

Selecting the Right LED for Energy Efficient Lighting Retrofits

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Overview

Review and examination of the different types of LED tube designs and their pros and cons, industry trends, safety issues, and critical criteria for selecting the right LED tubes for energy efficient lighting retrofit projects.

Objectives

At the end of this course, participants will learn:

- Understand the difference among the various LED tube designs
- Understand the pros and cons of different LED tubes
- Understand the safety issues related to LED tube retrofits
- Understand the critical criteria when selecting the right LED tube for energy efficient lighting retrofits

Types of LED Tubes

- External-driver double-ended tube
- Internal-driver single-ended tube
- Internal-driver double-ended tube
 - Without safety switch
 - With safety switch
 - With safety switch & replaceable driver
- Internal-driver double-ended tube on ballast
- Internal-driver double-ended tube on ballast & AC-in

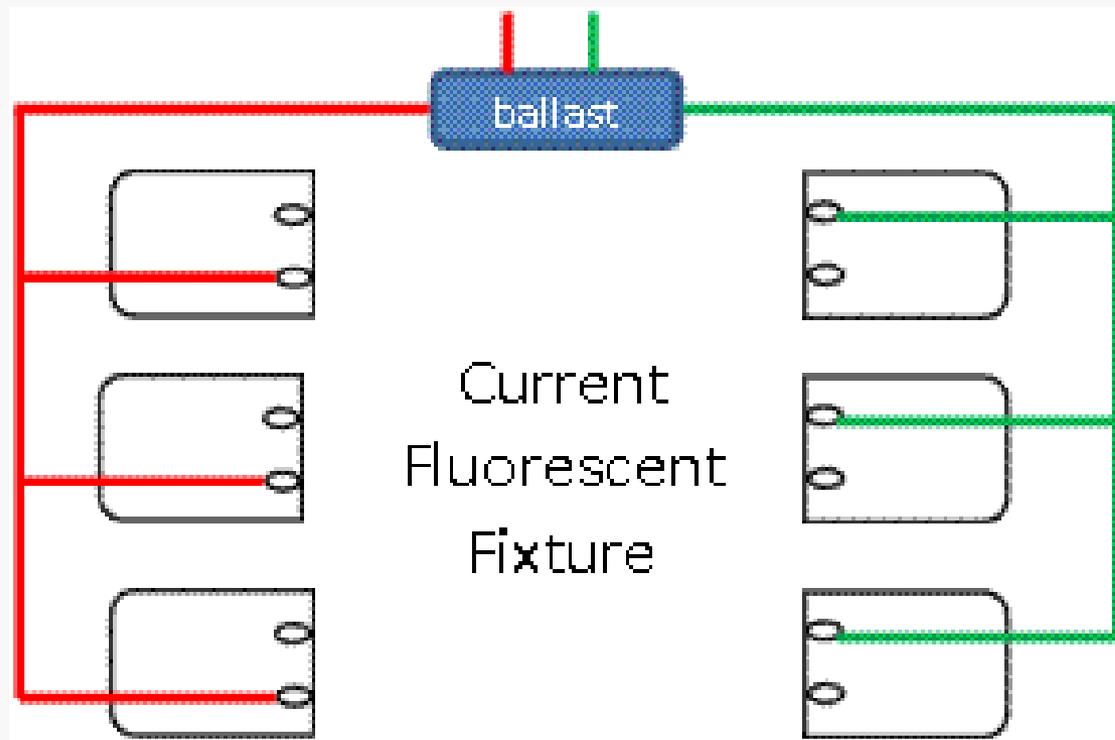
Which LED Tube Should I Consider?

- The answer is: it depends ...

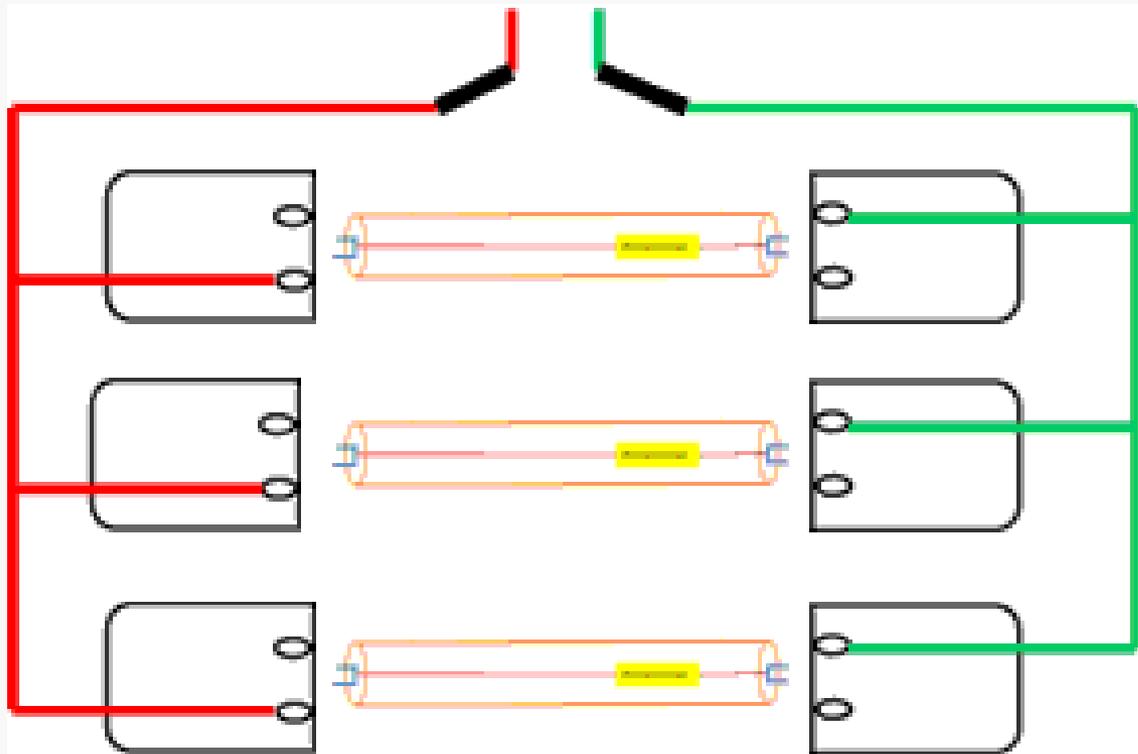
It Depends ...

- On how long you would stay on your job
- On whether your company has a good lawyer
- On whether you have a good insurance coverage

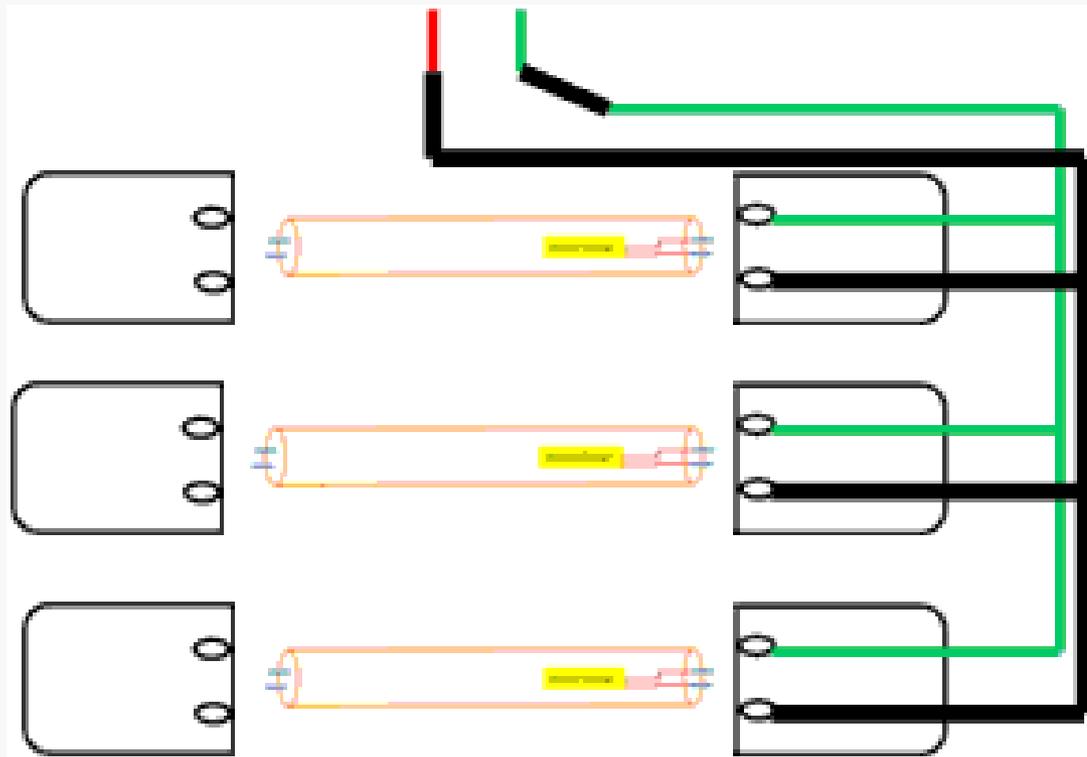
Fluorescent Tube Wiring



Double-end Wiring



Single-end Wiring Retrofit



What's Wrong with These Tubes?



Standards

- Safety Standards
 - UL1598C
 - ETL – not the same as UL (Don't bet your career on it)
- Energy Standards
 - Energy Star: does not have an LED tube category
 - Lighting Facts: performance data listing
 - DLC: only 4-ft and 2-ft LED tube category
 - Title 24 – California: lighting control, dimming, daylight harvesting

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 - IFAM/IFAM7: LED Surface-mounted Luminaires
 - OOLV/OOLV7: LED lamps (without retrofit, direct replacement)
- IFAR samples



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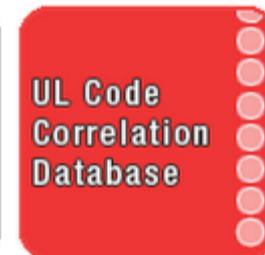
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LIGHTEL TECHNOLOGIES INC	Lamps, Self-ballasted, Light-emitting-diode Type	OOLV.E331115
LIGHTEL TECHNOLOGIES INC	Lamps, Self-ballasted, Light-emitting-diode Type Certified for Canada	OOLV7.E331115
LIGHTEL TECHNOLOGIES INC	Light-emitting-diode Luminaire Retrofit Kits	IFAR.E325073
LIGHTEL TECHNOLOGIES INC	Light-emitting-diode Luminaire Retrofit Kits Certified for Canada	IFAR7.E325073
LIGHTEL TECHNOLOGIES INC	Light-emitting-diode Surface-mounted Luminaires	IFAM.E360983
LIGHTEL TECHNOLOGIES INC	Light-emitting-diode Surface-mounted Luminaires Certified for Canada	IFAM7.E360983

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IFAR.E325073
Light-emitting-diode Luminaire Retrofit Kits

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Light-emitting-diode Luminaire Retrofit Kits

[See General Information for Light-emitting-diode Luminaire Retrofit Kits](#)

LIGHTEL TECHNOLOGIES INC

E325073

SUITE 100
2210 LIND AVE SW
RENTON, WA 98057 USA

Retrofit Kit Model/Part No.	Retrofitted Luminaire Type or Model/Part No.	Light Source	Rating
LED retrofit luminaire conversion kit			
LLT-2-TT-X-YZ-BA-110	Type Surface Mount Luminaire with G13 Bipin	Non-replaceable type LED Array with driver	120V, 60Hz, 9.5W
LLT-2-TT-X-YZ-BA-227	Type Surface Mount Luminaire with G13 Bipin	Non-replaceable type LED Array with driver	277, 60Hz, 9.5W
LLT-3-TT-X-YZ-BA-110	Type Surface Mount Luminaire with G13 Bipin	Non-replaceable type LED Array with driver	120V, 60Hz, 14W
LLT-3-TT-X-YZ-BA-227	Type Surface Mount Luminaire with G13 Bipin	Non-replaceable type LED Array with driver	277, 60Hz, 14W
LLT-4-TT-X-YZ-BA-110	Type Surface Mount Luminaire with G13 Bipin	Non-replaceable type LED Array with driver	120V, 60Hz, 19W
LLT-4-TT-X-YZ-BA-227	Type Surface Mount Luminaire with G13 Bipin	Non-replaceable type LED Array with driver	277, 60Hz, 19W
LLT-5-TT-X-YZ-BA-110	Type Surface Mount Luminaire with G13 Bipin	Non-replaceable type LED Array with driver	120V, 60Hz, 24W
LLT-5-TT-X-YZ-BA-227	Type Surface Mount Luminaire with G13 Bipin	Non-replaceable type LED Array with driver	277, 60Hz, 24W

Notes:

Nomenclature:

LLT-2-TT-X-YZ-BA-110V-D-3

LLT	2	TT	X	YZ	BA	110V	D	3
I	II	III	IV	V	VI	VII	VIII	IX

I - LLT: Series name

II - Length of tube: 2 - 2 ft, 3 - 3 ft, 4 - 4ft, 5 - 5 ft

III - TT, Tube type: T8

IV - Diffuser Type: C - Clear, D - Diffused

V - LED Color: SW - Sun White

VI - BA, Beam Angle: 75, 90 or 120

VII - Input voltage, 110V, 277V or U: 110-120V Universal Voltage

VIII - Pin Configuration Type: D - Double ended, S - Single ended

IX - Number of LEDs used in 4-ft LLTs: 3 - 312 LEDs, 2 - 264 LEDs, 27 - 273 LEDs, 10 - 104 LEDs; in 2-ft LLTs: 52- 52 LEDs

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Retrofit Kit Model/Part No.	Retrofitted Luminaire Type or Model/Part No.	Light Source	Rating
LED retrofit luminaire conversion kit			
Model LiLEDs-T8-2FT-I	Permanently- connected fluorescent	Replaceable- type T8 self- ballasted LED lamp	100- 277 V ac, 0.1.A
Model LiLEDs-T8-4FT-I	Permanently- connected fluorescent	Replaceable- type T8 self- ballasted LED lamp	100- 277 V ac, 0.2.A
Models LiLEDs-T8-2FT-E, LiLEDs-T8-3FT-E, LiLEDs-T8-4FT-E, LiLEDs-T8-4FT-E23, LiLEDs-T8-4FT-E30, LiLEDs-T8-5FT-E, LiLEDs-T8-6FT-E, LiLEDs-T8-8FT-E23, LiLEDs-T8-8FT-E30	Permanently- connected fluorescent	Replaceable- type T8 self- ballasted LED with external driver	100- 277 V ac

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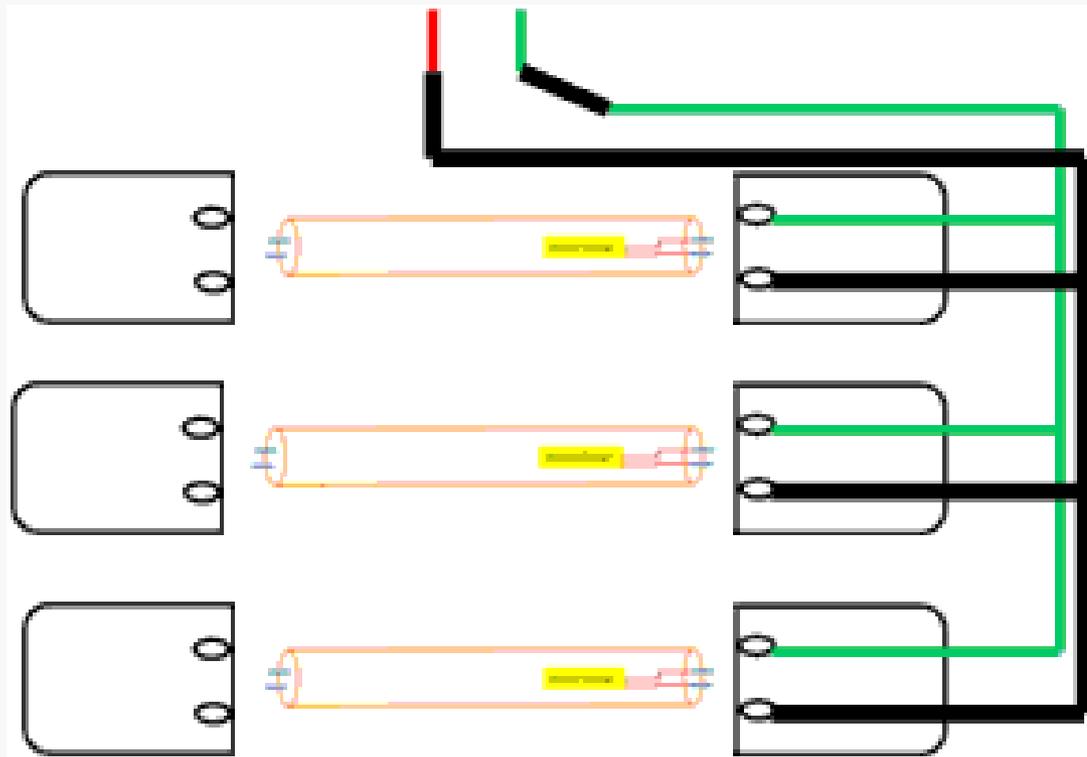
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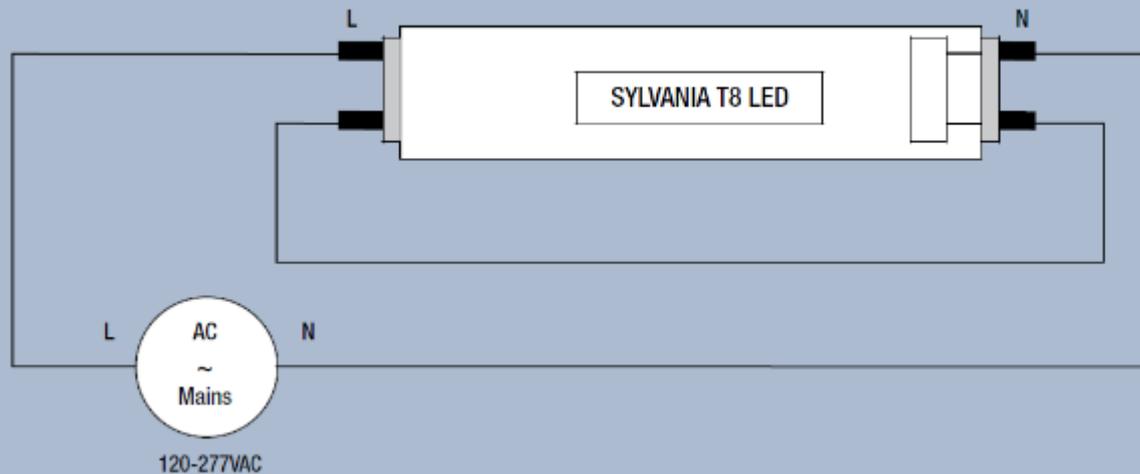
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Single-end Wiring Retrofit

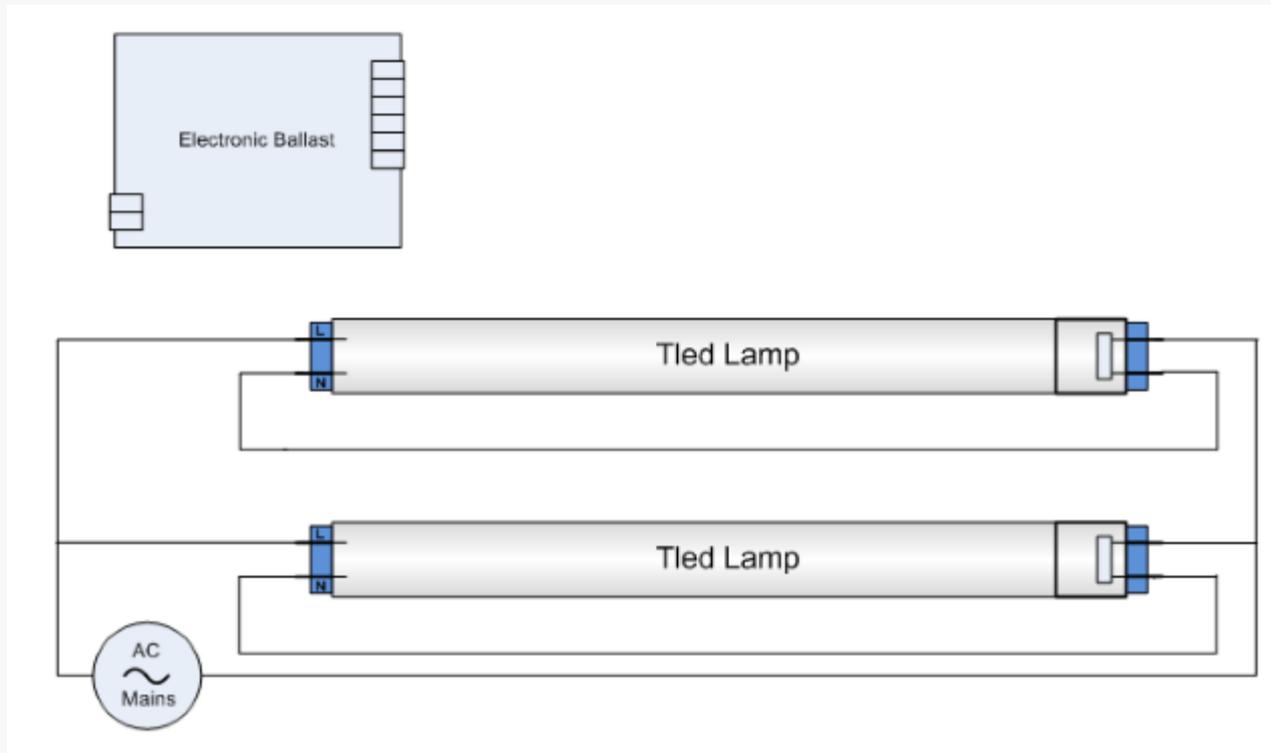


Single-end Tube with Double-end Wiring

Wiring Diagram

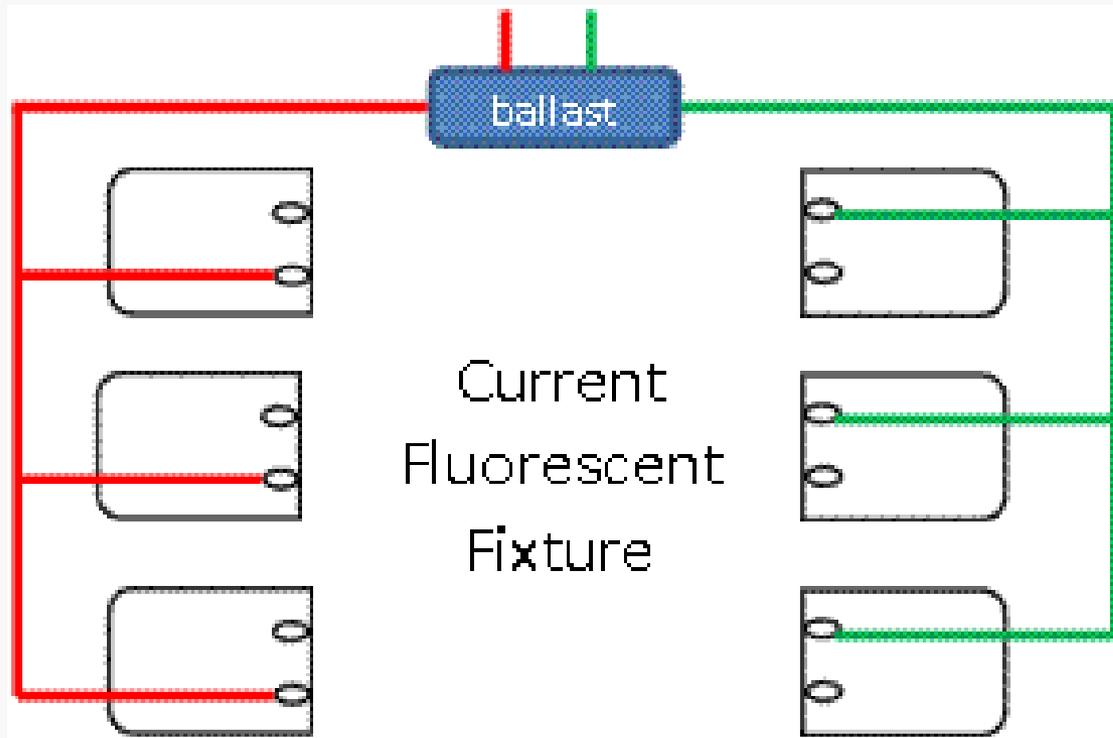


Single-end Tube with Double-end Wiring



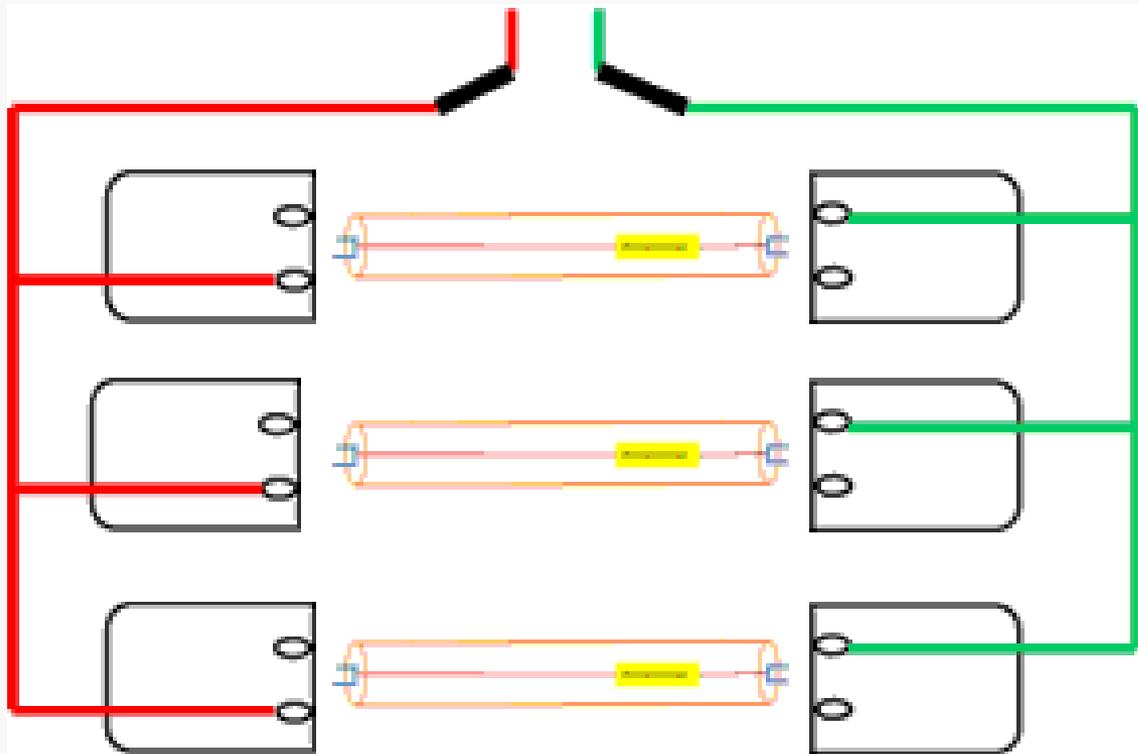
Ballast-compatible Tube:

- Is it safe?



Double-end Wiring

– How to make it safe



Costs – Upfront and Down the Road

- Installation costs:
 - Materials: lamp, non-shunted socket, ballast
 - Labor: how much re-wiring involved
 - Rebates
- Operation and Maintenance costs **over 10 years**:
 - Materials: lamp, ballast for ballast-compatible tube
 - Labor: any new wiring required? Yes for ballast replacement
 - Energy consumption: lamp, ballast **(by how much?)**
 - Disposal: 5-year or 10-year

Timeframe Matters on ROI

- 10-year ROI Comparison

Cost	Safety Switch tube w/ Replaceable Driver	Ballast Compatible Tube
Material	1x lamp purchase 1x driver purchase (1/3 tube cost)	2x lamp purchase 2x ballast purchase
Labor	1x ballast removal & tube install. by electrician 1x tube spot replacement	1x tube installation 1x tube spot replacement 2x ballast spot replacement by electrician
Extra energy consumption	None	10-year energy consumption on ballast

And the Winner Is ...

And the Winner Is ...

- **External Driver Double End:** Use only when external driver is a must
- **Internal Driver Single End:** Use when safety is not an issue
- **Internal Driver Double End w/o Safety Switch:** Use if your company has a very good lawyer or you have a superb insurance policy
- **Internal Driver Double End w/ Safety Switch:** Use if you will be retired in 5 years
- **Internal Driver Double End w/ Safety Switch & Replaceable Driver:** Use if you want to stay in your job for more than 5 years
- **Internal Driver Double End w/ Ballast Compatibility:** Use if you will be retired in 3 years

Ultimate Winner – Miracle Tube

- Internal-driver tube with safety switch
- Supports single-end and double-end wired fixture
- Works with ballast and AC input
- Has a replaceable driver
- Dimmable and daylight harvesting-ready
- Rotatable end cap
- Extendable and retractable length
- Fool-proof, fail-safe, patent-hassle-free
- Politician-proof, Wall Street-blessed, Russian-banned

SureFit DBA Tube

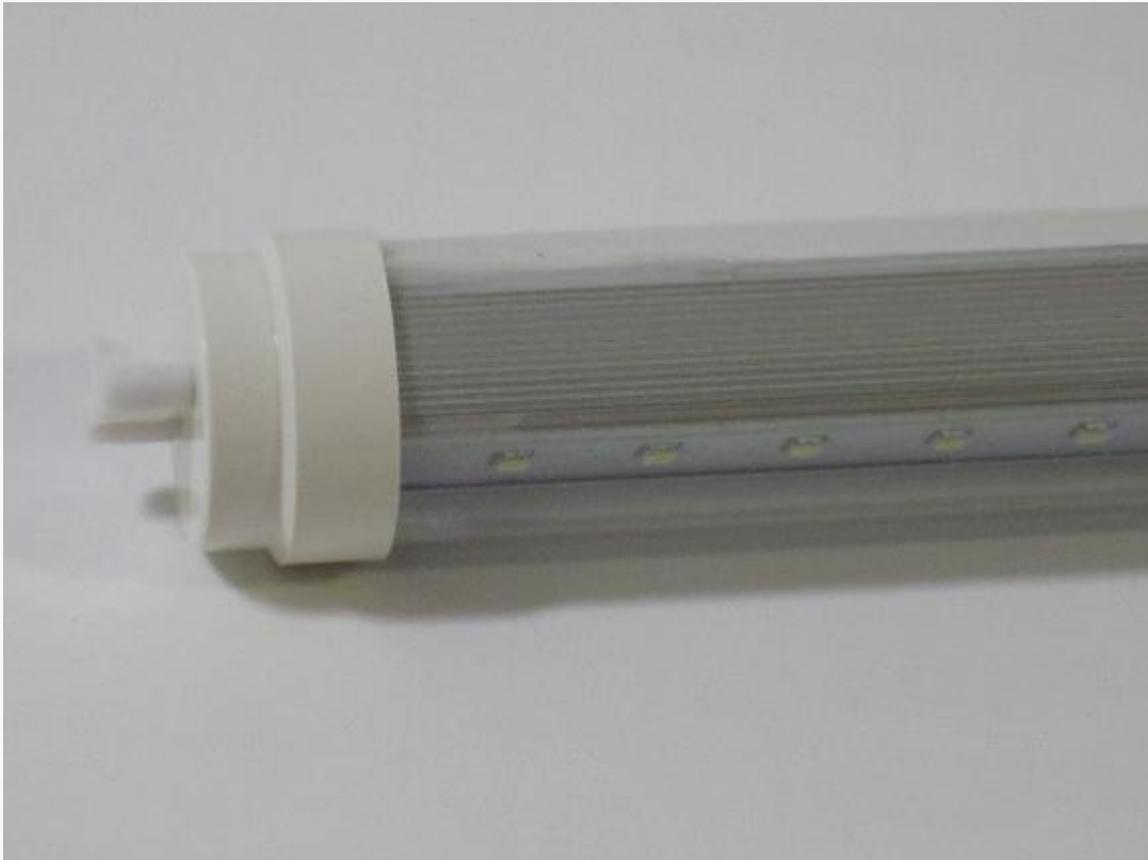
- Double-end safety switch
- Ballast-compatible
- AC-in friendly

Other Features to Be Considered

- Dimmable: TRIAC vs. 0-10V dimming
- Voltage range: 110, 277V, or both?
- Rotatable end cap
- Extendable end cap(?)
- Replaceable driver
- Beam angle: 120, 240, 360 degree
- IP65
- Suitable for vapor tight fixture or high temp. environment

Quality Issues/Concerns

What's Wrong with This Tube?



What's Wrong with This Tube?



What's Wrong with These Tubes?



What's the Difference in These Tubes?



Quality Issues

- Design issues
 - Heat dissipation area
 - Heat dissipation medium
 - Heat conductivity
- T8 vs T8-oval vs T10
- Low quality components, e.g., soft lens, cheap resistor, capacitor, transistor
- Watch out for “cheap” prices: **you get what you pay for!**

Warranty Issues/Concerns

Warranty Issues

- Would you like to pay yourself for the injury/damage caused due to LED products?
 - A national chain of department store
- How to protect yourself and your colleagues and your organization?

Warranty Issues

- How sure are you that your vendor will still be in business if and when you have a warranty claim on your LED product?
 - A national snack food company in Vancouver, WA
- How to be sure?

Warranty Issues

- How do you know your vendor could continually support you on the same product?
 - A major business property management company in Pasadena, CA
- Do you have a backup plan if they can't?

Warranty Issues

- Are you covered on liability/injury due to LED product?
- Will your vendor still exist when you need the warranty?
- Will the LED product still available when you need it?

Patent Issues/Concerns

Patent Issues

- Risk of patent infringement lawsuits?
- Do you know manufacturers, distributors, resellers, and end users can all be subject to IP/patent lawsuits?
- Can your vendor indemnify you on legal disputes related to their LED products?
 - Do you know Philips holds patents on dimmable LED lamps?

What Do They Have in Common?



Double-ended Tube with Safety Swtich

- Aleddra End Cap close-up



Financing – Need Budget, Really?

- Energy efficient financing available from manufacturers, distributors, 3rd parties
- Project costs may be paid by energy saving in full - assuming \$1 energy saving per lamp per month:
 - **2-year Net Zero program**: \$1 per lamp per month
 - **5-year Cash Flow Positive program**: \$.50 back per lamp per month
 - Cash flow positive on the first month

Re-cap

- LED products are not created equal
- The right choice of LED products depends on a number of different factors.
- Issues to consider:
 - ROI Timeframe
 - Safety
 - Cost
 - Quality
 - Warranty
 - Financing

Resources

- Demo videos: www.YouTube.com/aleddra
- UL: www.UL.com
- DLC: www.designlights.org
- LightingFacts: www.lightingfacts.com
- EnergyStar: www.energystar.gov/certified-products/certified-products?c=products.pr_find_es_products

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