HARDWARE DESCRIPTION

PART NAME: TCS Multi-Layer Blanket
PART NO: V070-361995-024 (L/H) & V070-361995-025 (R/H)
SERIAL NO: 52B51B (-024) & 52C0XX (-025)

PROBLEM DESCRIPTION

Blankets were installed incorrectly over PVD Drain Lines in FRC3. Incorrect installation allowed the blankets to billow toward the Xo 378 Bulkhead vents, restricting venting of the FRCS cavity.

ANALYSIS/INVESTIGATION

During STS-121 ascent, the Xo 378 bulkhead delta-pressure transducer showed higher than normal pressure differential across the bulkhead. This was documented as IFA STS-121-V-11. The actual pressure differential encountered was 1.2 psi. The structure is certified to .95 psid. Blockage of the Xo 378 purge vents from the FRCS side was considered the most likely cause.

Instrumentation Engineering Troubleshooting/Testing:

- Electrical check out of the circuit
- The Transducer check showed proper function – no anamolies

TCS Engineering post flight inspection of FRC3:
Borescope inspections on FRC3 showed that TCS blankets in the FRCS module were very close to the vents, and were not installed under PVD drain lines. Design intent is to install the V070-361995-024 (LH) and V070-361995-025 (RH) MLI blankets under PVD drain lines in the FRCS. The blankets contain existing cutouts and cutlines, allowing installation under these lines. When properly installed, the blankets are restrained by the PVD drain lines and cannot billow into the Xo 378 vent areas. Using templates to simulate a Xo378 vent port (on FRC5) TCS Engineering determined that blockage of the vent ports can occur when blankets are installed on top of the drain lines. Improper installation of the TCS blankets was determined to be the cause of the vent anomaly.

FRC3-33-1113 was written to document the problem on OV-103. CAR 121RF08 was written for corrective action. Closeout photo from STS-121 is attached, showing discrepant blanket installation.

FRC4 and FRC5 were evaluated for the same condition. Blankets were observed installed over (aft side of) the drain lines (FRC3 for STS 121, & FRC5) and under (fwd side of) the drain lines (FRC4 for STS-115). Related PR's FRC4-27-1044 and FRC5-20-0638 were written for documentation.

FAILURE HISTORY

None prior to STS-121 - Blankets for missions prior to STS-121 were installed behind drain lines. Blankets had been removed during return-to-flight inspection/OMM for all FRCS modules.

REMEDIAL ACTION

See Corrective Action

CORRECTIVE ACTION

(This narrative corresponds to photos attached.)

Installation drawing V070-361900, F/D shows blankets V070-361995-024 & -025 at zone 55A but does not specify installation details. Specific installation details for these blankets are needed to prevent blanket migration over the PVD purge vents on Xo 378. Engineering recommended the following installation drawing clarifications to ensure no venting obstructions with blankets:

- Install under drain lines
- Tie to thruster box blankets using lacing cord and buttons
- Tape to thruster box blankets along inboard seams

Rework of FRC3 and FRC4 Blankets (interim without FRC removal):
FRC3 and FRC4 blankets were reworked and repositioned to eliminate the interference with the Xo378 vents and prevent any possibility of billowing. Blankets were installed under drain lines as per design intent, fastened to thruster box blankets with buttons and tie cord per drawing, and taped to thruster box blankets along inboard seams with approved TCS tape per Specification instructions. Post rework borescope photos show no obstruction to purge vent operation. Reference attached photo.

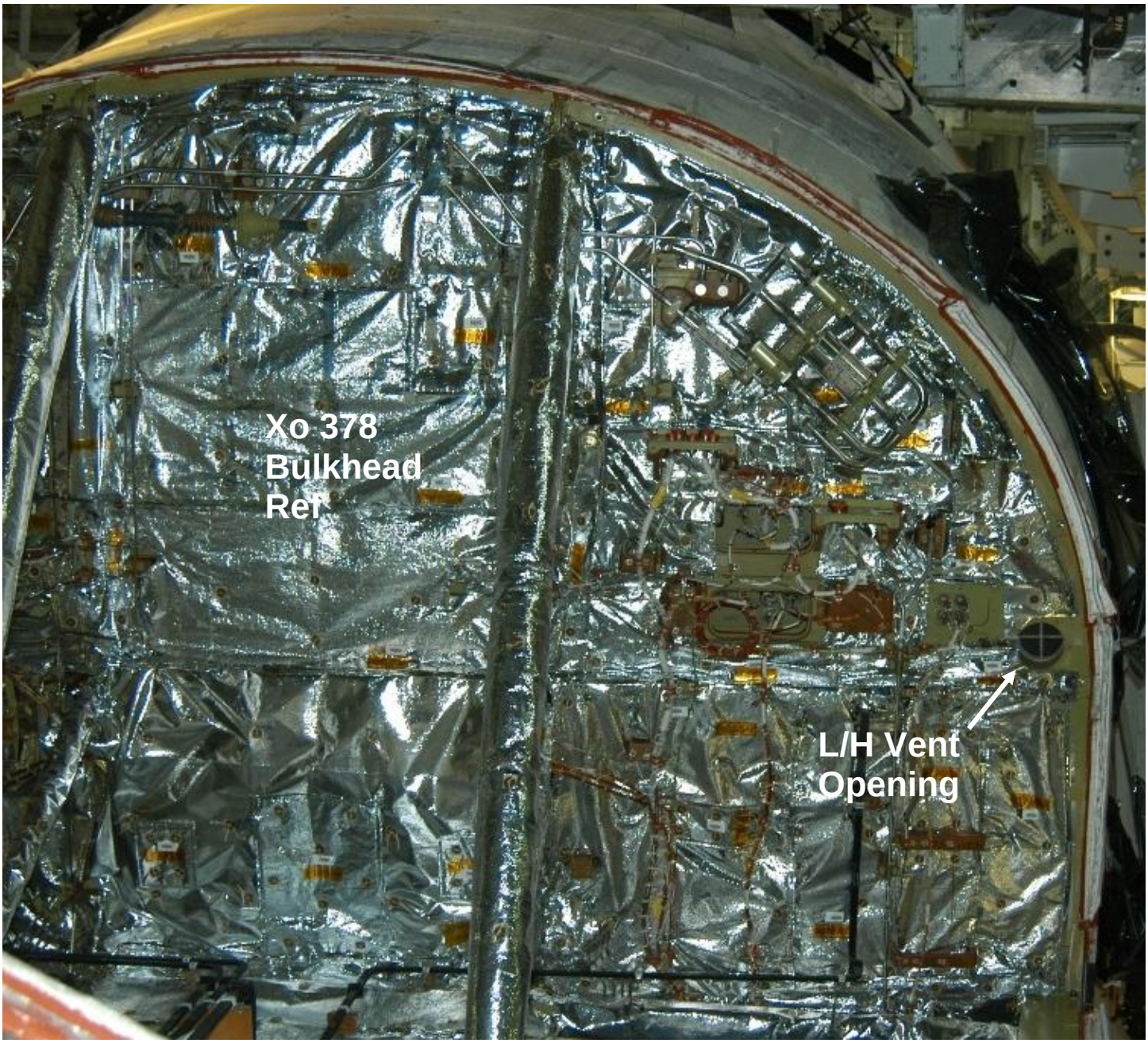
Rework of FRC5 Blankets (completed mod with FRC removed):
FRC5 was reworked with FRC removed. This access is preferred. FRC5 blankets were reworked and repositioned under drain lines to eliminate the interference with the Xo378 vents and prevent any possibility of billowing. Blankets were installed under drain lines per new updated drawing views, fastened to thruster box blankets with buttons and tie cord per drawing, and taped to thruster box blankets along inboard and outboard seams with approved TCS tape per drawing. Reference attached photo of blanket configuration after rework.

The blanket rework was evaluated and approved by Boeing, USA and NASA TCS, PVD and STR engineering groups, at both KSC and JSC.

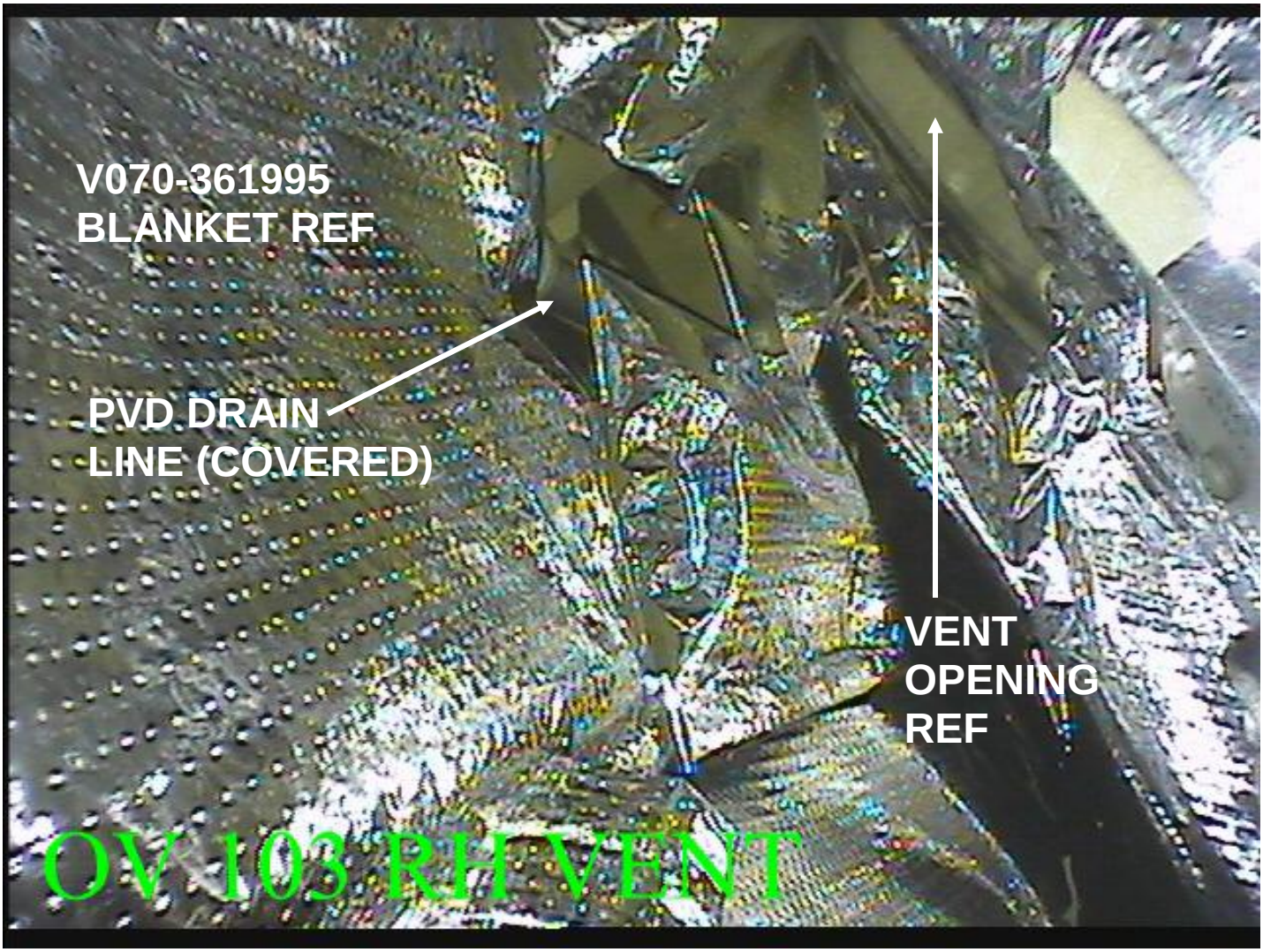
Drawing correction - The TCS installation drawing V070-361900 was changed to include detailed requirements for installation of blankets V070-361995-025 & -025 (incorporated by EOTF on FRC5 and after pod removal on FRC3 and FRC4).

Procedure correction - Blanket Installation Job Card V63-50049 has been updated to provide detailed work steps, as well as cautions and warnings, requiring blanket installation under PVD drain lines.

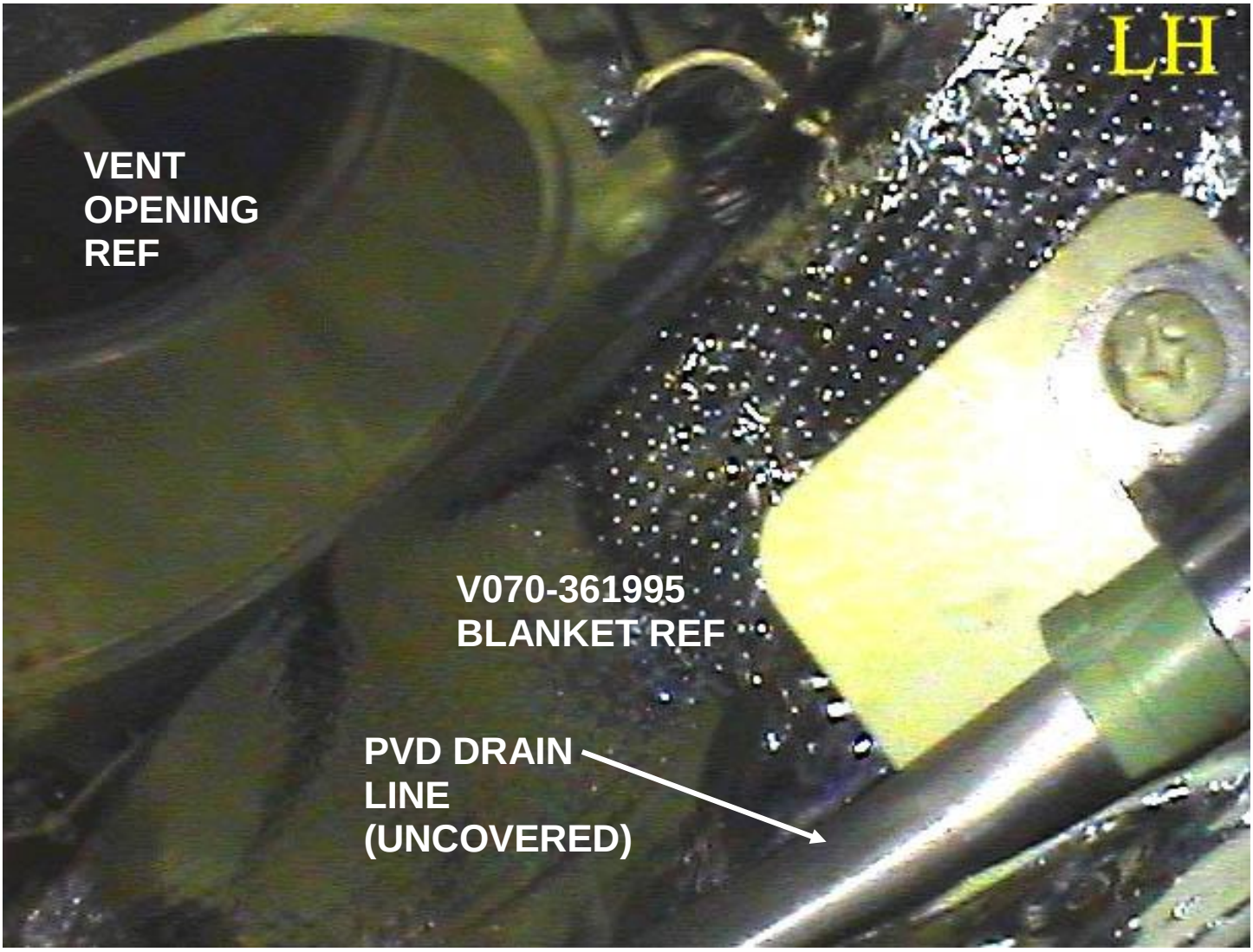
STS-116 Flight Delta Pressure Data:
Flight data from STS-116 showed the pressure across the bulkhead returned to nominal (as compared to previous mission data) after the FRCS blankets were repositioned following STS-121. All blanket rework has been completed. Both TCS Hardware and PVD PRT's are satisfied with the accomplished blanket rework, drawing correction and procedure correction.



L/H Vent Opening and Xo 378 Bulkhead Shown
R/H Vent Opening Opposite and Symmetrical Orientation View



Borescope Inspection Photo of OV-103 PRIOR to Blanket Rework
(View Looking Down and Outboard from Electrical Access Door)



Borescope Inspection Photo of OV-103 AFTER Blanket Rework
(View Looking Down and Outboard from Electrical Access Door)

STS-121 Closeout Photo **Configuration after Blanket Rework**

Above photos are provided for side-by-side comparison of incorrect STS-121 FRC3 blanket installation (over PVD drain line) with correct blanket installation (under PVD drain line). Correct blanket installation photo above is from FRC5 after blanket rework. OV-105 photo was chosen because FRC5 was removed, which provided clear access for photograph.

APPROVAL SIGNATURES:

			USA/NASA		
TITLE	NAME	DATE	TITLE	NAME	DATE
CAE/DE	Anthony M. Chambers	2007-01-02	SMA		
SSM	Anthony M. Chambers	2007-01-02	SSM		
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