DATE 8-8-52	TMC SPECIFICATION NO. S 114	
SH. 1 OF 1		
COMPILED BY LH	TITLE: ZINC CHROMATE PRIMER	JOB
APPROVED LH		

PURPOSE:

The purpose of this specification is to outline the materials and method of applying zinc chromate primer as a finish, or undercoat prior to applying the final finish.

MATERIAL REQUIRED: SOURCE:

#SV319 Zinc Chromate Wash Primer	Maas & Waldstein Co.
#FC320 Reducer	Maas & Waldstein Co.
Lacquer Thinner	Any

SURFACE PREPARATION:

Clean surface of all foreign materials.

PROPORATIONS OF MATERIAL:

Four parts primer.
One part reducer.
Thin if necessary with lacquer thinner.

CAUTION: Mix only enough primer for one day operation.

METHOD OF APPLICATION:

Apply by spraying one uniform coat of mixed primer and air dry for 15 to 30 minutes before applying final finish.

If only part of the surface is to be finaly finished and all surfaces are primed, then the unfinished primed surface will change color from greenish-yellow to brownish-green after baking.

APPLICABLE SPECIFICATIONS:

MIL-P-15328

SHIPPING AND MARKING:

All finished material shall be shipped in suitable containers to give maximum protection during transit.

All containers shall be plainly marked with the purchase order number, manufacturer's name and the TMC part number.

CONTROL METHODS

Hexavalent Chromium Determination

Equipment:
Pipette	10 ml.
Burette	50 ml.
Beaker	400 ml.
Graduate	10 ml.
Stirring rod	

Solutions:
1. Sodium thiosulfate $Na_2S_2O_3$ 0.1 N standardized against $K_2Cr_2O_7$
2. Potassium Iodide KI 10%
3. Starch Indicator

Method:
1. Pipette 10 ml. of solution into beaker and dilute to 250 ml. with distilled water.
2. Add 10 ml. of potassium iodide and 5 ml. of conc. sulfuric acid. Stir.
3. Titrate with sodium thiosulfate solution to a light yellow color.
4. Add 1 to 2 ml. starch solution.
5. Continue titration adding thiosulfate solution dropwise with constant stirring until the dark blue color produced by the starch fades to a clear solution.

Calculations: Ml. thiosulfate x Normality x 0.81 = oz/gal. compound

pH Determination:
1. Measure pH with electrometric pH meter.
2. After addition of any necessary Al-Coat compound adjust pH as follows:
   Add concentrated Nitric Acid (42°Be') 13 oz. (384 ml.) per 100 gal. for each pH 0.1 desired.

Example: 200 gallon tank at pH 1.7
Desired pH 1.5
1.3 (present pH - desired pH) x tank capacity in gallons = fl. oz. HNO_3
1.3 x (1.7 - 1.5) x 200 = 52 fl. oz. HNO_3

CLEANING PROCEDURES

General

A uniformly clean surface is of prime importance in securing satisfactory adhesion and complete coverage by subsequent surface treatment of aluminum and aluminum alloys. Failure to follow this rule results in costly rejections of finished products, and in even more costly failures in service.

Surface contamination of metals may be divided into two general classes. (1) Organic contamination consisting of oils, greases, forming and polishing lubricants, etc. (2) Inorganic contamination is typified by metal and abrasive particles loosely held in the grease films and by oxides more or less closely bonded to the metal.

Chemically clean surfaces are produced on metals generally in three stages.

Solvent Cleaning - Solvent vapor degreasing, solvent washing, or solvent emulsion cleaning is used to remove loose particles and to reduce organic contamination to a uniformly low level.

Alkaline Cleaning - is used to remove the last traces of organic contamination. The effectiveness of this operation is indicated by the presence of an unbroken film of water on the work after the succeeding rinse.

Acid Cleaning - removes metal oxides and, under ideal conditions, leaves the surface chemically clean and receptive for further processing. Chromate type deoxidizers are recommended as producing the most economical and satisfactory results.

Aluminum is available commercially in a number of alloys and forms, some of which differ widely in their response to various chemical treatments. Consequently, the choice of a cleaning cycle will depend upon the following considerations:

1. The alloy or alloys of aluminum in use.
2. The amount and kind of contamination to be removed.
3. The appearance required in the finished surface.
4. The equipment available.

Cleaning Method I-A and I-B

For Aluminum Wrought Alloys, Extrusions, and all alloys containing less than 1% silicon.

A. Hot etch type cleaning procedure

1. Vapor degrease if necessary
2. Etch type alkaline cleaner - ARP 150 or equivalent

Usual concentration	2 to 8 oz/gallon
temperature	160 to 200°F.
Immersion time	15 to 60 seconds

3. Rinse
4. Acid Clean
   a. ARP 170 Deoxidizer or equivalent

Usual concentration	8 to 16 oz/gallon
temperature	70° to 100°F.
Immersion time	30 seconds to 5 minutes

5. Rinse
6. Iridite #14-2 Al-Coat as per instructions.

Note: When using the etch type cleaning cycle on work which has been heat treated, a more even etch by the alkali cleaner may be obtained if the work is pre-cleaned for a few minutes in the acid cleaner. This removes heat treating oxides.

B. Alternate - Cold Clean

1. Acid chromate type deoxidizer-

ARP 170 or equivalent	6 to 8 oz/gallon
ARP #2 Detergent	1 1/4 fl. oz/gallon (38 ml/gal.)
Temperature	70° to 90°F.
Immersion time	3 to 5 minutes

2. Rinse
3. Iridite #14-2 Al-Coat as per instructions.

Cleaning Method II-A and II-B

For aluminum sand, die and permanent mold castings and all alloys with silicon over 1%.

A. Hot etch type cleaning procedure

1. Vapor degrease if necessary
2. Etch type alkaline cleaner- ARP 150 or equivalent

Usual concentration	2 to 8 oz/gallon
temperature	160 to 200°F.
Immersion time	15 to 60 seconds

3. Rinse
4. Acid Pickle for smut removal

Nitric Acid conc.	3 gallon
Hydrofluoric Acid 48 - 52%	1 gallon
Room temperature	
Time	2 to 5 seconds

5. Rinse
6. Iridite #14-2 Al-Coat as per instructions.

B. Alternate - Cold Clean

1. Acid chromate type deoxidizer- ARP 170 or equivalent 6 to 8 oz/gallon
   ARP #2 Detergent 1-1/4 fl. oz/gallon (38 ml/gallon)
   Temperature 70° to 90°F.
   Immersion time 3 to 5 minutes
2. Rinse
3. Iridite #14-2 Al-Coat as per instructions.

IRIDITE #14-2 AL-COAT

For Aluminum and Aluminum Alloys

INTRODUCTION

Iridite #14-2 Al-Coat is a chemical dip process for aluminum and aluminum alloys which can be applied by dip, brush, swab or spray and will produce a clear to a brown coating providing a maximum in corrosion protection. The solution is applied at room temperature and produces a film which can be used as a final finish or can be dyed various colors. (See separate data sheet Dye Colors for Aluminum) It is an ideal base for paints or lacquers and can also be used as a base for rubber bonding.

Concentration of working solution is extremely flexible and should be governed by the immersion time available, the corrosion protection i.e. film thickness desired, and the alloy to be treated. Solution concentrations of 3/4 to 4 oz/gallon are practical with the intermediate concentration of 1 1/4 oz/gallon used for the majority of conditions. Lower and higher concentrations can be used as found desirable.

Iridite #14-2 Al-Coat, in contrast with other protective chemical treatments for aluminum, has a minimum effect on the electrical characteristics for either high or low frequency work when used at lower concentrations. The coating can be used to protect abraded anodized surfaces and at the same time provides electrical contact to those surfaces. The Iridite #14-2 Al-Coat surface can be welded by the shielded arc method.

QUICK GLANCE FLOW CHART

For Dip Operation

1. Clean as recommended
2. Warm or Cold Running Rinse
3. Iridite #14-2 Al-COAT
4. Cold Running Rinse
5. Hot Water Rinse
6. Dry

OPERATING DATA

Tank linings to hold working solution

Stainless steel 18-8
Polyethylene
Koroseal or equal

Heating Coils

Stainless steel 18-8

Solution Make-up and Operating Controls

A. Dip Application

The powdered compound, as received, is dissolved in water at the rate of 3/4 to 2-1/4 oz/gallon for dip operation. Warm water can be used to assist the solution of the compound. The temperature should be allowed to drop below 100°F before use.

The concentration chosen should depend upon the protection desired i.e. film thickness, the procedures used and the alloy to be treated. Higher concentrations produce heavier, more protective coatings faster than slower acting solutions of lower concentrations.

Standard working solution concentration of 3/4, 1-1/4, and 2-1/4 oz/gallon are given. The intermediate concentration of 1-1/4 oz/gallon is suggested for normal use.

Yellow Coating - 3 to 6 minutes is generally used with the 1-1/4 oz/gallon concentration in obtaining a yellow coating of maximum protection. Use of higher concentrations will reduce immersion time necessary to produce a comparable film thickness.

The color varies to some extent with the alloy treated. For example, coatings on "soft" alloys, such as 3S (3003) and 52S (5052), tend to be dark in color. Coatings on 61ST (6061-T), 75ST (7075-T) and die cast alloys tend to be light in color. The immersion time selected should take this variation into consideration. Excessive immersion times will cause a loose powdery coating and are not recommended. Best results on high silicon cast alloys are obtained using a concentration of 3/4 oz/gallon and a 3 to 5 minute immersion time.

Clear Coating - A protective clear finish is obtained from the yellow coating, using an immersion time of 30 seconds to 3 minutes at a 1-1/4 oz/gallon concentration, by immersion in the final hot rinse water, which bleaches out the yellow color. At a temperature of 200°F, one minute immersion is sufficient. As the temperature is lowered, time of immersion must be increased. Immersion time in excess of the time necessary to remove the yellow color should not be used since this will reduce the protective value of the film.

Iridite 14-2 concentration range	3/4 to 2-1/4 oz/gallon
Temperature	60° to 100°F.
Immersion time	30 seconds to 6 minutes
pH range 3/4 oz/gallon conc.	1.6 to 1.9
pH range 1-1/4 oz/gallon conc.	1.3 to 1.6
pH range 2-1/4 oz/gallon conc.	1.1 to 1.4

No agitation is used in the Iridite #14-2 bath, other than that necessary to free any entrapped air bubbles. Harsh continuous agitation will produce a powdery, non-adherent film and should not be used.

B. Spray Application

Pre-treatment

1. Acid Cleaning - Where stainless steel spray cleaning equipment is available, an acid cleaner is recommended (Method B) using concentrations as low as 1-1/2 to 2 ounces per gallon of acid cleaner in conjunction with ARP #2 Detergent.

2. Alkaline Cleaning - Where plain steel spray cleaning equipment is available, an alkaline cleaner of the inhibited type is preferred. Proprietary cleaners most suitable for the operation may be chosen and used as per manufacturers recommendations.

Cleaning Method III-A

For polished aluminum surfaces, all aircraft parts, and similar applications where etching is undesirable. Use on all alloys.

A. Hot non-etch cleaning procedure

1. Vapor degrease if necessary
2. Non-etch alkaline clean- ARP 160 or equivalent

Usual concentration	5 to 6 oz/gallon
temperature	160 to 180°F.
immersion time	1 to 5 minutes

3. Rinse
4. Acid clean
   a. ARP 170 Deoxidizer or equivalent

Usual concentration	8 to 16 oz/gallon
temperature	70° to 100°F.
immersion time	30 seconds to 5 minutes

5. Rinse
6. Iridite #14-2 Al-Coat as per instructions.

B. Alternate - Cold Clean

1. Acid chromate type deoxidizer-

ARP 170 or equivalent	6 to 8 oz/gallon
ARP #2 Detergent	1-1/4 fl. oz/gallon (38 ml/gallon)
Temperature	70° to 90°F.
Immersion time	3 to 5 minutes

2. Rinse
3. Iridite #14-2 Al-Coat as per instructions.

RINSING AND DRYING PROCEDURES

Rinsing Before Iriditing - Drag-in of acid or alkali is detrimental to the Iridite #14-2 bath. Consequently, rinsing between the cleaning and Iriditing operations must be particularly thorough. A clean, running rinse or a spray rinse is desirable.

Rinsing After Iriditing - The rinse after Iriditing should be a running rinse to flush off clinging Iridite solution. Final hot rinse to facilitate drying is recommended. Rinse temperature should be kept below 160°F. and an in-and-out dip used, except where a clear coating is desired. Prolonged hot rinse causes a removal of color and some reduction in protective value.

Drying - Drying may be accomplished by air blast, centrifuge or warm circulating air. Temperature of 200°F. or more should be avoided since they will tend to lower the corrosion protective value of the finish.

STRIPPING IRIDITE FILMS FOR RE-PROCESSING

A. Where etching is permissible

Work to be stripped is put through etch cleaning cycle. Use Cleaning Cycle I-A for low silicon alloys, and Cleaning Cycle II-A for high silicon alloys. The entire cycle may be repeated several times until the coating has been completely removed and the aluminum surface is uniformly etched.

B. Where etching is objectionable

1. Work is first put through non-etching alkaline cleaner, Step 2 of Cleaning Cycle III-A and is then rinsed thoroughly.

2. Stripping Solution

Nitric Acid (40°Be')	3 parts (by volume)
Water	1 part (by volume)
Ammonium bifluoride	7-1/2 grams per gallon of solution

Work is immersed at room temperature until gassing begins (10 seconds to 2 minutes) and is then rinsed thoroughly.

After stripping, work may be re-processed using the regular cleaning cycle.

WARRANTY

All formulas referred to in these instructions are guaranteed as to formulated quality upon shipment from our plant. If the above recommended procedures and instructions are followed, desired results will be obtained. However, as actual use of our product by others is beyond our control, no guarantee, expressed or implied, is made as to the effects of such use, or the results to be obtained.

Note: All gallons measurements are U. S. Gallons.

April 15, 1955

3. Spray Nozzles for Cleaner Operation - These can vary to suit application. Nozzles and pressure should be adjusted so that a continuous flow of solution is in contact with the metal surface.

Operating Conditions

Iridite #14-2 concentration range	1 to 2 oz/gallon
Temperature	60° to 120°F.
Time of Spray	15 seconds to 3 minutes
pH range	1.3 to 1.6
Spray pressure	5 to 50 p.s.i.

Spray nozzles and pressure used can be varied to suit the application. A continuous flow of solution is more satisfactory than a fine spray. All nozzles and other equipment in contact with the Iridite #14-2 solution must be made of or lined with acid resisting materials.

C. Brush and Swab Application

Pre-treatment

1. Degrease by solvent wash if necessary.
2. Acid Clean - Apply solution a. or b. below with brush or swab until water breaks disappear and surface is completely wet.

a. Acid Chromate deoxidizer (ARP 170 or equal) 6 to 8 oz/gallon
ARP #2 Detergent 1 1/4 fl. oz/gallon (38 ml/gallon)
Temperature 70 to 90°F.

b. Phosphoric Acid 1 part
Butyl Cellosolve 1 part
Water 8 parts
ARP #2 Detergent 1 1/4 fl. oz/gallon

Rinse thoroughly and apply Iridite #14-2 in the same manner.

3. Mechanical Cleaning- Sanded, ground, wire brushed, or freshly cut surfaces may be treated with Iridite without cleaning provided this is accomplished immediately.

Operating Conditions

Iridite #14-2 concentration range	1-1/4 to 4 oz/gallon
Temperature	60° to 100°F.
pH range 1-1/4 oz/gallon conc.	1.3 to 1.6
pH range 2-1/4 oz/gallon conc.	1.1 to 1.4
pH range 4 oz/gallon conc.	0.9 to 1.1

Iridite #14-2 Al-Coat solution can be applied by swab, brush or flow and allowed to dry on the surface or rinsed and dried if desired.

A single application is the equivalent of 5 to 10 seconds treatment by immersion. Usually the film produced by a single application is light in color. Repeated applications of fresh solution will increase the film thickness to where a golden yellow to brown color will appear and also increase the protective value of the coating. Faster results can be obtained using a concentration of 4 oz/gallon producing a yellow coating in 15 to 30 seconds.

ARP #2 Detergent can be added to the solution at the rate of 1 gallon per 100 gallons of working solution if the surface is difficult to coat.

ARP 7 Spot Test Solution - This is a liquid spot test which can be used for determining the presence of a clear or colored Iridite film on the aluminum surface; and to some extent, its protective value.

Maintenance

1. pH pius Titration Control - pH is the most critical factor in solution control. An increase in pH causes a lightening of film color while a decrease in pH cause a darkening in color. In the extreme case, too high a pH will give no coating at all, while too low a pH will give a loose and powdery coating.

For the most accurate control, it is recommended that the Hexavalent Chromium Determination be used. The result will be more economical operation and the ultimate in uniformity of the product. By this procedure, Iridite #14-2 compound is added to the bath to adjust concentration. When this addition does not bring pH within the operating range, further pH adjustment is made with Nitric Acid (40°Be'). 13 fluid oz. (385 ml.) of Nitric Acid per 100 gallons of solution lowers pH by about 0.1 unit.

If excessive additions should be made accidentally causing too low a pH, this can be corrected by small additions of caustic soda or ammonia. One-half pound of caustic soda (flake or granular) per 100 gallons of solution will raise pH about 0.1 unit.

It may be noticed that as the Iridite #14-2 solution ages during use, the coatings obtained become gradually lighter in color, even though these optimum conditions are maintained. If this occurs, the solution can be restored to normal operation by gradually increasing the concentration within the range given and lowering the pH limit 0.1 below the range specified.

2. Control by pH Only - By this method, pH alone is measured. Maintenance additions of Iridite #14-2 and Nitric Acid (40°Be') are made at the following rate:

Per 100 gallons of Iridite #14-2 Solution

Iridite #14-2 compound 1 lb.
Nitric Acid (40°Be') 3 1/2 fl. oz. (110 ml.)
pH will be lowered approximately 0.07 unit.

This dual addition is to be repeated, if necessary, until pH is within the operating range. If the coatings are too light, even though pH is within the optimum range, further additions may be made in the above proportions, to lower the pH to 0.1 below the range specified.

3. Control by Color of Finish - Where analytical equipment is not available, a very simple method can be used to determine whether or not the solution is in satisfactory working order. A sample panel is cleaned and processed in a fresh Iridite #14-2 bath, using a 2-minute immersion time. This panel is used as a color standard.

As the coatings produced become lighter due to bath depletion, maintenance additions are made at the same rate as given above, under Method 2, Control by pH Only. The dual addition is repeated, if necessary, until a test panel has approximately the same appearance as the color standard.

Caution: When using either Method 2 or 3, the Iridite #14-2 compound and Nitric Acid must be added in the stated proportions. The use of excessive quantities of acid can cause poor results.

Caution: Iridite powdered mix or solution on the skin should be washed off immediately with a good quantity of water. It should be kept from contact with wood and other organic materials since it is oxidizing in nature. Iridite #14-2 solution is an acid solution and should be handled with the same care as other acid mixes.

Hardening of the Coating - Freshly formed coatings, particularly the heavier coatings, are soft and subject to abrasion. "Setting", or hardening, begins immediately after drying. Coatings that are to be given standard corrosion resistance tests should be aged at least 24 hours before testing.