

Electrical Level 2



Electrical Lighting 26203-14



Objectives

When trainees have completed this lesson, they should be able to do the following:

1. Describe the characteristics of light.
2. Recognize the different kinds of lamps and explain the advantages and disadvantages of each type:
 - Incandescent
 - Fluorescent
 - Halogen
 - High-intensity discharge (HID)
3. Properly select and install various lamps in lighting fixtures.
4. Recognize and describe the installation requirements for various types of lighting fixtures:
 - Surface-mounted
 - Suspended
 - Recessed
 - Track-mounted
5. Recognize ballasts and describe their use in fluorescent and HID lighting fixtures.



Objectives and Performance Tasks

6. Explain the relationship of Kelvin temperature to the color of light produced by a lamp.
7. Recognize basic occupancy sensors, photoelectric sensors, and timers used to control lighting circuits and describe how each device operates.

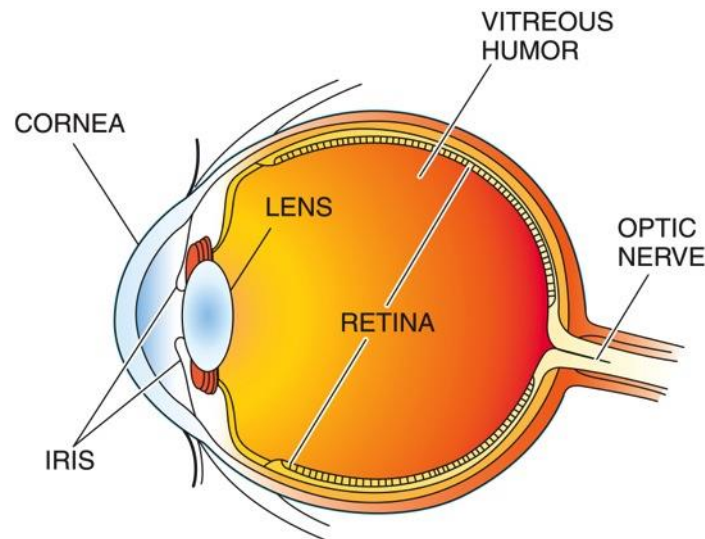
Performance Tasks

1. Read and interpret information given in lamp manufacturers' catalogs for one or more selected lamps.
2. Properly select and install lamps into lighting fixtures.
3. Install one or more of the following lighting fixtures and their associated lamps:
 - Surface-mounted
 - Recessed
 - Suspended
 - Track-mounted



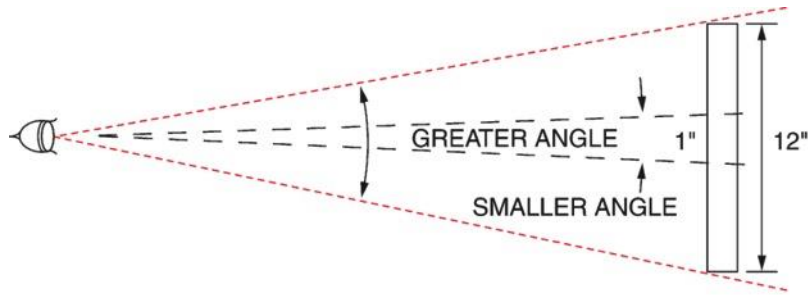
Introduction; Human Vision

- Appropriate lighting is essential for safety and also helps to improve efficiency and reduce eyestrain.
- The structure of the human eye is similar to a camera. Like a camera, it responds best to well-lit, high-contrast lighting conditions.



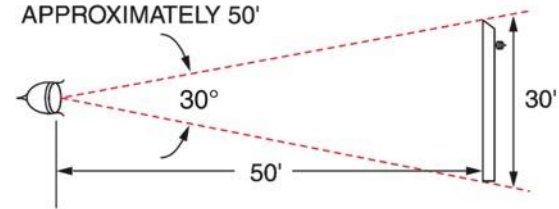
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Visual Angle

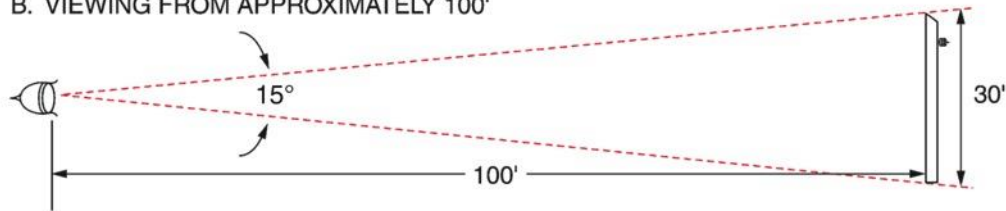


WHEN THE OBJECT IS SMALLER, THE ANGLE FROM THE EYE TO THE OBJECT IS ALSO SMALLER.

A. VIEWING FROM APPROXIMATELY 50'



B. VIEWING FROM APPROXIMATELY 100'

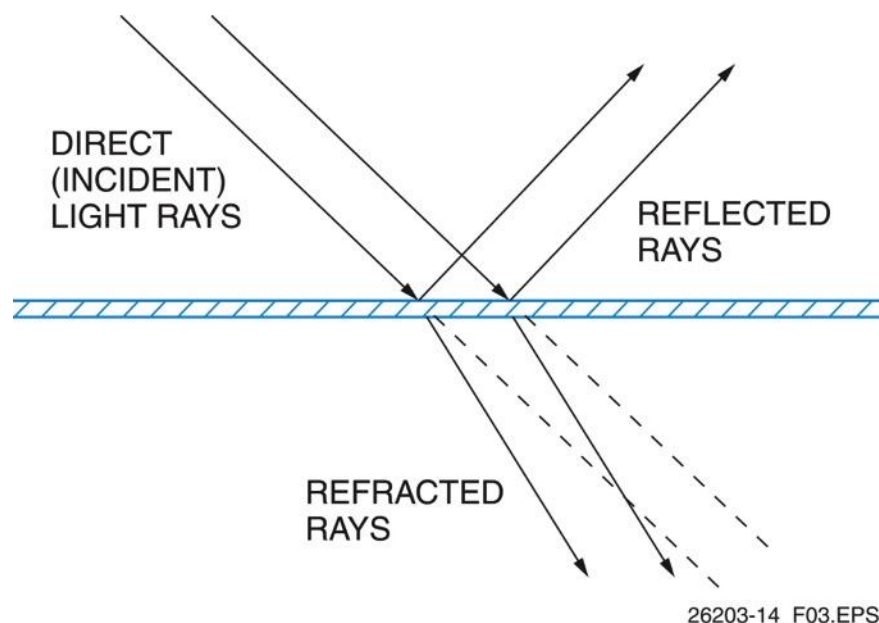


WHEN THE OBJECT IS PLACED FARTHER AWAY, THE ANGLE FROM THE EYE TO THE OBJECT BECOMES SMALLER.

3.0.0 – 3.1.0

Light Characteristics

- Incident light is direct light from the sun or another source.
- When light strikes an object, it can be absorbed, refracted, or reflected. Absorbed light is dissipated as heat. Reflected light bounces back at a 90-degree angle. Refracted light bounces off in a different direction.



3.0.0 – 3.1.0

Percentages of Light Reflected by Common Surface Materials

The color of walls, ceilings, and floors and their degree of reflection are major considerations in the design of effective lighting systems.

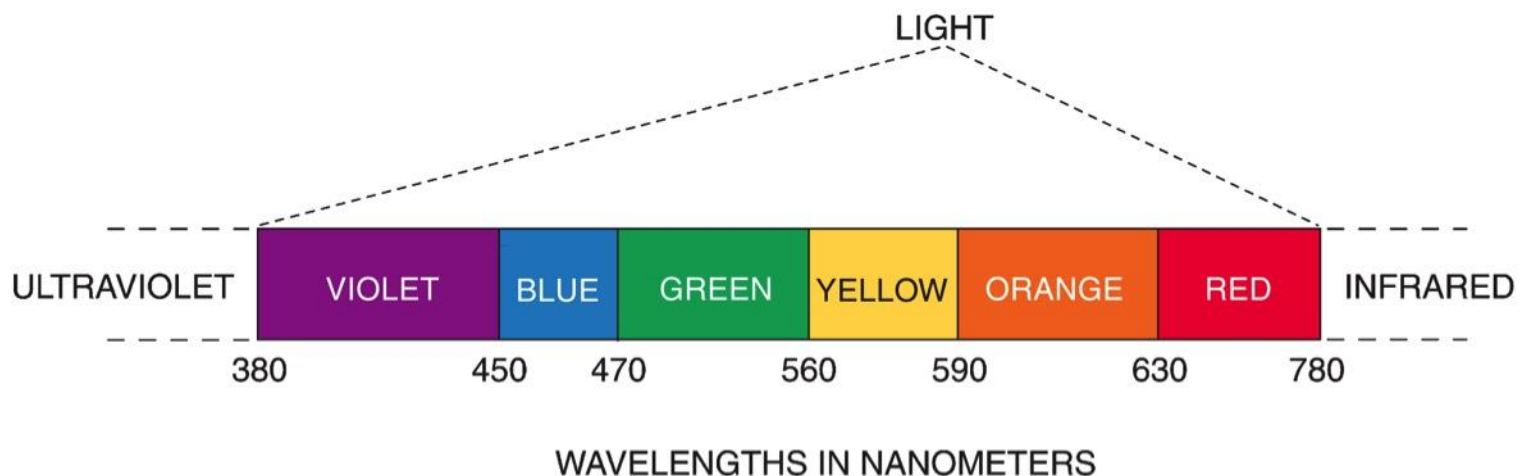
Surface Material	Percentage of Light Reflected
White plaster	90% to 92%
Mirrored glass	80% to 90%
White paint	75% to 90%
Metalized plastic	75% to 85%
Polished aluminum	75% to 80%
Stainless steel	55% to 65%
Limestone	35% to 65%
Marble (white)	45%
Concrete	40%
Dark red-glazed bricks	30%



3.2.0

Light Colors

- Light is a form of radiant energy.
- Visible light exists in a fairly narrow range of wavelengths, with each wavelength representing a different color. White light is made up of all the wavelengths that create the different colors.



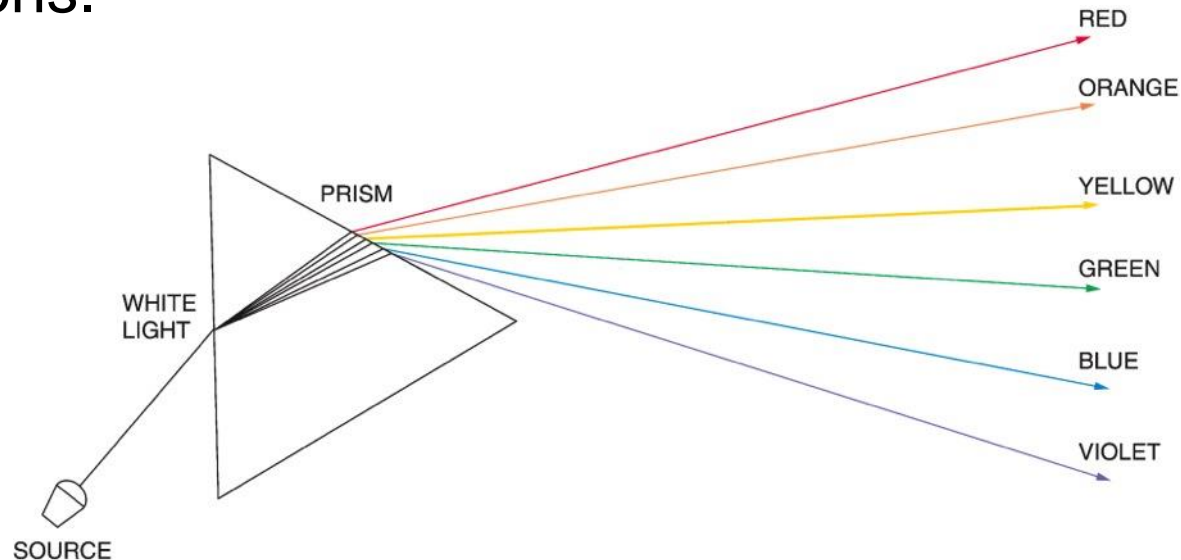
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3.2.0

Light Being Separated into its Component Colors by Refraction

- When white light is refracted through a prism, it splits into the colors of the rainbow.
- All objects absorb light of different wavelengths in different proportions.

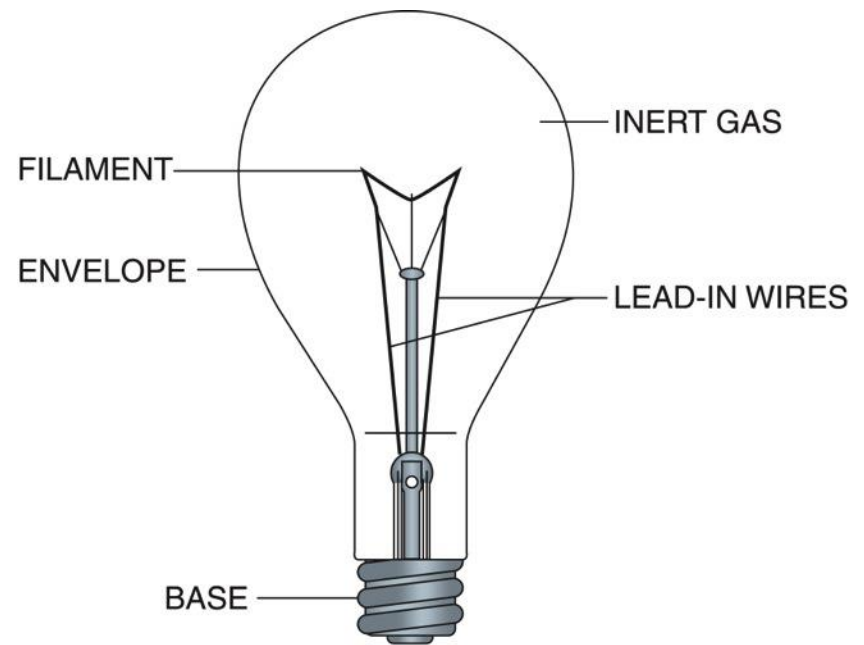


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4.0.0 – 4.5.0

Lamps

- Three common categories of lamps include incandescent, fluorescent, and high-intensity discharge (HID).
- Incandescent lamps produce light by passing an electric current through a filament. Incandescent lamps are very inefficient and have been phased out of production as of January 2014.



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4.0.0 – 4.5.0

Think About It: Energy Consumed by Incandescent Lamps

How much of the energy consumed by incandescent lamps is dissipated as heat?

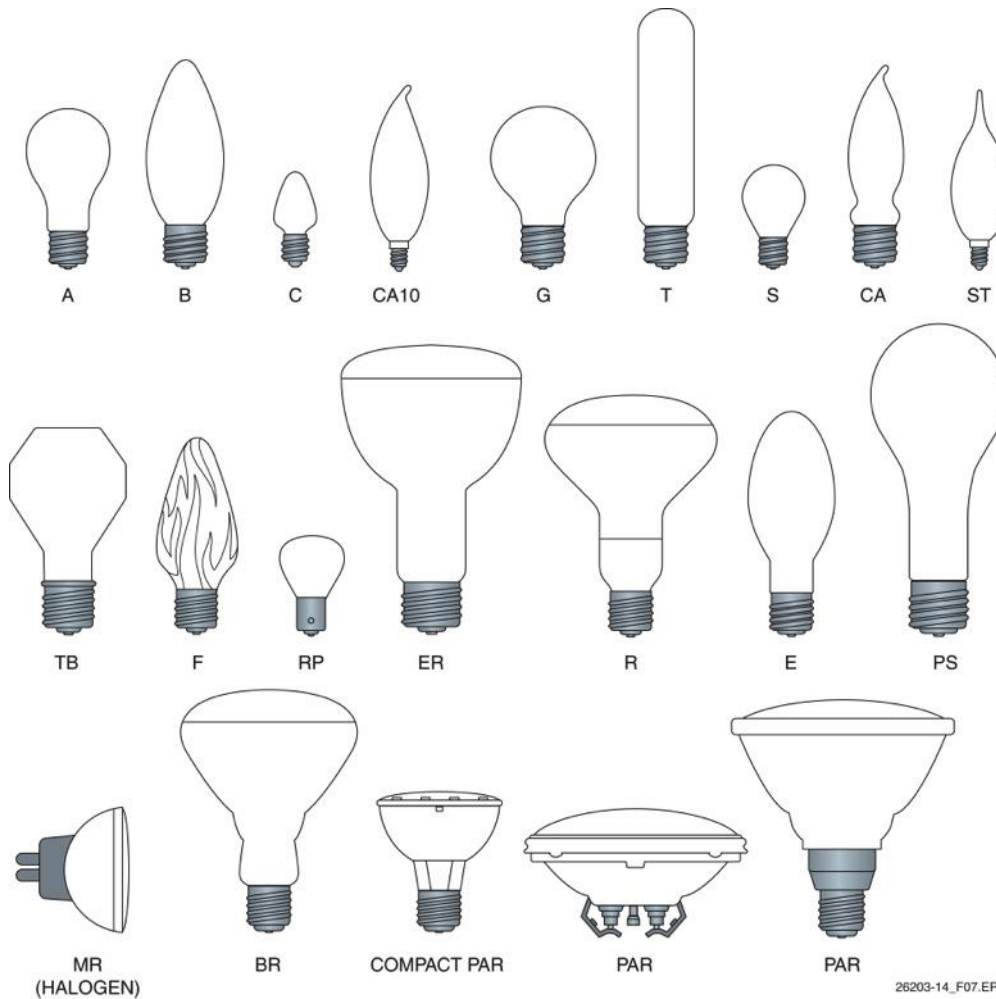
- a. 25%
- b. 50%
- c. 75%
- d. 90%



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4.0.0 – 4.5.0

Incandescent Lamp Shapes



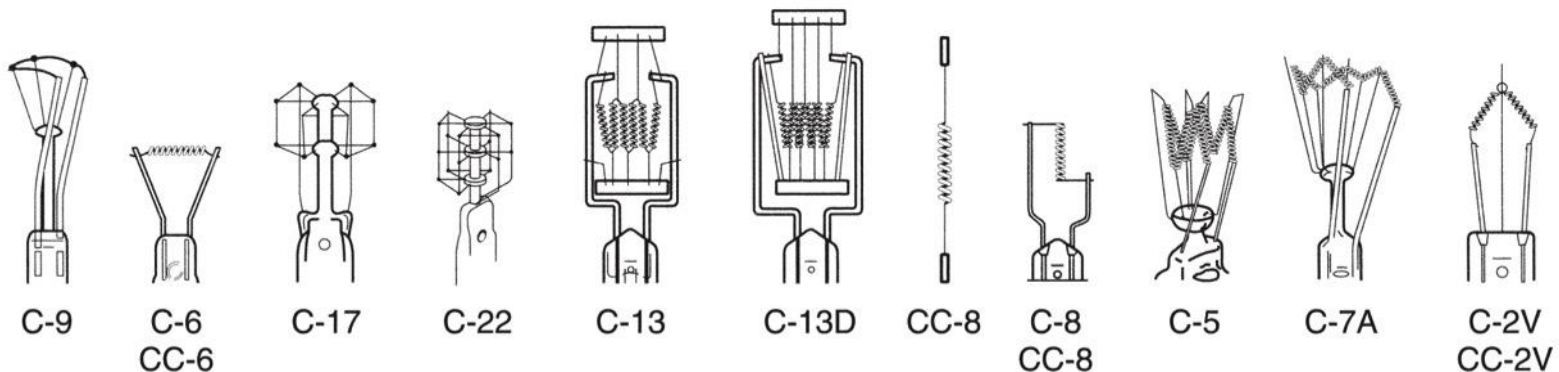
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4.0.0 – 4.5.0

Examples of Incandescent Lamp Filament Forms

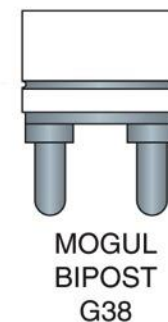
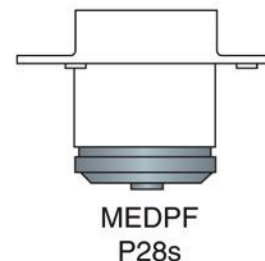
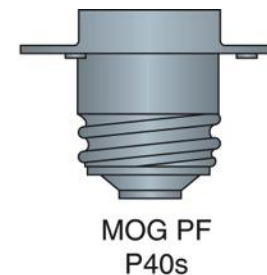
- Filaments are identified by letter and number combinations. The letter represents the shape of the filament.
- Common letters include C (coiled), CC (coiled coil), and S (straight).



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4.0.0 – 4.5.0

Examples of Incandescent Lamp Bases



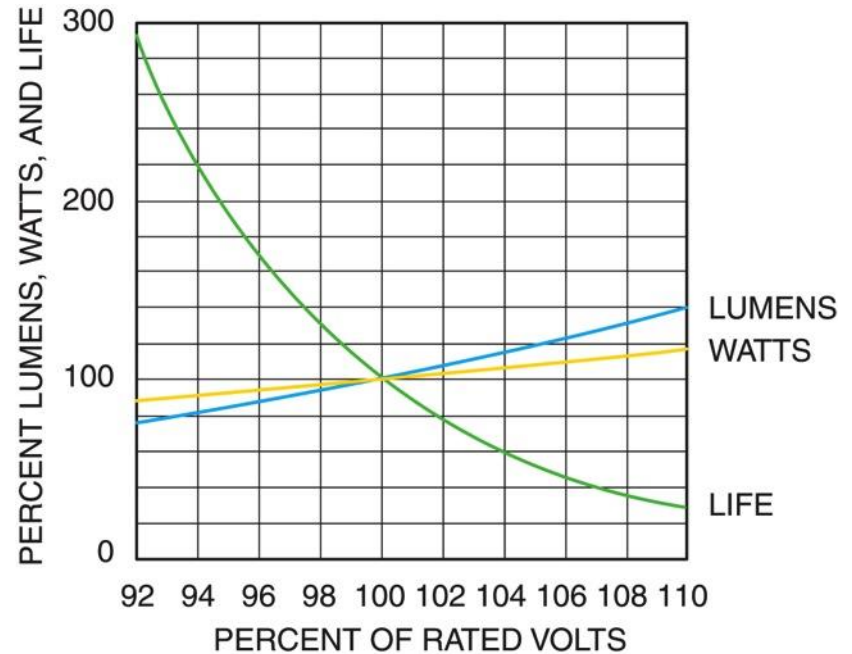
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4.0.0 – 4.5.0

Relationship of Rated Lamp Voltage to Watts, Lumens, and Lamp Life

- The supply voltage has a significant impact on incandescent lamp life.
- The lamp wattage indicates how much energy the lamp consumes to produce its rated light output.
- Lumens are a measure of light output. The greater the number of lumens, the brighter the light.



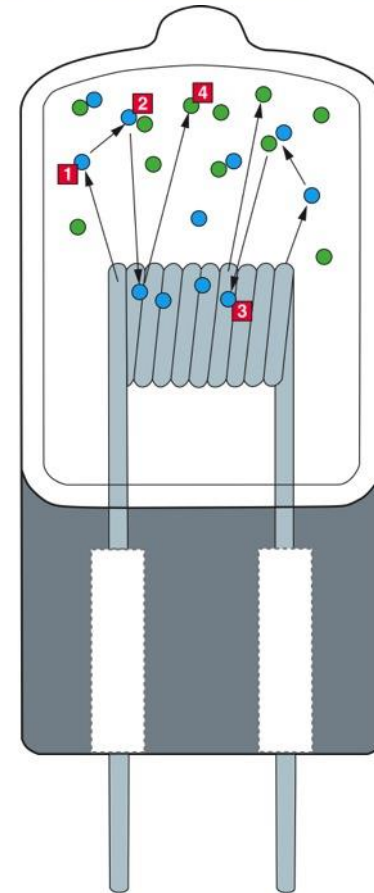
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4.0.0 – 4.5.0

Basic Tungsten Halogen Lamp

- Halogen lamps are more efficient than incandescent lamps and also have a greater service life and improved light quality.
- However, halogen lamps burn hot and produce more ultraviolet radiation than other lamp types.



● Halogen Atoms
● Tungsten Atoms

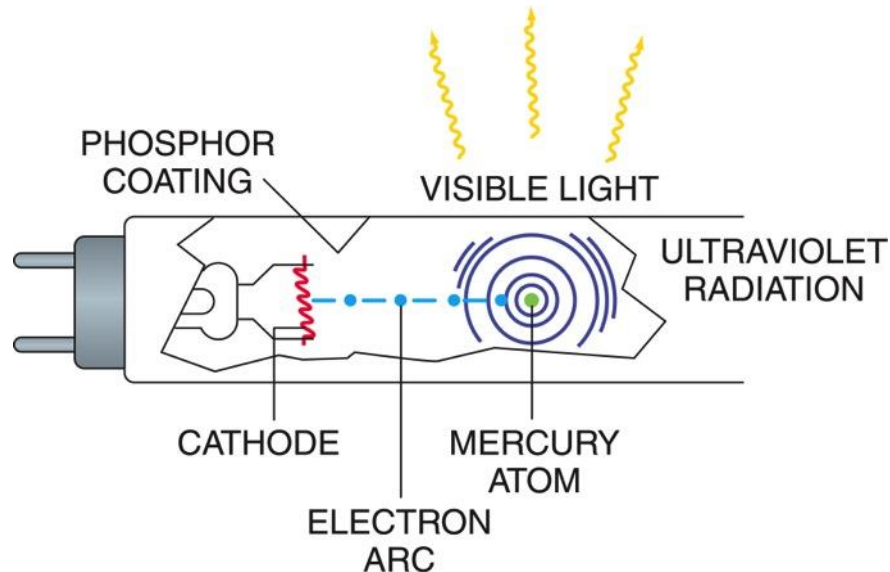
1. Tungsten atoms evaporate from filament.
2. Tungsten atoms combine with halogen atoms.
3. Gaseous compound returns to hot filament, redepositing tungsten atoms.
4. Halogen atoms are released to combine with additional tungsten atoms.

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4.0.0 – 4.5.0

Basic Fluorescent Lamp

- Fluorescent lamps are low-pressure mercury discharge lamps.
- They offer high efficiency and are available in an increasing variety of shapes and sizes.



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4.0.0 – 4.5.0

Typical Fluorescent Lamps

- Fluorescent lamps require a high-voltage surge to establish an arc in the mercury vapor and a ballast to regulate the current flow through the lamp.
- There are three classes of fluorescent lamps: preheat, rapid start, and instant start.



(A) CURVALUME®



(B) T8 ARRAY



(C) T12 ARRAY

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4.0.0 – 4.5.0

Compact Fluorescent Lamps



(A) CIRCLINE FLUORESCENT



(B) CLASSIC BULB
SHAPE FLUORESCENT



(C) TRIPLE COMPACT
FLUORESCENT

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- Compact fluorescent lamps fit into standard screw-in lamp sockets and are currently the most popular replacement lamps for incandescent lamps in all types of lighting fixtures (luminaires).
- However, light-emitting diode (LED) lamps are rapidly gaining popularity.

4.0.0 – 4.5.0

Typical Fluorescent Lamp Holders

Lamp holders are available with various pin configurations to allow for various spacings and mounting methods in fixtures.



(A) BI-PIN SLIDE-ON
AND SCREW MOUNT
LAMP HOLDER



(B) HIGH-OUTPUT
(HO) LAMP HOLDER



(C) SINGLE-PIN (SLIMLINE)
LAMP HOLDER

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4.0.0 – 4.5.0

Typical High-Intensity Discharge Lamps

- High-intensity discharge (HID) lamps provide both long life and high efficiency.
- They are similar to fluorescent lamps in that they produce light by exciting gases in a pressurized bulb.

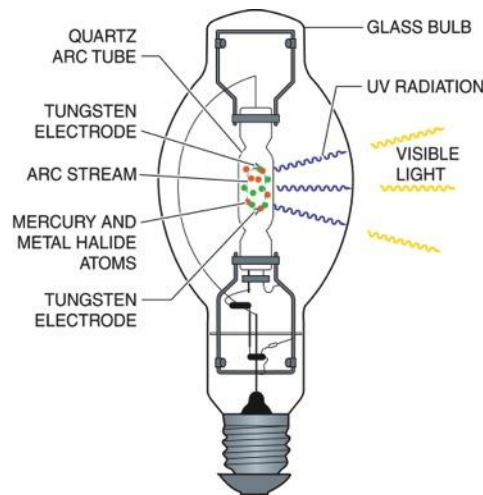


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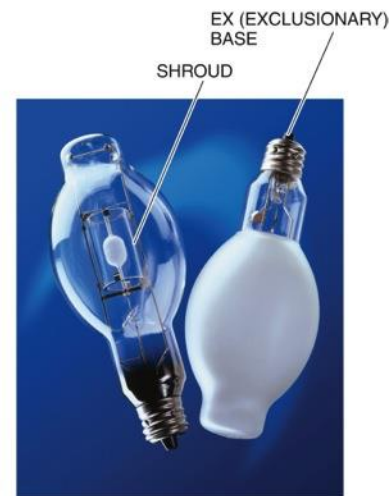
4.0.0 – 4.5.0

Basic Metal Halide Lamp

- Metal halide lamps combine mercury and metal halide atoms under high pressure.
- Metal halide lamps can present a fire or explosion hazard if the arc tube is ruptured, and must be protected with a containment barrier or protective socket.



(A) BASIC METAL HALIDE LAMP



(B) TYPE O METAL HALIDE LAMP

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4.0.0 – 4.5.0

Next Session... Color Rendering and Color Temperature Characteristics

- The color rendering index (CRI) is a scale that indicates how natural objects appear under artificial light. It ranges from 0 (least natural) to 100 (most natural).
- Lamps are also rated by color temperature in kelvins (K): at or below 3,000k is warm, 3,500k is moderate and 4,100k and above is cool.

Ballasts

Type of Lamp	Advantages	Disadvantages
Incandescent	<ul style="list-style-type: none">• Low initial cost• Small size• Excellent color rendering index (CRI)• Variety of shapes• Dimmable• Wattage interchangeable	<ul style="list-style-type: none">• Inefficient• Excessive heat output• High operating costs• Short service life• Glare potential
Halogen	<ul style="list-style-type: none">• Small size• Increased efficiency*• Longer life*• Excellent CRI• Bright white light• Dimmable	<ul style="list-style-type: none">• Excessive heat output• Glare potential
Fluorescent	<ul style="list-style-type: none">• Highly efficient• Long service life• Choice of color temperatures and CRI• Low operating costs• Low heat output• Diffuse light source	<ul style="list-style-type: none">• High initial cost• Temperature sensitive• Limited optical control• Requires matched fixture/ballast
Metal halide (HID)	<ul style="list-style-type: none">• Highly efficient• Long service life• Low operating costs• Good color rendering	<ul style="list-style-type: none">• High initial cost• Requires matched fixture/ballast• Long startup/restrike period• Glare potential
High-pressure sodium (HID)	<ul style="list-style-type: none">• Long service life• Exceptionally efficient• Very low operating costs• High lumen maintenance	<ul style="list-style-type: none">• High initial cost• Requires matched fixture/ballast• Long startup/restrike period• Poor color rendering• Glare potential

Performance Task

This session will conclude with trainees reading and interpreting the information given in lamp manufacturers' catalogs, and then selecting and installing lamps into lighting fixtures.



5.0.0 – 5.1.6

Ballasts

- Fluorescent and HID lamps require a ballast to provide the voltage surge required to spike an arc between the electrodes.
- Ballasts also regulate current and compensate for voltage variations.

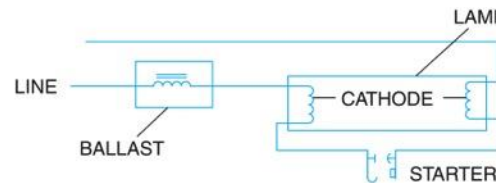


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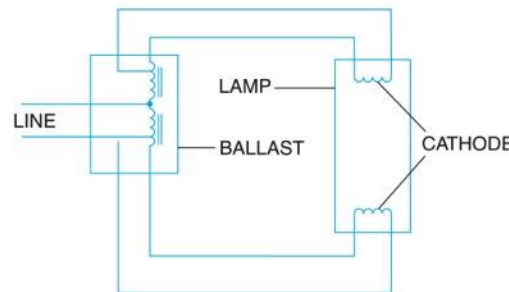
5.0.0 – 5.1.6

Basic Fluorescent Lighting Fixture Circuits

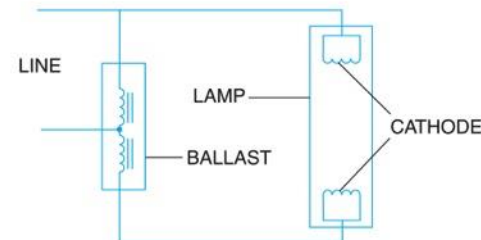
- In preheat circuits, the lamp electrodes are heated before application of the high voltage across the lamp(s).
- Rapid-start lamps allow one second for the electrodes to heat and are the most common type of fluorescent lamp.
- Instant-start lamps are not preheated.



(A) PREHEAT



(B) RAPID START



(C) INSTANT START

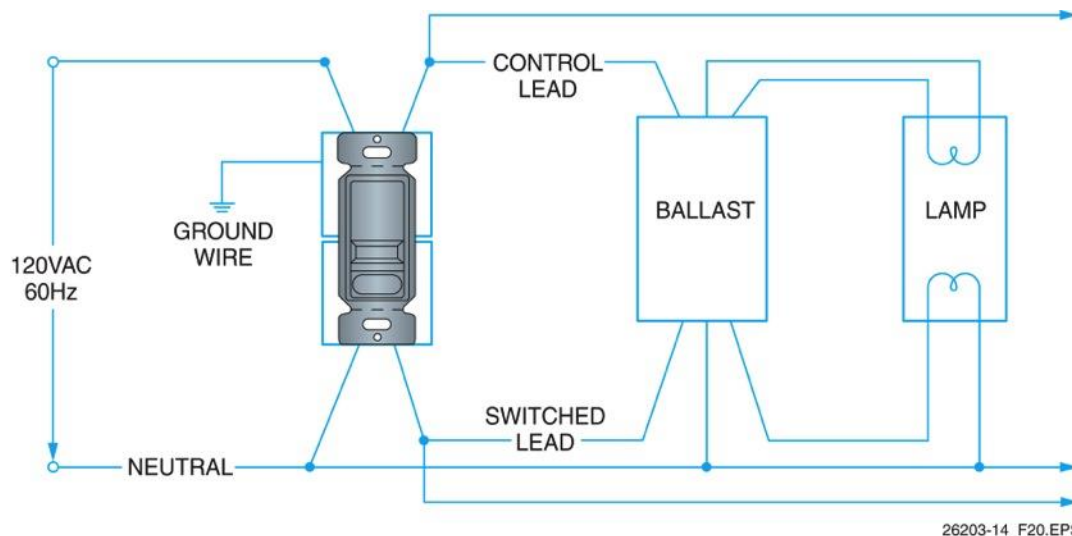
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5.0.0 – 5.1.6

Dimmer Circuit Using Dimming Ballast for Rapid-Start Lamp

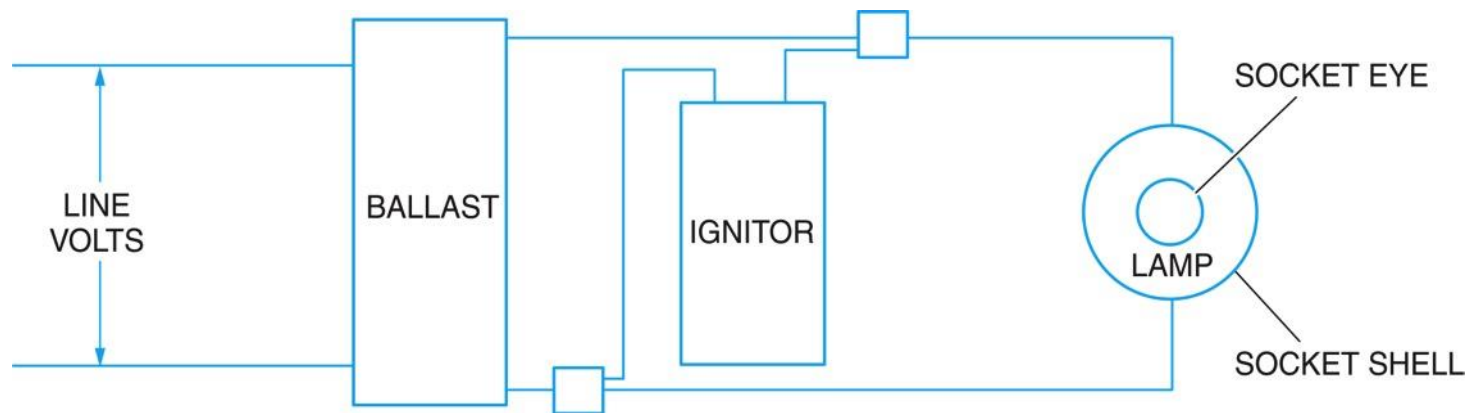
- Special ballasts are required for use with dimmer circuits.
- Electronic dimming ballasts are more efficient and less bulky than magnetic types.



5.2.0 – 5.2.4

HID Lighting Fixture Ballasts

- The voltage surge required to strike the arc in an HID lamp can be provided by the ballast or a separate ignitor circuit.
- The circuit shown here provides a pulse of 2,500V to initiate the lamp arc.



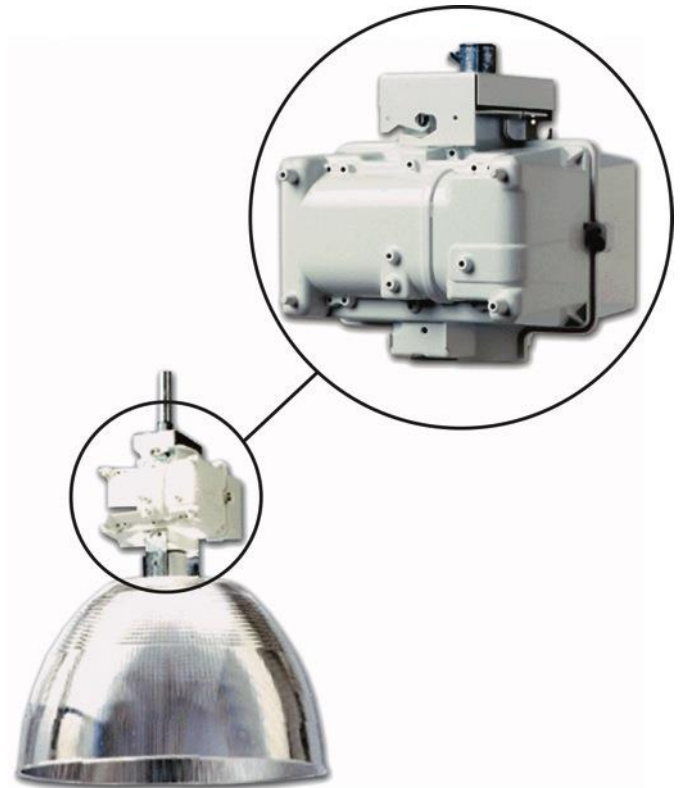
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5.2.0 – 5.2.4

HID Ballast and Lamp

- There are three types of HID ballasts: linear, nonregulating circuit ballasts; constant-wattage autotransformer ballasts; and three-coil ballasts. Three-coil ballasts use isolated windings to provide operating stability and offer the best performance of the three types.
- Some ballasts allow the use of different supply voltages, such as 120V, 208V, 240V, and 277V.



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5.2.0 – 5.2.4

Next Session... Simplified HID Ballast Circuits



(A) REACTOR BALLAST



(B) AUTO-LAG BALLAST

Lighting Fixtures



(C) CONSTANT-WATTAGE AUTOTRANSFORMER (CWA) BALLAST



(D) CONSTANT-WATTAGE ISOLATED (CWI) BALLAST

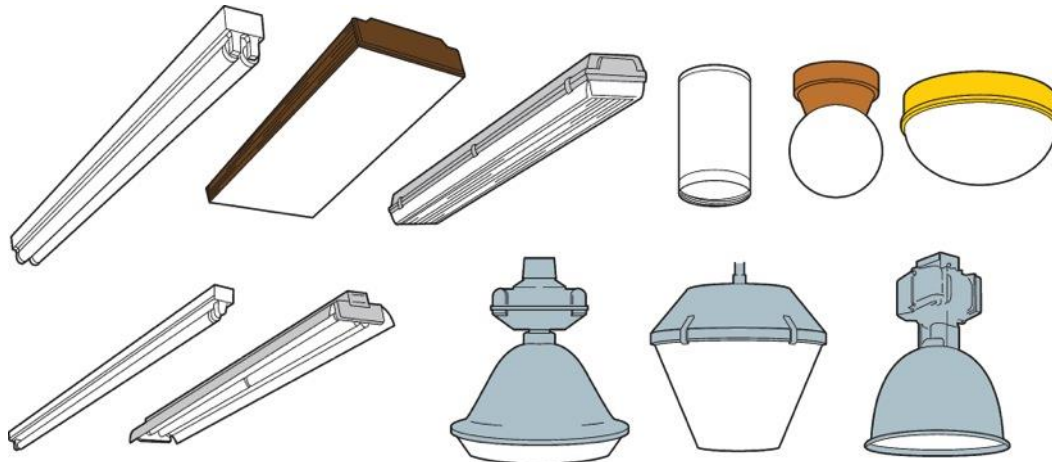
(E) THREE-COIL BALLAST

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Lighting Fixtures

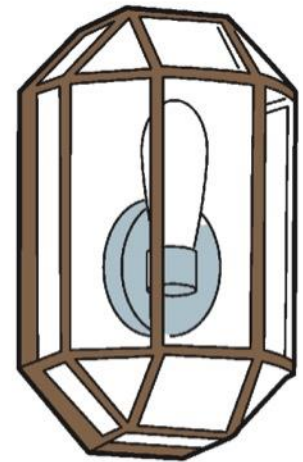
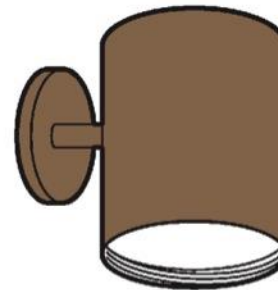
- The word lamp is used to indicate a replaceable bulb. A lighting fixture or luminaire includes the complete lighting unit, including the lamp, its base, and the wiring required to connect it to the circuit.
- There are four basic fixture installation methods: surface-mounted, recessed, suspended, and track-mounted.



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6.0.0 – 6.5.0

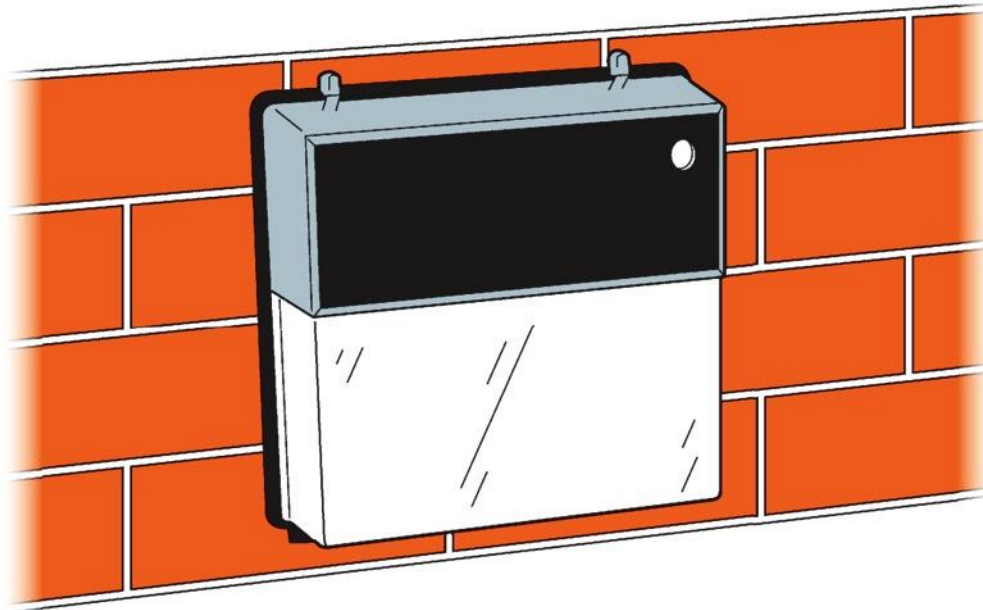
Surface-Mounted Indoor Wall Lighting Fixtures



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6.0.0 – 6.5.0

Surface-Mounted Outdoor Wall Fixture

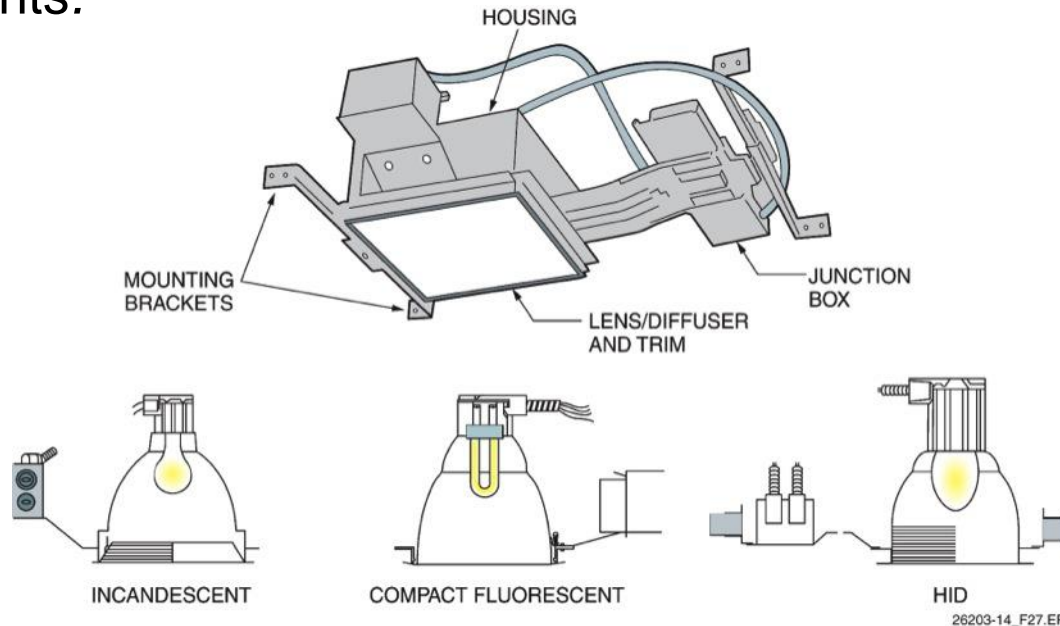


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6.0.0 – 6.5.0

Typical Recessed Lighting Fixtures

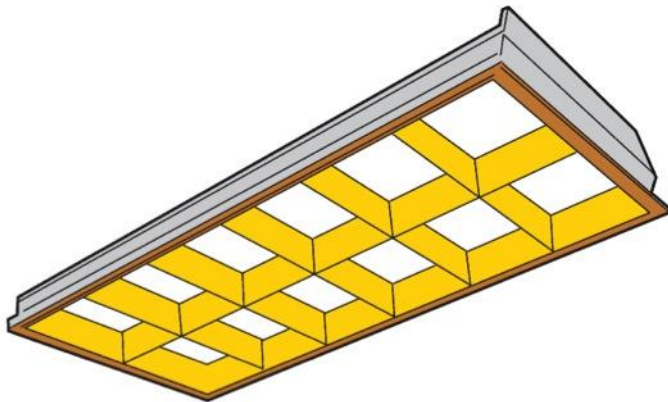
- Recessed fixtures have the main body of the luminaire mounted in the wall or ceiling. Only the related lens/diffuser are visible on the finished ceiling or wall surface.
- Incandescent recessed fixtures generate considerable heat and may present a fire hazard if not installed in accordance with *NEC*[®] requirements.



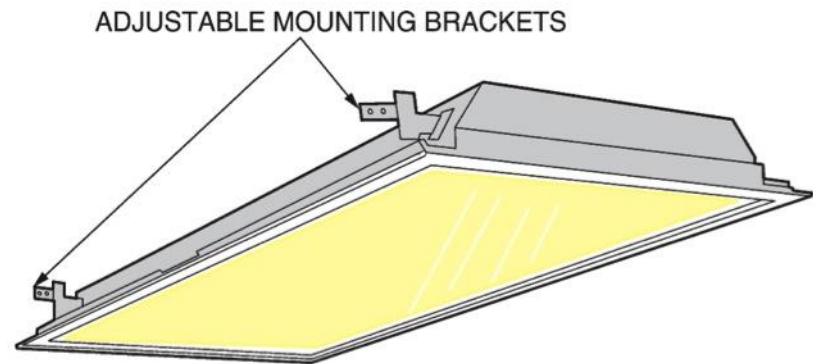
6.0.0 – 6.5.0

Typical Recessed Fluorescent Troffers

- Fluorescent troffers are installed above a suspended ceiling.
- They are typically available in 2' by 4' or 2' by 2' units for use with two, three, or four lamps.



FOR USE IN INVERTED-T OR GRID CEILINGS



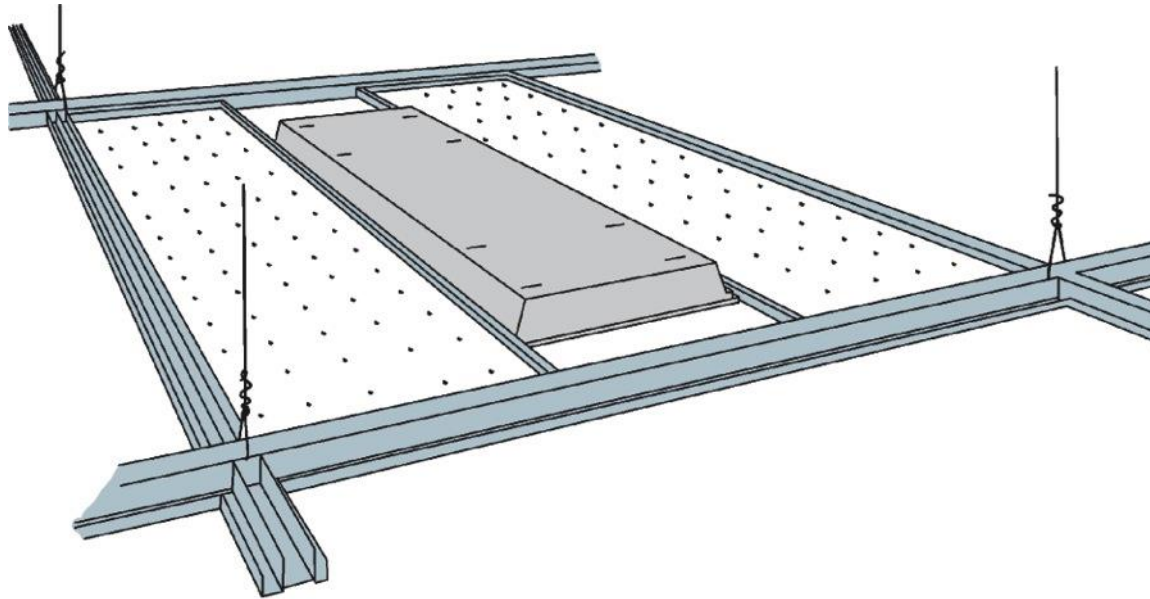
FOR USE IN DRYWALL OR PLASTER CEILINGS

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6.0.0 – 6.5.0

Fluorescent Troffer Mounted in a Suspended Ceiling

Grid-type troffers are designed for installation in grid T-bar suspended ceilings.

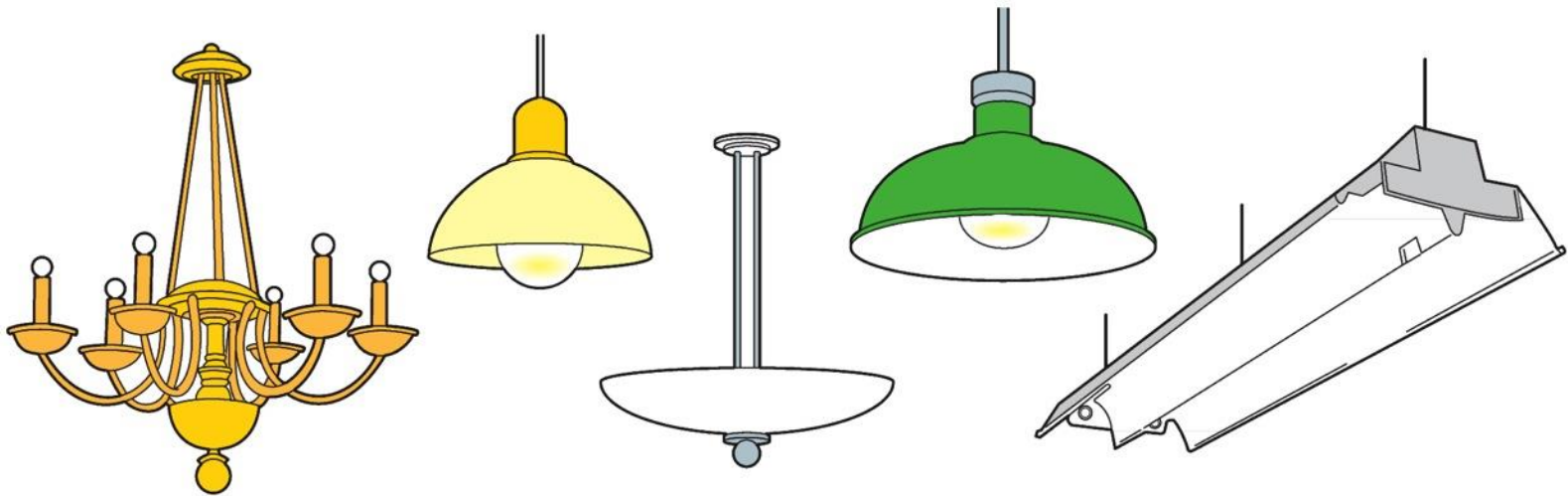


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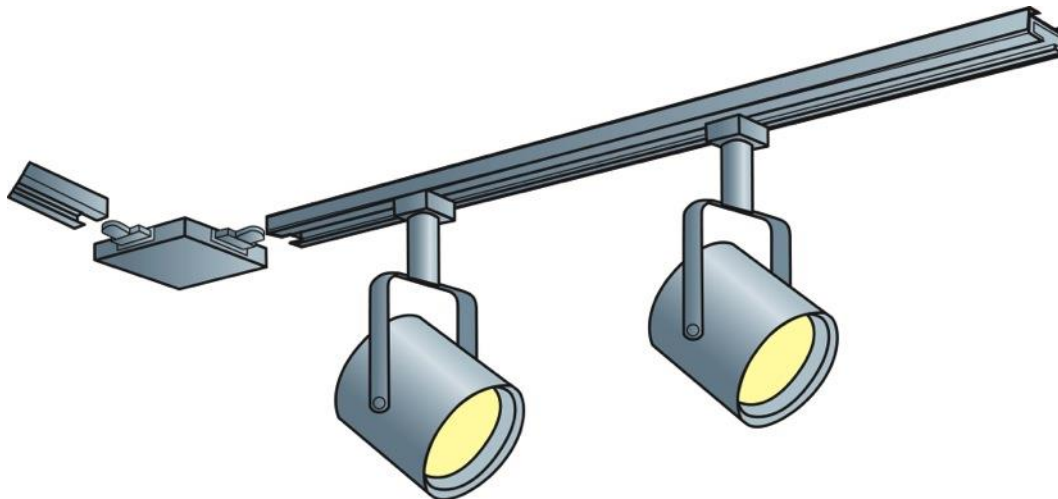
Suspended Lighting Fixtures

- Suspended lighting fixtures include chandeliers and pendant units.
- They are secured to the ceiling using chains, aircraft cords, or metal rods.



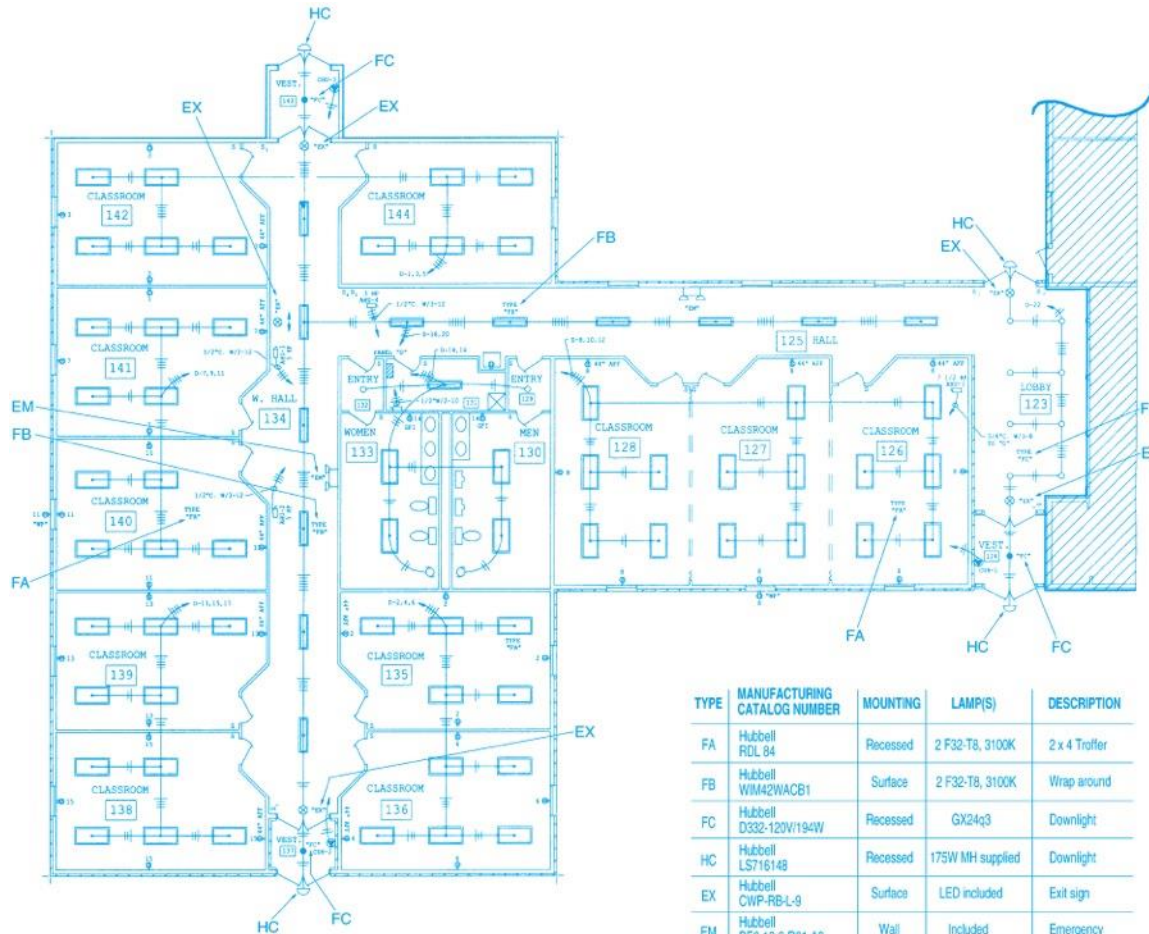
Track Lighting

- Track units include a track, an electrical feed box, and two or more fixtures that can be positioned as desired along the track.
- Track lighting can be either ceiling-mounted or wall-mounted.



7.0.0

Lighting Fixture Installation



TYPE	MANUFACTURING CATALOG NUMBER	MOUNTING	LAMP(S)	DESCRIPTION
FA	Hubbell RDL B4	Recessed	2 F32-T8, 3100K	2 x 4 Troffer
FB	Hubbell WM42WACB1	Surface	2 F32-T8, 3100K	Wrap around
FC	Hubbell D332-120V/194W	Recessed	GX24q3	Downlight
HC	Hubbell LS716148	Recessed	175W MH supplied	Downlight
EX	Hubbell CWP-RB-L-9	Surface	LED included	Exit sign
EM	Hubbell PE6-12-2-R61-A3	Wall	Included	Emergency

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7.0.0

Example of Lighting Fixture Installation Instructions

INSTALLATION INSTRUCTIONS FOR MSV



See warnings on carton.

WARNING

- Disconnect power before installation or servicing.
- Install, operate and maintain to meet all applicable codes.
- Labeled ballast voltage must match supply voltage.
- Protect all wiring connections with approved insulators (by others).
- Insure that all internal wiring, excluding lead wires from reflector, do not contact reflector assembly due to high lamp temperatures.
- Do not overtighten lens door hinge and retaining screws.

PRE-INSTALLATION

1. Remove lens door and set aside (See Figure 1). To remove lens door, loosen lens door retaining screws (2) and one hinge screw (1).
2. Remove the two reflector retaining screws and lift out reflector assembly.
3. Remove shipping bolt located in arm mounting hole.
4. When a multi-tap ballast is supplied, the fixture is factory wired to the highest voltage. Verify that fixture wiring matches the supply voltage.

ARM INSTALLATION (See Figure 2)

NOTE: Guide electrical supply wires from fixture through the bearing plate, fixture, gasket, cover, positioning bracket, pole and bolt plate as each mounting step is completed.

1. Insert longer threaded end of hex rods (5) through lockwashers, positioning bracket (4) and pole.
2. Tighten securely to bolt plate (3).
3. Slide cover (6) over hex rods. Drain hole in cover must be on bottom.
4. Slide gasket (7) over threaded end of hex rods.
5. Place fixture onto hex rods.
6. Slide bearing plate (8) and lockwashers over end of hex rods on inside of fixture.
7. Install and tighten nuts securely.
8. Install supply wire (by others) thru the cord grip bracket in pole using appropriate supplied cord grip (9).
9. Make wiring connections.
10. Push wires and wirenuts into pole top and install cap (10).

FINAL ASSEMBLY

1. Re-install and secure reflector assembly using the reflector retaining screws. The reflector assembly is fully rotatable 360° by 90° increments.
2. Install proper lamp.
3. Re-install lens door and insure that all fasteners are securely tightened.

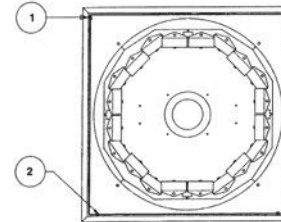


FIGURE 1
FIGURA 1

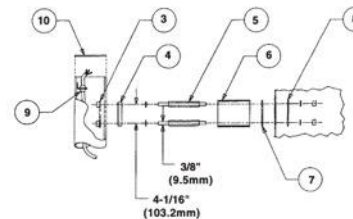
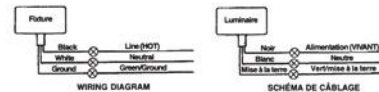


FIGURE 2
FIGURA 2



WIRING DIAGRAM

SCHEMA DE CÂBLAGE



DIAGRAMA DE CABLEADO

Hubbell Lighting
® A Division of Hubbell Lighting, Inc.
2000 Electric Way
Christiansburg, VA 24073-2500
(540) 382-6111
FAX (540) 382-1526

268-1072-9901

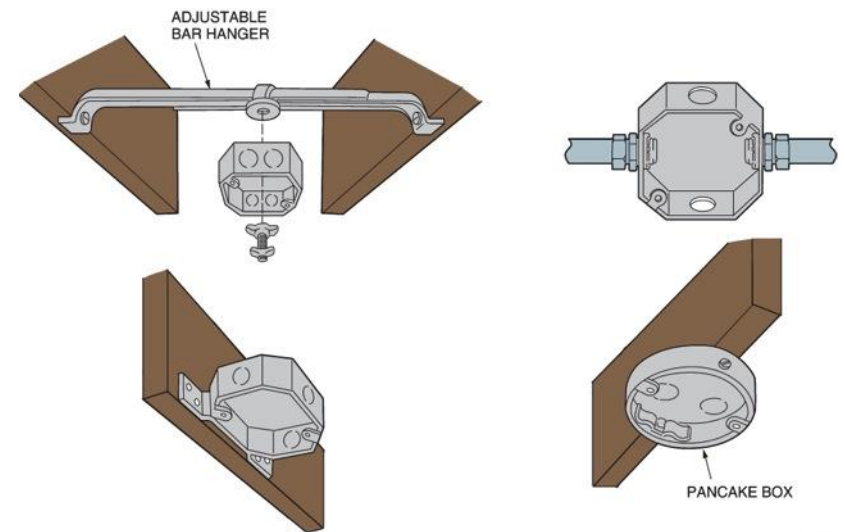
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7.1.0

Mechanical Installation of Surface-Mounted Lighting Fixture

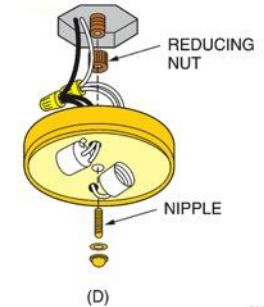
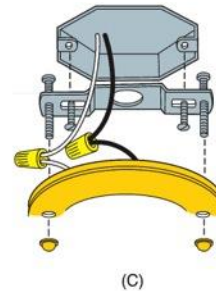
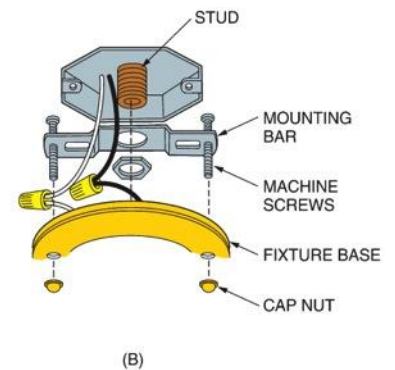
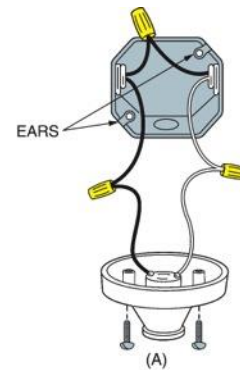
- The size and weight of the fixture determine the outlet box to be used.
- When mounting fixtures that weigh more than 50 pounds, the *NEC*[®] requires that the fixture be supported independently of the box or mounted to a listed outlet box marked with the maximum weight to be supported.



7.1.1

Drum, Globe, Sconce, and Similar Lighting Fixtures

- Globe, sconce, and similar fixtures are typically mounted directly to the outlet box with no additional support.
- Some lamps mount directly to the ears of the outlet box, while others connect to mounting bars attached to a threaded stud in the box.

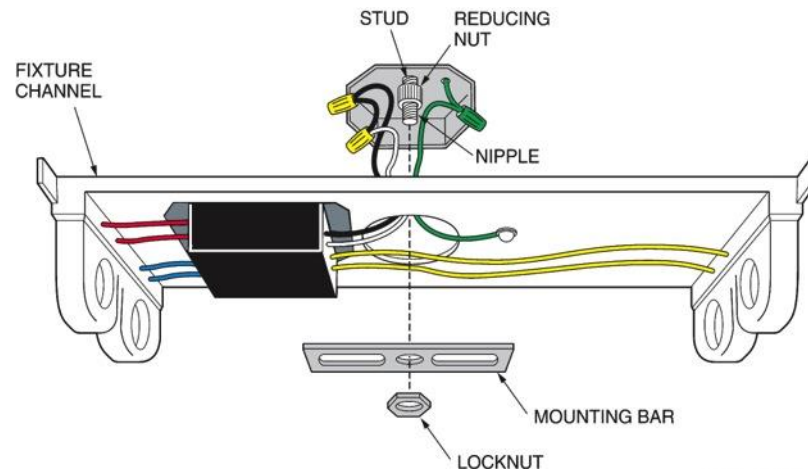


26203-14_F35.EPS

7.1.2

Fluorescent Lighting Fixtures

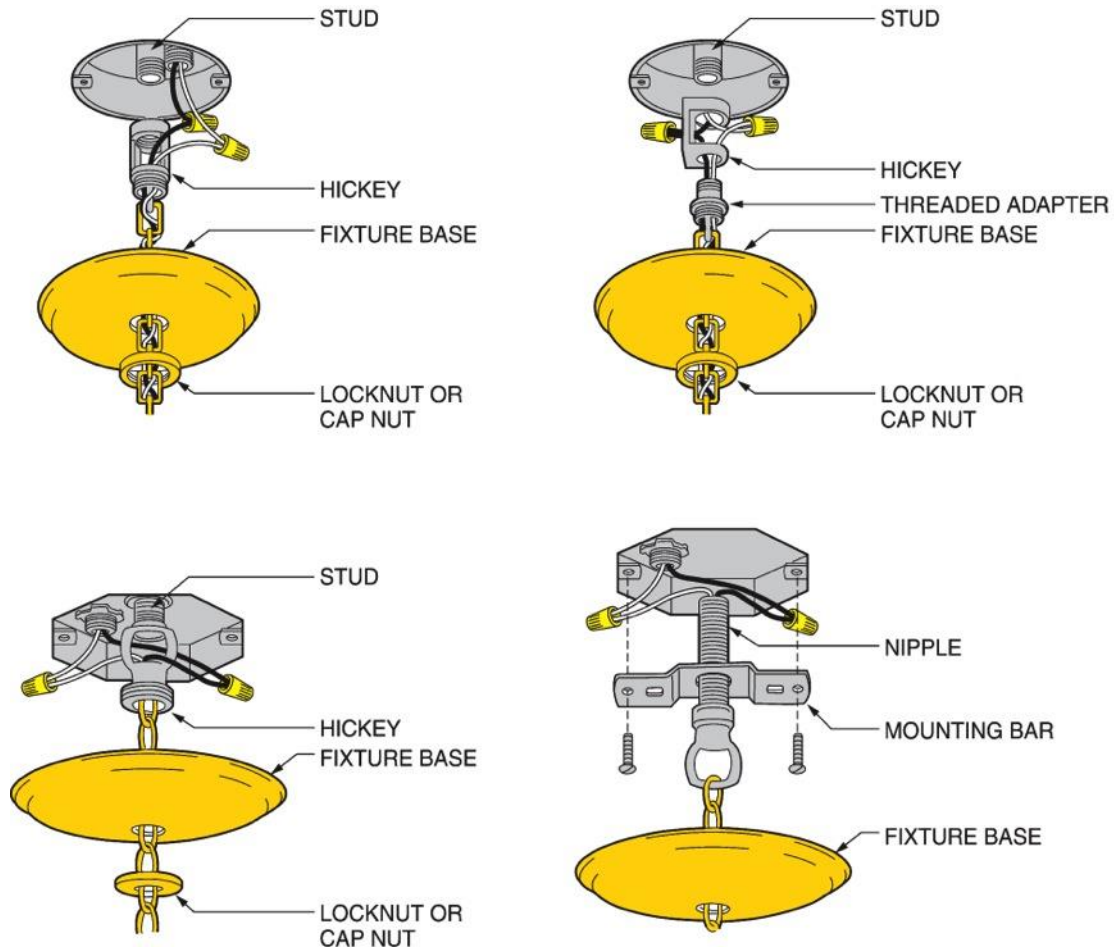
- Some lightweight fluorescent fixtures can be mounted directly to an outlet box, while others connect to a mounting bar inside the housing.
- Heavier fluorescent fixtures are supported using toggle bolts, anchors, or other fasteners connected to ceiling joists or other structural members.



26203-14_F36.EPS

7.1.3

Chandeliers and Pendants



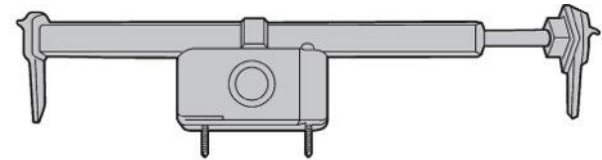
26203-14_F37.EPS



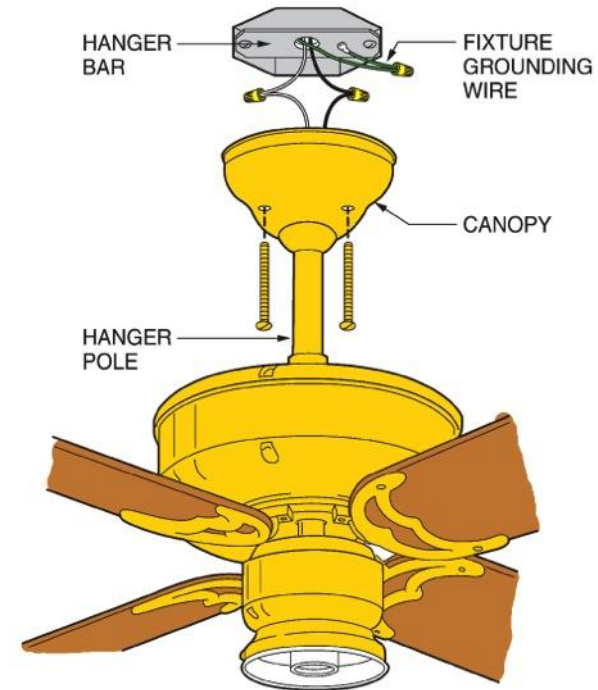
7.1.4

Chandeliers and Pendants

- **NEC Section 422.18** covers the installation requirements for ceiling fans.
- Fans weighing more than 35 pounds must be mounted independently of the outlet box or the box must be listed for such use and marked with the maximum weight to be supported.



TYPICAL FAN JOIST HANGER

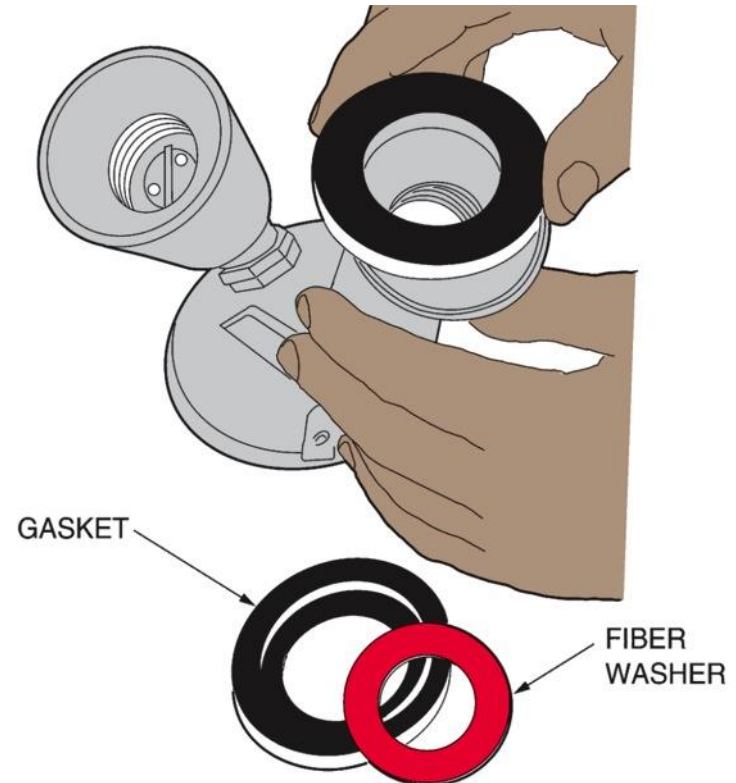


26203-14_F38.EPS

7.1.5

Outdoor Lighting Fixtures

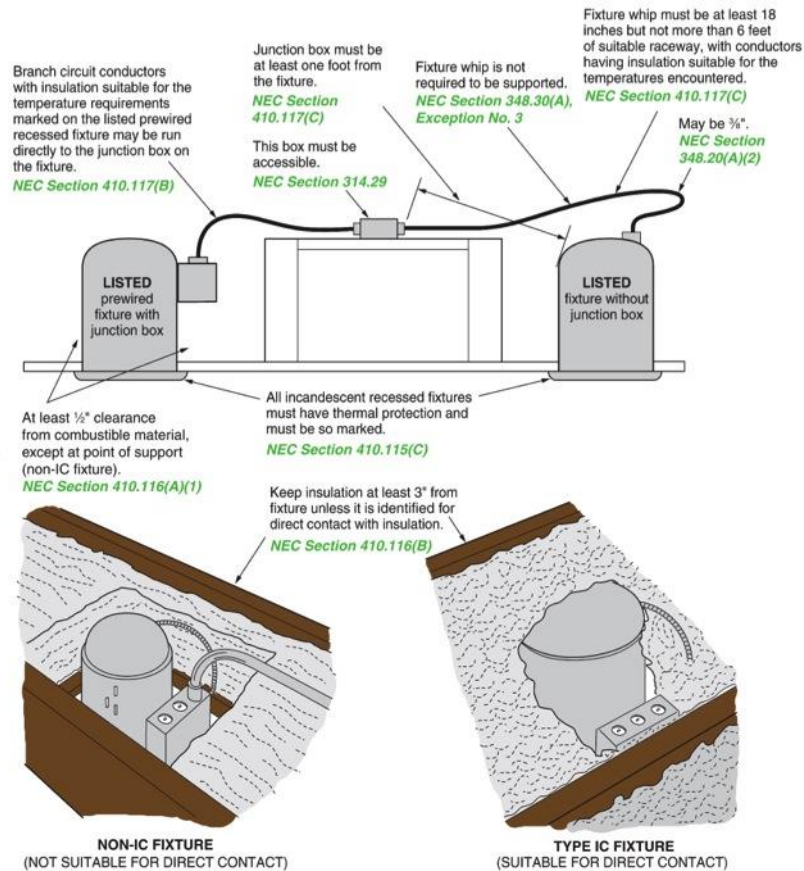
- Outdoor lighting fixtures must be listed for such use and provide watertight connections.
- Special washers and gaskets must be installed to protect the wiring within the fixture.



26203-14_F39.EPS

7.1.5

Mechanical Installation of Recessed Lighting Fixtures



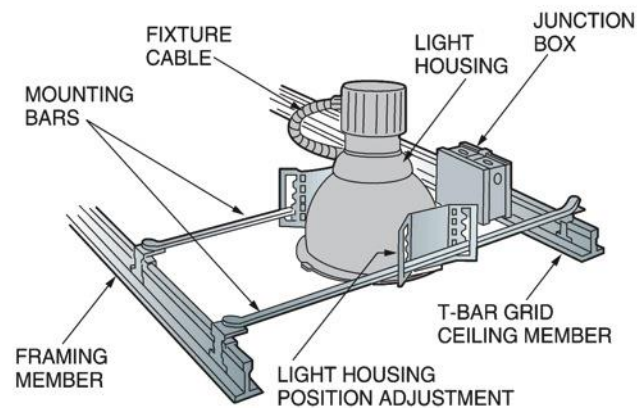
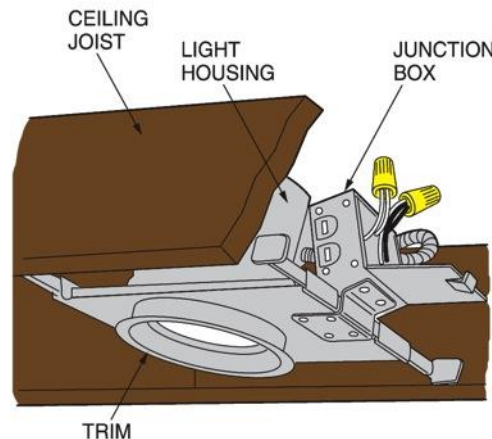
26203-14_F40_EPS



7.2.1

Incandescent, Compact Fluorescent, and HID Recessed Fixtures

- Recessed fixtures typically include bar hangers for attachment to wooden joists or suspended ceiling members.
- Always use the trim supplied with a given fixture. Mismatching may result in a fire hazard and is prohibited by the *NEC*[®].

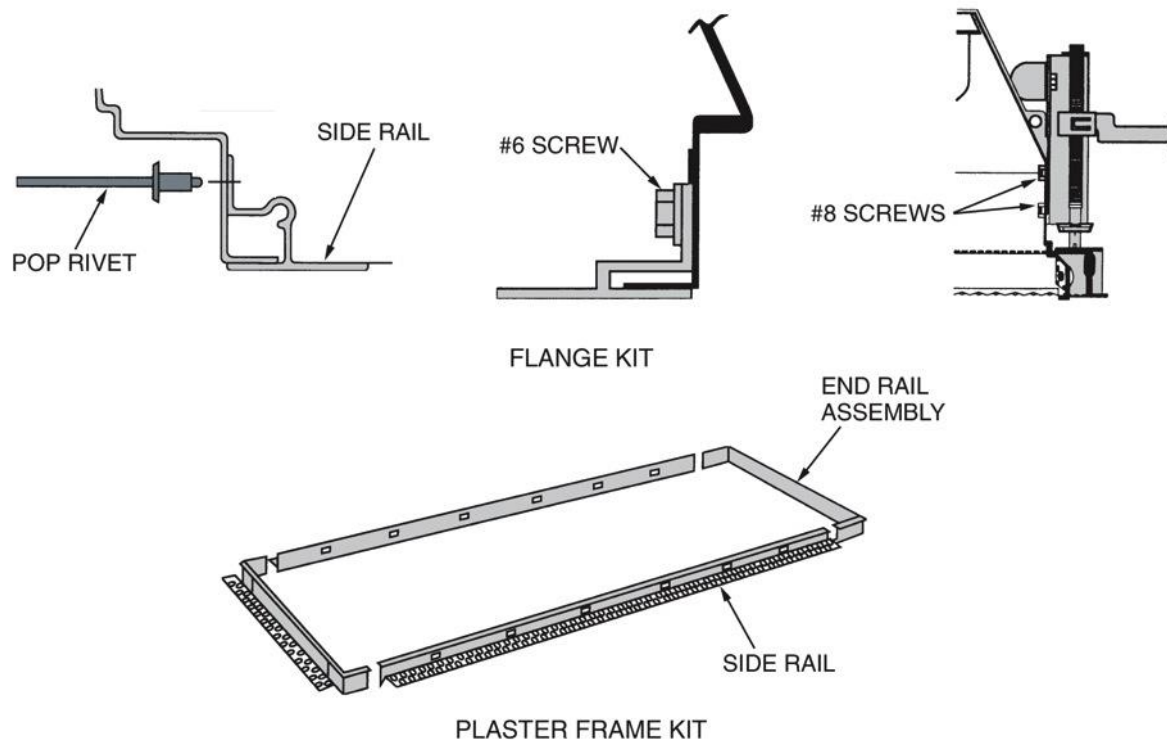


26203-14_F41.EPS

7.2.2

Fluorescent Troffers

Fluorescent troffers are installed using plaster frame kits or flange kits used to trim out a ceiling opening.



26203-14_F42.EPS

7.2.2

What's wrong with this picture?

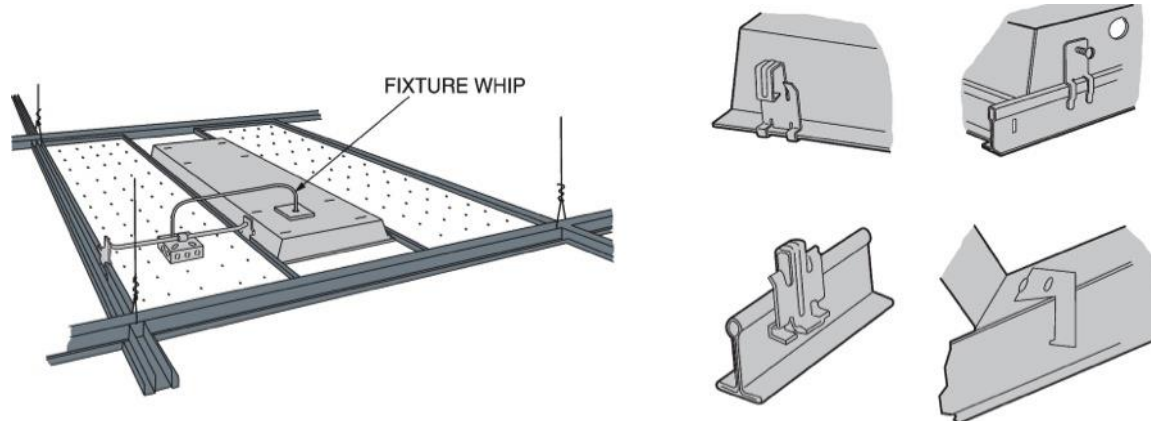


26203-14_SA05.EPS

7.2.2

Typical Clips Used to Fasten Lay-In Troffers to Suspended Ceiling Grid Systems

- All lighting fixtures must be securely fastened to the main ceiling framing members using bolts, screws, rivets, or listed clips.
- A variety of locking clips are used to secure lay-in troffers to suspended ceiling grid systems.

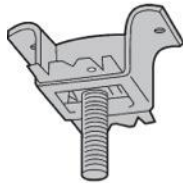


26203-14_F43.EPS

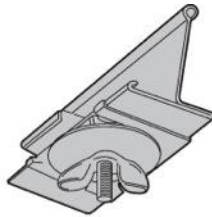
7.3.0

Mechanical Installation of Suspended Lighting Fixtures

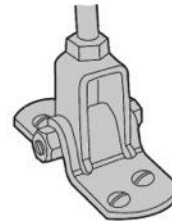
A variety of hangers and rods are used to secure suspended fixtures to the building ceiling or beam structure.



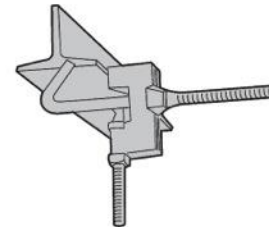
CONCRETE
INSERT



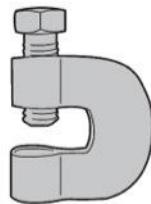
T-BAR CLIP



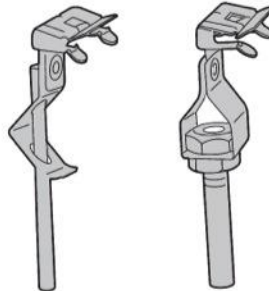
ADJUSTABLE
SWING HANGER



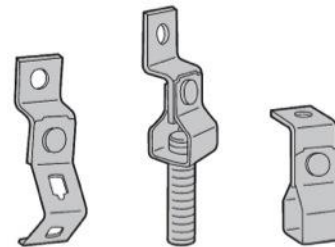
I-BEAM CLIP



BEAM CLAMP



FLANGE HANGERS



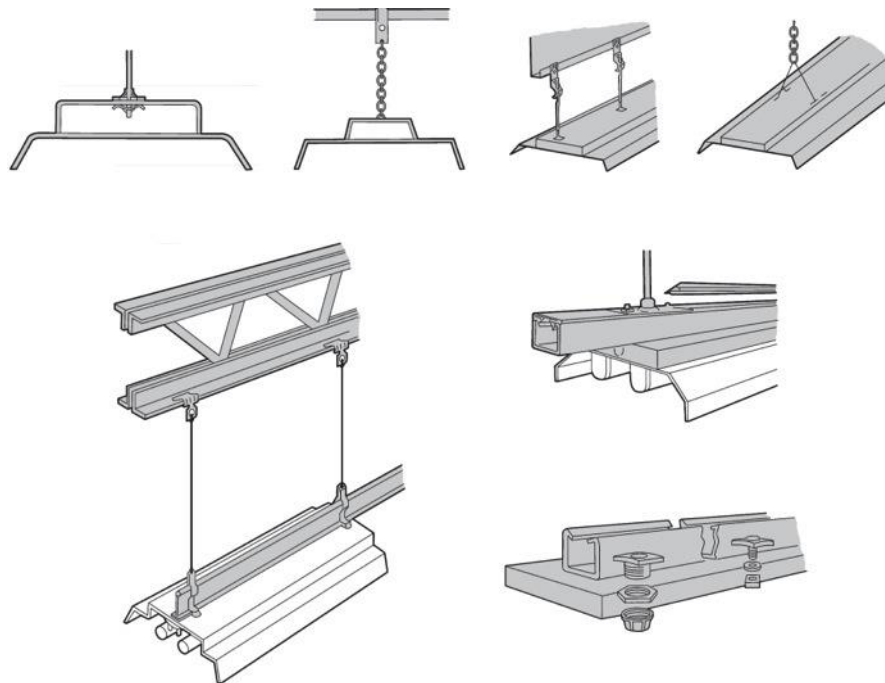
FLAT SURFACE HANGERS

26203-14_F44.EPS

7.3.0

Typical Methods of Support for Suspended Fluorescent Fixtures

Fluorescent fixtures can be suspended at the desired height using supporting rods, cables, or chains.

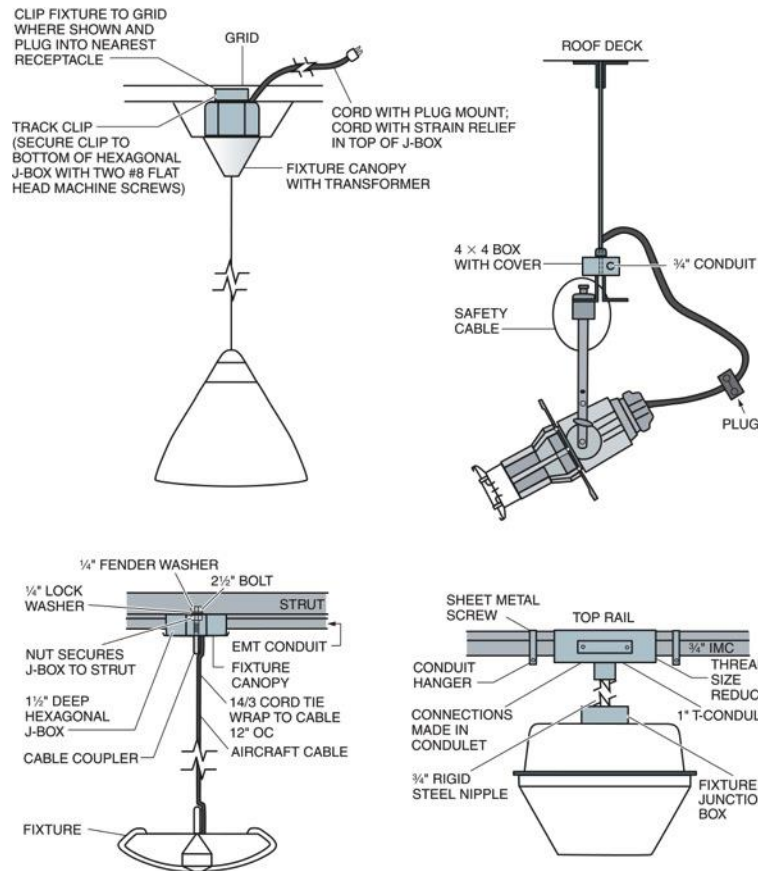


26203-14_F45.EPS



7.3.0

Examples of Fixture Supports for Commercial/Industrial Applications



26203-14_F46.EPS

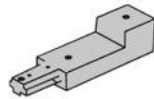


7.4.0

Mechanical Installation of Track Lighting Fixtures



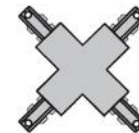
END POWER FEED



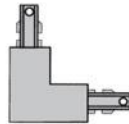
END POWER FEED WITH CONDUIT FILTER



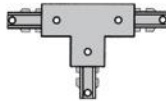
STRAIGHT CONNECTOR WITH POWER ENTRY



X CONNECTOR WITH POWER ENTRY



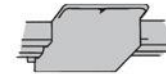
L CONNECTOR, RIGHT TURN



T CONNECTOR, RIGHT TURN



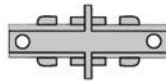
CORD AND PLUG SET



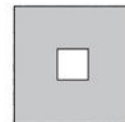
FLOATING POWER FEED FOR ENTRY ANYWHERE ALONG TRACK RAIL



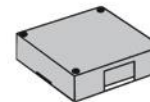
FLEX CONNECTOR CONNECTS TRACK AT ANY ANGLE WITH POWER ENTRY



STRAIGHT CONNECTOR



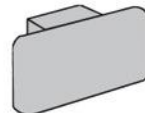
CANOPY KIT; OUTLET BOX COVER



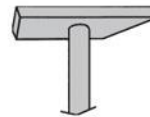
POWER FEED COVER FOR SUSPENDED CEILING



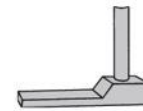
CANOPY ADAPTER MOUNTS TO OUTLET BOX



DEAD END CAP



PENDANT ASSEMBLY



WIRE COVER FOR POWER FEED THROUGH PENDANT ASSEMBLY

26203-14_F47_EPS



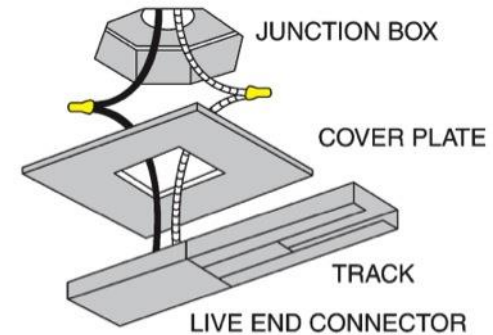
7.4.0

Typical End Feed and Floating Canopy Track Connectors

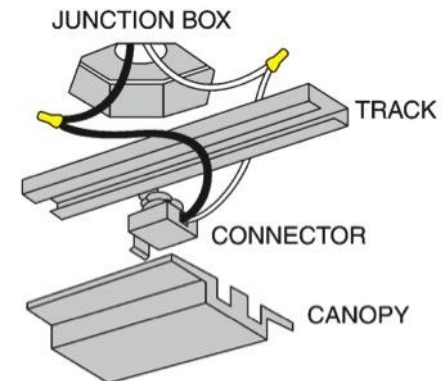
- Track lighting must be capable of supporting the maximum number of fixtures that can be installed.
- Track must be supported at a minimum of two points if less than four feet in length and at the manufacturer-specified intervals for longer lengths.

Performance Task

This session will conclude with trainees installing various fixtures and their associated lamps.



END FEED



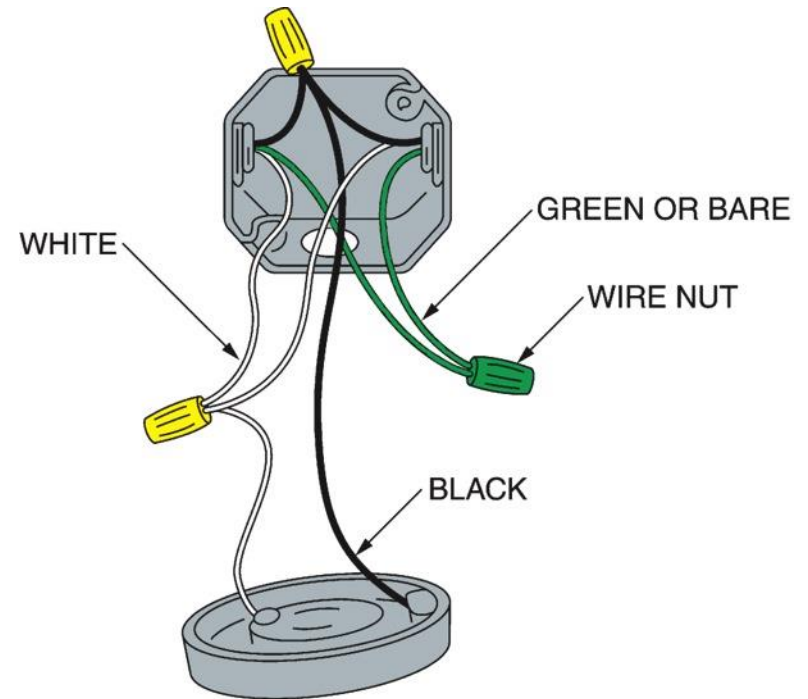
FLOATING CANOPY

26203-14_F48.EPS

7.5.0 – 7.5.1

Electrical Connection of Lighting Fixtures

- **NEC Section 300.14** requires at least six inches of free conductor length at each outlet or junction box where it emerges from its cable sheath or raceway.
- When connecting a fixture, connect the bare grounding wire to one end of a grounding jumper and the other end to the box using a grounding clip or the box grounding screw.

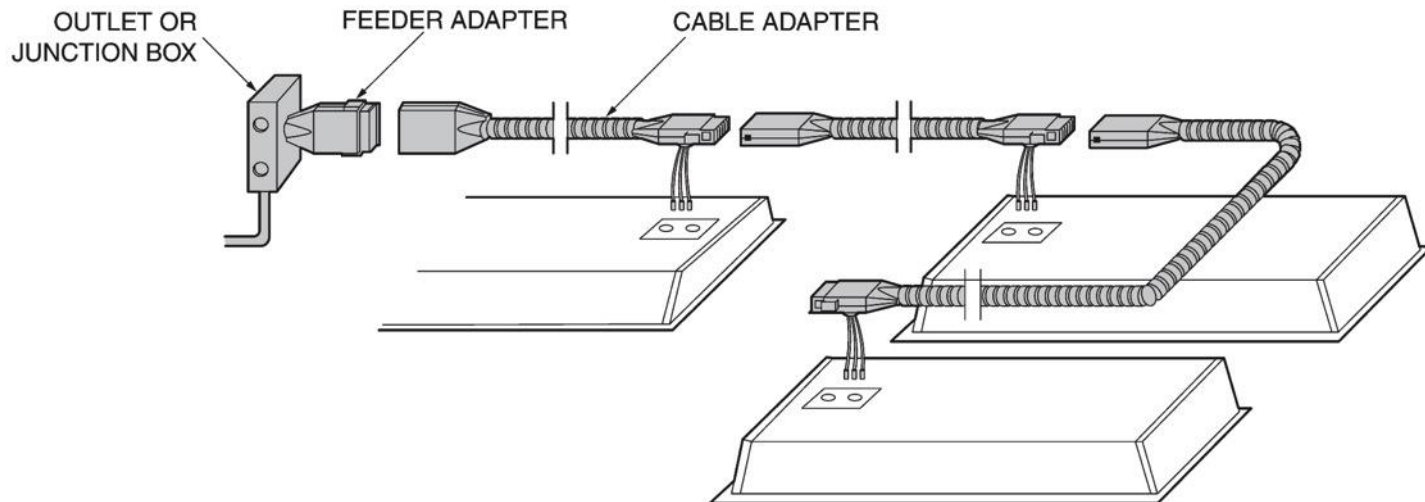


26203-14_F49.EPS

7.5.2

Modular System Wiring

- Modular wiring systems offer an alternative to conventional hard wiring.
- An outlet or junction box is installed as the starting point and a feeder adapter is wired or mounted in place. The rest of the wiring is installed using connectors.



26203-14_F50.EPS

Controls for Lighting



(A) INDOOR WALL SWITCH SENSOR



(B) OUTDOOR SENSOR



(C) ULTRASONIC CEILING SENSOR



(D) INFRARED CEILING SENSOR

26203-14_F51.EPS

- Lighting controls can be installed to conserve energy and include occupancy sensors, photosensors, and timing devices.
- Occupancy sensors are used to automatically turn lights on/off in response to motion, heat, or sound. A typical application is a wall switch sensor used to turn on restroom lights when the room is occupied.

8.2.0

Photosensors

- Photosensors are commonly used in outdoor lighting to turn lights on at dusk.
- Some units include infrared sensors for use as motion detectors.



8.3.0

Timers

- Timers are used to turn lights on in response to scheduled sequences of events.
- Units range from simple clock timers used with holiday lighting to complex programmable models for multiple switching operations.



(A) BASIC ELECTROMECHANICAL



(B) SIMPLE ELECTRONIC



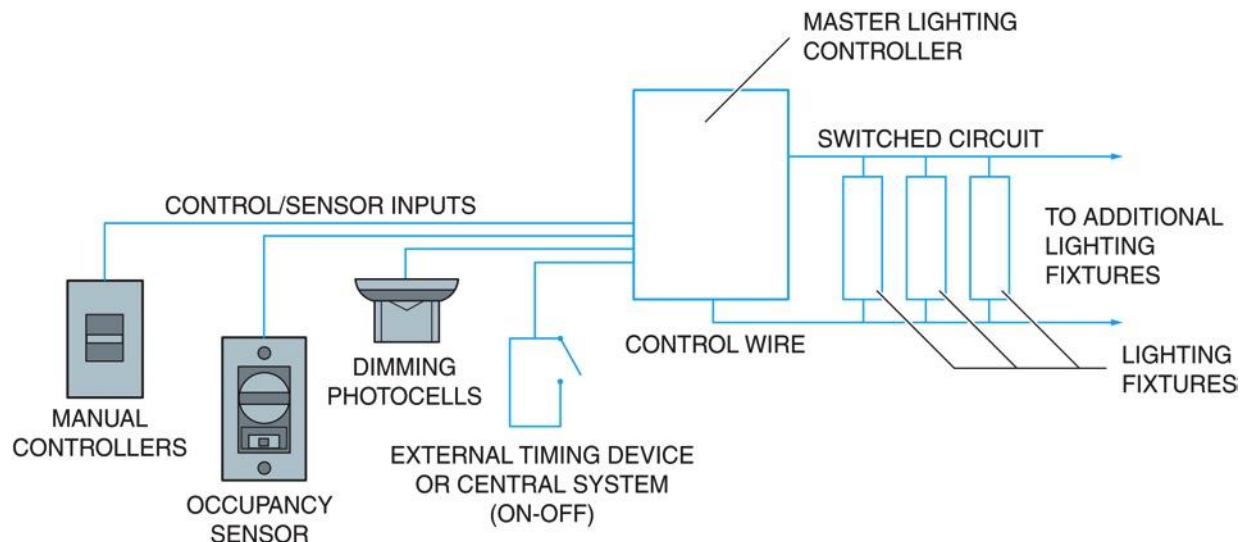
(C) MULTI-FUNCTION PROGRAMMABLE

26203-14_F53.EPS

9.0.0

Energy Management Systems

- Energy management systems can be programmed to provide both lighting and HVAC equipment control.
- An EMS typically contains a computer or control processor, scheduling software, sensors, and a communication system.

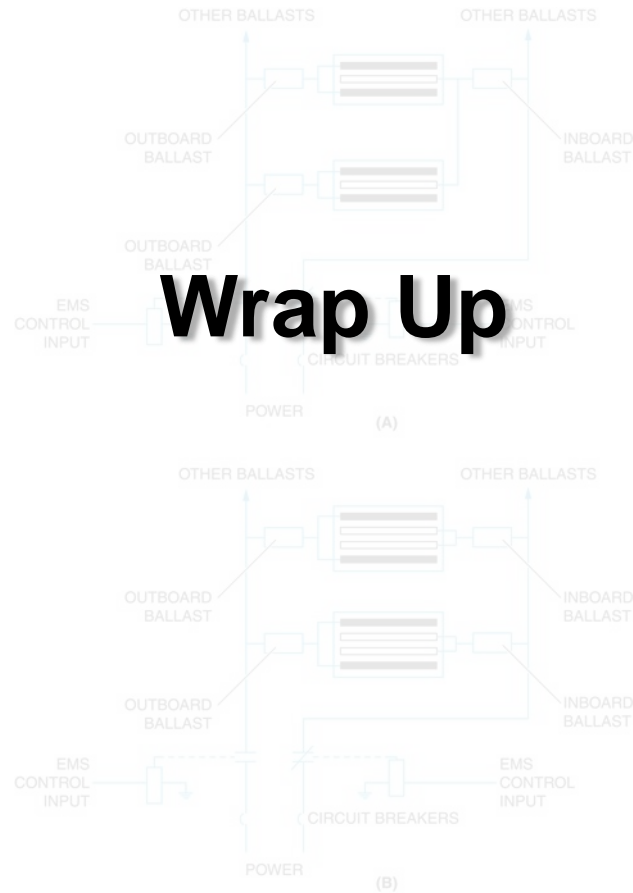


26203-14_F54.EPS



9.0.0

Next Session... Wiring Diagrams of Relay-Controlled Lighting Fixture Circuits



20203-14_F55.EPS



Wrap Up

3-2-1

- 3 – Write 3 important things learned during class
- 2 – Write 2 questions you have about the material
- 1 – Write 1 thought you had about the material



Next Session...

MODULE EXAM

Review the complete module to prepare for the module exam. Complete the Module Review as a study aid.

