General Aviation Modifications, Inc.

2800 Airport Rd.
Ada, OK 74820

G100UL Avgas Material Compatibility
Summary of Testing

Document No.: **06-6570024, Rev. Initial Release** **Date: 08-29-2025**

	Name	Signature	Date
Author:	George W. Braly	[Original Signature on File]	8/29/25
Checked:	John-Paul Townsend	[Original Signature on File]	8/29/25
Approved:	TC Roehl	[Original Signature on File]	8/29/25

Rev	Date	Author	Check	Approval	Description
IR	8-29-25	G.W.Braly	JPT	TCR	Initial Release

ABSTRACT

This report compiles and summarizes the scope of the extensive or exhaustive Material Compatibility Testing (MCT) completed and approved by the FAA during the course of the certification approval process for G100UL Avgas, beginning in January of 2010 and which resulted in the approval for use of G100UL Avgas in 100% of the airplanes and 100% of the piston engines on September 1st, 2022. Reference FAA Project No. SA06786WI-E, SA06769WI-E, ST13515AT-E, SA06787WI-A, and SA06768WI-A & STC

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The FAA approved reports prepared by Cirrus Design remain confidential to Cirrus. Therefore, only the cover page of those reports can be included in order to document the extensive material compatibility testing performed by Cirrus.

References:

1. 06-65700002 Engine PSCP Rev IR March 7, 2021 and later
2. 06-6570040 G100UL and xG100UL Detonation Results Rev IR, March 7, 2021
3. ERAU_Report_GAMI_001_Rev_A, Flight Test Report of GAMI G100UL Fuel in Cessna Aircraft Company 172 Series Aircraft, Feb 16, 2015

INTRODUCTION

This report compiles and summarizes the extensive scope of the Material Compatibility Testing (MCT) completed and approved by the FAA during the course of the certification approval process for G100UL Avgas, beginning in January of 2010 and which resulted in the approval for use of G100UL Avgas in 100% of the airplanes and 100% of the piston engines on September 1st, 2022. Also included are the results of some additional testing conducted both before and after the FAA approval of the STCs.

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Appendix H: Twin Cessna Fuel Selector-Actuator Testing.

Significant Finding: **Use of the correct size (-12 or -13) Nitrile (Buna-N) or FKM (Viton) "O-Rings" results in normal functioning of the Cessna Fuel Selector. Use of the wrong size O-Ring (-14) results in failure / breakage of the O-Rings in either 100LL or G100UL Avgas.**

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Appendix A1-A5: **Full Scale Aircraft Component Testing with Inventory of Tested Components. (FAA Approved/Accepted)**

<u>Significant Finding:</u> **An expansive and comprehensive set of used/high time in service aircraft and engine fuel wetted components continued to function normally (as intended) and without detectable degradation when operationally exposed to G100UL Avgas for more than six months while under adverse operating conditions (elevated fuel temperature, to enhance the chemical activity of the fuel.)**

Detailed Description: See Exhibits A-1 through A-5, below and associated remarks descriptions.

Chart 1 – Component Applicability

Ex. A-1

	Part Number	Description	Manufacturer	Where U	rks
1	LW-15473	Engine Driven Fuel Pump	Lycoming	Lycoming O-360 series IO-360 series O-540 series IO-540 series	Diaphragm style fuel pump Uses rubber diaphragm
2	ETI-SR22-2-12	Engine Driven Fuel Pump	Teledyne Continental Motors	Turbonormalized TCM IO-550-N	Modified per STC SE10589SC
3	4404-00-7NVCJ	Electric Fuel Pump	CJ Aviation	Various Aircraft	Replaces Dukes 4140-00-39
4	3009-C	Electric Fuel Pump	Weldon	Various aircraft	27 VDC 1.7 Amp
5	366-00	Check Valve	Dukes	Various	2 each
6	653353-8A1	Throttle Body	Teledyne Continental Motors	IO-550-N	
7	646433-9A4	Fuel Spider	Teledyne Continental Motors	IO-550-N	
8	C100203	Gascolator	Commercial Aircraft Products	Cirrus SR20 Cirrus SR22	Metal mesh screen filter
9	0756039-10	Gascolator	Cessna Aircraft Co.	Various Cessna aircraft	
10	FS2520D2-4B-2M-C	Fuel Selector Valve	Andair LTD	Cirrus SR20 Cirrus SR22	*
11	36-380026-1 73D-64	Fuel Selector Valve	Beech Aircraft Corp.	Hawker Beechcraft 33 series 35 series 36 series	*
12	55034	Fuel Selector Valve	Osborne Tank and Supply	Hawker Beechcraft 33 series 35 series 36 series	*

Chart 1 - Component Applicability (cont.)

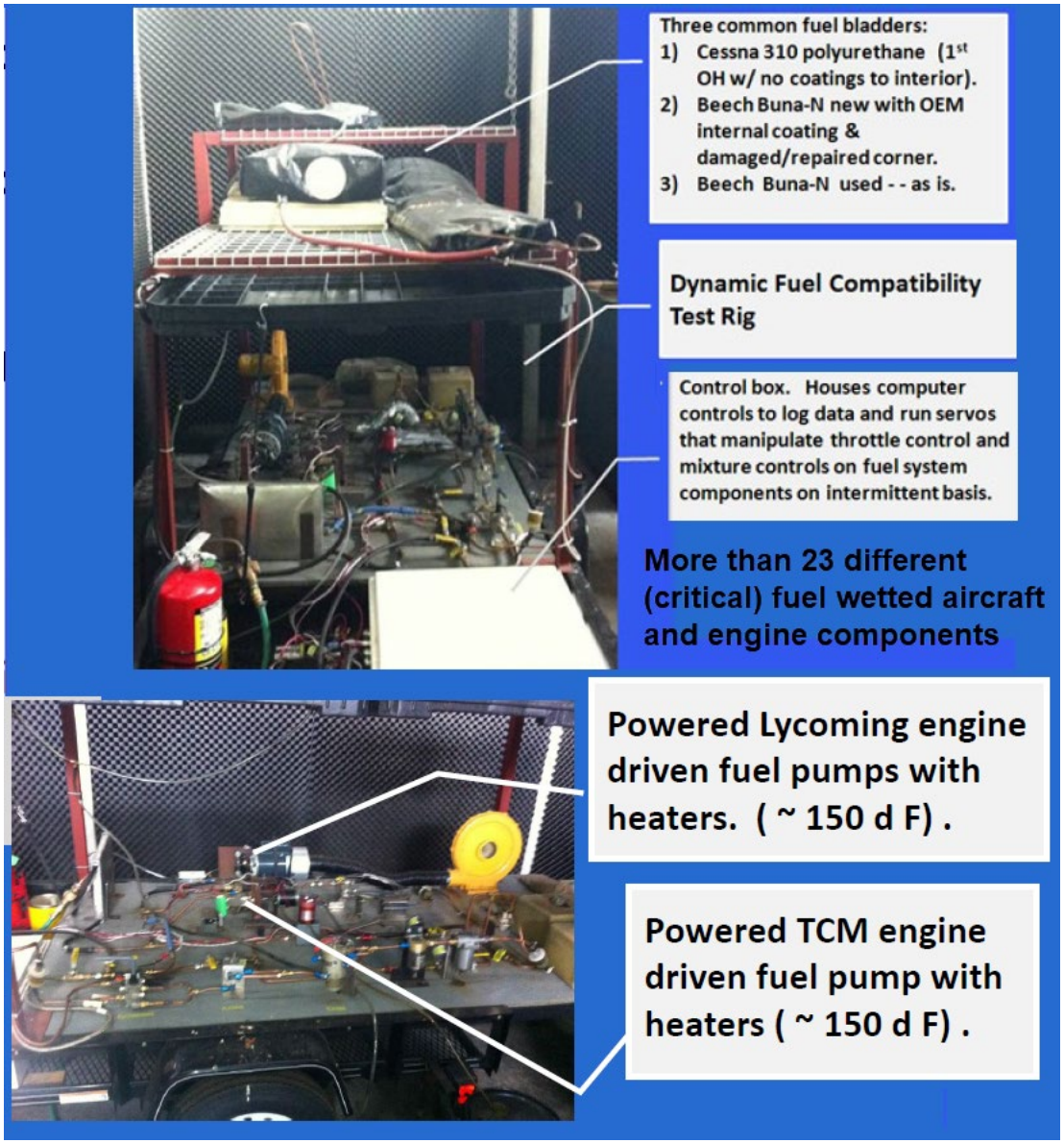
	Part Number	Description	Manufacturer	Where Used	Remarks
13	120824	Fuel Flow Transducer	Flo-Scan	Various aircraft	
13	700900-1	Fuel Flow Transducer	Flo-Scan	Various aircraft	
14	642100	Fuel Pressure Limiter	TCM	GTSIO-520-H	
15	601 / AE701	Flexible Fuel Hose	Aeroquip	Various aircraft	Synthetic rubber reinforced with stainless steel braids
16	MIL-H-8794	Flexible Fuel Hose	Aeroquip	Various aircraft	Aeroquip 303 fuel hose
17	TSO C53a Type D	Flexible Fuel Hose	Aeroquip	Various aircraft	Teflon lined hose per TSO C53a Type D
18	58-380003-11	Buna Nitrile Fuel Cell	Uniroyal	Hawker Beechcraft 58 series	1st Overhaul No coatings applied to interior
19	0823362-3LH	Urethane Fuel Cell	Goodyear	Cessna 310 LH inboard	1st Overhaul No coatings applied to interior
20	35-921540-1E	Buna Nitrile Fuel Cell with Eagle Fuel proprietary surface coating	Eagle Fuel Cells	Hawker Beechcraft 35 series right hand	Newly manufactured never installed
21	111417-6S0230	Flexible Fuel Hose	Stratoflex (Parker)	Cessna 150	TSO C53a Type A
22	2B6-64	Electric Fuel Pump	Airborne	Piper Navajo	
23	A10014-D40	Electric Fuel Pump	Weldon	Piper Navajo	

* Note: Many of these components included 10 to 25 year old “O-rings”. Three examples are flagged with an *.

Also note - - none of these components were “new”. The FAA want real “in service” components to be used. Clearly, that is the “right” way to do material compatibility tests and evaluation for new fuel chemistries.

Appendix A (Continued):

Ex. A-2. Further Details of the Dynamic Rig Test for Aircraft / Engine Material & Component Compatibility with G100UL Avgas.



Ex. A-3. FAA "sign off" for Dynamic Rig Test.

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

STATEMENT OF COMPLIANCE WITH AIRWORTHINESS STANDARDS

1. DATE: May 7, 2015

AIRCRAFT OR AIRCRAFT COMPONENT IDENTIFICATION

2. MAKE	3. MODEL NO.	4. TYPE (Aircraft, Engine, Propeller, etc.)	5. NAME OF APPLICANT
Listed below	Listed below	Aircraft Engine	General Aviation Modifications, Inc.

LIST OF DATA

6. IDENTIFICATION	7. TITLE
06-6570016 Rev NC dtd 06/05/2014	G100UL Dynamic Fuel Test Results FAA Accepted, AIR-21 Date 1/26/16 END With : Report 06-6570016A,Rev. NC dated 1-21-2016, Addendum to G100UL Dynamic Fuel Test Results

This FAA Form 8110-3 contains the FAA stamp and signature documenting the approval of the results of the dynamic fuel test of material and components exposed to G100UL Avgas.

8. PURPOSE OF DATA: To define Part 23 and Part 33 dynamic fuel test results in support of STC approval of General Aviation Modifications, Inc. G100UL fuel in various airframes and engines. FAA Project Numbers ST13515AT-E and ST00001FO-A.

9. APPLICABLE REQUIREMENTS (List specific sections)

14 CFR Part 23 §23.963 Fuel Tanks: General §23.993 Fuel System Lines and Fittings §23.1183 Lines Fittings and Components

14 CFR Part 33 §33.15 Materials §33.19 Durability §33.53 Engine System and Component Tests

10. CERTIFICATION - Under authority vested by direction of the Administrator and in accordance with conditions and limitations of appointment under 14 CFR Part 183, data listed above and on attached sheets numbered n/a have been examined in accordance with established procedures and found to comply with applicable requirements of the Airworthiness Standards listed.

I (We) Therefore: ☐ Recommend approval of these data ☒ Approve these data

11. SIGNATURE(S) OF DESIGNATED ENGINEERING REPRESENTATIVE(S)	12. DESIGNATION NUMBERS(S)	13. CLASSIFICATION(S)
George W. Braly	DERT-830960-SW	Engines, Powerplant, Flight Test, Flight Test Analyst

FAA Form 8110-3 (03/10) SUPERSEDES PREVIOUS EDITION

Ex. A-4. Cirrus Verification of the traceability of the used Fuel System Components removed from one of the Cirrus' SR22 series aircraft and sent to GAMI in 2011 for use in the G100UL Dynamic Rig Test for evaluating the material compatibility and serviceability of a comprehensive collection of aircraft and engine fuel wetted components when exposed to 100LL and then also exposed to G100UL Avgas.

September 13, 2011

General Aviation Modifications, Inc.,
Attention: George Braly
2800 Airport Road
Ada, Oklahoma 74820

Re: History of supplied Gascolator and Fuel Selector Valve for use in G100UL fuel compatibility testing.

Dear George:

This letter is to verify that the following fuel system parts from Cirrus Design Corporation Model SR22 aircraft were sent to GAMI for the purpose of testing those parts in General Aviation Modifications, Inc. unleaded G100UL fuel:

Description	Cirrus P/N	Manufacturer	Manufacturer P/N	Serial Number
Gascolator	14069-002	APPH Wichita	C100203	168
Fuel Selector Valve	11627-001	Andair LTD	FS2520D2-4B-2M-C	3265

The parts listed above are unmodified production intent parts that were previously utilized for company flight testing in Cirrus SR22 aircraft and the fuel used for that flight testing was 100LL.

The total time of exposure to 100LL is not known.

Sincerely,

Herbie T. Dillon
Director, Procurement
Cirrus Aircraft

Ex. A-5. Supplementing the Dynamic Rig Testing, there was also traditional ASTM Coupon testing to verify that polysulfide (Pro Seal) (and also polythioether) fuel tank sealants performed as required and intended for the same sealant materials soaked in 100LL.

F. A. A.
ACCEPTED
Wichita ACO Branch
AIR-7K0
Name/Date:

General Aviation Modifications, Inc.

ENGINEERING REPORT 06-6570018, Rev. None

SEALING COMPOUND PEEL STRENGTH AFTER EXPOSURE TO FUEL

INTRODUCTION

This report details the tests conducted to verify that G100UL fuel does not adversely affect the adhesive qualities of commonly used fuel tank sealant. The fuels used in this test were GAMI G100UL unleaded fuel and ASTM D910 100LL fuel. This test was performed in support of STC approval of the G100UL fuel.

This test procedure is based upon the peel strength test procedures of MIL-S-8802F, "Sealing Compound, Temperature-Resistant, Integral Fuel Tanks and Fuel Cavities, High-Adhesion". Fuel tank sealants meeting the MIL-S-8802, Type II, Class B specifications are commonly used in many general aviation applications.

TEST COUPONS

Test coupons were prepared as outlined in MIL-S-8802F, paragraph 4.8.17. Four coupons were prepared from a sheet of .040 inch thick 7075-T6 aluminum per QQ-A-250/13, T6. The 7075-T6 aluminum was sheared to four each 2.75 x 6.00 inch pieces. The 2.75 x 6.00 inch pieces were cleaned and treated with a chemical conversion coating per MIL-DTL-5541. Within 48 hours of the conversion coating sealing compound per MIL-S-8802, Type II, Class B was mixed and applied 1/8 inch thick to a 5 inch end of each aluminum piece. The sealing compound was also applied to 4 pieces of 30 x 30 mesh Monel wire cloth 2.75 x 5.00 inches making sure the sealant penetrated the Monel mesh without any air bubbles. Each sealant impregnated Monel fabric piece was placed on one sealant coated aluminum panel taking care not to trap air beneath the fabric. An additional 1/32 inch of sealant was applied over the fabric to form a total of four coupon test panels. The coupon test panels were cured for 14 days at 77° ± 2° F.

CONCLUSION

The most common fuel tank sealants in use for general aviation aircraft are sealants meeting the requirements of MIL-S-8802, Type II, Class B. MIL-S-8802, Type II, Class B fuel tank sealing compound after exposure to G100UL fuel continues to meet the peel strength requirements of MIL-S-8802 with large margins. When comparing the same fuel tank sealant exposed to 100LL fuel, there is no notable difference.

Note: Mil-Spec pass/fail test requirement is for a minimum 20 pound force peel strength. The average for the G100UL was 86 lbs and the average for the 100LL reference coupons was 83 lbs.

Appendix B1-B3: **Independent 3rd Party Testing by Cirrus Design - G100UL Avgas in Cirrus Fiberglass-Epoxy Carbon Fiber / Composite Fuel Tanks. (FAA Approved)**

Significant Finding: **There was no adverse effect on the Cirrus fiberglass – epoxy resin nor on the later fiberglass tanks with carbon fiber spars - - as a result extended exposure to an FAA required high aromatic blend of G100UL Avgas. (Note: % aromatic significantly elevated above the G100UL Avgas specification limits).**

Ex. B-1. Cover page of Cirrus Company's Initial Round of Material Compatibility Testing of Epoxy Prepregs and Adhesives with prototype formulation of G100UL Avgas.

CIRRUS DESIGN CORPORATION

CIRRUS DESIGN

Internal Test Report

G100UL Unleaded Fuel Compatibility with Epoxy Prepregs and Adhesives

Document No.: 25045 Rev A Date: 10/27/2010

	Name	Signature	Date
Author:	A. Nielsen		10/27/10
Checked:	M. Eltgroth		10/27/10
Approved:	M. Stone		10/27/10

ABSTRACT

This document includes the results from coupon level testing to determine sensitivity of various epoxy prepregs and adhesives to G100 UL unleaded fuel produced by GAMI.

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Document Control OCT 28 2010 Release CDC

Ex. B-2. Cover Page of Second Cirrus Company Test Report Documenting Successful Testing of G100UL Avgas as approved by the FAA.

CIRRUS DESIGN CORPORATION

Test Report

G100UL Unleaded Fuel Compatibility with Epoxy Prepregs and Adhesives

Doc. No. 25581

ABSTRACT

This document includes the results from coupon level testing to determine sensitivity of various epoxy prepregs and adhesives to G100 UL unleaded fuel produced by GAMI.

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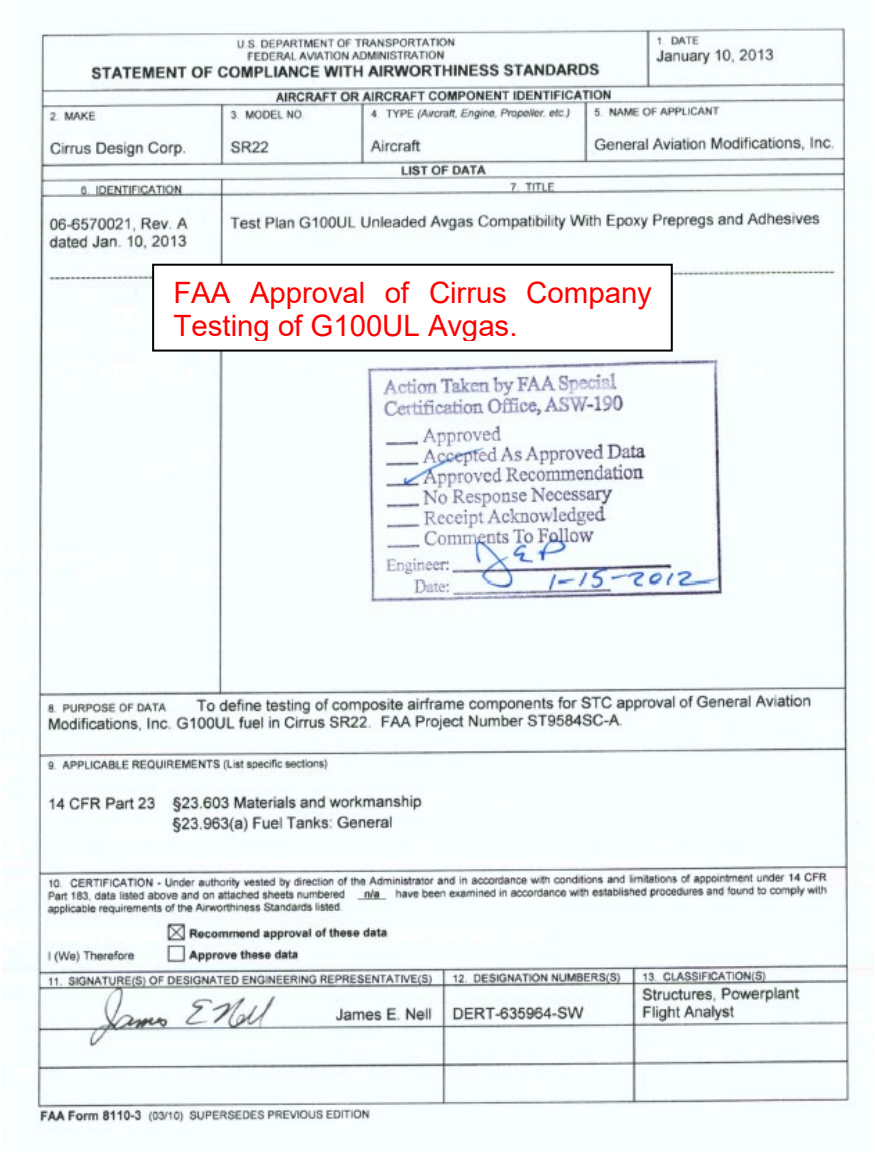
Approval and Signature

The CDC release process is an electronic process. All approvals and signatures are located in the Product Data Management (PDM) database. The state appearing in the watermark displayed on each document is evidence the appropriate approvals for the specified states conform to the closed loop approval process in the CDC PDM system.

G100UL Unleaded Fuel Compatibility with Epoxy Prepregs and Adhesives 25581 Page 1 of 29

Viewed or Printed On: April 18, 2014 02:18PM Alan Nielsen

Ex. B-3. FAA Form 8110-3 Documenting FAA Approval of Final Cirrus Design Report Demonstrating Full Compatibility G100UL Avgas with all of the Cirrus fuel wetted airframe components.



U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

STATEMENT OF COMPLIANCE WITH AIRWORTHINESS STANDARDS

1. DATE: January 10, 2013

AIRCRAFT OR AIRCRAFT COMPONENT IDENTIFICATION

2. MAKE	3. MODEL NO.	4. TYPE (Aircraft, Engine, Propeller, etc.)	5. NAME OF APPLICANT
Cirrus Design Corp.	SR22	Aircraft	General Aviation Modifications, Inc.

LIST OF DATA

6. IDENTIFICATION	7. TITLE
06-6570021, Rev. A dated Jan. 10, 2013	Test Plan G100UL Unleaded Avgas Compatibility With Epoxy Prepregs and Adhesives

FAA Approval of Cirrus Company Testing of G100UL Avgas.

Action Taken by FAA Special Certification Office, ASW-190
___ Approved
___ Accepted As Approved Data
___ Approved Recommendation
___ No Response Necessary
___ Receipt Acknowledged
___ Comments To Follow
Engineer: [signature]
Date: 1-15-2012

8. PURPOSE OF DATA: To define testing of composite airframe components for STC approval of General Aviation Modifications, Inc. G100UL fuel in Cirrus SR22. FAA Project Number ST9584SC-A.

9. APPLICABLE REQUIREMENTS (List specific sections)

14 CFR Part 23 §23.603 Materials and workmanship
§23.963(a) Fuel Tanks: General

10. CERTIFICATION - Under authority vested by direction of the Administrator and in accordance with conditions and limitations of appointment under 14 CFR Part 183, data listed above and on attached sheets numbered n/a have been examined in accordance with established procedures and found to comply with applicable requirements of the Airworthiness Standards listed.

I (We) Therefore ☒ Recommend approval of these data ☐ Approve these data

11. SIGNATURE(S) OF DESIGNATED ENGINEERING REPRESENTATIVE(S)	12. DESIGNATION NUMBERS(S)	13. CLASSIFICATION(S)
James E. Nell	DERT-635964-SW	Structures, Powerplant Flight Analyst

FAA Form 8110-3 (03/10) SUPERSEDES PREVIOUS EDITION

Further Comments Related to Material Compatibility Testing Completed by Cirrus Design Using G100UL Avgas:

The Testing described in **Ex. B-1** was completed very early in the prototype G100UL Avgas development process.

That report demonstrated that even very high levels of aromatics (> 50%) when used in that early prototype test formulation resulted in:

A) No degradation in the strength of the multiple fiberglass laminates used by Cirrus. The specifments immersed in prototype G100UL "exceeded the baselin (strength) for all composite materials" tested. Further, there was no change in hardness. Further, the hardness trendline over a month of soaking at elevated termperatrue was completely flat - - demonstrating that there would be no further change over still further lengths of time.

- and -

B) No degradation in the adhesive strength of the epoxy adhesive used by Cirrus to bond their structural laminates together. In fact, the samples tested by Cirrus in that early formulation of very high aromatic G100UL Avgas (>50% aromatic content by mass) exceeded the strength of the epoxy adhesive exposed to reference fuels at the same temperature for the same duration.

Appendix C1–C6: **Independent 3rd Party Testing by Embry Riddle. "Real World" Functionality & Reliability Testing of Full Scale Aircraft In-Service Material Compatibility, and high time in service Engine & Aircraft Durability Testing of G100UL Avgas. (FAA Approved)**

Significant Finding: **No detectable difference between aircraft and engine operation on G100UL Avgas and 100LL. Durability test on 1400 hour TIS engine for 150+ additional hours (14CFR33.xx engine durability test) demonstrated excellent durability and wear characteristics on the engine and fuel system, including the high time carburetor.**

Ex. C-1 EMBRY-RIDDLE Final Report of its Extended "Real World" Performance and Maaterial Compatibility Testing of G100L Avgas.

EMBRY-RIDDLE AERONAUTICAL UNIVERSITY

GAMI G100UL Fuel Flight Test Report

1. Executive Summary

This report details the results of TIA ground and flight testing of GAMI G100UL fuel in an Embry-Riddle Aeronautical University (ERAU) Cessna 172N assigned to the Eagle Flight Research Center. This testing was performed as part of FAA Project Numbers ST13515AT-E/ST00001FO-A and General Aviation Modifications, Inc. Test Plan 06-6570027, Revision B, dated Mar 18, 2013. All test points were successfully completed and these tests were performed in the local area of the Daytona Beach airport between Sept 16, 2013 and July 20, 2014. Before testing began two of the four cylinders in the engine were replaced and internal engine dimensions were recorded. The testing consisted of three primary phases. Phases 1 and 3 were used to assess engine performance and power characteristics on the ground and in flight. Included in these phases were various mixture sweeps through peak EGT, as well as engine shutdowns and restarts. Phase 2 was an inflight 150 hour operational phase that replicated the Part 33 engine block testing. During all tests the performance of the G100UL was equal to or better than the 100LL fuel in back-to-back comparisons. There were no unusual operational considerations that would require any AFM changes. Post Phase 3 teardown of the engine and carburetor showed no internal degradation of internal dimensions or other issues with the operation on this fuel.

These flight tests demonstrated that the G100UL fuel performed its intended function, satisfactorily passed the certification requirements and does not degrade the performance or operation of the Cessna 172 Series airplane. It is recommended that these results be accepted to demonstrate compliance with the certification requirements for these STC's.

Note: This page from the 83 page ERAU report documents ERAU's successful nine month "real world" use of G100UL Avgas in one their standard flight school Cessnas. Important: This type of "real world" testing (rather than laboratory or "coupon" testing) verifies that the fuel wetted aircraft and engine "materials" would continue to perform their intended functions after changing from 100LL to G100UL Avgas.

This is the FAA stamp from the associated Form 8110-3 accepting this ERAU report as FAA "Approved" data.

FAA Accepted, AIR-21

DOCUMENT NO. ERAU_Report_GAMI_001 Proprietary and Confidential REV: A

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Ex. C-2 Excerpt from EMBRY-RIDDLE final report establishing full material compatibilty of G100UL Avgas with the engine carburetor and all of its internal components.

EMBRY-RIDDLE AERONAUTICAL UNIVERSITY

GAMI G100UL Fuel Flight Test Report

Martin Induction Systems, Inc.
3415 N. 138th Street • Enid, Oklahoma 73701
FAA #BF2R714K

SEP 18 2014

DISASSEMBLY AND INSPECTION REPORT

Work Order # 6468 Date Received: 10 Sept 2014

Carburetor Inspection Report after ERAU G100UL Avgas nine months of operational flight testing on a 1,500 hour high time Lycoming engine.

COMPONENT DATA
Carburetor, Precision MA-4-5
Part # 10-5193 Serial # 75017225
Approximately 1500+ hours in service

INCOMING INSPECTION AND TEST
Test for fuel level was within required range at 4-6 PSI
Accelerator Pump showed good flow and quantity.
Mixture Control Shaft action was smooth with no binding.
Throttle Shaft had smooth rotation with no binding. A slight friction from o-rings is normal.
Strainer gasket showed no leaks.
Outside appearance looks good with no visible leaks and is serviceable.

DISASSEMBLY
Strainer has normal deposits for time in service.
Accelerator pump strainer has light deposits which are normal for time in service.
Polymer float is in good condition with no leaks and working smoothly.
Accelerator pump plunger serviceable and in normal condition for time in service.
Mixture control shaft o'ring pliability is good.
Float needle is in good condition with good pliability.
Parting surface gasket has good pliability and is in good condition.
Throttle shaft o'rings indicated a slight air leak. Pliability is good for time in service and wear is normal.
O'ring on idle needle is serviceable and has good pliability.

COMMENTS
The condition of the carburetor appears to be serviceable and in good condition for 1500 hours time in service.

INSPECTION COMPLETED BY
Gene R. Martin Date 9-10-14
Gene R. Martin

Phone (580) 446-5601 • Fax (580) 446-5411 • 1-800-848-6486

DOCUMENT NO. ERAU_Report_GAMI_001 Proprietary and Confidential REV: A

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6. The inlet strainer was clean with some signs of normal amounts of varnish.
7. The accelerator pump strainer had normal amounts of light deposits.
8. The polymer float was in good condition with no signs of leaks (see photo 3).

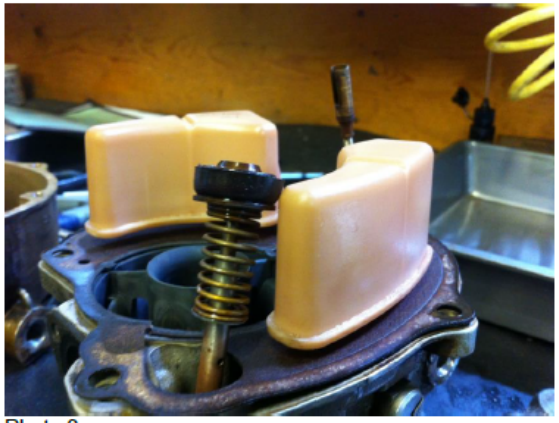


Photo 3

9. The accelerator pump packing appeared normal for a high time packing (see photo 3).
10. The float was working smoothly.
11. The mixture control shaft O-rings were still pliable.
12. The float needle was in good condition with a pliable needle tip.
13. The parting gasket was undamaged and still pliable (see photo 4).

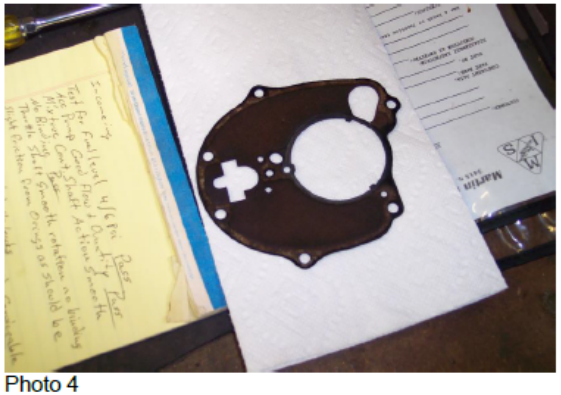


Photo 4

Left - Ex. C-3.

Further excerpt from the carburetor tear down / inspection report after the nine month long ~ 180 flight hour "real world" "Functionality & Reliability" testing of G100UL Avgas conducted by ERAU.

Note: These tests provided data to demonstrate the continued suitability of a wide variety of fuel-wetted aircraft and engine components for use of G1000UL Avgas, after extended functionality and reliability testing conducted by an independent set of ERAU pilots, mechanics, and engineers.

Below - Ex. C-4.

Further excerpt from the nine month long ~ 180 hour carburetor tear down / inspection report.

16. The throttle shaft O-rings were worn but pliable with flattened inside surfaces (normal). The O-ring thicknesses were measured and compared to new O-rings.
Old O-rings: 0.058 inch thick outboard, 0.056 / 0.057 inch thick inboard
New O-rings: 0.064 / 0.065 thick
Photo 6 shows new O-rings next to the old ones.

Photo 6

Ex. C-5. Two Aircraft Used for Extensive Functionality and Reliability Testing of G100UL Avgas.

Right: C-172 used by ERAU for its extended engine and material compatibility testing of G100UL Avgas.

Almost all of that testing was done at the ERAU campus in Daytona Beech. However, after the conclusion of that testing, ERAU brought the aircraft to GAMI in Oklahoma where it was used for an FAA supervised "hot day" – "hot fuel" fuel vaporization/vapor lock climb test.

All of the other testing by ERAU was done at their campus in Daytona Beech, Florida.

There were no reports from Embry Riddle of any fuel leaks nor any report of any paint staining or paint damage.

Note: ERAU later evaluated one of the PAFI fuel candidates that ended up being rejected because it would strip paint from a refueling spil event - - and do so in a matter of minutes, even with aggressive and prompt efforts to clean up the spill.

On the left hand side of the photograph is a TNSR22 Cirrus which had earlier been successfully used for FAA supervised & witnessed hot day – hot fuel vaporization / vapor lock climb test to 25,000 feet (September 5, 2012.) This Cirrus first started using G100UL Avgas on Jauary 27, 2010. It has had G100UL Avgas in the fuel tanks for most of the past 15 years, and all of the past two years.

There have been no leaks or seepage of G100UL Avgas from this aircraft during its 15 years of G100UL avgas use, except for a 19 year old sump drain which began to seep from the O-ring in January 2025. The O-ring was replaced and there has been further seepage of any kind.

Ex. C-6. Sign-off sheet from the FAA approved final ERAU report which documents ERAU's nine month long ~ 180 hour, FAA supervised, "functionality and reliability testing" of a Cessna 172 aircraft and its high time Lycoming engine using G100UL Avgas.

EMBRY-RIDDLE AERONAUTICAL UNIVERSITY

GAMI G100UL Fuel Flight Test Report

DOCUMENT NO:	ERAU_Report_GAMI_001_Rev_A	FAA PROJECT NO:	ST13515AT-E / ST00001FO-A-1),
CURRENT REVISION:	A 2/16/2015	INITIAL DATE:	8/15/2014
		MODEL:	172N
		ATA NO:	N/A

CERTIFICATION DATA TOP ASSEMBLY NO (if applicable): _____

Flight Test Report of GAMI G100UL Fuel in Cessna Aircraft Company 172 Series Aircraft

Proprietary and Confidential

DEPARTMENT: Embry-Riddle Aeronautical University Flight Research Center

PREPARED BY: Scott Martin

TECHNICAL APPROVAL: Thomas C. Horne

PREPARED BY: Thomas C. Horne

Appendix D1-D5: **Full scale Infrastructure / Fuel Delivery Systems Material Compatibility.**

Significant Finding: **Typical FBO Fuel Tanks, Plumbing, Pumps & Hoses are Fully Compatible with G100UL Avgas. Filter integrity was verified by independent 3rd party laboratory testing by one of the three major filter manufacturers.**

This standard Airport FBO 10,000 gallon 100LL Avgas storage and fueling tank has been in service with G100UL Avgas since August of 2022.

Since then it has pumped thousands of gallons and the hoses, plumbing, seals, and filter have been exposed to G100UL avgas on a continuous basis.

There have been no service or maintenance issues of any kind. None.

Standard FBO Airport 10,000 gallon storage tank and associated pump and aircraft fueling hose.

Refueling Hose is manufactured by Continental Hose. It is a 10 year old hose which has been used to pump & transfer G100UL Avgas for more than two and a half years. .

Ex. D-1: Photos taken May of 2025. Standard Airport FBO storage and refueling system, currently used to store 7-8,000 gallons of G100UL Avgas. This tank was originally filled with aromatic components, then later used to produce finished G100UL Avgas, in September of 2022.

Ex.D-2: Photo at left taken in August of 2022. Transport truck in background is filling this tank with components to produce finished G100UL.

Facet
Filtration Group®

ENGINEERING LABORATORY REPORT

Subject: Gami 100UL service
Report No.: 24-01-4124
To: George Braly
Date: 1/26/24
Samples Received: 2 of FG-O-612-7, MR228927, Date: 10/22

Summary

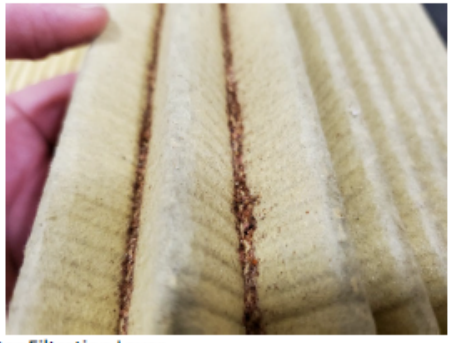
Elements show signs of solids loading primarily from iron oxides including large particulate and particulate sub 15um. Filter #2 shows significantly more and finer contaminant than the fist. Both elements show no signs of serious structural deterioration, the only apparent material compatibility issue is found in Filter #2 where seam adhesive has contracted and surface cracked, this did not penetrate into he seam and did not cause structural failure. From this inspection elements of this model and type as well as other element models or types designed for qualified aviation service should be acceptable for service in 100UL including microfilter and coalescer type elements.

RESULTS OF LABORATORY EXAMINATION

Transfer Pump Filter #1 - 21,367 gallons throughput Installation date 3/13/23, replaced 8/9/23.

Element received used in good condition with no sign of structural deformation. Epoxy powder coated components apper in good condition with no crazing or peeling. Orings are in good condition with no swell or cracking. Spacer gaskets on the bottom of the element have become detached but are not considered detrimental to the function of the element. Element was dissected for farther examination. Pleated first filtration layers show some large particulate captured in the depths of the pleats. Most particulate is iron oxides most likely from pipe scale. Finer internal filtration layers have captured smaller particulate mostly in the < 15um range, coloration of this contaminant is not consistent with iron oxide and could likely be silicas (dust). The wrapped section for water removal shows some discoloration from ultra fine particulate but otherwise does not apper to show issues. No material deformation or degradation is apparent.

End Cap


Outer Filtration Layer

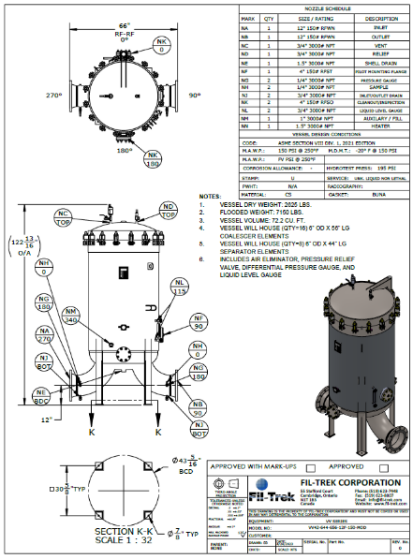
Ex.D-3 Report from Facet Filter Laboratory, documenting that G100UL Avgas is compatible with the large fuel tank filters that are used by FBOs.

There were two filters (older and more recent types) that were examined and evaluated.

One had ~21,000 gallons of throughput and the second had 52,000 gallons of G100UL Avgas throughput at the time of the Facet report.

At the time of this evaluation, these filters had been exposed to (soaking with) G100UL Avgas for two years, in addition to the fuel that was actively transferred through each of them.

Below. the metal housing for the filters.



New type "filter coalescer" - - passes latest Energy Institute test requirements when exposed to G100UL Avgas.

Facet Filtration Group
5935 S 129th E Ave Suite A
Tulsa, OK. 74134 U.S.A.
(918) 272-8700 Fax (918) 272-8787

energy INSTITUTE

	Parameter	US customary units	Qualified Vessel	Candidate Vessel	Pass/Fail	Notes
2	EI 1582 2nd edition Similarity Sheet Reference Number/ID Code:		EI-6-17799			
3	1581 Qualification Report Number:	API5-3-014	Prepared for:	VALIN - SERVICE IN G100UL		
5	**Vessel Manufacturer**		Facet	ISOMETRICS		
6	**Vessel Model Number**		HCS-C-756-248	526FS303		
7	**Vessel Serial Number**		FO-4180 +spacing	Unknown		
8	**EI 1581 Category (2.6)**		C	C	Pass	Category must be the same
9	**EI 1581 Type (2.6)**		S-LW	S-LW	Pass	Type must be the same or Qualified = S
10	**Number of Element Stages**	EA	2	2	Pass	Stages must be the same
11	**Vessel configuration**					
12	Orientation (2.2a)		Horizontal	Horizontal	Pass	Orientation must be the same
13	Vessel Inside Diameter	in	25.500	19.400		
14	**Element Layout (2.2b & 2.4)**		Side-by-side/ Engaged	Side-by-side/ Side-to-side	Pass	Layout must be the same
15	**Sump**					
16	Location (2.2c)		Horizontal vessel – bottom, centre	Horizontal vessel – bottom, centre	Pass	Location must be the same
17	Volume (2.2c)	in3	1701.5	265.0	*	* Pass, but requires water defense system per 1581 5th ed. 3.2.4.5
18	Inlet Connection Position (2.2d)		Horizontal – pipe entering lower side, opposite element area	Horizontal – pipe entering lower side, opposite element area	Pass	Inlets must be in the same location
19	Outlet Connection Position (2.2e)		Horizontal – pipe exiting upper side, opposite element area	Horizontal – pipe exiting upper side, opposite element area	Pass	Outlet must be in the same location
20	**Element mounting positions (2.2f)**		Horizontal – side-by-side, engaged with separators at the top	Horizontal – side-by-side, side-to-side with separators at the top	Pass	Location must be the same
21	**Water Defense System Present?**			Unknown		
22	**Rated flow of vessel (2.5)**	usgpm	1317	373	Pass	Candidate must be < or = to Qualified or when qualified is at max (9464 liters, 2500 USG) candidate must be <= 2 times qualified
23	**1st Stage (filter/coalescer element)**					
24	Model Number (2.6)		CAA56-5SB	CAA38-5SB	Pass	Model/Series/Family = Qualified
25	Quantity	EA	7	3		
26	Number of Elements/Cartridges in Stack	EA	1	1		
27	Element/Cartridge Overall Length	in	56.000	38.000		
28	Element/Cartridge Effective Media Length	in	53.320	35.320		
29	Outside Diameter	in	6.000	6.000		
30	Number of filter/coalescer plugs and their part number	EA	0	0		Part Number: 698428 for Facet vessels. Part Number: 698428-375 for Velcon vessels.
31	Spacing					
32	Between 1st Stage Elements (2.3a)	in	0.250	1.100	Pass	Candidate must be > or = to Qualified
33	Between 1st & 2nd Stage Elements (2.3c)	in	0.250	0.500	Pass	Candidate must be > or = to Qualified
34	Between 1st Stage Elements & Vessel (2.3d)	in	0.250	0.500	Pass	Candidate must be > or = to Qualified
35	Mean Linear Flowrate (2.7)	usgpm/in	**3.528**	**3.520**	Pass	Candidate must be < or = to Qualified
36	Volume	in3	**11083.5**	**3223.3**		
37	**2nd Stage (separator element)**					
38	Model Number (2.6)		SS648FF-5	SS633H-5V	Pass	Model/Series/Family = Qualified
39	Quantity	EA	2	1		
40	Number of Elements/Cartridges in Stack	EA	1	1		
41	Element/Cartridge Overall Length	in	48.000	33.250		
42	Element/Cartridge Effective Media Length	in	46.750	32.250		
43	Outside Diameter	in	6.000	6.000		
44	Number of separator plugs and their part number	EA	0	0		Part Number: 698428 for Facet vessels. Part Number: 698428-375 for Velcon vessels.
46	Spacing					
46	Between 2nd Stage Elements (2.3b)	in	2.000	N/A	Pass	Candidate must be > or = to Qualified
47	Between 2nd Stage Elements & Vessel (2.3d)	in	0.250	0.500	Pass	Candidate must be > or = to Qualified
48	Length/Outside Diameter (L/D) Ratio (2.6)		**8.00**	**5.54**	Pass	Candidate must be < or = to Qualified
49	Liquid Entrance Velocity (2.8)	ft/s	**0.240**	**0.197**	Pass	Candidate must be < or = to Qualified
50	Volume	in3	**2714.3**	**940.1**		Volume of all 2nd Stage Elements
51	**3rd Stage (filter monitor elements in separators)**					
52	Model Number					
53	Quantity	EA				
54	Quantity per 2nd Stage Separator	EA				
55	**Vessel**					
56	Length of Vessel	in	58.375	45.000		Deck plate to lid opening
57	Vessel Volume	in3	**29812.4**	**13301.7**		Volume inside of the vessel
58	Vessel Void Volume	in3	**16014.5**	**9138.3**		Empty space not occupied by elements
59	Positive water drainage (2.10)			**Yes**	Pass	Candidate must have positive water drainage
60	**Area Ratio**					
61	Void Volume Ratio (2.9)		**0.537**	**0.687**	Pass	Candidate must be > or = to Qualified
62	åSAe/Acv (2.9a) Side-by-side		**17.227**	**8.813**	Pass	Candidate must be < or = to Qualified
63	åAe/Acv (All elements to vessel) (2.9b) End opposed		**N/A**	**N/A**		Candidate must be < or = to Qualified

For the candidate system to meet EI 1581 by similarity, each entry is required to produce a pass in the pass/fail column.
Data are not required in any cells shaded grey.

The passes above confirm that the candidate vessel meets all requirements of EI 1582 2nd edition, and therefore is qualified to EI 1581 6th edition.

Name: Andrew Thompson
Signed: Andrew Thompson
Company: Facet - Tulsa, OK
Date: 4/2/2024

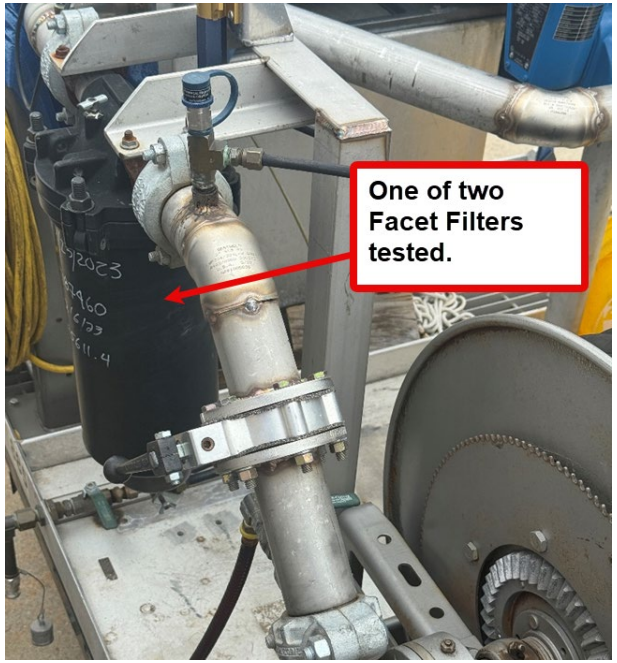
Ex.D-4 Additional Report from Facet Filter Laboratory, documenting that G100UL Avgas is fully compatible with the newer type "filter coalescer", showing compliance to the most recent test matrix specified by the Energy Institute (E.I.)

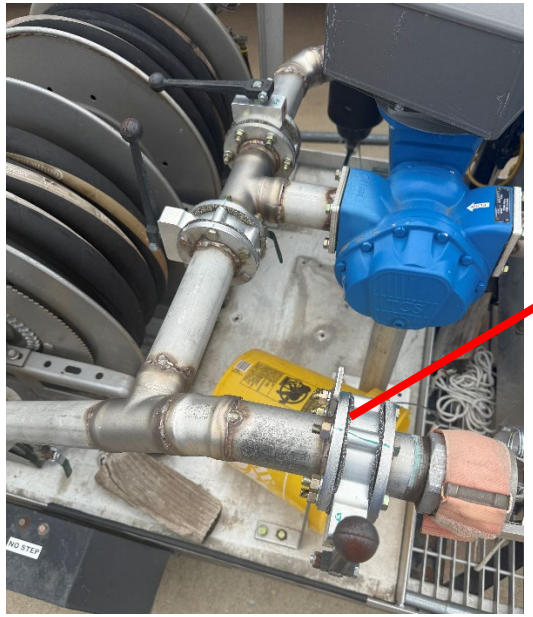
Ex.D-5 Fuel transfer unit. G100UL Avgas Field Evaluation.

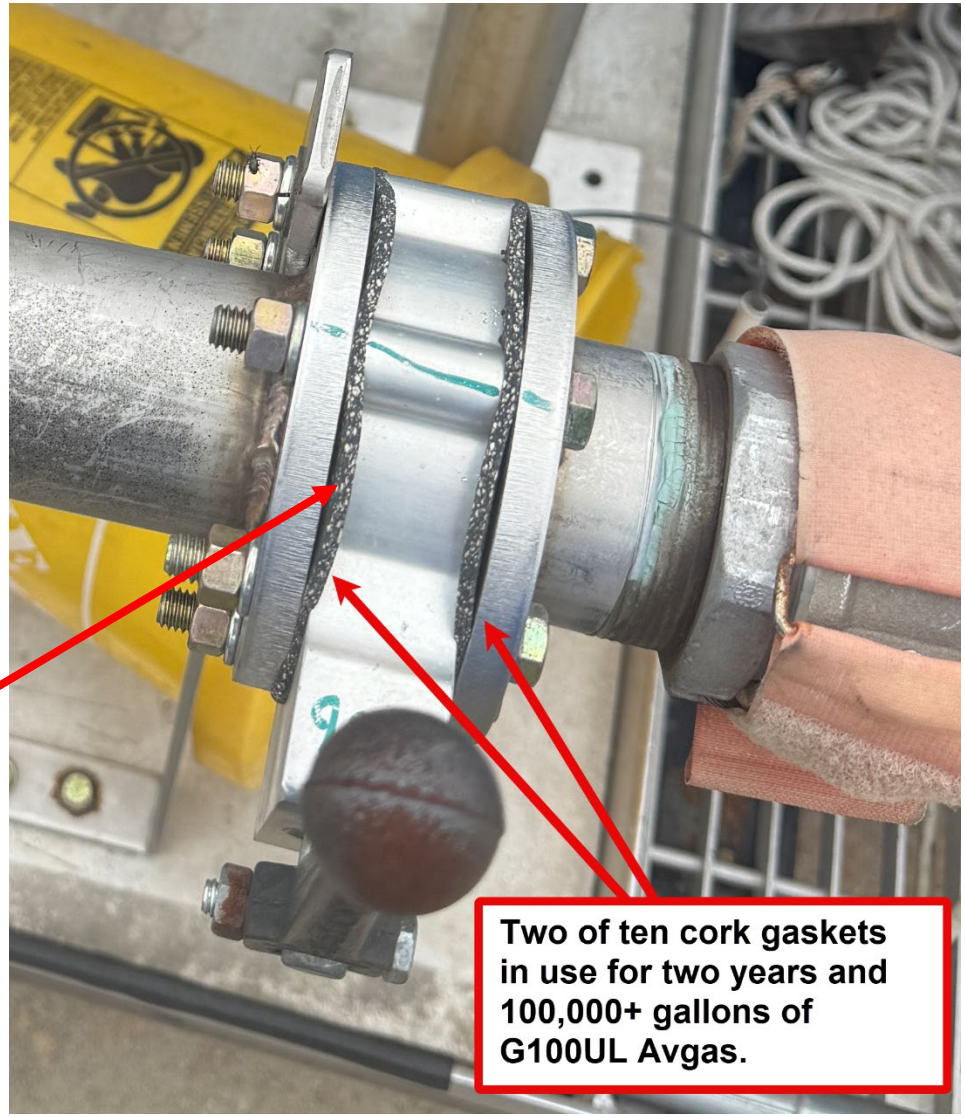
This unit had been used to transver approximately 100,000 gallons of 100LL before it was acquired by GAMI. Thereafter it has been used to transfer an additional ~120,000 gallons of G100UL Avgas. Initially, it had Buna gaskets. There were 10 of those. One was leaking from the beginning. We replaced all ten with new cork gaskets. They have been in place with fuel filling the lines and no leaks and not even any sign of deterioration for over two years and more than 100,000 gallons of G100UL Avgas flowing through each of those fittings.

Note: The wet spot is water from a tarp that was covering the motor.

Ex.D-6 Cork gaskets - - performing perfectly after two plus years of use and continuous exposure to G100UL Avgas.





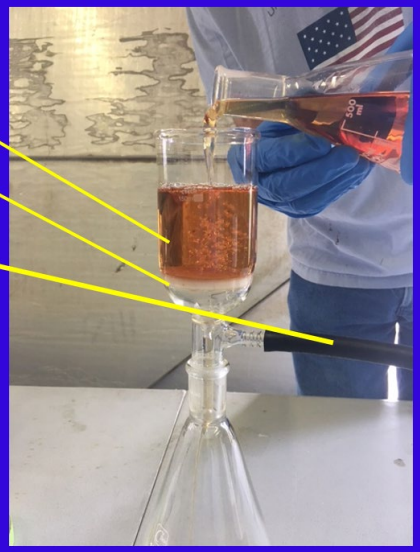


Appendix F: Long Term Storage Stability Testing (3 years):

Significant Finding: **Three year storage in Daytona Florida shows no gum formation or other contaminants or particles that can adversely affect an aircraft fuel system.**

Details: **5.4 liters (about 1.4 gallons) of very aged G100UL Avgas was filtered though a 10-15 micron glass filter which was weighed incrementally during the viltration.**
The weight of the filter did not measurably increase by more than 0.01 milligrams.
There was "no discernable trend line" of increasing accumulation of particulates with increasing volume of aged fuel.

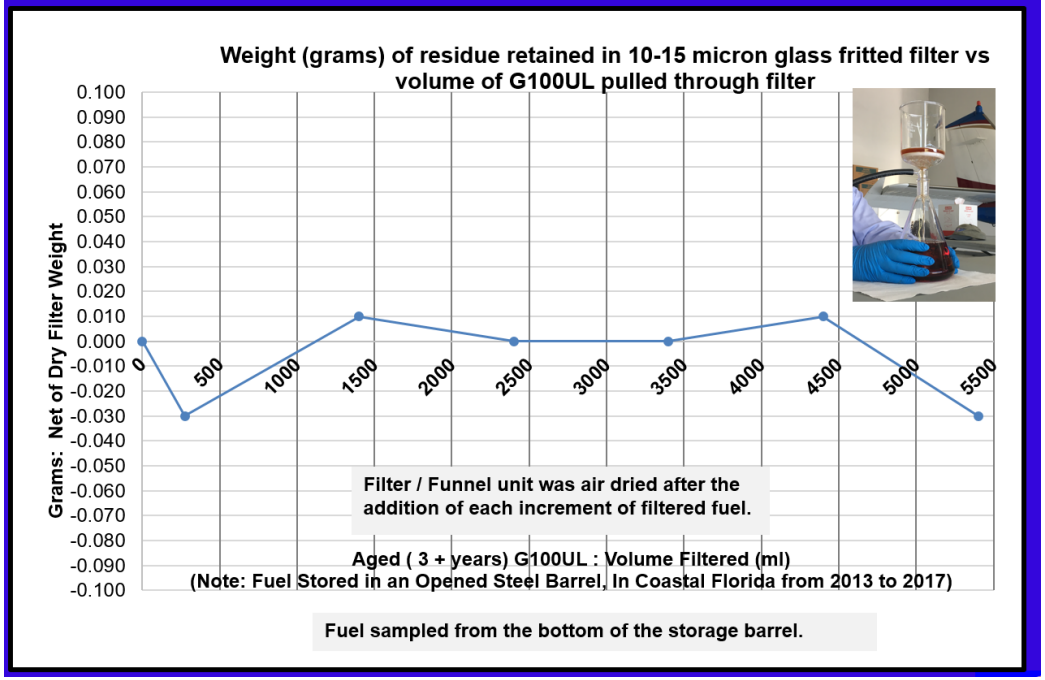
Ex. F-1. Evaluation of aged G100UL Avgas by micron filtration.



5.40 liters of "aged" G100UL pulled through the Buchner funnel with sealed-in glass fritted disc of 10-15 micron porosity).

Ex. F-2. Graph demonstrating that there was no particle accumulation in the stored fuel during the 3 year aging period.

Results of pulling 5.40 liters of "aged" G100UL through 10 – 15 micron filter.



Appendix G1-G2: **Additional (months long) Testing of Cirrus Fiberglass-Epoxy Carbon Fiber / Composite Fuel Tanks Sealed with PolythioEther Sealant With Additional Testing of PolySulfide (a.k.a. "Pro Seal") Sealant. Testing witnessed by both the FAA and by Cirrus.**

Significant Finding: **No Adhesion Failure of Any Kind for either type of fuel tank sealant when exposed to G100UL Avgas for extended periods of time (months and years).**

Ex. G1 Multiple sealants in Cirrus fiberglass / carbon fiber "wet wing" fuel tank, soaked in G100UL Avgas for months at elevated temperature. No adhesion failure. https://www.youtube.com/watch?v=LQabrbFc9K0

Ex. G2 Multiple sealants in Cirrus fiberglass / carbon fiber “wet wing” fuel tank, soaked in G100UL Avgas for months at elevated temperature. No adhesion failure.

Appendix H: **Twin Cessna Fuel Selector-Actuator Testing.**

Significant Finding: **Use of the correct size (-12 or -13) Nitrile (Buna-N) or FKM (Viton) "O-Rings" results in normal functioning of the Cessna Fuel Selector. Use of the wrong size O-Ring (-14) results in failure / breakage of the O-Rings in either 100LL or G100UL Avgas.**

Note: The country's largest Twin Cessna Repair Facility advised GAMI that the *correct* sized O-rings for use in these actuators are -12 or -13, not -14. They further advised that use of -14 sized O-rings in 100LL would always result in failure. Based on that information, extended testing was conducted using a salvage yard Twin Cessna fuel tank selector valve assembly. Some of the results are documented, below. Conclusion: Testing demonstrates that using the correct sized O-rings work normally and *as intended* in the Twin Cessna Fuel Selector valves – using either high aromatic (conforming) 100LL or G100UL avgas..