

PROJECT # 51034  
FILE CATEGORY 11.4  
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# Pu Sealed Source Project

## FINAL ASSEMBLY SPECIFICATION

PSS-SPEC-007

Revision No. 2

Issue Date: October 9, 2007

Project #51034

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## 1.0 Scope and Purpose

This assembly specification defines the procedure for assembling the prefabrication test article, the blank source, the final source and the post fabrication test article. Only the blank and the final source will be delivered to the customer. Both the pre and post test articles will be subjected to radiographic examination to evaluate the weld penetration along the entire weld.

## 2.0 Applicable Materials and Equipment

Plutonium will be required per PSS-SPEC-003, *Material Specifications for Plutonium Metal*. Welding equipment will be required. Weld schedules and personnel will be qualified in accordance with PSS SPEC-005, *Welding Specification for Stainless Steel Capsule Closure Welds* and PSS-SPEC-006, *Welding Specification for Tantalum Closure Welds*.

## 3.0 Warnings and Precautions

Ensure plutonium fabrication procedures and welding procedures have been approved by lab safety and qualified per PSS-SPEC-005 and PSS-SPEC-006 prior to final fabrication.

## 4.0 Process Steps and Requirements for Assembly of the Blank

The following components are required for assembly: a puck cover, a tantalum cup, a tantalum liner base, a tantalum liner cover, an inner housing base, an inner housing cover, an outer housing base, and an outer housing cover. These components will be made per drawing H-3-310767 *Plutonium Source Assembly* (except the plutonium metal disk) and fabricated according to PSS-PLAN-MAQP-006, *Manufacturing and Quality Plan for the Plutonium Sealed Source*.

Clean all components using acetone, de-ionized water, and then de-natured ethyl alcohol.

A puck cover and a tantalum cup will be placed into the tantalum liner base and the tantalum liner cover will be spot welded to liner base per PSS-SPEC-006.

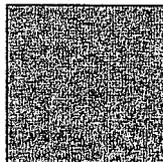
The tantalum assembly will be placed inside inner housing base and inner housing cover will be screwed shut until there is no gap between the two parts. Weld inner housing assembly per PSS SPEC-005.

The inner housing assembly will be placed inside outer housing base and covered with the outer housing cover. Make sure there is no gap between stainless parts and weld per PSS SPEC-005.

The surfaces shall appear metal clean and free of organic films and contaminants.

Permanently mark (Chemical etch) assembly on the top of Outer Housing Cover marked blank with the following information.

THIS BLANK CONTAINS NO RADIOACTIVE MATERIAL



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Pu Sealed Source 96E66646 Mod 0 (ANSI N43.6)  
Serial No. PSS-BLANK  
THIS CONTAINS NO PLUTONIUM OR RADIOACTIVE MATERIAL  
(Current date)

Markings are to be applied in compliance with the Manufacture's instructions (Exhibit A). The chemicals used for the application of the markings do not generally pose significant health hazard. Irritation of the skin and eyes is a possible signs of exposure. Flushing of eyes with water is recommended if material enters the eye. Safety glasses shall be used during application. Protective gloves can be used as an option of sensitive skin. Aprons or lab coats are optional. In case of spills, flush with water and mop up.

## 5.0 Process Steps and Requirements for Final Assembly

The following components are required for assembly: one puck cover, one tantalum cup, one tantalum liner base, one tantalum liner cover, two welded liners with tantalum plutonium surrogates (for example from the vibration tests or new weld liners), three inner housing bases, three inner housing covers, three outer housing bases, three outer housing covers, and the plutonium metal. These components will be made per drawing H-3-310767 *Plutonium Source Assembly* (except the plutonium metal disk).

The plutonium metal must meet PSS-SPEC-003, *Material Specifications for Plutonium Metal*, including a radiochemical analysis prior to final assembly.

Clean all components, except plutonium metal, using acetone, de-ionized water, and then de-natured ethyl alcohol.

The tantalum liner cover will not be marked with a Sharpie

Welded liners with surrogate material will be loaded into both the pre and post fabrication test articles. The welded liners with plutonium surrogates will be marked with a Sharpie. Both will be marked with "Non-radioactive liner with surrogate".

The inner housing covers will be marked with a Sharpie. One cover will be marked "pre", one will be unmarked, and one will be marked "post".

The outer housing covers will be marked with a Sharpie. One cover will be marked "pre", one will be pre-marked with the final source markings, and one will be marked "post".

Permanently mark (Chemical etch) assembly on the top of the Outer Housing Cover (the pre-marked outer housing) before assembling the source with the following information.

CAUTION : RADIOACTIVE MATERIAL



Pacific Northwest National Laboratory  
Pu Sealed Source 96E66646 Mod 0 (ANSI N43.6)  
Project #51034 Serial No. PSS-00X  
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Each new source will be given a unique serial number starting with 001. Markings are to be applied in compliance with the Manufacture's instructions (Exhibit A). The chemicals used for the application of the markings do not generally pose significant health hazard. Irritation of the skin and eyes is a possible signs of exposure. Flushing of eyes with water is recommended if material enters the eye. Safety glasses shall be used during application. Protective gloves can be used as an option of sensitive skin. Aprons or lab coats are optional. In case of spills, flush with water and mop up.

The plutonium shall be formed in to the tantalum cup between [redacted] and [redacted] Pu. The plutonium shall be in an approximately 3 inch diameter flat disk. The plutonium forming shall be performed according to a formal casting or machining procedure that is approved by the design task manager. Other forming processes can be considered but must be approved by the design task manager. A step in the procedure will determine the actual weight of the plutonium in the tantalum cup to within 0.1 grams. Before casting the plutonium, place the tantalum puck cover on the top of the plutonium.

### Closure of Tantalum Liners

The tantalum cup with Pu and puck cover will be placed into the tantalum liner base and spot weld the unmarked tantalum liner cover to liner base per PSS-SPEC-006.

**SURVEY REQUIRED:** The welded Ta liner will need to undergo sufficient cleaning using a dry rag, or equivalent, to ensure that all loose contamination is removed to the maximum extent practicable. The Ta liner will be surveyed to ensure it is free of loose contamination prior to being loaded into the inner housing.

### Closure of Stainless Steel Capsules

The unmarked tantalum assembly will be placed inside the inner housing base and the unmarked inner housing cover will be screwed shut until there is no gap between the two parts.

**SURVEY REQUIRED:** The inner housing will need to undergo sufficient cleaning ensuring that all contamination is removed. A survey will be performed to ensure that the inner housing is free of contamination.

The "Non-radioactive liner with surrogate" will be placed inside the inner housing base and inner housing cover marked "pre" will be screwed shut until there is no gap between the two parts. The inner housing assembly will be welded per PSS SPEC-005 and inspected per section 6.1 of PSS-SPEC-005.

Weld the unmarked inner housing assembly per PSS SPEC-005. Perform a visual inspection of the weld per Section 6.1 of PSS-SPEC-005.

**SURVEY REQUIRED:** The inner housing will need to undergo sufficient cleaning ensuring that all contamination is removed. A survey will be performed to ensure that the inner housing is free of contamination and can be released for further inspection.

Perform both dimensional and helium leak testing per section 6.1 of PSS-SPEC-005. Radiographic examination is not required.

The "Non-radioactive liner with surrogate" will be placed inside inner housing base and the inner housing cover marked post will be screwed shut until there is no gap between the two parts. The inner housing assembly will be welded per PSS SPEC-005 and inspected per section 6.1.

The inner housing assembly marked "pre" will be placed inside outer housing base and covered with the outer housing cover marked "pre". Make sure there is no gap between stainless parts and weld per PSS SPEC-005 and inspected per section 6.2.

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The unmarked inner housing assembly will be placed inside outer housing base and covered with the pre-marked outer housing cover. Make sure there is no gap between stainless parts and weld per PSS SPEC-005 and inspected per section 6.2, except for the radiographic and destructive tests.

The inner housing assembly marked "post" will be placed inside outer housing base and covered with the outer housing cover marked "post". Make sure there is no gap between stainless parts and weld per PSS SPEC-005 and inspected per section 6.2.

The surfaces shall appear metal clean and free of organic films and contaminants.

### 6.0 Process Limits

The process limits for welding shall be as described by weld schedules qualified in accordance with PSS-SPEC-005 for the stainless steel closures and PSS-SPEC-006 for the Ta resistance welds. The plutonium forming process shall identify all critical process parameters. The as fabricated Pu disc shall weigh between [REDACTED] and [REDACTED] grams. Process limits associated with the Pu forming procedure shall be appropriately defined in fabrication documents.

### 7.0 Quality Control Measures

After completion of the Plutonium Sealed Source the following activities need to be completed.

- A swipe survey to verify that the outside of the source has less than 185 Bq (0.005  $\mu$ Ci) removable contamination and that the source is releasable.
- A radiation survey to determine the contact and 30 cm dose rates.
- Check all markings for clarity and legibility.
- Verify that the final production source meets the leak requirements per PSS-SPEC-005 section 6.2.

### 8.0 References

PSS-SPEC-005, "Welding Specification for Stainless Steel Capsule Closure Welds"  
PSS-SPEC-006, "Weld Specification for Closure Tantalum Liner Welds"  
PSS-SPEC-003, "Material Specifications for Plutonium Metal"

## Exhibit A

### Instructions for Etch-O-Matic



#### HOW TO MARK USING GROUND PLATE

1. To prepare the Stencil just type the message to be imprinted inside the printed rectangle on the Electronic Stencil or anywhere in the middle of the stencil. Be sure printed side is up while preparing stencil and do not type on the white backing paper. When stencil is ready, remove its paper backing. NOTE: If using typewriter, remove ribbon or put ribbon position on "Stencil" and type firmly. ALSO NOTE: Check on back page for information on making long lasting DURA-FILM stencils with your own trademark, logo or computer generated artwork in your office. This will be the way most stencils will be made in the future. We can also MAKE THEM FOR YOU...CHECK IT OUT.
2. Remove End Cap from Head of ETCH-O-MATIC by inserting coin or screwdriver in the slot under the electrical cord and pry it off gently. Wet the felt pad on the Grid with the Electrolyte solution from the plastic squeeze bottle. Make sure pad is thoroughly soaked, not just dampened. Puncture spout top on bottle by pushing tip of pin through hole in top if using 2 oz. bottle with Yorker Spout, otherwise pull up spout.
3. Lay the prepared stencil on this wet pad so that the printed rectangle is face down and the message reads backwards. Center the message on the Head for best results. Gently replace the End Cap over the stencil and snap it into place. You can also lay the stencil on part to be marked.
4. Attach the small Alligator Clip to the terminal on the Ground Plate. Then plug the electrical cord into any 110 Volt A. C. outlet. (When ETCH-O-MATIC is plugged into the line current, it is completely safe to touch either the Head or the Ground Clip while unit is in use). In fact you can easily use ETCH-O-MATIC by holding the Ground Clip in your hand and touching the part to be marked instead of "clipping it onto the Ground Plate".
5. Use a piece of scrap metal to test your message imprint. Lay the metal on the Ground Plate and place the head of the ETCH-O-MATIC on the test metal for 6 - 8 seconds, then remove. You need not press hard. (Alligator Clip can be attached to the metal itself, if more convenient). You can mark round surfaces, such as drills, etc., by placing the tool on the Ground Plate

and rolling the Marker Head over it. When you mark your real part use a light oil or WD-40 (very lightly) on the place you are going to mark Before You Mark. This helps to reduce corrosion and makes cleaning easier.

If mark is not dark enough then add more Electrolyte or use a longer "dwell" time of 10-12 seconds on the next try. You should get 20 to 40 marks before you need more Electrolyte if pad is properly wet the first time. IMPORTANT NOTE: Too long a dwell time will "Burn Out" the stencil. For best results after every 4 - 6 marks, gently wipe a wet cloth or your finger across the stencil while still on the Head, in order to keep it from clogging with oxidized residue. A stencil can be used for 50 - 100 marks if handled carefully. You can also mark parts or tools by laying the stencil directly on the part or even using a piece of scotch tape and taping the stencil in place. This works especially well when you have to put a mark in a specific place on the part or tool.

After you have marked your tools or equipment it helps to preserve the mark if you let it dry for a minute or so and then wipe the marked areas with a damp cloth moistened with Neutralizer-Cleaner to remove the excess Electrolyte. Then use a cloth wet with plain water and wipe off the Neutralizer-Cleaner completely. Next dry and if necessary oil parts lightly to prevent rust. Another way to neutralize parts is to put the Neutralizer-Cleaner in a pan or shallow tray and lay the parts in the tray for a few minutes. Afterwards it is best to rinse the parts in clear water, air dry completely with an inexpensive "hair dryer" and then oil lightly. Remember if you get any "Rust" it is because there was water left on the part or it was not dried completely before applying oil, rust preventive or W-D 40.

#### **HOW TO MARK WITHOUT THE GROUND PLATE**

6. Many times it is easier to mark by turning the ETCH-O-MATIC on END (as shown at left) and rolling the round tool or instrument over the Marker Head. In so doing, be sure to line up the mark on the stencil so it will touch the tool in the correct place. Also it is important to TOUCH the Alligator GROUND Clip to the tool (or attach) so that an etch mark will occur.
7. On many tools you will find that you can simply place them directly on the imprint mark on the stencil (while the ETCH-O-MATIC is standing on END) and after you are SURE of correct placement. .. then either Touch the Ground Clip to the tool or Clip it on for 6 - 8 seconds.
8. Marks that require special placement can be made by removing the stencil from the Head of the ETCH-O-MATIC and placing the stencil exactly in the place desired directly on the tool. Place stencil so that the message is readable (NOT BACKWARD, as when mounted on the Head). Next, gently place the Head of ETCH-O-MATIC with its wet felt pad, on the stencil and hold. Then, touch the Ground Clip to the tool for 6 - 8 seconds and remove. You may even "scotch tape" the stencil to the part for placement. Always

use a very small amount of light oil on part as above before marking.

### **HOW TO MAKE DEEP ETCH MARKS (REQUIRES AN ADAPTER CLIP)**

9. Your ETCH-O-MATIC in regular usage marks with Alternating Current and produces a BLACK MARK (except on Aluminum). This mark is approximately 1/10,000 inch deep. You can etch down to about .003 inch deep by changing the normal A C. to DIRECT Current by the use of an ADAPTER CLIP. In most cases the D. C. mark will be CLEAR or FROSTY (Except on Aluminum where it is BLACK).

To make a DEEP ETCH simply clip your regular Ground Wire Alligator Clip to the RING TERMINAL on the RED ADAPTER CLIP. You now automatically have DIRECT CURRENT. You can Deep Etch Marks with or without the Ground Plate using any of the methods previously outlined and by using these SIX Hints. (1) Use ADAPTER CLIP (2) Use plenty of Electrolyte and wet pad every few marks (3) Use a time dwell of 8 - 40 seconds (8 seconds usually etches through normal Chrome plating on tools). (4) Use a moderate amount of hand pressure. Too little pressure makes a FUZZY mark. Too much pressure captures the escaping gases and causes very shallow etches. (5) Use a clean pad and wash it out or replace it every 100 - 200 DEEP ETCH MARKS, otherwise pad clogs with oxidized residue and does not produce good marks (6) Let set for one minute after etching before wiping with damp cloth to remove excess electrolyte and oxides Cloth should be wet with Neutralizer-Cleaner.

Then rinse with clean water, completely dry and oil if part would rust.

### **HOW TO MAKE DEEP ETCH BLACK MARKS**

10. Occasionally you may want to make a BLACK mark on something and yet have the mark etched DEEP into the metal. You can do this by simply starting with the ADAPTER CLIP attached and etch for at least 10 to 30 seconds to get the depth. Then WITHOUT MOVING THE ETCH-O-MATIC FROM THE TOOL EVEN THE SLIGHTEST BIT, TAKE THE ADAPTER CLIP OFF OF THE GROUND WIRE AND THEN TOUCH THE REGULAR ALLIGATOR (WITHOUT THE ADAPTER ATTACHED) TO THE TOOL AGAIN FOR ABOUT 10 SECONDS. This will first etch out a mark deep into the metal and then by using the A C. current you put BLACK in the bottom of the etched hole. This gives you a much more Permanent Black mark, which can't be easily removed.

### **HOW TO MARK ALUMINUM**

11. Use special ALUMINUM Electrolyte together with an ADAPTER CLIP and proceed as outlined in DEEP ETCHING. You can NOT mark Anodized Aluminum.

### **HOW TO MARK BLACK OXIDE SURFACES**

12. To mark BLACK OXIDE SURFACES USE THE SPECIAL Black Oxide Electrolyte together with an ADAPTER CLIP. Use a time dwell of 30 - 40 seconds depending on how deep the oxide coating is. HINT: Lay the stencil face up directly on the part to be marked as in direction 8 above. Alternately press and lift the hand marker in a slight "pulsing" action to create a white frosty mark. Black Oxide coatings vary in depth and you may have to experiment to find the best method for your situation. There are several different Electrolytes of Black Oxide and you may want to experiment to find the best for your purposes. Also Note: (Black Oxide is difficult to mark with the standard 10 Volt - 1 Amp ETCH-O-MATIC. We highly recommended you use the 15 Volt - 10 Amp SUPER ETCH-O-MATIC).

### **HOW TO MARK BRASS, COPPER & BRONZE**

13. For best results use the BRASS, COPPER, BRONZE electrolyte. (There are several types.)

### **NEUTRALIZERS**

14. Since most Electrolytes are slightly acid it is best to neutralize any mark or etch in order to completely stop etching process and to inhibit corrosion. To do so simply use some Neutralizer-Cleaner to either soak your parts for 5 - 10 minutes or wet a soft cloth and use this to wipe away the excess electrolyte. After wiping with the Neutral Cleaner you should rinse them, then dry the parts off and OIL them to keep them from rusting. It is especially important that any Ferrous type metal (Steels) be cleaned thoroughly with Neutralizer-Cleaner, rinsed with water, dried and oiled or you will find rust appearing after a period of time. HINT: in many cases it is best to wipe a very light coat of oil or WD-4 on the part Before marking and this way the electrolyte does not penetrate the metal pores and cause rust after a period of time in a humid climate. (If you get RUST there was Water Moisture left on the part somehow. Be sure it is completely dry)

### **CARE OF ETCH-O-MATIC**

15. When finished using ETCH-O-MATIC, unplug electrical cord and remove stencil. (Rinsing stencil will permit later use). For best results also remove both felt pads from the Head and wash them. To remove felt pads, loosen the stainless steel screws, which hold on the Grid and slip the Grid off. The reservoir pad will be found under the grid. If Grid becomes corroded, clean it with a wire brush, sand paper or emery cloth.

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**PAINT AND VARNISH**

16. ETCH-O-MATIC WILL NOT MARK THROUGH PAINT, VARNISH OR PLASTIC COATINGS. THE SURFACE MAY BE "ELECTRICALLY CONDUCTIVE".

**IMPORTANT INFORMATION:** Order from your **ETCH-O-MATIC** distributor or if he does not stock supplies you can order directly from **MARTRONICS CORPORATION. TERMS: F.O.B. SALKUM, WA**

**MINIMUM ORDER \$15.00. ORDER PHONE # (360) 985-2999 FAX # (360) 985-2996 MARTRONICS CORPORATION P.O. BOX 200 SALKUM, WA 98582**  
**WEBPAGE: [www.etch-o-matic.com](http://www.etch-o-matic.com) - E-MAIL ADDRESS: [Martronics@l-link-2-net](mailto:Martronics@l-link-2-net)**

## INSTRUCTIONS FOR

**Etch-O-Matic**

## LARGE GRID KIT

**HOW TO ATTACH LARGE GRID TO ETCH-O-MATIC**

First remove the plastic end cap from the head of your ETCH-O-MATIC. Next remove the regular grid from the ETCH-O-MATIC by using a screwdriver and removing the two screws that hold it in place. (You will find new screws included in your Large Grid Kit to replace the old screws). You will notice that inside the Large Grid there is a regular grid spotwelded in place. Slide the Large Grid into place and tighten the screws. Be sure that the screws are tight for a good electrical connection. A bad connection will make unsatisfactory marks.

**HOW TO ATTACH FELT PADS AND STENCIL TO LARGE GRID**

Remove the two plastic "snap on holders" from the edges of the grid. Next lay the pad and stencil across the grid and place the stencil in the position you desire with the ends of the pad and grid extending over the edges of the grid. Then press one of the "snap on holders" down over the stencil and pad tightly. Stretch the pad and stencil up over the edge of the grid on the opposite side. Next press on the other plastic "snap on holder" and your pad and stencil should now be ready for marking.

From this point on you can proceed exactly like marking with your regular grid on the ETCH-O-MATIC. You can mark either with or without the stencil being attached to the grid and you should refer to the "instructions for the ETCH-O-MATIC" to answer any remaining questions.

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## Change History

Rev. No.	Date	Change Description	Pages Changed
0		Original document	All originals
1	July 17, 2007	Clarification of final assembly requirements	Pages 3 through 6
2	October 9, 2007	Added puck cover and the engineered the helium vent system as required by PSS-CR-007.	All