

Design guide for Warehouse – T5HO fluorescent

The Problem

Provide high quality lighting that illuminates the warehouse shelves to IESNA recommended light levels while beating ASHRAE/IESNA 90.1-2004 Standard for Warehouse Lighting of 0.8W/ft².

The Solution

Install high bay fluorescent industrial fixtures located in the center of each aisle. Fixtures are equipped with T5HO electronic ballasts and (2) 54W T5HO lamps to provide 10+ average maintained vertical footcandles on the face of the racks.



Room Characteristics

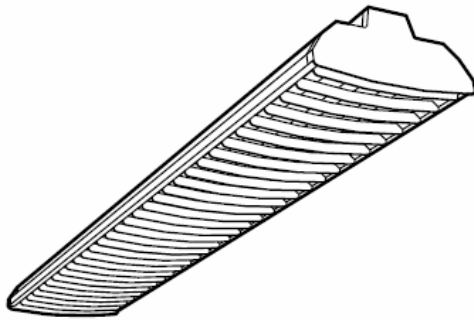
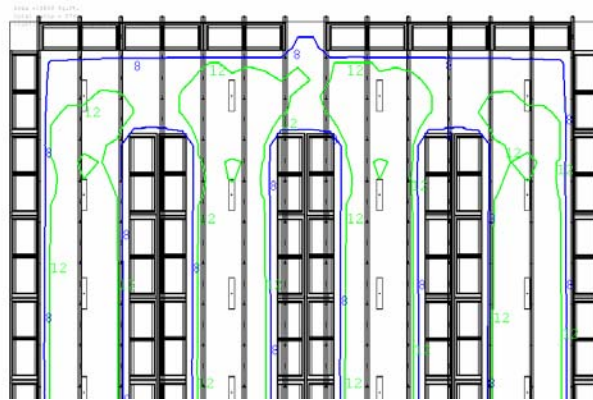
Dimensions

Length	Width	Height
72'	150'	28'

- open ceiling

Surfaces/Reflectivity

- Ceiling: White (0.80)
- Walls: Paint – Gray (0.30)
- Floor: Concrete (0.20)
- Displays: Product (0.30)



Product Specification

- Description: Pendant mounted industrial fluorescent with louvers
- Dimension: 9 3/4" X 48"
- Lens: Blade Louver
- **Watts: 120**
- Number of lamps: 2
- Lamp: F54T5HO
- Lumens per lamp: 4400
- Ballast Factor: 1.0
- Lamp Lumen Depreciation: 0.95

Product Installation

- **Number of luminaires: 48**
- Mounting: 24 feet AFF
- Luminaire spacing: Center of rows 18' O.C.
- **Average Footcandles:**
Horizontal = 14.3
Vertical = 10.9
- **Watts/ft²: 0.54**

Affordability: This is a medium cost option compared to other energy efficient lighting designs.

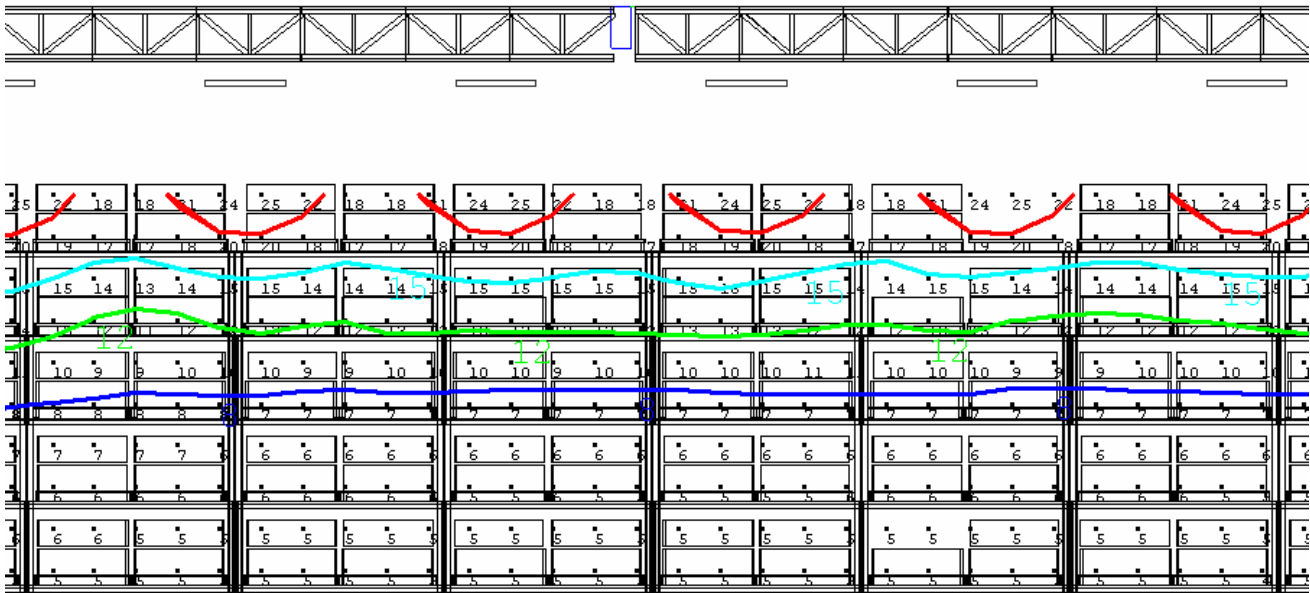
Design Implications

The shelving/luminaire layout along with the mounting height of the fixture is the most important consideration because vertical product lighting is critical. Improper location or mounting height can create shadows and low light levels on the racks.

Energy Saving Options	Watts per luminaire	Energy Savings from Base Design	Light level from Base Design
Integrated occupancy sensor	120	20 – 40%	Equal
Daylight dimming	120	20 – 50%	Higher

- Washington code allows 0.5W/sf (1.15W/sf using rack allowance – footnote 11)
- Oregon code allows 0.8W/sf
- Idaho code allows 0.8W/sf
- Montana code allows 0.8W/sf
- **EPACT 2005 requires 0.55 W/sf (this design does meet the W/sf and light level requirements)**





Lighting Calculations

The above image shows the vertical footcandles provided on the face of the stacks. Vertical footcandles are much more important than the typical horizontal footcandles, because the task is the vertical stacks. Light loss factors (lamp lumen depreciation and luminaire dirt depreciation) along with the ballasts factor have been factored into the calculated numbers.

Design Issues

The quality of rendering is not indicative of how the human eye will perceive this space lighted. The eye will see the surfaces as having a more graduated illumination and more light in the workspaces. While the product is normally a low reflectance the space will actually feel darker when the shelves are not full.

Lensed Luminaire

High glare potential when looking up to the top racks. Use luminaires with cross blade louvers or diffusing lens to minimize glare. High reflectance ceiling and some uplight will make the space feel bright and open.

Luminaire Selection

Not all luminaires are created equally. Just because two luminaires look alike does not mean they perform the same. If you are unsure of a luminaire's performance do not hesitate to ask distributors and representatives for calculations using their product. Make sure ballast information, light loss factors, and reflectance's are the same for each calculation.

Stacks

Stacks have a large impact on the illumination of a space. The vertical surfaces absorb and block light as well as create shadows if positioned off-center from a direct fixture. The stack layout must correspond to the lighting layout to minimize the shadows.

Affordability

Affordability is based on fixture and lamp costs only. Variables of cost include ease of installation, contractor knowledge of product and the time it takes for installation. In retrofit situations, costs are variable depending on existing wiring layouts.

Controls

Occupancy sensors or building energy management systems should be incorporated to turn the lights off when the occupants are away or after hours. One of the most cost effective solutions is to have the fixtures come from the factory with integral occupancy sensors to minimize wiring labor costs.

Daylight harvesting controls should be used on all luminaires within the daylight zone (typically 70% of the ceiling height in all directions from the edge of a skylight). Provide about 6% of the roof area in skylights to achieve 50% annual lighting energy savings.