

Circuit Board Assembly Inspection

Beyond the Naked Eye

Some circuit board assembly defects, such as surface board damage, misaligned components and soldering flaws, can easily be seen with the naked eye; others require more sophisticated equipment.

Visual inspection (about 80% accuracy) still serves as a primary way of inspecting completed printed circuit boards (PCBs). Highly trained inspectors look for many things when examining PCBs and know how to spot small flaws the untrained eye may miss. They also may be able to compare a series of matching boards side by side to identify defects. Not all defects, however, can be seen with the naked eye and with components becoming smaller and smaller, inspection requires more sophisticated equipment, like the microscope, to view miniaturized parts and assemblies.

The Basics of Quality

Eye fatigue, ergonomics and how much the inspection equipment can be adjusted and positioned factors greatly into quality inspections, as does sufficient magnification and proper illumination. When starting to think about inspections, begin with a well-trained operator and proper equipment. Experienced operators know what to look for when inspecting and having the proper equipment, including lighting, will not only help guarantee a quality inspection but also lessen operator fatigue.

From Eyes to Scopes

Knowing the kind of application the microscope will be used for will help determine the type of microscope needed. Do you want a bench-type microscope or one that can handle a boom and articulated arm? Microscopes can be built out piece by piece or be purchased pre-assembled with common components and accessories designed to fit a variety application purposes such as assembly, rework and inspections.

Another big decision will be to determine if you need a binocular-stereo or trinocular microscope. Common binocular microscopes have two eyepieces and show images via a single high-power objective lens. The image looks flat and 2-dimensional.

Binocular-stereo microscopes also have two eyepieces (essentially two microscopes with separate optical paths) and show an image for the left and right eye from different angles creating a 3-dimensional image.

The trinocular microscope has a third eyepiece or port where a digital or video camera can be fitted. The captured image(s) can then be viewed or shared as needed, e.g., over the internet, or for training purposes and documentation.

From Fluorescents to Fiberoptics

Light and illumination used during inspections play a key role when looking through a microscope at an object. Providing the right type can help the operator see the object clearly and reduce eye fatigue, a major factor in worker comfort and quality outcomes.

When fluorescents first came into use, they were considered a significant advancement because they produced cooler light compared to halogens; however, they made humming noises, flickered and cast a

greenish spectrum of light. Today's fluorescents have improved and can now deliver higher intensities of cool light, no longer hum, cast white light instead of green and can be dimmed. Being able to dim a fluorescent bulb from 100% down to 25%, e.g., a [fluorescent ring light](#), significantly reduces the glare caused by highly reflective surfaces.

O. C. White's [MicroLite® ESD-Safe Fiber Optic Light](#) provides another type of illumination and one generated by an external power unit. A flexible fiberoptic cable with a halogen light at the end extends from the unit. The tentacle-like light can be easily manipulated and bent to illuminate specific areas on a PCB.

Color and Light

Some applications require a constant Kelvin color temperature, such as during machine vision inspections. This type of specialty light isn't used often and is generally limited to specialized applications. Other types of colored lighting may include yellow bulbs for inspecting photoresist, and ultraviolet (UV/black light) for inspecting conformal coatings, plating voids and other faults.

Illuminated Magnifiers

Microscopes can be hard on the eyes and sometimes illuminated magnifiers will suffice for an inspection that doesn't require high levels of magnification. An illuminated magnifier has a wide field of focus and whole assemblies can be inspected in one view. Their simple operation and maneuverability, i.e., easy to adjust and focus, make working with them less tiring, along with reducing eye fatigue.

Think of an illuminated magnifier as a large magnifying lens mounted in a frame with built-in illumination. The lens attaches to an adjustable arm that can clamp to a workbench. Even though the description sounds uncomplicated, the levels of glass and clarity of the lens can all affect the light quality allowed through the magnifier.

When speaking about lenses, diopters measure the units of magnification, i.e. the refractive power of lenses equal to the reciprocal of the focal length in meters. For example, a typical 5" diameter lens may be rated a 3 diopter, with a magnification of 1.75X, whereas, the same lens in 5 diopter would be 2.25X magnification.

Magnifiers can also be fitted with glare-free bulbs like [O.C. White's Big Eye Glare Free Screw Down Magnifier](#). The light emitted from the circular bulb produces no shadows and disperses light evenly. Additionally, newly created phosphor blends, differing from the normal cool white phosphors, help reduce glare by 60%. Any reduction of glare reduces eye fatigue so operators work more comfortably and efficiently.

ESD Safety

ESD-safe microscopes and lights can be critical to some inspections. Most operators concentrate on grounding workers and their workspaces; however, in the throes of making sure the right equipment is in place, they may forget that the illuminated magnifier must also be ESD-safe.

Proper equipment helps operators perform effective quality inspections while using good practices and procedures. Optical inspection equipment can be complicated by the number of choices available to operators as well as by the vast differences in the capabilities of visual inspection equipment.

Understanding the technologically advanced options available will help in the selection of appropriate equipment and components for the inspection.