SU/GP-B P0063

STANFORD UNIVERSITY
W.W. HANSEN EXPERIMENTAL PHYSICS LABORATORY
GRAVITY PROBE B, RELATIVITY GYROSCOPE EXPERIMENT
STANFORD, CALIFORNIA 94305-4085

PROCEDURE FOR THERMAL CYCLING IN LIQUID NITROGEN

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1. SCOPE

This procedure describes the method used for thermal cycling generic subassemblies prior to leak test. The cryogen used is liquid nitrogen LN2.

2. GENERAL REQUIREMENTS

2.1 Cleanliness

Precautions must be taken to ensure cleanliness requirements of Stanford Procedure P0059 are satisfied. The test unit must be cleaned and bagged after testing.

2.2 Test Personnel

2.2.1 Test Director

The Test Director has overall responsibility for the implementation of this procedure and shall sign off the completed procedure.

2.2.2 Other Personnel

All engineers and technicians participating in this procedure work under the direction of the Test Director who shall determine whether the person is qualified to participate in this procedure.

2.3 Safety

2.3.1. General

Special emphasis shall be placed on safety when handling cryogens. The test director shall ensure that all personnel are aware of the specific personnel and hardware safety concerns associated with this procedure.

2.3.2. Protective Garments

Minimum protective garments for personnel working in the clean rooms shall be the standard Tyvek clean room apparel for clean room classes 10,000 to 1,000. When handling cryogens, safety glasses and protective gloves shall be worn.

2.4. Quality Assurance

All testing shall be conducted on a formal basis to approved and released test procedures. A Quality Assurance representative shall review and document any discrepancy noted during test, and approve its disposition. Upon completion of each procedure, the QA representative will certify his/her concurrence that the effort was performed and accomplished in accordance with the prescribed instructions by signing and dating his/her approval line at the end of the procedure. QA and/or other observers shall be welcome during the procedures with Test Director approval.

2.5. Red-line Authority

Authority to red-line (make minor changes during execution) this procedure is given solely to the responsible integration engineer and the Test Director.

3. REQUIRED EQUIPMENT

Test Unit

Ground Support Equipment (GSE)

Dewar flask of appropriate height and diameter for the test unit. The height of the dewar shall be tall enough so that the test article can be placed entirely in the liquid, cold vapor, or warm vapor

Liquid Nitrogen Supply Bottle

Nylon monofilament line - ≥ 3 ft

4. OPERATIONS

4.1. Initial Preparation

4.1.1. Align the dewar flask under a pulley (a tack on a shelf above the bench may be sufficient), so that the plumb line of a line on the pulley is in the approximate center of the flask.

4.1.2 Mark the line holding a dummy test unit such that the marks indicate when the unit is in the liquid, cold vapor (1 to 3 inches above liquid level), and warm vapor (greater than 3 incles above liquid and below 1 inch from top of flask). The marks must be visible above the top of the flask.

4.1.3 Fill the flask with liquid nitrogen from the supply bottle up to a depth of sufficient to fully submerge the test unit.

WARNING: Take extreme care not to spill cryogen onto personnel. Liquid Nitrogen is capable of causing severe frostbite, particularly if it saturates clothing which is in close contact with the skin. Safety glasses and protective gloves shall be worn when handling cryogen.

4.1.4 Tie the test item securely onto the end of the guide line. If it is important to avoid water condensation on the test item, it may be enclosed in a sealed plastic bag.

4.2. Thermal Cycling

4.2.1. Lower the test unit entirely in the cold vapor, using the marker on the guide line, and hold for at least 15 minutes. Allow the part to reach a stabilized temperature, as evidenced by a steady vapor flow, prior to proceeding.

4.2.2. Lower the test unit entirely into the liquid, using the marker on the guide line. Keep submerged in liquid until boiling has subsided to its original rate (minimum 5 minutes).

4.2.3. Lift the test unit to the warm vapor, using the marker on the guide line, and hold for approximately 10 minutes.

4.2.4 Repeat steps 4.2.1 through 4.2.3 two more times, for a total of 3 thermal cycles.

4.3. Place Unit in Storage Compartment

4.3.1. Place the test unit in a clean, marked storage compartment, and allow to warm to ambient.

5. DATA BASE ENTRY

The following data shall be entered into the GP-B Data Base:

1) Name, number and revision of this procedure