



Inside Racking

In our computerized world, every rack ordered should be the perfect fit. This article focuses on identifying and controlling those variables that make up the perfect fit. It highlights the importance of careful and complete attention

to detail at the design, engineering and manufacturing stages. The perfect fit means racks are the right size, material and rack design for all operations. Racks should minimize labor costs while maximizing throughput. The perfect fit means a well designed racking system that contributes to smooth operations and makes business more profitable.

Everyone Is Looking for The Perfect Fit

The perfect fit exists in clothes, in friends, even in golf swings. But, what goes into making a golf swing just right? Each golfer has to make choices about clubs, stance, shoes, balls...the list goes on and on. And, the choices are different for every player on every fairway. The same can be said for the perfect fit in anodizing rack design. The variables are endless. But, the goal is the same. We are all looking for the right rack for each job, for consistency in the end result. And every job is ultimately unique in its requirements.



Outside Racking

A manufacturer with aircraft landing gear to anodize has parts weighing 200 pounds each. He wants a system that not only holds multiple parts per rack, but also prevents air pockets and solution entrapment. The perfect fit for him revolves around material handling and drainage. Meanwhile, another anodizer is running small parts where hand line issues come into play. Efficiency in loading and unloading is paramount to him.

What the perfect fit concept does for each of these anodizers is to collect vital details during the planning phase. Design engineers then create a racking system that addresses the key concerns of each anodizing process, making every rack contribute to the increased productivity and overall success of the operation. The perfect fit in manufacturing includes reducing solution drag out and rack marks, increasing throughput, paying attention to material handling concerns and matching cross-sections of rack elements to rectifier capacity. The perfect fit from an economic standpoint includes parts per load, loading time, rack flexibility and overall cost. It is this balance between engineering and economics that makes a racking system right for you.

Rack Design Factors

The following four factors must be considered for all racking systems. These are the minimum design details that will translate into an efficient anodizing operation. A well designed system that runs smoothly with little wear and tear is a profitable system.

- Material Selection
- Point of Contact/Rack Marks
- Tank Size/Rectifier Output
- Drainage/Drag Out

**THE
PERFECT
FIT**

Material Choices

Your first decision depends on which of the many types of anodizing you do.

See reverse side for more information...

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Each process has its own requirements and demands its own attention to detail. No one knows your system better than you do. So, no one will be better than you are at identifying these details. Write down the strengths and limitations of your processes. Don't just lump your anodizing lines under generic categories. Identify the factors peculiar to your application and give the anodizing rack design team the details it needs to provide you with the perfect fit.

The most important of these additional details are the temperature of the bath, the solution used, the required coating thickness, the required softness or hardness of the anodic film and clear anodizing versus color or dye work. Each of these must be considered at the very start because each can have a positive or negative influence on your end result. Write them down. Keep track of the details and they will work for you.

Begin the design process at the most basic step. What material should you use?

Aluminum is the choice for high amperage when conductivity is at the top of your priority list. It is also best with tough aluminum alloys (7000 zinc, 5000 magnesium, 2000 copper) and, because of its flexibility, difficult configurations. Aluminum is often the most economical choice for short runs.

Titanium, however, is more desirable for longer runs, easier aluminum alloys (the 6000 series) and maximizing your rectifier capacity. It also draws minimum current, as compared to the huge amount drawn by aluminum. So, using titanium means that more of your energy is going directly to the parts. And, titanium is more durable than aluminum.

Comparative conductivity is probably the most important component in material selection. Try to visualize the route electricity must take in your anodizing process. Think of the flight bar as the highway, the spline as the off ramp, the contact made as the feeder roads and the part being anodized as your destination. The amperage in every anodizing process must travel this route.

Because this is a complicated equation, with so many component parts and variables, a hybrid racking system is often the best solution to material questions. The perfect fit may in fact mean combining two choices to satisfy your particular needs.

A Type II anodizer was running a large volume operation. Titanium contacts offered longevity without the need to replace tips on a monthly basis. But, the anodizer was concerned with the current carrying capacity of a titanium frame. Working with his rack supplier, he was able to design a hybrid aluminum-titanium system that best fit his manufacturing and profit profile.

Point of Contact/Rack Marks

Now that you've decided whether to use titanium or aluminum (or a combination of the two), you can focus on the finer details of rack design. Point of contact/rack marks relates back to conductivity while also addressing the issue of holding each part firmly while leaving little or no evidence of the holding clip. Too much movement during the anodizing process will cause scratching and burning. Inadequate contact will do the same. Yet, while reducing part movement, the clip must also be easily loaded and unloaded to reduce labor costs.

Do you require inside or outside diameter holding? How critical is consistent rack mark placement to your final product? Would you prefer line contact for better current flow or an individual point system? As always, the goal is a consistent end product that demonstrates your standards for your customers. Providing the same contact point for each part helps to maintain uniform coating thickness. This will be beneficial further on in the process when dye work is required and color matching is important. So, again, attention to detail at an early stage means a more efficient, successful process throughout. Why? Because the most effective point of contact, like all the other factors discussed here, relates back to conductivity. And, conductivity is at the heart of anodizing.

Tank Size/ Rectifier Output

Tank size and rectifier output are linked on every anodizing line. The dimension of one determines the size of the other. And, the key to this link is the maximum racking envelope.

This refers not to tank size, but instead, to the largest rack that the tank can accommodate. It takes into

account extension, depth, width and length as well as the solution displaced by the rack and its parts. The goal is to utilize this area to its fullest without over-building for your tank and rectifier size. When determining the maximum racking envelope, you should also consider the size of the seal and dye tanks in your line. The racking system you design must be usable in every tank in your process.

Once you have determined that you have the tank space to run 4000 small parts, you need to consider your rectifier capacity. If each of your 4000 parts requires .30 amps to be anodized, you need a rectifier capable of producing 1200 amps. Anything less would result in unusable parts. On the other hand, large rectifiers can have their capacities limited by small tanks. In order to insure maximum throughput, you must be sure to match these two critical issues when designing a racking system

Drainage/Drag Out

Some parts, by their nature, create air pockets. Spacing and staggering can insure proper drainage and eliminate solution entrapment.

It is also important to reduce the carryover of solution from one tank to the next, or to “drag out.”

Proper rack design can minimize the amount of drag out by orienting parts to allow the solution to run off efficiently before the load is moved to the next step in the process. This can greatly reduce your maintenance labor on the line and leave more time for actual parts’ processing.

While using a small parts racking system centered around hand loading, an anodizer discovered that the clips were trapping solution in part crevices. Undrained solution was then dripping on to parts below, creating spotting. Welding 100% around the perimeter of every clip quickly eliminated the problem, providing the perfect fit between engineering and economics.

Types of Racking Systems

Once you’ve identified the four vital design factors, it’s time to design the racking system that best



combines these details. As always, engineering and economics must be balanced in the final product. They are the key components of your success and the reasons for demanding the perfect fit.

Disc Racks are low cost and versatile. Specialty disc designs enable the fast, efficient racking of unusual, difficult-to-rack parts. Most discs require only two inches of vertical clearance on a spline, leaving more room for additional tiers and greater load densities per rack. They are also well suited to hand operated lines with lightweight parts. But, disc racks don’t always make the best use of tank space.

Box Racks have higher upfront costs, but are more efficient for medium and large parts. They are also versatile enough to be used in large tanks with high parts per load densities, thus utilizing tank space more completely. Overall, they combine adjustability with compact design to increase throughput and reduce rack investment costs.

High Density Racks are extremely flexible. Different types of racks can be attached to the same frame set-up, making this system great for handlines, hoists, semi-automated or fully automated systems. High density racks are easily customized for maximum throughput and varying tank sizes. This is most often the best choice for small part/high volume anodizing lines.

See reverse side for more information...

Utility Racks are lightweight and moderately priced. These timeless designs can be used in a variety of applications where production quantities are small to moderate and there is, therefore, a need for a simplified, off-the-shelf racking solution. Utility racks can also be used for a growing variety of parts since they provide enormous flexibility in station spacing.

And, finally, **Custom Racks** - a description that speaks for itself. Though custom systems are often the most expensive upfront, they are so well designed for their specific jobs that they usually pay for themselves after only a few billing cycles. Racks that work perfectly to increase your throughput, maximize your tank space and solve rack mark and drag out problems are the answer for unusual parts in many jobs and industries.

Loading is another consideration in choosing a racking system. Even the most automated designs still demand repetitive motion by the operator. This is a hot topic now being addressed both by government regulators and responsible rack manufacturers. In order to lessen such stress, today's computer designed racks are uniform enough to be loaded from both sides or even in tiers, allowing your employees greater flexibility of movement. This increases throughput and enhances overall success while protecting your employees from injury.

Regardless of which rack best suits your needs, each system is made up of component parts. In our computerized manufacturing environment, you have a right to expect consistency in these parts, Splines, fingers, hooks, fasteners, stations and clamps are critical to your system's success. You should specify these in the same detail you've used to choose materials and rack types.

Organizing Your Details

Once you have determined the right mix of materials, point of contact, tank size/rectifier output and spacing, you and your rack supplier are ready to design a rack that's the perfect fit for your operation, Calculate the answers to the following questions.

How many different part sizes or configurations would you like to anodize on the same rack?

Where can the parts NOT be held?

What is your anticipated throughput?

Is this a long running project?

You should also know the flight bar dimensions, whether you prefer a hand or hoist system, maximum weight capacity, cathode material and agitation method.

With these answers, your rack design details and cost requirements in hand, your supplier can provide you with the right rack for every one of your jobs. Even standard racks become custom when designed to fit your applications this perfectly.

Can We Find The Perfect Fit?

Step out of the box. Don't be limited by racking systems you've used in the past. Don't settle for that old "it's the best we can do" attitude.

Today's Computer Aided Drawing (CAD) engineering programs and Computer Numerical Control (CNC) stamping facilities give you the tools to be more efficient and more profitable. Use these tools to gather and understand all the specifications of your anodizing line. Then plan these specifications into your racking system from the very start. Changes at the design stage require paper and pencil. Changes once your line is up and running will eat up profits very quickly.

There is no longer any reason to settle for less than the perfect fit for your business. There is no longer any reason to expect less than custom work at a standard price. When a racking system is designed properly, the subsequent flow and results achieved on your anodizing line can make your rack costs disappear.

The right rack will make you more profitable and that is what the perfect fit is all about.

