



# Technical Process Bulletin

This Revision: 07/07/2011

## ALODINE® 600

### 1. Introduction:

ALODINE 600 is a powdered chemical used to produce a chromate conversion coating on aluminum and its alloys, which ranges in color from light, iridescent gold to tan. ALODINE 600 can be applied by immersion, spray, or brush method, does not contain complex cyanides, and is particularly recommended where a low electrical resistance coating is desired.

ALODINE 600 is an approved material of QPL-81706, Classes 1A (A) and 3 (B), Methods A, B, C. Being on the QPL-81706 allows for use of Alodine 600 on parts that need to meet MIL-DTL-5541 coatings.

Alodine 600 is a hexavalent chrome conversion coating which meets the requirements of MIL-DTL-81706, Type I, Classes 1A (A) and 3 (B), Methods A, B, C.

Alodine 600 is listed on the QPL for MIL-DTL-81706

Alodine 600 is authorized for use on parts that need to meet MIL-DTL-5541 coatings.

### 2. Operating Summary:

<u>Chemical</u>	<u>Bath Preparation per 100 gallons:</u>
Immersion and Spray Application:	
ALODINE 600 Chemical	12.5 pounds
ALODINE TONER 22	9.9 pounds (1.0 gallons)
Brush Application:	
Alodine 600 Chemical	18.75 pounds (3 oz./ gal)
Alodine Toner 22	2 gallons (2% by volume)
<u>Operation and Control:</u>	
ALODINE Titration	7.4 to 9.4 ml
Temperature	70° to 100° Fahrenheit
Time	1 to 5 minutes

pH

1.5 to 2.0

### 3. The Process:

The complete process sequence for the ALODINE 600 treatment normally consists of the following steps:

- A. Cleaning
- B. Water rinsing
- C. Deoxidizing (Optional)
- D. Water rinsing
- E. Treating with the ALODINE 600 processing solution
- F. Water rinsing
- G. Drying.

### 4. Materials:

ALODINE 600  
ALODINE TONER 22  
Nitric Acid  
Testing Reagents and Apparatus

### 5. Equipment:

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

#### Brush Application:

It is applied using an acid-resistant brush, a swab, a synthetic sponge, or portable non-atomizing spray equipment. e.g., a paint spray gun or insect sprayer.

Acid-resistant (wood, rubber, stainless steel, or plastic) buckets, troughs, or other suitable containers are used to hold the diluted ALODINE 600 coating chemical solution. Lead, glass, tin, or galvanized iron should not be used. Storing the solution in mild steel containers will result in a slow decomposition of the solution.

Ordinary spray equipment (satisfactory for short or infrequent applications) will be slowly attacked by ALODINE 600 coating chemicals. This may be minimized by thoroughly flushing with water immediately after use. For continuous use, plastic or stainless steel cups and nozzles should be used in spray equipment.

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#### Spray and Immersion Application:

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 being generally recommended. PVC Type I is limited to maximum process temperatures of 140° Fahrenheit. CPVC and PP may be used up to a maximum process temperature of 190° Fahrenheit. 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, Viton™ or Teflon™.

Chemical feed pump parts and other elastomers which may come into contact with the concentrated replenishing chemical should be Viton or Teflon.

Support equipment available from Henkel Technologies for this process includes: chemical feed pumps, level controls, transfer pumps and bulk storage tanks.

Your local sales representative should be consulted for information on Henkel Technologies automatic process control equipment for this process and any additional questions.

#### 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 our representative should be consulted.

##### Water Rinsing:

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

##### Deoxidizing (optional):

When aluminum to be treated with ALODINE 600 processing chemical has corrosion products or heavy oxide on the surface, it should be cleaned by installing two additional stages between the post cleaner rinse and the ALODINE 600 treatment stage. One is for deoxidizing with a deoxidizing chemical and one is for an additional cold water rinse.

#### 7. Treating with the ALODINE 600 Processing Solution:

##### Buildup (Immersion or Spray):

Fill the tank about three-fourths full with cold water. For each 100 gallons of final solution volume, add 12.5 pounds of pre-dissolved ALODINE 600 chemical and circulate until thoroughly mixed; add, while mixing, 9.9 pounds (1.0 gallon) of ALODINE TONER 22 chemical. Finally, add sufficient water to bring the solution up to the working level and then heat, if necessary, to the operating temperature.

##### Buildup (Brush):

Mix 3 oz. of ALODINE 600 coating chemical with each gallon of water (this is equivalent to 22.5 g per liter of water). Stir well until the powder is dissolved. Then add 2% by volume of Alodine Toner 22 and stir.

##### Operation:

Time: 1 to 5 minutes.

Temperature: 70° to 100° Fahrenheit.

Each alloy reacts with the ALODINE 600 solution to produce a coating that is characteristic of that alloy. The bath should produce a light, iridescent, gold to tan coating within the operating conditions selected.

If the Coating is Powdery:

- a. The pH of the bath may be too low for the bath concentration selected.
- b. The work may have been improperly cleaned and/or rinsed.
- c. The ALODINE 600 bath may have become contaminated with phosphates, sulfates, or some other contaminant. In most cases, phosphate contamination will stop-off the coating completely.
- d. The bath temperature may be too high.
- e. The process time may be too long.

If the Coating is too Light or too Iridescent:

- a. The temperature of the ALODINE 600 bath may be too low for the process time selected.
- b. The process time may be too short
- c. The concentration of the bath may be too low.
- d. The pH of the bath may be outside of the proper range.

8. Testing and Control:

Never pipet by mouth, use a pipet filler.

ALODINE Titration:

Pipet a 5 ml sample of the ALODINE 600 bath into an iodimetric flask and dilute to approximately 100 ml 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 rezero the buret. Add several milliliters of Indicator 10 to the sample and continue the titration until the blue-black color disappears. The milliliters of Titrating Solution 104 used is the ALODINE titration.

ALODINE titration range: 7.4 - 9.4 ml.

To increase the value 1.0 ml: Add 1.5 pounds of ALODINE 600 chemical per 100 gallons of bath.

Concentration: 1 ml of titrant = 1.73 mg/ml of hexavalent chrome in the Alodine 600

pH Adjustment:

As the bath is used, the pH has a tendency to rise. Nitric acid is added to restore the pH to its proper operating level.

pH range: 1.5 to 2.0

Large additions of nitric acid are to be avoided in favor of frequent small additions.

#### 9. After Treatment:

##### Water Rinsing:

After treating with ALODINE 600 the work should be thoroughly rinsed in cold water. The rinse should be continuously overflowed such that the main body of the rinse never becomes excessively contaminated.

##### Drying:

Parts coming from the post treatment stage should be dried as soon as possible 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 140° Fahrenheit.

#### 10. Storage Requirements:

ALODINE 600 chemical should be stored in a dry ventilated area. ALODINE TONER 22 freezes as 3° Fahrenheit. Should freezing occur, the chemical should be agitated after thawing.

#### 11. Waste Disposal Information:

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

Disposal information for ALODINE 600 and ALODINE TONER 22 is given on the Material 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 the discharge to the sewer. (Refer to Waste Treatment Information Bulletin WT1004, available on request.)

#### 12. Precaution:

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

## 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 .....	Buret Assembly, 25-ml Automatic, Glass
592489 .....	2* .....	Flasks, iodimetric, 250-ml
592484 .....	2* .....	Graduated Cylinder, 50-ml, Glass
592401 .....	1/2 pt .....	Indicator 10 (0.5% starch solution)
592475 .....	1 .....	Indicator Dropping Bottle, 2 oz
592497 .....	2 .....	Pipet, 5-ml, plastic
592413.....	1 lb .....	Reagent 2 (KI)
592438 .....	5 pt .....	Reagent Solution 49 (C.P. HCl)
594334 .....	1 .....	Thermometer, Floating
592416 .....	2 qts .....	Titration Solution 104 (0.1N Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> )

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