

# **BONDERITE C-IC DEOXIDIZER 6MU AERO and BONDERITE C-AD DEOXIDIZER 16R AERO ACID DEOXIDIZER (KNOWN AS TURCO DEOXIDIZER 6 and 16)**

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## **1. Introduction:**

The BONDERITE C-IC DEOXIDIZER 6MU AERO and BONDERITE C-AD DEOXIDIZER 16R AERO (Known as TURCO DEOXIDIZER 6 and 16) process primarily utilizes two liquid products, BONDERITE C-IC DEOXIDIZER 6 MU AERO (Known as TURCO DEOXIDIZER 6 MAKEUP) and BONDERITE C-AD DEOXIDIZER 16R AERO (Known as TURCO DEOXIDIZER 16 REPLENISHER). These are added to either dilute nitric acid or dilute sulfuric acid to produce an efficient production bath for the deoxidizing, desmutting or acid etching aluminum and its alloys.

The BONDERITE C-IC DEOXIDIZER 6MU AERO and BONDERITE C-AD DEOXIDIZER 16R AERO (Known as TURCO DEOXIDIZER 6 and 16) nitric acid bath is suitable for use in most applications, particularly where water rinsing is marginal, or on assemblies or fayed surfaces.

The BONDERITE C-IC DEOXIDIZER 6MU AERO and BONDERITE C-AD DEOXIDIZER 16R AERO (Known as TURCO DEOXIDIZER 6 and 16) sulfuric acid bath is especially suitable for deoxidizing aluminum for spot-welding. The surface resistance of the work so treated is low and remains low enough for several days to permit satisfactory spot-welding.

When a high percentage of high copper alloys are deoxidized or desmuted, buildup of dissolved copper in the bath, of as low as 200 ppm, can result in redeposition of metallic copper on parts particularly when titanium or stainless steel racks are used. At this point the BONDERITE C-AD DEOXIDIZER DE7-17 (Known as DEOXIDIZER DE7-17 TONER) can be added to the bath to precipitate the dissolved copper.

BONDERITE C-IC DEOXIDIZER 6MU AERO and BONDERITE C-AD DEOXIDIZER 16R AERO (Known as TURCO DEOXIDIZER 6 and 16) baths impart a slight etch on aluminum alloys and bath conditions can be adjusted to bring the etch rate within customer specifications.

BONDERITE C-IC DEOXIDIZER 6MU AERO and BONDERITE C-AD DEOXIDIZER 16R AERO is an approved process for BAC 5765, Solution 27 (A, B & C).



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**2. Operating Summary:**

General Use BONDERITE C-IC DEOXIDIZER 6MU AERO and BONDERITE C-AD DEOXIDIZER 16R AERO -  
Nitric or Sulfuric Acid Bath Makeup:

<u>Chemical:</u>	<u>Bath Preparation per 100 Gallons:</u>	
Acid	<u>Nitric Acid</u>	<u>Sulfuric Acid</u>
BONDERITE C-IC DEOXIDIZER 6MU AERO	10 gallons	5 gallons
(Known as TURCO DEOXIDIZER 6 MAKEUP)	5 gallons	5 gallons

<u>Chemical:</u>	<u>Bath Preparation per 100 Gallons:</u>		
	<u>Nitric Acid</u>	<u>Sulfuric Acid</u>	<u>C-IC 6MU</u>
BAC Soln. 27A	10 gallons	0 gallons	7 gallons
BAC Soln. 27B	0 gallons	5 gallons	7 gallons
BAC Soln. 27C	10 gallons	0 gallons	4 gallons

Operation and Control:

Deoxidizer Titration	14 to 24 ml
Nitric Acid Titration (10%)	3.0 ± 0.3 ml
Sulfuric Acid Titration (5%)	3.5 ± 0.3 ml
RT - DT Value, without BONDERITE C-AD DE7-17 AERO (Known as DEOXIDIZER DE7-17 TONER)	30 ml max.
RT - DT Value, with BONDERITE C-AD DE7-17 AERO (Known as DEOXIDIZER DE7-17 TONER)	70 ml max.
Etch Rate (2024 Clad alloy)	0.1- 0.4 mils/surf./hr.
Bath Temperature	60° to 90°F (15.6° to 32°C)
Time	
Spray:	30 sec. to 3 minutes
Immersion:	1 to 10 minutes

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### 3. The Process:

A complete process sequence normally consists of the following steps:

- A. Cleaning
- B. Water rinsing
- C. Treating with the BONDERITE C-IC DEOXIDIZER 6MU AERO and BONDERITE C-AD DEOXIDIZER 16R AERO Working solution
- D. Water rinsing
- E. Further processing

### 4. Materials:

BONDERITE C-IC DEOXIDIZER 6MU AERO  
BONDERITE C-AD DEOXIDIZER 16R AERO  
BONDERITE C-AD DEOXIDIZER DE7-17 AERO  
BONDERITE M-AD A (Known as ADDITIVE A)  
Nitric Acid, 42° Bé  
Sulfuric Acid, 66° Bé  
Testing Reagents and Apparatus

### 5. Equipment:

The tanks for the BONDERITE C-IC DEOXIDIZER 6MU AERO and BONDERITE C-AD DEOXIDIZER 16R AERO bath may be constructed of 300 Series stainless steel (Type 316 preferred for weldability) or lined with high density polyethylene or similar acid-resistant materials.

### 6. Surface Preparation:

Most work can be cleaned using a suitable cleaner or degreaser. Our representative will recommend the proper type of cleaner and any necessary detergent additives or degreaser for each processing line.

The work, after cleaning, should be rinsed thoroughly with water. This rinse should be continuously overflowed to avoid contamination.

### 7. Treating with the BONDERITE C-IC DEOXIDIZER 6MU AERO and BONDERITE C-AD DEOXIDIZER 16R AERO-Working Solution:

#### Buildup:

Fill the tank three-fourths full with cold water. For each 100 gallons of final solution volume slowly add 10 gallons of 42° Bé nitric acid for the BONDERITE C-IC DEOXIDIZER 6MU AERO nitric acid bath or 5 gallons of 66° Bé sulfuric



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acid for the BONDERITE C-IC DEOXIDIZER 6MU AERO sulfuric acid bath and mix thoroughly. Add, while mixing, 5 gallons of BONDERITE C-IC DEOXIDIZER 6MU AERO. Add sufficient water to bring the solution up to the working level.

BAC 5765 BONDERITE C-IC DEOXIDIZER 6MU AERO and BONDERITE C-AD DEOXIDIZER 16R AERO - Nitric or Sulfuric Acid Bath Makeup:

For use under BAC 5765, Solutions 27A or 27B, increase the makeup addition of BONDERITE C-IC DEOXIDIZER 6MU AERO to 7 gallons per 100 gallons of final solution volume. For use under BAC 5765, Solution 27C, reduce the makeup addition of BONDERITE C-IC DEOXIDIZER 6MU AERO to 4 gallons per 100 gallons of solution.

### Operation:

Time/Spray:	30 seconds to 3 minutes
Time/Immersion:	1 to 10 minutes
Temperature:	60° to 90°F (15.6° to 32°C)

The BONDERITE C-IC DEOXIDIZER 6MU AERO and BONDERITE C-AD DEOXIDIZER 16R AERO nitric acid or sulfuric acid bath works very effectively at ambient temperatures. Heating of the bath is not recommended.

The time required for deoxidizing depends on the amount and nature of the oxide. Natural oxide usually is removed in 1 to 3 minutes; heavier, heat-treat oxide may require 5 to 10 minutes. Deoxidizing prior to spot welding is usually accomplished in 3 to 5 minutes for most alloys. Immersion application usually requires more time than spray application. The bath should be mildly agitated in order to obtain greater surface uniformity.

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

### Acid Titration:

Pipet two, 2 ml samples of the BONDERITE C-IC DEOXIDIZER 6MU AERO and BONDERITE C-AD DEOXIDIZER 16R AERO acid bath into two beakers and dilute to approximately 100 ml with either distilled or deionized water. Add 10 drops of Indicator 2 to each sample. One of the two samples is used as a blank so that it is easier to distinguish the color change in the dark-colored solution.

Titrate one sample with Titrating Solution 89, while stirring the sample, until a blue-green color appears. Compare with the blank sample during the titration so that the development of the blue-green color will be more apparent.

The mls of Titrating Solution 89 used is the Acid Titration.

In very heavily loaded baths where the determination of the blue-green endpoint is extremely difficult, a potentiometric titration is recommended using a pH of 3.7 as the end point of the titration.

Acid titration range: 3.0 ± 0.3 mls for bath containing 10% nitric acid.  
3.5 ± 0.3 mls for bath containing 5% sulfuric acid.

grams/liter of nitric acid = (ml titration value) \* 4.27 \* 7.5



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grams/liter of sulfuric acid = (ml titration value) \* 1.83 \* 7.5

The acid concentration may be increased or reduced to achieve desired results. For concentrations other than those specified, maintain the Acid Titration range within  $\pm 0.3$  ml of that obtained on bath preparation.

To increase acid titration 1 ml: Add 3.4 gallons of 42° Bé nitric acid or 1.3 gallons of 66° Bé sulfuric acid per 100 gallons of bath volume.

### Deoxidizer Titration:

Pipet a 5 ml sample into an iodimetric flask and dilute to approximately 100 mls with water. Add 1/2 teaspoon (approximately 1 g) of Reagent 2 and agitate to dissolve. Add about 15 ml of Reagent Solution 49. Stopper the flask and allow to sit for about one minute.

After the sample has sat for approximately one minute, titrate with Titrating Solution 104 until a straw color is obtained. Do Not rezero the buret. Add several mls of Indicator 10, stir, and continue the titration until the blue-black color disappears for at least one minute. The mls of Titrating Solution 104 used is the Deoxidizer Titration value.

Deoxidizer Titration range: Within  $\pm 1$  ml of the value which gives the desired results.

grams/liter of BONDERITE C-IC DEOXIDIZER 6MU AERO and BONDERITE C-AD DEOXIDIZER 16R AERO (Cr6+) = (ml titration value) \* 0.346

### Etch Rate:

The most reliable method to control the fluoride content of the bath is to control the etch rate. The etch rate is determined by immersing a panel for a specific length of time and measuring the mass loss.

$$\text{Etch Rate} = \frac{(I - F) (Th) 30}{(I) (I.T.)} \quad (\text{mils/surface/hour})$$

I = Initial mass (grams)

F = Final mass (grams)

Th = Initial Thickness (mils)

I.T. = Immersion Time (minutes)

A 2024 Clad panel should exhibit an etch rate of 0.1 - 0.4 mils/side/hour. For most applications an etch rate of 0.15-0.20 is best. Once an optimum etch rate is established, it should be maintained at approximately  $\pm .025$ .

To raise the etch rate by approximately 0.100 mils/side/hour, add 0.9 gallon of BONDERITE M-AD A (Known as ADDITIVE A) per 100 gallons of bath.

### Replenishment:

#### Mechanical Loss:

Whenever a portion of the bath is discarded or otherwise lost, the volume should be restored with the same proportion of chemicals and water as used in the original bath makeup.



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Normally, the Deoxidizer Titration is maintained by additions of BONDERITE C-AD DEOXIDIZER 16R. However, due to variations in drag out as compared to the amount of chemicals consumed by the deoxidizing process, periodic additions of BONDERITE C-IC DEOXIDIZER 6MU may be necessary. The most practical means of determining the required replenisher is to monitor the etch rate of the bath as well as the titrations. The following table gives the necessary additions of the respective additives.

<u>To raise the Deoxidizer Titration by one ml, add</u>	<u>Etch rate of 2024 clad will increase by approximately</u>
42 fl oz (0.33 gal)/100 gal BONDERITE C-AD DEOXIDIZER 16R (Known as TURCO DEOXIDIZER 16 REPLENISHER)	0.0175 mils/surface/hour
or 42 fl oz (0.33 gal)/100 gal BONDERITE C-IC DEOXIDIZER 6MU (Known as TURCO DEOXIDIZER 6 MAKEUP)	0.0044 mils/surface/hour

In cases where the etch rate needs to be raised when the deoxidizer titration is within range, an addition of 8.8 fl oz (0.068 gal) BONDERITE M-AD A (Known as ADDITIVE A)/100 gals of bath will increase the etch rate (of 2024 clad alloy) by 0.01 mils/surface/hour. Note: These replenishment values regarding etch rate are applicable to baths which have been in use. For relatively new baths, the required amount of BONDERITE M-AD A (Known as ADDITIVE A) may be less than the amount indicated above.

Important: Note that etch rates are given for clad 2024 alloy in a still (non-agitated bath). Other alloys, such as bare 2024, can have etch rates up to 50% higher than the values listed. Excessive agitation in the deoxidizer bath should be avoided as the etch rate will increase with increased solution flow rate around the parts.

BONDERITE C-AD DE7-17 AERO can be added to prolong bath life. The BONDERITE C-AD DE7-17 AERO can be added whenever an addition of BONDERITE C-IC DEOXIDIZER 6MU AERO and BONDERITE C-AD DEOXIDIZER 16R AERO is needed to raise the Deoxidizer Titration of the bath. For every 100 gallons of BONDERITE C-IC DEOXIDIZER 6MU AERO and BONDERITE C-AD DEOXIDIZER 16R AERO added, add approximately 4.4 gallons of BONDERITE C-AD DE7-17 AERO. In unusually extreme cases where dissolved copper builds up in the bath despite routine BONDERITE C-AD DE7-17 AERO additions, the BONDERITE C-AD DE7-17 AERO can be added separately. An addition of 0.15 gallons of BONDERITE C-AD DE7-17 AERO per 100 gallons of bath will reduce the copper content by approximately 70 ppm.

Alternatively, if instrumentation is available to routinely monitor the copper content of the BONDERITE C-IC DEOXIDIZER 6MU AERO and BONDERITE C-AD DEOXIDIZER 16R AERO bath, the BONDERITE C-AD DE7-17 AERO can be added only as necessary to maintain the copper content below 200 ppm, using the above addition rate of BONDERITE C-AD DE7-17 AERO. Excessive additions of BONDERITE C-AD DE7-17 AERO are not recommended.

#### Reaction Product Titration:

As aluminum is processed, reaction products will gradually accumulate unless there is sufficient drag-out of the bath during processing.



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Pipet a 5 ml sample into an iodimetric flask and dilute to approximately 100 ml with water. Add 2 to 4 ml of Auxiliary Test Solution 53 and mix well. Add 7 to 8 ml of Reagent Solution 46. Add several boiling chips or glass beads and bring to a boil. (NOTE: The glass beads may be reused.) Boil for about 20 minutes and then cool to room temperature.

NOTE: The solution should be yellow in color. If it is green, after cooling repeat the addition of Reagent Solution 46 and again boil for about 20 minutes and cool to room temperature.

Add about 15 ml of Reagent Solution 49. Add 1 teaspoonful (approximately two grams) of Reagent 2 and agitate the solution until the Reagent 2 is dissolved.

After the sample has settled for approximately one minute, titrate with Titrating Solution 104 until a straw color is obtained.

Do not rezero the buret. Add several ml of Indicator 10, stir, and continue the titration until the blue-black color disappears. The ml of Titrating Solution 104 used is the Reaction Product Titration.

### Control of Reaction Products:

Determine the Reaction Product Level as shown in the equation:

$$\text{Reaction Product Level} = \text{Reaction Product Titration (RT)} - \text{Deoxidizer Titration (DT)}$$

When using the BONDERITE C-IC DEOXIDIZER 6MU AERO and BONDERITE C-AD DEOXIDIZER 16R AERO process without the addition of BONDERITE C-AD DE7-17 AERO Toner, the maximum RT-DT value is 30 points, above which part of the bath volume should be decanted.

When using the BONDERITE C-IC DEOXIDIZER 6MU AERO and BONDERITE C-AD DEOXIDIZER 16R AERO process with the addition of BONDERITE C-AD DE7-17 AERO, the maximum RT-DT value is 70 points above which part of the bath volume should be decanted.

Record the number of days required for the Reaction Titration minus the Reaction Product Level (RT-DT) to reach a value of 70.0.

Divide the number of gallons in the bath by the number of days found above. This value is the number of gallons of bath which should be drawn off daily to keep the level of reaction products below 70.0.

Example: A 500 gallon bath requires 20 production days to reach an RT-DT value of 70.0. Therefore, 25 gallons per day should be withdrawn from the bath (500 divided by 20 = 25). This amount should be prorated per processing hour, i.e. for an 8 hour day, 3.1 gallons should be removed per hour (25 / 8 = 3.1 gal/hr).

### **9. After Treatment:**

After the work has been treated in the BONDERITE C-IC DEOXIDIZER 6MU AERO and BONDERITE C-AD DEOXIDIZER 16R AERO-Acid bath, it must be thoroughly rinsed with cold or hot water (a cold water rinse results in lower surface resistance). It is then ready for further processing. If the work, after rinsing, is to be welded, it should



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be dried and handled carefully to avoid soiling the surface. If the work is to be treated with a chemical conversion coating, it is not necessary to dry after rinsing.

### **10. Storage Requirements:**

BONDERITE C-IC DEOXIDIZER 6MU and BONDERITE C-AD DEOXIDIZER 16R will freeze at 19°F (-7°C) and 0°F (-18°C), respectively. BONDERITE C-AD DE7-17 AERO will freeze at 25°F (-4°C). Freezing is not detrimental to the products. Should they freeze, simply thaw them in a warm place and stir prior to use. The active components of BONDERITE M-AD A (Known as ADDITIVE A) will begin to precipitate below 30°F (-1°C). If this should occur, move the chemical to a warm place and stir until fully dissolved. It is recommended that the products be stored indoors in a cool, dry place apart from combustible or oxidizable materials.

### **11. Waste Disposal Information:**

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

Disposal information for BONDERITE C-IC DEOXIDIZER 6MU, BONDERITE C-AD DEOXIDIZER 16R, BONDERITE C-AD DE7-17 AERO, and BONDERITE M-AD A (Known as ADDITIVE A) is given on the Material Safety Data Sheets for each product. The processing bath is acidic and contains nitric or sulfuric acid, hexavalent and trivalent chromium and fluoride. Waste treatment and neutralization will be required before discharging.

The processing bath and sludge can contain ingredients other than those present in the chemical as supplied and analysis of the solution and/or sludge may be required prior to disposal.

### **12. Precaution:**

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





# BONDERITE C-IC 6 and 16 ACID DEOXIDIZER (KNOWN AS TURCO DEOXIDIZER 6 and 16)

## Testing Reagents and Apparatus

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

<u>Code</u>	<u>Quantity</u>	<u>Item</u>
592425 .....	1 qt .....	Auxiliary Test Solution 53 (50% caustic soda)
592436 .....	500 ml.....	Reagent Solution 46 (30% hydrogen peroxide)
592463 .....	3* .....	Beaker, 250-ml, Glass
596491 .....	1 .....	Bung Wrench
592477 .....	1 .....	Buret Assembly, 25-ml Automatic, Glass
592481 .....	1 .....	Cylinder, graduated, 25-ml, Glass
592485 .....	1 .....	Cylinder, graduated, 100-ml, Glass
592489 .....	3 .....	Flasks, iodimetric, 250-ml, Glass
** .....	1 box .....	Glass beads, 4mm
595193 .....	2 .....	Indicator Bottle, clear plastic, 4 oz.
592396 .....	1 qt .....	Indicator 2 (Bromcresol Green)
592401 .....	1 qt .....	Indicator 10 (Soluble Starch)
592490 .....	2* .....	Pipet, 2-ml, Glass
592491 .....	..2* .....	Pipet, 5-ml, Glass
592494 .....	1 .....	Pipet Filler
592413 .....	1 lb .....	Reagent 2 (Potassium Iodide)
592438 .....	5 pint .....	Reagent Solution 49 (CP hydrochloric acid)
595584 .....	1 .....	Pocket Thermometer (0-220°F)
592445 .....	1 gal .....	Titration Solution 89 (1.0 N Sodium Hydroxide)
592416 .....	1 gal .....	Titration Solution 104 (0.1 N Sodium Thiosulfate)

\*Includes one more than actually required, to allow for possible breakage,

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