

BLAZETAMER380™ MEETS USFS CORROSION SPECIFICATIONS WHEN MIXED AT 0.2%-0.65%



BLAZETAMER380™ MEETS USFS SPECIFICATION 5100-360B, FOR BOTH UNIFORM CORROSION AND INTERGRANULAR CORROSION FOR CONCENTRATE & AT MIX RATIOS BETWEEN 0.2%-0.65%.

Uniform corrosion is the destruction of a metal, relatively uniformly over the entire surface.

Intergranular corrosion is the destruction of metal at the grain boundaries, usually on a microscopic scale.

Both types of corrosion can result in loss of structural integrity of the affected metal and potential loss of the use of the metal item. In the case of corrosion to aircraft, the loss can result in catastrophic failure.

Corrosion Testing:

USFS National Technical Development Program (NTDP) Acceptable Standards for Mixed Products

Fixed-Tank Helicopters, Fixed-Wing Airtankers, Helicopter Bucket & Ground-Based Application

Temperature: °F	2024-T3 Aluminum				4130 Steel				Yellow Brass	Az31B Magnesium			
	Total	Partial	Total	Partial	Total	Partial	Total	Partial	Partial	Total	Partial	Total	Partial
	70	120	70	120	70	120	70	120	120	70	120	70	120
-----mils-per-year-----													
Concentrates													
Wet concentrates for fixed-tank helicopters	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Wet concentrates except fixed-tank helicopters	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0				
Mixed Products													
Fixed-tank helicopters ²	2.0	2.0	2.0	2.0	5.0	5.0	5.0	5.0	5.0	4.0	4.0	4.0	4.0
Fixed-wing air tankers ³	2.0	2.0	2.0	2.0	5.0	5.0	5.0	5.0	5.0				
Helicopter bucket and Ground-based application	2.0	2.0	2.0	2.0	5.0	5.0	5.0	5.0	5.0				
¹ All uniform corrosion rates shall be determined by 90-day weight loss tests. All uniform corrosion rates are the maximum allowable average of all replicates.													
² Intergranular corrosion tests shall be performed on aluminum and magnesium coupons; no intergranular corrosion is allowed.													
³ Intergranular corrosion tests shall be performed on aluminum coupons; no intergranular corrosion is allowed. Intergranular corrosion tests are not required on magnesium.													

Footnote #2 - Fixed-Tank Helicopters – No intergranular corrosion allowed, aluminium & magnesium

Footnote #3 - Airtankers - No intergranular corrosion allowed, aluminium only.

Corrosion testing of Wildland Fire Chemicals is a two-part process if intergranular corrosion tests apply. Initial tests are conducted for uniform corrosion and products must meet the specifications listed in the table above. There are no intergranular corrosion requirements for helicopter bucket or ground-based application equipment.

If a product is to be approved for use in fixed-tank helicopters or fixed-wing air tankers they must be further tested for intergranular corrosion.

As per USFS Specification 5100-306b, the phrase “no intergranular corrosion” is determined from using samples that were used for uniform corrosion testing with further testing that includes slicing, polishing, etching and examination with a microscope, as described below.

SOURCE – USFS Wildland Fire Chemicals website

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FOREST SERVICE

3.5.5.2. Intergranular Corrosion. When tested in accordance with 4.4.2, coupons of the alloys specified in 3.5.5.2.1 through 3.5.5.2.4 exposed to enhanced water mixtures shall show no evidence of intergranular corrosion as summarized in Table 3A.

Application Method	Alloy	
	Aluminum 2024-T3	Magnesium AZ-31-B
Helicopter, Fixed-Tank	No detectable IGA	No detectable IGA
Multi-Engine, Fixed-Wing Airtanker	No detectable IGA	Not Applicable
Single-Engine, Fixed-Wing Airtanker	No detectable IGA	Not Applicable
Helicopter Bucket	Not Applicable	Not Applicable
Ground Based Equipment	Not Applicable	Not Applicable

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- Figure 1: Dimensions of the test specimen. The diagram shows a rectangular specimen with a total width of 4 inches (10.2 cm) and a total height of 1 inch (2.5 cm). The width is divided into three sections: a left section of 1-1/2 inches (3.8 cm), a middle section of 1-1/2 inches (3.8 cm), and a right section of 1/8 inch (0.3 cm). The height is divided into two sections: a top section of 1/8 inch (0.3 cm) and a bottom section of 1/2 inch (1.3 cm). The bottom section is shaded and labeled 'Discard Shaded Portion'. The top section is labeled 'Transverse Cross-section' and the bottom section is labeled 'Longitudinal Cross-section'.

Figure 1. Diagram for cutting and examining coupons for intergranular corrosion.

The USDA Forest Service originally conducted corrosion testing of BLAZETAMER380™ at 0.65% solution in 2008. The following table, from the USFS Wildland Fire Chemicals website, documents BLAZETAMER380™ meets specifications for both Uniform Corrosion and Intergranular Corrosion. Footnote #5 & #6 indicate BLAZETAMER380™ meets intergranular corrosion requirements for both aluminium and magnesium, so BLAZETAMER380™ is approved for use in fixed-tank helicopters and fixed-wing airtankers.

 Uniform Corrosion¹ BioCentral Blazetamer 380 													
Temperature: °F	2024-T3 Aluminum				4130 Steel				Yellow Brass	Az31B Magnesium			
	Total	Partial	Total	Partial	Total	Partial	Total	Partial	Partial	Total	Partial	Total	Partial
	70	120	70	120	70	120	70	120	120	70	120	70	120
-----mils-per-year-----													
Concentrate													
Fresh	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3	1.7	4.0	0.7	1.9
0.65-Percent Solution													
Fresh ^{5,6}	0.1	0.3	0.1	0.1	0.2	0.6	0.2	0.4	0.1	1.6	2.0	1.0	1.4
1 Year – Missoula ^{5,6}	0.1	0.3	0.1	0.1	0.1	1.0	0.2	0.9	0.1	2.0	1.8	1.5	1.0
1 Year - San Dimas ^{5,6}	0.1	0.3	0.1	0.1	0.1	0.9	0.2	0.6	0.1	1.6	2.0	1.0	1.1
Notes:													
1	Uniform corrosion rates (expressed in mils-per-year) were determined by 90-day weight loss tests. Values shown are the average of all replicates.												
2	Results up to 0.1 mils-per-year are recorded as 0.1 mils-per-year.												
3	Uniform corrosion tests are performed on wet concentrates. Uniform corrosion tests are not performed on dry concentrates.												
4	Products for use only at portable or temporary bases do not require 1-year stability and corrosion tests.												
5	Meets the intergranular corrosion requirements for aluminum.												
6	Meets the intergranular corrosion requirements for magnesium.												

The USDA Forest Service conducted corrosion testing of BLAZETAMER380™ at 0.2% in 2021. Initial uniform corrosion tests were conducted at NTDP on eight (8) metal coupons; four (4) 2024 T3 aluminum coupons and four (4) magnesium coupons. These coupons were all found to be within specifications for uniform corrosion and were then forwarded to G2MT Laboratories, LLC, of Houston, to be tested for intergranular corrosion. All eight coupons examined by G2MT Laboratories were free of any detectable intergranular corrosion.

 Forest Service	Washington Office- National Technology and Development Program	5785 Highway 10 West Missoula, MT 59808
		444 East Bonita Avenue San Dimas, CA 91773
		File Code: 5162
		Date: December 7, 2021

Notification from NTDP that BLAZETAMER380™ meets specifications for uniform corrosion was delivered in a letter from NTDP to BioCentral Laboratories, Ltd. dated December 7, 2021. A table that shows weight loss after 90 days was included in the letter. The body of this letter is as follows:

“The initial uniform corrosion tests on Bio-central Blazetamer (formulation identification #LEM-380) have been completed in accordance with Forest Service Specification 5100-306b.

Table 1 summarizes the results of the uniform corrosion tests performed on the product diluted to 0.2%. The corrosion rates on aluminum, mild steel, yellow brass, and magnesium are acceptable.

To continue with the testing of this product, please arrange for intergranular corrosion testing, and provide me with a letter of authorization to have the testing performed and a purchase order to cover the costs of testing 4 aluminum coupons and 4 magnesium coupons.”

Table 1
Uniform corrosion by 90-day Weight Loss Test
of
Bio-central Blazetamer380
FID #LEM-380
Mixed at 0.2%
Fresh

	Total Immersion		Partial Immersion	
	70° F	120° F	70° F	120° F
	----- mils-per-year -----			
2024 - T3 Aluminum	0.1	0.8	0.2	0.5
	0.2	0.8	0.2	0.3
	0.3	0.6	0.4	0.5
Average	0.2	0.7	0.3	0.4
4130 Steel	0.2	0.8	0.3	0.6
	0.2	0.7	0.3	0.6
	0.3	1.0	0.4	1.1
Average	0.2	0.8	0.3	0.8
Yellow Brass	-	-	-	<0.1
	-	-	-	<0.1
	-	-	-	<0.1
Average	-	-	-	<0.1
Az31B Magnesium	2.0	2.3	1.4	1.5
	1.8	2.1	1.1	1.5
	2.0	2.4	1.0	1.4
Average	1.9	2.3	1.2	1.5

	Forest Service	Washington Office- National Technology and Development Program	5785 Highway 10 West Missoula, MT 59808
			444 East Bonita Avenue San Dimas, CA 91773
File Code:			5162
Date:			January 26, 2022

Notification from NTDP that BLAZETAMER380™ meets specifications for intergranular corrosion included both a letter from NTDP to BioCentral Laboratories, Ltd. dated January 26, 2022, and a report, *WFC21003: Metallurgical Examination of Four Aluminum and Four Magnesium Coupons*, dated January 17, 2022.

This body of the letter is as follows:

“Intergranular corrosion tests from the BioCentral Blazetamer (FID# LEM-380) have been completed in accordance with the Water Enhancer Forest Service Specification 5100-306b. The tests were performed on representative aluminum and magnesium coupons exposed to the mixed product at 0.2-percent. Intergranular corrosion testing is conducted on the uniform corrosion specimens after weight loss calculations have been completed.

Testing showed no intergranular attack on any of the samples tested. The specifics of these findings are in the attached report (provided by G2MT Laboratories, LLC).”

SUMMARY: BLAZETAMER380™ meets USFS Specification 5100-360b, for both uniform corrosion and intergranular corrosion for undiluted concentrate and at mix ratios between 0.2%-0.65%.