# NERLITE®

## Machine Vision Lighting Products

Quick Reference

Use the **"A T-E-S-T"** method to identify the effects of different lighting techniques on part features. Select a relevant feature of your part, then compare the effects of the various lighting techniques on that feature. The goal is to select a lighting technique that creates the highest possible contrast between the feature of interest and its surroundings.

| Part Feature[1] | Examples | Backlight | DOAL | Array, Ring Light | Dome, SCDI, CDI[2] | Dark Field | Structured |
|---|---|---|---|---|---|---|---|
| **A**bsorption:<br>*Look for change in light absorption, transmission or reflection* | • Fuses in block<br>• Wire colors<br>• Printed ink<br>• UV emission<br>• IR through plastic | None | Uniformity of technique ensures absorption changes on FLAT surfaces are observable | Application dependent | Uniformity of technique ensures absorption changes on BUMPY surfaces are observable | Minimal effect | None |
| **T**exture[3]:<br>*Look for change in surface texture or finish* | • Polished surfaces<br>• Laser annealed<br>• Sandpaper grit<br>• Scratched surfaces<br>• Material changes | None | Textured surfaces DARKER than polished | Application dependent | Minimizes texture | Textured surfaces BRIGHTER than polished | Some effect |
| **E**levation:<br>*Look for change in height from surface to camera (Z axis)* | • Notched parts<br>• Dot peen marks<br>• Embossing<br>• Engraving<br>• Angled/beveled<br>• Foreign debris | None | Angled surfaces are darker | Application dependent | Minimizes shadows | Outer edges are bright | Shows elevation changes |
| **S**hape:<br>*Look for change in shape or contour along X/Y axis* | • Parts on conveyor<br>• Coins<br>• Edge dimensions<br>• Short shots | Shows outside contours | Changes evident if background is different | None | None | Contours highlighted, flat surfaces DARKER than raised | None |
| **T**ranslucency:<br>*Look for change in density-related light transmission* | • Drilled holes<br>• Thin plastic areas<br>• Plastic lens ID<br>• Multi-layered materials<br>• Debris in liquid<br>• LCD inspection | Shows changes in translucency vs. opaqueness | Minimizes clear, FLAT overcoats (such as varnishes, glass), shows changes in translucency vs. opaqueness if background is different | Application dependent | Minimizes clear, BUMPY overcoats (such as plastic overwrap, curved glass), shows changes in translucency vs. opaqueness if background is different | None | None |

1 Surface absorption is affected by the color (spectrum) of illumination. Surface texture, elevation, shape and translucency are affected by the direction of illumination.
2 Uniformity of lighting increases in ascending order: Dome, SCDI, CDI.
3 Texture is both the presence of texture (matte, diffused, bumpy) or its absence (shiny, specular, polished).

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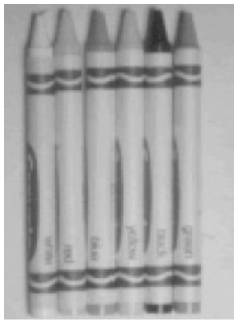
# HELPFUL TIPS For Selecting The Right Lighting Solution

## Use Infrared To Diminsh Color

**White Light Grayscale Camera**



**Infrared Light Grayscale Camera**

Use an infrared light source to diminish the grayscale difference between multicolored objects. In the images above, notice that the black areas absorb infrared.

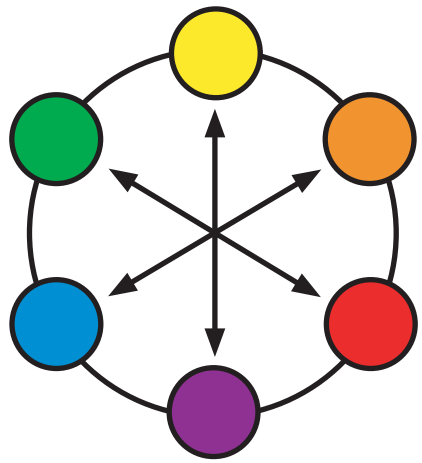
## Use Infrared To Eliminate Reflections

**False Cap Diameter With Ambient Light**

**Infrared Light Removes Unwanted Reflection**

Ambient light (e.g. overhead room lighting) sources can contribute unwanted bright reflections. Use an infrared light source to stop the ambient light from reaching the vision system.

## Use Color To Create Contrast



Using the opposite light spectrum will make a part feature appear darker. Using the same light spectrum will make a part feature appear lighter.

**Examples:**

- If the part feature you want to make darker is red, use a green light.
- Use a green light to make a green feature appear lighter.
- Note the differences in red and blue lighting below:


**Red Illumination**

**Blue Illumination**

## When To Use a Strobe

**NERLITE strobe models are available for high speed apps**

A light should be strobed when a part is moving quickly and the image captured appears blurred. Use this formula to calculate Strobe Pulse Width (maximum acceptable blur image = 1 pixel).

$$\frac{\textbf{Field of View (in/s)} \div \textbf{Pixels}}{\textbf{Part Speed (in/s)}} = \textbf{Strobe Pulse Width}$$

In the formula, field of view (FOV) and pixels are from the axis of travel. For example, assuming a typical 1 inch FOV and a 640 pixel frame, and a part speed of 500 inches per second, a strobe pulse width of 3.1 μs would be needed.

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