Source Selection Guide
HID and Fluorescent

With recent technological advancements in lighting sources, it is no longer easy to categorize a lighting project as fluorescent or HID. The introduction of high-output fluorescent lamps like T5HO has added more possibilities when choosing products for a quality lighting job. In addition, pulse-start metal halide has significantly improved the performance of white light HID sources, bringing with it more wattage choices, increased energy efficiency and improved quality. Commercial and industrial spaces can be very complex environments with various solutions, and now more than ever, you must analyze the space carefully to decide what lighting system is best for the situation.

When trying to determine which source is best for an application, look at these nine main categories:

1. Light Output - Lumens Per Watt (LPW)
2. Light Loss Factor (LLF)
3. Distribution/Uniformity/Mounting Height
4. Color Rendering Index (CRI)
5. Ambient Temperature
6. Controls
7. Apples-to-Apples
8. Maintenance
9. Owning and Operating Cost

1. Light Output is usually measured and evaluated at two different points in the life cycle: initial lumens and mean lumens. The initial lumen value is achieved at the beginning of lamp life. Because the output of every lamp, regardless of type, will decrease over time, many designers use mean lumens – the light output at 40% of rated life – in their design criteria. One of the primary features of newer fluorescent sources is that they have very low lamp lumen depreciation when compared to HID sources. When comparing the sources, another key factor is Lumens Per Watt (LPW), which tells you how much light you will get for every watt of power consumed. Below is a chart showing the performance of commonly used lamps, rated for operation in a 25°C (77°F) environment.

Chart 1 - Lamp Characteristics

Description	Initial Lumens	Mean Lumens	Mean Lumens Per Watt	Average Rated Life (Hours)	Lamp Lumen Depreciation Factor	CRI
Fluorescent - 4- & 8-Foot Lamps						
F54T5HO – High Output	4,400	4,136	71	20,000	0.94	82
F32 T8	2,850	2,710	94	20,000	0.95	75
F96T8HO (8 Ft.)	8,200	7,380	89	18,000	0.90	84
F96T12HO (8 Ft.)	9,400	8,638	84	12,000	0.92	80
Metal Halide (HID)						
MH400 (Probe Start)	36,000	23,500	51	20,000	0.65	65
MH400 PS (Pulse Start)	42,000	32,800	73	20,000	0.78	65
Ceramic MH400	40,000	32,000	71	20,000	0.80	92
MH400 PS (Electronic)	42,000	36,120	85	20,000	0.86	65

[Source: lamp & ballast manufacturers' published information]

2. The Light Loss Factor (LLF) of a fixture is used to determine how much light a luminaire will produce over time. When comparing HID to fluorescent, there are four main factors that can vary greatly between the two source types: Lamp Lumen Depreciation (LLD), Luminaire Dirt Depreciation (LDD), Ballast Factor (BF), and Luminaire Ambient Temperature Factor (LATF).

Lamp Lumen Depreciation (LLD) is the most commonly applied, and often the only factor considered when selecting the lighting fixture type. It represents the amount of light the lamp produces when it reaches 40% of its rated life. As shown in Chart 1, fluorescent lamps tend to have a more gradual depreciation of lumens over the life of the lamp. In particular, a T8 lamp retains up to 95% of its original output compared to about 65% for traditional probe-start metal halide lamps. The gap in LLD between fluorescent and metal halide lamps narrows when you compare pulse-start metal halide at 75% and pulse-start metal halide with an electronic ballast at 86% LLD. T8 fluorescent is still on top at 95%, but lamp lumen depreciation is only one of the factors to weigh when comparing lighting systems.

Luminaire Dirt Depreciation (LDD) is a factor that is commonly misunderstood. If a luminaire sits in a dirty environment long enough, its light output will diminish due to the contaminants settling on the fixture and the lamp itself. While sometimes ignored in lighting calculations, LDD can account for light reductions as high as 50% under dirty conditions.

Ballast Factor (BF) is often overlooked, but is significant particularly when evaluating fluorescent systems. BF is the percentage of a lamp's rated lumen output that can be expected when operated on a specific ballast. For example, a ballast having a BF of 0.92 will result in the lamp emitting 92% of its rated lumen output. Ballast factor for T8 fluorescent lamps can range from 0.78 to 1.32, directly affecting the light output proportionally; however, the higher the BF, the higher the input wattage. Ballast factor for HID lamps is typically 1.0.

Luminaire Ambient Temperature Factor (LATF) has recently become a more important component in this process. This is because fluorescent sources, formerly not widely used in areas where temperature can vary significantly, are now being regarded as suitable for such use. With higher lumen output and distribution control available with the newer T5 and T8 lamps, they are being considered for many (primarily industrial) applications that are not climate controlled and thus can be subjected to wide swings in temperature. As shown in Chart 2, the lumen output of T5 and T8 lamps is significantly affected by changes in temperature. It is important to note that the values in Chart 2 are for a single bare lamp only. When the lamp is placed within a fixture, and particularly if multiple lamps are used, the temperatures immediately surrounding the lamps (LATF) can be significantly higher than what the general ambient temperature indicates.

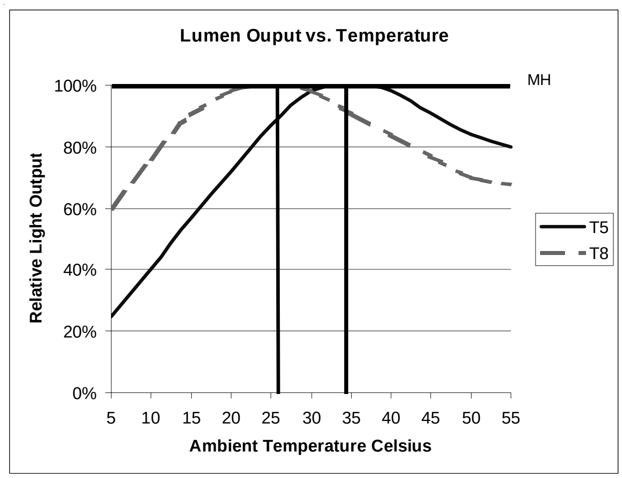


Chart 2 - Lumen Output vs. Temperature MH/T5/T8

3. Distribution, Uniformity and Mounting Height are three topics that are very closely related. When investigating the best system to use, it is important to look not only at the source itself, but also at the optics used to control the source and put the light where it is needed. With the smaller diameter of T5HO lamps, fluorescent luminaires can now reach a higher degree of control of light distribution and can achieve tighter beam patterns and lower spacing-to-mounting-height ratios than could previously be achieved with T8 or T12 lamps. This allows for increased mounting heights for fluorescent products, possibly in the range of 35 feet or higher. It is important to note though, that this control is achieved primarily in the plane that is perpendicular to the lamps. It is difficult to control the distribution of light that runs parallel to the lamp beyond the length of the fixture. These characteristics make fluorescent products very well suited for linear applications like aisles, where you can use a continuous row of fixtures or more closely spaced fixtures.

HID sources, with their small arc tubes, are a point source more than a linear source. This allows for a high degree of control of the light distribution. This can provide for narrow distribution for high mounting heights or a wider light spread for lower mounting heights. With HID sources it is very important to consider the optical material being used. For general areas and horizontal surfaces (e.g., floors, assembly lines), aluminum reflectors are inexpensive and provide the right type lighting. When lighting vertical tasks (e.g., storage racks, aisles, walls), prismatic reflectors of acrylic or glass allow light to pass through the reflector as well as reflect light downward, providing better uniformity on the vertical surfaces while also delivering needed light onto the floors for visibility.

When comparing HID and fluorescent lighting systems, consider the task to be lighted — vertical or horizontal — and apply the appropriate reflector type to HID fixtures in your evaluation. For vertical tasks such as an aisle, glass or acrylic reflectors in HID fixtures often produce light levels and lighting uniformity similar to or better than fluorescent.

4. Color Rendering is not often a critical design issue, but it can become very important in retail areas or inspection areas within an industrial facility. With the advent of triphosphors, fluorescent lamps can produce light with a Color Rendering Index (CRI) of 80 or higher. In comparison, standard metal halide lamps and even pulse-start lamps tend to be in the low 70s. The exception in HID is the ceramic metal halide lamp which can produce a CRI as high as 92. Chart 1 also provides general comparison information on color rendering capabilities of the different source types.

5. Ambient Temperature directly affects the light output and wattage consumption of fluorescent lamps. Most fluorescent lamps reach their maximum light output at "room temperature" and begin to lose performance when operated either above or below that level. The design of the lighting fixture affects the temperature in which the fluorescent lamp(s) will be operating. A fixture that operates either too warm or too cool will result in lower output from the lamp(s) and reduced lighting levels.

Conversely, HID light output is not as affected by ambient temperatures. Typical HID systems are designed to operate in ambients ranging from 131°F (55°C) down to as low as -20°F (-30°C) without impacting light output. The one significant effect is thermal impact on ballast life as shown in Chart 3.

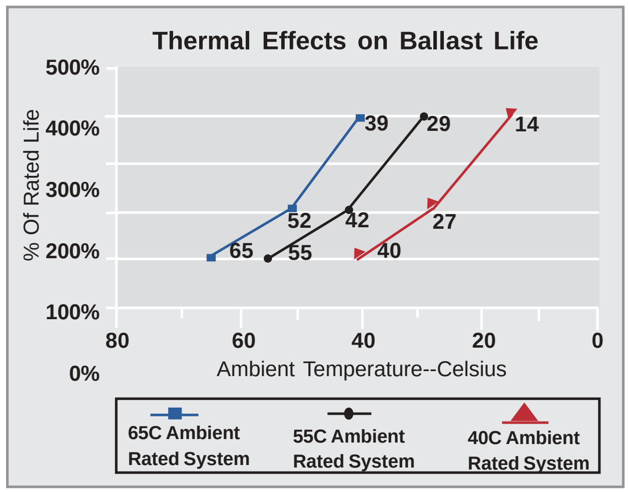


Chart 3 - Thermal Effects on Ballast Life

6. Controls can be an effective way to reduce energy by governing the amount of light needed to maintain desired lighting levels and by limiting use to occupied spaces. Fluorescent systems provide a range of choices that are not typically available with HID systems (because of HID startup time and restrike requirements). The fluorescent choices include (a) turning off when not needed, and immediately on when needed; (b) selecting one or more lamps (properly wired to respective ballasts) for varying levels of light as required; or (c) dimming to desired level of light output. These choices can be implemented by way of manual controls or various automatic devices. Occupancy sensors using either infrared or ultrasonic technologies (or both) can provide effective coverage for on/off lighting control. Dimming photocells automatically maintain a constant preset lighting level: (a) in response to the availability of natural daylight (daylighting) or (b) over the life of the lighting system (lumen depreciation maintenance). Another choice is a lighting control system that would integrate all aspects of lighting control into a single system platform to meet the requirements of virtually any lighting control application.

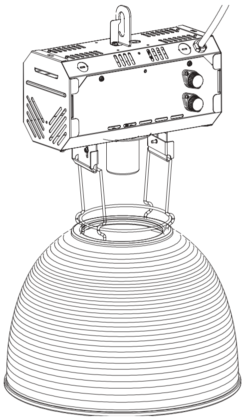
For HID applications, a KiloWatch® dual-level lighting system provides full light output when needed and a reduced level for energy conservation during other periods. Control is accomplished with automatic sensors (infrared or ultrasonic), manual switches, photocells, or even with a computer system control. New electronic HID ballast systems provide opportunity for continuous dimming along with occupancy sensing and daylight harvesting.

7. Apples-to-Apples. Comparing systems accurately – “apples-to-apples” – is an important first step in determining need for changes. Often when new lighting fixtures are presented, they are compared to fixtures in “existing” conditions. The conditions may include 20-year-old fixtures, two- to five-year-old lamps, operating in a dirty fixture. Before accepting the “difference” between old and new, bring the existing fixture(s) into the comparison arena by cleaning the reflectors and replacing the lamps. This will provide a more realistic comparison of new vs. existing, enabling you to better evaluate the benefits of the change.

8. Maintenance of lighting systems can be viewed from two perspectives. In HID fixtures, if a lamp goes out, the result may be a dark spot that will require an immediate response. In multi-lamp fluorescent fixtures, if a lamp goes out, there will be less of a dark spot; a slight light reduction may not necessitate the same urgency to correct it. Note, however, that many fluorescent ballasts run lamps in series; if one lamp goes out, other lamps on the same ballast will also go out. Group relamping is recommended on both fluorescent and HID systems in order to provide more uniform lighting as well as reduce overall lamp/fixture maintenance costs.

9. Owning and operating costs are bottom-line decisions that should be part of the lighting evaluation. Tools are available to help identify various alternatives and determine optimum performance/costs. There are some situations where fluorescent is the right choice and others where HID is called for. Whether fluorescent or HID, be sure to look at the latest technology offerings when making comparisons. Don’t just accept a statement that says one system is better than the other or that it is the best way to go. A careful analysis of all pertinent factors should always be part of the decision process.

Lithonia Lighting manufactures the broadest range of lighting products to suit a variety of applications. We have no particular bias toward either fluorescent or HID. Our goal is to provide the information and the tools to help you make the right choices when it comes to selecting lighting fixtures and controls for your specific application.



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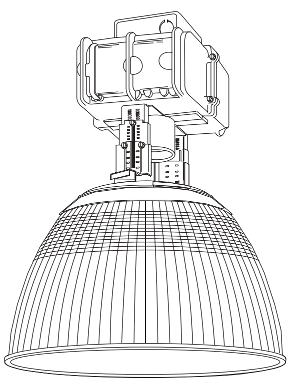

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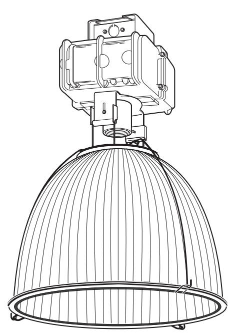

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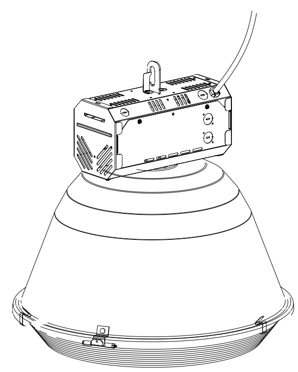

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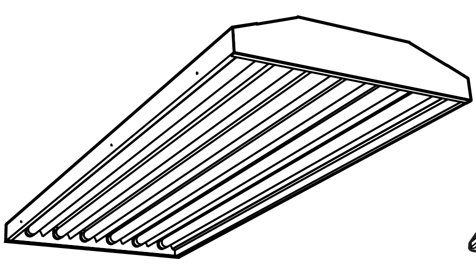

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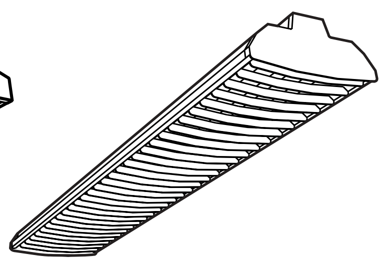

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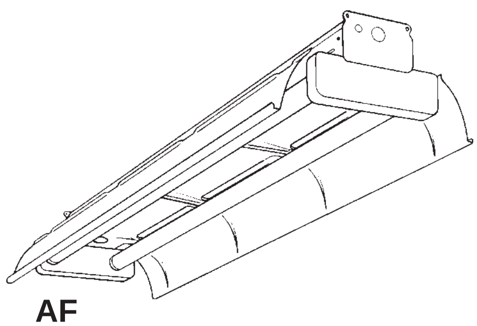

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