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Increasing Productivity in your Metal Finishing Operation

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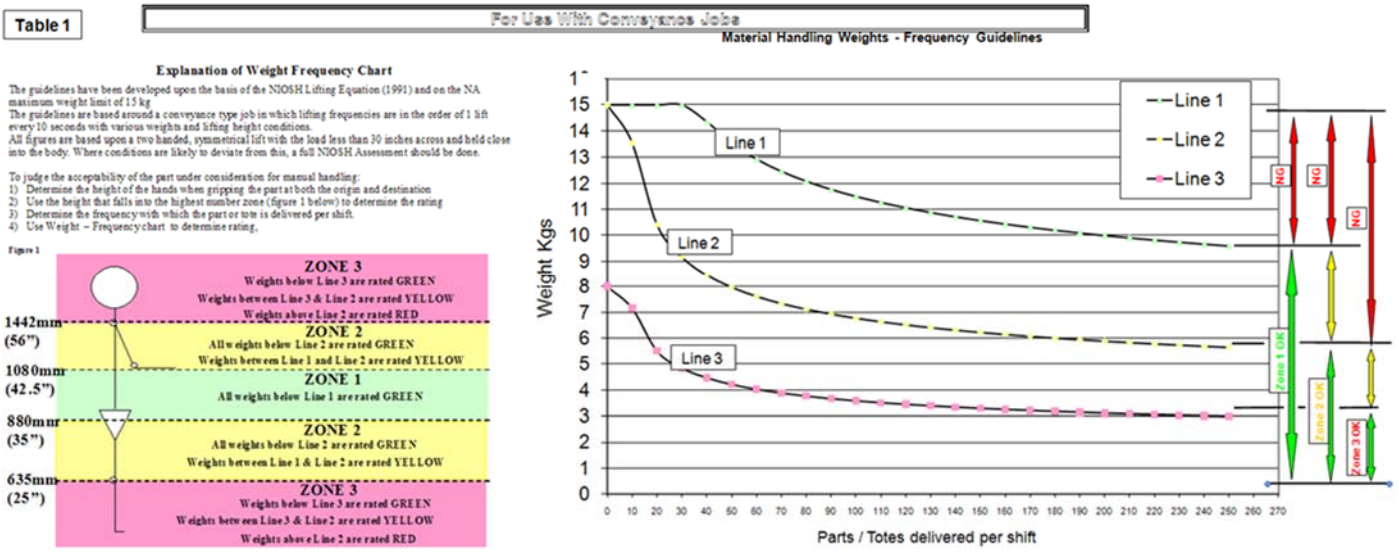
The key principle - maximize efficient rack loading and unloading system - any movement other than placing parts on and off the rack is wasted time and effort. Obviously, it is impossible to eliminate all movement completely, but most movements can be reduced. For the purpose of this article racking/unracking and loading and unloading are all replaced with racking as the principles are the same.

There are three basic designs to increase efficiency of racking of parts: (1) cart station, (2) fixed station or (3) shuttle. The key factors in determining the best design for your system are: (1) safety, (2) ergonomics, (3) space and (4) labor payback. It is also important, to consider rack storage (queue) in your design as there can be great production efficiencies gained in storing and retrieving racks.

Safety should include protecting the operator from automatic hoist movement when dropping off the finished rack. This is commonly achieved by either fencing or a light curtain (see Photos 2 and 3 below). Also the use of gloves, sleeves and an apron should be used to protect the body from the parts.

Sound ergonomics includes an acceptable height for racking the parts as well as having the part containers very close to the racks themselves. A typical rack and container height should be in the height range of 25”- 56” with 35”- 42.5” optimal. The weight of the parts should be kept to less than 15 pounds with minimal bending (see the graph below). If you can design your racking area to incorporate these guidelines, either by rack height in the racking area or by the use of a lowerator to lift and lower the rack to a desirable height, your personnel will be able to stay healthy.



The most common choice for racking is a cart station (see pictures below). If the line is automatic, there should be some safety fencing or light curtains to protect the operator from the automatic movement of the hoist (the pictures below show a fence and light curtain option). While this is the most common, the simplest and lowest cost option it is the least efficient. The use of a cart can utilize efficient racking systems if the carts with racks are moved to a set up racking station which utilizes very sound ergonomics, with part bins very close to the racks and the use of a lowerator, if needed. The negative side to this option comes with the labor to move the carts, the storage of carts takes up a tremendous amount of space and moving the carts can cause injuries to the feet as well as take some effort to move around in small spaces. Many shops have carts everywhere and to get to the cart/racks you need, you have to move many carts, all taking a great deal of time.

Photo 1

Photo 2

Photo 3

The second most common choice for rack loading and unloading is a fixed station (see pictures below). The advantage of a fixed station is that it removes the moving of carts from a safety, space and labor standpoint. This can save a great deal of labor and space and should have a very good payback. Photo 4 shows a fixed station with very high racking rates - up to 20,000 pieces per hour. The design utilizes a lowerator for lifting and lowering the racks to a safe ergonomic position. The lowerator moves the rack into the floor so the top of the rack can be moved down for ease of racking. The fixed station lends itself very nicely to the queuing of racks for storage and quick retrieval (to be discussed later). There are two negatives to the fixed station design. The first is safety as the load is automatically lowered into the fixed position and the second is proximity of part containers. The safety can be handled with light curtains or the use of a cupboard style design as shown in the Photo 6. The first picture below utilized the hole with toe guard and had no light curtain and in 18 years there have been no accidents.

Photo 4

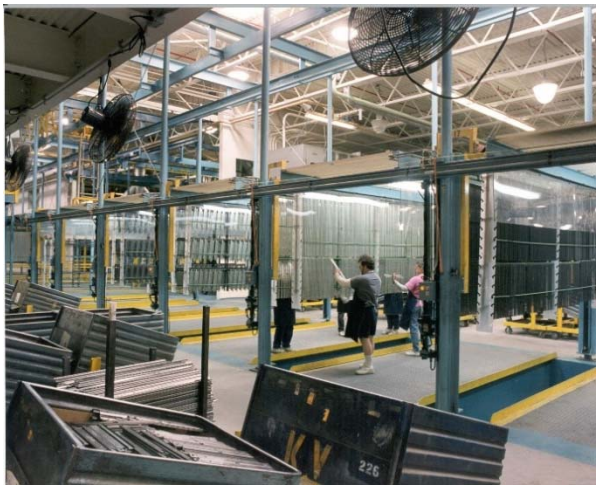


Photo 5

Photo 6

The third option utilizes a shuttle, either manual or automatic to move the parts out from under the hoist activity and into a safe position (see photos below). This accomplishes no cart movement and moves the

racker out from under the hoist. The shuttle can be moved manually as in the Photo 7 or automatically like Photos 8 and 9. Photos 8 and 9 show an automatic shuttle moving carts through an automatic door (Photo 8 shows where the hoist drops the load onto a shuttle cart next to the finishing line). The cart on the floor-mounted shuttle track goes through the automatic door into the air conditioned loading area (Photo 9). The shuttle can go in the same direction as the workflow (shown below) or shuttle ninety degrees to flow as shown in the Photo 7. The shuttle option provides some great features including the fact that the racker works outside the finishing area away from fumes and heat and the potential for an air conditioned area for racking becomes possible. The shuttle can be as long as necessary to bring the rack to the parts needed for the rack. The shuttle lends itself very nicely to the queuing of racks for storage and quick retrieval (to be discussed later).

Photo 7

Photo 8

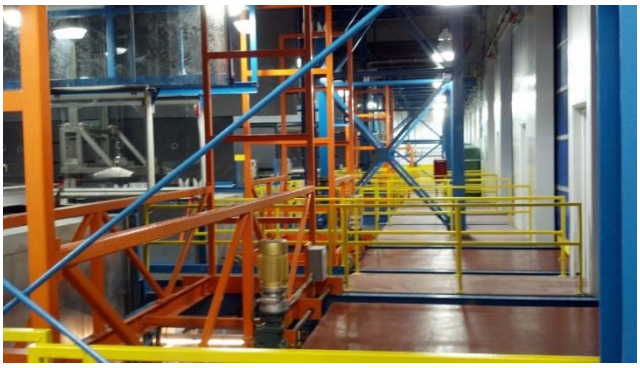


Photo 9

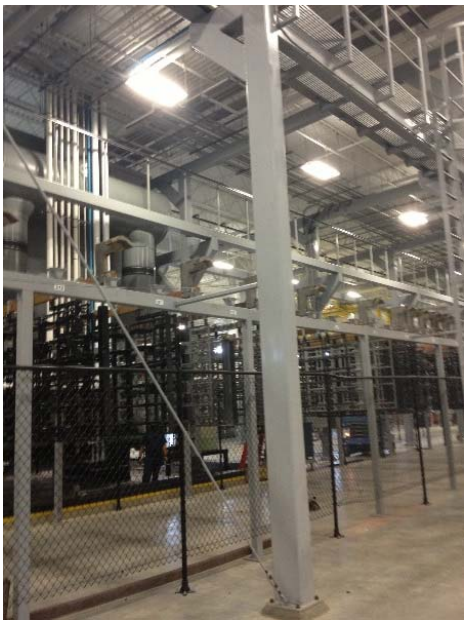
It is difficult to get the parts close to the racks ,as most racks have two sides and it is difficult to get one container on both sides of the rack for all the options. If your part is amenable to being a one sided rack - either with only one plane of parts or with two planes both easily accessed from the same side, the parts can be located very close to the rack and walking is greatly reduced. In most of photos shown, the part positions require significant walking. The racker loves this, but the industrial engineer does not. If two

containers of parts are available and can be placed on both sides of the racks, this requires very little walking. The part containers can be the same parts or different - they just need to utilize the same racks. Consider how your racking system could be one-sided or if you can create enough space for bins to be on both sides of the rack.

There are many advantages to queueing racks; increasing machine productive time and quality by running through breaks, storing racks to minimize space and for easy access to all racks without labor, less damage to racks, and utilizing a rack repair station at the end of the queue area.

The production gain from racking ahead of the machine and running through breaks is very large. It is often standard practice to have two 15-minute breaks and one half-hour break every shift. If the rackers could rack ahead of the machine and run full production during those breaks there would be a gain of one hour for every eight hours worked. This is the minimum gain, as what usually happens before break is that the platers (or other tanks) are left empty so quality is not lost due to longer process times. This means for each break there is even a greater loss of production. If the tanks are not strategically left empty, poor quality parts are run every break. If the shop is not a three-shift operation at the end of every day, the line will be emptied. The queue makes the rackers efficient, as they can unrack and rack at the end of the day instead of only unracking at night. The queue keeps everyone working at full potential, creating efficient use of labor. The racked parts can be stored in queue every night and the line could be started by an operator an hour before the rackers come and the work would be coming out as soon as they arrive - another gain in efficiency.

Photo 10

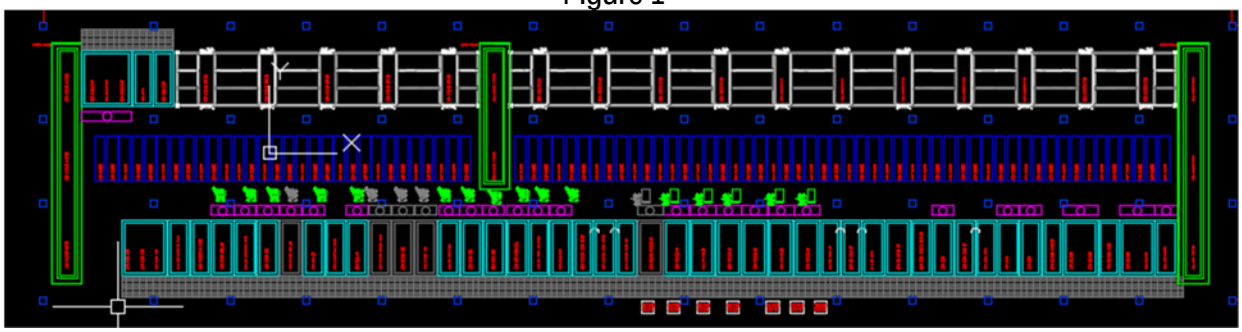


Storing the racks in queue stations provides several other benefits. Most of rack damage comes from storage and the tangling of contacts and the effort it takes to untangle racks can cause damage. Rack retrieval becomes very easy as you simply move the hoist manually or automatically down to retrieve the rack needed as the incoming parts change. Lastly, you can put a rack repair station at the end of the queue area so the racks are easily accessible for repair. On an automatic machine, you can set up a schedule for each rack to be repaired or if the operator notices bad contacts, they can use the hoist to bring the rack to rack repair. Lost or damaged contacts cause poor quality and lost production. The drawing in Figure 1 below, of a very high production line, shows an anodize line on the bottom, queuing in the middle and load and unload on the top of the line. The load, unload and strip can be part of the queue line for a lower output line.

While it is sometimes difficult to modify an existing line, there are some great efficiencies which can be gained from organizing your racking and utilizing a queue area. Consider how to layout your loading/unloading area to gain efficiencies. Can you reduce walking? Can you make it safer? Can you make it ergonomically better? This is usually a win/win situation as the job should be safer and easier and you can gain efficiencies to sustain your business. The use of a queue to

gain up to two hours per shift is huge - do not miss this opportunity. If you cannot accomplish all of this in your existing line, consideration should be given in your next line design.

Figure 1



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