

Electrical Level 1



Basic Electrical Construction Drawings 26110-14



Objectives

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

1. Explain the basic layout of a set of construction drawings.
2. Describe the information included in the title block of a construction drawing.
3. Identify the types of lines used on construction drawings.
4. Using an architect's scale, state the actual dimensions of a given drawing component.
5. Interpret electrical drawings, including site plans, floor plans, and detail drawings.
6. Interpret equipment schedules found on electrical drawings.
7. Describe the type of information included in electrical specifications.



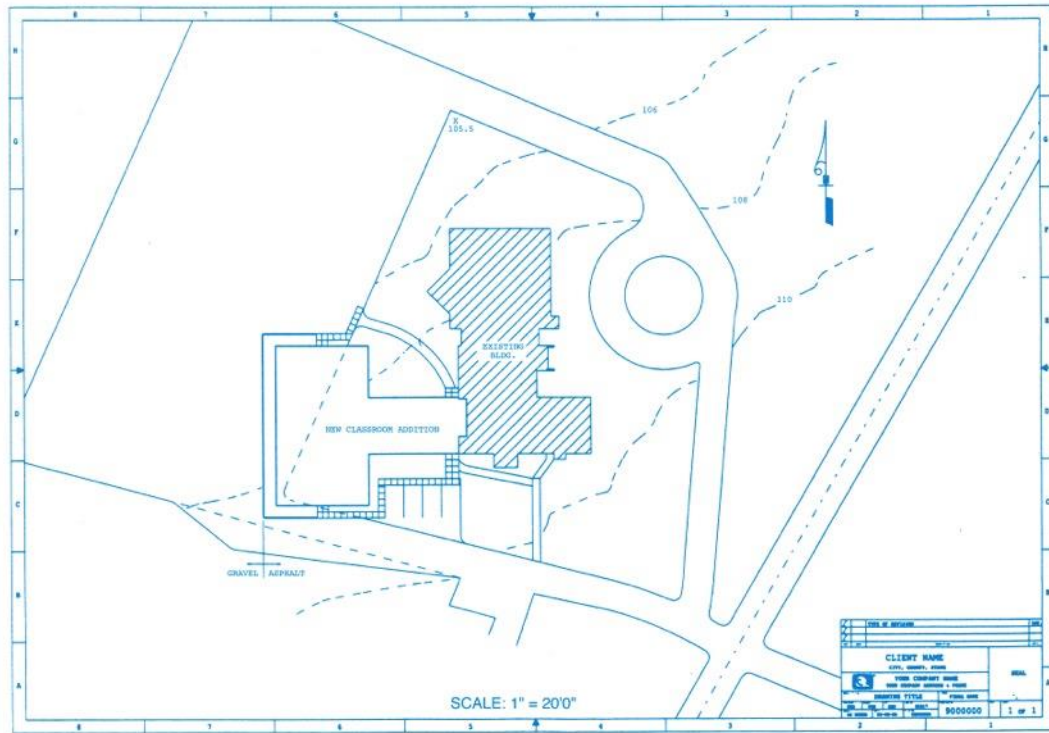
Performance Tasks

1. Using an architect's scale, state the actual dimensions of a given drawing component.
2. Make a material takeoff of the lighting fixtures specified in Performance Profile Sheet 2 using the drawing provided on Performance Profile Sheet 3. The takeoff requires that all lighting fixtures be counted, and where applicable, the total number of lamps for each fixture type must be calculated.



1.0.0 – 1.1.0

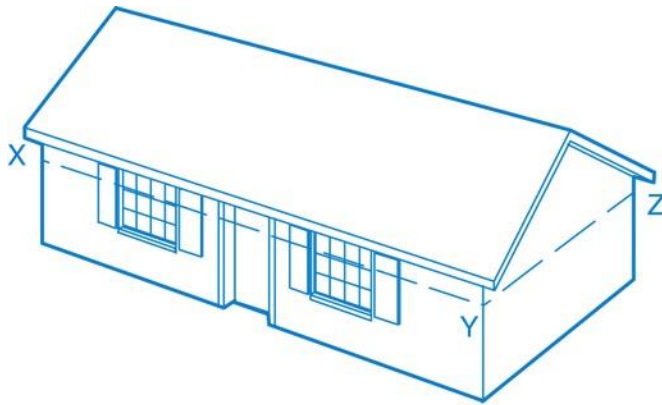
Introduction to Construction Drawings



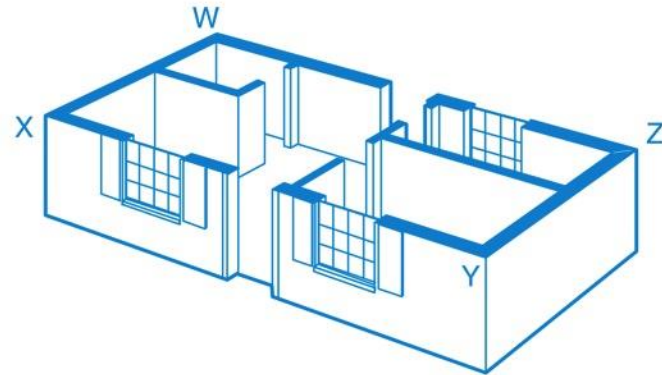
Working drawings include site plans, floor plans, detail drawings, and elevations. A site plan shows the location of the building on the property.

1.2.0

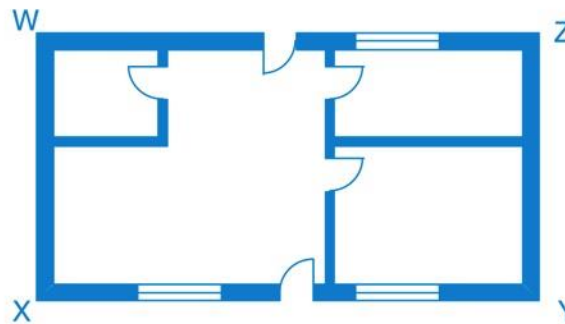
Floor Plans



PERSPECTIVE VIEW SHOWING SECTION CUTS



TOP HALF OF SECTION REMOVED

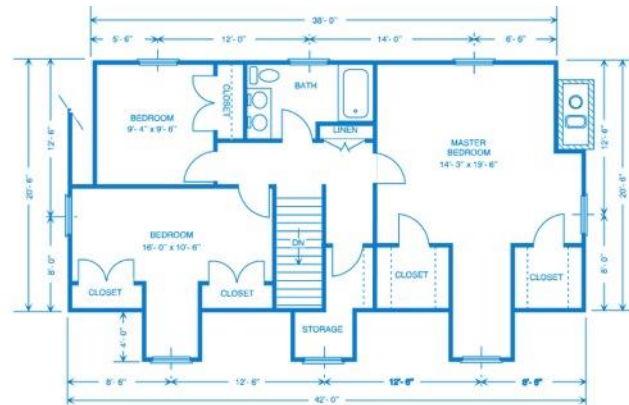


RESULTING FLOOR PLAN IS WHAT THE REMAINING
STRUCTURE LOOKS LIKE WHEN VIEWED FROM ABOVE

26110-14_F02.EPS

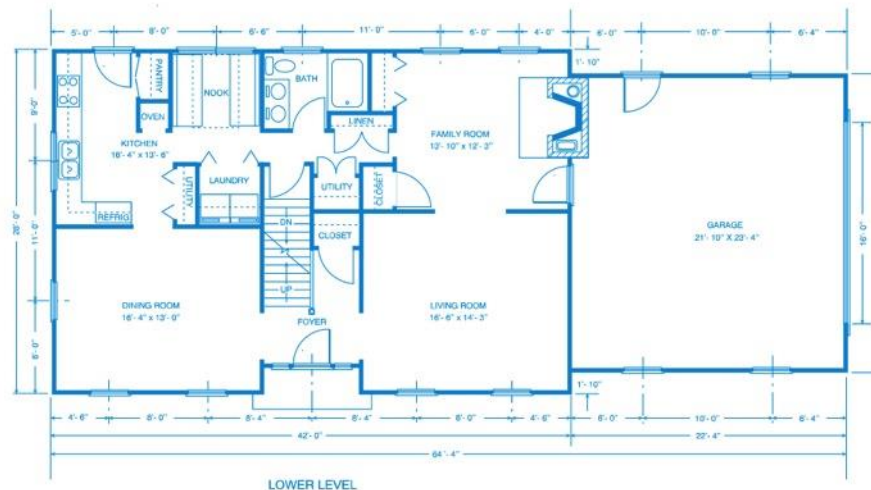
1.2.0

Floor Plans of a Building



FLOOR PLAN

UPPER LEVEL



LOWER LEVEL

26110-14_F03.EPS



1.3.0

Elevations



FRONT ELEVATION



REAR ELEVATION

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1.3.0

Left and Right Elevations



LEFT ELEVATION

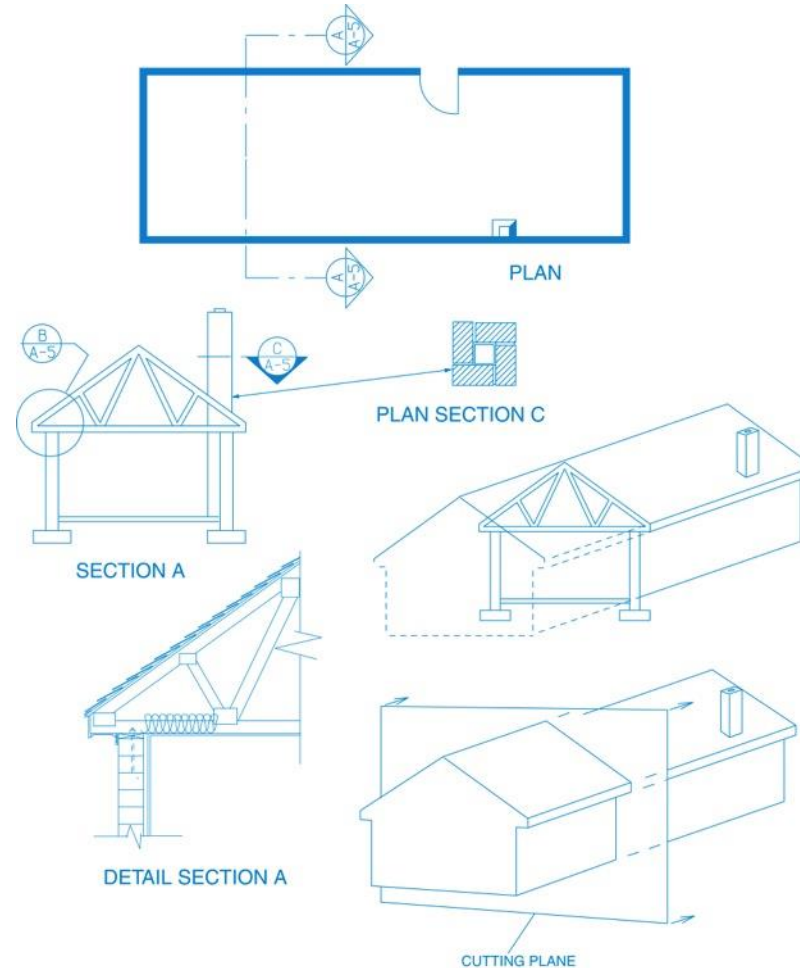


RIGHT ELEVATION

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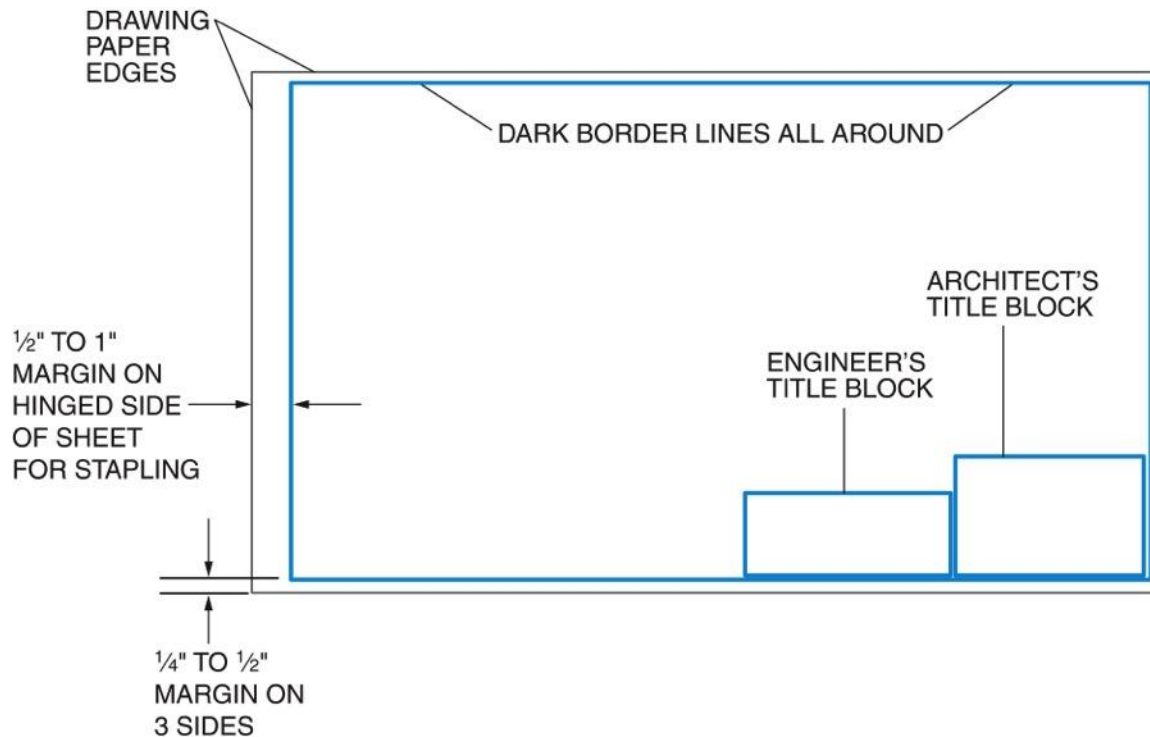
1.4.0 – 1.5.0

Sections; Electrical Drawings



2.0.0

Drawing Layout




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Drawing sets vary according to the preparer, but most sets include a title block. Some may also include a revision block and approval block.

2.1.0

Title Block

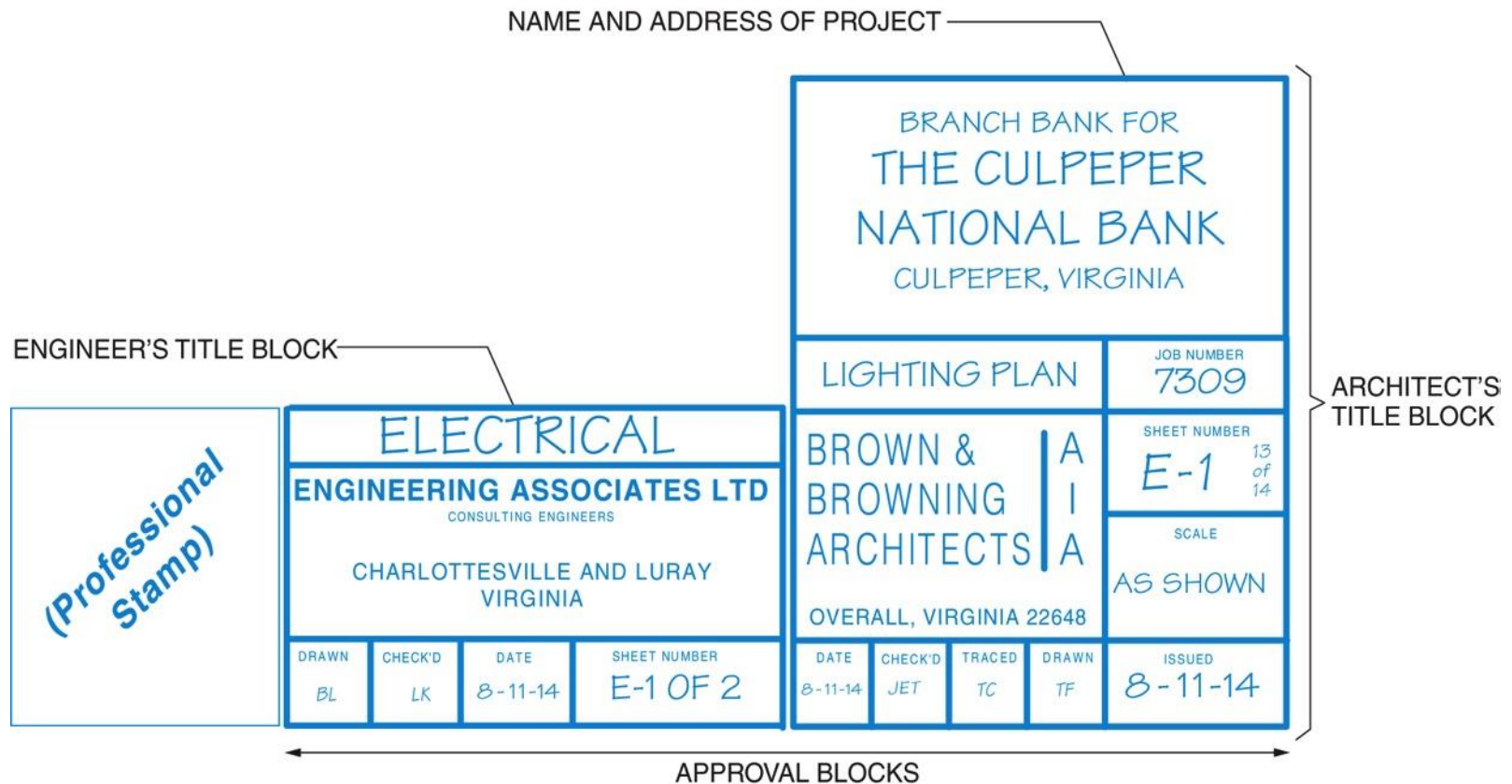
 <i>Professional Stamp</i>	ELECTRICAL				SCALE AS SHOWN
	DISTRICT HOME LAUNDRY BUILDING AUGUSTA COUNTY, VIRGINIA				
	G. LEWIS CRAIG, ARCHITECT WAYNESBORO, VIRGINIA				SHEET NO.
	COMM. NO. 7215	DATE 8/11/14	DRAWN GK	CHECKED GLC	REVISED
					E-1

26110-14_F08.EPS

- The title block is usually found in the lower right corner of the sheet. It includes identifying information such as the project name and location, owner, architectural firm, and job number.
- The title block also contains the scale of the drawing and sheet number.

2.1.0

Title Blocks



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2.2.0

Approval Block

COMM. NO.	DATE	DRAWN	CHECKED	REVISED
7215	8/11/14	GK	GLC	


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The approval block may contain an official stamp along with the initials of the drafter, design supervisor, owner, and architect.



2.2.0

Alternate Approval Block

 <p>PROFESSIONAL STAMP</p>	DESIGN SUPERVISOR	DATE
	DRAWN	DATE
	CHECKED	DATE
	APPROVED	DATE
	OWNER'S APPROVAL	DATE

26110-14_F11.EPS


2.3.0

Revision Block

When a drawing must be revised during construction, all revisions must be noted on the working drawings.

REVISIONS

9/5/14 - REVISED LIGHTING FIXTURE
NO. 3 IN. LIGHTING FIXTURE SCHEDULE

 Professional Stamp	ELECTRICAL				
	DISTRICT HOME LAUNDRY BUILDING AUGUSTA COUNTY, VIRGINIA				
	G. LEWIS CRAIG, ARCHITECT WAYNESBORO, VIRGINIA				SHEET NO. E-1
	COMM. NO. 7215	DATE 8/11/14	DRAWN GK	CHECKED GLC	REVISED TF

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2.3.0

Alternate Method of Showing Revisions on Working Drawings

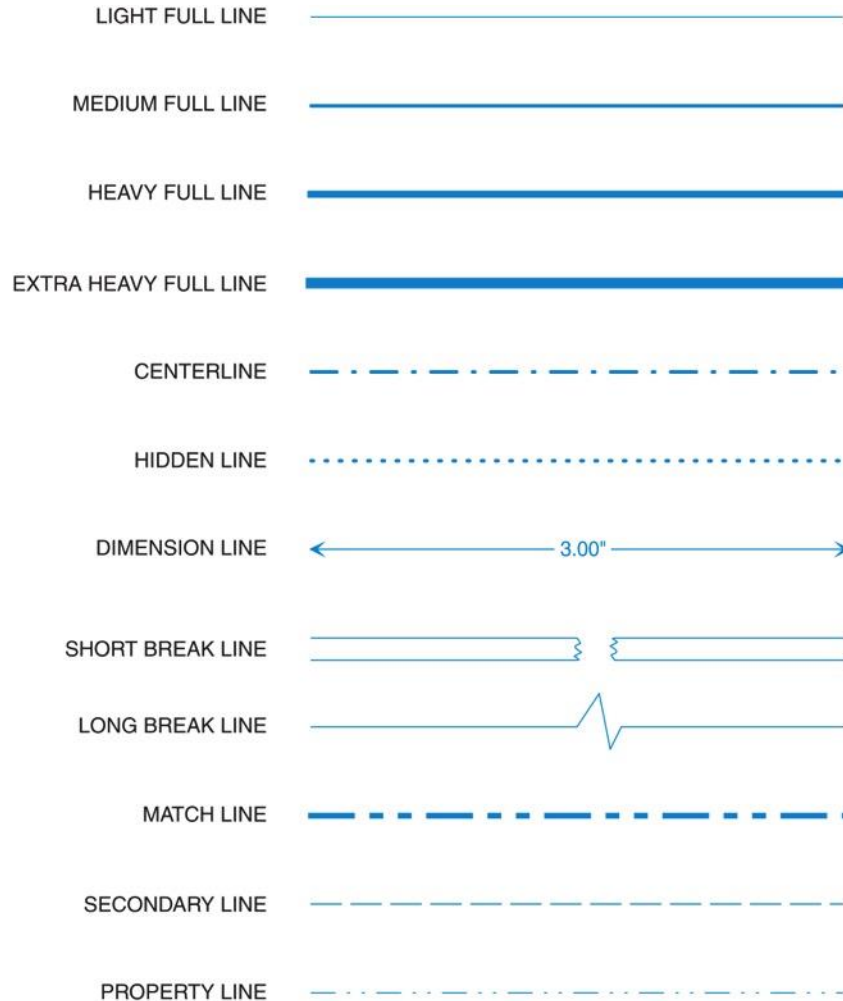
REVISIONS				
REV	DESCRIPTION	DR	APPD	DATE
1	FIXTURE NO. 3 IN. LIGHTING-FIXTURE SCHDL	GK	GLC	9/5/14

 Professional Stamp	ELECTRICAL				
	DISTRICT HOME LAUNDRY BUILDING AUGUSTA COUNTY, VIRGINIA				
	G. LEWIS CRAIG, ARCHITECT WAYNESBORO, VIRGINIA				
	COMM. NO. 7215	DATE 8/11/14	DRAWN GK	CHECKED GLC	REVISED TF
	SHEET NO.				E-1

26110-14_F13.EPS



3.0.0

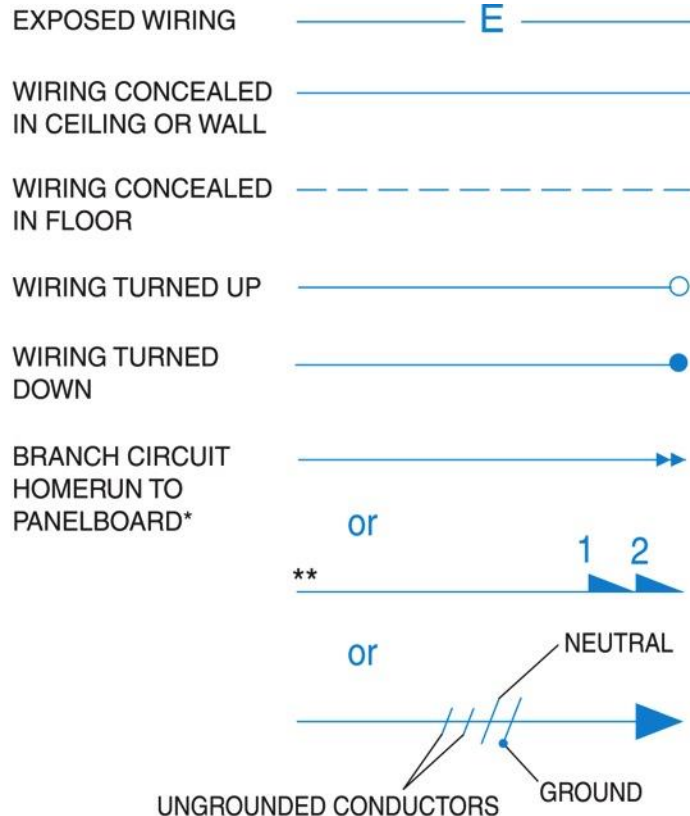


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Drafting Lines

- Each line on a drawing has a specific meaning.
- Lines may vary from drawing to drawing. Always consult the legend or symbol list.

3.1.0



* Number of arrowheads indicates number of circuits. A number at each arrowhead may be used to identify circuit numbers.

** Half arrowheads are sometimes used for homeruns to avoid confusing them with drawing callouts.

26110-14_F15.EPS

Electrical Drafting Lines

- Electrical circuits and their components are also shown using lines.
- Each drawing should include a symbol list or legend to identify the types of lines.

Electrical Symbols

SWITCH OUTLETS Single-Pole Switch Double-Pole Switch Three-Way Switch Four-Way Switch Key-Operated Switch Switch w/Pilot Low-Voltage Switch Switch & Single Receptacle Switch & Duplex Receptacle Door Switch Momentary Contact Switch	 	LIGHTING OUTLETS Surface Fixture Surface Fixt. w/Pull Chain Recessed Fixture Surface or Pendant Fluorescent Fixture Recessed Fluor. Fixture Surface or Pendant Continuous Row Fluor. Fixtures Recessed Continuous Row Fluorescent Fixtures	
RECEPTACLE OUTLETS Single Receptacle Duplex Receptacle Triplex Receptacle Split-Wired Duplex Recep. Single Special Purpose Recep. Duplex Special Purpose Recep. Range Receptacle Special Purpose Connection or Provision for Connection. Sub- script letters indicate Function (DW - Dishwasher; CD - Clothes Dryer, etc.) Clock Receptacle w/Hanger Fan Receptacle w/Hanger Single Floor Receptacle	 	CIRCUITING Wiring Concealed in Ceiling or Wall Wiring Concealed in Floor Wiring Exposed Branch Circuit Homerun to Panelboard. Number of arrows indicates number of circuits in run. Note: Any circuit without further identification is 2-wire. A greater number of wires is indicated by cross lines as shown below. Wire size is sometimes shown with numerals placed above or below cross lines.	

Note: A numeral or letter within the symbol or as a subscript keyed to the list of symbols indicates type of receptacle or usage.

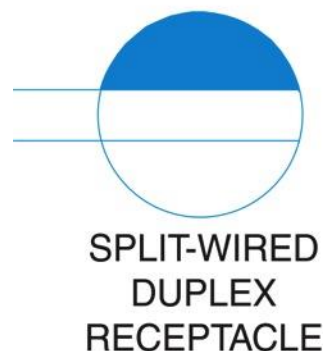
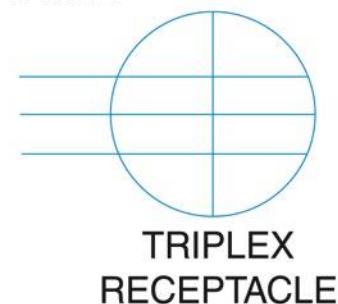
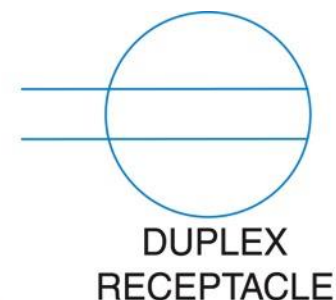
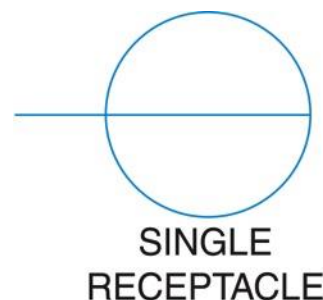
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4.0.0

Various Receptacle Symbols Used on Electrical Drawings

- Receptacles are shown using the basic form of a circle, with one or more lines crossing it to indicate whether it is a single, duplex, or triplex type.
- Split-wired receptacles are shown with the upper half of the circle filled in.
- Range receptacles are marked with the letter R.

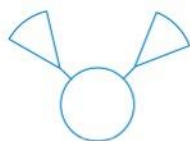


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4.0.0

General Types of Symbols Used on Electrical Drawings

Some electrical symbols are simply shapes, while others include abbreviations within or near the shape to indicate additional information, such as a specific type of fixture or device.



DOUBLE FLOODLIGHT FIXTURE



INFRARED ELECTRIC HEATER
WITH TWO QUARTZ LAMPS



FUSIBLE SAFETY SWITCH



NON-FUSIBLE SAFETY SWITCH

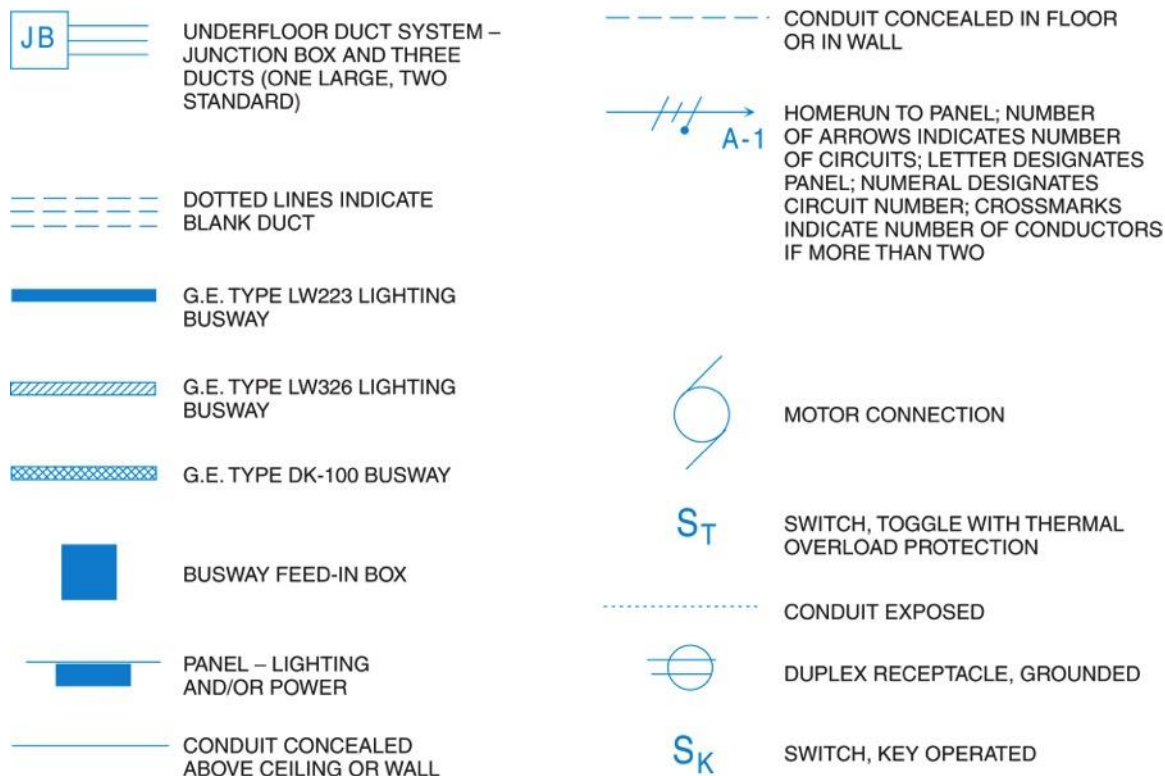


DOUBLE-THROW SAFETY SWITCH

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4.0.0

Electrical Symbols Used by One Consulting Engineering Firm



While symbols are slowly being standardized, each architectural or engineering firm may develop its own set of symbols.

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4.0.0

Recommended Electrical Symbols

SWITCH OUTLETS		RECEPTACLE OUTLETS	
Single Pole Switch	S	Where weatherproof, explosionproof, or other specific types of devices are to be required, use the upper-case subscript letters to specify. For example, weatherproof single or duplex receptacles would have the upper-case WP subscript letters noted alongside the symbol. All outlets must be grounded.	
Double Pole Switch	S ₂		
Three-Way Switch	S ₃		
Four-Way Switch	S ₄		
Key-Operated Switch	S _K		
Switch and Fusestat Holder	S _{FH}	Single Receptacle Outlet	
Switch and Pilot Lamp	S _P	Duplex Receptacle Outlet	
Fan Switch	S _F	Triplex Receptacle Outlet	
Switch for Low-Voltage Switching System	S _L	Quadruplex Receptacle Outlet	
Master Switch for Low-Voltage Switching System	S _{LM}	Duplex Receptacle Outlet Split Wired	
Switch and Single Receptacle	S	Triplex Receptacle Outlet Split Wired	
Switch and Duplex Receptacle	S	250-Volt Receptacle/Single Phase Use Subscript Letter to Indicate Function (DW - Dishwasher, RA - Range) or Numerals (with explanation in symbols schedule)	
Door Switch	S _D	250-Volt Receptacle/Three Phase	
Time Switch	S _T	Clock Receptacle	
Momentary Contact Switch	S _{MC}	Fan Receptacle	
Ceiling Pull Switch		Floor Single Receptacle Outlet	
Hand-Off-Auto Control Switch		Floor Duplex Receptacle Outlet	
Multi-Speed Control Switch		Floor Special-Purpose Outlet	
Pushbutton		Floor Telephone Outlet - Public	
		Floor Telephone Outlet - Private	

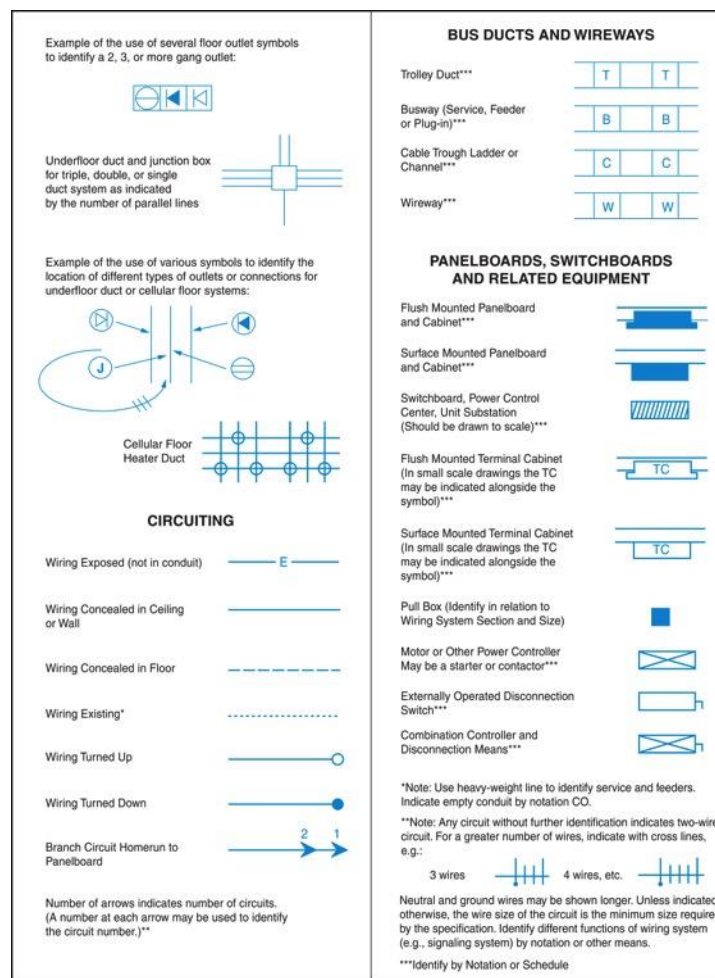
* Use numeral keyed explanation of symbol usage

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4.0.0

Recommended Electrical Symbols (Cont.)



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4.0.0

Recommended Electrical Symbols (Cont.)

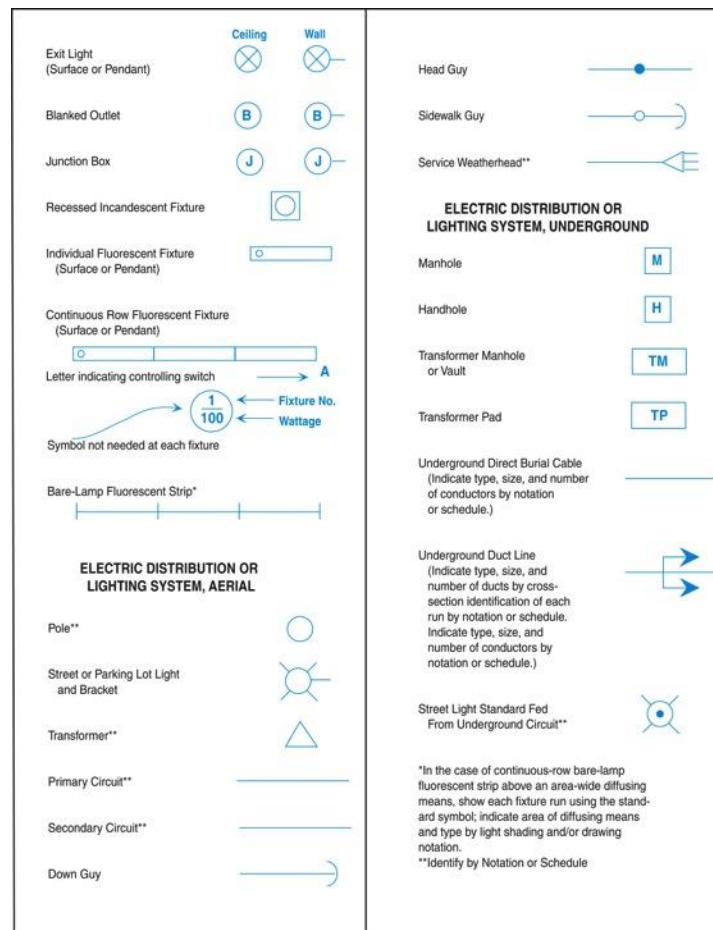
POWER EQUIPMENT		REMOTE CONTROL STATIONS FOR MOTORS OR OTHER EQUIPMENT	
Electric Motor (HP as Indicated)		Pushbutton Station	
Power Transformer		Float Switch - Mechanical	
Pothed (Cable Termination)		Limit Switch - Mechanical	
Circuit Element e.g., Circuit Breaker		Pneumatic Switch - Mechanical	
Circuit Breaker		Electric Eye - Beam Source	
Fusible Element		Electric Eye - Relay	
Single-Throw Knife Switch		Temperature Control Relay Connection (3 Denotes Quantity)	
Double-Throw Knife Switch		Solenoid Control Valve Connection	
Ground		Pressure Switch Connection	
Battery		Aquastat Connection	
Contactor		Vacuum Switch Connection	
Photoelectric Cell		Gas Solenoid Valve Connection	
Voltage Cycles, Phase	EX: 480/60/3	Flow Switch Connection	
Relay		Timer Connection	
Equipment Connection (as noted)		Limit Switch Connection	
		LIGHTING OUTLETS	
		Ceiling	Wall
		Incandescent Fixture (Surface or Pendant)	
		Incandescent Fixture with Pull Chain (Surface or Pendant)	

26110-14_F20C.EPS



4.0.0


























Recommended Electrical Symbols (Cont.)



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Recommended Electrical Symbols (Cont.)

SIGNALING SYSTEM OUTLETS	
INSTITUTIONAL, COMMERCIAL, AND INDUSTRIAL OCCUPANCIES	
I NURSE CALL SYSTEM DEVICES (Any Type)	
Basic Symbol	
(Examples of Individual Item Identification Not a Part of Standard)	
Nurses' Annunciator (Add a number after it as +① 24 to indicate number of lamps)	+① 
Call Station, Single Cord, Pilot Light	+② 
Call Station, Double Cord, Microphone Speaker	+③ 
Corridor Dome Light 1 Lamp	+④ 
Transformer	+⑤ 
Any Other Item On Same System Use Number As Required	+⑥ 
II PAGING SYSTEM DEVICES	
Basic Symbol	
(Examples of Individual Item Identification Not a Part of Standard)	
Keyboard	① 
Flush Annunciator	② 
2-Face Annunciator	③ 
Any Other Item On Same System Use Numbers As Required	④ 
III FIRE ALARM SYSTEM DEVICES (Any Type) Including Smoke and Sprinkler Alarm Devices	
Basic Symbol	
(Examples of Individual Item Identification, Not a Part of Standard)	
Control Panel	+1 
Station	+2 
10" Gong	+3 
Pre-Signal Chime	+4 
Any Other Item On Same System Use Numbers As Required	+5 
IV STAFF REGISTER SYSTEM DEVICES (Any Type)	
Basic Symbol	
(Examples of Individual Item Identification, Not a Part of Standard)	
Phone Operators' Register	① 
Entrance Register - Flush	② 
Staff Room Register	③ 
Transformer	④ 
Any Other Item On Same System Use Numbers As Required	⑤ 
V ELECTRIC CLOCK SYSTEM DEVICES (Any Type)	
Basic Symbol	
(Examples of Individual Item Identification, Not a Part of Standard)	

26110-14_F20E.EPS

Recommended Electrical Symbols (Cont.)

Master Clock	
12" Secondary - Flush	
12" Double Dial - Wall Mounted	
18" Skeleton Dial	
Any Other Item On Same System Use Numbers As Required	
VI PUBLIC TELEPHONE SYSTEM DEVICES	
Basic Symbol	
(Examples of Individual Item Identification. Not a Part of Standard)	
Switchboard	
Desk Phone	
Any Other Item On Same System Use Numbers As Required	
VII PRIVATE TELEPHONE SYSTEM DEVICES (Any Type)	
Basic Symbol	
(Examples of Individual Item Identification. Not a Part of Standard)	
Switchboard	
Wall Phone	
Any Other Item On Same System Use Numbers As Required	
VIII WATCHMAN SYSTEM DEVICES (Any Type)	
Basic Symbol	
(Examples of Individual Item Identification. Not a Part of Standard)	
Central Station	
Key Station	
Any Other Item On Same System Use Numbers As Required	
IX SOUND SYSTEM	
Basic Symbol	
(Examples of Individual Item Identification. Not a Part of Standard)	
Amplifier	
Microphone	
Interior Speaker	
Exterior Speaker	
Any Other Item On Same System Use Numbers As Required	
X OTHER SIGNAL SYSTEM DEVICES	
Basic Symbol	
(Examples of Individual Item Identification. Not a Part of Standard)	
Buzzer	
Bell	
Pushbutton	
Annunciator	
Any Other Item On Same System Use Numbers As Required	

26110-14_F20F.EPS

4.0.0

Recommended Electrical Symbols (Cont.)

RESIDENTIAL OCCUPANCIES

Signaling system symbols for use in identifying standardized residential-type signal system items on residential drawings where a descriptive symbol list is not included on the drawing. When other signal system items are to be identified, use the above basic symbols for such items together with a descriptive symbol list.

Pushbutton



Buzzer



Bell



Combination Bell - Buzzer



Chime



Annunciator



Electric Door Opener



Maid's Signal Plug



Interconnection Box



Bell-Ringing Transformer



Outside Telephone



Interconnecting Telephone



Television Outlet



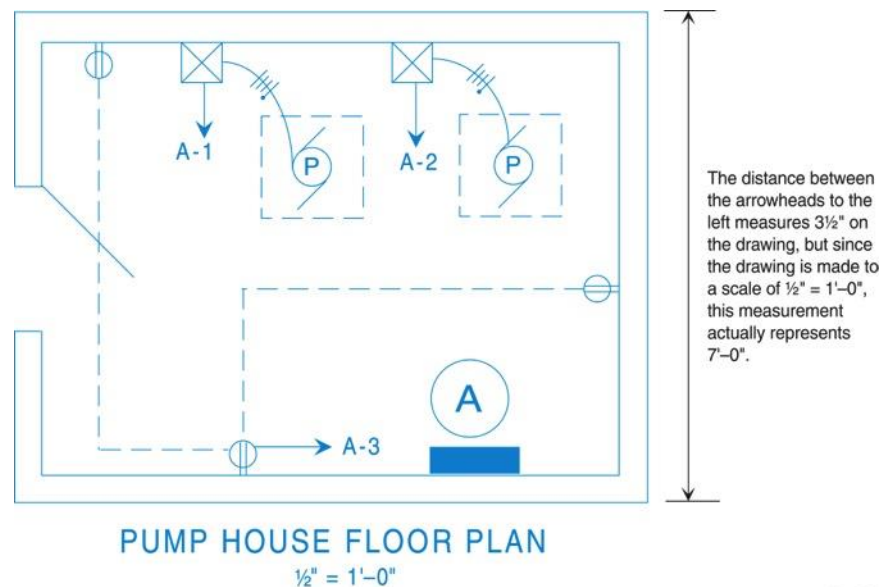
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5.0.0

Scale Drawings

- To use a scale drawing, note the dimension on the drawing and then convert it to the value of the scale.
- For example, if a drawing shows a scale of $\frac{1}{2}" = 1'-0"$, this means that every inch on the drawing represents two feet, so a drawing distance of 3" represents an actual dimension of 6'.



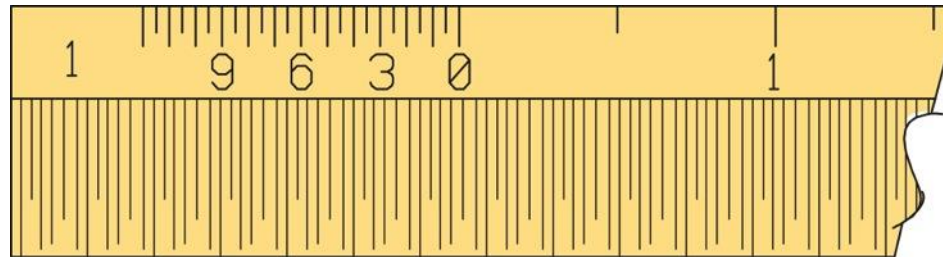
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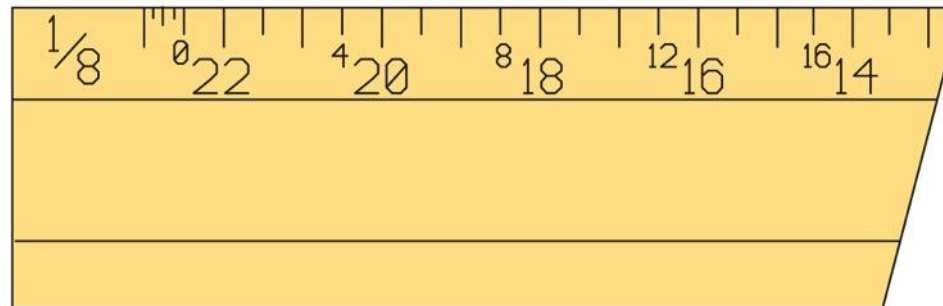
5.1.0

Architect's Scale

An architect's scale is a special ruler that is marked with various scales to simplify drawing dimensions.



1" = 1'-0"



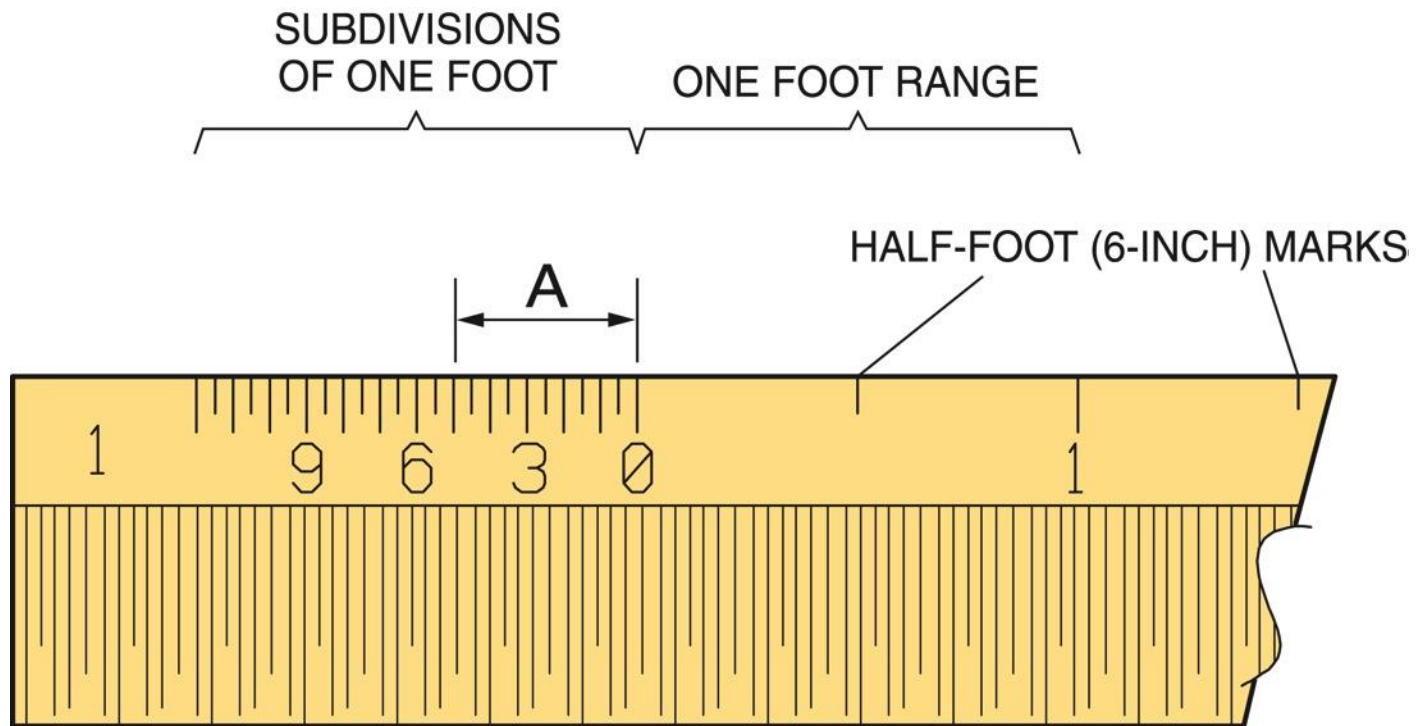
1/8" = 1'-0"

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5.1.0

One-Inch Architect's Scale

A one-inch architect's scale has a scale of 1" = 1'.

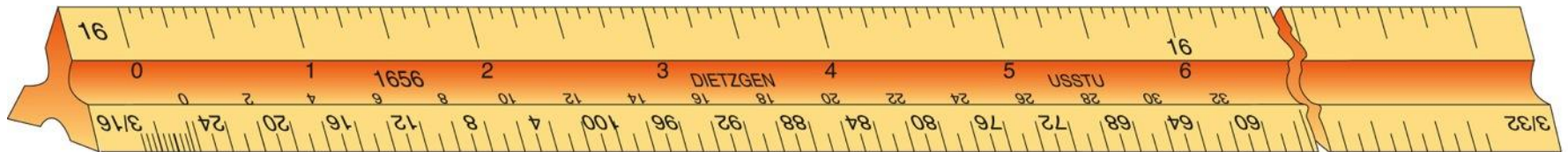


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5.1.1

Types of Architect's Scales

- Both flat and triangular architect's scales are available.
- Triangular architect's scales are marked with 12 different scales, one on each edge.



26110-14_F24.EPS

5.1.1

Various Scales on a Triangular Architect's Scale

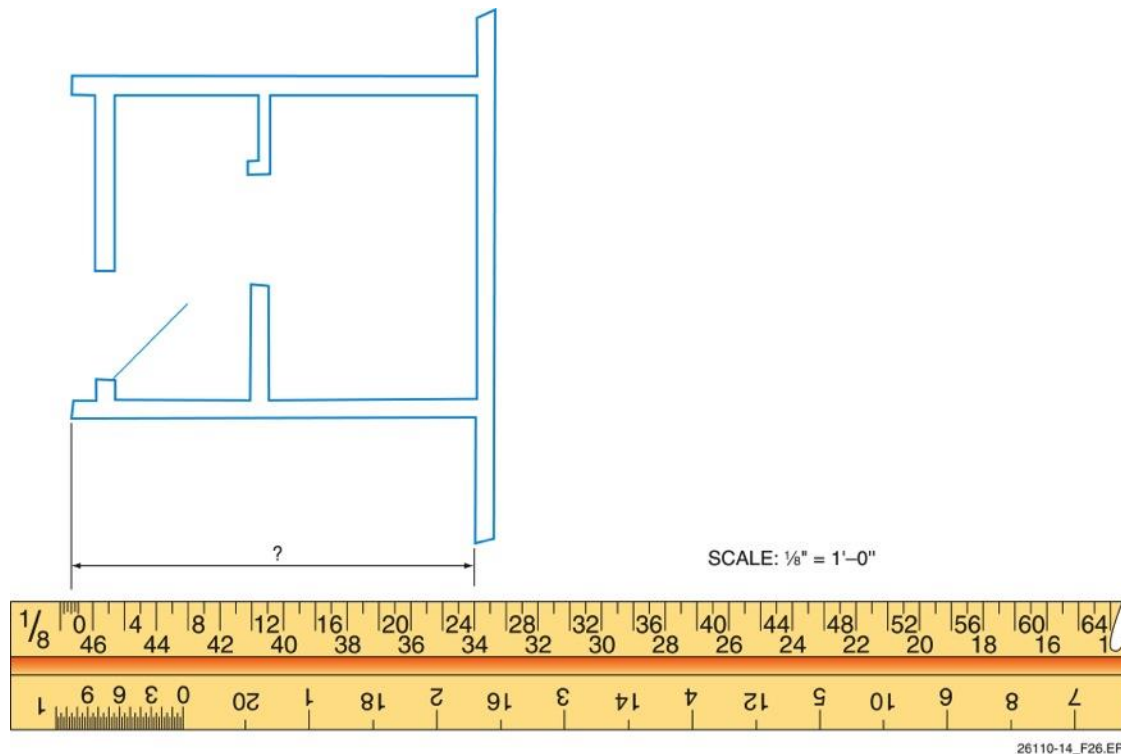


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5.1.1

Using the $\frac{1}{8}"$ Architect's Scale to Determine the Dimensions on a Drawing

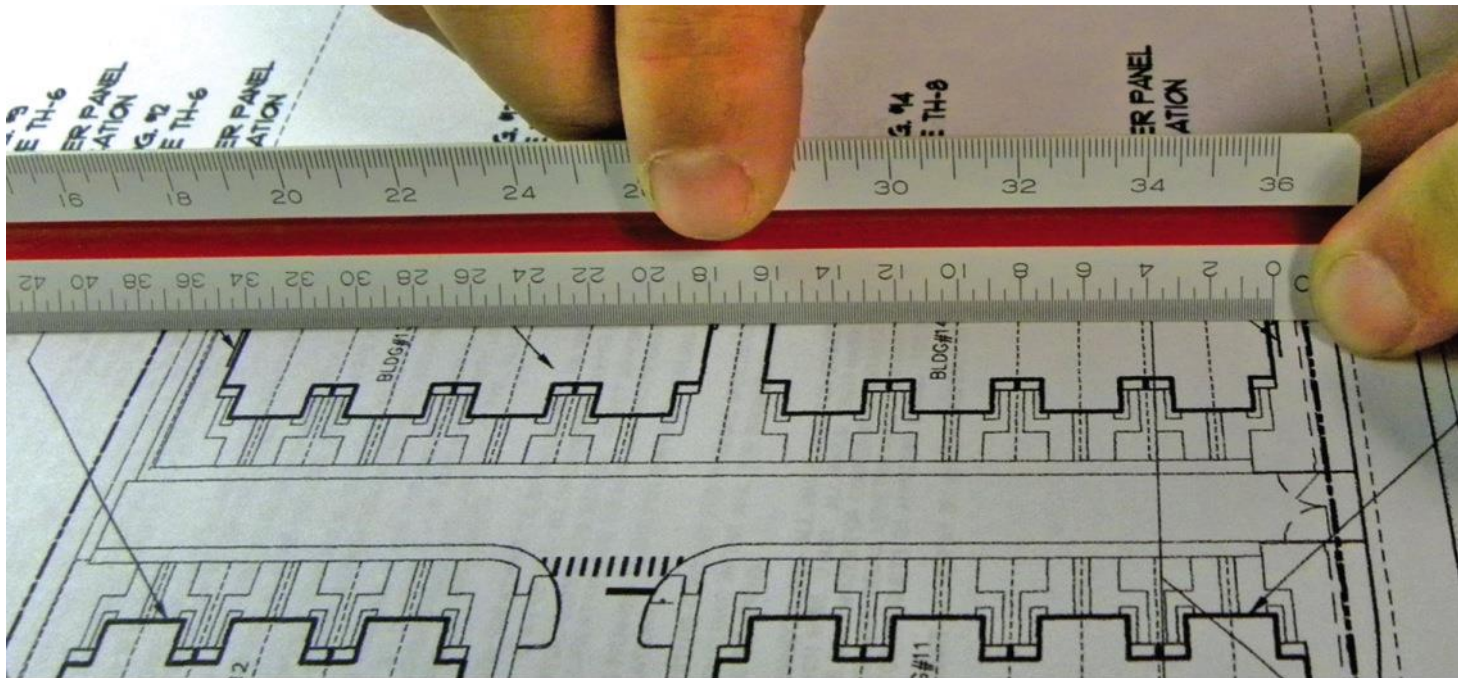
Using the $\frac{1}{8}"$ scale, the dimension shown here is 25'-6".



5.2.0

Engineer's Scale

Engineer's scales are similar to architect's scales except that dimensions are expressed in decimal units.

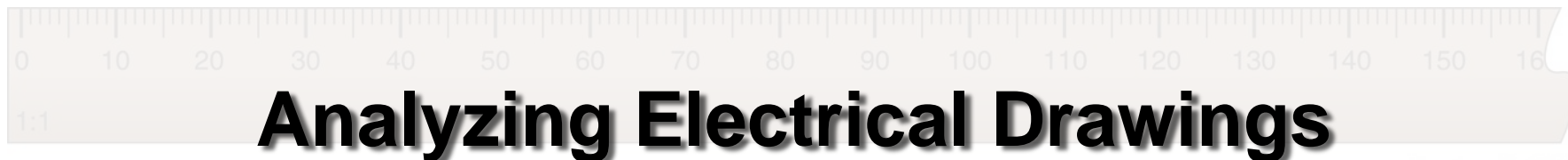


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5.3.0

Next Session... Metric Scale

Drawings prepared for US government or international use require a metric scale.



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Analyzing Electrical Drawings

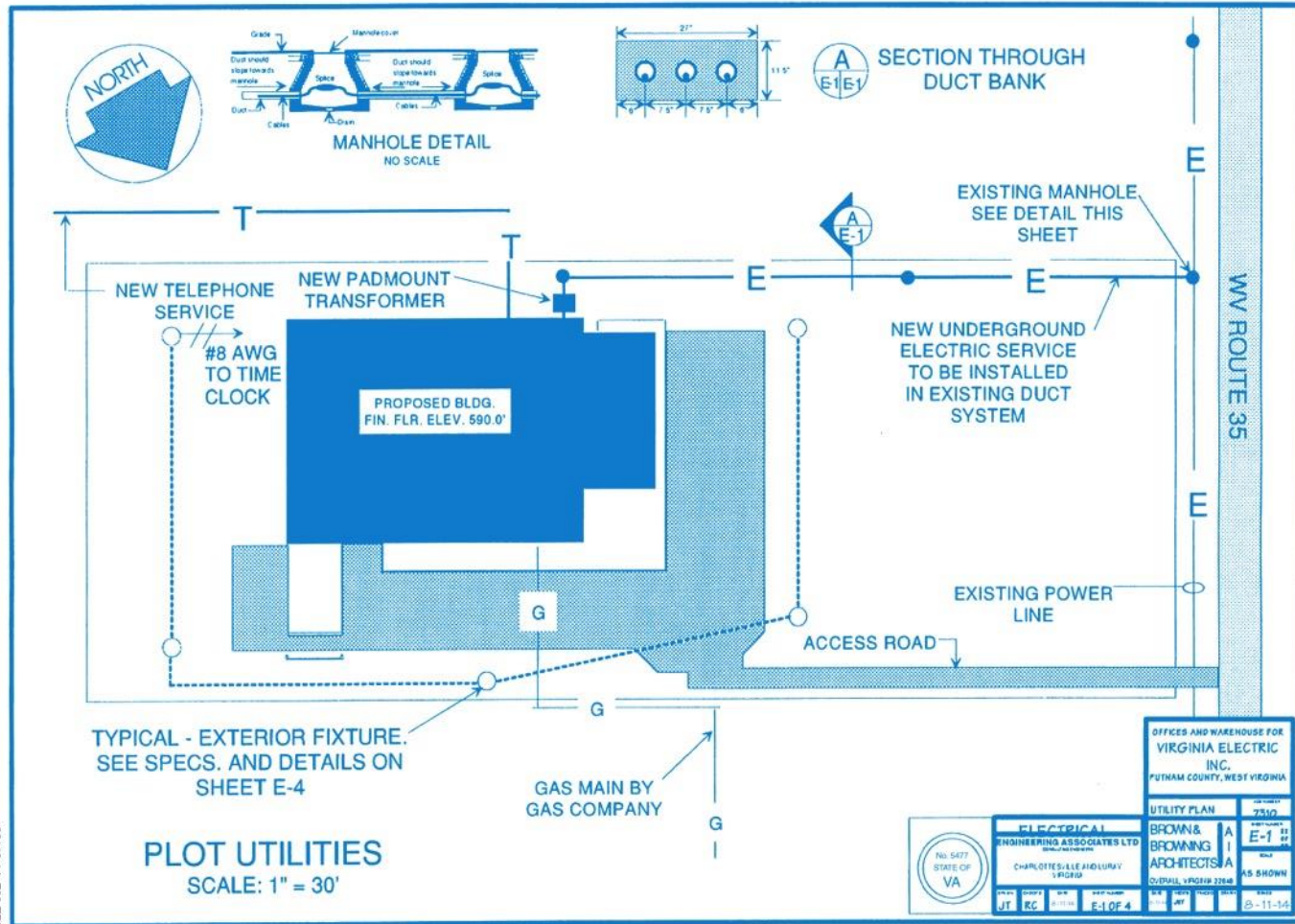
Performance Task

Have the trainees use an architect's scale to determine the actual dimensions of a given drawing component.



6.0.0 – 6.1.0

Analyzing Electrical Drawings



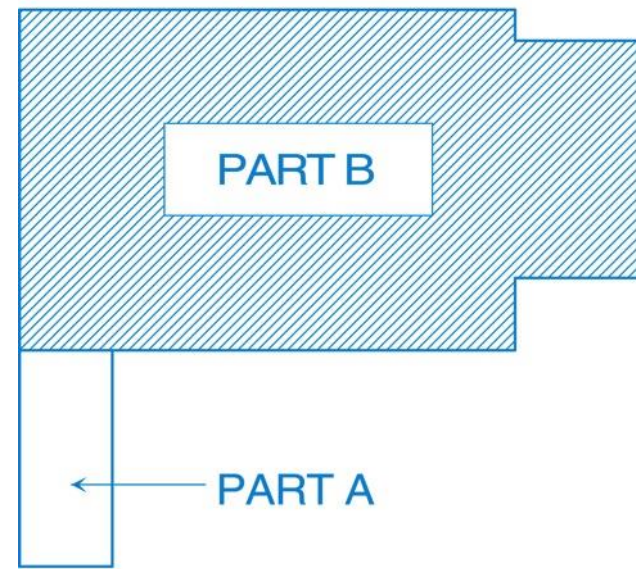
Power Plans



7.1.0

Key Plan

- A key plan identifies the part of a project to which the sheet applies.
- Key plans are not drawn to scale and only indicate the general shape of the applicable building or section.



KEY PLAN
NO SCALE



























NOTE: NO ELECTRICAL WORK
IN PART "A"

26110-14_F31.EPS

7.2.0

Symbol List

Most symbol lists include only those symbols applicable to the particular project.

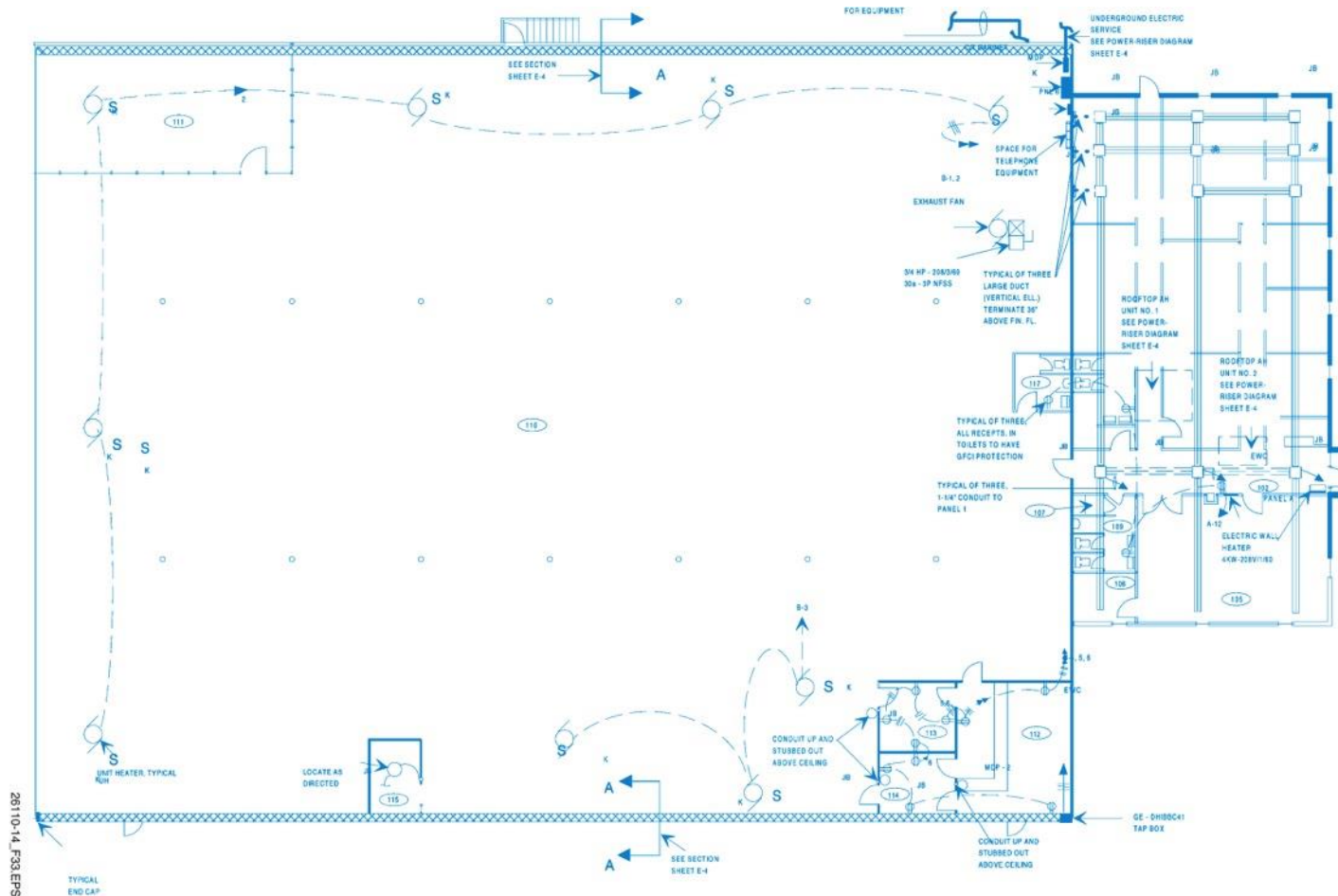
	Underfloor duct system – junction box and three ducts (one large, two standard)		Dotted lines indicate blank duct		G.E. Type LW223 lighting busway		G.E. Type LW326 lighting busway		G.E. Type DK-100 busway		Busway feed-in box		Panel-lighting and/or power		Conduit concealed above ceiling or wall		Conduit concealed in floor or in wall		Homerun to panel; number of arrows indicate number of circuits; letter designates panel; numeral designates circuit number; crossmarks indicate number of conductors if more than two		Motor connection		Switch, toggle with thermal overload protection		Conduit exposed		Duplex receptacle, grounded		Switch, key operated		Motor controller		Combination motor controller		Safety switch		Exit light		Incandescent fixture, surface		Fluorescent fixture, surface		Fluorescent fixture, wall		Fixture type – see schedule		Fire alarm striking station		Fire alarm bell		Smoke detector
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7.3.0 – 7.3.1

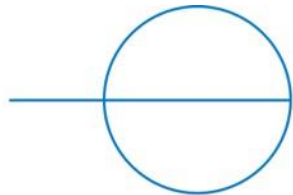
Floor Plan



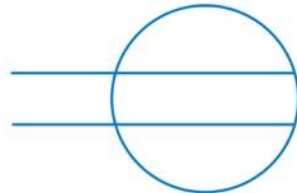
Busways



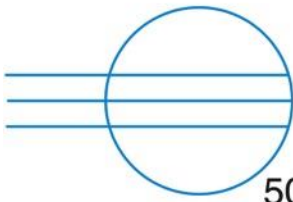
7.4.0



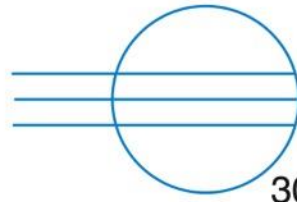
SINGLE
RECEPTACLE



DUPLEX
RECEPTACLE



RANGE
RECEPTACLE



DRYER
RECEPTACLE



SPLIT-WIRED
RECEPTACLE



SPECIAL-PURPOSE
OUTLET

26110-14_F35.EPS

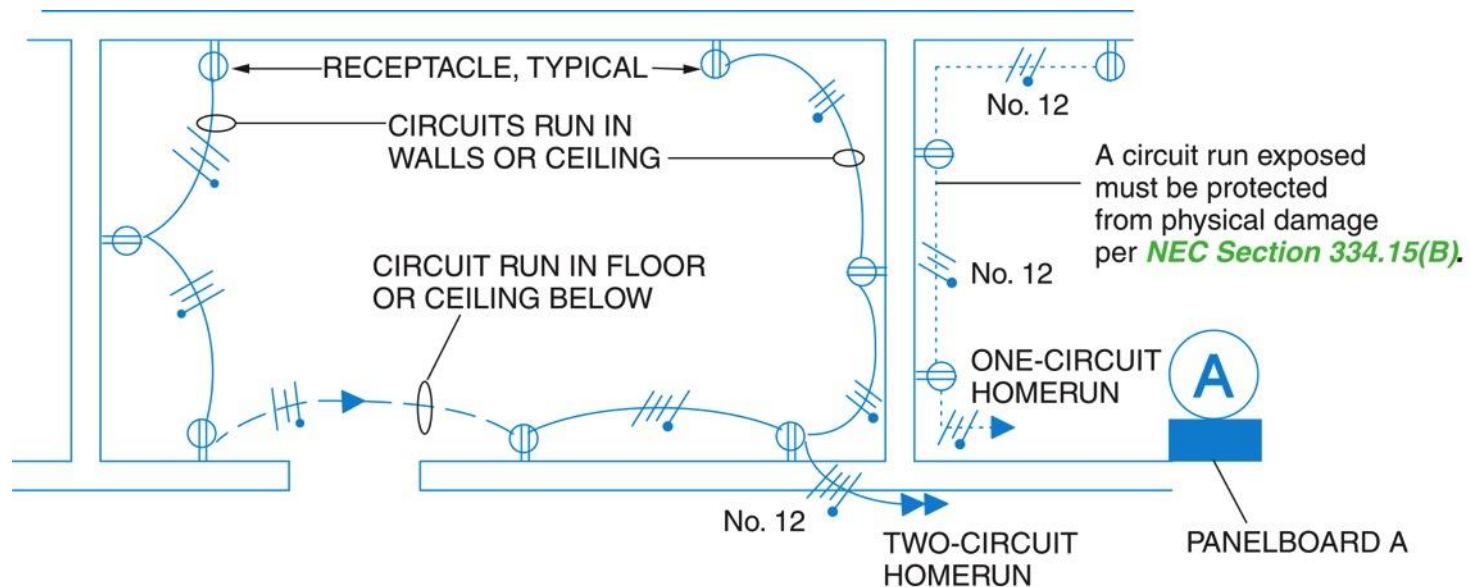
Branch Circuit Layout for Power

- An outlet is any point at which electrical equipment is connected to the wiring system.
- This may include direct-wired equipment such as lighting and other equipment, as well as power outlets, such as receptacles.

7.4.1

Branch Circuit Drawings

- Branch circuits are shown on electrical drawings as a single line drawn from a panelboard to an outlet.
- If the drawing does not show the panelboard, a homerun symbol is used.



26110-14_F36.EPS

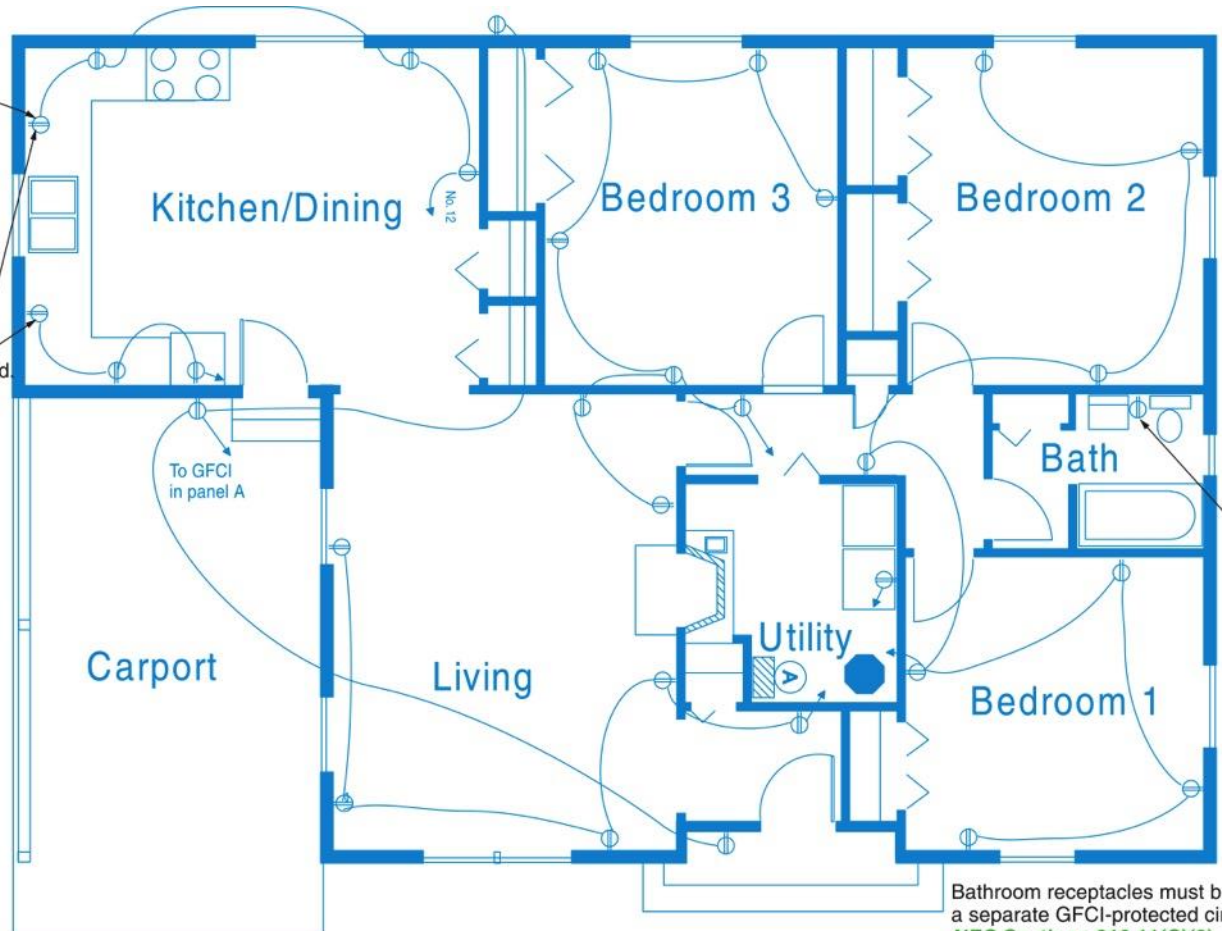


7.4.2

Locating Receptacles

Receptacles located above countertops in kitchens must be mounted so that no point on the wall is more than 24" from a receptacle.
NEC Section 210.52(C)(1)

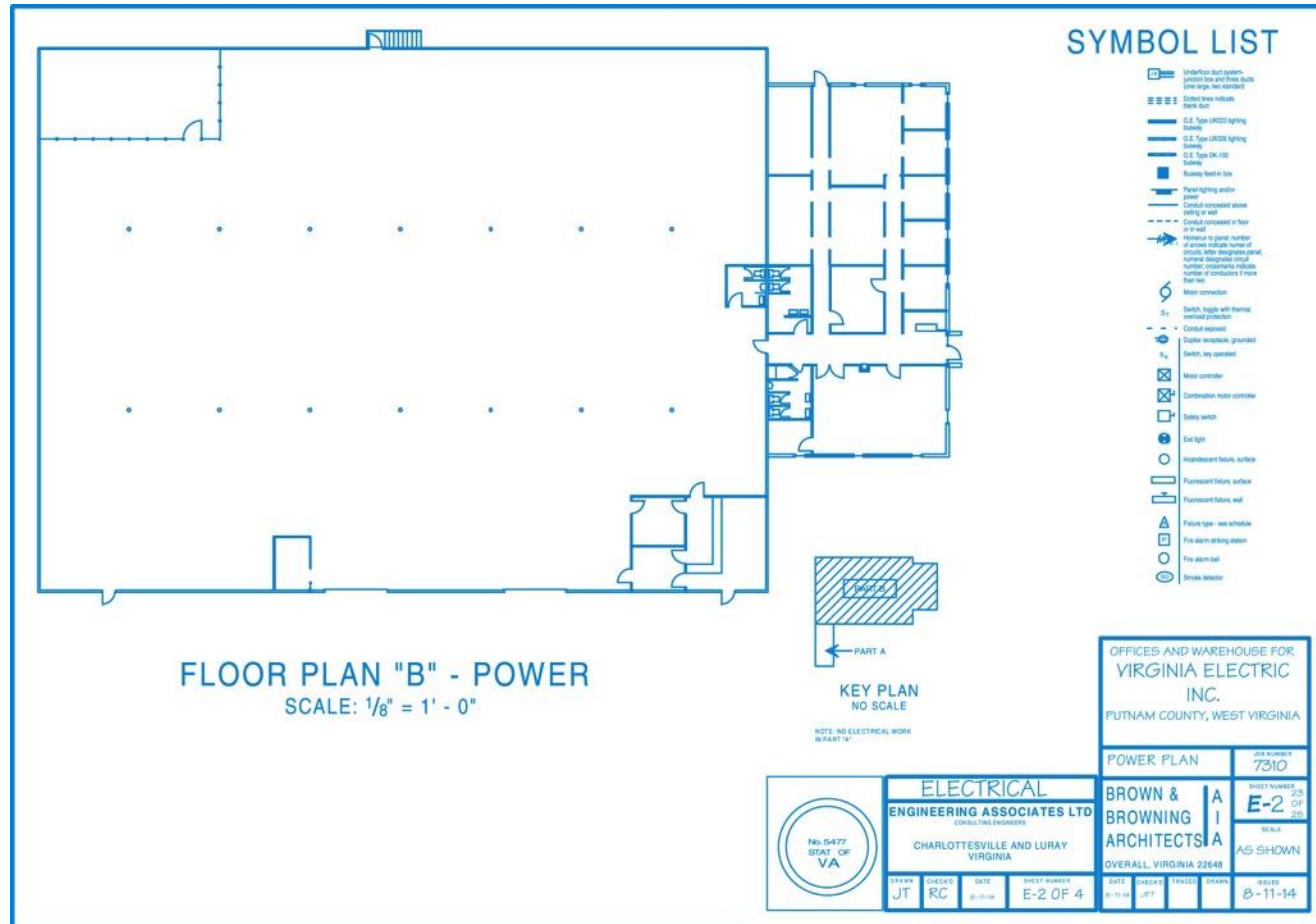
Receptacles installed to serve the countertop area must be GFCI-protected.
NEC Section 210.8(A)(6)



Bathroom receptacles must be on a separate GFCI-protected circuit.
NEC Sections 210.11(C)(3) and 210.8(A)(1)

8.0.0

Lighting Floor Plan



26110-14_F38.EPS



8.1.0

Drawing Schedules

- Schedules provide a list of various types of equipment required by the drawing.
- A lighting schedule identifies each fixture (luminaire) by manufacturer and catalog number. It also explains how the fixture is mounted, provides the drawing symbol, and indicates the number of lamps required.

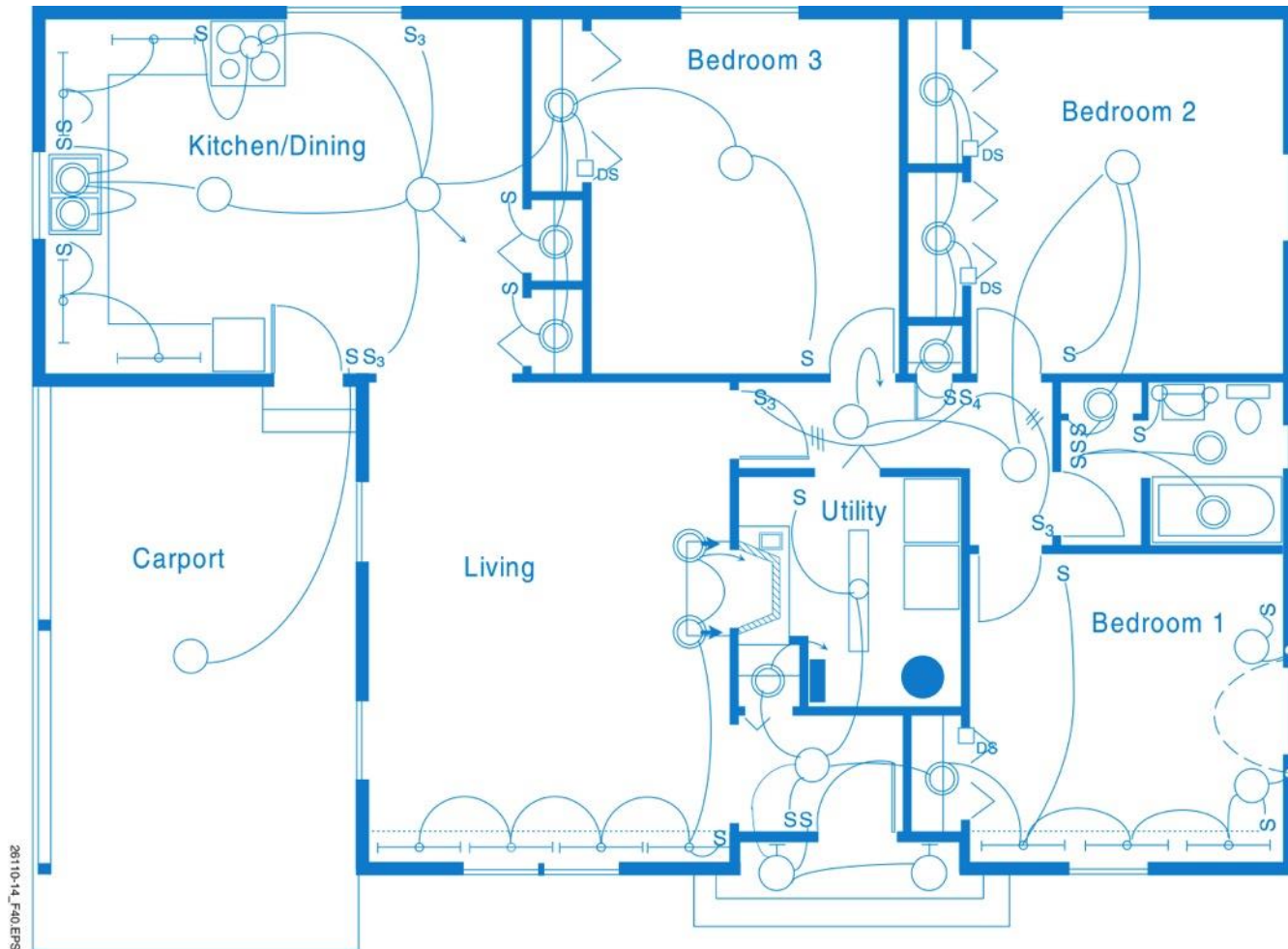
LIGHTING FIXTURE SCHEDULE				
SYMBOL	TYPE	MANUFACTURER AND CATALOG NUMBER	MOUNTING	LAMPS
		LIGHTOLIER 10234	WALL	2-40W T-12WWX
		LIGHTOLIER 10420	SURFACE	2-40W T-12 WWX
		ALKCO RPC-210-6E	SURFACE	2-8W T-5
		P 7 S AL 2936	WALL	1-100W 'A'
		P 7 S 110	SURFACE	1-100W 'A'

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8.2.0

Branch Circuit Layout for Lighting



8.2.0

Electrical Symbols List



SURFACE-MOUNTED CEILING
LIGHTING FIXTURE WITH
INCANDESCENT LAMP



SURFACE-MOUNTED WALL
LIGHTING FIXTURE WITH
INCANDESCENT LAMP



RECESSED CEILING LIGHTING
FIXTURE WITH INCANDESCENT LAMP



DIRECTIONAL RECESSED CEILING
LIGHTING FIXTURE WITH
INCANDESCENT LAMP
ARROW INDICATES DIRECTION
THAT LAMP IS POINTED



SURFACE-MOUNTED CEILING
LIGHTING FIXTURE WITH
FLUORESCENT LAMP



SINGLE-POLE SWITCH



THREE-WAY SWITCH



DOOR-ACTUATED SWITCH

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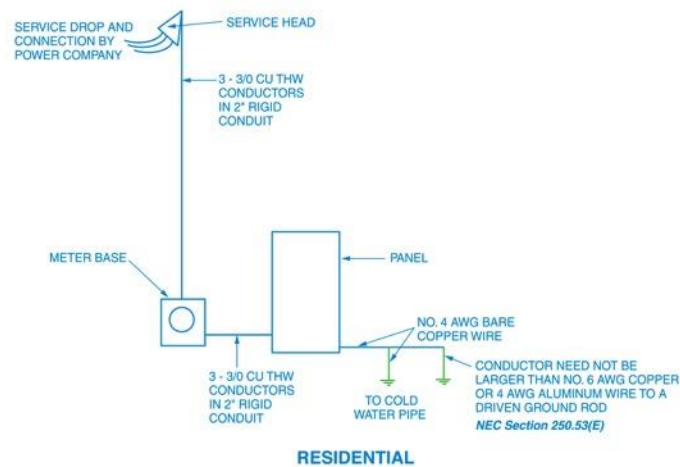
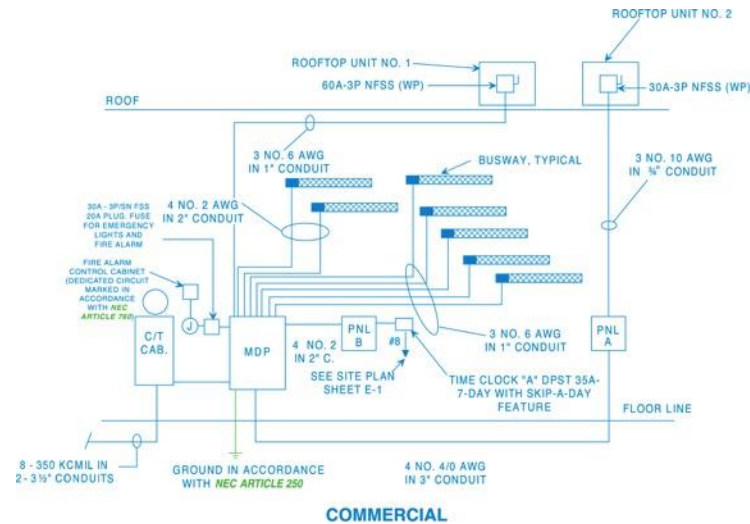
Performance Task

Have the trainees prepare a materials takeoff.



9.0.0 – 9.1.0

Electrical Details and Diagrams



26110-14_F42.EPS



9.0.0 – 9.1.0

Typical Panelboard Schedule

- A panelboard schedule lists the components contained in the panelboard.
- The panelboard schedule also indicates how the panelboard is to be mounted, the size of the panel in amps, its voltage rating, and whether it is single-phase or three-phase power.
- Branches indicate the type of overcurrent protection and the circuits fed by each device.

PANELBOARD SCHEDULE										
PANEL No.	CABINET TYPE	PANEL MAINS			BRANCHES					ITEMS FED OR REMARKS
		AMPS	VOLTS	PHASE	1P	2P	3P	PROT.	FRAME	
MDP	SURFACE	600A	120/208	3 ϕ , 4-W	-	-	1	225A	25,000	PANEL "A"
					-	-	1	100A	18,000	PANEL "B"
					-	-	1	100A		POWER BUSWAY
					-	-	1	60A		LIGHTING BUSWAY
					-	-	1	70A		ROOFTOP UNIT #1
					-	-	1	70A	↓	SPARE
					-	-	1	600A	42,000	MAIN CIRCUIT BRKR

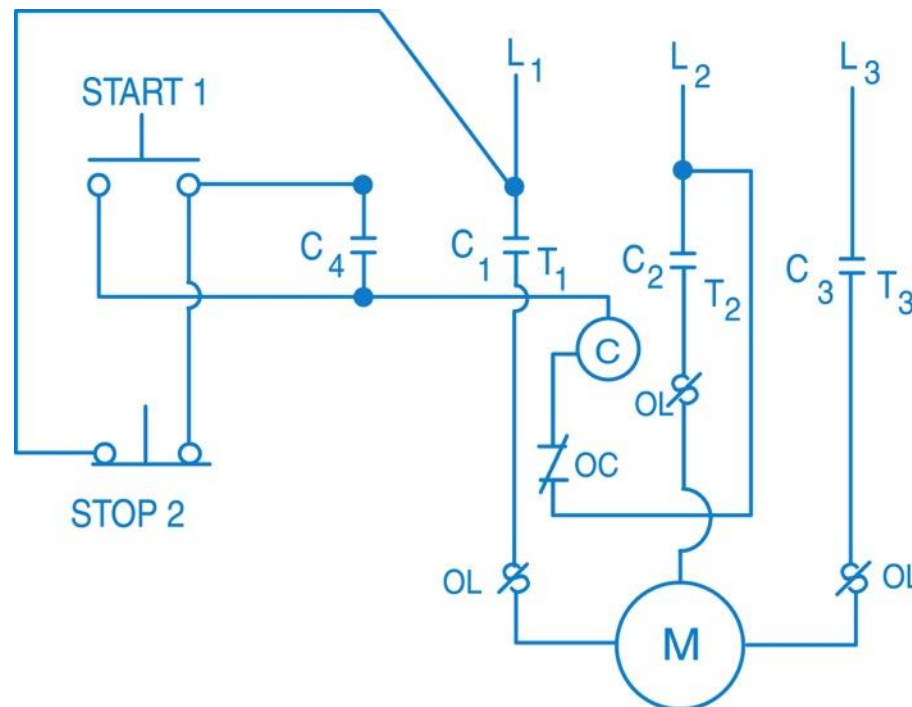
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9.2.0 – 9.3.0

Schematic Diagrams

Schematic diagrams show the actual connections between devices and are normally only provided for complex electrical systems.



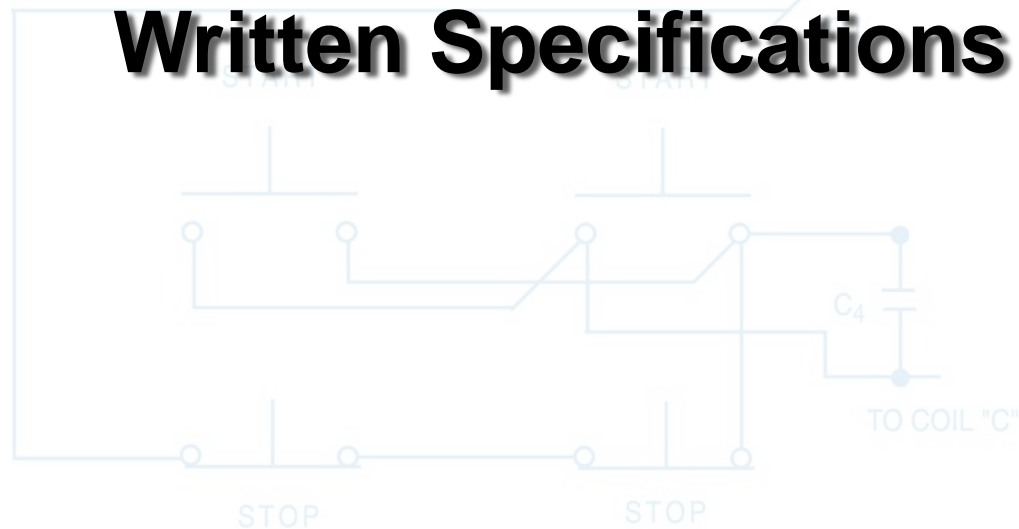
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9.2.0 – 9.3.0

Next Session... Being Controlled by Two Sets of Start/Stop Buttons

When adding pushbutton stations, the stop buttons are always connected in series and the start buttons in parallel.

Written Specifications



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Written Specifications

Applications Guide	
MasterFormat GROUPS, SUBGROUPS, AND DIVISIONS	
<u>PROCUREMENT AND CONTRACTING REQUIREMENTS GROUP</u>	<u>FACILITY SERVICES SUBGROUP</u>
Division 00 – Procurement and Contracting Requirements Introductory Information Procurement Requirements Contracting Requirements	Division 20 – Reserved for Future Expansion Division 21 – Fire Suppression Division 22 – Plumbing Division 23 – Heating, Ventilating, and Air-Conditioning (HVAC) Division 24 – Reserved for Future Expansion Division 25 – Integrated Automation Division 26 – Electrical Division 27 – Communications Division 28 – Electronic Safety and Security Division 29 – Reserved for Future Expansion
<u>SPECIFICATIONS GROUP</u>	<u>SITE AND INFRASTRUCTURE SUBGROUP</u>
<u>GENERAL REQUIREMENTS SUBGROUP</u>	Division 30 – Reserved for Future Expansion Division 31 – Earthwork Division 32 – Exterior Improvements Division 33 – Utilities Division 34 – Transportation Division 35 – Waterway and Marine Construction Division 36 – Reserved for Future Expansion Division 37 – Reserved for Future Expansion Division 38 – Reserved for Future Expansion Division 39 – Reserved for Future Expansion
<u>FACILITY CONSTRUCTION SUBGROUP</u>	<u>PROCESS EQUIPMENT SUBGROUP</u>
Division 02 – Existing Conditions Division 03 – Concrete Division 04 – Masonry Division 05 – Metals Division 06 – Wood, Plastics, and Composites Division 07 – Thermal and Moisture Protection Division 08 – Openings Division 09 – Finishes Division 10 – Specialties Division 11 – Equipment Division 12 – Furnishings Division 13 – Special Construction Division 14 – Conveying Equipment Division 15 – Reserved for Future Expansion Division 16 – Reserved for Future Expansion Division 17 – Reserved for Future Expansion Division 18 – Reserved for Future Expansion Division 19 – Reserved for Future Expansion	Division 40 – Process Integration Division 41 – Material Processing and Handling Equipment Division 42 – Process Heating, Cooling, and Drying Equipment Division 43 – Process Gas and Liquid Handling, Purification, and Storage Equipment Division 44 – Pollution and Waste Control Equipment Division 45 – Industry-Specific Manufacturing Equipment Division 46 – Water and Wastewater Equipment Division 47 – Reserved for Future Expansion Division 48 – Electrical Power Generation Division 49 – Reserved for Future Expansion



10.0.0 – 10.2.0

Detailed Breakdown of the Electrical Division

NUMBER		TITLE	EXPLANATION	Division 26
DIVISION 26 – ELECTRICAL				
26 00 00	Electrical		may be used as division level section title. See: 02 41 19 for selective demolition of existing electrical systems. 03 30 00 for cast-in-place concrete equipment bases. 07 84 00 for firestopping. 07 92 00 for joint sealants. 08 31 00 for access doors and panels. 09 91 00 for field painting. 31 23 33 for trenching and backfilling.	
26 01 00	Operation and Maintenance of Electrical Systems		Includes: maintenance, repair, rehabilitation, replacement, restoration, preservation, etc. of electrical systems. medium voltage: 2400 V to 69 kV. low voltage: 600 V and less. Notes: Definitions medium voltage: 2400 V to 69 kV. low voltage: 600 V and less. Level 4 Numbering Recommendation: following numbering is recommended for the creation of Level 4 titles: .51-.59 for maintenance. .61-.69 for repair. .71-.79 for rehabilitation. .81-.89 for replacement. .91-.99 for restoration.	
26 01 10	Operation and Maintenance of Medium-Voltage Electrical Distribution			
26 01 20	Operation and Maintenance of Low-Voltage Electrical Distribution			
26 01 26	Maintenance Testing of Electrical Systems			
26 01 30	Operation and Maintenance of Facility Electrical Power Generating and Storing Equipment			
26 01 40	Operation and Maintenance of Electrical and Cathodic Protection Systems			
26 01 50	Operation and Maintenance of Lighting			
26 01 50.51	Luminaire Relamping			
26 01 50.81	Luminaire Replacement			
26 05 00	Common Work Results for Electrical		Includes: subjects common to multiple titles in Division 26. raceway and boxes includes conduit, tubing, surface raceways, and electrical boxes. medium voltage: 2400 V to 69 kV. low voltage: 600 V and less. control voltage: 50 V	

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10.0.0 – 10.2.0

Detailed Breakdown of the Electrical Division (Cont.)

DIVISION 26		
NUMBER	TITLE	EXPLANATION
		and less.
		Alternate Terms/Abbreviations: EMT: electrical metallic tubing.
		Notes: Definitions medium voltage: 2400 V to 69 kV, low voltage: 600 V and less, control voltage: 50 V and less.
		See 01 80 00 for performance requirements of subjects common to multiple titles.
		05 35 00 for raceway decking assemblies.
		05 45 16 for electrical metal supports.
		13 48 00 for sound, vibration, and seismic control.
		25 05 13 for conductors and cables for integrated automation.
		25 05 26 for grounding and bonding for integrated automation.
		25 05 28 for pathways for integrated automation.
		25 05 48 for vibration and seismic control for integrated automation.
		25 05 53 for identification for integrated automation.
		27 05 28 for pathways for communications systems.
		27 05 46 for utility poles for communications systems.
		27 05 48 for vibration and seismic controls for communications.
		27 05 53 for identification for communications.
		28 05 13 for conductors and cables for electronic safety and security.
		28 05 26 for grounding and bonding for electronic safety and security.
		28 05 28 for pathways for electronic safety and security.
		28 05 48 for vibration and seismic controls for electronic safety and security.
		28 05 53 for identification for electronic safety and security.
		33 71 16 for electrical utility poles.
		33 71 19 for electrical utility underground ducts and manholes.
26 05 13	Medium-Voltage Cables	
	26 05 13.13	Medium-Voltage Open Conductors
	26 05 13.16	Medium-Voltage, Single- and Multi-Conductor Cables
26 05 19	Low-Voltage Electrical Power Conductors and Cables	
	26 05 19.13	Undercarpet Electrical Power Cables
	26 05 19.23	Manufactured Wiring Assemblies
26 05 23	Control-Voltage Electrical Power Cables	
26 05 26	Grounding and Bonding for Electrical Systems	
26 05 29	Hangers and Supports for Electrical Systems	
26 05 33	Raceway and Boxes for Electrical Systems	
	26 05 33.13	Conduit for Electrical Systems
	26 05 33.16	Boxes for Electrical Systems
	26 05 33.23	Surface raceways for Electrical Systems
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10.0.0 – 10.2.0

Detailed Breakdown of the Electrical Division (Cont.)

DIVISION 26		
NUMBER	TITLE	EXPLANATION
26 05 36	Cable Trays for Electrical Systems	
26 05 39	Underfloor Raceways for Electrical Systems	
26 05 43	Underground Ducts and Raceways for Electrical Systems	
26 05 46	Utility Poles for Electrical Systems	
26 05 48	Vibration and Seismic Controls for Electrical Systems	
26 05 53	Identification for Electrical Systems	
26 05 73	Overcurrent Protective Device Coordination Study	
26 05 83	Wiring Connections	
26 06 00	Schedules for Electrical	
		Notes: a schedule may be included on drawings, in the project manual, or a project book.
		Definitions: medium voltage: 2400 V to 69 kV. low voltage: 600 V and less.
		Includes: schedules of items common to multiple titles in Division 26.
26 06 10	Schedules for Medium-Voltage Electrical Distribution	
26 06 20	Schedules for Low-Voltage Electrical Distribution	
26 06 20.13	Electrical Switchboard Schedule	
26 06 20.16	Electrical Panelboard Schedule	
26 06 20.19	Electrical Motor-Control Center Schedule	
26 06 20.23	Electrical Circuit Schedule	
26 06 20.26	Wiring Device Schedule	
26 06 30	Schedules for Facility Electrical Power Generating and Storing Equipment	
26 06 40	Schedules for Electrical and Cathodic Protection Systems	
26 06 50	Schedules for Lighting	
26 06 50.13	Lighting Panelboard Schedule	
26 06 50.16	Lighting Fixture Schedule	
26 08 00	Commissioning of Electrical Systems	
		Includes: commissioning of items common to multiple titles in Division 26.
		See: 01 91 00 for commissioning of subjects common to multiple divisions.
26 09 00	Instrumentation and Control for Electrical Systems	
		Includes: instrumentation and control associated with electrical systems.
		See: 13 50 00 for special instrumentation.
		25 36 00 for integrated automation instrumentation and terminal devices for electrical systems.
		25 56 00 for integrated automation control of electrical systems.

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10.0.0 – 10.2.0

Detailed Breakdown of the Electrical Division (Cont.)

DIVISION 26		
NUMBER	TITLE	EXPLANATION
		25 96 00 for integrated automation control sequences for electrical systems. 33 09 70 for instrumentation and control for electrical utilities.
26 09 13	Electrical Power Monitoring	
26 09 15	Peak Load Controllers	
26 09 16	Electrical Controls and Relays	
26 09 17	Programmable Controllers	
26 09 19	Enclosed Contactors	
26 09 23	Lighting Control Devices	Includes: clock and calendar, photoelectric switches, occupancy sensors, and light-leveling control devices. control- and low-voltage lighting control devices connected through computers. addressable lighting control devices and lighting components (ballasts) connected through computers. See: 11 61 00 for theater and stage equipment. 26 50 00 for lighting. 26 55 61 for theatrical lighting. See Also: 11 61 00 for theatrical lighting controls.
26 09 26	Lighting Control Panelboards	
26 09 33	Central Dimming Controls	
	26 09 33.13 Multichannel Remote-Controlled Dimmers	
	26 09 33.16 Remote-Controlled Dimming Stations	
26 09 36	Modular Dimming Controls	
	26 09 36.13 Manual Modular Dimming Controls	
	26 09 36.16 Integrated Multipreset Modular Dimming Controls	
26 09 43	Network Lighting Controls	
	26 09 43.13 Digital-Network Lighting Controls	
	26 09 43.16 Addressable Fixture Lighting Control	
26 09 61	Theatrical Lighting Controls	
26 10 00 Medium-Voltage Electrical Distribution		Includes: substations, transformers, switchgear, and circuit protection devices to distribute medium-voltage electrical power from the facility service point to the point of delivery. Notes: Definitions medium voltage: 2400 V to 69 kV. See 26 05 13 for medium-voltage cables. 26 20 00 for low-voltage electrical distribution. 26 30 00 for facility electrical power generating and storing equipment. 33 71 00 for electrical utility distribution.



10.0.0 – 10.2.0

Detailed Breakdown of the Electrical Division (Cont.)

DIVISION 26		
NUMBER	TITLE	EXPLANATION
26 11 00	Substations	Includes: assembly of switches, circuit breakers, buses, and transformers to switch circuits and convert power from one voltage to another. See: 33 72 00 for utility substations. 34 21 16 for traction power substations.
26 11 13	Primary Unit Substations	
26 11 16	Secondary Unit Substations	
26 12 00	Medium-Voltage Transformers	Includes: transformers for medium-voltage applications. See: 26 22 00 for low-voltage transformers. 33 73 00 for utility transformers. 34 21 23 for traction power transformer-rectifier units.
26 12 13	Liquid-Filled, Medium-Voltage Transformers	
26 12 16	Dry-Type, Medium-Voltage Transformers	
26 12 19	Pad-Mounted, Liquid-Filled, Medium-Voltage Transformers	
26 13 00	Medium-Voltage Switchgear	Includes: switchgear for medium-voltage applications. See: 26 23 00 for low-voltage switchgear. 33 77 00 for medium-voltage utility switchgear. 34 21 19 for traction power switchgear.
26 13 13	Medium-Voltage Circuit Breaker Switchgear	
26 13 16	Medium-Voltage Fusible Interrupter Switchgear	
26 13 19	Medium-Voltage Vacuum Interrupter Switchgear	
26 13 23	Medium-Voltage Metal-Enclosed Switchgear	
26 13 26	Medium-Voltage Metal-Clad Switchgear	
26 13 29	Medium-Voltage Compartmentalized Switchgear	
26 16 00	Medium-Voltage Metering	
26 18 00	Medium-Voltage Circuit Protection Devices	Includes: circuit protection devices for medium-voltage applications. See: 26 28 00 for low-voltage circuit protective devices. 26 41 23 for lightning protection surge arresters and suppressors. 33 77 00 for medium-voltage utility circuit protection devices.
26 18 13	Medium-Voltage Cutouts	

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10.0.0 – 10.2.0

Detailed Breakdown of the Electrical Division (Cont.)

DIVISION 26		
NUMBER	TITLE	EXPLANATION
26 18 16	Medium-Voltage Fuses	
26 18 19	Medium-Voltage Lightning Arresters	
26 18 23	Medium-Voltage Surge Arresters	
26 18 26	Medium-Voltage Reclosers	
26 18 29	Medium-Voltage Enclosed Bus	
26 18 33	Medium-Voltage Enclosed Fuse Cutouts	
26 18 36	Medium-Voltage Enclosed Fuses	
26 18 39	Medium-Voltage Motor Controllers	
26 20 00 Low-Voltage Electrical Transmission		
Includes: overhead power systems, transformers, switchgear, switchboards, panelboards, enclosed bus assemblies, power distribution units, controllers, wiring devices, and circuit protection devices to distribute low-voltage electrical power from the point of voltage transformation to the point of use. typical voltages: 120, 208, 230, 240, 277, 460, and 480.		
Notes: Definitions low voltage: 600 V and less.		
See 26 05 19 for low-voltage electrical power conductors and cables.		
26 10 00 for medium-voltage electrical distribution.		
26 30 00 for facility electrical power generating and storing equipment.		
26 21 00 Low-Voltage Electrical Service Entrance		
See: 26 05 19 for low-voltage electrical power conductors and cables.		
26 05 46 for utility poles for electrical systems.		
33 71 13 for site electrical transmission towers.		
33 71 16 for electrical utility poles.		
26 21 13	Low-Voltage Overhead Electrical Service Entrance	
26 21 16	Low-Voltage Underground Electrical Service Entrance	
26 22 00 Low-Voltage Transformers		
Includes: transformers for low-voltage applications.		
See: 26 12 00 for medium-voltage transformers.		
26 22 13	Low-Voltage Distribution Transformers	
26 22 16	Low-Voltage Buck-Boost Transformers	
26 22 19	Control and Signal Transformers	
26 23 00 Low-Voltage Switchgear		
Includes: switchgear for low-voltage applications.		

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10.0.0 – 10.2.0

Detailed Breakdown of the Electrical Division (Cont.)

DIVISION 26		
NUMBER	TITLE	EXPLANATION
		See: 26 13 00 for medium-voltage switchgear.
26 23 13	Paralleling Low-Voltage Switchgear	
26 24 00	Switchboards and Panelboards	Includes: switchboards, panelboards, and control centers.
		See: 26 27 16 for electrical cabinets and enclosures. 26 29 13 for enclosed controllers. 26 29 23 for variable-frequency motor controllers.
26 24 13	Switchboards	
26 24 16	Panelboards	
26 24 19	Motor-Control Centers	
26 25 00	Enclosed Bus Assemblies	Includes: busway, step bus, and tap boxes.
		See: 33 72 26 for utility substation bus assemblies.
26 26 00	Power Distribution Units	Includes: distribution units with integral transformers, panelboards, and power conditioning components.
		See: 26 24 16 for panelboards.
26 27 00	Low-Voltage Distribution Equipment	Includes: wiring devices includes receptacles, switches, dimmers, and finish plates.
		See: 26 24 00 for switchboards and panelboards. 33 71 73 for utility electric meters.
26 27 13	Electricity Metering	
26 27 16	Electrical Cabinets and Enclosures	
26 27 19	Multi-Outlet Assemblies	
26 27 23	Indoor Service Poles	
26 27 26	Wiring Devices	
26 27 73	Door Chimes	
26 28 00	Low-Voltage Circuit Protective Devices	Includes: circuit protection devices for low-voltage applications. enclosed switches and transfer switches.
		See: 26 18 00 for medium-voltage circuit protection devices.

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10.0.0 – 10.2.0

Detailed Breakdown of the Electrical Division (Cont.)

DIVISION 26		
NUMBER	TITLE	EXPLANATION
26 28 13	Fuses	
26 28 16	Enclosed Switches and Circuit Breakers	
26 28 16.13	Enclosed Circuit Breakers	
26 28 16.16	Enclosed Switches	
26 29 00	Low-Voltage Controllers	
		Includes: contactors and motor controllers.
		May Include: fuses.
		Alternate Terms/Abbreviations: enclosed controllers: motor controllers.
		See: 26 24 19 for motor-control centers. 26 28 13 for fuses.
26 29 13	Enclosed Controllers	
26 29 13.13	Across-the-Line Motor Controllers	
26 29 13.16	Reduced-Voltage Motor Controllers	
26 29 23	Variable-Frequency Motor Controllers	
26 29 33	Controllers for Fire Pump Drivers	
26 29 33.13	Full-Service Controllers for Fire Pump Electric-Motor Drivers	
26 29 33.16	Limited-Service Controllers for Fire Pump Electric-Motor Drivers	
26 29 33.19	Controllers for Fire Pump Diesel Engine Drivers	
26 30 00	Facility Electrical Power Generating and Storing Equipment	
		Includes: equipment to generate and store electrical power for a single facility.
		Notes: 48 10 00 for electrical power generation equipment.
26 31 00	Photovoltaic Collectors	
		Includes: solar cells to convert sunlight to electricity.
		See: 07 31 00 for solar collector roof shingles. 22 33 30 for residential, collector-to-tank, solar-electric domestic water heaters. 23 56 00 for solar energy heating equipment. 42 12 23 for solar process heaters. 42 13 26 for industrial solar radiation heat exchangers. 48 14 00 for solar energy electrical power generation equipment.
26 32 00	Packaged Generator Assemblies	
		Includes: generators, frequency changers, and rotary converters and uninterruptible power units.

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10.0.0 – 10.2.0

Detailed Breakdown of the Electrical Division (Cont.)

DIVISION 26		
NUMBER	TITLE	EXPLANATION
		See: 23 11 00 for facility fuel piping. 23 24 00 for internal-combustion engine piping. 48 11 00 for fossil fuel plant electrical power generation equipment. 48 13 00 for hydroelectric plant electrical power generation equipment. 48 15 00 for wind energy electrical power generation equipment.
26 32 13	Engine Generators	
26 32 13.13	Diesel-Engine-Driven Generator Sets	
26 32 13.16	Gas-Engine-Driven Generator Sets	
26 32 13.26	Gas-Turbine Engine-Driven Generators	
	Alternate Terms/Abbreviations: microturbines	
	See: 48 11 23 Fossil Fuel Electrical Power Plant Gas Turbines	
26 32 16	Steam-Turbine Generators	
26 32 19	Hydro-Turbine Generators	
26 32 23	Wind Energy Equipment	
26 32 26	Frequency Changers	
26 32 29	Rotary Converters	
26 32 33	Rotary Uninterruptible Power Units	
26 33 00	Battery Equipment	
		Includes: batteries, battery racks, battery chargers, static power converters, uninterruptible power supplies, and accessories.
		May Include: battery-operated emergency light fixtures.
		See: 25 36 23 for integrated automation battery monitors. 26 31 00 for photovoltaic collectors. 33 72 33 for electrical utility substation. 48 17 13 for electrical power generation batteries.
		See Also: 26 52 00 for emergency lighting incorporating batteries.
26 33 13	Batteries	
26 33 16	Battery Racks	
26 33 19	Battery Units	
26 33 23	Central Battery Equipment	
26 33 33	Static Power Converters	
26 33 43	Battery Chargers	
26 33 46	Battery Monitoring	

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10.0.0 – 10.2.0

Detailed Breakdown of the Electrical Division (Cont.)

DIVISION 26		
NUMBER	TITLE	EXPLANATION
26 33 53	Static Uninterruptible Power Supply	
26 35 00	Power Filters and Conditioners	
		Includes: capacitors, chokes and inductors, filters, power factor controllers, and voltage regulators.
		Alternate Terms/Abbreviations: EMI: electromagnetic interference. RFI: radio frequency interference. power factor correction equipment: power factor controllers.
		See: 08 34 46 for RFI shielding doors. 08 56 46 for RFI shielding windows. 13 49 00 for radiation protection. 26 18 23 for medium-voltage surge arresters. 28 32 00 for radiation detection and alarm. 40 91 16 for electromagnetic process measurement devices.
26 35 13	Capacitors	
26 35 16	Chokes and Inductors	
26 35 23	Electromagnetic-Interference Filters	
26 35 26	Harmonic Filters	
26 35 33	Power Factor Correction Equipment	
26 35 36	Slip Controllers	
26 35 43	Static-Frequency Converters	
26 35 46	Radio-Frequency-Interference Filters	
26 35 53	Voltage Regulators	
26 36 00	Transfer Switches	
		Includes: switches transfer from one source of electricity to another.
26 36 13	Manual Transfer Switches	
26 36 23	Automatic Transfer Switches	
26 40 00	Electrical and Cathodic Protection	
26 41 00	Facility Lightning Protection	
		Includes: wiring and equipment for lightning protection.
		See: 26 18 19 for medium-voltage lightning arresters. 33 79 00 for site grounding. 33 79 93 for site lightning protection.
26 41 13	Lightning Protection for Structures	
	26 41 13.13 Lightning Protection for Buildings	
26 41 16	Lightning Prevention and Dissipation	
26 41 19	Early Streamer Emission Lightning Protection	
26 41 23	Lightning Protection Surge Arresters and Suppressors	
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10.0.0 – 10.2.0

Detailed Breakdown of the Electrical Division (Cont.)

DIVISION 26		
NUMBER	TITLE	EXPLANATION
26 42 00	Cathodic Protection	Includes: equipment, controls, and installation for cathodic protection of structures and underground metal construction and piping. See: 40 46 42 for cathodic process corrosion protection.
26 42 13	Passive Cathodic Protection for Underground and Submerged Piping	
26 42 16	Passive Cathodic Protection for Underground Storage Tank	
26 43 00	Transient Voltage Suppression	Includes: devices to protect against voltage surges on electrical distribution systems.
26 43 13	Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits	
26 50 00	Lighting	Includes: luminaires, lighting equipment, ballasts, dimming controls, and lighting accessories, fluorescent, high intensity discharge, incandescent, mercury vapor, neon, and sodium vapor lighting. Alternate Terms/Abbreviations: HID: high intensity discharge. See: 10 84 00 for Gas Lighting. 25 36 26 for integrated automation lighting relays. 26 09 23 for lighting controls. 26 20 00 for low-voltage electrical transmission.
26 51 00	Interior Lighting	Includes: lighting for interior locations, except for emergency lighting, lighting in hazardous locations, and special purpose lighting, chandeliers, troffers. See: 09 54 16 for luminous ceilings. 09 58 00 for integrated ceiling assemblies. 10 14 33 for illuminated panel signage.
26 51 13	Interior Lighting Fixtures, Lamps, And Ballasts	
26 52 00	Emergency Lighting	Includes: equipment for exitway lighting and other emergency applications, including emergency battery units, fixtures with integral batter power supplies. See: 26 53 00 for exit signs.

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10.0.0 – 10.2.0

Detailed Breakdown of the Electrical Division (Cont.)

DIVISION 26		
NUMBER	TITLE	EXPLANATION
26 53 00	Exit Signs	Includes: electric exit signs. See: 26 52 00 for emergency lighting.
26 54 00	Classified Location Lighting	Includes: lighting for application in areas classified as hazardous. See: 26 55 33 for hazard warning lighting.
26 55 00	Special Purpose Lighting	Includes: lighting equipment for specialized applications. Alternate Terms/Abbreviations: healthcare lighting: medical lighting. See: 11 13 26 for loading dock lights. 11 18 00 for security equipment. 11 19 00 for detention equipment. 11 59 00 for exhibit and display equipment. 11 61 00 for theater and stage equipment. 11 70 00 for healthcare equipment. 13 10 00 for swimming pools. 13 12 00 for fountains. 13 14 00 for aquatic park structures. 13 17 00 for tubs and pools. 26 54 00 for classified location lighting. 34 40 00 for transportation signals. 35 13 13 for navigation signals. See Also: 11 61 00 for theatrical lighting.
26 55 23	Outline Lighting	
26 55 29	Underwater Lighting	
26 55 33	Hazard Warning Lighting	
26 55 36	Obstruction Lighting	
26 55 39	Helipad Lighting	See: 34 43 00 Airfield Signaling and Control Equipment
26 55 53	Security Lighting	
26 55 59	Display Lighting	
26 55 61	Theatrical Lighting	
26 55 63	Detention Lighting	
26 55 70	Healthcare Lighting	

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10.0.0 – 10.2.0

Detailed Breakdown of the Electrical Division (Cont.)

DIVISION 26		
NUMBER	TITLE	EXPLANATION
26 56 00	Exterior Lighting	<p>Includes: lighting equipment for exterior locations, except for special purpose and signal lighting, airfield general exterior lighting.</p> <p>Alternate Terms/Abbreviations: athletic lighting: sports lighting.</p> <p>See: 10 14 33 for illuminated panel signage. 11 13 26 for loading dock lights. 11 68 23 for exterior court athletic equipment. 32 94 00 for planting accessories. 34 41 13 for traffic signals. 34 42 13 for railway signals. 34 43 13 for airfield signals. 34 43 16 for airfield landing equipment. 34 71 00 for roadway construction. 34 72 00 for railway construction. 34 73 00 for airfield construction. 34 75 00 for roadway equipment.</p>
26 56 13	Lighting Poles and Standards	
26 56 16	Parking Lighting	
26 56 19	Roadway Lighting	
26 56 23	Area Lighting	
26 56 26	Landscape Lighting	
26 56 29	Site Lighting	
26 56 33	Walkway Lighting	
26 56 36	Flood Lighting	
26 56 68	Exterior Athletic Lighting	

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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.

