

Cleaning Procedure for SMEI Cameras

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Table of Contents

1.	Introduction	3
2.	Strong-Box and Door Assembly	3
2.1	Mechanical Components	3
2.2	Mirrors	4
2.3	Electrical Components	4
2.4	Cleaning and Bakeout of Assembled Strong-Box	4
3.	Baffles	4
4.	E-Box	5
5.	Final Assembly	5

Cleaning and Bakeout Procedures for SMEI Cameras

1. Introduction

This document outlines the basic cleaning and bakeout procedures to be used during assembly of the SMEI cameras.

The procedures are derived from those used for the EPIC instrument on XMM. This instrument is an x-ray sensitive CCD camera and consequently is much more susceptible to deposited contamination than the SMEI Cameras.

It is assumed that all normal clean-room handling procedures are used throughout.

2. Strong-Box and Door Assembly

2.1 Mechanical Components

The procedure for cleaning of all mechanical components prior to assembly shall be as follows:

1. Pre-clean to normal workshop standards to remove swarf, oil, grease, etc.
2. Ultrasonic clean for 5 min in a hydrocarbon solvent at room temperature. Solvent shall be Forane.
3. Wash in hot tap water with 1% detergent (e.g. Te-pol), cleaning with a brush.
4. Rinse in tap water until all obvious traces of detergent have been removed.
5. Ultrasonic clean for 10 minutes with a mixture of de-mineralised water and HPCL grade propan-2-ol (mix ratio 1:3) at a temperature of +60°C.
6. Ultrasonic clean for 10 minutes with fresh de-mineralised water at a temperature of +60°C.
7. Check on removal from the bath that the water forms an even film on the surface of the part and does not form globular droplets. This indicates a high degree of cleanliness.
8. Blow with dry nitrogen to remove as much water as possible.
9. Air bake at +100°C.
10. Place the cleaned components in Class 100 cleanroom protective bags as soon as possible.

- Notes:
1. Cleanroom gloves shall be worn throughout the above procedure and shall be changed at each stage of handling the components being cleaned.
 2. The ultrasonic cleaner shall be cleaned by washing out with the appropriate solvent at each stage in the procedure.
 3. When cleaning the Flight Mirror Mounting Hardware in May 2000, Triklone-N was used as a solvent in place of Forane in step 2. The temperature of the ultrasonic bath used in steps 5 and 6 was +40°C. It is considered that these deviations from the procedure had no significant impact on the effectiveness of the cleaning.

2.2 Mirrors

It is strongly recommended that handling and cleanliness procedures should be designed to avoid the need for any cleaning of the mirrors. The mirrors shall be handled with gloved hands at all times, and great care shall be used to avoid touching the optical surfaces to avoid contamination. Whenever practical the mirrors (and assembled mirror assemblies) shall be stored in a desiccator.

If cleaning of the mirrors does become necessary the advice of the manufacturer shall be sought regarding safe cleaning processes and procedures.

2.3 Electrical Components

The following bought-in electrical components shall have their outer surfaces cleaned by wiping with HPCL grade propan-2-ol and shall then undergo a bakeout in the thermal vacuum chamber at a temperature of +80°C for 7 days (TBC) prior to assembly in the Strong-box:

- Shutter Motors
- Flexi-Rigid PCBs
- Wire.

All soldered connections to components in the Strong-Box (e.g. flat-field LED, Hall-effect sensors, thermistors, etc) shall be thoroughly cleaned using analytical grade propan-2-ol.

3. Baffles

Once the blackened baffles are received back from Martin Marietta the highest level of cleanliness must be assured by rigorous cleanroom handling procedures (no further solvent cleaning possible):

- All handling shall take place in the class 1000 cleanroom.
- During assembly of the baffle stacks the baffle sections shall only be removed from their transportation containers as and when they are required for assembly.
- Prior to assembly, each section shall be examined for particulate contamination using an ultra-violet lamp in the darkened cleanroom.
- Attempts shall be made to remove any particulate contamination by either (i) using a flexible tube blowing a jet of pure, dry nitrogen, or (ii) using a flexible tube connected to a vacuum line (TBD). Extreme care shall be taken to avoid touching the "Martin-Black" surfaces.
- The completed baffle assemblies shall be stored in a class 100 clean cabinet until required for assembly of Cameras.
- Exposed apertures shall be protected from possible ingress of particulate contamination by covering with polythene sheet or bags (unless protected by fitting of Door).

4. E-Box

Since there is no direct path for contamination from the E-box to enter the Strong-Box or Baffle no special precautions need be taken during construction and assembly of the E-Box, other than those normally followed for all space-flight electronics – construction in class 100,000 cleanroom (or better), regular cleaning of PCBs during assembly by brushing with propan-2-ol, cleaning of mechanical housings by washing with propan-2-ol.

However, if time permits the E-Boxes will undergo the same vacuum bakeout as the Strong-Boxes and Baffles (see Section 5).

5. Final Assembly

The following procedures shall be followed during final assembly of the Cameras:

- The major sub-assemblies of each Camera – Baffle Assembly, BOS, Strong-Box and E-Box – shall all undergo a bakeout in the thermal vacuum chamber for a period of 7 days (TBC). In the case of the Baffle, BOS, Strong-Box and E-Box the bakeout temperature shall be +80°C, whilst in the case of the Door and Door Actuator the temperature shall be +60°C.
- Prior to assembly of the Baffle onto the Strong-box and of the Door onto the Baffle, a final check shall be made for particulate contamination within the Strong-Box and Baffle Assembly using an ultra-violet lamp in the darkened cleanroom.
- Attempts shall be made to remove any particulate contamination as described in Section 3.
- The Camera Doors shall be closed as early as possible during, or after, the assembly procedure.

After final assembly of the Cameras, the Doors shall be opened as infrequently as possible, only as and when required by AIT procedures, and then only under conditions of strictly controlled cleanliness,
