

CONTENTS

1. INTRODUCTION	4
2. REQUIRED EQUIPMENT	4
3. PREPARATION OF EQUIPMENT	4
4. AP100 DECANTING	7
5. TRANSFER TO EIS CLEAN AREA.....	8
6. APIEZON AP100 APPLICATION ON SOLAR-B EIS	9
Appendix A.....	12
Appendix B	13

1. INTRODUCTION

SOLAR-B EIS is extremely sensitive to both particulate and molecular contamination. The mechanism for EIS hardware contamination can be:

- Fallout on sensitive surfaces (molecular and particulate).
- Off gassing of materials used in or near EIS
- Migration of contamination to adjacent sensitive surfaces.
- Transfer of contamination to sensitive surfaces by direct and indirect contact.

The latter two points above are of particular concern when applying Apiezon AP100 to EIS flight hardware as there is a real risk of migration and transfer to sensitive surfaces. Unintentional transfer of Apiezon to sensitive surfaces via glove or other hardware contact is the most common mechanism and it is very important to personnel working on EIS that they are constantly aware of the potential risk of contaminating sensitive surfaces via this method. In order to eliminate potential seizure of metallic components (screws, nuts, bolts etc.) which have direct contact with each other it is necessary to use Apiezon AP100. It is absolutely imperative that correct usage, handling and application of Apiezon AP100 are observed. This document covers the dispensing, application and handling of Apiezon AP100 grease on SOLAR-B EIS.

2. REQUIRED EQUIPMENT

- 1 off Clean Pyrex dish (100 ml, 50 mm Dia. x 65 mm H)
- 1 off Clean Pyrex dish (125 ml, 60 mm Dia. x 80 mm H)
- 1 off Clean Pyrex dish (1000 ml)
- Isopropyl Alcohol (IPA), Spectro grade only
- Acetone, Analar grade
- Acetone, Spectro grade
- Vapour degreaser/Ultrasonic cleaner
- Polyester cleanroom wipes (sealed edge)
- Black light inspection lamp
- UV protective spectacles
- Tube Apiezon AP100
- Cleanroom approved Nitrile gloves (for dish handling and Apiezon transfer)
- Polyethylene gloves (for solvent handling)
- Stainless steel spatula and stainless steel dental pick for Apiezon application
- Stainless steel spatula for Apiezon transfer (optional)
- Stainless steel tongs for item handling
- UHV Aluminium (Al) foil certified to ASTM-B-479
- Stainless steel screw holder (see Appendix A for diagram)

3. PREPARATION OF EQUIPMENT

All equipment used must first undergo a rigorous cleaning regime. Pyrex dishes and stainless steel spatulas and dental picks should be cleaned in the following manner:

3.1. COARSE CLEANING

- 3.1.1. Don a pair of polyethylene gloves for solvent handling
- 3.1.2. Coarse clean the 1000 ml Pyrex dish using Analar grade acetone and polyester wipes. Ensure all surfaces are wiped. Do not use a circular motion to wipe but instead pull the wipe in a single direction and lift the wipe off the surface at the end. Inspect and replace the wipe after three pull and lift actions.
- 3.1.3. When no visible contaminants can be seen on the wipes, decant 250 ml of Analar grade Acetone into the dish. Agitate the solvent by gently moving the dish from side to side to ensure as much of the internal surface of the dish is washed.
- 3.1.4. Pour the “dirty” solvent into a used solvent container. Ensure the container is clearly marked as “Contaminated solvent”.
- 3.1.5. Cover the 1000 ml Pyrex dish with UHV Al foil and store in a Laminar flow bench ready for intermediate cleaning.
- 3.1.6. Coarse clean the stainless steel tongs using Analar grade acetone and polyester wipes. Use the procedure in 3.1.1 and 3.1.2 above for coarse cleaning.
- 3.1.7. Once inspection of the wipes indicates no visible contaminants are present on the wipes, wash the tongs with Analar grade solvent. Do not immerse the tongs in acetone but rather wash under a slow stream of solvent.
- 3.1.8. Cover the tongs with UHV Al foil and store in a laminar flow bench ready for intermediate cleaning.
- 3.1.9. Coarse clean the stainless steel spatulas and the two smaller Pyrex dishes using Analar grade Acetone and polyester wipes as described in 3.1.1 and 3.1.2 above.
- 3.1.10. Once inspection of the wipes indicates no visible contaminants are present on the wipes, wash the spatulas and smaller Pyrex dishes under a steady stream of Analar grade Acetone. Do not handle the items in gloved hands but instead use the stainless steel tongs that have been cleaned in a similar manner as described in this section.
- 3.1.11. Cover the spatulas and smaller Pyrex dishes in UHV Al foil and store in a laminar flow bench.

3.2. INTERMEDIATE CLEANING

After coarse cleaning, transfer the Pyrex dishes and stainless steel spatulas to the ultrasonic cleaning facilities ready for intermediate cleaning as defined below:

- 3.2.1. Don a pair of cleanroom approved nitrile gloves.
- 3.2.2. Uncover the 1000 ml Pyrex dish.

- 3.2.3. Set the ultrasonic timer to six minutes and insert the dish into the vapour degrease compartment. Ensure the Pyrex dish is inserted with the open end facing downwards. This will ensure the internal surfaces of the dish are thoroughly cleaned.
- 3.2.4. After three minutes in the vapour degrease compartment, transfer the 1000 ml Pyrex dish to the ultrasonic solvent cleaning compartment. Slowly immerse the dish ensuring that it is completely immersed in the bath.
- 3.2.5. The ultrasonic cleaner will audibly alert you that six minutes has passed. Slowly remove the Pyrex dish from the bath.
- 3.2.6. Cover in UHV Al foil.
- 3.2.7. Repeat steps 3.2.1 through 3.2.5 above for the remainder of the smaller Pyrex dishes and stainless steel screw holder and spatulas.
- 3.2.8. After six minutes remove the spatulas and small Pyrex dishes from the ultrasonic cleaner and store these inside the larger 1000 ml dish. Double wrap the dish with clean UHV Al foil completely. Do not re-use UHV Al foil. Ensure that no part of the clean items come into contact with surrounding surfaces to avoid contaminant transfer.
- 3.2.9. Transfer the covered items to the MSSL cleanroom.

3.3. PRECISION CLEANING AND INSPECTION

After intermediate cleaning, the items should be transferred to the anteroom. Follow cleanroom dressing procedures as defined in MSSL/ME/PS/Q002 "MSSL Cleanroom Gowning Procedure".

- 3.3.1. After following the correct gowning procedure, move into the white cleanroom and lay a fresh piece of UHV Al foil on the laminar flow bench work surface. Ensure that the UHV foil is big enough so that all items can be laid out on it without touching the uncovered parts of the laminar flow bench work surface.
- 3.3.2. Move back to the anteroom and remove the outer layer of UHV Al foil from the items and transfer these to the white cleanroom laminar flow bench. Remove the inner layer of UHV AL foil and discard.
- 3.3.3. Remove the screw holder, spatulas and smaller Pyrex dishes from the large dish and lay these out on the UHV AL foil covering the work surface.
- 3.3.4. Don a pair of UV spectacles.
- 3.3.5. Carefully inspect the surfaces of the dishes, screw holder and spatulas with a UV black light inspection lamp.
- 3.3.6. Any particulates on the surfaces should be wiped off using spectro grade IPA and cleanroom polyester wipes. Use a pull and lift method of wiping.
- 3.3.7. Any fluorescence under black light inspection should be cause for recleaning using spectro grade IPA and polyester cleanroom wipes. Use a pull and lift method for wiping. If fluorescence is still evident change the solvent to spectro grade Acetone and re-clean.
- 3.3.8. Once all items have been inspected under black light and cleaned where necessary, transfer the items to the bake out chamber. Ensure that the bake out chamber is certified clean as defined in MSSL/PA/PS/Q014 "Procedure for vacuum bake out chamber cleaning and certification prior to flight hardware bake out" before installing the items into the chamber.
- 3.3.9. The stainless steel screw holder, spatulas and Pyrex dishes can then be baked out for a minimum period of twenty four hours. Note that the twenty

- four hour period should only start when the chamber has reached a minimum of 5×10^{-5} mbar and item temperatures are at 100°C.
- 3.3.10. After bake out has completed, vent the chamber using zero grade nitrogen. Remove the items from the chamber, cover with UHV Al foil and store in the white cleanroom laminar flow bench ready for the next stage.
 - 3.3.11. Double wrap the Stainless steel screw holder in UHV Al foil and then seal in cleanroom Llumalloy bag ready for transfer to RAL cleanroom.

4. AP100 DECANTING

At this stage the Apiezon AP100 is ready to be transferred into the small 100 ml Pyrex dish. Transferring the Apiezon to a clean dish is necessary to ensure that grease transfer does not occur between Apiezon tube and gloves and potentially to other parts of EIS. The following procedure should be used to transfer AP100 to the Pyrex dish:

4.1. Before entering the anteroom and cleanroom

- 4.1.1. Don a pair of polyethylene gloves for solvent handling.
- 4.1.2. Thoroughly wipe down the exterior of the tube with IPA and polyester cleanroom wipes. Carefully inspect the exterior surface and wipe away any residue grease remaining. Pay particular attention the cap of the tube. Reclean if necessary and then transfer AP100 tube to cleanroom approved bagging material. Transfer the bagged AP100 tube to the anteroom.

4.2. In the Anteroom and cleanroom

- 4.2.1. Follow cleanroom dressing procedures as defined in MSSL/ME/PS/Q002 "MSSL Cleanroom Gowning Procedure".
- 4.2.2. Move into the cleanroom leaving the bagged AP100 tube in the anteroom.
- 4.2.3. In the cleanroom, make three Llumalloy bags big enough to accommodate the AP100 tube.
- 4.2.4. Insert the tube into a pre made Llumalloy bag. Do not handle the tube with gloves but instead use a clean pair of tongs to hold the cap of the tube while inserting into the bag. This will minimise grease transfer from glove to the inner bag.
- 4.2.5. Use the other two bags to cover the inner bagging.
- 4.2.6. The two inner bags should be tied down around the neck below the cap of the tubing with flight quality tie wraps.
- 4.2.7. The third outer bag should cover the two inner bags and the cap. Seal the third bag and transfer to the cleanroom Laminar flow bench.
- 4.2.8. Lay a fresh piece of UHV Al foil on the laminar flow workbench surface. Ensure the foil is big enough to accommodate all items.
- 4.2.9. Remove the UHV foil from the small 100 ml Pyrex dish and place on the Laminar flow work bench.
- 4.2.10. Remove the AP100 tube cap and place the cap away from the cleaned items. Ensure the tube cap does not contact any laminar flow bench surfaces. If necessary wrap the tube cap in UHV Al foil to minimise grease

- transfer to other surfaces. Inspect your gloves for any grease residue. Replace gloves if they become contaminated.
- 4.2.11. Squeeze out AP100 grease into the small 100 ml Pyrex dish ensuring that enough grease is available to do the job.
 - 4.2.12. Ensure that the grease does not contact the top lip of the 100 ml Pyrex dish to minimise risk of grease transfer.
 - 4.2.13. Replace tube cap and immediately transfer the AP100 tube to the anteroom.
 - 4.2.14. Make a fresh Llumalloy bag and cover the AP100 tube and inner bags. Seal the bag. The bagged AP100 tube can then be stored ready for subsequent transfer if required.
 - 4.2.15. While in the anteroom, don a fresh pair of cleanroom nitrile gloves and move back into the cleanroom.
 - 4.2.16. Remove the UHV Al foil covering the Laminar flow work surface and discard. Lay a fresh piece of UHV Al foil down on the Laminar flow work surface.
 - 4.2.17. Take a piece of UHV AL foil big enough to cover the 125 ml dish completely and place on the workbench.
 - 4.2.18. Remove the old UHV AL foil from the 125 ml Pyrex dish and place on the UHV Al foil just laid down in 4.2.17.
 - 4.2.19. Take the small 100 ml dish and place it inside the 125 ml Pyrex dish. Ensure that the smaller dish spout rests within the larger 125 ml dish spout. This will ensure that the smaller 100 ml dish does not roll or move around within the larger 125 ml dish.
 - 4.2.20. Ensuring minimal glove contact, cover the 125 ml dish with UHV Al foil laid out previously in 4.1.19. Cover the inner UHV AL foil with another layer of foil and finally bag and seal the complete item with Llumalloy. Ensure that the bagged dishes are not handled upside down by labelling the correct way up.
 - 4.2.21. Cover the stainless steel spatulas and dental picks with a second layer of UHV AL foil and then bag and seal these items with Llumalloy.
 - 4.2.22. Transport the spatulas, dental picks and dishes containing AP100 to RAL. It is recommended that these items are put into a clean protective container during transport to minimise risk of accidental breakage.
 - 4.2.23. Inform RAL personnel that these items need to be transferred to the EIS clean area.

5. TRANSFER TO EIS CLEAN AREA

At this stage the items should be transferred to the EIS clean area through the clear poly tunnel via the highbay area. Once in the highbay area, the outer Llumalloy bags can be removed and the items moved to a progressively cleaner area. The inner UHV AL foil should be removed just prior to transfer to the EIS clean area. Procedures for equipment transfer into the EIS clean area should be observed. Please note that cleaning of the equipment is not necessary as they will be clean as they come out of the packaging. However, once all packaging has been removed it is recommended that all items are inspected prior to transfer to the EIS clean area. The idea here is to have minimal contact with the clean items for transfer. Personnel who are applying the Apiezon AP100 lubricant should not make physical contact with the inner Pyrex dish or its contents. If contact is made or gloves become contaminated with lubricant personnel must stop immediately, move out of the EIS clean area and replace the contaminated gloves. Ensure that no tables, hardware, tools etc are touched when moving out of the clean area to minimise lubricant transfer. Remove gloves carefully and replace with a clean pair of gloves. The same will apply for lubricant contamination on cleanroom garments; in all cases follow the EIS procedures for changing contaminated garments and gloves.

6. APIEZON AP100 APPLICATION ON SOLAR-B EIS

6.1. PREPARATION

- Before the Apiezon AP100, screw holder and dental pick are transferred to the EIS clean area, ensure that a work area has been prepared close to the EIS instrument.
- It is recommended that a dedicated work area is covered with UHV Al foil prior to Apiezon AP100 transfer. This dedicated work area should only be for Apiezon AP100 GSE handling. No other GSE or flight hardware should be used on or near this dedicated area. This will ensure that lubricant transfer to other sensitive work surfaces/hardware is minimised.
- In all cases good cleanroom practice dictate that work surfaces and Apiezon lubricant should not be upstream from the EIS instrument.
- Forward planning of what is needed in terms of screws, nuts, lock nuts and bolts is essential.
- Only screws/bolts should be lubricated. Nuts and lock nuts should be kept away from the screws during lubrication.
- Do not thin Apiezon AP100 with solvent, instead use as supplied. Thinning the lubricant will cause Apiezon AP100 to migrate to adjacent surfaces which has the potential to contaminate sensitive surfaces.
- SOLAR-B EIS requires a buddy work system and procedures for the buddy system should be observed. It is important that the person doing the assembly on EIS should not be the person that applies Apiezon to the screws and bolts etc. In all cases contact with screws must be minimised by using split blade screw drivers to hold screws in place while applying Apiezon AP100 to the screw thread and during assembly work. Under no circumstance should the screw be held in a gloved hand while applying Apiezon AP100 and assembly.

6.2. REQUIRED EQUIPMENT

- UHV Al Foil (certified)
- IPA, Spectro grade, in suitable fluorinated wash bottle
- Acetone, Spectro grade, in suitable fluorinated wash bottle
- Polyester wipes, sealed edge cleanroom approved
- Swabs, swab heads made of polyester sealed edge approved cleanroom wipe material
- Flat blade screw drivers, captive type only (split blade)
- Apiezon AP100 in clean Pyrex dish
- Stainless steel dental pick (pre-cleaned)
- Stainless steel screw holders (pre-cleaned)

6.3. PROCEDURE – Apiezon application by the “greaser”

For clarity, the person assembling the EIS hardware will be known as the “assembler” and the person applying the Apiezon AP100 to screws/bolts will be known as the “greaser”. The following procedure should only be carried out by the “greaser”. The “assembler” should not aid/help the “greaser” in this procedure.

- Take an appropriate sized sheet of UHV Al foil and lay this down on the designated Apiezon work area.
- Move all the necessary equipment to the work area and layout as needed.
- Gather the screws and bolts necessary to perform the lubrication activity.
- With a split blade screw driver or close fitting Allen key pick up each screw/bolt in turn.
- Taking the dental tooth pick apply a pin head sized amount of Apiezon to the first thread of the screw or bolt. It is very important that only a tiny amount of Apiezon AP100 is applied to the threads. A pin head sized amount is all that is required for efficient lubrication and this should be applied to the first thread on the screw or bolt. Tightening down the screw or bolt will ensure a thin layer of lubricant will be transferred to subsequent threads on the screw or bolt. See Appendix B for example of excessive Apiezon AP100 use and effects of thinning lubricant using solvent.
- Put down the dental tooth pick in a clean Pyrex container. Do not lay on the work surface. This will minimise accidental transfer.
- Move the lubricated screw/bolt to the screw holder and place in the correct sized clearance hole and release.
- Repeat this process for all the required screws/bolts.
- Move to the EIS hardware area and lay out a piece of UHV Al foil close to the assembly area.
- Move back to the Apiezon application area and pick up the screw holder. Ensure gloves do not come into contact with the lubricated screws/bolts.
- Move the screw holder to the assembly area and place on the laid out piece of UHV Al foil. Move back to the Apiezon area ensuring no GSE or hardware is touched.
- Follow the above procedure for the additional screw holders.

Once the “assembler” has finished using a set of screws from the screw holder the “greaser” should move to the assembly area with the second set of screws/bolts in the screw holder and place these on the UHV Al foil. The “greaser” should then remove the empty screw holder back to the Apiezon area and refill using the above procedure. The “assembler” must not move or touch the empty screw holder.

6.4. PROCEDURE – Assembly of hardware by the “assembler”

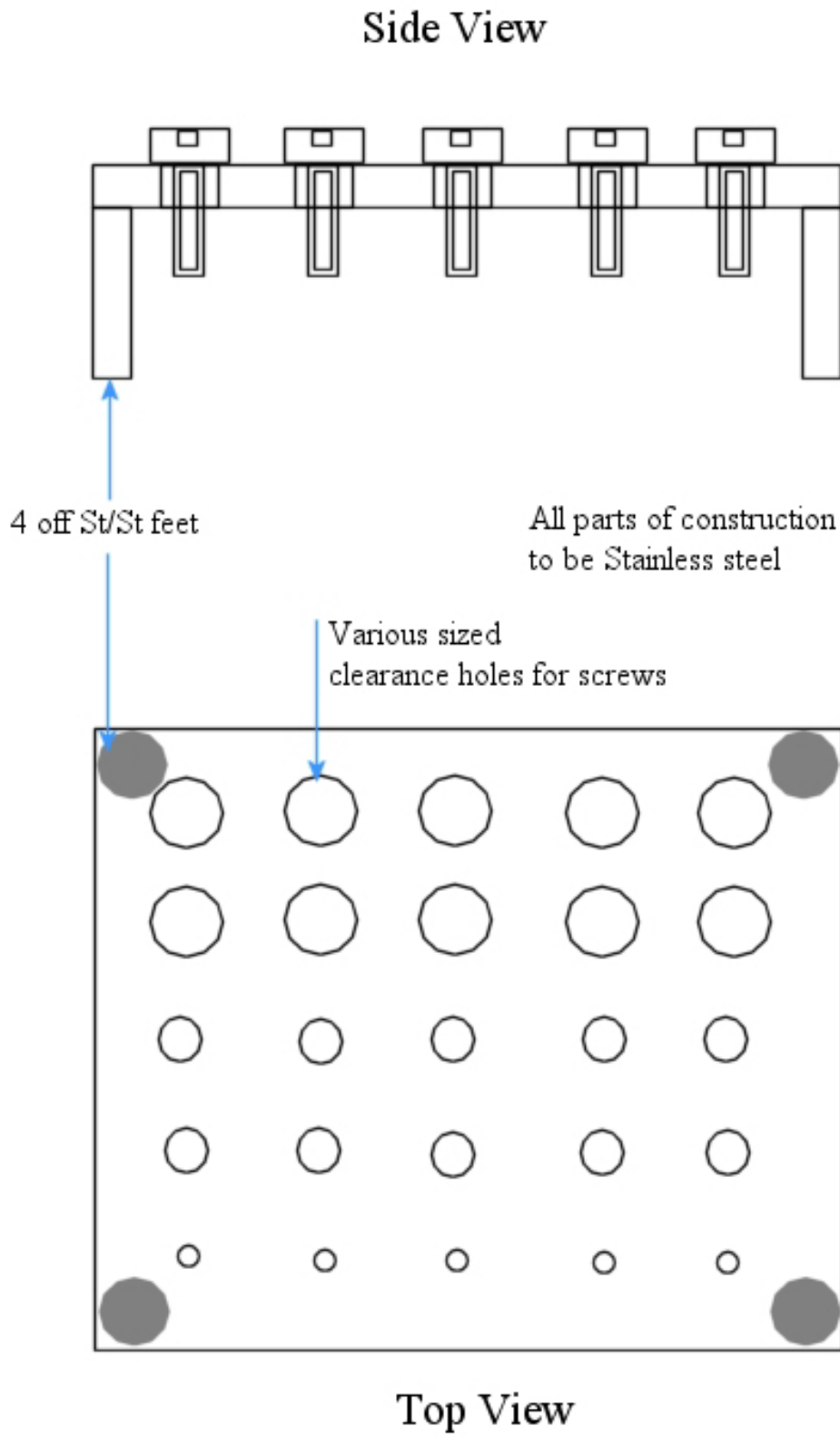
- With the screw holder laid out on the UHV Al foil near the assembly area, the “assembler” should use a flat bladed split screw driver or close fitting Allen key to pick up and hold the screws/bolts and then assemble. The “assembler” must not touch the screw or screw holder.
- Once the screw holder becomes empty the “assembler” should let the “greaser” know, who will replace the screw holder with a freshly lubricated set of screws/bolts in additional screw holders.

Initially this procedure may seem convoluted but with practice and methodical planning it will become an efficient method to apply Apiezon AP100 to screws/bolts and then using the screws/bolts to assemble the hardware. The idea here is to minimise direct contact and subsequent unwanted lubricant transfer to sensitive areas. Both the “greaser” and “assembler” must plan how the work flow will proceed and be very clear as to what activities they are responsible for to ensure transfer of lubricant to sensitive areas on EIS is

minimised. It is recommended that a UV light source is available to both the “assembler” and “greaser” and that the light source is used frequently to inspect gloves, work surfaces and EIS hardware. If fluorescing is observed on any piece of flight hardware this should be cleaned up following EIS hardware cleaning procedures. If Apiezon AP100 has been transferred to gloves it is essential that the gloves are replaced immediately.

Appendix A

Suggested design for screw holder.



Appendix B

Example of excessive Apiezon AP100 application and transfer under UV light inspection. Note the fluorescing of lubricant migrating out of screw holes.

