LISTA WHITE PAPER

The Role Of Workstations in Lean Manufacturing

Lean manufacturing may be known by a number of names – lean production, agile manufacturing, cellular manufacturing, JIT manufacturing, KANBAN, etc. However, all these variants were born of the Toyota Production System created and perfected by the Toyota Motor Co of Japan. Regardless of what your company calls it, all variants essentially share the same goal – eliminate waste in all aspects of the manufacturing process.

With a focus on the customer's specific need and not on "production for production's sake," lean manufacturing asks the question "what things are we doing that the customer will not pay for, and how do we stop doing those things?" The premise is simple. Customers have no interest in paying for waste of any kind, which may include rework, inventory, excessive set up or production times, inefficient use of space, product transportation, etc.

Organizations which fully adopt lean manufacturing principles produce products economically in lower volumes and get them to market faster. In some cases, lean manufacturers can double production at similar or better quality levels using half the time and space, at half the cost, with greatly reduced inventory.

Principles of lean manufacturing

The following nine principles are generally accepted to be representative core elements of all lean manufacturing programs:

1. Lean equipment
2. Elimination of waste
3. Flexibility
4. Visual factories
5. Error proofing
6. Local stores / point of use storage
7. Set up reduction / quick changeover
8. Workplace organization
9. Just In Time production

What does lean manufacturing have to do with workstations?

Even in today's automated environment, skilled workers are and will continue to dominate the shop floor, from material preparation through product shipment. Tasks and processes will change, with increasing frequency. People and the work they perform at workstations will continue to be critical in a wide variety of manufacturing operations. When selecting workstations for lean manufacturing environments, the entire use cycle should be considered.

The Workstation Use Cycle consists of the following phases:

- Initial installation
- Adjustment and flexibility during use
- Reconfiguration
- Individual workstation
- Entire facility layout

Lean principles may be applied in all phases of the workstation use cycle. The following sections discuss workstation attributes as they relate to the nine lean manufacturing principles outlined above.

Lean principles and workstation features

1. Lean Equipment

Workstations must be thought of as production equipment, and not as "furniture". The term "lean equipment" is an umbrella term that may be applied to equipment that exhibits characteristics such as quick changeover, no/minimal maintenance and error proofing in set ups. To determine if a workstation may be considered "lean", evaluate it in terms of each of these categories: How quickly can changeover be accomplished? What maintenance does the system require and how often? How easily can an operator make an error when setting up or using the workstation? These questions are examined in greater detail in other sections of this article.

2. Elimination of Waste

Wasted Workstation Parts. Workstation layouts should be expandable at low cost and with minimal extra part purchases. For example, when converting from a single-sided workstation to a double-sided workstation, or from stand-alone to in-line, consider the incremental cost for additional parts required. Ask which parts previously purchased are not usable in the new layout. Incremental costs for these conversions can vary dramatically depending on the workstation design.

Wasted Space. Factory floor space savings can be substantial depending upon workstation design and the layout selected. By making the most effective use of vertical space above and below the worksurface, worksurface area can be reduced and the footprint of the workstation decreased – sometimes as much as 30%. Consider the space that structural components of workstations use, such as columns and frames, and look for workstations with small, high strength structures so the worksurface area can be maximized within the workstation envelope, and not be unduly impacted by the intrusion of columns or other structural members.

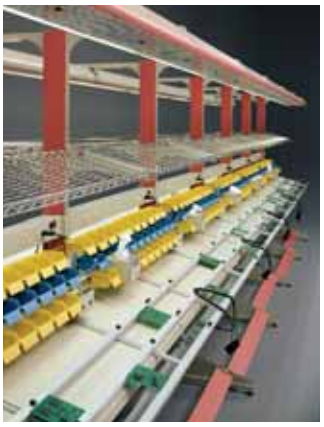
3. Flexibility

Flexibility is the ability to adjust easily to change and to be adaptable. This applies to changes at the individual workstation as well as changes in the process flow or facility layout. Modular systems (as opposed to stand-alone units) are inherently the most flexible in this regard. Modular systems are characterized by the sharing of structural components and the ability to create layouts such as in-line, C, X, U, or L layouts. The ability to easily and quickly convert from one layout to another is important if a system's flexibility is to be truly practical. There are great differences between workstations in the ease with which layouts can be changed, and the associated costs.

4. Visual Factories

Visual Factories, Visual Management, or Management by Eye are all terms that refer to the ability to quickly assess the state of production activity by simply looking around. Clear lines of sight and use of color are two important concerns. Clear lines of sight are important to be able to see production

bottlenecks, operator movements, parts shortages or floor inventory issues, etc. Workstations need to have slim structural profiles and a minimum of visual obstacles that may interfere with observations. Color may be used to code processes, departments, or product lines. The ability to add or change color accents on workstations enables managers to use color for these purposes.



5. Error Proofing

Specific instructions are typically provided for the set up of workstations based upon the task, product, or tools to be used. Diagrams may be used showing locations of essential tools and materials. Set up personnel need to be able to set up workstations with less opportunity to make errors. When performing set ups, accurate assembly, placement and leveling of system components is best achieved when there are no tools or hardware required, and when the components can be attached to the system in a predefined location by means of a positive "lock" connection. This eliminates the need for leveling, calibration, or the potential to incorrectly assemble attachment hardware. Eliminating the need for tools also prevents use of an incorrect tool, such as a damaged screwdriver or over-sized wrench, which could damage hardware or result in the inability to properly tighten the hardware and increasing risk of injury.

6. Local Stores/Point of Use Storage

Local stores are "mini" storage areas for tools and materials located close to the point of use, containing quantities sufficient to maintain production but without any excess. Point of use storage locates materials as close to their point of incorporation in the product as possible, typically at the workstation itself.

Workstation systems may incorporate part bin boards, carousels, parts storage and transport carts, off-line parts kitting modules, or flow rack modules, to support the concept. Workstation systems that enable users to configure parts racks, mobile parts carts, flow racks, etc. using interchangeable system components not only facilitate the creation of local stores, but further contribute to the overall agility of the equipment on the factory floor. For example, a mobile parts cart that can use all the same parts storage accessories as the workstation allows for easy transfer of parts from delivery carts to point of use storage.

7. Set Up Reduction/ Quick Changeover

As product variety increases, and lot sizes decrease, the need to more frequently create new set ups at the workstation exists. To optimize production efficiencies, operators must be encouraged and be able to make adjustments to the workstation. They should find this easy to accomplish, and preferably, without the need to involve other people. Adjustments such as changing the height or angle of shelves, adding or relocating tool and equipment holders, positioning materials on the workstation for easy access, adjusting lighting, etc. are most easily accomplished when no tools are required and components are light weight. In multi-shift operations, workers on different shifts need to be able to make adjustments to the workstation to accommodate their physical attributes.

8. Workplace Organization

Organizing a work area for the maximum possible efficiency is essential for cycle time reduction and process control. Tools and materials should be arranged near the operator according to frequency of use, and returned to designated tool holders or storage areas.

The ability to fully utilize the vertical space available at the workstation is critical to effective workplace organization. This includes space above and also below the worksurface, which is often overlooked. For example, shelving installed below the worksurface can be an excellent place for storage of tools, fixtures, or materials that are only seldom used. Maximize use of vertical space by selecting workstations that take the most advantage of the space above the factory floor. The average male can reach to 7.5' when standing, and the workstation should make full use of this reach envelope. Items used less frequently can be positioned further from the operator, often on swing arms, moveable platforms, or shelves to bring the items within the reach envelope when needed. Drawers should be able to be located at any position beneath the worksurface – right, left, or center – to accommodate all possibilities for best positioning.

Workstation manufacturers who offer a wide range of storage options such as tool holders, material bins, drawer units, shelves in a variety of depths, etc. will better be able to support workplace organization. Orderliness results in minimum waste of human energy while contributing to effective inventory management at the workstation.

9. Just In Time Production

Just in time production requires that only the needed number of units be produced on demand. This results in smaller lot sizes and greater product variety. Workstations must be easily reconfigured and set up to enable small lot size, or even lot size one production, practical and affordable. The workstation should be system compatible with off-line kitting practices and parts delivery methods. Examples include a parts/kit cart that can be rolled up to and "plugged in" to the workstation or an off-line parts bin holder that can be kitted with parts and attached to a swing arm for presentation to the operator.

Summary

Workstations as tools of production are important elements of a lean manufacturing system. Lean manufacturing focuses on the elimination of waste, which can typically be categorized as overproduction of product, excessive waiting or delay times, excessive transportation of product or materials during the assembly process, or wasted motion at the workstation. Properly designed and configured workstations can make significant impact on reducing waste in all these areas. Workstation manufacturers should be able and willing to provide consulting services, application specific solutions, and graphical simulations of proposed solutions for customers pursuing lean manufacturing to insure that the workstations contribute to the overall goals of the manufacturing enterprise.

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