INCREMENTAL CHANGE Release Notification Date: 06/10/2021

SPM 70-24-01 SWAB ETCHING PROCEDURE

DISCLAIMER

The Incremental Changes published by GE Aviation are considered Instructions for Continued Airworthiness. These Incremental Changes, along with the current Manual revision and published Temporary Revisions, constitute the latest Instructions for Continued Airworthiness.

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HIGHLIGHTS

HIGHLIGHT REFERENCE	DESCRIPTION OF CHANGE
tk70-24-01-110-034	Technical Change: Added material R142 to the procedure.

TASK 70-24-01-110-034

1. General.

This procedure describes the materials and process for swab etching used as a preliminary step before fluorescent-penetrant inspection that is used to permit revealing local indications in the metal surface. The intent of this procedure is to describe localized swab etching methods that will uniformly remove approximately 0.0001 to 0.0002 inch (0.0025 to 0.0051 mm) of metal from the surface being etched without preferential attack (i.e. pitting or intergranular attack). These etchants are used as described herein or with exceptions as specified for individual parts in the Engine/Shop Manual.

NOTE: If the Engine Manual repair procedure gives any in-process vacuum heat treatment (that is in the temperature range of 1900 - 2000 °F (1038-1093 °C) or above) for a minimum of 15 minutes for R77, R125, R80, ReneN5, IN100, DS200, and R142 as a preceding process step of the fluorescent penetrant inspection, this in-process heat treatment step can be used as a thermal etch, and chemical swab etch will be not necessary. No intermediate operations are permitted between Fluorescent Penetrant Inspection (FPI) and thermal etch. If any intermediate operations (that includes aging, any surface treatment, etc.) are done between the FPI and thermal etch, the chemical etch must be done before the FPI. Thermal etch must not be used as an alternative method instead of chemical etch if the in-process heat treatment is not defined in the repair manual.

2. Materials.

Subtask 70-24-01-110-341

A. Refer to TASK 70-24-99-990-005, Consumable Materials - Etching Solutions.

(1) Storage: Plastic containers (polyethylene or polypropylene, acid-resistant quality) are recommended for storing all stock etchant solutions. Class B etchant attacks glass. Class B and Class F etchants must be stored in plastic bottles. Class A, C, E, G, and H etchants may be stored in glass bottles, if desired. Store away from heat, and keep from freezing.

WARNING: CLOSED CONTAINERS OF CLASS C ETCHANTS CAN BUILD UP GAS PRESSURE. OPEN ALL CAPS SLOWLY AND CAREFULLY TO ALLOW BUILT UP GAS PRESSURE TO GRADUALLY ESCAPE. OTHERWISE, A SUDDEN

ESCAPE OF GAS PRESSURE CAN CAUSE INJURY TO YOU AND OTHER PERSONS AND CAN DAMAGE EQUIPMENT.

(2) Shelf Life: The shelf life of each class of etchants is as follows:
Class A: 1 year.
Class B: 3 months in a plastic bottle.
Class C: 6 months.
Class D: Cancelled. Replaced by Class C. Use Class C when Class D is specified.
Class E: 6 months.
Class F: 1 year in a plastic bottle.
Class G: 6 months.
Class H: 6 months

(3) Handling: Each container of stock solution shall be stored with tightly fitting caps or stoppers, labelled with the etchant Class identification of the contents, and the expiration date of the shelf-life period. A supply of distilled or deionized water should be available for mixing etchants, and for rinsing them from the etched area of the work.

3. Procedure.

Subtask 70-24-01-110-342

WARNING: ETCHANT CHEMICALS ARE TOXIC AND CORROSIVE. FOLLOW ALL ENVIRONMENTAL, HEALTH, AND SAFETY REQUIREMENTS AND RECOMMENDATIONS LISTED ON THE MATERIAL SAFETY DATA SHEETS (MSDS) FOR ALL OF THESE CHEMICALS.

A. Unless otherwise specified in the Engine/Shop Manual, etch specimens as follows:

(1) All surfaces to be etched shall be clean and free from oil, grease, oxides, scale, or other extraneous material. An indication of a clean and active material surface is required. This is demonstrated by a water-break free surface or a continuous film (no beading) of the etch solution on the surface being etched. Light abrasion by hand sanding with woven or non-woven coated abrasive products (C10-010 , C10-062 or C10-211) can be used to clean and activate the surface prior to etching.

(2) Pour a small quantity of stock solution into a clean chemical resistant beaker or dish. This quantity will be the working solution, and is not to be returned to the stock bottle.

CAUTION: ETCHANTS CONTAINING HYDROFLUORIC ACID (HF) SHALL NOT BE USED ON CASTING OR PARTS MANUFACTURED FROM GAMMA TITANIUM ALUMINIDE ALLOYS. THIS RESTRICTION SHALL NOT APPLY TO METALLOGRAPHIC SAMPLES USED FOR MICROSTRUCTURAL EVALUATION.

(3) Saturate an applicator (a cotton swab is preferred and recommended) with the working solution and rub the surface to be etched. Swab etch the surface for the time specified in the repair or use Table 1 to determine the etching time for the etchant class and material type.

Guideline for Etching Time, Etchant Class, and Material Time - Table 1

Material	Time	Etchant Class							
		A	B	C	E	F	G	H	I
All Magnesium Alloys	60-90 sec	X							
All Titanium Alloys except Titanium Aluminide Alloys	60-90 sec		X						
All Aluminum Alloys	60-90 sec					X			
Carbon and Low Alloy Steels (4340, 9310, etc.)	60-90 sec				X				
Maraging Steels (Marage 250, etc.)	60-90 sec			X	X				
Low Expansion Alloys (Incoloy 903, 907, 909, Thermospan, etc.)	2.5-3 min			X					
All Stainless Steels (300s, 400s, PH, etc.)	4-5 min			X					
Iron Superalloys (A286, V57, etc.)	4-5 min			X					
Turbine Airfoil Nickel Superalloys (Inconel 738, Rene 77, 80, 125, 142, N5, etc.)	60-90 sec			X					
Non-Turbine Airfoil Nickel Superalloys - Chromium content less than 20% (Inconel 600, 718, Rene 41, 88DT, 95, 104, UDIMET 500, 700, etc.) See Note 3.	4-5 min			X			X		
Non-Turbine Airfoil Nickel Superalloys - Chromium content 20% and above (Hastelloy X, Inconel 601, 625, 939, MA754, etc.) See Note 3.	4-5 min			X					
Cobalt Superalloys (HS188, L605, MarM 509, X40, etc.) See Note 3.	4-5 min			X					
Copper-Cobalt-Beryllium Alloy (B11H49 or B11H68) - Solution Heat Treated. See Note 5.	60-90 sec							X	
Copper-Cobalt-Beryllium Alloy (B11G25, B11H49, or B11H68) or Copper-Nickel-Silicon-Chromium Alloy (B11G48) - Age Hardened. See Note 6.	75-105 sec							X	
Gamma Titanium Aluminide Alloys	11-13								X

min

NOTE: 1. The materials listed in parentheses are examples only. The lists are not intended to be all inclusive.

NOTE: 2. When etching surfaces containing two different alloys with different etching times specified in Table 1, use the shortest etching time specified.

NOTE: 3. A clean and active surface (a surface containing no oxides and no scale) is required for effective etching of cobalt and nickel superalloys. Light abrasion is recommended to activate the surface prior to etching. Refer to paragraph 3.A.(1), Subtask 70-24-01-110-342 for abrasive products.

NOTE: 4. Class D is cancelled. Class D is superseded by Class C.

NOTE: 5. When etching solution heat-treated Copper-Cobalt-Beryllium Alloys, etching should be done using a pair of two cotton swabs with approximately 0.02 to 0.04 grams of cotton on each swab.

NOTE: 6. When etching cast or age hardened Copper-Cobalt-Beryllium or Copper-Nickel-Silicon-Chromium Alloys, etching should be done using one cotton swab with approximately 0.02 to 0.04 grams of cotton on the swab.

(4) Keep the etching solution within the defined boundaries of the area to be etched. Masking may be required to contain the etchant inside the area to be etched.

(5) The size of the cotton swab should be as large as practical while still allowing good control of the etchant within the boundaries of the area to be etched. Larger applicators increase the volume of etchant available on the surface being etched. To get good results it is very important to set well-defined procedures and to train operators.

(6) All etchant solutions must be at room temperature.

(7) Keep fresh solution in contact with the metal surface at all times by frequently dipping the cotton swab into the working solution and frequently rubbing the surface area to be etched. Solutions that become weakened due to lack of periodic swabbing while on the part can cause local pitting. When the etching times specified in Table 1 are 4-5 minutes, the frequency of etchant reapplication/surface rubbing shall not exceed 90 seconds.

(8) After etching, thoroughly rinse the etched surface and surfaces that had been masked to remove any remaining etchant.

(9) If etching a small area, first blot up the etching solution from the metal surface with a clean cloth or paper towel. Then, wipe the etched area at least three times with a clean cloth or paper towel saturated with clean water. Rinsing the metal surface in a container of clean water is permitted.

(10) Use distilled or deionized water to rinse Class B etchant from titanium alloys. A supply of distilled or deionized water shall be available in the work area for this purpose.

(11) Once Class I solution is mixed, this solution has a working life of 20 minutes maximum. A solution exceeding the working life shall not be used and shall be discarded.

CAUTION: DO NOT POUR WORKING SOLUTION BACK INTO STOCK CONTAINER. DISPOSE OF THE USED WORKING SOLUTION IN ACCORDANCE WITH LOCAL ENVIRONMENTAL, HEALTH, AND SAFETY REGULATIONS.

(12) Discard used working solution. Rinse and dry the working solution container for future use.