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Effect of Disinfectants on Aircraft Cabin Interior Materials

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Final report

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16. Abstract

Due to the coronavirus 2019 (COVID-19) public health emergency, the airline industry implemented meticulous and frequent interior disinfection procedures. This excessive use of disinfectants raised concerns on its potential negative impact on materials performance. This research focuses on evaluating the performance of aircraft cabin materials when conditioned with liquid chemical disinfectants in a controlled manner. In collaboration with the SAE Aircraft Seat Committee and SAE S-9 Cabin Safety Provisions Committee, the researchers identified five different types of materials commonly used in the aircraft cabin. Additionally, five liquid disinfectants commonly used at the time of this research were selected. All materials were evaluated for changes in flammability performance and physical properties such as weight, color, and texture. Change in mechanical properties were also evaluated for the selected materials.

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Finally, the authors would like to acknowledge contribution of members from the SAE Seat Committee and members from the SAE S-9 Cabin Safety Provisions Committee.

Contents

Figures

Tables

Acronyms

Acronym	**Definition**
ACES	Aviation Consulting and Engineering Solutions
ASTM	American Society for Testing and Materials
AVET	Advanced Virtual and Engineering Testing Laboratories
CFR	Code of Federal Regulations
CIE	International Commission on Illumination
CMH-17	Composite Materials Handbook-17
CV	Coefficient of Variation
DIC	Digital Image Correlation
FAA	Federal Aviation Administration
FAR	Federal Acquisition Regulation
IPA	Isopropyl Alcohol
LBF	Pound-Force
NIAR	National Institute for Aviation Research
PSI	Pounds per square inch
SAE	Society for Automotive Engineers

Executive summary

Due to the coronavirus 2019 (COVID-19) public health emergency, aircraft owners, and operators may find it necessary to increase the frequency with which they disinfect aircraft interiors and to include additional areas of the aircraft not previously disinfected. The excessive use of disinfectants raises concerns about its potential negative impact on material performance. Thus, there was a need to evaluate the effect of disinfectants on the mechanical, flammability, and physical properties of materials used in aircraft interiors. In the first phase of this research, the effect of liquid disinfectants was evaluated on materials commonly used in aircraft seats (Olivares, et al., 2021). This phase of the research focuses on evaluating the performance of materials used in the aircraft cabin when conditioned with liquid disinfectants in a controlled manner. Future work explores the impact of long-term exposure of UltraViolet-C (UV-C) irradiation on various aircraft cabin interior materials.

In conjunction with the SAE Aircraft Seat Committee (SAE aircraft SEAT committee, n.d.) and SAE S-9 Cabin Safety Provisions Committee (S-9 Cabin safety provisions committee, n.d.), the researchers identified five commonly used liquid disinfectants and five different types of materials used in aircraft cabin. All materials were evaluated for flammability performance, color, and weight changes. Additionally, the mechanical performance of selected materials was evaluated.

Materials selected for this research:

- Honeycomb Sandwich Panel (Nomex® core + fiberglass/phenolic resin facesheet)
- Decorative laminate (Aerform LHR, Aerfilm LHR, and Aerfusion fit)
- Carpet (Polyamide carpet and wool carpet)
- ULTEM™ (ULTEM™ 9075 and ULTEM™ 9085)
- Fiberglass laminate (Fiberglass G-10/FR4)

Liquid disinfectants selected for this research:

- 70% IPA,
- Calla 1452,
- Sani-Cide EX3,
- BactroKill+, and
- PREempt RTU

Two different conditioning methods were used in this research – submersion and wiping. The submersion method was used to condition specimens by fully immersing them in the liquid

disinfectant for extended time periods. This conditioning approach simulated accelerated cycle testing and was considered conservative. The wiping conditioning method simulated the real-world application of the liquid disinfectants in aircraft cabin interior and was achieved by wiping the test specimens by hand for 1000 cycles.

Mechanical performance of honeycomb sandwich panel, decorative laminate, ULTEM™ 9075, ULTEM™ 9085, and fiberglass laminate G-10/FR4 were evaluated by selecting appropriate test methods. For honeycomb sandwich panel, flatwise compression (ASTM C365), long beam flexure (ASTM D7249), and climbing drum peel (ASTM D1781) tests were conducted. For decorative laminate Aerform LHR, ULTEM™ 9075, and ULTEM™ 9085, uniaxial tension (ASTM D638) tests were conducted. For fiberglass G-10/FR4, uniaxial tension (ASTM D3039) and short-beam shear (ASTM D2344) tests were conducted.

Statistical evaluation following the methods in the Composite Materials Handbook-17 (CMH-17) was performed to determine the equivalency of mechanical properties of conditioned specimens to the properties of unconditioned specimens. Based on limited test data, all specimens treated with selected liquid disinfectants were equivalent to the unconditioned specimens with modified coefficient of variation (CV) method as presented in Table 1.

Table 1. Mechanical properties results summary

Material Name	Properties	Disinfectant Type				
		70% IPA	Calla 1452	Sani-Cide EX3	BactroKill+	PREempt RTU
Honeycomb Sandwich Panel	Ultimate Compressive Strength					
	Maximum Flexural Load					
	Average Peel Torque					
Aerform LHR	Tensile Strength					
	Yield Stress					
ULTEM™ 9075	Tensile Strength					
	Yield Stress					
ULTEM™ 9085	Tensile Strength					
	Yield Stress					
Fiberglass G-10/FR4	Longitudinal Modulus					
	Tensile Strength					
	Short-Beam Strength					

Material properties “equivalent” to unconditioned specimens

Flammability performance was evaluated by performing Vertical Bunsen Burner Tests with a 60-second flame exposure were conducted per 14 CFR Appendix F to Part 25(Part I - Test Criteria and Procedures for Showing Compliance With § 25.853 or § 25.855, 2022) to evaluate the effect of using liquid disinfectants on the flammability properties of the materials. It should be noted that not all the materials selected for this research would be required to meet the 60-second test. However, the purpose of these tests was to compare the flammability performance of the material when conditioned with liquid disinfectants against unconditioned specimens, using a test method that would be likely to expose any differences. Some of the required test methods, being less severe than the 60-second test, might not reveal differences due to the disinfection methods. The flammability performance criterion was defined as below:

- Flammability results for cabin interior materials were considered not significantly different if the increase in average burn length of the conditioned specimens was less than or equal to approximately 50% of the average burn length obtained from the unconditioned specimens test data. These results were referred to as "normally equivalent."

- Flammability results for cabin interior materials were considered significantly different if the increase in average burn length of conditioned specimens was greater than approximately 50% of the average burn length obtained from the unconditioned specimens test data.

All materials had flammability results that were normally equivalent to the untreated materials, as summarized in Table 2.

Table 2. Flammability results summary

Material Type	Material Name	Liquid Disinfectant Type				
		70% IPA	Calla 1452	Sani-Cide EX3	BactroKill +	PREempt RTU
Sandwich Panel	Honeycomb+Facesheet					
Decorative Laminate	Aerform LHR					
	Aerfilm LHR					
	Aerfusion Fit					
Carpet	Polyamide Carpet					
	Wool Carpet					
ULTEM	ULTEM™ 9075					
	ULTEM™ 9085					
Fiberglass Laminate	Fiberglass G-10/FR4					

Increase in average burn length is less than or equal to approximately 50 % of the average burn length obtained from the unconditioned specimens test data.

In this research, only qualitative comparisons of color appearance and surface texture were performed. The comparison showed no significant change in color appearance for conditioned specimens. Change in texture was observed for test specimens that were conditioned with Sani-Cide EX3. This disinfectant type left a tacky residual finish on the surface.

1 Introduction

In December 2019, an outbreak of a new type of coronavirus was identified in the province of Hubei, China. Since that time, the outbreak has reached most countries worldwide (Panait, 2020). During air travel, the main source of infection for travelers is proximity to an infected person due to the droplet-propagated infections. Once an infected person has left the scene, most of the risk from droplet exposure would have been reduced. Nevertheless, the scientific evidence (Kampf, 2020; van Doremalen, et al., 2020) showed that the SARS-CoV-2 aerosol and fomite transmission is plausible, since the virus can remain viable and infectious in aerosols for hours and on surfaces for up to days depending on the type of surface and the environmental conditions. In this context, the possibility that the virus can remain in the aircraft environment by contaminating common surfaces after the infected passenger has departed requires action to prevent further dissemination (Panait, 2020).

This resulted in the airline industry implementing meticulous and frequent interior disinfection procedures to allow the passengers confidence that they would not contract the virus while in an aircraft. However, the requirement for excessive use of disinfectants raised concerns about its potential negative impacts on materials performance, thus leading to this research. Without the existence of proper guidance on methodologies to identify the potential impact of disinfectants on aircraft interiors, it became an urgent issue to determine what materials to test, what disinfectants to consider, how to prepare the test articles, and finally, how to perform the test. Using engineering judgement and airline background information assumptions, the collaborative research team rapidly put together a methodology.

1.1 Overview

This research aimed to identify and evaluate the effects of liquid disinfectants on the mechanical and flammability properties of aircraft interior materials. The first phase of the research focused on the materials used in aircraft seats (Olivares, et al., 2021). This investigation focuses on the materials used in aircraft cabin interior which were selected in conjunction with the SAE S-9 Cabin Safety Provisions Committee (S-9 Cabin safety provisions committee, n.d.). Different material types used in this investigation include honeycomb sandwich panel, decorative laminate, floor carpet, ULTEM^{TM} 9075, ULTEM^{TM} 9085, and fiberglass reinforced epoxy laminate, as presented in Figure 1. Test materials conditioned with liquid disinfectants were evaluated to quantify mechanical properties, resistance to flame using vertical burner tests, change in weight, and qualitative measurement of color change. The materials' performance was then compared and analyzed against unconditioned control specimens.

The results of this work may be used by the SAE Committee, other standards organizations, design approval holders, operators, or regulators to create guidelines on the use of disinfectants and application procedures that would minimize the impact on the mechanical and flammability characteristics of aircraft interior components.

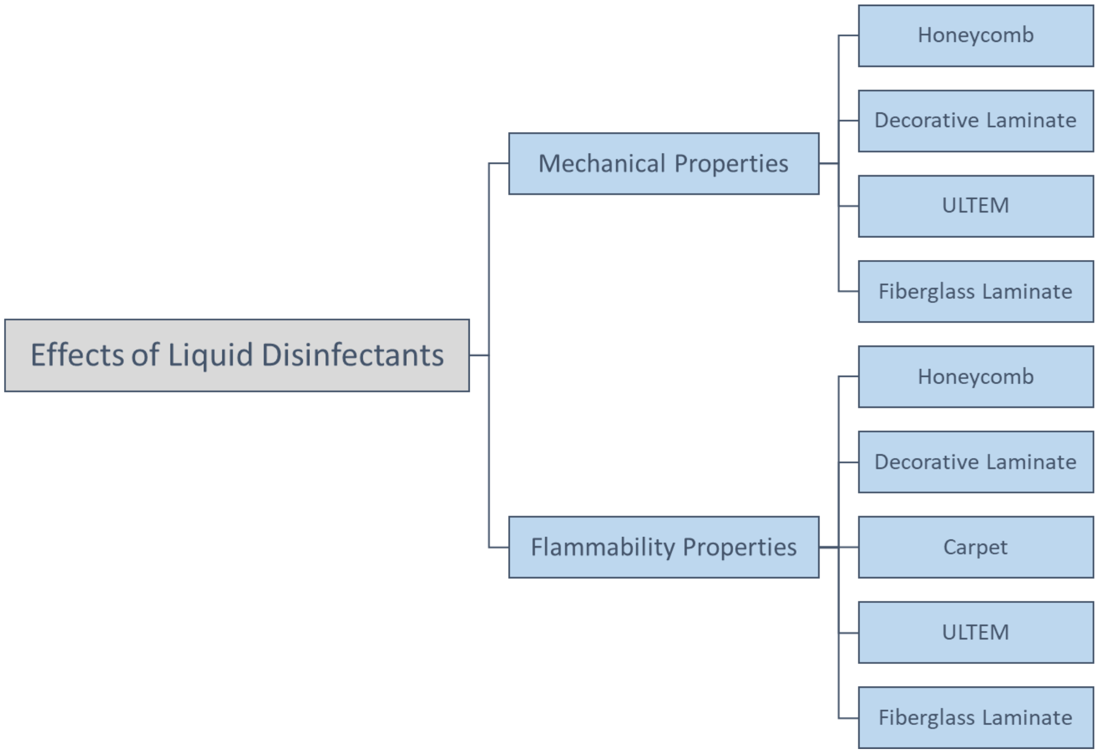


Figure 1. Flowchart outlining project overview

1.2 Selection of materials to test

For this phase of the study, cabin materials were selected based on their utilization in cabin products and their possible exposure to disinfectants. The following types of interior applications were considered:

1. Honeycomb Sandwich Panels (Nomex® core + fiberglass/Phenolic Resin) – Floor, ceilings, kitchen walls, cabinets
2. Decorative laminate – Cabinet walls, Partitions, Bulkheads
3. Carpet – Floors
4. ULTEM™ – Sidewalls, galleys, stowage bins

5. Fiberglass/Epoxy Laminate – Honeycomb sandwich panels used in aircraft interior can be manufactured with fiberglass/epoxy resin facesheets.

1.3 Selection of disinfectants to test

The first phase of this research on the effects of disinfectants on occupant seats already identified common disinfecting materials. The same disinfectants were used in this study. They are:

- No treatment – As a control test
- 70% Isopropyl Alcohol (IPA)
- Calla 1452
- Sani-Cide EX3
- BactroKill+
- PREempt RTU

1.4 Performing the testing

The concerns of the effects of disinfectants on cabin interior materials were determined to be:

- Structural integrity
- Flammability
- Aesthetics

It is understood that the most significant immediate concerns are the evaluations of structural integrity and flammability, as their effect could have a near term impact on the continued airworthiness of the seating certification. Aesthetic concerns are a by-product of the testing, and while not a concern for continued airworthiness, they aid in selecting a disinfectant based on long term replacement costs.

2 Material information

As discussed in Section 1.2, five different types of cabin applications were selected in conjunction with the SAE S-9 Cabin Safety Provisions Committee (S-9 Cabin safety provisions committee, n.d.). One or more materials were evaluated for each application. These materials included Nomex® honeycomb sandwich panels, three different types of decorative laminates, two different types of floor carpets, ULTEM™ 9075, ULTEM™ 9085, and fiberglass reinforced epoxy laminate, as shown in Figure 2. All the materials were conditioned with liquid disinfectants and evaluated for flammability properties and color changes. Besides floor carpet, the effect on mechanical properties was evaluated for the remaining material types.

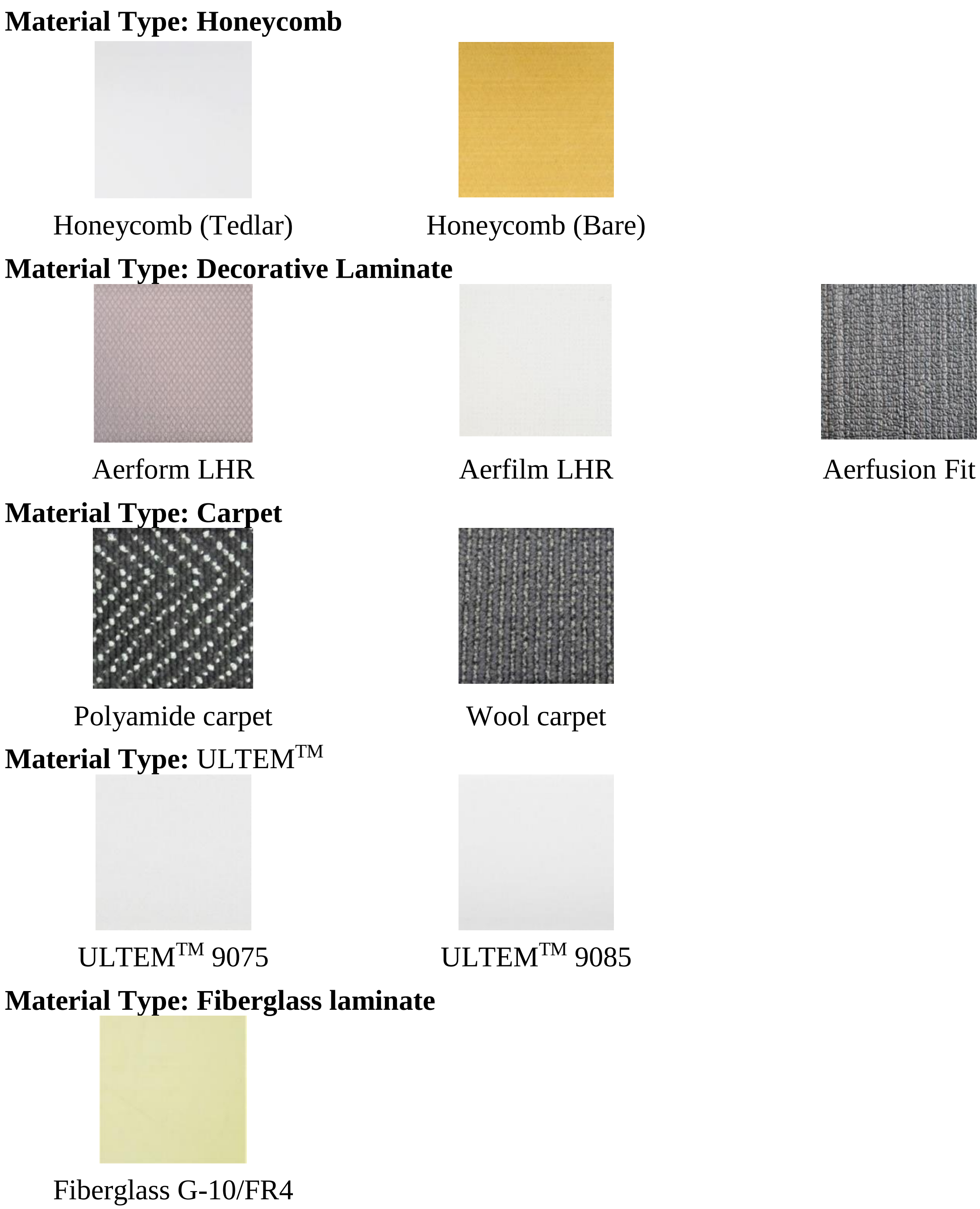


Figure 2. Materials used in this investigation

3 Disinfectants information

As discussed in Section 1.3, five liquid disinfectants typically used for disinfecting aircraft interiors were selected in conjunction with the SAE Seat Committee and based on the FAA operator survey. Table 3 shows the disinfectants used and their composition (Safety data sheet for isopropyl alcohol 70% in water, 2010/2018; Calla® 1452 neutral disinfectant concentrated cleaner, 2020; Safety data sheet for Sani-Cide EX3, 2017; Safety data sheet for BatroKill Plus®, 2017; Safety data sheet for PREempt RTU, 2015).

Table 3. Liquid disinfectants used in this investigation

Disinfectant	Composition		
	Active Ingredients	**Weight (%)**	**Inert Ingredients (%)**
70% IPA	Isopropyl alcohol	64.7	Water – 35.3
Calla 1452	Octyl decyl dimethyl ammonium chloride	0.814	97.287
	Dioctyl dimethyl ammonium chloride	0.407	
	Didecyl dimethyl ammonium chloride	0.407	
	Alkyl (50% C_{14}, 40% C_{12}, 10% C_{16}) dimethyl benzyl ammonium chloride	1.085	
Sani-Cide EX3	L-Lactic Acid	0.4	99.6
Bactrokill+	Chlorine Dioxide	0.2	Water - 99.59 Other ingredients – 0.04
	n-Alkyl Dimethyl benzyl ammonium chloride	0.085	
	n-Alkyl Ethylbenzyl ammonium chloride	0.085	
PREempt RTU	Hydrogen peroxide	0.5	99.5

4 Specimen conditioning

Test materials were conditioned with chemical liquid disinfectants using two different methods, submersion and wiping. The submersion method was considered conservative and was an accelerated way of conditioning the test specimens. Flammability properties of unreinforced plastics conditioned using submersion method in Phase-I (Olivares, et al., 2021), were equivalent to the unconditioned specimens. Based on these results, plastics investigated in the current phase were also conditioned using submersion method. All other material types were conditioned using wiping method. Details for both the conditioning method are explained in consecutive sections.

4.1 Submersion method

In this conditioning method, test materials were conditioned by submerging them in liquid disinfectants for extended time periods and allowed to try before conducting any tests. Specimens extracted from both the ULTEM™ types were submerged in liquid disinfectants for one week. After submersion, specimens were dried for 24 hours at room temperature and relative ambient humidity. This was followed by conditioning the specimens for a further 24 hours, as per 14 CFRAppendix F of Part 25 (Part I - Test Criteria and Procedures for Showing Compliance With § 25.853 or § 25.855, 2022). Weight was measured for each specimen before submersion and after conditioning (Effect of liquid chemical disinfectants in cabin interior: Flammability evaluation of materials - test plan, 2021; Effect of disinfectants in aircraft interior: Strength characterization of plastics - R1, 2020; Effect of disinfectants in aircraft interior: Strength characterization of seat belt webbings - IR, 2020). Figure 3 and Figure 4 show strength specimens and vertical flammability specimens submerged in liquid disinfectant.

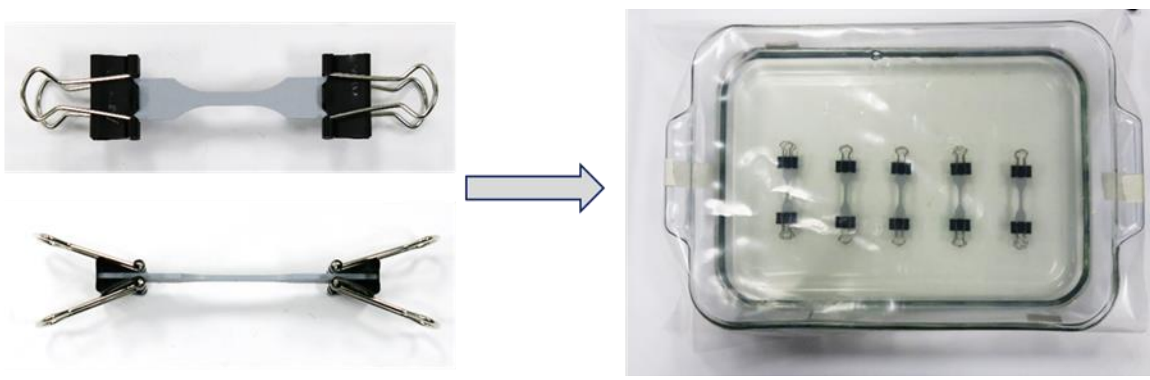


Figure 3. Specimen conditioning using submersion method for strength characterization

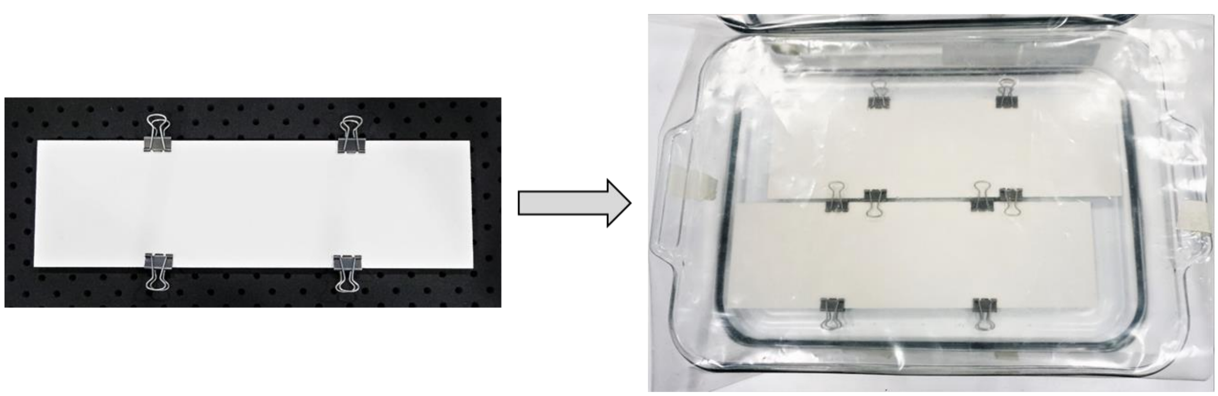


Figure 4. Specimen conditioning using submersion method for flammability testing

4.2 Wiping method

The objective of the wiping conditioning method was to simulate the real-world application of the liquid disinfectants in aircraft interior. This was achieved by wiping the test specimens by hand for 1000 cycles. The test specimens were arranged on a flat surface and desk fans (without a heated element) were used to accelerate the drying of the specimens, as shown in Figure 5. Specimens were wiped with a microfiber cloth, soaked in the required liquid disinfectants. The wiping process was repeated for 1000 cycles and the microfiber cloths were re-soaked in the disinfectants periodically to ensure that the cloths were always damp. Each test specimen was weighed before and after conditioning.

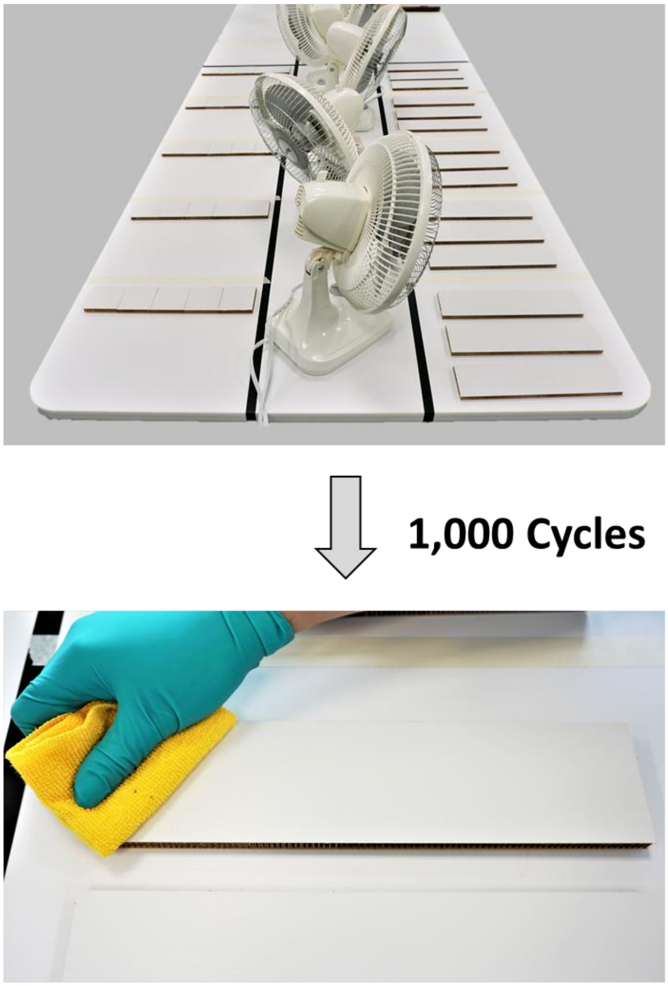


Figure 5. Specimen conditioning using wiping method

5 Mechanical properties

To understand the effects of liquid disinfectants on mechanical properties of the selected cabin interior materials, different loading conditions based on material type were selected. The details of the test methods and experimental observations are discussed in this section.

5.1 Honeycomb

For honeycomb sandwich panels, the characterization methods comprised of ASTM C365 flatwise compression (Standard test method for flatwise compressive properties of sandwich cores, 2016), ASTM D7249 long beam flexure (Standard test method for facesheet properties of sandwich constructions by long beam flexure, 2020), and ASTM D1781 climbing drum peel (Standard test method for climbing drum peel for adhesives, 1998).

5.1.1 Test Matrix

Five specimens were tested per test method per disinfectant type, as shown in Table 4.

Table 4. Test matrix for honeycomb strength characterization

Honeycomb Type	**Test Standard**	**Liquid Disinfectant Type**					
		Pristine	70% IPA	Calla 1452 /Matrix 3	Sani-Cide EX3	BactroKill +	PREempt RTU
Honeycomb Sandwich Panel	ASTM C365	x 5	x 5	x 5	x 5	x 5	x 5
	ASTM D7249	x 5	x 5	x 5	x 5	x 5	x 5
	ASTM D1781	x 5	x 5	x 5	x 5	x 5	x 5

5.1.2 Specimen dimension and nomenclature

Specimens were manufactured from large honeycomb sandwich panels in accordance with ASTM standards, as shown in Figure 6 to Figure 8. Nominal dimensions are summarized in Table 5 to Table 7. Dimensions were measured for all the specimens and summarized in appendix A.

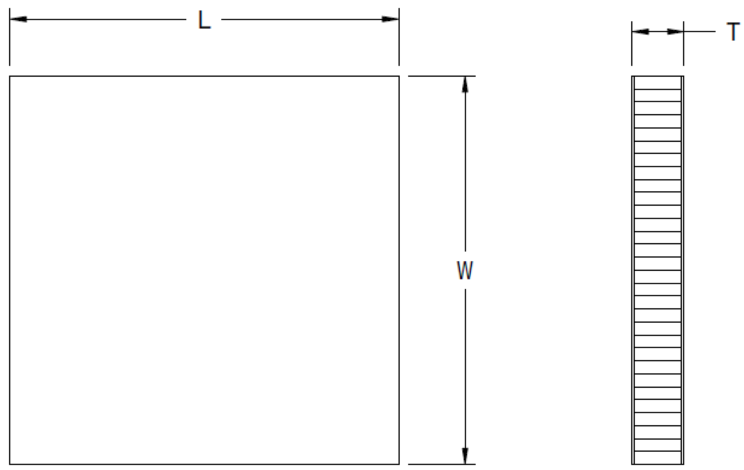


Figure 6. ASTM C365 flatwise compression specimen geometry

Table 5. ASTM C365 flatwise compression specimen nominal dimensions

Length overall [L], in	3.00
Width overall [W], in	3.00
Thickness [T], in	0.40

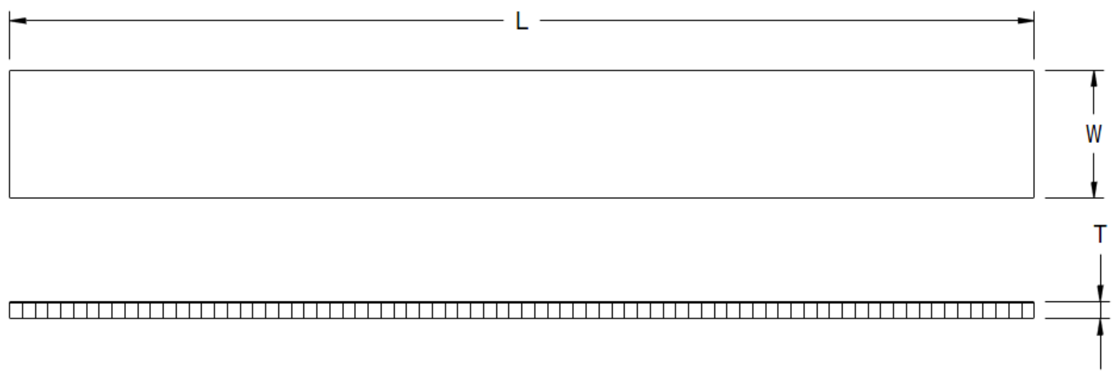


Figure 7. ASTM D7249 long beam flexure specimen geometry

Table 6. ASTM D7249 long beam flexure specimen nominal dimensions

Length overall [L], in	24.0
Width overall [W], in	3.00
Thickness [T], in	0.40

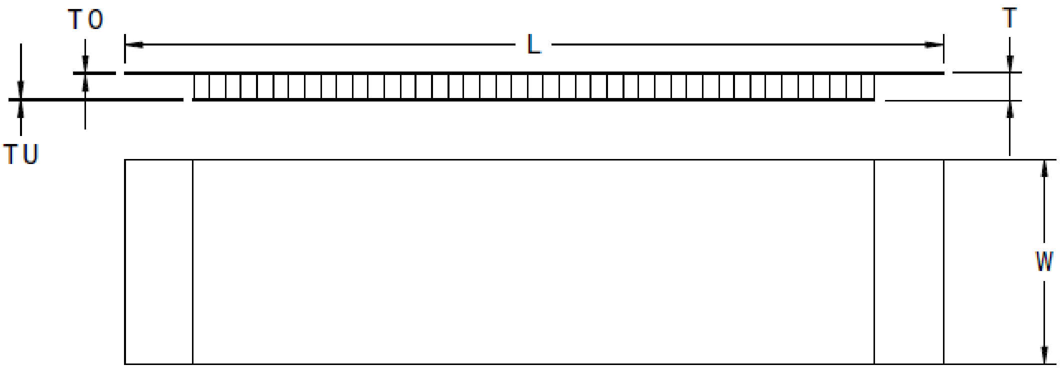


Figure 8. ASTM D1781 climbing drum peel specimen geometry

Table 7. ASTM D1781 climbing drum peel specimen nominal dimensions

Length overall [L], in	12.0
Width overall [W], in	3.00
Thickness overall [T], in	0.40
Overhang layer thickness [TO], in	0.02
Unpeel layer thickness [TU], in	0.02

To facilitate specimen identification and tracking, the following nomenclature was used [Client ID – Test Method ID – Honeycomb Type ID – Disinfectant ID – Specimen #]. Table 8 summarizes specimen identification nomenclature to be used.

Table 8. Specimen ID nomenclature for honeycomb strength characterization

Client ID	FAA	FAA
Test Method ID	ASTM C365 Flatwise compression	C
	ASTM D7249 Long beam flexure	F
	ASTM D1781 Climbing drum peel	P
Honeycomb Type	Honeycomb Sandwich Panel	H1
Liquid Chemical Disinfectant	Pristine (No Disinfectant)	D0
	70% IPA	D1
	Calla 1452 /Matrix 3	D2
	Sani-Cide EX3	D3
	BactroKill+	D4
	PREempt RTU	D5

5.1.3 Flatwise compression

5.1.3.1 Test setup

Flatwise compression tests were conducted at a nominal displacement rate of 0.02 in/min. The test apparatus used was an MTS Servo-Hydraulic test frame with a load capacity of 22,000 lbf. Non-contact strain measurement technique, digital image correlation (DIC), was employed to measure the relative displacement of the platens, as shown in the test setup in Figure 9. All tests were conducted at room temperature.

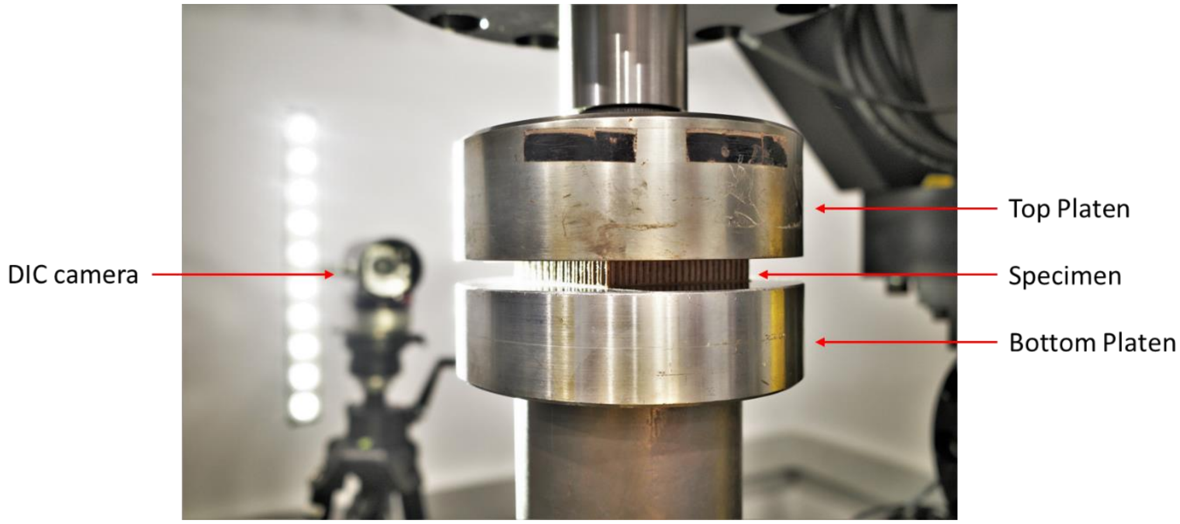


Figure 9. Honeycomb flatwise compression test setup

5.1.3.2 Test results

The stress-strain plots for all the configurations have been shown in Figure 10. For each configuration, five specimens were tested. Post-test pictures can be found in Appendix E. A comparison of the ultimate compressive strength obtained has been shown in Figure 11. There was no reduction in compressive strength when the specimens were conditioned with 70% IPA, Calla 1452, Sani-Cide EX3 and less than 5% reduction in compressive strength, when the specimens were conditioned with Bactrokill+ and PREempt RTU in comparison to pristine specimens.

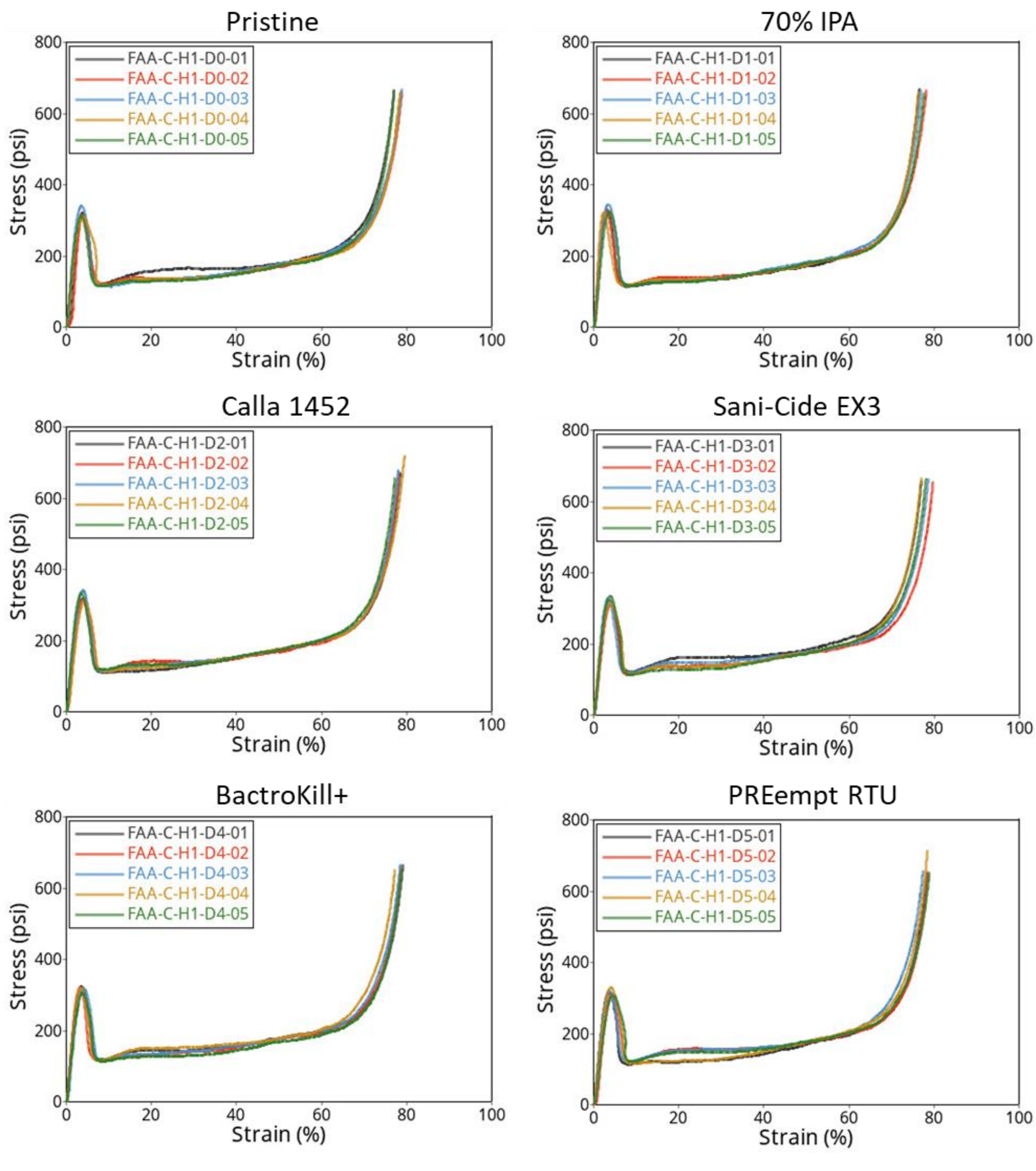


Figure 10. Stress-strain response – Honeycomb sandwich panel

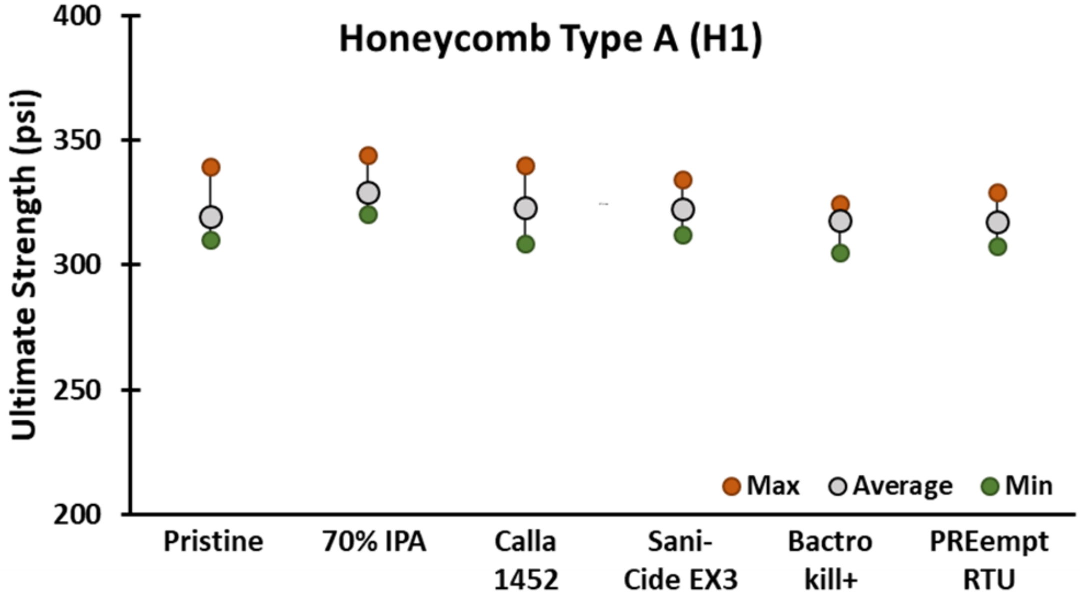


Figure 11. Ultimate strength comparison – Honeycomb sandwich panel

5.1.4 Long beam flexure

5.1.4.1 Test setup

Long beam flexure tests were conducted at a nominal displacement rate of 0.25 in/min. The test apparatus used was an MTS Servo-Hydraulic test frame with a load capacity of 22,000 lbf. The test setup is shown in Figure 12. All tests were conducted at room temperature until failure.

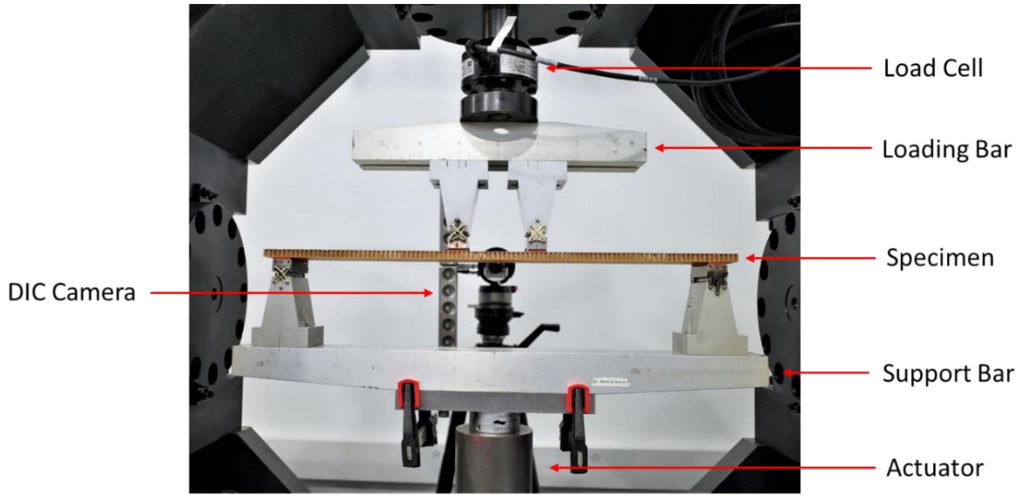


Figure 12. Honeycomb long beam flexure test setup

5.1.4.2 Test results

Specimens were tested until failure following the test matrix in Table 4. Load-displacement plots and comparison of maximum flexural load are shown in Figure 13 and Figure 14. Reduction in average flexural load was less than 5% for all the specimens conditioned with selected liquid disinfectants.

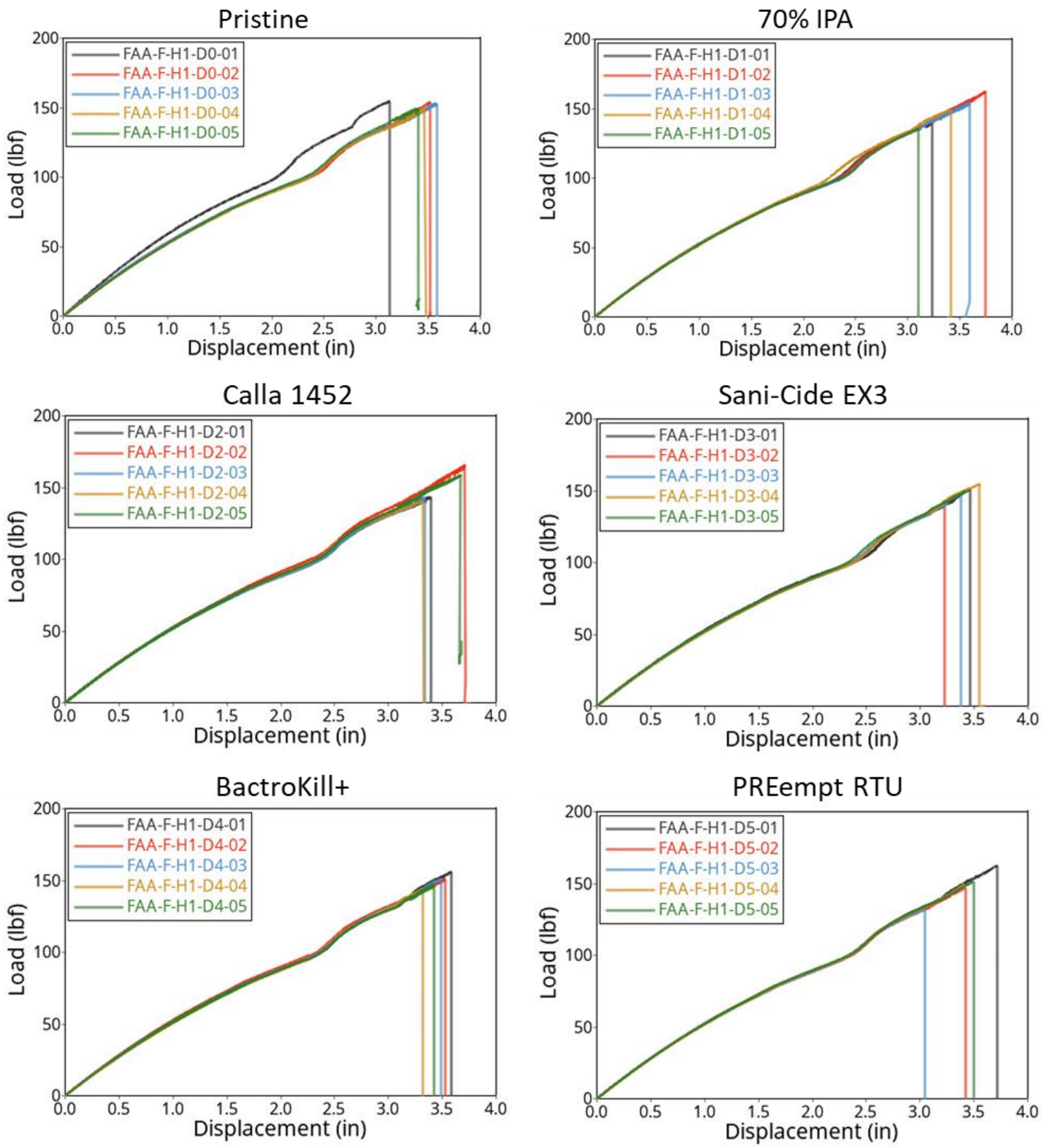


Figure 13. Load-displacement response – Honeycomb sandwich panel

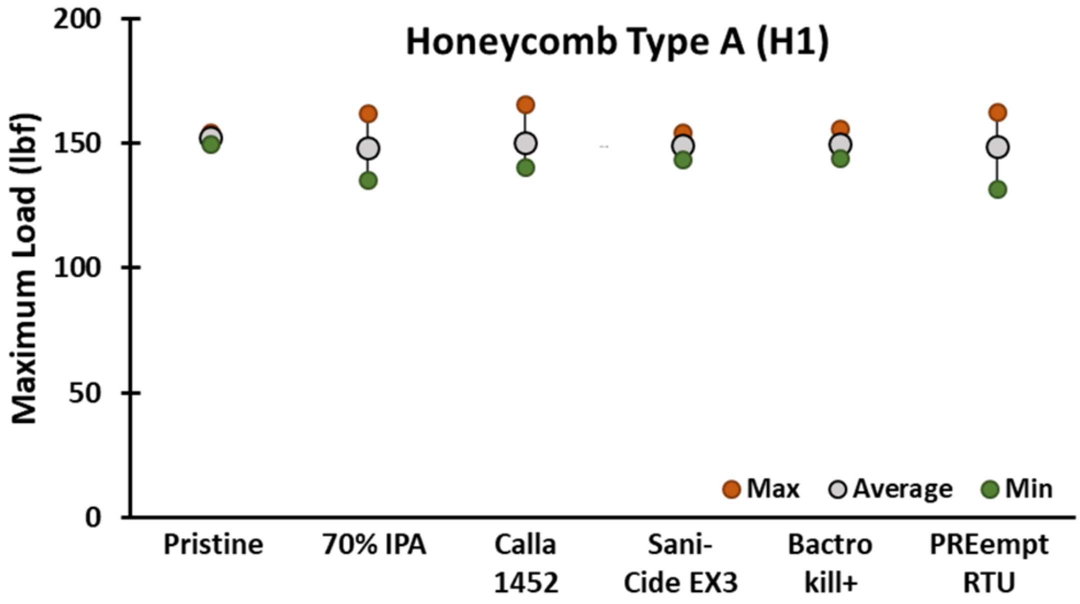


Figure 14. Maximum load comparison – Honeycomb sandwich panel

5.1.5 Climbing drum peel

5.1.5.1 Test setup

Climbing drum peel tests were conducted at a nominal displacement rate of 1 in/min. The test apparatus used was an MTS Servo-Hydraulic test frame with a load capacity of 110,000 lbf. Test fixture consists of top clamp and climbing drum as shown in Figure 15. The top clamp secures the specimen in place while the climbing drum peels the overhanging layer as the actuator moves. All tests were conducted at room temperature.

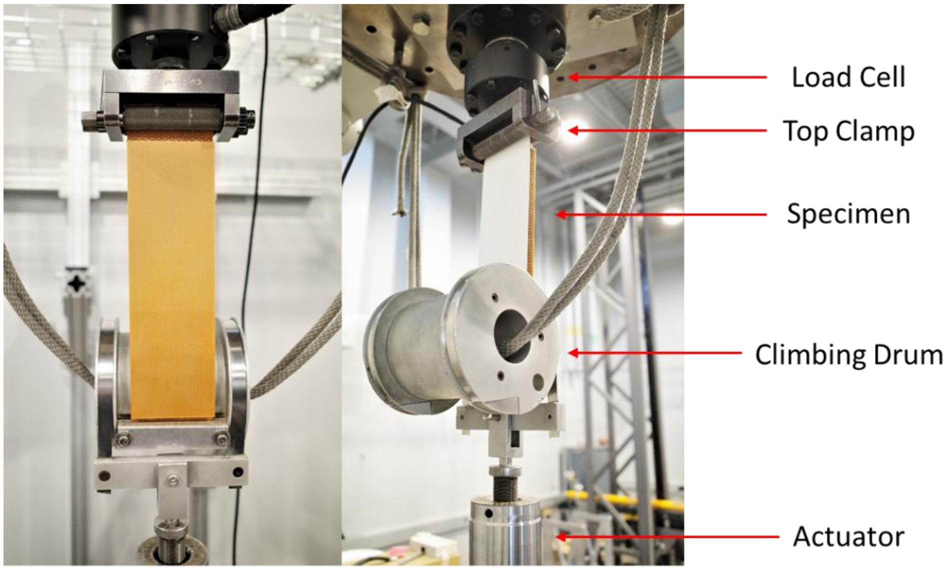
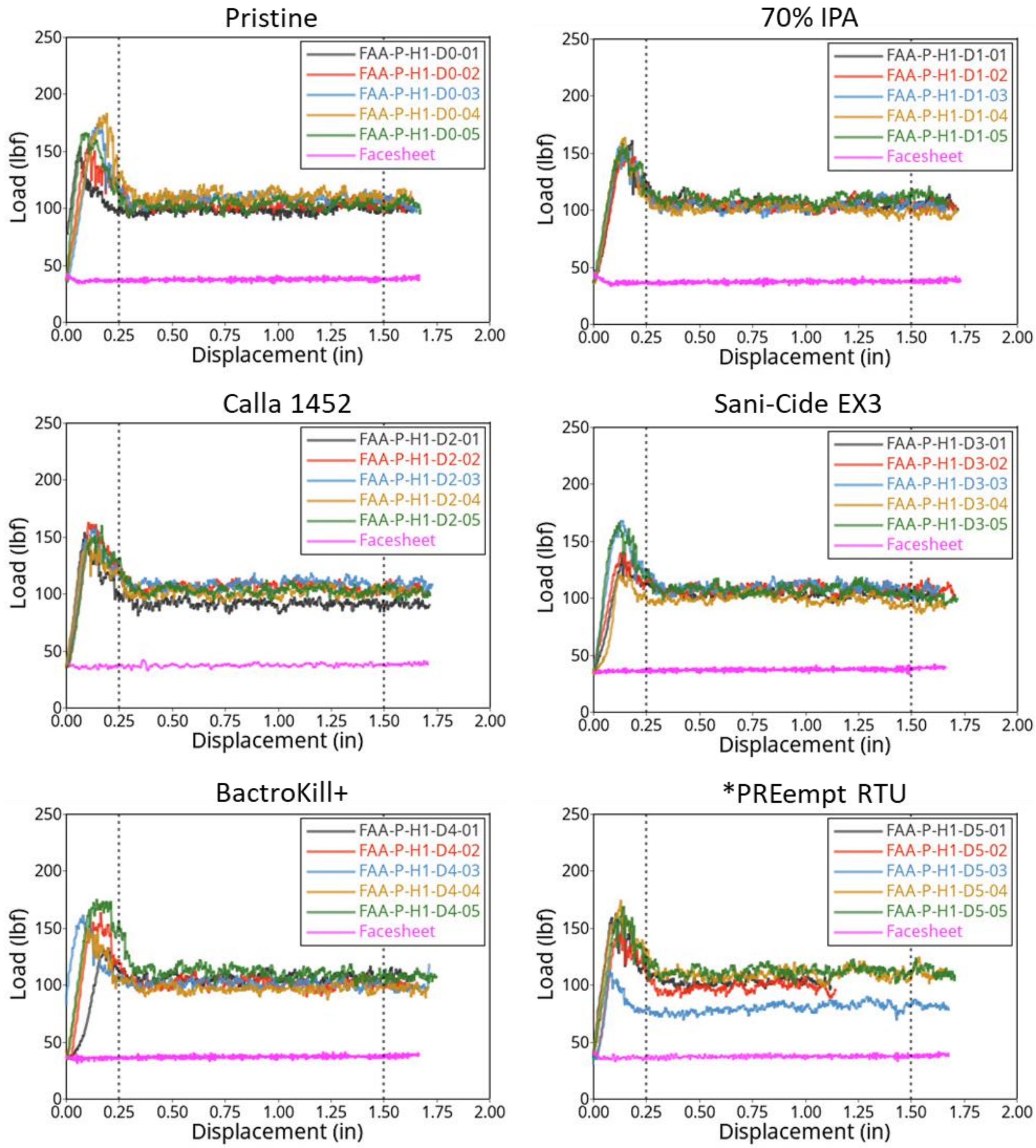


Figure 15. Honeycomb climbing drum peel test setup

5.1.5.2 Test results

Specimens were tested until failure following the test matrix in Table 4. Post-test failure pictures of all the climbing drum peel specimens can be found in appendix G. Load-displacement plots and comparison of average peel strength are shown in Figure 16 and Figure 17.

For honeycomb Sandwich Panel, no reduction in average peel strength was observed when the specimens were conditioned with 70% IPA, Sani-Cide EX3, BactroKill+ and PREempt RTU. Specimens conditioned with Calla 1452 resulted in less than a 5% reduction in average peel strength.



*Specimen FAA-P-H1-D5-03 is considered as an outlier.

Figure 16. Load-displacement response – Honeycomb sandwich panel

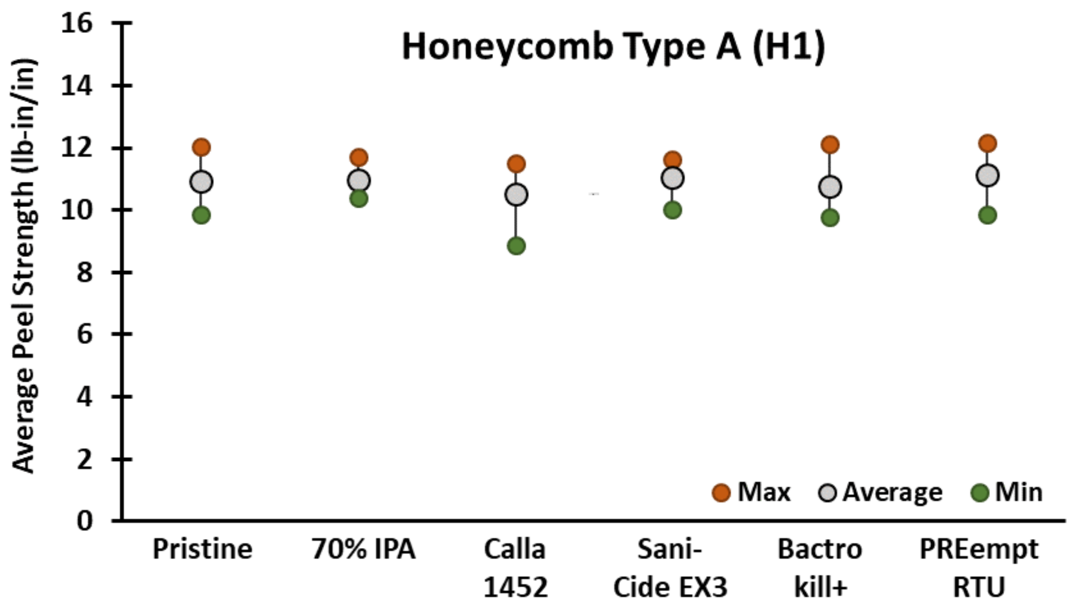


Figure 17. Average peel strength comparison – Honeycomb sandwich panel

5.1.6 Statistical data evaluation

To further investigate if the liquid disinfectants had any detrimental effect on the material properties of selected honeycomb material, statistical analysis following guidelines in CMH-17 (Polymer matrix composites: Guidelines for characterization of structural materials, 2012) was done. Due to the limited amount of material available, additional tests were not conducted for basis value calculation. Hence, the basis value estimates will not be reported.

For acceptance of the material properties from any batch, it must be shown that the properties obtained from the current batch are "equivalent" to the qualification batch; i.e., the batch data meets the material specification limits (Polymer matrix composites: Guidelines for characterization of structural materials, 2012). In the current research, material properties obtained from unconditioned honeycomb specimens are treated as the qualification batch. Equivalencies of the ultimate compressive strength, maximum flexural load and average peel strength of honeycomb Sandwich Panel conditioned with disinfectants are shown in Table 9 to Table 11.

For honeycomb Sandwich Panel, specimens treated with all the liquid disinfectants pass equivalency criteria for ultimate compressive strength, average peel strength, and maximum flexure load with a CV of 6%.

Table 9. Equivalency of ultimate compressive strength of Honeycomb sandwich panel

Compression Ultimate Strength (psi)	D1		D2		D3		D4		D5	
	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.
Data as measured	Insufficient Data		Insufficient Data		Insufficient Data		Insufficient Data		Insufficient Data	
Mean Compressive Strength (psi)	319.5	329.5	319.5	323.3	319.5	322.3	319.5	317.8	319.5	317.0
Standard Deviation	12.0	9.1	12.0	12.4	12.0	8.9	12.0	7.4	12.0	8.4
Coefficient of Variation %	3.8	2.8	3.8	3.8	3.8	2.7	3.8	2.3	3.8	2.7
Minimum	310.4	320.7	310.4	308.5	310.4	312.3	310.4	305.1	310.4	307.8
Maximum	339.8	344.4	339.8	339.9	339.8	334.5	339.8	324.6	339.8	329.5
Number of Specimens	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
RESULTS	**PASS**		**PASS**		**PASS**		**PASS**		**PASS**	
Minimum Acceptable Equiv. Sample Mean	309		309		309		309		309	
Minimum Acceptable Equiv. Sample Min	289		289		289		289		289	
MOD CV RESULTS	**PASS with MOD**		**PASS with MOD**		**PASS with MOD**		**PASS with MOD**		**PASS with MOD**	
Modified CV%	6.000		6.000		6.000		6.000		6.000	
Minimum Acceptable Equiv. Sample Mean	303		303		303		303		303	
Minimum Acceptable Equiv. Sample Min	271		271		271		271		271	

Table 10. Equivalency of maximum flexural load of Honeycomb sandwich panel

Maximum Load (lbf)	D1		D2		D3		D4		D5	
	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.
Data as measured	Insufficient Data		Insufficient Data		Insufficient Data		Insufficient Data		Insufficient Data	
Mean Maximum Load (lbf)	152.4	148.3	152.4	150.4	152.4	149.5	152.4	150.0	152.4	148.4
Standard Deviation	2.257	10.802	2.257	11.153	2.257	4.125	2.257	4.364	2.257	11.053
Coefficient of Variation %	1.481	7.284	1.481	7.416	1.481	2.759	1.481	2.909	1.481	7.446
Minimum	149.7	135.5	149.7	140.6	149.7	143.5	149.7	144.4	149.7	131.8
Maximum	154.7	162.2	154.7	165.9	154.7	154.4	154.7	156.1	154.7	162.6
Number of Specimens	5	5	5	5	5	5	5	5	5	5
RESULTS	**FAIL**		**FAIL**		**FAIL**		**FAIL**		**FAIL**	
Minimum Acceptable Equiv. Sample Mean	150.4		150.4		150.4		150.4		150.4	
Minimum Acceptable Equiv. Sample Min	146.6		146.6		146.6		146.6		146.6	
MOD CV RESULTS	**PASS with MOD**		**PASS with MOD**		**PASS with MOD**		**PASS with MOD**		**PASS with MOD**	
Modified CV%	6.000		6.000		6.000		6.000		6.000	
Minimum Acceptable Equiv. Sample Mean	144.6		144.6		144.6		144.6		144.6	
Minimum Acceptable Equiv. Sample Min	129.2		129.2		129.2		129.2		129.2	

Table 11. Equivalency of average peel strength of Honeycomb sandwich panel

Average Peel Strength (lb-in/in)	D1		D2		D3		D4		D5	
	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.
Data as measured	**Insufficient Data**		**Insufficient Data**		**Insufficient Data**		**Insufficient Data**		**Insufficient Data**	
Mean Average Peel Strength (lb-in/in)	10.9	11.0	10.9	10.5	10.9	11.1	10.9	10.8	10.9	11.1
Standard Deviation	0.849	0.483	0.849	1.025	0.849	0.651	0.849	0.886	0.849	1.049
Coefficient of Variation %	7.767	4.398	7.767	9.735	7.767	5.883	7.767	8.214	7.767	9.422
Minimum	9.8	10.4	9.8	8.9	9.8	10.0	9.8	9.8	9.8	9.9
Maximum	12.1	11.7	12.1	11.5	12.1	11.6	12.1	12.1	12.1	12.2
Number of Specimens	5	5	5	5	5	5	5	5	5	4
RESULTS	**PASS**		**PASS**		**PASS**		**PASS**		**PASS**	
Minimum Acceptable Equiv. Sample Mean	10.20		10.20		10.20		10.20		10.20	
Minimum Acceptable Equiv. Sample Min	8.78		8.78		8.78		8.78		8.78	
MOD CV RESULTS	**PASS with MOD**		**PASS with MOD**		**PASS with MOD**		**PASS with MOD**		**PASS with MOD**	
Modified CV%	7.86		7.86		7.86		7.86		7.86	
Minimum Acceptable Equiv. Sample Mean	10.19		10.19		10.19		10.19		10.19	
Minimum Acceptable Equiv. Sample Min	8.75		8.75		8.75		8.75		8.75	

5.2 Decorative laminate

5.2.1 Test matrix

Uniaxial tension tests were conducted for one decorative laminate type following ASTM D638 (Standard test method for tensile properties of plastics, 2014). Five specimens were tested per disinfectant type, as shown in Table 12.

Table 12. Test matrix for strength characterization of decorative laminate

Decorative Laminate Type	**Test Standard**	**Liquid Disinfectant Type**					
		Pristine	70% IPA	Calla 1452 /Matrix 3	Sani-cide EX3	BactroKill +	PREempt RTU
Aerform LHR	ASTM D638	x 5	x 5	x 5	x 5	x 5	x 5

5.2.2 Specimen dimensions and nomenclature

Specimens were manufactured from decorative laminate sheets in accordance with ASTM D638 (Standard test method for tensile properties of plastics, 2014). Based on the thickness of the sheets, specimen Type V was selected as shown in Figure 18. Nominal dimensions for the same are summarized in Table 13. Dimensions were measured for all the specimens and have been summarized in appendix B.

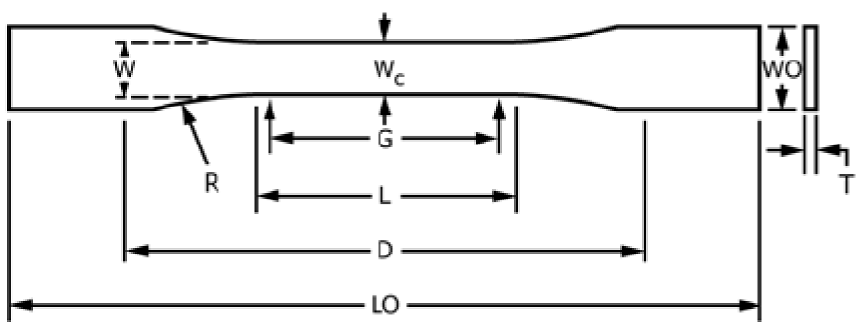


Figure 18. ASTM D638 tensile specimen geometry

Table 13. ASTM D638 tensile test specimen nominal dimensions, type V

Length overall [LO], in	2.500
Length of narrow section [L], in	0.375
Gage length [G], in	0.300
Width overall [WO], in	0.375
Width narrow section [W], in	0.125
Distance between grips [D], in	1.000
Radius of fillet [R], in	0.500

To facilitate specimen identification and traceability, the following nomenclature was used [Client ID – Test method ID – Decorative laminate type ID – Disinfectant ID – Specimen #]. Table 14 summarizes specimen identification nomenclature.

Table 14. Specimen ID nomenclature for decorative laminate strength characterization

Client ID	FAA	FAA
Test Method ID	ASTM D638 – Tension	T
Plastic Type	Aerform LHR	DL1
Liquid Disinfectant	Pristine (No Disinfectant)	D0
	70% IPA	D1
	Calla 1452 /Matrix 3	D2
	Sani-cide EX3	D3
	BactroKill +	D4
	PREempt RTU	D5

5.2.3 Test Setup

Tests were conducted at room temperature at 0.05 in/min nominal displacement rate. Non-contact strain measurement technique, DIC was employed to measure longitudinal strains, as shown in the test setup in Figure 19. All tests were conducted at room temperature until failure. The test apparatus used was an MTS Electrodynamic testing load frame with a static load capacity of 450 lbf.

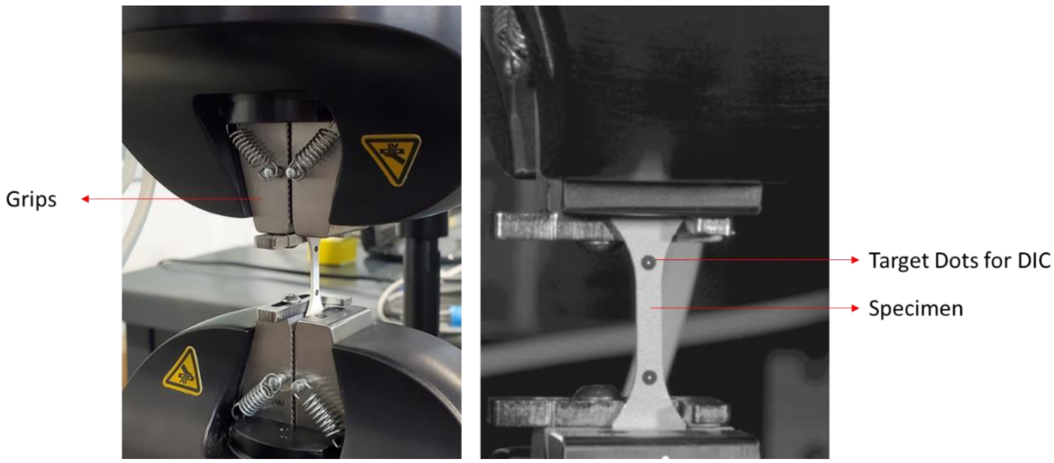


Figure 19. Uniaxial tensile test setup

5.2.4 Test results

Specimens were tested until failure following the test matrix in Table 12. Post-test failure pictures of all the specimens can be found in appendix H. Longitudinal stress-strain plots and comparison of yield stress, tensile strength, and failure strain are shown in Figure 20 to Figure 21.

For Aerform LHR, no reduction in average tensile strength was observed with the use of liquid disinfectants. The reduction in average yield stress was less than 5%, when the specimens were conditioned with Bactrokill+ and PREmpt RTU. No reduction in average yield stress was observed for specimens conditioned with other liquid disinfectants. The reduction in average failure strain was between 5% to 10% with the specimens conditioned with 70% IPA and Sani-Cide EX3. The reduction in average failure strain was less than 5% when specimens were conditioned with PREempt RTU. No reduction in failure strain was observed with specimens conditioned with Calla 1452 and BactroKill+.

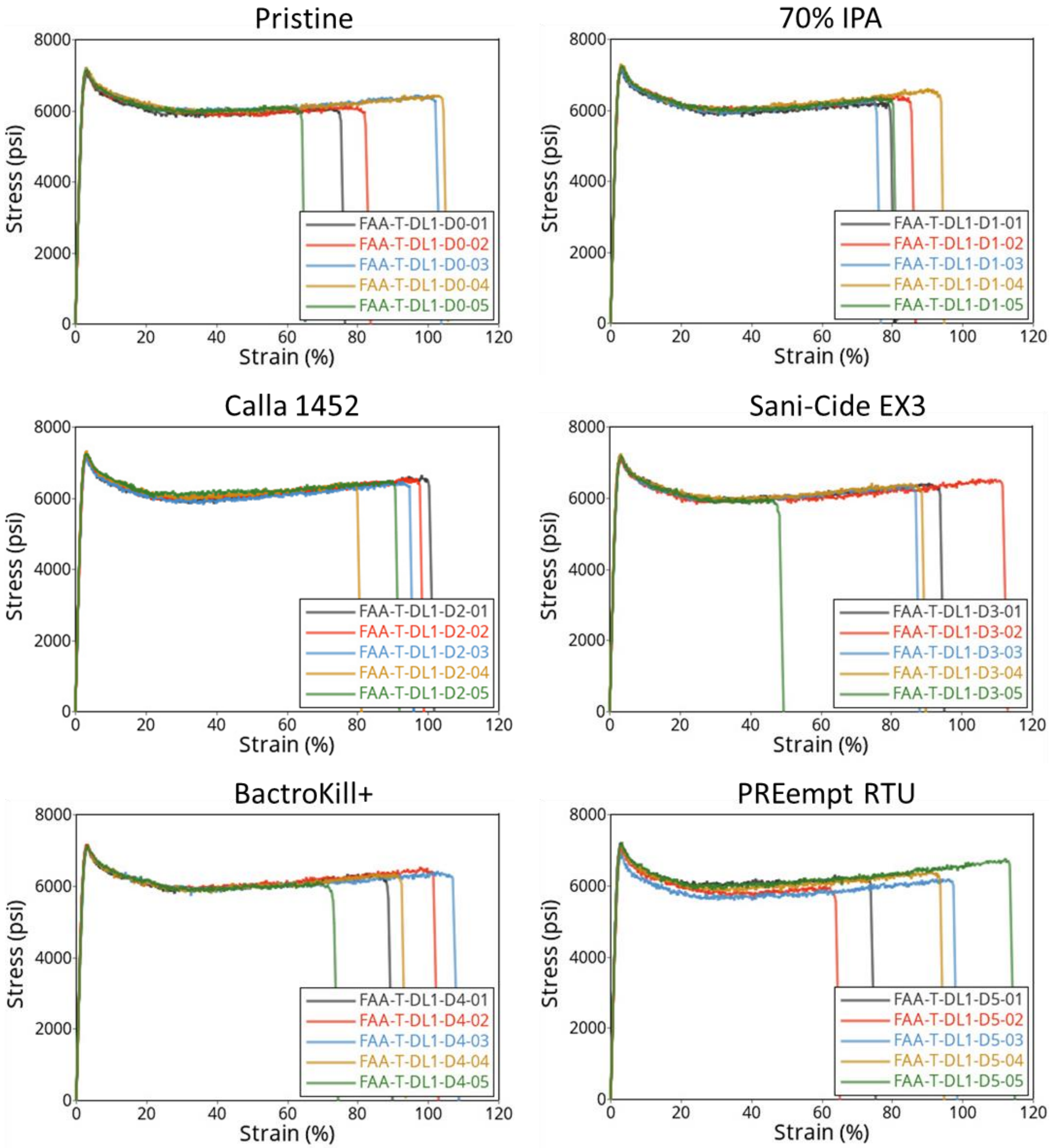


Figure 20. Longitudinal stress-strain response – Aerform LHR

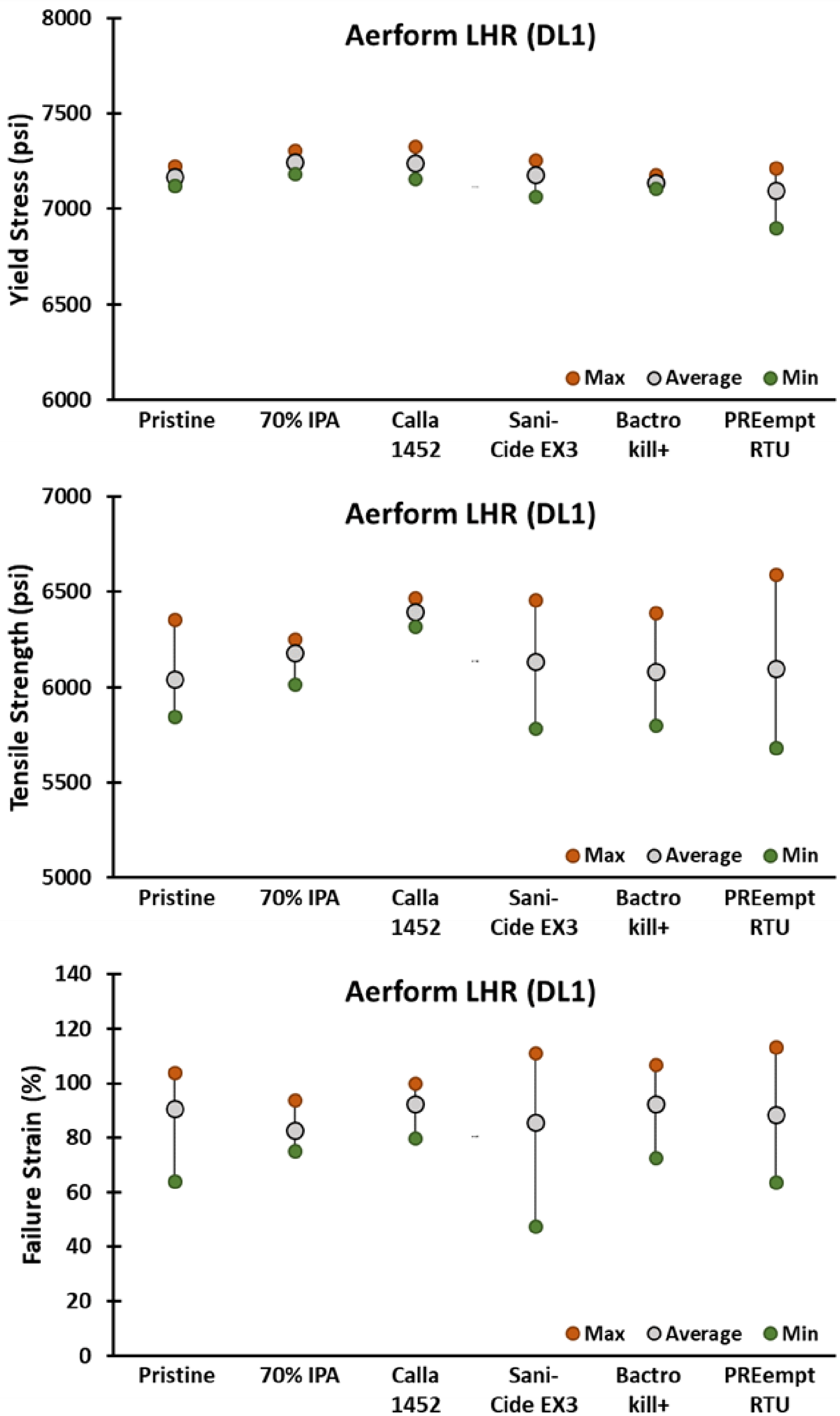


Figure 21. Yield stress, tensile strength and failure strain comparison – Aerform LHR

5.2.5 Statistical data evaluation

In the current research, material properties obtained from unconditioned decorative laminate specimens are treated as the qualification batch. Equivalency of the tensile strength and yield stress of Aerform LHR conditioned with disinfectants is shown in Table 15 and Table 16.

For Aerform LHR, specimens treated with all the liquid disinfectants pass equivalency criteria for ultimate tensile strength and yield stress except specimens with a modified CV of 6%.

Table 15. Equivalency of tensile strength of Aerform LHR

AerForm LHR Tensile Strength (psi)	D1		D2		D3		D4		D5	
	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.
Data as measured	Insufficient Data		Insufficient Data		Insufficient Data		Insufficient Data		Insufficient Data	
Mean Tensile Strength (psi)	6043	6182	6043	6399	6043	6135	6043	6059	6043	6098
Standard Deviation	220.8	95.2	220.8	64.0	220.8	239.5	220.8	220.4	220.8	327.3
Coefficient of Variation %	3.654	1.541	3.654	0.999	3.654	3.904	3.654	3.638	3.654	5.368
Minimum	5847	6016	5847	6320	5847	5786	5847	5802	5847	5681
Maximum	6358	6253	6358	6470	6358	6459	6358	6390	6358	6590
Number of Specimens	5	5	5	5	5	5	5	5	5	5
RESULTS	**PASS**		**PASS**		**PASS**		**PASS**		**PASS**	
Minimum Acceptable Equiv. Sample Mean	5854		5854		5854		5854		5854	
Minimum Acceptable Equiv. Sample Min	5484		5484		5484		5484		5484	
MOD CV RESULTS	**PASS with MOD**		**PASS with MOD**		**PASS with MOD**		**PASS with MOD**		**PASS with MOD**	
Modified CV%	6.000		6.000		6.000		6.000		6.000	
Minimum Acceptable Equiv. Sample Mean	5734		5734		5734		5734		5734	
Minimum Acceptable Equiv. Sample Min	5126		5126		5126		5126		5126	

Table 16. Equivalency of yield stress of Aerform LHR

AerForm LHR Yield Stress (psi)	D1		D2		D3		D4		D5	
	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.
Data as measured	Insufficient Data		Insufficient Data		Insufficient Data		Insufficient Data		Insufficient Data	
Mean Yield Stress (psi)	7172	7248	7172	7241	7172	7182	7172	7141	7172	7097
Standard Deviation	44.8	50.0	44.8	63.9	44.8	71.2	44.8	31.1	44.8	132.0
Coefficient of Variation %	0.625	0.690	0.625	0.883	0.625	0.991	0.625	0.435	0.625	1.860
Minimum	7125	7186	7125	7160	7125	7067	7125	7109	7125	6902
Maximum	7223	7310	7223	7327	7223	7256	7223	7180	7223	7214
Number of Specimens	5	5	5	5	5	5	5	5	5	5
RESULTS	**PASS**		**PASS**		**PASS**		**PASS**		**FAIL**	
Minimum Acceptable Equiv. Sample Mean	7134		7134		7134		7134		7134	
Minimum Acceptable Equiv. Sample Min	7059		7059		7059		7059		7059	
MOD CV RESULTS	**PASS with MOD**		**PASS with MOD**		**PASS with MOD**		**PASS with MOD**		**PASS with MOD**	
Modified CV%	6.000		6.000		6.000		6.000		6.000	
Minimum Acceptable Equiv. Sample Mean	6805		6805		6805		6805		6805	
Minimum Acceptable Equiv. Sample Min	6084		6084		6084		6084		6084	

5.3 ULTEM™ Plastic

5.3.1 Test matrix

Uniaxial tension tests were conducted for ULTEM™ 9075 and ULTEM™ 9085 following ASTM D638 (Standard test method for tensile properties of plastics, 2014). Five specimens were tested per disinfectant type, as shown in Table 17.

Table 17. Test matrix for strength characterization of ULTEM™

ULTEM™ Type	**Test Standard**	**Liquid Disinfectant Type**					
		Pristine	70% IPA	Calla 1452 /Matrix 3	Sani-cide EX3	BactroKill +	PREempt RTU
ULTEM™ 9075	ASTM D638	x 5	x 5	x 5	x 5	x 5	x 5
ULTEM™ 9085		x 5	x 5	x 5	x 5	x 5	x 5

5.3.2 Specimen dimensions and nomenclature

Specimens were manufactured from ULTEM™ sheets in accordance with ASTM D638 (Standard test method for tensile properties of plastics, 2014). Based on the thickness of the sheets, specimen Type V was selected, as shown in Figure 22. Nominal dimensions for the same are summarized in Table 18. Dimensions were measured for all the specimens and have been summarized in appendix C.

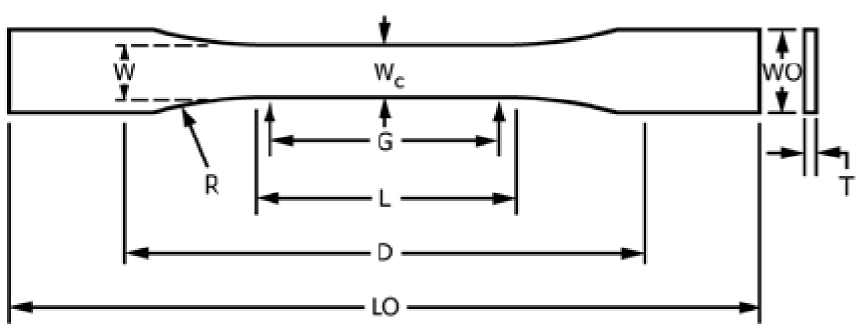


Figure 22. ASTM D638 tensile specimen geometry

Table 18. ASTM D638 tensile test specimen nominal dimensions, type V

Length overall [LO], in	2.500
Length of narrow section [L], in	0.375
Gage length [G], in	0.300
Width overall [WO], in	0.375
Width narrow section [W], in	0.125
Distance between grips [D], in	1.000
Radius of fillet [R], in	0.500

To facilitate specimen identification and traceability, the following nomenclature was used [Client ID – Test method ID – ULTEM^{TM} ID – Disinfectant ID – Specimen #]. Table 19 summarizes specimen identification nomenclature used for different materials.

Table 19. Specimen ID nomenclature for ULTEM^{TM} strength characterization

Client ID	FAA	FAA
Test Method ID	ASTM D638 - Tension	T
ULTEM^{TM} Type	ULTEM^{TM} 9075	P5
	ULTEM^{TM} 9085	P6
Liquid Disinfectant	Pristine (No Disinfectant)	D0
	70% IPA	D1
	Calla 1452 /Matrix 3	D2
	Sani-cide EX3	D3
	BactroKill +	D4
	PREempt RTU	D5

5.3.3 Test setup

Tests were conducted at room temperature at 0.05 in/min nominal displacement rate. Non-contact strain measurement technique, DIC was employed to measure longitudinal strains, as shown in the test setup in Figure 23. All tests were conducted at room temperature until failure. The test apparatus used was an MTS Electrodynamic testing load frame with a static load capacity of 450 lbf.

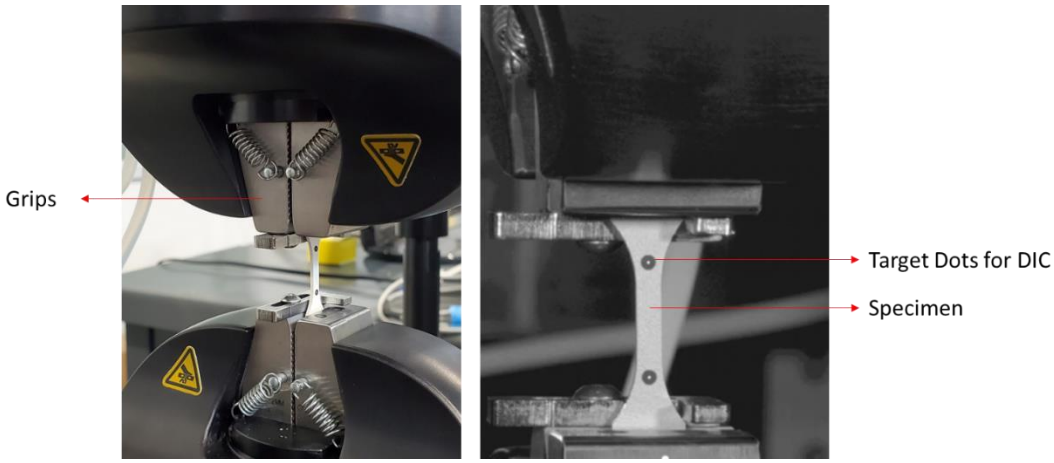


Figure 23. Uniaxial tensile test setup

5.3.4 Test results

For ULTEM™ 9075 and ULTEM™ 9085, specimens were tested until failure following the test matrix in Table 17. Post-test failure pictures of all the specimens can be found in Appendix I. Longitudinal stress-strain plots and comparison of yield stress, tensile strength, and failure strain are shown in Figure 24 to Figure 27.

For ULTEM™ 9075, no reduction in average yield stress and average tensile strength was observed with the use of liquid disinfectants. However, the average failure strain increases when conditioned with the selected liquid disinfectants.

For ULTEM™ 9085, no reduction in average yield stress and average tensile strength was observed with the use of liquid disinfectants. The reduction in failure strain was less than 5% when the specimens were conditioned with Calla 1452 and PREempt RTU. Specimens conditioned with 70% IPA, Sani-Cide EX3, and BactroKill+ have a reduction in failure strain up to 15%

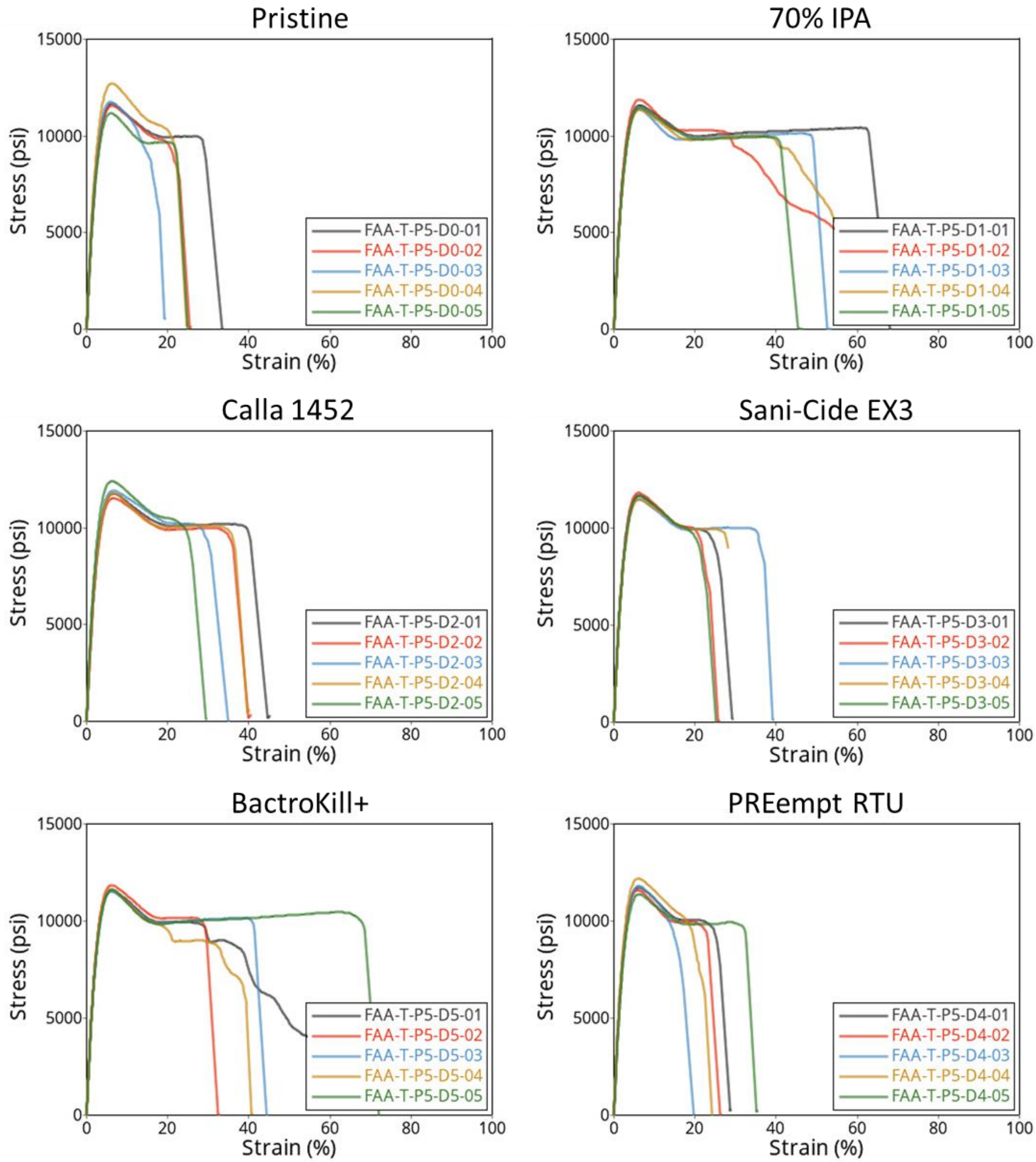


Figure 24. Longitudinal stress-strain response – ULTEM™ 9075

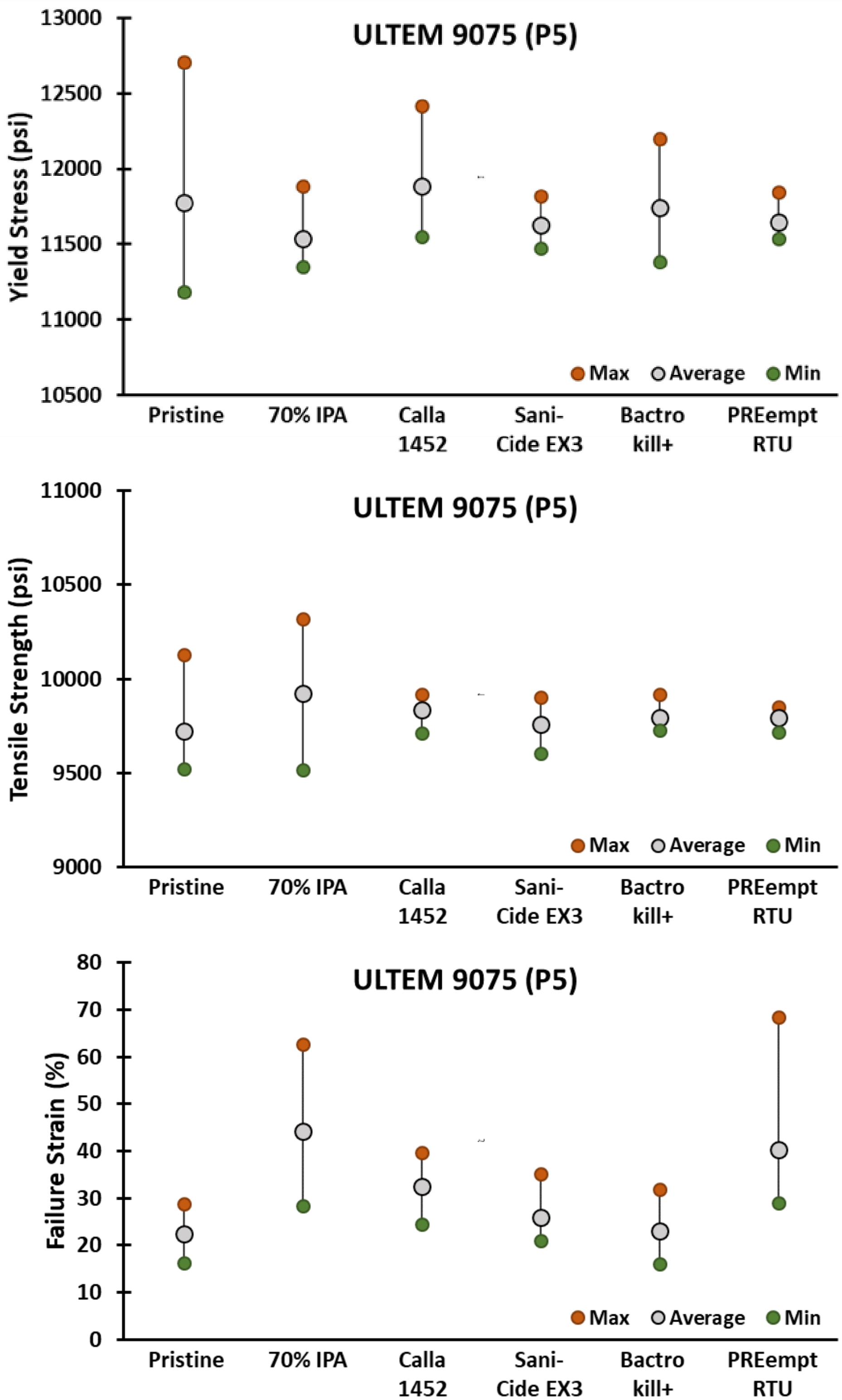


Figure 25. Yield stress, tensile strength, and failure strain comparison – ULTEM^{TM} 9075

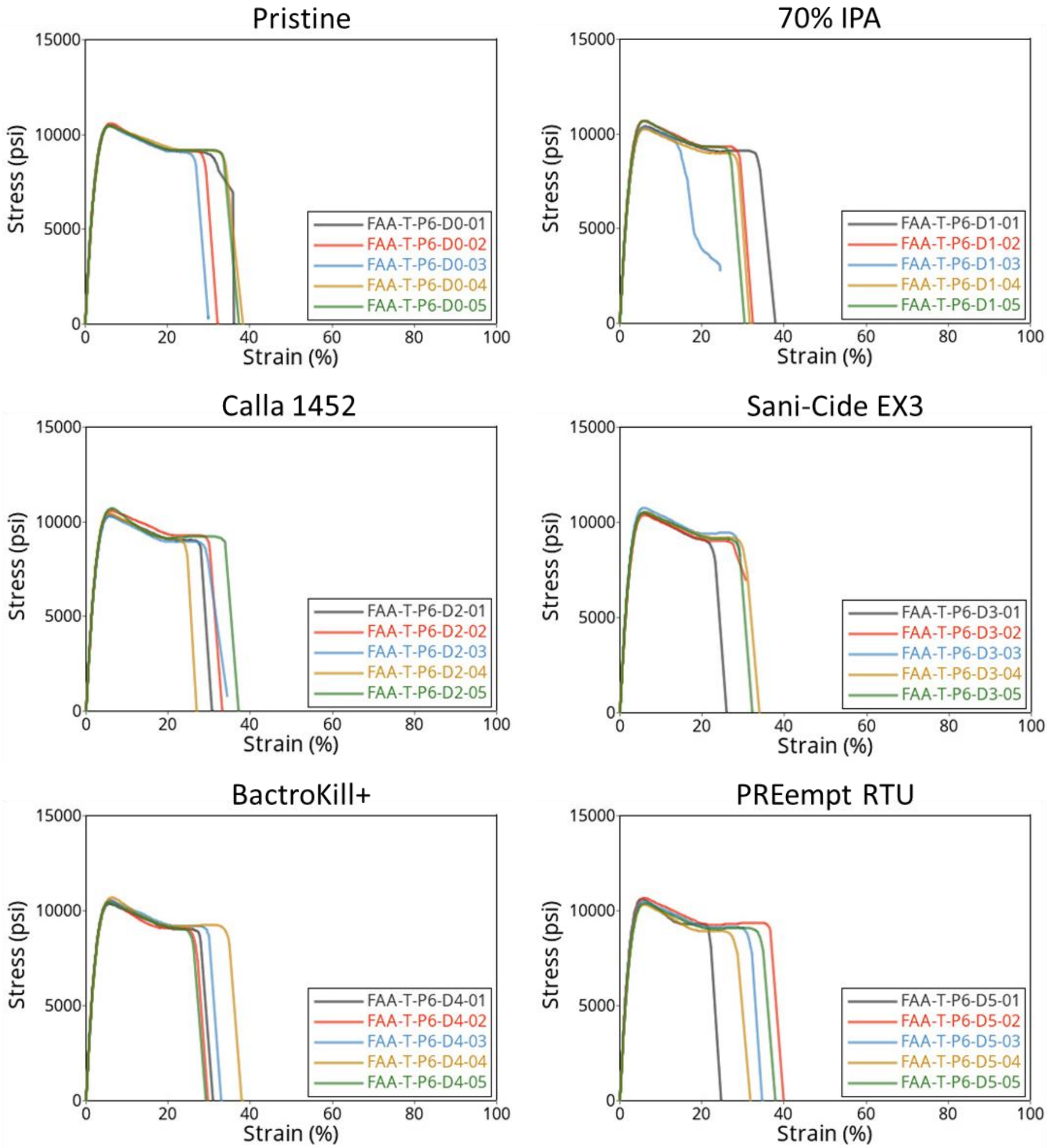


Figure 26. Longitudinal stress-strain response – ULTEM^{TM} 9085

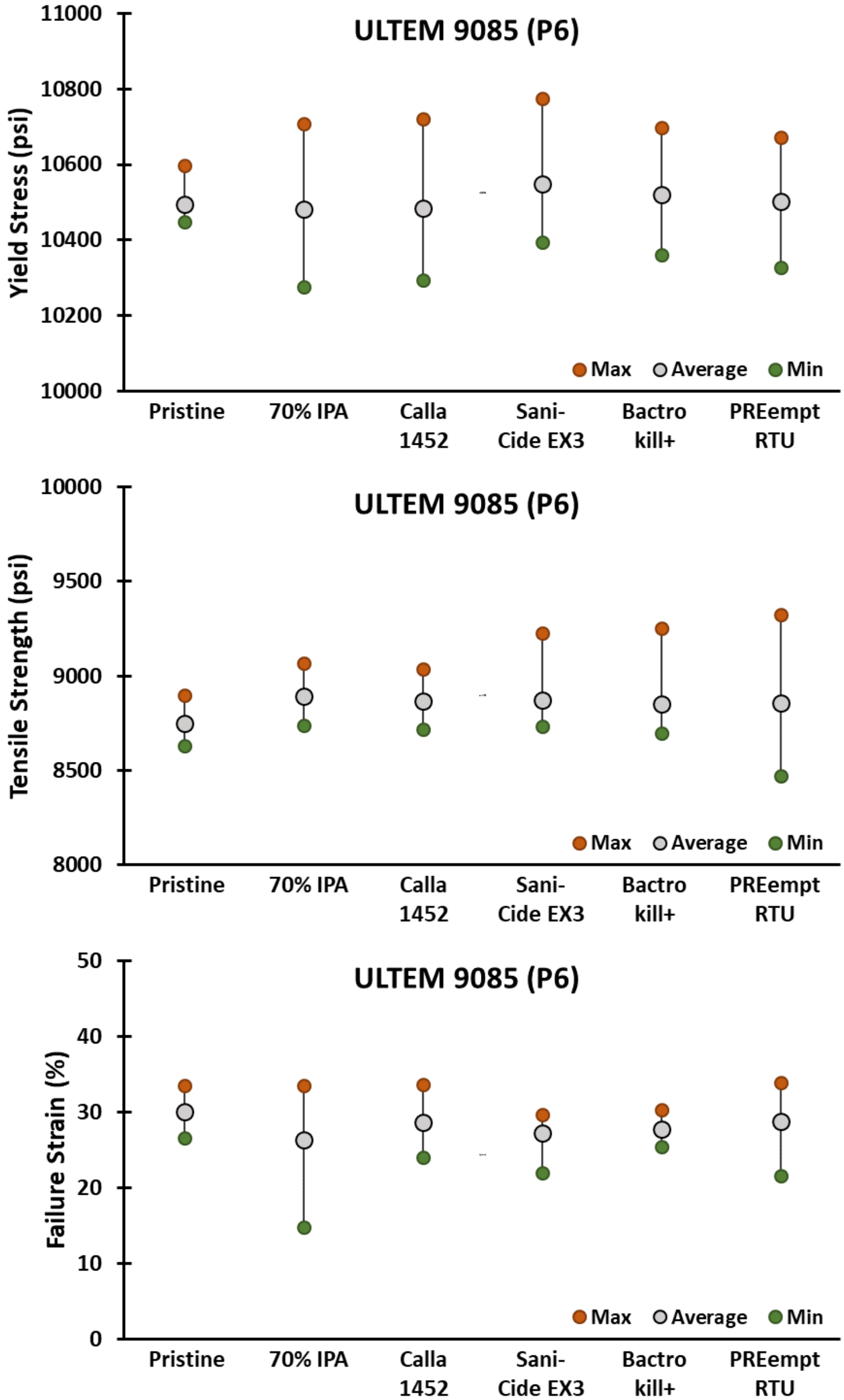


Figure 27. Yield stress, tensile strength, and failure strain comparison – ULTEM™ 9085

5.3.5 Statistical data evaluation

In the current research, material properties obtained from unconditioned ULTEM™ 9075 and ULTEM™ 9085 specimens are treated as the qualification batch. Equivalency of the tensile strength and yield stress of all specimens conditioned with disinfectants is shown in Table 20 to Table 23.

For ULTEM™ 9075, specimens treated with all the liquid disinfectants pass equivalency criteria for ultimate tensile strength and yield stress.

For ULTEM™ 9085, specimens treated with all the liquid disinfectants pass equivalency criteria for ultimate tensile strength and yield stress with a modified CV of 6%.

Table 20. Equivalency of tensile strength of ULTEM™ 9075

ULTEM 9075 Tensile Strength (psi)	D1		D2		D3		D4		D5	
	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.
Data as measured	Insufficient Data		Insufficient Data		Insufficient Data		Insufficient Data		Insufficient Data	
Mean Tensile Strength (psi)	9723	9926	9723	9835	9723	9759	9723	9795	9723	9791
Standard Deviation	275.2	292.6	275.2	75.4	275.2	136.0	275.2	87.9	275.2	53.7
Coefficient of Variation %	2.830	2.948	2.830	0.766	2.830	1.393	2.830	0.898	2.830	0.548
Minimum	9525	9517	9525	9712	9525	9607	9525	9728	9525	9717
Maximum	10130	10320	10130	9917	10130	9905	10130	9917	10130	9854
Number of Specimens	4	5	4	5	4	5	4	4	4	5
RESULTS	**PASS**		**PASS**		**PASS**		**PASS**		**PASS**	
Minimum Acceptable Equiv. Sample Mean	9488		9488		9488		9461		9488	
Minimum Acceptable Equiv. Sample Min	9027		9027		9027		9051		9027	
MOD CV RESULTS	**PASS with MOD**		**PASS with MOD**		**PASS with MOD**		**PASS with MOD**		**PASS with MOD**	
Modified CV%	6.000		6.000		6.000		6.000		6.000	
Minimum Acceptable Equiv. Sample Mean	9225		9225		9225		9169		9225	
Minimum Acceptable Equiv. Sample Min	8247		8247		8247		8298		8247	

Table 21. Equivalency of yield stress of ULTEM™ 9075

ULTEM 9075 Yield Stress (psi)	D1		D2		D3		D4		D5	
	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.
Data as measured	Insufficient Data		Insufficient Data		Insufficient Data		Insufficient Data		Insufficient Data	
Mean Yield Stress (psi)	11776	11537	11776	11887	11776	11626	11776	11746	11776	11644
Standard Deviation	563.6	213.6	563.6	323.9	563.6	142.7	563.6	302.0	563.6	121.8
Coefficient of Variation %	4.786	1.851	4.786	2.725	4.786	1.228	4.786	2.571	4.786	1.046
Minimum	11187	11352	11187	11550	11187	11471	11187	11386	11187	11535
Maximum	12707	11885	12707	12418	12707	11822	12707	12202	12707	11847
Number of Specimens	5	5	5	5	5	5	5	5	5	5
RESULTS	**PASS**		**PASS**		**PASS**		**PASS**		**PASS**	
Minimum Acceptable Equiv. Sample Mean	11295		11295		11295		11295		11295	
Minimum Acceptable Equiv. Sample Min	10351		10351		10351		10351		10351	
MOD CV RESULTS	**PASS with MOD**		**PASS with MOD**		**PASS with MOD**		**PASS with MOD**		**PASS with MOD**	
Modified CV%	6.393		6.393		6.393		6.393		6.393	
Minimum Acceptable Equiv. Sample Mean	11134		11134		11134		11134		11134	
Minimum Acceptable Equiv. Sample Min	9872		9872		9872		9872		9872	

Table 22. Equivalency of tensile strength of ULTEM™ 9085

ULTEM 9085 Yield Stress (psi)	D1		D2		D3		D4		D5	
	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.
Data as measured	Insufficient Data		Insufficient Data		Insufficient Data		Insufficient Data		Insufficient Data	
Mean Yield Stress (psi)	10496	10483	10496	10484	10496	10548	10496	10522	10496	10501
Standard Deviation	61.2	200.9	61.2	176.4	61.2	140.9	61.2	124.6	61.2	143.9
Coefficient of Variation %	0.583	1.917	0.583	1.683	0.583	1.336	0.583	1.184	0.583	1.371
Minimum	10449	10276	10449	10294	10449	10394	10449	10361	10449	10328
Maximum	10599	10708	10599	10720	10599	10774	10599	10699	10599	10673
Number of Specimens	5	5	5	5	5	5	5	5	5	5
RESULTS	**FAIL**		**FAIL**		**PASS**		**PASS**		**FAIL**	
Minimum Acceptable Equiv. Sample Mean	10444		10444		10444		10444		10444	
Minimum Acceptable Equiv. Sample Min	10341		10341		10341		10341		10341	
MOD CV RESULTS	**PASS with MOD**		**PASS with MOD**		**PASS with MOD**		**PASS with MOD**		**PASS with MOD**	
Modified CV%	6.000		6.000		6.000		6.000		6.000	
Minimum Acceptable Equiv. Sample Mean	9959		9959		9959		9959		9959	
Minimum Acceptable Equiv. Sample Min	8904		8904		8904		8904		8904	

Table 23. Equivalency of yield stress of ULTEM™ 9085

ULTEM 9085 Tensile Strength (psi)	D1		D2		D3		D4		D5	
	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.
Data as measured	Insufficient Data		Insufficient Data		Insufficient Data		Insufficient Data		Insufficient Data	
Mean Tensile Strength (psi)	8748	8891	8748	8867	8748	8870	8748	8853	8748	8856
Standard Deviation	129.2	136.2	129.2	142.2	129.2	203.8	129.2	230.0	129.2	343.5
Coefficient of Variation %	1.477	1.532	1.477	1.604	1.477	2.297	1.477	2.598	1.477	3.878
Minimum	8629	8739	8629	8719	8629	8736	8629	8699	8629	8470
Maximum	8899	9068	8899	9036	8899	9228	8899	9253	8899	9327
Number of Specimens	5	5	5	5	5	5	5	5	5	5
RESULTS	**PASS**		**PASS**		**PASS**		**PASS**		**PASS**	
Minimum Acceptable Equiv. Sample Mean	8638		8638		8638		8638		8638	
Minimum Acceptable Equiv. Sample Min	8422		8422		8422		8422		8422	
MOD CV RESULTS	**PASS with MOD**		**PASS with MOD**		**PASS with MOD**		**PASS with MOD**		**PASS with MOD**	
Modified CV%	6.000		6.000		6.000		6.000		6.000	
Minimum Acceptable Equiv. Sample Mean	8301		8301		8301		8301		8301	
Minimum Acceptable Equiv. Sample Min	7421		7421		7421		7421		7421	

5.4 Fiberglass laminate

Uniaxial tension and short-beam shear tests were conducted on fiberglass G-10/FR4 following ASTM D3039 (Standard test method for tensile properties of polymer matrix composite materials, 2017) and ASTM D2344 (Standard test method for short-beam strength of polymer matrix composite materials and their laminates, 2016) respectively.

5.4.1 Test matrix

Five specimens were tested per disinfectant type, as shown in Table 24.

Table 24. Test matrix for fiberglass laminate strength characterization

Fiberglass Laminate Type	**Test Standard**	**Liquid Disinfectant Type**					
		Pristine	70% IPA	Calla 1452 /Matrix 3	Sani-cide EX3	BactroKill +	PREempt RTU
Fiberglass G-10/FR4	ASTM D3039	x 5	x 5	x 5	x 5	x 5	x 5
	ASTM D2344	x 5	x 5	x 5	x 5	x 5	x 5

5.4.2 Specimen dimension and nomenclature

Specimens were manufactured from laminated fiberglass panels in accordance with ASTM standards as shown in Figure 28 and Figure 29. Nominal dimensions for the same are summarized in

Table 25 and Table 26. Dimensions were measured for all the specimens and have been summarized in appendix D.

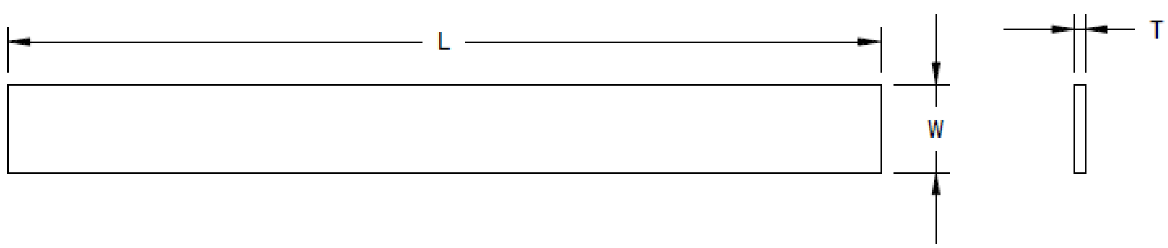


Figure 28. ASTM D3039 tensile test specimen geometry

Table 25. ASTM D3039 tensile test specimen nominal dimensions

Length overall [L], in	10.0
Width overall [W], in	1.00
Thickness [T], in	0.125

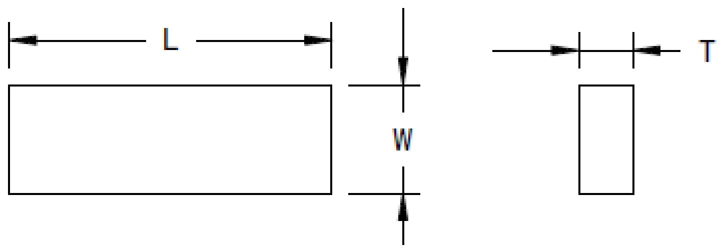


Figure 29. ASTM D2344 short-beam shear specimen geometry

Table 26. ASTM D2344 short-beam shear specimen nominal dimensions

Length overall [L], in	1.50
Width overall [W], in	0.50
Thickness [T], in	0.25

To facilitate specimen identification and tracking, the following nomenclature was used [Client ID – Test Method ID – Fiberglass Laminate Type ID – Disinfectant ID – Specimen #]. Table 27 summarizes specimen identification nomenclature to be used.

Table 27. Specimen ID nomenclature for fiberglass laminate strength characterization

Client ID	FAA	FAA
Test Method ID	ASTM D3039 – Tension	T
	ASTM D2344 – Short beam shear	S
Fiberglass Laminate Type	Fiberglass G-10/FR4	FG1
Liquid Chemical Disinfectant	Pristine (No Disinfectant)	D0
	70% IPA	D1
	Calla 1452 /Matrix 3	D2
	Sani-cide EX3	D3
	BactroKill +	D4
	PREempt RTU	D5

5.4.3 Tension

5.4.3.1 Test setup

Tensile tests were conducted at room temperature until failure under displacement control at a nominal displacement rate of 0.05 in/min. The test apparatus used was an MTS Servo-Hydraulic testing load frame with a static load capacity of 55,000 lbf. Hydraulic self-aligning grips were used to grip the specimen at a gripping pressure of 3,000 psi. An axial extensometer was utilized for strain measurement. Figure 30 shows the test setup with the tensile specimen installed and equipped with the extensometer.

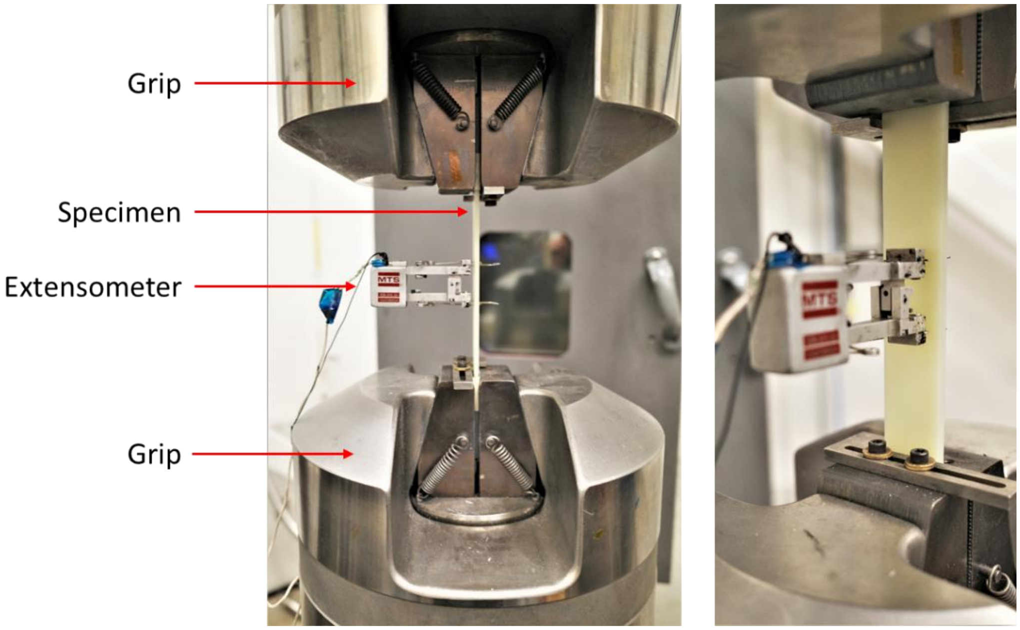


Figure 30. Fiberglass laminate tensile test setup

5.4.3.2 Test results

Specimens were tested until failure following the test matrix in Table 24. Post-test failure pictures of all the tensile specimens can be found in appendix J. Longitudinal stress-strain plots and comparison of longitudinal modulus and tensile strength are shown in Figure 31 and Figure 32. It is important to note that the reported longitudinal strain is based on the maximum displacement limit of the extensometer.

For fiberglass G-10/FR4, the reduction in tensile strength was less than 5% when conditioned with liquid disinfectants compared to pristine specimens. The reduction in longitudinal modulus was less than 5% when conditioned with 70% IPA. There was no reduction in longitudinal modulus when conditioned with other liquid disinfectants.

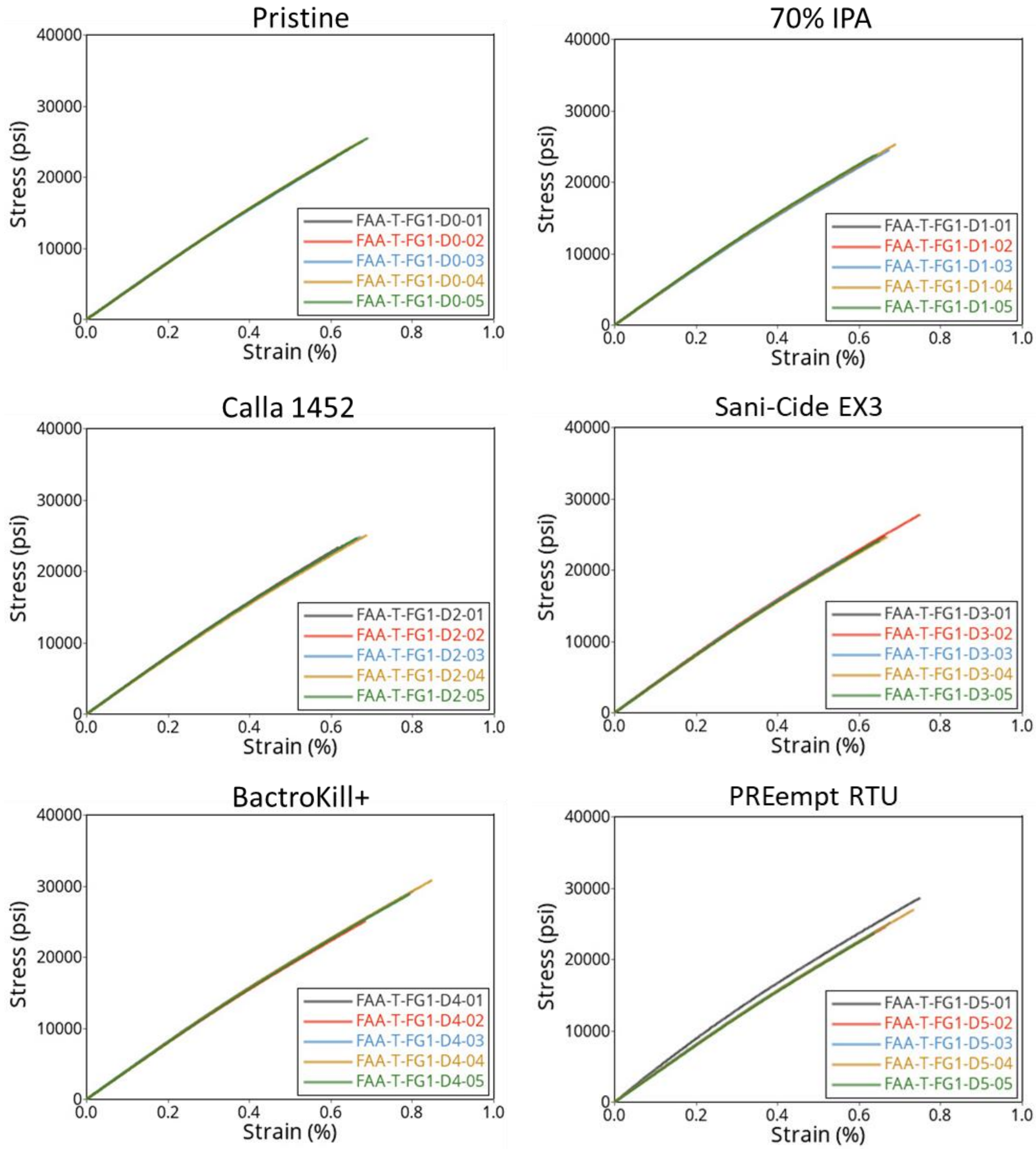


Figure 31. Stress-strain response – Fiberglass G-10/FR4

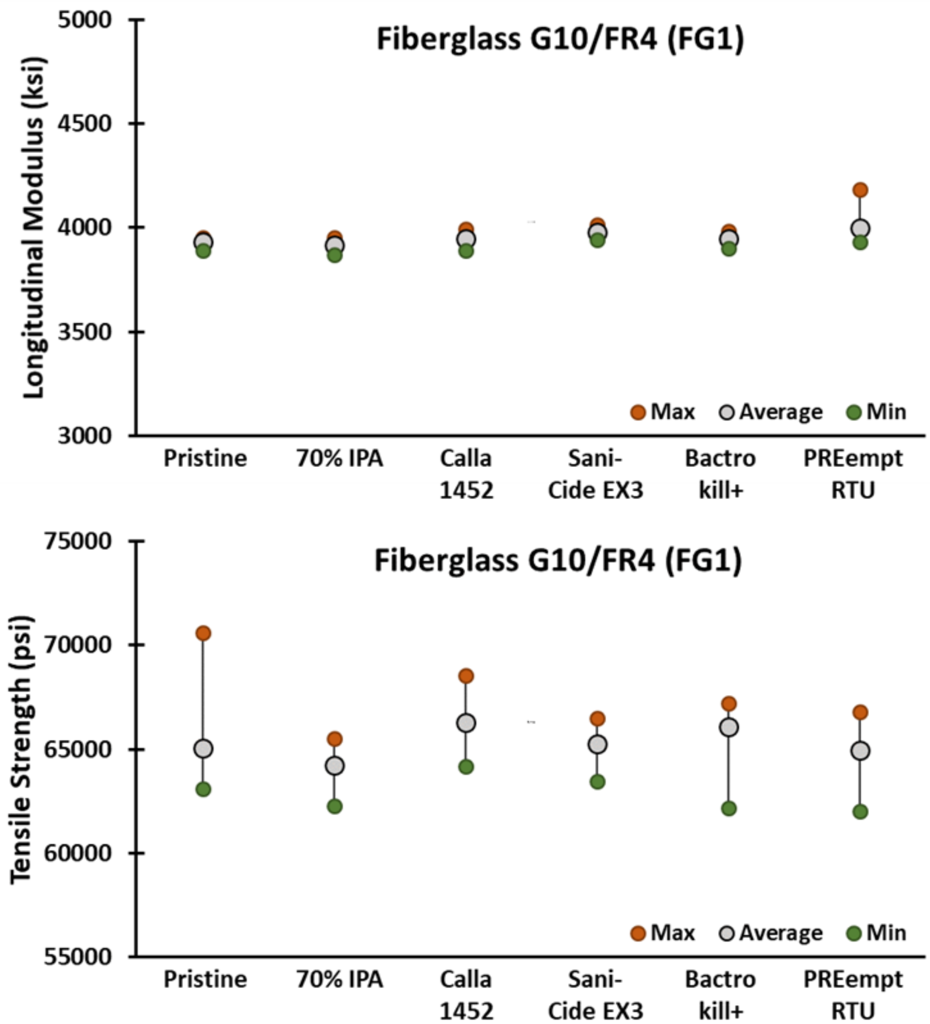


Figure 32. Longitudinal modulus and tensile strength comparison – Fiberglass G-10/FR4

5.4.4 Short-beam shear

5.4.4.1 Test setup

Short-beam shear tests were conducted at room temperature under displacement control at a nominal displacement rate of 0.05 in/min. The test apparatus used was an MTS Servo-Hydraulic testing load frame with a static load capacity of 22,000 lbf. Figure 33 illustrates the short-beam shear test setup.

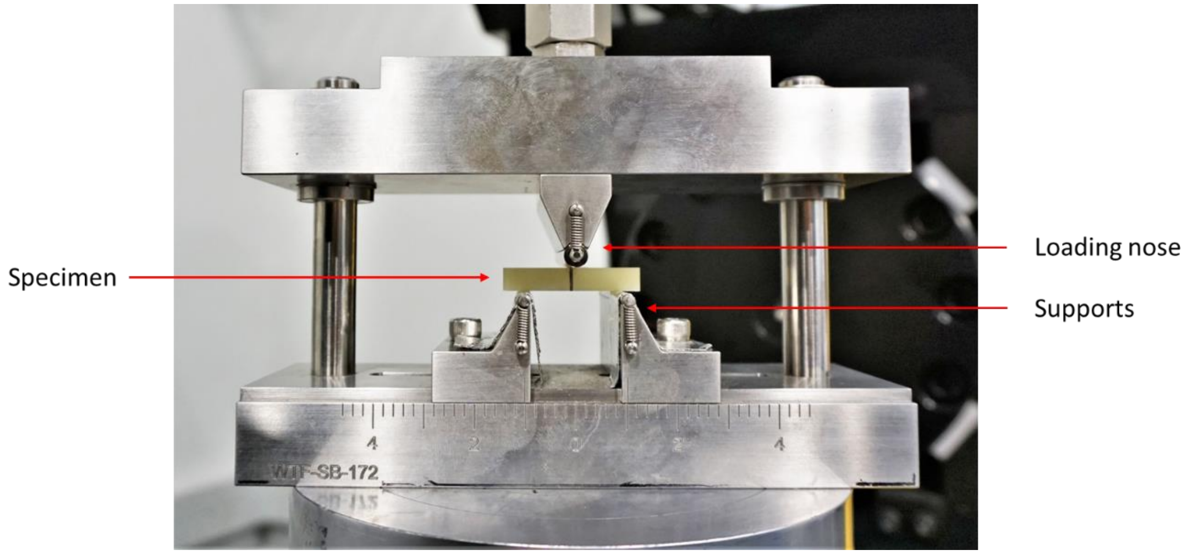


Figure 33. Fiberglass laminate short-beam shear test setup

5.4.4.2 Test results

Specimens were tested until failure following the test matrix in Table 24. Post-test failure pictures of all the tensile specimens can be found in appendix K. Load-displacement plots and comparison of short-beam strength are shown in Figure 34 and Figure 35.

For fiberglass G-10/FR4, the reduction in short-beam strength was less than 5% for specimens conditioned with liquid disinfectants.

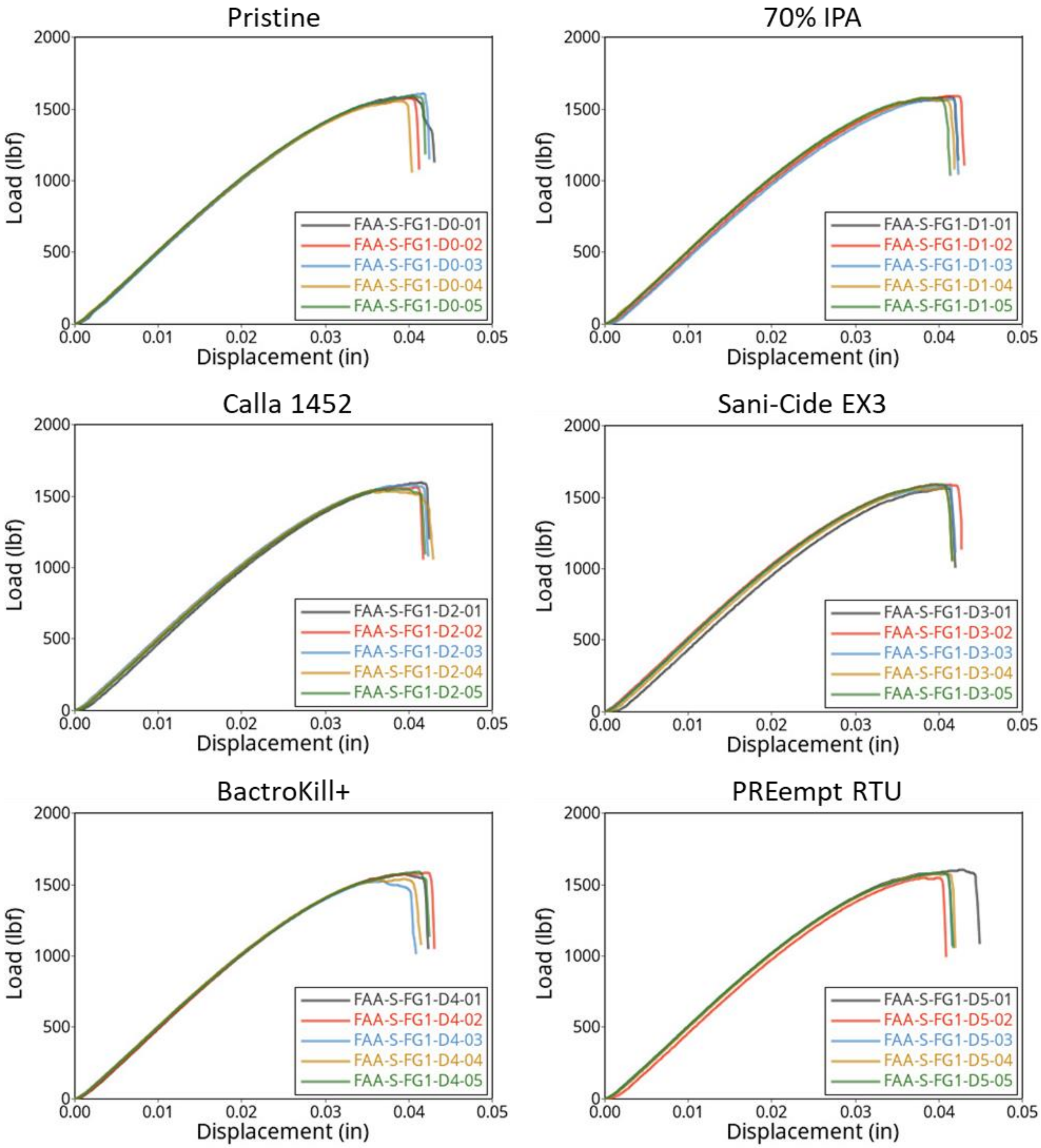


Figure 34. Load-displacement response – Fiberglass G-10/FR4

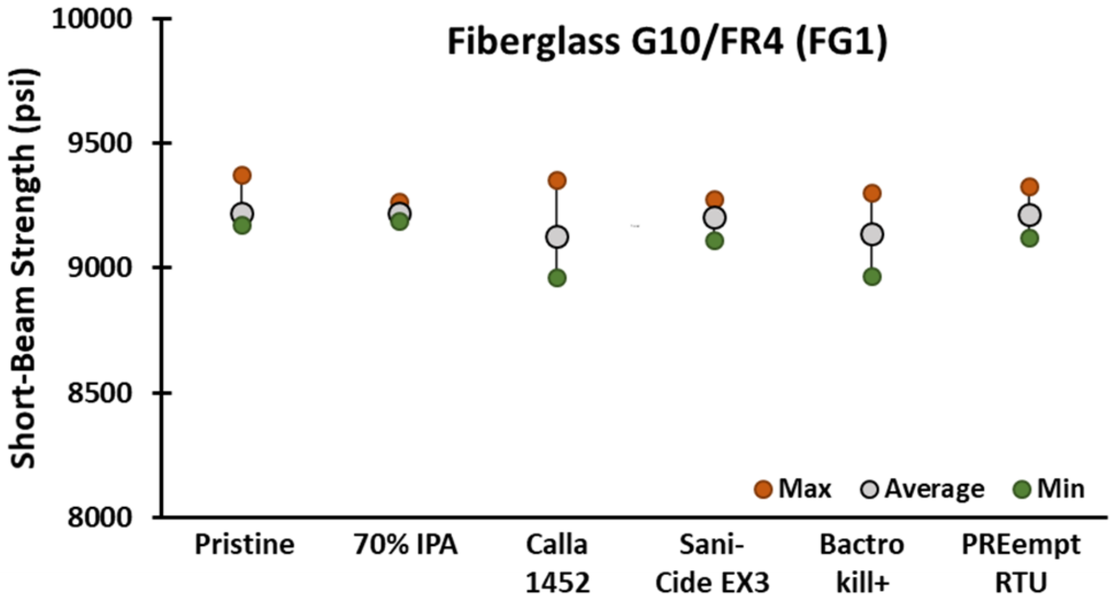


Figure 35. Short-beam strength comparison – Fiberglass G-10/FR4

5.4.5 Statistical data evaluation

In the current research, material properties obtained from unconditioned fiberglass laminate specimens are treated as the qualification batch. Equivalencies of the mechanical properties characterized from Fiberglass G-10/FR4 conditioned with disinfectants are shown in Table 28 to Table 30.

For fiberglass G-10/FR4, specimens treated with the liquid disinfectants passed equivalency criteria for tensile strength, longitudinal modulus, and short-beam strength with a modified CV of 6%.

Table 28. Equivalency of tensile strength of Fiberglass G-10/FR4

Tensile Strength (psi)	D1		D2		D3		D4		D5	
	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.
Data as measured	Insufficient Data		Insufficient Data		Insufficient Data		Insufficient Data		Insufficient Data	
Mean Tensile Strength (psi)	66,176	64,251	66,176	66,317	66,176	65,262	66,176	66,067	66,176	64,925
Standard Deviation	2,960	1,367	2,960	1,555	2,960	1,226	2,960	2,172	2,960	1,944
Coefficient of Variation %	4.472	2.127	4.472	2.344	4.472	1.879	4.472	3.288	4.472	2.994
Minimum	63,102	62,308	63,102	64,176	63,102	63,451	63,102	62,201	63,102	62,010
Maximum	70,617	65,511	70,617	68,554	70,617	66,521	70,617	67,236	70,617	66,807
Number of Specimens	5	5	5	5	5	5	5	5	5	5
RESULTS	**PASS**		**PASS**		**PASS**		**PASS**		**PASS**	
Minimum Acceptable Equiv. Sample Mean	63,653		63,653		63,653		63,653		63,653	
Minimum Acceptable Equiv. Sample Min	58,692		58,692		58,692		58,692		58,692	
MOD CV RESULTS	**PASS with MOD**		**PASS with MOD**		**PASS with MOD**		**PASS with MOD**		**PASS with MOD**	
Modified CV%	6.000		6.000		6.000		6.000		6.000	
Minimum Acceptable Equiv. Sample Mean	62,791		62,791		62,791		62,791		62,791	
Minimum Acceptable Equiv. Sample Min	56,136		56,136		56,136		56,136		56,136	

Table 29. Equivalency of longitudinal modulus of Fiberglass G-10/FR4

Longitudinal Modulus (ksi)	D1		D2		D3		D4		D5	
	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.
Data as measured	Insufficient Data		Insufficient Data		Insufficient Data		Insufficient Data		Insufficient Data	
Mean Longitudinal Modulus (ksi)	3,934	3,916	3,934	3,948	3,934	3,978	3,934	3,949	3,934	3,998
Standard Deviation	24.41	29.25	24.41	37.25	24.41	29.04	24.41	30.09	24.41	106.22
Coefficient of Variation %	0.620	0.747	0.620	0.943	0.620	0.730	0.620	0.762	0.620	2.657
Minimum	3,892	3,872	3,892	3,893	3,892	3,943	3,892	3,903	3,892	3,935
Maximum	3,951	3,954	3,951	3,997	3,951	4,016	3,951	3,983	3,951	4,186
Number of Specimens	5	5	5	5	5	5	5	5	5	5
RESULTS	**FAIL**		**PASS**		**PASS**		**PASS**		**PASS**	
Minimum Acceptable Equiv. Sample Mean	3,914		3,914		3,914		3,914		3,914	
Minimum Acceptable Equiv. Sample Min	3,873		3,873		3,873		3,873		3,873	
MOD CV RESULTS	**PASS with MOD**		**PASS with MOD**		**PASS with MOD**		**PASS with MOD**		**PASS with MOD**	
Modified CV%	6.000		6.000		6.000		6.000		6.000	
Minimum Acceptable Equiv. Sample Mean	3,733		3,733		3,733		3,733		3,733	
Minimum Acceptable Equiv. Sample Min	3,337		3,337		3,337		3,337		3,337	

Table 30. Equivalency of short-beam strength of Fiberglass G-10/FR4

Short-Beam Strength (psi)	D1		D2		D3		D4		D5	
	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.	Qual.	Equiv.
Data as measured	Insufficient Data		Insufficient Data		Insufficient Data		Insufficient Data		Insufficient Data	
Mean Short-Beam Strength (psi)	9,250	9,222	9,250	9,127	9,250	9,206	9,250	9,140	9,250	9,214
Standard Deviation	85.83	35.50	85.83	155.79	85.83	72.08	85.83	165.95	85.83	78.92
Coefficient of Variation %	0.928	0.385	0.928	1.707	0.928	0.783	0.928	1.816	0.928	0.857
Minimum	9,172	9,189	9,172	8,962	9,172	9,115	9,172	8,967	9,172	9,123
Maximum	9,376	9,268	9,376	9,352	9,376	9,275	9,376	9,303	9,376	9,330
Number of Specimens	5	5	5	5	5	5	5	5	5	5
RESULTS	**PASS**		**FAIL**		**PASS**		**FAIL**		**PASS**	
Minimum Acceptable Equiv. Sample Mean	9,177		9,177		9,177		9,177		9,177	
Minimum Acceptable Equiv. Sample Min	9,033		9,033		9,033		9,033		9,033	
MOD CV RESULTS	**PASS with MOD**		**PASS with MOD**		**PASS with MOD**		**PASS with MOD**		**PASS with MOD**	
Modified CV%	6.000		6.000		6.000		6.000		6.000	
Minimum Acceptable Equiv. Sample Mean	8,777		8,777		8,777		8,777		8,777	
Minimum Acceptable Equiv. Sample Min	7,847		7,847		7,847		7,847		7,847	

5.5 Summary of mechanical test results

To understand the effect of liquid disinfectants on the mechanical properties of cabin interior materials, mechanical tests were conducted on honeycomb sandwich panels, decorative laminates, ULTEM^{TM} 9075, ULTEM^{TM} 9085, and fiberglass reinforced epoxy laminate on pristine and conditioned specimens. Different loading conditions were evaluated based on the material type. Tests were conducted on five specimens per disinfectant type and per loading condition.

To evaluate if the material properties obtained from the conditioned specimens were equivalent to unconditioned specimens, statistical analysis was performed following the guidelines in CMH-17 (Polymer matrix composites: Guidelines for characterization of structural materials, 2012). According to CMH-17, a minimum of eight specimens from two different batches is recommended for determining material equivalency. However, only five specimens were tested per material due to sample unavailability, which is considered insufficient data. Moreover, the small set of data consisting of five specimens resulted in a low coefficient of variation values, ranging from 0.5% to 5% for pristine specimens. Lower CV causes a higher minimum acceptable value and results in the material properties not meeting the equivalency criterion. To adjust for the insufficient number of specimens, a modified CV value of 6% was used to find the minimum acceptable values.

As summarized in Table 31, the mechanical properties of materials conditioned with liquid disinfectants were found to be equivalent to unconditioned specimens following a CV of 6%.

Table 31. Mechanical properties results summary

Material Name	Properties	Disinfectant Type				
		70% IPA	Calla 1452	Sani-Cide EX3	BactroKill+	PREempt RTU
Honeycomb Sandwich Panel	Ultimate Compressive Strength					
	Maximum Flexural Load					
	Average Peel Torque					
Aerform LHR	Tensile Strength					
	Yield Stress					
ULTEM™ 9075	Tensile Strength					
	Yield Stress					
ULTEM™ 9085	Tensile Strength					
	Yield Stress					
Fiberglass G-10/FR4	Longitudinal Modulus					
	Tensile Strength					
	Short-Beam Strength					

■ Material properties "equivalent" to unconditioned specimens

6 Flammability properties

In this research, effect of liquid disinfectants was evaluated on the flammability properties of all the materials. Tests were conducted according to the Vertical Bunsen Burner Tests specified in 14 CFR Appendix F of Part 25 (Part I - Test Criteria and Procedures for Showing Compliance With § 25.853 or § 25.855, 2022). All the flammability tests were conducted at Aviation Consulting and Engineering Solutions, Inc. (ACES) (KanUS).

6.1 Flammability performance criterion

The purpose of these tests was to compare the flammability performance of the material when conditioned with liquid disinfectants against unconditioned specimens. This data was not to be used for certification purposes. Hence, there was a need to define a criterion to measure the severity on flammability performance. The test method and conditioning environment was selected during Phase 1 to conservatively be able to measure effects. In lieu of having a separate test method for each type of application, a generally accepted application was agreed upon and was also used in this program. To cover as many types of disinfectants and application methods as possible, this generally accepted application is considered more conservative than what is being performed on current in-use seating products. The criterion is defined below:

- Flammability results for cabin interior materials were considered not significantly different if the increase in average burn length of the conditioned specimens was less than or equal to approximately 50% of the average burn length obtained from the unconditioned specimens test data. We call these results "normally equivalent."

- Flammability results for cabin interior materials were considered significantly different, if the increase in average burn length of conditioned specimens was greater than approximately 50% of the average burn length obtained from the unconditioned specimens test data.

6.2 Vertical flammability

For each material type, three specimens were tested, as shown in Table 32.

Table 32. Test matrix for vertical flammability tests

Material Type	Material Name	Flammability Evaluation: Disinfectant Type					
		Pristine	70% IPA	Calla 1452	Sani-Cide EX3	BactroKill +	PREempt RTU
Honeycomb	Honeycomb type A	x3	x3	x3	x3	x3	x3
Decorative Laminate	Aerform LHR	x3	x3	x3	x3	x3	x3
	Aerfilm LHR	x3	x3	x3	x3	x3	x3
	Aerfusion fit	x3	x3	x3	x3	x3	x3
Carpet	Polyamide carpet	x3	x3	x3	x3	x3	x3
	Wool carpet	x3	x3	x3	x3	x3	x3
ULTEM	ULTEM 9075	x3	x3	x3	x3	x3	x3
	ULTEM 9085	x3	x3	x3	x3	x3	x3
Fiberglass laminate	Fiberglass G-10/FR4	x3	x3	x3	x3	x3	x3

6.2.1 Honeycomb

For the honeycomb sandwich panel, the change in flammability properties was considered normally equivalent to the untreated material when conditioned with selected disinfectants, as summarized in Table 33 and Figure 36.

Table 33. Flammability results for Honeycomb type A

Vertical Flammability Test Results for Honeycomb Type A (H1)									
Disinfectant Type	After Flame Time (s)			Burn Length (in)			Drip Flame Time (s)		
	#1	#2	#3	#1	#2	#3	#1	#2	#3
No Conditioning	1.60	2.70	2.80	2.90	2.40	2.50	0.00	0.00	0.00
70% IPA	3.10	0.00	1.40	2.00	2.00	2.00	0.00	0.00	0.00
Calla 1452	3.40	2.80	4.00	2.20	2.60	2.70	0.00	0.00	0.00
Sani-Cide EX3	1.50	3.50	2.70	2.40	2.70	3.40	0.00	0.00	0.00
BactroKill+	0.00	1.90	2.70	2.30	3.20	2.20	0.00	0.00	0.00
PREempt RTU	3.50	0.00	2.10	2.40	3.10	2.20	0.00	0.00	0.00

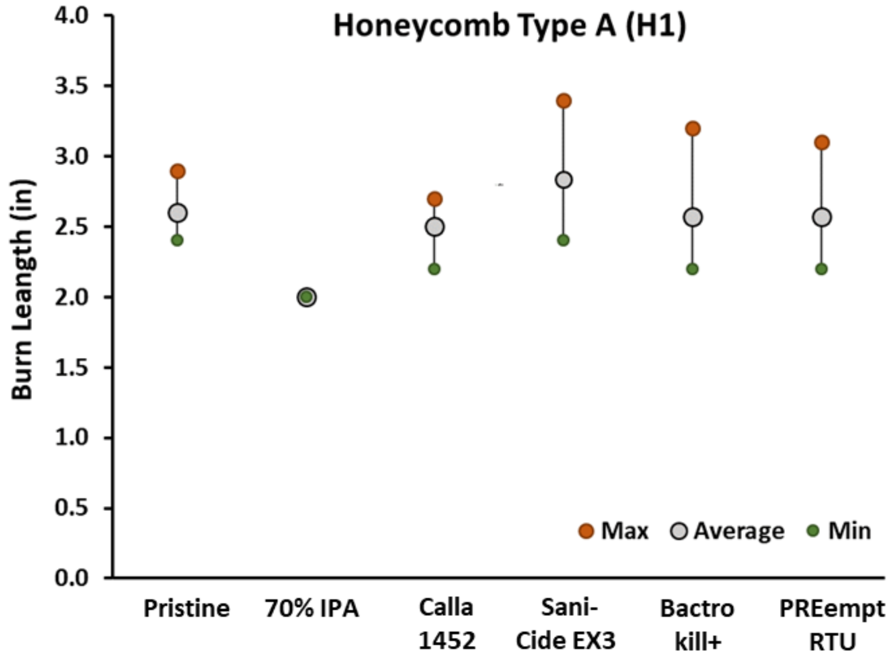


Figure 36. Burn length comparison for Honeycomb sandwich panel

6.2.2 Decorative laminate

For Aerform LHR, the change in flammability properties was considered normally equivalent to the untreated material when conditioned with selected disinfectants as summarized in Table 34 and Figure 37.

For Aerfilm LHR, the change in flammability properties was considered normally equivalent to the untreated material when conditioned with selected disinfectants as summarized in Table 35 and Figure 38.

For Aerfusion fit, the change in flammability properties was considered normally equivalent to the untreated material when conditioned with selected disinfectants as summarized in Table 36 and Figure 39.

Table 34. Flammability results for Aerform LHR

Vertical Flammability Test Results for Aerform LHR (DL1)									
Disinfectant Type	After Flame Time (s)			Burn Length (in)			Drip Flame Time (s)		
	#1	#2	#3	#1	#2	#3	#1	#2	#3
No Conditioning	0.00	0.00	0.00	4.00	3.40	3.50	0.00	0.00	0.00
70% IPA	0.00	0.00	0.00	2.80	2.70	2.40	0.00	0.00	0.00
Calla 1452	0.00	0.00	0.00	2.60	2.40	2.50	0.00	0.00	0.00
Sani-Cide EX3	0.00	0.00	0.00	2.40	2.60	2.70	0.00	0.00	0.00
BactroKill+	0.00	0.00	0.00	2.20	2.20	2.60	0.00	0.00	0.00
PREempt RTU	0.00	0.00	0.00	2.70	2.30	2.50	0.00	0.00	0.00

Table 35. Flammability results for Aerfilm LHR

Vertical Flammability Test Results for Aerfilm LHR (DL2)									
Disinfectant Type	After Flame Time (s)			Burn Length (in)			Drip Flame Time (s)		
	#1	#2	#3	#1	#2	#3	#1	#2	#3
No Conditioning	0.00	0.00	0.00	3.50	3.90	3.10	0.00	0.00	0.00
70% IPA	0.00	0.00	0.00	4.00	3.80	3.80	0.00	0.00	0.00
Calla 1452	0.00	0.00	0.00	3.80	3.60	3.90	0.00	0.00	0.00
Sani-Cide EX3	0.00	0.00	0.00	3.40	3.30	3.10	0.00	0.00	0.00
BactroKill+	0.00	0.00	0.00	3.30	3.40	3.70	0.00	0.00	0.00
PREempt RTU	0.00	0.00	0.00	3.60	3.10	3.40	0.00	0.00	0.00

Table 36. Flammability results for Aerfusion fit

Vertical Flammability Test Results for Aerfusion Fit (DL3)									
Disinfectant Type	After Flame Time (s)			Burn Length (in)			Drip Flame Time (s)		
	#1	#2	#3	#1	#2	#3	#1	#2	#3
No Conditioning	3.90	5.80	3.90	3.50	4.60	4.30	0.00	0.00	0.00
70% IPA	3.80	3.60	3.60	4.10	4.40	4.00	0.00	0.00	0.00
Calla 1452	2.60	3.10	2.60	3.90	4.40	4.20	0.00	0.00	0.00
Sani-Cide EX3	0.00	3.30	0.00	3.90	3.70	3.90	0.00	0.00	0.00
BactroKill+	3.40	5.00	3.30	3.90	3.90	4.00	0.00	0.00	0.00
PREempt RTU	2.80	2.80	3.50	3.80	4.30	3.60	0.00	0.00	0.00

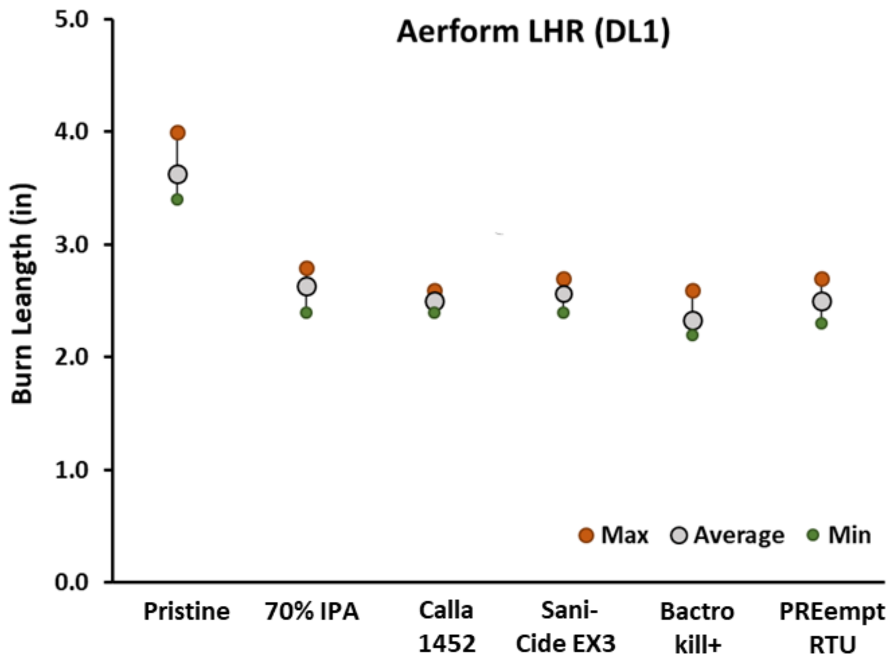


Figure 37. Burn length comparison for Aerform LHR

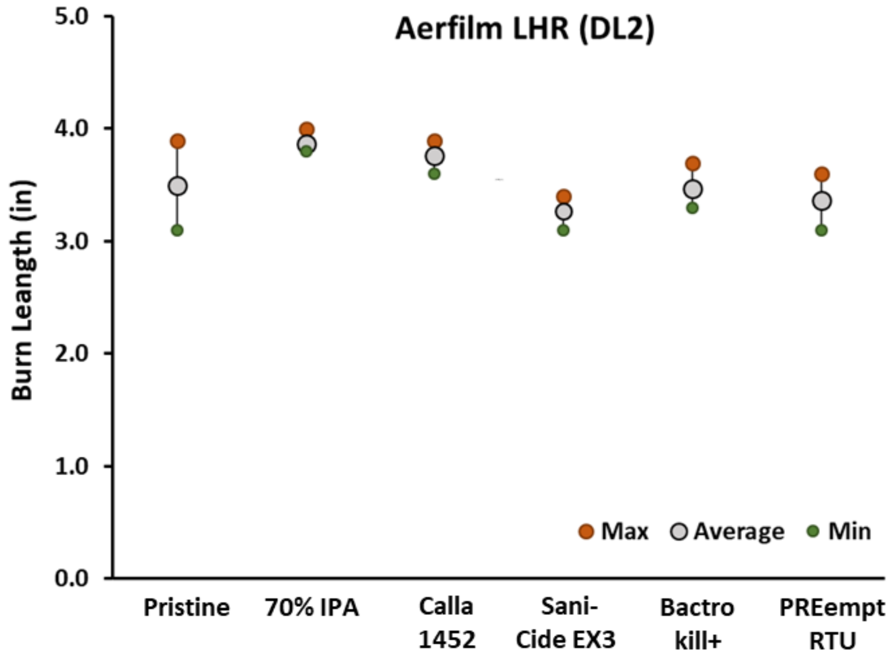


Figure 38. Burn length comparison for Aerfilm LHR

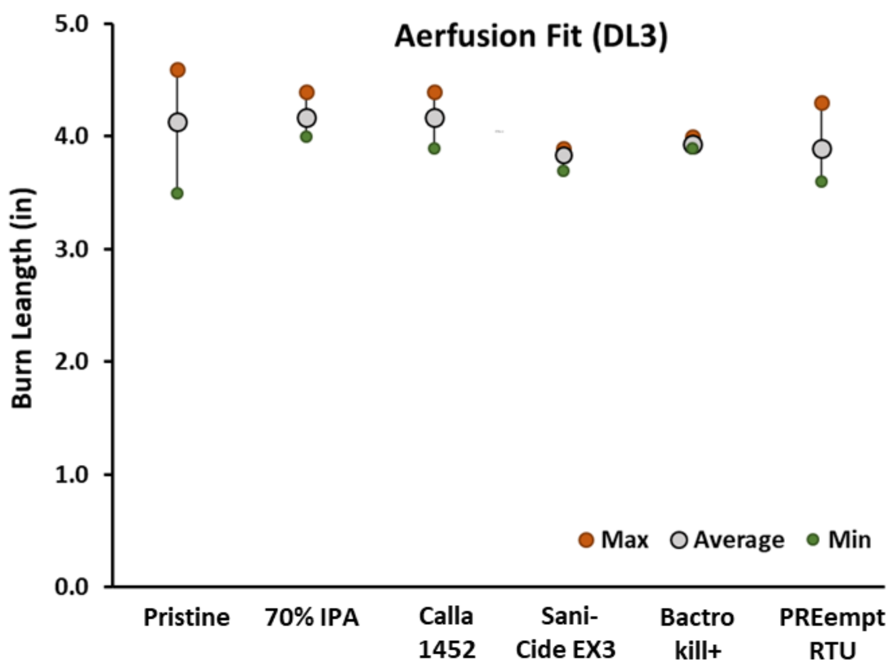


Figure 39. Burn length comparison for Aerfusion fit

6.2.3 Carpet

For polyamide carpet, the change in flammability properties was considered normally equivalent to the untreated material when conditioned with selected disinfectants as summarized in Table 37 and Figure 40.

For wool carpet, the change in flammability properties was considered normally equivalent to the untreated material when conditioned with selected disinfectants as summarized in Table 38 and Figure 41.

Table 37. Flammability results for polyamide carpet

Vertical Flammability Test Results for Polyamide Carpet (C1)									
Disinfectant Type	After Flame Time (s)			Burn Length (in)			Drip Flame Time (s)		
	#1	#2	#3	#1	#2	#3	#1	#2	#3
No Conditioning	19.40	22.80	28.20	5.50	6.00	5.90	0.00	0.00	0.00
70% IPA	19.40	21.80	20.50	5.60	5.40	5.30	0.00	0.00	0.00
Calla 1452	19.40	16.00	19.50	5.50	5.30	5.70	0.00	0.00	0.00
Sani-Cide EX3	47.60	77.50	24.80	5.60	6.20	4.90	0.00	0.00	0.00
BactroKill+	27.40	144.10	16.90	5.20	7.10	4.70	0.00	0.00	0.00
PREempt RTU	7.00	22.40	20.70	5.20	5.50	5.20	0.00	0.00	0.00

Table 38. Flammability results for wool carpet

Vertical Flammability Test Results for Wool Carpet (C2)									
Disinfectant Type	After Flame Time (s)			Burn Length (in)			Drip Flame Time (s)		
	#1	#2	#3	#1	#2	#3	#1	#2	#3
No Conditioning	6.80	8.70	0.00	2.10	1.70	1.70	0.00	0.00	0.00
70% IPA	10.10	7.20	2.00	2.00	1.70	1.80	0.00	0.00	0.00
Calla 1452	3.30	6.60	4.60	2.00	2.20	2.00	0.00	0.00	0.00
Sani-Cide EX3	10.60	11.20	18.40	2.10	2.10	2.00	0.00	0.00	0.00
BactroKill+	4.40	2.20	3.00	1.60	2.40	2.00	0.00	0.00	0.00
PREempt RTU	11.50	7.30	29.70	2.60	2.30	3.00	0.00	0.00	0.00

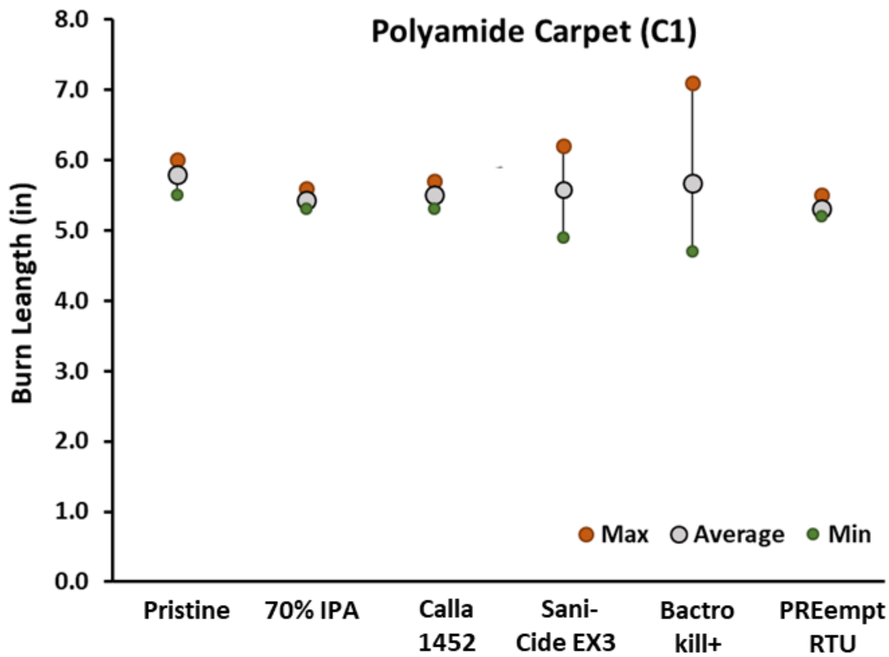


Figure 40. Burn length comparison for polyamide carpet

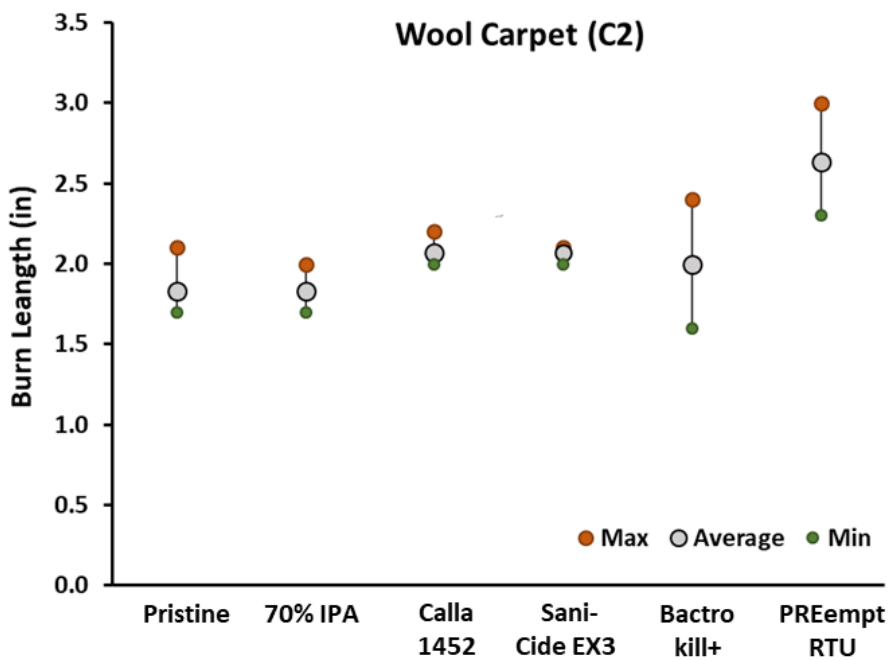


Figure 41. Burn length comparison for wool carpet

6.2.4 ULTEM™ plastic

For ULTEM™ 9075, the change in flammability properties was considered normally equivalent to the untreated material when conditioned with selected disinfectants as summarized in Table 39 and Figure 42.

For ULTEM™ 9085, the change in flammability properties was considered normally equivalent to the untreated material when conditioned with selected disinfectants as summarized in Table 40 and Figure 43.

Table 39. Flammability results for ULTEM™ 9075

Vertical Flammability Test Results for ULTEM 9075 (P5)									
Disinfectant Type	After Flame Time (s)			Burn Length (in)			Drip Flame Time (s)		
	#1	#2	#3	#1	#2	#3	#1	#2	#3
No Conditioning	0.00	0.00	0.00	0.80	0.90	0.90	0.00	0.00	0.00
70% IPA	0.00	0.00	0.00	0.70	0.70	0.80	0.00	0.00	0.00
Calla 1452	0.00	1.40	0.00	0.80	0.80	0.70	0.00	0.00	0.00
Sani-Cide EX3	0.00	0.00	0.00	0.70	0.70	0.60	0.00	0.00	0.00
BactroKill+	0.00	0.00	0.00	0.80	0.90	0.80	0.00	0.00	0.00
PREempt RTU	0.00	0.00	1.60	0.80	0.80	0.90	0.00	0.00	0.00

Table 40. Flammability results for ULTEM™ 9085

Vertical Flammability Test Results for ULTEM 9085 (P6)									
Disinfectant Type	After Flame Time (s)			Burn Length (in)			Drip Flame Time (s)		
	#1	#2	#3	#1	#2	#3	#1	#2	#3
No Conditioning	2.00	0.00	2.40	0.90	0.80	0.70	0.00	0.00	0.00
70% IPA	0.00	0.00	0.00	0.90	1.00	1.00	0.00	0.00	0.00
Calla 1452	0.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00
Sani-Cide EX3	0.00	0.00	0.00	1.00	0.90	0.90	0.00	0.00	0.00
BactroKill+	0.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00
PREempt RTU	0.00	0.00	0.00	1.10	1.00	0.90	0.00	0.00	0.00

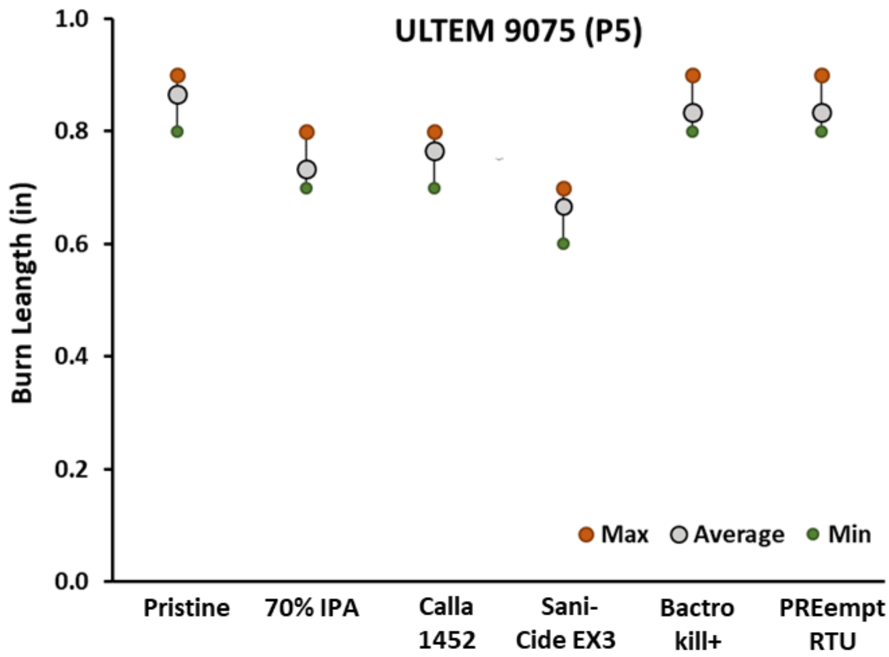


Figure 42. Burn length comparison for ULTEM™ 9075

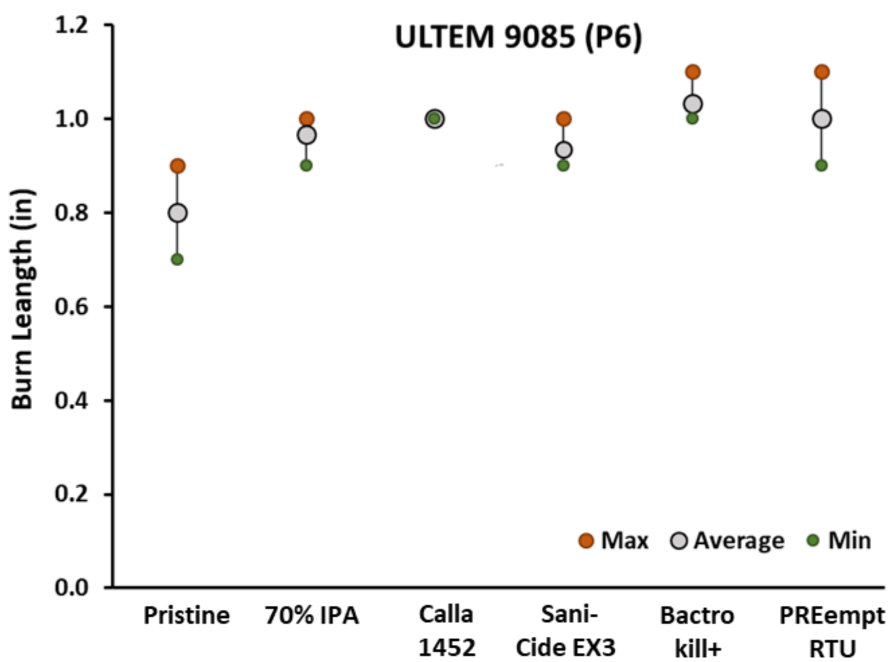


Figure 43. Burn length comparison for ULTEM™ 9085

6.2.5 Fiberglass laminate

For Fiberglass G-10/FR4, the change in flammability properties was considered normally equivalent to the untreated material when conditioned with selected disinfectants as summarized in Table 41 and Figure 44.

Table 41. Flammability results for Fiberglass G-10/FR4

Vertical Flammability Test Results for Fiberglass G-10/FR4 (FG1)									
Disinfectant Type	After Flame Time (s)			Burn Length (in)			Drip Flame Time (s)		
	#1	#2	#3	#1	#2	#3	#1	#2	#3
No Conditioning	0.00	0.00	0.00	1.30	1.20	1.00	0.00	0.00	0.00
70% IPA	1.40	0.00	0.00	0.90	0.70	0.60	0.00	0.00	0.00
Calla 1452	2.20	3.10	1.20	0.70	0.70	0.60	0.00	0.00	0.00
Sani-Cide EX3	0.00	0.00	8.60	1.30	0.80	0.50	0.00	0.00	0.00
BactroKill+	0.00	2.30	0.00	1.30	0.70	0.70	0.00	0.00	0.00
PREempt RTU	0.00	0.00	0.00	1.20	0.60	0.60	0.00	0.00	0.00

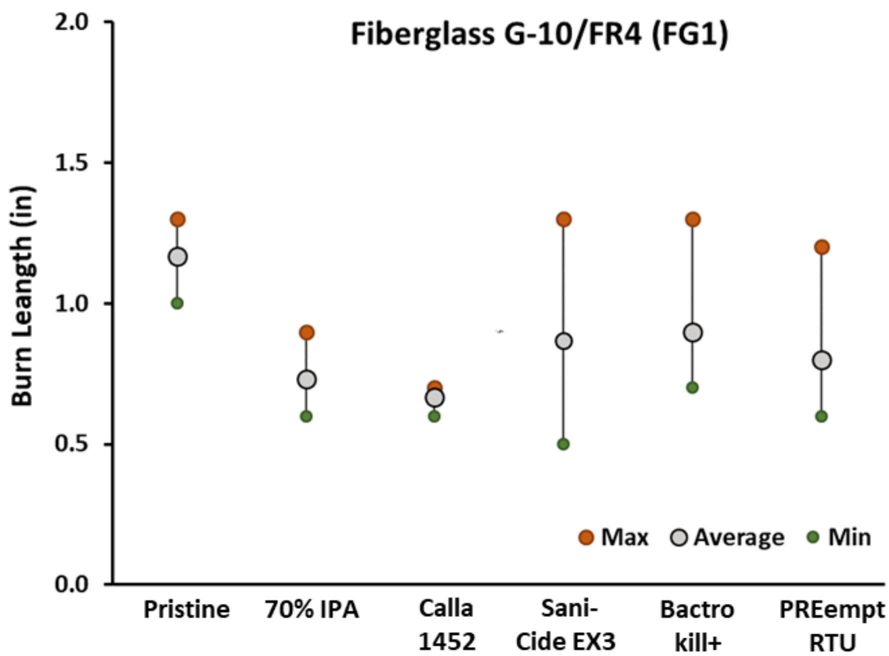


Figure 44. Burn length comparison for Fiberglass G-10/FR4

6.2.6 Summary

Vertical Bunsen Burner Tests were conducted to evaluate the effect of using liquid disinfectants on the flammability properties of selected materials using the wiping methodology. To determine the performance of the flammability results, the criterion defined in Section 6.1 was used. Results based on this criterion are summarized in Table 42.

Table 42. Flammability results summary

Material Type	Material Name	Disinfectant Type				
		70% IPA	Calla 1452	Sani-Cide EX3	BactroKill+	PREempt RTU
Honeycomb	Honeycomb Type A					
Decorative Laminate	Aerform LHR					
	Aerfilm LHR					
	Aerfusion Fit					
Carpet	Polyamide Carpet					
	Wool Carpet					
ULTEM	ULTEM 9075					
	ULTEM 9085					
Fiberglass Laminate	Fiberglass G-10/FR4					

Increase in average burn length is less than or equal to approximately 50% of the average burn length obtained from the unconditioned specimens test data.

7 Physical properties

In this investigation, the effect of liquid disinfectants was evaluated on the weight and color of all the materials. The details of the test methods and observations are discussed in this section.

7.1 Weight change

Weight was measured to an accuracy of 0.01g before and after conditioning the specimens with the conditioning methodology as described in section 4. The change in weight for the materials is summarized in Table 43 through Table 47. No significant weight increase was observed for the selected materials.

Table 43. Weight change comparison of Honeycomb sandwich panel

Material Type	Average Recorded Weight (g)									
	70% IPA		Calla 1452		Sani-cide EX3		BactroKill +		PREempt RTU	
	Pre (g)	Post (g)	Pre (g)	Post (g)	Pre (g)	Post (g)	Pre (g)	Post (g)	Pre (g)	Post (g)
Honeycomb Type A (H1)	47.67	47.64	47.63	47.59	47.63	48.00	47.54	47.56	47.27	47.35

Table 44. Weight change comparison of decorative laminate

Material Type	Average Recorded Weight (g)									
	70% IPA		Calla 1452		Sani-cide EX3		BactroKill +		PREempt RTU	
	Pre (g)	Post (g)	Pre (g)	Post (g)	Pre (g)	Post (g)	Pre (g)	Post (g)	Pre (g)	Post (g)
Aerform LHR (DL1)	46.11	46.12	45.91	45.92	47.11	47.09	47.27	47.24	45.70	45.71
Aerfilm LHR (DL2)	31.59	31.64	32.71	32.75	32.17	32.46	32.34	32.50	32.50	32.56
Aerfusion Fit (DL3)	70.75	70.37	71.21	70.72	71.64	71.50	71.57	71.56	71.77	71.27

Table 45. Weight change comparison of carpet

Material Type	Average Recorded Weight (g)									
	70% IPA		Calla 1452		Sani-cide EX3		BactroKill +		PREempt RTU	
	Pre (g)	Post (g)	Pre (g)	Post (g)	Pre (g)	Post (g)	Pre (g)	Post (g)	Pre (g)	Post (g)
Polyamide Carpet (C1)	42.15	42.16	42.08	42.00	41.90	45.46	42.30	42.91	42.83	43.95
Wool Carpet (C2)	70.25	70.15	68.73	69.21	68.88	73.39	68.17	69.49	64.71	65.94

Table 46. Weight change comparison of ULTEM™

Material Type	Average Recorded Weight (g)									
	70% IPA		Calla 1452		Sani-cide EX3		BactroKill +		PREempt RTU	
	Pre (g)	Post (g)	Pre (g)	Post (g)	Pre (g)	Post (g)	Pre (g)	Post (g)	Pre (g)	Post (g)
ULTEM 9075 (P5)	111.01	111.17	110.29	110.37	111.73	111.85	111.71	111.83	109.14	109.28
ULTEM 9085 (P6)	113.26	113.37	110.04	110.07	114.75	113.14	111.07	111.13	111.03	111.11

Table 47. Weight change comparison of fiberglass laminate

Material Type	Average Recorded Weight (g)									
	70% IPA		Calla 1452		Sani-cide EX3		BactroKill +		PREempt RTU	
	Pre (g)	Post (g)	Pre (g)	Post (g)	Pre (g)	Post (g)	Pre (g)	Post (g)	Pre (g)	Post (g)
Fiberglass G-10/FR4 (FG1)	170.39	167.03	169.42	169.33	170.40	170.39	169.29	169.20	169.49	169.36

7.2 Color change

In this investigation, the effects of the liquid disinfectants on the material color were evaluated. Only qualitative comparison was done by capturing images of test specimens before and after conditioning.

7.2.1 Qualitative change

Table 48 summarizes qualitative color change due to conditioning of selected materials with liquid disinfectants. A comparison of the images before and after conditioning for selected materials is shown in Figure 45 to Figure 54.

Honeycomb sandwich and fiberglass laminate specimens conditioned with Sani-Cide EX3 had a tacky residue on the surface. No color change was observed when conditioned with 70% IPA, Calla 1452, BactroKill+, and PREempt RTU.

No color change was observed for decorative laminate when conditioned with Calla 1452, BactroKill+, and PREempt RTU. A tacky residue appeared on the material surface when conditioned with Sani-Cide EX3. Due to the use of microfiber cloths during the process, a change of color occurred only on Aerfusion fit while conditioning with 70% IPA. No color or texture change was observed on Aerform LHR and Aerfilm LHR when conditioned with 70% IPA.

No color change was observed for carpet and ULTEM™ materials when conditioned with selected liquid disinfectants.

Table 48. Qualitative color change summary

Material Type	Material Name	Liquid Disinfectant Type				
		70% IPA	Calla 1452	Sani-Cide EX3	BactroKill +	PREempt RTU
Honeycomb	Honeycomb Type A					
Decorative Laminate	Aerform LHR					
	Aerfilm LHR					
	Aerfusion Fit					
Carpet	Polyamide Carpet					
	Wool Carpet					
ULTEM	ULTEM 9075					
	ULTEM 9085					
Fiberglass Laminate	Fiberglass G-10/FR4					

No change in color nor texture
Change in color only
Change in color due to the microfiber cloth

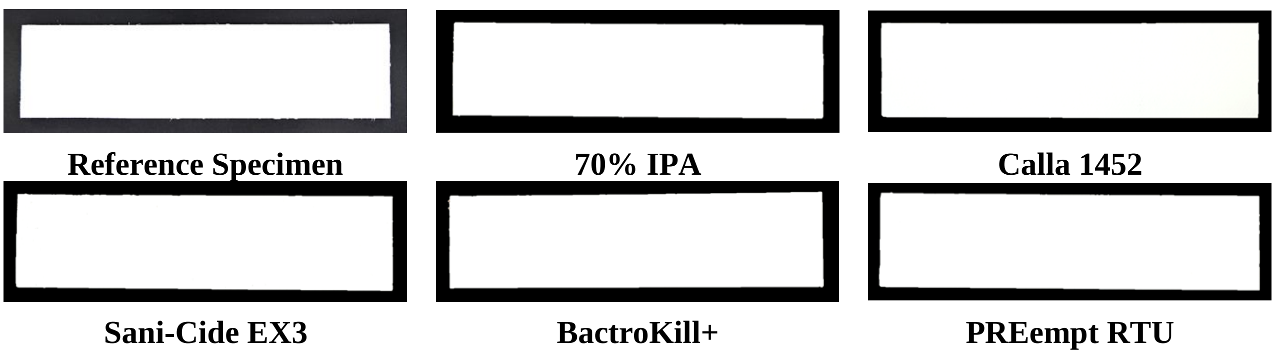


Figure 45. Color qualitative comparison of honeycomb Sandwich Panel Tedlar side

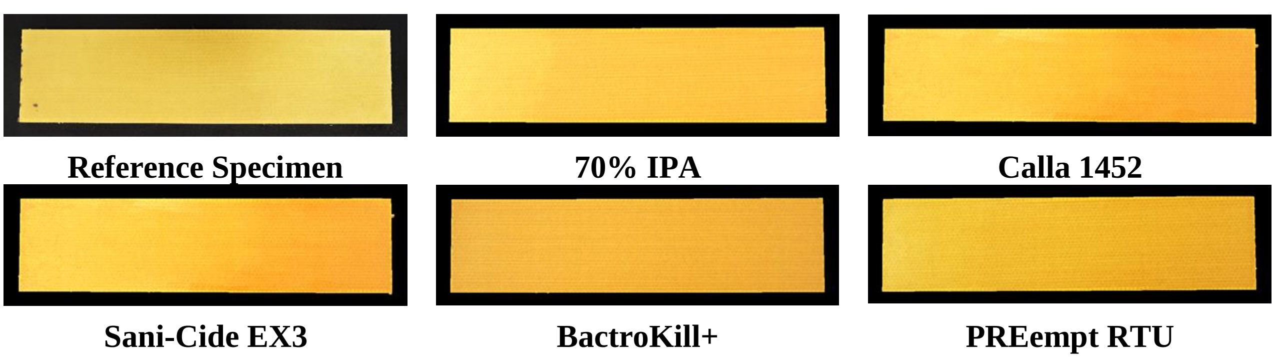


Figure 46. Color qualitative comparison of honeycomb type A bare side

Figure 47. Color qualitative comparison of Aerform LHR

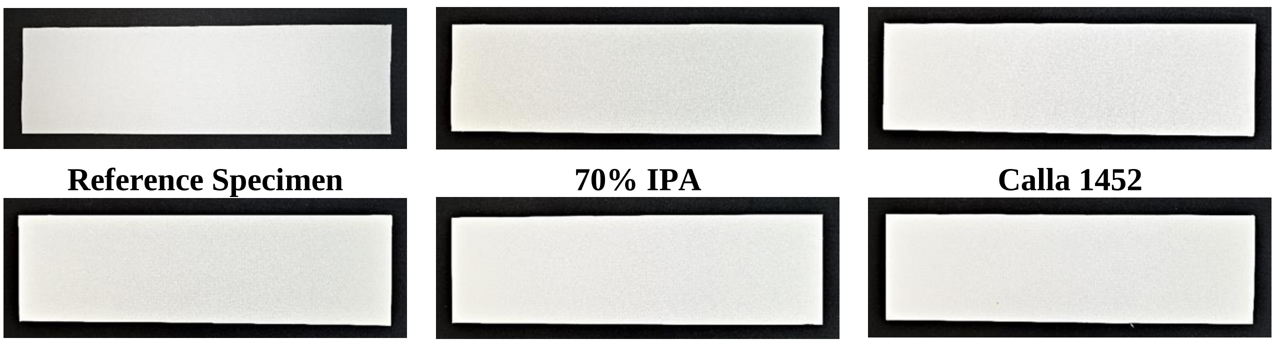


Figure 48. Color qualitative comparison of Aerfilm LHR

Figure 49. Color qualitative comparison of Aerfusion Fit

Figure 50. Color qualitative comparison of polyamide carpet

Figure 51. Color qualitative comparison of wool carpet

Figure 52. Color qualitative comparison of ULTEM^{TM} 9075

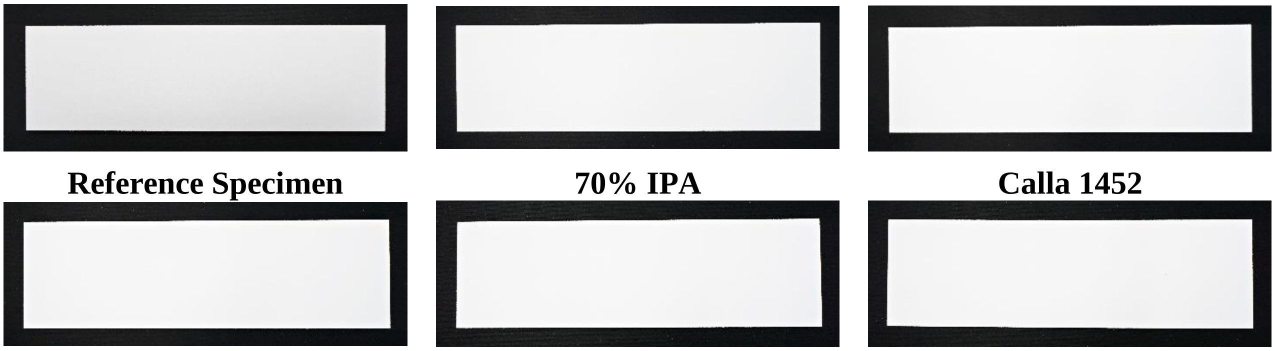


Figure 53. Color qualitative comparison of ULTEM™ 9085

Figure 54. Color qualitative comparison of Fiberglass G-10/FR4

8 Conclusions

The effect of liquid chemical disinfectants was evaluated on the flammability, mechanical, and physical properties of materials used in an aircraft cabin interior. Materials and disinfectants used in this research were selected in conjunction with the SAE Aircraft Seat (SAE aircraft SEAT committee, n.d.) and SAE Cabin Interior committees (S-9 Cabin safety provisions committee, n.d.). Materials were conditioned with liquid disinfectants following one of two different methods – submersion or wiping. The submersion method is to condition specimens by fully immersing them in the liquid disinfectant for extended time periods. This conditioning approach simulated accelerated cycle testing and it was conservative. Hence, the submersion method was selected for ULTEM™ materials only and the wiping method was the primary conditioning method for the remaining materials. The wiping conditioning method was to simulate the real-world application of the liquid disinfectants in aircraft cabin interior, which was achieved by wiping the test specimens by hand for 1000 cycles.

In this research, only qualitative comparisons of color appearance and surface texture were performed. The comparison showed no color change due to the use of liquid disinfectants. Change in texture was observed for all honeycomb, decorative laminate, and fiberglass laminate materials that were treated with Sani-Cide EX3. The disinfectant left a tacky residual finish on the surface.

Flatwise compression, long beam flexure, and climbing drum peel were conducted on honeycomb sandwich material following ASTM C365, ASTM D7249, and ASTM D1781, respectively. Uniaxial tension tests were conducted on ULTEM™ and decorative laminate per ASTM D638. Uniaxial tension test per ASTM D3039 and short-beam shear test per ASTM D2344 were conducted on fiberglass laminate. Statistical evaluation following CMH-17 guidelines was performed for equivalency of the material properties when comparing the conditioned specimens to the pristine specimens. Due to the small sample batches tested, a modified coefficient of variation method was utilized for equivalency criteria. All specimens treated with selected liquid disinfectants were equivalent to the unconditioned specimens with the modified CV method, as presented in Table 49.

Table 49. Mechanical properties results summary

Material Name	Material Properties	Disinfectant Type				
		70% IPA	Calla 1452	Sani-Cide EX3	BactroKill+	PREempt RTU
Honeycomb Type A	Ultimate Compressive Strength					
	Maximum Flexural Load					
	Average Peel Strength					
Aerform LHR	Tensile Strength					
	Yield Stress					
ULTEM 9075	Tensile Strength					
	Yield Stress					
ULTEM 9085	Tensile Strength					
	Yield Stress					
Fiberglass G-10/FR4	Tensile Strength					
	Longitudinal Modulus					
	Short-Beam Strength					

Material properties "equivalent" to unconditioned specimens based on limited data with modified coefficient of variation

Vertical Bunsen Burner Tests, as per 14 CFR Appendix F of Part 25 (Part I - Test Criteria and Procedures for Showing Compliance With § 25.853 or § 25.855, 2022), were conducted to evaluate the effect of using liquid disinfectants on the flammability properties. The purpose of these tests was to compare the flammability performance of the material when conditioned with liquid disinfectants against unconditioned specimens. Based on the criterion defined, the change in flammability properties was either considered significantly different or normally equivalent to the untreated material. All materials had flammability results that were normally equivalent to the untreated materials, as summarized in Table 50.

Table 50. Flammability results summary

Material Type	Material Name	Disinfectant Type				
		70% IPA	Calla 1452	Sani-Cide EX3	BactroKill+	PREempt RTU
Honeycomb	Honeycomb Type A					
Decorative Laminate	Aerform LHR					
	Aerfilm LHR					
	Aerfusion Fit					
Carpet	Polyamide Carpet					
	Wool Carpet					
ULTEM	ULTEM 9075					
	ULTEM 9085					
Fiberglass Laminate	Fiberglass G-10/FR4					

Increase in average burn length is less than or equal to approximately 50 % of the average burn length obtained from the unconditioned specimens test data.

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A Honeycomb strength specimen dimensions

Table A- 1. Specimen dimensions for honeycomb Sandwich Panel – Flatwise compression

Specimen	L1	L2	L3	Lavg	W1	W2	W3	Wavg	T1	T2	T3	Tavg
FAA-C-H1-D0-01	3.0245	3.0255	3.0250	3.0250	3.0145	3.0160	3.0225	3.0177	0.4095	0.4095	0.4095	0.4095
FAA-C-H1-D0-02	3.0320	3.0290	3.0280	3.0297	3.0185	3.0195	3.0200	3.0193	0.4055	0.4050	0.4045	0.4050
FAA-C-H1-D0-03	3.0205	3.0165	3.0185	3.0185	3.0280	3.0255	3.0245	3.0260	0.4085	0.4085	0.4075	0.4082
FAA-C-H1-D0-04	3.0285	3.0280	3.0285	3.0283	3.0195	3.0210	3.0160	3.0188	0.4140	0.4140	0.4135	0.4138
FAA-C-H1-D0-05	3.0250	3.0270	3.0225	3.0248	3.0210	3.0180	3.0150	3.0180	0.4125	0.4125	0.4125	0.4125
FAA-C-H1-D1-01	3.0190	3.0185	3.0180	3.0185	3.0260	3.0245	3.0240	3.0248	0.4110	0.4110	0.4115	0.4112
FAA-C-H1-D1-02	3.0200	3.0165	3.0145	3.0170	3.0275	3.0240	3.0250	3.0255	0.4060	0.4060	0.4060	0.4060
FAA-C-H1-D1-03	3.0260	3.0270	3.0255	3.0262	3.0095	3.0125	3.0185	3.0135	0.4095	0.4090	0.4100	0.4095
FAA-C-H1-D1-04	3.0215	3.0225	3.0305	3.0248	3.0215	3.0200	3.0180	3.0198	0.4125	0.4130	0.4125	0.4127
FAA-C-H1-D1-05	3.0255	3.0300	3.0255	3.0270	3.0210	3.0165	3.0140	3.0172	0.4125	0.4125	0.4130	0.4127
FAA-C-H1-D2-01	3.0255	3.0260	3.0270	3.0262	3.0150	3.0210	3.0215	3.0192	0.4085	0.4085	0.4075	0.4082
FAA-C-H1-D2-02	3.0275	3.0260	3.0260	3.0265	3.0215	3.0215	3.0195	3.0208	0.4075	0.4080	0.4080	0.4078
FAA-C-H1-D2-03	3.0270	3.0270	3.0235	3.0258	3.0205	3.0215	3.0160	3.0193	0.4155	0.4145	0.4145	0.4148
FAA-C-H1-D2-04	3.0220	3.0255	3.0270	3.0248	3.0170	3.0075	2.9965	3.0070	0.4130	0.4130	0.4135	0.4132
FAA-C-H1-D2-05	3.0125	3.0155	3.0120	3.0133	3.0210	3.0230	3.0235	3.0225	0.4050	0.4055	0.4055	0.4053
FAA-C-H1-D3-01	3.0190	3.0125	3.0045	3.0120	3.0185	3.0265	3.0260	3.0237	0.4060	0.4065	0.4045	0.4057
FAA-C-H1-D3-02	3.0260	3.0250	3.0235	3.0248	3.0170	3.0120	3.0070	3.0120	0.4130	0.4130	0.4130	0.4130
FAA-C-H1-D3-03	3.0210	3.0195	3.0175	3.0193	3.0245	3.0210	3.0240	3.0232	0.4055	0.4050	0.4055	0.4053
FAA-C-H1-D3-04	3.0245	3.0260	3.0270	3.0258	3.0215	3.0150	3.0160	3.0175	0.4120	0.4120	0.4120	0.4120
FAA-C-H1-D3-05	3.0175	3.0100	3.0050	3.0108	3.0250	3.0235	3.0220	3.0235	0.4060	0.4055	0.4065	0.4060
FAA-C-H1-D4-01	3.0250	3.0270	3.0280	3.0267	3.0140	3.0145	3.0150	3.0145	0.4035	0.4040	0.4040	0.4038
FAA-C-H1-D4-02	3.0280	3.0295	3.0250	3.0275	3.0150	3.0120	3.0085	3.0118	0.4110	0.4115	0.4115	0.4113
FAA-C-H1-D4-03	3.0245	3.0220	3.0240	3.0235	3.0170	3.0115	3.0065	3.0117	0.4145	0.4135	0.4130	0.4137
FAA-C-H1-D4-04	3.0265	3.0260	3.0265	3.0263	3.0215	3.0185	3.0170	3.0190	0.4095	0.4095	0.4095	0.4095
FAA-C-H1-D4-05	3.0230	3.0225	3.0215	3.0223	3.0205	3.0195	3.0205	3.0202	0.4100	0.4105	0.4110	0.4105
FAA-C-H1-D5-01	3.0265	3.0280	3.0265	3.0270	3.0260	3.0205	3.0185	3.0217	0.4075	0.4065	0.4070	0.4070
FAA-C-H1-D5-02	3.0120	3.0210	3.0195	3.0175	3.0215	3.0195	3.0260	3.0223	0.4070	0.4075	0.4075	0.4073
FAA-C-H1-D5-03	3.0245	3.0280	3.0235	3.0253	3.0155	3.0145	3.0100	3.0133	0.4035	0.4035	0.4035	0.4035
FAA-C-H1-D5-04	3.0260	3.0270	3.0250	3.0260	3.0215	3.0165	3.0115	3.0165	0.4035	0.4040	0.4040	0.4038
FAA-C-H1-D5-05	3.0195	3.0195	3.0185	3.0192	3.0255	3.0305	3.0225	3.0262	0.4055	0.4055	0.4050	0.4053

Table A- 2. Specimen dimensions for honeycomb Sandwich Panel – Long beam flexure

Specimen	L	W1	W2	W3	Wavg	T1	T2	T3	Tavg	Tt11	Tt12	Ttavg	Tb21	Tb22	Tbavg
FAA-F-H1-D0-01	24.0000	3.0190	3.0195	3.0215	3.0200	0.4085	0.4150	0.4140	0.4125	0.0190	0.0185	0.0188	0.0175	0.0170	0.0173
FAA-F-H1-D0-02	24.0000	3.0180	3.0200	3.0195	3.0192	0.4085	0.4080	0.4080	0.4082	0.0180	0.0185	0.0183	0.0175	0.0165	0.0170
FAA-F-H1-D0-03	24.0000	3.0210	3.0195	3.0210	3.0205	0.4045	0.4085	0.4075	0.4068	0.0160	0.0205	0.0183	0.0155	0.0135	0.0145
FAA-F-H1-D0-04	24.0000	3.0195	3.0210	3.0215	3.0207	0.4160	0.4100	0.4090	0.4117	0.0185	0.0185	0.0185	0.0175	0.0150	0.0163
FAA-F-H1-D0-05	24.0000	3.0170	3.0160	3.0260	3.0197	0.4150	0.4155	0.4150	0.4152	0.0195	0.0185	0.0190	0.0190	0.0190	0.0190
FAA-F-H1-D1-01	24.0000	3.0195	3.0215	3.0200	3.0203	0.4085	0.4300	0.4085	0.4157	0.0165	0.0160	0.0163	0.0150	0.0155	0.0153
FAA-F-H1-D1-02	24.0000	3.0200	3.0195	3.0230	3.0208	0.4085	0.4120	0.4115	0.4107	0.0170	0.0175	0.0173	0.0165	0.0175	0.0170
FAA-F-H1-D1-03	24.0000	3.0215	3.0195	3.0205	3.0205	0.4070	0.4100	0.4055	0.4075	0.0170	0.0170	0.0170	0.0155	0.0160	0.0158
FAA-F-H1-D1-04	24.0000	3.0110	3.0130	3.0135	3.0125	0.4100	0.4170	0.4125	0.4132	0.0195	0.0185	0.0190	0.0165	0.0160	0.0163
FAA-F-H1-D1-05	24.0000	3.0200	3.0260	3.0230	3.0230	0.4075	0.4075	0.4095	0.4082	0.0195	0.0185	0.0190	0.0190	0.0195	0.0193
FAA-F-H1-D2-01	24.0000	3.0210	3.0190	3.0180	3.0193	0.4045	0.4075	0.4185	0.4102	0.0185	0.0180	0.0183	0.0170	0.0170	0.0170
FAA-F-H1-D2-02	24.0000	3.0195	3.0185	3.0270	3.0217	0.4185	0.4150	0.4150	0.4162	0.0220	0.0190	0.0205	0.0195	0.0215	0.0205
FAA-F-H1-D2-03	24.0000	3.0180	3.0185	3.0165	3.0177	0.4065	0.4280	0.4205	0.4183	0.0190	0.0195	0.0193	0.0170	0.0160	0.0165
FAA-F-H1-D2-04	24.0000	3.0205	3.0250	3.0215	3.0223	0.4045	0.4300	0.4215	0.4187	0.0155	0.0160	0.0158	0.0240	0.0150	0.0195
FAA-F-H1-D2-05	24.0000	3.0205	3.0220	3.0230	3.0218	0.4120	0.4205	0.4245	0.4190	0.0185	0.0205	0.0195	0.0210	0.0195	0.0203
FAA-F-H1-D3-01	24.0000	3.0230	3.0245	3.0270	3.0248	0.4065	0.4345	0.4205	0.4205	0.0190	0.0195	0.0193	0.0205	0.0220	0.0213
FAA-F-H1-D3-02	24.0000	3.0230	3.0180	3.0175	3.0195	0.4090	0.4150	0.4125	0.4122	0.0200	0.0195	0.0198	0.0175	0.0185	0.0180
FAA-F-H1-D3-03	24.0000	3.0185	3.0190	3.0200	3.0192	0.4120	0.4255	0.4170	0.4182	0.0210	0.0195	0.0203	0.0205	0.0190	0.0198
FAA-F-H1-D3-04	24.0000	3.0195	3.0195	3.0185	3.0192	0.4130	0.4110	0.4115	0.4118	0.0205	0.0195	0.0200	0.0180	0.0190	0.0185
FAA-F-H1-D3-05	24.0000	3.0195	3.0180	3.0160	3.0178	0.4095	0.4110	0.4100	0.4102	0.0190	0.0190	0.0190	0.0155	0.0155	0.0155
FAA-F-H1-D4-01	24.0000	3.0195	3.0205	3.0200	3.0200	0.4080	0.4280	0.4310	0.4223	0.0195	0.0190	0.0193	0.0175	0.0190	0.0183
FAA-F-H1-D4-02	24.0000	3.0215	3.0210	3.0255	3.0227	0.4115	0.4190	0.4095	0.4133	0.0170	0.0185	0.0178	0.0190	0.0175	0.0183
FAA-F-H1-D4-03	24.0000	3.0185	3.0190	3.0185	3.0187	0.4085	0.4175	0.4080	0.4113	0.0195	0.0185	0.0190	0.0195	0.0150	0.0173
FAA-F-H1-D4-04	24.0000	3.0215	3.0200	3.0185	3.0200	0.4200	0.4360	0.4140	0.4233	0.0215	0.0210	0.0213	0.0205	0.0185	0.0195
FAA-F-H1-D4-05	24.0000	3.0185	3.0190	3.0240	3.0205	0.4075	0.4075	0.4120	0.4090	0.0210	0.0205	0.0208	0.0175	0.0185	0.0180
FAA-F-H1-D5-01	24.0000	3.0190	3.0215	3.0220	3.0208	0.4170	0.4215	0.4295	0.4227	0.0180	0.0175	0.0178	0.0230	0.0185	0.0208
FAA-F-H1-D5-02	24.0000	3.0260	3.0195	3.0215	3.0223	0.4085	0.4100	0.4230	0.4138	0.0190	0.0190	0.0190	0.0150	0.0155	0.0153
FAA-F-H1-D5-03	24.0000	3.0185	3.0200	3.0180	3.0188	0.4060	0.4090	0.4275	0.4142	0.0210	0.0165	0.0188	0.0185	0.0175	0.0180
FAA-F-H1-D5-04	24.0000	3.0200	3.0225	3.0225	3.0217	0.4105	0.4150	0.4255	0.4170	0.0185	0.0175	0.0180	0.0205	0.0175	0.0190
FAA-F-H1-D5-05	24.0000	3.0195	3.0200	3.0190	3.0195	0.4090	0.4080	0.4085	0.4085	0.0170	0.0170	0.0170	0.0175	0.0175	0.0175

Table A- 3. Specimen dimensions for honeycomb Sandwich Panel – Climbing drum peel

Specimen	L	W1	W2	W3	Wavg	T1	T2	T3	Tavg	TO1	TO2	Tavg	TU1	TU2	Tavg
FAA-P-H1-D0-01	12.1250	3.0355	3.0210	3.0240	3.0268	0.4065	0.4075	0.4090	0.4077	0.0220	0.0230	0.0225	0.0225	0.0200	0.0213
FAA-P-H1-D0-02	12.0625	3.0280	3.0185	3.0180	3.0215	0.4085	0.4075	0.4075	0.4078	0.0220	0.0230	0.0225	0.0225	0.0200	0.0213
FAA-P-H1-D0-03	12.0625	3.0250	3.0200	3.0225	3.0225	0.4095	0.4080	0.4055	0.4077	0.0215	0.0275	0.0245	0.0225	0.0240	0.0233
FAA-P-H1-D0-04	12.0625	3.0145	3.0180	3.0100	3.0142	0.4055	0.4060	0.4085	0.4067	0.0250	0.0245	0.0248	0.0275	0.0220	0.0248
FAA-P-H1-D0-05	12.0625	3.0195	3.0190	3.0180	3.0188	0.4115	0.4110	0.4100	0.4108	0.0200	0.0220	0.0210	0.0200	0.0230	0.0215
FAA-P-H1-D1-01	12.0625	3.0215	3.0150	3.0170	3.0178	0.4085	0.4105	0.4125	0.4105	0.0230	0.0215	0.0223	0.0185	0.0210	0.0198
FAA-P-H1-D1-02	12.0625	3.0165	3.0560	3.0280	3.0335	0.4080	0.4090	0.4100	0.4090	0.0210	0.0210	0.0210	0.0190	0.0210	0.0200
FAA-P-H1-D1-03	12.0625	3.0205	3.0475	3.0310	3.0330	0.4125	0.4120	0.4105	0.4117	0.0220	0.0195	0.0208	0.0160	0.0185	0.0173
FAA-P-H1-D1-04	12.0625	3.0250	3.0455	3.0420	3.0375	0.4080	0.4085	0.4095	0.4087	0.0215	0.0230	0.0223	0.0190	0.0215	0.0203
FAA-P-H1-D1-05	12.0625	3.0300	3.0460	3.0210	3.0323	0.4100	0.4095	0.4105	0.4100	0.0185	0.0215	0.0200	0.0165	0.0185	0.0175
FAA-P-H1-D2-01	12.0625	3.0165	3.0190	3.0205	3.0187	0.4150	0.4120	0.4150	0.4140	0.0195	0.0175	0.0185	0.0200	0.0205	0.0203
FAA-P-H1-D2-02	12.0625	3.0520	3.0520	3.0310	3.0450	0.4105	0.4155	0.4165	0.4142	0.0155	0.0240	0.0198	0.0185	0.0180	0.0183
FAA-P-H1-D2-03	12.0625	3.0315	3.0315	3.0330	3.0320	0.4125	0.4090	0.4090	0.4102	0.0175	0.0190	0.0183	0.0195	0.0180	0.0188
FAA-P-H1-D2-04	12.0625	3.0345	3.0245	3.0420	3.0337	0.4220	0.4110	0.4145	0.4158	0.0150	0.0185	0.0168	0.0175	0.0150	0.0163
FAA-P-H1-D2-05	12.0625	3.0260	3.0370	3.0455	3.0362	0.4170	0.4205	0.4110	0.4162	0.0200	0.0190	0.0195	0.0170	0.0190	0.0180
FAA-P-H1-D3-01	12.0625	3.0070	3.0195	3.0180	3.0148	0.4110	0.4095	0.4055	0.4087	0.0205	0.0210	0.0208	0.0210	0.0200	0.0205
FAA-P-H1-D3-02	12.0625	3.0125	3.0095	3.0095	3.0105	0.4185	0.4200	0.4065	0.4150	0.0220	0.0200	0.0210	0.0185	0.0180	0.0183
FAA-P-H1-D3-03	12.0625	3.0235	3.0445	3.0460	3.0380	0.4160	0.4100	0.4075	0.4112	0.0205	0.0250	0.0228	0.0210	0.0205	0.0208
FAA-P-H1-D3-04	12.0625	3.0270	3.0545	3.0490	3.0435	0.4130	0.4105	0.4085	0.4107	0.0195	0.0220	0.0208	0.0210	0.0210	0.0210
FAA-P-H1-D3-05	12.0625	3.0280	3.0330	3.0390	3.0333	0.4140	0.4100	0.4085	0.4108	0.0190	0.0175	0.0183	0.0205	0.0170	0.0188
FAA-P-H1-D4-01	12.0625	3.0135	3.0320	3.0425	3.0293	0.4050	0.4175	0.4050	0.4092	0.0220	0.0240	0.0230	0.0200	0.0215	0.0208
FAA-P-H1-D4-02	12.0625	3.0180	3.0305	3.0200	3.0228	0.4110	0.4115	0.4135	0.4120	0.0270	0.0220	0.0245	0.0195	0.0185	0.0190
FAA-P-H1-D4-03	12.0625	3.0195	3.0260	3.0215	3.0223	0.4115	0.4095	0.4100	0.4103	0.0225	0.0205	0.0215	0.0215	0.0185	0.0200
FAA-P-H1-D4-04	12.0625	3.0210	3.0260	3.0370	3.0280	0.4110	0.4100	0.4060	0.4090	0.0165	0.0210	0.0188	0.0185	0.0195	0.0190
FAA-P-H1-D4-05	12.0625	3.0205	3.0205	3.0200	3.0203	0.4100	0.4085	0.4085	0.4090	0.0210	0.0230	0.0220	0.0195	0.0200	0.0198
FAA-P-H1-D5-01	12.0625	3.0200	3.0205	3.0200	3.0202	0.4135	0.4105	0.4175	0.4138	0.0175	0.0170	0.0173	0.0190	0.0175	0.0183
FAA-P-H1-D5-02	12.0625	3.0200	3.0205	3.0190	3.0198	0.4155	0.4165	0.4170	0.4163	0.0195	0.0160	0.0178	0.0225	0.0210	0.0218
FAA-P-H1-D5-03	12.0625	3.0250	3.0200	3.0200	3.0217	0.4120	0.4115	0.4100	0.4112	0.0220	0.0235	0.0228	0.0220	0.0220	0.0220
FAA-P-H1-D5-04	12.0625	3.0075	3.0070	3.0075	3.0073	0.4030	0.4035	0.4060	0.4042	0.0205	0.0195	0.0200	0.0200	0.0200	0.0200
FAA-P-H1-D5-05	12.0625	3.0180	3.0175	3.0200	3.0185	0.4090	0.4090	0.4090	0.4090	0.0180	0.0210	0.0195	0.0180	0.0185	0.0183

B Decorative laminate strength specimen dimensions

Table B- 1. Specimen dimensions for Aerform LHR

Specimen	LO	WO	W1	W2	W3	Wavg	T1	T2	T3	Tavg
FAA-T-DL1-D0-01	2.5070	0.3765	0.1225	0.1205	0.1210	0.1213	0.0485	0.0485	0.0485	0.0485
FAA-T-DL1-D0-02	2.4995	0.3780	0.1210	0.1205	0.1215	0.1210	0.0475	0.0475	0.0480	0.0477
FAA-T-DL1-D0-03	2.5050	0.3770	0.1210	0.1215	0.1215	0.1213	0.0475	0.0475	0.0475	0.0475
FAA-T-DL1-D0-04	2.5060	0.3770	0.1215	0.1205	0.1205	0.1208	0.0475	0.0475	0.0480	0.0477
FAA-T-DL1-D0-05	2.4965	0.3770	0.1215	0.1205	0.1210	0.1210	0.0480	0.0475	0.0475	0.0477
FAA-T-DL1-D1-01	2.5055	0.3780	0.1210	0.1205	0.1210	0.1208	0.0480	0.0475	0.0475	0.0477
FAA-T-DL1-D1-02	2.5065	0.3770	0.1220	0.1215	0.1210	0.1215	0.0470	0.0470	0.0470	0.0470
FAA-T-DL1-D1-03	2.5055	0.3770	0.1215	0.1205	0.1205	0.1208	0.0485	0.0485	0.0480	0.0483
FAA-T-DL1-D1-04	2.5050	0.3770	0.1220	0.1215	0.1215	0.1217	0.0470	0.0470	0.0470	0.0470
FAA-T-DL1-D1-05	2.5055	0.3770	0.1215	0.1205	0.1205	0.1208	0.0475	0.0485	0.0475	0.0478
FAA-T-DL1-D2-01	2.5055	0.3770	0.1215	0.1205	0.1205	0.1208	0.0480	0.0485	0.0480	0.0482
FAA-T-DL1-D2-02	2.5055	0.3785	0.1215	0.1215	0.1210	0.1213	0.0470	0.0470	0.0470	0.0470
FAA-T-DL1-D2-03	2.5065	0.3770	0.1215	0.1210	0.1215	0.1213	0.0485	0.0480	0.0480	0.0482
FAA-T-DL1-D2-04	2.5055	0.3780	0.1215	0.1210	0.1215	0.1213	0.0470	0.0475	0.0475	0.0473
FAA-T-DL1-D2-05	2.5070	0.3775	0.1205	0.1205	0.1210	0.1207	0.0470	0.0475	0.0475	0.0473
FAA-T-DL1-D3-01	2.5060	0.3775	0.1220	0.1210	0.1210	0.1213	0.0480	0.0475	0.0475	0.0477
FAA-T-DL1-D3-02	2.4990	0.3770	0.1220	0.1205	0.1210	0.1212	0.0480	0.0490	0.0480	0.0483
FAA-T-DL1-D3-03	2.5055	0.3775	0.1215	0.1210	0.1205	0.1210	0.0475	0.0480	0.0475	0.0477
FAA-T-DL1-D3-04	2.5040	0.3770	0.1220	0.1210	0.1210	0.1213	0.0475	0.0480	0.0470	0.0475
FAA-T-DL1-D3-05	2.5050	0.3770	0.1220	0.1215	0.1230	0.1222	0.0480	0.0480	0.0475	0.0478
FAA-T-DL1-D4-01	2.5065	0.3775	0.1215	0.1205	0.1215	0.1212	0.0470	0.0480	0.0475	0.0475
FAA-T-DL1-D4-02	2.5060	0.3780	0.1215	0.1215	0.1215	0.1215	0.0475	0.0470	0.0475	0.0473
FAA-T-DL1-D4-03	2.5060	0.3765	0.1215	0.1215	0.1215	0.1215	0.0475	0.0475	0.0480	0.0477
FAA-T-DL1-D4-04	2.5040	0.3770	0.1215	0.1205	0.1210	0.1210	0.0480	0.0480	0.0480	0.0480
FAA-T-DL1-D4-05	2.5040	0.3775	0.1215	0.1210	0.1220	0.1215	0.0470	0.0470	0.0475	0.0472
FAA-T-DL1-D5-01	2.5055	0.3780	0.1305	0.1290	0.1290	0.1295	0.0470	0.0470	0.0470	0.0470
FAA-T-DL1-D5-02	2.5040	0.3775	0.1215	0.1210	0.1205	0.1210	0.0475	0.0480	0.0480	0.0478
FAA-T-DL1-D5-03	2.5045	0.3770	0.1210	0.1205	0.1215	0.1210	0.0470	0.0470	0.0470	0.0470
FAA-T-DL1-D5-04	2.5040	0.3770	0.1220	0.1215	0.1205	0.1213	0.0470	0.0475	0.0470	0.0472
FAA-T-DL1-D5-05	2.5015	0.3770	0.1220	0.1210	0.1215	0.1215	0.0470	0.0470	0.0470	0.0470

C ULTEM™ strength specimen dimensions

Table C- 1. Specimen dimensions for ULTEM™ 9075

Specimen	LO	WO	W1	W2	W3	Wavg	T1	T2	T3	Tavg
FAA-T-P5-D0-01	2.5080	0.3805	0.1245	0.1240	0.1250	0.1245	0.1245	0.1255	0.1270	0.1257
FAA-T-P5-D0-02	2.5065	0.3800	0.1230	0.1230	0.1235	0.1232	0.1255	0.1265	0.1255	0.1258
FAA-T-P5-D0-03	2.5065	0.3805	0.1245	0.1240	0.1240	0.1242	0.1275	0.1280	0.1275	0.1277
FAA-T-P5-D0-04	2.5040	0.3795	0.1265	0.1250	0.1260	0.1258	0.1195	0.1195	0.1195	0.1195
FAA-T-P5-D0-05	2.5045	0.3805	0.1245	0.1250	0.1265	0.1253	0.1280	0.1285	0.1280	0.1282
FAA-T-P5-D1-01	2.5065	0.3805	0.1240	0.1240	0.1240	0.1240	0.1215	0.1220	0.1225	0.1220
FAA-T-P5-D1-02	2.5055	0.3780	0.1240	0.1240	0.1245	0.1242	0.1250	0.1250	0.1250	0.1250
FAA-T-P5-D1-03	2.5045	0.3800	0.1250	0.1240	0.1245	0.1245	0.1270	0.1270	0.1275	0.1272
FAA-T-P5-D1-04	2.5025	0.3800	0.1260	0.1250	0.1250	0.1253	0.1260	0.1250	0.1235	0.1248
FAA-T-P5-D1-05	2.5075	0.3795	0.1240	0.1235	0.1240	0.1238	0.1280	0.1280	0.1275	0.1278
FAA-T-P5-D2-01	2.5045	0.3800	0.1225	0.1225	0.1235	0.1228	0.1210	0.1215	0.1210	0.1212
FAA-T-P5-D2-02	2.5065	0.3800	0.1295	0.1290	0.1260	0.1282	0.1220	0.1215	0.1230	0.1222
FAA-T-P5-D2-03	2.5075	0.3805	0.1275	0.1260	0.1255	0.1263	0.1215	0.1220	0.1210	0.1215
FAA-T-P5-D2-04	2.5065	0.3805	0.1235	0.1240	0.1230	0.1235	0.1255	0.1260	0.1250	0.1255
FAA-T-P5-D2-05	2.5055	0.3800	0.1220	0.1230	0.1240	0.1230	0.1225	0.1235	0.1235	0.1232
FAA-T-P5-D3-01	2.5015	0.3800	0.1255	0.1245	0.1250	0.1250	0.1245	0.1240	0.1250	0.1245
FAA-T-P5-D3-02	2.5060	0.3805	0.1235	0.1235	0.1240	0.1237	0.1240	0.1235	0.1230	0.1235
FAA-T-P5-D3-03	2.5050	0.3800	0.1255	0.1255	0.1265	0.1258	0.1240	0.1240	0.1250	0.1243
FAA-T-P5-D3-04	2.5060	0.3800	0.1240	0.1230	0.1230	0.1233	0.1245	0.1240	0.1240	0.1242
FAA-T-P5-D3-05	2.5065	0.3810	0.1245	0.1230	0.1230	0.1235	0.1225	0.1230	0.1240	0.1232
FAA-T-P5-D4-01	2.5060	0.3800	0.1240	0.1240	0.1240	0.1240	0.1280	0.1275	0.1280	0.1278
FAA-T-P5-D4-02	2.5050	0.3800	0.1275	0.1255	0.1250	0.1260	0.1260	0.1260	0.1260	0.1260
FAA-T-P5-D4-03	2.5030	0.3800	0.1240	0.1235	0.1250	0.1242	0.1240	0.1245	0.1245	0.1243
FAA-T-P5-D4-04	2.5065	0.3795	0.1240	0.1245	0.1250	0.1245	0.1215	0.1220	0.1215	0.1217
FAA-T-P5-D4-05	2.5050	0.3810	0.1240	0.1235	0.1240	0.1238	0.1250	0.1250	0.1240	0.1247
FAA-T-P5-D5-01	2.5055	0.3795	0.1250	0.1240	0.1240	0.1243	0.1245	0.1245	0.1240	0.1243
FAA-T-P5-D5-02	2.5040	0.3795	0.1250	0.1240	0.1240	0.1243	0.1245	0.1245	0.1245	0.1245
FAA-T-P5-D5-03	2.5055	0.3795	0.1245	0.1245	0.1245	0.1245	0.1235	0.1240	0.1240	0.1238
FAA-T-P5-D5-04	2.5065	0.3805	0.1245	0.1240	0.1250	0.1245	0.1275	0.1275	0.1280	0.1277
FAA-T-P5-D5-05	2.5055	0.3805	0.1250	0.1240	0.1250	0.1247	0.1220	0.1230	0.1225	0.1225

Table C- 2. Specimen dimensions for ULTEM™ 9085

Specimen	LO	WO	W1	W2	W3	Wavg	T1	T2	T3	Tavg
FAA-T-P6-D0-01	2.5055	0.3805	0.1235	0.1235	0.1240	0.1237	0.1210	0.1210	0.1215	0.1212
FAA-T-P6-D0-02	2.5065	0.3800	0.1245	0.1240	0.1240	0.1242	0.1205	0.1210	0.1205	0.1207
FAA-T-P6-D0-03	2.5055	0.3805	0.1240	0.1240	0.1240	0.1240	0.1220	0.1230	0.1230	0.1227
FAA-T-P6-D0-04	2.5065	0.3795	0.1235	0.1235	0.1235	0.1235	0.1210	0.1215	0.1220	0.1215
FAA-T-P6-D0-05	2.5055	0.3805	0.1240	0.1240	0.1245	0.1242	0.1220	0.1220	0.1220	0.1220
FAA-T-P6-D1-01	2.5065	0.3790	0.1240	0.1230	0.1235	0.1235	0.1230	0.1220	0.1220	0.1223
FAA-T-P6-D1-02	2.5055	0.3800	0.1240	0.1240	0.1240	0.1240	0.1205	0.1210	0.1210	0.1208
FAA-T-P6-D1-03	2.5065	0.3805	0.1235	0.1230	0.1235	0.1233	0.1245	0.1240	0.1240	0.1242
FAA-T-P6-D1-04	2.5060	0.3795	0.1240	0.1235	0.1240	0.1238	0.1230	0.1240	0.1235	0.1235
FAA-T-P6-D1-05	2.5055	0.3815	0.1315	0.1315	0.1320	0.1317	0.1185	0.1190	0.1190	0.1188
FAA-T-P6-D2-01	2.5055	0.3805	0.1240	0.1235	0.1240	0.1238	0.1240	0.1235	0.1230	0.1235
FAA-T-P6-D2-02	2.5065	0.3800	0.1270	0.1270	0.1275	0.1272	0.1200	0.1205	0.1205	0.1203
FAA-T-P6-D2-03	2.5065	0.3805	0.1240	0.1240	0.1245	0.1242	0.1250	0.1250	0.1250	0.1250
FAA-T-P6-D2-04	2.5065	0.3815	0.1245	0.1250	0.1250	0.1248	0.1190	0.1200	0.1195	0.1195
FAA-T-P6-D2-05	2.5055	0.3805	0.1240	0.1240	0.1240	0.1240	0.1195	0.1205	0.1200	0.1200
FAA-T-P6-D3-01	2.5055	0.3800	0.1250	0.1245	0.1240	0.1245	0.1240	0.1230	0.1240	0.1237
FAA-T-P6-D3-02	2.5050	0.3800	0.1235	0.1235	0.1240	0.1237	0.1250	0.1250	0.1240	0.1247
FAA-T-P6-D3-03	2.5065	0.3805	0.1250	0.1245	0.1250	0.1248	0.1195	0.1195	0.1195	0.1195
FAA-T-P6-D3-04	2.5060	0.3795	0.1240	0.1235	0.1235	0.1237	0.1205	0.1210	0.1210	0.1208
FAA-T-P6-D3-05	2.5055	0.3805	0.1230	0.1235	0.1240	0.1235	0.1230	0.1235	0.1230	0.1232
FAA-T-P6-D4-01	2.5070	0.3805	0.1235	0.1240	0.1230	0.1235	0.1235	0.1230	0.1240	0.1235
FAA-T-P6-D4-02	2.5055	0.3795	0.1250	0.1240	0.1240	0.1243	0.1220	0.1220	0.1220	0.1220
FAA-T-P6-D4-03	2.5055	0.3800	0.1240	0.1240	0.1250	0.1243	0.1230	0.1220	0.1210	0.1220
FAA-T-P6-D4-04	2.5070	0.3795	0.1235	0.1235	0.1235	0.1235	0.1200	0.1205	0.1205	0.1203
FAA-T-P6-D4-05	2.5070	0.3815	0.1230	0.1230	0.1235	0.1232	0.1230	0.1235	0.1230	0.1232
FAA-T-P6-D5-01	2.5060	0.3805	0.1145	0.1140	0.1160	0.1148	0.1205	0.1215	0.1215	0.1212
FAA-T-P6-D5-02	2.5055	0.3805	0.1235	0.1235	0.1235	0.1235	0.1205	0.1220	0.1225	0.1217
FAA-T-P6-D5-03	2.5065	0.3800	0.1240	0.1240	0.1240	0.1240	0.1230	0.1235	0.1230	0.1232
FAA-T-P6-D5-04	2.5065	0.3810	0.1240	0.1235	0.1240	0.1238	0.1245	0.1240	0.1240	0.1242
FAA-T-P6-D5-05	2.5055	0.3775	0.1230	0.1230	0.1235	0.1232	0.1220	0.1225	0.1220	0.1222

D Fiberglass laminate strength specimen dimensions

Table D- 1. Specimen dimensions for Fiberglass G-10/FR4 – Tension

Specimen	L	W1	W2	W3	Wavg	T1	T2	T3	Tavg
FAA-T-FG1-D0-01	10.0000	1.0055	1.0060	1.0050	1.0055	0.1245	0.1245	0.1245	0.1245
FAA-T-FG1-D0-02	10.0000	1.0055	1.0055	1.0055	1.0055	0.1240	0.1240	0.1240	0.1240
FAA-T-FG1-D0-03	10.0000	1.0055	1.0060	1.0055	1.0057	0.1245	0.1245	0.1245	0.1245
FAA-T-FG1-D0-04	10.0000	1.0055	1.0055	1.0055	1.0055	0.1235	0.1240	0.1235	0.1237
FAA-T-FG1-D0-05	10.0000	1.0055	1.0055	1.0055	1.0055	0.1235	0.1240	0.1235	0.1237
FAA-T-FG1-D1-01	10.0000	1.0055	1.0055	1.0060	1.0057	0.1240	0.1240	0.1240	0.1240
FAA-T-FG1-D1-02	10.0000	1.0055	1.0055	1.0055	1.0055	0.1250	0.1250	0.1250	0.1250
FAA-T-FG1-D1-03	10.0000	1.0055	1.0055	1.0055	1.0055	0.1245	0.1245	0.1245	0.1245
FAA-T-FG1-D1-04	10.0000	1.0055	1.0055	1.0055	1.0055	0.1250	0.1245	0.1250	0.1248
FAA-T-FG1-D1-05	10.0000	1.0050	1.0050	1.0055	1.0052	0.1240	0.1240	0.1240	0.1240
FAA-T-FG1-D2-01	10.0000	1.0045	1.0045	1.0050	1.0047	0.1235	0.1235	0.1235	0.1235
FAA-T-FG1-D2-02	10.0000	1.0050	1.0050	1.0050	1.0050	0.1240	0.1240	0.1240	0.1240
FAA-T-FG1-D2-03	10.0000	1.0040	1.0035	1.0040	1.0038	0.1235	0.1235	0.1235	0.1235
FAA-T-FG1-D2-04	10.0000	1.0050	1.0050	1.0050	1.0050	0.1240	0.1240	0.1240	0.1240
FAA-T-FG1-D2-05	10.0000	1.0050	1.0050	1.0050	1.0050	0.1235	0.1235	0.1235	0.1235
FAA-T-FG1-D3-01	10.0000	1.0035	1.0030	1.0035	1.0033	0.1240	0.1240	0.1240	0.1240
FAA-T-FG1-D3-02	10.0000	1.0055	1.0055	1.0055	1.0055	0.1245	0.1245	0.1245	0.1245
FAA-T-FG1-D3-03	10.0000	1.0050	1.0045	1.0050	1.0048	0.1240	0.1240	0.1240	0.1240
FAA-T-FG1-D3-04	10.0000	1.0050	1.0050	1.0050	1.0050	0.1245	0.1245	0.1245	0.1245
FAA-T-FG1-D3-05	10.0000	1.0050	1.0050	1.0050	1.0050	0.1240	0.1240	0.1235	0.1238
FAA-T-FG1-D4-01	10.0000	1.0050	1.0050	1.0050	1.0050	0.1240	0.1240	0.1240	0.1240
FAA-T-FG1-D4-02	10.0000	1.0055	1.0050	1.0050	1.0052	0.1240	0.1240	0.1240	0.1240
FAA-T-FG1-D4-03	10.0000	1.0050	1.0050	1.0050	1.0050	0.1240	0.1240	0.1240	0.1240
FAA-T-FG1-D4-04	10.0000	1.0045	1.0050	1.0045	1.0047	0.1240	0.1240	0.1240	0.1240
FAA-T-FG1-D4-05	10.0000	1.0045	1.0045	1.0045	1.0045	0.1240	0.1235	0.1240	0.1238
FAA-T-FG1-D5-01	10.0000	1.0045	1.0050	1.0045	1.0047	0.1240	0.1240	0.1240	0.1240
FAA-T-FG1-D5-02	10.0000	1.0050	1.0050	1.0050	1.0050	0.1240	0.1240	0.1240	0.1240
FAA-T-FG1-D5-03	10.0000	1.0050	1.0045	1.0050	1.0048	0.1240	0.1240	0.1235	0.1238
FAA-T-FG1-D5-04	10.0000	1.0050	1.0050	1.0050	1.0050	0.1240	0.1235	0.1240	0.1238
FAA-T-FG1-D5-05	10.0000	1.0050	1.0050	1.0050	1.0050	0.1240	0.1240	0.1240	0.1240

Table D- 2. Specimen dimensions for Fiberglass G-10/FR4 – Short-beam shear

Specimen	L	W1	W2	W3	Wavg	T1	T2	T3	Tavg
FAA-S-FG1-D0-01	1.5075	0.5010	0.5015	0.5020	0.5015	0.2565	0.2565	0.2565	0.2565
FAA-S-FG1-D0-02	1.5070	0.5015	0.5010	0.5015	0.5013	0.2565	0.2565	0.2565	0.2565
FAA-S-FG1-D0-03	1.5065	0.5015	0.5010	0.5010	0.5012	0.2565	0.2565	0.2565	0.2565
FAA-S-FG1-D0-04	1.5070	0.5010	0.5015	0.5015	0.5013	0.2525	0.2530	0.2545	0.2533
FAA-S-FG1-D0-05	1.5080	0.5015	0.5015	0.5015	0.5015	0.2565	0.2565	0.2565	0.2565
FAA-S-FG1-D1-01	1.5075	0.5015	0.5020	0.5020	0.5018	0.2560	0.2555	0.2555	0.2557
FAA-S-FG1-D1-02	1.5065	0.5020	0.5020	0.5020	0.5020	0.2570	0.2565	0.2565	0.2567
FAA-S-FG1-D1-03	1.5070	0.5020	0.5020	0.5020	0.5020	0.2530	0.2535	0.2555	0.2540
FAA-S-FG1-D1-04	1.5080	0.5015	0.5015	0.5020	0.5017	0.2560	0.2565	0.2565	0.2563
FAA-S-FG1-D1-05	1.5070	0.5020	0.5015	0.5010	0.5015	0.2565	0.2565	0.2570	0.2567
FAA-S-FG1-D2-01	1.5075	0.5000	0.5010	0.5015	0.5008	0.2555	0.2550	0.2550	0.2552
FAA-S-FG1-D2-02	1.5075	0.5015	0.5020	0.5020	0.5018	0.2565	0.2565	0.2565	0.2565
FAA-S-FG1-D2-03	1.5075	0.5020	0.5020	0.5020	0.5020	0.2560	0.2560	0.2565	0.2562
FAA-S-FG1-D2-04	1.5075	0.5010	0.5015	0.5015	0.5013	0.2565	0.2565	0.2565	0.2565
FAA-S-FG1-D2-05	1.5100	0.5020	0.5020	0.5015	0.5018	0.2565	0.2565	0.2565	0.2565
FAA-S-FG1-D3-01	1.5080	0.5015	0.5010	0.5015	0.5013	0.2565	0.2560	0.2555	0.2560
FAA-S-FG1-D3-02	1.5090	0.5020	0.5020	0.5020	0.5020	0.2560	0.2560	0.2565	0.2562
FAA-S-FG1-D3-03	1.5075	0.5015	0.5010	0.5015	0.5013	0.2555	0.2555	0.2555	0.2555
FAA-S-FG1-D3-04	1.5075	0.5020	0.5020	0.5020	0.5020	0.2560	0.2560	0.2560	0.2560
FAA-S-FG1-D3-05	1.5075	0.5020	0.5020	0.5020	0.5020	0.2560	0.2560	0.2560	0.2560
FAA-S-FG1-D4-01	1.5080	0.5020	0.5020	0.5015	0.5018	0.2570	0.2570	0.2565	0.2568
FAA-S-FG1-D4-02	1.5090	0.5020	0.5020	0.5020	0.5020	0.2545	0.2545	0.2540	0.2543
FAA-S-FG1-D4-03	1.5095	0.5015	0.5020	0.5020	0.5018	0.2525	0.2535	0.2550	0.2537
FAA-S-FG1-D4-04	1.5070	0.5020	0.5020	0.5020	0.5020	0.2560	0.2565	0.2565	0.2563
FAA-S-FG1-D4-05	1.5075	0.5010	0.5015	0.5020	0.5015	0.2560	0.2555	0.2555	0.2557
FAA-S-FG1-D5-01	1.5070	0.5020	0.5020	0.5015	0.5018	0.2565	0.2565	0.2570	0.2567
FAA-S-FG1-D5-02	1.5110	0.5020	0.5020	0.5020	0.5020	0.2535	0.2535	0.2535	0.2535
FAA-S-FG1-D5-03	1.5075	0.5015	0.5015	0.5015	0.5015	0.2565	0.2565	0.2560	0.2563
FAA-S-FG1-D5-04	1.5075	0.5020	0.5020	0.5020	0.5020	0.2565	0.2570	0.2570	0.2568
FAA-S-FG1-D5-05	1.5075	0.5015	0.5015	0.5015	0.5015	0.2565	0.2560	0.2560	0.2562

E Honeycomb flatwise compression test pictures

Table E- 1. Test photographs for FAA-C-H1-D0-0X (Honeycomb Sandwich Panel)

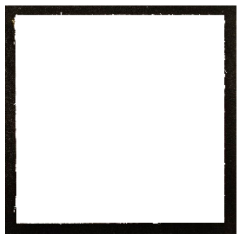
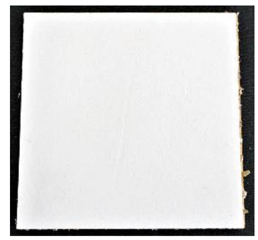
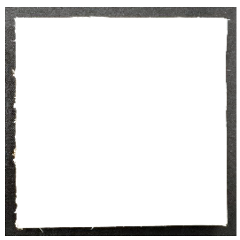
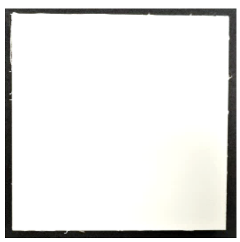
	Pre-Conditioning	**Post-Test**
FAA-C-H1-D0-01		
FAA-C-H1-D0-02		
FAA-C-H1-D0-03		
FAA-C-H1-D0-04		
FAA-C-H1-D0-05		

Table E- 2. Test photographs for FAA-C-H1-D1-0X (Honeycomb Sandwich Panel)

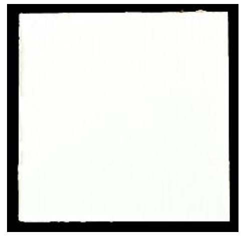
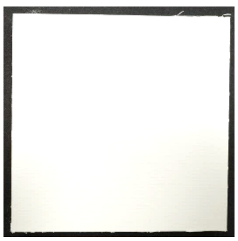
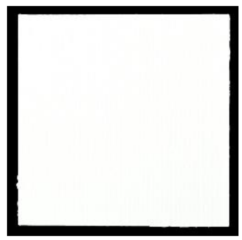
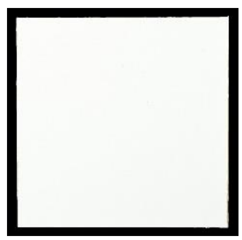
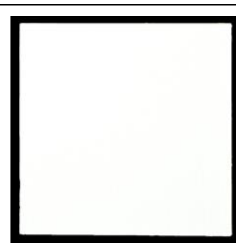
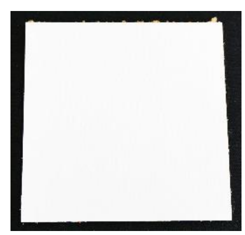
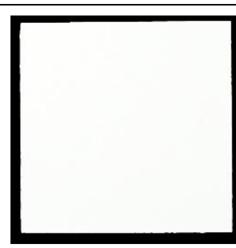
	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-C-H1-D1-01			
FAA-C-H1-D1-02			
FAA-C-H1-D1-03			
FAA-C-H1-D1-04			
FAA-C-H1-D1-05			

Table E- 3. Test photographs for FAA-C-H1-D2-0X (Honeycomb Sandwich Panel)

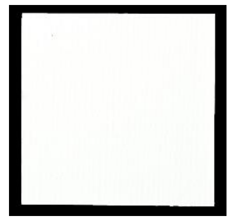
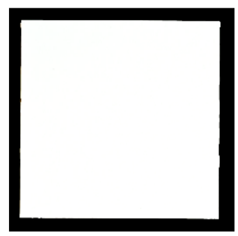
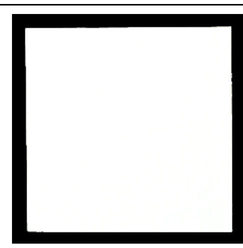
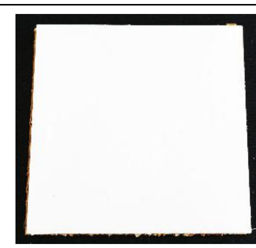
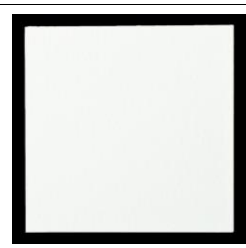
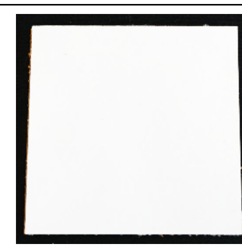
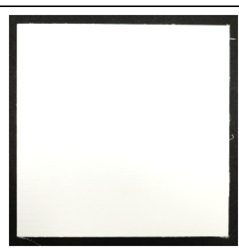
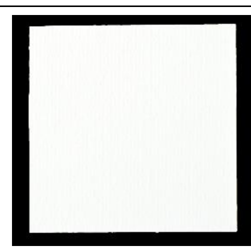
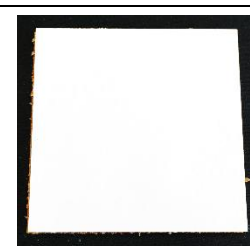
	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-C-H1-D2-01			
FAA-C-H1-D2-02			
FAA-C-H1-D2-03			
FAA-C-H1-D2-04			
FAA-C-H1-D2-05			

Table E- 4. Test photographs for FAA-C-H1-D3-0X (Honeycomb Sandwich Panel)

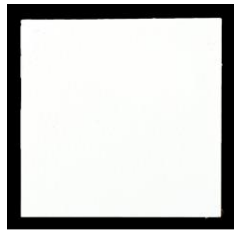
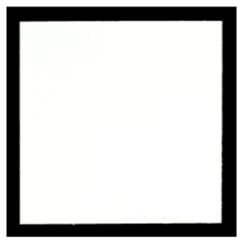
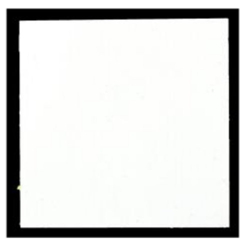
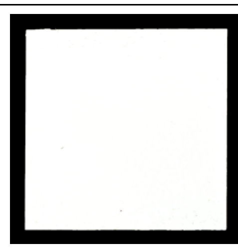
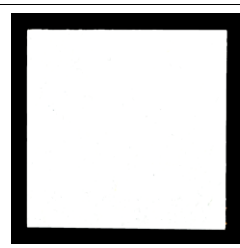
	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-C-H1-D3-01			
FAA-C-H1-D3-02			
FAA-C-H1-D3-03			
FAA-C-H1-D3-04			
FAA-C-H1-D3-05			

Table E- 5. Test photographs for FAA-C-H1-D4-0X (Honeycomb Sandwich Panel)

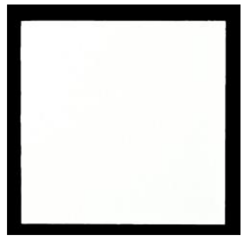
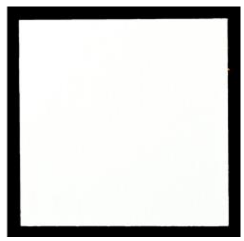
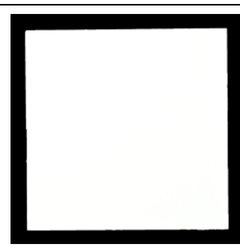
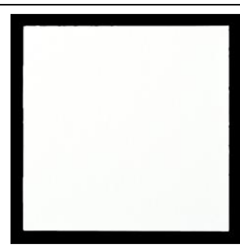
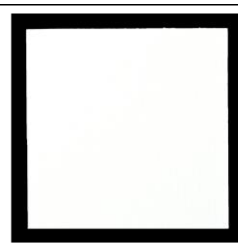
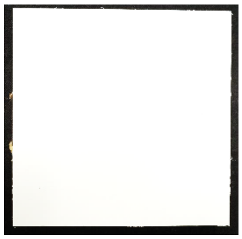
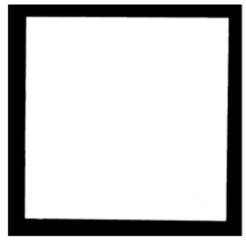
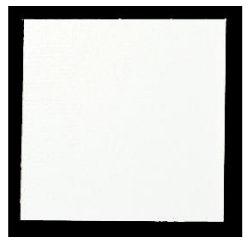
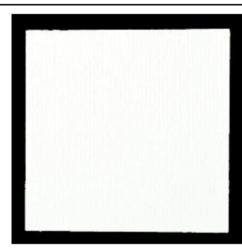
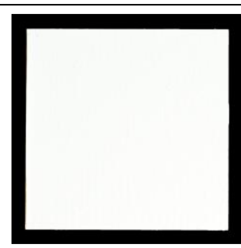
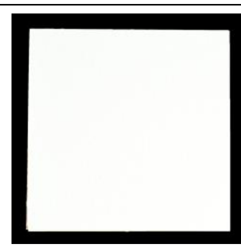
	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-C-H1-D4-01			
FAA-C-H1-D4-02			
FAA-C-H1-D4-03			
FAA-C-H1-D4-04			
FAA-C-H1-D4-05			

Table E- 6. Test photographs for FAA-C-H1-D5-0X (Honeycomb Sandwich Panel)

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-C-H1-D5-01			
FAA-C-H1-D5-02			
FAA-C-H1-D5-03			
FAA-C-H1-D5-04			
FAA-C-H1-D5-05			

F Honeycomb flexure test pictures

Table F- 1. Test photographs for FAA-F-H1-D0-0X (Honeycomb Sandwich Panel)

	Pre-Test	**Post-Test**
FAA-F-H1-D0-01		
FAA-F-H1-D0-02		
FAA-F-H1-D0-03		
FAA-F-H1-D0-04		
FAA-F-H1-D0-05		

Table F- 2. Test photographs for FAA-F-H1-D1-0X (Honeycomb Sandwich Panel)

	Pre-Conditioning	**Post-Conditioning/ Pre-Test**	**Post-Test**
FAA-F-H1-D1-01			
FAA-F-H1-D1-02			
FAA-F-H1-D1-03			
FAA-F-H1-D1-04			
FAA-F-H1-D1-05			

Table F- 3. Test photographs for FAA-F-H1-D2-0X (Honeycomb Sandwich Panel)

	Pre-Conditioning	**Post-Conditioning/ Pre-Test**	**Post-Test**
FAA-F-H1-D2-01			
FAA-F-H1-D2-02			
FAA-F-H1-D2-03			
FAA-F-H1-D2-04			
FAA-F-H1-D2-05			

Table F- 4. Test photographs for FAA-F-H1-D3-0X (Honeycomb Sandwich Panel)

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-F-H1-D3-01			
FAA-F-H1-D3-02			
FAA-F-H1-D3-03			
FAA-F-H1-D3-04			
FAA-F-H1-D3-05			

Table F- 5. Test photographs for FAA-F-H1-D4-0X (Honeycomb Sandwich Panel)

	Pre-Conditioning	**Post-Conditioning/ Pre-Test**	**Post-Test**
FAA-F-H1-D4-01			
FAA-F-H1-D4-02			
FAA-F-H1-D4-03			
FAA-F-H1-D4-04			
FAA-F-H1-D4-05			

Table F- 6. Test photographs for FAA-F-H1-D5-0X (Honeycomb Sandwich Panel)

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-F-H1-D5-01			
FAA-F-H1-D5-02			
FAA-F-H1-D5-03			
FAA-F-H1-D5-04			
FAA-F-H1-D5-05			

G Honeycomb climbing drum peel test pictures

Table G- 1. Test photographs for FAA-P-H1-D0-0X (Honeycomb Sandwich Panel)

	Pre-Test	**Post-Test**
FAA-P-H1-D0-01		
FAA-P-H1-D0-02		
FAA-P-H1-D0-03		
FAA-P-H1-D0-04		
FAA-P-H1-D0-05		

Table G- 2. Test photographs for FAA-P-H1-D1-0X (Honeycomb Sandwich Panel)

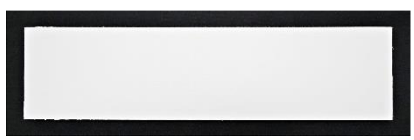
	Pre-Conditioning	**Post-Conditioning/ Pre-Test**	**Post-Test**
FAA-P-H1-D1-01			
FAA-P-H1-D1-02			
FAA-P-H1-D1-03			
FAA-P-H1-D1-04			
FAA-P-H1-D1-05			

Table G- 3. Test photographs for FAA-P-H1-D2-0X (Honeycomb Sandwich Panel)

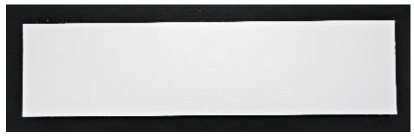
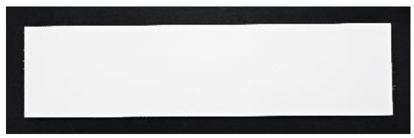
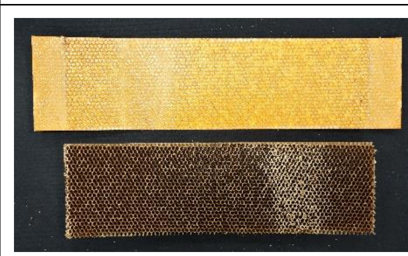
	Pre-Conditioning	**Post-Conditioning/ Pre-Test**	**Post-Test**
FAA-P-H1-D2-01			
FAA-P-H1-D2-02			
FAA-P-H1-D2-03			
FAA-P-H1-D2-04			
FAA-P-H1-D2-05			

Table G- 4. Test photographs for FAA-P-H1-D3-0X (Honeycomb Sandwich Panel)

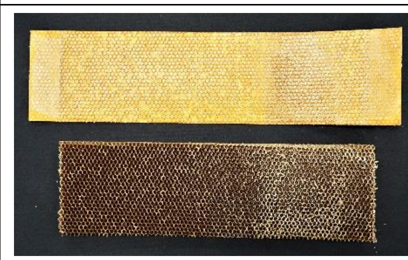
	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-P-H1-D3-01			
FAA-P-H1-D3-02			
FAA-P-H1-D3-03			
FAA-P-H1-D3-04			
FAA-P-H1-D3-05			

Table G- 5. Test photographs for FAA-P-H1-D4-0X (Honeycomb Sandwich Panel)

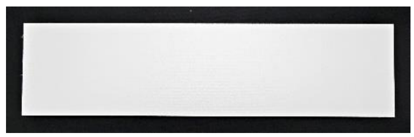
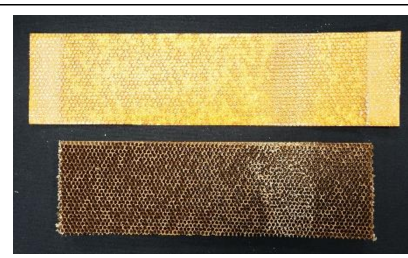
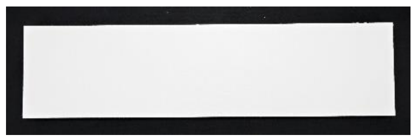
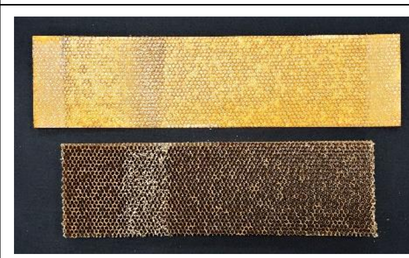
	Pre-Conditioning	**Post-Conditioning/ Pre-Test**	**Post-Test**
FAA-P-H1-D4-01			
FAA-P-H1-D4-02			
FAA-P-H1-D4-03			
FAA-P-H1-D4-04			
FAA-P-H1-D4-05			

Table G- 6. Test photographs for FAA-P-H1-D5-0X (Honeycomb Sandwich Panel)

	Pre-Conditioning	**Post-Conditioning/ Pre-Test**	**Post-Test**
FAA-P-H1-D5-01			
FAA-P-H1-D5-02			
FAA-P-H1-D5-03			
FAA-P-H1-D5-04			
FAA-P-H1-D5-05			

H Decorative laminate strength test pictures

Table H- 1. Test photographs for FAA-T-DL1-D0-0X (Aerform LHR)

	Pre-Test	**Post-Test**
FAA-T-DL1-D0-01		
FAA-T-DL1-D0-02		
FAA-T-DL1-D0-03		
FAA-T-DL1-D0-04		
FAA-T-DL1-D0-05		

Table H- 2. Test photographs for FAA-T-DL1-D1-0X (Aerform LHR)

	Pre-Conditioning	**Post-Conditioning/ Pre-Test**	**Post-Test**
FAA-T-DL1-D1-01			
FAA-T-DL1-D1-02			
FAA-T-DL1-D1-03			
FAA-T-DL1-D1-04			
FAA-T-DL1-D1-05			

Table H- 3. Test photographs for FAA-T-DL1-D2-0X (Aerform LHR)

	Pre-Conditioning	**Post-Conditioning/ Pre-Test**	**Post-Test**
FAA-T-DL1-D2-01			
FAA-T-DL1-D2-02			
FAA-T-DL1-D2-03			
FAA-T-DL1-D2-04			
FAA-T-DL1-D2-05			

Table H- 4. Test photographs for FAA-T-DL1-D3-0X (Aerform LHR)

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-T-DL1-D3-01			
FAA-T-DL1-D3-02			
FAA-T-DL1-D3-03			
FAA-T-DL1-D3-04			
FAA-T-DL1-D3-05			

Table H- 5. Test photographs for FAA-T-DL1-D4-0X (Aerform LHR)

	Pre-Conditioning	**Post-Conditioning/ Pre-Test**	
FAA-T-DL1-D4-01			
FAA-T-DL1-D4-02			
FAA-T-DL1-D4-03			
FAA-T-DL1-D4-04			
FAA-T-DL1-D4-05			

Table H- 6. Test photographs for FAA-T-DL1-D5-0X (Aerform LHR)

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-T-DL1-D5-01			
FAA-T-DL1-D5-02			
FAA-T-DL1-D5-03			
FAA-T-DL1-D5-04			
FAA-T-DL1-D5-05			

I ULTEM™ strength test pictures

Table I- 1. Test photographs for FAA-T-P5-D0-0X (ULTEM™ 9075)

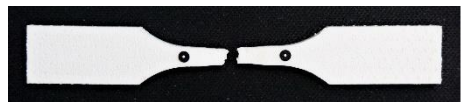
	Pre-Test	**Post-Test**
FAA-T-P5-D0-01		
FAA-T-P5-D0-02		
FAA-T-P5-D0-03		
FAA-T-P5-D0-04		
FAA-T-P5-D0-05		

Table I- 2. Test photographs for FAA-T-P5-D1-0X (ULTEM™ 9075)

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-T-P5-D1-01			
FAA-T-P5-D1-02			
FAA-T-P5-D1-03			
FAA-T-P5-D1-04			
FAA-T-P5-D1-05			

Table I- 3. Test photographs for FAA-T-P5-D2-0X (ULTEM^{TM} 9075)

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-T-P5-D2-01			
FAA-T-P5-D2-02			
FAA-T-P5-D2-03			
FAA-T-P5-D2-04			
FAA-T-P5-D2-05			

Table I- 4. Test photographs for FAA-T-P5-D3-0X (ULTEM™ 9075)

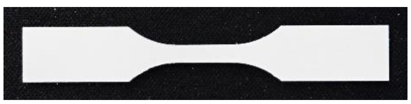
	Pre-Conditioning	**Post-Conditioning/ Pre-Test**	**Post-Test**
FAA-T-P5-D3-01			
FAA-T-P5-D3-02			
FAA-T-P5-D3-03			
FAA-T-P5-D3-04			
FAA-T-P5-D3-05			

Table I- 5. Test photographs for FAA-T-P5-D4-0X (ULTEM^{TM} 9075)

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-T-P5-D4-01			
FAA-T-P5-D4-02			
FAA-T-P5-D4-03			
FAA-T-P5-D4-04			
FAA-T-P5-D4-05			

Table I- 6. Test photographs for FAA-T-P5-D5-0X (ULTEM^{TM} 9075)

	Pre-Conditioning	**Post-Conditioning/ Pre-Test**	**Post-Test**
FAA-T-P5-D5-01			
FAA-T-P5-D5-02			
FAA-T-P5-D5-03			
FAA-T-P5-D5-04			
FAA-T-P5-D5-05			

Table I- 7. Test photographs for FAA-T-P6-D0-0X (ULTEM™ 9085)

	Pre-Test	**Post-Test**
FAA-T-P6-D0-01		
FAA-T-P6-D0-02		
FAA-T-P6-D0-03		
FAA-T-P6-D0-04		
FAA-T-P6-D0-05		

Table I- 8. Test photographs for FAA-T-P6-D1-0X (ULTEM™ 9085)

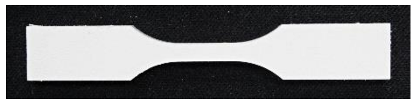
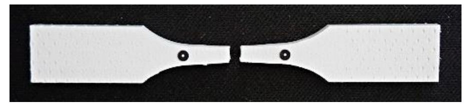
	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-T-P6-D1-01			
FAA-T-P6-D1-02			
FAA-T-P6-D1-03			
FAA-T-P6-D1-04			
FAA-T-P6-D1-05			

Table I- 9. Test photographs for FAA-T-P6-D2-0X (ULTEM™ 9085)

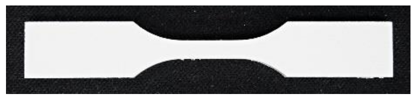
	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-T-P6-D2-01			
FAA-T-P6-D2-02			
FAA-T-P6-D2-03			
FAA-T-P6-D2-04			
FAA-T-P6-D2-05			

Table I- 10. Test photographs for FAA-T-P6-D3-0X (ULTEM^{TM} 9085)

	Pre-Conditioning	**Post-Conditioning/ Pre-Test**	**Post-Test**
FAA-T-P6-D3-01			
FAA-T-P6-D3-02			
FAA-T-P6-D3-03			
FAA-T-P6-D3-04			
FAA-T-P6-D3-05			

Table I- 11. Test photographs for FAA-T-P6-D4-0X (ULTEM^{TM} 9085)

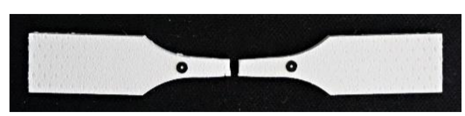
	Pre-Conditioning	**Post-Conditioning/ Pre-Test**	**Post-Test**
FAA-T-P6-D4-01			
FAA-T-P6-D4-02			
FAA-T-P6-D4-03			
FAA-T-P6-D4-04			
FAA-T-P6-D4-05			

Table I- 12. Test photographs for FAA-T-P6-D5-0X (ULTEM™ 9085)

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-T-P6-D5-01			
FAA-T-P6-D5-02			
FAA-T-P6-D5-03			
FAA-T-P6-D5-04			
FAA-T-P6-D5-05			

J Fiberglass laminate tension pictures

Table J- 1. Test photographs for FAA-T-FG1-D0-0X (Fiberglass G-10/FR4)

	Pre-Test	**Post-Test**
FAA-T-FG1-D0-01		
FAA-T-FG1-D0-02		
FAA-T-FG1-D0-03		
FAA-T-FG1-D0-04		
FAA-T-FG1-D0-05		

Table J- 2. Test photographs for FAA-T-FG1-D1-0X (Fiberglass G-10/FR4)

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-T-FG1-D1-01			
FAA-T-FG1-D1-02			
FAA-T-FG1-D1-03			
FAA-T-FG1-D1-04			
FAA-T-FG1-D1-05			

Table J- 3. Test photographs for FAA-T-FG1-D2-0X (Fiberglass G-10/FR4)

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-T-FG1-D2-01			
FAA-T-FG1-D2-02			
FAA-T-FG1-D2-03			
FAA-T-FG1-D2-04			
FAA-T-FG1-D2-05			

Table J- 4. Test photographs for FAA-T-FG1-D3-0X (Fiberglass G-10/FR4)

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-T-FG1-D3-01			
FAA-T-FG1-D3-02			
FAA-T-FG1-D3-03			
FAA-T-FG1-D3-04			
FAA-T-FG1-D3-05			

Table J- 5. Test photographs for FAA-T-FG1-D4-0X (Fiberglass G-10/FR4)

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-T-FG1-D4-01			
FAA-T-FG1-D4-02			
FAA-T-FG1-D4-03			
FAA-T-FG1-D4-04			
FAA-T-FG1-D4-05			

Table J- 6. Test photographs for FAA-T-FG1-D5-0X (Fiberglass G-10/FR4)

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-T-FG1-D5-01			
FAA-T-FG1-D5-02			
FAA-T-FG1-D5-03			
FAA-T-FG1-D5-04			
FAA-T-FG1-D5-05			

K Fiberglass laminate short beam shear test pictures

Table K- 1. Test photographs for FAA-S-FG1-D0-0X (Fiberglass G-10/FR4)

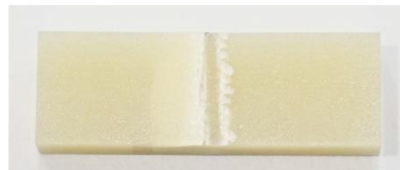
	Pre-Test	**Post-Test**
FAA-S-FG1-D0-01		
FAA-S-FG1-D0-02		
FAA-S-FG1-D0-03		
FAA-S-FG1-D0-04		
FAA-S-FG1-D0-05		

Table K- 2. Test photographs for FAA-S-FG1-D0-0X (Fiberglass G-10/FR4)

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-S-FG1-D1-01			
FAA-S-FG1-D1-02			
FAA-S-FG1-D1-03			
FAA-S-FG1-D1-04			
FAA-S-FG1-D1-05			

Table K- 3. Test photographs for FAA-S-FG1-D2-0X (Fiberglass G-10/FR4)

	Pre-Conditioning	**Post-Conditioning/ Pre-Test**	**Post-Test**
FAA-S-FG1-D2-01			
FAA-S-FG1-D2-02			
FAA-S-FG1-D2-03			
FAA-S-FG1-D2-04			
FAA-S-FG1-D2-05			

Table K- 4. Test photographs for FAA-S-FG1-D3-0X (Fiberglass G-10/FR4)

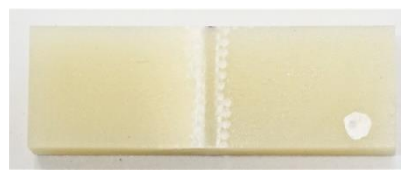
	Pre-Conditioning	**Post-Conditioning/ Pre-Test**	**Post-Test**
FAA-S-FG1-D3-01			
FAA-S-FG1-D3-02			
FAA-S-FG1-D3-03			
FAA-S-FG1-D3-04			
FAA-S-FG1-D3-05			

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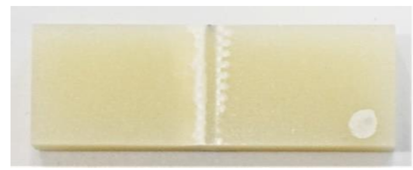
Table K- 5. Test photographs for FAA-S-FG1-D4-0X (Fiberglass G-10/FR4)

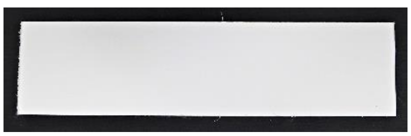
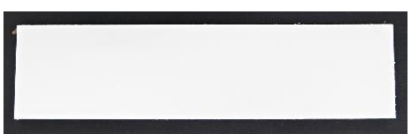
	Pre-Conditioning	**Post-Conditioning/ Pre-Test**	**Post-Test**
FAA-S-FG1-D4-01			
FAA-S-FG1-D4-02			
FAA-S-FG1-D4-03			
FAA-S-FG1-D4-04			
FAA-S-FG1-D4-05			

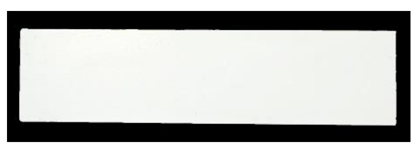
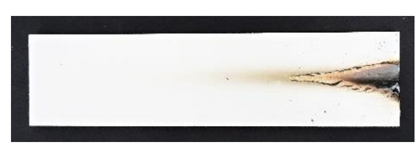
Table K- 6. Test photographs for FAA-S-FG1-D5-0X (Fiberglass G-10/FR4)

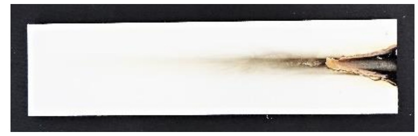
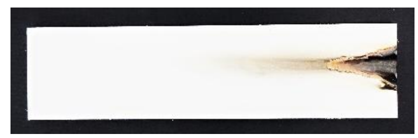
	Pre-Conditioning	**Post-Conditioning/ Pre-Test**	**Post-Test**
FAA-S-FG1-D5-01			
FAA-S-FG1-D5-02			
FAA-S-FG1-D5-03			
FAA-S-FG1-D5-04			
FAA-S-FG1-D5-05			

L Honeycomb flammability pictures

Table L- 1. Test photographs for FAA-VF-H1-DX-0X (Honeycomb Sandwich Panel)

	Pre-Conditioning	**Post-Conditioning/ Pre-Test**	**Post-Test**
FAA-VF-H1-D0-01			
FAA-VF-H1-D0-02			
FAA-VF-H1-D0-03			
FAA-VF-H1-D1-01			
FAA-VF-H1-D1-02			
FAA-VF-H1-D1-03			

FAA-VF-H1-D2-01			
FAA-VF-H1-D2-02			
FAA-VF-H1-D2-03			
FAA-VF-H1-D3-01			
FAA-VF-H1-D3-02			
FAA-VF-H1-D3-03			

FAA-VF-H1-D4-01			
FAA-VF-H1-D4-02			
FAA-VF-H1-D4-03			
FAA-VF-H1-D5-01			
FAA-VF-H1-D5-02			
FAA-VF-H1-D5-03			

M Decorative laminate flammability pictures

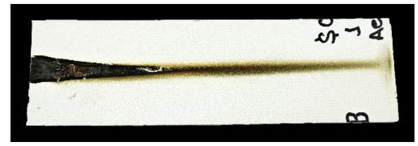
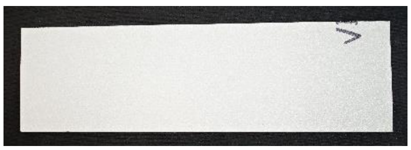
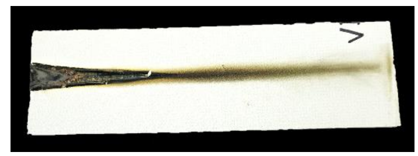
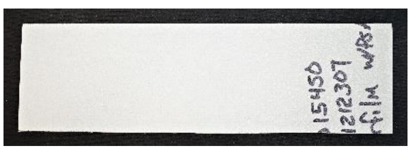
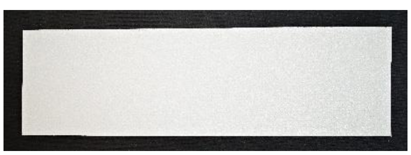
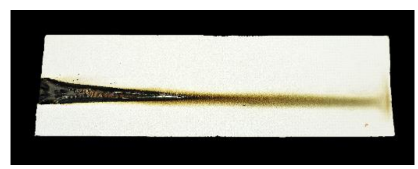
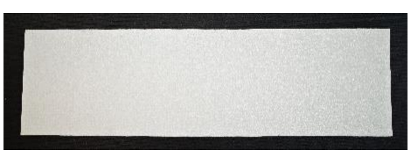
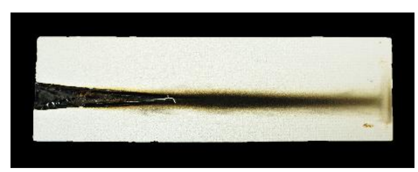
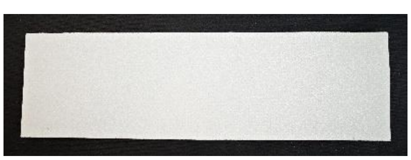
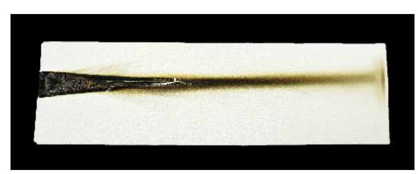
Table M- 1. Test photographs for FAA-VF-DL1-DX-0X (Aerform LHR)

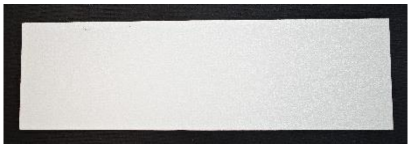
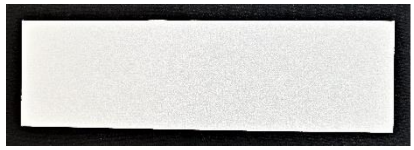
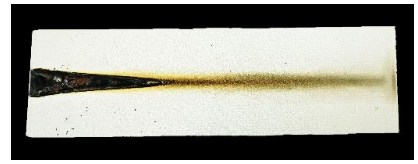
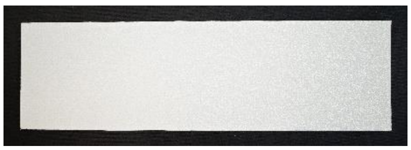
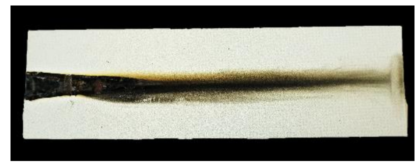
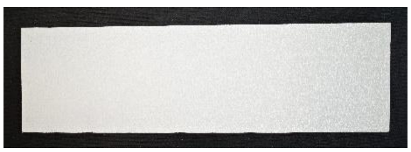
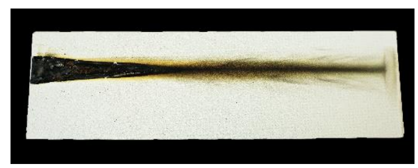
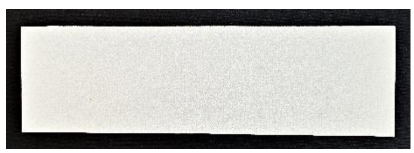
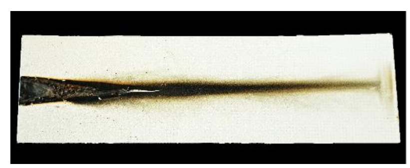
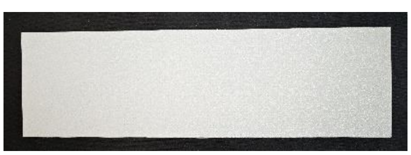
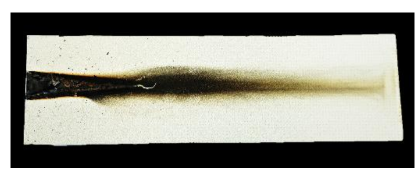
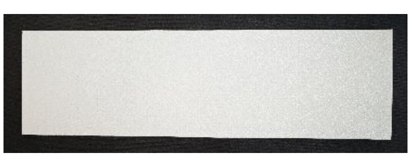
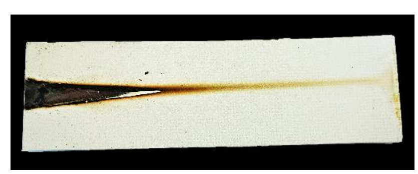
	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-VF-DL1-D0-01			
FAA-VF-DL1-D0-02			
FAA-VF-DL1-D0-03			
FAA-VF-DL1-D1-01			
FAA-VF-DL1-D1-02			
FAA-VF-DL1-D1-03			

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-VF-DL1-D2-01			
FAA-VF-DL1-D2-02			
FAA-VF-DL1-D2-03			
FAA-VF-DL1-D3-01			
FAA-VF-DL1-D3-02			
FAA-VF-DL1-D3-03			

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-VF-DL1-D4-01			
FAA-VF-DL1-D4-02			
FAA-VF-DL1-D4-03			
FAA-VF-DL1-D5-01			
FAA-VF-DL1-D5-02			
FAA-VF-DL1-D5-03			

Table M- 2. Test photographs for FAA-VF-DL2-DX-0X (Aerfilm LHR)

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-VF-DL2-D0-01			
FAA-VF-DL2-D0-02			
FAA-VF-DL2-D0-03			
FAA-VF-DL2-D1-01			
FAA-VF-DL2-D1-02			
FAA-VF-DL2-D1-03			

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-VF-DL2-D2-01			
FAA-VF-DL2-D2-02			
FAA-VF-DL2-D2-03			
FAA-VF-DL2-D3-01			
FAA-VF-DL2-D3-02			
FAA-VF-DL2-D3-03			

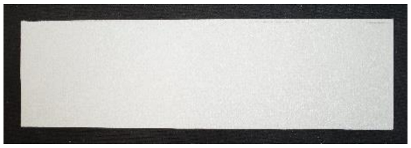
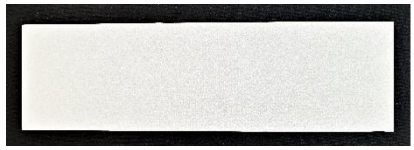
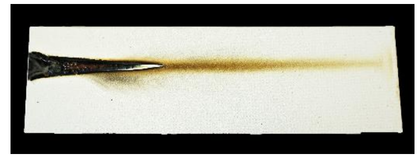
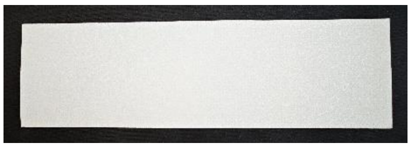
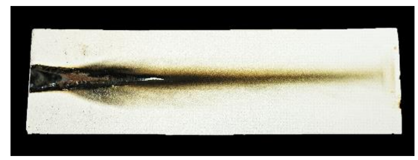
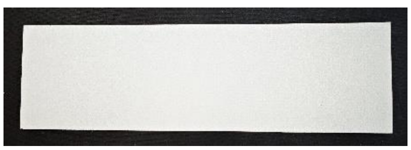
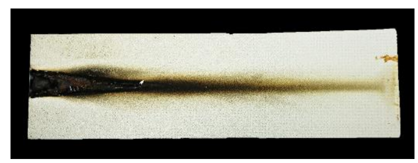
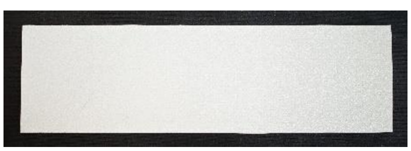
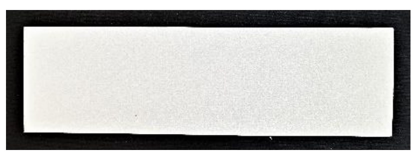
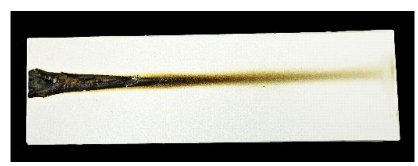
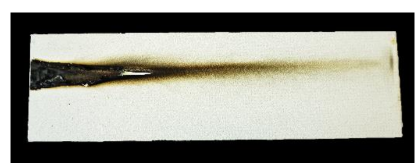
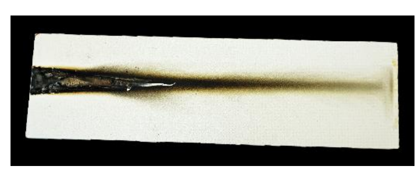
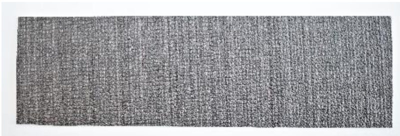
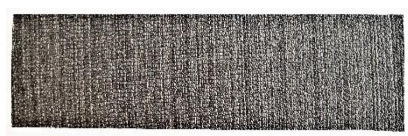
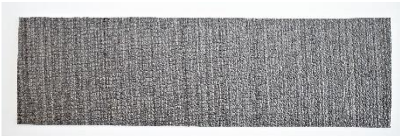
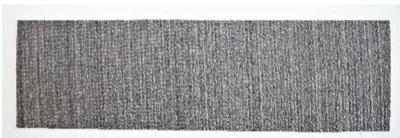
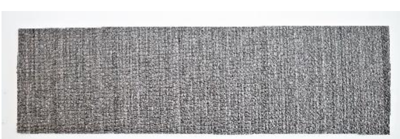
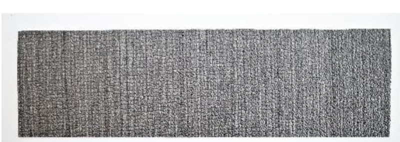
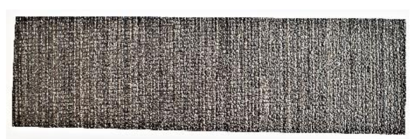
	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-VF-DL2-D4-01			
FAA-VF-DL2-D4-02			
FAA-VF-DL2-D4-03			
FAA-VF-DL2-D5-01			
FAA-VF-DL2-D5-02			
FAA-VF-DL2-D5-03			

Table M- 3. Test photographs for FAA-VF-DL3-DX-0X (Aerfusion Fit)

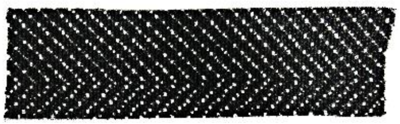
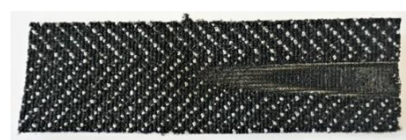
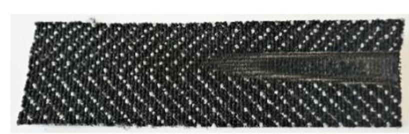
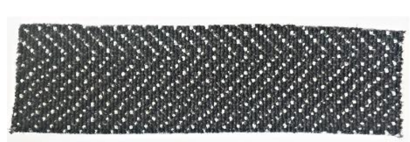
	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-VF-DL3-D0-01			
FAA-VF-DL3-D0-02			
FAA-VF-DL3-D0-03			
FAA-VF-DL3-D1-01			
FAA-VF-DL3-D1-02			
FAA-VF-DL3-D1-03			

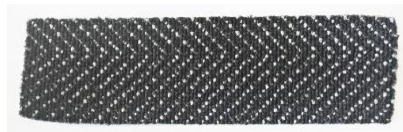
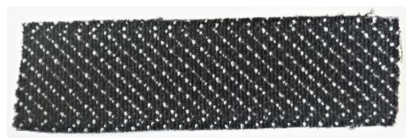
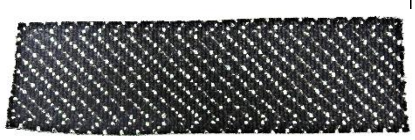
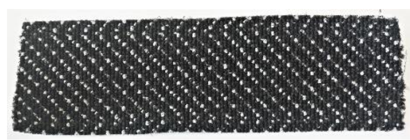
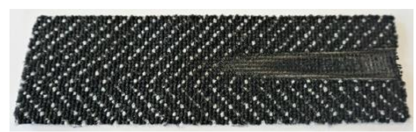
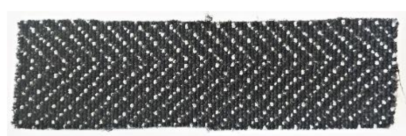
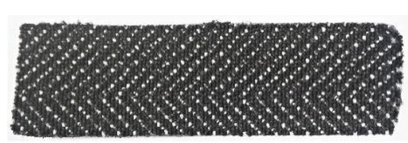
	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-VF-DL3-D2-01			
FAA-VF-DL3-D2-02			
FAA-VF-DL3-D2-03			
FAA-VF-DL3-D3-01			
FAA-VF-DL3-D3-02			
FAA-VF-DL3-D3-03			

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-VF-DL3-D4-01			
FAA-VF-DL3-D4-02			
FAA-VF-DL3-D4-03			
FAA-VF-DL3-D5-01			
FAA-VF-DL3-D5-02			
FAA-VF-DL3-D5-03			

N Carpet flammability pictures

Table N- 1. Test photographs for FAA-VF-C1-DX-0X (Polyamide carpet)

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-VF-C1-D0-01			
FAA-VF-C1-D0-02			
FAA-VF-C1-D0-03			
FAA-VF-C1-D1-01			
FAA-VF-C1-D1-02			
FAA-VF-C1-D1-03			

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-VF-C1-D2-01			
FAA-VF-C1-D2-02			
FAA-VF-C1-D2-03			
FAA-VF-C1-D3-01			
FAA-VF-C1-D3-02			
FAA-VF-C1-D3-03			

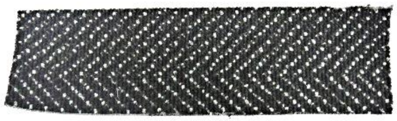
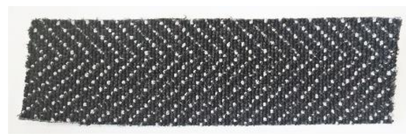
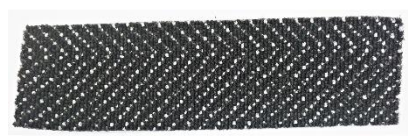
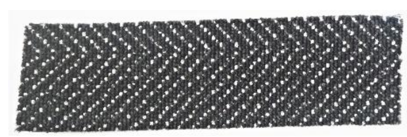
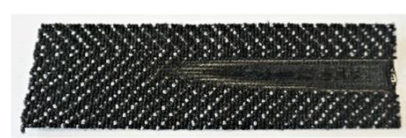
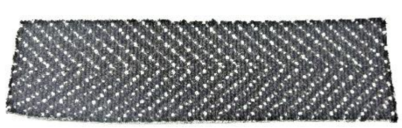
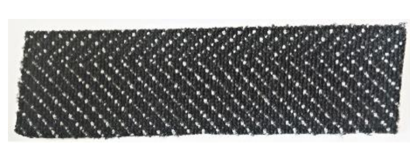
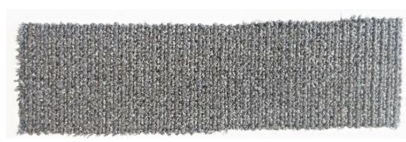
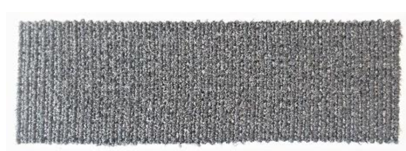
	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-VF-C1-D4-01			
FAA-VF-C1-D4-02			
FAA-VF-C1-D4-03			
FAA-VF-C1-D5-01			
FAA-VF-C1-D5-02			
FAA-VF-C1-D5-03			

Table N- 2. Test photographs for FAA-VF-C2-DX-0X (Wool carpet)

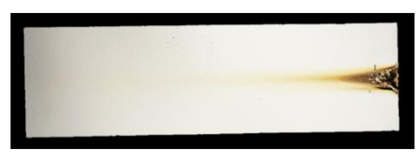
	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-VF-C2-D0-01			
FAA-VF-C2-D0-02			
FAA-VF-C2-D0-03			
FAA-VF-C2-D1-01			
FAA-VF-C2-D1-02			
FAA-VF-C2-D1-03			

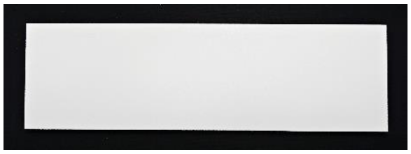
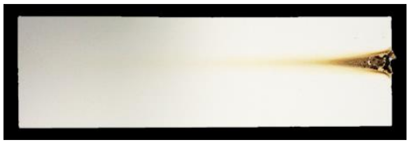
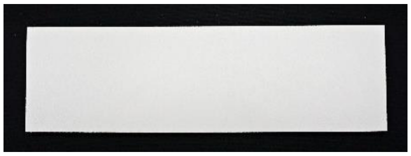
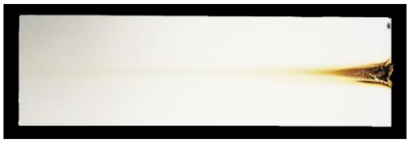
	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-VF-C2-D2-01			
FAA-VF-C2-D2-02			
FAA-VF-C2-D2-03			
FAA-VF-C2-D3-01			
FAA-VF-C2-D3-02			
FAA-VF-C2-D3-03			

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-VF-C2-D4-01			
FAA-VF-C2-D4-02			
FAA-VF-C2-D4-03			
FAA-VF-C2-D5-01			
FAA-VF-C2-D5-02			
FAA-VF-C2-D5-03			

O ULTEM^{TM} flammability pictures

Table O- 1. Test photographs for FAA-VF-P5-DX-0X (ULTEM^{TM} 9075)

	Pre-Conditioning	**Post-Conditioning/ Pre-Test**	**Post-Test**
FAA-VF-P5-D0-01			
FAA-VF-P5-D0-02			
FAA-VF-P5-D0-03			
FAA-VF-P5-D1-01			
FAA-VF-P5-D1-02			
FAA-VF-P5-D1-03			

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-VF-P5-D2-01			
FAA-VF-P5-D2-02			
FAA-VF-P5-D2-03			
FAA-VF-P5-D3-01			
FAA-VF-P5-D3-02			
FAA-VF-P5-D3-03			

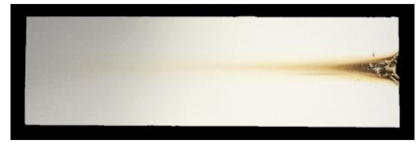
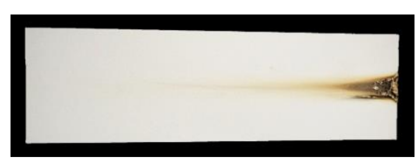
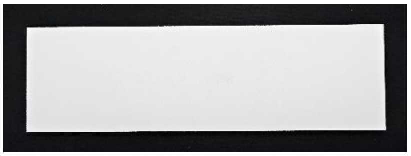
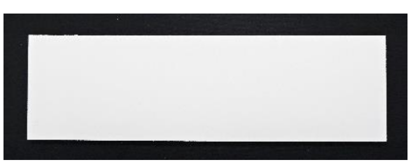
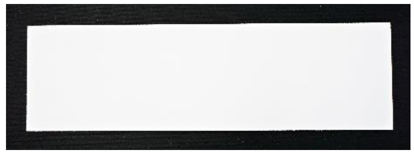
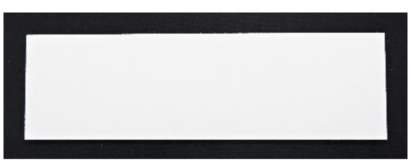
	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-VF-P5-D4-01			
FAA-VF-P5-D4-02			
FAA-VF-P5-D4-03			
FAA-VF-P5-D5-01			
FAA-VF-P5-D5-02			
FAA-VF-P5-D5-03			

Table O- 2. Test photographs for FAA-VF-P6-DX-0X (ULTEM™ 9085)

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-VF-P6-D0-01			
FAA-VF-P6-D0-02			
FAA-VF-P6-D0-03			
FAA-VF-P6-D1-01			
FAA-VF-P6-D1-02			
FAA-VF-P6-D1-03			

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-VF-P6-D2-01			
FAA-VF-P6-D2-02			
FAA-VF-P6-D2-03			
FAA-VF-P6-D3-01			
FAA-VF-P6-D3-02			
FAA-VF-P6-D3-03			

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-VF-P6-D4-01			
FAA-VF-P6-D4-02			
FAA-VF-P6-D4-03			
FAA-VF-P6-D5-01			
FAA-VF-P6-D5-02			
FAA-VF-P6-D5-03			

P Fiberglass laminate flammability pictures

Table P- 1. Test photographs for FAA-VF-FG1-DX-0X (Fiberglass G-10/FR4)

	Pre-Conditioning	**Post-Conditioning/ Pre-Test**	**Post-Test**
FAA-VF-FG1-D0-01			
FAA-VF-FG1-D0-02			
FAA-VF-FG1-D0-03			
FAA-VF-FG1-D1-01			
FAA-VF-FG1-D1-02			
FAA-VF-FG1-D1-03			

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-VF-FG1-D2-01			
FAA-VF-FG1-D2-02			
FAA-VF-FG1-D2-03			
FAA-VF-FG1-D3-01			
FAA-VF-FG1-D3-02			
FAA-VF-FG1-D3-03			

	Pre-Conditioning	Post-Conditioning/ Pre-Test	Post-Test
FAA-VF-FG1-D4-01			
FAA-VF-FG1-D4-02			
FAA-VF-FG1-D4-03			
FAA-VF-FG1-D5-01			
FAA-VF-FG1-D5-02			
FAA-VF-FG1-D5-03