Tagnite PEO Process for Gearbox Overhaul

TECHNOLOGY APPLICATIONS GROUP
EXCELLENCE IN MAGNESIUM SURFACE PROTECTION

ASETSDefense 2012
San Diego, CA August 27 – 30, 2012

Bill Elmquist – President
**Title:** Tagnite PEO Process for Gearbox Overhaul

**Performing Organization:** Technology Application Group, 810 48th Street South, Grand Forks, ND, 58201

**Abstract:**

**Security Classification:**
- Report: Unclassified
- Abstract: Unclassified
- This Page: Unclassified

**Distribution:**
Approved for public release; distribution unlimited

**Number of Pages:** 29
Environmentally Clean Magnesium Finishing

TAGNITE®

HAE

Dow 17

5% * chemical concentration

25%* chemical concentration

56% * chemical concentration

HAE contains heavy metals; Dow 17 contains heavy metals and chromium

*Approximations
Coating Morphology

Dow 17

HAE

All photos shown at 500x magnification.

TAGNITE®
**Superior Corrosion Resistance**

*TAGNITE®, HAE & Dow 17 (Type I) on magnesium alloy ZE41 after 168 hours in salt spray*

*Only Tagnite Provides Inherent Corrosion Resistance*
USMC EFV

F-22 Fighter

CH-53

AH-6

F-35 Fighter

MD 500/600

F-22 Fighter

Widely Specified

USMC EFV

KC-135 Tanker

B-52 Bomber

Pratt & Whitney 308 Engine

Pratt & Whitney PT-6 Engine
Magnesium Oil Pan

Magnesium Transmission Housing

Magnesium Gearbox

Magnesium Jet Engine Gearbox

Environmentally Clean Magnesium Finishing Since 1994
Why Anodize a Magnesium Component During Overhaul

• Magnesium Corrosion is a Costly Issue Affecting Most All DoD Platforms

• Current Overhaul Coatings are Mostly Chromate Conversion Based Processes That Provide Little Corrosion Protection

• These Poor Performing Conversion Coatings Have Resulted in High Life Cycle Costs for Most Magnesium Components
Superior Corrosion Resistance Without the Environmental Headaches of Hexavalent Chromium
Why Use An Ineffective Chromate Conversion Coating During Overhaul?

Because You Can’t Anodize in Presence of Ferrous Metal Inserts. Chromate Conversion Coatings are Compatible with Ferrous Metal Inserts.
The Solution is to Mask The Ferrous Metal Inserts to Allow Successful Anodization to Occur.

Successfully Anodized After Masking:

- 6 Steel Bearing Liners
- 42 Helicoils
- 52 Studs
Why Spend Hours Masking Ferrous Metal Inserts to Allow Anodization When Chromate Conversion Coatings Are Inexpensive and Easy to Apply?

Because Magnesium Castings are Expensive and Require Long Lead Times to Replace.

Replacement Cost: Over $45,000
Masking Ferrous and Anodizing Could Allow Overhaul Parts to be Better Protected Than OEM New
Matting Faces are Often Times Re-Machined After Bearing Liners are installed. This Now Bare Magnesium is Then Typically Treated with a Chromate Conversion Coating.
Before Bearing Liner Installation

Post Bearing Liner Installation Machining

Next Step – Apply Chromate Conversion Coating to Now Bare Magnesium
Before Bearing Liner Installation

Post Bearing Liner Installation Machining

Next Step – Apply Chromate Conversion Coating to Now Bare Magnesium
Solution – Mask Ferrous Metal Inserts and Apply Chromate Free Anodize
Before Bearing Liner Installation

Post Bearing Liner Installation
Machining

Next Step – Apply Chromate Conversion Coating to Now Bare Magnesium
Solution – Mask Ferrous Metal Inserts and Apply Chromate Free Anodize
Before Bearing Liner Installation

Post Bearing Liner Installation Machining

Next Step – Apply Chromate Conversion Coating to Now Bare Magnesium
Solution – Mask Ferrous Metal Inserts and Apply Chromate Free Anodize
TAG Demo Parts – As Received

As received condition of scrap castings as part of an IBIF III project
Key to Successful Anodization of Used Magnesium Castings is Starting with a Clean Casting that is free of paint and old anodize coatings.
After Media Blasting and Tagnite Anodization
Small Data Markings Still Clearly Visible
Approved by Many Aerospace and Defense Companies, Brush Tagnite is an Effective Method to Touch-up Magnesium Castings Without Using Hexavalent Chromium
Why Go Through the Expense of Masking Ferrous Metal Inserts? Magnesium Castings are Expensive and Conversion Coatings are Ineffective
By selecting Tagnite the Air Force was able to eliminate hexavalent chromium and attain corrosion resistance superior to standard chromate conversion coatings typically used during overhaul.

Tagnite has been employed now on 33 different part numbers between the B-52 Bomber and KC-135 Tanker.

Well over 500 KC-135/B-52 Bomber components have been successfully coated with Tagnite.
Over 75 Units of This Production Part Number Have Been Successfully Anodized After Masking Ferrous Metal Inserts.

Bearing Liner is flush with magnesium on one side
And raised above magnesium on other side. On raised side
a core passage way comes directly to bearing liner.

Multiple Pressed in Steel Bushing
Summary

• It is Possible to Avoid Hexavalent Chromium When Finishing New or Used Magnesium Aerospace and Defense Components
• Masking of Ferrous Metal Inserts is Expensive and Time Consuming but that Cost Represents a Small Fraction of the Replacement Cost of the Parts