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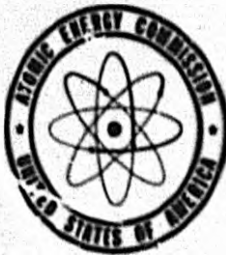
AECD-3901

**UNITED STATES ATOMIC ENERGY COMMISSION**

**OPERATING PROCESS FOR CANNING OF  
X-10 SLUGS**

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(2-858-1)  
AUCD-1901

INSPECTION, DIMENSION, WEIGHT, AND SURFACE

Date Issued \_\_\_\_\_ Page No. 1

Issued By \_\_\_\_\_ Operating Process Uranium Slugs Component Uranium Slugs

Approved By \_\_\_\_\_ Canning of X-10 Slugs Operation No. \_\_\_\_\_

Drawing No. AlOs-17547

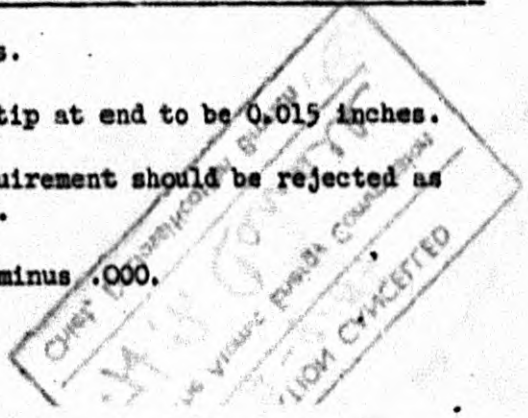
SPECIFICATIONS	CONTROL
1. Type "N" machined slugs (a) Diameter: 1.102" - 0.003" + 0.000 (b) Length: 4.000 ± 0.005" (c) Weight: 1165 - 1181 grams	1. (a) Gage or micrometer calipers (b) Gage or micrometer calipers (c) Balance accurate to 1 gram
2. Type "R" reclaimed slugs (a) Minimum weight, 1160 grams	2. (a) Balance accurate to 1 gram

OPERATING PROCEDURE

- Machined pieces with a greater diameter than 1.102 and/or a greater length than 4.005 shall be classified "RM" and returned to Account 47 for re-machining.
- Machined pieces with a smaller diameter than 1.099 and/or a smaller length than 3.995 shall be classified as Type 749 material and transferred to Account 46.
- Reclaimed slugs (Type "R") which fail to meet the minimum weight requirement should be transferred to Account 46.

RECOMMENDED OPERATING DETAILS AND PROCEDURES

- Slug surface: Maximum roughness 250 microinches.
- Maximum recess resulting from removing cut off tip at end to be 0.015 inches.
- Slugs which fail to meet the minimum weight requirement should be rejected as Type 749 material and transferred to Account 46.
- The chamber dimension is to be .060" plus .040 minus .000.



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DEGREASING

Date Issued \_\_\_\_\_

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Operating Process

Component Uranium Slugs

Approved By \_\_\_\_\_

Canning of X-10 Slugs

Operation No. \_\_\_\_\_

Drawing No. \_\_\_\_\_

SPECIFICATIONS	CONTROL
1. Solvent vapor degreaser using stabilized tetrachloroethylene.	1. No control necessary
2. Minimum time of immersion in vapors: 2-1/2 minutes.	2. Timer

OPERATING PROCEDURE

1. Place basket of slugs in the solvent vapor for the time specified.

RECOMMENDED OPERATING DETAILS AND PROCEDURES

1. Depth of solvent in boiling chamber: between marks on sight glass.
  2. Minimum pH of solvent vapor: 7 (determine with moist indicator paper).
  3. Maximum moisture in the solvent: less than that required to produce cloudy vapors.
  4. Maximum period of use of solvent: one week.
  5. Minimum temperature of tetrachloroethylene vapors: 120° C.
  6. At end of week draw off clean condensate using pump until boiling sump contains only dirty oil. Sump should then be cleaned, after which solvent may be replaced. Sump cleanings should be salvaged using standard procedures for uranium contaminated combustibles in Account 25.
- ~~XXXXXXXXXX~~

PICKLE, RINSE, AND DRY

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Operating Process

Component Uranium Slugs

Approved By \_\_\_\_\_

Canning of X-10 Slugs

Operation No. \_\_\_\_\_

Drawing No. \_\_\_\_\_

SPECIFICATIONS

1. Pickle: commercial nitric acid
  - (a) Concentration: 50%  $\text{HNO}_3$  (by weight)
  - (b) Temperature: 60° - 70° C.
  - (c) Contamination: Cations  
Precipitable as hydroxides, from 10 ml. sample. (If precipitate is brown, indicating iron contamination, 2 ml. maximum volume.)
    - (1) Uranium contamination (canary yellow precipitate): 12 ml. maximum volume.
  - (d) Phosphate ion: 0.1% (maximum)
2. Immersion time: 1 minute. Followed by cold water rinse. Immersion time on recovered slugs: 2 minutes.
3. Drying time: until no liquid remains.

CONTROL

1.
  - (a) Titration with standard caustic solution (NaOH).
  - (b) Thermometer
  - (c) Volumetric measurement of solids precipitated by addition of ammonium hydroxide ( $\text{NH}_4\text{OH}$ ).
    - (1) Visual determination of color; gradual tube.
  - (d) Quantitative test for phosphate.
2. Timer
3. Visual

OPERATING PROCEDURE

1. Immerse slugs in pickle solution for specified time.
2. Avoid contamination of slug surface after pickling.

RECOMMENDED OPERATING DETAILS AND PROCEDURES

1. Rinse in cold water flowing at rate of full discharge; dry in forced hot air blast.
2. Rinse is transferred from tank to drum as necessary.
3. Pickle and rinse are sampled and waybilled to Account 60.

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SURFACE AND QUALITY INSPECTION

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Issued By \_\_\_\_\_ Operating Process Component Uranium Slugs  
Approved By \_\_\_\_\_ Canning of X-10 Slugs Operation No. \_\_\_\_\_  
Drawing No. AlOe-17547

SPECIFICATIONS	CONTROL
1. Compound layer on reclaimed slugs (Type R): No visible spots.	1. Visual

OPERATING PROCEDURE

1. Reclaimed pieces rejected for incomplete removal of the compound layer should be returned to the recovery process.

RECOMMENDED OPERATING DETAILS AND PROCEDURES

1. The following defects are acceptable; if present in greater degree, they are unacceptable:
    - (a) Defects which assume a clear metallic lustre on surface of defect when slug is pickled.
    - (b) Defects with such a structure that no liquid remains in recesses after remainder of slug is dry.
    - (c) Defects which do not deform slug to such an extent that it interferes with assembly in canning.
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INSPECTION

Date Issued \_\_\_\_\_

Page No. 5

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Operating Process

Component Aluminum Can

Approved By \_\_\_\_\_

Canning of X-10 Slugs

Operation No. \_\_\_\_\_

Drawing No. \_\_\_\_\_

SPECIFICATIONS	CONTROL
1. Length: $4 \frac{21}{32} \pm \frac{1}{64}$	1. Rule or gage
2. I.D.: $1.121" \pm 0.0003"$	2. Gage
3. Wall thickness: $0.033" \pm 0.0003"$	3. Gage
4. Bottom thickness: $0.051" \pm 0.005"$	4. Gage
5. Gage for straightness: to pass full length plug $1.117" \pm 0.0005"$ without tightness.	5. Plug gage
6. Bottom radii: (a) Outside: rounded, free from burrs. (b) Inside: $0.055"$ maximum	6. (a) Visual (b) Gage
7. Surfaces: Free from dents, tool marks or other imperfections $> 0.002"$ deep.	7. Visual - aided by standards

OPERATING PROCEDURE

1. Surfaces of all cans are to be inspected by operations personnel following etching, rinsing, and drying.

RECOMMENDED OPERATING DETAILS AND PROCEDURES

1. Following etching, rinsing, and drying, cans must be handled while wearing clean, dry gloves.

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DEGREASING

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Operating Process

Component Aluminum Can

Approved By \_\_\_\_\_

Canning of X-10 Slugs

Operation No. \_\_\_\_\_

Drawing No. \_\_\_\_\_

SPECIFICATIONS	CONTROL
1. Solvent vapor degreaser using stabilized tetrachloroethylene.	1. No control required.
2. Minimum time for immersion of cans in vapors: three minutes.	2. Timer
3. Minimum time for immersion of cans in condensates: fill and empty 3 times.	3. No control required.
4. Minimum time for draining in vapors: three minutes.	4. Timer

OPERATING PROCEDURE

1. Degreaser unit used for degreasing cans and caps shall be used for this purpose only.
2. Insert basket of cans in vapors in horizontal position for three minutes.
3. Flush cans with clean condensate using spray, filling and emptying three times.
4. Dry in vapors, mouth down.

RECOMMENDED OPERATING DETAILS AND PROCEDURES

1. Depth of solvent in boiling chamber: between marks on sight glass.
  2. Minimum pH of solvent vapor: 7 (determine with moist indicator paper).
  3. Maximum moisture in the solvent: less than that required to produce cloudy vapors.
  4. Minimum temperature of tetrachloroethylene vapors: 120° C.
  5. Maximum period of use of solvent: one week.
  6. At end of week draw off clean condensate using pump until boiling sump contains only dirty oil. Sump should then be cleaned, after which solvent may be replaced. Sump cleanings may be discarded.
- ~~XXXXXXXXXX~~

ETCH, RINSE, AND DRY

Date Issued \_\_\_\_\_

Page No. 7

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Operating Process

Component Aluminum Can and Caps

Approved By \_\_\_\_\_

Canning of X-10 Slugs

Operation No. \_\_\_\_\_

Drawing No. \_\_\_\_\_

SPECIFICATIONS	CONTROL
1. Etch solution: hydrofluoric acid and nitric acid (HF and HNO <sub>3</sub> ). (a) Concentration: 1 part (by volume) commercial HF (~40% HF) 2 parts (by volume) commercial HNO <sub>3</sub> (~60% HNO <sub>3</sub> ). (b) Immersion time: approximately 2 to 5 minutes, as determined by visual appearance of reaction. (c) Bath temperature: 150 - 170° F. (d) Maximum period of use - one week.	1. (a) None (b) Timer (c) Dial thermometer (d) Log sheets
2. Rinse solution: flowing water.	
3. Dehydrant: methyl alcohol. (a) Maximum water concentration: 18% (b) pH: not more than 0.1 unit less than new methanol.	3. (a) Sp.G. or turbidity tests (b) Test paper
4. Drying: hot air blast. (a) Time: 10-15 minutes. (b) Maximum time of dry storage: 4 hours.	4. (a) Timer (b) Clock

OPERATING PROCEDURE

1. Immerse cans, mouth end up, for specified time in etch solution.
2. Rinse thoroughly, filling and emptying cans in rinse at least five times.
3. Invert cans and drain drip free.
4. Rinse cans in methanol; drain, place inverted on dryer.
5. Cans must not be re-etched.

RECOMMENDED OPERATING DETAILS AND PROCEDURES

1. Rinse in cold water flowing at a rate equivalent to full discharge from 1/2" pipe.
2. Dry in air 50° - 80° C. Dryer should be kept clean so that the maximum air velocity approaches 400 feet per minute, as measured with velometer.



SEQUENCE OF OPERATIONS

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Operating Process

Component Steel Sleeves

Approved By \_\_\_\_\_

Canning of X-10 Slugs

Operation No. \_\_\_\_\_

Drawing No. \_\_\_\_\_

SPECIFICATIONS	CONTROL

OPERATING PROCEDURE

Sequence of operations for:

1. New sleeves:
  - (a) Degrease Shop Operation
  - (b) "Bluing" Shop Operation
  - (c) Wash and rinse
  - (d) Inspection
  - (e) Caustic treatment and rinse
  - (f) Soap, rinse, and dry
  - (g) Re-inspection for I. D. and warp
  
2. Used Sleeves
  - (a) Descale
  - (b) Caustic treatment and rinse
  - (c) Soap, rinse, and dry
  - (d) Inspection for surface, I. D., and warp

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RECOMMENDED OPERATING DETAILS AND PROCEDURES

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DEGREASE

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Operating Process

Component Steel Sleeves (New)

Approved By \_\_\_\_\_

Canning of X-10 Slugs

Operation No. \_\_\_\_\_

Drawing No. \_\_\_\_\_

SPECIFICATIONS	CONTROL
1. Solvent vapor degreaser using stabilized tetrachloroethylene.	1. No control required.
2. Minimum time of immersion in leaching solvent. Fill and empty 3 times.	2. No control required.
3. Minimum time of immersion of sleeves in condensate: fill and empty 3 times.	3. No control required.
4. Minimum time of draining in vapors: three minutes.	4. Electric timer.

OPERATING PROCEDURE

1. This operation applies to new sleeves only.
2. Immerse sleeves horizontally in boiling solvent: fill and empty three times.
3. Repeat in clean condensate.
4. Dry, mouth down, in vapors.

RECOMMENDED OPERATING DETAILS AND PROCEDURES

1. Depth of solvent in boiling chamber: between marks on sight glass.
2. Minimum pH of solvent: 7 (test with moist indicator paper).
3. Maximum moisture in the solvent: less than that required to produce cloudy vapors.
4. Minimum temperature of tetrachloroethylene vapors: 120° C.
5. Maximum period of use of solvent: follow manufacturer's recommendations.

"BLUING" AND DESCALING

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Operating Process

Component Steel Sleeves

Approved By \_\_\_\_\_

Canning of X-10 Slugs

Operation No. \_\_\_\_\_

Drawing No. \_\_\_\_\_

SPECIFICATIONS	CONTROL
1. Surface oxidation or "bluing" (new sleeves only). (a) Heat sleeves, batchwise in an oxidizing atmosphere until blue in appearance. (b) Temperature: 3150 - 3450 C. (6000 - 6500 F.)	1:  (a) Visual  (b) Electric furnace control

OPERATING PROCEDURE

RECOMMENDED OPERATING DETAILS AND PROCEDURES

1. Descaling (used sleeves only):
  - (a) Loose scales and heavy lumps of Al-Si should be removed mechanically from outside sleeve surface by rubbing or scraping.
  - (b) Unfilled cans are removed by forcible withdrawal, but care must be taken not to mar inside surface of sleeves.

SECRET  
DEFENSE INFORMATION

WASH, RINSE, AND DRY

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Operating Process

Component Steel Sleeves (New)

Approved By \_\_\_\_\_

Canning of X-10 Slugs

Operation No. \_\_\_\_\_

Drawing No. \_\_\_\_\_

SPECIFICATIONS	CONTROL
<p>This operation applies to new sleeves only:</p> <ol style="list-style-type: none"><li>1. Wash solution: Ivory soap flakes or equivalent 0.2% ± 0.05%, by weight.</li><li>2. Wash solution temperature: 45° - 60° C.</li><li>3. Motor driven rotary brush or equivalent.</li></ol>	<ol style="list-style-type: none"><li>1. As made up.</li><li>2. Thermometer</li><li>3. No control required.</li></ol>

OPERATING PROCEDURE

1. Wash for a time sufficient to insure complete removal of metal and abrasive particles.
2. Rinse in cold flowing water.
3. Dry.

RECOMMENDED OPERATING DETAILS AND PROCEDURES

1. Dry sleeves in warm air blast to prevent rusting.
- SECRET  
DEFENSE INFORMATION

DIMENSIONAL INSPECTION

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Operating Process

Component Steel Sleeves

Approved By \_\_\_\_\_

Canning of X-10 Slugs

Operation No. \_\_\_\_\_

Drawing No. A10e-17548a

SPECIFICATIONS	CONTROL
<p>1. Dimensions:</p> <p>(a) I.D. 1.197" minimum, 1.200" maximum.</p> <p>(b) Warp: must pass over full length plug 1.1968" <math>\pm</math> <math>\frac{0.000}{0.006}</math> in diameter without tightness.</p> <p>(c) Inside depth: 4-22/32" <math>\pm</math> 1/64".</p>	<p>1.</p> <p>(a) Plug gage, air gauge</p> <p>(b) Drawing No. <u>A9F-17613</u></p> <p>(c) Rule or templet</p>

OPERATING PROCEDURE

1. No fillet or weld bead shall be permitted at juncture of bottom with inside wall.
2. New sleeves shall be 100% inspected for I.D. warp, inside depth, inclination of bottom surface, fillet, and weld bead.
3. Used sleeves, to be acceptable for re-use, shall pass full length over a mandrel  $\pm$   $\frac{0.0000}{1.1968}$ " in diameter without forcing.

RECOMMENDED OPERATING DETAILS AND PROCEDURES

1. Mouth radius: 3/32".
2. Should difficulty with slugs stuck in sleeves be encountered, an air pressure plug gage may be used to check variations in sleeve I.D.

CAUSTIC TREATMENT AND RINSE

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Operating Process

Component Steel Sleeves

Approved By \_\_\_\_\_

Canning of X-10 Slugs

Operation No. \_\_\_\_\_

Drawing No. \_\_\_\_\_

SPECIFICATIONS	CONTROL
<p>This operation applies to both new and used sleeves:</p> <ol style="list-style-type: none"><li>1. Caustic bath: commercial sodium hydroxide (NaOH).<ol style="list-style-type: none"><li>(a) Concentration: make up to 20% by weight. Replace bath when concentration drops to 10%.</li><li>(b) Temperature: 70° - 90° C.</li><li>(c) Treatment time: until sleeves are entirely free of Al-Si.</li><li>(d) Solution level: adequate to immerse charge of sleeves completely.</li></ol></li><li>2. Rinse: cold flowing water.</li></ol>	<ol style="list-style-type: none"><li>1.<ol style="list-style-type: none"><li>(a) Titration methods</li><li>(b) Thermometer</li><li>(c) Cessation of evolution of gas bubbles.</li><li>(d) Visual</li></ol></li><li>2. Water flow at tap temperature.</li></ol>

OPERATING PROCEDURE

1. Immerse used sleeves, mouth upward, completely under hot caustic solution until Al-Si is completely dissolved.
2. Remove sleeves from bath, drain drip-free in inverted position; rinse thoroughly in cold flowing water, filling and emptying at least five times.

RECOMMENDED OPERATING DETAILS AND PROCEDURES

1. New sleeves should be immersed 5 - 8 minutes.
2. Frequently remove floating scum by skimming.

RUST PREVENTIVE RINSE AND DRY

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Operating Process

Component Steel Sleeves

Approved By \_\_\_\_\_

Canning of X-10 Slugs

Operation No. \_\_\_\_\_

Drawing No. \_\_\_\_\_

SPECIFICATIONS	CONTROL
<p>This operation applies to both new and used sleeves.</p> <p>1. Rinse solution:</p> <p>(a) Composition: 3% - 4% by weight, Ivory soap chips or equivalent, plus 0.1% ± 0.02%, by weight, tetrasodium pyrophosphate.</p> <p>(b) Temperature: 50° - 80° C.</p> <p>(c) Period of use: change as required.</p> <p>2. Drying time: until no liquid remains on surfaces.</p>	<p>1.</p> <p>(a) As made up</p> <p>(b) Thermometer</p> <p>(c) Visual: soap film such that rust formation is prevented.</p> <p>2. Visual</p>

OPERATING PROCEDURE

1. Sleeves shall be completely immersed in rust preventive solution immediately following cold water rinse, in such a manner as to insure complete wetting of all sleeves surfaces both inside and outside.
2. This operation is followed by a 100% inspection of sleeves for I. D. and warp.

RECOMMENDED OPERATING DETAILS AND PROCEDURES

1. Dryer temperature 50° - 80° C.
2. Drain drip-free and dry, inverted, on forced air dryer.
3. Dryer should be clean so that the maximum air velocity approaches 400 feet per second as measured with velometer.
4. Avoid condition of application whereby a heavy soap film or irregular deposits are left on inside surfaces or at mouth.

INSPECTION

Date Issued \_\_\_\_\_

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Operating Process

Component Aluminum Cap

Approved By \_\_\_\_\_

Canning of X-10 Slugs

Operation No. \_\_\_\_\_

Reference  
Drawing No. AlOe-17549

SPECIFICATIONS	CONTROL
1. Material: 99.3% - 99.6% aluminum 2. Cap base: (a) Diameter 1.116" $\pm$ 0.000" - 0.004" 3. Side surfaces: fine finish 4. Bottom surface: (a) Flat within 0.003" T.I.R. (b) No cut off top permitted (c) No scratches > 0.003"	1. Laboratory acceptance tests 2. (a) Micrometer calipers or gage 3. Visual (compare to CEW-TEC standards)

OPERATING PROCEDURE

1. Caps shall be 100% inspected for diameter and surface.

RECOMMENDED OPERATING DETAILS AND PROCEDURES



SECRET  
RESTRICTED INFORMATION

**HEAT TREATING CONTROL**

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Operating Process

Component Uranium Slugs

Approved By \_\_\_\_\_

Canning of X-10 Slugs

Operation No. \_\_\_\_\_

Drawing No. \_\_\_\_\_

SPECIFICATIONS	CONTROL
1. Bath composition: Liquid heat #980 heat treating salt (E.F.Houghton Co.)	
2. Time of dip: 90 seconds	2. Timer
3. Temperature: 730° ± 10° C.	3. Potentiometer

**OPERATING PROCEDURE**

1. Immerse slugs, held in suitable tongs, in molten salt for specified time.
2. Quench slugs in flowing water quench tank.

**RECOMMENDED OPERATING DETAILS AND PROCEDURES**

1. Samples will be taken at specified intervals of the molten salt bath for uranium and iron analysis. Bath must be agitated vigorously before each sample in order that samples may be truly representative.

COMPOSITE BATH

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Operating Process

Component Uranium Slugs

Approved By \_\_\_\_\_

Canning of X-10 Slugs

Operation No. \_\_\_\_\_

Drawing No. \_\_\_\_\_

SPECIFICATIONS	CONTROL
<p>1. Composition:</p> <ul style="list-style-type: none"><li>(a) 9" layer of commercial lead (plus lead in channels) in Ajax pot.</li><li>(b) 6" layer of Al-Si (11.0% - 11.5% Si) alloy.</li><li>(c) 1" layer of flux (Eutector #190 aluminum brazing flux).</li></ul>	
<p>2. Period of use of flux: one day</p>	
<p>3. Operating temperature: 590°-615° C.</p>	<p>3. Potentiometer</p>
<p>4. Time cycle:</p> <ul style="list-style-type: none"><li>(a) In lead layer: 35 seconds</li><li>(b) In Al-Si layer: 5 seconds</li></ul>	<p>4. Timer</p>

OPERATING PROCEDURE

1. Immerse slugs, held two at a time in appropriate fixture, into lead layer. Agitate slugs in lead for specified time.
2. Raise slugs into Al-Si layer and agitate for proper time.
3. Raise slugs through flux layer out of bath for subsequent operations.

RECOMMENDED OPERATING DETAILS AND PROCEDURES

1. When making up a new bath Al-Si must be melted first, with pigs of lead added to the melt later in order to prevent excessive oxidation. In any case when a new bath is made up, layer of oxide forms at the lead-Al-Si interface and must be removed before canning can start since presence of the oxide affects wetting of slugs.

COMPOSITE BATH

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RECOMMENDED OPERATING DETAILS AND PROCEDURES (CONTINUED)

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2. Slugs showing evidence of incomplete wetting after removal from composite dip shall be quenched immediately without carrying through further stages of canning.
3. Batch will be sampled daily for Si content of alloy by thermal analysis. Adjustments will be made to keep Si content between 11.0% - 11.5%.
4. Flux layer should be deep enough to cover Al-Si at all times. It will be necessary to add flux periodically during each day's operation in order to maintain this level.

ALUMINUM-SILICON DIP

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Operating Process

Component Uranium Slugs

Approved By \_\_\_\_\_

Canning of X-10 Slugs

Operation No. \_\_\_\_\_

Drawing No. \_\_\_\_\_

SPECIFICATIONS	CONTROL
1. Operating temperature: $595^{\circ} \pm 5^{\circ}$ C.	1. Recording potentiometer

OPERATING PROCEDURE

1. This bath may be made up from either virgin Al-Si and Al to give 11.0% - 11.5% silicon content, or it may consist of the discarded Al-Si removed from the canning furnace.
2. Surface of bath shall be free from oxide and dirt immediately before immersion and removal of slugs from the dipping bath.
3. Slugs showing evidence of incomplete wetting after removal from the Al-Si dip shall be quenched immediately without carrying through further stages of canning.

RECOMMENDED OPERATING DETAILS AND PROCEDURES

1. Time of dip: 3 seconds.
2. Vigorously agitate slug in bath during dipping period.

ALUMINUM-SILICON CANNING BATH

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Operating Process

Component All

Approved By \_\_\_\_\_

Canning of X-10 Slugs

Operation No. \_\_\_\_\_

Drawing No. \_\_\_\_\_

SPECIFICATIONS	CONTROL
<p>1. Canning bath composition: Al-Si (a) Silicon content: 11.2% - 11.5% NOTE: (b) The compositions specified above are not critical in the sense that exceeding the limits constitutes cause for rejection, but they are important in maintaining efficiency.</p> <p>2. Operating temperature: <math>593^{\circ} \pm 3^{\circ}</math> C.</p> <p>3. Maximum time of dip of slug prior to insertion in can: 2 seconds.</p>	<p>1. (a) Thermal analysis checked by chemical analysis. (b) Spectrographic analysis or chemical analysis.</p> <p>2. Recording potentiometer</p> <p>3. Electric timer</p>

OPERATING PROCEDURE

1. Transfer slugs from Al-Si dip to canning bath using suitable tongs.
2. Skim surface immediately prior to immersion of slugs. Give slugs a quick dip to flush off oxides.
3. Remove slugs from bath and begin assembly.

RECOMMENDED OPERATING DETAILS AND PROCEDURES

CANNING ASSEMBLY

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Operating Process

Component All

Approved By \_\_\_\_\_

Canning of X-10 Slugs

Operation No. \_\_\_\_\_

Drawing No. \_\_\_\_\_

SPECIFICATIONS	CONTROL
1. Assembly cycle (a) Sleeve-can preheat: 45 seconds ± 5 seconds. (b) Sleeve-can submersion time: 40 seconds ± 15 seconds. (c) Standard cap preheat: 20 seconds ± 5 seconds.	1. (a) Electric timer (b) Electric timer (c) Electric timer

OPERATING PROCEDURE

Preheating of can-sleeve assembly and of cap is begun during slug dipping, at such times that all component parts will be ready for assembling in the proper sequence.

1. Place can and sleeve, previously assembled, in canning fixture.
2. Immerse can-sleeve assembly in vertical position in molten bath to within 1/2" of mouth.
3. Immediately prior to submerging can, flare its mouth with suitable flaring tool.
4. Submerge can-sleeve assembly in bath. Hold submerged for specified time.
5. After giving slug a quick dip in canning bath, insert its lower end in can mouth.
6. Lower can-sleeve assembly gently to submerged level, meanwhile keeping slug aligned coaxial with can.
7. Keeping slug aligned coaxial with can, allow slug to slip into can under its own weight for at least half its length.
8. Push slug to bottom of can with a push rod, if necessary.
9. Remove cap, hold in tongs, from bath (in which it has now been preheating) and scrape its bottom vigorously across a piece of transite board.

CANNING ASSEMBLY

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OPERATING PROCEDURE (CONTINUED)

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10. Re-submerge cap in bath for two seconds, during which it is given three vigorous swirls with rotary motion.
11. Without removing cap from bath, insert it with a twisting motion in open end of can above slug.
12. Apply pressure to cap to insure that it is completely seated.
13. Raise assembled piece from canning bath and transfer it to quench.

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RECOMMENDED OPERATING DETAILS AND PROCEDURES

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1. Holding cap in suitable tongs, submerge cap in bath for twenty seconds.
2. Skim surface of bath with spatula just prior to arrival of slug from Al-Si dipping bath.
3. Raise can-sleeve assembly sufficiently to permit orientation of slug in can mouth.

QUENCH

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Operating Process

Component Canned Assembly

Approved By \_\_\_\_\_

Canning of X-10 Slugs

Operation No. \_\_\_\_\_

Drawing No. \_\_\_\_\_

SPECIFICATIONS

CONTROL

1. Quench medium: cold flowing water

1. Water flow at tap temperature

OPERATING PROCEDURE

1. Transfer canned assemblies to quenching baskets.
2. Quench. When assembly is quenched, remove it from sleeve.

RECOMMENDED OPERATING DETAILS AND PROCEDURES

1. Time of immersion: until cool to the touch.



CANNED ASSEMBLY MACHINING

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Operation Process

Component Canned Assembly

Approved By \_\_\_\_\_

Canning of X-10 Slugs

Operation No. \_\_\_\_\_

Drawing No. \_\_\_\_\_

SPECIFICATIONS	CONTROL
1. Total length of slug should be 4.120" ± 0.003".	1. Calipers or gage

OPERATING PROCEDURE

1. Adjust automatic chucking device and milling blade to give specified length without defacing slug top.
2. Chuck ten slugs into machine and start automatic cycle mechanism.

RECOMMENDED OPERATING DETAILS AND PROCEDURES

1. Mill bed and chuck must be cleaned with air blast to assure proper seating of slugs before each operation.
2. Cooling water flow must be adjusted so that milling blade does not overheat and so that slug caps are milled smoothly.
3. If milling blade is dull, as evidenced by tool marks on slug top, blade should be replaced and sent to shop for re-grinding.
4. Periodic checks must be made with dowel gage to assure that slug length is properly maintained.

CANNED ASSEMBLY WELDING

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Operating Process

Component Canned Assembly

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Canning of X-10 Slugs

Operation No. \_\_\_\_\_

Drawing No. \_\_\_\_\_

SPECIFICATIONS	CONTROL
1. Minimum argon purity: 99.8%	
2. Current setting: 65 - 70 amps	2. Ammeter
3. Condition of weld bead: free from pin holes, porosity, and all other visual defects.	3. Visual
4. Rate of rotation: such that a molten pool stays ahead of arc.	4. Visual
5. Argon flow: 6 - 8 cubic feet/hour.	5. Rotameter

OPERATING PROCEDURE

1. Chuck slug into welding machine collet.
2. Lower electrode to center of slug and strike arc.
3. Start rotation of slug, gradually moving electrode toward outer edge of slug, allowing preheat pass to continue until molten pool of proper characteristics builds up in front of arc.
4. As soon as preheat pass has produced proper welding conditions, move arc to extreme edge of slug and make only one welding pass completely around slug.

RECOMMENDED OPERATING DETAILS AND PROCEDURES

1. Electrode is set, when fully lowered, to clear slug by .050".
2. Speed of rotation of collet will govern size of weld bead obtained.

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SECURITY INFORMATION

AUTOCLAVE TEST

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Operating Process

Component Canned Assembly

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Canning of X-10 Slugs

Operation No. \_\_\_\_\_

Drawing No. \_\_\_\_\_

SPECIFICATIONS	CONTROL
1. Steam pressure: 125 psi	1. Pressure gage
2. Duration of test: 40 hours minimum	2. Log Sheets

OPERATING PROCEDURE

1. After placing the lid on autoclave, the chamber shall be thoroughly purged of air with live steam for 30-45 seconds. Then the autoclave should be put under a steam pressure of 125 psi.
2. The steam may be turned off after 40 hours and the lid removed. With as little lapse of time as possible, the slugs should be quenched with a spray of tap water. The autoclave may be flooded with water if it becomes necessary in cooling the slugs.
3. The burned slugs from the autoclave should be accounted for as rejects and salvaged by putting in solution with  $\text{HNO}_3$ .

RECOMMENDED OPERATING DETAILS AND PROCEDURES

1. The slugs and baskets should be free from dust or grit which would cause abrasions.
2. The water accumulated in the autoclave from quenching the slugs should be handled as condensate which is collected in the "sump" tank. The "sump" tank should be sampled daily and condensate pumped to the pit if ppm is low enough. Handle solutions in Account 97.
3. The Alsop filter used in removing solids from condensate line should be salvaged as combustible solids in Account 25.

PENETRATION ETCH, RINSE, AND DRY

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Operating Process

Component Canned Assembly

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Canning of X-10 Slugs

Operation No. \_\_\_\_\_

Drawing No. \_\_\_\_\_

SPECIFICATIONS	CONTROL
1. Etch solution: commercial nitric acid ( $\text{HNO}_3$ ) (a) Composition: 40% - 50% nitric acid by weight (b) Temperature: 80° - 90° C. (c) Maximum period of use: none	1. (a) Titration or specific gravity (b) Dial thermometer
2. Etch time: 10 - 20 minutes	2. Timer
3. Rinse: cold flowing water	3. Water flow at tap temperature
4. Dryer: forced air dryer	4. No control required

OPERATING PROCEDURE

1. Etch pieces until they are clean and bright, and until any imbedded particles (or scale) have been removed.

RECOMMENDED OPERATING DETAILS AND PROCEDURES

1. The water flow should be equivalent to the full discharge of a 1/2" pipe.
2. Dryer should be kept clean so that air velocity approaches 400 feet per minute at point of maximum velocity as measured by anemometer.

FINAL INSPECTION

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Operating Process

Component Canned Assembly

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Canning of X-10 Slugs

Operation No. \_\_\_\_\_

Drawing No. \_\_\_\_\_

SPECIFICATIONS	CONTROL
<p>1. Causes for rejection:</p> <ul style="list-style-type: none"><li>(a) Evidence of Al-Si penetration.</li><li>(b) Evidence of Al-Si soldered to outside of can.</li><li>(c) Marred surfaces; any scratch or dent &gt; 0.003" in depth.</li><li>(d) Pinholes, porosity, or larger defects in weld.</li><li>(e) Evidence of pitting.</li><li>(f) Any swelling or rupture of can wall or cap.</li><li>(g) Failure to pass through 1.191" + 0.002" I.D. tube gage. - 0.000"</li></ul>	<p>1.</p> <ul style="list-style-type: none"><li>(a) Visual</li><li>(b) Visual</li><li>(c) Visual, aided by standards</li><li>(d) Visual, aided by lens</li><li>(e) Visual, aided by lens</li><li>(f) Visual</li><li>(g) Gage, Drawing No. A9e-17612</li></ul>

OPERATING PROCEDURE

1. Cases of doubtful penetration shall be abraded with a soft rubber eraser, examined under the lens and, if necessary, re-etched to determine whether Al-Si has penetrated to the outer surface.
2. Pieces bearing white stains without visual evidence of pitting shall be accepted without re-etching.
3. Pieces having red, brown, or black stains shall be re-autoclaved for 40 hours and re-etched.

RECOMMENDED OPERATING DETAILS AND PROCEDURES

REJECT RECOVERY (HF BATH)

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Rejected Canned

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Operating Process

Component Assembly

Approved By \_\_\_\_\_

Canning of X-10 Slugs

Operation No. \_\_\_\_\_

Drawing No. \_\_\_\_\_

SPECIFICATIONS

CONTROL

1. Bath solution: hydrofluoric acid (HF)

1. Acceptance tests

OPERATING PROCEDURE

1. After placing the slugs in a hastalloy basket, immerse in a 10% hydrofluoric acid bath. The temperature should be held at 75° or 80° F.
2. After the slugs have been immersed for one hour they should be removed and allowed to drip while being suspended above the bath, and rinsed free of HF with cold water by immersing the slugs in a 55 gallon stainless steel drum of cold water.
3. The slugs are now ready for the nitric acid bath.

RECOMMENDED OPERATING DETAILS AND PROCEDURES

1. This operation requires adequate exhaust venting. Because of the hazardous nature of the solution, safety rules must be rigidly observed.
2. The 10% hydrofluoric acid bath may be prepared by filling half the tank with water and adding three and a half gallons of HF, a half gallon at a time, from a rubber bucket. After this operation the tank should have water added to an outage of 5 or 6 inches.
3. After the hydrofluoric acid bath loses its strength, aluminum nitrate should be added (about 25 or 30 pounds) in sufficient quantity so as to make it unreactive toward stainless steel. The solution should be handled in Account 60 and sampled.
4. The water rinse solution should have aluminum nitrate added (about 5 or 6 pounds), sampled, and handled in Account 60.

REJECT RECOVERY (CAUSTIC BATH)

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Operating Process

Rejected Canned  
Component Assembly

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Canning of X-10 Slugs

Operation No. \_\_\_\_\_

Drawing No. \_\_\_\_\_

SPECIFICATIONS	CONTROL
1. Caustic bath: commercial sodium hydroxide (NaOH)	1. Chemical acceptance tests

OPERATING PROCEDURE

1. By means of a hoist, immerse a stainless steel basket filled with de-capped slugs into the caustic bath. Caution should be taken so as to avoid over-heating of the bath due to heat of reaction of the aluminum with the caustic solution. After the reaction has subsided somewhat, the temperature should be maintained at 150° F. The temperature of the bath may be increased to bring about a more vigorous reaction as the caustic solution becomes weaker with use.
2. The slugs should remain in the caustic bath until free of aluminum (about two hours).
3. Rinsing of the slugs free from caustic may be carried out by immersing in a 55 gallon stainless steel drum or by playing a fine spray of water on the slugs while they are suspended above the caustic bath.
4. The rinsed slugs should be transferred to the hastalloy basket before the hydrofluoric acid bath process is begun.

RECOMMENDED OPERATING DETAILS AND PROCEDURES

1. A 15% sodium hydroxide and 13% sodium nitrate solution may be prepared by adding H<sub>2</sub>O to an outage of 20" (239 liters), 50 Kg. of NaOH and 43.2 Kg. NaNO<sub>3</sub> (approximately one 96 pound bag). Caution should be taken in adding the solids due to splattering -- wear monogoggles.
2. The depleted caustic solution is pumped into a 55 gallon stainless steel drum, sampled, and handled in Account 60.
3. If a water rinse is used (using a 55 gallon stainless steel drum) the water solution should be sampled and handled in Account 60.

REJECT RECOVERY (HNO<sub>3</sub> BATH)

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Operating Process

Component Assembly

Approved By \_\_\_\_\_

Canning of X-10 Slugs

Operation No. \_\_\_\_\_

Drawing No. \_\_\_\_\_

SPECIFICATIONS	CONTROL
1. Bath solution: nitric acid (HNO <sub>3</sub> )	1. Laboratory acceptance tests

OPERATING PROCEDURE

1. Using a stainless steel or Hastelloy basket, the slugs should be completely immersed in a 20% solution of nitric acid at a bath temperature of about 170° F for 3 - 10 minutes until the slugs are clean.
2. The slugs are removed from the HNO<sub>3</sub> bath and rinsed by dipping into a 55 gallon drum containing water.
3. After rinsing and drying, the slugs are ready for inspection.

RECOMMENDED OPERATING DETAILS AND PROCEDURES

1. The 20% nitric acid bath may be prepared by adding eight and one-half gallons of 60% HNO<sub>3</sub> and adding water to an outage of 20 inches.
2. The nitric acid solution should be sampled and handled in Account 60.
3. The water solution should be sampled and handled in Account 60.



SAFETY RULES TO BE OBSERVED IN USING  
HYDROFLUORIC ACID IN SLUG RECOVERY ROOM

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Operating Process

Component Rejected Canned  
Assembly

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Canning of X-10 Slugs

Drawing No. \_\_\_\_\_

Operation No. \_\_\_\_\_

NOTE: Personal protective equipment should not be used as a substitute for good safe working conditions.

1. Protective Clothing Long rubber gloves, rubber suit, rubber shoes, respirator, and face shield should be worn when handling hydrofluoric acid. These should be kept clean and dry for use.
2. Containers Rubber carboys containing hydrofluoric acid should be stored in a cool place and the stopper should be released cautiously, wearing face shield and respirator, in an adequately ventilated space. Protective clothing should be worn to avoid contact with the skin.
3. Handling Hydrofluoric Acid A large rubber bucket (two gallon) may be used in transferring hydrofluoric acid if only a half gallon at a time is transferred. Extreme caution should be taken, and the protective clothing mentioned in article one must be used. Pouring hydrofluoric acid from a bucket should be done very slowly to avoid splattering. The hydrofluoric acid is diluted by pouring acid into water. A safety shower must be available in this operation.
4. Ventilation The inhaling of hydrofluoric acid fumes must be avoided. Wearing of respirator and working with the acid in open spaces or well ventilated rooms are musts. The working atmosphere of hydrofluoric acid should be kept below three parts per million, by volume. The acid vapor or liquid should not be allowed to come in contact with the body.
5. First Aid Speed in removing hydrofluoric acid from the skin or eyes is of primary importance. A person should get under a safety shower immediately, and contaminated clothing should be removed. After the exposed area of the skin has been rinsed thoroughly for about fifteen minutes, an ice cold solution of saturated magnesium sulfate should be applied for at least 30 minutes. An injured eye should be propped open and thoroughly rinsed with water for fifteen minutes and a doctor summoned for further treatment. All contacts of the skin with hydrofluoric acid should be given treatment regardless of how slight the accident may appear. It takes several hours for the damage done by a weak solution of hydrofluoric acid to show up.

OPERATING PROCEDURES FOR SLUG CANNINGFLUX - ALPHA CANNING PROCESSINDEX

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