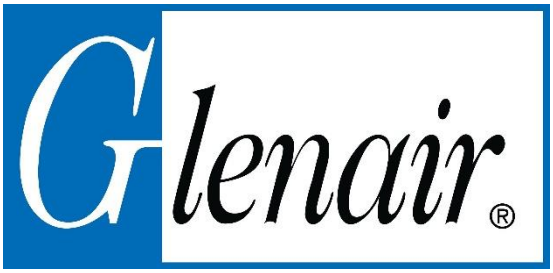
# Test Report

## Hermetic Connector Cryogenic Thermal Cycling

## GT-15-116

Revision 2

9/29/17

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# TEST REPORT

| Cage Code: 06324 | Hermetic Connector Cryogenic Thermal Cycling | Document #: GT-15-116<br>Revision: 2 |
|---|---|---|

| | |
|---|---|
| Conducted by: | Preston Clover |
| Approved by: | Guido Hunziker |

## 1. Report Revision History

| Date | Revision | Notes |
|---|---|---|
| 8/17/2015 | 1 | Initial Release |
| 9/29/2017 | 2 | Formatting & Typo Corrections |

## 2. Scope

This testing has been conducted to confirm the hermeticity performance of Glenair Inc. hermetic connectors before, during, and after Cryogenic Thermal Cycling.

## 3. Summary of Results

The table below contains a chronological summary of all testing and their results:

| Test | Test Item #1 | Test Item #2 |
|---|---|---|
| **Workmanship** | PASS | PASS |
| **Initial Helium Leak Test** | PASS | PASS |
| **Cryogenic Temperature Cycle #1** | PASS | PASS |
| **Helium Leak Test** | PASS | PASS |
| **Cryogenic Temperature Cycle #2** | PASS | PASS |
| **Helium Leak Test** | PASS | PASS |
| **Cryogenic Temperature Cycle #3** | PASS | PASS |
| **Helium Leak Test** | PASS | PASS |

## 4. Description of Samples

**Group 1**: Samples 1 and 2. Glenair hermetic connectors.

Singer Laboratories

139 W. Walnut Ave
Monrovia, CA 91016
P: (626) 599-9080
F: (626) 773-8180

**Test Report** **Laboratory Report No. GA-3371-0001**

**Test Item(s)/Lab No(s):** GA-3371-0001

**Glenair Report Number:** GT-15-116

**Customer:** Glenair Inc. 1211 Airway, Glendale CA 91201

**Main Contact:** Guido Hunziker

**Performed by:** Preston Clover **Performed on:** 8/1/2015

**Submitted by:** Preston Clover **Submitted on:** 8/17/2015

**Test Results Approved by:** Drew Price, Quality Representative, 8/17/2015

**Purpose of Test:**

The purpose of this testing is to measure the hermeticity of the test articles when they are subjected to cryogenic temperature cycling. All results from this testing are recorded and reported in this Laboratory Test Report. All testing was conducted at Singer Laboratories in Monrovia, CA.

**Test Criteria:**

The units under test shall be considered to meet the specification requirements when they have successfully completed the following test criteria:

a) No visual physical damage to the test samples after testing.

b) All test units shall be helium leak tested before and after cryogenic temperature cycling. In order to be considered “hermetic” the test samples must have a helium leak rate no greater than 1.0E-7 cc/sec helium at 1 atm.

**Test Item Identification:**

Testing shall be performed on the test items identified in **Table 1** in the sequence specified in **Table 2**, unless otherwise stated herein. Any deviations and/or requests for alternative sequence and/or groupings to the specified requirements shall be submitted in writing and approved by Singer Labs prior to incorporation. Unless otherwise specified, one (1) each of the test items identified in Table 1 shall be used.

| Test Item Identification Numbers | Glenair Part Number | Test Item Qty. |
|---|---|---|
| Sample 1 | SA5160 | 1 |
| Sample 2 | SA5160 | 1 |

***Table 1: Test Item Identification***

| Test Group | Test Item Numbers |
|---|---|
| **Test Group #1** | 1 & 2 |

***Table 2: Test Group Identification***

| Test | Test Item #1 | Test Item #2 |
|---|---|---|
| **Workmanship** | PASS | PASS |
| **Initial Helium Leak Test** | PASS | PASS |
| **Cryogenic Temperature Cycle #1** | PASS | PASS |
| **Helium Leak Test** | PASS | PASS |
| **Cryogenic Temperature Cycle #2** | PASS | PASS |
| **Helium Leak Test** | PASS | PASS |
| **Cryogenic Temperature Cycle #3** | PASS | PASS |
| **Helium Leak Test** | PASS | PASS |

***Table 3: Order of Testing***

**Calibrated Test Equipment:**

1. Wilson Scientific Glass, Helium leak standard
   Model GGK3264301, Serial #: LLK2089
   Calibrated 8/19/2014
   Calibration due 8/19/2016
   Singer Labs # PV00001

2. Dickson One, Temperature Monitor
   Model #R400, Serial #: 15070187
   Calibrated 3/17/2015
   Calibration due 3/17/2016
   Singer Labs # TC00007

*Calibration certificates for all equipment attached to this report*.

**General Information:**

Two items were tested. Test samples were designated Sample #1 and Sample #2.

***Figure 1: Test samples #1 and #2***

**Test Methods:**

**Workmanship:**

The test articles will be free of defects detrimental to product performance when examined by the unaided eye. Photographs of each test article will be taken before and after each major test to compare and check for defects.

**Helium Leak Testing:**

Both test samples were helium leak checked on a Varian helium leak tester. Each test sample was pumped down for 5 minutes and allowed to stabilize before helium was introduced. Helium was injected into the possible leak surface for 3 seconds, the reading was allowed to stabilize and the greatest leak that is detected shall be recorded.

**Cryogenic Temperature Cycling:**

Test in accordance with customer instructions listed below:

- Place test samples in environmental chamber at room temperature.
- Slowly ramp chamber up to 150°C at 2°C per minute.
- Dwell at 150°C for 2 hours.
- Slowly ramp chamber down to -65°C at 2°C per minute.
- Slowly add liquid nitrogen to exterior of insulated sample container.
- Once temperature on the test samples has reached -185°C slowly immerse test samples in liquid nitrogen.
- Leave samples in liquid nitrogen for 2 hours.
- Remove samples and place in environmental chamber. Ramp up at 2°C per minute to room temperature.

**Test Results:**

**1. Workmanship:**

All samples were inspected visually. There was no evidence of poor workmanship. All plating was complete and there was no cracking. All samples were found to be in good condition.

**2. Helium Leak Testing:**

**2.1 Test set up:**

Samples were placed directly on helium leak tester port using a custom machined interface. Vacuum oil and Buna-N material were utilized to ensure a leak free connection. Before any leak testing was performed on the internal features of the connector the outer seal was checked to ensure there was no external leaks.

***Figure 2: Test setup for Contact Resistance testing.***

### 2.2 Helium Leak Testing Results:

Samples #1 and #2 both maintained leak rates better than 1.0 E-7 cc/sec helium at 1 atm throughout the temperature cycling program.

| Sample Number | #1 | #2 |
|---|---|---|
| **Initial leak rate [cc/sec helium at 1 atm]** | 1.09E-9 | 2.02E-9 |
| **Leak rate after 1st Cold Soak [cc/sec helium at 1 atm]** | 1.29E-9 | 1.58E-9 |
| **Leak rate after 2nd Cold Soak [cc/sec helium at 1 atm]** | 1.08E-9 | 1.29E-9 |
| **Leak rate after 3rd Cold Soak [cc/sec helium at 1 atm]** | 1.52E-9 | 9.1E-10 |

***Table 4: Helium leak test results***

**3. <u>Cryogenic Temperature Cycling:</u>**

Samples were initially placed in an insulated stainless steel beaker inside of an environmental chamber. Once the temperature of the samples reached -185°C the samples were removed and placed directly into a dewar of liquid nitrogen and left to soak for 2 hours.

Test samples underwent Cryogenic Temperature Cycling and were visually inspected before and after testing. There was no evidence of cracking, peeling, or other mechanical degradation. Additionally, samples were helium leak tested before and after each cycle. There was little to no increase in helium leak rate once measured after cryogenic temperature cycling. See **Table** 4 in section **2.2** for measured leak rate values.

***Figure 3: Samples were placed in environmental chamber in an insulated stainless steel beaker.***

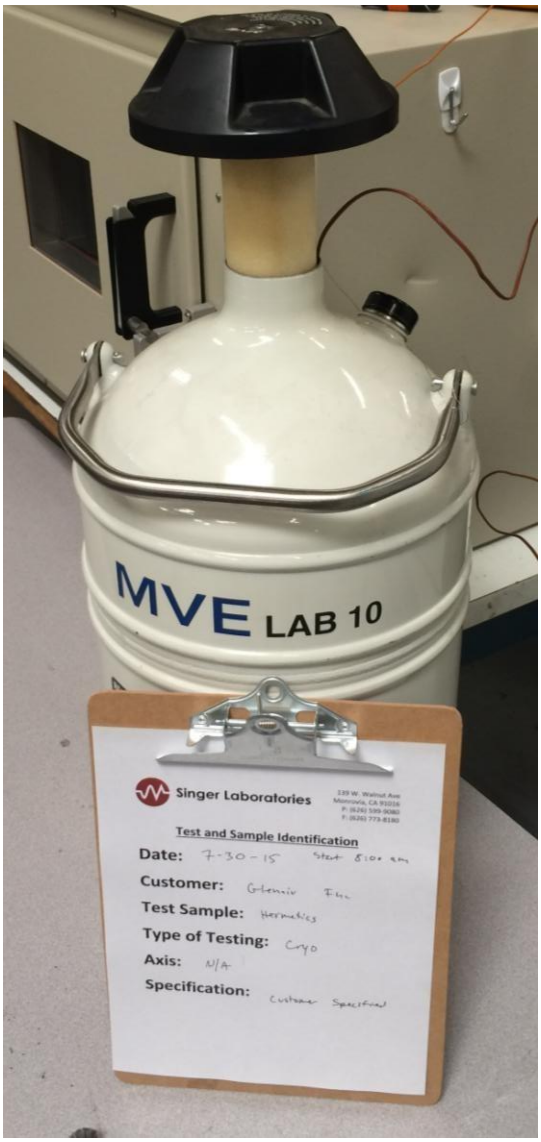


***Figure 4: Test samples where immersed in liquid nitrogen for a two hour dwell time.***


***Figure 5: Example of temperature data from a cryogenic temperature cycling.***

**Willson Scientific Glass, Inc. and High Vacuum Products**
**528 E. Fig Ave., Monrovia, CA 91016-4225**
**626-303-1656/Fax.626-303-0599**
**Website: www.willsonscientific.com**

# *Certificate of Calibration*

traceable to

## National Institute of Standards and Technology

Willson Scientific Glass Primary Leak Standard Serial No: 115

Calibration Date: May 2014 Re-Calibration Due: May 2016

National Institute of Standards and Technology Test No.:285301-14

## Leak Standard Tested

Model No.: GGK3264301 Serial No.: LLK2089

Calibration Date: 08/19/14 Calibration Temp.: 24°C

Calibrated Leak Rate: $1.47 \times 10^{-7}$ ATM cc/sec $\pm$ 10% for Helium.
*Note:* Depletion Rates less than 1% per year.

Tested By: J. Palmer Date: 08/19/14

Willson Scientific Glass certifies the above test leak standard was comparatively calibrated to a primary leak standard which is traceable to the National Institute of Standards and Technology.

Brent Palmer

Brent Palmer, Operations Manager Stamp

# USEFUL HELIUM LEAK STANDARD INFORMATION

1. DESCRIPTION AND PRINCIPLE OF OPERATION.

   The leak element is a thin glass membrane inserted into a metal reservoir of helium at slightly higher than atmospheric pressure. Helium leakage is by diffusion through the glass and the rate depends on the differential pressure of helium across the membrane.

2. SPECIFICATION.

   A. Accuracy: ± 10% when calibrated

   B. Depletion rate: less than 1% per year

   C. Temperature coefficient: 2.7% per °C (1.5% per °F)

3. TEMPERATURE CORRECTION

   As indicated by the temperature coefficient, 2.7% per °C (1.5% per °F), the rate of the leak widely different that the temperature of calibration. To correct the leak rate for temperature:

   a) Determine the temperature of the leak standard (room temperature)
   b) If room temperature is warmer than the calibration temperature stated on the leak standard you must add (+) the temperature coefficient, if the room temperature is colder than the calibration temperature stated on the leak standard you must subtract (-) the temperature coefficient.

4. STORAGE.

   A. Daily usage-
   In order to optimize the overall daily accuracy in the use of you leak standard, it should be stored with the shut off valve open. A dust cover can be used to protect the vacuum port.

   B. Storage for 30 days or more-
   When the leak is not in use, the valve should be closed to hold helium loss to a minimum. Leakage will continue as long as a helium pressure difference exists and burst of helium will occur when the valve is opened. Also, the unit should not be stored at elevated temperatures, again to avoid depleting the helium supply.

5. CAUTION.

   The leak element is glass and will break if subjected to rough treatment. **Avoid dropping.** The filling tube has been permanently sealed and is not removable.

6. If you have any questions regarding your Helium Standard Leak please do not hesitate to call or write us at **WILLSON SCIENTIFIC GLASS,INC.,**528 E. Fig Ave., Monrovia, CA 91016 626-303-1656.

**Willson Scientific Glass, Inc. and High Vacuum Products**
**528 E. Fig Ave., Monrovia, CA 91016-4225**
**626-303-1656/Fax.626-303-0599**
**Website: www.willsonscientific.com**

We certify that the leak rate is accurate in accordance with the following comparative measurement technique.

This procedure compares, through the use of a DuPont Mass Spectrometer Leak Detector, each unit against a primary standard, which is certified and calibrated by the NATIONAL INSTITUE OF STANDARDS AND TECHNOLOGY (285301-14). This leak detector is continuously calibrated and becomes the instrument used to calibrate the Helium Leak Standard.

WSG recommends that your calibrated leak be returned for recalibration annually.

If you have any questions please do not hesitate to contact us.

Brent Palmer
Operations Manager

# Certificate of Instrument Calibration



## Customer Instrument

**Dickson Model Number:** R400

**Serial Number:** 15070187

**Calibration Tech/Approved By:** *Karen Dargenio*

**Calibration Date:** 03/17/2015

**Calibration Type:** 3 PT NIST

## Calibration Standards

Fluke 525B
Ser. #1652006

Azonix Model A1011 Ser. #T2513-9027
Probe Ser. #496013
Customer Notes Field:

(for entry of name/address/location or internal unit ID)

*The calibration is traceable through the National Institute of Standards and Technology.*

## Calibration Procedure P1130

The customer instrument was compared to the calibration standard. Drifts and faults were determined, and any necessary mechanical or electronic adjustments were taken. The Dickson calibration system conforms to the requirements of MIL-STD-45662A, ANSI/NCSL Z540-1, and ISO 17025 as appropriate. This certificate only relates to this specific unit. The unique certificate number equals the model # + serial # + cal date.

## Environmental Conditions

72 °F 41 %RH

| Calibration Standard Reading | Customer Instrument Reading | Temperature Specification | |
|---|---|---|---|
| Temperature °F (°C) | Temperature °F (°C) | Channel 1 | Channels |
| 0 (-17.8) | 0 (-17.8) | ±1.8°F from -22 to 122F<br>±3.8°F Remaining | Pass |
| 500 (260) | 500.3 (260.2) | | |
| 1000 (537.8) | 1000 (537.8) | | |
| Temperature °F (°C) | Temperature °F (°C) | Channel 2 | |
| | | ±1.8°F (±1°C) | |
| | | | |
| | | | |

## FOR YOUR NEXT CALIBRATION NO PHONE CALLS REQUIRED

Fill out and send this form along with your instrument to Dickson. Label the outside of the box with "CCM" - that is your RA#.

**That's all there is to it!**

1. Purchase Order #: _____
   Name: _____
   Phone: _____
   Model #: R400
   Serial #: 15070187

**A 3-pt Deluxe NIST will be performed unless otherwise requested**

2. ☐ 1-Point Deluxe NIST Calibration $156.00
   ☐ 3-Point Deluxe NIST Calibration $209.00
   ☐ 3-Point A2LA Accredited Calibration $315.00 (includes incoming readings)
   ☐ N995 - User selectable NIST Temperature points $50.00 each
   (to be selected in addition to one of the above calibration options)
   ☐ N997- Priority Service $53.00 (Not available for A2LA Accredited service)

3. Please return via:
   ☐ Ground Freight*
   ☐ 2nd Day Air*
   ☐ Next Day Air*

*Charges added at factory

**Returned 2nd Day unless otherwise requested**

4. Ship To: _____

Bill To: _____

*Prices are subject to change*

*Let Dickson remind you the next time your unit is due for calibration. Register for our FREE Calibration Club now at www.dicksondata.com*

**Dickson**
930 South Westwood Avenue Addison, Illinois 60101 630-543-3747 Fax 630-543-0498