Non-Electrical Considerations for Electrical Rooms

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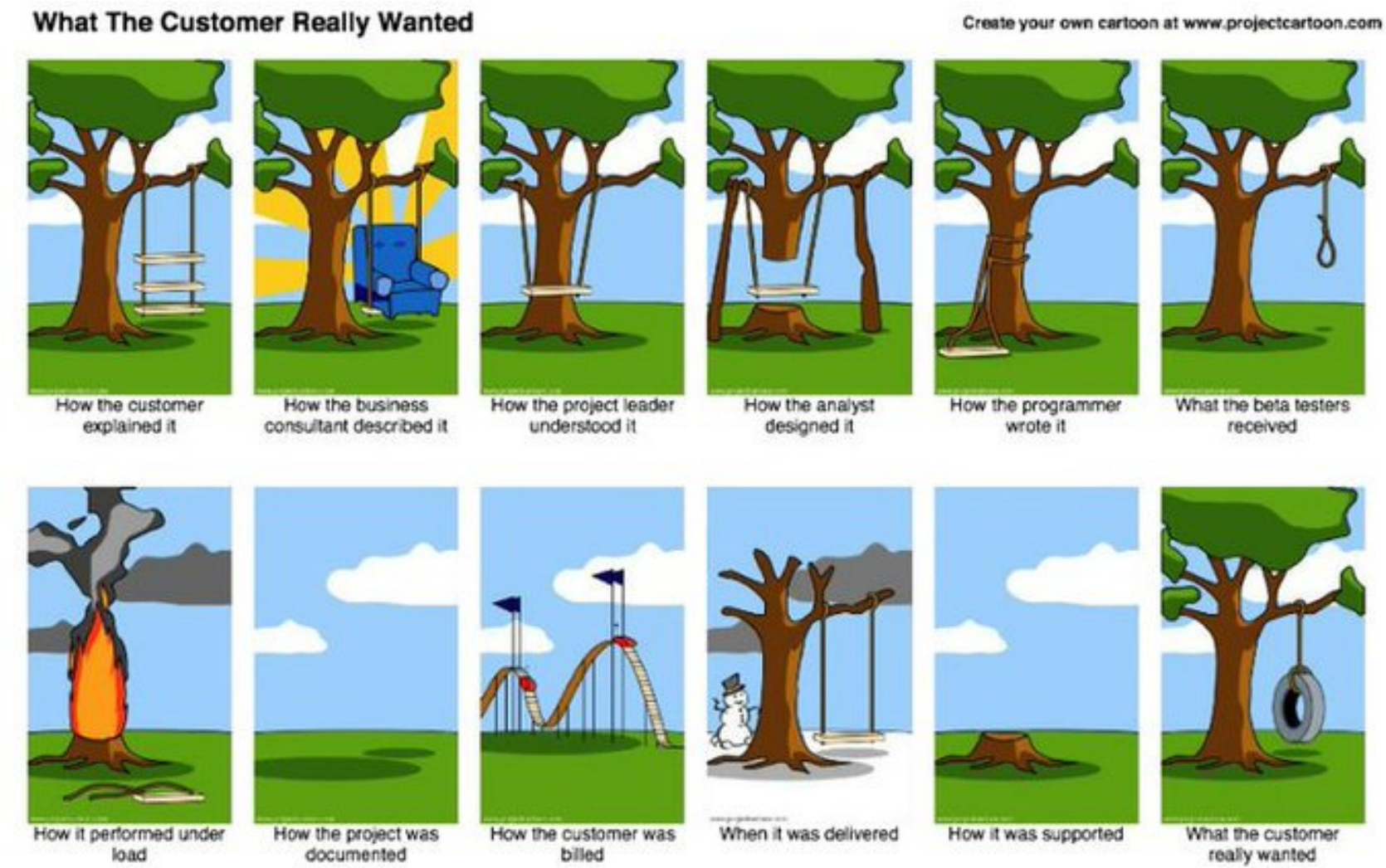
Learning Goals

- Identify code & standard concerns
- Identify non-code coordination issues
  - Methodology
  - Physical interferences
- Encourage the use of a checklist to ask the right questions

Electrical Room (or not)



Electrical Room

Electrical Room

aka

- IPA
- PCR
- PDU
- PDC
- E-House
- ECR

ELECTRICAL Rooms interface with:

Primary

- Civil / Structural / Architectural
- HVAC, Dust/Fume Control
- Materials Handling / Piping / Process

Secondary

- Instrument & Control Systems
- Fire Protection

Electrical Room Considerations

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Electrical Room Considerations

Georgia Codes

- Dept Community Affairs (https://www.dca.ga.gov/)
  - Mandatory Codes
    - IBC (International Building Code) 2018 w/ GA amendments
    - IFC (International Fire Code) See SFM
    - IPC, IMC, IFGC
    - National Electrical Code 2017 2020 adoption effective 01/01/2021
    - IECC (International Energy Conservation Code) 2015 w/ GA supplements and amendments

Georgia Codes

- State Fire Marshal (https://www.oci.ga.gov/firemarshal/)
  - Subject 120-3-3 RULES AND REGULATIONS FOR THE STATE MINIMUM FIRE SAFETY STANDARDS
    - Rule 120-3-3-.04. State Minimum Fire Safety Standards with Modifications: Adopts 177 Codes, etc.

    - IFC (International Fire Code) 2018 w/ modifications
    - NFPA 13 (Standard for the Installation of Sprinkler Systems) 2019 w/ modifications
    - NFPA 72 (National Fire Alarm and Signaling Code) 2019 w/ modifications
    - NFPA 101 (Life Safety Code) 2018 w/ modifications

Civil / Structural / Architectural

Civil / Structural / Architectural

Codes & Standards

- IBC Chapter 3 OCCUPANCY CLASSIFICATION AND USE
  - 10 major Groups i.e. classifications
  - Some groups have breakout by use
  - e. g. Assembly group A, uses A-1 through A-5
    - A-3: Indoor swimming pool *without* spectator seating
    - A-4: Indoor swimming pool with spectator seating
  - Educational Group E – no breakouts based on use
  - NOTE: No “special occupancy classification” for Electrical Rooms

Civil

Codes & Standards

- IBC Chapter 16 STRUCTURAL DESIGN § 1603 CONSTRUCTION DOCUMENTS
  - Per 1603.1 documents shall show:
    - 1603.1.6 Geotechnical information: Load bearing values of soils
    - § 1610 SOIL LATERAL LOADS
    - 1603.1.7 Flood design data: Located in *flood hazard areas*
    - § 1612 FLOOD LOADS

Civil / Structural

Codes & Standards

- 1603.1.5 Earthquake design data
  - 1. Risk category
  - 2. Seismic importance factor, I_e
  - 3. Mapped spectral response acceleration parameters
  - 6. *Seismic design category* NOTE: The term Design Zone is no longer in use.
  - and other factors
- § 1613 EARTHQUAKE LOADS
  - invokes Minimum Design Loads for Buildings and Other Structures (ASCE 7-16). Includes chapters 11-13 specifically

Civil / Structural

Codes & Standards

- ASCE 7-16 Chapter 11 SEISMIC DESIGN CRITERIA
  - "11.1.1 Purpose. Chapter 11 presents criteria for the design and construction of buildings and other structures subject to earthquake ground motions."
  - "11.1.2 Scope. Every structure and portion thereof, including nonstructural components, shall be designed and constructed to resist the effects of earthquake motions as prescribed by the seismic requirements of this standard."

Civil / Structural

Codes & Standards

- ASCE 7-16 Chapter 12 SEISMIC DESIGN REQUIREMENTS FOR BUILDING STRUCTURES
- ASCE 7-16 Chapter 13 SEISMIC DESIGN REQUIREMENTS FOR NONSTRUCTURAL COMPONENTS
    - “13.1.1 Scope. …nonstructural components that are permanently attached to structures and for their supports and attachments.”
    - “13.1.2 Seismic Design Category. For the purposes of this chapter, nonstructural components shall be assigned to the same Seismic Design Category as the structure that they occupy or to which they are attached.”

Structural

Codes & Standards

- IBC Chapter 16 STRUCTURAL DESIGN § 1603 CONSTRUCTION DOCUMENTS
  - Per 1603.1 documents shall show:
    - 1603.1.1 Floor live load: Uniformly distributed, concentrated and impact floor live load
    - 1603.1.2 Roof live load
    - § 1607 LIVE LOADS
    - 1603.1.3 Roof snow load data
    - § 1608 SNOW LOADS
    - 1603.1.4 Wind design data
    - § 1609 WIND LOADS

Architectural

Codes & Standards

- IBC Chapter 7 FIRE AND SMOKE PROTECTION FEATURES
  - § 706 FIRE WALLS
    - 706.4 *fire resistance rating* not less than table …

TABLE 706.4
FIRE WALL FIRE-RESISTANCE RATINGS

GROUP	FIRE-RESISTANCE RATING (hours)
A, B, E, H-4, I, R-1, R-2, U	3[a]
F-1, H-3[b], H-5, M, S-1	3
H-1, H-2	4[b]
F-2, S-2, R-3, R-4	2

a. In Type II or V construction, walls shall be permitted to have a 2-hour fire-resistance rating.

b. For Group H-1, H-2 or H-3 buildings, also see Sections 415.7 and 415.8.

Architectural

Codes & Standards

- IBC Chapter 7 FIRE AND SMOKE PROTECTION FEATURES
  - § 707 FIRE BARRIERS
    - 707.3.10 **Fire areas** … single occupancy … *fire resistance rating* not less than table …

TABLE 707.3.10
FIRE-RESISTANCE RATING REQUIREMENTS FOR FIRE BARRIERS, FIRE WALLS OR HORIZONTAL ASSEMBLIES BETWEEN FIRE AREAS

OCCUPANCY GROUP	FIRE-RESISTANCE RATING (hours)
H-1, H-2	4
F-1, H-3, S-1	3
A, B, E, F-2, H-4, H-5, I, M, R, S-2	2
U	1

Architectural

Codes & Standards

- FM Global Property Loss Prevention Data Sheet 5-4 Transformers **2.3 Fire Protection for Outdoor Transformers 2.3.1 Location and Construction**

Transformers **5-4**

FM Global Property Loss Prevention Data Sheets Page 23

Table 5. Separation for Exposure Protection of Main Building Walls (also refer to Figure 3)

Fluid or Transformer Type	*Fluid Volume, gal (m^3)*	*Minimum Horizontal Distance from Containment to Exposed Building Wall (Dimension X in Figure 3)*		
		2-hour fire-rated wall, ft (m)	Non-combustible wall,[1] ft (m)	Combustible Wall,[1] ft (m)
FM Approved transformer	Per Approval Listing	3 (0.9)		
FM Approved Liquid in non-Approved transformer	<10,000 (38)	5 (1.5)		25 (7.6)
	>10,000 (38)	15 (4.6)		50 (15.2)
Non-Approved transformer liquid	<500 (1.9)	5 (1.5)	15 (4.6)	25 (7.6)
	≤5,000 (1.9-19)	15 (4.6)	25 (7.6)	50 (15.2)
	>5,000 (19)	25 (7.6)	50 (15.2)	100 (30.5)

[1] For definition of combustible and noncombustible construction materials, see Appendix of Data Sheet 1-1, *Firesafe Building Construction and Materials*

IEEE IAS

Architectural

Codes & Standards

- IBC Chapter 10 MEANS OF EGRESS
  - § 1003 GENERAL MEANS OF EGRESS
    - 1003.5 Elevation change. Ramp if less than 12 inches. Exception 1 Single step with maximum riser of 7 inches … at exterior doors not required to be accessible …
  - § 1011 STAIRWAYS
    - "1011.6 Stairway landings. There shall be a floor or landing at the top and bottom of each stairwell."

Architectural

Codes & Standards

- IBC Chapter 10 MEANS OF EGRESS
  - § 1020 CORRIDORS
    - 1020.2 Width and capacity. The required capacity of corridors shall be determined as specified in Section 1005.1, but the minimum width shall not be less than that specified in Table 1020.2.

TABLE 1020.2
MINIMUM CORRIDOR WIDTH

OCCUPANCY	MINIMUM WIDTH (inches)
Any facility not listed in this table	44
Access to and utilization of mechanical, plumbing or electrical systems or equipment	24
With an occupant load of less than 50	36

Civil / Structural / Architectural

Non – Code Issues

- Opening
  - Wall Penetration: Size & Location
  - Floor Penetration: Size & Location
- Overhead
  - Ceiling height: NEC 110.26(E)(1)(a) *Dedicated Electrical Space* 1.8m (6ft)
    - Cable trays – 3 layers minimum 1.37m (4½ ft)
- Load Support
  - Wall loads: small transformers
  - Leveling channels
  - "Housekeeping" pads

HVAC, Dust/Fume Control

HVAC, Dust/Fume Control

Codes & Standards

- IECC Section C401 GENERAL
  - "C401.1 Scope: The provisions in this chapter are applicable to commercial *buildings* and their *building sites*."
  - "C401.2 Application: Commercial buildings shall comply with one of the following:
    - 1. The requirements of ANSI/ASHRAE/IESNA 90.1"
- ASHRAE/IES 90.1 (Energy Standard for Buildings Except Low-Rise Residential Buildings) [2013]
    - TABLE 9.6.1 Lighting Power Density Allowances …

HVAC

Codes & Standards

- NFPA 72 Chapter 21 Emergency Control Function Interfaces
  - 21.7 Heating, Ventilating and Air-Conditioning (HVAC) Systems.
    - 21.7.1 through 21.7.8 describe various interconnections. NO prescribed interlocks
  - *"N 21.8* **High Volume Low Speed (HVLS) Fans.** Where required by NFPA 13, all HVLS fans shall be interlocked to shut down …"

HVAC

Codes & Standards

- NFPA 13 Chapter 19 Design Approaches
  - 19.2 General Design Approaches.
    - "**19.2.7* High Volume Low Speed (HVLS) Fans.** The installation of HVLS fans in buildings equipped with sprinklers, including ESFR sprinklers, shall comply with the following:"
      - (1), (2), (3) …
      - "(4) All HVLS fans shall be interlocked to shut down immediately upon a waterflow alarm. Where the building is protected with a fire alarm system, this interlock shall be in accordance with the requirements of NFPA 72."

Dust/Fume Control

Codes & Standards

- National Electrical Code 2017 § 480 Storage Batteries
  - § 480.10 Battery Locations.
    - **"(A) Ventilation.** Provisions appropriate to the battery technology shall be made for sufficient diffusion and ventilation of gases from the battery, if present, to prevent the accumulation of an explosive mixture."
      - Info. Note 1: NFPA 1-2015 Chapter 52. No interlock / interconnection requirements.
      - Info. Note 2 …
      - Info. Note 3: IEEE 1635 /ASHRAE GD 21 – 2012 No interlock / interconnection *requirements*. Potential interlock with outside air flow.

HVAC, Dust/Fume Control

Non – Code Issues

- Inlet air vent location(s)
- Distribution ductwork
- MV AFD cooling
- Arc Flash exhaust vents

Materials Handling / Piping / Process

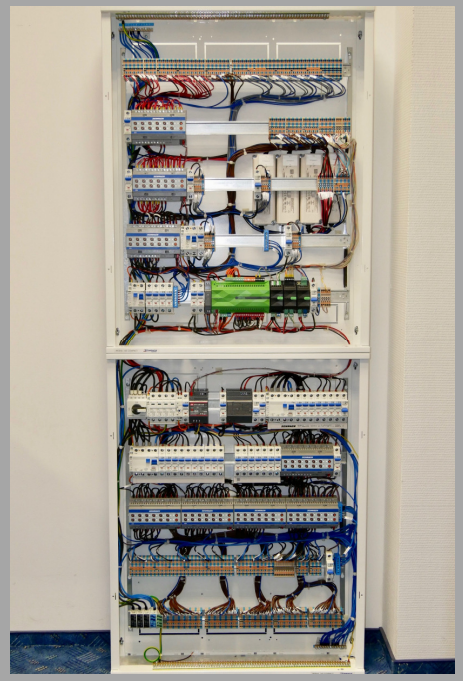
Materials Handling / Piping / Process

Non – Code Issues

- Hallways, Aisles
- Removal egress for equipment
  - Large frames
  - Shafts

- Clear area adjacent to cable exit pathway
  - Piping
  - HVAC ductwork

- Location of loads (i.e. which direction)
- Feeder lengths (VFD's)



Instrument & Control Systems
Fire Protection

Instrument & Control Systems

Non – Code Issues

- Separate or Integrated Rack Room
  - Heating & Cooling Loads
  - Power requirements for I/O & processor(s)
    - Normal Power
    - UPS requirements (essential NOT emergency)
- Type of I/O: Cabling requirements
  - Ethernet, Profibus, etc.
  - Distributed racks or Integrated into MCC's

Fire Protection: Sprinkler Ratings

Norbulb Model	Fast Response per NFPA 13 RTI < 50 $(ms)^{1/2}$	Nominal Dia. in mm	Operating Time in Seconds	Response Time Index (RTI) $(ms)^{1/2}$ $(fts)^{1/2}$
N2.5	Yes	2.5	9	25 / 45
N3	Yes	3	11.5	33 / 59
N3.3	Yes	3.3	13.5	38 / 68
NF5	No	5	23	65 / 115
N5	No	5	32	90 / 162
	(https://en.wikipedia.org/wiki/Fire_sprinkler)			

Maximum Ceiling Temperature	Temperature Rating	Temperature Classification	Color Code (with Fusible Link)	Liquid Alcohol in Glass Bulb Color
100 °F / 38 °C	135-170 °F / 57-77 °C	Ordinary	Uncolored or Black	Orange (135 °F / 57 °C) or Red (155 °F / 68 °C)
150 °F / 66 °C	175-225 °F / 79-107 °C	Intermediate	White	Yellow (175 °F / 79 °C) or Green (200 °F / 93 °C)
225 °F / 107 °C	250-300 °F / 121-149 °C	High	Blue	Blue
300 °F / 149 °C	325-375 °F / 163-191 °C	Extra High	Red	Purple
375 °F / 191 °C	400-475 °F / 204-246 °C	Very Extra High	Green	Black
475 °F / 246 °C	500-575 °F / 260-302 °C	Ultra High	Orange	Black
NFPA 13-2019 Table 7.2.4.1 Temperature Ratings, Classifications, and Color Codings				

Fire Protection

Codes & Standards

- NFPA 13 (To Sprinkle or Not To Sprinkle)
  - Chapter 9 Sprinkler Location Requirements
    - 9.3.20 Electrical Equipment.
      - "9.3.20.1* Unless the requirements of 9.2.6 are met, sprinkler protection shall be required in electrical equipment rooms."
    - "9.2.6* Sprinklers shall not be required in electrical equipment rooms where all of the following conditions are met:
      - (1) The room is dedicated to electrical equipment only.
      - (2) Only dry-type or liquid-type with listed K-class fluid electrical equipment is used.
      - (3) Equipment is installed in a 2-hour fire-rated *enclosure (emphasis added)* including protection for penetrations.
      - (4) Storage is not permitted in the room."

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Questions?