



# BONDERITE M-CR 1600 AERO CHROMATE COATING (KNOWN AS ALODINE 1600)

Issued: 9/18/2020

## 1. Introduction:

BONDERITE M-CR 1600 AERO (known as ALODINE 1600) is a concentrated two-package liquid chemical used to produce a hexavalent chromate conversion coating on aluminum and all its alloys. The color ranges from a light iridescent gold to a gold tan. BONDERITE M-CR 1600 AERO can be applied by immersion or spray method and it does not contain complex cyanides. BONDERITE M-CR 1600 AERO is approved for use under MIL-DTL-81706.

## 2. Operating Summary:

<u>Chemical:</u>	<u>Bath Preparation per 100 gallons:</u>
BONDERITE M-CR 1600 AERO (known as ALODINE 1600)	0.65 gallons
BONDERITE M-AD 1660 AERO (known as ALODINE 1660 ADDITIVE)	1.3 gallons
BONDERITE M-AD 22 AERO (known as ALODINE 22 TONER)	1.0 gallons

  

<u>Operation and Control:</u>	
Concentration Titration	7.4 to 11.4 ml
Relative Fluoride (Orion)*	-70 to -85 (mV*)
pH	1.5 to 2.1
Temperature	60° to 130° Fahrenheit (15 to 54°C)
Time	1 to 5 minutes

\*NOTE: The relative fluoride value stated above is not a bath control but it can be monitored for trouble shooting purposes.



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### 3. The Process:

The complete process sequence for the BONDERITE M-CR 1600 AERO treatment normally consists of the following steps:

- A. Non-Etch Cleaning
- B. Water rinsing
- C. Deoxidizing for Mil-C-5541, Class 3; optional for Class 1A
- D. Water rinsing
- E. Treating with the BONDERITE M-CR 1600 AERO processing solution
- F. Water rinsing
- G. Post treatment (optional)
- H. Drying

### 4. Materials:

BONDERITE M-CR 1600 AERO  
BONDERITE M-AD 1660 AERO  
BONDERITE M-AD 22 AERO  
Nitric Acid, dilute  
Sodium hydroxide, dilute  
Testing Reagents and Apparatus

### 5. Equipment:

Process tanks and housings should be fabricated from stainless steel, such as 316L or 304L. Alloy 316L is preferred for maximum tank life. In all cases, use approved welding techniques. Polyvinyl chloride (PVC) or CPVC lined mild steel can be used. In spray applications, nozzles fabricated from 300 series stainless steel are preferred.

Process piping and pumps should be constructed of 316 or 304 stainless steel alloys. Various formulations of plastic pipe may be used with recommended support spacing, Schedule-80 is recommended. PVC Type I is limited to maximum process temperatures of 140° Fahrenheit (60°C). CPVC and PP may be used up to a maximum process temperature of 190° Fahrenheit (83°C). PVDF may be used for all expected operating temperatures.

Heat exchanger plates should be polished 316 stainless steel. Gas fired burner tubes are not recommended. All process circulation pump seals, valve seats, door seals, etc., which come into contact with the process solution and occasional acid equipment cleaners, should be EPDM, FKM or PTFE.

Chemical feed pump parts and other elastomers, which may come into contact with the concentrated replenishing chemicals, should be FKM or PTFE.

### 6. Surface Preparation:

#### Cleaning:

All metal to be treated with the processing solution must be free from grease, oil, and other foreign matter before the treatment. A complete line of cleaners is available, and your Henkel Sales Representative should be consulted.

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**Water Rinsing:**

After cleaning, the metal must be thoroughly rinsed with water. This rinse water should be overflowed continuously at a rate which will keep it clean and free from scum and other contamination.

**Deoxidizing (optional):**

When aluminum is to be treated with the BONDERITE M-CR 1600 AERO processing chemical for Class 3 coatings or if the surface has corrosion products or heavy oxides, these surfaces should be conditioned by installing two additional steps between the post cleaner rinse and the BONDERITE M-CR 1600 AERO treatment step. One is for deoxidizing with a deoxidizing chemical and one is for a post deoxidizer cold water rinse.

**7. Treating with the BONDERITE M-CR 1600 AERO / BONDERITE M-AD 1660 AERO Processing Solution:****Initial Buildup:**

Acid proof equipment is required. Fill the tank about three-fourths full with water, temperature 60° to 130° Fahrenheit (15 to 54°C). For each 100 gallons of final solution volume, add 1.3 gallons of BONDERITE M-AD 1660 AERO and circulate or thoroughly mix, then add 0.65 gallons of BONDERITE M-CR 1600 AERO and thoroughly mix; add 1 gallon of BONDERITE M-AD 22 AERO while mixing. Finally, add sufficient water to bring the solution up to the working level, mix, and then heat, if necessary, to the desired operating temperature.

**Operation:**

Time: 1 to 5 minutes  
Temperature: 60° to 130° Fahrenheit (15 to 54°C)

Each alloy reacts with the BONDERITE M-CR 1600 AERO / BONDERITE M-AD 1660 AERO solution to produce a coating that is characteristic of that alloy. The bath should produce a light, iridescent, gold to gold tan coating within the operating conditions selected.

Under most operation conditions it is recommended to replenish a working bath with the ratio of BONDERITE M-CR 1600 AERO at 0.65% (0.65 gallons per 100 gallons) to BONDERITE M-AD 1660 AERO at 1.3% (1.3 gallons per 100 gallons).

BONDERITE M-AD 22 AERO is usually only needed for initial buildup of a fresh BONDERITE M-CR 1600 AERO / BONDERITE M-AD 1660 AERO bath.

When first charging a new bath, it is desirable to process about 10 ft<sup>2</sup> per 100 gallons of bath of clean scrap aluminum or aluminum foil for 15 minutes to break in the bath.

**If the Coating is Powdery or Dull:**

- a. The pH of the bath may be too low for the bath concentration or the bath activity selected.
  - b. The work may have been improperly cleaned and/or rinsed.
  - c. The BONDERITE M-CR 1600 AERO bath may have become contaminated with phosphates, sulfates, or some other contaminant.
  - d. The bath temperature may be too high.
  - e. The process time may be too long.
  - f. The fluoride level through BONDERITE M-AD 1660 AERO additions may be too high.
  - g. The transfer time between the treatment to the water rinse may be too long.
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### If the Coating Weight is too low:

- The temperature of the BONDERITE M-CR 1600 AERO bath may be too low for the method or the processing time selected.
- The process time may be too short.
- The concentration of the bath may be too low.
- The pH of the bath may be outside of the proper range.
- The fluoride level might be too low. Increase the additions of the BONDERITE M-AD 1660 AERO.

### **8. Testing and Control:**

Never pipet by mouth, use a pipet filler.

#### Concentration Titration:

Pipet a 5 ml sample of the BONDERITE M-CR 1600 AERO bath into an iodometric flask and dilute to approximately 100 mls with water. Add approximately 1 gm (1/2 teaspoonful) of Reagent 2 and agitate the solution until the compound is dissolved. Add approximately 10 ml of Reagent Solution 49 in 5 ml increments to the lip of the flask, raising the stopper slightly after each addition to allow the acid to run into the flask. Rinse the lip several times with water and replace the stopper. Let sit for approximately one minute.

Titrate with Titrating Solution 104 until a straw color is obtained. Do not re-zero the burette. Add several milliliters of Indicator 10 to the sample and continue the titration until the blue-black color disappears. The total milliliters of Titrating Solution 104 used is the concentration titration.

Concentration titration range: 7.4 - 11.4 ml.

To increase the concentration titration value by 1.5 ml: add 0.1 gallon of BONDERITE M-CR 1600 AERO per 100 gallons of working bath.

Concentration: 1 ml of titrant = 1.73 mg/ml of hexavalent chrome in the BONDERITE M-CR 1600 AERO

#### pH Adjustment:

Always make any needed additions of water, BONDERITE M-CR 1600 AERO, and BONDERITE M-AD 1660 AERO to the bath and allow for complete mixing before measuring and adjusting the pH.

If needed, dilute sodium hydroxide (caustic) or dilute ammonium hydroxide can be used to raise the pH of the solution. Dilute nitric acid can be used to lower the pH of the bath.

#### Fluoride Activity Measurement:

The method of measuring fluoride activity makes use of a standardized Orion Fluoride Ion electrode and an Orion Meter or an equivalent instrument capable of measuring relative Millivolts.

Immerse the Orion Fluoride Ion Electrode and the reference electrode into Standard Solution 120MC. Using the expanded relative millivolt scale, set the meter to zero.

Remove the electrodes from the activity Standard Solution 120MC, rinse with distilled water and dry.

Cool a sample of the bath to the same temperature as the Standard Solution 120MC used for the electrode standardization. Immerse the electrodes into the bath sample and record the relative negative Millivolts.



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The product is designed so that as long as the relative millivolts reading is approximately -70 to -85 excellent salt spray corrosion resistance should be obtained. Fluoride activity is monitored only, and under normal bath operation it is **not a control point**.

## 9. After Treatment:

### Water Rinsing:

After treating with BONDERITE M-CR 1600 AERO the work is thoroughly rinsed in clean cold water. The rinse water should be continuously overflowed such that the main body of the rinse never becomes excessively contaminated.

### Post Treatment:

The BONDERITE M-CR 1600 AERO treated metal may be treated with an acidic post treatment solution. The post treatment adds to the overall quality of the coating and prevents the formation of hard water salts blistering. In some cases, the post treatment stage may be heated to facilitate work drying.

### Drying:

Parts coming from the final water rinse or post treatment stage can be dried in an indirectly fired oven or by any other means which will not contaminate the metal with fumes, oil, or partially burnt gases. Peak metal temperature should not exceed 120° Fahrenheit.

## 10. Storage Requirements:

Do not store with chloride containing compounds. Do not store with oxidizable materials. No special storage temperature requirements are required for BONDERITE M-CR 1600 AERO, BONDERITE M-AD 1660 AERO, or BONDERITE M-AD 22 AERO. If any of these products were to freeze after extended storage at a low temperature, thaw in a warm place and very carefully stir thoroughly (until no solids are observed) before use.

## 11. Waste Disposal Information:

Applicable regulations covering disposal and discharge of chemicals should be consulted and followed.

Disposal information for BONDERITE M-CR 1600 AERO, BONDERITE M-AD 1660 AERO and BONDERITE M-AD 22 AERO is given on the Safety Data Sheet for each product.

The processing bath is acidic and contains chromium and complex fluorides. Waste treatment and neutralization will be required prior to discharge.

## 12. Precaution:

Consult the appropriate Safety Data Sheets for safety and handling guidelines for the products listed in this bulletin.

### **NOTICE:**

**The above information and recommendations concerning this product are based upon our laboratory tests and field use experience with this or similar products. However, since conditions of actual use are beyond our control, any recommendations or suggestions are made without warranty, express or implied. Manufacturer's and seller's sole obligation shall be to replace that portion of the product shown to be defective. Neither shall be liable for any loss, damage, or injury, direct or consequential, arising out of the use of this product.**

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**Testing Reagents and Apparatus**

(Order only those items which are not already on hand.)

<u>Code</u>	<u>Quantity</u>	<u>Item</u>
592477 .....	1 .....	Burette Assembly, 25-ml Automatic, Glass
592489 .....	2* .....	Flasks, iodometric, 250-ml
592484 .....	2* .....	Graduated Cylinder, 50-ml, Glass
592401 .....	250 ml .....	Indicator 10 (0.5% starch solution)
592475 .....	1 .....	Indicator Dropping Bottle, 2 oz
592491 .....	2 .....	Pipet, 5-ml, plastic
592413 .....	450 gm .....	Reagent 2 (KI)
592438 .....	2.5 liters ....	Reagent Solution 49 (C.P. HCl)
594334 .....	1 .....	Thermometer, Floating
592416 .....	1.0 liters ....	Titrating Solution 104 (0.1N Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> )
-- .....	1 .....	Orion #9409BN, solid state F- electrode
-- .....	1 .....	Orion #900100, reference electrode
-- .....	1 .....	Orion #900011, reference filling solution
-- .....	1 .....	Orion Model 250A portable pH/mV meter (or equivalent)

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