

## **Machine Safety**

### **Integrating equipment reliability with personnel liability.**

By Antonio Reis.

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The design of manufacturing equipment has always been a continuous improvement effort. It is rare that manufacturing equipment is designed from a virgin concept. When evaluating the approach to development of manufacturing equipment and or processes, the designer, with rare exceptions, considers modifying, improve and reconfigure existing systems. The basic approach is “not to reinvent the wheel” while trying to find a way to manufacture a new product or increase the efficiency of an existing process without spending large amounts of money in design development.

The process to adapt known equipment to a new manufacturing process is likely to include an objective assessment and efforts to improve the shortcomings (real and perceived) of the said equipment.

OEM equipment manufacturers constantly strive to improve their product lines and in the process they reach breakthroughs often called new products. For an OEM, integration of improved safety systems does not represent many difficulties and it has economical value since it can be used to promote or differentiate the product. However, in-house equipment development, equipment retrofits and integration of various manufacturing systems are the industry’s best kept secrets and represent the true difference between manufacturers; between the quality of similar products.

With respect to equipment retrofits and in-house equipment development, integration of safety systems is not viewed as a necessity or an advantage for the process. In general safety related systems have little if any influence in the quality and output of a manufacturing process. Only after detail analyses and consideration of all factors one could state that safety systems contribute to productivity. Without much detail we can all agree that safety systems increase the level of complexity of a manufacturing process and cost money.

The various methods or processes to reach a decision on the design concept of manufacturing equipment often exclude considerations to operation and safety. Every manufacturer has to determine, implement and maintain a level of safety. In the USA and in many other countries the manufacturer is obligated by government regulations to establish a safety level. However manufacturers are interested in safety systems that integrate with the manufacturing process and positively influence the output.

Management wish lists rarely include state-of-the-art safety integrated systems. From their perspective concept designs are developed with the emphasis on solving manufacturing issues. With limited funds and limited time, safety issues are often let to be resolved by the designer. Safety specifications often are labeled as compliant with company policy and OSHA regulations and don’t go any further.

In most situations safety control systems require hard wiring dedicated components. Safety sensors and controls are not to be integrated on existing industrial automation circuits without means of failsafe control. Today, industrial control networks are not accepted as replacement for dedicated hardwired safety systems. Equipment designer and control engineers should consider safety systems from the beginning of concept design. The ability to identify all possible operations of the equipment should be one of the priorities in the design development process. Once one can visualize the operations and the hazards that that operation comprises, one can proceed with a design that minimizes the risk for the foreseen hazards.

Equipment automation is based on “sensing and control”, where control usually means management of a sequence of events or making an adjustment to a component based on input from sensors. Relative to safety the sensing often mirrors the automation system while the control takes a much different approach.

The basic function of a safety system is to prevent injury to personnel and damage to the equipment. Enclosures and guards along with reliable electrical interlock systems provide the best method to prevent injuries and damage to equipment. When that is not possible other means such light curtains and safety mats are used. However when physical enclosure is not possible one needs to incorporate safety so that it becomes part of the process’ function using all input information from sensors and drive systems. As an example, rotary machinery time to stop depends on the systems inertia. Certainly a light curtain will not be sufficient if the rolling component is not completely stopped by the time of contact.

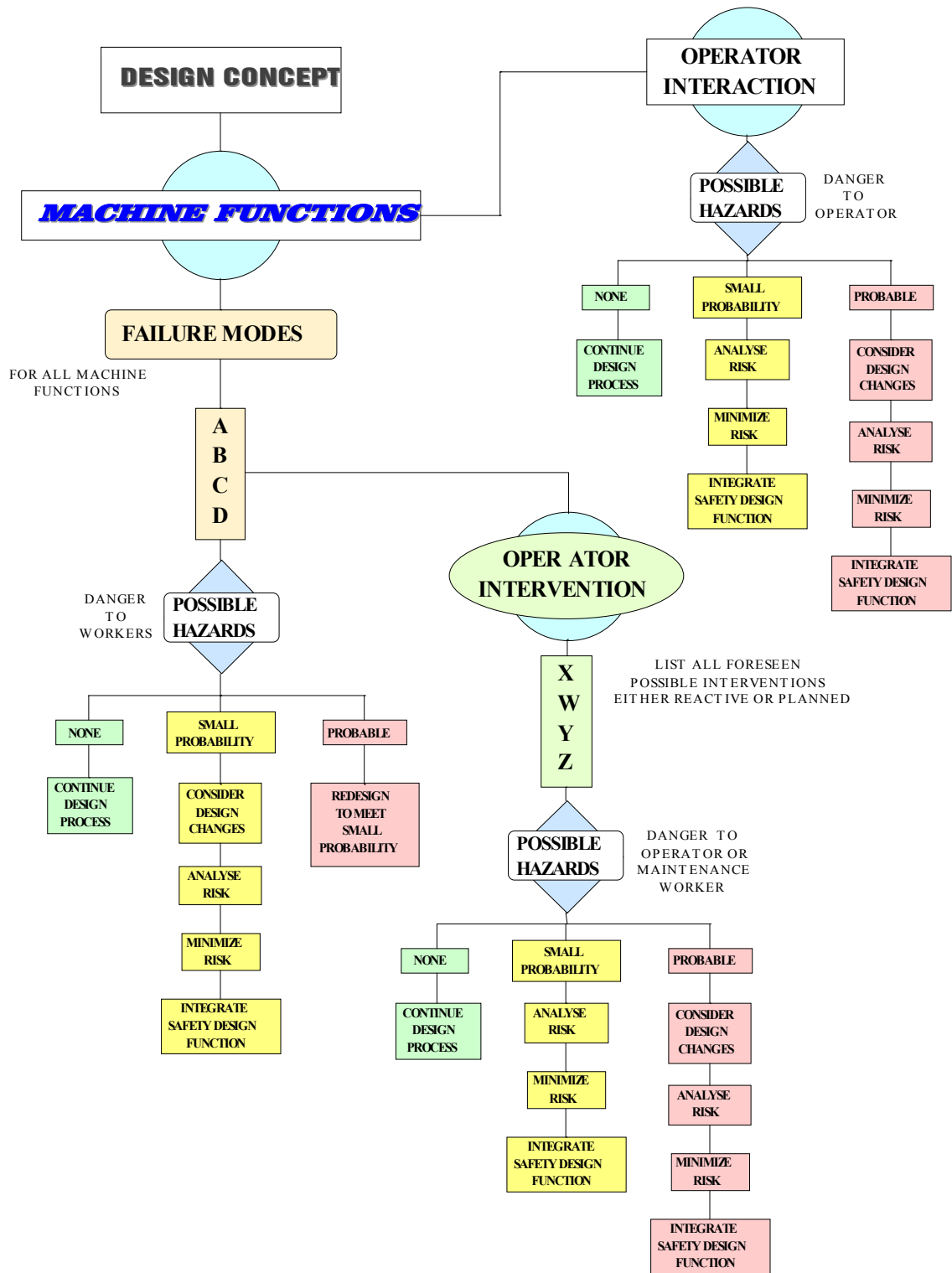
Addressing safety issues during the design development saves time and money and provides machinery with the right features to maximize equipment availability. To address safety, the designer has to have a comprehensive understanding of the equipment functions and the limits of the individual subassemblies and components. Only then he can evaluate the risk for each potential hazard and determine the safety measures to be integrated on the equipment.

Once safety systems are integrated with the equipment control system, they can be treated in the same manner as the rest of the machine in terms of status, diagnostics, alarms, and maintenance issues. Total systems integration in manufacturing equipment reduces the level of complexity and creates friendly safe man/machine environments.

The diagram on page 3 shows the method that Vitrom uses in the design development process for customized manufacturing systems. This method defines a reproducible path to obtain reliable safety systems in all equipment we design. The activities to achieve these may vary in sophistication and formality but always follow the described path.

In general the safety level for prototype equipment is not identical to that of a manufacturing environment and prototype equipment is not tested in real manufacturing environment. One can argue that significant savings can be achieved by the omission of safety systems integration in the prototype phase. While I agree that with today’s designing tools, equipment prototyping can be done piece meal, one must take into account that as any manufacturing system, safety systems must be tested. At times the cost of equipment is too large as to redesign or start from scratch when one finds that the initial concept was a bad idea. This is of special relevance if the equipment has to meet the criteria of regulatory directives such as CE and SEMI.

# SAFETY INTEGRATED DESIGN



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