

# ANODIZING MACHINE

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Anodizing is a process of treating the surface of an aluminum to convert it to aluminum oxide. Anodizing aluminum takes so many processes to arrive at the state of aluminum oxide. The reason for anodizing aluminum is to make the oxide layer to thicken for wear resistance and better corrosion. To make an aluminum part anodic, it must pass through an electrolytic cell to make the chemical processes complete. Sometimes, people dye the oxide layer which forms on the aluminum to improve its appearance.

Apart from corrosion resistance, there are many reasons for the anodizing machine. When there is an electrolytic anodic coating on aluminum, it improves durability as a result of wear resistance. Also, the aluminum thick state makes it harder as well. Anodizing machine improves its adhesive bonding, paint adhesion and enhances the aluminum capacitance in relations to electronic applications.

The process of aluminum anodizing is quite simple for those who work in the industry. It involves immersing the aluminum in the electrolyte which is, of course, an acid. Then you apply direct current to it i.e. electrical current which in turn splits the water content of the acid into negatively charged oxygen and positively charged hydrogen. The positively charged surface of the aluminum will attract the negative oxygen and the reaction results of these two chemical process will be the formation of aluminum hydroxide and other compounds that relate to it.

Many types of anodic coatings exist through an electrolytic formation. The important ones you need to know are:

## 1. Chromic Acid or Type 1

This type of anodizing coating is also known as "Chromic Acid Anodize or CAA". This type is the oldest process of the anodizing machine. Chromic acid anodizing generate a thin film on some parts that have tight tolerance and complex

geometries. This anodizing works well on many alloys and it is popular amongst defense and aerospace industry. Also, it often comes handy on other components that contain crevices, lap joints, recesses or any other feature capable of trapping electrolyte.

## **2. Sulfuric Acid or Type 11**

This anodizing coating is as a result of “sulfuric acid bath” Sulfuric acid anodizing is very popular and also a suitable process when you want to color the surface for decorative purposes. If it is a conventional coating, you expect a coating that is up to 1 mil and as a result, many people follow sulfuric acid bath process for anodizing machine.

## **3. Hard Coat or Type 111/hard coat anodizing/ HCA**

This process uses higher current densities and voltages to generate a maximum of 4 mil coatings. Type 111 anodizing is also the highest when it comes to wearing performance, darkest coloring and smoothest surface. The primary use of a hard coat is engineering applications due to the thicker coating. Another important thing is that you can either dye or not dye the finishing from the coating.

## **4. PAA/ Phosphoric acid**

It is also known as phosphoric acid anodizing is a Boeings (BAC5555) process. This type is common when it involves adhesive bonding and when you want to improve the performance of aluminum in environments with high humidity.

## **5. Boric and Sulfuric acid**

Other names for this type of anodizing coating is “Boric-Sulfuric Acid Anodize” BSAA is a creation of Boeing Company as a replacement of chromic acid anodizing for mostly fatigue parts that are non-critical. This coating also goes by BAC 5632 and it gained popularity and acceptance as a result of environmental laws that favored using chromic-free chemistry instead of others. The reasons for preferring chrome-free chemistries is the superior paint adhesion and the energy-efficiency in comparison to chrome-based process.

There are other anodizing machine processes like Titanium anodizing, Chem film, TFSAA (Thin film sulfuric acid), Tartaric acid, Sealing, Dye penetrant, Bright dip. Each of these processes makes use of electrolytic oxidation to create a strong oxide coating on an aluminum component or sheet surface.

## **Anodizing line**

When it comes to how to anodize aluminum or what a typical anodizing line will look like, you can equip yourself with the following steps below. However, bear in mind that before the anodizing line, every part of the aluminum must be clean, rack mounted and masked before the processing you are seeing.

This anodizing line is a Sulfuric Acid or Type 11 anodizing coating process.

### **1. Anodizing**

**Step 1:** place the parts in your cleaner tank for at least 5 to 10 minutes so that light oils and dust will clear out. Afterwards, rinse the parts before going further. If you want the parts to be sparkling clean, dip them many times in the cleaner tank as many times as possible while processing. Also, for best results, your cleaner tank must have a pump and inside weir so that oils from the aluminum parts will run off the cleaner solution surface.

**Step 2:** After passing through the cleaner tank and rinsing, place the aluminum parts in your etch tank and leave for 30 seconds -2 minutes. This time will depend on the level of aggressiveness of your etch solution. Afterwards, rinse the parts thoroughly.

**Step 3:** After the etch tank, remove any form of oxidation on the parts using your Detox tank. Swish the aluminum parts around in the tank and leave them for 5-15 minutes tops. When you bring them out, make sure to rinse them properly as well

**Step 4** in the anodizing line involves dipping the parts 2-3 times to make sure that you remove every air bubble in them before placing in your aluminum anodize tank. Once you dip them, start your rectifier and allow to ramp to the right amperage or voltage. Sometimes, the specifications may require a ramp time of at least 3-5 volts every minute. After like 30 or 45 minutes in the anodizing tank, bring out the parts and then, rinse them properly.

**Step 5** is where you put the parts into your Hot Sealer tank and leave for 15-30 minutes to process properly. When you remove the aluminum parts from the sealer tank, blow them with dry and clean air to dry.

This may be a process using Type 11 but it is also an overview of the aluminum anodizing procedure.

## 2. Coloring

Electrolytic Coloring: this type of coloring is sometimes called the 2-step method of coloring and is popular for Aluminum Alloys. After anodizing, the parts, immerse the aluminum in a metal salt electrolytic bath. As you apply current, this salt will enter into the base of the aluminum pores and different shades of colors will become visible.

Dyeing; depending on what your Aluminum profile requires, you can add color to the oxide film. Anytime you add color for aluminum anodized parts, you are putting the parts through a dyeing process and this process is possible because of the oxide film that forms after anodizing. The two dyes that are applicable to aluminum anodizing are the inorganic metal salt dye and the organic dye. These two types of dyes come in handy for decoration profile and architecture extrusion.

## 3. Sealing

There are two types of sealing: Chemical sealing and Electrophoretic deposition coating.

## Anodizing Equipment

To ensure a good result after anodizing machine, the right anodizing equipment must be in place for the whole process to work.

### 1. Anodizing Tank

The first thing is the way you construct the anodizing tank. If you want to get a good anodizing tank, it must come in Polypropylene material because this tank material is more resistant to corrosion. The size of your tank may range from ½-inch thickness to 1-inch thickness and it will depend on the size of your tank. Sometimes, some external reinforcements become necessary so that the tank will be stronger.

### 2. Water chillers

The tank's temperature must not exceed the limit therefore, there should be sufficient cooling in the tank to make sure that the variation in temperature that may occur during the anodizing process will not be much. To achieve the cooling you require water chillers in the system so that chilled water will circulate in the tank from a water reservoir.



### 3. Rectifiers

For standard anodizing, the DC rectifiers will be up to 18 -24 V. The current output should be 12-24 asf. While hard coat applications will require about 75 V at the current output of 24 to 40 asf.

There are many control options for rectifier which include voltage control, current control and adjustable ramping.

### 4. Cathodes

Aluminum cathodes with 6063-T6 alloy are necessary for newer systems and tanks. If you want to achieve a consistent result, use anode to cathode ratio of at least 3:1. As for older tanks or anodizing systems, lead cathodes is common in them but aluminum is better if you want the parts to last for a longer time. Also, with aluminum cathodes, there will not be contamination in the bath from any metal and heat buildup will be lesser.

### 5. Sparger pipes

This anodizing equipment part is necessary to facilitate agitation. These pipes that have 3/32-inch holes disperse air near the anodizing tank bottom.

### 6. Pumps

If you don't want to use the sparger pipes, pumps sizes of about 4 to 6 tank turnover/should be used to pump your anodizing solution. You can also make use of eductors to facilitate the solution flow. PVC hoods also come in handy to provide exhaust ventilation.

### 7. Racks

Most popular racks for anodizing equipment are titanium and aluminum. Aluminum racks come in 6061 or 606-T6 material while titanium racks come with pure titanium and are more costly.

### 8. Hoist

There is also a side-arm hoist to handle loads ranging from 250 to 750 lb. Also, if overhead hoists are required, it can carry a load of 2000 or 4000 lb.

## Aluminum anodizing machine

There are many applications of aluminum anodizing which include: Hydraulic jacks screw thread, Dental components, Architectural and marine hardware, Surgical trays and cases, Handles of surgical instruments, Gear components of aircraft, Spraying systems and equipment, Medical handling & processing equipment, Nuclear equipment, Race housings, Textile machinery, Food processing and handling equipment, Piston & gears, control valves of jet engine, etc.



## Anodizing machine price

Anodizing machine price varies depending on the size of the system and your specifications. There are low-price and high-price anodizing machine depending on what you have a budget for it. However, before ordering any aluminum anodizing machine, you must equip the sender with four important information about the requirement.

### 1. Alloy

It is true that you can apply aluminum anodizing on any alloy but don't forget that no two alloys are the same. Therefore, make sure that you specify the particular alloy for the aluminum anodizing on your purchase order or drawing.

### 2. Surface build-up

Be specific on the type of build-up you require. Let the sender understand that you need hard anodize buildup so that you will not get plating buildup.

### 3. Racking

Don't forget the importance of properly racking the components so that both mechanical and electrical contact will be firm during the anodizing process. Therefore, make sure that you tell the fabricator the type of rack placing you require.

### 4. Masking

This process is necessary so that the coatings will not touch bored holes or threaded holes, mating surfaces, ground points or other areas that are not relevant. Make sure that you specify the areas where you want the providers to mask on your purchase order or machine blueprint. This specification is very important to reduce high costs of masking due to wrong specifications.



Anodizing machine is very important to protect the aluminum parts from wear and corrosion. Anodizing is necessary for every aluminum alloy but if the components don't follow the right alloy, you may experience difficulties. Therefore, always specify correctly to avoid mistakes.

After anodizing, you can also test the anodized coatings to check the seal quality, weight, paint adhesion, lightfastness, and corrosion resistance. If it is hard coatings, you can also test for abrasion resistance and thickness.

Sometimes, after testing, there may need to rework the coating. To remove the first one, you can use caustic soda in an "alkaline etch tank." However, you must be very fast to remove the aluminum from the tank to prevent an attack on the substrate. If you know that you may not get the timing right, make use Chromic-phosphoric acid.