

Design for Maintainability in the Semiconductor Industry

Author: Nathan Rucker, PhD, CPE

Advancement of semiconductor technology and manufacturing practices has changed considerably and so have many other aspects of the semiconductor business over the past 20 years. With the transition in technology and wafer size, equipment design, construction, operation, and maintenance continue to be challenges. Increases in size, weight and complexity of equipment make safe and efficient equipment maintainability a concern.

Equipment maintenance tasks vary from daily cleans to less frequent annual preventative maintenance tasks. Safety concerns arise when performing these types of tasks, many of which can be classified as ergonomics concerns. They are considered ergonomics concerns because a large portion of maintenance tasks require individuals to work in compromising body positions and handle components. Frequently, components are heavy and push the physical capabilities of workers resulting in overexertion type injuries.

Reducing ergonomic risk factors during maintenance tasks and maintenance cycle times is a challenge that both equipment manufacturers and users need to address. Through sound engineering design and facility layout practices, reduction in ergonomics risk factors and maintenance cycle times can be realized. Implementing design for manufacturability strategies and concepts at the equipment and facility design level can provide many benefits including reduced risk for injury, reduced equipment maintenance down-time, faster manufacturing cycle times, and greater reliability. To solve these problems many designers make the mistake of applying or specifying a lifting assist or designating work clearances long after the design phase, whereas design for maintainability goes far beyond these basic solutions.

This paper will present some of the concerns with safe and efficient equipment maintainability as well as offer a framework for a design for manufacturability success in the semiconductor industry. Concepts such as strategic design placement of components, utilization of common and mistake-proof fasteners, integration of lifting assists or other material coupling fixtures, and layout of equipment will be provided as methods to reduce risks of overexertion injuries.