MANUFACTURING SPECIFICATIONS MANUAL FOR PRODUCTS CONTAINING CARBON-14

EG&G ELECTRONIC COMPONENTS

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12/15/87

OVER-VOLTAGE GAP CONTAINING CARBON 14

The product incorporating Carbon 14 is classified as an over-voltage gap. As shown on Figure 1, the gap is a two-electrode, gas-filled device designed to operate in an arc discharge mode. It conducts moderate to high peak currents for very short periods.

The over-voltage gap containing Carbon 14 is made in accordance with the specifications attached Figures 2 through 12. Not more than 20 microcuries of Carbon 14 in amorphous powder form is embedded internally in a ceramic body positioned in proximity to the electrodes of each device.

The Carbon 14 may only be released by crushing, grinding or abrading the finished device. In normal use, such treatment is unlikely to occur. Completed units have been shock tested to withstand as high as 3500 G's in 0.5 millisecond pulses in each of three perpendicular planes. Gaps withstand a thermal shock of plunging from boiling water (> 97°C) into supercooled (-55°C) fluorinert, and again into boiling water for five cycles. They have also been vibration tested for ten minutes of 50 to 3000 HZ sinusoidal forcing function with a constant power spectral density of 0.6 G^2/HZ with no effect. With the exception of destroying (crushing) the devices, it is highly unlikely that the Carbon 14 contained within the over-voltage gaps will be released to the environment.

Each unit is visually inspected at 20X magnification during assembly, and rejected for any of the several defective characteristics. As described in Figure 11, radioactivity measurements are made on the ceramic bodies in each gap prior to final assembly. In addition, each unit is pre-conditioned and electrically tested for its low and high speed overload protection performance prior to acceptance. The units are labeled with a decal bearing the standard yellow and magenta radioactivity caution symbol identifying Carbon 14. The manufacturer's name is stenciled on the ceramic body of the gap.

Although not directly applicable, the requirements of Section 32.14 (b)(7), 10CFR Part 32 are met by observing less than 1 mR per hour on a Victoreen Meter, Model 490 with Pancake Probe, Model 489-110 (or equivalent) with the window of that instrument in direct contact with the side of the envelope of each finished device. The effective window thickness of this instrument is 2 mg per square centimeter.

The attached specifications constitute all of the pertinent documentation relating to EG&G's manufacturing of the gap (P/N 343814) containing Carbon 14.

Authorization is requested to distribute this device to persons exempt under Section 30.12, 10CFR Part 30, and persons licensed by the Nuclear Regulatory Commission to receive this device.

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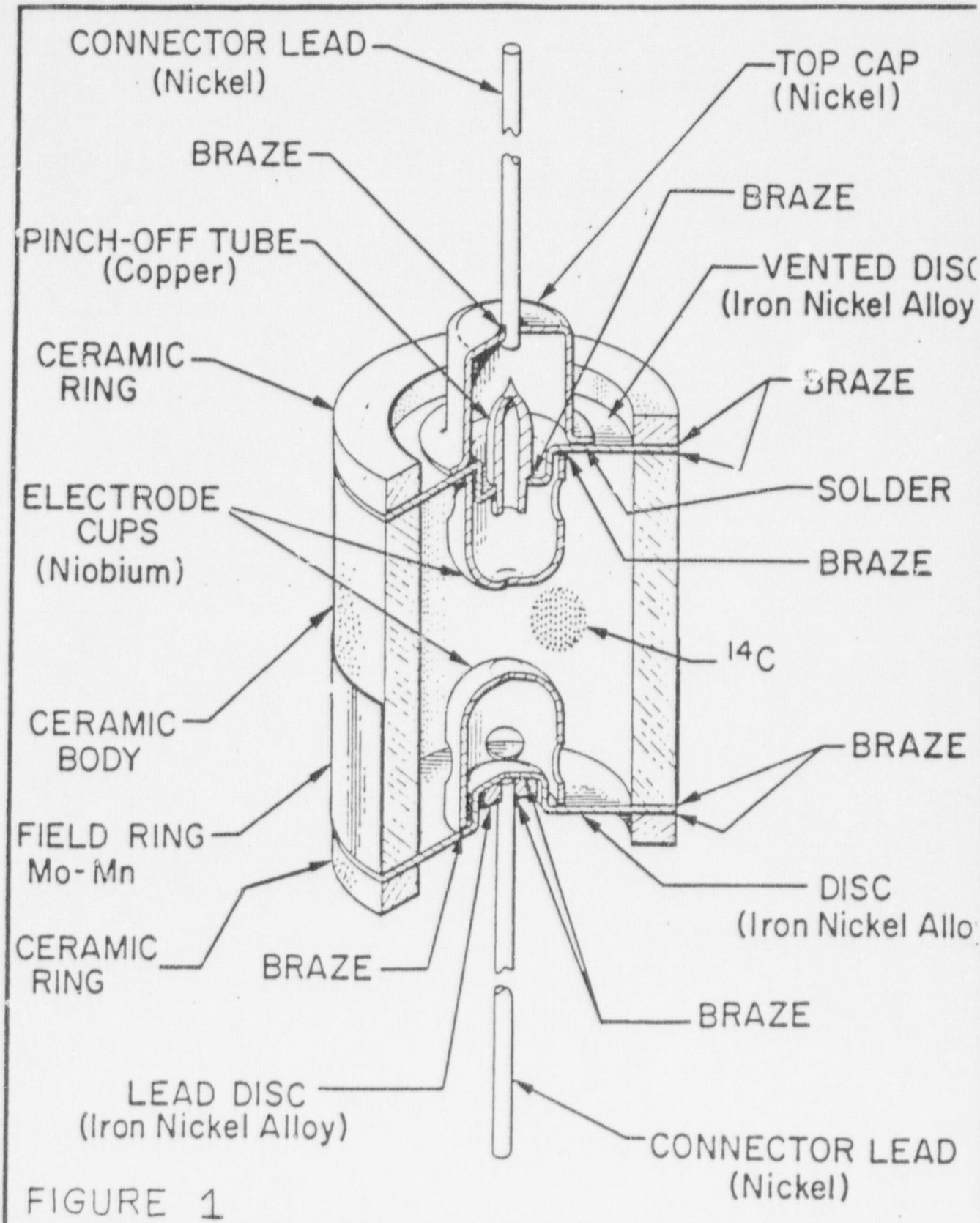
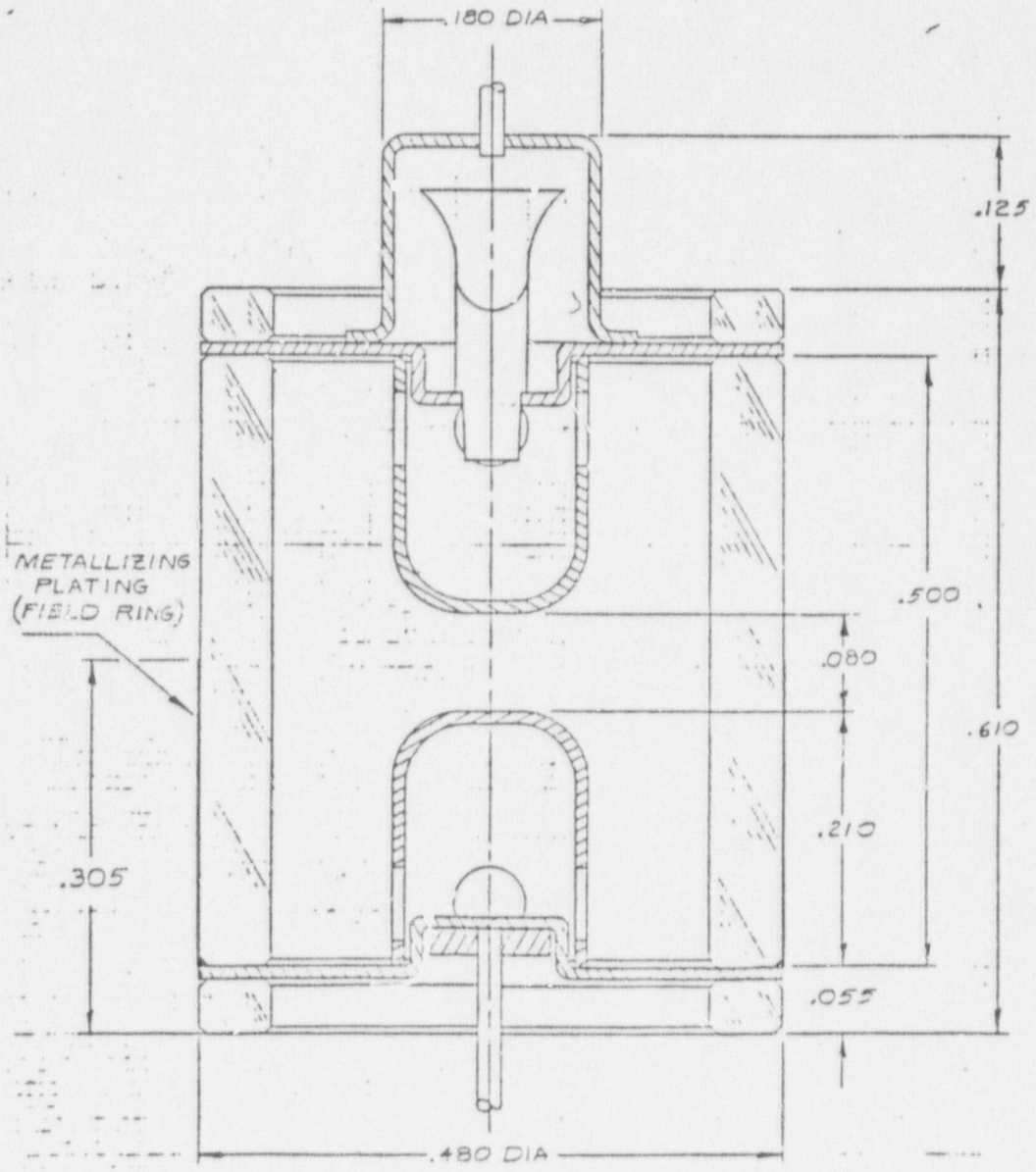


FIGURE 1

PICTORIAL SPECIFICATION				TITLE		GAP						CODE IDENT NO. 25508	SPEC. NO.	SL1-343814-(
				PRODUCT		343814							PART NO.	343814
RDC #	139												DATE	4-24-81
INIT	FJP												SHEET	1 OF 2

BRUNING 40-135 35608

SL58 B



NOTE:

1. ALL DIMENSIONS ARE LESS METALIZING & BRAZING MATERIAL.

SCALE: .010

PICTORIAL SPECIFICATION			TITLE	CAP						CODE IDENT NO. 26606	SPEC NO	SL: 343814 -0
			PRODUCT	343814							PART NO	343814
RDC #											DATE	4-24-81
INIT											SHEET	2 OF 2

SL58 A

1.0 PURPOSE

To specify a standard procedure for assembling 343814 Gaps.

2.0 SCOPE

This procedure shall apply to all 343814 manufacturing up to, but not including, exhaust.

3.0 MATERIAL

3.1 Brazing Material

3.2 Ceramic Bodies

3.3 Ceramic Rings

3.4 Electrode Cups

3.5 Discs (vented)

3.6 Discs (solid)

3.7 Pinch-off Tubes

3.8 Exhaust Extensions

3.9 Adapter Couplings

3.10 Lead Discs

3.11 Connector leads

3.12 Top Gaps

Plus additional material as required by applicable specifications.

4.0 EQUIPMENT

4.1 Brazing Fixture

4.2 Finger Cots

4.3 Tef'on Coated Tweezers

4.4 Microscope 10X

4.5 Glass Pen

Plus additional equipment as listed on applicable specifications.

5.0 PROCEDURE

5.1 General

5.1.1 This procedure applies only to parts covered by specified processing, quality control, and material control allocation procedures and bear inspectors approved stamp.

5.1.2 All brazing fixtures shall be cleaned prior to initial utilization as follows:

5.1.2.1 Stainless Steel Fixtures:

Brazing Fixtures shall be processed per SL3-01-101, SL3-01-112, and fired per SL3-02-300 (F-366).

5.1.2.2 Ceramic Fixtures:

Brazing fixtures shall be processed per SL3-01-085 and fired per SL3-02-400 (F-467).

NOTE

All braze fixtures shall be vacuum fired per SL3-02-500 (F-557) after cleaning and firing process prior to use. Any unusual part appearance, during any step of processing or firing shall be called to the attention of the type engineer by the department chemist and/or technical supervisor.

All brazing fixtures shall be stored in vacuum per SL6-04-061 during periods of inactivity. The fixtures shall be examined after each use for obvious signs of contamination. Fixtures shall be cleaned once a month per initial cleaning procedures. Cleaning of contaminated fixtures to be determined by Chemist.

5.1.3 Finger Cots are to be worn when handling all parts, and brazing fixtures.

5.1.4 This procedure applies to the assembling of the 343814 after the parts have been processed and as specified in SL1-343814-01.

5.1.5 Assembly progress and related reference information shall be recorded on suitable forms.

5.2 Gap Identification & Starter Assembly (SL1-343814-03-02)

5.2.1 Identify ceramic body (SL2-08-061) by marking on unmetallized ceramic outer area the appropriate serial # with glass pen.

5.2.2 Apply Carbon 14 after gap identification per (SL1-343814-03-02, Note #2).

5.2.3 Measure the effective PA level of each gap body per SL6-05-070.

5.3 Electrode Cup/Disc. or Vented Disc. Assembly (SL1-343814-03-03) (SL1-34814-03-04)

NOTE

The following steps applies for both vented and solid disc. (1 gap needed per gap).

5.3.1 Place the electrode cup (SL2-11-518) over the raised dimple on the disc. (SL2-11-516) or (SL2-11-517).

5.3.2 Slide a braze ring (SL2-07-060) over the electrode cup until it is flush against the disc.

5.3.3 Place the electrode cup/disc. assembly into a moly boat.

5.3.4 Braze per SL6-02-064.

5.3.5 Inspect per SL7-04-037.

5.3.6 Store per SL6-04-062.

5.4 First Step Braze Assembly (SL1-343814-03-06)

5.4.1 Assemble ceramic insert of SL2-20-487 to insert base of SL2-20-487.

5.4.2 With reference to SL1-343814-03-06 drawing, assemble all components inside the assembled fixture in the manner and sequence illustrated by the drawing (from bottom to top).

5.4.3 Position the ceramic tubing (SL2-20-487, Item 5) over the connector lead.

5.4.4 Position the ceramic spacer (SL2-20-487) over the assembly.

5.4.5 Place the tungsten weight over the spacer.

5.4.6 Braze per SL6-02-064, using copper program.

5.4.7 Inspect per SL7-04-037.

5.4.8 Store per SL6-04-062.

5.5 Pinch-off Tube/Adapter Coupling/Exhaust Extension Assembly (SL1-343814-03-07)

5.5.1 Place SL2-20-452 into SL2-20-474 firing boat.

5.5.2 With reference to SL1-343814-03-07 drawing, assemble all components in the manner and sequence illustrated by the drawing by first positioning the polished end of SL2-11-487 into SL2-20-452.

5.5.3 Braze per SL3-02-720.

5.5.4 Inspect per SL7-04-037.

5.5.5 Store per SL6-04-062.

5.6 Final Braze Assembly (SL1-343814-03-08)

5.6.1 Place ceramic spacer of SL2-20-487 into circular cut-out of SL2-20-445 base plate.

5.6.2 With reference to SL1-343814-03-08 drawing, assemble as follows:

5.6.2.1 Position the completed 1st braze gap on the ceramic spacer (SL2-20-487) with connector lead thru center hold, bend connector and position in venting slot of SL2-20-445 base plate.

5.6.2.2 Place the braze ring (SL2-07-050) over the pinch-off tubulation.

5.6.2.3 Place the braze washer (SL2-07-052) directly over the vent hole gap of assembly and center on the hole.

5.6.2.4 Position the extension and pinch-off tube assembly (with the pinch-off tube end downward) thru the SL2-20-445 tripod cut out per SL1-343814-03-08.

5.6.2.5 Insert the pinch-off tubulation into disc. vent hole.

5.6.2.6 Braze per SL6-02-064, using nioro braze program.

5.6.2.7 Identify SL5-05-015.

5.6.2.8 Inspect per SL7-04-037.

5.6.2.9 Leak Test per SL6-02-061.

5.6.2.10 Store per SL6-04-061.

5.6.2.11 Exhaust per SL1-343814-08.

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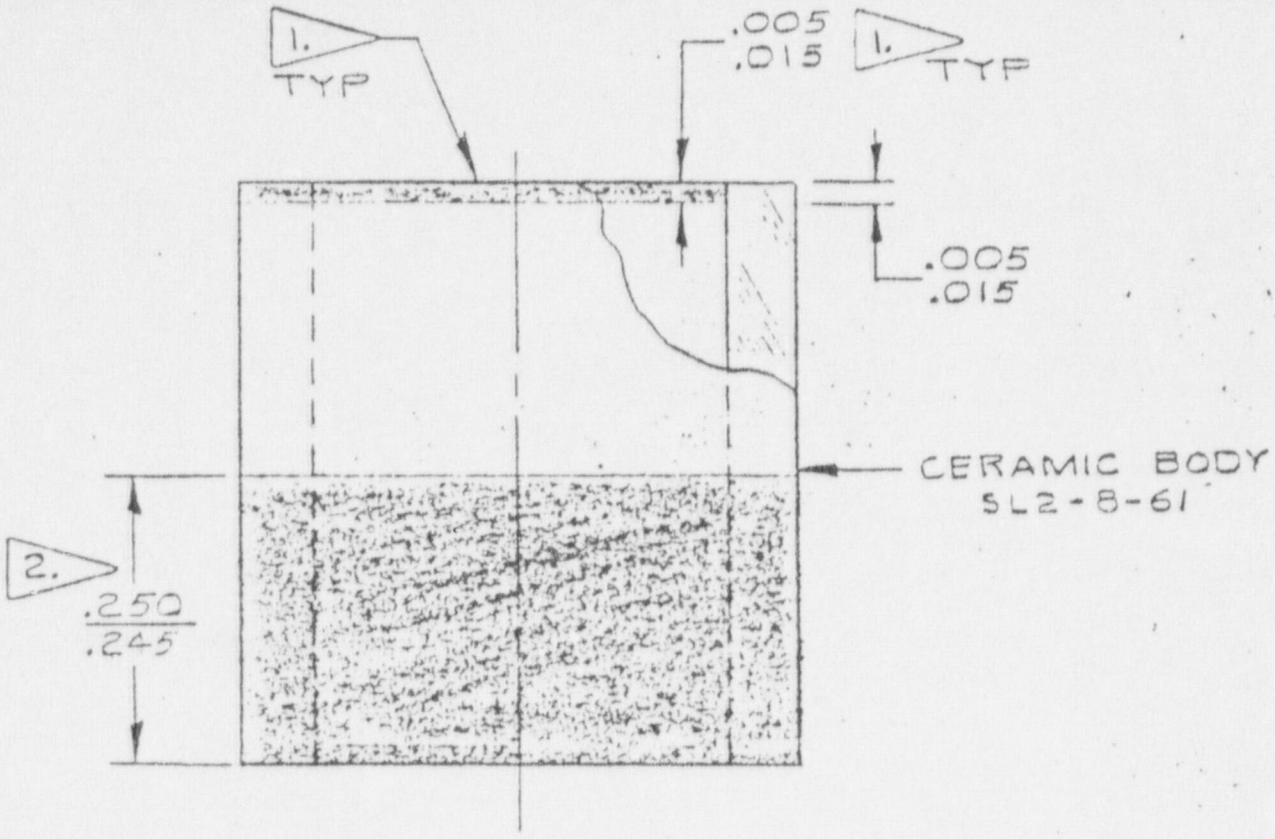

NOTES:

1. Metalize surfaces at both ends. Metalizing shall break over both edges of ceramic wall (internally & externally) from .005" - .015".

2. Metalize O.D. of ceramic at one end. Metalizing shall be .245/.250 in height. ($\approx$ 1/2 length of ceramic).

FIGURE 3

CONSTRUCTION SPECIFICATION				TITLE	Metallized Ceramic Body						CODE IDENT NO. 25506	SPEC. NO.	SL1-343814 -3
				PRODUCT	343814							PART NO.	343814
RDC#	EJ30											DATE	4-24-81
INIT	PJS											SHEET	1 OF 1

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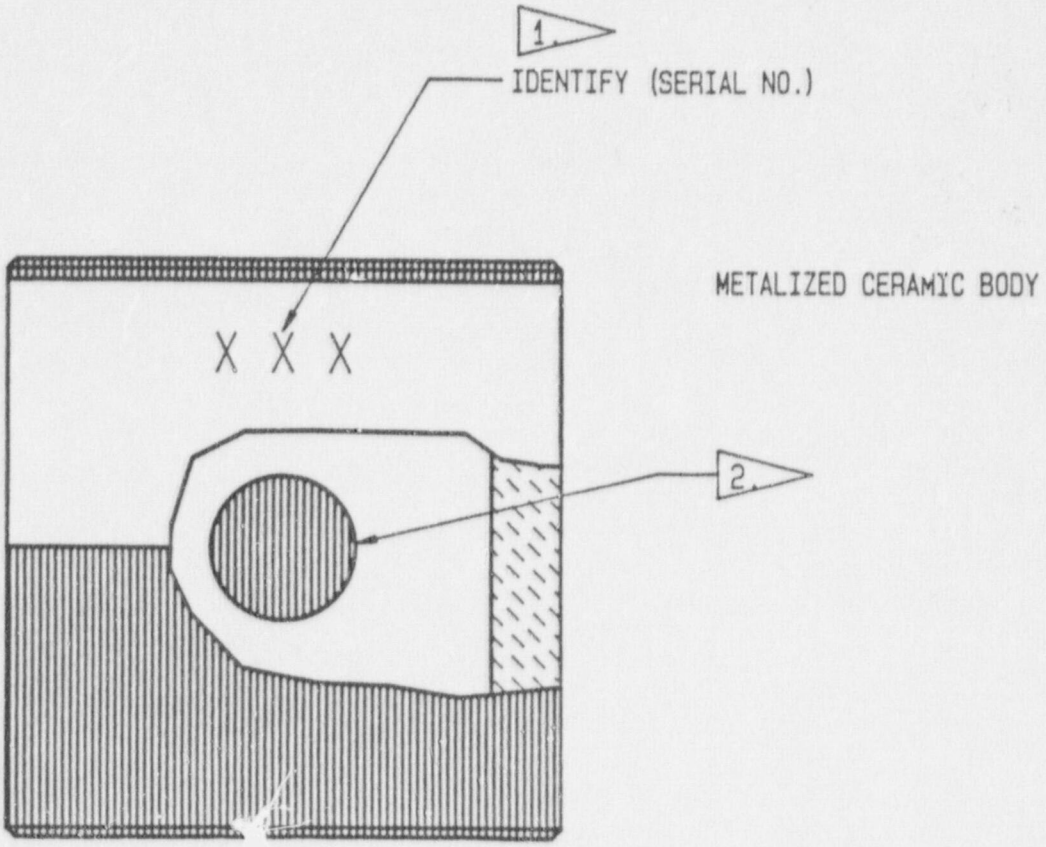
SL56 R



NOTES:

1. THE CERAMIC BODY SHALL HAVE BEEN COMPLETELY PROCESSED UP TO AND THRU NICKEL PLATE FIRING PRIOR TO IDENTIFYING CERAMIC BODY BY SERIAL # WITH GLASS PEN. THE STARTER SHALL BE APPLIED PRE-1st STEP BRAZE ASSEMBLY.

2. APPLY FOUR 1/8" DIA (APPROX.) SPOTS OF CARBON 14 (DRY) EVENLY SPACED, (APPROX), 1/2 WAY UP INNER WALL, TO MEASURE APPROX. 5 µc R.A. LEVEL, AND MAXIMUM 20 µc R.A. LEVEL. CARBON 14 SHALL BE APPLIED PER SL3-04-062. R.A. LEVEL SHALL BE MEASURED PER SL6-05-070.

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TITLE: GAP IDENTIFICATION & STARTER ASSEMBLY
PRODUCT: 343814
SPECIFICATION: CONSTRUCTION
DCN#: J003 K171 K472
INIT: SAT LAM JB

FIGURE 4

FSCM: 25506
SPEC. NO.: SL1-343814-03-02
PART NO.: 343814
DATE: 02-01-87
ISSUE: A
SHEET 1 OF 1

UNCLASSIFIED

1.0 PURPOSE

This procedure describes the steps to be taken following the Exhaust Specification (SL1-343814-08).

2.0 SCOPE

This procedure shall apply to all 343814 Gaps. This procedure shall be performed in the following sequence.

3.0 PROCEDURE

3.1	Test (3 shots SBV immediately post pinch-off)	SL1-343814-10
3.2	Clean Tip Acetone and Wipe	SL6-04-063
3.3	Pre-Sandblast Clean	SL3-01-254
3.4	Cover S/N with Tape (white adhesive)	SL6-04-063
3.5	Sandblast (protect pinch-off)	SL6-04-063
3.6	Post Sandblast Clean	SL3-01-092
3.7	Inspect	SL6-04-063
3.8	Nickel Plate	SL3-04-084
3.9	Post Nickel Strike Bake 225°C/2 hours vacuum	SL3-02-717
3.10	Nickel Wet	SL3-01-094
3.11	Inspect	SL7-04-034
3.12	Tin (flux; 200L corrosive)(pot; 250°C)	SL3-04-059
3.13	Inspect	SL7-04-038
3.14	Assemble Pre-tinned Top Cap	SL6-04-095, SL1-343814-09-02
3.15	Post Tin Clean	SL6-04-095
3.16	Inspect	SL7-04-038
3.17	X-ray (2 copies each gap)	SL1-343814-10
3.18	Test VL	SL1-343814-10
3.19	Test: SBV	SL1-343814-10
3.20	Test: DBV (30 shots, + polarity)	SL1-343814-10
3.21	Temp. Storage (72 hours min., 150°C)(Nitrogen Oven)	SL3-02-733
3.22	Inspect	SL7-04-038
3.23	Test: VL	SL1-343814-10
3.24	Test: SBV	SL1-343814-10
3.25	Test: DBV (20 shots, + polarity)	SL1-343814-10

FIGURE 5

3.26	Mask all metal parts and identify	SL6-04-063
3.27	Pre-brand clean (sandblast ceramic only)	SL6-04-063
3.28	Brand	SL5-05-015
3.29	Final Inspection	SL7-05-025
3.30	Cross Section	SL1-343814-09

NOTES:

1. Dates performed, operators and type of shrinkage shall be recorded on EG&G Overvoltage Gap Post Exhaust Traveler Form SL-350.
2. Soldering iron tips shall be cleaned and tinned before using and recleaned and retinned during use at the sign of any black oxide buildup.
3. Post Temperature Storage Test.
   After temperature storage allow 1 hour minimum at room temperature before performing VL, SBV and DBV Tests.
4. Cross Section (Metallurgical).
   From any completed D-Test unit (RE: PS343814) with the exception of the "Potted" sample (Env. Seq.), ONE unit shall be selected for cross-sectioning from every two consecutive exhaust batches; preferrably the pulse life unit.
   The unit shall be cross-sectiond along the major axis (see Drawing SL1-343814-09 Cross Section).
   Micrographs shall be taken of each seal area. Micrographs shall be available, verifying completion of cross-section when a lot is submitted for buyer acceptance.
   CAUTION: For tubes containing ^{14}C, refer to the "special" handling requirements of specification SL3-04-066 (Decontamination of ^{14}C).
   Pre-Potting Procedure
   1. Cut leads approximately .100 inches from device.
   2. Inspect device for any mechanical defects. (Photograph any defects.)
   3. Remove cover of top cap to reveal pinch-off orientation.

4. Cut vent window as shown on SL1-343814-09 drawing.

Areas to Micrographed.

A. Pinch-off Closure

   a. As Polished

   b. As Etched

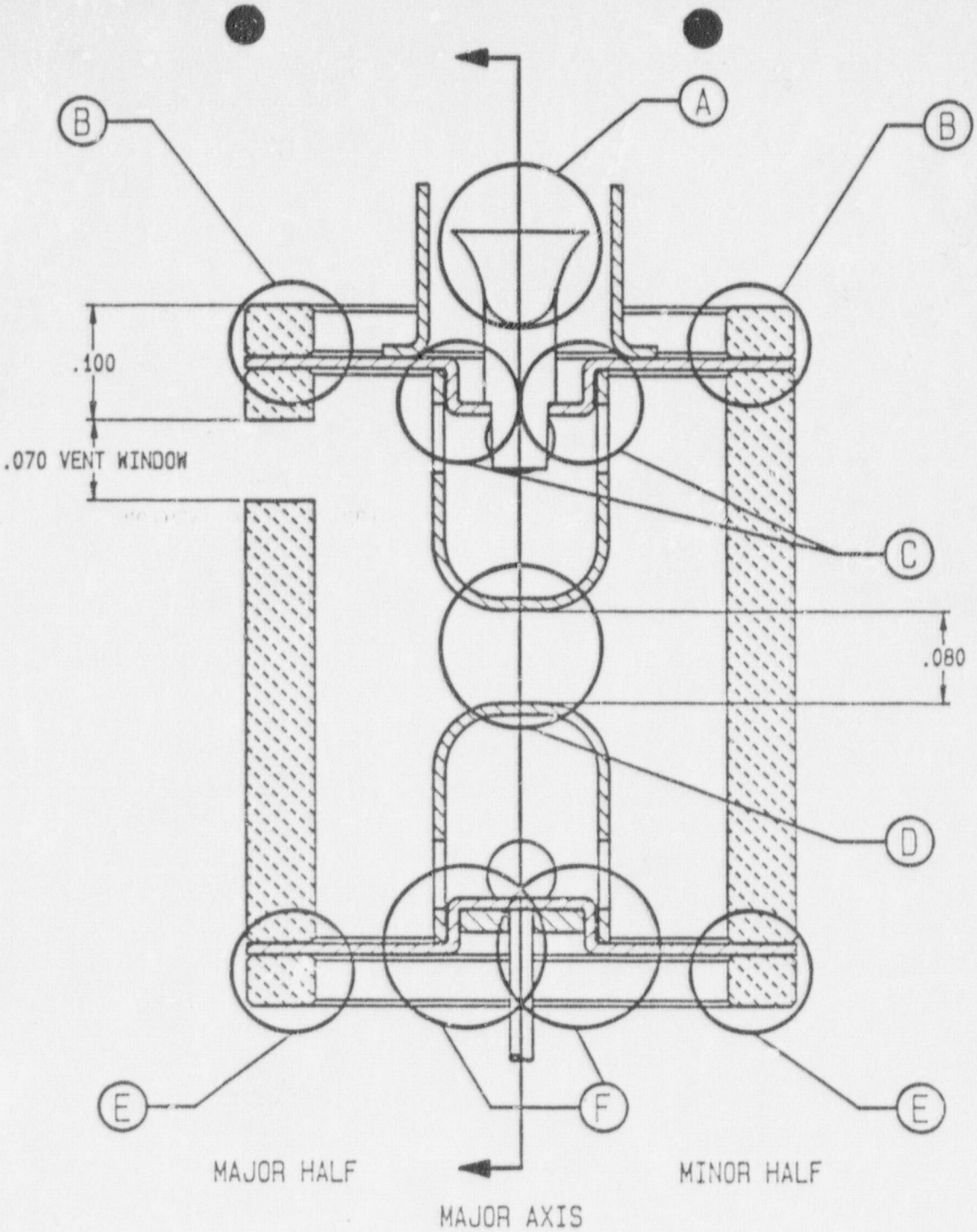
B. Ceramic Ring (I-062) to Vented Disc (R-517) to Ceramic Body (I-061) (2 Points, 180° apart).

C. Pinch-off Tubulation (R-618) to Vented Disc (R-517) to Electrode Cup (R-518) (2 Points, 180° apart).

D. Electrode (R-518) to Electrode (R-518) spacing (Measure).

E. Ceramic Ring (I-062) to Disc (R-516) to Ceramic Body (I-061) (2 Points, 180° apart).

F. Lead (W-209) to Lead Disc (R-520) to Disc (R-516) to Electrode Cup (R-518) (2 Points, 180° apart).



CROSS SECTION

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TITLE: POST EXHAUST PROCESSING	FSCM: 25506
PRODUCT: 343814	SPEC. NO.: SL1-343814-09
SPECIFICATION: PROCESSING	PART NO.: 343814
DCN#: K156 K131 K314 K251	DATE: 11-25-86
INIT: JBW RER RJB AFD	ISSUE: C
	SHEET 4 OF 4

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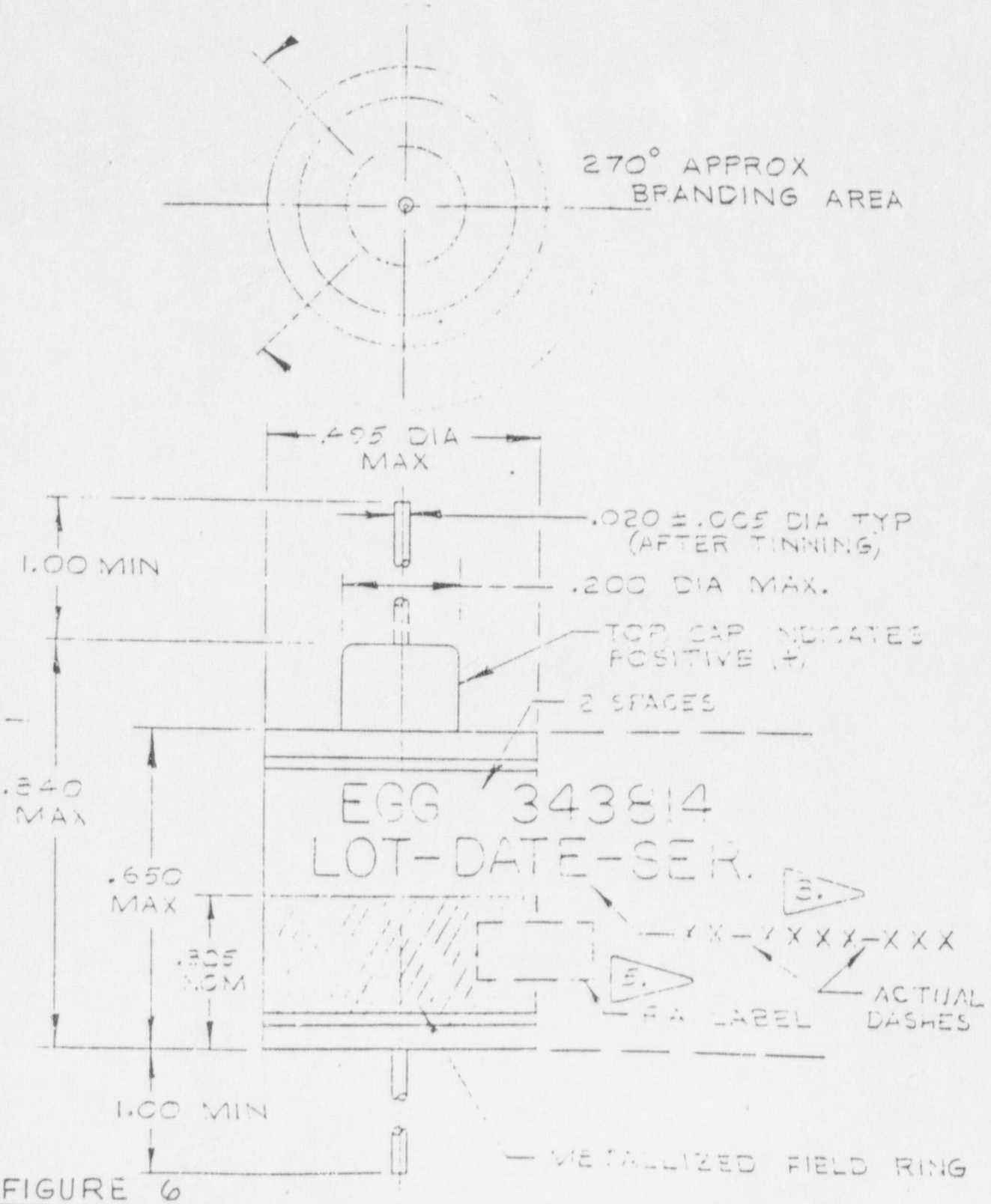

FIGURE 6

CONSTRUCTION SPECIFICATION				TITLE	Gap Outline Drawing							CODE IDENT NO. 25506	SPEC. NO.	SL1-343814-9-3	
				PRODUCT	343814								PART NO.	343814	
RDC #													DATE	1-29-82	
INIT													SHEET	1 OF 2	

BRUNING 40 135 35608 3

SIZE D

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NOTES:

1. All exposed metalic surfaces shall be tinned with a continuous coating as observed under 10X magnification.
2. All leads shall be tinned for their full length, and shall be 0.020 ± .003 inch diameter after tinning.
3. Marking. Gaps in each acceptable lot shall be branded with the supplier's initials, EGG and part no. 343814, the inspection lot number and serial designation. Engineering gaps will be identified by the EWS# and the letter "E" in place of the lot#. Marking shall be applied per SL5-5-14. The serial designation shall be a seven-digit number. The first two digits shall indicate the year of production, the second two digits shall indicate the week of production and the last three digits shall indicate a number assigned in serial fashion for each gap built in a given production lot.

   For example: 02-8033-120, where 80 represents 1980 and 33, the 33rd week, and 120, the 120th gap built, for example, in lot #02. Each gap shall keep the same serial number at final branding that it had at in-process identification. Prior to T M S approval, all gaps shall be marked X343814. MARKING SHALL BE LOCATED ON MAIN BODY CERAMIC APPROXIMATELY AS SHOWN. Other supplier marking is optional.
4. Dimensions are in inches. All untoleranced dimensions are referenced dimensions.
5. RA Label (SL5-1-48-2) placed on field lining; centrally located in respect to marking.

CONSTRUCTION SPECIFICATION				TITLE	Gap Outline Drawing						CODE IDENT NO. 25506	SPEC. NO.	SL1-343814-9-3
				PRODUCT	343814							PART NO.	343814
DCN	1110	1305										DATE	1-29-82
INIT	PHL	PH										SHEET	2 OF 2

BRUNING 40-135 50030

SL56 R

1.0 PURPOSE

This specification details the dry method application of radioactive amorphous carbon 14 to ceramic devices.

2.0 SCOPE

Requirements as to packaging, storing, handling, inspecting and testing of incoming Carbon 14 are specified. Safety rules to be observed during handling of radioactive Carbon 14 and/or devices containing this material are included.

3.0 MATERIALS

3.1 Approved Product

Product Designation	Material Producer or Authorized Supplier
Amorphous Carbon [^{14}C]	New England Nuclear
Cat. No. NEC-998C	Boston, Mass.

4.0 EQUIPMENT

NOTES

1. Items 4.1 through 4.47 lists general equipment.
2. Items 4.48 through 4.55 lists approved safety apparel.

4.1 Limited Access ^{14} Carbon Application/Storage Room.

4.2 Labconco Fiberglass Radioisotope Glove Box, Model No. 50002 or equivalent. Modifications:

4.2.1 High impact Lexan Observation Window in lieu of standard shatterproof safety glass window. Labconco Specialty Modified Model No. 50002-90-S53126.

4.2.2 Externally attached B & L Stereozoom 5 Power Pod (Item 4.3) and Illuminator (Item 4.5).

4.2.3 EG&G designed Plexiglass Safety Box installed in exhaust line with gasketed test port for monitoring against pollution of the outside environment with radioactive dust or particles due to filter leaks or failure.

4.3 B & L Model No. 31-27-40 Microscope Power Pod, 0.8 - 4.0X or equivalent.

4.4 B & L Model No. 31-15-71-02 Wide Field Eyepieces (with eyeguards) 10X or equivalent.

FIGURE 7

4.5 B & L Model No. 31-33-40-40, General Purpose Illuminator with adjustable transformer or equivalent.

4.6 Fiber-Lite Optic Illuminator, Dolan-Jenner Industries, Inc., Model 190.

4.7 Dry Box Gloves, Dual Thickness Neoprene, Size 8-1/2, Mohawk Industrial Supply, Inc., Cat. No. 8N-1532-S8.

4.8 Radioactive Material Container (Lead Pig), Lab Safety Supply, Model No. 984-M or equivalent.

4.9 Vacuum Generator System, Techni-Tool, Model No. 50 or equivalent.

4.10 Anodized Aluminum Probe, Techni-Tool, Model No. E-5 or equivalent.

4.11 Glass Vacuuming Tips, EG&G Design.

4.12 Replacement Filters (Disposable) for Vacuum Generator System, Model No. 50 or equivalent.

4.13 Test Tube Rack, VWR, Cat. No. 60982-060 or equivalent.

4.14 Pyrex Test Tubes with Caps, VWR, Cat. No. 60827-555 or equivalent.

4.15 Boston Round Bottles with Caps, Cap. 4 oz., Ansell, Cat. No. AW-451 or equivalent.

4.16 Ceramic Rod with Full Radius, AD94 Alumina, Precision Ground, .080" dia. x 4" length or equivalent.

4.17 Nylon Cleaning Brushes, Sperry-Remington or equivalent.

4.18 Watch Glasses, VWR, Cat. No. 66112-220 or equivalent.

4.19 Petri Dishes with Covers, Fisher Cat. No. 8-747C or equivalent.

4.20 Radioactive Materials (Restricted) Storage Cabinet, Utility Model No. 72S (NUTAN).

4.21 Non-Radioactive Materials (Restricted) Storage Cabinet, Utility Model No. 72S (NUTAN).

4.22 Radioactive Waste Material Storage Drum, Lab Safety Supply, Cat. No. 1007-M or equivalent.

4.23 Radioactive Materials Storage Desiccator, Fisher, Cat. No. 8-624B or equivalent.

4.24 "Caution Radioactive Materials" Tape, Lab Safety Supply, Cat. No. 1133-M or equivalent.

4.25 Radioactive Materials "Isotope, Quantity and Date" Tape, Lab Safety Supply, Cat. No. 1135-M or equivalent.

4.26 Primary Radioactive Materials Carrier, Clear Plexiglass Container with Cover, 5-1/2" x 7-1/2" x 3-1/2" Deep.

4.27 Secondary Radioactive Materials Carrier, Clear Plexiglass Container with Cover, 7-1/2" x 10-1/2" x 4" Deep.

4.28 Polyethylene Bags, 8 x 10 x 24" or equivalent.

4.29 Polyethylene Bags, 3 x 6 x 18" or equivalent.

4.30 Bench-size Bagholder, 5 x 3 x 8", Fisher Scientific, Cat. No. 01-815-2.

4.31 DURX 670 Wipers, 9 x 9" and 12 x 12", Bukshire Paper Co.

4.32 CREW Wipers, No. 33330, Kimberly-Clark Corp.

4.33 Foam Wipers, Washed, 8 x 8 x 1/8" or equivalent.

4.34 Polyethylene Wash Bottles, 4 oz, 8 oz and 16 oz Capacity.

4.35 Teflon Coated Tweezers, BEL-ART Products, Cat. No. 37935.

4.36 Teflon Tweezers, Fluoroware No. C20 or equivalent.

4.37 Pointed Tweezers, Cross Lock; Hub Materials Co., Cat. No. 47-046.

4.38 Delrin Tipped Tweezers, EG&G Design using Item 4.37.

4.39 Parts Tray, 5 x 7", Black Phenolic, 32 Sections or equivalent.

4.40 Dressing Jar with Stainless Steel Cover, 5 x 5", VWR, No. 36311-046 or equivalent.

4.41 Radiacwash Towelettes, Nuclear Associates, No. 03-400 or equivalent.

4.42 Methanol, Reagent Grade or equivalent.

4.43 Deionized Water.

4.44 Cotton Tipped Applicators, 6" Length or equivalent.

4.45 Radiation Survey Meter, Victoreen-Frisher, Model 495, Atlantic Nuclear or equivalent.

4.46 "Pancake" GM Probe, Victoreen Model No. 489-110, Atlantic Nuclear or equivalent.

4.47 Radioation Monitoring Film Badge.

4.48 Laboratory Coat, Standard Tyvek, Lab Safety Supply, No. G968 or equivalent.

4.49 Vinyl Gloves, Sensikleen or equivalent.

4.50 Nylon Gloves.

4.51 Cotton Gloves.

4.52 Latex Rubber Gloves, Derma-Thin, Style 1005, Best Mfg. Co.

4.53 Unpowdered Fingercots.

4.54 Non-Toxic Particle Mask, 3M, No. 8500.

4.55 Rubber Bands, Assorted.

5.0 PROCEDURE

5.1 Safety Rules

(Refer to: Radiological Safety and Information Manual for The Salem Laboratory of EG&G, Inc., Electron Devices Group, Nov. 10, 1986".)

5.1.1 All ^{14}C applications shall be made in the approved radiosotope glove boxes located in the Limited Access Carbon 14 Application/ Storage Room at 10X magnification unless otherwise designated by Engineering and approved by the Radiological Safety Officer.

NOTES:

1. The glove boxes have been assembled and adjusted by the manufacturer for operation in the negative pressure mode and will be operated in accordance with the manufacturer's operation and maintenance manual. Any modifications required shall be primarily for greater flexibility. The integrity of the glove boxes shall be maintained at all times.
2. Door of ^{14}C room is to be closed when personnel are working in the room.

5.1.2 Safety apparel listed in Section 4.0 shall be worn by operators at times specified below.

5.1.3 Other supplies and safety equipment listed in Section 4.0 shall be utilized, cleaned and/or disposed of as specified below.

5.1.4 Turn on Radiation Survey Meter when working in ^{14}C room.

5.1.5 Radiation Monitoring Film Badge shall be worn by all personnel whenever performing storage, handling, application, cleaning and/or disposal operations. Film badges shall be read and maintained monthly by Radiological Safety Officer and/or his authorized representative.

5.1.6 Supplies, equipment and devices required inside the glove box shall be transferred in and out via the transfer chamber.

5.1.7 Standard Practice When Utilizing Transfer Chamber shall be:

a. Operator must wear buttoned lab coat, film badge, particle mask and vinyl gloves when transfer chamber door is to be opened. Use rubber

hands to confine sleeves at wrists in order to avoid contamination from inside the chamber.

b. Close any open windows or doors.

c. Turn off all sources of air turbulence in the room such as fans, air conditioners, vacuum cleaners, etc.

d. Turn on glove box motor to a minimum setting of two (2).

e. Outer transfer door shall be unlatched and the door opened and gently rested on a disposable surface.

f. While using transfer chamber, carefully avoid all personal contact (hand, arm, lab coat sleeve, etc.) with the interior of the chamber or the holding tray inside the chamber.

g. After outer transfer chamber door is secured, monitor self and area for contamination. Decontaminate if necessary.

h. Air conditioner(s) are not to be turned back on until decontamination is completed.

5.1.9 Devices Processed with ^{14}C shall be decontaminated immediately upon transfer out of the glove box.

5.1.10 Contaminated waste items upon removal from inside the glove box shall be carefully rebagged and sealed before disposal in the Radioactive Waste Material Storage Drum (Item 4.22).

5.1.11 Standard Practice For Transporting Of Devices With Exposed Areas Of Applied Radioactive ^{14}C.

a. Decontaminated devices/parts are to be placed on a clean parts tray (Item 4.39).

b. Parts tray with devices are placed into a Primary Radioactive Materials Carrier (Item 4.26) and covered with an appropriate sized foam wiper before putting cover on carrier.

c. Primary carrier is placed into a Secondary Carrier (Item 4.27) which is then covered.

d. Secondary carrier is placed into a polyethylene bag (Item 4.28). Appropriate Radioactive Material identification labels shall be attached to the bag.

e. The protected Engineering Travel Card shall be placed on the cover of the secondary carrier inside the bag.

f. Close bag. Fold open end under the carrier box.

g. Carrier kits containing radioactive materials as specified above may be carefully transported to other areas for further processing of devices.

5.1.12 Vial of ^{14}C in current production shall be stored inside "Lead Pig" in the glove box whenever it is not being used.

5.2 Preparation

5.2.1 Place devices on incoming work table.

5.2.2 Put on lab coat and fasten front button/snaps. Wear film badge.

5.2.3 Put Radiation Survey Meter in a convenient location. Leave meter on until processing is completed through decontamination and final clean-up of all work areas is completed.

5.2.4 Place Engineering Travel Card in polyethylene bag to protect it from contamination.

5.2.5 Open a clean Radioactive Materials Carrier Kit (for transportinge devices after ^{14}C application). Label tray to be used for transporting devices after ^{14}C application with RA labels and labels for identification of devices. Place labeled tray into Primary Carrier.

5.2.6 Place CREW wiper(s) (lint free wipers) on table under and in front of transfer/chamber.

5.2.7 Check to ascertain that all necessary equipment, supplies and facilities required for sucessful completion of the ^{14}C application procedure and clean-up afterwards are available and operational.

5.2.8 Amass any additional items required for use inside the glove box.

5.2.9 Label a polyethylene bag (Item 4.29) for RA waste material disposal. Open bag and place it over the bag holder. Put waste bag holder on a CREW wiper near glove box.

5.2.10 Place required teflon tweezers on CREW wiper.

5.2.11 Inspect external door latches of large access door and knob of transfer box door to check that they are secure. Turn on switches for glove box light and electrical receptacle.

5.2.12 Set glove box motor knob at six (6). Gloves should gradually extend well into box. After gloves have extended, return motor setting to four (4).

5.2.13 Wearing disposable nylon or cotton gloves (optional), place hands into extended neoprene glove box gloves. Use rubber wrist bands or any other approved method for better glove control.

5.2.14 Position "Lead Pig" containing ^{14}C and the test tube rack containing miscellaneous supplies clear of the inner door of the transfer box.

5.2.15 Plug vacuum generator into receptacle outlet. Adjust the generator for high speed. Attach suitable glass probe to the system. Check suction. Change filter if suction is poor or if filter is filled more than 1/4 with black particles. Place used filters into waste container inside glove box. Position covered waste container in a convenient location.

5.2.16 Open inner door to the transfer box. Place holding tray into transfer chamber. Close and secure inner door.

5.2.17 Position plastic "Spill Tray" under application area. Remove cover. Invert cover and place in a suitable location. Place petri dish containing apparatus onto inverted cover.

5.2.18 Disengage from glove box gloves. Immediately monitor hands or gloves if they were used. Take proper action depending on monitoring results.

5.2.19 Place tray of devices on table in front of the outer door of the transfer box.

5.2.20 Follow Section 5.17, "Standard Practice When Utilizing Transfer Chamber" and open door to chamber.

5.2.21 With the teflon tweezers, carefully transfer the devcies onto the holding tray inside the chamber. Place any other items needed inside glove box into the chamber. Secure outer transfer chamber door. Monitor self, apparel, tweezers and work area before continuing. Take necessary action. Tweezers may be left on the CREW wipers for later use.

5.2.22 If particle mask and/or gloves show no contamination upon careful monitoring, they may be placed in a clean polyethylene bag until required later. If contaminated, gently put into designated RA waste bag for disposal. Air conditioners may be turned on again after the outer transfer door has been closed and secured and any decontamination required has

been completed.

5.2.23 Turn on external B & L Illuminator and Fiber Optic Light. If necessary, adjust microscope for 10X magnification and focus. Adjust lighting for best illumination of work.

5.2.24 Repeat Steps 5.2.12 and 5.2.13. Be sure motor setting is at four (4).

5.2.25 Open internal transfer box door. Transfer holding tray with devices into glove box and place in a convenient position. Position a clear protective plastic cover over devices to protect them from fallout while they are in the glove box atmosphere. Transfer into box any other items in the transfer chamber.

5.2.26 Close and secure the inner transfer box door.

5.3 Application of ^{14}C

NOTE: A single device shall be processed as below and the RA level measured. *This unit is to serve as a guide for the amount of ^{14}C to be applied to the remaining devices in the batch.

5.3.1 Open petri dish and invert cover. Remove cover from "Lead Pig" and set aside. Carefully take out the packaged vial. Remove vial from its polyethylene bag. Place the vial in the petri dish cover. Return polyethylene bag to "Pig" and replace its cover. Gently tap tightly sealed vial to concentrate carbon particles on the bottom. Carefully disperse particles onto wall of the vial (to facilitate pick up with ceramic rod) and return vial to petri dish.

5.3.2 Remove ceramic rod #1 (the applicator rod) from test tube #1 and place it where its identity can be maintained. Recap test tube and return it to the rack. Repeat procedure for rod #2.

5.3.3 Carefully remove ^{14}C vial cap and place both back onto petri dish cover.

5.3.4 Pick up a ceramic device with tipped tongs. Set tongs holding the device aside. Pick up ceramic rod #1 and the opened vial. Insert rod into vial and pick up several carbon particles by rubbing the rod gently on the wall of the vial.

5.3.5 Under the microscope, carefully apply the ^{14}C particles to the specified area of the device.

5.3.6 With same rod, slowly grind the particles with a rotary motion until a gray smudge is produced, leaving no black particles and very little loose debris. When necessary, put rod aside and carefully vacuum to remove scattered and/or loose particles.

5.3.7 Continue in this manner with rod #1 until the application of ^{14}C is sufficient to meet requirements. Compare with processed sample.

5.3.8 With rod #2, continue to grind ^{14}C into a smooth gray smudge area. When necessary, use the vacuum probe.

5.3.9 Continue grinding and vacuuming until smudge is smooth and adjoining area is clean.

5.3.10 Repeat the applying, grinding, and vacuuming procedure for all other areas (as required) in the device. When all areas are completed, return device to the covered holding tray.

5.3.11 Continue as in Steps 5.3.4 through 5.3.10 until all devices in the batch have been processed.

5.3.12 Replace cover securely on vial of ^{14}C. Vacuum exterior of vial. Return vial to its polyethylene bag and replace inside the "Lead Pig".

5.3.13 Vacuum clean the rods and return them to their respective test tubes.

5.3.14 Carefully open internal transfer box door and place the uncovered holding tray with the completed devices into the transfer chamber.

5.3.15 Shut door carefully and secure.

5.3.16 Clean interior of glove box.

a. Vacuum to remove any visible black particles.

b. Use Radiacwash Towelettes sparingly to wipe up any area which are extremely dirty.

c. Using DURX 670 wipers moistened with deionized water or methanol, rinse and wipe to remove any detergent. Clean floor of glove box, petri dishes, waste container cover, spill tray and its cover.

d. Wipe all areas with dry DURX 670 wipers.

e. Put all waste materials used for cleaning into waste container inside glove box and cover container. Waste materials to be removed for disposal when necessary.

5.3.17 Put glass vacuuming tips and other small accessories back into cleaned petri dish. Cover dish and store inside the cleaned spill tray.

5.3.18 Repeat 5.2.18

5.3.19 Assemble equipment required for decontamination of devices with applied ^{14}C.

5.3.20 Follow Section 5.1.7, "Standard Practice When Utilizing Transfer Chamber". Open outer transfer chamber door.

5.3.21 With the feflon tweezers, carefully transfer devices with applied ^{14}C from holding tray to the foam wiper surfaces provided. Set tweezers on foam wiper for monitoring and decontamination later.

5.3.22 Close transfer chamber door carefully and secure.

5.3.23 Immediately proceed to decontaminate devices. Refer to SL3-04-066.

5.3.24 After decontamination of devices, follow Section 5.1.11, "Standard Practice for Transporting of Devices With Exposed Areas of Applied Radioactive ^{14}C.

5.3.25 Monitor entire work area including exterior of glove box, microscopes, illuminators, etc. Decontaminate as necessary.

5.3.26 Put all radioactive waste materials into labeled waste bags. Secure bag(s) and place into the Radioactive Waste Material Storage Drum.

5.3.27 Complete all required Radiation Records.

5.3.28 Shut off all equipment and secure cabinets.

5.3.29 Carefully transport Carrier Kit containing decontaminated devices to inspection area after securing door of ^{14}C room.

5.3.30 RA levels to be read and recorded on ETR Form (Baird Polyspec Research Nuclear Spectrometer). Refer to SL6-05-070.

6.0 QUALITY ASSURANCE PROVISIONS

6.1 Lot Definition

A lot shall consist of a homogeneous quantity of material offered for acceptance at one time by authorized producer or supplier.

6.2 Lot Inspection and Testing

Authorized producer or supplier shall provide EG&G R.I.D. with acceptable C of C for each incoming shipment that material meets or exceeds specific activity and type carbon requirements specified below. Each lot offered

for acceptance shall be inspected as required for conformance with the requirements listed below and approved by Department Chemist and/or Engineering prior to production use.

6.3 Test & Inspection Methods - Appearance

Material shall be free from gross contaminants. Contaminants are defined as foreign material which can be detected visually by operator at 10X magnification. Notify Department Chemist immediately of any unusual appearance and/or condition.

6.4 Test & Inspection Methods - Color & Form

Material shall have a characteristic black color and amorphous form, when inspected visually by operator at 10X magnification. Notify Department Chemist immediately of any unusual appearance and/or condition.

6.5 Material Properties

Material shall conform to the following requirements.

Property	Requirements	Test Method
Specific Activity	4.0m Ci/M_g $\pm$ 0.5	C of C
Type Carbon	^{14}C	C of C
Appearance	Free from Contaminants	6.3
Color & Form	Black & Amorphous	6.4

6.6 Packaging

Incoming material shall be packaged in a screw-cap bottle sealed in zip-lock polyethylene bag contained within sealed plastic shipping container. Incoming material shall be kept in its original shipping containers until inspected and approved for production use.

6.7 Incoming Container Information

Incoming Shipping container shall be marked by the supplier with at least the following information:

a. Product Designation

b. Name of Material Producer or Supplier

c. Material Suppliers Lot No. (or)

d. Purchase Order Number

e. Date of Shipment

6.8 Safety and Material Handling Precautions

All operators shall comply with required rules and procedures specified in "Radiological Safety and Information Manual for the Salem Laboratory of EG&G, Inc., Electron Devices Group, Nov. 10, 1986", as applicable.

All personnel handling radioactive materials shall inform their supervisors immediately of any incidents which could cause excessive exposure to personnel. The applicable supervisor shall immediately inform Department Chemist and/or Radiological Officer of all such incidents.

All responsible supervisors shall insure that all personnel who have access to work with radioactive materials are properly oriented and cleared by Radiological Officer to work with radioactive materials.

6.9 Monitoring

All areas of storage, handling, working and disposal shall be monitored with proper radiation detection devices. Any areas with radiation levels above background levels shall be decontaminated. See SL3-04-066.

6.10 Evaluation

The permissible exposure guides set forth by appropriate Federal Agency will be utilized to control all exposures.

6.11 Storage

6.11.1 All incoming material shall be stored in its original shipping containers at room temperature in the approved "Radioactivity Storage Area" and all activities such as material storage, testing, sample selection etc. must be properly coordinated with the "Radioactivity Storage Area Attendant".

6.11.2 Each vial of material issued by "Radioactivity Storage Area Attendant" in its original plastic shipping container to Production Supervisor for production use shall be stored at all times in Radioactive Materials (Restricted) Storage Cabinet (Item 4.20) located in approved work area until required for application to ceramic devices.

6.11.3 When required for production, the sealed plastic container shall be opened and only the polyethylene bag containing the screw capped vial shall be transferred into the glove box. Retain original plastic container (store in RA Materials Cabinet) for later disposal of emptied vial.

6.11.4 After each production application, vial shall be capped securely, returned to its original polyethylene bag and stored inside the "Lead Pig" in the glove box.

6.11.5 In all cases, materials shall be stored in such a manner to minimize exposures to the surrounding area and the persons who are to work with the material.

6.12 Shelf Life

This material has unlimited shelf life as long as it is kept tightly sealed and properly stored to prevent contamination as described under Section 6.11.

1.0 PURPOSE

To describe the procedure for decontamination of parts which have been exposed to Radioactive Carbon 14.

2.0 SCOPE

This procedure applies to exteriors of parts, work area and equipment.

3.0 MATERIALS

3.1 Methanol, Reagent Grade or equivalent

3.2 Mild Detergent or Soap

4.0 EQUIPMENT

See SL3-04-062 - Utilize any equipment listed in Section 4.0.

5.0 PROCEDURE

5.1 Refer to "Radiological Safety and Information Manual for The Salem Laboratory of EG&G, Inc., Electron Devices Group, Nov. 10, 1986" for approved safety rules and regulations.

5.2 Operators must wear buttoned lab coat, particle mask, finger cots and/or vinyl gloves and film badges during decontamination of parts with exposed areas of applied ^{14}C.

5.3 Radiation Survey Meter will be kept on during entire decontamination process of parts and work area(s).

5.4 All sources creating movement of air such as air conditioners, fans, etc., must be turned off and windows closed during decontamination.

5.5 Cover working area with disposable paper wipers. Place foam wipers over the disposable paper wipers.

5.6 Label polyethylene bag for disposal of RA Waste Material. Attach RA material labels to bag. Open and place it over the bag holder. Put holder with bag onto a disposable surface next to decontamination work area.

5.7 Place a supply of foam wipers next to work area.

5.8 Put wash bottle filled with methanol in work area.

5.9 Move survey meter and/or pancake probe to the work area. Set meter onto scale that will read 2000 cpm. Place probe on a foam wiper adjacent to the work area. Position with its face perpendicular to the table.

5.10 Place Primary Carrier with labeled tray to receive decontaminated parts next to the survey meter.

FIGURE 8

5.11 Place additional foam wipers for the decontamination process on top of covered working area adjacent to parts. Wet (do not flood or soak) the top foam wiper with methanol from the wash bottle.

NOTE: Keep all parts on or over the protected, covered work surface area throughout decontamination.

5.12 Using finger cots, hold part securely. Rotate and rub bottom end of part on the wet foam wiper. Moving to a fresh, clean area of wet foam wiper each time, repeat rotating and rubbing three (3) times.

5.13 Repeat Step 5.12 for the other end of the part. Put part on a clean dry disposable surface.

5.14 Dispose of contaminated costs and gloves as follows:

5.14.1 Hold covered hand and fingers over the RA Material Waste bag.

5.14.2 Gently roll off cots and drop them into the bag.

5.14.3 Remove contaminated gloves by carefully turning them inside out while taking them off. Place glove(s) into waste bag.

5.15 With clean gloves and cots, pick up part by its cleaned ends. Rub the outer side wall surface across clean wet foam wiper areas. Rotate part to clean entire side wall surface three (3) times.

5.16 With clean cots, rub cleaned surface areas of decontaminated part. Monitor finger cots. If no radioactivity is detected upon monitoring of cots (no transferring of RA), pick up part by its ends to shield applied ^{14}C area from the detector. Monitor part. If reading is $\leq$ 2000 cpm, the approved level after decontamination, part may be placed onto labeled tray in Primary Carrier. If reading is >2000 cpm, repeat complete decontamination process until approved RA level of $\leq$ 2000 cpm is attained.

5.17 Continue to decontaminate each part as above until entire batch meets approved level.

5.18 Dispose of contaminated foam wipers by gently folding with contaminated surface on the inside and placing them into RA waste bag. Replace wipers, gloves and finger cots as they are needed.

5.19 When the batch has been completely decontaminated, handle parts per "Standard Practice for Transporting" (See SL3-04-062, Section 5.1.11). Be sure outer polyethylene bag has no contamination. Move Carrier Kit out of

the way.

5.20 Put all used disposable materials into RA Waste Bag.

5.21 Monitor the work area and all equipment used.

5.22 Record radiation readings on record sheet.

5.23 Decontaminate every place and everything that has a radiation reading above the background level.

5.23.1 Use Radia-wash towelettes and disposable wet paper or foam wipers (wet with methanol, detergent, soap or water).

5.23.2 Wipe carefully but firmly.

5.23.3 Fold used wiping materials so that used surface is on inside. Put all used material into RA Waste Bag.

5.23.4 Change to new wipers frequently to avoid spreading any contamination.

5.23.5 Use methanol or water when wetting for the final wiping.

5.24 Remonitor the decontaminated areas and equipment.

5.24.1 If readings are $\leq$ background, record readings.

5.24.2 If readings are > background, repeat decontamination until background level is reached.

5.25 Monitor and record readings for personal apparel.

5.25.1 Put disposables into RA Waste Bag. Mark records.

5.25.2 If lab coat is uncontaminated, it may be retained for future use.

5.26 Monitor unprotected hands, fingers, face, hair, etc. Record RA readings.

5.26.1 If readings show any contamination, thoroughly wash with soap and water per "Radiological Safety Manual". Remonitor.

5.26.2 If no contamination shown - wash thoroughly anyways.

5.26.3 Record all readings on record sheet.

5.27 Gently remove any excess air from RA Waste Bag. Close/tie bag securely.

5.28 Gently place sealed, labeled RA Waste Bag into Radioactive Waste Material Storage Drum (Item 4.22) which is in the Limited Access ^{14}C Application/Storage Room. Replace drum cover and monitoring film badge. If inner plastic bag with waste has been removed for disposal, replace plastic bag before using drum.

5.29 Have ^{14}C room checked/monitored by Radiological Officer or his representative before room is used again.

1.0 PURPOSE

To establish a procedure for the handling and packing of Krytrons, Sprytrons and/or other applicable Glass or Ceramic envelope devices prior to shipment.

2.0 SCOPE

This procedure shall apply to the aforementioned devices manufactured at Salem Lab.

3.0 MATERIAL

3.1 Clear Plastic Box, SL5-01-041 or SL5-01-044 or other box more suitable to physical dimensions of the device being packaged. See SL1-Type-01.

3.2 Foam Pads, SL5-01-042 or SL5-01-045 or SL5-01-046 or other pads to suit device and box. See SL1-Type-01.

3.3 Label, SL5-01-043 or SL5-01-060.

3.4 Detail Packing List Form, EG&G Form # U-228.

3.5 Black Ballpoint Pen and Scotch Tape.

3.6 RA Label (if applicable), SL5-01-047 or SL5-01-048.

3.7 High Reliability Label, SL5-01-049.

4.0 PROCEDURE

4.1 Devices presented for packaging shall have been branded and inspected.

4.2 Quality Control shall supply packing personnel with detailed packing list forms on which the serial numbers shall be listed as they are packaged.

4.3 The packer will record the individual device serial no. on the detailed packing list and will give special attention to overall appearance of the device. Detail of Packing List to be completed per each lot of devices shipped.

4.4 Each device, in numerical order, shall be placed in it's own padded plastic box per SL5-02-017, PP-017, Figure 1 (Sprytron) or Figure 2 (Cap) or Figure 3 (Cap).

4.5 When all devices are packed per steps 1 thru 4 above, Quality Control will cross reference the completed detailed

packing list against the Q.C. serial number list to ascertain that all the proper devices have been packed.

4.6 The boxes will then be fastened with scotch brand tape.

4.7 The labels will then be affixed to the top of the plastic boxes and the detail information filled in per SL5-02-017, PP-017 Figure 1A (Sprytron) or Figure 2A (Gap) or Figure 3A (Gap).

4.8 The specified RA label shall be affixed to the center label as shown in Figure 2A or Figure 3A.

4.9 The filled and completed boxes will then be placed in an appropriate sized, approved outer shipping carton. The individual detailed packing lists will be folded and packed in their respective boxes. The boxes will be sealed and readied for mailing.

EG&G

ELECTRONIC PRODUCTS DIVISION

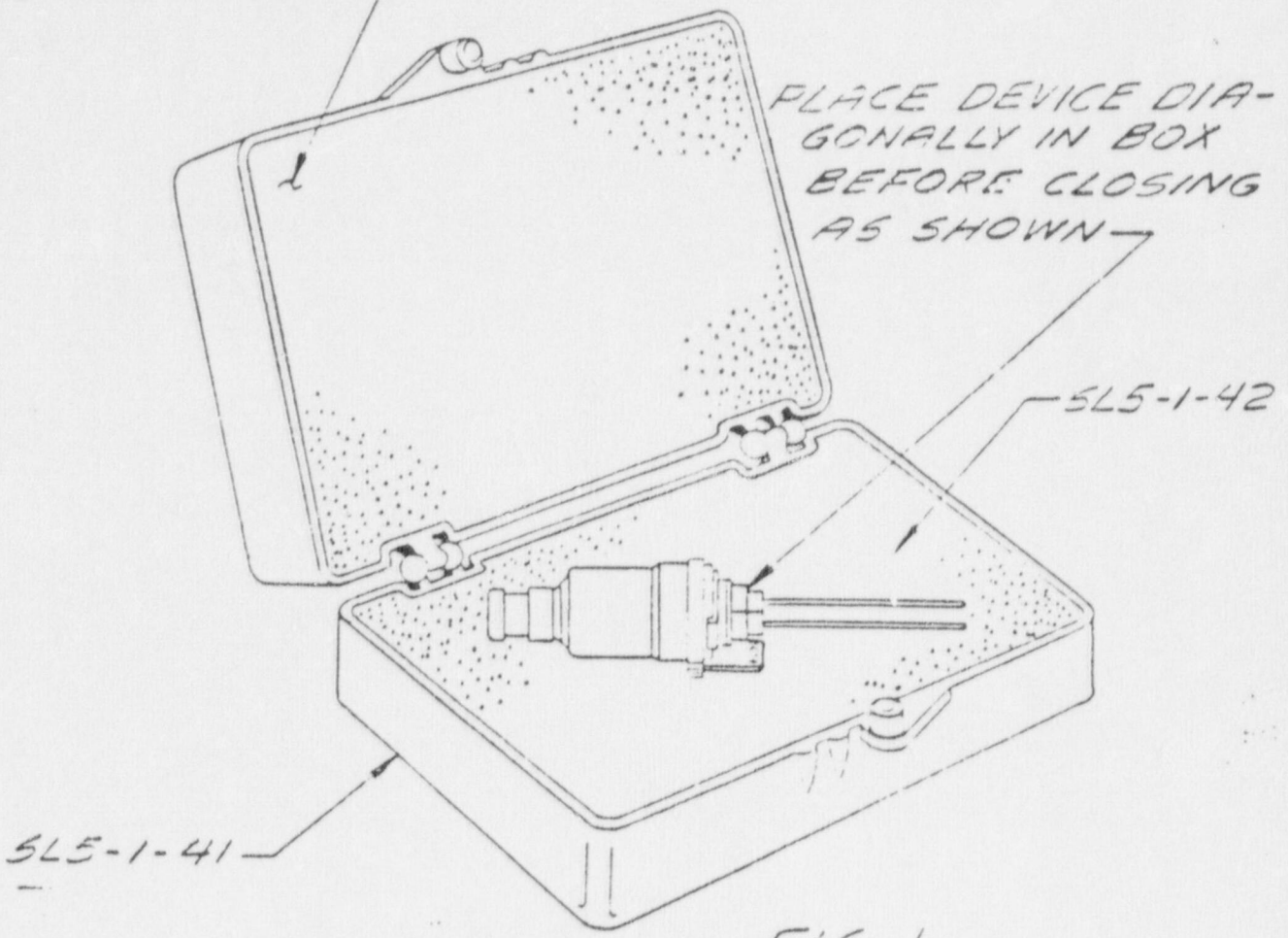

FIG. 1

PACKAGING SPECIFICATION				TITLE	Packing Procedure						CODE IDENT NO. 25506	SPEC. NO.	SL5-2-17
				PRODUCT	LMSC Devices							PART NO.	PP-17
RDC #												DATE	
INIT												SHEET	5 OF 5

SL58 B

EG&G
ELECTRONIC PRODUCTS DIVISION

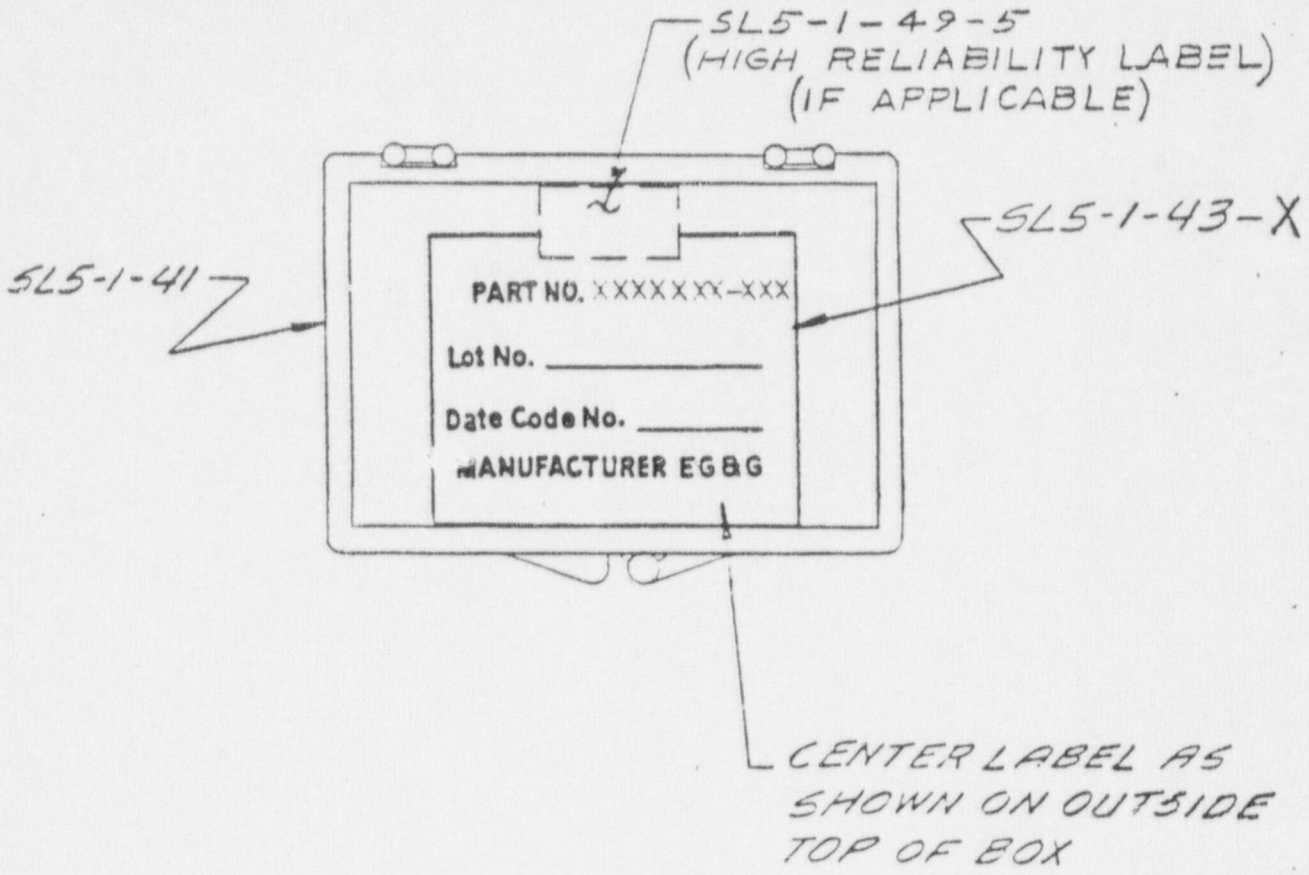

FIG. 1A

PACKAGING SPECIFICATION				TITLE	Packing Procedure						CODE IDENT NO. 25506	SPEC. NO.	SL5-2-17
				PRODUCT	LMSC-Devices							PART NO.	PP-17
RDC #	P29	5213	5365	5193								DATE	10-27-83
INIT	PA.	AT.	PJG	VHM								SHEET	4 OF 8

BRUNING 40-135 35608

SL5B R-1-

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ELECTRONIC PRODUCTS DIVISION

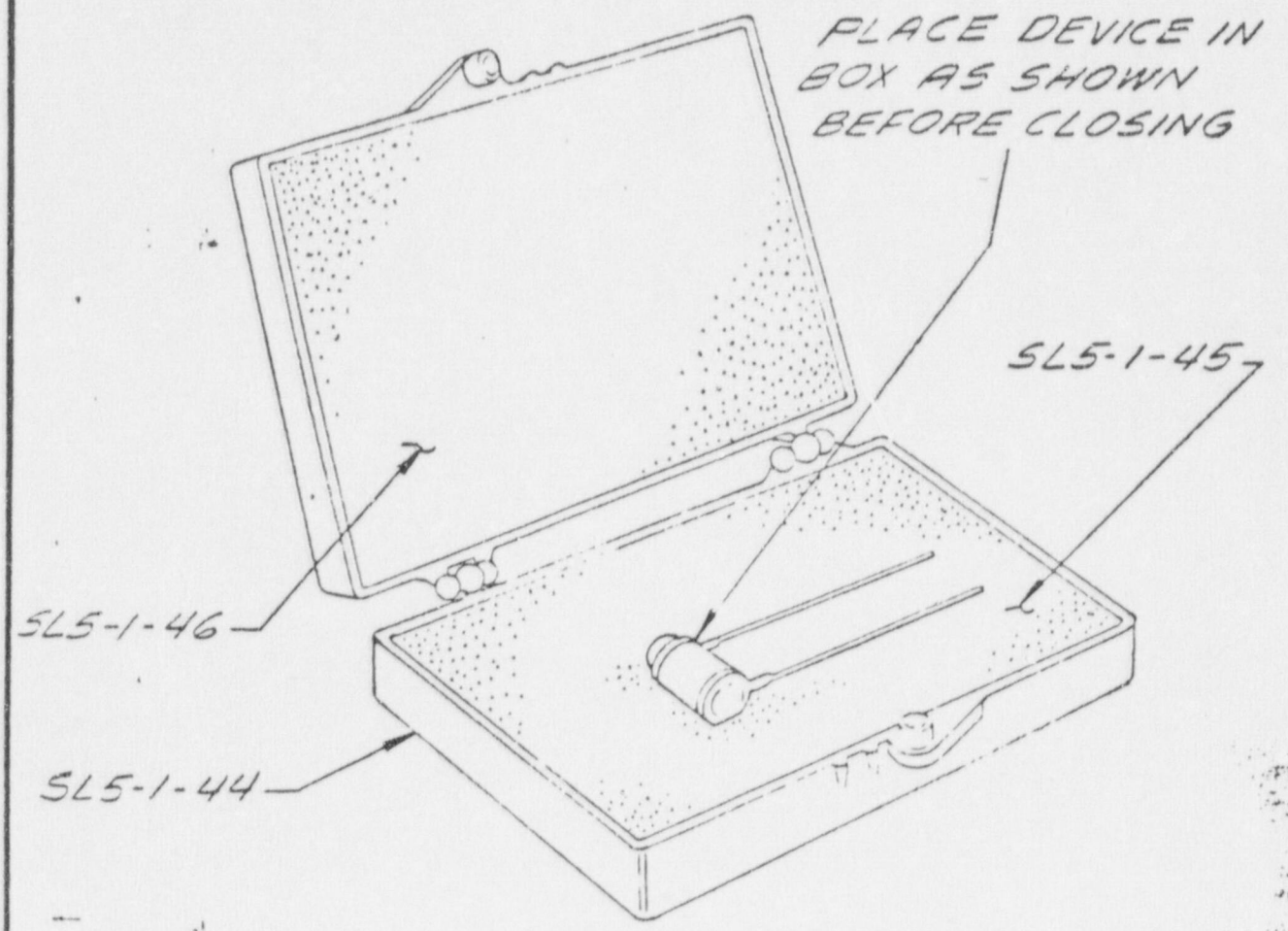

FIG. 2

PACKAGING SPECIFICATION					TITLE	Packing Procedure						CODE IDENT NO. 25506	SPEC. NO.	SL5-2-17
					PRODUCT	LMSC Devices							PART NO.	PP-17
RDC #	Q39	D213	5425	743									DATE	10-27-83
INIT	[illegible]	[illegible]	[illegible]	[illegible]									SHEET	5 OF 5

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SL56 B

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ELECTRONIC PRODUCTS DIVISION

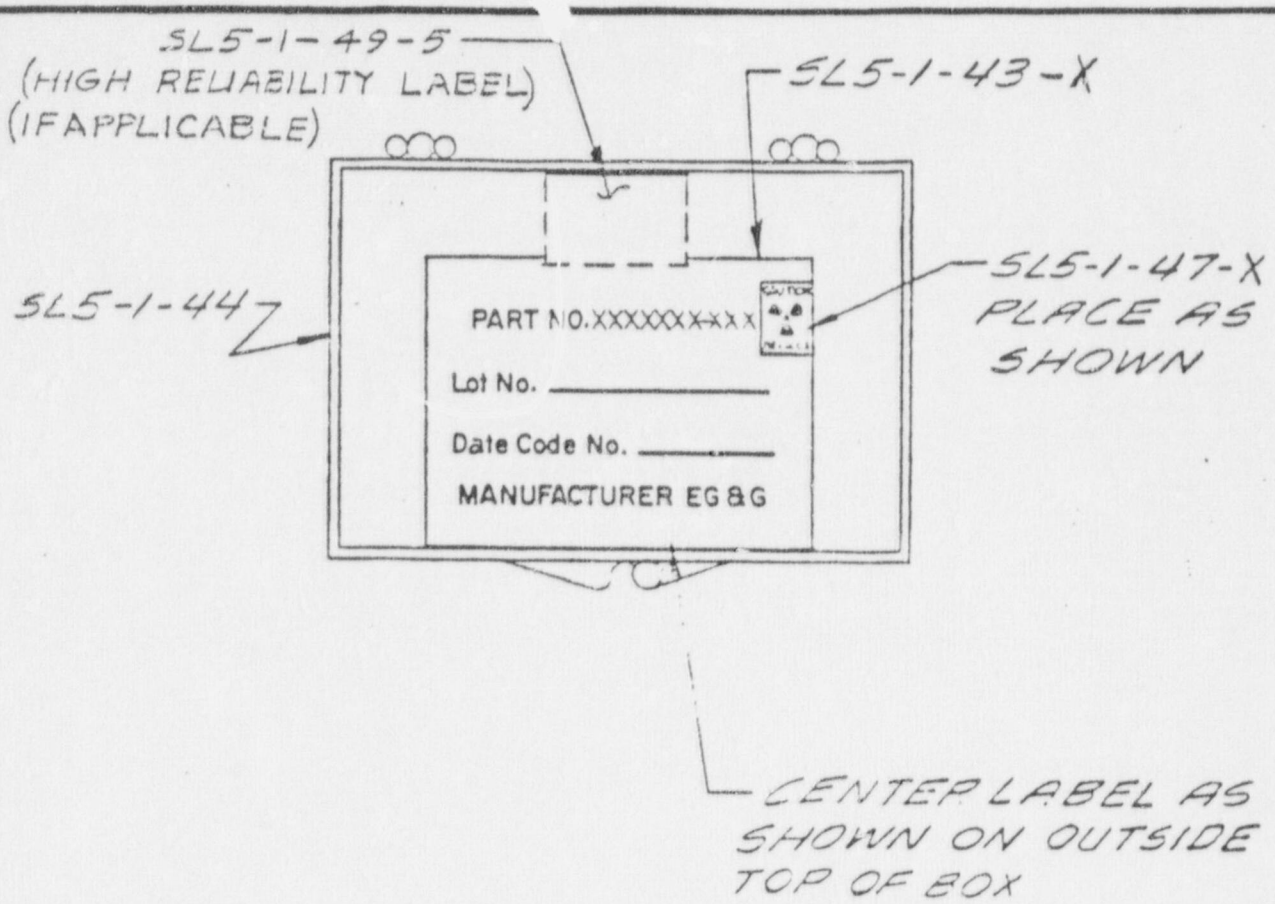

FIG. 2A

PACKAGING SPECIFICATION					TITLE	Packing Procedure						CODE IDENT NO. 25508	SPEC. NO.	SL5-2-17
					PRODUCT	LMOS Devices							PART NO.	PP-17
RDC #	439	0213	505	723									DATE	10-27-83
INIT	[illegible]	[illegible]	[illegible]	[illegible]									SHEET	6 OF 8

BRUNING 40 135 35608

SL58 B

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ELECTRONIC COMPONENTS DIVISION

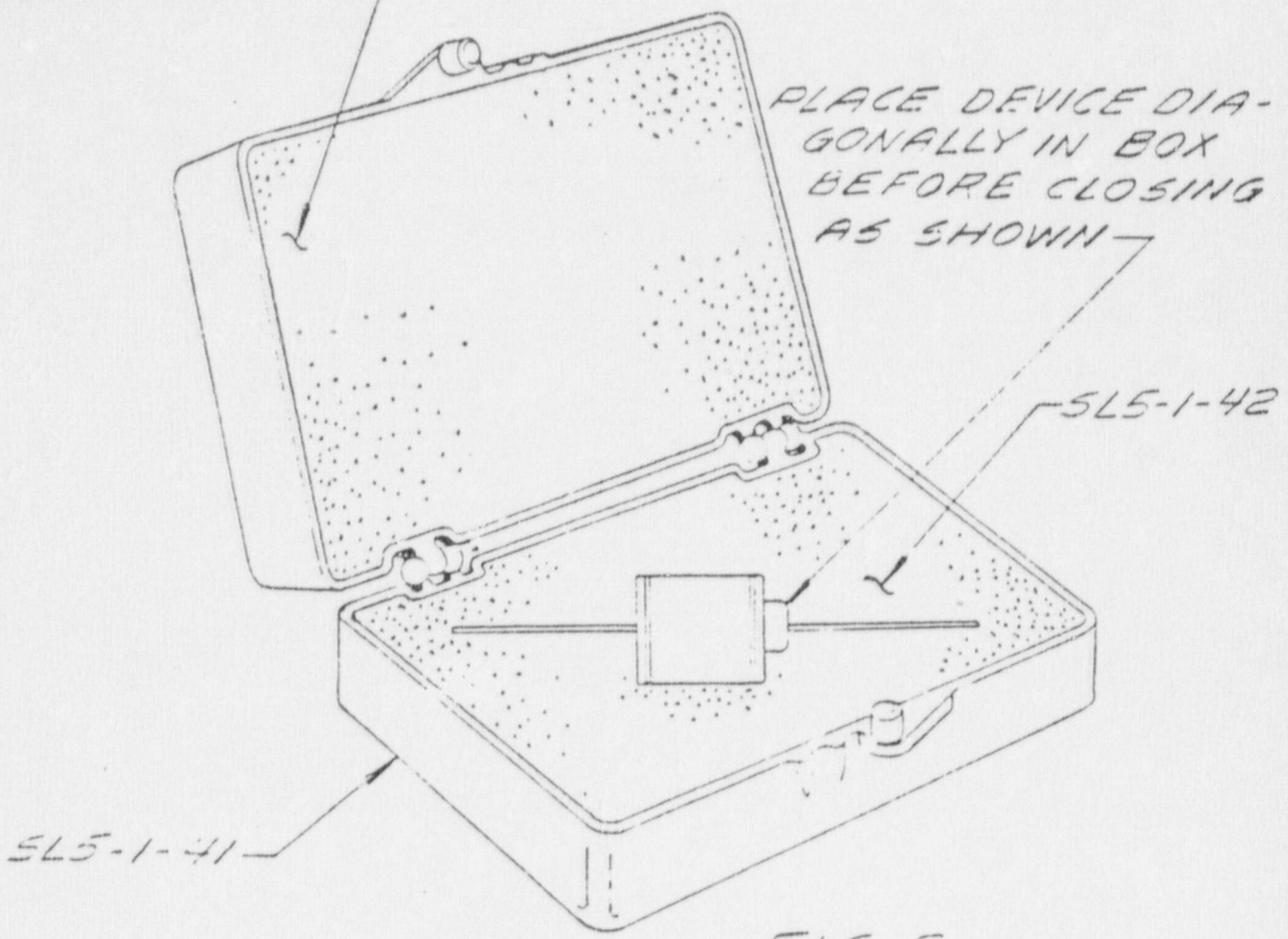

FIG. 3

PACKAGING SPECIFICATION				TITLE	Packing Procedure						CODE IDENT NO. 25508	SPEC. NO.	SL5-2-17						
				PRODUCT	LMSC Devices							PART NO.	PP-17						
RDC #												DATE							
INIT												SHEET	OF						

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ELECTRONIC COMPONENTS DIVISION

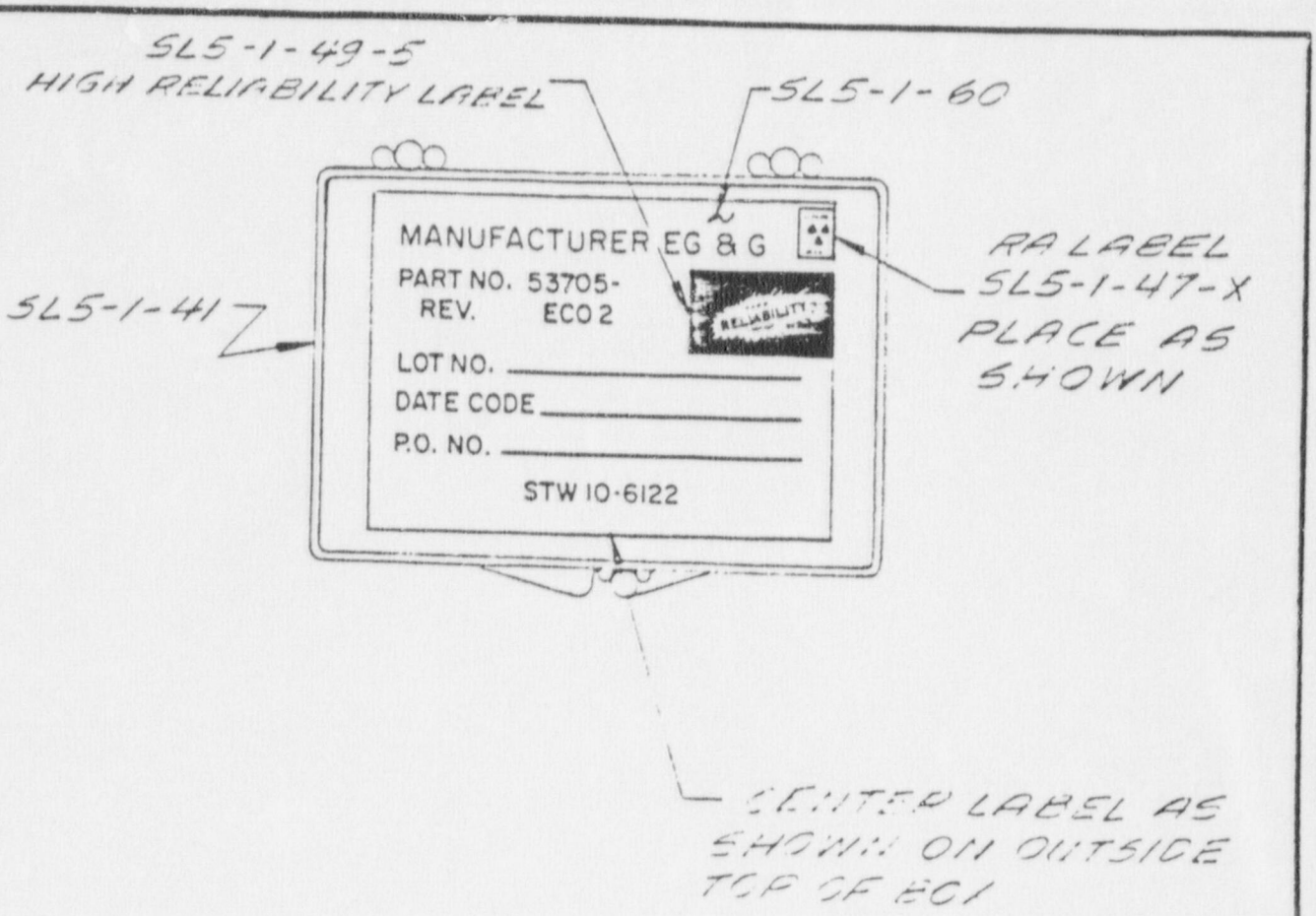

FIG. 3A

PACKAGING SPECIFICATION				TITLE	Packing Procedure							CODE IDENT NO. 25506	SPEC. NO.	SL5-2-17
				PRODUCT	LMSC Devices								PART NO.	PP-17
RDC #													DATE	
INIT													SHEET	OF

BRUNING 40 135 35608 3

1.0 PURPOSE

This procedure describes the processing of vacuum devices during exhaust and pinchoff.

2.0 SCOPE

This procedure covers all vacuum processing of tubes on exhaust units such as #12 which are equipped with pump bakeout heaters, bakeout control, etc. [It also applies to systems such as 13,14, and 15, which are also equipped for back-filling. When back fill equipped units are used for non-back fill applications, the all metal valve to the fill manifold is closed.] The sequence assumes a start with the system under vacuum with the previous batch of tubes having been tipped off. The exhaust procedure, SL1-Type-8, for the tube type being exhausted shall be reviewed for any special instructions prior to mounting tubes on the exhaust unit.

3.0 PROCEDURE

3.1 Breaking the system to nitrogen

If pump down is to be started within the next several hours, chill the sorption pump. Put Dewar in place, fill with liquid nitrogen, refill occasionally during the steps described below. (See Figure 1)

3.1.1 Close main valve. Shut off DIG (Digital Ion Gauge) and RGA.

3.1.2 Make sure nitrogen valves are open. Set at approximately 1 PSI (gauge).

3.1.3 Open 1/2" valve partially.

3.1.4 Open 1-1/2" valve to dry vane pump, slowly, slightly. Check that gauge of dry vane pump goes positive (CCW). This insures that positive nitrogen pressure is present.

3.1.5 Close 1-1/2" dry vane valve.

3.1.6 Close 1/2" valve, open 2 turns. Open all metal valve 1 turn or until audible flow occurs. Watch N_2 gauge. Indicated pressure should drop to zero with flow then come back to 1 PSI to be sure that system is at slight overpressure.

3.1.7 Open 1-1/2" dry vane valve slightly, gauge on dry vane pump should indicate positive pressure (CCW motion). Close dry vane valve.

3.1.8 Open all metal valve all the way (just until threads of stem are visible).

3.1.9 Remove stubs by removing clamping nut (1 wrench on body, 1 on nut) and

FIGURE 10

rocking gently. Nitrogen should blow out. Adjust N_2 flow with 1/2" valve. (If air should suck in, instead of N_2 blowing out, note on processing sheet of next batch, notify engineering, and continue with N_2 adjusted to flow out).

3.2 Mounting Tubes

In opening up the ports caution must be exercised in order to avoid overstressing the manifold joints. Open the port with one wrench on the body of the compression port and one wrench on the nut. Loosen the nut smoothly, without jerking. Rock the stub of tubing gently to break it free. In removing collet it is necessary to grasp the collet on the cylindrical section to pull it off. Open up no more than 6 ports at one time. Apply a small dab of Milk of Magnesia (Phillips, unflavored) to the male threads at each use. Wire brush male and female threads as necessary [CAUTION: Use dustmask and safety eyeware].

3.2.1 In assembling the tube with its length of 3/8" tubing on the manifold care must be taken to see that no foreign matter enters the tube. Don't touch the open end of the tube or the open port on the manifold except with cotton or plastic gloves. Do not invert the tube so that foreign matter could fall into the tube. Assemble the nut, clamping ring and collet onto the tubing. Some force may be required to push the collet onto the tubing. The use of a clean stainless steel rod having an end diameter of 27/64" with slight bevel (45^{o} x .010") is advisable to spread the collet slightly to aid in getting the collet onto the tubing.

3.2.2 Bring each tube to the manifold and assemble tubing to seal surface observing trigger lead alignment with respect to manifold (SL6-02-063, Figure 7), so that end of tubing and collet are flush with top surface of body. Slight force may be required to force tubing over the sealing edges. This can indicate improper size or bevel of the I.D. of the tubing and although usable should be brought to the supervisor's attention for possible corrective action on following batches of tubes.

Slide clamping ring in place and hand tighten nut.

Tightening to seal: With one wrench on body and torque wrench on nut tighten smoothly to 10 ft-lbs (120 in-lbs).

As the last tube is pressed onto compression port shut off 1/2" nitrogen feed valve.

3.3 Pump Down

3.3.1 Make sure all compression seals are tightened and all ports filled.

3.3.2 Sorption pump should have been pre-chilled a minimum of 15 minutes.

3.3.3 Check: 1/2" valve tight, closed, all metal valve open.

3.3.4 Start dry vane pump. Open 1-1/2" valve 5 or 6 turns. Watch gauge, when it shows approximately 28 lbs vacuum or stops improving, close 1-1/2" dry vane valve and then switch off pump. Dry vane pump is intended for intermittent use only and should not be operated for more than 2 minutes at a time.

3.3.5 Switch TC gauge on. Open 1-1/2" valve to pre- chilled sorption pump. When pressure as indicated on TC gauge drops below 10u switch on DIG (Digital Ion Gauge) on .01 scale. Push red "filament" button to start (I/T button on DIG III). When DIG reading drops below 1×10^{-3} TORR close sorption pump valve. If pressure rises to 2×10^{-3} in less than 1 minute reopen sorption pump valve and leak check with helium using a plastic tube which fits over the tube and fittings down to the manifold. Repair any leaks, noting on the exhaust form. If pressure does not rise to 2×10^{-3} in 1 minute, leave sorption pump valve closed, throw switch on ion pump control to "start" and open main poppet valve slowly to a full open position. Close 1-1/2" all metal valve tight with wrench. When pressure drops into the 10^{-6} TORR range switch DIG II emission to .1 and ion pump control to "protect", switch TC off. On units equipped with Residual Gas Analyzer (RGA) turn RGA on, set "multiplier" on,"manual" on, set to monitor helium (4amu). Use this manual/ helium setting for all leak checking described below. Turn titanium sublimation pump "on" with timer set on 100% and current on 45 amps for 10 minutes then switch sub. pump to 40%. Leak check with helium. If pressure doesn't drop to below 1×10^{-7} TORR leak check further to find leak. Do not proceed with bake out until pressure is below 1×10^{-7}. Turn "on" 6 channel recorder when DIG is turned on. Switch 3 compensators on. If tubes are to be baked then leave on until specification indicates they should be turned off. If tubes are going to

be baked the next day, leave recorder, titanium sublimation pump and compensators on for only 1/2 hour then turn them on again the next morning. Set RGA to monitor as directed by SL1-Type-8. Turn RGA on. Operate per manufacturer's instruction. During bake monitor a single species of gas as directed by tube engineering.

3.4 Bake Out

Purpose: To heat the tubes to an extreme temperature to remove traces of gas which might otherwise release into the tube after tip off. To heat manifold and pump to aid in achieving the desired ultimate pressure at pinch- off. To control heating during the bakeout cycle in order to keep manifold pressure below a limit.

3.4.1 Place monitor thermocouples at left most and right most tubes on the manifold. Tip of 1/16" dia. thermocouple will be at height of midpoint of tube and will not touch tube. Wire into place at extension tube. Place so that they will not interfere with assembly of table. (See Figure 2).

3.4.2 Assemble the inner table with care that gaps in insulation are minimal. Cover all front-to-back joints with thin mineral board or equivalent. Lower oven, checking clearance. (See Figure 1A)

3.4.3 Turn the sublimation pump "ON" with timer set at 40% and current set at 45 amps on the lowest (A,B, or C) of the filaments available and working well (or Ti ball if Ti ball is used).

NOTE: When the last filament only is in working order the next available free time on the unit should be used to install three new filaments.

3.4.4 Check that programmer is set properly for starting. The program corresponding to the bakeout conditions required should be selected using the prog sel button found on the Honeywell DCP. Once a program is chosen it should be verified to see that it corresponds to the same program listed in table 1. temperature soak set points (labeled with * in table) must be consistent with the current calibration sticker affixed to the unit.

Prior to starting the bakeout cycle, check to see that the ready light on the DCP is lit, and that the display on the micromaster reads Reset. Confirm that DIG set points A and B (1 AND 2 on DIG III model) correspond to the set points listed in table 2.

Turn the oven heater circuit breaker on.

At the beginning of the oven bake the manometer head temperature controller should be set to 150°C. At the end of the bake the head temperature controller should be turned back to 50°C. After the tubes are pinched off the heater should be turned off. If there are two heads both should be heated according to above schedule.

3.4.5 Monitoring the 6 channel recorder output.

During the bake cycle it is important for the operator to be alert to signs of process irregularities. Described here is the normal appearance of the 6 channel recorder output and some possible problems.

Pre Bake Cycle: the three thermocouple channels should be lying together about one minor division above zero. The ion pump current channel and the DIG channel will be lying roughly between 20 and 50% of full scale. The RGA channel should be marking on the chart at a level consistent with the output reading on the right hand RGA meter (for instance a reading of 6.21 on this meter should be matched by a chart reading of between 60 and 65% of full scale.)

Beginning of bake cycle: Oscillations in temperature may occur initially but should have settled out by the time the recorded signal passes 8 small divisions above zero (approximately 200°C). The manifold thermocouple channel should remain at approximately 1 small division above zero, only drifting towards 1-1/2 small divisions after 10-15 minutes. DIG and RGA channels may show rise in levels at this stage in the cycle. Ion pump channel will not.

Set point 150°C, manifold heaters on: the cycle is now entering a phase where pressure control is evident. The 2 channels indicating oven temperature which would be rising in a straight line up until this time would show some slower rising or even flat portions of their curves from now until the bakeout temperature is reached. Manifold temperature will climb in several steps. DIG levels will oscillate, overshooting once or twice and then cycling with a max below 5×10^{-7} TORR. If RGA reading goes off scale, change scale on the RGA instrument to bring the reading back on scale, mark the chart. Ion pump current is generally stable.

Bakeout portion of cycle: oven thermocouple channels should remain essentially constant at a level indicated by the calibration of the instrument. Manifold temperature will be higher than 150°c due to heat escaping from the oven. this will cause the DIG signal to oscillate with manifold temperature. The RGA will generally show a slight amount of oscillation with manifold temperature. Ion pump current is relatively unstable but the average level is fairly constant.

Common signs of trouble and action recommended.

a) 2 thermocouples measuring oven temperature should not differ by more than 1 minor division. If they do it is necessary to correct the problem, probably improper placement of thermocouples.

b) In the case where one channel is unexpectedly seen to follow closely the channel before it in the 1-2-3-4-5-6 printing sequence it is likely that the oddly acting channel has developed an open circuit. Contact engineering to correct.

If an accelerated cool down is to be attempted in order to pinch tubes off the same day leave the sublimation pump on. Turn the oven heater circuit breaker off. Raise the oven 2". When the temperature on the recorder indicates that the oven temperature has dropped to below 400°C raise the oven to 3". Below 300°C the oven may be fully raised and the inner table removed. After 15 minutes cooling bring into use any auxiliary fans available to cool tubes and manifold.

3.4.6 When the manifold is cool to the touch (or the next morning if overnight cooling is used) add liquid nitrogen to the liquid nitrogen reservoir with manifold pressure in the 10^{-10} TORR range leak check with helium. Leak check by bringing a suitable container (e.g. plastic bell) into which helium is fed at a just perceptible rate, over each tube, compression seal and mini-conflat joint (on old style manifolds), for several seconds. Residual gas analyzer should be set at 4 AMU and switched to a most sensitive usable scale. An observer watches the RGA meter for changes. See section 3.6 for action to take in the case where a leak is found.

3.5 Pinch-off

3.5.1 Tubes are ready for pinch off if the manifold pressure is below 1×10^{-9}

TORR. In addition, if the pressure is below 1×10^{-9} TORR but not as good as has been experienced, contact engineering for clearance to tip off.

The tubes are prepared for pinch-off by brushing the small pinch off tubing clean of thick oxides with a suitable manual or driven brush. Tubes are pinched off with the manual pinch off tool or with the hydraulic tool per SL6-04-087, using castor oil lubricant on the pinch off rollers before each tube is pinched. Care must be exercised that the pinch offs are not damaged as they are particularly vulnerable until tinned. Recheck the manifold pressure between pinches to be sure that a leak has neither been added to the system nor pinched off in the form of a leaky tube. Check the vacuum recorder chart with this in mind and note on the chart, beginning and end of "pinch off". After pinching off all tubes in a batch, leak check the stubs remaining on the manifold. Experience shows that if one of the stubs should exhibit a leaky pinch off it's tube will exhibit a leaky pinch off. Save stubs for examination by operator as to visible internal contamination. If found contact type engineer and note on batch record.

Turn off 6 channel recorder and all 3 compensators.

If a leak should develop act as directed in Section 3.6.

3.5.2 Complete records and forward tubes for further processing. Pump is now in proper standby condition.

3.6 Leaks

3.6.1 In the event of substantial leaks at any stage quick action is necessary to procect the tubes and pump from damage. Damage to the tubes can only occur while they are hot or, less dangerous, after they are baked out. Damage to the pump can occur if ion pump current rises above 20ma or pressure remains in the 10^{-4} TORR range for long periods of time. In the absence of a leak, ion pump current during processing might rise to 10ma then drop as bakeout progresses. In the absence of a leak, manifold pressure rises in response to increased temperature in the oven or at the manifold within 3 or 4 minutes of the increase. Climbs without increased heating are to be regarded with suspicion. Proper operator reaction to discovery or suspicion of a leak depends on the condition of the system at that time and the rate of leakage.

3.6.2 In the event of a catastrophic leak (perhaps from breaking of a tube) such that the ion pump shuts itself off, if the tubes are cold, shut off all pumps and DIG and liquid nitrogen, if in use, close the main valve as quickly as possible (assuming pump is not baking out), pinch off the leaking device then contact engineering for restart of pump. Tubes, if not baked out are unaffected by having gone to air.

3.6.3 If tubes had been baked out and cooled, after pump is protected, leak is found and eliminated and pump restarted. A full 2 hours bakeout is required (2 hours at temperature). Contact enginereering before restarting bakeout. A small leak found in tubes after bakeout will only need elimination of the leak and full rebaking for 2 hours.

3.7 Record Keeping

The 6 channel chart with annotations will serve as the exhaust record. (See Figure 5). Mark each channel with the variable being monitored. In the case of the RGA channel note the atomic weight and name of the species being watched and the scale being used. Attach a scale as shown in Figure 6 to the original so that all copies include a scale.

Mark chart with type, lot no., batch no. and date. Also add any information concerning exhaust which might have been out of the ordinary. Forward this chart to the type engineer on completion of the exhaust process. The exhaust information sheet provided with the tubes should also be filled out and forwarded.

3.8 Special Recovery Procedure

In some cases when the main valve is closed and nitrogen is admitted to the manifold, enough leakage will occur at the main valve to cause the "Protect" circuit to shut off the ion pump. Do not restart this pump with the "Protect" switch thrown to the "start" position at this time.

Do complete the mounting of fresh tubes on the manifold and continue with the first parts of the pump down of the manifold as normally done per section 3.3. When the sorb pump is pumping and the TC gauge passes the 100u mark, open the main valve, throw the "start" switch "on" then reset the "overload" button. Then proceed as normally.

3.9 RGA Procedures

Where exhaust units are equipped with residual gas analyzers the type specification should specify what pictures should be taken. Unless otherwise directed by the type specification the procedure of SL6-02-012 to monitor the condition of the system after bakeout shall be followed. Whenever the RGA system may be used at low pressures, it is necessary that it be outgassed by running it on "Multiplier" or "Faraday Cup" during the entire bakeout.

For operation of the RGA with the system refer to the manufacturers operating manuals and the block diagrams attached to this specification.

3.10 Maintenance

3.10.1 Sublimation pump filaments (See paragraph 3.4.3) as necessary.

3.10.2 Pump Bakeout: At intervals of 2 weeks or after processing 5 or more batches on the system, whichever is longer, the pump shall be baked out to insure optimum performance. Without tubes on the system, select and verify DCP program #6. Start program. Manifold and pump temperature will be under control of pressure controller and thermostat mounted on manifold. Sublimation pump "ON", 40%, 45 amps. Main valve wide open and must remain open until pump is cool to prevent o-ring from deforming or sticking to seat. Bake out may be performed more often if desired.

3.10.3 Bake out sorption pump for 2 hours or more once a week when in use.

3.10.4 Experience and the results of monitoring the system per SL6-02-012 will dictate how often the following maintenance procedures are required, to be performed per manufacturers instructions.

1) Change main seal o-ring.
2) Mechanically and chemically clean main pump chamber and pump elements.
3) Clean dry vane pump with solvent.
4) Change sorption pump fill.
5) Change sorption pump, check valve sleeve.
6) Change o-ring and/or sealing gaskets of valves in roughing manifold.
7) Lubricate threads of all metal valve(s).
8) Disassemble and rebuild all metal valve(s).

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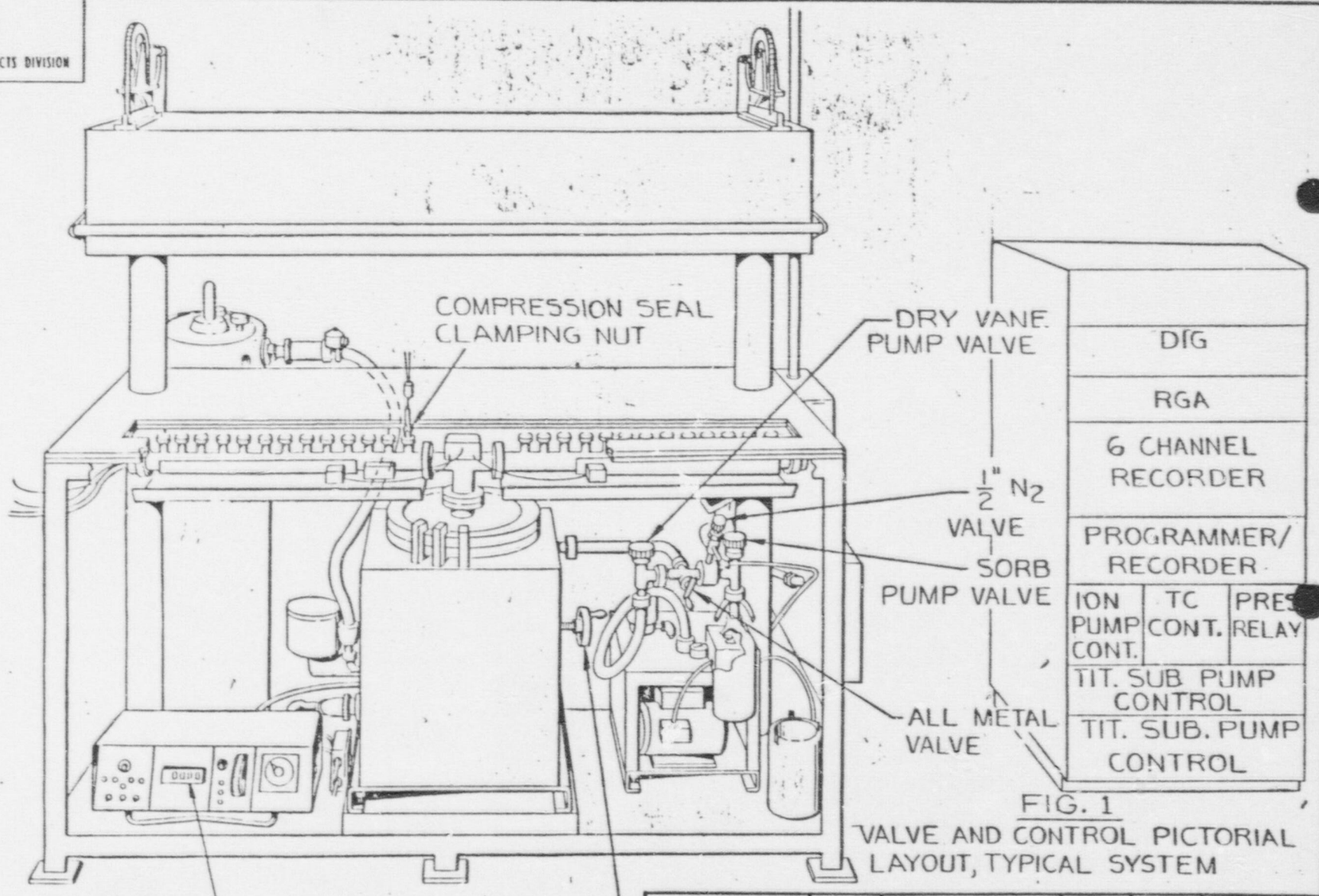

FIG. 1
VALVE AND CONTROL PICTORIAL LAYOUT, TYPICAL SYSTEM

STD. PRACTICE SPECIFICATION				TITLE PRODUCT		Exhaust Procedure Ceramic Tubes						CODE IDENT NO. 25506	SPEC. NO.	SL6-2-63			
RDC#	W 307	Y 507	153	C 193	D 174	C 168	Y 156	T 327	L 181				PART NO.	SP-VS03			
INIT	[illegible]	[illegible]	2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	MCB				DATE	5-28-87			
													SHEET	10 OF 50			

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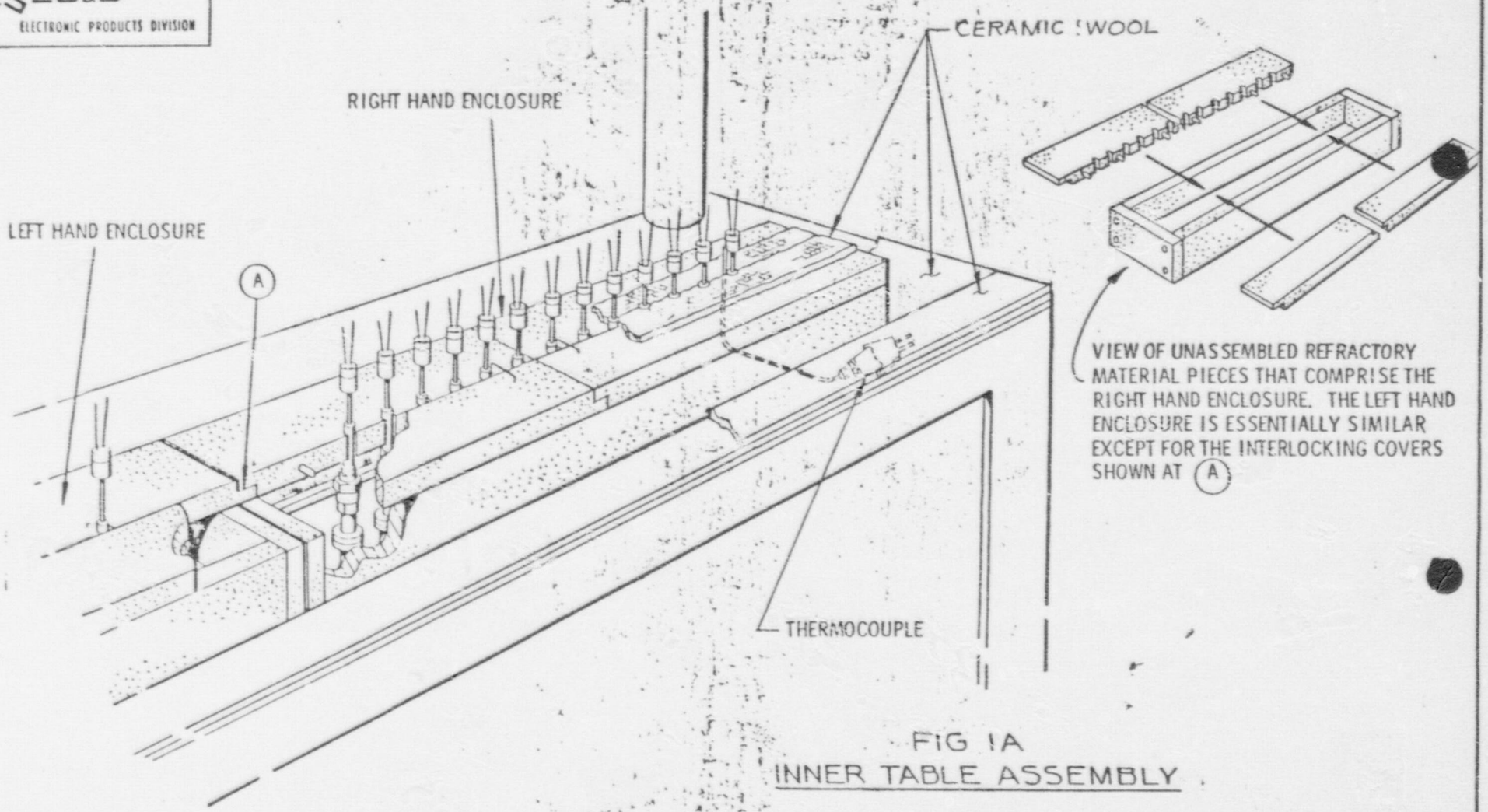

FIG 1A
INNER TABLE ASSEMBLY

STD. PRACTICE SPECIFICATION				TITLE	Exhaust Procedure					CODE IDENT NO. 25506	SPEC. NO.	SL6-2-63
				PRODUCT	Ceramic Tubes						PART NO.	SP-VS63
RDC #	307	507	123	159	174	168	256	327	481		DATE	5-28-87
INIT	JWP	JWP	JWP	JWP	JWP	JWP	JWP	JWP	MCC		SHEET	11 OF 30

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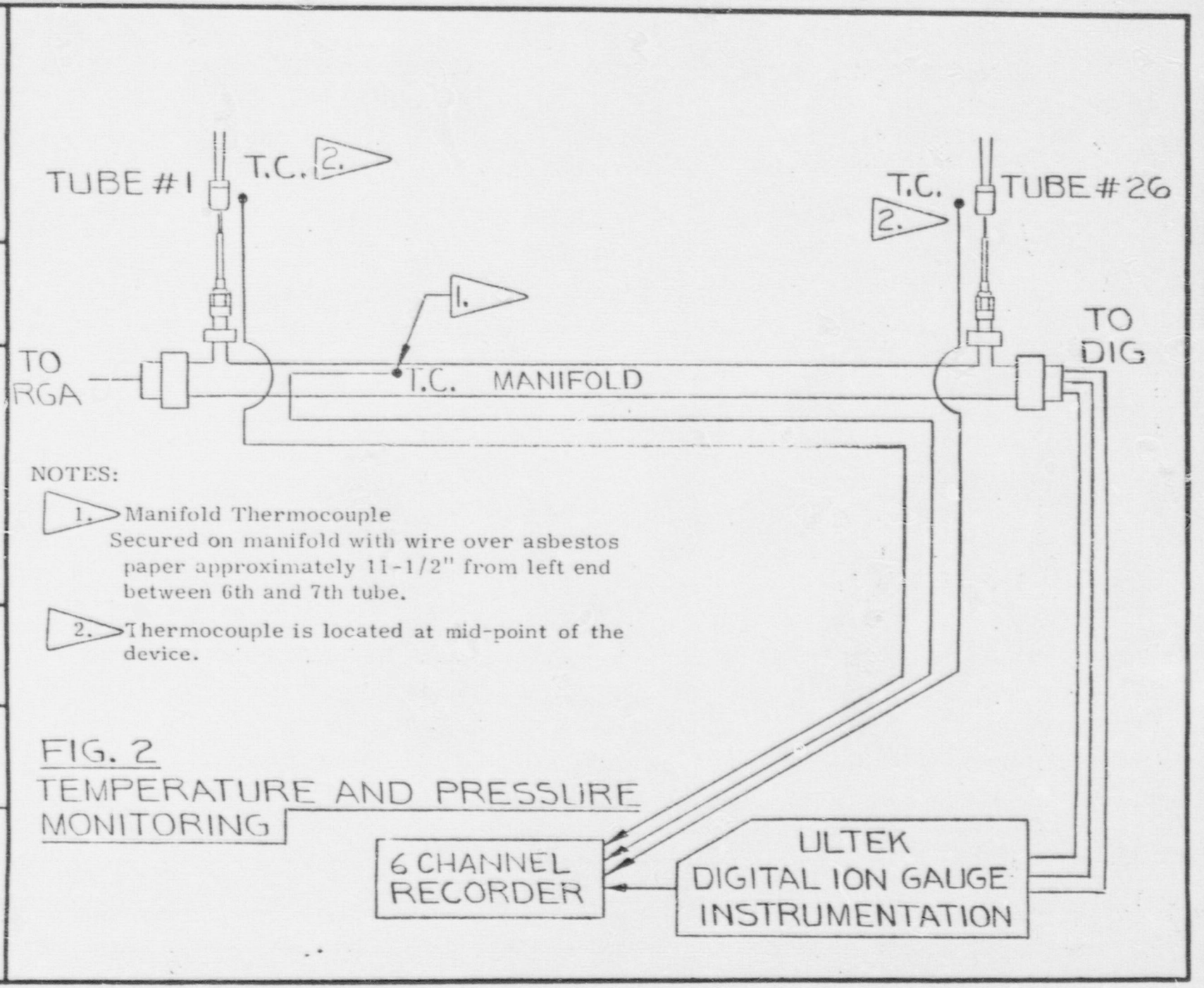

FIG. 2
TEMPERATURE AND PRESSURE
MONITORING

INIT										
RDC #										
STD. PRACTICE										
SPECIFICATION										
TITLE	Exhaust Procedure									
PRODUCT	Ceramic Tubes									
CODE IDENT NO. 25506										
SPEC. NO.	SL6-2-63									
PART NO.	SP-VS63									
DATE										
SHEET	OF									

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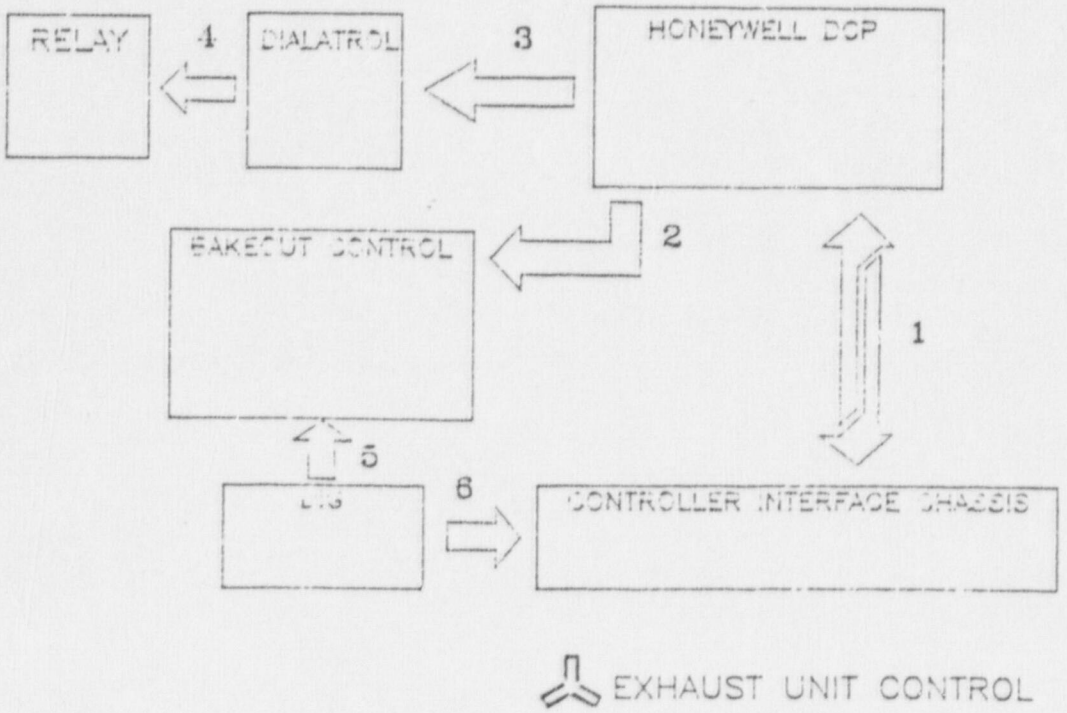

FIGURE 4 - CONTROL DIAGRAM

EXHAUST UNIT CONTROL DESCRIPTION

1 Provides on demand pressure limiting control for bake cycles and aborts any bake cycle if the pressure exceeds a maximum set point. When activated by TEV#1 the controller interface chassis monitors the DIG set points. If the high limit set point is exceeded the MICROMASTER holds the DCP (equiv. to depressing HOLD) until the pressure drops below the high set point. At the end of the bake cycle the MICROMASTER checks the DIG low set point to determine if the pressure is satisfactory, if the low limit is exceeded the DCP is held until either a timeout occurs or the pressure drops below the set point.

2 Pump, fill lines, and manifold heaters are activated by the DCP and power is switched through relays located in the bakeout control unit. Pump and fill lines are operated by time event outputs (TEV 4,5) and are on full when activated. A relay in the bakeout control unit provides pressure control for these heaters (see #5) and a thermostat on the pump provides temperature control for the pump heaters. Manifold heaters are operated by channel 2 and therefore have the same proportional and pressure control features as the oven (channel 1) heaters have.

3 Channel 1 output controls the oven heaters. The DIALATROL provides an overtemperature alarm and shutdown feature.

4 120 Vac switched by the DIALATROL and DCP channel 1 switch the oven heater relay. NOTE: on systems with the solid state relay power for the heaters (240V 40A) is disconnected by a single circuit breaker.

5 A 0-9 Vdc output signal from the DIG to the ACTIONPAK relay in the bakeout control circuit (K1) provides pressure control for the pump and fill line heaters.

6 2 set point outputs and a 0-9 Vdc signal supply pressure information to the controller interface chassis.

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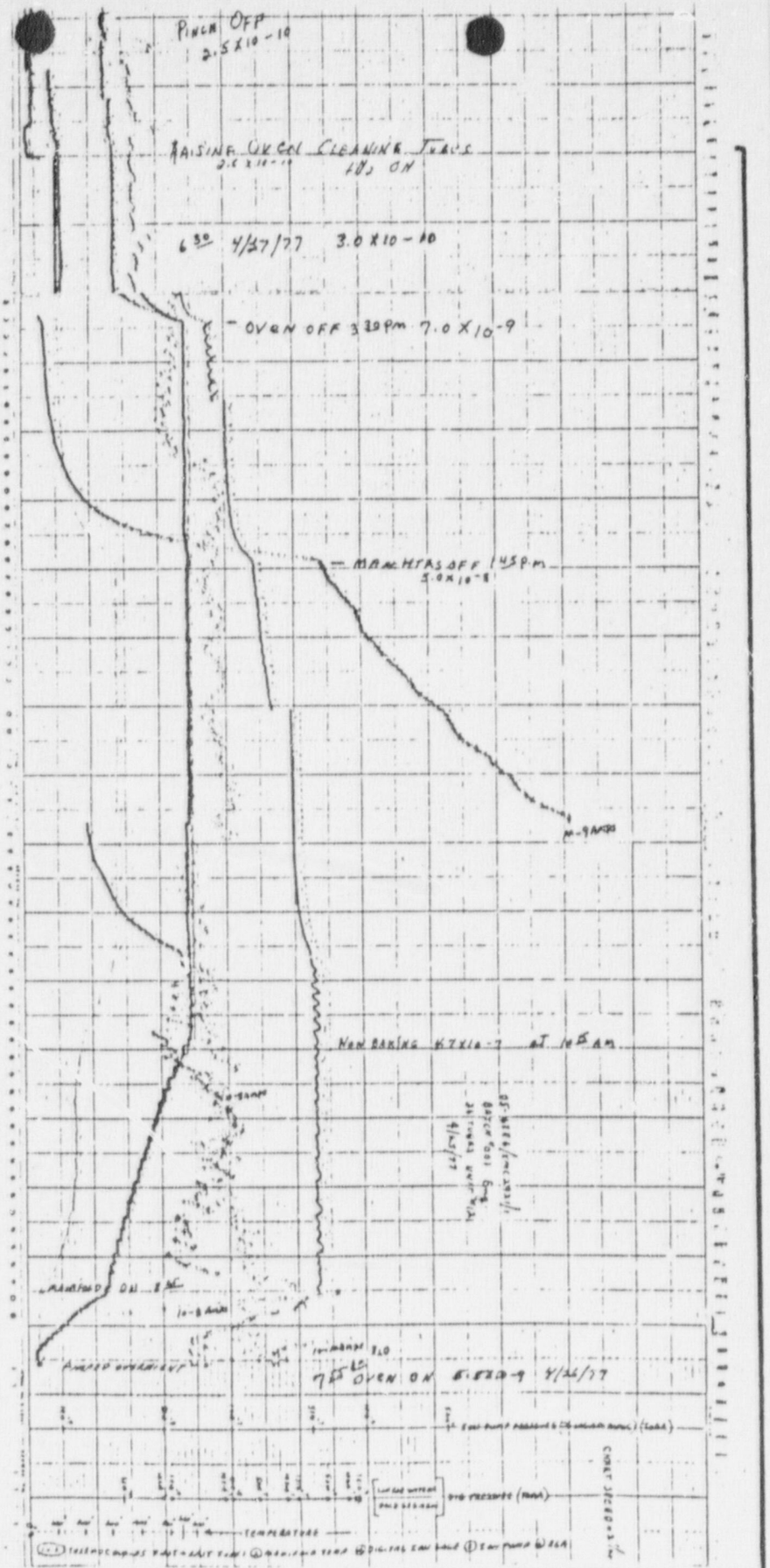

FIGURE 5

TYPICAL CHART

STD. PRACTICE SPECIFICATION				TITLE	Exhaust Procedure	CODE IDENT NO. 25506	SPEC. NO.	SL6-2-63
				PRODUCT	Ceramic Tubes		PART NO.	SP-VS63
RDC #	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		DATE	5-12-77
INIT	[illegible]	[illegible]					SHEET	1 OF [illegible]

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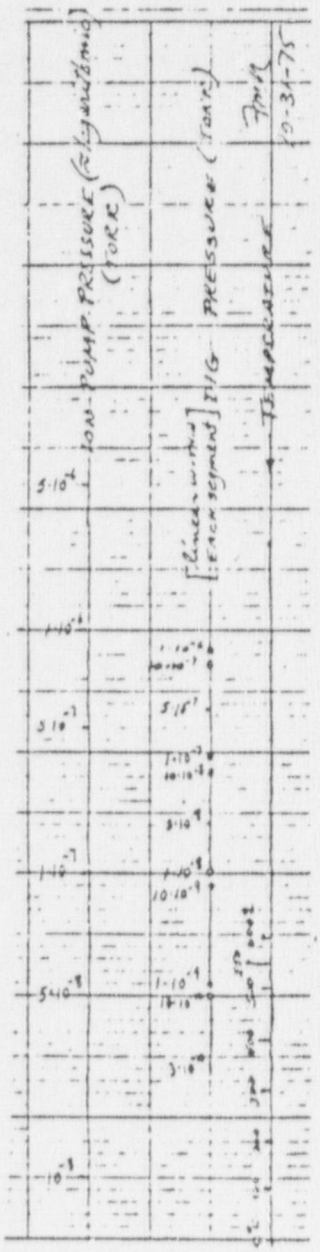

FIG. 6

TYPICAL CHART READING AID

STD. PRACTICE SPECIFICATION				TITLE	Exhaust Procedure					CODE IDENT NO. 25506	SPEC. NO.	SL6-2-63	
				PRODUCT	Ceramic Tubes						PART NO.	SP-VS63	
RDC #											DATE		
INIT											SHEET		

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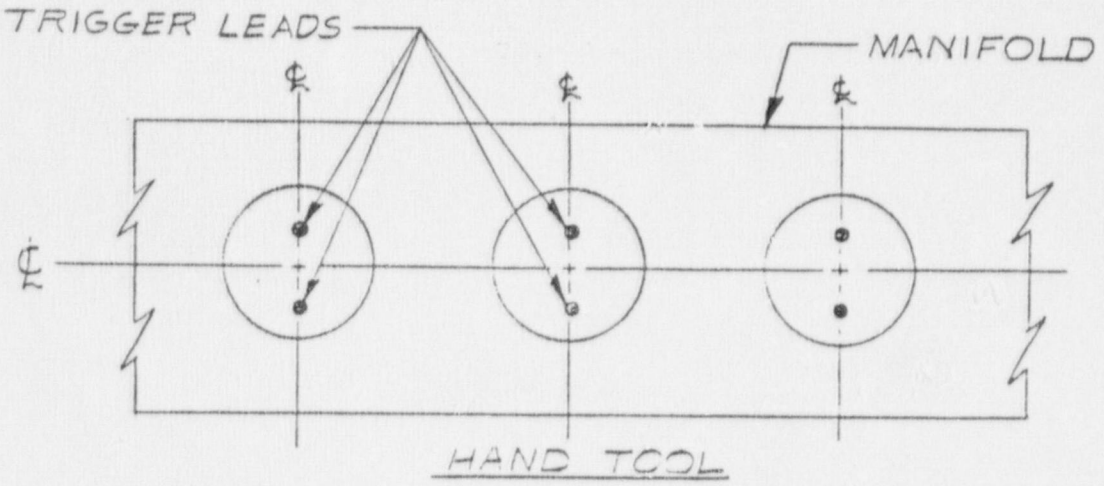
TOP VIEW OF TUBE MOUNTING ORIENTATION PER PINCH-OFF TOOL

The center lines of the trigger leads are perpendicular to the center line of the manifold.



The center lines of the trigger leads are parallel to the center line of the manifold.

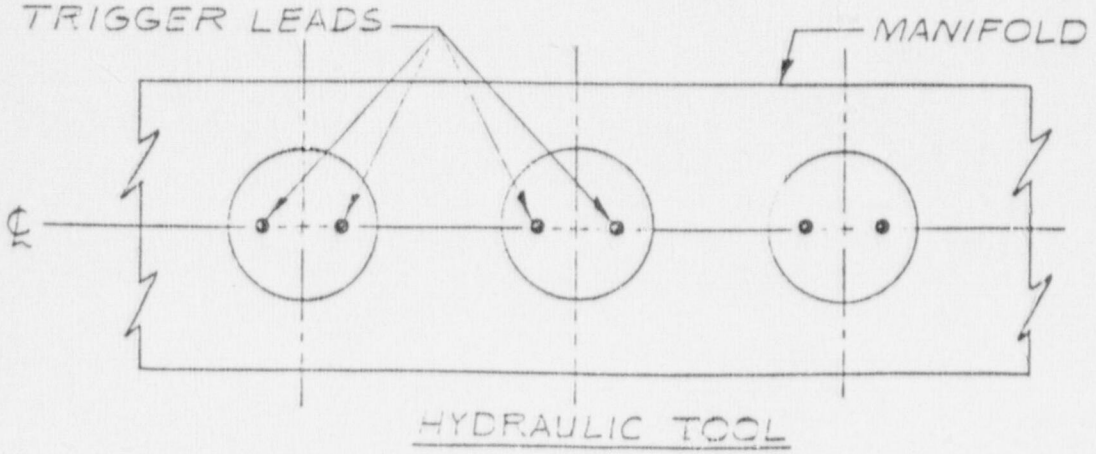


FIG. 7

STD. PRACTICE SPECIFICATION				TITLE	Exhaust Procedure						CODE IDENT NO. 25508	SPEC. NO.	SL6-02-063		
				PRODUCT	Ceramic Tubes							PART NO.	SPVS-063		
RDC #												DATE			
INIT												SHEET	11 OF 30		

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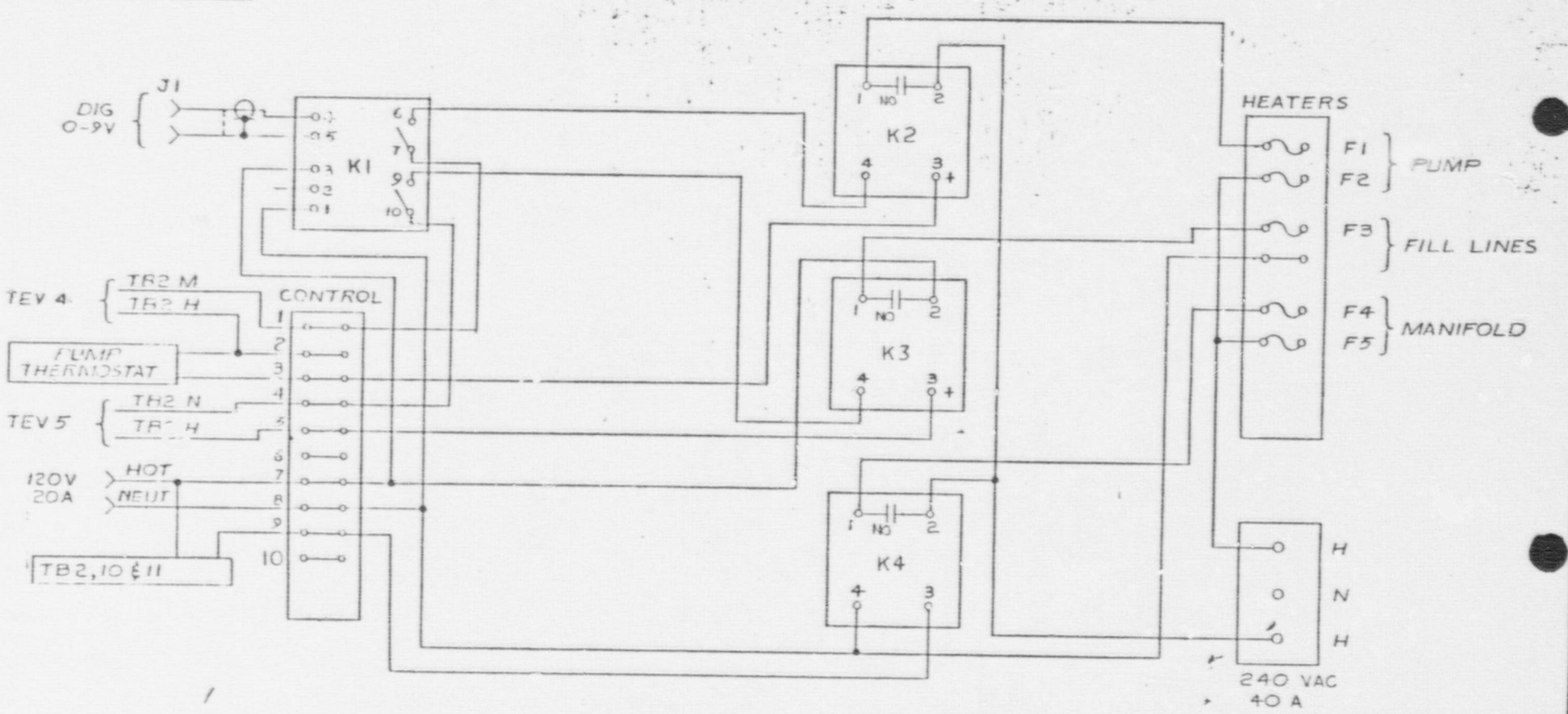

PUMP/MANIFOLD BAKEOUT CONTROL

FIG. 9

Standard Practice SPECIFICATION	TITLE	Exhaust Procedure	CODE IDENT NO. 25508	SPEC. NO.	SL6-02-063
	PRODUCT	Ceramic Tubes		PART NO.	SFVS-063
RDC # 256 327 181				DATE	5-28-87
INIT MCC				SHEET	19 OF 20

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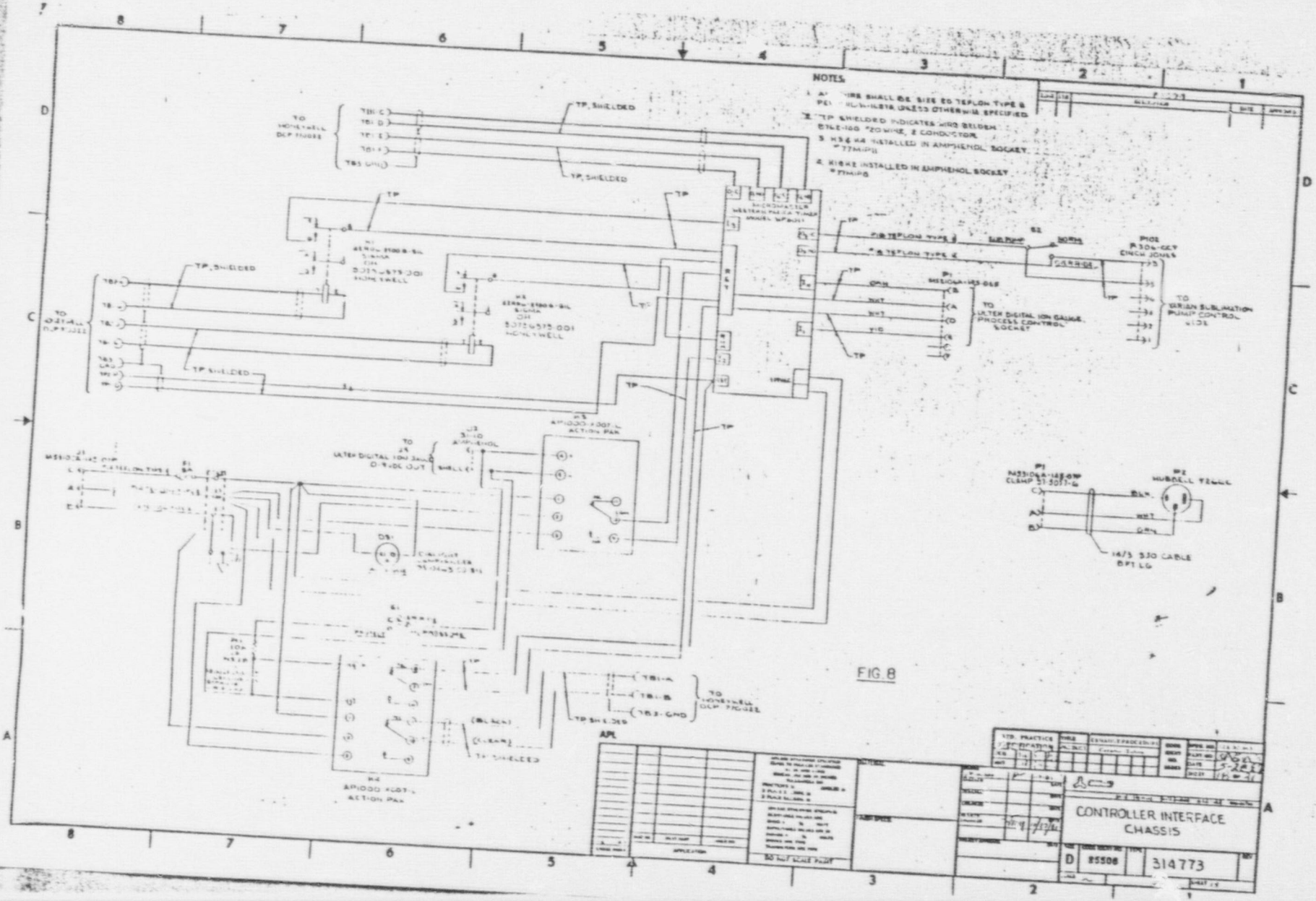

FIG. 8

PARTS LIST FOR PUMP/MANIFOLD

PART	DESCRIPTION
F1-F5	FNM 15 Fuse (15A, 125V)
K1	Action Pak MDL1000-2007 (or equivalent)
K2,K3	Potter & Bromfield EOM1DB72 (or equivalent)
K4	Potter & Bromfield ECT1A74 (or equivalent)
J1	BNC Isolated Bulkhead (Amphenol 31-010)

MISCELLANEOUS

QTY	DESCRIPTION
1	Relay socket, 11 pin, Voltrex Type RS-11B
4	Hole Plug Screen Snap in, 1 inch
1	Panel Enclosure, Nema Type 1, 16 x 16 x 6-5/8
1	Louver Panel Kit, 10-9/16 x 9-1/2
1	Fuse Block 3835-6
1	Heat Sink AAVID #60315, 1 foot
1	Barrier Strip, Alco #MTB-106D
1	Barrier Strip, TRN8-542

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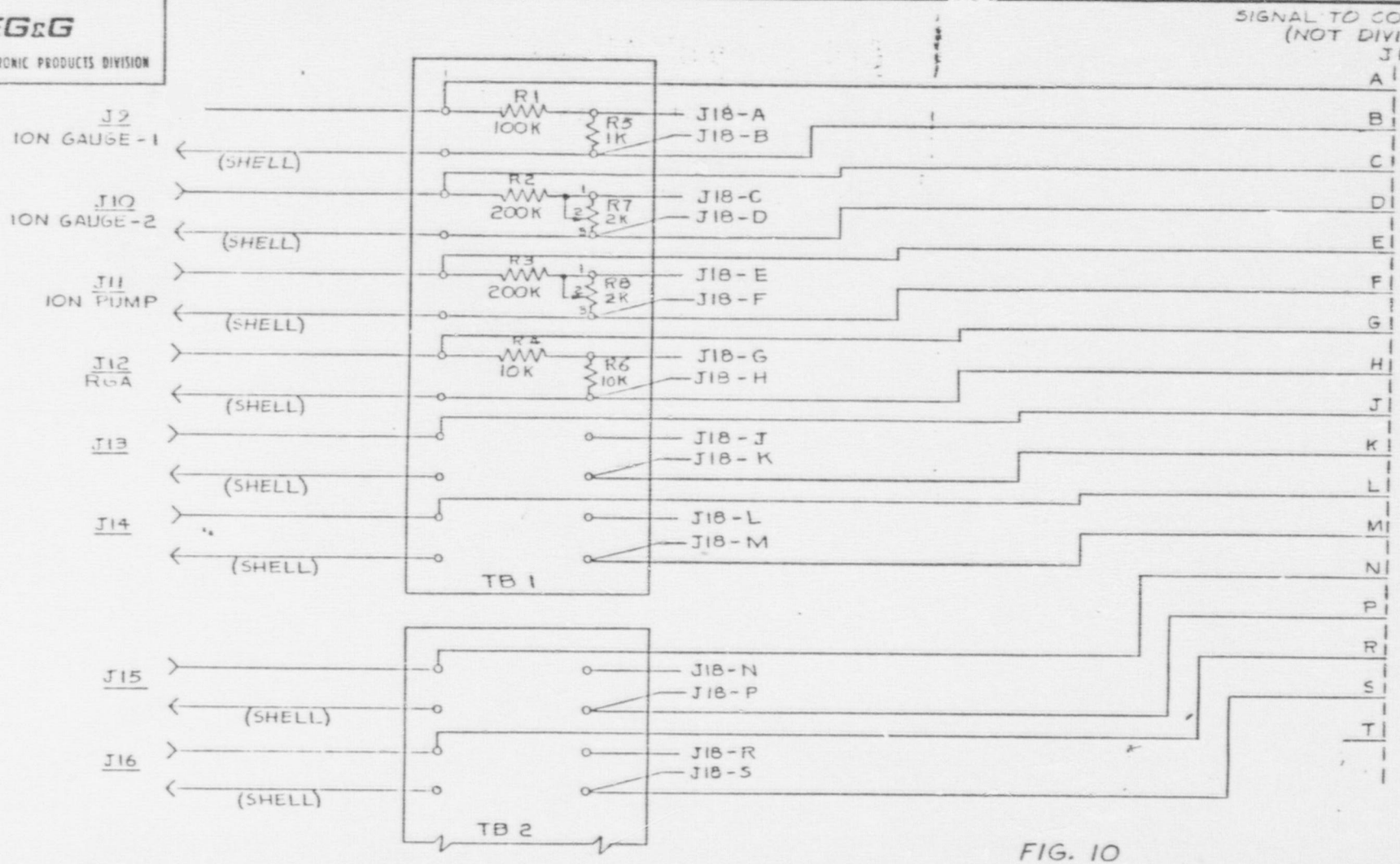

FIG. 10

SIGNAL DISTRIBUTION PANEL

R1-R6 = 1/4 W ±5%
R7, R8 = BECKMAN 8143P 66WR2K OR EQUIV.
J17 = MS3102A-20-29P
J18 = MS3102A-24-0?P, NOT SHOWN (SIGNAL TO RECORDER)
TB1, TB2 = CAMBION NO. 1402-4501-02

Standard Practice SPECIFICATION				TITLE PRODUCT	Exhaust Procedure Ceramic Tubes								CODE IDENT NO. 25508	SPEC. NO.	SL6-02-063		
RDC #	254	327	181											PART NO.	SPVS-063		
INIT		HHR	mac											DATE	5-28-87		
														SHEET	21 OF 30		

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LIST OF PROGRAMS FOR HONEYWELL CONTROLLER IN EXHAUST UNIT

Temp = °C

Time = Min.

PROGRAM #1 Standard 600° (Vacuum Device) Bake, Oven Warm Overnight

(Channel 1)

Seg #1				Seg #2			Seg #3
R	TE#1	TE#2	TE#6	SP	T	TE#2	R
5.0	0.1/0.2	0.2/0.2	0.1/999	600*	300	0.1/0.2	0.0

Seg #4			Seg #5	Seg #6	
SP	T	TE#2	R	SP	T
600*	1.0	0.1/0.2	30.0	150*	999.0

(Channel 2)

Seg #1		Seg #2	Seg #3		Seg #4
SP	T	R	SP	T	R
5	25	4.1	150*	210	0

Seg #5			Seg #6	Seg #7	
SP	T	TE#2	R	SP	T
150*	0.3	0.1/0.2	300	20	999.9

* Temperature settings must be adjusted as indicated by calibration sticker.

Temp - °C

Time - Min.

PROGRAM #2 Standard 600°C (Gas filled Device) Bake (With Gas Fill Line Heating)

(Channel #1)

Seg #1				Seg #2			Seg #3
R	TE#1	TE#2	TE#6	SP	T	TE#2	R
5.0	0.1/0.2	0.2/0.2	0.1/999	600*	300	0.1/0.2	0.0

Seg #4			Seg #5	Seg #6	
SP	T	TE#2	R	SP	T
600*	1.0	0.1/0.2	30.0	20	999.0

(Channel 2)

Seg #1		Seg #2		Seg #3		Seg #4
SP	T	R	TE#5	SP	T	R
5	25	10	0.0/210	150*	210	0

Seg #5			Seg #6	Seg #7	
SP	T	TE#2	R	SP	T
150*	0.3	0.1/0.2	300	20	999.9

* Temperature settings must be adjusted as indicated by calibration sticker.

Temp = °C

Time = Min.

PROGRAM #3 400°C KCL + Al. Mix., Gas Filled Device Bake
(With Gas Fill Line Heating)

(Channel 1)

Seg #1				Seg #2			Seg #3
R	TE#1	TE#2	TE#6	SP	T	TE#2	R
5.0	0.1/0.2	0.2/0.2	0.1/999	400*	600	0.1/0.2	0.0

Seg #4			Seg #5	Seg #6	
SP	T	TE#2	R	SP	T
400*	1.0	0.1/0.2	30.0	20	999.0

(Channel 2)

Seg #1		Seg #2		Seg #3		Seg #4
SP	T	R	TE#5	SP	T	R
5	25	10	0.0/245	150*	510	0

Seg #5			Seg #6	Seg #7	
SP	T	TE#2	R	SP	T
150*	0.3	0.1/0.2	300	20	999.9

* Temperature settings must be adjusted as indicated by calibration sticker.

Temp = °C

Time = Min.

PROGRAM #5 (Pinch-off)

(Channel 1)

Seg #1		Seg #2	
R	TE#6	SP	T
30	0.1/999	350	120

PROGRAM #6 PUMP BAKEOUT (Oven, Pump, Manifold, Backfill)

(Channel 1)

Seg#1			Seg#2			Seg#3		Seg#4	Seg#5	
SP	T	TE#6	R	TEV#4	TEV#5	SP	T	R	SP	T
5	0.0	0.1/999	50	.1/360	.1/360	400*	360	50	20	0.1

(Channel 2)

Seg#1			Seg#2	Seg#3		Seg#4	Seg#5	
SP	T	TE#6	R	SP	T	R	SP	T
5	2.0	0.1/999	15.0	150*	360	35	20	0.1

* Temperature settings must be adjusted as indicated by calibration sticker.

Temp = °C

Time = Min.

PROGRAM #8 (Slow Rise/Slow Cool)

(Channel 1)

Seg#1					Seg#2	Seg#3		Seg#4
SP	T	TEV#1	TEV#2	TE#6	R	SP	T	R
5	20	.1/.2	.2/.2	0.1/999	2.4	600*	570	2.4

Seg#5			Seg#6	Seg#7	
SP	T	TEV#2	R	SP	T
600*	1.0	.1/.2	15	15	99.9

(Channel 2)

Seg#1		Seg#2	Seg#3			Seg#4	Seg#5		
SP	T	R	SP	T	TEV#5	R	SP	T	TEV#2
20	96	.9	150*	210	.1/210	0	150*	.3	.1/.2

Seg#6	Seg#7	
R	SP	T
300	20	999.0

* Temperature settings must be adjusted as indicated by calibration sticker.

Temp = °C

Time = Min.

PROGRAM #9 (Calibration)

(Channel 1)

Seg#1		Seg#2	Seg#3		Seg#4	Seg#5		Seg#6
SP	T	T	SP	T	R	SP	T	R
20	00	20	150*	20	30	400	30	30

Seg#7		Seg#8
SP	T	R
600*	30	100

(Channel 2)

Seg#1		Seg#2	Seg#3		Seg#4	Seg#5	
SP	T	R	SP	T	R	SP	T
20	00	50	150*	45	100	20	0

* Temperature settings must be adjusted as indicated by calibration sticker.

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ELECTRONIC COMPONENTS DIVISION

MicroMaster PROGRAMMING FORM for Series WP6000

PROGRAM: Exhaust Unit #13
Process Control
TE-1 = Micromaster Run Signal From D.C.P. (1 = High)

DATE / / PAGE OF

INPUT 0 = "B" DIG Set Point 5 x 10^{-7} (1 - Low)
OUTPUT 0 = "Hold" Signal to D.C.P.

INPUT 1 = "A" DIG Set Point 7 x 10^{-8} (1 - Low)
OUTPUT 1 = "Start" Signal to D.C.P.

INPUT 2 = "Action Pa[illegible]ressure Relay 5x10^{-8} (1 = TE#2 On)
OUTPUT 2 = Not Used

INPUT 3 = Honeywe[illegible]otle
OUTPUT 3 = Sublimation Pump Enable

LABEL	STEP NUMBER	FUNCTION	O_0	O_1	O_2	O_3	COMMENTS
	01	SS 05.00					
Ret Counter	02	Go to 40					Go to 40 to Set Excess Time Counter
	03	Go to 04					
Exam RAMP Pr	04	If 0→10				On	If DIG Press.High Go to Loop 10-14 for hold Repeat
Start Cont.	05	SS 00.50		On		On	For DIG Pressure < 5x10^{-7} Torr Loop in 5-9 Waiting for TE#2 Signal (Input = 3)
	06	Go to 07				On	
	07	SS 06.00				On	6 Second Wait
	08	If 03→15				On	Leave 5-9 Loop on TE#2 (Input = 3) Signal at Start of Oven Soak
Return	09	Go to 04				On	
	10	Go to 11				On	
Press. Alrm Hold	11	SS 00.50	On			On	During Initial RAMP, Pressure Exceeds Limit on DIG Set Point "B". Loop 10-15, Recheck at Step 04
	12	SS 03.00				On	3 Second Wait
	13	Go to 14				On	
Return	14	Go to 04				On	
	15	SS 00.00		On		On	As Oven/Manifold soak begins, push Start 10 Seconds here to allow enable(TE#2)to stay off
Alarm, Man Soak	16	If 3→19				On	After Manifold Soak, acts on [illegible] Enable Maximum Jumps to 19
	17	SS 03.00				On	
	18	Go to 16				On	Return to 16 Waiting for Manifold to Complete Minimum Bake Time, Wait for End TE#2
Return, Counter	19	Go to 48				On	Sends to Loop to Decrement Counter to Limit Extra Wait to 24 Hours Total
Press. Alarm Off-Man	20	Go to 20				On	Loop waiting for Satisfactory Pressure to Put Manifold OFff. DIG Set Point "A", 7 x 10^{-8}
Hold	21	SS 00.00	On			On	Set DCP to Hold
	22	SS 03.00				On	Wait 3 Seconds

FIG. 11

Standard Practice SPECIFICATION				TITLE	EXHAUST PROCEDURE						CODE IDENT NO. 25508	SPEC. NO.	SL6-02-063		
				PRODUCT	Ceramic Tubes							PART NO.	SPVS-063		
DCN												DATE	[illegible]		
INIT												SHEET	[illegible] OF [illegible]		

BRUNING 40 135 50030

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ELECTRONIC COMPONENTS DIVISION

MicroMaster

PROGRAMMING FORM for Series **WP6000**

PROGRAM DATE / / PAGE OF

INPUT 0 = ... OUTPUT 0 = ...

INPUT 1 = ... OUTPUT 1 = ...

INPUT 2 = ... OUTPUT 2 = ...

INPUT 3 = ... OUTPUT 3 = ...

LABEL	STEP NUMBER	FUNCTION	O_0	O_1	O_2	O_3	COMMENTS
Return	23	Go to 19				On	Loop Back to Examine Pressure
	24	Go to 25				On	
Start	25	SS 00.50		On		On	On Leaving Loop Set DCP to Start
	26	SS 20.00				On	Allows Manifold Soak (.3 Min.) to Run Out Before Seeking Next TE#2 (Input #3)
	27	SS 03.50				On	Wait 3.5 Seconds
	28	If 3=32				On	Remains in Loop (DCP Running) Until 3rd, Enable Signal (TE#2)(Input 3) Indicates Min. Oven Bake
Return	29	Go to 27				On	Loops Back Waiting for End of Oven Min. Bake Signal
	30					On	
	31					On	
	32	SS 03.00				On	3 Second Wait
	33	If 2=38				On	Checks for Satisfactory Pressure to Shut Off 5×10^{-8} Torr
Decrement Counter	34	Go to 45				On	Go to Counter, Decrement
	35	SS 00.50	On			On	Set DCP to Hold if Minimum Oven Time is Exceeded but Pressure is > 5×10^{-8} Torr
	36	Go to 37				On	
Return	37	Go to 32				On	Loops
Final Start	38	SS 00.50		On			Gives Final Start to DCP, Removes Subpump Enable (output 3)
Reset	39	Go to 00					Reset to allow DCP to Initiate System Cooldown
Set Counter	40	C = 2500					Counter; Decremented by 42 or 45, 3.5 seconds per Cycle, 2500 = 2.43 Hours
	41	Go to 03					After Initial Set of Counter Return to Program
	42	C=20			On		Decrements Counter Flash Output #2 Returns to 20 as Indicator
	43	SS 00.50		On			Set Start on DCP
Reset	44	Go to 00					Reset Counter Ran Out

FIG. 12

STANDARD PRACTICE SPECIFICATION				TITLE	EXHAUST PROCEDURE							CODE IDENT NO. 25508	SPEC. NO.	SL6-02-063			
				PRODUCT	Ceramic Tubes								PART NO.	SPV3-063			
DCN													DATE				
INIT													SHEET	OF			

BRUNING 40 135 50030

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ELECTRONIC COMPONENTS DIVISION

LABEL	STEP NUMBER	FUNCTION	O_0	O_1	O_2	O_3	COMMENTS
	45	L→35			On		Decrements Counter Output #2 Flashes as Indicator Return to 35
	46	SS 00.50		On			Set Start
Reset	47	Go to 00					Counter Ran out Reset
	48						
	49						
	50						
	51						
	52						
	53						
	54						
	55						
	56						
	57						
	58						
	59						
	60	SS 03.00				On	Wait 3 Seconds
	61	If 1→63					
	62	Go to 25					
	63	SS 00.50	On			On	
	64	Go to 19				On	

FORM A-PE050 10/1 2-79

FIG. 13

STANDARD PRACTICE SPECIFICATION	TITLE	EXHAUST PROCEDURE	CODE IDENT NO. 25506	SPEC. NO. SL6-02-063
	PRODUCT	Ceramic Tubes		PART NO. SPVS-063
DCN [illegible]				DATE 5-28-87
INIT [illegible]				SHEET 30 OF 40

BRUNING 40-135 50030

1.0 PURPOSE

To define a method for performing Carbon 14 RA measurements on ceramic bodies using a Polyspec coupled with a proportional gas flow detector head.

2.0 SCOPE

This procedure shall apply to all ceramic bodies in which amorphous Carbon 14 is applied as an ionization starter along the inside wall of the envelope.

3.0 MATERIAL

3.1 P-10 Gas, 10% Methane/90% Argon

4.0 EQUIPMENT

4.1 Baird Polyspec Research Nuclear Spectrometer.

4.2 Baird Preamplifier, Model 942224.

4.3 Baird Microthin End Window Flow Counter, Model 821C.

4.4 Baird Aluminum Mylar Windows, 0.9 mg/cm2 thick, Part No. 821CW, or equivalent.

4.5 Planchet, Aluminum, 1.2" Diameter x .1" Walls. Designated for use with Carbon 14.

4.6 N.E.N. 14C Standard, .165 microcuries (.099 effective microcuries), Assay Date 5-21-79.

4.7 Tweezers, Polypropylene or Polyethylene. Designated for use with Carbon 14.

4.8 Clean Room Laboratory Coat, Dacron or equivalent.

4.9 Vinyl Gloves, Disposable, Sensikleen or equivalent.

4.10 Surgical Mask, Disposable, 3M Catalogue No. 8100 or equivalent.

4.11 Paper Mat, Disposable, Dexter Catalogue No. 1140 or equivalent.

4.12 Polyethylene Bags, Disposable, 4" x 10" x 24", or equivalent.

4.13 Radiation Survey Meter, Dosimeter Corp. of America, Model No. 300 or equivalent.

4.14 Sign, "CAUTION RADIOACTIVE MATERIAL", Bright Yellow and Magenta, approximately 6" x 12" or equivalent.

4.15 Label, "CAUTION RADIOACTIVE MATERIAL", Adhesive Backed, Bright Yellow and Magenta, approximately 1/4" x 1/4" or equivalent.

FIGURE 11

4.16 Personal Dosimeter, EG&G distributed, monitored by RA Officer.

4.17 Radiac Wash, Pre-moistened Decontamination Wipes, Nuclear Associates, Cat. #03-400 or equivalent.

5.0 EQUIPMENT SET-UP

5.1 Set large red power button to ON position.

5.2 Insure that the High Voltage RANGE is set to 3.0 kV (red light).

5.3 Turn the P-10 gas valve to the ON position. Purge the detector head for 1-2 minutes with P-10 gas. Adjust the bubble flow rate in the counter to 3-4 bubbles per second.

5.4 Set the High Voltage ON/STANDBY switch to the ON position.

5.5 Set the Scaler OFF/TEST switch to the OFF position.

5.6 Set the Scaler PSC/BS switch to the BS position.

5.7 Set the Scaler PRESET thumbwheel switches to read 000000.

5.8 Set the Analyzer DIFF/INTEGER switch to INTEGER.

5.9 Set the Analyzer WINDOW thumbwheel switches to 00.

5.10 Set the Display Knob to SCAL.1.

5.11 Set the Timer TIME BASE switch to 0.1 SEC.

5.12 Set the Timer PRESET TIME thumbwheel switches to read 000060.

5.13 Set the Timer Knob to TIMER.

5.14 Set the Control MANUAL/AUTOMATIC switch to MANUAL.

5.15 Set the Control OFF/D.R.M. switch to the OFF position.

5.16 Do not touch the Fine High Voltage Adjust, Coarse High Voltage Adjust, Analyzer Lower L. thumbwheel switches, Amplifier Coarse Gain Knob or Amplifier Fine Gain Knob as they are pre-set during calibration. If one of the settings is accidentally disturbed by the operator, please notify the appropriate engineer before proceeding further.

6.0 PROCEDURE

6.1 All safety apparel specified under Section 4.0 of this specification shall be worn by the operator(s) at all times while performing RA measurements on Carbon 14 treated ceramics or 14C standards.

6.2 All 14C standards, planchets, and treated ceramic bodies shall be handled with tweezers. The operator(s) should always utilize maximum body distance and minimum exposure time wher handling RA parts. All other

safety equipment and supplies specified under Section 4.0 of this specification shall be utilized by the operator(s) as directed by this specification.

6.3 Each operator shall wear the personal dosimeter assigned to them by the RA Officer at all times whenever performing the RA measurement procedure described in this specification.

6.4 Each operator is responsible for familiarizing themselves with, and practicing the procedures outlined in the Radiological Safety and Information Manual for the Salem Laboratory of E.G.&G., latest issue.

6.5 All decontamination procedures shall be performed per the procedures specified in the Radiological Safety and Information Manual for the Salem Laboratory of E.G.&G.

6.6 All RA waste, including contaminated gloves, masks, finger cots, tweezers, paper, and used decontamination materials shall be disposed of in a polyethylene bag. The bag shall be secured, and clearly labelled with adhesive backed RA warning labels The secured and labelled bag shall then be disposed of in a barrel designated for RA waste per the Radiological Safety and Information Manual for the Salem Laboratory of E.G.&G.

6.7 The Polyspec must warm-up for at least 1/2 hour prior to operator use.

6.8 Place a clean sheet of paper mat material under the immediate work area.

6.9 Position the "CAUTION RADIOACTIVE MATERIAL" sign in a conspicuous position, next to the work area.

6.10 Turn the RA Survey Meter "on" to its lowest scale. Place the meter within the immediate work area, allowing for the continuous monitoring of the background RA level.

6.11 Remove the planchet from the planchet holder. Replace the planchet with one specifically designated for use with Carbon 14 (para. 4.5).

6.12 Remove the Carbon 14 standard from its container. Place the standard in the center of the planchet, with the foil side positioned up.

NOTE: Care should be taken when handling the Carbon 14 standard. The operator should always use tweezers, grasping the standard carefully along its outer metal edge. Frequent and/or prolonged contact with the radioactive portion of the reference source can result in

significant localized radiation exposure, even though the source contains a relatively small level of radioactivity. The operator should take care not to puncture, scratch, or dent the standard's foil face.

6.13 Place the planchet holder, planchet, and standard on level two of the gas flow detector. Depress the start button of the Polyspec. Record the reading shown in the digital display of the Polyspec onto the ETR in the space labelled "14 STD. READING #1".

6.14 Remove the Carbon 14 standard from the planchet. Return the standard to its designated container. Place the planchet holder and planchet on level three of the gas flow detector.

6.15 Using tweezers, select the first ceramic body. Designate this ceramic serial number 001. Record the serial number on the ETR. Place the ceramic body in the middle of the planchet, with the large nickel plated portion of the ceramic positioned up.

6.16 Depress the start button on the Polyspec. Record the reading from the digital display onto the ETR, in the first column marked "C/.1M (Arrow Up)".

6.17 Using tweezers, turn the ceramic body over so that the large nickel plated portion is positioned down. Depress the start button on the Polyspec. Record the reading from the digital display onto the ETR, in the second column marked "C/.1M (Arrow Down)".

6.18 Repeat steps 6.15 through 6.17 for all the ceramic bodies in the lot. Designate each ceramic body with the next lowest available serial number. Return the planchet holder and planchet to level two when all the ceramic bodies have been measured.

6.19 Remove the Carbon 14 standard from its container. Place the standard, foil side positioned up, in the center of the planchet. Depress the start button on the Polyspec. Record the reading on the ETR in the space labelled "14 STD. READING #2".

6.20 Return the standard to its designated container. Slide the empty planchet holder and planchet into position on level two. Depress the start button on the Polyspec. Decontaminate the planchet and planchet holder if the

reading in the digital display is above 000050. Return the planchet directly to its designated container, post decontamination.

6.21 Monitor the tweezers with the Survey Meter for signs of contamination. If the needle of the meter goes off the first scale, then discard the tweezers in a polyethylene bag designated for RA waste.

6.22 Carefully fold up the paper mat covering the work area. Discard the mat in a polyethylene bag designated for RA waste.

6.23 Monitor the work area with the RA Survey Meter. Decontaminate any area in which the needle of the meter goes off the first scale. Discard all used decontamination material (i.e., Radiac Wash pads), in a polyethylene bag designated for RA waste.

6.24 Monitor all gloves on the RA Survey Meter prior to removal by the operator(s). Discard gloves in the polyethylene bag designated for RA waste.

6.25 Remove the mask. Monitor the mask for contamination on the RA Survey Meter. Discard the mask in a polyethylene bag designated for RA waste.

6.26 Position the High Voltage "ON STANDBY" switch on the Polyspec in the "STANDBY" mode.

6.27 Shut off the P-10 gas supply to the gas flow counter.

6.28 Secure the labelled RA waste bag. Discard in the barrel designated for RA waste (para. 6.6).

6.29 Record all RA level readings in the appropriate columns of the "Radiation Readings Report".

7.0 CALCULATIONS

7.1 Refer to the ETR cited in Section 6 above. Add the RA measurement recorded in the space "14 STD. READING #1" to the measurement recorded in the space "14 STD. READING #2".

7.2 Divide the total from para. 7.1 by two (2). The result is the average effective RA measurement for the Carbon 14 standard.

7.3 Divide the average RA measurement for the Carbon 14 standard by .099 (effective RA level of standard). The result of this calculation is known as the Conversion Factor.

7.4 Divide each reading in the column labelled "C/.1M (Arrow Up)" by the

conversion factor. Record each result in the space to the right under the column labelled "u Ci (Arrow Up)".

7.5 Divide each reading in the column labelled "C/.1M (Arrow Down)" by the conversion factor. Record each result in the space to the right under the column labelled "u Ci (Arrow Down)".

7.6 For each serial number recorded, add across the number in the column "u Ci (Arrow Up)" to the number in the column labelled "u Ci (Arrow Down)". Divide the total by two. Record the result in the space to the right under the column marked "X-bar". This result is the average effective u Ci of Carbon 14 per ceramic body.

7.7 Add together all the numbers recorded under the column labelled "X-bar". Divide the total by the number of readings in the column to obtain an average. Record the average on the form. This number is the average effective RA level in u Ci of Carbon 14 for the entire batch of ceramic bodies.

1.0 PURPOSE

To establish inspection criteria for Factory Final and Q.C. Acceptance Inspections.

2.0 SCOPE

Applies to all devices prior to submittal for source inspection or shipment.

3.0 EQUIPMENT

3.1 Vernier Caliper, 6"

3.2 Micrometer, 0-1"

3.3 Scale, 6"

3.4 10X Microscope

3.5 Victoreen Meter Model 490 and Pancake Probe Model 489-110, or equivalent

4.0 GENERAL

At Factory Final Inspection, 100% mechanical and visual inspection shall be performed. All rework shall be completed before proceeding to Q.C. Acceptance Testing. Devices shall then be submitted to Q.C. Acceptance Inspection for a 100% visual inspection. All test and inspection results, from both Factory Final and Q.C. Acceptance, shall be reported to the Production Supervisor, Product Engineer and Department Manager.

5.0 TYPES OF DEFECTS

5.1 Dimensional Any tolerance dimensions that do not conform to customers A. drawing, shall be cause rejected.

5.2 Visual

5.2.1 Ceramic Parts Chips, grooves, gouges, cracks, dirt, stains, solder splashes, heavy tin abrasions or any foreign substance are unacceptable. Minute tin abrasions are allowable except for small ceramic devices where a high resistance leakage path between electrodes could cause a problem.

5.2.2 Metal Components (Leads, A & K contacts, plates, etc.)

5.2.2.1 Condition Knotted, kinked or corroded.

5.2.2.2 Tinning Blisters, voids, holes, lumpy, discolored, fractures, copper showing, sandblasts effects, residual flux, cleaning residue, closed contact holes or excessive tinning where maximum dimensions are exceeded, are all unacceptable.

TITLE: FINAL INSP. OF CERAMIC DEVICES
PRODUCT: GENERAL
SPECIFICATION: OUTGOING Q.A.
DCN#:E11,H115,J531
INIT:SPB, RER, RJB
DATE PRINTED: 3/8/86

FIGURE 12

FSCM: 25506
SPEC NO: SL7-05-025
PART NO: OQ-025
DATE: 01-02-86
ISSUE: A
SHEET 1 OF 2

5.2.3 Capacitor Components Cracks, chips, gouges, metal marks or bridging more than half way to external electrical connections are unacceptable.

5.2.4 Branding Not legible, incomplete or considerable slanting are all unacceptable. Branding shall be located in designated area per customers AY drawing.

6.0 RESIDUAL IONIC CONTAMINATION INSPECTION

6.1 After all Factory Final Inspection repairs have been completed, the batch shall then be tested for ionic contamination per SL7-04-050, before proceeding to Q.C. Acceptance Testing.

7.0 ACCEPTANCE INSPECTION REPAIRS

7.1 Devices that are reworked for visual defects and subsequently exposed to a soldering iron after Acceptance Testing, shall have the following passive tests performed: Sprytrons - VL, Rp and Ct; Gaps - VL; MC3509 - VL, ID and ID2.

7.2 The acceptance rework procedure for those devices that need to be retested are: repair, clean, inspect, test and reinspect.

8.0 EXTERNAL RADIO ACTIVITY MEASUREMENT (Where applicable)

8.1 Prior to final packaging, each device containing radioactive by-product shall be scanned using the specified survey meter and probe.

8.2 Any device exhibiting readings in excess of .10 R/h (background) shall be brought to the attention of the Laboratory Chemist and/or the Radiological Safety Officer for correction action.

8.3 Any units submitted for re-cleaning shall be re-scanned prior to final packaging.

8.4 Only properly handled and cleaned devices shall be packed for shipment and shall not indicate any measureable radio activity reading.