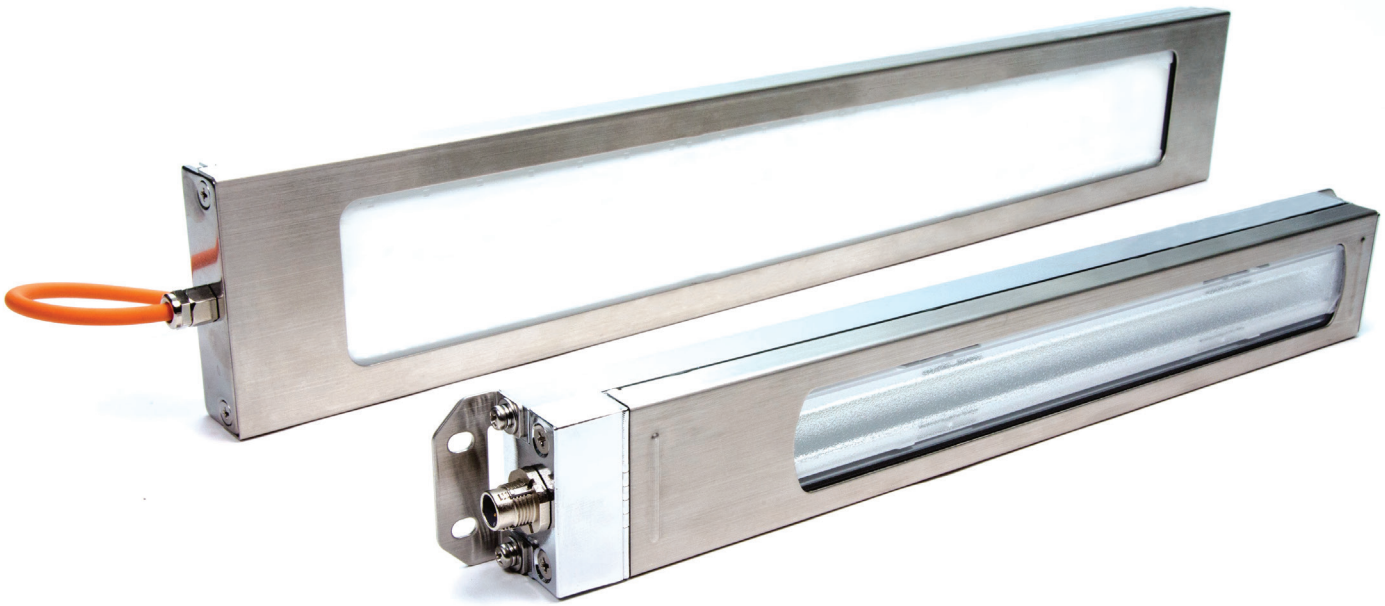
IDEC

Optimizing Machine Tool Lighting

Modern LED lighting makes it easier to see workpieces during set up and inspection.

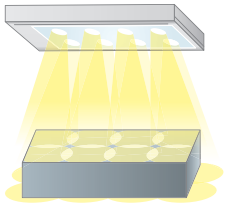


In today's fast paced world of automated equipment, it is more critical than ever for machinery operators to have properly illuminated work spaces. Perhaps nowhere is this more important than in the work cell of a CNC machine tool. Whether it's a cutting or grinding chamber or the business end of a vertical machining center, well-lit work areas can make all the difference when it comes to visual inspections, final product quality and maintenance. Having even, glare-free illumination, for example, is imperative for technicians whenever they have to shut the machine and place their hands in the chamber.

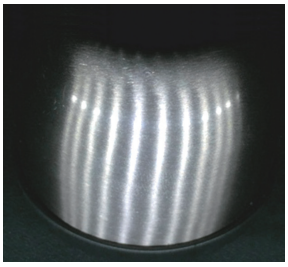
As the machine tool industry continues to move away from fluorescent and incandescent lighting in favor of energy-efficient light emitting diode (LED) technology, it is important to realize that not all LEDs are created equal. From bright and uniform light distribution to the ability to survive in harsh environments, here are some of the most important considerations when choosing the best lighting for your machine tool interior.

UNIFORM LIGHT DISTRIBUTION

Bright light and even illumination are key attributes when it comes to visually inspecting the work taking place at the machine tool tip. However, with highly reflective surfaces, such as metal parts, traditional LED strip (bar) designs tend to create a striped pattern on the work piece. This zebra striping effect makes visual spot checks difficult, as portions of the metal object appear dark and are not illuminated properly. In addition to striping, conventional LEDs comprised of several individual dot lights can also cause multiple shadows to appear behind the object being inspected, leading to visual clutter and challenging inspections.

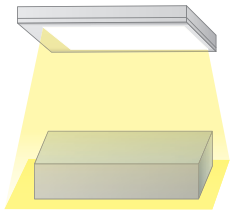


CONVENTIONAL LED

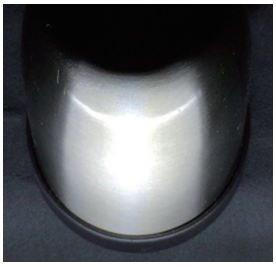


metal object

LED sources are reflected on the object's surface, creating a striped pattern.



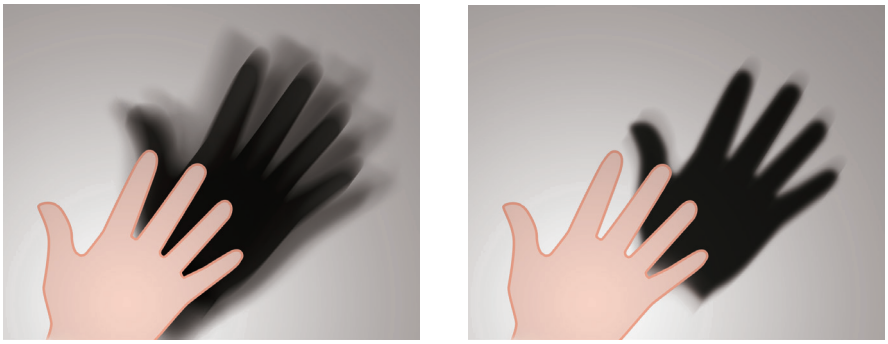
LF1D/ LF2D-EN



metal object

Uniform lighting on metal objects with a surface-emitting LED.
- Easy visual inspection

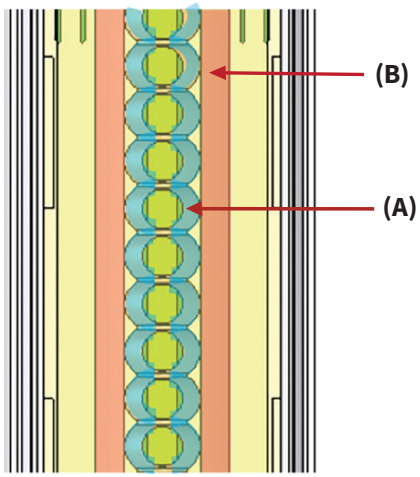
When inspecting metal parts and other work pieces with reflective exteriors, look for an even light source with surface-emitting LED technology, rather than an LED source comprised of multiple lights. Not only do surface-emitting LEDs reduce light source reflection, but they also eliminate multi-shadows—leading to cleaner and faster spot checks.



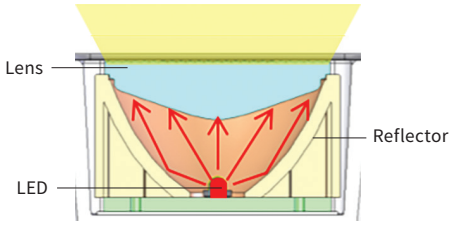
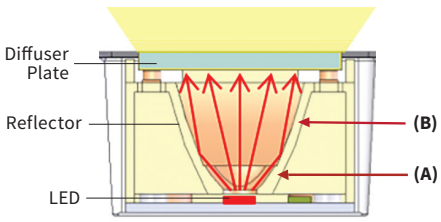
Reduced multi-shadow makes visual inspection easy.

Bear in mind that LEDs that have a flat-panel design will also eliminate glare, reflection and multi-shadows, but in terms of optical design, they supply light sideways—resulting in a loss of light. IDEC's unique and efficient optical design not only eliminates these pain points, but it also maintains high luminance (see table). The design integrates a diffuser plate, which reduces glare and increases light penetration, as well as a two-tier reflective plane. This plane collects the light, while its polished surface finish provides high reflectance. And finally, multiple LEDs are placed at optimal levels on a line for the best electrical and therefore luminous efficiency.

Proprietary optical structure reduces shadows and glare.



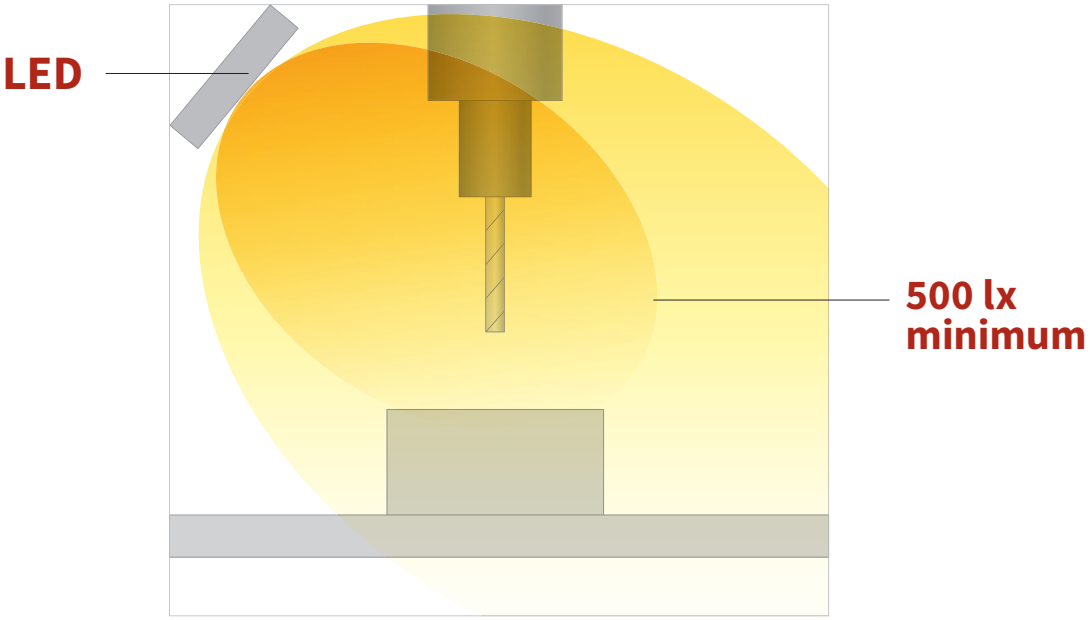
1. Rounded reflectors surround each LED, collecting full light → **(A)**
2. Extended reflector realizes uninterrupted light flow → **(B)**

Traditional LED Design	New LF1D/LF2D-EN Design
	
• **LED arrangement:** Fewer high-output LEDs applied • **Optical design:** Lens /reflector (or both lens and reflector)	• **LED arrangement:** More low-output LEDs applied in row • **Optical design:** 2-tier structure–reflector and diffuser plate

STANDARDS COMPLIANCE

When specifying lighting for machine tool interiors, it is important to keep relevant standards in mind. For example, EN 1837:1999+A1:2009 covers machinery safety and integral machine lighting. As such, the standard calls for at least 500 lx to be provided for interior machine lighting. To satisfy this standard, look for wide-angle, high-illuminance lighting that brightly illuminates target objects at the machine tool tip and surrounding area.

Another applicable standard is ISO 16089, which covers safety for machine tools that perform stationary grinding operations. This standard calls for at least 300 lx of lighting in the area to be observed in its immediate vicinity and also states that glare, reflections and shadows should be avoided as much as possible. In addition, the light source should be positioned to minimize contamination during machining.



SAFE AND SUITABLE FOR HARSH ENVIRONMENTS

Beyond energy savings, LEDs have other advantages over traditional light sources such as fluorescent and incandescent options. For one, the crisp and natural light quality of high performance LEDs produces a well-lit work chamber, boosting visibility and safety at the same time. Further, when LEDs are designed with durable materials such as reinforced glass lenses, stainless steel construction and aluminum die-cast housings, they can stand up to the flying chips and debris often found in machine tool work chambers. For harsh environments, look for LEDs that can operate in extended temperatures up to 55°C and those that offer IP67, IP67G or IP69K protection ratings for use around dust, water, oil and metal shavings.

LED ILLUMINATION IN MULTIPLE STYLES

Machine tool work chambers come in many shapes and sizes. To meet these needs, IDEC Corp. offers several styles to fit a wide range of machine interiors.

- **For small to medium machines:** Uniform light source/slim model LF1D/2D-EN is designed to light machine tool tips and objects with high luminance, such as metal workpieces. Key specs: 1530 lm, 1700 lx. Dimensions: 350 to 389 × 50 to 80 mm. Wide model LF1D/2D-FH provides bright and wide illumination inside the machine. Key specs: 1540 lm, 1500 lx. Dimensions: 270 to 308 × 75 to 105 mm. Surface mount (LF1D) and recessed mount (LF2D) options are available.
- **For miniature machines:** Mini model LF1D-C provides bright and even lighting inside small machines. Key specs: 560 lm, 180 lx, wide 120° light distribution. Dimensions: 100 × 50 mm.
- **For large machines:** Long model LF1D-H/J is the best choice for replacing fluorescent lighting that illuminates the entire machine interior. Key specs: 2000/3000 lm, 560/840 lx, wide 120° light distribution. Dimensions: 365/510 × 84 mm.
- **For lathing machines and other applications:** Models LF1B-N and LF2B are available in a wide variety of lengths and color options, such as warm white, cool white, yellow, red, green and blue. They are also IP65 rated for water and dust. Key specs: 95 to 1520 lx. Dimensions: 134 to 1080 × 27 mm (for LF). Voltages: 12V/24VD, 24 VDC or 100-240 VAC.

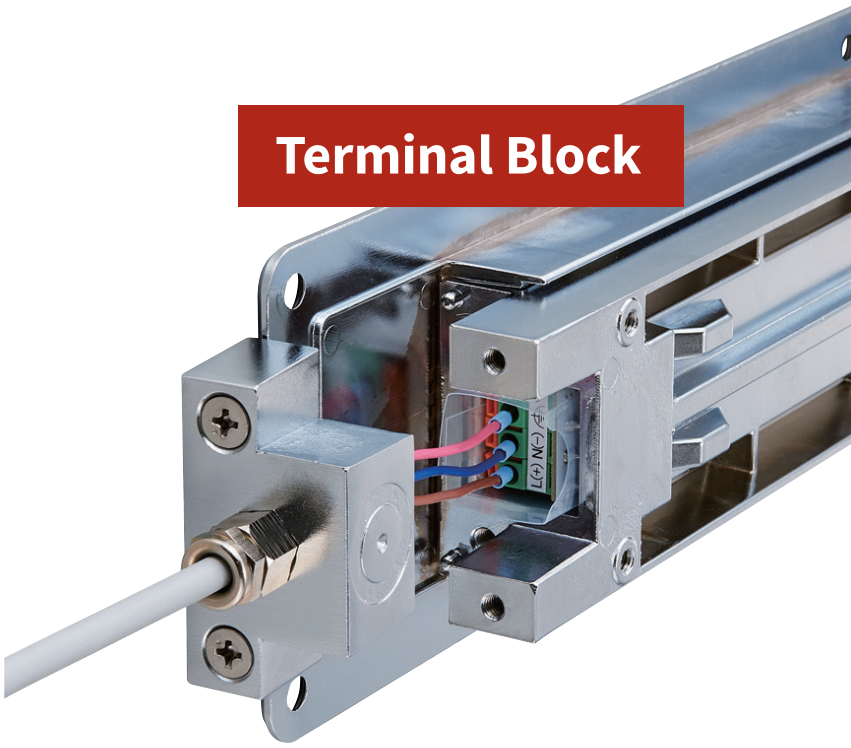
LOW MAINTENANCE

One of the best qualities of LED lighting is its long and maintenance-free lifespan. Because LEDs are basically zero-maintenance components, they should only need attention when they need to be replaced. Even then, swapping a light out is quick and easy as long as the light offers a plug-and-play connection. These options include quick-connect and pigtail M12 connections as well as prewired models with removable plug-in or spring-clamp terminals (see some examples on the next page).

CONNECTION EXAMPLES

M12 Pigtail Connection

Terminal Block



M12 Quick Connect

LUMIFA LIGHTING ATTRIBUTES

Not all LEDs are designed with the same attention to detail. IDEC's LUMIFA LEDs feature the following qualities:

- Bright, crisp light – 1530 lm, 153 lm/watt (LF1D/LF2D-EN)
- Compact design – from 100 mm in length to 1,080 mm
- Rugged and reliable – heavy duty design, durable, water and oil resistant
- Environmentally friendly – LUMIFA LEDs are made of nontoxic materials
- Effective heat dissipation
- Hazardous location LED flood lights available (Class 1 and Zone 2), IECex and ATEX certified

TECHNICAL HELP AVAILABLE

When it comes to illuminating the work chambers of various machine tools, LEDs are the clear choice over fluorescent and incandescent options. Yet not all LEDs are created equal, and design details can make all the difference in achieving evenly lit work spaces with bright and uniform light that is free of distracting shadows and stripes. This is especially true with workpieces that have highly reflective surfaces such as metal parts. Keep in mind that proper illumination leads to faster and more accurate visual inspection of the work taking place at the machine tool tip, leading to higher productivity. Many LED styles and sizes are available to suit the needs of different machine tool interiors and work environments. For help with LED selection and sizing, IDEC's engineering team is available for advice and consultation.

Contact IDEC Corp. at 408.747.0550, **opencontact@idec.com** or visit w**ww.idec.com** to learn more.

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