REV	DATE	VENDOR	RESUB	SERIAL NO.	QTY	REQ. NO.	HEAT LOT NO.	CLASS OF DEFECT A	B	C	INSP. DISP. ACC	REJ	INSP. REPORT NO.	INSPT. INIT.	REMARKS
1	01	5-18-84	Bennett Hydro		1-16	16	46	15-047				16	0	0001	T.J.R	Ok
2			CHAMP		17-26	10	56436	K-235	✓				10	0002	[illegible]	RTU 16
3		7-29-84	Champ		27-36	10	56436	K-235				10	0	0003	T.J.R	No discrepancies 16
4		10-8-84	Champ		37-45	9	56436	K-231				9	0	0004	[illegible]	R.T.U. Electric-Pencil d/c
5	0	12-12-84	EDWARDS													
5	0	10-30-84	CHAMP		46-64	19	56436	234				19	0	0005	[illegible]	
		11-6-84														
6	0	12-12-84	Edwards		66-75	10	59496	349				10	0	0006	[illegible]	
7	0	1-7-85	Edwards		76-95	20	"	"				20	0	0007	[illegible]	
8	0	1-7-85	EDWARDS		96-115	20	51496	349				20	0	0008	[illegible]	
9	0	4/5/85	CHAMP		116-188	73	70158	497				0	73	0009	[illegible]	WAI/MRB 4-8-85
10	0	3-21-85	champ		189-198	10	8963	K-646				0	10	0010	[illegible]	
11	0	3-24-85	CHAMP		199-208	10	8963	K-646						0011	[illegible]	WAI 3 RTV 3
~~12~~	~~0~~	~~3-26-85~~	~~CHAMP~~		~~209-218~~	~~10~~	~~8963~~	~~K-646~~								
13	0	10-3-85	champ		219-228	10	8963	K-645				4	6	0013	[illegible]	6 WAI 4 RTV
14	0	10-10-85	CHAMP		229-238	10	8963	K645				5	5	0014	[illegible]	WAI 4 - 1pc RTV
15	0	10-10-85	CHAMP		239-248	10	8963	K645				4	6	0015	[illegible]	4 WAI & 2pc RTV
11	0	10-11-85	CHAMP	✓	203-207 208	3	"	"				3	0	0011	J.T.	
16	0	10-16-85	CHAMP		249-263	15	8963	K-645 K-652				15	0	0016	J. ROCHA	NO RESISTANCE READ
12	0	10-23-85	CHAMP	✓	211, 213 214, 215	4	8963	K646				4	0	0012A	[illegible]	
14	0	10-31-85	CHAMP	✓	232	1	8963	K-645				0	1	0014	J T	SCRAP
15	0	10-31-85	"	✓	244-248	2	"	K-645				2	0	0015	J T	
16	0	12-2-85	EDWARDS		264-343	80	78211	K-356				68	80	0016	[illegible]	RTU 10
16	0	2-11-86	"	✓	C.I.R.	77	"	"				75	2	0016A	[illegible]	2-RTU
16	0	2-13-86	EDWARDS		265, 329 343	3	1342	K-356				2	1	0016B	[illegible]	1-RTU
17	0	8-13-86	CHAMP		344-396	53	1572	K-911				51	2	0017	JOE	
18	RED	12-3-86	KLYSTRON	✓	C&R. 108, 109 400	5	M-1776	N/R				5	0	0018	JOE R.	SPECIALS 1.0HR.
19	RED	1-6-87	KLY			3	SA591	N/R				3	0			2.0 SEE 1167-41 I.R. 0053
20	C/S	1-20-87	KLY	✓	C.I.R.	7	1823	—				7	0	0019	[illegible]	
21			KLY	3	C.I.R.									0020	K.V.	
21	R/S	2-17-87	KLY	✓	C.I.R.	9	50 1734	N/R						0020	K.V.	2.5
22	0	2-18-87	T.S.	2	C.I.R.	9	0	—				9	—	0021	[illegible]	
23	N/A	3-24-87	KLYSTRON	3	C.I.R.	9	1752	N/R				8	1	0022	JOE R.	2HC
28	0	4-6-87	KLYSTRON	1	SN 14	1	1752	N/R				0	1	0022A		
24	0	5-26-87	Holz		401-428	28	1682	C&R SHEET				28	0	0024	[illegible]	20
25	01	7-1-87	Holz Precision		429-452	24	1682					20	4	0025	[illegible]	
25	1	7-21-87	Holz Precision	✓	436	1	"					1	0	0025	[illegible]	

Appendix B.5e: Tube Manufacturing Reports

Bake Section Report (1)

Collector Section Report (1)

Klystron Autopsy Inspection (1)

Window Bake and Inspection Sheets (4)

Gun Section Report (1)

Cavity Section Report (1)

BAKE SECTION
TUBE-NO 5045-349a

TUBE-TYPE: 5045 CATHODE-NO: SP-329-5C

BAKE-STN-NO: 3 DATE-ON: 11 / 5 / 86

AUTO-SCHL: 5045 MANUAL-SCHL:

AUTO-REY: Q3 MANUAL-DATE: / /

SPECIAL COMMENTS:

	DATE	TIME	PRESS	I_f	TEMP
01. VENT-STN	11 / 5 / 86	11 :00			
02. VESSEL-RGH	11 / 5 /	12 30			
03. ACH-BAKE-1	11 / 6 /	04 :00	1.6 E-5	15.6	550
04. FIN-BAKE-1	11 / 11 /	08 :10	2.4 E-8	30.0	550
05. START-COOL	11 / 12 /	(18 :00)	(1.0 E-8)	(34.0)	430
06. LEAK-CHK	11 / 13 /	07:12	1.4 E-9		LEAK? YES / (NO)
			1.4 E-9		CMTS:
07. HOT-SHOT	11 / 13 /	:	E-		MIN: 15
			E-		AMPS: 41.
08 STRT-EMM	11 / 13 /	09:45	1.0 E-8	34.8	EXT-PROC 22 hrs @ 37 A
09. FIN-EMM	11 / 14 /	08:05	7.0 E-9	35.0	76 mA @ 114 Volts
10. FIN-APP	11 / 14 /	08:15	7.2 E-9	35.0	APP-PUMP-CURRENT: .3 μA
11. PINCH-OFF	11 / 14 /		1.9 E-9		
			1.9 E-9		
12. REMOVE	11 / 14 /				DELIVERY TO: Test
13. DELIVER	11 / 14 /				CERAMIC RES: 9.5 E+8 Ω

HRS-INSTALL (02 - 01) => 1.5

HRS-BAKE-1 (04 - 03) => 128

HRS-BAKE-2 (05 - 04) => 34

DAYS-BAKED (06 - 02) => 8

DAYS-ON-STN (12 - 01) => 9

BAKE-DISP => pass

PROCESS-COMM-1 => gassy during initial age.

PROCESS-COMM-2 =>

EXPER-NO =>

(Please separate numbers with commas)

COLLECTOR SECTION
TUBE-NO 5045- 349a

Note: For each item, don't write the value if it is the same as the value given here.

SEGMENT	BASE DIAMETER	ALPHA	LENGTH
1	1.500	45	1.381
2	3.030	∞	3.200
3	3.030	∞	3.200
4	3.030	∞	3.600
5	3.030	04	3.125
6	2.633	06	3.125
7	1.996	15	1.875
8	1.010	15	1.527

COLL-COMMENTS : _____

_____

ASSEMBLY

READY-DATE : 10/28/86 WELD-DATE : 10/29/86 by _____ (initials)

SPECIAL-CHAR : _____

_____

_____

EXPER-NO : _____

(Please separate numbers with commas)

Klystron Autopsy Inspection Inspected by: .....

Tube No. 349a Date: .....

Cathode:

Focus Electrode & Gun-Stem:

Alignment: Parallel: +_____ -_____ Concent.:

Anode & Housing:

Drift Tubes:

Window(s):

Cavities:

Collector:

Other:

5045 WINDOW

FINAL INSPECTION SHEET

* Window # a114 *

Date Ring Tested 10-17-86

OK (X) Fail ( )

ceramic mat'l: AL-995
sleeve mat'l : Cu
sleeve # : ~~884~~ 887

approved use	rejected	date	initial
(X)	( )	10-28-86	

PIT

Microscope examination of braze area

SMALL PIT W/DARK SPOT ON TOP SIDE.
REMOVED ~~SURFACE~~ SURFACE PARTICLES
SOME DARK SPOTS IN CERAMIC
LOOKS OK

Top side:

edge arcing (yes) (no)
arc spots (yes) (no)

Bottom side:

REMOVED SURFACE PARTICLES
SOME DARK SPOTS IN CERAMIC
LOOKS OK

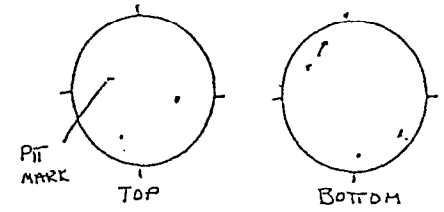
edge arcing (yes) (no)
arc spots (yes) (no)

Visual examination of both surfaces

List:
defect(s): TOP- ONE SMALL PIT MARK TOP SIDE. IS OK
BOT- NO DEFECTS

discoloration(s): DISCOLORATION OF CERAMIC DUE TO COATING

Back-light examination of both surfaces



Ring data examination

WINDOW SECTION

TUBE-NO 5045-~~3~~349A

please circle: LEFT / (RIGHT) WINDOW ISSUE-DATE: 10 / 28 / 86

WINDOW-NO	=> 2114	CERAMIC-MAT	=>
SLEEVE-MAT	=> Cu	METALLIZING	=> NiO_2
CERAMIC-EDGE	=> Beveled / (Straight)		
COAT-DATE	=> 9-24-86	COAT-TYPE	=> TiN
COAT-METHOD	=> D.C. Sputt	TIME/SIDE	=> 65 (min (sec))
COAT-PRESS	=> 50.0 MTORR	COAT-VOLTAGE	=> 2.8 KV
F-TOP-FRONT	=> 64 Hz	F-TOP-REAR	=> 129 Hz
F-BOTTOM-FRONT	=> 71 Hz	F-BOTTOM-REAR	=> 150 Hz
GAS-MIX	=> 40% OF N_2 / 60 % OF AR		
RING-TEST-DATE	=> 10 / 17 / 86		

CENTER TEMP, UNCOOLED, 6µS, 40MW, 43.2KW	=> 54	°C
CENTER TEMP, UNCOOLED, 6µS, 60MW, 64.8KW	=> 62	°C
SLEEVE TEMP, UNCOOLED 43.2KW	=> 55.8	°C
SLEEVE TEMP, UNCOOLED 64.8KW	=> 62.4	°C
RING OBSERVATIONS	=> BRIGHT GREEN GLOW THRU (SHORT TEST)	
POST TEST OBSERVATIONS	=>	
RECOAT-DATE	=>	RECOAT-TIME => (min sec)
RECOAT-CURRENT	=>	RECOAT-RESULTS =>
WINDOW-COMMENTS	=> PRE BAKED 600°C FOR 24 hrs	

EXPER-NO =>

(Please separate numbers with commas)

5045 WINDOW

FINAL INSPECTION SHEET

****
* Window # 2124 *
****

Date Ring Tested 10-18-86

OK (X) Fail ( )

ceramic mat'l: AL-995
sleeve mat'l : CU
sleeve # : 1061

approved use	rejected	date	initial
(X)	( )	10-20-86	GH

Microscope examination of braze area

Top side:

edge arcing (yes) (no)
arc spots (yes) (no)

REMOVED SURFACE PARTICLES. SOME DARK SPOTS IN CERAMIC LOOKS GOOD

Bottom side:

edge arcing (yes) (no)
arc spots (yes) (no)

REMOVED SURFACE PARTICLES COUPLE OF BURN SPOTS REMOV SOME DARK SPOTS IN CERAMIC LOOKS GOOD

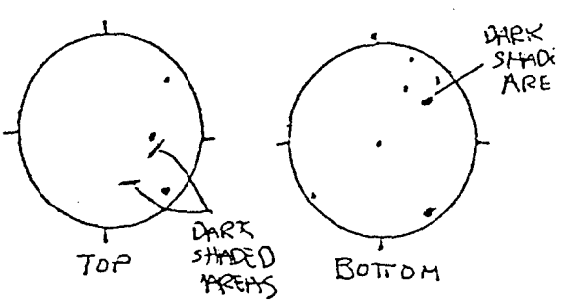
Visual examination of both surfaces

List:

defect(s): TOP - COUPLE OF DARK SHADED AREAS, LOOKS OK UNDER MICROSCOPE
BOT - ONE DARK SHADED AREA, LOOKS OK UNDER MICROSCOPE.

discoloration(s): DISCOLORATION OF CERAMIC DUE TO COATING

Back-light examination of both surfaces.



Ring data examination

WINDOW SECTION

TUBE-NO 5045-349A

please circle: (LEFT) / RIGHT WINDOW ISSUE-DATE: 10/28/86

WINDOW-NO	=> 2124	CERAMIC-MAT	=> AL-995
SLEEVE-MAT	=> C4	METALLIZING	=> NiO_2
CERAMIC-EDGE	=> Beveled / (Straight)		
COAT-DATE	=> 10-2-86	COAT-TYPE	=> TiN
COAT-METHOD	=> D.C. Sputt	TIME/SIDE	=> 65 (min (sec))
COAT-PRESS	=> 50.0 mTorr	COAT-VOLTAGE	=> 2.8 KV
F-TOP-FRONT	=> 82 Hz	F-TOP-REAR	=> 154 Hz
F-BOTTOM-FRONT	=> 67 Hz	F-BOTTOM-REAR	=> 119 Hz
GAS-MIX	=> 40% OF N_2 / 60% OF Ar		
RING-TEST-DATE	=> 10/18/86		
LOSSES,COOLED,6μS,100MW,108KW	=> 70.0 Watts		
CENTER TEMP,COOLED,6μS,100MW,108KW	=> 54 °C		
CENTER TEMP,UNCOOLED,6μS,50MW,54KW	=> 54 °C		
CENTER TEMP,UNCOOLED,6μS,25MW,27KW	=> 40 °C		
SLEEVE TEMP,UNCOOLED,54KW	=> 58.2 °C		
SLEEVE TEMP,UNCOOLED,27KW	=> 46.0 °C		
RING OBSERVATIONS	=> MED BLUE EDGES THRU (LONG TEST)		
POST TEST OBSERVATIONS	=>		
RECOAT-DATE	=>	RECOAT-TIME	=> (min sec)
RECOAT-CURRENT	=>	RECOAT-RESULTS	=>
WINDOW-COMMENTS	=> PRE BAKED 600°C FOR 24 hrs		

EXPER-NO =>

(Please separate numbers with commas)

GUN SECTION

TUBE-NO 5045- 349a

NOTE : Example of a value for Pressure: 3.2 E-8 (where 3.2 E-8 = 3.2×10^{-8})

GUN-NO =>	SA-316	CATHODE-NO =>	SP-329-SC
GUN-USED-IN =>	New	CATH-USED-IN =>	New
FE-NO =>	SA-370	CATHODE-TYPE =>	Scandate
FE-USED-IN =>	New	CATH-AN-SPAC =>	1.691
FE-SPAC =>	(0.216)	MOUNT-DATE =>	10 1 28 86
FIN-PRESS-HOT =>	9.7 E-8	HEATER-RES =>	.0624 Ω
FIN-PRESS-COLD =>	0.3 E-8	HV-SEAL =>	LI-139
VAC-FIRE-STN =>	4	A =>	.496
CONCENTR =>	.001	B =>	.467
PARALLEL =>	.00075	C =>	.463

GUN-COMMENTS =>

PHASE-NO	TEMP	AMPS	VOLTS	PRESS.	HOURS	RF
1	1015°C	31.7	14.0	1.5 E-6	20.5	(ON) / OFF
2	1017°C	32.0	14.1	6.1 E-7	18.0	(ON) / OFF
3	1119°C	36.6	17.7	3.0 E-7	18.0	(ON) / OFF
4	1010°C	31.5	14.1	6.7 E-8	6.5	(ON) / OFF
5	1038°C	33.4	15.4	6.0 E-8	6	ON / (OFF)
6	1073°C	35.1	16.7	9.7 E-8	1	ON / (OFF)

EXPER-NO =>
(Please separate numbers with commas)

GUN AUTOPSY

GUN-AUT-COMM=>

FE-COMMENTS=>

CATH-COMMENTS=>

AUTO-CONCENTR=>

AUTO-PARALLEL=>

CAVITY SECTION

TUBE-NO 5045-349a

Cavity #	1	2	3	4	5	6		
SPEC'S MHz	2860±3	2855±2	2877±2	2887±2	2935±7	2853+3,-8		
Q_e	175±25					16.5+1,-3	Date	Initials
CLAMPED MHz	2856.1	2858.2	2874.3	2883.4	2932.5	2857.1		
Q_e	173					18.0		
FINAL MHz	2857.6	2862.0	2874.9	2883.1	2932.2	2848.2	10/24/86	AN
ADJUST MHz		2855.1	2876.4	2888.0				
FINAL Q_e	206					16.2		
	A-IN: I-201		A-GAIN: G-196			A-OUT: 0-197		
RECHECK MHz					/		/ /	
READJUST MHz					/			
RECHECK Q_e								

CAVITY COMMENTS :

EXPER-NO :

(Please separate numbers by commas)

Appendix B.5f: Tube Assembly Reports

Klystron Final Assembly Procedure (4)

Anode Housing Assembly Sheets (2)

KLYSTRON FINAL ASSEMBLY PROCEDURE.

Uyeda/Sirois Jan.85

Tube Serial No. 349a Date Assembled 10-28-86

1. Check sub-assemblies for serial numbers:

a. Input	201	e. Recombiner	RV-49
b. Gain	196	f. Collector	C-175
c. Output	197	g. Anode	AH-21
d. Splitter	SV-49	h. Gun	SP-329-S.C

2. Dimensions (indicate name of person doing the work)

	Reading	Engraving	SHIM THICKNESS
a. Gap btwn. 2a & 2b drift tubes	.029		
b. Gap btwn. 5a & 5b drift tubes	.021		
c. Dim. 2.125" on 2a drift tube	2.130		
d. Dim. 2.122" on 2b drift tube	2.126		
e. Dim. 2.125" on 5a drift tube	2.130		
f. Dim. 2.122" on 5b drift tube	2.120		

3. Install H_2O jackets on Gain Sub-Assembly ____

4. Clean stacking mandrel with acetone and ether ____

5. Clean ceramic ring and place on mandrel ____

6. Stack Sub-Assemblies on mandrel. Check for foreign objects, scratches, etc: ____

Note: 1. 2 people needed, to guide pieces.

2. All heliarc eyelets to be cleaned with ether before assembling.

a. Input section.

b. Gain Section (Orient correctly to Input)

c. Output Section (Orient correctly to Gain)

d. Bolt the 3 sections together

7. Lift Assembly with nylon sling and place on "cold test" cart (2 people required)

8. Bolt on 2 dummy windows and the recombiner section (3 bolts/flange snug fit - not torqued)

9. Transport to Cold Test Area

10. Have Tube Engineer indicate disposition of tube with his signature

Accept _____ Reject _____

11. Lift Assembly from cold test cart with nylon sling and place on a tube stand (2 people required)

12. Blow off flanges with filtered N_2 and remove dummy windows

13. Install permanent windows:

a. Record serial no. or nos. 2114 2124

b. Blow off faces of window(s) with N_2

c. Blow off Recombiner flanges with N_2

d. Bolt window(s) in place:

1. Install 1 stud/window

2. Torque nuts to 17 ft/lbs using a 180° criss-cross pattern

3. Use WG alignment tool for single windows

b. Blank off WG flange

14. Install Collector and weld Welder:

15. Install Collector H_2O Jacket

a. Add the Lifting Fixture

16. Lift Assembly from tube cart with nylon sling

17. Weld heliarc eyelets

a. Gain to Output Welder:

b. Gain to Input Welder:

18. Weld icm pump flange Welder:

19. Weld blank-off disc on input Welder:

20. Install Gun Assembly:

a. Visual check of drift tube for foreign objects, etc. J. L. K.

b. Clean anode nose with ether J. L. K.

c. Blow off Focus Electrode with filtered N_2 J. L. K.

d. Orient Gun Assembly with Input J. L. K.

e. Attach with 4 studs J. L. K.

f. Weld eyelets Welder J.

21. Attach 8 liter ion pump. Orient properly to leave room for its magnet J.

22. Leak check with H_e Leak Detector

a. Output side of window(s) Name: J.

b. Tube side of window(s) Name: J.

23. Weld H_2O Jackets on Gain Section Welder: J.

24. Place tube back on a tube stand J.

25. Complete "Blue Sheet" with Travel Folder J.

26. Turn Tube and Travel Folder over to Bake Shop personnel J.

Received _____

ANODE HOUSING

SERIAL NO. AH-211
Used Anode Housing.

ITEM	NO.	SERIAL NO.
PUMPOUT RING	PF-700-860-60	A/A
HELIARC RING (short)	PF-700-861-12	H
HELIARC RING (long)	PF-700-861-13	G
ANODE HOUSING	PF-700-861-42	#42 b
ANODE HOUSING RING	PF-700-867-43	SA-116-A

SERIAL NO. AH-178 b in #350

ITEM	NO.	SERIAL NO.
PUMPOUT RING	PF-700-860-60	B3/A
HELIARC RING (short)	PF-700-861-12	A
HELIARC RING (long)	PF-700-861-13	H
ANODE HOUSING	PF-700-861-42	SN-310
ANODE HOUSING RING	PF-700-867-43	SA-350A/SN-176

SERIAL NO. In #351 AH-113 b Reworked. From #254

ITEM	NO.	SERIAL NO.
PUMPOUT RING	PF-700-860-60	A/A
HELIARC RING (short)	PF-700-861-12	G
HELIARC RING (long)	PF-700-861-13	G
ANODE HOUSING	PF-700-861-42	SN-215
ANODE HOUSING RING	PF-700-867-43	SA-288a-SN-244

SERIAL NO. AH-212 #352a

ITEM	NO.	SERIAL NO.
PUMPOUT RING	PF-700-860-60	A/B3
HELIARC RING (short)	PF-700-861-12	G
HELIARC RING (long)	PF-700-861-13	SN-I
ANODE HOUSING	PF-700-861-42	SN-311
ANODE HOUSING RING	PF-700-867-43	SA-381

EXPERIMENT # 0269 "024

ASSEMBLY	SERIAL NO.
BASE	B - 101
CATHODE ASSY.	SA-395 7.7 x 10^5 after bake
PELLET	SP-418-5C/ E.C.
H.V. SEAL	LI-186 ✓ No Nucleations.
ANODE HOUSING	85 B rework.
INPUT	199
GAIN	187
OUTPUT CAVITY WAVEGUIDE	202
OUTPUT SPLITTER	SV-48
WINDOW (LEFT)	2093 ✓ Support test Repeated with 2104
WINDOW (RIGHT)	2126
OUTPUT RECOMBINER	RV-47
ION PUMP	HIA 6099
COLLECTOR	C-172

TUBE NO. 349a

10-28-86

ASSEMBLY	SERIAL NO.
BASE	A-44b
CATHODE ASSY.	SA-316
PELLET	SP-329-5C
H.V. SEAL	LI-139 has Nucleations
ANODE HOUSING	AH-211
INPUT	201
GAIN	196
OUTPUT CAVITY WAVEGUIDE	197
OUTPUT SPLITTER	SV-49
WINDOW (LEFT)	2114
WINDOW (RIGHT)	2124
OUTPUT RECOMBINER	RV-49
ION PUMP	HIA 6088
COLLECTOR	C-175

Appendix B.5g: Tube Bake Processing Reports

Klystron Processing Check List (4)

Processing Schedule Authorization (1)

Klystron Bake Processing Log (4)

Process Graphs (5)

Tube Process Report - Station Log (1)

KLYSTRON PROCESSING CHECK LIST
Revision 5/8/86 -- "BAKE LIST"

S/N & REWORK LEVEL 349a STATION# 3

TUBE TYPE 5045 DATE 11-5-86

| INITIAL EACH STEP WHEN COMPLETED |

Station Preparation

RB Check station status and maintenance list
RB Ion guage spare filament available for tube & vessel
RB Cooling air and heat tape switches properly set
RB Station vented and logged

Tube Preparation

RB Borescope Inspected
RB Input connector removed.
RB All tape and foreign matter removed
RB O'rings removed
RB Appendage pump orientation and bolt clearance okay
RB Appendage pump heat shield installed and ground spring removed
RB Folder received from tube shop
RB Proper collector water jacket
RB Visual inspection

Tube Installation

RB Let-up fixture purged with nitrogen
RB Tube vented. Handle CAREFULLY
RB Pinch-off flange and station flange visually inspected
RB Tube valved-in and logged
RB Filament continuity normal 11.8 .8
RB All thermocouples working
RB Waveguide blown out using high pressure N2
RB Tube body not visually shorted to ground
RB Bellows restraint adjusted and plate installed
RB All thermocouples not shorted by visual inspection
RB Heat shields on gun, input, and appendage pump
RB Earthquake restraints installed
RB Window pump started or leak rate < = 1mT per second
RB All foreign matter cleared and base plate blown off
RB Wipe down O'ring
RB Window manifold number 14
JN Second person visually check

Vessel Installation

BB Vessel oven power cord connected (fan on Sta #5)
RB Groundstrap on vessel
BB Water lines connected
BB Bake status switch correct
BB Interlocks complete; except 20 K
KB Vessel roughing and logged
BB Schedule authorization obtained
MD Paperwork initiated, folder obtained, schedule authorization posted, summary sheet and graph labeled
BB Log tube on calendar
BB Set-up fan on ion pump
RB Enter tube on computer and in logbook
DB Vessel valved-in, interlocks complete and computer normal

Before Leak Check

BB Computer prompt "LEAK", or all TC's < = 150C
BB Vessel gate valve and bypass valve shut
BB RGA tuned to helium
BB Helium purged
BB Readings logged

Leak Check

BB Vent vessel
DB Log tube leak check status
FB Log O/P waveguide leak status. Subsequent leak check needed? Yes X No ____
/
BB Wait until TC#3 < = 100 degree C
BB Remove vessel
BB Vent window manifold
BB Log through window leak status
BB Appendage pumps started
BB Heat shields removed
BB Start filament pre-stabilization
BB Waveguide cover installed
BB Retorqued bolts and log

Before Emission

BB Hot shot complete, and fil back to operating condition
BB Record appendage pump current, then disconnect
BB Hook up high voltage equipment, and check visually for shorted tube body

BM Set up safety equipment. Clear ladder and bystanders.

End Emission

Pressure & emission current OK or notify supervisor
High voltage off (Fil. on)
Appendage ion pump on (Fil. on)
Log final readings with filament on
Filament off. Tube cooling for pinch

Before Pinch-off

Bellows support properly adjusted
Rubber grommet in place
Pinch-off tool properly centered and leveled
Pump-out tubing oiled
JH Second person checks set-up
Log pressure before pinch-off. Must be normal

After Pinch-off

Log after pinch-off pressure
Conclude computer processing and sign out logbook
Leak check pinch-off
Epoxy
Pinch-off cup installed
Input installed and covered
Evaluate need for sandblasting. Sandblasted?
Yes X No ____
Gun ceramic resistance check

$\frac{9.5}{\text{meter reading}} \times \frac{10^{6}}{\text{megohms}} \times \frac{10}{\text{switch multiplier}} \times \frac{10}{\text{volt meter multiplier}} = 9.5 \times 10^{8}$ Ohms

Notify supervisor if resistance < 1×10^{6} ohm.
Water jacket leak checked
O/P waveguide leak checked if required. Checked?
Yes X No ____
O/P blown out using high pressure N2 and properly sealed.
Plastic bag over gun
Log tube off calendar
Final visual inspection by Mike or Chuck

Delivery

BB

Tube delivered to Test cage, noted on blackboard;
Person notified: X LW

Tube delivered to Mechanical; Person notified _____

Appendage pump started and logged

Paperwork complete; tube folder, processing folder etc.

| RETURN COMPLETED CHECKLIST TO CHUCK |

PROCESSING SCHEDULE AUTHORIZATION BAKE DETAIL ORIG

STATION NO.: 3	DATE ON: 11 / 5 / 86
TUBE TYPE: 5045	S/N: 349a

SPECIAL FEATURES:

CATHODE S/N: SP-329-SC

SCHEDULE : AUTOMATED ☒ MANUAL ☐	REV. NO.: 03

HIGH BAKE TEMPERATURE: 550°C FILAMENT: 30.A

LOW BAKE TEMPERATURE: 430°C FILAMENT: 34.A

APPROVED BY	DATE
Rebecca Russell	1-5-86
	11/5/86

BAK

S.L.A.C. KLYSTRON BAKE PROCESSING LOG

STATION# 3

TUBE# 3499

DATE 11-5-86

TIME	FILAMENT AMPS	FILAMENT VOLTS	STATION ION PUMP CURRENT	WINDOW ION CURRENT / APPENDAGE ION CURRENT	TEMPERATURE °C TC1	TC2	TC3	AVG.	EMISSION H.V. TRIAC SET	EMISSION CURRENT TRIAC CURRENT	'T' TAPES 'A' AIR	TUBE PRESSURE	VESSEL PRESSURE	INITS	COMMENTS
11:00					Station vented							1.8^{-9}		BB	
1150			.75MA		Tube valved IN							6.8^{-7}		BB	
1203			.6 MA									1.8^{-7}		BB	
1230			.42 MA		Ucss & Pumping							1.0^{-7}		BB	
1300			.3MA		DP valved IN							5.9^{-8}	10^{-5}	BB	
1325	11.6	.7	.25MA	2 MA								4.8^{-8}	2.0^{-5}	BB	
1500	11.3	1.5	.6MA	4.7 MA								1.0^{-6}	4.5^{-6}	BB	
1715	11.9	2.1	1.35MA	1.0MA	60	75	75		8	3.2	—	2.0^{-7}	8.0^{-6}	cy	Set TSP
pump	for	100 mA	auto activation. (Fil2 continuous 50A)												
2145	11.9	2.4	.28mA	3.8 MA	290	290	330		30	8.7	T	3.0^{-6}	3.2^{-5}	VN	
0410	15.6	4.7	121mA	10.5mA	555	565	575		34	8.7	T	1.6^{-5}	2.8^{-5}	STD	
0720	22.9	8.5	57 MA	4.2 MA	515	555	545		41	9.9	T	6.2^{-6}	1.4^{-5}	BM	
1205	30.0	13.7	.23MA	1.7 MA	550	553	540		29	7.8	T	2.5^{-6}	4.3^{-6}	BB	
1430	29.9	13.0	141.4 MA	1.1MA	550	555	540		29	7.8	T	1.7^{-6}	3.2^{-6}	BB	
2100	24.5	12.8	8.0mA	.9MA	560	555	550		30	8.0	T	1.0^{-6}	2.1^{-6}	VN	
0355	29.7	13	4.9mA	.6 MA	565	575	560		30	8.1	T	5.0^{-7}	1.5^{-6}	TS	
0711	29.5	12.9	3.7MA	.46 MA	565	570	560		30	7.7	T	4.7^{-7}	1.3^{-6}	BB	
1155	29.9	13.1	2.2MA	.27 MA	545	550	535		30	7.8	T	2.1^{-7}	4.6^{-7}	BB	
1639	29.9	13.0	1.56mA	.25mA	550	555	535		19	5.3	T	1.7^{-7}	3.9^{-7}	cy	
2145	30.0	13.2	1.16mA	170 μA	550	555	535		28	7.0	T	1.3^{-7}	3.3^{-7}	VN	
0400	29.9	13.1	.91mA	120μA	550	560	540		27	7.0	T	1.0^{-7}	2.4^{-7}	STD	
1500	30.0	13.1	.7ma	85ua	560	565	550		27	7.4	T	7.8^{-8}	2.7^{-7}	BT	
1600	29.9	13.1	.7ma	80ua	560	565	550		27	7.5	T	7.8^{-8}	2.8^{-7}	BT	
1700	29.9	13.1	.68ma	78ua	560	565	550		27	7.5	T	7.5^{-8}	2.8^{-7}	BT	
1800	29.7	13.0	.65ma	70ua	560	565	550		27	7.4	T	7.1^{-8}	2.7^{-7}	BT	
1900	29.9	13.1	.63ma	69ua	560	565	550		27	7.3	T	7^{-8}	2.7^{-7}	BT	
2000	29.9	13.1	.6ma	64ua	560	565	550		27	7.3	T	6.7^{-8}	2.6^{-7}	BT	

S.L.A.C. KLYSTRON BAKE PROCESSING LOG

STATION# 3

TUBE# 349a

DATE 11-8-86

TIME	FILAMENT AMPS	FILAMENT VOLTS	STATION ION PUMP CURRENT	WINDOW ION CURRENT / APPENDAGE ION CURRENT	TEMPERATURE °C TC1	TC2	TC3	AVG.	EMISSION H.V. TRIAC SET	EMISSION CURRENT TRIAC CURRENT	'T' TAPES 'A' AIR	TUBE PRESSURE	VESSEL PRESSURE	INITS	COMMENTS
2100	29.9	13.1	.58ma	60μa	560	565	550		27	7.1	T	6.3^{-8}	2.5^{-7}	BT	
2200	29.9	13.1	.55ma	58μa	560	565	550		27	7.2	T	6.1^{-8}	2.5^{-7}	BT	
2300	29.1	13.1	.53MA	55μA	560	565	550		27	7.1	T	6.0^{-8}	2.5^{-7}	LC	
0000	29.9	13.1	.50MA.	53μA.	560	565	550		27	7.1	T	5.8^{-8}	2.5^{-7}	LC	
0100	29.9	13.1	.50MA.	60μA.	560	565	550		27	7.2	T	5.7^{-8}	2.4^{-7}	LC.	
0200	29.9	13.1	.47MA	50μA	560	565	550		27	7.1	T	5.5^{-8}	2.3^{-7}	LC	
0300	29.9	13.1	.45MA	47μA	560	565	550		27	7.3	T	5.4^{-8}	2.2^{-7}	LC	
0400	29.9	13.1	.45MA	45μA	560	565	550		27	7.4	T	5.3^{-8}	2.2^{-7}	LC	
0500	29.9	13.1	.45MA	43μA	560	565	550		27	7.1	T	5.2^{-8}	2.1^{-7}	LC	
0600	29.9	13.1	.45MA	40μA.	560	565	550		27	7.0	T	5.0^{-8}	2.1^{-7}	LC.	
0700	29.9	13.1	.43MA	40μA.	560	565	560		27	7.1	T	4.8^{-8}	2.1^{-7}	LC.	
1500	29.9	13.0	.4ma	36μa	560	565	550		27	7.6	T	4.4^{-8}	2.1^{-7}	BT	
1600	29.9	13.1	.4ma	36μa	560	565	550		27	7.6	T	4.4^{-8}	2.1^{-7}	BT	
1700	29.9	13.0	.38ma	34μa	560	565	550		27	7.6	T	4.3^{-8}	2.1^{-7}	BT	
1800	29.8	13.0	.32ma	30μa	550	560	540		24	6.9	T	3.8^{-8}	1.8^{-7}	BT	
1900	29.9	13.1	.32ma	30μa	550	560	540		30	8.2	T	3.8^{-8}	1.8^{-7}	BT	
2000	29.9	13.1	.32ma	30μa	550	560	540		22	6.3	T	3.8^{-8}	1.8^{-7}	BT	
2100	30.0	13.1	.3ma	30μa	550	560	540		29	7.9	T	3.7^{-8}	1.8^{-7}	BT	
2200	29.9	13.1	.3ma	30μa	550	560	540		25	7.0	T	3.7^{-8}	1.9^{-7}	BT	
2300	30.0	13.1	.3MA	27μA	550	560	540		24	6.7	T	3.5^{-8}	1.8^{-7}	LC.	
0000	29.8	13.0	.28MA	27μA.	550	560	540		27	7.3	T	3.4^{-8}	1.7^{-7}	LC	
0100	30.0	13.1	.28MA	27μA	550	560	540		27	7.6.	T	3.4^{-8}	1.7^{-7}	LC	
0200	29.9	13.0	.28MA	27μA	550	560	540		25	7.0.	T	3.3^{-8}	1.7^{-7}	LC.	
0300	30.0	13.1	.28MA	25μA	550	560	540		25	6.7	T	3.3^{-8}	1.7^{-7}	LC	
0400	30.0	13.1	.28MA	25μA.	550	560	540		25	6.8	T	3.2^{-8}	1.6^{-7}	LC.	
0600	29.9	13.1	.25MA.	25μA.	550	560	540		25	6.7	T	3.1^{-8}	1.6^{-7}	LC.	
0600	30.0	13.1	.25MA.	25μA.	550	555	540		27	7.2	T	3.0^{-8}	1.6^{-7}	LC	

S.L.A.C. KLYSTRON BAKE PROCESSING LOG

STATION# 3

TUBE# 349A

DATE 11-10-86

TIME	FILAMENT AMPS	FILAMENT VOLTS	STATION ION PUMP CURRENT	WINDOW ION CURRENT / APPENDAGE ION CURRENT	TEMPERATURE °C TC1	TC2	TC3	AVG.	EMISSION H.V. TRIAC SET	EMISSION CURRENT TRIAC CURRENT	'T' TAPES 'A' AIR	TUBE PRESSURE	VESSEL PRESSURE	INITS	COMMENTS
0650	29.8	13.0	2.5μA	23 μA	550	560	540		27	7.2	T	3.0-8	1.6-7	LC	
1154	30.1	13.2	.26MA	24μA	555	560	545		27	7.4	T	3.1-8	1.8-7	BB	
1500	29.7	13.0	.25MA	24μA	555	560	545		26	7.2	T	3.0-8	1.7-7	BB	
2000	29.8	13.0	.24MA	22μA	555	560	540		26	7.2	T	2.8-8	1.6-7	FF	
0320	29.8	13.0	.24MA	20μA	555	560	540		26	6.9	T	2.6-8	1.6-7	JS	
0700	29.8	13.0	.2MA	18μA	550	555	540		26	6.7	T	2.4-8	1.5-7	BB	
0810	30.0	13.1	.2MA	17μA	550	560	540		27	7.3	T	2.4-8	1.4-7	CY	→ 2nd
1155	34.0	15.9	182μA	160μA	455	460	405			-.01	T	3.0-6	1.1-6	JS	
1500	33.8	15.7	154μA	16.2μA	450	455	395		8	2.9	T	2.5-8	4.1-8	BB	
1928	33.9	15.8	122μA	15μA	455	460	400		7	2.6	T	2.3-8	3.4-8	FF	
0357	33.9	15.8	87μA	13μA	450	455	395		6	2.2	T	1.8-8	2.8-8	STD	
0740	33.8	15.8	82μA	13.5μA	450	460	395		7	2.4	T	1.8-8	2.8-8	BB	
1200	33.9	15.8	82μA	14.4μA	450	455	395		6	2.2	T	1.7-8	3.5-8	BB	
1430	33.9	15.8	85μA	14.5μA	455	460	395		7	2.5	T	1.8-8	3.8-8	BB	
1950	10.2	2.4	13.4μA	13.9μA	385	390	350		—	—	—	2.3-9	2.4-8	FF	
0220	3.8	0.4	11μA	12.1μA	150	180	150		—	—	—	1.5-9	1.2-6	STD	
0700	4.0	.4	7.6μA	11.8μA	105	135	105				A	1.3-9	6.5-9	BB	Prep for leak
0717	—	—	7.8μA	11.7μA	105	135	105				A	1.4-9	3.8-9	BB	Before leak ✓
0715			7.8μA	.25MA	1110	145	1110		TUBE NIL		A	1.4-9		BB	@ 2⁵ Hg
0830			8μA	1.05MA	85	95	100				A	1.4-9		BB	
0833			8.1μA	—							A	1.4-9		BB	@ ATM
0840			8.1μA	.4μA					Through window NIL			1.4-9			appendage on pie stabilization
0945	34.8	16.1	44μA	.6μA								1.0-8		BB	1 KV 83mA
0950	34.9	16.2	41μA	—					1KV	80MA		8.3-9		BB	Press got Better
1100	34.9	16.2	43μA						1KV	78MA		9.0-9		BB	
	PER NORM OPER. leave HV ON for 11 hr @ 35.A											Record ever		ISM	N. Then
	Proceed as Planned														

S.L.A.C. KLYSTRON BAKE PROCESSING LOG

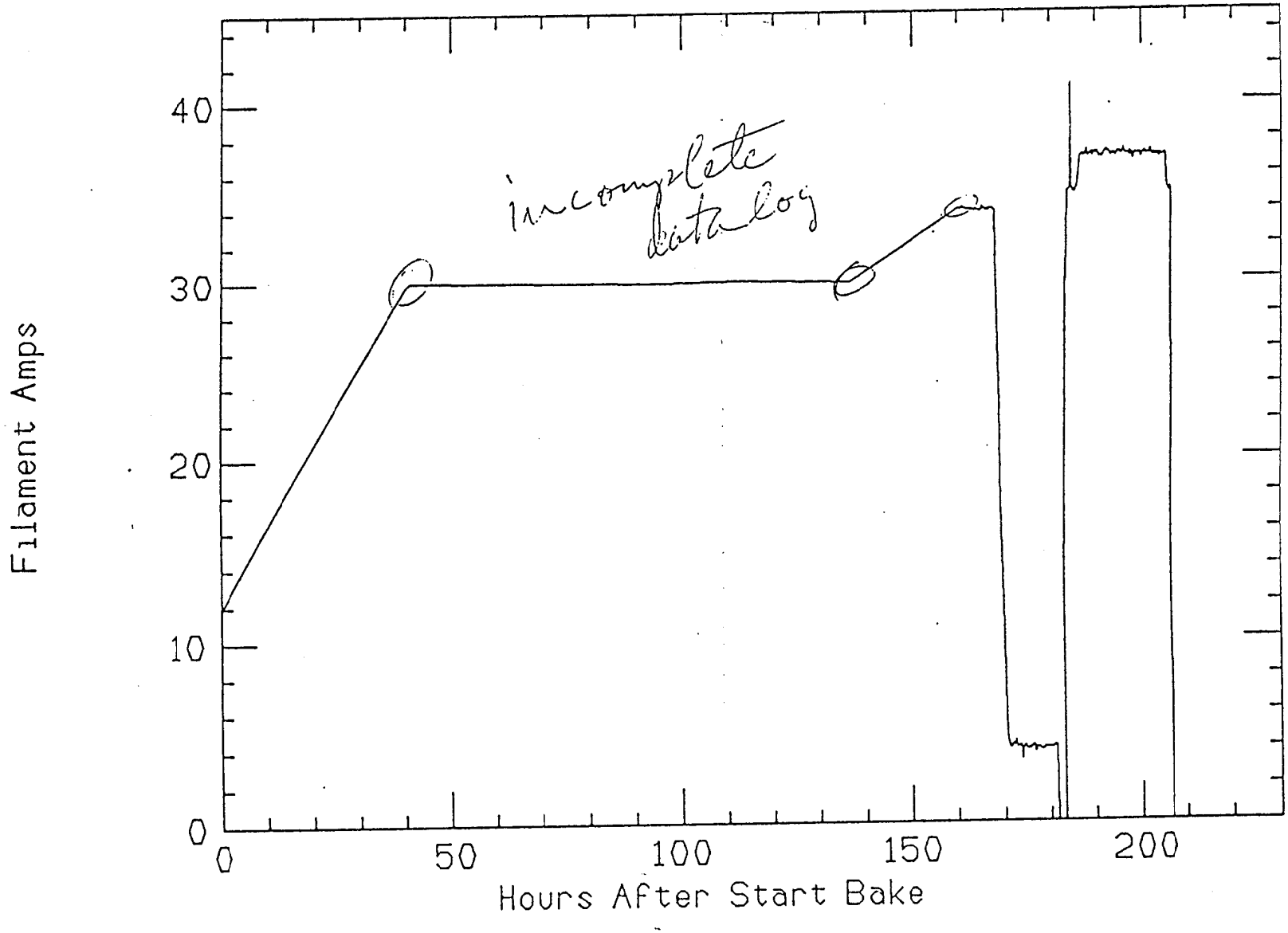
STATION# 3

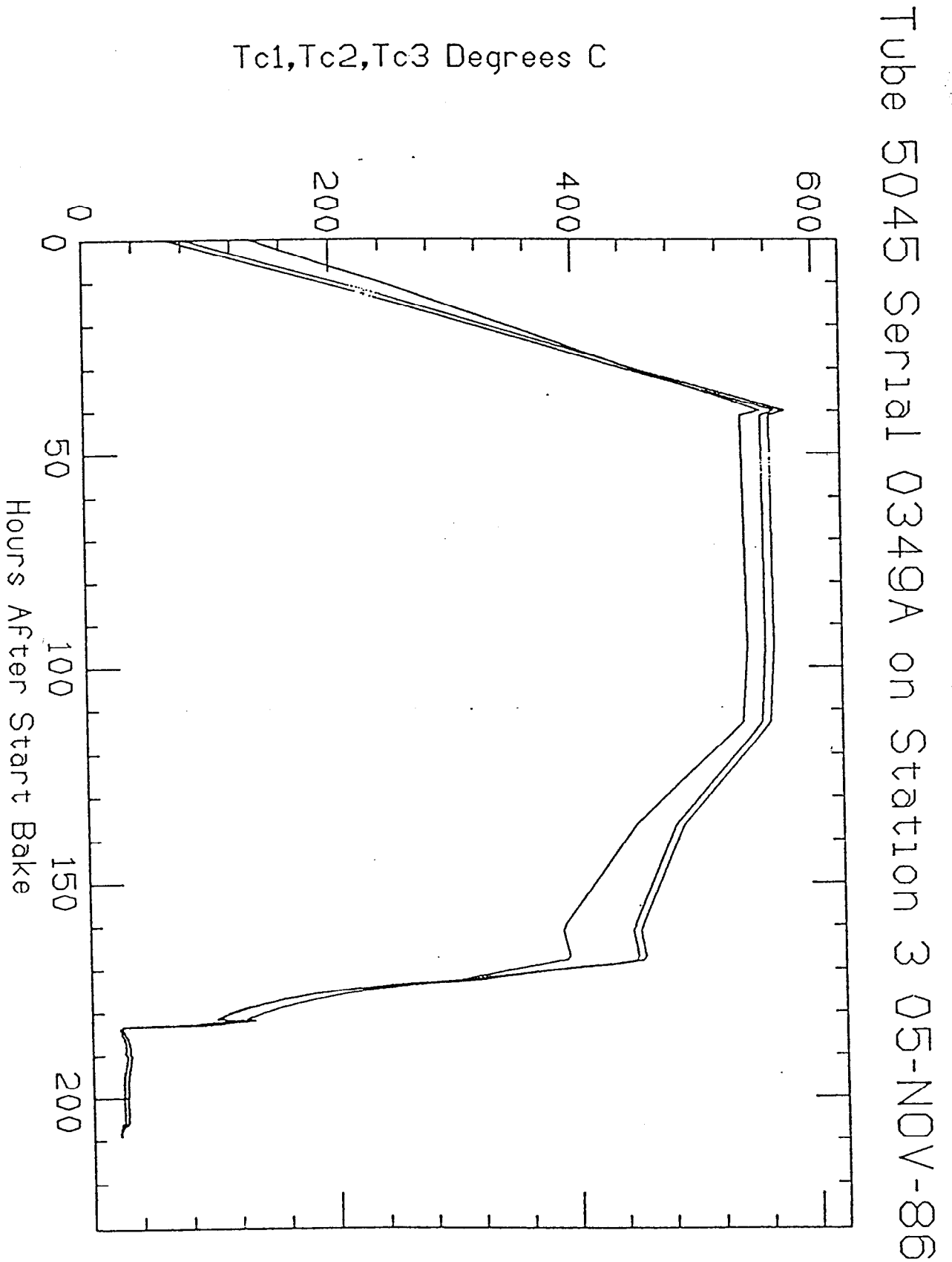
TUBE# 349q

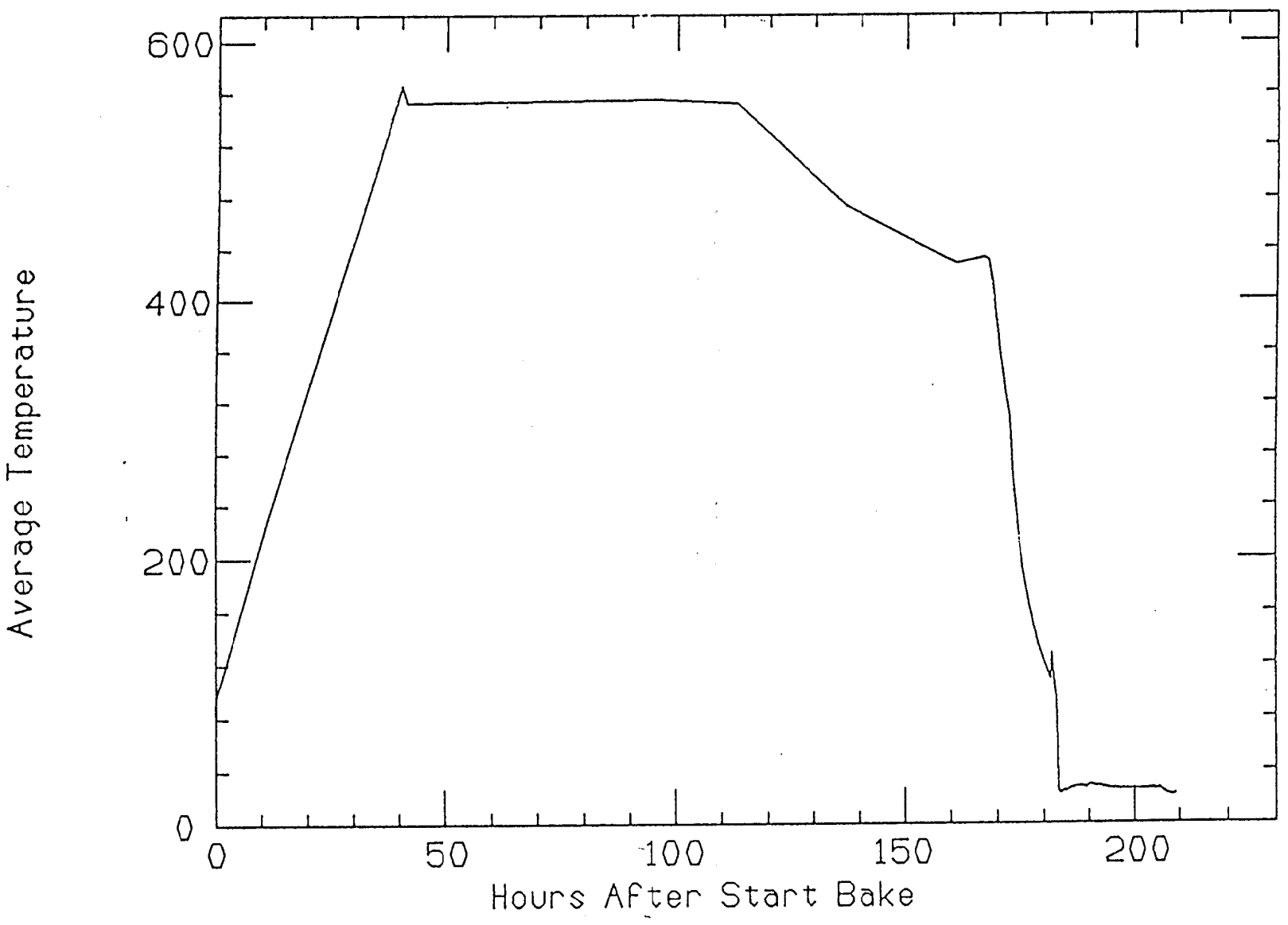
DATE 11-13-86

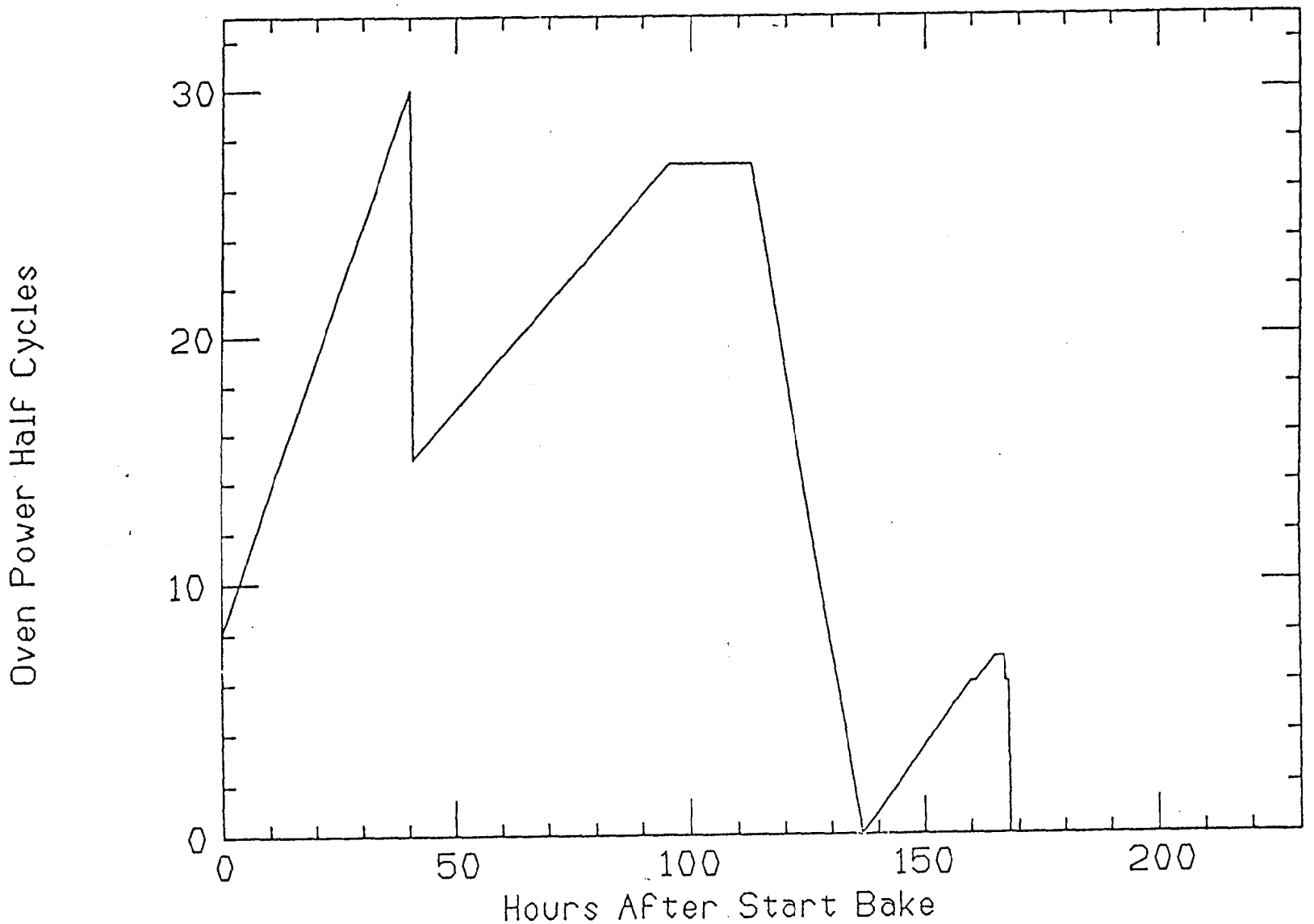
TIME	FILAMENT AMPS	FILAMENT VOLTS	STATION ION PUMP CURRENT	WINDOW ION CURRENT / APPENDAGE ION CURRENT	TEMPERATURE °C TC1	TC2	TC3	AVG.	EMISSION H.V. TRIAC SET	CURRENT TRIAC CURRENT	'T' TAPES 'A' AIR	TUBE PRESSURE	VESSEL PRESSURE	INITS	COMMENTS
1115	35.0	16.3	45μA						1KV	76MA		9.4-9		BB	
1130	35.0	16.3	47μA						1KV	75MA		1.0-8		BB	
1145	35.0	16.2	46μA						1KV	74MA		1.0-8		BB	→37.A
	Not. M		not a	Rowud,	Proceed		with		a low	MA	(	Gassy	tube	proc	edure.
1200	36.9	17.7	80μA						1KV	75MA		1.8-8		BB	
1300	36.9	17.8	91μA						1KV	77MA		2.0-8		BB	
1355	36.9	17.7	89μA						1KV	77MA		1.9-8		BB	
1500	36.9	17.7	86μA						1KV	79MA		1.9-8		BB	
1702	36.9	17.7	82μA						1KV	70mA		1.8-8		CG	
1900	36.9	17.7	79μA						1KV	72MA		1.6-8		AH	
035	36.9	17.6	20μA						—	—	T	1.5-8	4.0-7	JS	
0201	36.9	17.7	68μA						1KV	81MA		1.5-8		BB	→35A
0700	35.3	16.6	56μA						1KV	79mA		1.1-8		BB	
0800	35.0	16.1	35μA						1KV	76MA		7.0-9		BB	1KV off
1800	34.9	16.1	36μA	.7μA					—	—		7.3-9		BB	
0815	35.0	16.2	36μA	.6μA								7.2-9		BB	fil off
0818	—	—	18μA	.3μA								2.7-9		BB	
1040	—	—	11μA	.3μA								1.9-9		BB	Before Pinch
1042	—	—	11μA	.3μA								1.9-9		JH	After Pinch

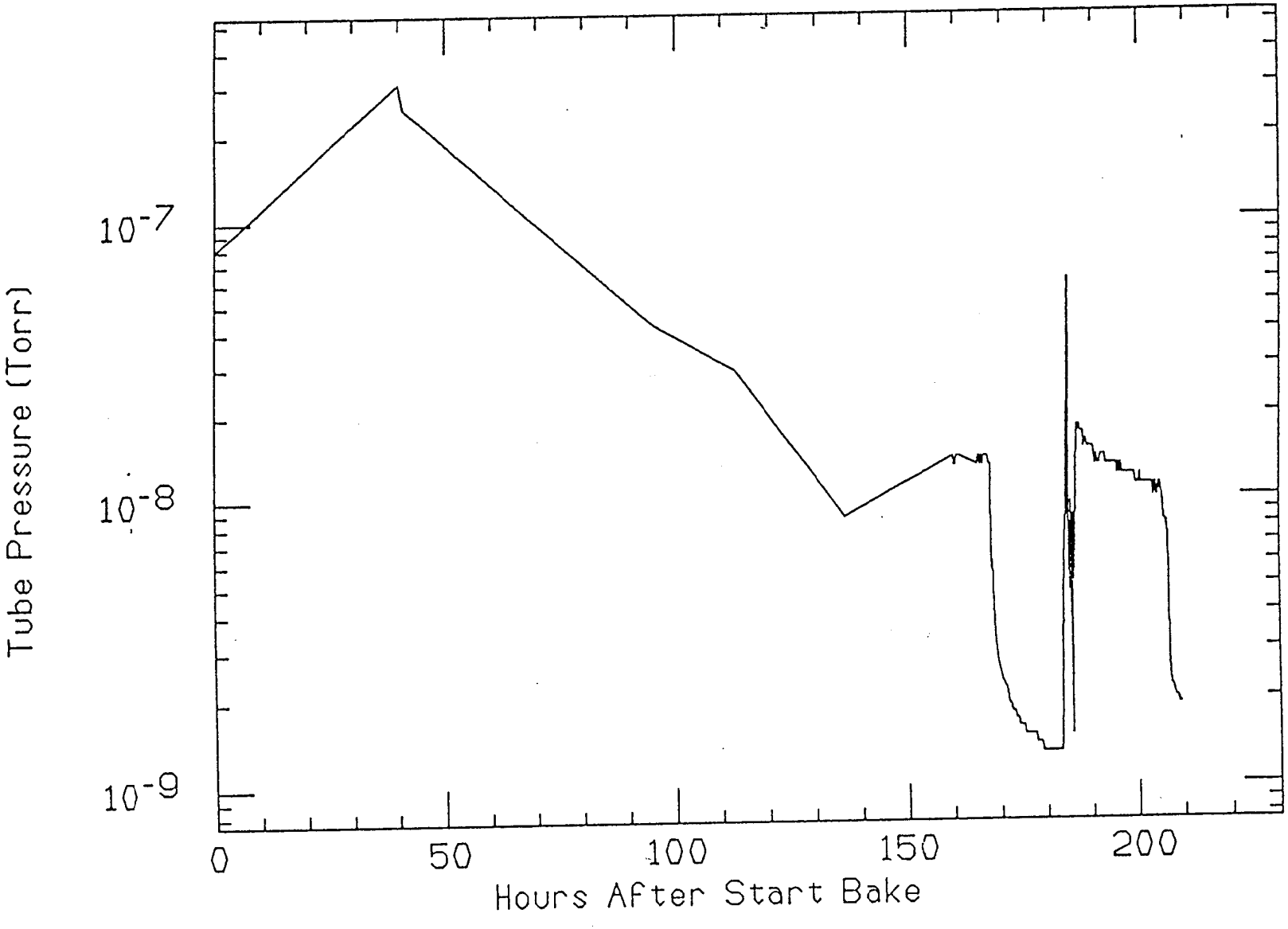
Tube 5045 Serial 0349A on Station 3 05-NOV-86




Tube 5045 Serial 0349A on Station 3 05-NOV-86
Tc1,Tc2,Tc3 Degrees C
0
200
400
600
0
50
100
150
200
Hours After Start Bake


Tube 5045 Serial 0349A on Station 3 05-NOV-86
Average Temperature
600
400
200
0
0
50
100
150
200
Hours After Start Bake


Tube 5045 Serial 0349A on Station 3 05-NOV-86
Oven Power Half Cycles
30
20
10
0
0
50
100
150
200
Hours After Start Bake


Tube 5045 Serial 0349A on Station 3 05-NOV-86
Tube Pressure (Torr)
10-7
10-8
10-9
0
50
100
150
200
Hours After Start Bake

Tube Process Report

1 STATION LOG OD:[300,303]50450349A.KDL CREATED AT 13:16:29 05-NOV-86 BY PROCE

Step	Step Start Time	Step Finish Time	Temperature Min	Temperature Max	Tube Pressure Min	Tube Pressure Max	Filament Min	Filament Max
4	17:48 05-NOV-1986	09:49 07-NOV-1986	566.2	566.2	3.1E-07	3.1E-07	29.7	29.7
7	09:49 07-NOV-1986	10:25 11-NOV-1986	474.6	555.3	8.6E-09	2.5E-07	29.9	30.0
8	10:25 11-NOV-1986	09:40 12-NOV-1986	430.2	430.2	1.4E-08	1.4E-08	34.0	34.0
11	09:40 12-NOV-1986	17:42 12-NOV-1986	428.7	432.9	1.3E-08	1.4E-08	33.9	34.1
12	17:42 12-NOV-1986	22:34 12-NOV-1986	306.0	431.2	1.8E-09	1.3E-08	4.0	33.9
13	22:34 12-NOV-1986	03:22 13-NOV-1986	155.8	293.6	1.5E-09	1.8E-09	3.4	4.1
14	03:22 13-NOV-1986	09:00 13-NOV-1986	24.6	155.8	1.3E-09	1.5E-09	0.0	30.0
15	09:00 13-NOV-1986	09:26 13-NOV-1986	22.9	24.6	1.4E-09	4.3E-09	29.8	34.9
16	09:26 13-NOV-1986	09:58 13-NOV-1986	23.0	23.8	6.0E-09	8.9E-09	35.0	35.0
17	09:58 13-NOV-1986	10:18 13-NOV-1986	24.2	24.4	5.0E-08	6.0E-08	40.7	40.9
18	10:18 13-NOV-1986	10:34 13-NOV-1986	24.2	24.6	7.6E-09	9.3E-09	35.2	35.3
19	10:34 13-NOV-1986	10:36 13-NOV-1986	24.2	24.2	6.5E-09	6.5E-09	35.0	35.0
20	10:36 13-NOV-1986	10:54 13-NOV-1986	24.2	24.3	4.7E-09	6.5E-09	34.9	35.1
21	10:54 13-NOV-1986	08:32 14-NOV-1986	23.3	29.1	1.5E-09	1.8E-08	0.0	37.3
0	08:32 14-NOV-1986	08:32 14-NOV-1986	23.5	23.5	4.8E-09	4.8E-09	0.0	0.0
22	08:32 14-NOV-1986	10:54 14-NOV-1986	21.2	23.5	1.9E-09	4.8E-09	0.0	0.0
23	10:54 14-NOV-1986	10:54 14-NOV-1986	21.8	21.8	1.9E-09	1.9E-09	0.0	0.0

Appendix B.5h: Klystron Test Reports

Index of Klystron Test Notes (2)

Test Stand Summary Sheet (1)

Tube Data Summary Sheet (1)

Processing Data Summary (1)

Interlock and Safety Check (1)

Emission Check (1)

Process Performance Data Work Sheet (5)

Test Sheet (2)

Heat Run Sheet (1)

Acceptance Test Report (1)

Final Test Data Summary (1)

Specification Conformance Summary (1)

Klystron Checkoff Sheet (1)

Acceptance Performance Data Work Sheet (5)

Stability Check Form (2)

Acceptance test Report (1)

KLYSTRON TESTING NOTE	DATE 01/26/87	KTN-01 (Revision 40)
TITLE *INDEX OF TEST NOTES*	AUTHOR	E. LaClair

The following is a list of material on klystron testing as of the above date.
In addition, all operators are expected to be familiar with the material listed under "TRAINING MATERIALS."

KLYSTRON TESTING NOTES

		TITLE	DATE REVISED
01	Rev.40	Index of Klystron Test Notes	01/26/87
02	Rev.4	Load Installation Guidelines	08/21/86
03	Rev.3	General Test Stand Information	08/22/86
04	Rev.5	Engineering Data Graphs	08/22/86
05		Cathode Cooling/Load Vac. Let-up	08/22/86
06		Test Operator Skills	08/22/86
07		5045 Installation/Removal	08/22/86
08	Rev.14	5045 Pre-Processing (1μs)	10/23/86
09	Rev.19	5045 Processing (3.5μs)	01/26/87
10	Rev.5	T/L Check on 5045 Klystron	11/20/86
11		Magnet Supply Run-down	04/29/84
12	Rev.8	Round Tank Processing	01/26/87
13		Thyratron Ranging	09/11/84
14	Rev.2	5045 Stability Check	12/05/86
15		Magnet Mating Test	11/14/85
16	Rev.2	T/S Start-up & Shut-down	12/10/85
17	Rev.15	5045 Final Test	01/26/87
18	Rev.2	5045 CDR/ Check/Set Procedures	01/27/86
19		Epx/Mismatch Check	03/04/85
20		Operating Data on 5045 Klystron	04/19/84
21		Operating the CALF	11/14/84
22		Klystron Aging Room	02/04/85
23		Window Testing Procedure	02/04/85
24	Rev.4	5045 Break Up Check	11/11/85
25		Data Acquisition Procedure	05/05/85
26	Rev.3	Power Balance Calculation	08/14/86
27		Tube Interception Calculation	04/02/85
28		XK5 Gallery Return Test	04/09/85
29	Rev.1	XK5 Final Test	07/08/85
30	Rev.4	5045 Gallery Return Test	04/11/86
31		E/M Focusing Interlock Protection	04/24/85
32	Rev.3	5045 Frequency Response Check	11/13/85
33		Window Thermocouple Installation	04/17/86
34		Sub-Booster Testing	05/12/86
35		Sub-Booster Power Out/Drive Curve	05/12/86
36	Rev.1	Barton Turbine Flow Measurements	08/27/86

MAINTENANCE NOTES

	TITLE	DATE REVISED
MN 29	Removal and Installation of Windows for Ring Testing	05/23/85

TRAINING MATERIALS

TECHNICAL SPECIFICATION SC-700-866-45-R3 SLAC 5045 KLYSTRON
Performance Data Work Sheet
Klystron Test Sheet
Heat Run Sheet
Radiation Check
Power Data Form
Installing a Klystron Tube
Slippery Perveance Test
Input VSWR Check
Stability Check (XK-5)
Acceptance Test Report
Thyratron Ranging
Klystron Emission Check
The Brazing Furnaces
Checking Breakdown Resistance of Pulse Transformer Oil
T/L Check
Breakup Check
Scope Sweep Linearity Check
Safety Memos

KLYSTRON TEST LAB FORM KTF-008A

T SECTION

TUBE-NO 5045 3499 TEST-START-DATE 11-21-86 TOTAL-HV-HOURS 79.0 TOTAL-FIL-HOURS 87.6

TEST STAND	LOAD NO.	TYPE TEST	START DATE	MAGNET NO.	ELMA	FOCUS BUCK	CURRENT TOP	BOTTOM	Ef / If START	Ef / If END	EPY KV	PRF Hz	TRF us	P-O MW	FAULT NO./HRS	AM Y-N
08	110-46	Pre-Burn	11-21-86	5005	15.0	—	—	—	12.6/30.0	12.4/30.0	300	180 ~	1.0	62.6	1/2	N
FM Y-N	HUM Y-N	IND Y-N	GLITCH Y-N	RUBBER Y-N	BODY delta t	BREAKUP NO./MIN	STABILITY +	STABILITY -	TUBE PRESSURE START	TUBE PRESSURE END	WINDOW COLOR	WINDOW FLASH	WINDOW LEFT T	WINDOW RIGHT T	TEST HV	HOURS FIL
N	N	N	N	N/A	.16	N/A	+2	-3	0.1	0.1	DARK	N	25.6	32.5	19.9	20.4

COMMENTS:

TEST STAND	LOAD NO.	TYPE TEST	START DATE	MAGNET NO.	ELMA	FOCUS BUCK	CURRENT TOP	BOTTOM	Ef / If START	Ef / If END	EPY KV	PRF Hz	TRF us	P-O MW	FAULT NO./HRS	AM Y-N
7	46-46	P	11-24-86	5005	14.8	—	—	—	12.6/30.0	12.3/29.0	350	180	3.5	64	1/4	—
FM Y-N	HUM Y-N	IND Y-N	GLITCH Y-N	RUBBER Y-N	BODY delta t	BREAKUP NO./MIN	STABILITY +	STABILITY -	TUBE PRESSURE START	TUBE PRESSURE END	WINDOW COLOR	WINDOW FLASH	WINDOW LEFT T	WINDOW RIGHT T	TEST HV	HOURS FIL
—	N	N	N	N	0.25	—	2	3	0.1	0.2	Y	N	31.1	32.2	30.3	31.5

COMMENTS:

TEST STAND	LOAD NO.	TYPE TEST	START DATE	MAGNET NO.	ELMA	FOCUS BUCK	CURRENT TOP	BOTTOM	Ef / If START	Ef / If END	EPY KV	PRF Hz	TRF us	P-O MW	FAULT NO./HRS	AM Y-N
7	46-46	P/F	11-25-86	5005	14.7	—	—	—	12.5/29.0	12.2/29.0	350	180	3.5	6.5	1/20	N
FM Y-N	HUM Y-N	IND Y-N	GLITCH Y-N	RUBBER Y-N	BODY delta t	BREAKUP NO./MIN	STABILITY +	STABILITY -	TUBE PRESSURE START	TUBE PRESSURE END	WINDOW COLOR	WINDOW FLASH	WINDOW LEFT T	WINDOW RIGHT T	TEST HV	HOURS FIL
N	N	N	N	N	.38	0/15	2	3	0.2	0.2	Y	N	41.3	43.3	27.8	30.1

COMMENTS:

TEST STAND	LOAD NO.	TYPE TEST	START DATE	MAGNET NO.	ELMA	FOCUS BUCK	CURRENT TOP	BOTTOM	Ef / If START	Ef / If END	EPY KV	PRF Hz	TRF us	P-O MW	FAULT NO./HRS	AM Y-N
FM Y-N	HUM Y-N	IND Y-N	GLITCH Y-N	RUBBER Y-N	BODY delta t	BREAKUP NO./MIN	STABILITY +	STABILITY -	TUBE PRESSURE START	TUBE PRESSURE END	WINDOW COLOR	WINDOW FLASH	WINDOW LEFT T	WINDOW RIGHT T	TEST HV	HOURS FIL

COMMENTS:

TEST STAND	LOAD NO.	TYPE TEST	START DATE	MAGNET NO.	ELMA	FOCUS BUCK	CURRENT TOP	BOTTOM	Ef / If START	Ef / If END	EPY KV	PRF Hz	TRF us	P-O MW	FAULT NO./HRS	AM Y-N
FM Y-N	HUM Y-N	IND Y-N	GLITCH Y-N	RUBBER Y-N	BODY delta t	BREAKUP NO./MIN	STABILITY +	STABILITY -	TUBE PRESSURE START	TUBE PRESSURE END	WINDOW COLOR	WINDOW FLASH	WINDOW LEFT T	WINDOW RIGHT T	TEST HV	HOURS FIL

COMMENTS:

KLYSTRON TEST LAB FORM KTF-008B DATA SUMMARY

TUBE-NO 5045 3/9rv. OPERATING Ef 17.1 OPERATING If 29.6

PULSE LENGTH 3.5 PPS 180 END-TUBE PRESSURE 0.3 ua

FOCUS CURRENTS		BUCK	TOP	BOTTOM	ELMA				
EPY KV	Ik A	Pave KW	Pout MW	uk	Pdr W	GAIN sat	EFF %	HUM @	dB
315									
AM @	dB	FAULT NO./HRS	MISSED PULSES	If @ TL	CHANGE IN Ik %	CHANGE IN If	WINDOW LEFT	TEMPS RIGHT	SUMMARY BY
									JE
EPY KV.	Ik A	Pave KW	Pout MW	uk	Pdr W	GAIN sat	EFF %	HUM @	dB
320	34.3	97.8	47.3	2.00	497	49.9	40.1	.2	-3
AM @	dB	FAULT NO./HRS	MISSED PULSES	If @ TL	CHANGE IN Ik %	CHANGE IN If	WINDOW LEFT	TEMPS RIGHT	>>>>>>> >>>>>>>
.1	-3.	—	0	—	—	—	40.0	41.7	
EPY KV	Ik A	Pave KW	Pout MW	uk	Pdr W	GAIN sat	EFF %	HUM @	dB
350	41.3	40.1	65.0	2.00	327	42.7	40.4	.1	-3.0
AM @	dB	FAULT NO./HRS	MISSED PULSES	If @ TL	CHANGE IN Ik %	CHANGE IN If	WINDOW LEFT	TEMPS RIGHT	>>>>>>> >>>>>>>
.2	+2.0	1/2.0	0	2.8	1.93	2.0	41.3	43.3	

COMMENTS:

DISPOSITION	DATE	COMMENTS:
HOLD		Help -Rx Receiver
ACCEPT		
RETURN		

K L Y S T R O N T E S T L A B R E P O R T

KTF - 009

PROCESSING DATA SUMMARY

TUBE # 349a
MAGNET # 5005
LOAD # A16-46
DATE IN 11-24-86

Read 1.1 12/1/86

TEST STAND # 7
HVRT 30.3
FRT 31.5
DATE OUT 11-25-86

epy,KV	ik Amps	Pdr Watts	Pout MW
315	—	—	—
320	362	553	45.0
350	413	362	64.5

Focus Current	
BUCK	—
MAIN/ELMA	14.8
TOP	—

WINDOW: COLOR Yes ARCING N FLASHING N

MAXIMUM WINDOW TEMPERATURES: LEFT 31.1 RIGHT 32.2 PRR 180

F.F.E. FAULTS:

350 KV _____ 15/MIN 320KV _____ 15/MIN 315KV _____ 15/MIN

PULSE STABILITY:

350KV SAT _____ 320KV SAT _____ 315KV SAT _____

+2 dB _____ +2 dB _____ +2 dB _____

-3 dB _____ -3 dB _____ -3 dB _____

FAULT RATE: 1 Fault in last 4 hrs

RADIATION: Normal around tube, above normal around tank

ABNORMALITIES: —

COMMENTS: —

DISPOSITION: Released to Acceptance

DATA SUMMARIZED BY: _____ APPROVED BY: _____

INTERLOCK AND SAFETY CHECK

DATE 11-24-86 TUBE 3499 TEST STAND # 07

FIL. CONTINUITY Before test ok STB After test _____

	(minimum)	UNITS	(set)
WATER FLOW (Low Limit) Tube	15 GPM	18.2 GPM	15.0 ✓ TRIP
Load	15 GPM	19.50 GPM	15.0 ✓ TRIP
XFMR	✓	Flow	ok

VAC ION SUPPLIES (High Limit)

	(maximum)		
Tube	1 X 10-7	1 X10-7	2.30 TRIP
Load	1 X 10-6 (0-270KV)	1 X10-6	TRIP
Load	4 X 10-7 (270-320KV)	5 X10-7	3.70 TRIP

FOCUS SUPPLIES

Klixon Connected ✓ Body Connected ✓

Under Current Amps ✓ Polarity ✓

Enter Focus Settings ___ (Bucking) 15.0 (Middle) ___ (Upper)

FILAMENT

Zero Reset ✓ Time Delay 60 min

Under Current 4.6 Proper Value (V/I) 30.0

TUBE TANK

Oil Level ✓ Tank Flow N/A

LEAD SHIELDING

Collector ✓ Collector Cap ✓

Magnet: Sides ✓ Top ___ Bucking Coil ___

Check Vac Ion Cables = Tied Down ✓

Ground Clip Connected ✓

Interlock Lamps = Replace if Needed No

Comments: All meters zeroed

Operator STB

KTF10.85

5045 KLYSTRON EMISSION CHECK

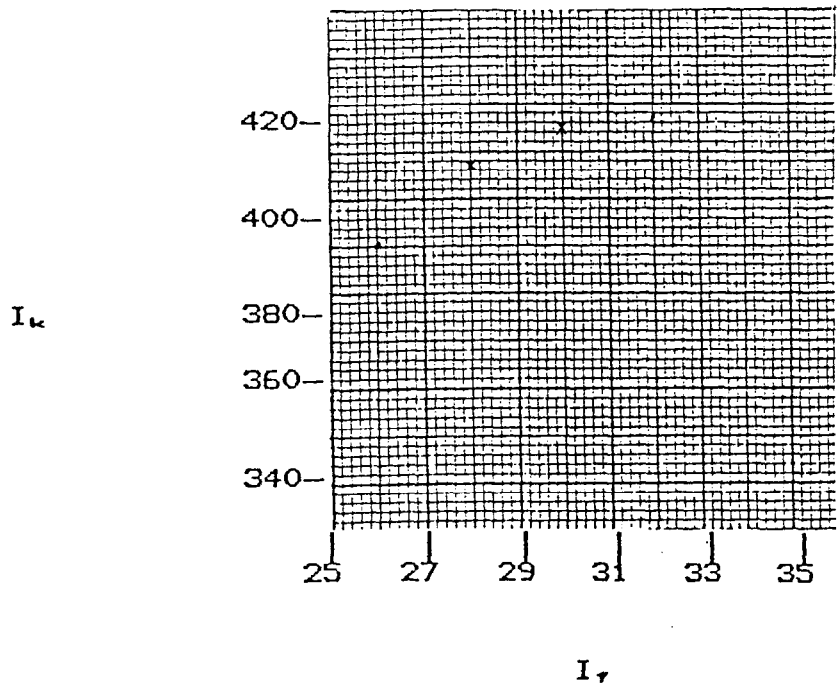
Tech. STE

STATION 07 TUBE 3419a DATE 11-24-86 HVRTM 2748.9 FRTM 8692.1

PRR 60~ INITIAL I_f 30.0 FINAL I_f 30.0 FOCUS — 45.0 —

	P_f SATURATION DATA							
E_f	14.1	12.7	11.5	10.2				
I_f	32.0	30.0	28.0	26.0				
Fil. W	451	381	322	265				
e_{py} KV	350	→						
i_k A	417	415	407	390				
μK	2.01	2.00	1.97	1.88				
P_t μa	0.5	0.1	0.1	<0.1				
Stbl Rng	0/-3	+2/-3	+2/-3	+2/-3				
Time	0900	0600	0700	0800				

Comments: _____



STANFORD LINEAR ACCELERATOR CENTER
WORK SHEET
PERFORMANCE DATA
(KTF003)

Page No. (1)

Date 11-24-86

	INITIAL (1μs)
✓	PROC. (3.5μs)
	ACCEPTANCE
	FINAL
	(OTHER)

	ROUND TANK ONLY
PTT	119
PT	54-233
CDR	5312:1
NEW CDR	

TUBE #	3499
MAGNET	3005
LOAD	ALO-46
T/S #	07
OPERATOR	STB

INSTALLED HVRTM: 2741.5 FRTM: 8686.5 TOTAL FRTM: TOTAL HVRTM: (6.1)

START OF SHIFT 2300	HVRTM —	Ef-MTR 12.5	Ef-TRUE 12.5	If-MTR 30.0	If-TRUE 30.0	PRR 60~

TIME	TUBE VAC 0.1 μa	LOAD VAC 3.5 μa	FOCUS — 15.0 —	EOLC FLTS	R/E	HVOC FLTS	WINDOW C° LEFT	WINDOW C° RIGHT	H_2O IN °C
0015	Interlock check complete - HV on, @ 150KV, 119A, 2.05μk								
0100	@ 175KV, 170A, 2.05 μk - Sat. Frf=1.0μs			0	0	0	22.0	22.2	21.6
0115	@ 200KV, 184A, 2.06 μk - Sat. ΔT=.02			0	0	0			
0130	@ 225KV, 217A, 2.03 μk - Sat ΔT=.02			0	0	0	22.2	22.3	21.8
0145	@ 250KV, 255A, 2.04 μk Sat ΔT=.02			0	0	0			
0200	@ 260KV, 271A, 2.04 μk Sat ΔT=.02			0	0	0	22.4	22.6	21.9
0215	@ 270KV, 286A, 2.04 μk - Sat ΔT=.03			0	0	0	22.7	22.6	21.9
0230	@ 280KV, 302A, 2.04 μk Sat ΔT=.03			0	0	0	22.7	22.8	21.6
0245	@ 290KV, 319A, 2.04 μk - Sat. ΔT=.03			0	0	0	23.9	23.0	21.9
0300	@ 300KV, 333 2.03 μk Sat ΔT=.05			0	0	0	22.2	23.4	22.0
0315	@ 310KV, 350A, 2.03 μk Sat. ΔT=.06			0	0	0	23.2	23.5	21.9
0330	@ 320KV, 366A, 2.02 μk Sat. ΔT=.06			0	0	0	23.2	23.4	21.8
0345	@ 330KV, 382A, 2.02 μk, Sat. ΔT=.06			0	0	0	23.3	23.5	21.8
0400	@ 340KV, 398A 2.01 μk, Sat. ΔT=.06			0	0	0	23.6	23.7	21.9
0415	350KV, Sat. LOD expanding trf=3.5μs			0	0	0			
0500	350KV - Recirc T/C check			0	0	0	26.2	26.4	21.7
0655	350KV - Sat.			(2)		(1)			
			total Faults	(2)		(1)			
	2710.6 2714.5								
	HVRT (6.1)								

STANFORD LINEAR ACCELERATOR CENTER
WORK SHEET
PERFORMANCE DATA
(KTF003)

Date 11/24/96

	INITIAL (1μs)
	PROC. (3.5μs)
	ACCEPTANCE
	FINAL
	(OTHER)

	ROUND TANK ONLY
PTT	119
PT	ST-733
CDR	5312:1
NEW CDR	

TUBE #	349a
MAGNET	5045
LOAD	A40-46
T/S #	7
OPERATOR	TM

INSTALLED HVRTM: FRTM: TOTAL FRTM: TOTAL HVRTM:

START OF SHIFT	HVRTM	Ef-MTR	Ef-TRUE	If-MTR	If-TRUE	PRR
0700	2750.9	11.5	11.5	28.0	* 28.0	* 60

TIME	TUBE VAC	LOAD VAC	FOCUS	EOLC FLTS	R/E	HVOC FLTS	WINDOW C° LEFT	WINDOW C° RIGHT	H_2O IN °C
0700	<0.1 μa	10.4 μa	15.0						
0700	To 26A - Psi CDR efficiency factor 98% per TF.								
0910	End TL ck - to 300 KV per PC - to 300KV/120 PRR - per unit								
0955	300KV To 310KV								
	310KV								
1010	310KV ↑ 320KV 362A μK 2.00			←	←	←	28.1	28.5	21.9
1025	↑ 330KV 379A μK 1.999			←	←	←	29.0	29.3	22.1
1040	↑ 340KV 395A μK 1.992			←	←	←	30.6	30.2	22.2
1105	↑ 350KV 413A μK 1.995			←	←	←	30.5	31.2	22.4
1140**	↑ 300 KV · PRR → 180 PPS			(2)	←	←	31.1	32.2	22.7
	300 329A μK 2.002								
1215	300KV ↑ 310KV 344A μK 1.993			←	←	←	31.2	31.7	23.1
1230	310KV ↑ 320KV 361A μK 1.999			←	←	←	32.1	32.8	22.8
1300	320KV ↑ 330KV 377A μK 1.989			←	←	←	32.8	33.7	22.8
1325	330KV ↑ 340KV 393A μK 1.992			←	←	←	33.5	34.5	22.7
1355	340KV ↑ 350 410A μK 1.980			(1)	←	←	34.0	35.3	22.7
1425	Plug on 4hr heat run								
	CDR check needed @ 1500								

STANFORD LINEAR ACCELERATOR CENTER
WORK SHEET
PERFORMANCE DATA
(KTF003)

Page No. 3

Date 11/2[illegible]/[illegible]

	INITIAL (1μs)
✓	PROC. (3.5μs)
	ACCEPTANCE
	FINAL
	(OTHER)

	ROUND TANK ONLY
PTT	119
PT	5T-733
CDR	5312:1
NEW CDR	

TUBE #	349
MAGNET	SDD5
LOAD	FLC-4b
T/S #	7
OPERATOR	HF

INSTALLED HVRTM: 27445 FRTM: TOTAL FRTM: TOTAL HVRTM: 14,2

START OF SHIFT	HVRTM	Ef-MTR	Ef-TRUE	If-MTR	If-TRUE	PRR
1500	2755.=	12.01	12.9	28.0	30.0	150

TIME	TUBE VAC 0.1 μa	LOAD VAC 18 μa	FOCUS 154	EOLC FLTS	R/E	HVOC FLTS	WINDOW C° LEFT	WINDOW C° RIGHT	H_2O IN °C	
1539	350 kV	Continue Heat Run		(2)	0	0	34.0	34.0	22.5	21.6
2230	350 kV	Heat Run Completed								
		Radiation not recorded.								
		Tank radiation = 3.5 MR/hr @ 3'								
2214	350 kV	Change H_2O to Hot		(1)	0	0	43.0	45.2	34.0	34.0

STANFORD LINEAR ACCELERATOR CENTER
WORK SHEET
PERFORMANCE DATA
(KTF003)

Page No. 4

Date 11-25-86

	INITIAL (1μs)
✓	PROC. (3.5μs)
	ACCEPTANCE
	FINAL
	(OTHER)

	ROUND TANK ONLY
PTT	119
PT	ST-733
CDR	5312:1
NEW CDR	5140: 1

TUBE #	349a
MAGNET	S-005
LOAD	ALO-46
T/S #	07
OPERATOR	RCG

INSTALLED HVRTM: FRTM: TOTAL FRTM: TOTAL HVRTM:

START OF SHIFT	HVRTM	Ef-MTR	Ef-TRUE	If-MTR	If-TRUE	PRR
2300	27669	12.9		30.0	30.0	150

TIME	TUBE VAC .4 μa	LOAD VAC μa	FOCUS 15.0	EOLC FLTS	R/E	HVOC FLTS	WINDOW C° LEFT	WINDOW C° RIGHT	H_2O IN °C
	CDR check Does not seem to have been								
	Done (see note Page 2, Time 1425)								
	found well under voltage New CDR 5140:1								(used ASidden's 98%)
2320	UNStable +.5db AT 350KV Lower IA TO 29A								
0030	350KV 424A 4K 2.05			③	0	0	33.1	34.9	22
0130	"			0	0	0	33.8	35.5	22.2
0230	"			①	0	0	33.9	35.5	22.3
0330	"			①	0	0	33.4	35.0	22.0
0430	"			②	0	0	33.7	35.2	22.3
0530	" switch TO Hot H_2O			0	0	0	34.0	35.3	22.4
	Power balance OFF, +6.9%, Suspect								
	hold For Further investigation.								
0630	350KV			①	0	0	43.8	46.6	35.3

STANFORD LINEAR ACCELERATOR CENTER
WORK SHEET
PERFORMANCE DATA
(KTF003)

Date _____

	INITIAL (1μs)
✓	PROC. (3.5μs)
	ACCEPTANCE
	FINAL
	(OTHER)

	ROUND TANK ONLY
PTT	119
PT	5-733
CDR	5512
NEW CDR	5190

TUBE #	349a
MAGNET	S-005
LOAD	410-415
T/S #	07
OPERATOR	JE

INSTALLED HVRTM: FRTM: TOTAL FRTM: TOTAL HVRTM:

START OF SHIFT	HVRTM	Ef-MTR	Ef-TRUE	If-MIR	If-TRUE	PRR
0700	2774.8	12.2	12.2	24.0	24.0	

TIME	TUBE VAC 0.2 μa	LOAD VAC 18.5 μa	FOCUS 15.0	EOLC FLTS	R/E	HVOC FLTS	WINDOW C° LEFT	WINDOW C° RIGHT	H_2O IN °C
	350KV Longpulse mode check								
	HVRTM 2794.5 FRTM 871.8.0								
	HVRT 30.3 FRT 31.5								

KLYSTRON TEST LAB FORM KTF-002R 5045 TEST SHEET Page# (1)

TUBE# 349a LOAD# A10-4b MAGNET# 005 TANK# 119 T/S# 07

~~5440~~ 1

1. V_f	Volts	12.7	SAME	12.9			
2. I_f	Amps	30.0		30.0			
3. V_{beam}	KV	320	350	320	320	350	
4. I_{beam}	Amps	366	415	330	362	413	
5. P_{beam} (Peak)	MW	117.1	145.3	99.0	115.8	144.5	
6. P_{beam} (Avg)	KW	38.3	47.5	65.2	75.7	94.5	
7. μk		2.02		2.01	2.000	1.995	
8. V_{focus}	Volts	211		212	212	212	
9. I_{focus}	Amps	15.0		15.0	15.0	15.0	
10. Bucking I_1	Amps						
11. Main I_2	Amps						
12. Upper I_3	Amps						
13. Frequency	MHz	2856	SAME		2856	2856	
14. PRR	Hz			120	120	120	
15. τ_{beam}(current)	µs	5.45		5.5	5.45	5.45	
16. τ_{rf}	µs	1.0		3.5	3.5	3.5	
17. P_d(fwd)	mw	.071	.058	0.56	.52	.134	
18. P_{out}(fwd)	mw	.126	.180	0.58	.80	1.15	
19. P_{out}(refl)	mw	0	0	—	.0078	.01	

20. Tube Flow	GPM	18.5	18.6	18.61	18.65	18.30	
21. Tube deltaT	°C	8.4	10.1	11.7	12.9	15.3	
22. Body deltaT	°C	.05	.07	0.04	.09	.25	
23. Load Flow	GPM	19.23	19.25	19.36	19.35	19.00	
24. Load deltaT	°C	.7	1.0	2.7	3.7	5.4	
25. Total H_2O pwr	KW	44.6	64.7	71.3	82.4	101.0	
26. Focus Pwr(-)	KW	-3.2	-3.2	3.2	3.180	3.180	
27. Real H_2O pwr	KW	41.4	51.5	68.1	79.2	97.8	
28. P_{out}(Avg)	KW	2.6	5.1	13.8	18.9	27.1	
29. P_{out}(Peak)	MW	59.2	81.7	32.8	45.0	64.5	
30. P_d(Peak) -26.5db	Watts	529	432	10%	553	362	
31. Efficiency	%	50.6	58.3	50.2	38.9	44.6	
32. Gain	db	50.5	52.9	47.4	49.1	52.5	

33. Stable Range	+	+2	+2	2.0	2.0	2.0	
34. Stable Range	-	-3	-3	3.0	3.0	3.0	
35. Glitches		N	N	N	NO	NO	
36. RF Breakup		N	N	N	NO	NO	
37. Tube Pressure	µA	0.1	0.1	0.1	0.2	0.2	
38. Load Pressure	µA	8.5	8.3	12.4	13.5	15.5	
39. Interception	%	0.5%	0.6%	0.3	1.56	1.23	
40. L. Wind. Temp.	°C	23.2	23.7	27.4	28.8	31.1	
41. R. Wind. Temp.	°C	25.5	27.9	27.6	29.3	32.2	
42. Window Color		DARK	DARK	ART GLOW	glow	glow	
43. H_2O in Temp.	°C	22.0	21.9	21.9	22.0	22.7	
44. Power Balance	%	6.7%	7.3%	-4.1	+4.42	+3.37	
45. Date		11-24-86	11-24-86		11-24-86	11-24-86	
46. Time		0940	0930	0955	1020	1140	
47. Operator		JTB	JTB	TM	JE	JE	

Comments:

KLYSTRON TEST LAB FORM KTF-002R 5045 TEST SHEET Page# 2

TUBE# 349A LOAD# A10-116 MAGNET# S-005 TANK# 119 T/S# 07

				5140:1			
1. V_f	Volts	12.9	12.9	12.2			
2. I_f	Amps	30.0	30.0	29.0			
3. V_{beam}	KV	320	350	350			
4. I_{beam}	Amps	361	410	424			
5. P_{beam} (Peak)	MW	115.5	143.5	148			
6. P_{beam} (Avg)	KW	113.3	140.8	146			
7. μk		1.994	1.780	2.05			
8. V_{focus}	Volts	212	212	213			
9. I_{focus}	Amps	15.0	15.0	14.8			
10. Bucking I_1	Amps	—	/				
11. Main I_2	Amps	/	/				
12. Upper I_3	Amps	/	/				
13. Frequency	MHz	2856	2856	2856			
14. PRR	Hz	180	180	180			
15. τ_{beam}(current)	μs	5.45	5.45	5.45			
16. τ_{rf}	μs	3.5	3.5	3.5			
17. P_d(fwd)	mw	.164	.161	.39			
18. P_{out}(fwd)	mw	1.2	1.170	1.85			
19. P_{out}(refl)	mw	.0087	.0214				
20. Tube Flow	GPM	18.42	18.50	18.44			
21. Tube deltaT	°C	19.3	22.3	24.0			
22. Body deltaT	°C	.12	.38	.78			
23. Load Flow	GPM	19.07	19.17	19.07			
24. Load deltaT	°C	5.7	7.8	8.5			
25. Total H_2O pwr	KW	122.5	148.4	160			
26. Focus Pwr(-)	KW	3.180	3.180	3.15			
27. Real H_2O pwr	KW	119.4	145.2	156			
28. P_{out}(Avg)	KW	28.7	37.5	42.7			
29. P_{out}(Peak)	MW	45.5	1.7.6	67.7			
30. P_d(Peak)	Watts	454	433	277			
31. Efficiency	%	39.4	43.6	45.7			
32. Gain	db	50.0	51.6	53.9			
33. Stable Range	+	2.0	2.0	2			
34. Stable Range	-	3.0	3.0	3			
35. Glitches		No	NO	N			
36. RF Breakup		NO	NO	N			
37. Tube Pressure	μA	0.2	6.2	.3			
38. Load Pressure	μA	17.0	19.0	17			
39. Interception	%	.49	1.28	2.43			
40. L. Wind. Temp.	°C	32.8	34.5	43.3			
41. R. Wind. Temp.	°C	33.6	36.3	46.0			
42. Window Color		glow	glow	Y			
43. H_2O in Temp.	°C	22.8	23.1	35.0			
44. Power Balance	%	6.1	3.03	6.9			
45. Date		11-24-86	11-24-86	11-25-86			
46. Time		1300	1425	0545			
47. Operator		JE	JE	JE			

Comments:

STANFORD LINEAR ACCELERATOR CENTER
HEAT RUN SHEET
SLAC 5045 KLYSTRON

TUBE SERIAL # 319a
TEST STAND # 5-7
EM # 5-305

SHEET # 1
DATE 11-20-86
LOAD # A10116

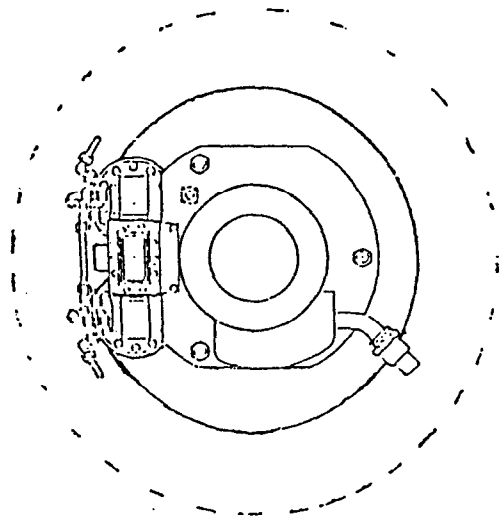
TIME HOURS ELAPSED	TIME HOURS ACTUAL	BEAM VOLTAGE KV	BEAM CURRENT AMPS	PRR HZ	RF IN MW	RF OUT READ MW	FAULTS EOLC	FAULTS HVOC	FAULTS RE	WINDOW TEMP. LEFT	WINDOW TEMP. RIGHT	INPUT WATER TEMP.	BODY DELTA T	FOCUS BUCK	FOCUS MIDDLE	FOCUS TOP	
1	1530	350	408	180	.56	1.70	(2)	0	0	34.0	35.9	22.8	.35	/	15.0	—	0.1
2	1630	350	405	180	.53	1.65	(2)	0	0	34.0	35.9	22.7	.34	/	15.0	—	0.1
3	1730	350	409	180	.57	1.71	(1)	0	0	33.9	35.8	22.7	.37	/	15.0	—	0.1
4	1830	350	409	180	.58	1.70	(1)	0	0	33.4	35.0	22.2	.36	/	15.0	—	0.1
5	1930	350	409	180	.59	1.72	0	0	0	33.1	34.8	22.2	.37	/	15.0	—	0.1
6	2030	350	409	180	.59	1.72	(1)	0	0	32.9	34.4	21.8	.38	/	15.0	—	0.1
7	2130	350	409	180	.56	1.71	0	0	0	33.0	34.6	22.2	.37	/	15.0	—	0.1
8	2230	350	408	180	.55	1.71	0	0	0	33.2	34.7	22.2	.38	/	15.0	—	0.1
9																	
10																	
11																	
12																	
13																	
14																	
15																	
16																	
17																	
18																	
19																	
20																	

Completed Run

COMMENTS:

STANFORD LINEAR ACCELERATOR CENTER
ACCEPTANCE TEST REPORT
SLAC 5045 KLYSTRON
RADIATION SURVEY

PRR 180-L



OPERATING CONDITIONS:

TUBE NO. 349a TEST 3.5 usec Pulses

EPY 350KV OPER. AF

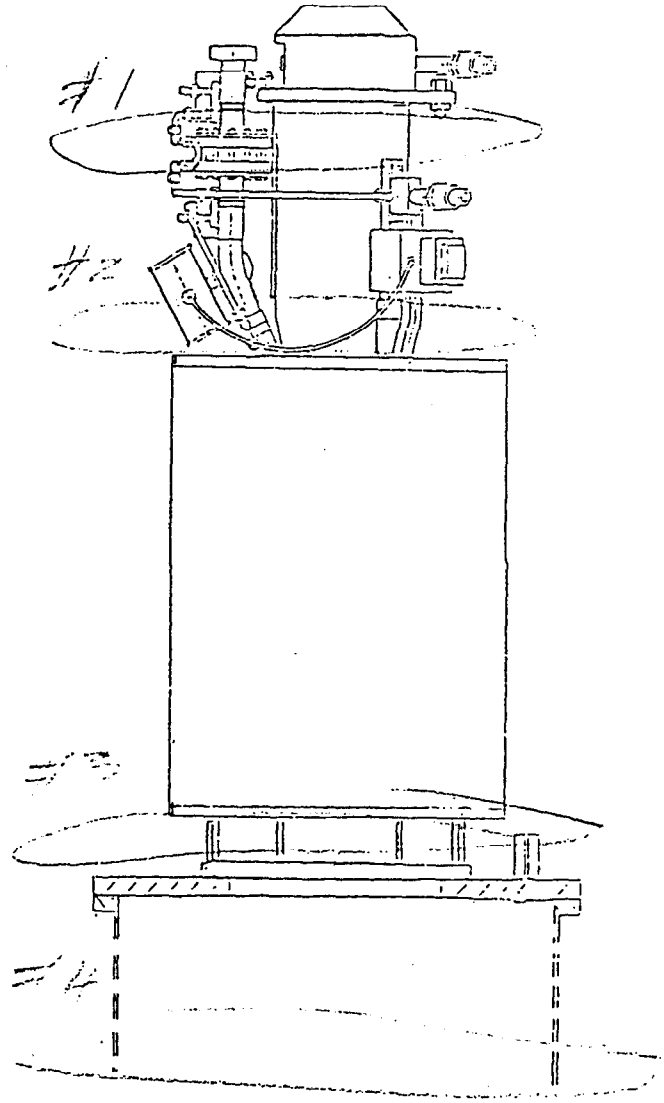
DATE 11/24/86 TEST STAND 27

SQUARE TANK (ROUND TANK)

MAGNET NO. EL-5005

RADIATION LEVELS IN mR/hr:

POSITION	BEFORE PB	AFTER PB
1	1	<1
2	2	<2
3	<2	<2
4	3.5	



COMMENTS:

Pos #1-2-3 <2MR/hr @ 3'

Pos #4 3.5MR/hr @ 3'

Tank should have lead shielding added.

STANFORD LINEAR ACCELERATOR CENTER
5045 KLYSTRON FINAL TEST DATA SUMMARY

DATE 11-26-86

accept. 1. Lee 12/1/86

TUBE # 349a
LOAD # A10-4b
MAGNET# S-005
TEST STAND # 07
HVRT 29.8 hrs
FRT 30.9 hrs
FILAMENT VOLTAGE 12.1
FILAMENT CURRENT 29.0

TANK # 119
TRANSFORMER # S+733
DIVIDER RATIO 5240:1
FOCUS(350kv) 14.7
FOCUS(320kv) 14.7
SHUNT (Y) (N) — Ω
SHUNT BOX LABEL YES
SUMMARIZED BY JE

epy KV	ik Amps	Pdr Watts	Pout MW	Stbl +	Stbl -
~~350~~ 340	363	497	47.3	2.0	3.0
~~320~~ 350	413	327	65.0	2.0	3.0

COMMENTS:

Faulting: (2) EOLC in 20hrs / 0 EOLC last shift

Po Pulse Quality: n.leak +2.0dB → -3.0dB @ both 350KV & 320KV
W < 1.5% AM & H.H. @ Both 350KV & 320 KV at all levels

Emission Check: If set @ 29.0A / 12.1V If @ TL 28.0A
change in IK 1.93% change in IB 2.0A

KLYSTRON TEST LAB FORM KTF - 006

SLAC 5045 KLYSTRON Accept. T. Lee 12/1/86

SPECIFICATION CONFORMANCE SUMMARY

TUBE 349a COMPLIED WITH SPECS: YES NO

ITEM	AREA	COMMENTS	LOG PG.
1	Pout Pdr & ik	epy,KV / ik,Amps / Pdr,W / Pout,MW / Focus,I 315 / / / / 320 / 363 / 497 / 47.3 / 14.7 350 / 413 / 327 / 65.0 / 14.7	10
2	PULSE STABILITY	STABLE RANGE + 2.6 dB (2.0 dB) - 3.0 dB (3.0 dB)	8-9
3		TESTS NOT PERFORMED *PHASE* *AMPLITUDE DRIFT* *NOISE*	
4	SHUNT	(NO) YES — Ω SHUNT BOX LABEL ATTACHED? YES	
5	SPURIOUS SIGNALS	FAST FORWARD ENERGY FAULTS (BREAK UP) Ø B/U @ 350KV Ø B/U @ 320KV	7
6	HEAT RUN	(2) EOLC LAST 20 hrs / (1) EOLC LAST 8 hrs	17
7	WINDOW CONDITION	MAX TEMPS L 44.7 °C ; R 45.6 °C COLOR: YES	17
8	IONIZING RADIATION	Pos # 4 (TANK AREA) 3.5 mR/hr @ 3' Tank SHOULD HAVE LEAD SKIRT Before going to gallery.	3.5 mrem

INSTALLED IN MAGNET # S-005 DATE: 11-26-86 DATA BY: JE

INSTALLED ON PULSE TANK # 119 REVIEWED BY: JM

COMMENTS:

See ionizing Radiation

KTF-001

K L Y S T R O N T E S T L A B F O R M

KLYSTRON CHECKOFF SHEET Tube # 3499

1 μsec Pre-processing

Initials		Check	Initials		Check
_____	Interlock check	☐	_____	Radiation	☐
_____	Process to 350Kv/60~	☐	_____	Heat Run	☐
_____	Process to 350Kv/180~	☐	_____	Yellow Sheet	☐
_____	PWR data: 320Kv/350Kv	☐	_____	Summary	☐

3.5 μsec Processing

STB	Interlock check	☑	AF	Radiation Survey	☑
STB	Process to 350Kv/60~	☑	AF	Heat Run (4 hr. minimum)	☑
STB/TM	T/L check (@ 3.5 μsec)	☑			
_____	Process to 350Kv/120~	☐	[illegible]	Yellow Sheet	☑
TM	Process to 350Kv/180~	☐	[illegible]	Process Summary	☑

Acceptance (Input water @ 35.0°C, T_{rf} @ 3.5μsec)

[illegible]	Breakup check	☐	_____	Heat Run	☐
[illegible]	Stability	☐	_____	Yellow Sheet	☐
[illegible]	Acceptance Test Report	☐	_____	Acceptance Summary	☐
[illegible]	Eng. Rundown Graphs	☐	_____	Acceptance Data Card	☐
[illegible]	Freq. Response Check	☐	_____	Hold For Acpt. Card	☐

Final

_____	Interlock Check	☐	_____	Heat Run @ 350Kv /120~ ☐
_____	T/L Check	☐	_____	Breakup @ 350Kv /120~ ☐
[illegible]	CDR Check	☑	_____	Summary Sheet ☐
_____	Radiation Survey	☐	_____	Final Data Card ☐
_____	Power Data 320Kv	☐	_____	Shunt Box Label ☐
_____	Power Data 350Kv	☐	_____	Tank Data Card ☐

STANFORD LINEAR ACCELERATOR CENTER
WORK SHEET
PERFORMANCE DATA
(KTF003)

Page No. 1

Date 11-25-86

	INITIAL (1μs)
	PROC. (3.5μs)
✓	ACCEPTANCE
	FINAL
	(OTHER)

	ROUND TANK ONLY
PTT	119
PT	5+ 735
CDR	5312
NEW CDR	5190

TUBE #	349a
MAGNET	S-005
LOAD	A16-A16
T/S #	07
OPERATOR	JC

INSTALLED HVRTM: 274.8 FRTM: 8718.6 TOTAL FRTM: TOTAL HVRTM:

START OF SHIFT 0700	HVRTM	Ef-MTR 12.2	Ef-TRUE 12.2	If-MTR 27.0	If-TRUE 27.0	PRR 180 *

TIME	TUBE VAC 0.2 μa	LOAD VAC 18.5 μa	FOCUS 14.8	EOLC FLTS	R/E	HVOC FLTS	WINDOW C° LEFT RIGHT	H_2O IN °C
0715	350KV checkout RI run							
	35.03 × 1038 × 15 × $\frac{1}{60}$ = 355KV							
	Standing Cond. V - 350 KV =							
	66.79 New CDR 5240:1							
0750	HV off to [illegible]							
0805	check RI CDC VALVE IS CORRECT							
	1038:1 * 350 KV to check Pwr Tst							
0950	HV off to install H_2O Standard							
	in tube flow							
1045	HV on to have HOT Flow							
	Tube flow at by -.40 gpm							
	HV off to disconnect standard							
	& Hook up to load flow							
	Load flow within .1 gpm of							
	minimum							
	Disconnect [illegible]							
	W/ tube flow to check and							
	K Factor not what it should							
	it is							

STANFORD LINEAR ACCELERATOR CENTER
WORK SHEET
PERFORMANCE DATA
(KTF003)

Date 11-25-86

	INITIAL (1μs)
	PROC. (3.5μs)
✓	ACCEPTANCE
	FINAL
	(OTHER)

	ROUND TANK ONLY
PTT	119
PT	5+733
CDR	5190.1
NEW CDR	5240.1

TUBE #	349a
MAGNET	S-CCS
LOAD	A10-H16
T/S #	07
OPERATOR	JE

INSTALLED HVRTM: FRTM: TOTAL FRTM: TOTAL HVRTM:

START OF SHIFT	HVRTM	Ef-MTR	Ef-TRUE	If-MTR	If-TRUE	PRR
0700	2778.7	12.2	12.2	29.0	29.0	120

TIME	TUBE VAC .2 μa	LOAD VAC 12.0 μa	FOCUS 14.7	EOLC FLTS	R/E	HVOC FLTS	WINDOW C° LEFT	WINDOW C° RIGHT	H_2O IN °C
1210	350KV -			2	0	2	37.4	38.5	32.3
1330	HV off Hooking up H_2O Standard for coil flow since flow is off by .4gpm DATA TO BE TAKEN USING H_2O STANDARD NAT STATION METERING OF COIL FLOW BECAUSE of PURGE. JE 11/25/86 OK'd BM								
1340	HV on 350 KV change Back to 180~ increased coil flow to 19.13gpm Allow 1 hr for tank temp to stabilize								

STANFORD LINEAR ACCELERATOR CENTER
WORK SHEET
PERFORMANCE DATA
(KTF003)

Date 11/25/86

	INITIAL (1μs)
	PROC. (3.5μs)
✓	ACCEPTANCE
	FINAL
	(OTHER)

	ROUND TANK ONLY
PTT	119
PT	ST-733
CDR	5198:1
NEW CDR	5240:1

TUBE #	349a
MAGNET	S-885
LOAD	ALO-46
T/S #	B7
OPERATOR	EL

INSTALLED HVRTM: 2774.8 FRTM: 8718.0 TOTAL FRTM: TOTAL HVRTM:

START OF SHIFT 1500	HVRTM 2781.7	Ef-MTR 12.2	Ef-TRUE	If-MTR 29.0	If-TRUE	PRR 180

TIME	TUBE VAC .2 μa	LOAD VAC 14.0 μa	FOCUS — 14.7 —	EOLC FLTS	R/E	HVOC FLTS	WINDOW C° LEFT	WINDOW C° RIGHT	H_2O IN °C
1500	350KV			⊖	⊖	⊖			
1600	Begin B/U check.			⊖	⊖	⊖			
1630	Complete B/U check & Stability Check.			⊖	⊖	⊖			
1700	Completed Acceptance Test Report			⊖	⊖	⊖			
1730	Complete Eng. Rundown			⊖	⊖	⊖			
1740	Begin Freq Response.			⊖	⊖	⊖			
	Unable to Set @ 2850 Mhz								
	Unable to Set @ 2866 Mhz								
	Unable to Set @ 2868 Mhz								
	Unable to Set @ 2870 Mhz								
1810	Completed Freq Response Test.			①	⊖	⊖			
1815	Placed on Acceptance Heat Run								

STANFORD LINEAR ACCELERATOR CENTER
WORK SHEET
PERFORMANCE DATA
(KTF003)

Page No. 3 (4)

Date 11-26-86

	INITIAL (1μs)
	PROC. (3.5μs)
L	ACCEPTANCE
	FINAL
	(OTHER)

	ROUND TANK ONLY
PTT	119
PT	ST-733
CDR	5A0:1
NEW CDR	5240:1

TUBE #	349a
MAGNET	S-005
LOAD	ALO-4
T/S #	07
OPERATOR	RLG

INSTALLED HVRTM: 2774.8 FRTM: TOTAL FRTM: TOTAL HVRTM: 14.8

START OF SHIFT	HVRTM	Ef-MTR	Ef-TRUE	If-MTR	If-TRUE	PRR
2300	2789.6	12.2		29.0	29.0	180

TIME	TUBE VAC μa	LOAD VAC μa	FOCUS	EOLC FLTS	R/E	HVOC FLTS	WINDOW C° LEFT	WINDOW C° RIGHT	H_2O IN °C
	3	9	14.2 ___ ___						
	continue heat Run								
0225	SLED Recvc - continue H/R								

STANFORD LINEAR ACCELERATOR CENTER
WORK SHEET
PERFORMANCE DATA
(KTF003)

Page No. 15

Date 11-26-86

	INITIAL (1μs)
	PROC. (3.5μs)
X	ACCEPTANCE
X	FINAL
	(OTHER)

	ROUND TANK ONLY
PTT	119
PT	ST-733.
CDR	5240
NEW CDR	

TUBE #	349a
MAGNET	S-005
LOAD	K10-416
T/S #	07
OPERATOR	JE

INSTALLED HVRTM: FRTM: TOTAL FRTM: TOTAL HVRTM:

START OF SHIFT	HVRTM	Ef-MTR	Ef-TRUE	If-MTR	If-TRUE	PRR
0700	2797.7	12.2	12.2	29.0	29.0	180

TIME	TUBE VAC 0.2 μa	LOAD VAC 6.0 μa	FOCUS ____ 14.7 ____	EOLC FLTS	R/E	HVOC FLTS	WINDOW C° LEFT	WINDOW C° RIGHT	H_2O IN °C
0700	350kV Cont beat run								
1400	HV off	Fil off							
	HVRTM 2801.6		FVRTM 8748.9						
	HVET 29.8		FVET 30.9						

(8)

KTF014 STABILITY CHECK FORM 5045 KLYSTRON DATE 11-25-86

TECH. EC

TUBE# 349-

Beam voltage (circle one) 270 315 (320) 350 ____

Optimum focus I1 — I2 14.7 I3 — PRR 180

Saturation drive (Peak) 497 W Set input H2O temp at 35.0° C.(±.5°)

Pulse width 3.5 µs Peak Power Out 47.3 MW

Body Interception 0.8 %

DESCRIPTION OF PULSE: (Instabilities, type, percentage of pulse, etc.)

Stable from: + 2 to - 3 db.

Saturation: % AM < 0.1

% Hum < 0.1

At Max Stable overdriven condition (+ 2 db) % AM < 0.1

% Hum < 0.1

At Max Stable underdriven condition (- 3 db) % AM < 0.1

% Hum 0.2

Comments: Pulse is clean at all observed levels.

(9)

KTF014 STABILITY CHECK FORM 5045 KLYSTRON DATE 11-25-80

TECH. EV

TUBE# 349

Beam voltage (circle one) 270 315 320 (350) ____

Optimum focus I1 — I2 14.7 I3 — PRR 180

Saturation drive (Peak) 327 W Set input H2O temp at 35.0° C.(±.5°)

Pulse width 3.5 µs Peak Power Out 65.0 MW

Body Interception 1.4 %

DESCRIPTION OF PULSE: (Instabilities, type, percentage of pulse, etc.)

Stable from: + 2 to - 3 db.

Saturation: % AM < 0.1

% Hum ≈ 0.1

At Max Stable overdriven condition (+ 2 db) % AM 0.2

% Hum < 0.1

At Max Stable underdriven condition (- 3 db) % AM < 0.1

% Hum < 0.1

Comments: Pulse is clean at all observed levels

KTF000.ATR

STANFORD LINEAR ACCELERATOR CENTER
ACCEPTANCE TEST REPORT – 5045 KLYSTRON

(10)

TUBE 349a MAGNET 5005 LOAD A10-46 TEST STAND 7

TECH. EL REVIEWED BY _____ DATE 11-25-86

DRIVE ATTN. 26.5 db FIL E. 12.1 FIL I. 29.0

PRR 180 FOCUS V 210 FOCUS I 14.7

BEAM PULSE LENGTH 5.5 µs RF PULSE LENGTH 5.5 µs INPUT H2O TEMP 33.1 °C

1. BEAM VOLTAGE	KV	315	320	350
2. BEAM CURRENT	AMPS		363	413
3. PERVEANCE	µK		2.00	2.00
4. TUBE PRESSURE	µA		0.2	0.2
5. AVE. DRIVE PWR.	mW		.70	.46
6. LOAD FLOW	GPM		19.14	19.15
7. LOAD ΔT	°C		5.9	8.1
8. TUBE FLOW	GPM		19.9	20.0
9. TUBE ΔT	°C		17.1	19.9
10. BODY ΔT	°C		0.18	0.38
11. WINDOW TEMP. L/R	°C		40.0 / 41.7	41.3 / 43.3
12. PK. BEAM POWER	MW		116.2	144.6
13. AVE. BEAM POWER	KW		114.9	143.1
14. PEAK DRIVE	WATTS		497	327
15. AVE. RF OUT	KW		29.8	40.9
16. PEAK RF OUT	MW		47.3	65.0
17. TUBE WATER PWR	KW			
18. TOTAL WATER PWR	KW		119.6	146.0
19. FOCUS POWER	KW		5.09	3.09
20. EFFICIENCY	%		40.7	44.9
21. GAIN	db		48.8	52.9
22. BODY INTERCEPTION	%		0.8	1.4
23. POWER BALANCE	%		1.42	-0.1

Appendix B.5i: Failure Reports

Trouble-Failure/Modification Report (1)

Window Inspection Data Sheet (1)

Klystron Failure Report (1)

Reject Klystron Tube Inspection (1)

Autopsy Report (1)

SYSTEM NO. 5

STANFORD LINEAR ACCELERATOR CENTER

TROUBLE-FAILURE/MODIFICATION REPORT

BELEBK CONTROL NO. 84

No. 3781

TROUBLE OBSERVED - DATE			TIME OBSERVED	LOCATION - STATION	REFERENCE NO.
1 (MONTH)	14 (DAY)	198 7 (YEAR)	1100 (24 HOUR SYSTEM)	16-3	

PRIORITY CODE: ☐ EMERGENCY ☒ ROUTINE ☐ MODIFICATION/ENGINEERING CHANGE

TROUBLE DESCRIPTION:

1) REMOVE KLY # 349A

2) INSTALL NEW KLY

(POSSIBLE BROMKON WINDOW)

ACTION:

O.K. to remove.

M. Allen

SUB-SYSTEM: —

RTM: FILA ____ HV ____

COMPONENT	REMOVED Serial No.	REMOVED Mfg.	INSTALLED Serial No.	INSTALLED Mfg.	SYMBOL
KLYSTRON	349A	SLAC	354A	SLAC	
				1-1587	

DATE COMPLETED			TIME COMPLETED
____ (MONTH)	____ (DAY)	198 (YEAR)	____ (24 HOUR SYSTEM)

NAME(S)

Trouble Reported By	Person Notified	Trouble Repaired By	AOG Acceptance
M. Fowler	Collins		

• Please see reverse side for instructions •

ACCELERATOR COPY #1

GPO-790-937

5045 KLYSTRON
WINDOW INSPECTION DATA SHEET

Tube Number: 349A

Inspection Number: 1283

Right Window Number: _____

Time Inspected: _____

Left Window Number: _____

Location: D-Tube Shop LETHBRW

Inspected By: (L)

Date: 1-26-87 Initials: (D)

	Right Window	Left Window
Blow off Req'd.	yes/no	yes/(no)
Number of Times	_____	_____
Metallic Particles Found	yes/no/uncertain	yes/(no)/uncertain
Spots Found	Yes/No	Yes/(No)
Hold Window	Yes/No	Yes/(No)

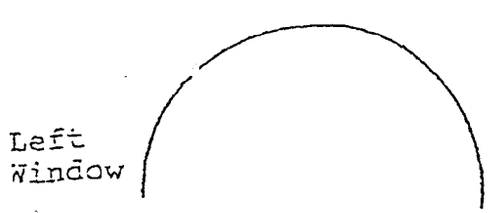
Return to Tube Shop (Yes/No)

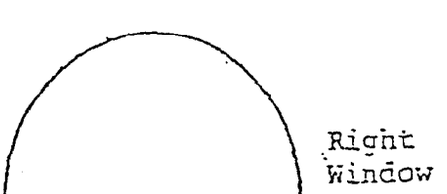
Return Approved By: _____

Particulates Recovered (Yes/No)

Date: _____

General Comments: _____





KLYSTRON FAILURE REPORT

TUBE 349a TANK 119 MAGNET S-005 DATE 1-20-87

FROM STATION 16-3 ELAPSED FRTM 4446.9 ELAPSED HVRTM 2816

REASON FOR RETURN (FROM TROUBLE REPORT):

Arcing in w/g valve

INITIAL INSPECTION: TUBE VACUUM 12 μa OIL BKDN 37 KV. BORESCOPED ☒

~~CHANGE~~ ~~TANK~~

BY [signature] 1-20-87

PRIMARY RESPONSIBILITY: KLYSTRON ☐, MAGNET ☐, TANK ☐ _____ ☐

ACTION TO FOLLOW:

BORESCOPE &
TEST AS IS.
Check, please

BY [signature] 1/20/87

ANALYSIS: Check for leaks in window area and leakage current in pump.

Leak checked through window NIL ⅓ OR output, used I.P. leak detector, also confirmed NO current leakage on 8½ pump R Barrows, very large leak up rate. Believed to have a leak suitable. Pump off ⅓ magnet off for approx 4 min leaked up from 1.5 μa to 20-30 μa. BB

There is a small leak through one of the windows. P_T is 1.5 μa when windows open to atm. P_T drops to <.1 μa when load pumped down. P_T goes back up when load let up to N_2. Leak size ≈ 2×10^{-8} T·L/sec.

R Call

PREVENTIVE ACTION:

1/23/87 Found leak using I.P. detector. tube press goes to > 2.5 μa when w/g pressurized w/Helium 1-22-87

1/23 - Same indication as R.C. Except when Blown out with N_2 tube press 2 μa R Barrows

ASSEMBLIES OK FOR REUSE IN GALLERY: KLYSTRON ☐ MAGNET ☐ TANK ☐

SEND TO TUBE SHOP if ☒ - H.V. Seal Resistance Corona Accepted - 1 kΩ 2/3/87 CSC

FAILURE CODE 051 SIGNATURE RS Callin DATE 3-13-87

COPIES: TUBE—WHITE; TANK—BLUE; DEP. REP.—PINK; DEPT. FILE—YELLOW; CLOSEOUT—BUFF

Reject Klystron Tube Inspection

Tentative date tube is to be opened 2-5-87 09:00

Confirmed by Garwin, Hoyt, etc. Hoyt, Callin

Tube No. 349a Type 5045

Gun Date

Serial No. SA-316 SP-329-5C Type Scandate

Vacuum Firing 8Hrs/750°C T&M ✓ Varian _____

RF Firing Duration 62 Hrs.

Final Pressure (HOT) 9.7E-8 Torr

Window Data

Serial No. 2114 2124 Type AL-995

Brazed in _____ Horizontal ✓ Bell Furnace

Sleeve Mat'l Cu Ceramic-Sleeve braze alloy 35-65

Sleeve-Housing braze mat'l 50-50

Type of coating Ti. Nitride Method used D.C. Spt'g

Cleaning method ✓ Wet blast ✓ Chemical

✓ Water Pik

_____ Other (specify) _____

Window temps. during operation at various power levels.

Bake Data

Date on bake 11/5/86 Date Pinched-off 11/14/86

Max temp. 550° °C For 128 hrs.

Pressure 7.0E-9 Torr and Emission Current 76 ma @ 1 kv

Pinch-off pressure 1.9E-9

Plans

_____ Rework _____ Scrap _____ Authorized by _____

Change _____ Window _____ Ion Pump _____ Collector _____

Other (specify) _____

Test Data

A SUMMARY

Operating E_f I_f

Ik Amp	P_{out} Mw	μk	P_{dr} W	Input VSWR w/o	Input VSWR w DST	Gain Sat.	Gain SS	Eff %	Hum @ db	AM % @ db	Fault/ 8 hrs.	Missed Pulses	E_f @TL	$\Delta Ik_{\%}$ / ΔE_f	Wind Temp

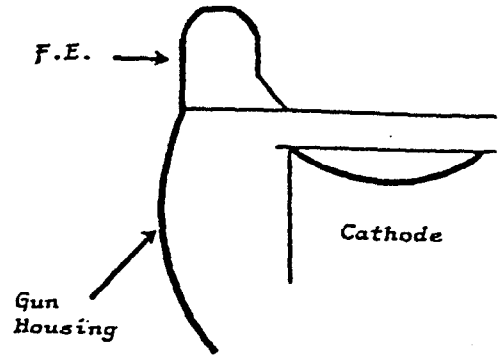
OSITION:	Date:	Comments/Reasons:
~~1060~~ Return	1/20/87	Window Failure

AUTOPSY REPORT

Tube No 349A Date Failed 1-20-87

Failure mode Window Failure Inspected by RC CG J.P. + EH

Date 2-5-87



Measurements: a) .83<
b) .836
c) .836

INSPECTION

Smell of C2H2: Strong (S) ☒ Weak (W) ☐ Absent (A) ☐

Comments:

Cathode No: SA-316 SP2-329-SC Clean: Y ☐ N ☐ Mottled: Y ☐ N ☐ SMALL

Comments: SLIGHT MOTTLING IN TWO AREAS NEAR EDGE

Gun Alignment:

.012 TOTAL / .006 T.I.R

*TIR Concentrici

+.0012

.0012 TOTAL PARALLEL

Parall

* Total Indicator Runout

Focus Electrode: Arcs Many: (M) ☐ Few: (F) ☐ Tiny: (T) ☐ Heavy: (H) ☐

Arcs on Radius (Yes) ☐ (No) ☐

Arcs on Outside (Yes) ☐ (no) ☐

Comments: A FEW TINY AND FEW HEAVY ARCS

Comments:

S.S. Housing: Arcs: FI/FH ☐ or MI/MH ☐

Comments: SOME HEAVY ARCS A FEW HEAVY ARCS ON OUTSIDE RADIUS OF CORONA SHIELD.

Recommendations for gun assembly a

Signature:

Ceramic Standoff Condition H.V.S. # 4E-139

Clean (C) ☐ Puncture (P) ☐ Breakdown (B) ☐

Comments: HV seal baked, leak checked - no leak (twice)

(small suspicious chip in seal)

Please check one of the following

☐ A ☐ Reprocess and reuse on n tube and or use on tube

☐ B ☐ Use as is on next availab on tube No. _____

☐ C ☐ Scrap

Anode Nose Arcs: Many Tiny (MT) ☐ Many Heavy (MH) ☐ Few Tiny (FT) ☐ Few Heavy (FH) ☒

Coating: Heavy (H) ☐ Light (L) ☒

Comments: slightly oxidized

few big arc spots to Ant. Top (S.S)

Other Notes:

H.V. Seal Res. After Bake 1.5E 8

H.V. Seal Res. Before Autoclave 1.6

Beam Interception (0) 360 ☐

Comments: None

some grain growth on anode tape I.D.

Appendix B.5j: Part Non-Conformance Report

NON-CONFORMANCE REPORT

KLYSTRON TUBE SHOP

Explain nature of non-conformance in detail and illustrate if necessary.

THE SPACING BETWEEN THE FOCUS ELECTRODE KNIFE EDGE AND THE CATHODE EDGE IS CLOSER THAN TOLERANCES ALLOW (.044 ± .006)

THE GUN ASSEMBLY SA-469 SP-65-SC SPACINGS ARE: .036, .037, .039

Name of person who first detected the problem. CHRIS GRAY

Non-conformance part accepted ~~rejected~~ by D. E. Wilcox (Cognizant engineer)

Steps taken to keep this problem from re-occurring

Part used in tube # #458a

Appendix B.5k: Engineering Change Order

CHANGE ORDER NO. 0254

TITLE GASKET, TUBE SEAL			DATE 10-28-87
DWG./SPEC. NO. PF-700-758-01		R 5	NEXT ASSY
ORIGINATOR M.Regan		APPROVAL [signature]	DATE 11/3/87
W.O./ACCT. NO. 08-8135-8			DATE REQUIRED
REASON FOR CHG:	✓	MFG. RELEASE NO.	
DESIGN CHG.	X	TUBE/SERIAL NO.	
MFG. CHG.		-- ACCEPTANCE --	
CORRECTION *		MFG. [signature]	DATE 10-28-87
AS BUILT *		TUBE	DATE
DOCUMENTATION *		FINAL	DATE
OTHER			

DESCRIPTION PLEASE MAKE THE FOLLOWING CHANGES (REF ATTACHED REDLINE DWG)

CHANGE FROM: 2. SURFACE MUST BE FREE OF SCRATCHES,DEEPER THAN .001.

TO: 2. SURFACE MUST BE FREE OF SCRATCHES,NICKS OR IRREGULARITIES.

CHANGE FROM: 32 FINISH (BLOCK TOLERANCE) TO: 125 FINISH (BLOCK TOLERANCE)

ADD: 32 FINISH AND NOTE: 2. TO .080±.005 DIMENSION,BOTH SURFACES

ADD: .005 FLATNESS (.080±.005)

* THIS TYPE OF CHG. WILL NOT REQUIRE APPROVAL OR ACCEPTANCE

DATE COMPLETED 11-17-87 BY [signature] SHT. _____ OF _____

APPENDIX C

Quality Assurance Policies and Standards in Electronics Department

Appendix C.1: List of Procedures and Standards In Electronics Production

S L A C M E M O R A N D U M March 1, 1988

To: J. Oijala - 07

From: F. Generali

Subject: ELD/EPC QC WORKMANSHIP STANDARDS AND PROCEDURES USED

The following list of documents are the present practices and procedures which our EPC groups use.

	SPECIFICATION	TITLE
1.	QC-119-100-00-R6	Production of Printed Circuit Boards (F. Generali 02/24/81)
2.	QC-140-561-00-R3	Component Installation of Printed Circuit Boards (F. Generali 11/09/73)
3.	QC-140-697-00-RO	Electronics Fabrication Workmanship Standards (F. Generali 04/05/74)
4.	Shop Handbook	Printed Circuit Board Processing Procedure (F. Generali 04/01/74)
5.	Shop Handbook	Printed Circuit Board Design and Drafting Procedure (F. Generali 01/27/88)
6.	Evaluation Procedure	Outside Vendor's Qualifications to Perform SLAC PC Design Work (F. Generali 02/22/88)
7.	Evaluation Procedure	Outside Vendor's Qualifications to Perform SLAC P/C Fabrication Work (F. Generali 02/22/88)
8.	Evaluation Procedure	Outside Vendor's Qualifications to Perform SLAC P/C Assembly Work (F. Generali 02/22/88)
9.	Evaluation Procedure	Outside Vendor's Qualifications to Perform SLAC Chassis Work (F. Generali 02/22/88)

10. EPC Work Processing Forms

    a. EPC Job Completed - Customer Review Sheet

    b. Printed Circuit Job-Flow Sheet

    c. EPC Labor Cost Estimate Sheet

    d. ELD/EPC Job Order Sheet

    e. Suggested Documentation & Prototype Unit Revision Job-Flow Sheet

    f. P/C Board Estimation Sheet

    g. Job Order Additional Charges (Customer Approval) Sheet

    h. CNC EPC Standard Drill Tool Number Sheet

    i. Engineering Change Request Sheet

11. QC-034-100-01-R3 SLAC/Quality Control Workmanship Standards

12. FP-027-100-01-R1 SLAC/Plating Standard for Corrosion Protection

13. DS-016-110-01-R6 SLAC General Drafting Instructions (Presently under review by the SLAC Standards Committee)

14. DS-016-310-01-R12 Engineering Document Numbering System (Presently under review by the SLAC Standards Committee)

FG/jbn

Copies: M. Allen

Appendix C.2: Examples of Documentation in Electronics Department

Customer Feedback Report (1)

Engineering Change Request (1)

Electronics Department Job Order (1)

Additional Work Request (1)

P/C Job-Flow Sheet (1)

Revision Summary Sheet (1)

DATE: _____

To : _____

FROM : F. Generali - Elect. Fab. Shop

SUBJECT: Job Order # _____

After you have carefully analyzed the above subject job order which our shop has just completed for you, I would greatly appreciate your comments of the findings.

The information given, will aid our shop in personal job satisfaction; to better understand our customers' needs and to perform a better job in the future.

EXCELLENT ☐ GOOD ☐ POOR ☐

SPECIFIC COMMENTS:

Please mail to F. Generali, Bin No. 51 Thank you.

• STANFORD UNIVERSITY • OFFICE MEMORANDUM • STANFORD UNIVERSITY • OFFICE MEMORANDUM • STANFORD UNIVERSITY • OFFICE MEMORANDUM

ENGINEERING CHANGE REQUEST STANFORD UNIVERSITY STANFORD LINEAR ACCELERATOR CENTER			EC	Page 1 of
RIGINATOR	EXT.	DATE	ORIG(GROUP):	W/O.No ACC.No
REQUEST DATE	PRIORITY	1.__ 2.__ 3.__	TO(GROUP):	JOB ORDER No
NOW IN PROTOTYPE: __Y __N			NOW IN PRODUCTION: __Y __N	
Recommended CHANGE __Y __N			By Resp. Engineer:	

AUTHORIZED BY: _____

SYSTEM TITLE: _____

APPLICABLE DRAWING NUMBER: _____

REASON ENGINEERING CHANGE REQUIRED:

DESCRIPTION OF CHANGE:

INTERNAL USE ONLY:
AFFECTED AREAS (DISTRIBUTION)

___COORDINATION _____(SUPV)
___DESIGN/DRAFTING _____(SUPV)
___P/C DESIGN _____(SUPV)
___PRODUCTION/
___MANUFACTURING _____(SUPV)

ASSOC. DRAWINGS
DL_____ BD_____
SD_____ FL_____
PF_____ SI_____
ML_____ OTHER_____
SA_____ _____
WD_____ _____

DATE COMPL:	COMPL BY:	ENG ACCEPT:

ELECTRONICS DEPARTMENT JOB ORDER

Job title				WO number				JO number			
Engineer/originator	Extension	Coord code		Acct number				Dwg number			
Initial status code P: A: R:	Rcvd date	Rqst date		Shop code				Priority			
Approved	Inspected	Quantity	Hours est	CD	EA	FI	EE	LD	MS	OP	PF

S/D	Preferred wiring:		
P/C	Kynar	Rad.	Teflon
MECH.			

Job description:

Date: _____

TO: _____ _____
EPC Customer's Name Bin #

FROM: _____ _____ _____
EPC Group Supervisor Bin # Phone #

SUBJECT: _____ _____ _____
EPC Job # Job Title Drawing #

This is to inform you that additional charges have been imposed on your work order # _____ for the following reasons:

	Original Hrs.	Additional Charges Hrs.	$/Hr.	Cost
1. Additional work requested by originator.				
2. Additional work which was not forseen during initial estimate.				
3. Systems or process problems.				
_____ (Specific Problem)				
TOTAL				

Please review this form, return to the above group supervisor with your comments, and sign so that we may take the appropriate action. Thank you.

☐ Continue the work. ☐ Stop all work.

Originator's Comments:

_____

_____

_____

_____ _____
Customer's Signature (Date)

cc: F. Generali
B. Barrera

2/88

P/C JOB-FLOW SHEET

JOB TITLE:

JOB NUMBER	W/O, ACC. NUMBER	PHOTOFAB. REC. DATE	DUE DATE

PROCESS	STATUS	NAME	DATE	INSP.	DATE
FILMS ENCLOSED					
MYLARS ENCLOSED					
OPTICAL PROGR.					
N/C DRILL TAPE AVAILABLE					
INNER LAYERS					
LAMINATE					
☐ DRILL N/C ☐ DRILL MANUAL					
FIRST ARTICLE					
SAND/CLEAN					
STEP I					
PHOTORESIST					
STEP II					
TIN/LEAD					
ETCH					
GOLD PLATE					
SOLDER-REFLOW					
TRIM					
SOLDER MASK					
SILKSCREEN					
FINAL INSP.					

SPECIAL INSTRUCTIONS

BOARDS QTY _____

SINGLE SIDED ▱ BD. THICK_____

DOUBLE SIDED ▱ BD. THICK_____

MULTI-LAYER ▱ BD. THICK_____

SPECIAL MATERIAL ▱ BD. THICK_____

ELECTRONICS
FABRICATION
SHOP

DATE _____
J.O. NO _____

JOB TITLE : _____

SUGGESTED DOCUMENTATION & PROTOTYPE UNIT REVISIONS :

APPENDIX D

Quality Assurance Policies and Standards in Plant Engineering

Appendix D.1: Quality Assurance Plans and Policies of Different Groups in Plant Engineering

Quality Assurance Plans: Electrical Engineering Group (2)

Plant Maintenance Shops (1)

Design Drafting Group (2)

Architectural/Civil/Structural Group (2)

Mechanical Group (1)

QUALITY ASSURANCE PLAN IN ELECTRICAL ENGINEERING GROUP

PLANT ENGINEERING DEPARTMENT

The work performed by this group can be broadly divided into three categories:

1. New installations by outside subcontractors.

2. New installations or modifications by in-house personnel.

3. Maintenance, trouble shooting, etc.

Each category is described below.

1. New installation by the Subcontractor:

   a. The drawings and specifications are prepared by an engineer/designer assigned to the project. Whenever possible or whenever it is very critical, the design is checked by another engineer. They are reviewed and approved by the group leader.

   b. During construction engineers make frequent field inspections to check for compliance with drawings and specifications.

   c. Subcontractors are required to perform testing, e.g. hipot and megger witnessed by the engineer.

   d. After the job is completed, a functional test is performed to ensure proper operation.

   e. "As built" mark-ups are returned to drafting.

2. New Installation by In-house:

   a. A work order is prepared by the engineer with an engineering sketch that describes the work to be done. This is sent to PMS. The work order and sketch are reviewed and approved by the group leader.

   b. The engineer makes site visits to explain the details to the electricians assigned to the project.

   c. Hipot and/or megger tests are performed by the electricians and witnessed by the engineer.

   d. After the job is completed a functional test is performed to ensure operation.

e. "As built" markups are returned to the Drafting Department.

3. Maintenance:

a. Trouble calls are received and attended by the shop (PMS). Engineering support is provided as needed. Electricians are supervised by their supervisors for safety and quality.

b. Preventive maintenance items are scheduled and performed whenever manpower and shutdown of equipment are available.

c. A new computerized system is being developed which will help in keeping precise records and better planning.

Carpenter

SLAC has two journeyman level carpenters, one carpenter laborer, and two journeyman level job shoppers.

All the carpenters are familiar with SLAC policies, safety programs, and building codes.

They can handle all carpenter related needs. All work orders are reviewed, estimated, material ordered, and coordinated by the Carpentry Supervisor. Small jobs are checked at least once, while in progress, and checked with the requestor on completion. Larger jobs are checked at least daily.

Paint Shop

The paint shop has three painters. One man works in spray booth painting electronic racks, panels, and stains items that come from the carpenter shop. The other two men do mud, tape, and paint offices, hall ways, rest rooms, or anything that can be painted with rollers or brushes.

Labor Pool

The labor pool has five people plus a supervisor. They cut weeds, clean up around the site, move furniture, dig trenches, drive the bus, and deliver materials.

Mechanics

The Mechanic Shop has seven journeymen. Two work full time on heavy equipment, diesel powered equipment, two pettibones, two diesel powered forktrucks, tractors, a backhoe, a flatbed trailer, the Letourneau, and generators. One man is on long term loan to IR-2 doing steel fabrication work. The other four men do metal fabrication jobs, crane repair, installation of HVAC units and duct work, earthquaking of equipment, removal and installation of pumps, overhaul of pumps, installation and repair of fans, and test runs, and preventive maintenance of M.G. sets.

All jobs are estimated and priorities are set. Most of the mechanic jobs are short term. The supervisor checks the jobs at least daily.

Quality Assurance Plan, Design Drafting Group,
Plant Engineering Department

The primary responsibility of this group is to provide design and drafting services for new facilities and for modifications to existing facilities which are engineered by the Plant Engineers. This may include estimating, material selection, take-off and ordering, scheduling, calculations, and field inspection, as well as drafting on both new and existing drawings.

A secondary responsibility of this group is to provide design and drafting service to other departments either in our own shop or to provide personnel to work in their areas. This shop also provides reference help to others for buildings and underground utilities for the various facilities type drawings.

A Drafting Standards

1. The SLAC general drafting standards, DS-016-110-01 is the reference for all disciplines. It outlines the general rules to assure that titles, numbers, and formats are similar for ease of understanding.

2. Specific other SLAC standards are used for various design and construction procedures within the different disciplines.

3. Specific industry standards, such as ANSI, AIA, AISC, etc. are also used where applicable.(SLAC standards are currently being revised and will include CADD standards.

B Design and Drafting Accuracy

1. This is accomplished by checking between the designer and the squad leader or another designer of the same discipline.

2. 2. The final check and acceptance is by the cognizant engineer.

C Drafting "As-Built"

After completion of construction, markups are usually returned to drafting when major field changes occur to assure decent reference drawings later. These are stockpiled to be accomplished during slack time and when funds are available.

QUALITY ASSURANCE

Document Control and Offset Printing

Document Control

A. Inspect incoming documents to be sure they comply with Document Control Procedures, AP-041-300-01, which calls for standards:
   1. Document has all authorized signatures.
   2. Correct format for new document and for revision.
   3. Titles and numbering.

B. Inspect keypunched slave card.
   1. Adequate information for identification.
   2. Process cards in correct sequence.

C. Microfilming.
   1. Check microfilm on densitometer.
   2. Process cards in correct sequence.
   3. Visual check of duplicate aperture card.

D. Keypunch aperture card.
   1. Process cards in correct sequence.

E. Hardcopy.
   1. Visual check for quality copy,too dark, too light, clean copy.
   2. Distribute to correct department.

F. Blueline duplicating.
   1. 100% inspection for quality of copy, within acceptable limits.
   2. Distribute to correct department.

G. Processing engineering document requisitions.
   1. Withdrawal of original tracing from vault.
      a. Authorized personnel only, signature required on preprinted card.

Offset Printing

A. Visual - random check for quality product.
   1. In proper sequence.
   2. Correct reproduction size.
   3. Quality image from master material to paper.

Quality Assurance Plan
Architectural/Civil/Structural Group - Engineering
Plant Engineering Department

The primary responsibility of the group is the planning and design of new facilities and modifications to existing facilities. As such, the primary output is of a service nature; producing drawings, specifications, design reports, calculations, cost estimates, schedules, and other engineering support. The quality of the services is not easy to determine since the primary product is a service, rather than a specific object like a piece of equipment or other fabricated component. However, the quality of the service can be judged by the end resultant: for example, a well-constructed building accomplished within budget and on schedule.

A. Construction Inspection

1. Engineers make daily field inspections during construction (not only civil, but mechanical and electrical as well) to check for compliance with drawings and specifications and to insure that construction is in accordance with codes and standards.

   Recently implemented policy is use of daily inspection reports that are kept in project and contract file.

2. Test cylinders are made for ready-mixed concrete and sent to lab for testing to insure strength of concrete. Reports are retained in project file.

3. Soil testing laboratory is hired to test compaction and backfill on larger projects were engineered fill is required. Reports are retained in project file.

4. Mill certifications are obtained from supplier for structural steel and steel reinforcing bars to check for composition and strength. Submittals for products are obtained from subcontractors and suppliers. Shop drawings are checked for compliance with design drawings and concept.

5. Structural steel is checked at random for bolt torque and weld quality.

6. Electrical and mechanical engineers make required tests on their equipment and installations also. This is not covered herein.

B. Drawings, Specifications, & Calculations

1. Checked by responsible engineer and another engineer for compliance with DOE design criteria, other codes, standards, and accepted engineering practice, and for errors, omissions, and clarity.

2. Reviewed and approved by Group Leader.

C. Feedback/Correction

1. As the job progresses, specifications and drawings are updated and filed to document changes or other corrections, some of which are due to errors or clarifications not found during the design phase. These are used as references on future, similar jobs.

2. Cost data and schedules from previous projects are used as a database for determining costs and schedules for new projects. Improvement is needed in this area.

Quality Assurance Plan - Mechanical Group

Purchasing: Group leader signs all requisitions over $1000.

Engineering: Crafts support: - Agreement with remaining engineer and/or crafts supervisor.

Design: - Review of drawings and specs by other engineers.
- Periodic review of design as it is being developed.

Formal sign-off of drawings.

Written cost estimates for all work orders over $2000 required.

Crafts: Surveillance: - On site work (sporadic supervision of major shutdowns/problems, none of minor shutdown problems).
- Purchases all reviewed by supervisor.
- Written log and operation log sheets reviewed 100% by supervisor.

Plumbing: - All cost estimates reviewed or produced by an estimator.
- Improvements (sporadic supervision of major work).
- All purchases reviewed by supervisor.

Instrument Shop: - All cost estimates completed by supervisor or lead man.
- Written log book reviewed 100% by supervisor.
- On site work and improvement work similar to plumbing and surveillance above.

APPENDIX E

Quality Assurance Policies and Standards in Accelerator Department

Appendix E.1: Quality Assurance in Software Engineering

In software engineering quality assurance issues arise in the areas of software design, implementation ("fabrication") and installation. The policies and practices described here are those that are in use routinely in the Accelerator Department Software Engineering Group, but many of these also apply elsewhere in the Laboratory.

Design phase involves reviews and presentations for public review along with written documents. The idea is to get as much conformity as possible with overall system architecture, design philosophy and general coding practice. Design specifications describe what the software is supposed to do, and reviews are to check that this will be accomplished before the final coding is started. Designs will have to go through this formal review process in order to maintain a standard software system in the Laboratory. Some of the documentation involved in a standard design review process is shown in Appendix E.1a.

During implementation the main quality assurance tool is an In-house Programmers Guide planned to help producing robust and maintainable code. Recently, a set of Coding Standard was implemented (see Appendix E.1b) for the SLC VAX Fortran. The purpose is to reduce the maintenance problem by producing code that is straightforward to debug and extend, either by the original author or someone else and to produce code that follows well-recognized software design principles and should, therefore, be less prone to errors and future problems. This system requires that programs be written in a standard format including a Standard Program Header. The header includes important information about the author, review process, any design changes, program description, etc, and thus serves as a logbook, traveler, and change order.

The installation phase involves integration of new software into existing systems. This is normally done using developmental system control programs to detect and fix errors before releasing the code for production use. Programmers are responsible for their work and the way their programs work or do not work. The new problem reporting system points out problems, both software and hardware, immediately, and brings them to the attention of responsible programmers.

Appendix E.1a: Examples of Documentation in Software Design Review

BPM Difference Design Review Action Items

December 11, 1987

Author:	Lou Sanchez-Chopitea	(LSC)
Moderator:	Dave Wiser	(DEW)
Reviewers:	Miguel Flores	(MICK)
	Mark Woodley	(MDW)
	Tony Gromme	(TEG)
Amanuensis:	Robert Sass	(RCS)

Considerable discussion was had at various times on the issue of how to use colors to tell 'good' differences from 'bad' differences which might have bad status, missing difference data etc. Dark blue is used for invalid difference data.

1. (DEW) On the display, show the name of the reference orbit being used. Look at what the ARC people have done. Do they do TMITs differences?

Opened:_____ Completed:_____ Approved:_____

2. (MICK) There should be two sets of limits and the same button should show different scales depending on the mode; difference vs. normal.

Opened:_____ Completed:_____ Approved:_____

3. (LSC) The title of the BPM plot is on the background.

Opened:_____ Completed:_____ Approved:_____

4. (MICK MDW) Need to save all of the button information from the BPMO measurement display in the config file based on where it is in the template. This is a functional enhancement.

Opened:_____ Completed:_____ Approved:_____

5. (MICK) Automated BPM setup to match the config file would be nice. This is a functional enhancement.

Opened:_____ Completed:_____ Approved:_____

6. (LSC) BPMDISP and BPMDISPV need more smarts when operating in both planes. Need to uncouple planes.

Opened:_____ Completed:_____ Approved:_____

It was noted that there is a management problem between the database and the config file but no further discussion ensued.

COMMENTS ON THE SOFTWARE

DESIGN REVIEW PROCESS

(Steve Moore, 10/8/87)

1. Audience

   a) technical supervisor, management type or someone responsible for the software under review

   b) people directly affected by, knowledgeable in or otherwise requiring interfaces to the software

   c) someone to act as amenuensis, maintaining a list of attendees and Action Items or Open Items that would be brought to a subsequent review...items to be closed off...in a smaller, less formal review with just the impacted parties; these Items might be one or more of the following:

      1) modules that must be modified
      2) any design issues that were ill-defined or incorrectly defined
      3) problems in format or style

   d) design review moderator/monitor, usually a management type or other person afforded respect who:

      1) paces the proceedings
      2) decides when it's time to move off trivial details (very important)
      3) determines when to table discussions for an external meeting
      4) deflects verbal abuse or other barblike comments directed toward the poor, hapless reviewee
      5) when it's time to quit

   e) optionally, interested hecklers and others

2. What To Bring

   Some or all of the following, to an appropriate level of detail:

   a) Data Flow Diagrams

      These should be high-level depictions of data and information flowing between software that has been partitioned into single logical functions (i.e., MODULES) represented by balloons. These diagrams should be of a hierarchical nature, where peering into balloons reveals lower-level data flow diagrams. Control flow is acceptable where necessary, shown with special arrows between balloons, but should be avoided. Contained inside the balloons are module names or descriptive text, preferably both.

   b) PDL

      This is a language of basically simple English descriptions of what each module is doing, laced with basic logical constructs:

```
1) IF something THEN
     [ELSEIF something else THEN]
     [ELSE]
   END IF

2) DO FOR all of something
   END DO

3) DO WHILE something's happening
   END DO

4) CALL {subroutine name}
```

Only a high level of detail should appear here, with no references to variable names or other such trivialities. The object is to communicate the basic design structure of the software, and the intentions of the developer. A more detailed discussion would be saved for the Code Review.

c) Hierarchical Charts

These are basic structure diagrams that show who-calls-whom, by a simple indentation scheme. (This assumes that you've gotten to the point of naming names in the data flow balloons.)

```
Module                  Description
----------------------- ------------------------------------------
MAIN                    main program
  SUBROUTINE_1          initialization routine
    SUBSUBROUTINE_1     device initialization
      UTILITY_4         set characteristics
  SUBROUTINE_2          the workhorse
  SUBROUTINE_3          the exit handler
    UTILITY_1           the error reporting utility
```

The listing of UTILITY* modules is optional, and can be used to enhance the understanding of what the parent module's function is. There is no need to go below the UTILITY* module, since this should have been done elsewhere...the scope here is limited to just the modules under development.

d) Relevant Data Structure Definition

This is a free-form pictorial containing the structure of any databases or other global data used in performing the functions under review ("...without which you would not understand what the software was doing...", as Someone Famous once said).

e) Functional Requirements Specification

If available, this document will serve to insure that all functional requirements are addressed by the software design.

3. Acceptance Criteria

This is a basic checklist of issues to be addressed or questions to be answered by each reviewer. Some may or may not be relevant to the software being reviewed. A typical list is as follows:

a) are all the functional requirements being met...if not, is there are valid reason and should the functional spec be changed?

b) is there adequate error recovery and/or exception handling capability?

c) what will be the approach for testing, validation and verification? when will we know it's "done", ready for production?

d) is the software easily enhanceable, modifiable, maintainable and expandable? (i.e., is it modular?)

e) what kind of post-release documentation is appropriate?

f) are all appropriate user devices supported (e.g., COWs, CALFs, WKS)?

g) what kind of hard limitations are being imposed inherent in the design, and is it justifiable? (i.e., are there arrays that are not sized large enough for future expansion?)

4. Agenda

a) brief overview of what the purpose of the software is, where it fits, who will use it, etc.

b) present data flow diagrams, from top to bottom; here, the reviewers should make sure that the functional requirements are being met

c) hierarchical chart is brought out for future reference, to allow reviewers a road map into the PDL modules

d) PDL is reviewed for content only...style, header and grammar criticisms are tabled, quashed or postponed for external discussion, otherwise the process gets bogged down; something that's worked well is to have reviewers red-line their trivial comments on the listing and submit to the reviewee, or mail the reviewee a list of comments afterwards; the list of Action or Open Items will simply contain a note to the effect that there are objections to the format of one or more modules.

e) reviewee is carried out on stretcher

5. Follow-up Review

This should be attended only by people who voiced objections to content or format from the initial review, to see that the Open Items are closed off. Hopefully, this process would go smoothly, as there would have been edicts handed down from above regarding trivial matters, and all that remains would be matters of content. Also, there would have been one-on-one meetings with impacted parties or those knowledgeable in these areas in order to clear up bones of contention or to resolve approaches to certain problems.

Appendix E.1b: SLC Coding Standards (VAX Fortran)

SLC Coding Standards

Computer: VAX
Language: Fortran

Intent:

The purpose of programming standards is to (a) reduce the maintenance problem by producing code that is straightforward to debug and extend, either by the original author or someone else and (b) to produce code that follows well-recognized software design principles and should, therefore, be less prone to errors and future problems. Generally the intent is to produce software that "flows" from top-to-bottom, start-to-end, and can be "read" easily by others because the block-structuring is readily apparent. These standards are not intended to be hard and fast (exceptions can be found), but should serve as a guide to achieving the goals stated in the first sentence. Enforcement of these standards may be either through a formal code review process, or a "spot" review of existing code. Any code following the standards will be generally acceptable as written. It is recognized that there are cases where following the standards may produce more awkward code, but these cases are rare and will be dealt with on a case-by-case basis. Code not conforming to the standards may be acceptable, but if it can be demonstrated that the same code can be written in an acceptable manner consistent with the standards, the original code will have to be modified. These standards will evolve as more experience is gained.

Program Organization:

185

1. All Fortran source file types are ".FOR".

2. All filenames must match the module name.

3. Only one module should be stored per filename.

4. All "INCLUDE" file types are ".TXT".

5. The main program is organized in the following order:
   a. Main program declaration on 1st line
   b. Library MEMBER line
   c. Prolog/Header (which includes the PDL)
   d. IMPLICIT NONE statement
   e. Declare arguments
   f. Data Base include statement
   g. Global parameter include statements
   h. Global common include statements
   i. Local parameter include statements
   j. Local common include statements
   k. Local data type declarations (include dimensions)
   l. Dimension statements
   m. Local equivalence statements
   n. Local data statements
   o. Statement functions
   p. Executable statements with comments
   q. END or STOP or CALL SYS$EXIT statement for main routine; RETURN for subprogram
   r. FORMAT statements
   s. END statement

   (sug-gested order)

6. All modules should be FUNCTIONs rather than SUBROUTINEs. In most

cases the return should be a status value. The only exceptions are for routines like SQRT() which are intended to be "embedded" elsewhere and the user must anticipate error conditions.

Compiler Directives:

1. Compiler directives are enforced by the SLC .COM files only. Inline compiler directives are not used.

2. The /NOF77 qualifier is not used.

3. The /NOWARNINGS qualifier is not used.

4. The /NOOPTIMIZE qualifier is used only when testing with the /DEBUG qualifier.

5. The /CHECK=ALL qualifier is used on all modules during the test/debug/development phase, but not when the module is put into production.

Control Constructs:

1. The following constructs are not used:
   a. the ASSIGNED GOTO statement
   b. the PAUSE statement
   c. the Arithmetic IF statement
   d. the alternate RETURN statement

2. Every DO loop is terminated with an END DO or (NNN) END DO, though use of statement numbers for defining DO ranges should be minimized.

3. There is only one entrance and one exit from a subprogram. (e.g.: no ENTRYs and only one RETURN statement for a subprogram).

4. There are no jumps or GO TOs into the range of statements for a DO loop or into an IF block.

5. The use of backward reference GO TOs is minimized.

6. The use of CALL SYS$EXIT or STOP is used only in main routines.

7. Shared DO-loop terminations should not be used.

8. Use of the EQUIVALENCE statement is minimized.

9. Use of GO TOs is minimized, being used mainly, if at all, for error handling.

Data Declarations:

1. All variables are explicitly data typed, and this is enforced by using IMPLICIT NONE.

2. Variables are used only for one functional purpose, with the exception of DO loop indices. Temporaries are allowed for intermediate mathematical results. Re-use of database access records is allowed.

3. INCLUDE files contain only the following types of statements:

a. Comments
b. COMMON statements
c. DATA statements
d. Structure definitions
e. PARAMETER statements
f. Global RECORD statements

Other types of statements are excluded, in particular:

a. Executable statements
b. Statement functions
c. Allocation of local storage
d. INCLUDE statements

4. All attributes, such as accuracy, convergence, and timing, which control processing are specified as named PARAMETERs.

5. The use of hard coded numbers should be minimized by using, for example, PARAMETER statements or resource management utilities (e.g: event flags, I/O unit numbers).

Commentary:

1. A prolog/header is provided for each subprogram and contains the following information (see Appendix):
   a. Purpose
   b. Calling sequence or context
   c. Inputs
   d. Outputs
   e. Assumptions
   f. Limitations and restrictions
   g. Accuracy and precision requirements
   h. Error recovery procedures
   i. External modules called
   j. PDL

2. Every local variable is described. This includes the variable name, its type, and a description of its use. Normally this will mean one variable per line, though similar variables may be grouped.

3. Comments are provided to explain the intent of key decision points and paths.

4. For every reference to machine, compiler, or operating systems unique features, comments are provided to that effect.

5. Comments are meaningful and not a repetition of the FORTRAN statement.

6. Comments are indented to match the indentation of the code being described.

7. Any relevant comments and parts of the header are to reflect any modifications done to existing code.

8. The letter "C" is used to identify full line comment statements. The "!" is used for in-line comments.

9. A (preferably inline) comment should be provided to describe why a particular INCLUDE file has been included.

Naming Reference:

1. Statement labels are in ascending order.

2. Language compiler keywords are not used as variable names.

3. Subprogram names must match the name of the file.

4. The first >=2 letters of the module name should provide some indentification of the type of software contained within. Use of the underscore is recommended, but not required.

5. All arguments in a calling sequence are clearly identified as input or output in the module commentary.

6. The first >=2 letters of the labelled COMMON name should provide some identification of the family of suppliers of this COMMON.

7. To avoid the O/0 confusion, the number 0 without another digital is not used in a name.

8. Within the constraints on naming described under standards, names are chosen to be mnemonic.

9. Numerics should generally be avoided as part of the name.

10. Reserved statement label(s):
    9999 RETURN

Language Usage:

1. VAX Fortran extensions are recommended over ANSI-standard Fortran.

2. Variables are explicitly initialized before their first use.

3. Equality tests are not performed on real variables or constants (except for checks against 0.0).

4. Parentheses are used to clarify expression evaluation.

5. The size of a module should not exceed about 100 executable statements.

6. A main program or subprogram does not modify itself or another subprogram.

7. DO loop indices are not modified within the loop.

8. Sections of code within a control block (DO-END DO, IF-ELSE-END IF) are progressively indented at least 2 spaces per level.

9. Non-loop dependent computations are kept out of the loop.

10. Compound expressions are defined once.

11. Functions are not duplicated.

12. For maximal flexibility, code should be database-, table-, or file-driven.

13. Block structures (IF, ELSEIF, ENDIF) rather than conditional branches (GOTO (1,2,...)) are used when possible.

14. When done with resources, they should generally be returned,

unless a routine is really used repeatedly.

15. Use of dynamic memory is encouraged for "large" variable-size arrays.

16. Blanks are considered significant and should not be inserted in keywords or variable names. END XXX is acceptable, where XXX is (DO, IF, MAP, ...).

17. It is recommended that every IF have a corresponding THEN and END IF. This is useful for making a program's block structure more apparent, and allows setting breakpoints on the condition.

18. When modifying code written by another, the modifications should follow the original author's style, providing the original style conformed to the standards.

Appendix -- Standard Program Header

```
      INTEGER*4 FUNCTION MY_FUNC( ARG1, ARG2 )
C                                        ----
C
C     **MEMBER**=SLCLIBS:xxxSHRLIB
C
C=======================================================================
C
C Abs:  This should be a real quick one-line abstract that *briefly*
C       states the purpose of this routine.
C
C Name: MY_FUNC
C
C Args: ARG1                    A real quick description indicating
C         Use:  char-string     the reason for this argument.  Note that
C         Type: longword        "Usage","Type","Access", and "Mechanism"
C         Acc:  read-only       follow the standard VMS format found in,
C         Mech: reference       for example, the RTL documentation.
C       ARG2                    Similar to ARG1, though this could start
C         Use:  char-string     down one line if "ARG2" has an especially
C         Type: char-string     long name.  It should be noted that this
C         Acc:  write           is an optional argument.
C         Mech: descriptor
C
C Rem:  This function does such and such and so and so and blah blah
C       blah, etc.  This should be an overview of the purpose, use,
C       underlying algorithms (or assumptions) of this routine.
C       References to other documentation and/or programs may be noted.
C
C Side: Any known side effects, such as: gets/frees virtual memory;
C       prints something; create/deletes/modifies a file; modifies a
C       value in a common block; modifies an entry in the SLC
C       database; etc.
C
C Ret:  If successful I*4 XXX_OKOK
C       otherwise I*4 XXX_NFG, or a DB access error (for example)
C       (Return codes specifically generated by THIS routine should be
C        detailed, others can be summarized).
C
C Auth: DD-MMM-YYYY, Author's Name
C Rev:  DD-MMM-YYYY, Reviewer's Name (.NE. Author's Name)
C
C-----------------------------------------------------------------------
C
```

```
C Mod:  DD-MMM-YYYY, My Name:
C          Changed such and such to so and so. etc. etc.
C       DD-MMM-YYYY, Your Name:
C          More changes ... The ordering of the revision history
C          should be such that the NEWEST changes are at the HEAD of
C          the list.
C
C-------------------------------------------------------------------------
C
C PDL :
C
C=========================================================================
```

1 Appendix -- Standard Include Header

```
 C=========================================================================
 C
 C Abs:  This should be a real quick one-liner that *briefly* states
 C       the purpose of this include file (items are described one
 C       per line as described in the standards).
 C
 C Name: FileName
 C
 C Auth: DD-MMM-YYYY, My Name
 C
 C-------------------------------------------------------------------------
 C
 C Mod:  DD-MMM-YYYY, My Name:
 C          Changed such and such to so and so. etc. etc.
 C       DD-MMM-YYYY, Your Name:
 C          More changes ... The ordering of the revision history
 C          should be such that the NEWEST changes are at the HEAD of
 C          the list
 C
 C=========================================================================
```

Appendix E.2: Examples of Documentation in Accelerator Department

Things Pending for Operations Support (1)

Weekly Summary Report (1)

Mark II Move Downtime Schedule (1)

Control Systems Maintenance Memo (2)

Spare SLC Equipment Memo (1)

Things Pending for Operations Support 05-Nov-1987
Priorities are listed A, B and C for high and low respectively.
This file is SLC::DISK1:[DEW.MTCIOPS_SW.DOC
It should be most up-to-date each Fri. evening

For the S/D (Spec/Design) column, the codes are as follows:
- means (not needed / not applicable)
N means does not yet exist
Y means does exist
? means 1. may not be necessary, or
2. exists, but needs more work

0. Current projects

Pri	Work Est.	Work Rem.	Work Done	Est. Avail.	Code	Status	S/D	Description
A	0.4	0.4	0.4		OP-KL-021	RKJ	N/-	Provide solid-state sub-booster support for CID/Sector 1; may only require data base mods plus beam test time, without new code
A		~0		Done	OP-KL-011	RKJ	Y/-	Damping Ring RF control (including configuration save/restore). [RKJ should talk with HW people + spec -- only. HW to be installed 7/4/87? MCR: wouldn't have to be RKJ. MCR and JSheppard to talk with RKJ.]
			~8		OP-OP-019	JRM	Y/N	Offline interface to HSTBUF (scale control, ... a la SAMPLE). Consider using MATLAB for phase 1. [Functional spec in works]
AA	8	5	6		OP-OP-028	MICK	Y/N	CUD to provide BPM display service. Approx. once per minute. [see spec MCR 8 soon, MICK. Can use reference orbits from config]
AA		1-2		thinking	OP-BP-007	TEC	Y/N	Think about MPS-1, MPG, BPMs, SBD, etc. 8 regional PP's Use of the Single Beam Dumper magnet. In rate limit mode not all affected devices (BPMs, Profs, ...) are YY triggered. Want to kill downstream PP's (Step IV of PF 3 step phase-in). Want to keep high power devices cycling as much as possible. [see also FF-BP-015]
AA	12		17	11/02/87	OP-TR-001	MCS JST	Y/Y	Scheme to enter trouble report (SCP entry, or terminal entry, or ...). Information should be accessible by people without consoles, but also by people with CALFs etc. [SPIRES integration not needed on 1st pass. Pass 2 should integrate with CUD / displays / SLC Database / ... Moved to 8600; DEVSCP exists; for hardcopy will use printers on VAX ports; inheritors coming online.]
AA	3.0	2	2		OP-HW-005	MAF KKU	Y/N	Software to control console video monitors [see spec MCR. Needed in 2-3 months (from 7/20). Separate address/data IDOM strobes.]
AA	4.0				OP-FU-002	AXK	Y/N	Toroid calibration. [see spec MCR ... JRM to patch JFC's code. Ultimately needs timing fudge in DD (calib. diff. from data acq. Needs attention!! A JRM kludge exists, but not final solution.]
	0.2	0		Done	OP-MA-026	KKU	?/?	Turn on Blow Torch Quads through ACCESS (zero DAC first) [BN] [Exists ... needs checkout]
				Need inp.	OP-AD-003	KKU	N/N	Make an error if flow switch goes OFF (currently white). Problem ... this may cause a "flood" of error msgs if a pump goes out. [KKU to try a few like this. Found in DR, PRL, FF, ARC. e.g. Flowswitch girder 700 EP02. Capability exists ... bits exist for color coding, logging, error msgs. Need info.]

WEEKLY SUMMARY

Week of July 6 to July 10 By W. Asher & R. Anderson

Date	Problem	Comments	Down Hours	Group	Follow-up
7/6 0141	S0/1 waveguide LCW still drained.	Many valves were closed which required effort to re-establish water system.	16	PEI	*****
1845	VV1A won't turn on.	No real problem found.	1.1	PEE	fixed
2033	K1-2 focus p.s. has failed.	Repaired p.s.	1.7	LS	
2250	K1-2 low power out.	Raised beam voltage.	.7	LS	
7/7 0045	NDR bend tripped many times.	Spent many hours trying to determine cause, trouble was in intlk. card.	8	LS	
5	NDR RF tripped on mag over/I.	Replaced remote pot.	1.4	CS	
2000	No output from NDR compressor klystron.	Replaced klystron.	18	KTF	
7/8 1457	Lost PPS power at FF.	Someone turned off breaker.	1.5	OPS	
1724	Lost vacuum in NARC.	Fixed vac. leak.	7.5	VAC	
1955	SDR Ext. kicker off.	Tripped on temperature installed fans.	3	CS	
7/9 0520	50B1 safe switch on, also SRBend valve not open.	Reset. Reset MPS for manual valve.	1	OPS	
0800	SDR RF tripped off due to focus O/I.	Focus p.s. was changed	3	CS	

MARK II MOVE DOWNTIME SCHEDULE — REVISION AS OF: 11 / 4 / 87

TASK SUMMARIES

		WK 1 10/12	WK 2 10/19	WK 3 10/26	WK 4 11/2	WK 5 11/9	WK 6 11/16	WK 7 11/23	WK 8 11/30	WK 9 12/7	WK 10 12/14	WK 11 12/21	WK 12 12/28	WK 13 1/4	WK 14 1/11
								T N K S				X M A S	N W Y R		
	CID - 01 [SODJA]														
CIDA	POLARIZED SOURCE		XXXX	XXXXX											
CIDM	MISCELLANEOUS	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XX									
CIDX	OPERATIONS CHECKOUT				XXXXXXX	XXX									
	DAMPING RINGS [LINEBARGER]														
DRA	INSTALL 2-BUNCH KICKER	XXXXXXX	XXXXXXX	XXX		XX									
DRB	NRTL MODIFICATION		XXXXXXX	XXXXXXX	XXXX										
DRC	REALIGNMENT				XXXX	XXXXX									
DRM	MISCELLANEOUS	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXX						XXXXX			
DRX	OPERATIONS CHECKOUT			XXXXXXX	XXXXXXX	XXXXX		XXX							
	POSITRON SOURCE [LINEBARGER]														
POSA	NEW LAMBERTSON INSTALLATION	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XX									
POSB	NEW UFS, SOURCE, ETC.	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXX							XXX
POSC	WTA MODIFICATION		XXXXXXX	XXXXXXX	X	XXXX									
POSM	MISCELLANEOUS	XXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXX						XXX			
POSX	OPERATIONS CHECKOUT				XXXXXXX	XXXXXXX	XXXXXX	X							
	LINAC UPSTREAM [INMAN]														
LIUB	ALIGNMENT		XXXXXXX	XXXXXXX	XXXXXXX	XXXXX									
LIUC	BEAMLINE 90		XXXXXXX	XXXXXXX	XXXXX										
LIUM	MISCELLANEOUS	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXX				XXX		XXX	
LIUX	OPERATIONS CHECKOUT												XXXX	XXX	
	LINAC DOWNSTREAM [INMAN]														
LIDA	NPAS	XXXX	X									XXX			
LIDB	ALIGNMENT	XXXXX										XXX			
LIDM	MISCELLANEOUS	XXXXXXX	X			X	X				XXXX	XXX	XXXX		
LIDX	OPERATIONS CHECKOUT	XXXXXXX	XX									XXX	XXXX	XX	
	BSY [INMAN]														
BSYA	NPAS	XXXXX													
BSYB	POLARIMETER	XXXXX													
BSYC	INSTALL SL3											XX	X X		
BSYM	MISCELLANEOUS	XXXXXXX	X		XXXXX							XXXX	XXXX		
BSYX	OPERATIONS CHECKOUT	XXXXX	XX			X						XXX	XXXX	X	
	NORTH ARCS [GEARHART]														
NRCM	MISCELLANEOUS	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXX	XXXX	XXXXXXX	XXXXXXX	XXXXX		XXX	XXXXX
NRCX	OPERATIONS CHECKOUT									XXXXXXX	XX				
	SOUTH ARCS [GEARHART]														
SRCM	MISCELLANEOUS	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXX			XXXXXXX	X
SRCA	INSTALL SXY SOUTH						XXXXXXX	XXXXXX	XXX						
SRCX	OPERATIONS CHECKOUT									XXXXXXX	XX				
	NORTH FINAL FOCUS [GRAY]														
NFFA	ELECTRONICS CABLE PLANT MOVE	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXX			XXXX				
NFFC	NORTH ENERGY SPECTROMETER	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXX				
NFFN	INSTALL PC8Y			XXXXX	X										
NFFO	INSTALL C0X		X												
NFFT	INSTALL PC10X					X			X		XXX	X			
NFFQ	INSTALL PC10.5Y									XXX	XXXXXXX	XX			
NFFR	INSTALL C1Y							XXXXXXX	X						
NFFS	INSTALL PC7.5										XXXXXXX	XX			
NFFM	MISCELLANEOUS	XXX		XXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXX	X	XXXXXXX		XXXXX	
NFFP	PPS KEYBANK INSTALLATION	X		XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXX					
NFFD	TUNNEL SHIELDING						X	XXX	XXXX	XXXXXXX	XXXXXXX				
NFFX	OPERATIONS CHECKOUT											XXXXXXX		XXXXXXX	XXXXX
	SOUTH FINAL FOCUS [GRAY]														
SFFB	INSTALL PC3									X					
SFFD	INSTALL PC12					X			XXX	X					
SFFN	INSTALL PC8Y					XXX	XXXXXXX	XX							
SFFO	INSTALL C0X					XXX	XXXXXXX	XXX							
SFFP	INSTALL PC10X							X	XXXXXX	X					
SFFQ	INSTALL PC10.5Y							X						XXX	XXX
SFFR	INSTALL C1Y														
SFFS	INSTALL PC7.5														
SFFE	ELECTRONICS CABLE PLANT MOVE	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXX					
SFFC	SOUTH ENERGY SPECTROMETER	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXX				
SFFM	MISCELLANEOUS		XX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XX	XXXXXX		XXXXX	
SFFT	POLARIMETER		XXX		XX			XXXXX							
SFFD*	TUNNEL SHIELDING						X	XXX	XXXX	XXXXXXX	XXXXXXX				
SFFX	OPERATIONS CHECKOUT										XXXXXXX	XXXXXXX		XXXXX	
	MKII MOVE ON BEAM LINE [GRAY]														
MKII	MKII MOVE ON BEAM LINE	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXX	XXXXXXX	XXXXX	XX	X		XXXXXXX	XXX
	MISCELLANEOUS [VARIOUS]														
MSCM	MISCELLANEOUS	XXXXXXX	XXXXXXX	XXXXX	X		X					XXX	XXX		
		10/12	10/19	10/26	11/2	11/9	11/16	11/23	11/30	12/7	12/14	12/21	12/28	1/4	1/11
		WK 1	WK 2	WK 3	WK 4	WK 5	WK 6	WK 7	WK 8	WK 9	WK 10	WK 11	WK 12	WK 13	WK 14

MEMO

March 19, 1988

To: Distribution

From: M. C. Ross and S. Ecklund

Topic: Control System maintenance

During the coming months, responsibility for exchange and repair of control system components will shift from 'Sector Ten Maintenance', 'MCC Maintenance' and 'Digital Maintenance' to accelerator and storage ring operators and the Accelerator Department Controls Section staff. There are several reasons for this change of responsibility. The primary reason is that, as we begin to make luminosity with the SLC, we need to bring more engineering manpower to bear on remaining control system problems. The best way to do this is to build engineering groups with full system responsibility extending from design to repair and preventative maintenance and it is for this reason that there will no longer be separate control system engineering and maintenance groups.

Engineers and Technicians in the Power Conversion Group will perform maintenance and diagnostic functions on power supply and klystron/modulator systems. They are responsible for magnet and power supply systems, including magnet protection interlocks, up to the CAMAC modules. They are also responsible for klystron modulator systems up to the CAMAC modules.

As a result of these changes, the following procedures will apply: (effective 3/18/88)

Off Shift (Weekdays 16:00 - 08:00, Holidays and Weekends)

1) In case of control system component failure serious enough to impact accelerator operation the MCC (or SPEAR/PEP) operators will carry out simple diagnostic tests and replace modular units. A set of system documents and a spares inventory will be located at MCC. Spares inventory appropriate for the PEP/SPEAR control systems will be located at SPEAR and PCR. During next few months, 'Sector Ten' based technicians will help show operators these tests and replacement techniques.

2) If the failure persists after these procedures are completed, the operator will call system specialists for telephone consultation. The system

specialist, if available, may be asked to come to SLAC to continue work on the problem.

3) If no system specialists are available, the operator will page the appropriate on-call Controls Section staff member. A senior staff member (or a pair of staff members) will be on call, 24 hours/day, 7 days/week, from each of the Controls Section Engineering groups; Software, Hardware and Beam Diagnostics. The on call schedule will extend from Monday 8:00 to Monday 8:00. Individuals who are on call will carry off-site, six Bay area county pagers similar to that carried by the program deputy.

If 'on call' personnel are summoned to the laboratory on off shifts, they are required to sign in and out at MCC. On signing out, they are required to document the action taken to solve the problem in the MCC log book. If they are unable to solve the problem, they are required to notify their supervisor or group leader as soon as possible.

4) In case of control system component failure not serious enough to impact accelerator operation, the operators will perform diagnostic tests, as time allows, in order to properly document the problem so that repair work can rapidly proceed the following work day.

On Shift (08:00 - 16:00)

1) In case of control system component failure serious enough to impact accelerator operation the MCC (or SPEAR/PEP) operators will carry out simple diagnostic tests and replace modular units.

2) If the failure persists after these procedures are completed, the operator will call system specialists to continue work on the problem.

3) If no system specialists are available, the operator will page the appropriate on-call Controls Section staff member.

4) In case of control system component failure not serious enough to impact accelerator operation, the operators will perform diagnostic tests, as time allows, and notify the appropriate system specialists. It is the responsibility of the operator to clearly and concisely log the problem.

S L A C M E M O R A N D U M March 16, 1988

To: Distribution

From: Dave Hamilton DH

Subject: Spare SLC Equipment

A stock of spare equipment that will be used as replacements will be kept in MCC. This list will obviously grow as needs dictate but will start off with a complement of the following that will reside in the "GOOD MODULE" locker next to the PDP-11s. A section of some room will be provided so the larger scale spares envisioned can easily be accomodated. THESE MODULES ARE ON AN EXCHANGE BASIS ONLY-- A GOOD ONE FOR A BAD ONE. NO LOANS OR GIVE AWAYS.

1. CAMAC Modules of all varieties.
2. CAMAC Crates with Power Supplies attached.
3. Multibus Cards of each type used.
4. Multibus Crates
5. Multibus Power Supplies
6. A Fluke DVM and tools that are commonly needed.
7. Special Fuses and a Fuse Puller for the ARC AC Power Distribution Feeders located behind the racks in the ARC's.

An ongoing effort has been made since the inception of the first SLC module to tag them with SLAC ID and serial numbers and to record their location each time they move in the LEP database. This effort will continue and will need the support of those changing modules, card, crates, etc. There will be a sign in/out sheet in the locker that will require entries to be made. The information required is as follows:

1. Module Type---SAM, DAC, PSC, etc.
2. SLAC ID #----- White bar-code # such as 160001234 or the older Red/White sticker # such as 12345
3. New Location of the Module. The general concept used is the physical location. Some of the key terms used are:
   A) NARC and SARC for the SLC ARCs
   B) S20-AL02 This meams Sector 20, ALcove rack 02
   C) S20-F5A This means Sector 20, Fiat rack 5A
   D) DR-DAC51 This means Damping Ring rack DAC51
   E) 751-R35 This means building 751, rack 35.
4. Users Name----Your Name
5. Loan Date---The date the transaction takes place.

The specific slot of a module or level location of a chassis is not needed, so do not include it.

Keep the above requirements in mind when using modules etc. from the spares.

APPENDIX F

Quality Assurance Policies and Standards in Research

APPENDIX G

Quality Assurance Policies and Standards in Purchasing

Appendix G.1: Examples of Documentation In Purchasing

Material Acceptance report (1)

Purchase Requisition (1)

Stores Material Requisition (1)

Typed 9/17/87 Recd 9/17/87

STANFORD UNIVERSITY

STANFORD LINEAR ACCELERATOR CENTER

P. O. BOX 4349, STANFORD, CALIFORNIA 94305

SUBCONTRACT OR PURCHASE ORDER NO. 515-S-1192

DATE RECEIVED 9/13/87

MATERIAL ACCEPTANCE REPORT

VENDOR: MARUBENI CORPORATION
MARBUENI AMERICA CORPORATION/

RECEIVING REGISTER NO.	SHIPMENT NUMBER	PURCHASE REQUISITION NUMBER
57294		

REJECTION ▶ *LIST THE ITEM(S) THAT ARE REJECTED AND TO BE RETURNED TO THE VENDOR FOR:* REWORK ☐ REPLACEMENT ☐ CREDIT ☐

ITEM NO.	QUANTITY REC'D	DESCRIPTION / SERIAL / DRAWING NO.	NO. ACCEPT.	NO. REJECT	REASON FOR REJECTION
	4	SLD LIQUID ARGON CALORIMETER SUBCONTRACT NO: 515-S-1192 PACKAGE NO. GP-L-1/14 NET WEIGHT KGS GROSS WEIGHT KGS DIMENSION X X CM MADE IN JAPAN 4 Packages			Gross weight: 94.800 KGS Measurement : 648.031

TIMELY ACCEPTANCE OR REJECTION ASSURES MAXIMUM DISCOUNTS WHEN OFFERED

ACCEPTANCE ▶

1 ☑ ALL ITEM(S) OF THIS SHIPMENT ARE ACCEPTED AS ORDERED AND RECEIVED.

2 ☐ ALL ITEM(S) OF THIS SHIPMENT ARE ACCEPTED EXCEPT THOSE LISTED ABOVE.

REQUISITIONER Robert G. Bell

RELEASE DATE 9-17-87

FOR BUSINESS SERVICE ONLY VENDOR NOTIFIED AND AGREES TO RETURN THE REJECTED ITEMS(S) BY _____ DATE

PROCUREMENT

FORM # 37207 (11-74) PURCHASING/CONTRACT ADMIN

PURCHASE REQUISITION

STANFORD UNIVERSITY
STANFORD LINEAR ACCELERATOR CENTER

Originator	Bin No.	Phone Ext.	Group	Code
Group Authorization	Req'n. Date		Date Required	
Account title	Account No.		Work Order No.	
Specific Delivery Point	Object	Budget Approval	Approved By (Business Services Only)	

Order Date

Requisition No. 05227 E

Reporting Code

Refer Inquires To Buyer

Ship to ☐ 2575 SAND HILL RD. ☐ OTHER SPECIFY BELOW:

Telephone Authorization Purchasing

Does Requisition Involve Hazardous Material? ☐ Yes ☐ No ◄ Must Be Checked

☐ Explosives ☐ Lasers ☐ Radioactive Mat'l. ☐ X-Ray Equip. ☐ Toxic, Corrosive, or Flammable Material

Special Handling or Packaging Requirements

Inspection Required ☐ Yes ☐ No

Attach Terms Cond. ☐ Yes ☐ No

	Vendor Name	Delivery Date	Ship Via	F.O.B. Dest.	F.O.B. Ship Pt.	Confirming To	Terms	P.O. Number
A								
B								
C								
D								

ITEM NO.	QUANTITY	UNIT	COMPLETE DESCRIPTION OF MATERIALS	ESTIMATED PRICE	UNIT PRICE	UNIT

GOV'T. Contract No. If Other Than "515"

List Suggested Vendors Below

REMARKS:

REQUISITION NO.
05227E

NO. 37700 (6/87)

PURCHASING

Stanford Linear Accelerator Center
Stores Material Requisition

R. ested by	Phone ext.	Department
Bldg.	Room	Material For: ☐ Shop Stock. ☐ Over Shop Stock Level

Instructions:
To fill your order promptly and correctly, list items by SLAC stock groups. For example, arrange by group 40–59–62–etc. in numerical order. All items to be charged to same Account or Work Order number. No back orders, request considered complete when filled. Use this form only when ordering 10 or more items.

Item No.	Quantity Required	Unit of Issue	Acc't. Use Only	Description of Item (Not required if SLAC stock no. shown)	SLAC Stock Number	Quantity Issued

Account / Work Order No.			
Si ature of Requisitor:		Issued by:	Date:
Date:	Staff No.	Posted by:	Date:

FORM 37705 (4-66)

Accounting / Stores / W / Material
(White) (Pink) (Blue)

APPENDIX H

Quality Assurance Policies and Standards in Experimental Facilities Department

Appendix H.1: Examples of Documentation in EFD

Hazardous Experimental Equipment Committee Operational Approval (1)

Earthquake Safety Committee Review (2)

Trim Code & Cabling Procedures (3)

SLC Cableplant Installation - Quality Assurance Check off List (11)

Instrument and Control Installations- Quality Check off List (3)

Procedure in Target Production (18)

HAZARDOUS EXPERIMENTAL EQUIPMENT COMMITTEE

Case No.: Date: ***March 22, 1988***

Description: Location:

Person in Charge:

Others Concerned:

OPERATION APPROVAL

The Hazardous Experimental Equipment Committee has approved the equipment named above for operation. Hazards, unique to this experiment are:

The following restrictions apply, and a list of these restrictions must be placed near the apparatus, and at the apparatus control panel.

Follow operating procedure.

This approval is based on

Inspection: ***Inspected by***

Schematic: ***SD-***

Procedure:

Drawing:

H. DeStaebler, Chairman

by J. Mark, Secretary

Distribution:

69	J. Cerino	96	H. DeStaebler	55	R. Gearhart
84	D. Gordon	55	J. Harris	84	I. Lin
95	R. Larsen	07	K. Lathrop	24	J. Mark
55	G. Nelson	21A	H. Petersen	15	J. Rees
80	B. Richter	20	S. St. Lorant	80	C. Prescott
84	G. Warren				

MINUTES OF THE SLAC EARTHQUAKE SAFETY COMMITTEE MEETING
September 10, 1987, 9:30 am

Members present: F. Halbo, H. Lynch, M. Obergfell.

Visitors present: B. Denton, R. Haddock, DOE/SAN

The agenda for today's meeting was a review of the *MARK II* muon facade upgrade which was just installed last month.

Denton provided the Committee with a sketch of the *MARK II* assembly showing the general appearance and location of the added Upper and Lower Facades. A copy of this sketch is attached.

There are 4 facade assemblies, two upper and two lower, each weighing 30 ton, for a total of 120 ton. The facades are attached to the magnet and central detector assemblies which weigh about 350 tons. The 100 ton top hadron absorber is supported by the top of the magnet assembly. Thus the total weight of this assembly is 570 tons. A check of Ross Johnson's calculations indicated that he assumed the combined weight to be 555, ton so the committee was satisfied that the original calculations are still valid since the actual versus assumed weights ony differ by 2.7%.

Denton explained that the isolation pads that are to be installed at the four corners of the detector once it has been moved into the beamline were designed to reduce earthquake induced input forces from .6g to .25g. His design for supporting each facade was conservatively based on the .6g, however.

The method of holding the individual 2-ton lead blocks together was reviewed next and appeared satisfactory for the lower facade. The upper facade is supported differently and it was not clear how the blocks are restrained in rotation.

The $1\frac{1}{2} \times 18'$ array of 9 ea, $2'$ wide, 2 ton blocks is supported by a shelf supported from above. The bottom of this shelf is supported vertically by two gussets, but there is not enough weld to prevent the shelf from swinging out in case of earthquake induced forces. Denton was also asked to either calculate the forces on the upper bolts due to rotation or to restrain the baseplate, thus preventing rotation. There was also a question about the possibility of an individual block rotating sideways out of the shelf. He is to discuss his solutions with us when we inspect the Mark II installation on the beamline before beam is turned on.

There was no further business to discuss so the meeting was adjourned at 10:30 am.

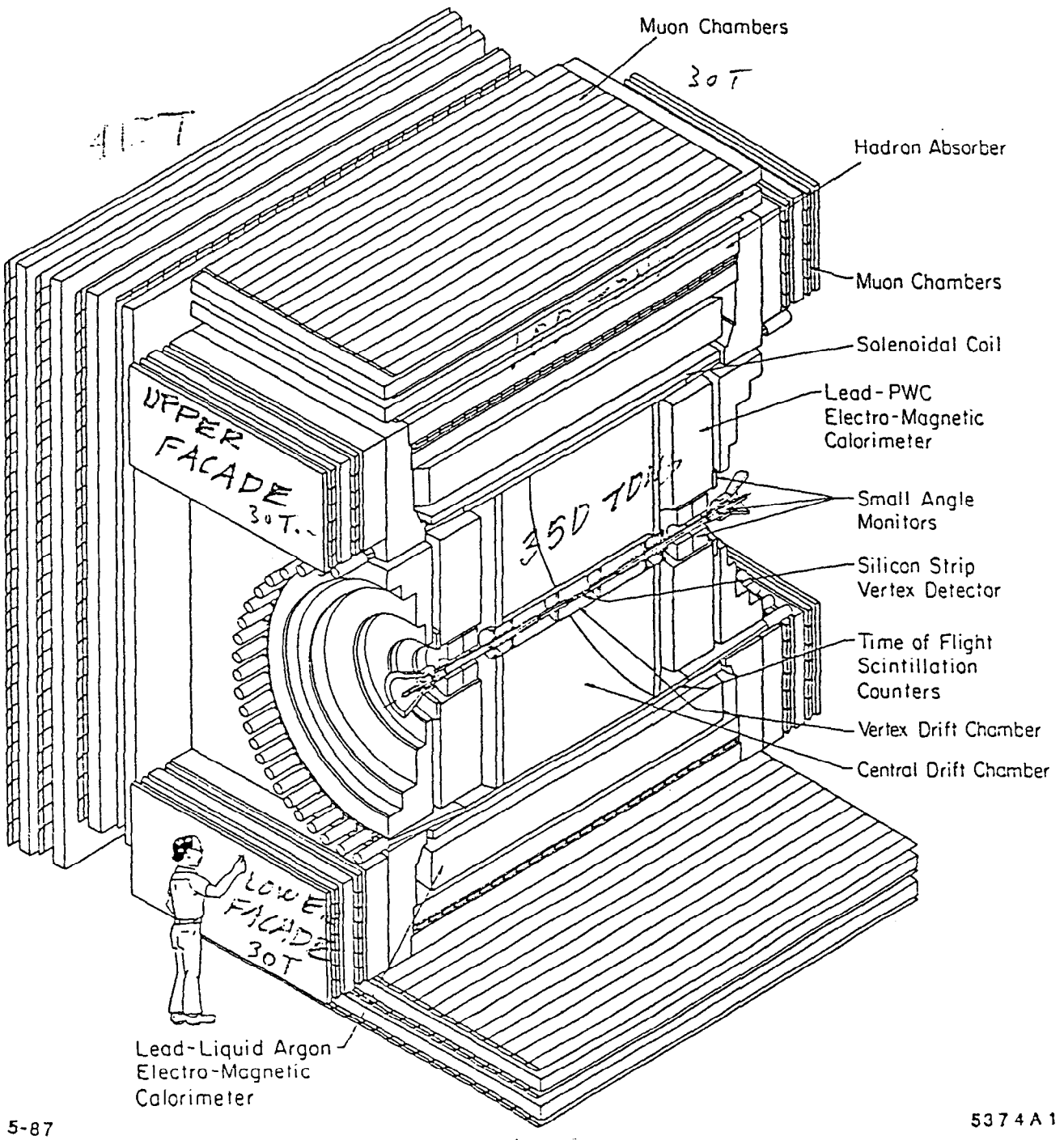
Distribution:

COMMITTEE MEMBERS:
49 R. Byers
20 F. Halbo
94 H. Lynch
22 M. Obergfell
96 K. Skarpaas
84 G. Warren

OTHERS:
22 C. Corvin
84 D. Gordon
22 J. Harm
15 L. Kral
07 K. Lathrop
15 E. McKeen
95 J. Dorfan
60 F. McLaughlin
03 A. Simpson
12 J. Rees
60 R. Pedersen
80 C. Prescott
02 E.B. Rickansrud
80 B. Richter

OCT 9 1987

MARK II AT SLC



5-87

5374A1

TABLE OF CONTENTS

CABLING PROCEDURE CP-400

CABLE RG-59

CONNECTOR BNC 59-81

STORES #59-299-014-62

CABLE RG-62

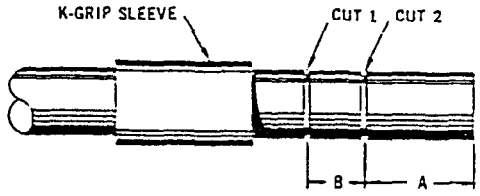
CONNECTOR BNC 59-294

STORES #59-299-014-52

TRIM CODE 401

DIE SIZE KTH 2002

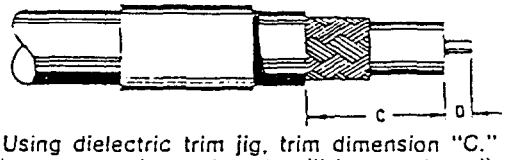
TRIM CODE CHART				
CODE	A	B	C	D
401	25/64	3/16	.468	7/64
402	13/32	3/16	.375	7/32
405	51/64	3/16	.871	7/64
406	9/32	0	.093	3/16
407	11/16	0	.496	3/16
408	47/64	3/16	.809	7/64
409	21/64	3/16	.406	7/64
416	27/64	3/16	.453	5/32
418	47/64	3/16	.805	7/64
420	21/32	3/16	.600	1/4
424	3/8	3/16	.450	7/64
425	19/32	0	.316	9/32
431	9/16	0	.366	3/16



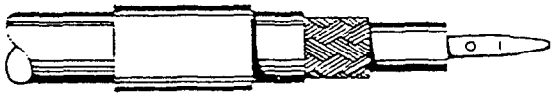
1. Cut cable end square, slide K-GRIP sleeve over jacket and with jacket trim jig make cuts 1 and 2 in jacket.

2. Remove jackets to dimension "A," flare or bulge back braid and trim with scissors at edge of jacket.

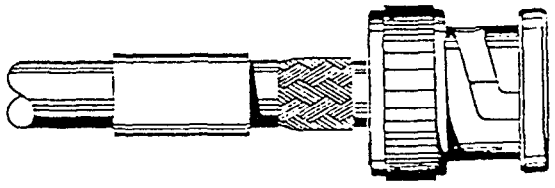
3. Remove jacket to dimension "B."



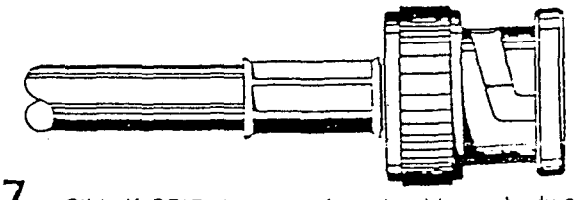
4. Using dielectric trim jig, trim dimension "C." Exposed center conductor length will be equal to dimension "D" of trim code.



5. Solder or crimp contact to center conductor. For captive contact connectors omit this step and proceed to step 6.



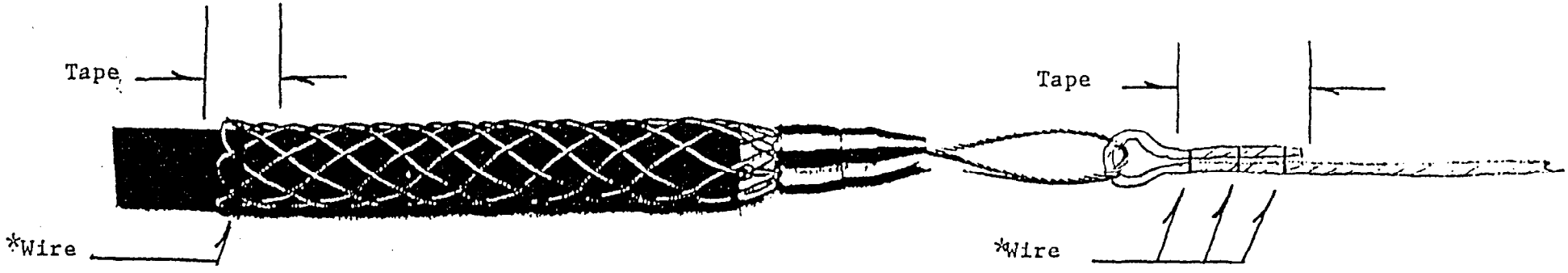
6. Push K-GRIP Jr. over dielectric and under braid until dielectric bottoms in connector. When the "B" dimension in the trim code is 0, the K-GRIP Jr. is pushed under both braid and jacket. Teflon jackets may be slit axially ¼" in two places to facilitate entry of the K-GRIP.



7. Slide K-GRIP sleeve against shoulder on body and form hex.

For captive contact connectors, solder contact to center conductor and thread assembly into connector.

CABLE PULLING HARNESS PROCEDURE



*NOTE:
DO NOT USE CABLE TIES
ON THIS PROCEDURE

LOOP PULL ROPE THROUGH EYE ON PULLING GRIP AND WIRE IN THREE PLACES AS SHOWN. EACH PLACE SHOULD HAVE TWO LOOPS. CINCH WIRE DOWN TIGHT WITH PLIERS AND CUT OFF EXCESS BEND ENDS OF WIRE BACK TOWARD END OF CABLE AND TAPE WITH ELECTRICAL TAPE AS SHOWN.

PLACE PULLING GRIP ON CABLE AS SHOWN AND WIRE TRAILING END WITH TWO LOOPS OF WIRE LACING IT THROUGH THE END LOOPS OF THE GRIP. TIGHTEN WITH PLIERS AND CUT OFF EXCESS AND BEND ENDS OF WIRE BACK TOWARD CABLE REEL AND TAPE WITH ELECTRICAL TAPE. THE REASON FOR WIRING THE GRIP IS IF THE CABLE GETS STUCK IN THE CONDUIT AND HAS TO BE PULLED BACK YOU WILL NOT LOOSE THE GRIP FROM THE CABLE.

MATERIAL NEEDED

1 Pulling Grip
2 Common Bailing Wire
3 Heavy Duty Pliers
4 Electrical Tape