



LABELING AND DOCUMENTATION

FOR AIRFIELD ELECTRICAL ELEMENTS



Presenter

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Disclaimers

Code references made in this presentation are subject to change, subject to amendment by local authority having jurisdiction, and subject to interpretation by local enforcing authority having jurisdiction.

This presentation is for educational purposes and is NOT intended to be a comprehensive guide for design of Airfield Lighting and Supporting Systems.

Engage a Licensed Electrical Engineer experienced with Airfield Electrical Designs and Products.



AGENDA

- | | | | |
|----------|---------------------------|----------|----------------|
| 1 | The Art of Identification | 4 | Light Fixtures |
| 2 | Electrical Equipment | 5 | Signage |
| 3 | Raceways and Cabling | 6 | Documentation |

The Art of Identification

“That which we call a rose by any other name would smell as sweet”

~ from Romeo & Juliet by William Shakespeare



The Art of Identification

Why not a Science?

Identification can be subjective based on the **Intended Audience**

- Design Team & Reviewers
- Contractors
- Owners & Maintenance Staff
- Operations and Maintenance Staff
- Future Designers and Engineers
- Non-Technical Staff

The Art of Identification

Why not a Science?

Identification can be subjective based on the **Intended Audience**

If there is any room for interpretation,
Remember who makes the rules...

AUTHORITY HAVING JURISDICTION (AHJ)



The Art of Identification

Ideally Identification is

INTELLIGENT

yet

INTUITIVE

e.g. information that can be understood with minimal training

The Art of Identification

Sometimes Being Obvious
Is Required

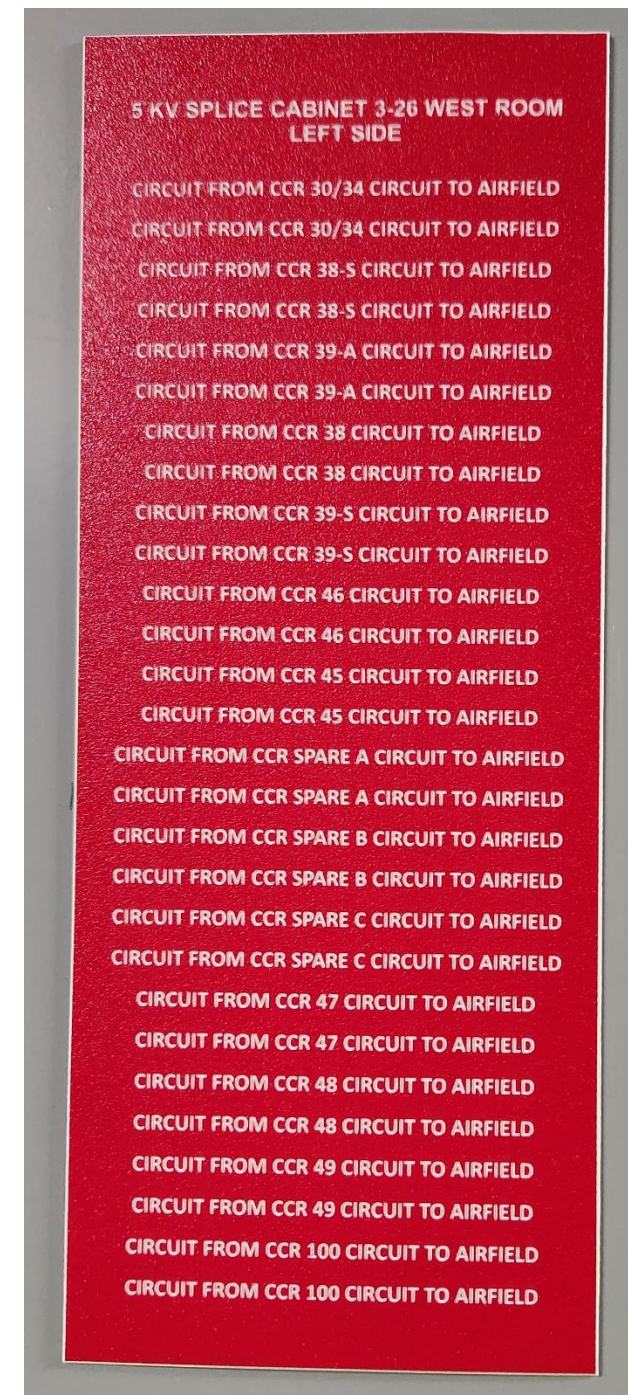


The Art of Identification

- Clear
 - Concise
 - Consistent
 - Coordinated

The Art of Identification

- Clear
- Concise



The Art of Identification

- Consistent



The Art of Identification

- Coordinated

Color Coded Conduits

Red Used for 5kV

Red Used for Fire
Protection & Fire
Detection Systems

Some conduits not color
coded



Exercise



Identification - Equipment

The Art of Identification

Numeric ₍₁₀₎ Identifier (Including 0)

1 Digit = 10 Unique IDs

2 Digits = 100

3 Digits = 1,000

4 Digits = 10,000 Unique IDs

...

9 Digits = 1,000,000,000 (1B)

SN 123-45-6789

10 Digits = 10,000,000,000 (10B)

(123)-456-7890

X Digits = 10^X Unique IDs

The Art of Identification

Letter₍₂₃₎ Identifier (Exclude Letters I, O, X)

1 Character = 23 Unique IDs

2 Characters = 529 Unique IDs

3 Characters = 12,167 Unique IDs

4 Characters = 279,841 Unique IDs

X Characters = 23^X Unique IDs

The Art of Identification

Letter₍₂₃₎ + Numeric₍₁₀₎ Identifier (Exclude Letters I, O, X)

1 Character = 33 Unique IDs

2 Characters = 1,089 Unique IDs

3 Characters = 35,937 Unique IDs

4 Characters = 1,185,921 Unique IDs

X Characters = 33^X Unique IDs

The Art of Identification

Letter~~(23)~~ + Numeric₍₁₀₎ Identifier (Exclude Letters I, O, X)

1 Character = ~~33~~ Unique IDs

2 Characters = ~~1,089~~ Unique IDs

3 Characters = ~~35,937~~ Unique IDs

4 Characters = ~~1,185,921~~ Unique IDs

X Characters = ~~38^X~~ Unique IDs

Letters Typically Used For Intuitive Identification

Let's Get Technical



Identification - Equipment

References

- OSHA 29 Code of Federal Regulations CFR 1910 Subpart S
- NFPA 70 – National Electrical Code (NEC)
- NFPA 70B – Recommended Practice for Electrical Equipment Maintenance
- NFPA 70E – Electrical Safety in the Workplace
- IEEE C2 – National Electrical Safety Code (NESC)
- ANSI TIA-606 – Cable Labeling Standards
- BICSI (Telecommunications Distribution Methods Manual (TDMM)
- American Public Works Association (APWA) Underground Utility Marking Local 811 Color Codes
- FAA Advisory Circulars, Orders, Engineering Briefs, and Specifications

Definitions of Terms

“Labeled” per NFPA

Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

“Listed” per NFPA (OSHA is roughly the same)

Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

Definitions of Terms

Not Fully Defined and Generally Interchangeable

“Label” – Material that is applied, printed, or engraved with numbers, letters, words, symbols, images, and/or color that provide useful information to the observer. Affixed directly to or located directly adjacent to associated element or material.

“Marking” – Same as Label. Usually Painted or Printed on Material.

“Tag” – Same as Label. Usually Larger and More Durable than a Label

“Sign / Signage” – Same as Label. Usually Larger and More Durable than a Label or Tag. Maybe located on personnel door or other entrance device.

Electrical Equipment – Identification

OSHA 29 Code of Federal Regulations CFR 1910 Subpart S

1910.303(e) Marking

1910.303(e)(1) Identification of **manufacturer and ratings**. Electric equipment may not be used unless the following markings have been placed on the equipment:

1910.303(e)(1)(i) The **manufacturer's name, trademark**, or other descriptive marking by which the organization responsible for the product may be identified; and

1910.303(e)(1)(ii) Other markings giving **Voltage, Current, Wattage, or Other Ratings** as necessary.

1910.303(e)(2) Durability. The marking shall be of sufficient durability to withstand the environment involved.

Electrical Equipment – Identification

NFPA 70 – National Electrical Code (NEC)

110.21 Marking (A) Equipment Markings.

(1) General. The **manufacturer's name, trademark**, or other descriptive marking by which the organization responsible for the product can be identified shall be applied or affixed onto all electrical equipment. Other markings that indicate **voltage, current, wattage, or other ratings** shall be provided as specified elsewhere in this *Code*. The marking shall be of sufficient durability to withstand the environment involved.

(2) Reconditioned Equipment. Reconditioned equipment shall be marked with the following:

(1) Name, trademark, or other descriptive marking of the organization **that performed the reconditioning**

(2) The **date of the reconditioning**

(3) **The term reconditioned** or other approved wording or symbol indicating that the equipment has been reconditioned

The original listing mark shall be **removed or made permanently illegible**. The equipment nameplate shall not be required to be removed or made permanently illegible, only the part of the nameplate that includes **the listing mark, if applicable**. Approval of the reconditioned equipment shall not be based solely on the equipment's original listing.

Electrical Equipment – Identification

NFPA 70E – Electrical Safety in the Workplace

205.11 Identification of Components

Identification of components, where required, and safety-related instructions (operating or maintenance), if posted, shall be **securely attached and maintained in legible condition.**

205.12 Warning Signs

Warning signs, where required, shall be visible, **securely attached, and maintained in legible condition**

205.13 Identification of Circuits

Circuit or voltage identification shall **be securely affixed and maintained in updated and legible condition.**

Electrical Equipment – Identification

FAA 150/5370-10H Standard Specifications for Construction of Airports

109-5.6 Marking and labeling. **All equipment, control wires, terminal blocks, etc., shall be tagged, marked, or labeled as specified below:**

a. Wire identification. The Contractor shall furnish and install self-sticking wire labels or identifying tags on all **control wires** at the point where they connect to the control equipment or to the terminal blocks. Wire labels, if used, shall be of the self-sticking preprinted type and of the manufacturer's recommended size for the wire involved. Identification -markings designated in the plans shall be followed. Tags, if used, shall be of fiber not less than 3/4 inch in diameter and not less than 1/32 inch thick. Identification markings designated in the plans shall be stamped on tags by means of small tool dies. Each tag shall be securely tied to the proper wire by a nonmetallic cord.

b. Labels. The Contractor shall **stencil identifying labels on the cases of regulators, breakers, and distribution and control relay cases with white oil paint as designated by the RPR.** The letters and numerals shall be not less than **one inch in height and shall be of proportionate width.** The Contractor shall also mark the correct circuit designations per the wiring diagram on the terminal marking strips, which are a part of each terminal block.

FAA Electrical Equipment – Identification

FAA-C-1391e Department of Transportation FAA Specification for Installation, Termination, Splicing, and Transient/Surge Protection of Underground Electrical Distribution System Power Cables

5.12.2 Equipment Markers and Labels. Design and select Electrical Line Distribution (ELD) equipment markers and labels for exterior use ...

5.12.2.1 Exterior Equipment Identification Tag, Labels, and Plaques
Aluminum tags, or any other tags or labels **approved by the project engineer**, shall be labeled to **identify ELD equipment**. Attachment options include wires and ties, or screw mounts, nails, or bolts. Contrasting Colors **shall be considered** when ordering tags and labels. Plaques may be made of laminated plastic.

Exercise



Identification – Disconnecting Means

Disconnecting Means – Identification

OSHA 29 Code of Federal Regulations CFR 1910 Subpart S

1910.303(f) Disconnecting means and circuits

1910.303(f)(1) Motors and appliances. Each disconnecting means required by this subpart for motors and appliances shall be **legibly marked to indicate its purpose**, unless located and arranged so the purpose is evident.

1910.303(f)(2) Services, feeders, and branch circuits. Each service, feeder, and branch circuit, at its disconnecting means or overcurrent device, shall be **legibly marked to indicate its purpose**, unless located and arranged so the purpose is evident.

1910.303(f)(3) Durability of markings. The markings required by paragraphs (f)(1) and (f)(2) of this section shall be of **sufficient durability to withstand the environment involved**.

Disconnecting Means – Identification

NFPA 70 – National Electrical Code (NEC)

110.22 Identification of Disconnecting Means

(A) General

Each disconnecting means shall be legibly marked to **indicate its purpose** unless located and arranged so the purpose is evident. In other than one- or two-family dwellings, the marking shall include the **identification and location of the circuit source** that supplies the disconnecting means unless located and arranged so the identification and location of the circuit source is evident. The marking shall be of **sufficient durability to withstand the environment** involved.

Disconnecting Means – Identification

NFPA 70 – National Electrical Code (NEC)

408.4 Descriptions Required (A) Circuit Directory or Circuit Description.

Every circuit and circuit modification shall be provided with a **legible and permanent description** that complies with all of the following conditions as applicable:

- (1) **Located at each switch or circuit breaker** in a switchboard or switchgear
- (2) **Included in a circuit directory** that is located on the face of, inside of, or in an approved location adjacent to the panel door in the case of a panelboard
- (3) **Clear, evident, and specific to the purpose or use** of each circuit including spare positions with an unused overcurrent device
- (4) Described with a **degree of detail and clarity** that is unlikely to result in confusion between circuits
- (5) Not dependent on **transient conditions** of occupancy (e.g. “Joe’s Office”)
- (6) **Clear** in explaining abbreviations and symbols when used

Disconnecting Means – Identification

NFPA 70 – National Electrical Code (NEC)

408.4 Descriptions Required (B) Source of Supply.

All switchboards, switchgear, and panelboards supplied by a feeder(s) in other than one- or two-family dwellings shall be **permanently marked** in accordance with the following:

- (1) With the **identification and physical location** of where the power originates
- (2) With a **label that is permanently affixed and of sufficient durability to withstand the environment involved**
- (3) Using a method that is **not handwritten**

Disconnecting Means – Identification

NFPA 70 – National Electrical Code (NEC)

224.37 Identification (Multiple Services)

Where a building or structure has any combination of feeders, branch circuits, or services passing through it or supplying it, a permanent plaque or directory shall be installed at each feeder and branch-circuit disconnect location denoting all other services, feeders, or branch circuits supplying that building or structure or passing through that building or structure and the area served by each.

Exception No. 1: A plaque or directory shall not be required for large-capacity multibuilding industrial installations under single management, where it is ensured that disconnection can be accomplished by establishing and maintaining safe switching procedures.

Hazards



Electrical Equipment – Hazard Labels, Tags, and Signs

OSHA 29 Code of Federal Regulations CFR 1910 Subpart S

NFPA 70E – Electrical Safety in the Workplace

- Shock Hazard Warnings (Semi-Permanent, May Reference a Report)
- Arc Flash Warning Labels (Semi-Permanent, May Reference a Report)
- Precautions before performing Electrical Work (Temporary)
 - Lockout – Tagout – Tryout (LOTO)
- Precautions while performing Electrical Work (Temporary)
 - Safety Signage and Tags
 - Barricades

Electrical Equipment – Hazard Labels, Tags, and Signs

OSHA 29 Code of Federal Regulations CFR 1910 Subpart S

1910.305(b)(3)

Pull and junction boxes for systems over 600 volts, nominal. In addition to other requirements in this section, the following requirements apply to **pull and junction boxes for systems over 600 volts, nominal**:

1910.305(b)(3)(iii)

Covers for boxes shall be permanently marked "**HIGH VOLTAGE.**" The marking shall be on the **outside of the box cover and shall be readily visible and legible.**

Electrical Equipment – Hazard Labels, Tags, and Signs

OSHA 29 Code of Federal Regulations CFR 1910 Subpart S

1910.303(h) **Over 600 volts, nominal**

1910.303(h)(5) Working space and guarding.

1910.303(h)(5)(iii)(B) Permanent and **conspicuous warning signs** shall be provided, reading substantially as follows:

“DANGER - HIGH VOLTAGE - KEEP OUT.”



Image Credit: Courtesy of Almetek Industries
<http://almetek.com>

Electrical Equipment – Hazard Signs

NFPA 70 – National Electrical Code (NEC)

110.27 Guarding of Live Parts (<1000V)

(C) Warning Signs. Entrances to rooms and other guarded locations that contain exposed live parts shall be marked with **conspicuous warning signs** forbidding unqualified persons to enter. The marking shall meet the requirements in 110.21(B).

110.34 Working Space and Guarding (>1000V)

(C) Locked Rooms or Enclosures. ...**Permanent and conspicuous danger signs** shall be provided. The danger sign shall meet the requirements in 110.21(B) and shall read as follows:

“DANGER — HIGH VOLTAGE — KEEP OUT”



Image Credit: Courtesy of Almetek Industries
<http://almetek.com>

Electrical Equipment – Temporary Tags

OSHA 29 Code of Federal Regulations CFR 1910

1910.147 - The control of hazardous energy
Lockout – Tagout – Tryout (LOTO)



Electrical Equipment – Hazard Labels

NFPA 70 – National Electrical Code (NEC)

110.16 Arc-Flash Hazard Warning

(A) General

Electrical equipment, such as switchboards, switchgear, enclosed panelboards, industrial control panels, meter socket enclosures, and motor control centers, that is in other than dwelling units, and is **likely to require examination, adjustment, servicing, or maintenance while energized, shall be field or factory marked** to warn qualified persons of potential electric arc flash hazards. The marking shall meet the requirements in 110.21(B) and shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.



Image Credit: Courtesy of Almetek Industries <http://almetek.com>

Electrical Equipment – Hazard Labels

NFPA 70 – National Electrical Code (NEC)

110.21 Marking

(B) Field Applied Hazard Marking. Where caution, warning, or danger hazard markings such as labels or signs are required by this Code, the markings shall meet the following requirements:

(1) The marking shall be of sufficient durability to withstand the environment involved and warn of the hazards using effective words, colors, symbols, or any combination thereof.

Informational Note No. 1: See ANSI Z535.2-2011 (R2017), Environmental and Facility Safety Signs, which describes the design, application, and use of safety signs in facilities and in the environment.

Informational Note No. 2: See ANSI Z535.4-2011 (R2017), Product Safety Signs and Labels, which details the design, application, use, and placement of safety signs and labels on a wide variety of products.

(2) The marking shall be permanently affixed to the equipment or wiring method and shall not be handwritten.

Exception to (2): Portions of the markings that are variable, or that could be subject to changes, shall be permitted to be handwritten and shall be legible.

Electrical Equipment – Hazard Labels

NFPA 70 – National Electrical Code (NEC)

110.24 Available Fault Current

- (A) Field Markings. Service equipment at other than dwelling units shall be **legibly marked in the field with the available fault current**. The field marking(s) shall include the **date the fault-current calculation was performed** and be of sufficient durability to withstand the environment involved. The calculation shall be documented and made available to those authorized to design, install, inspect, maintain, or operate the system.
- (B) Modifications. When modifications to the electrical installation occur that affect the available fault current at the service, the available fault current shall be **verified or recalculated as necessary** to ensure the service equipment ratings are sufficient for the available fault current at the line terminals of the equipment. The required **field marking(s) in 110.24(A) shall be adjusted to reflect the new level of available fault current**.

Exception: The field marking requirements in 110.24(A) and 110.24(B) shall not be required in industrial installations where conditions of maintenance and supervision ensure that only qualified persons service the equipment.

FAA Electrical Equipment – Hazard Labels

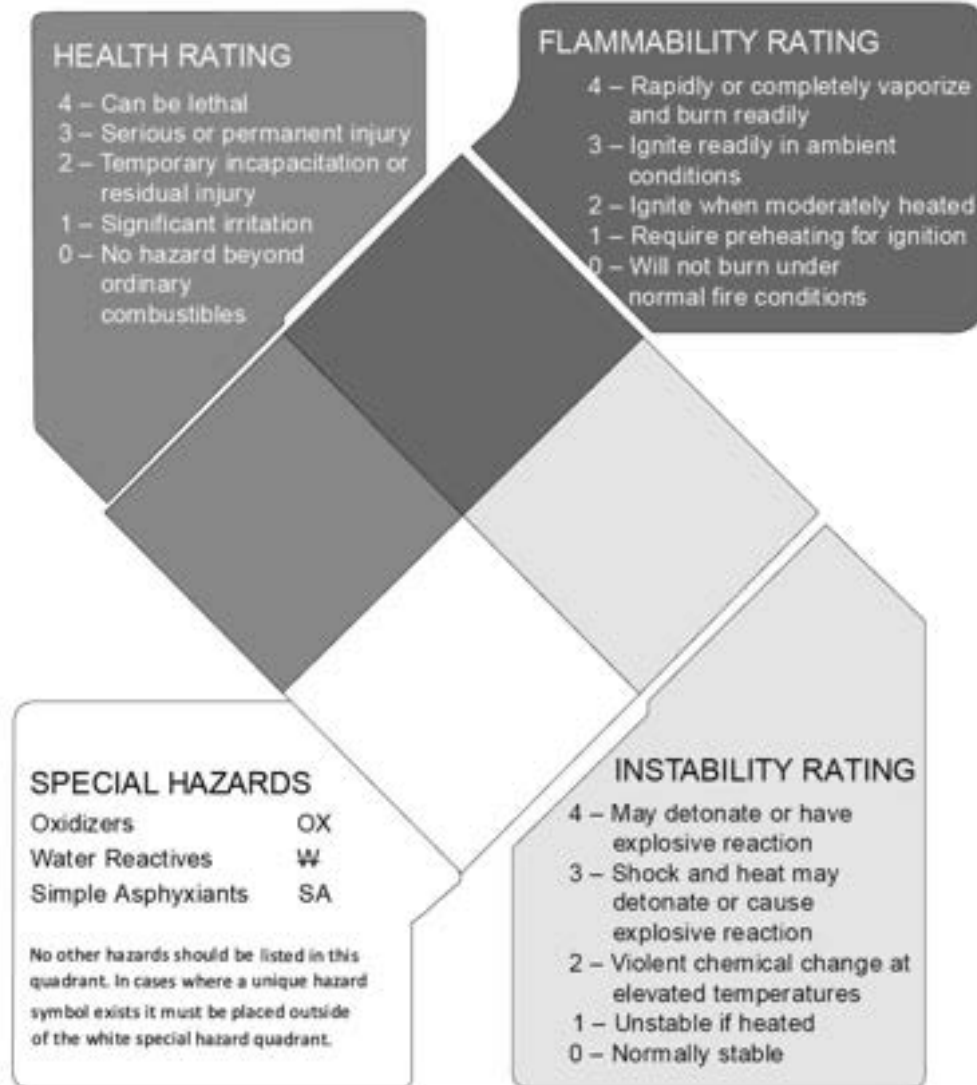
FAA-C-1391e Department of Transportation FAA Specification for Installation, Termination, Splicing, and Transient/Surge Protection of Underground Electrical Distribution System Power Cables

5.12.2.2 Warning and Safety Signs and Labels. To minimize accidents, manufacturers of electrical products use ANSI Z535, Safety Alerting Standards, to make their products and manuals safer. Contractors shall ensure that colors, safety signs and labels, safety symbols, barricade types, and information on product manuals, instructions and collateral material applying to FAA Electric Line Distribution (ELD) equipment meet ANSI Z535.1 thru .6 standards

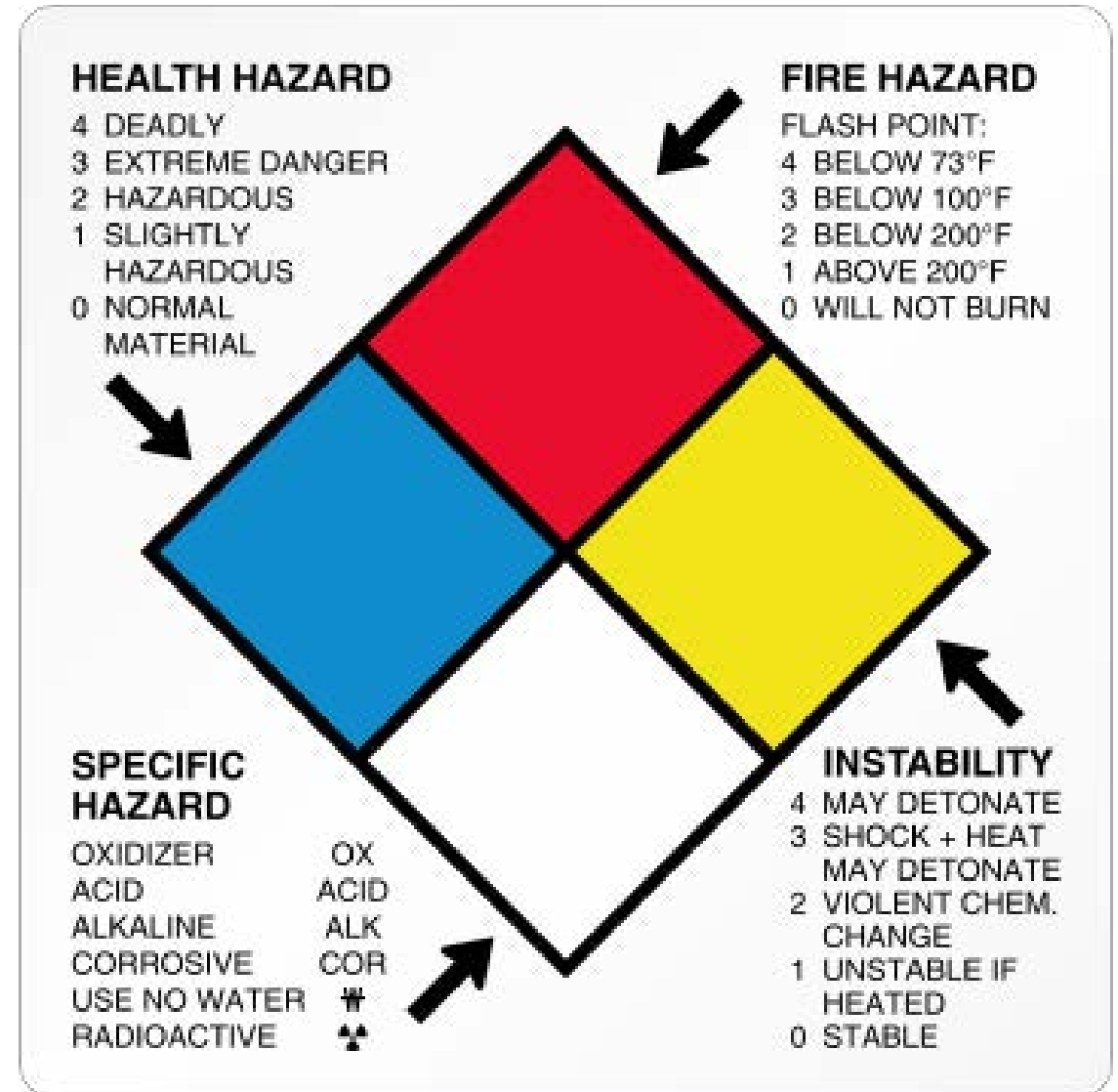
5.12.2.3 Arc Flash Hazard Labeling. In Instances where an arc flash analysis has been completed and updated with any as-built changes, the results of the study shall be labeled on all corresponding equipment, as well as the drawings. Follow NEC Article 110.16 for guidance on warning labels.

Electrical Equipment – Hazard Signs

NFPA 704



ANSI Z535; OSHA 29 CFR 1910.145



Examples



Electrical Equipment – Code Required

Electrical Equipment – Manufacturer Data



LOGO

Electrical Data

Manufacturer

MANUFACTURER

NRTL Label

Electrical Equipment – Manufacturer Data

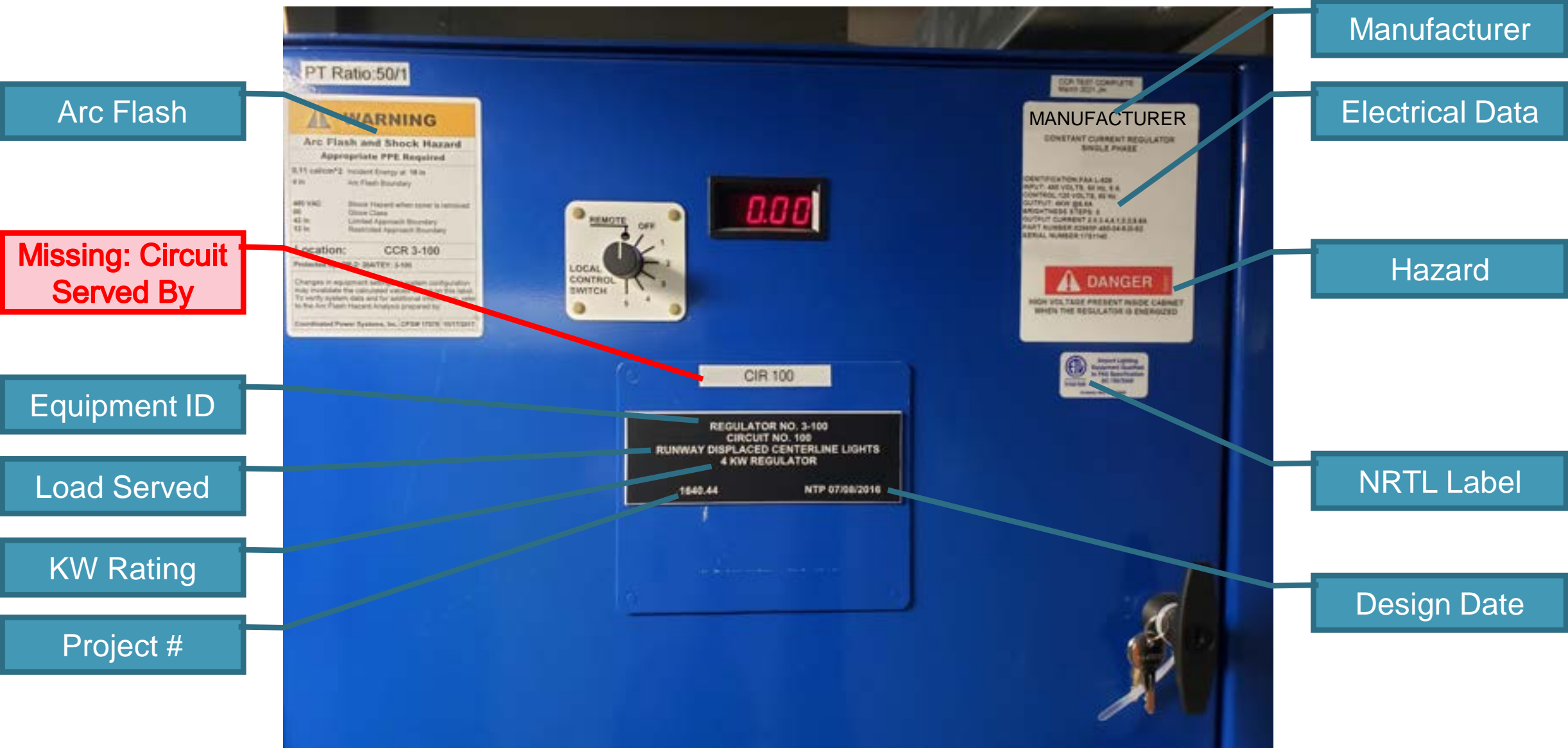


Electrical Data

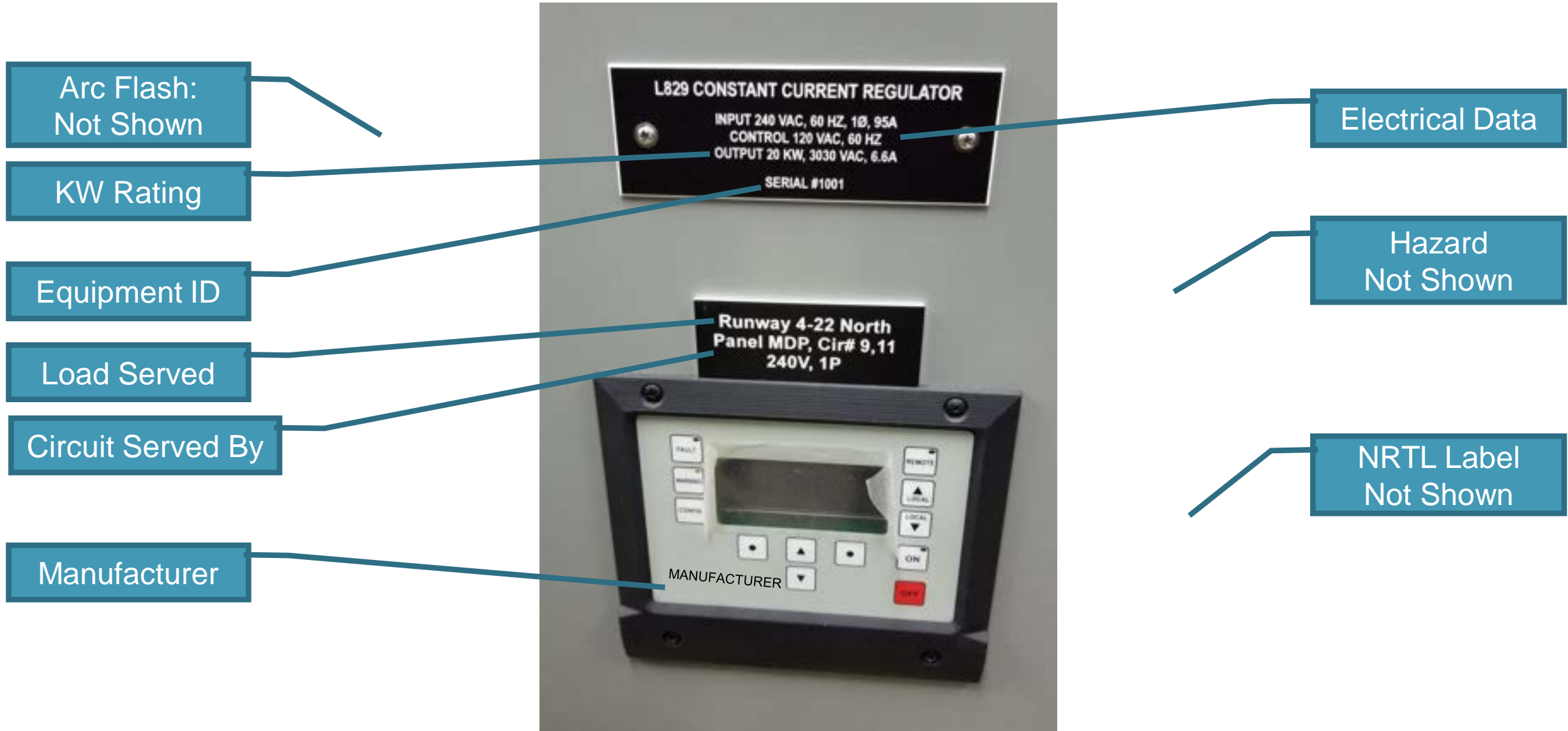
Manufacturer

NRTL Label

Electrical Equipment – Best Practices



Electrical Equipment – Best Practices



Electrical Equipment – Durability



Electrical Equipment – Durability



Electrical Equipment – Durability



Electrical Equipment – Size of Labels



Electrical Equipment – Switchboards / Panelboards



Electrical Equipment – Switchboards / Panelboards



Electrical Equipment – Switchboards / Panelboards



Underground Raceway Structures

IEEE C2 – National Electrical Safety Code (NESC)

32 Underground Conduit Systems – 323 Manholes, Handholes, and Vaults

Rule 323J. Identification – Manhole and Handhole covers should have an identifying mark that will indicate ownership or type of utility.

NFPA 70 – National Electrical Code (NEC)

110.75 Access to Manholes

(E) Marking.

Manhole covers shall have an identifying mark or logo that prominently indicates their function, such as “electric”

Underground Raceway Structures

AC 150/5370-10H Standard Specifications for Construction of Airports

115-2.7 Frames and covers

Each cover shall have the word “ELECTRIC” or other approved designation cast on it.

Each manhole shall be provided with a “DANGER -- PERMIT-REQUIRED CONFINED SPACE, DO NOT ENTER” safety warning sign as detailed in the Contract Documents and in accordance with OSHA 1910.146 (c)(2).

OSHA 1910.146 - Permit-required confined spaces

1910.146(c)(2) If the workplace contains permit spaces, the employer shall inform exposed employees, by posting danger signs or by any other equally effective means, of the existence and location of and the danger posed by the permit spaces.

Note: A sign reading "DANGER - PERMIT-REQUIRED CONFINED SPACE, DO NOT ENTER" or using other similar language would satisfy the requirement for a sign.



Image Credit: Courtesy of Almetek Industries <http://almetek.com>

Underground Raceway Structures



Underground Raceways / Cables

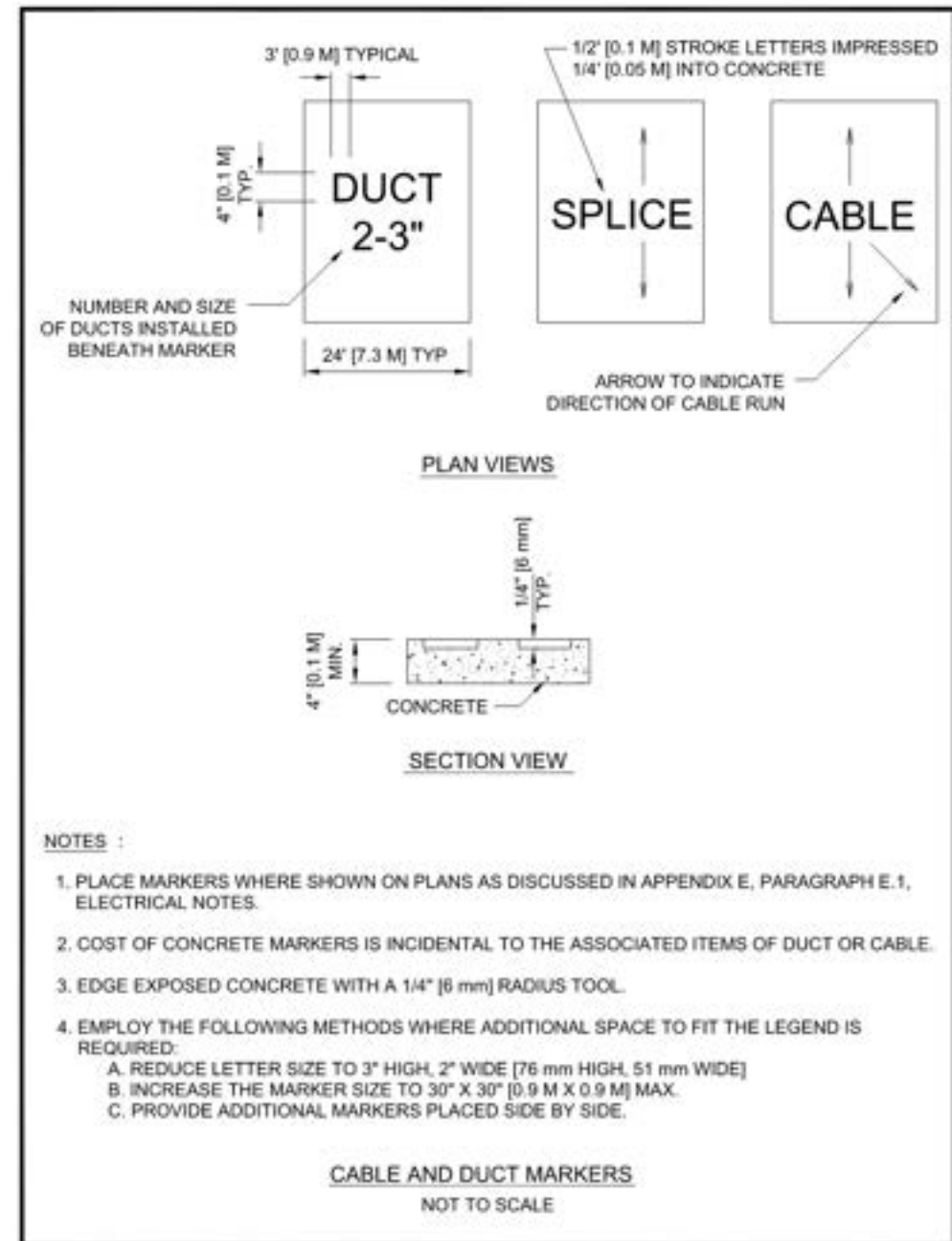
AC 150/5340-30J Design and Installation Details
for Airport Visual Aids

12.3.1 & Figure A-110

AC 150/7350-10H Standard Specifications for
Construction of Airports
L-110

FAA-C-1391e Department of Transportation FAA
Specification for
Installation, Termination, Splicing, and
Transient/Surge Protection of Underground
Electrical Distribution System Power Cables
5.13. Cable Markers. (6" & 4000PSI)

Figure A-110. Cable and Duct Markers



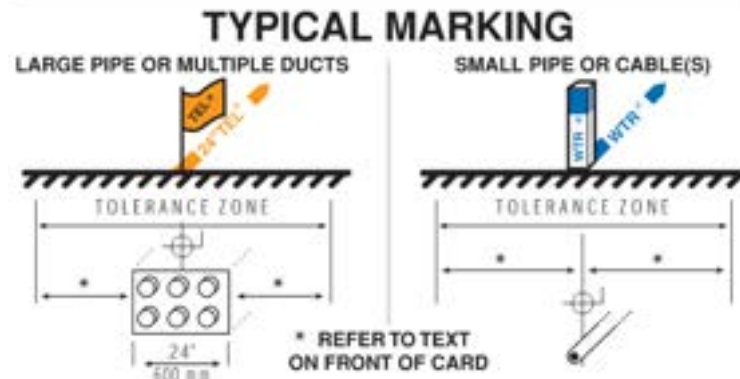
Underground Raceways / Cables



Underground Cabling / Raceways

American Public Works Association (APWA) Underground Utility Marking Local 811 Color Codes (Referenced by FAA-C-1391e 5.13)

	WHITE - Proposed Excavation
	PINK - Temporary Survey Markings
	RED - Electric Power Lines, Cables, Conduit and Lighting Cables
	YELLOW - Gas, Oil, Steam, Petroleum or Gaseous Materials
	ORANGE - Communication, Alarm or Signal Lines, Cables or Conduit
	BLUE - Potable Water
	PURPLE - Reclaimed Water, Irrigation and Slurry Lines
	GREEN - Sewers and Drain Lines



GUIDELINES FOR UNIFORM TEMPORARY MARKING OF UNDERGROUND FACILITIES

This marking guide provides for universal use and understanding of the temporary marking of subsurface facilities to prevent accidents and damage or service interruption by contractors, excavators, utility companies, municipalities or any others working on or near underground facilities.

ONE-CALL SYSTEMS

The One-Call damage prevention system shall be contacted prior to excavation.

PROPOSED EXCAVATION

Use white marks to show the location, route or boundary of proposed excavation. Surface marks on roadways do not exceed 1.5" by 18" (40 mm by 450 mm). The facility color and facility owner identity may be added to white flags or stakes.

USE OF TEMPORARY MARKING

Use color-coded surface marks (i.e., paint or chalk) to indicate the location or route of active and out-of-service buried lines. To increase visibility, color coded vertical markers (i.e., stakes or flags) should supplement surface marks. Marks and markers indicate the name, initials or logo of the company that owns or operates the line, and width of the facility if it is greater than 2" (50 mm). Marks placed by other than line owner/operator or its agent indicate the identity of the designating firm. Multiple lines in joint trench are marked in tandem. If the surface over the buried line is to be removed, supplementary offset markings are used. Offset markings are on a uniform alignment and clearly indicate the actual facility is a specific distance away.

TOLERANCE ZONE

Any excavation within the tolerance zone is performed with non-powered hand tools or non-invasive method until the marked facility is exposed. The width of the tolerance zone may be specified in law or code. If not, a tolerance zone including the width of the facility plus 18" (450 mm) measured horizontally from each side of the facility is recommended.

ADOPT UNIFORM COLOR CODE

The American Public Works Association encourages public agencies, utilities, contractors, other associations, manufacturers and all others involved in excavation to adopt the APWA Uniform Color Code, using ANSI standard Z535.1 Safety Colors for temporary marking and facility identification.

Exercise



Cabling

Cabling

FAA 150/5370-10H Standard Specifications for Construction of Airports

108-2.8 Cable identification tags. Cable identification tags shall be **made from a non-corrosive material with the circuit identification stamped or etched onto the tag. The tags shall be of the type as detailed on the plans.**

Cabling

FAA 150/5370-10H Standard Specifications for Construction of Airports

109-5.6 Marking and labeling. All equipment, control wires, terminal blocks, etc., shall be tagged, marked, or labeled as specified below:

a. Wire identification. The Contractor shall furnish and install **self-sticking wire labels or identifying tags on all control wires at the point where they connect to the control equipment or to the terminal blocks**. Wire labels, if used, shall be of the self-sticking preprinted type and of the manufacturer's recommended size for the wire involved. Identification -markings designated in the plans shall be followed. Tags, if used, shall be of fiber not less than 3/4 inch in diameter and not less than 1/32 inch thick. Identification markings designated in the plans shall be stamped on tags by means of small tool dies. Each tag shall be securely tied to the proper wire by a nonmetallic cord.

Cabling

OSHA 29 Code of Federal Regulations CFR 1910 Subpart S

1910.304(a) Identification of conductors.

1910.304(a)(1)(i) A conductor used as a grounded conductor shall be **identifiable and distinguishable from all other conductors.**

1910.304(a)(1)(ii) A conductor used as an equipment grounding conductor shall be **identifiable and distinguishable from all other conductors.**

1910.304(b) Branch circuits -

1910.304(b)(1) Identification of multiwire branch circuits. Where more than one nominal voltage system exists in a building containing multiwire branch circuits, each ungrounded conductor of a multiwire branch circuit, where accessible, shall be identified by phase and system. **The means of identification shall be permanently posted at each branch-circuit panelboard.**

Cabling

IEEE C2 – National Electrical Safety Code (NESC)

34 Cable in Underground Structures – 341 Installation

Rule 341B(3). Identification of Cable in Manholes and Vaults -

1. Cables shall be **permanently identified by tags or otherwise at each manhole or other access opening on the conduit system**. Exception: This requirement does not apply where the position of a cable, in conjunction with diagrams or maps supplied to workers, gives sufficient identification.
2. All identification shall be of **corrosion-resistant material suitable for the environment**.
3. All identification shall be of such quality and located so as to be **readable with auxiliary lighting**.

Cabling

NFPA 70 – National Electrical Code (NEC)

210.5 Identification of Branch Circuits (<1000VAC , <1500VDC)

(1) Branch Circuits Supplied from More Than One Nominal Voltage System

...each ungrounded conductor of a branch circuit shall **be identified by phase or line and by nominal voltage system at all termination, connection, and splice points ...**

(a) Means of Identification. ... **separate color coding, marking tape, tagging, or other approved means.**

(b) Posting of Identification Means. The method used for conductors originating within each branch-circuit panelboard or similar branch-circuit distribution equipment **shall be documented in a manner that is readily available or shall be permanently posted at each branch-circuit panelboard or similar branch-circuit distribution equipment.** The label shall be of sufficient durability to withstand the environment involved and shall not be handwritten.

(2) Branch Circuits Supplied from Direct Current Systems...

Label polarity. + (red) / - (black)

Cabling

NFPA 70 – National Electrical Code (NEC)

235.5(C) Identification of Ungrounded Conductors (>1000VAC , >1500VDC)

(1) Feeders Supplied from More than One Nominal Voltage System

Where the premises wiring system has feeders supplied from more than one nominal voltage system, each ungrounded conductor of a feeder shall **be identified by phase or line and system at all termination, connection, and splice points ...**

(a) Means of Identification. **The means of identification shall be permitted to be by separate color coding, marking tape, tagging, or other approved means.**

(b) Posting of Identification Means. The method utilized for conductors originating within each feeder panelboard or similar feeder distribution equipment **shall be documented in a manner that is readily available or shall be permanently posted at each feeder panelboard or similar feeder distribution equipment.**

(2) Branch Circuits Supplied from Direct Current Systems...

Label polarity. + (red) / - (black)

Cabling

NFPA 70 – National Electrical Code (NEC)

Article 200.6 Means of Identifying Grounded Conductors (Neutral).

- (1) A continuous **white** outer finish.
- (2) A continuous **gray** outer finish.

Cabling

NFPA 70 – National Electrical Code (NEC)

Article 250 Grounding and Bonding

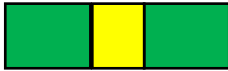
250.119 Identification of Wire-Type Equipment Grounding Conductor

(A) General

Unless required elsewhere in this Code, equipment grounding conductors shall be permitted to be bare, covered, or insulated. Individually covered or insulated equipment grounding conductors of the wire type shall have a continuous outer finish that is either **green** or **green with one or more yellow stripes** except as permitted in this section. Conductors with insulation or individual covering that is green, green with one or more yellow stripes, or otherwise identified as permitted by this section shall not be used for ungrounded or grounded circuit conductors.

Cabling

Voltage Driven Systems

- 120/240V 1-Phase: A - Black, B - Red, N - White
- 208/120V 3-Phase: A - Black, B - Red, C - Blue, N - White
- 480/277V 3-Phase: A - Brown, B - Orange, C - Yellow, N - Gray
- 120/240V 3-Phase High-Leg:
A - Black (120V), B - Orange (208V High Leg), C – Red (120V), N - White
- Grounding - Green. 
- Isolated Ground - Green with Yellow Tracer. 

Cabling

BICSI Telecommunications Distribution Methods Manual (TDMM)

ANSI TIA-606 – Cable Labeling Standards (Telecommunications)

- Color Code Terminations associated with System/Usage

- Demarcation point: Orange



- Network connection: Green



- Common equipment: Purple



- Key system: Red



- First-level backbone: White



- Second-level backbone: Gray



- Campus backbone: Brown



- Horizontal: Blue



- Miscellaneous: Yellow



Cabling

BICSI (Telecommunications Distribution Methods Manual (TDMM)

ANSI TIA-606 – Cable Labeling Standards (Telecommunications)

- Label Locations: Sites, Buildings, Rooms, Racks, Panels, and Termination (Ports)
- Label Cables and Pathways with Source and Destination
- Label Fire Walls and Fire Stops
- Label Grounding and Bonding Locations (Busbars and Cables)
- Labels Broken into 4 Classes
 1. Single Possible Source – 1 Building
 2. Multiple Possible Sources – 1 Building
 3. Multiple Buildings – 1 Site
 4. Multiple Buildings and Sites

Cabling

BICSI (Telecommunications Distribution Methods Manual (TDMM)

Cable and Component Labels should:

- Read uniquely without disconnection of cables or components after installation.
- Be located within 12 inches of the connecting hardware
- Be located on user side and the cabling side of the connecting hardware.
- Provide a direct link to the identifier of the component with the administration system.
This direct link may be the identifier itself or a code that uniquely links to the record for the component.

FAA Cabling

FAA-C-1391e Department of Transportation FAA Specification for Installation, Termination, Splicing, and Transient/Surge Protection of Underground Electrical Distribution System Power Cables

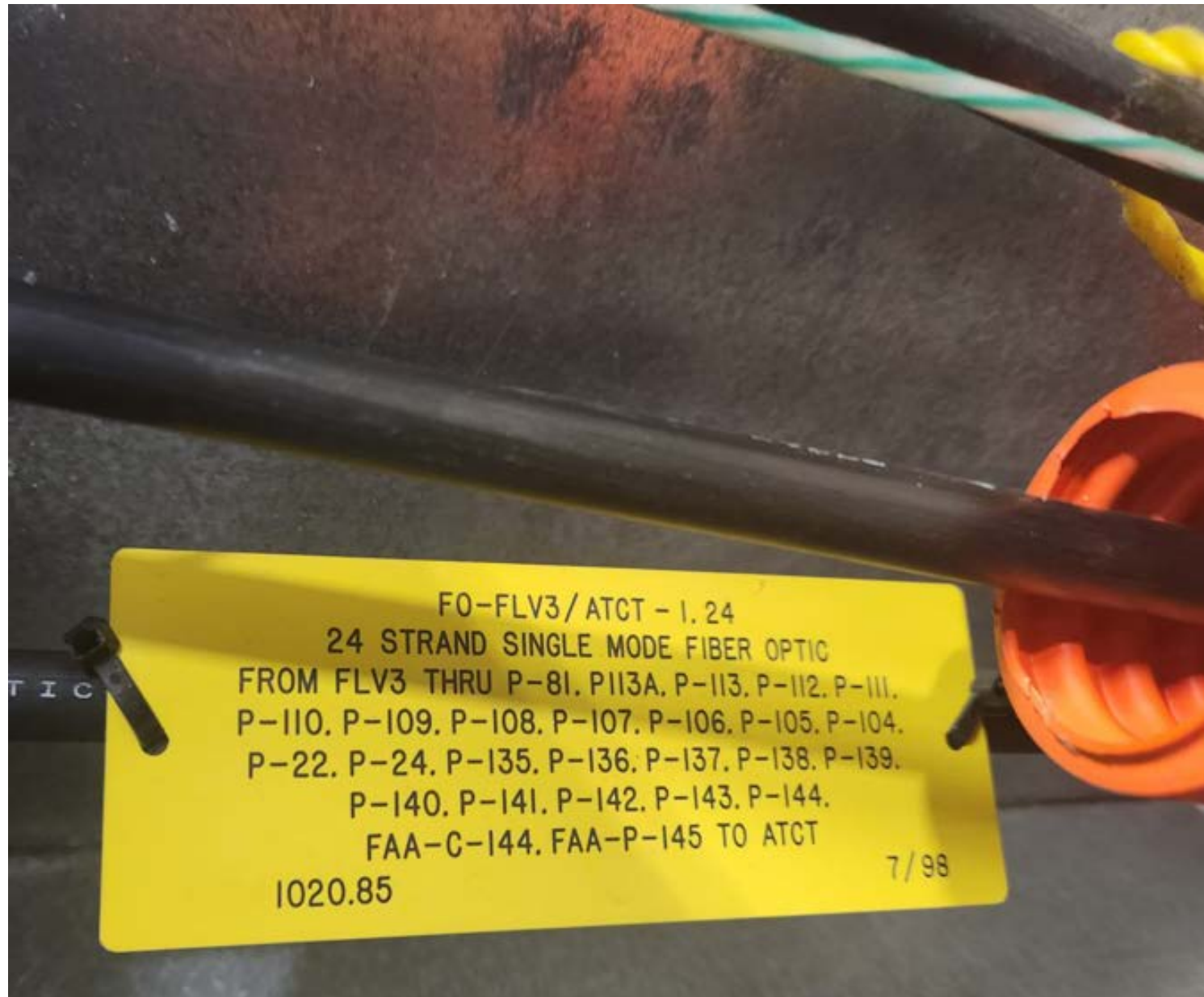
- 5.12.1 Cable Tags: Metal or exterior 2-Ply UV stable engraved acrylic cable tags with white text on black background. 2 Tags per cable in Pulling Structure near entrances into structure.

Cable terminations and potheads shall be tagged as to function, including facility which they serve and any pertinent data (e.g. voltage, source, destination). Tags shall be marked with abbreviation of the name of the facility or facilities served by the cable plus the letter “P” (Power). Where more than one identical cable is used to serve the same facility, cables may be bundled under one tag unless job plans state otherwise.

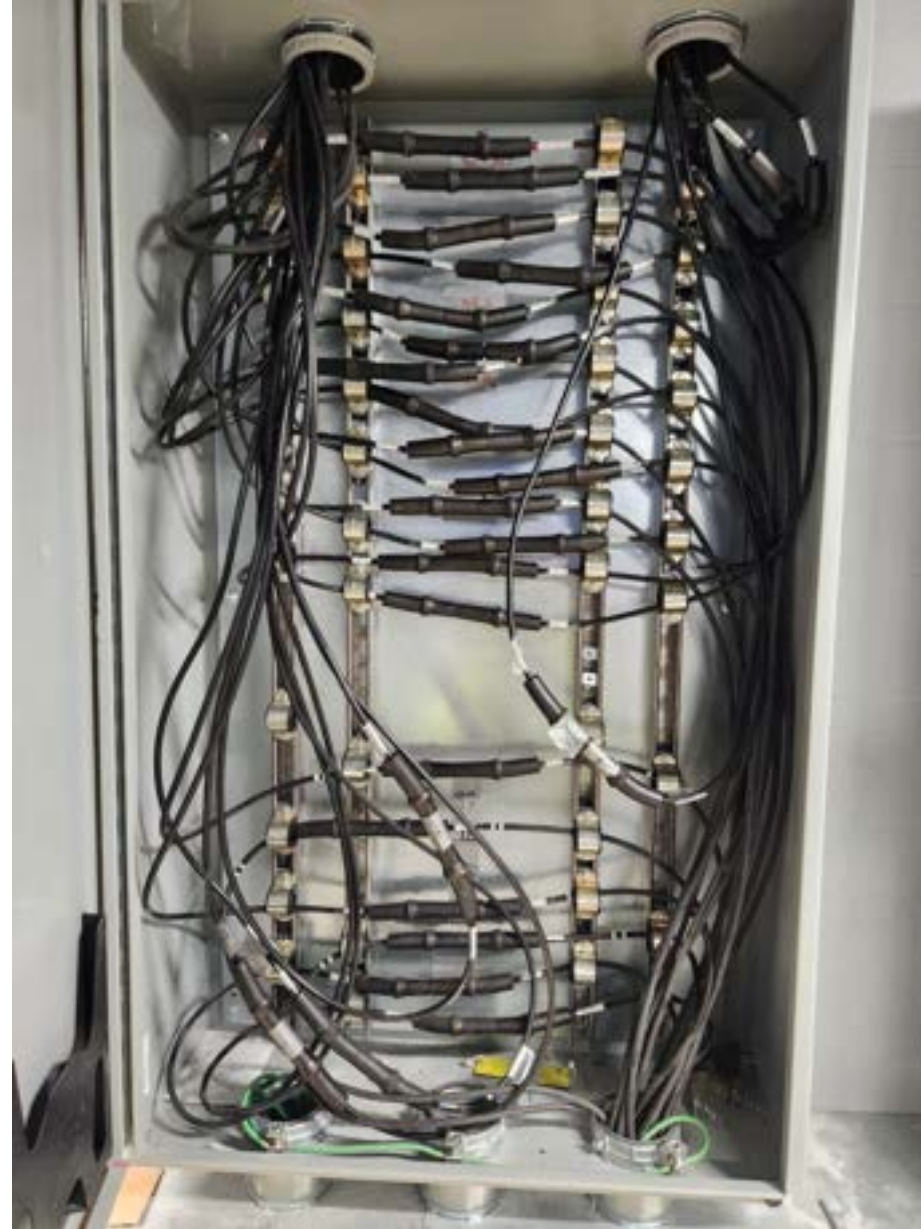
Cabling



Cabling



Cabling



Cabling



Cabling



Cabling



Cabling



Cabling



Cabling



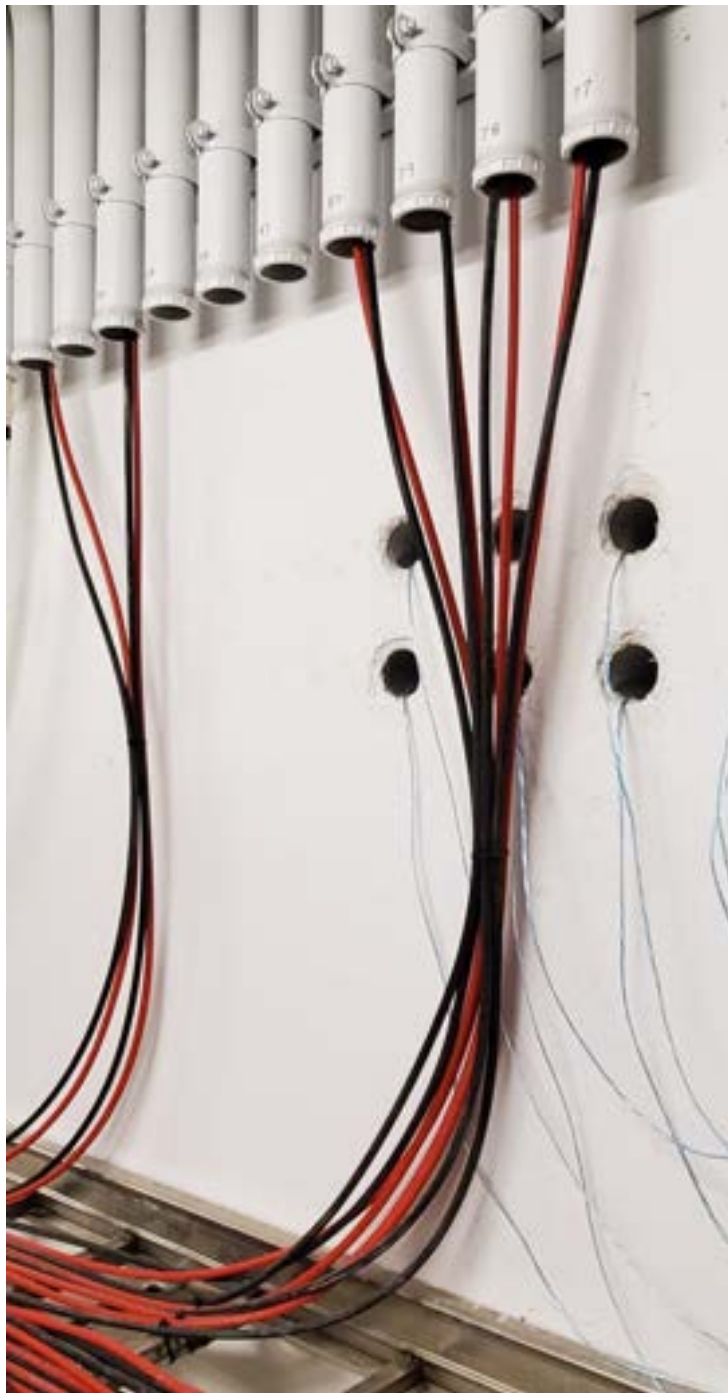
Cabling



Cabling



Cabling



Cabling



Cabling



Light Fixtures

AC 150/5340-30J Design and Installation Details for Airport Visual Aid

Chapter 11 Fixture Mounting Bases

11.5. Installation. 11.5.4 Light Fixtures - General.

11.5.4.8 To facilitate maintenance of light fixtures, we recommend that identification numbers be assigned and installed by one of the following or similar methods:

1. Stencil numbers with black paint on the runway side of the base plate.
 - a. Attach a non-corrosive disc with permanent numbers to the light fixture.
 - b. A minimum height of the numbers of 2 inches is recommended.
2. Impress numbers on a visible portion of the concrete backfill.
 - a. It is recommended that the minimum height of the numbers be 3 inches.
 - b. A permanent survey marker may also be installed in the concrete base or pavement.

Light Fixtures

AC 150/5340-30J Design and Installation Details for Airport Visual Aids

Chapter 12 Equipment and Materials

12.4. Cable, Cable Connectors, Plugs, and Receptacles

12.4.1 Cable Installation Series Circuit / 12.4.1.8 Identification Numbers.

1. Assign identification numbers to each station (transformer housing installation) per the plans.
2. Place the numbers to identify the station by one of the following methods:
 - a. Stencil numbers of a 2 inch (51 mm) minimum height using black paint on the pavement side of the transformer housing base plate.
 - b. Attach a non-corrosive metal disc of 2 inch (51 mm) minimum diameter with numbers permanently stamped or cut out under the head of a transformer housing base plate bolt.
 - c. Stamp numbers of a 3 inch (75 mm) minimum height on a visible portion of the concrete backfill surrounding the L-867 base.

Light Fixtures

AC 150/5340-30J Design and Installation Details for Airport Visual Aids

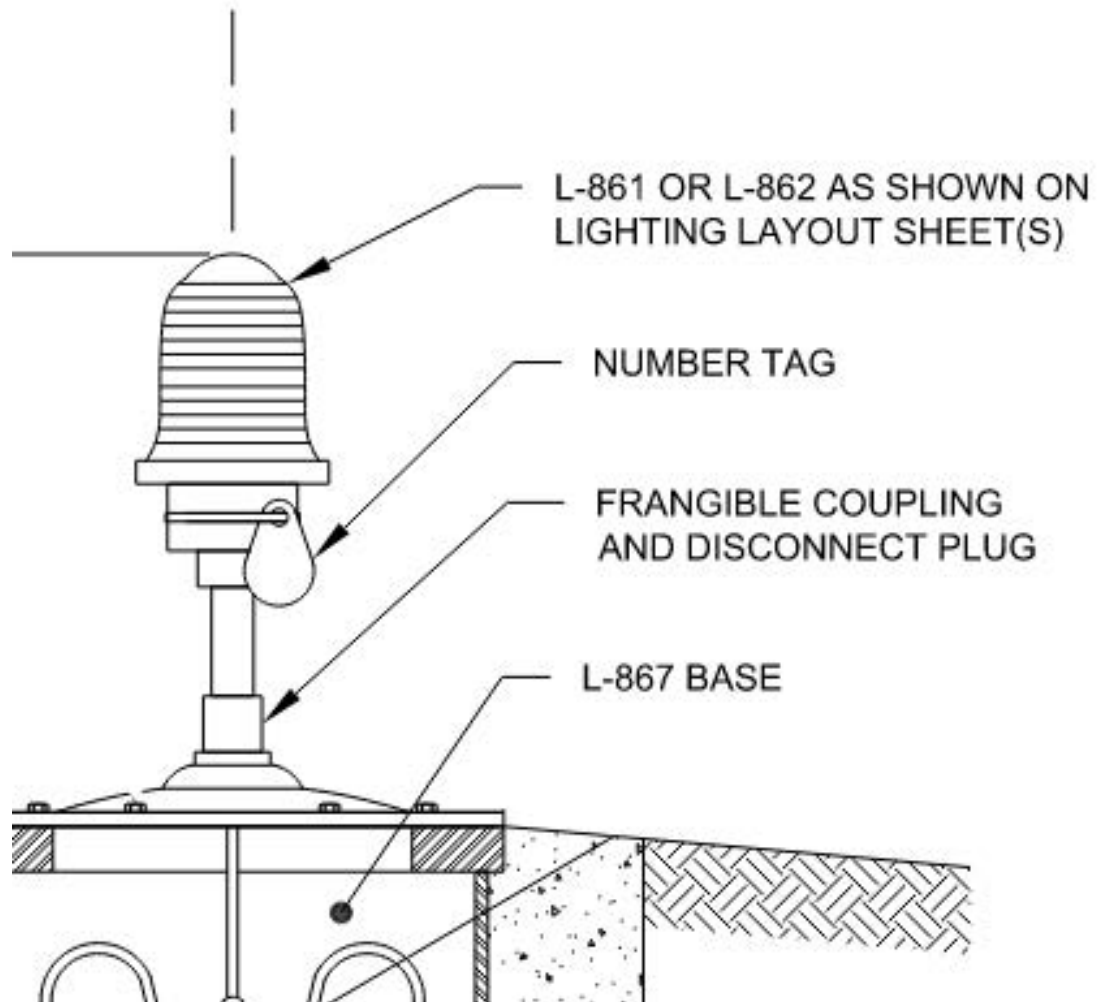
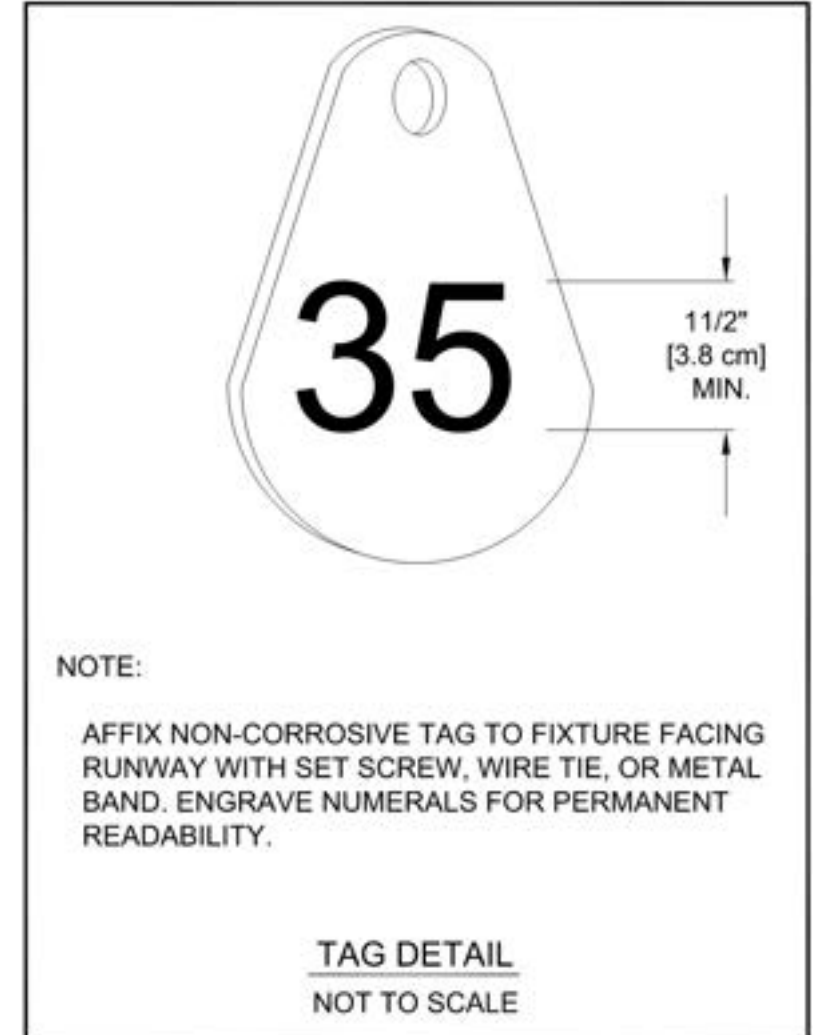


Figure E-5. Identification (ID) Tag Detail



Light Fixtures



Light Fixtures



Light Fixtures



Light Fixtures



Polyethylene Tag Holder
 A – Aluminum Embossed
 B – Aluminum Flat
 X – Aluminum Reflective
 8 – Polyethylene Stamped
 A – Polyethylene Engraved



Aluminum Tag Holder
 A – Aluminum Embossed
 B – Aluminum Flat
 X – Aluminum Reflective
 8 – Polyethylene Stamped



Image Credit Above and Below: Courtesy of Almetek Industries <http://almetek.com>



Light Fixtures



Light Fixtures



Signage



Signage



Signage



Signage



Documentation

How do we know what we know?

Do we have Records?

Are my records Digital?

Are my records Native or Scanned?

Do we need Special Software?

Are my records Accurate?

Are my records Consistent?

Are my records Sensitive?

Maintaining Records

**If Not, Create Records though
Research and Subsurface Surveys**

**Digital is Easy to Transfer and won't
Decay, but be prepared for Corruption
Backup – Backup – Backup – Backup**

Scanned PDFs require Recreation

REVIT, ACAD, PDF, Excel, Proprietary

Garbage In = Garbage Out

Symbols, Legends, Labeling, Layouts

Protect Sensitive Data

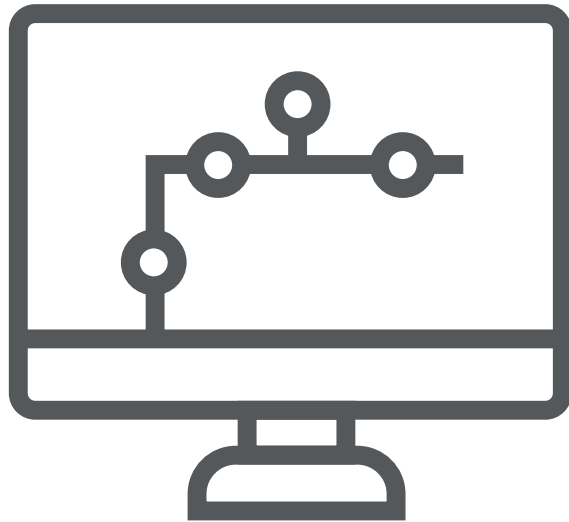
Need to Know (Password Protect)

Documentation



Documentation – Next Level

- Geographic Information System (GIS) Asset Management
- Part 139 Inspections
- Maintenance Work Order Integration
- Real-Time Data



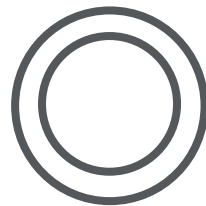
Documentation

Ultimate Goal: Efficiently and Accurately Document Current and Actionable Data
that can be Replicated, Sorted, and Searched
while Avoiding ROT (Redundant, Obsolete, and Trivial) Data

WHAT
WE DONT KNOW
WE DON'T KNOW



WHAT
WE KNOW
WE DON'T KNOW



WHAT
WE KNOW
WE KNOW



Documentation

Ultimate Goal: Create a Consolidated Record that Documents ALL Known Existing Conditions Accessible to Owners, Users, Designers, Engineers, Contractors, Inspectors, etc.

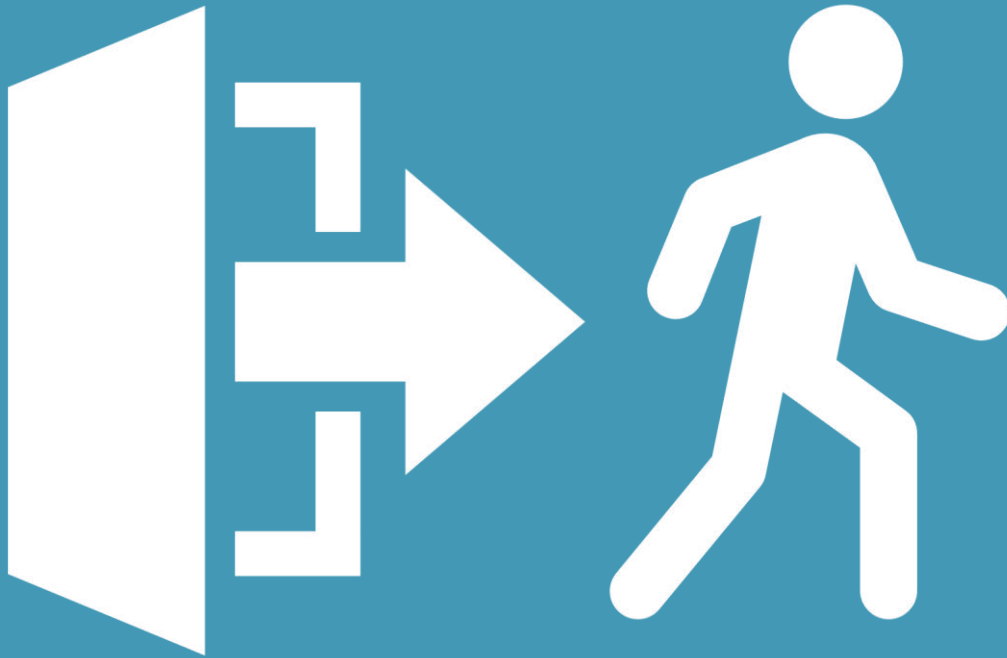
WHAT
WE DON'T KNOW
WE KNOW



WHAT
WE KNOW
WE KNOW



Call To Action



- Label Everything for
Safety and Ease of Maintenance
- Be Clear
Be Concise
Be Consistent
Be Coordinated
- Consider your Audience
- Create, Maintain, and Update
Consolidated Records

IESALC

ILLUMINATING ENGINEERING SOCIETY
AVIATION LIGHTING COMMITTEE



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Questions? & Thank you!

LABELING AND DOCUMENTATION FOR AIRFIELD ELECTRICAL ELEMENTS

