Tech Article

Develop Your Cleaning Scorecard: Criteria in Selecting Cleaning Equipment

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When it comes to selecting a new, long-term cleaning process, the challenge is to clean more with less. Regulators continue to impose new air quality regulations (fewer VOCs), new shipping, handling and storage regulations (fewer HazMats) and new waste treatment rules (less impact on wildlife). In some locations, a lack of water and rising energy costs are additional challenges (less again).

Basically, you need a cleaning process that is fast, safe, sustainable, versatile and affordable. While this is a tricky objective, there is a tool that will help you select the optimal solution for your cleaning needs and these numerous, and sometimes conflicting, demands. Here at MicroCare, we call it the cleaning scorecard.

Understanding the Cleaning Scorecard

Most people believe the cleaning game begins and ends with the cost of a machine or a drum of solvent. They think the lowest priced machine or the lowest cost-per liter is the best choice. Not so. In most instances, those two costs are (almost) completely irrelevant. What is important is the score or cleaning index when measuring the economics of cleaning. And the best cleaning index is total cost-per-part-cleaned. This puts the focus on cleaning parts at the lowest total cost-where your profits are made or lost. Let's look at the numbers to put on your cleaning scorecard.

Your Cleaning Fit

Cleaning machines come in all different sizes. But don't grab the tape measure yet. The size of a machine is not measured in inches. The best fit is measured in production capacity or cleaning capacity. You have to select the machine that fits your needs.

Your cleaning fit can be measured several ways. The least precise (but often adequate) method is to measure capacity, the number of units which have to be cleaned. For example, 300 boards per day, 500 pieces per week, and so on. Another option is to estimate the total surface area of all the parts for cleaning. This is useful when there are a large variety of parts with many different shapes. Keep an eye on the extremes: very small or very fragile components may have different cleaning requirements than larger pieces.

Choose the Technology

Now that you have defined the capacity you need, you can evaluate which type of cleaning technology is best for your situation. For example, benchtop cleaning machines are slow, but small and cheap. High-volume systems are larger, more capable, usually more efficient and always more expensive.

Be sure to take the systems which appear to have the best fit out for a test drive. Prepare a batch of typical products and have each manufacturer run them through their cleaning systems. The manufacturer should be able to produce a brief written report that describes the process, solvents, temperatures, times and results. Be sure the systems perform to your standards. Do this testing first, because this is the easiest part of the selection process.

Now comes the more difficult part; computing which system produces clean parts at the lowest total cost. Here is a shopping list of the major costs, but each project may require other items too.

Vapor degreasers are ideal for cleaning electronics and metal parts.

Compute Throughput

When comparing different cleaning technologies, you need to estimate the average productivity of the system in terms of assemblies per hour. This is crucial to computing the cost-per-part-cleaned because operational and labor expenses usually are tabulated as hourly costs.

Start with the cycle time. This is the duration of one complete cleaning cycle, including loading and unloading. A machine that cleans twenty boards simultaneously in a forty minute cleaning cycle has a throughput of one board every two minutes, or an average throughput of thirty boards per hour. Your vendors should be able to provide benchmark numbers.

Many factors affect throughput. For example, loading and unloading a machine is part of the cycle. Water-based machines often cycle quickly when cleaning large, simple shapes; vapor systems are faster when cleaning tight spaces and components with many voids.

Throughput will affect operating expenses dramatically. For example, Chemours™ reports that in a small, modern vapor degreaser, normal solvent losses are about 0.118 lbs. per square foot of vapor area per hour of operation, or roughly one pound per day (larger and more efficient machines have lower loss rates). In stand-by mode, this drops 75%. To compute total cleaning costs, engineers will need a fairly accurate estimate of the throughput requirements placed on the systems.

Bear in Mind One-Time Costs

To calculate and compare total cleaning costs, all of the costs for each system need to be re-calibrated into one standard unit of measure, the total cost-per-part-cleaned. That is easy to track for consumables like solvent and electricity, but often the initial acquisition costs are ignored. Up-front capital costs include the actual cost of the machine, freight, site preparation and set-up costs. You will also want to include building renovations, ventilation enhancements, electrical upgrades and water-treatment subsystems required to support the new system. These expenses can be as costly as the cleaning machine itself, so be sure to include your facilities manager, your health and safety people, your environmental people and your fire safety team, as well as the production people, in developing these plans.

You should also include the cost of the funds tied up in the machinery. With a spreadsheet, it is easy to use the Payment (PMT) financial function to estimate the cost-per-month of the equipment, which can easily be converted into a cost-per-part.

How Much Space?

Another consideration is the actual cost of the space and the support systems of the cleaning machine. The floor space requirement is a multiple of the physical size of the machine.

It has been my experience that aqueous and semi-aqueous systems require more floor space than solvent-based systems. Aqueous systems often require water-treatment facilities which can be as large as the cleaners themselves. Aqueous systems also have slower cycle times, so more space is needed for work-in-progress,supplies, conveyor systems and access aisles.

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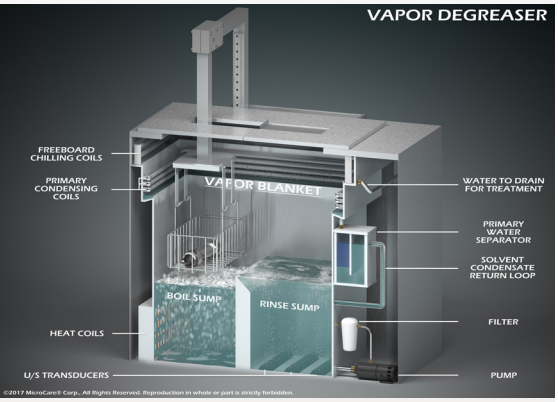

Vapor degreasing is fast, safe, sustainable, versatile and affordable.

For example, I have seen a 30-foot aqueous cleaner which had a 200 sq. ft. footprint in the factory. But the system tied-up 1,400 square feet of floor space with ancillary systems: a 7X floor space factor. For vapor systems, a 4X factor would be a reasonable rule-of-thumb.

To estimate floor space costs, call your financial people and ask them for the fully loaded per-foot costs for the space in which you are interested. This will usually be expressed as a triple-net rent per square foot. Included in this number should be the cost of the space itself, plus heating, cooling and lighting costs, and some portion of the cost of shared facilities, like the lavatories.

Calculating Operating Costs

Once the throughput has been defined, it is relatively easy to compute operating costs. Normally the equipment manufacturers will provide rule-of-thumb guidelines for typical installations. Direct operating costs include the cost of lost solvent, electricity and required consumables (e.g., saponifiers, filters, etc.).

Drag-out is a special operating cost, and one of the few areas where the cost of the solvent comes into play. Drag-out is the loss of solvent due to being trapped in, on and around the clean parts as they move through the cleaning system. High-boiling solvents like water and hydrocarbons are prone to high drag-out losses but the chemicals are relatively cheap. With boiling solvents, proper processes can almost completely eliminate drag-out because even small losses can be expensive.

Look for optional equipment which helps eliminate dragout losses. Newer vapor degreasers use extra refrigeration, superheat and hoists to reduce drag-out losses and save money. Aqueous systems have similar money-saving options such as air-knives and extra drying chambers which cut solvent losses but add to the electric bill.

A good vendor should be able to document incremental operating costs and drag-out losses on a feature-by-feature basis. Furthermore, they should be able to highlight specific environments (e.g., types of contamination, cycle times) which optimize the usefulness of each feature. With this data, it becomes simple for you to add these costs to the cleaning scorecard.

Often Overlooked Labor Costs

Labor is the dirty secret of cleaning and should be handled separately from the other operating costs. Many companies feel their automated cleaning processes are under control. But inspection reveals they often have technicians performing auxiliary inspections, hand-spraying, re-cleaning and drying of products outside the machine. In today's world, manual intervention should be rare. If it is not, something is wrong.

Recently, I inspected an old aqueous system originally designed for through-hole boards. Originally the system had been fast and efficient but now it was cleaning denser Ball Grid Array (BGA) circuit boards. The change caused the cleaning cycle to slow by almost 50%. Technicians spent an extra ten minutes on each board manually drying them with compressed air. This inexpensive but inflexible cleaning system had suddenly become a very expensive choice.

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To price out your labor costs, obtain the fully-loaded labor rate for the technicians who will operate the machine (this number will be at least 2-3 times the actual take-home pay). Remember to include the value of the engineer's time, making sure the solvents remain within specs and the waste treatment systems are operating correctly. Also include the cost of training, maintenance techs, and any chemical safety training. If turnover is a problem, add additional funds for quarterly supplemental training.

Not All Maintenance is the Same

Big machines have complex maintenance problems, and aqueous systems have the most complexities. In part, this is due to the size of the systems (30 feet long is not unusual) and the number of moving parts. They also have complex water-treatment and recycling processes which must be maintained and sustained for the life of the machine. Another complexity is the alkaline additives used to boost the cleaning power of many systems; these additives coat the machine's interior and can cause additional maintenance problems.

Vapor systems, on the other hand, are not maintenance-free. Checking and replacing filters is required. From time to time, the cleaning fluid in the degreaser needs to be boiled down and the sludge at the bottom of the system removed. This usually results in the loss and disposal of approximately 10% of the solvent in the machine on a quarterly basis.

You're Ready to Complete Your Cleaning Scorecard

Now that you know the many factors when selecting a new cleaning system, get started by answering the questions on our cleaning scorecard:

What are the likely cleaning requirements for today's products as well as those of tomorrow?

Average those requirements into a daily or hourly rate of required throughput.

How do different cleaning technologies compare?

Send samples to the equipment makers to prove the ability of their systems to clean the components to your specifications. Eliminate the systems that cannot do the job.

What is the comparative data on every important characteristic from among the surviving candidates?

Be sure to examine up-front capital costs, floor space costs, installation costs, energy costs, water costs, solvent costs, labor costs and maintenance costs.

How does all this cost data look when put into a performance index?

The industry's most popular index is total cost-per-part-cleaned.

Which option minimizes total cost-per-part-cleaned?

When you know this, you will know your best option.

Using standard statistical tools, you can model all the operating costs for systems of different types and sizes. If completed accurately, thoroughly and impartially, the scorecard helps you choose the system to support the production process for years to come.

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To Sum Up

The issue is not the solvent cost per pound but the cost per part cleaned. Unlike aqueous systems, vapor degreaser solvent consumption is measured in pounds per week instead of gallons per hour. In addition, vapor degreasers concentrate soil and contaminants, minimizing waste disposal. Aqueous systems generally dilute contaminants, making waste disposal more complex and costly.

All the evidence favors the cost effective, environmentally friendly and headache-free vapor degreasing cleaning process. If you are serious about cutting operating expenses, now is the time to take a closer look at the new face of vapor degreasers.

Use a cleaning scorecard checklist to determine the total cost-per-part cleaned. See scorecard on page 6 to get started.

About the Author:

Mike Jones, retired Vice President of International Sales for MicroCare, has over 30 years of experience in the critical cleaning industry. He is a prolific writer and educator focusing on critical cleaning in general and vapor degreasing and benchtop cleaning in particular. For more information, visit www.microcare.com.

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Cleaning Scorecard

When comparing long-term cleaning processes, you need to consider more than the cost of equipment or a drum of solvent. It's the total cost-per-part-cleaned that is important. Health, safety and environmental regulations must always be a priority when evaluating the best cleaning process for your business.

Use these important calculations to determine the lowest cost-per-part cleaned.

One-Time Capital Costs

Cost of Capital	$ _____
Cost of Cleaning System	$ _____
Freight & Insurance	$ _____
Site Engineering & Architectural Planning Costs	$ _____
Construction	$ _____
Electrical Changes	$ _____
Water/Plumbing	$ _____
Ventilation	$ _____
Total Capital Costs:	$ _____

System Set-Up

Actual Footprint or Size of Machine	_____
Work Space Multiplier	_____
Cost per Square Foot	$ _____
Total System Set-Up:	$ _____

Throughput Calibration Factors

Cycle Time	_____
Parts per Cycle	_____
Max. Parts per Hour	_____
Required Operating Hours/Day	_____
Stand-by Hours/Day (normally much lower costs per hour)	_____
Total Throughput:	_____

Operating Costs

Labor: Operator, Cost per Hour (fully-loaded labor rate)	$ _____
Labor: Inspection & Re-cleaning, Cost per Hour	$ _____
Labor: System Testing	$ _____
Labor: System Maintenance, Cost per Hour	$ _____
Electricity	$ _____
Water	$ _____
Consumables (Filters, etc.)	$ _____
Solvent	$ _____
Solvent Losses (Drag-Out)	$ _____
Solvent Disposal	$ _____
Total Operating Costs:	**$** _____

Cost Per Part Cleaned = Total Operating Costs ÷ Total Throughput **$** _____

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