

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 ³	Dark Field	Structured
A bsorption: <i>Look for change in light absorption, transmission or reflection</i>	<ul style="list-style-type: none"> • Fuses in block • Wire colors • Printed ink • UV emission • 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 ² : <i>Look for change in surface texture or finish</i>	<ul style="list-style-type: none"> • Polished surfaces • Laser annealed • Sandpaper grit • Scratched surfaces • Material changes 	None	Textured surfaces DARKER than polished	Application dependent	Minimizes texture	Textured surfaces BRIGHTER than polished	Some effect
E levation: <i>Look for change in height from surface to camera (Z axis)</i>	<ul style="list-style-type: none"> • Notched parts • Dot peen marks • Embossing • Engraving • Angled/beveled • Foreign debris 	None	Angled surfaces are darker	Application dependent	Minimizes shadows	Outer edges are bright	Shows elevation changes
S hape: <i>Look for change in shape or contour along X/Y axis</i>	<ul style="list-style-type: none"> • Parts on conveyor • Coins • Edge dimensions • Short shots 	Shows outside contours	Changes evident if background is different	None	None	Contours highlighted, flat surfaces darker than raised	None
T ranslucency: <i>Look for change in density-related light transmission</i>	<ul style="list-style-type: none"> • Drilled holes • Thin plastic areas • Plastic lens ID • Multi layered materials • Debris in liquid • 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.

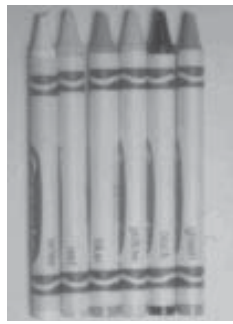
³ Texture is both the presence of texture (matte, diffused, bumpy) or its absence (shiny, specular, polished).

HELPFUL TIPS For Selecting The Right Lighting Solution

Use Infrared To Diminish 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



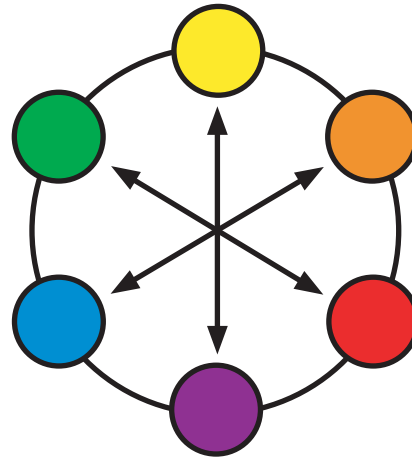
**False Cap Diameter
With Ambient Light**



**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:

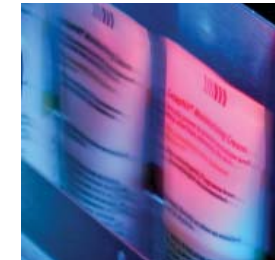


Red Illumination



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).

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

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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