TITLE :**THEMIS Instrument Purge Plan**	**DOC #: THM-SYS-032**

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THEMIS PURGE OUTLINE							
LINE	**DESCRIPTION**	**WHERE**	**RESPONSIBLE**	**PURGE**	**GAS SOURCE**	**GAS SUPPLIED BY**	**REMARKS**
1	INSTRUMENTS ON BENCH	UCB	UCB	CONSTANT EXCEPT WHEN IMPRACTICAL (MAX 24 HRS OFF PURGE)	NITROGEN GAS M27401-2-B PER MIL-P-27401D, TYPE 1, GR B	UCB	
2	INSTRUMENT SUITE INTEGRATION	UCB	UCB	CONSTANT EXCEPT WHEN IMPRACTICAL (MAX 24 HRS OFF PURGE) OR DURING TVAC TESTING	NITROGEN GAS M27401-2-B PER MIL-P-27401D, TYPE 1, GR B	UCB	
3	SUITE TVAC	UCB	UCB	NO PURGE	N/A	UCB	
4	PROBE INTEGRATION	UCB	UCB	CONSTANT EXCEPT WHEN IMPRACTICAL (MAX 24 HRS OFF PURGE)	NITROGEN GAS M27401-2-B PER MIL-P-27401D, TYPE 1, GR B	UCB	
5	TRANSPORT TO JPL	TRUCK	UCB	CONSTANT EXCEPT WHEN IMPRACTICAL (MAX 24 HRS OFF PURGE)	MANIFOLDED K BOTTLES: PRAXAIR NI5.0UH IN TRUCK	UCB	
6	JPL VIBE/MAG/EMC TESTING	JPL	UCB	CONSTANT EXCEPT DURING VIBE	NITROGEN GAS M27401-2-B PER MIL-P-27401D, TYPE 1, GR B	JPL	
7	JPL TVAC	JPL	UCB	CONSTANT EXCEPT DURING TVAC	NITROGEN GAS M27401-2-B PER MIL-P-27401D, TYPE 1, GR B	JPL	
8	JPL SPIN BALANCE	JPL	UCB	CONSTANT EXCEPT DURING SPIN BALANCE	NITROGEN GAS M27401-2-B PER MIL-P-27401D, TYPE 1, GR B	JPL	

9	TRANSPORT TO AstroTech	TRUCK	UCB	CONSTANT EXCEPT WHEN IMPRACTICAL (MAX 24 HRS OFF PURGE)	MANIFOLDED K BOTTLES: PRAXAIR NI5.0UH IN TRUCK	ATO	
10	PROBE AND PCA INTEGRATION ACTIVITIES	AstroTech	UCB	CONSTANT EXCEPT WHEN IMPRACTICAL (MAX 24 HRS OFF PURGE)	NITROGEN GAS M27401-2-B PER MIL-P-27401D, TYPE 1, GR B	ATO	
11	PROBE FUELING	FUELING CONTRACTOR	UCB	CONSTANT EXCEPT WHEN IMPRACTICAL (MAX 24 HRS OFF PURGE)	NITROGEN GAS M27401-2-B PER MIL-P-27401D, TYPE 1, GR B	ATO	
12	PROBE AND THEN PCA BAGGING (ENCAPSULATION)	ATO	UCB	CONSTANT EXCEPT WHEN IMPRACTICAL (MAX 24 HRS OFF PURGE)	NITROGEN GAS M27401-2-B PER MIL-P-27401D, TYPE 1, GR B	ATO	A FRAME-WORK WILL BE INST'D BY UCB TO PROTECT THERMAL SURFACES
13	POST ENCAPSULATION PURGE OF THE BAG	ATO	UCB	PURGE BAG FOR 24 HRS	NITROGEN GAS M27401-2-B PER MIL-P-27401D, TYPE 1, GR B	ATO	
14	TRANSPORT TO PAD	KSC	BOEING	PURGE CANISTER	PURGE WITH BOEING LN2 GRADE B BOIL-OFF	BOEING	
15	LIFT TO L.V.	KSC	BOEING	NO PURGE EXCEPT RESIDUAL NI IN PCA BAG	N/A	N/A	
16	PCA AND PROBES BAGGED ON LV	KSC	BOEING	CONSTANT EXCEPT WHEN IMPRACTICAL (MAX 24 HRS OFF PURGE)	PURGE WITH BOEING LN2 GRADE B BOIL-OFF	BOEING (SEE PLUMBING NOTE)	BOEING TO SUPPLY 1/4 FEMALE AN 37 DEG FITTING
17	REMOVALOF BAG JUST PRIOR TO FINAL CHECK AND FIRST FAIRING INSTALLATION	KSC	BOEING	REMOVE PURGE BAGS	N/A	N/A	FRAME-WORK AND PURGE BAG REMOVAL

Table 1
Purge Outline

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1.0 Overview
This document is intended to provide the purge requirements for the THEMIS spacecraft from instrument assembly through launch site operations.

Two of the instruments on the THEMIS probes require high purity (99.995%) nitrogen purging – the SST (Solid State Telescope) and ESA (Electrostatic Analyzer) instruments. The detectors in these are sensitive to condensable hydrocarbons, particulates, and in the case of the ESA microchannel plates, water vapor. Purge pressure is 5 psi and flow rate is less than 1 liter per hour per instrument. Total flow rate for two SST's, one EESA and one IESA (i.e. one probe) is 4 liters per hour. Total flow for 5 probes is 20 liters per hour. 3 x 180 Liter cylinders are sufficient for 2 days.

Purge System – Flow Rates				
System Pressure (Regulated)	System Flow Rate (per Instrument)	System Flow Rate (per Probe)	System Flow Rate (per 5 Probes)	Nitrogen Specification per MIL-P-27401D
5 psi	1 liter/hour	4 liter/hour	20 liter/hour	Type I or II, Class B

Table 2

2.0 Purge Requirements
The SSTs and ESAs shall be constantly purged after detectors are installed, except that these instruments may be off purge during any continuous maximum 24 hour period as necessary when required for unpacking, installation onto the probes, and during tests where purging is impractical (vibration, TVAC, spin balance, etc). Purge is required during shipment between UCB and JPL and between JPL and AstroTech. Purge shall otherwise be maintained as outlined here up to the points denoted below for each instrument type. Reference Table 2.

2.1 SST's – purge per 1.1 until probe to PCA integration. Purge covers shall be left on at all times whether purge is underway or not, unless removal is required (vibration, TV, spin balance, etc).

2.2 ESA's – purge per 1.1 until Probe to PCA Integration.. Aperture dust cover to be left on whenever possible. Purge and dust cover removed for final time at Probe to PCA Integration.

3.0 Hardware Responsibility
UCB SSL will supply all purge system hardware. All hardware shall be cleaned and maintained per Cleaning Procedure THM-ESA-PRC-004 REV A. Boeing will supply a purge line fitting ¼ male AN 37 degrees.

4.0 Nitrogen Supply Requirements
Nitrogen shall be Type I or II, Class B per MIL-P-27401D, Nitrogen Performance Specification. Nitrogen part numbers are: M27401-1-b or M27401-2-B. GN2 K bottles and LN2 GP160 type Dewars shall meet all applicable commercial and NASA Standards.

4.1 UCB will arrange to provide LN2 Dewars or GN2 per section 4.0 during operations at UCB.
4.2 UCB will arrange to provide LN2 Dewars or GN2 per section 4.0 during truck shipment to JPL.
4.3 JPL will arrange to provide LN2 Dewars or GN2 per section 4.0 during operations at JPL.
4.4 UCB will arrange to provide LN2 Dewars or GN2 per section 4.0 during truck shipment to AstroTech.
4.5 AstroTech will arrange to provide LN2 Dewars or GN2 per section 4.0 during operations at AstroTech.
4.6 Boeing will to provide a purged shipping canister during 3rd Stage Transport.

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4.7 Boeing will to provide LN2 Dewars or GN2 per section 4.0 after the third stage is stacked at the pad. UCB will supply regulators and hose to connect to Boeing fitting. Boeing is responsible for monitoring nitrogen supply at the pad.

5.0 Monitoring Responsibility
UCB is responsible for purging the instruments. JPL and AstroTech will provide assistance in monitoring the gas supply level, but the setup and monitoring responsibilities remain with UCB.

6.0 Monitoring Hardware
A two stage regulator reduces pressure from bottle pressure to 5 psig. Flow regulation is built into each instrument using a sintered metal flow orifice. Flow is 1 Liter per hour at 5 psig for each instrument. A flow meter allows verification of flow. A 10 psig relief valve is provided for overpressure relief. An oxygen sensor is provided to ensure safety. All Gages have blowout protection. Relief valves are tested at a pressure of 10 psi. Regulator handles are modified to prevent unauthorized or inadvertent adjustment. UCB supplies a hose to connect to Boeing gas fitting.

7.0 Safety

7.1 Danger!
This system uses nitrogen gas. A suffocation danger exists.

7.2 Mitigation

7.2.1 Very small volumes of gas are used (20 liters per hour for all instruments on all probes combined).

7.2.2 UCB/SSL will supply a tested and certified oxygen sensor whenever the purge system is used.

7.2.3 Ventilation will be used in enclosed spaces to prevent the buildup of a dangerous level.

8.0 Purge Apparatus

8.0 Applicable Standards
The purge system was designed to comply with the following standards:

NASA-STD-5005	Ground Support Equipment Design Criteria
EWR 127	Eastern and Western Range Safety Policies and Practices
PAIP	THEMIS Performance Assurance Implementation Plan, (UCB Document)
THM-SYS-011	THEMIS Configuration Management Plan, (UCB Document)
THM-SYS-004	THEMIS Contamination Control Document, (UCB Document)
SAI-PLAN- 0647	THEMIS Mission System Safety Program Plan, (Swales Document)

9.0 Purge Apparatus
Figure 1 shows the general probe purge arrangement; Figure 2 shows the purge hardware, Figures 3 and 4 shows the instrument purge connections, Figure 5 shows Purge Bagging for PCA, Figure 6 shows Purge Bagging connected to Boeing gas fitting.

Reference drawing THM-ESA-MEC-990, Purge System, for more hardware information.

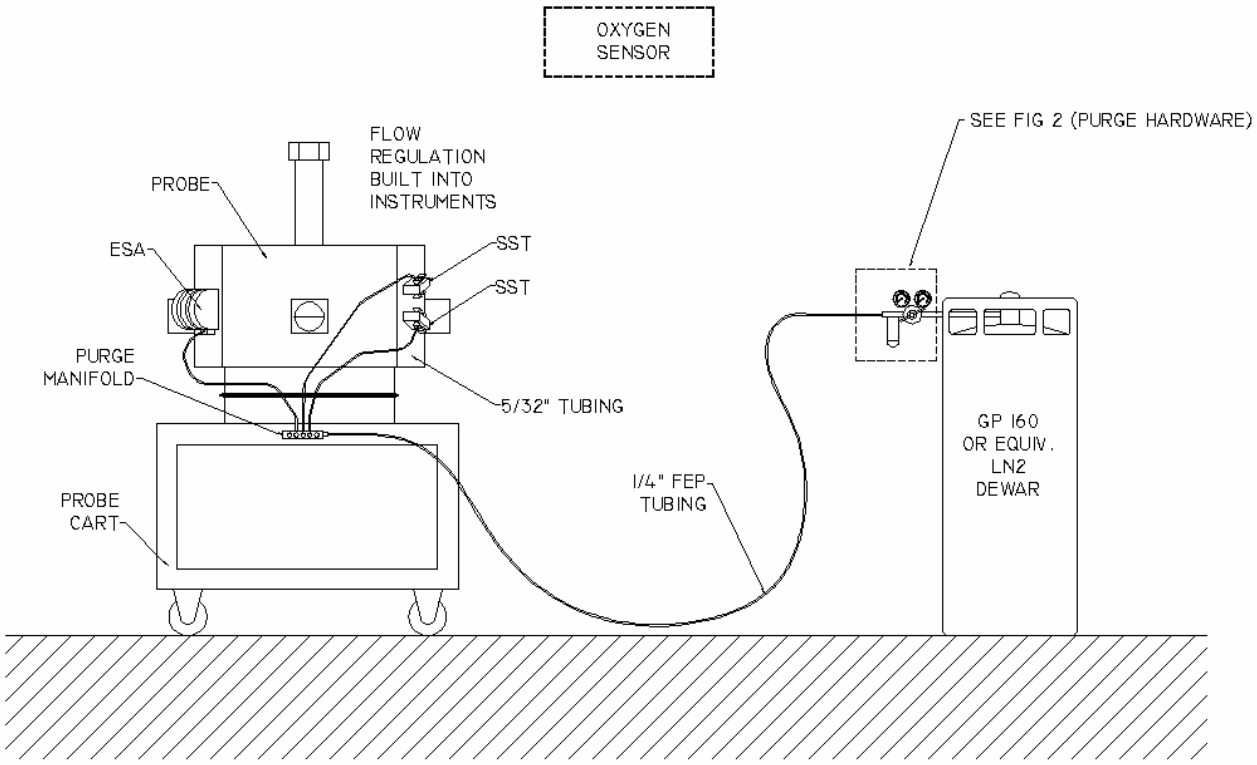

Figure 1
Purge System – Probe Mounted On Cart At UCB OR JPL

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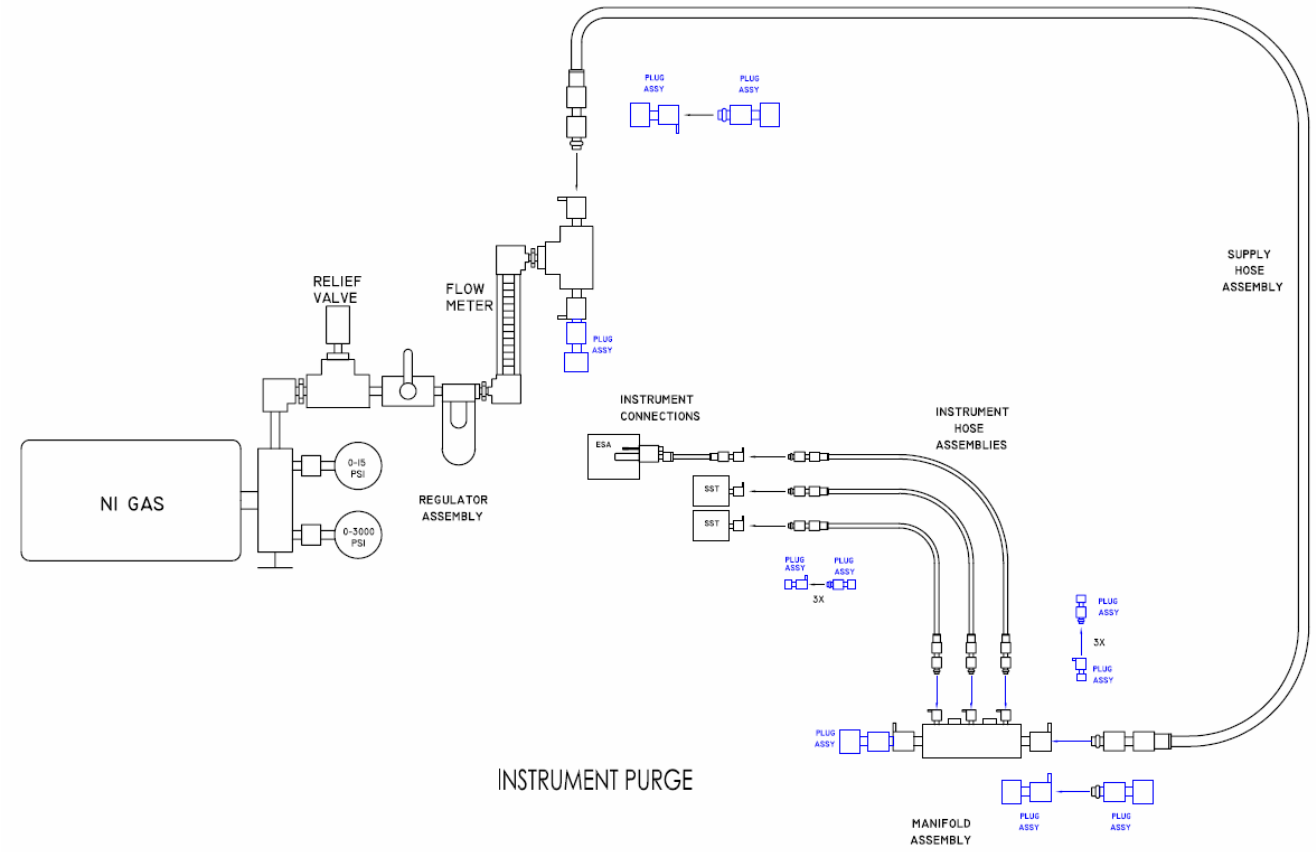

Figure 2
Purge Hardware

Ref Drawing: THM-ESA-MEC-990 REV B PURGE ASSEMBLY

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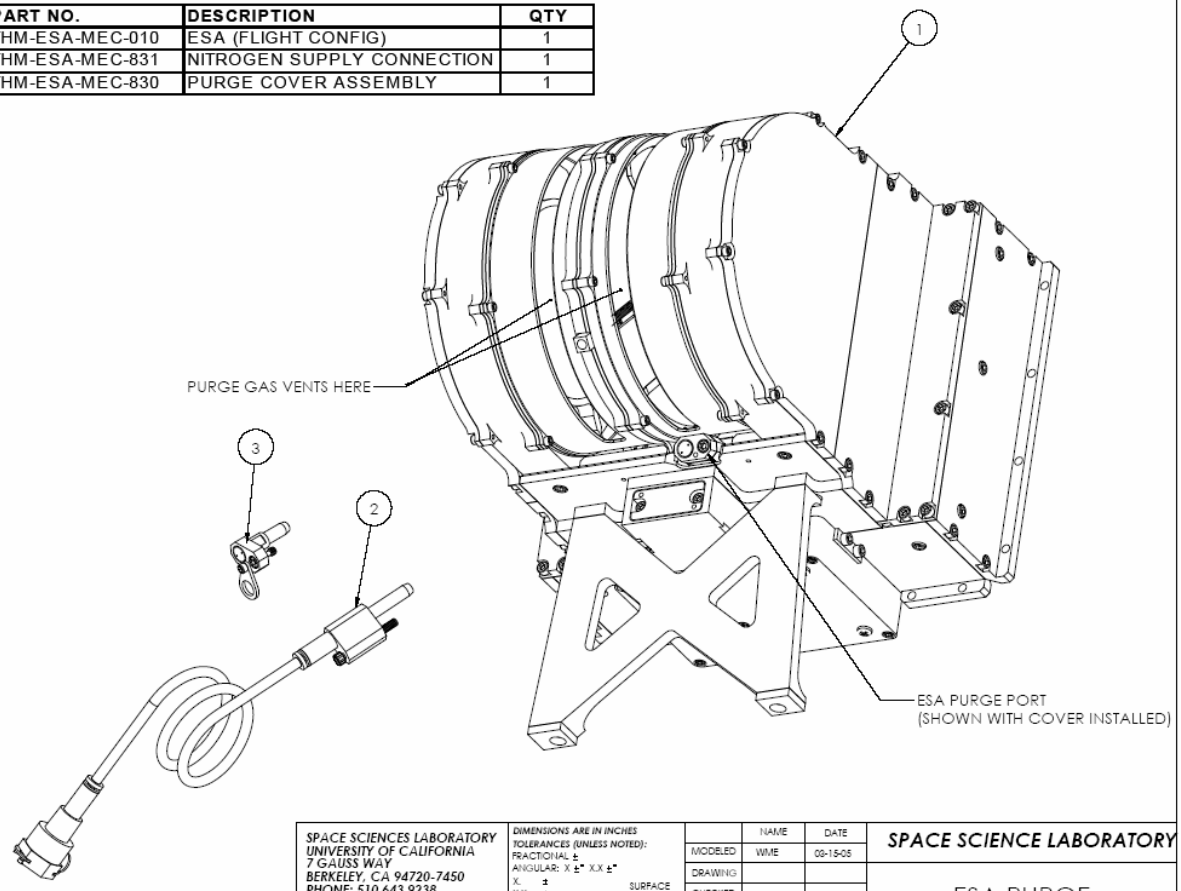
ITEM	PART NO.	DESCRIPTION	QTY
1	THM-ESA-MEC-010	ESA (FLIGHT CONFIG)	1
2	THM-ESA-MEC-831	NITROGEN SUPPLY CONNECTION	1
3	THM-ESA-MEC-830	PURGE COVER ASSEMBLY	1



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	NAME	DATE
MODELED	WME	09-15-05
DRAWING		
CHECKED		

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ESA PURGE CONNECTIONS

SIZE	DWG. NO.	REV.
A	THM-ESA-MEC-009	A

SCALE: 1/2 | MASS: LBS | SHEET 1 OF 1

Figure 3
ESA Purge Connections

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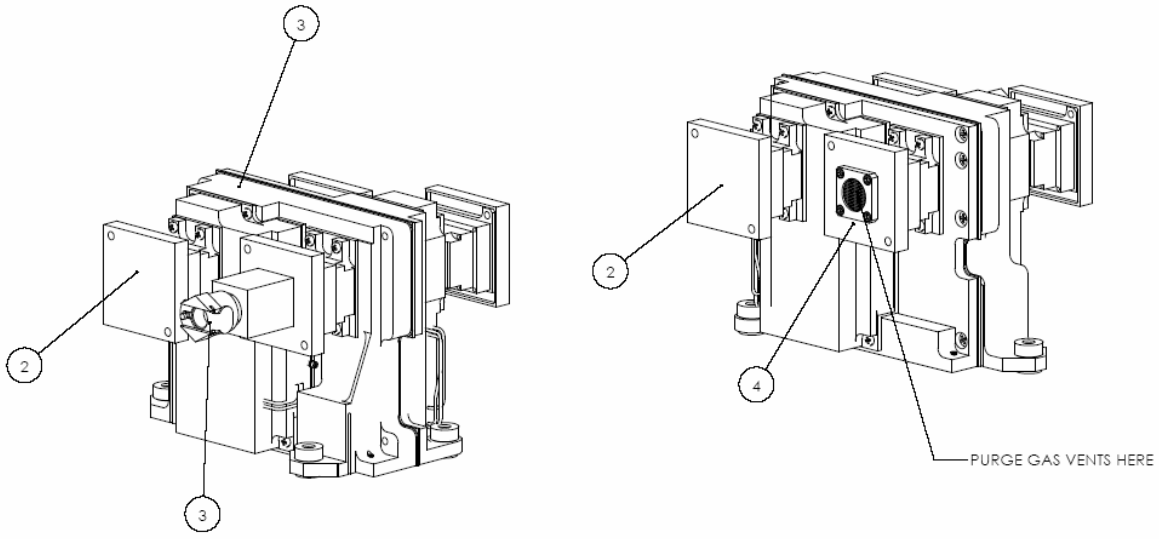
ITEM	QTY	PART NUMBER
1	1	THM-SST-MEC-010 (SST ASSEMBLY)
2	2	THM-SST-MEC-905 (DUST COVER)
3	1	THM-SST-MEC-090 (PURGE SUPPLY ASSEMBLY)
4	1	THM-SST-MEC-091 (PURGE VENT ASSEMBLY)



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X. ±0.3
X.X ±0.1
X.XX ±0.01
X.XXX ±0.005
SURFACE 32
MATERIAL
FINISH
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MODELED	RKL	05-11-04
DRAWING	RKL	05-11-04
CHECKED		

CHARGE NO. SST F-THMSST-F
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SST PURGE CONNECTION

SIZE A | DWG. NO. THM-SST-MEC-009 | REV. A
SCALE: 1:2 | MASS: GMS | SHEET 1 OF 1

Figure 4
SST Purge Connections

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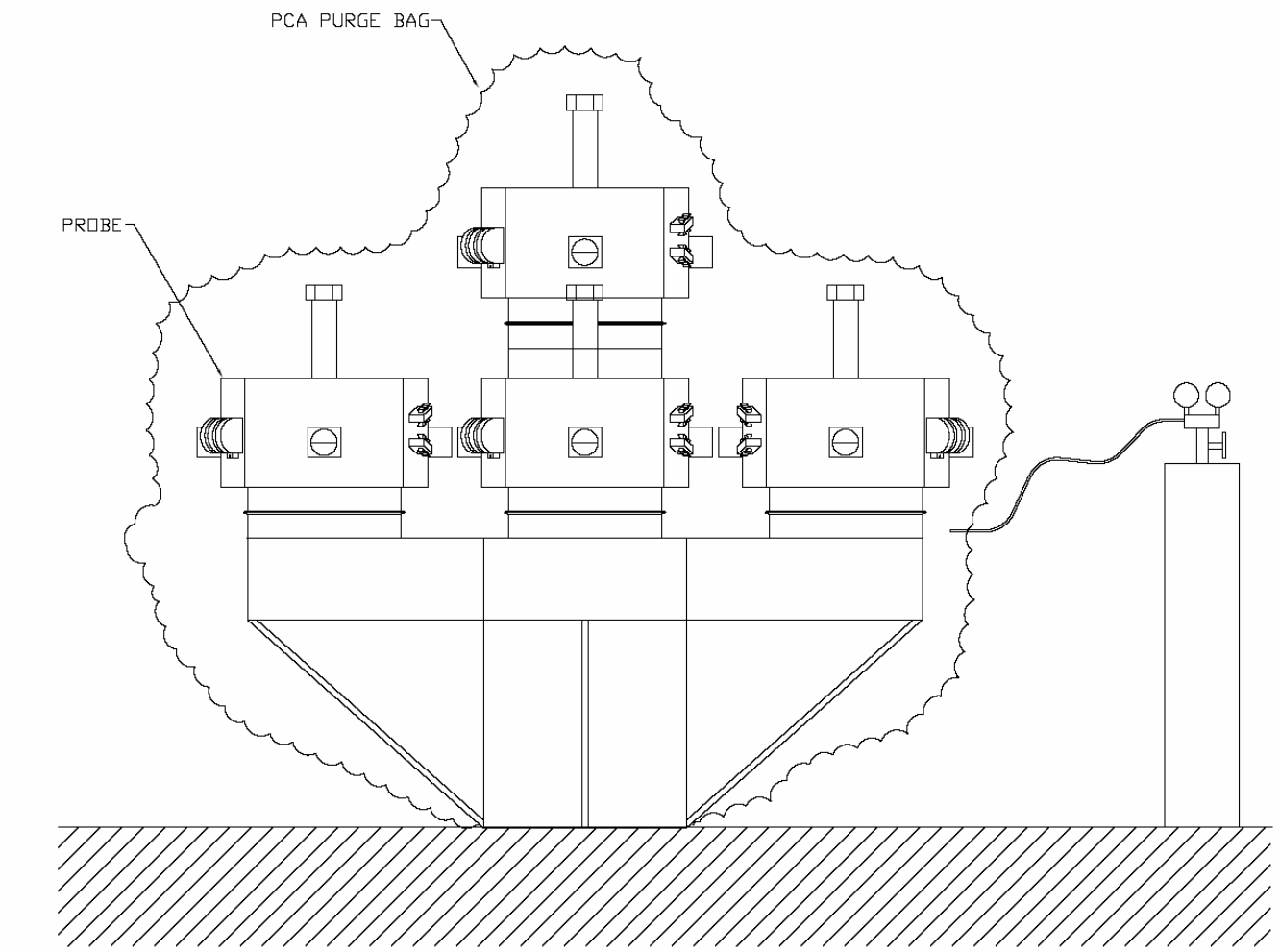

Figure 5
PCA Purge
Bag (Schematic)

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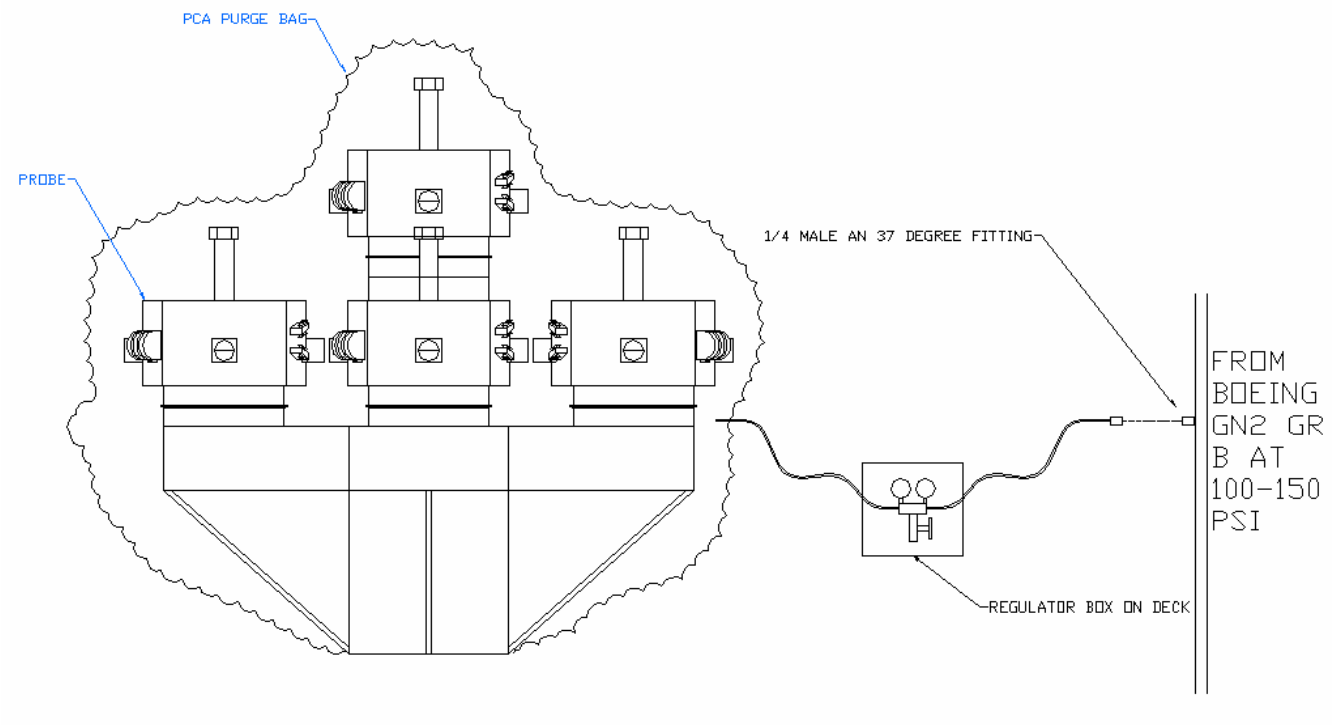

Figure 6
PCA Purge Bag (Schematic) – Connected to Boeing Nitrogen Supply