December 2012

RV PRO

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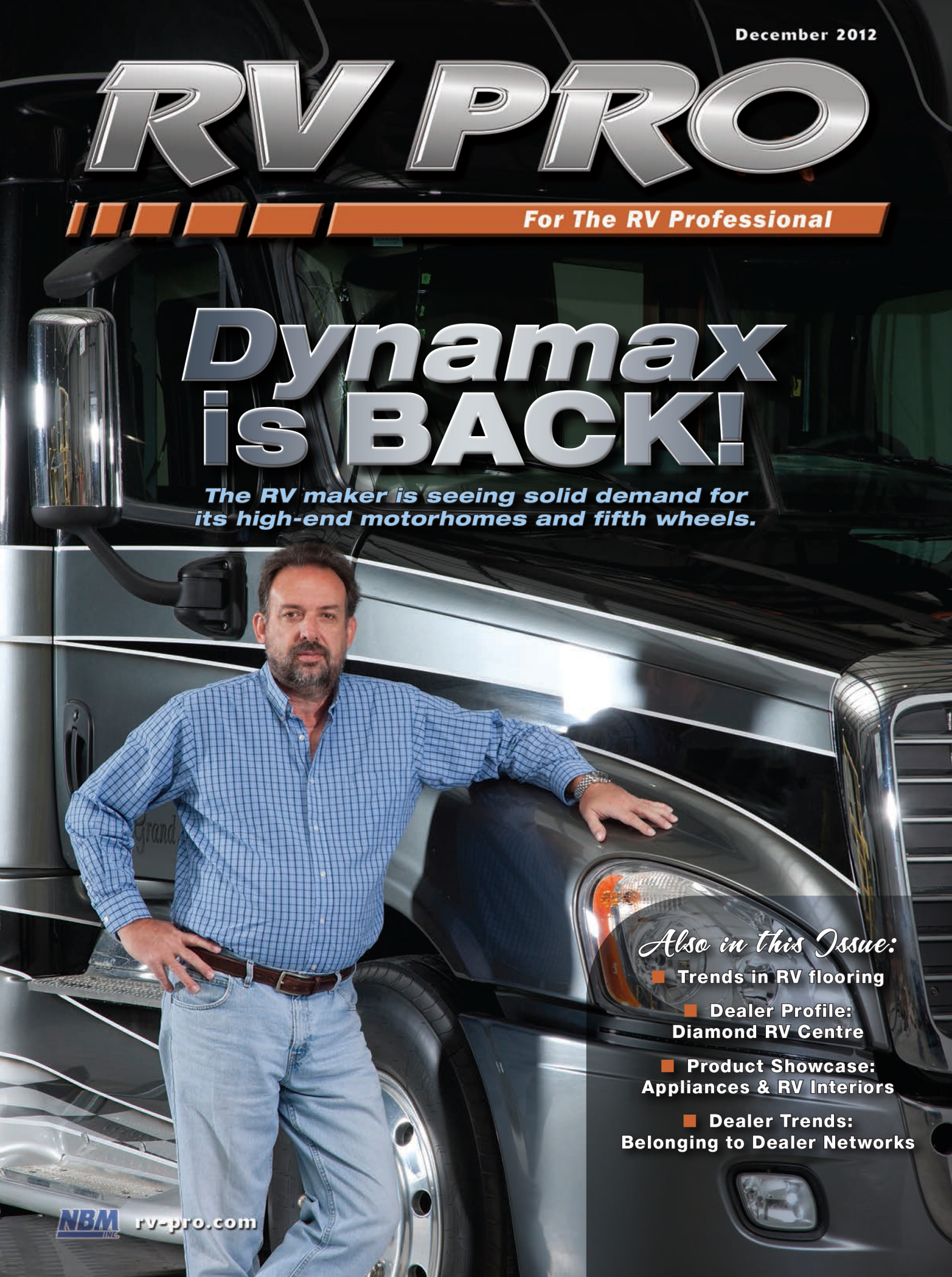

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Bottlenecks: The Hidden Enemy

Identifying and clearing bottlenecks can do wonders for manufacturing productivity and profitability.

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Most people understand the concept of a bottleneck, whether it's pouring water out of a narrow-necked jug, traffic backed up behind an automobile accident, or people lined up waiting to be checked out at the grocery store. Sometimes the effects don't matter too much, but most of the time there is a cost involved with bottlenecks. In the cases above, some of the effects might be: lost time, missed appointments, wasted gasoline, and maybe lost sales if a customer gets frustrated and walks out before completing their purchase.

Bottlenecks occur in all industries and in virtually all processes and systems. Some of them are designed-in for safety or performance control; however, whether in health care, fast-food restaurants, insurance processing, manufacturing or the government, bottlenecks can be identified which cause delays, increase costs and produce unnecessary waste.

Wikipedia defines a bottleneck as "a phenomenon by which the performance or capacity of an entire system is severely limited by a single component." Liebig's Law of the Minimums states that "growth is controlled not by the total of resources available, but by the scarcest resource" – or in other words – the bottleneck.

Broadly defined, a bottleneck is anything that causes a restriction, a constraint, or a slowdown to the desired process flow or production demand.

Bottlenecks *are* the enemy of manufacturing, and they don't just occur on the shop floor. They can occur in virtually any productive endeavor to include order taking, order processing, quoting, scheduling, purchasing, engineering, design, or any process where there are multiple steps to produce a desired end result. For the purposes of this article, we will be talking about bottlenecks as they relate to manufacturing processes out on the shop floor.

What Are the Causes?

There are many causes, some of which may be industry-specific. However, here are some causes that fit manufacturing. Some can be considered

Bottlenecks result from a variety of causes, including material shortages, poor equipment utilization, poor scheduling and poorly trained operators. Whatever the cause, the effect is reduced productivity and profitability.

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temporary, like defective parts, where the problem goes away when the parts are used up. Many of them are considered permanent until you identify and eliminate them. These can include:

- Material shortages
- Poor equipment utilization
- Poor or degraded machine cycle times
- Excessive equipment downtime
- Insufficient quantity of tools or equipment
- Poor balancing or failing to balance the work on an assembly line.
- Poor or substandard tools
- Poor or substandard lighting
- Poorly trained operators
- Too few operators
- Poor manufacturing methods
- Poor scheduling
- Over-processing (due to poor supervision or quality standards)
- Engineering changes adding work to the product, causing a slowdown at certain work stations on the line.
- Defective parts or raw materials being introduced to the line, which cause extra labor or rework to make it fit or function.
- Quality problems causing extra inspections, sorting or witness marking, adding delays to the production process.
- Batching. This is especially true when there is no physical assembly line or where you still operate in functional departments.

Bottlenecks can and do occur simply by unplanned increases in sales, causing a demand on your assets greater than your ability to produce. The effects and the solutions are the same. Regardless of the cause, the results can be costly. You must identify the bottlenecks and eliminate them.

Bottleneck Identification

Sometimes a bottleneck is easy to identify, but many times the actual culprit is a bit more insidious and difficult to spot in the day-to-day operations. Sometimes it is not a single restriction, but can be an accumulation of events on a line, or it can actually move around, making it very difficult to locate.

To complicate matters, downstream operators tend to slow down and pace themselves to the constraint, making things look smoother than they really are. In addition, bottlenecks can be impossible to locate during those periods when the demand is less than the capacity of the slowest operation.

Production lines are rarely perfectly balanced. This means when you identify and solve one bottleneck there is usually a lesser one somewhere else that then moves to the top and becomes the system constraint. After you locate and resolve that one, then you look for another and so on, until the desired effect is achieved. This is the age-old industrial engineering tactic used to lean out any production line or process. This is usually accomplished with the use of time studies and is still one of the most effective methods today.

There are simulation software programs on the market that can help you identify bottlenecks and other system constraints. Sometimes these programs can be pricey or difficult to use, but they are worth mentioning, especially if you have a very complex process to analyze.

Bottlenecks can manifest themselves in many ways such as:

- Overtime
- Downtime
- Missed production schedules
- Missed or late shipments
- Excessive labor costs
- Increases in inventory or WIP
- Increases in rework or scrap
- Upset customers
- Unnecessary outsourcing
- Unnecessary capital expenditures
- Overproduction
- Idle time or inefficient workers

In recent articles for *RV PRO,* I have written about the Eight Forms of Waste. One of the reasons to address bottlenecks specifically in its own article is due to the fact that the adverse effects that bottlenecks cause contribute to virtually every one of the Eight Forms of Waste.

Manufacturing is a chain of many systems. The bottleneck is the weakest or poorest performing link in that chain. If you have good systems for tracking overtime, inventory values and other performance metrics, they can be used as indicators as to the presence of problems, like bottlenecks, especially if you monitor that information for anomalies. I have seen companies spend money buying unnecessary capital equipment because they failed to properly identify the bottlenecks.

I believe the best way to identify bottlenecks is through direct observation coupled with time study analyses.

Clearing Bottlenecks

The underlying desire in any bottleneck identification and elimination is the desire to produce more products or reduce costs, but most of the time it is both. The solutions depend on the causes that you have

identified and corrective actions that are available to you. Of course, they can be significantly different depending on your industry. Below we will discuss some typical ones that I have seen in manufacturing.

An Assembly Line or Cell

Let's say you have some type of an assembly line or a manufacturing cell with a known or unknown bottleneck. The best approach, I believe, is to conduct time studies of each operator or operation on the line and assign each one a time value in minutes, seconds or hours per cycle.

Of course, the industrial engineer will break the work into elements and assign a standard time to each work element as he goes for use later during the balancing process. After all operations have been timed, each one will be listed on a summary sheet along with its standard overall time.

Obviously, the operation with the most time (slowest) is the bottleneck in this example. This operation would be called the *control*, given that the line can make no more parts than the slowest operator. If the controlling operator's time is higher than the desired production rate (takt) time, then you may have properly identified the problem.

(Note: takt is a Lean term that refers to the cycle time or the rate at which the external or internal customer wants your company's product. For example, if your company works eight hours per day and you are building 12 RVs a day, the takt time for your RVs would be 0.67 hours each. This time is used to ace all of the other systems supporting that rate.)

Typically, in the scenario above, you would take some of the work elements from the controlling operator and move the work to other operators on the line in an effort to further smooth out or balance the workload in an effort to reduce the controlling time to something equal to or below the target or takt time. Be careful not to inadvertently move the control to a different operator. The most efficient assembly lines are the ones that achieve the most balanced workloads between all of the operators / operations on the line.

A Single Machine

Many times, I have seen a single machine turn out to be the bottleneck. Whether it is a punch press, a CNC machine, a robotic welder, etc., it – and it alone – is the process bottleneck keeping manufacturers from making shipments.

Usually, everyone knows that this machine is the problem. Typically it is scheduled to run more hours, and sometimes extra operators are added to help keep it going.

This one can be tough. In the short term, you keep adding hours until you run out of hours in the day or you achieve the production requirements, whichever comes first. Usually, downtime causes are carefully analyzed and addressed, as well as optimizing the equipment and tooling maintenance.

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I suggest contacting the machine vendor to make sure it is running to speed and specification. Setups should be minimized and buffer stock should be maintained ahead of the machine so that it never waits. In this scenario, studies should be conducted to identify all process delays and engineer them out.

If the machine cannot be made to perform, you may have to buy another one. I have seen companies go back and set up the manual machinery that they had mothballed when they bought the new automated machine. They used the more manual methods to supplement production. I also have seen vendors brought in to produce the product on an outsourced basis until the in-house problems have been corrected.

Multiple Separate Machines or Operations

This category describes operations that are not necessarily tied in tandem (but probably should be) and one being slower than the others causing it to be the bottleneck. The goal, of course, is to balance the work by pacing all the other operations to the slowest one – if the slowest one is achieving your production goals. There is no benefit to having the other operations run faster.

Looking to the Lean principles, this will help reduce over-production and inventory wastes. If the slowest machine is truly a bottleneck, then take the steps as described above under the A Single Machine subcategory.

Moving Bottlenecks

Some companies encounter unique problems like bottlenecks that move around from work station to work station. This can make them more difficult to identify. This usually occurs when products with large differences in complexity and labor content are run down the same line while manpower remains about the same. Examples of this would be running a 45-foot motorhome down the same line as a 30-foot motorhome or a 30-foot travel trailer down the same line as a pop-up camper.

One way to avoid this would be to do a better job of grouping similar products together and producing them on their own assembly lines. Some companies cross-train workers that float, as needed, to work stations with heavier workloads to help smooth and balance the work flow.

In Summary

Only you know the severity of your bottleneck. You will almost always want to invest in reducing bottlenecks, whether by solving the problems causing it, balancing the work, adding machinery, or adding operators as required to achieve your productions goals.

Remember, if you have a bottleneck somewhere in your system, nothing that you do anywhere else in that system will improve your throughput. You have to identify and eliminate the bottleneck itself. PRO