

## Chemical Compatibility of Materials and TwinOxide

May 26, 2020

To whom it may concern:

The current COVID-19 pandemic emphasizes the need for an effective cleaning solution to safely disinfect surfaces of a variety of materials. There is also a need for a disinfecting mist solution with the ability to remove bacteria, viruses, molds, and other harmful pathogens from the air and nearby surfaces.

Such a solution cannot be harmful to the materials on which they are used. To certify the performance of a given solution in aircrafts, the Boeing Company developed the *Boeing Specification Support Standard BSS7434* (Original Issue, 04-Jun-2019). This test calls for exposing the solution to the wide range of materials found within an aircraft and evaluating the effect it had on each surface.

TwinOxide, a chlorine dioxide solution (50ppm), passed the test on all surfaces as reported on May 13, 2020 by SMI, Inc. (Scientific Material International). The test results can be seen at [chemdepot.com/boeingreport](https://chemdepot.com/boeingreport).

This is an important development for commercial airlines because TwinOxide is the disinfectant of choice for a number of reasons.

1. The solution is certified as safe on all surfaces within an aircraft.
2. The solution is a stronger oxidizer than bleach and has better staying power than hydrogen peroxide or ozone, yet it is safe and effective.
3. The solution is safe to handle and does not require additional PPE.
4. The solution disinfects effectively on surfaces as a spray and in air as a mist.

The tested materials include metal, rubber sealant, painted surfaces, Tedlar® surfaces, vinyl, fabric, carpet, leather, Naugahyde® surfaces, and polycarbonate crazing.

While these tests were specific to the materials in commercial aircraft, the results impact a wide range of industries which use similar materials. Disinfecting with TwinOxide is a safe and cost-effective method to eliminate the spread of harmful pathogens.

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Attn: Joe Nieuwma PhD  
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Date: 13-May-2020

SMI/REF: 2004-537

Product: **TWINOXIDE** (received 08-Apr-2020)

Dilution: As received

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**BOEING SPECIFICATION SUPPORT STANDARD  
BSS7434  
CHEMICAL COMPATIBILITY OF CLEANING PRODUCTS AND INTERIOR  
PARTS/MATERIALS OF COMMERCIAL TRANSPORT AIRCRAFT**

(Version: Original issue, 04-Jun-2019)

Supersedes Boeing D6-7127

(Note: Boeing D6-7127 was cancelled and superseded by BSS7434 on 04-Jun-2019)

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Respectfully submitted,



Patricia D. Viani, SMI Inc.

Client: Twinoxide, Inc. North America  
 Product: TWINOXIDE  
 Dilution: As received  
 BSS7434

Date: 13-May-2020  
 SMI/REF: 2004-537

**PROCEDURE**

**7.a Cleaning materials must be tested in accordance with BAC5150 test requirements.**

**5.1 / 7.1 Sandwich Corrosion Test**

Requirement (BAC5150 / 11.3.1): Corrosion in excess of that on the control panel constitutes failure when tested in accordance with the procedures section for sandwich corrosion in BSS7434.

	CLAD 7075-T6 ALUMINUM (AMS 4049)	BARE 7075-T6 (AMS-QQ-A-250/12) ANODIZED PER MIL-A-8625 TYPE I (with dichromate seal)
<b>PRODUCT (AS RECEIVED)</b>	<b>1</b>	<b>1</b>
CONTROL (D.I WATER)	1	1

Result           Conforms          

**5.2 / 7.2 Immersion Corrosion Test**

Requirement (BAC5150 / 11.3.2): The average weight change of each test specimen shall not exceed  $\pm 10$  mg in a 24 hour immersion period when tested in accordance with the procedures section for immersion corrosion in BSS7434.

	<b>PRODUCT (AS RECEIVED)</b> (Loss per 1" x 2" panel )
Clad 2024-T3 aluminum (AMS-QQ-A-250/5)	<b>&lt; 1.0 mg</b>
Bare 2024-T3 aluminum (AMS-QQ-A-250/4) alodined per MIL-C-5541	<b>1.3 mg</b>
Bare 2024-T3 aluminum (AMS-QQ-A-250/4) anodized per MIL-A-8625 Type I	<b>&lt; 1.0 mg</b>
Bare 7178-T6 aluminum (AMS-QQ-A-250/14) anodized per MIL-A-8625 Type I	<b>&lt; 1.0 mg</b>

Result           Conforms          

**5.3 / 7.3 Rubber Test**

Requirement (BAC5150 / 11.3.3): Changes in properties must not exceed the following, when tested in accordance with the procedures section for rubber test in BSS7434.

PROPERTY RUBBER: BMS1-72* <small>*Note: BMS1-63 replaced with BMS1-72 according to Triangle Rubber Co.</small>	MAX. CHANGE ALLOWED	PRODUCT (AS RECEIVED)
Tensile Strength	25 % loss	<b>&lt; 5%</b>
Elongation	25 % loss	<b>&lt; 5%</b>
Volume	$\pm 15\%$ change	<b>&lt; 5%</b>

24 hour immersion at room temperature

Result           Conforms

Client: Twinoxide, Inc. North America  
Product: TWINOXIDE  
Dilution: As received  
BSS7434

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#### 5.4 / 7.4 Sealant Test

Requirement (BAC5150 / 11.3.4): The sealant must not lift at the edges or lose adhesion when tested in accordance with the procedures section for sealant test in BSS7434.

**Sealant: BMS 5-95**

*Water control: No lifting or loss of adhesion when pried away from edge*

**PRODUCT (AS RECEIVED):**

**No lifting or loss of adhesion when pried away from edge**

Result Conforms

#### 5.5 / 7.5 Painted Surface Test

Requirement (BAC5150 / 11.3.5): When tested in accordance with the procedures section for painted surface test in BSS7434 and Section 7.c, the following is required:

*Exposure: 2 minutes, then rinsed*

- Paint film hardness shall not decrease more than 2 pencil hardnesses.
- Greater than minimal color change or staining constitutes test failure.

*Paint System: BMS10-83 enamel prepared in accordance with BAC5755*

**PRODUCT (AS RECEIVED):**

**Hardness change: < 2 pencil hardness change**

**Color change (AATCC Gray Scale): Grade 5 / minimal to none**

*(No perceived difference in color or contrast between original material and tested specimen).*

Result Conforms

#### 5.6 / 7.6 Tedlar Surface Test

Requirement (BAC5150 / 11.3.6): When tested in accordance with the procedures section for tedlar surface test in BSS7434 and Section 7c., the following is required:

*Exposure: 2 minutes, then rinsed*

- Greater than minimal color change or staining constitutes test failure.
- Examine for scratches

**PRODUCT (AS RECEIVED):**

**Color change (AATCC Gray Scale): Grade 5 / minimal to none**

*(No perceived difference in color or contrast between original material and tested specimen).*

**No scratches**

Result Conforms

#### 5.7 / 7.7 Vinyl Surface Test

Requirement (BAC5150 / 11.3.7): When tested in accordance with the procedures section for vinyl surface test in BSS7434 and Section 7c., the following is required:

*Exposure: 2 minutes, then rinsed*

- Cracking or brittleness of exposed specimen constitutes test failure.
- Greater than minimal color change or staining constitutes test failure.

**PRODUCT (AS RECEIVED): No cracking or brittleness**

**Color change (AATCC Gray Scale): Grade 5 / minimal to none**

*(No perceived difference in color or contrast between original material and tested specimen).*

Result Conforms

Client: Twinoxide, Inc. North America  
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Dilution: As received  
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5.8 / 7.8 Fabric and Carpet Test

Requirement (BAC5150 / 11.3.8): When tested in accordance with the procedures section for fabric and carpet test in BSS7434 and Section 7c., the following is required:

**Upholstery:**

- a. Greater than minimal color change or staining constitutes test failure.

**PRODUCT (AS RECEIVED):**

**Color change (AATCC Gray Scale): Grade 5 / minimal to none**

*(No perceived difference in color or contrast between original material and tested specimen).*

Result Conforms

- b. Flammability: maximum values:

PROPERTY	MAXIMUM VALUE	FABRIC (cut perpendicular "fill")	FABRIC (cut parallel "warp")
Extinguishing Time	15 seconds	<b>Less than 3 seconds</b>	<b>Less than 3 seconds</b>
Burn Length	8 inches	<b>4 inches</b>	<b>4 inches</b>
Drip Extinguish Time	5 seconds	<b>Less than 3 seconds</b>	<b>Less than 3 seconds</b>

Result Conforms

**Carpet:**

- a. Greater than minimal color change or staining constitutes test failure.

**PRODUCT (AS RECEIVED):**

**Color change (AATCC Gray Scale): Grade 5 / minimal to none**

*(No perceived difference in color or contrast between original material and tested specimen).*

Result Conforms

- b. Flammability: maximum values:

PROPERTY	MAXIMUM VALUE	CARPET (cut perpendicular "fill")	CARPET (cut parallel "warp")
Extinguishing Time	15 seconds	<b>Less than 3 seconds</b>	<b>Less than 3 seconds</b>
Burn Length	8 inches	<b>4 inches</b>	<b>4 inches</b>
Drip Extinguish Time	5 seconds	<b>Less than 3 seconds</b>	<b>Less than 3 seconds</b>

Result Conforms

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5.9 / 7.9 Leather and Naugahyde Test

Requirement (BAC5150 / 11.3.9): When tested in accordance with the procedures section for leather and naugahyde in BSS7434 and Section 7c., the following is required:

*Leather:*

- a. *Cracking or brittleness of exposed specimen constitutes test failure.*
- b. *Greater than minimal color change or staining constitutes test failure.*

**PRODUCT (AS RECEIVED): No cracking or brittleness**  
**Color change (AATCC Gray Scale): Grade 5 / minimal to none**  
*(No perceived difference in color or contrast between original material and tested specimen).*

Result           Conforms          

*Naugahyde:*

- a. *Cracking or brittleness of exposed specimen constitutes test failure.*
- b. *Greater than minimal color change or staining constitutes test failure.*

**PRODUCT (AS RECEIVED): No cracking or brittleness**  
**Color change (AATCC Gray Scale): Grade 5 / minimal to none**  
*(No perceived difference in color or contrast between original material and tested specimen).*

Result           Conforms          

5.10 / 7.10 Flash Point Test

Requirement (BAC5150 / 11.3.10): All cleaning candidates having a flash point must be approved by Fire Protection Engineering before they can be evaluated for use.

**PRODUCT (AS RECEIVED):**  
**No Flash point observed to IBP: 212 °F**  
**(IBP = Initial Boiling Point)**

Result           Informational          

5.11 / 7.11 Polycarbonate Crazing Test

Requirement (BAC5150 / 11.3.11): Any cracking or crazing of the polycarbonate sheet constitutes failure, when tested in accordance with the procedures section for polycarbonate crazing test in BSS7434.

*(Strain = 0.008; 10 minute exposure)*

**PRODUCT (AS RECEIVED):**

**LEXAN 9600: No cracking or crazing**  
**BMS8-400 BAC 70913: No cracking or crazing**

Result           Conforms