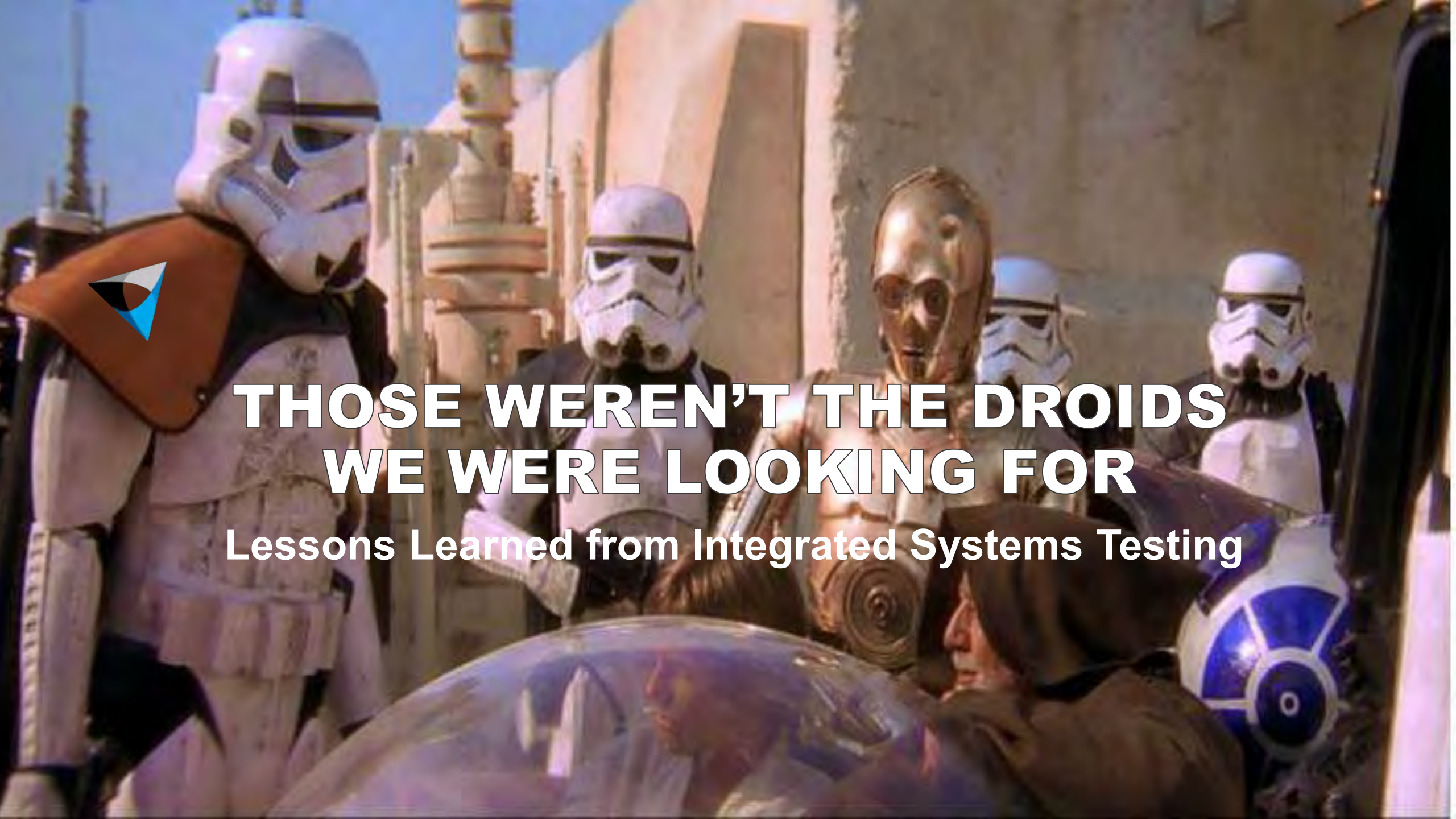


THOSE WEREN'T THE DROIDS WE WERE LOOKING FOR

Lessons Learned from Integrated Systems Testing

TLC ENGINEERING SOLUTIONS®

THOSE WEREN'T THE DROIDS WE WERE LOOKING FOR

Lessons Learned from Integrated Systems Testing

Mark Gelfo, PE, CxA, LEED Fellow, EMP

Managing Principal

THINK. LISTEN. CREATE.®

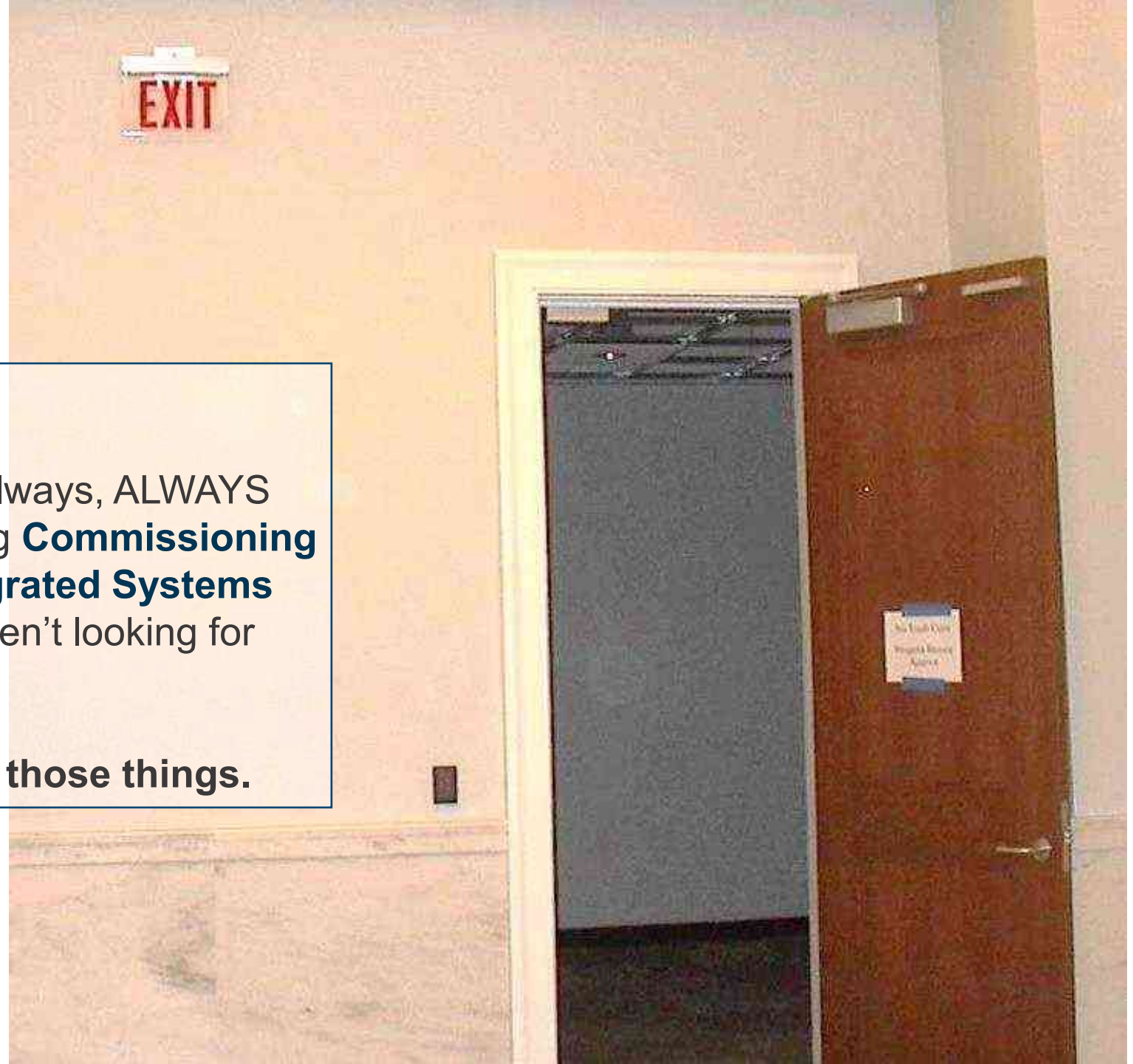
The Force Will Be With You

Learning Objective 1: Understand what **Integrated Systems Testing** is and why it is an important part of the commissioning process

Learning Objective 2: Know what a **Black-Site Test** is, and why it is an important test for any new building

Learning Objective 3: Apply **lessons learned** from our projects case study examples on their next commissioning project.

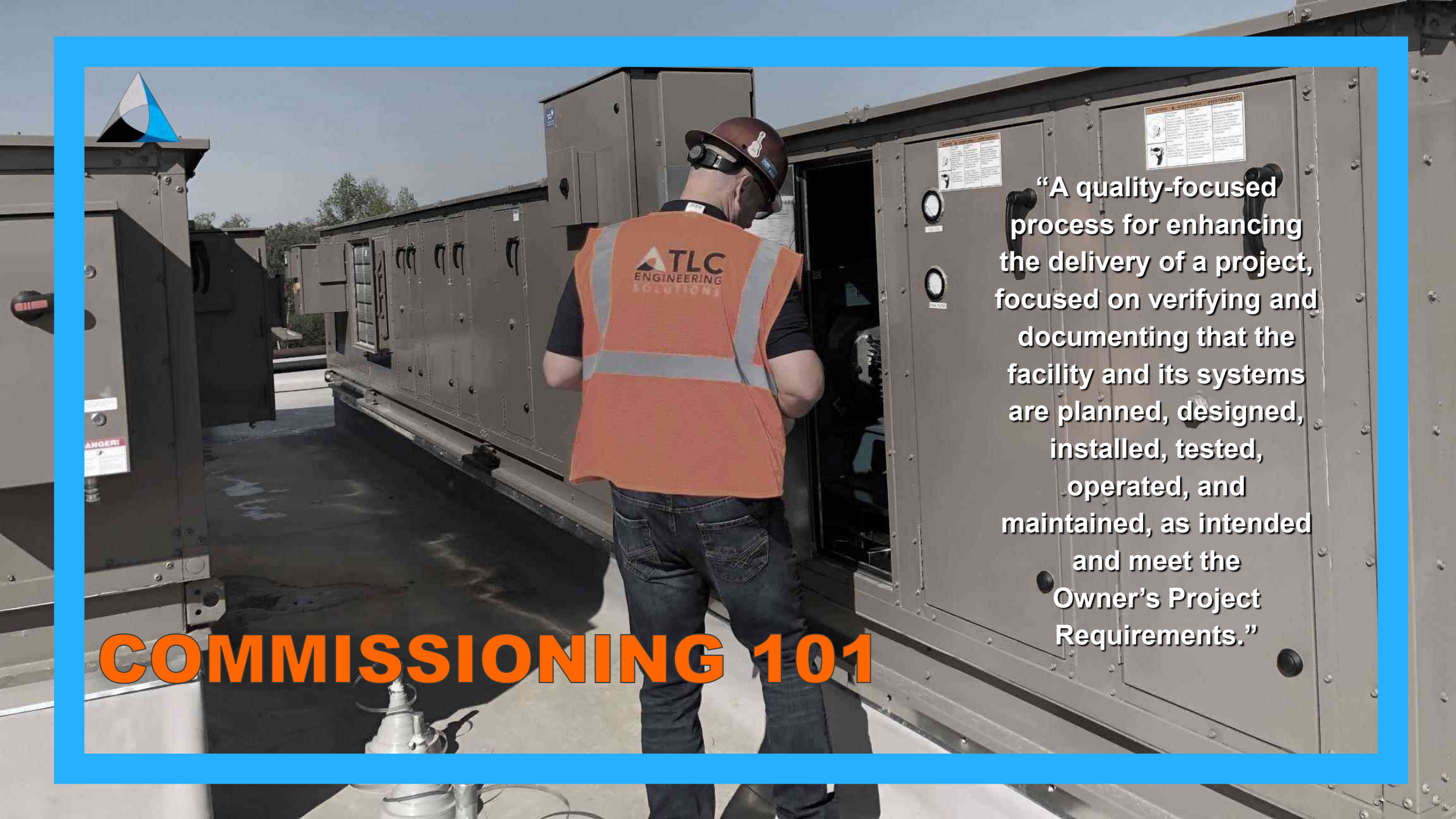
Learning Objective 4: Understand how to prepare a **Functional Test Procedure** for IST that is repeatable.



The Premise:

There are always, always, ALWAYS things we find during **Commissioning** and especially **Integrated Systems Testing** that we weren't looking for and didn't expect.

These are some of those things.



COMMISSIONING 101

“A quality-focused process for enhancing the delivery of a project, focused on verifying and documenting that the facility and its systems are planned, designed, installed, tested, operated, and maintained, as intended and meet the Owner’s Project Requirements.”

When is Commissioning Required ?

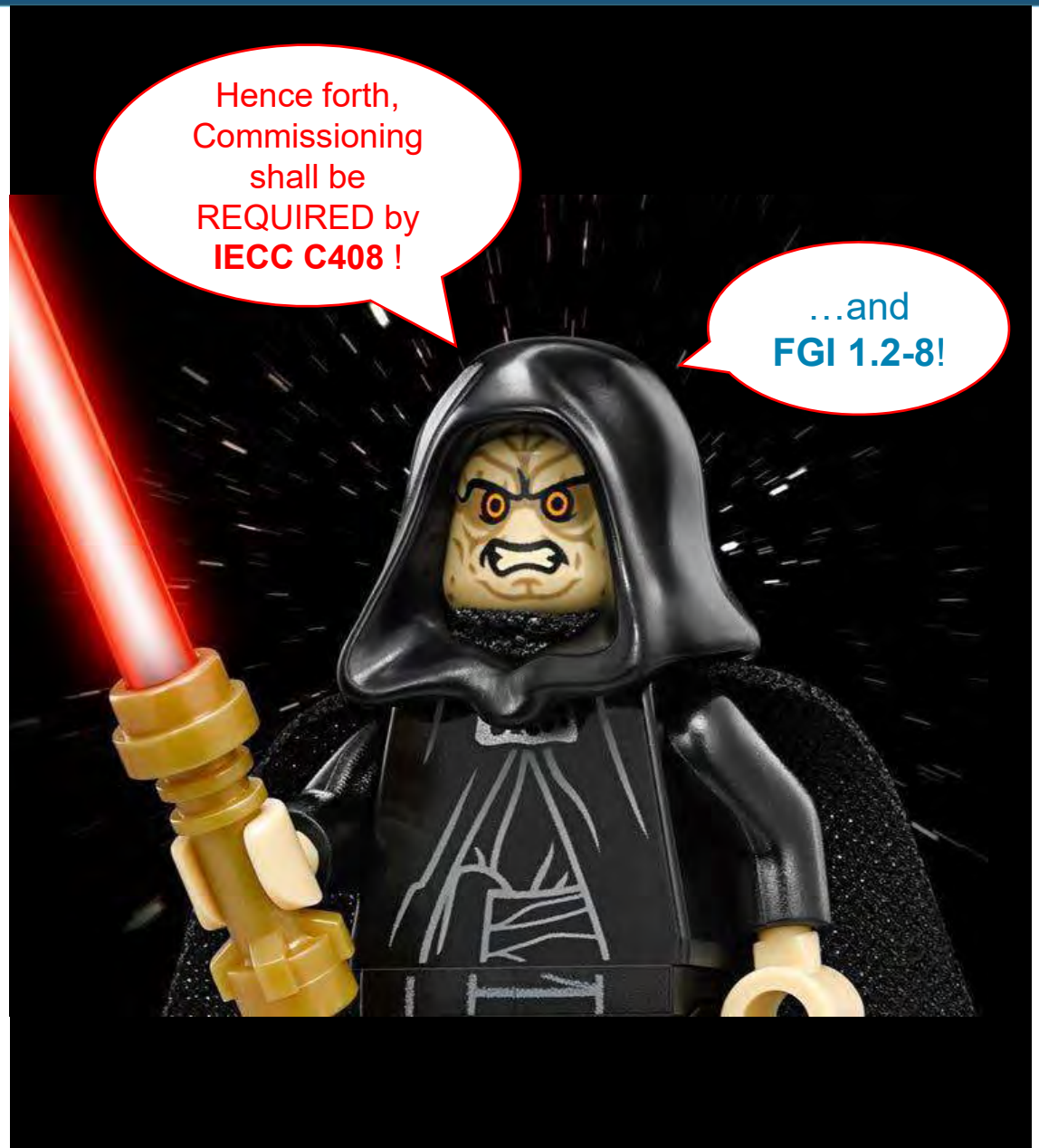
8th Edition FBC 2023 C408 Maintenance Information and Systems Commissioning

- Mechanical Systems (C408.2): >40 Tons Cooling, 600 MBH Heating
  - *Code official SHALL REQURE Preliminary Cx Report be made available for review by code official prior to final inspection (C408.2.4.2)
- Service Water Heating (C408.2): If Mech Cx is Required
- Lighting Controls (C408.3): All Projects
  - Expanded Requirements for Lighting Controls Testing

2022 FGI Guidelines for Design and Construction of Hospitals

Chapter 1.2-8 Commissioning:

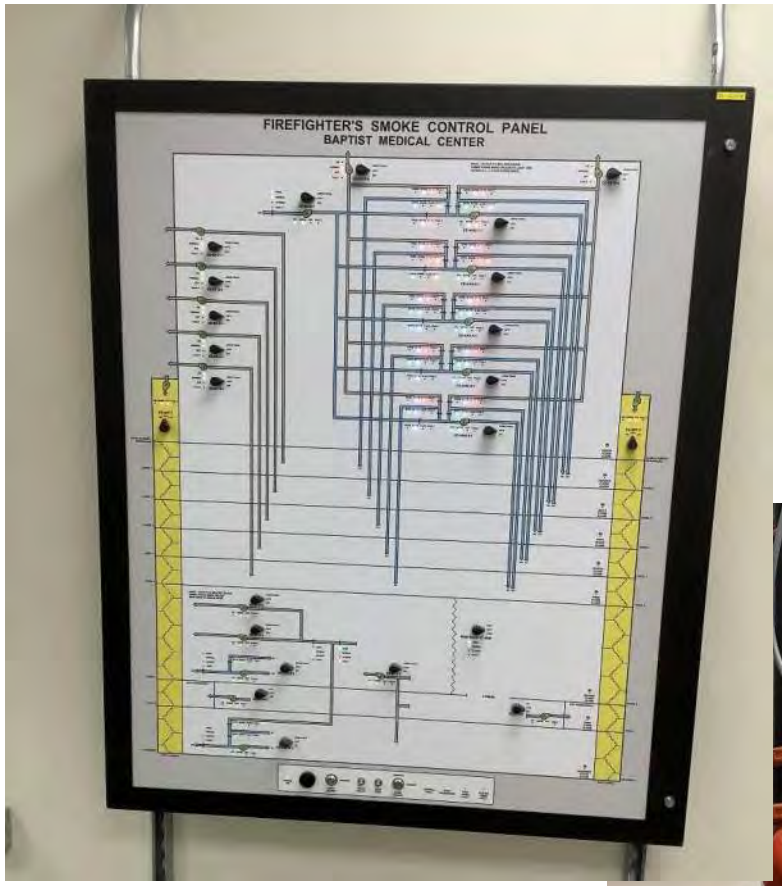
- 1.2-8.1.1 HVAC
- 1.2-8.1.2 Automatic temperature control
- 1.2-8.1.3 Domestic hot water
- 1.2-8.1.4 Fire alarm and fire protection systems (integration with other systems)
- 1.2-8.1.5 Essential electrical power systems
- 1.2-8.1.6 Security systems
- *Telecommunications & Wireless Communication Systems



When is Commissioning Required ?

NFPA 3-2018: Standard for Commissioning of Fire Protection and Life Safety Systems (NOT ADOPTED)

- Developed as request from the National Institute of Building Sciences (NIBS),
- outlines the commissioning process and integrated testing of fire protection & life safety systems
- Goal to ensure systems perform in per design intent.



NFPA 4-2021: Standard for Integrated Fire Protection and Life Safety System Testing

- Requires Commissioning and Integrated Testing of FP & LS systems
- Defines Role of the Integrated Testing Agent (ITa)
- outlines test scenarios to confirm the operation & interaction of FP & LS systems via Integrated Testing Plan

2018 is code TODAY

When is Commissioning Required ?

NFPA 99 6.8 (2021) Site Acceptance Testing

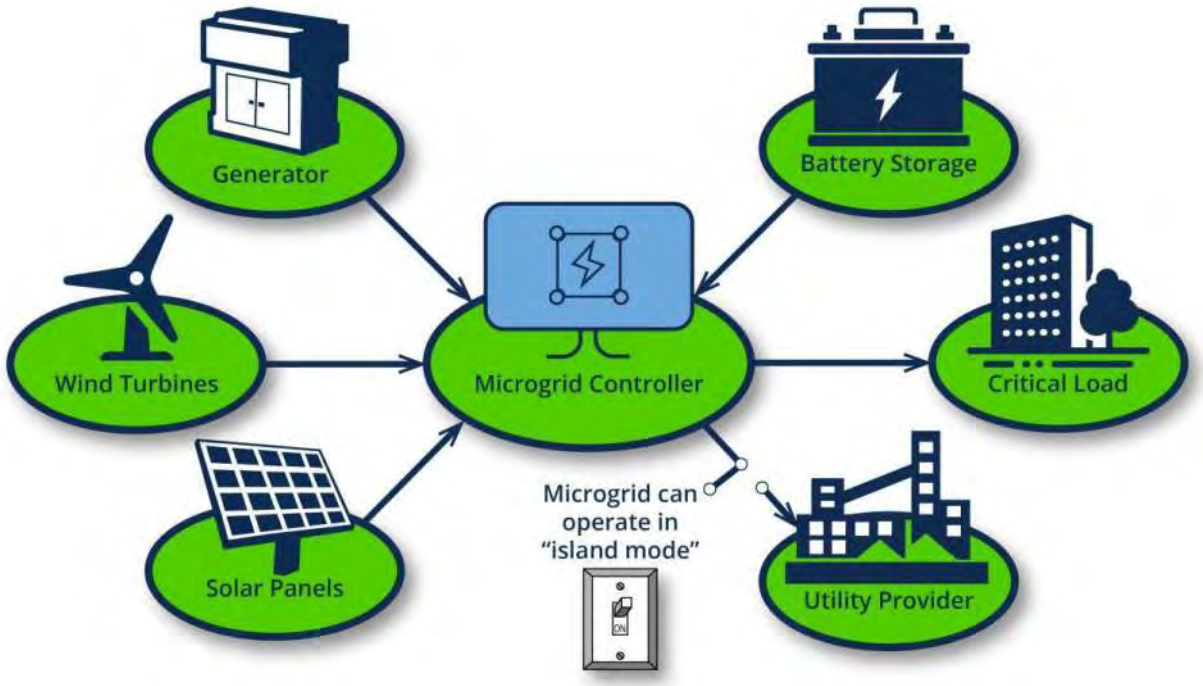
- Site acceptance testing and commissioning of **electrical system** serving Category 1 and Category 2 spaces

NFPA 99 6.10 (2021) Healthcare Microgrids

- Microgrids permitted as EPSS in Healthcare Facilities
- Cx of Microgrid Required (6.10.7)

NFPA 99 9.3.3 (2021) Commissioning

- **HVAC** Cx'd per ASHRAE 90.1



Commissioning is a Process, not an Event

Design Phase

- Select CxA
- Review OPR
- Review BOD
- OPR Workshop
- Draft Cx Plan
- Cx Req in Const Docs
- Validate Early Design Decisions
- Design Reviews

Construction Phase

- Refine Cx Plan
- Develop PreFunctional Checklists
- Develop Functional Performance Tests
- Cx Kickoff Mtg
- Monthly Cx Mtgs
- Site Observation
- Issues Logs
- Start-up Testing

Acceptance Phase

- Red Zone Mtg
- Controls Integration Mtg
- Verify TAB
- Functional Testing
- Integrated Systems Testing
- Issues Logs
- Prelim Cx Report

Occupancy Phase

- Deferred Testing
- Staff Training
- Lessons Learned
- Re-Cx Plan
- Systems Manuals
- Record Drawings
- Final TAB
- Final Cx Report

FBC 2023, Florida Energy Code C408

Cooling > 40 Tons **Heating > 600 MBH**

- Mechanical Systems Commissioning (C408.2)
- Service Water Heating Systems, Pools, Spas (C408.2) – same as Mechanical Systems
- Lighting Controls Functional Testing (C408.3)

Guidelines for Design and Construction of Hospitals, 2022

- Essential Electrical Systems
- Security Systems

NFPA 99 2021 Healthcare Facilities

- Electrical Systems
- HVAC
- Microgrids

NFPA 4, 2021 Standard for Integrated Fire Protection and Life Safety System Testing

- Fire Alarm
- Fire Protection
- Integrated Life Safety Systems

Commissioning is a Process, not an Event

Design Phase

Project Initiation
Select CxA
Determine Cx Scope
Determine Systems to be Cx'd
Review OPR & BOD
OPR Workshop

Design
Preliminary Cx Plan
Cx Req in CDs
Peer Reviews
Validate Early Design Decisions
Design Issues Log

Construction Phase

Construction
Submittal Review
Refine Cx Plan
Cx Kickoff Mtg
Monthly Cx Mtgs
Site Observation
Issues Logs
Start-up Testing

Acceptance Testing
Red Zone Mtg
Controls Integration Mtg
Functional Testing
Integrated Systems Testing
Issues Logs
Prelim Cx Report

Occupancy & Operations Phase

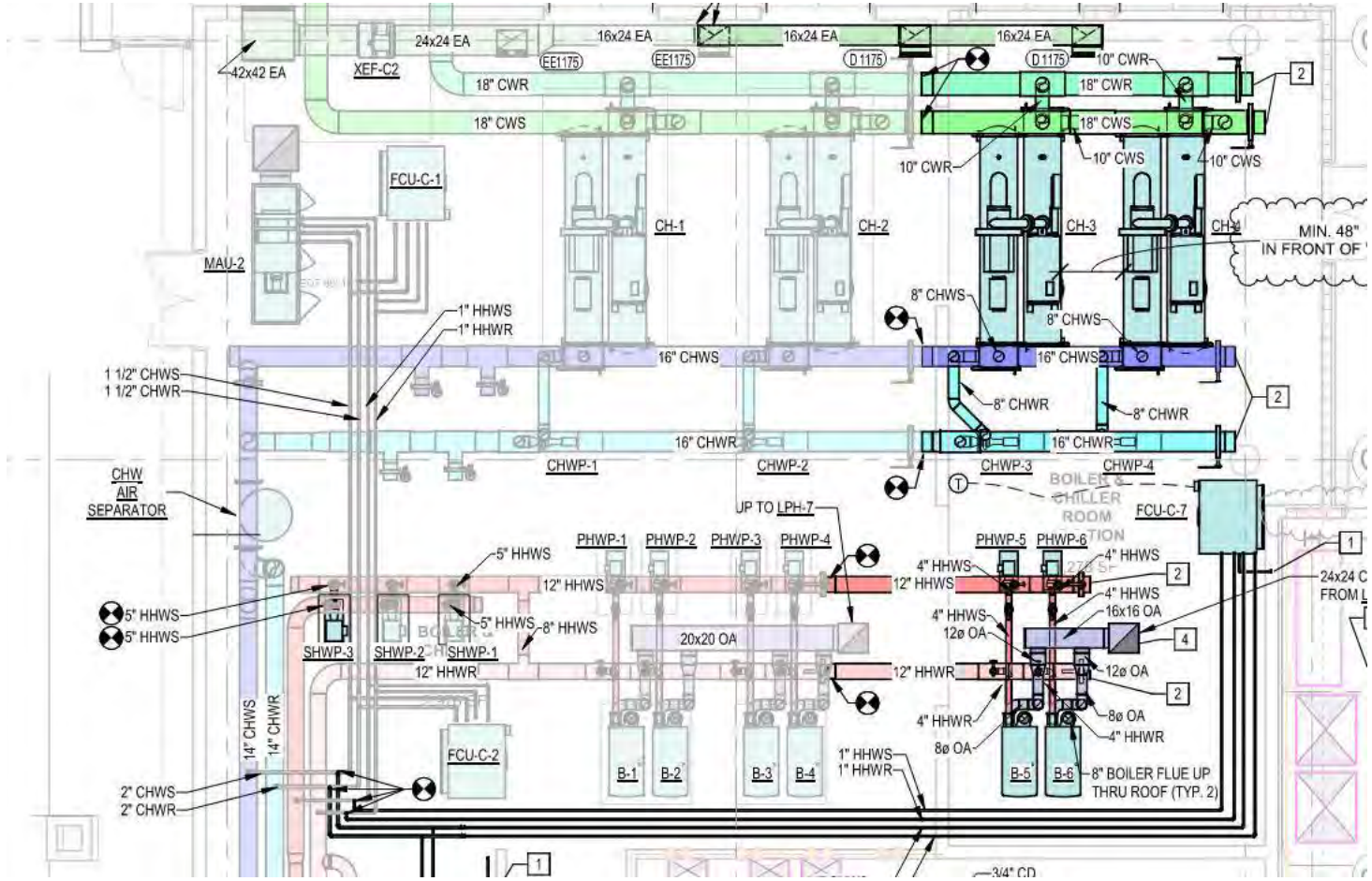
Occupancy
Deferred Testing
Staff Training
Lessons Learned
Re-Cx Plan
Systems Manuals
1yr Post Occ Reviews
Closeout Docs
Final Cx Report

Schematic Design → Design Development → Construction Documents → Bid / Negotiations → Construction Administration → Warranty


WHAT IS
INTEGRATED
SYSTEMS TESTING ?

IST: New Equipment added to Existing

Example: New Chillers & Boilers added to Existing CEP



Test New Equipment Independently

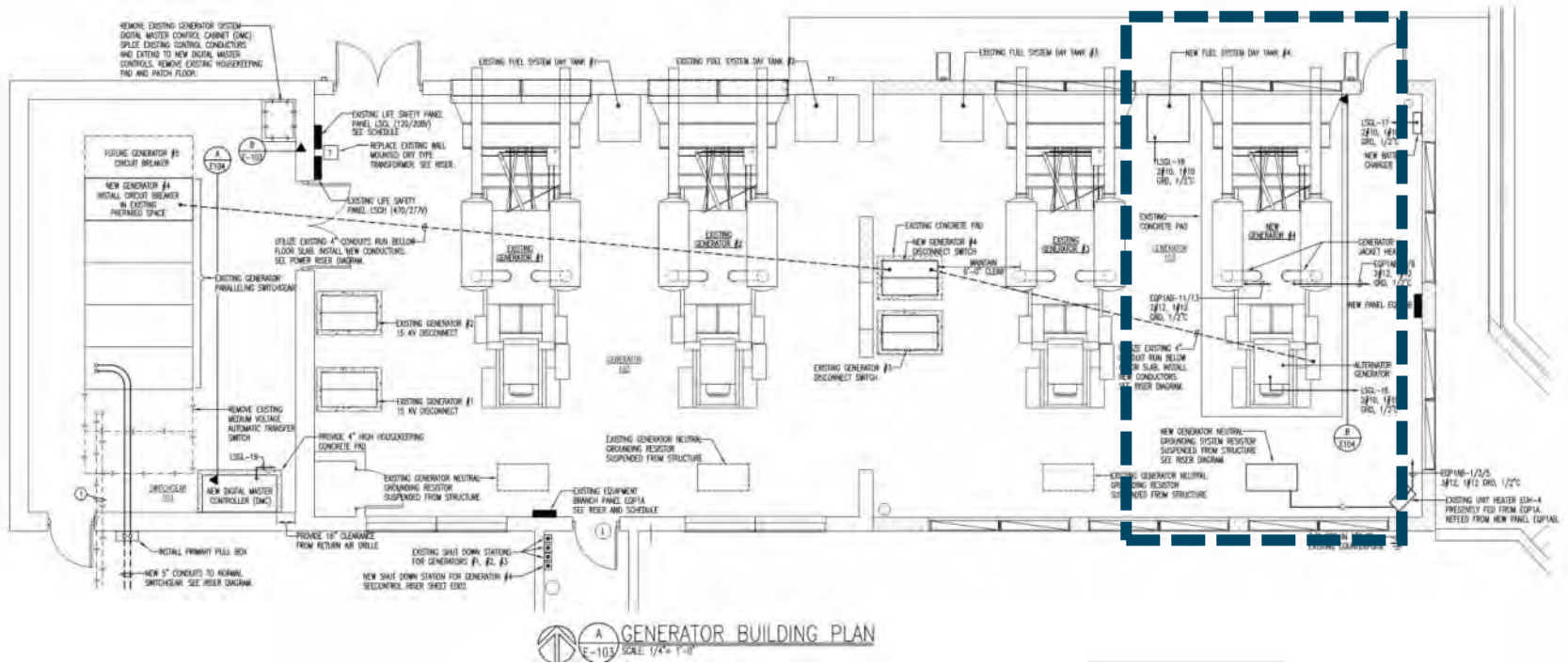
Then Test New Equipment in Combination with Existing Equipment

Ensure Operating as “One System”

- Lead Machine Logic
- Lag Machine Logic
- Pumping

IST: New Equipment added to Existing

Example: New Generator added to Existing CEP



Test New Generator Independently

Then Test New Generator in Combination with Existing Generator

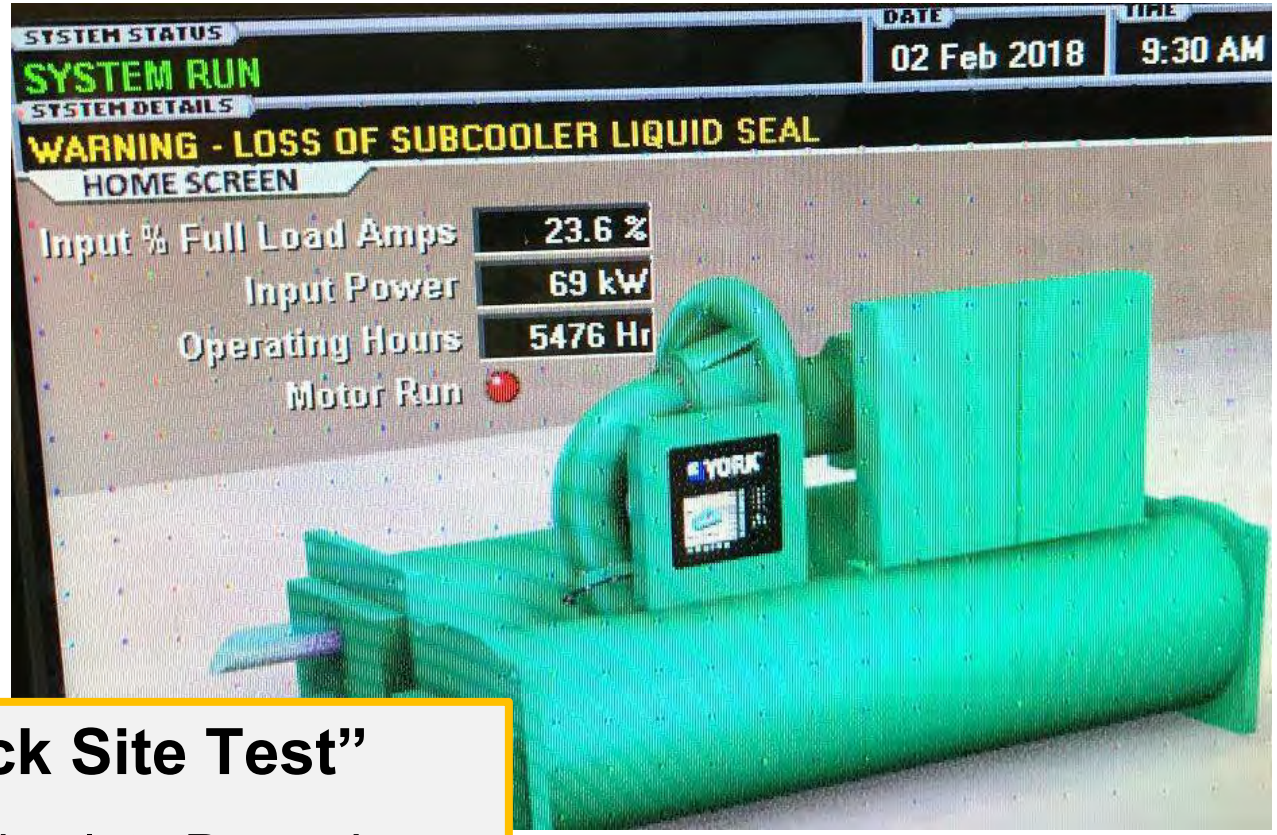
Ensure Operating as “One System”

- Paralleling
- Load Shed / Load Add
- Load Prioritization Changes
- Fuel System

Integrated Systems Testing (IST) – Full Building

We've testing everything individually… now lets test it all together

- Does HVAC system work properly on emergency power? Chillers? After return to normal power?
- Does FIRE ALARM SYSTEM work on emergency power? AHU shutdown? Damper Closing and Reopening?
- Do ELEVATORS run properly on emergency power? Recall? After return to normal power?
- UPS SYSTEMS? Large and Small?
- Are EMERGENCY COMMUNICATION SYSTMS functional?
- SECURITY / ACCESS CONTROL ?



"Black Site Test"

Step 1: Simulate Power Loss

Step 2: See What Happens

Commissioning Plan: Integrated System Test

TEST

#507 Integrated Systems Test

TLC Engineering Solutions |
Arrival Tower | 818045

Asset Arrival Tower

Attempts

Attempt No. 1

PRE-TEST CHECKLIST

WHO WE NEED

✓	1	Participants: Lead Team - ONE PERSON directing the test and acting as single / central point for all communications. GC, Lead CxA, Owner communicate & coordinate with Owner's facilities group walks the building and floats between teams as needed each team communicates results of each step of the test gives the go-ahead to proceed with each step of the test also confirm Elevator Operation portion of FPT
✓	1	Participants: Electrical Team – GC, EC, Elec EOR, Owner, CxA Initiate Black Site Test portion of FPT Verify UPS Operation portion of FPT Verify Nurse Call Operation of FPT
✓	1	Participants: Fire Alarm Team – GC, FA Contractor, Elec EOR, Owner, CxA – to initiate Fire Alarm test, verify alarms, door closure, coordinate with HVAC team on shutdown
✓	2	Participants: HVAC Team - GC, MC, CC, Mech EOR, Owner, CxA verify HVAC / BAS Operation portion of FPT
✓	3	Participants: Med Gas Team – GC, Plumb Contractor, Mech EOR, Owner, CxA verify Medical Gas System Operation portion of test
✓	4	Participants: Low Voltage Team: LV Contractor, LV Eng, Owner, CxA Verify IT Equipment portion of FPT Verify Emergency Communications portion of FPT Verify Access Control / Auto Door Operation portion of FPT

WHO WE NEED

WHAT WE NEED

✓	10	Access to Main Electrical Rooms
✓	11	Access to penthouse elevator machine room
✓	12	Card Key for Access Control system
✓	13	Canned smoke to test smoke detectors
✓	14	Access to BAS
✓	15	Access to TDR rooms
✓	16	Ladders on each floor
✓	17	All Elevators set on automatic control

WHAT WE NEED

TLC ENGINEERING

✓	18	All HVAC systems set in Auto (not hand) operation
✓	18	Generator / EPS set in Auto
✓	18	Owner Notified and Occupants Aware / Prepared for Testing
✓	19	Fire Department Notified Testing is Occurring / Not Actual Fire
		PART 1 - INITITATE BLACK SITE TEST
✓	23	Disconnect Main Building Power - Open Main Service Breakers
✓	24	Verify Generator(s) Start
✓	25	Record Start Time
✓	26	Verify All Transfer Switches Transfered
		LIST TRANSFER SWITCHES
✓	28	CE-ATS-LS1
✓	29	CE-ATS-CR1
✓	30	CE-ATS-CR2
✓	31	CE-ATS-EQ1
✓	32	CE-ATS-EQ2
✓	33	Walk building - verify Life Safety Lighting
✓	34	Site - Verify Emergency Power Site Lighting
✓	35	Walk building - verify Critical Lighting / Critical Power
✓	36	Walk building - verify Equipment Branch HVAC Equipment
		VERIFY HVAC / BAS OPERATION
✓	38	Verify HVAC System - AHUs, RTUs, Exhaust Fans are operational
✓	39	Verify VFD operation
✓	40	Verify Chillers and Chilled Water Pumps are operational
✓	41	Verify VFD operation
✓	42	Verify Cooling Towers and Condeser Water Pumps are operational
✓	43	Verify VFD operation
✓	44	Verify Boilers and Hot Water Pumps are operational
✓	45	Verify BAS System is operational and online
✓	46	Verify operation of Stair Pressurization fans
✓	47	Verify operation of Smoke Control System fans
		MEDICAL GAS SYSTEM OPERATION
✓	49	Verify Medical Vacuum Pump Operation, Pressure, Output
✓	50	Verify Medical Air Compressor Operation, Pressure, Output

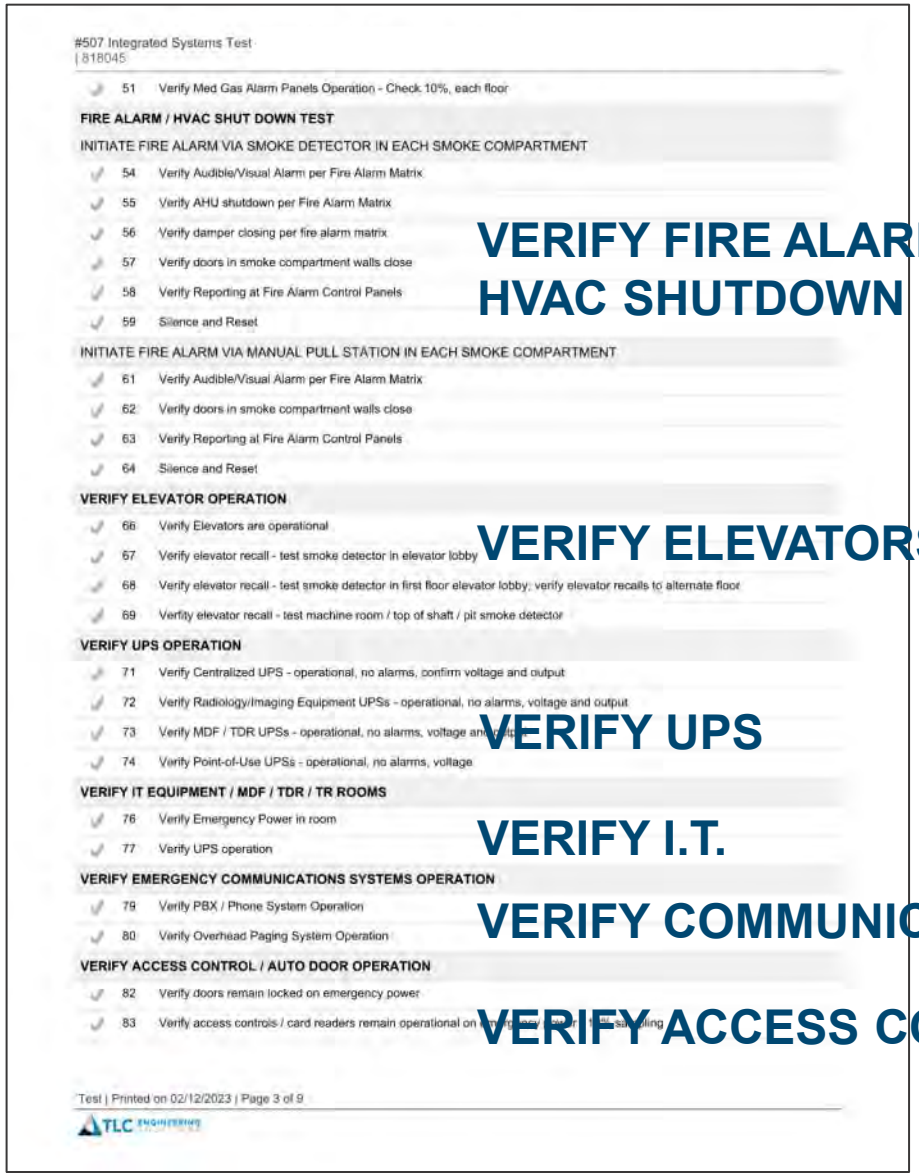
BLACK-SITE TEST

VERIFY HVAC

VERIFY MED-GAS

TLC ENGINEERING

Integrated System Test



#507 Integrated Systems Test
| 818045

	51	Verify Med Gas Alarm Panels Operation - Check 10%, each floor
FIRE ALARM / HVAC SHUT DOWN TEST		
INITIATE FIRE ALARM VIA SMOKE DETECTOR IN EACH SMOKE COMPARTMENT		
	54	Verify Audible/Visual Alarm per Fire Alarm Matrix
	55	Verify AHU shutdown per Fire Alarm Matrix
	56	Verify damper closing per fire alarm matrix
	57	Verify doors in smoke compartment walls close
	58	Verify Reporting at Fire Alarm Control Panels
	59	Silence and Reset
INITIATE FIRE ALARM VIA MANUAL PULL STATION IN EACH SMOKE COMPARTMENT		
	61	Verify Audible/Visual Alarm per Fire Alarm Matrix
	62	Verify doors in smoke compartment walls close
	63	Verify Reporting at Fire Alarm Control Panels
	64	Silence and Reset
VERIFY ELEVATOR OPERATION		
	66	Verify Elevators are operational
	67	Verify elevator recall - test smoke detector in elevator lobby
	68	Verify elevator recall - test smoke detector in first floor elevator lobby; verify elevator recalls to alternate floor
	69	Verify elevator recall - test machine room / top of shaft / pit smoke detector
VERIFY UPS OPERATION		
	71	Verify Centralized UPS - operational, no alarms, confirm voltage and output
	72	Verify Radiology/Imaging Equipment UPSs - operational, no alarms, voltage and output
	73	Verify MDF / TDR UPSs - operational, no alarms, voltage and output
	74	Verify Point-of-Use UPSs - operational, no alarms, voltage
VERIFY IT EQUIPMENT / MDF / TDR / TR ROOMS		
	76	Verify Emergency Power in room
	77	Verify UPS operation
VERIFY EMERGENCY COMMUNICATIONS SYSTEMS OPERATION		
	79	Verify PBX / Phone System Operation
	80	Verify Overhead Paging System Operation
VERIFY ACCESS CONTROL / AUTO DOOR OPERATION		
	82	Verify doors remain locked on emergency power
	83	Verify access controls / card readers remain operational on emergency power - 10% sampling

Test | Printed on 02/12/2023 | Page 3 of 9

TLC ENGINEERING

VERIFY FIRE ALARM & HVAC SHUTDOWN

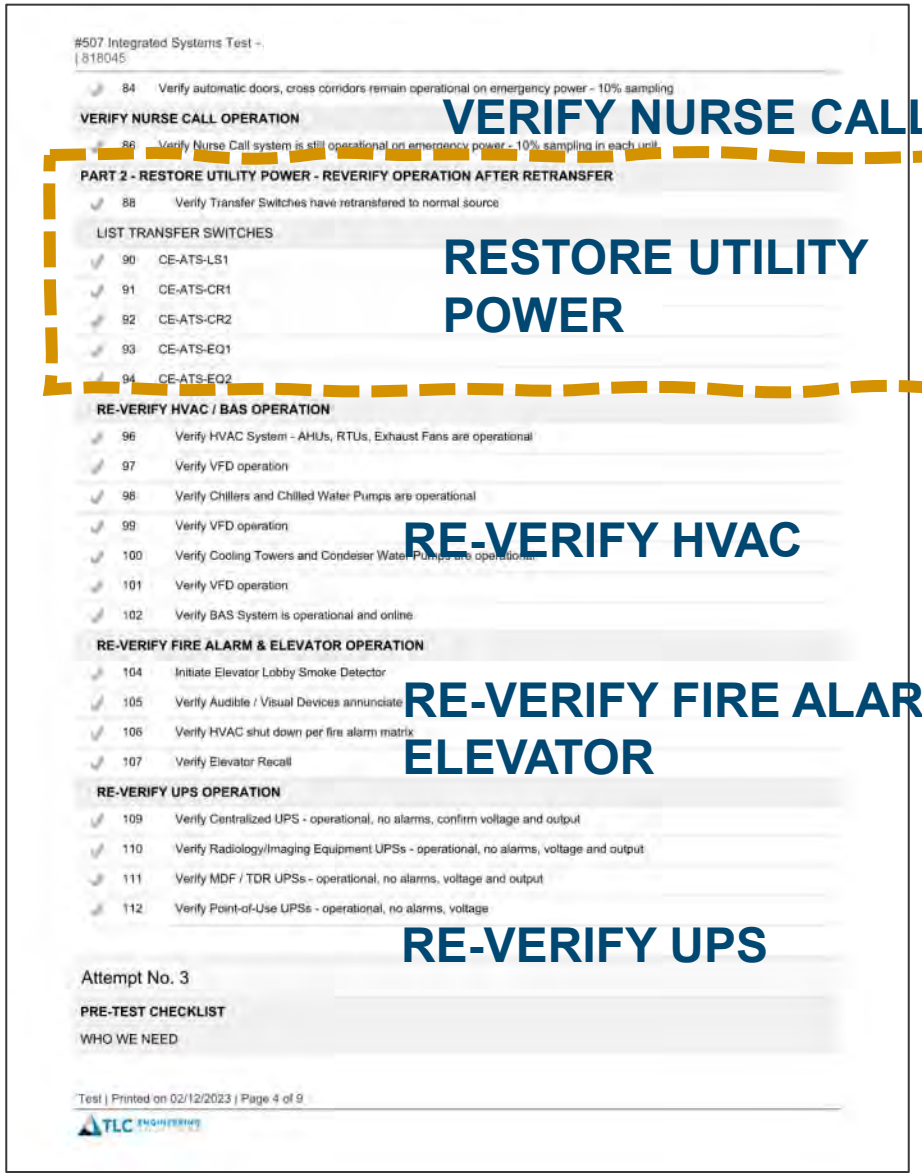
VERIFY ELEVATORS

VERIFY UPS

VERIFY I.T.

VERIFY COMMUNICATIONS

VERIFY ACCESS CONTROL



#507 Integrated Systems Test -
| 818045

	84	Verify automatic doors, cross corridors remain operational on emergency power - 10% sampling
VERIFY NURSE CALL OPERATION		
	86	Verify Nurse Call system is still operational on emergency power - 10% sampling in each unit
PART 2 - RESTORE UTILITY POWER - REVERIFY OPERATION AFTER RETRANSFER		
	88	Verify Transfer Switches have retransfered to normal source
LIST TRANSFER SWITCHES		
	90	CE-ATS-LS1
	91	CE-ATS-CR1
	92	CE-ATS-CR2
	93	CE-ATS-EQ1
	94	CE-ATS-EQ2
RE-VERIFY HVAC / BAS OPERATION		
	96	Verify HVAC System - AHUs, RTUs, Exhaust Fans are operational
	97	Verify VFD operation
	98	Verify Chillers and Chilled Water Pumps are operational
	99	Verify VFD operation
	100	Verify Cooling Towers and Condeser Water Pumps are operational
	101	Verify VFD operation
	102	Verify BAS System is operational and online
RE-VERIFY FIRE ALARM & ELEVATOR OPERATION		
	104	Initiate Elevator Lobby Smoke Detector
	105	Verify Audible / Visual Devices annunciate
	106	Verify HVAC shut down per fire alarm matrix
	107	Verify Elevator Recall
RE-VERIFY UPS OPERATION		
	109	Verify Centralized UPS - operational, no alarms, confirm voltage and output
	110	Verify Radiology/Imaging Equipment UPSs - operational, no alarms, voltage and output
	111	Verify MDF / TDR UPSs - operational, no alarms, voltage and output
	112	Verify Point-of-Use UPSs - operational, no alarms, voltage

Attempt No. 3

PRE-TEST CHECKLIST

WHO WE NEED

Test | Printed on 02/12/2023 | Page 4 of 9

TLC ENGINEERING

VERIFY NURSE CALL

RESTORE UTILITY POWER

RE-VERIFY HVAC

RE-VERIFY FIRE ALARM & ELEVATOR

RE-VERIFY UPS

Special Consideration for Existing Hospitals

Assigned To Commissioning Authority
Asset Phase 3

Attempts Most Recent

Attempt No. 1

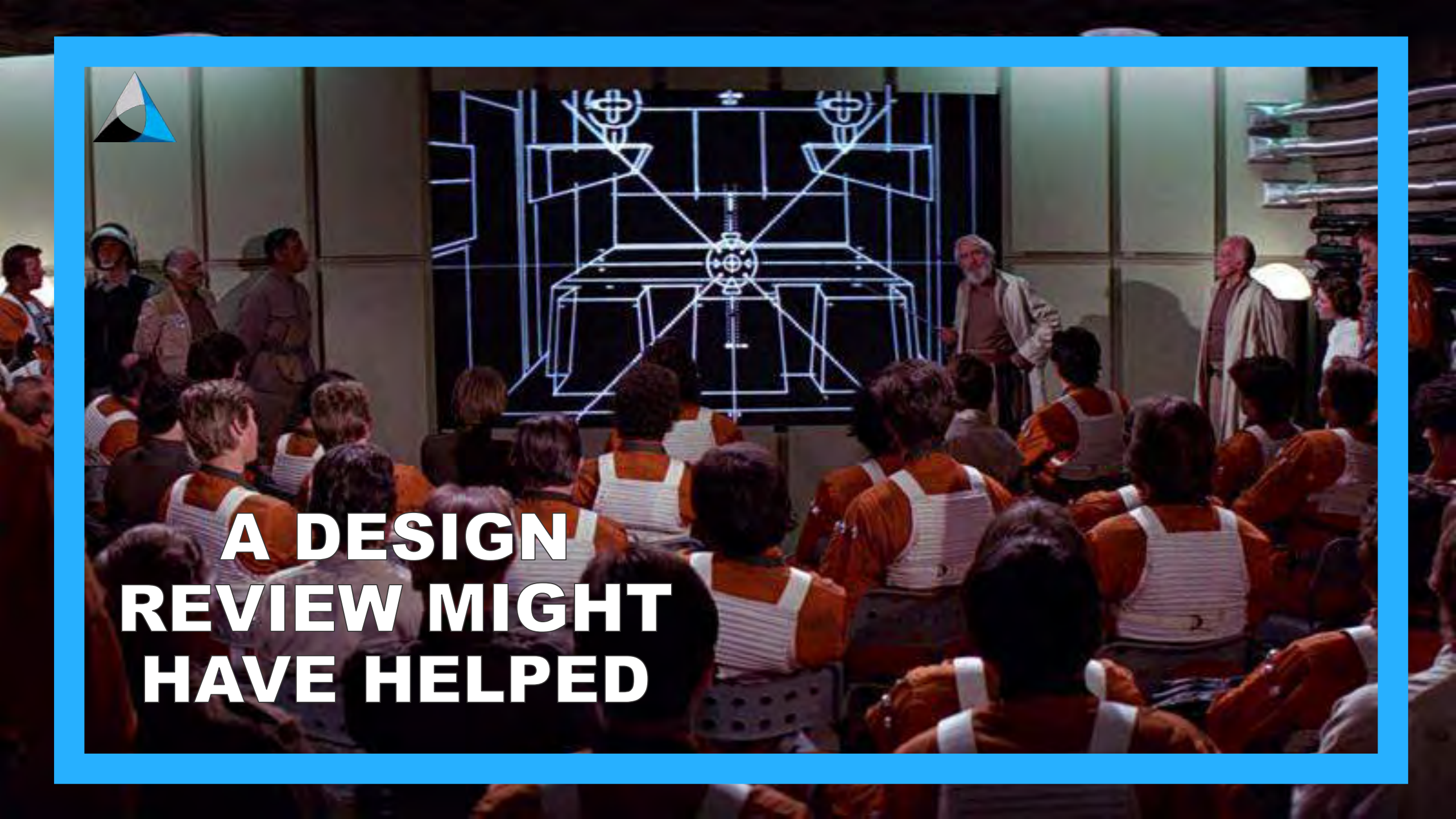
The purpose of this test is to test all new . . . . systems and equipment together in all modes including emergency operations modes. This test is NOT INTENDED TO IMPACT EXISTING OCCUPIED AREAS OF THE HOPSITAL . If you see something in this testing procedure that might directly or indirectly impact existing occupied areas of the hospital, please notify the commissioning team, construction team, or owner immediately.

PRE-TEST CHECKLIST

WHO WE NEED

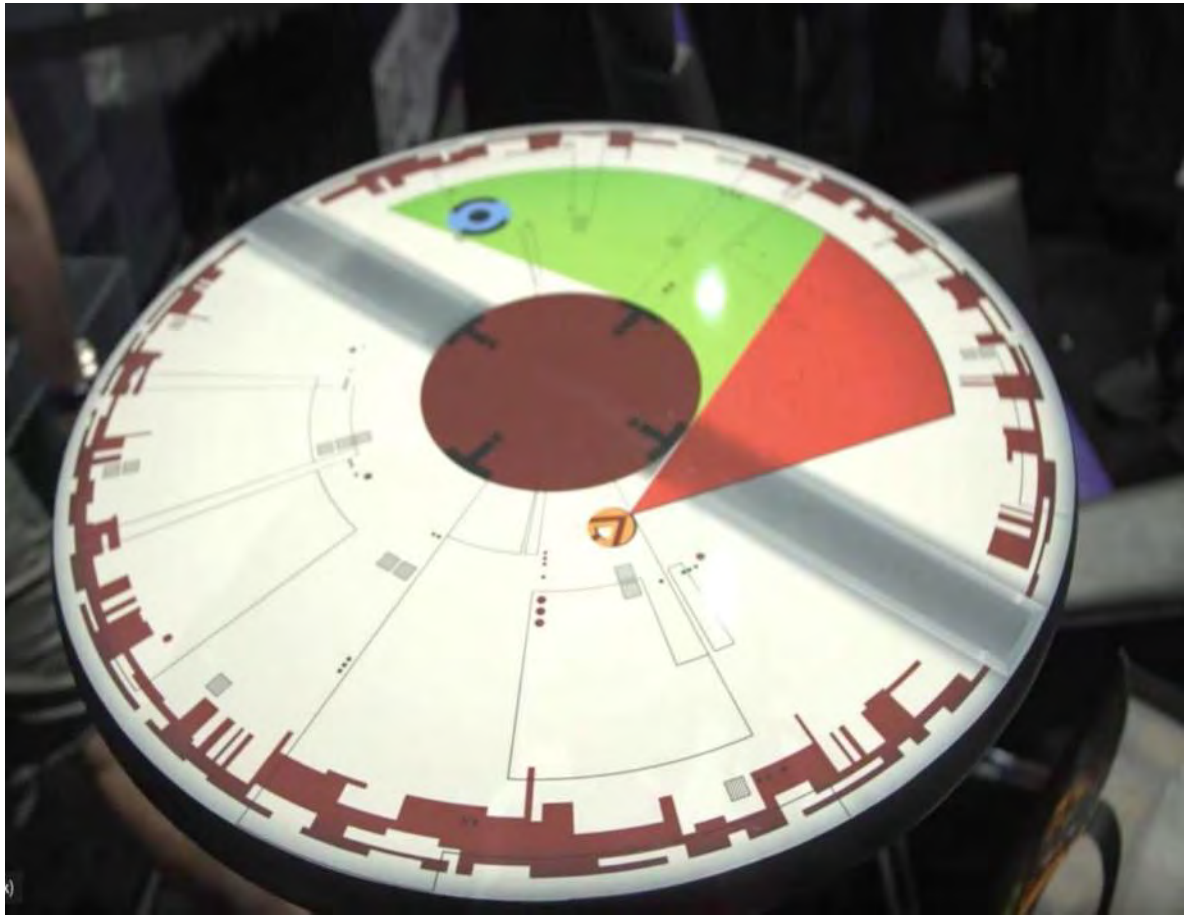
1 Participants: Electrical Team

Initiate Black Site Test portion of FPT
Verify UPS Operation portion of FPT

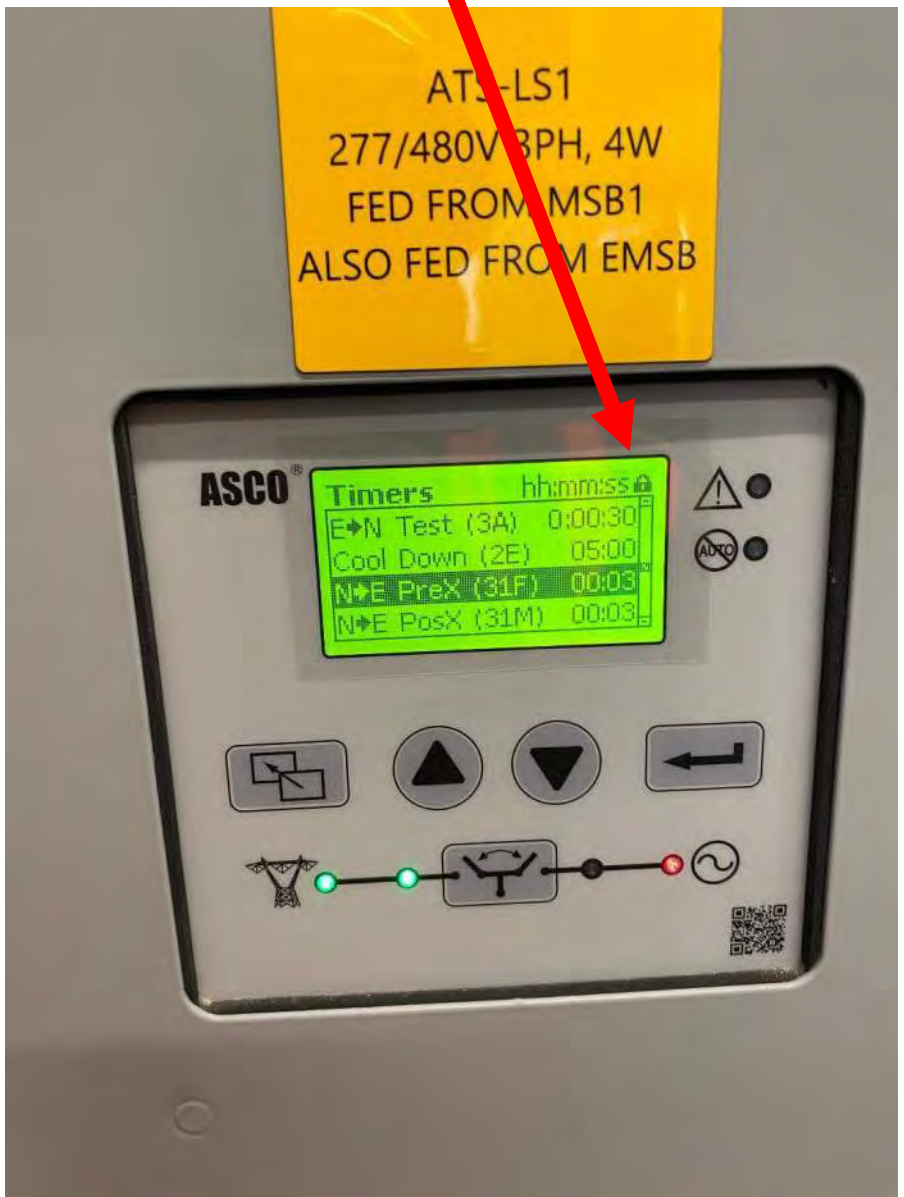

A DESIGN
REVIEW MIGHT
HAVE HELPED

Top 10 Common Design Review Issues

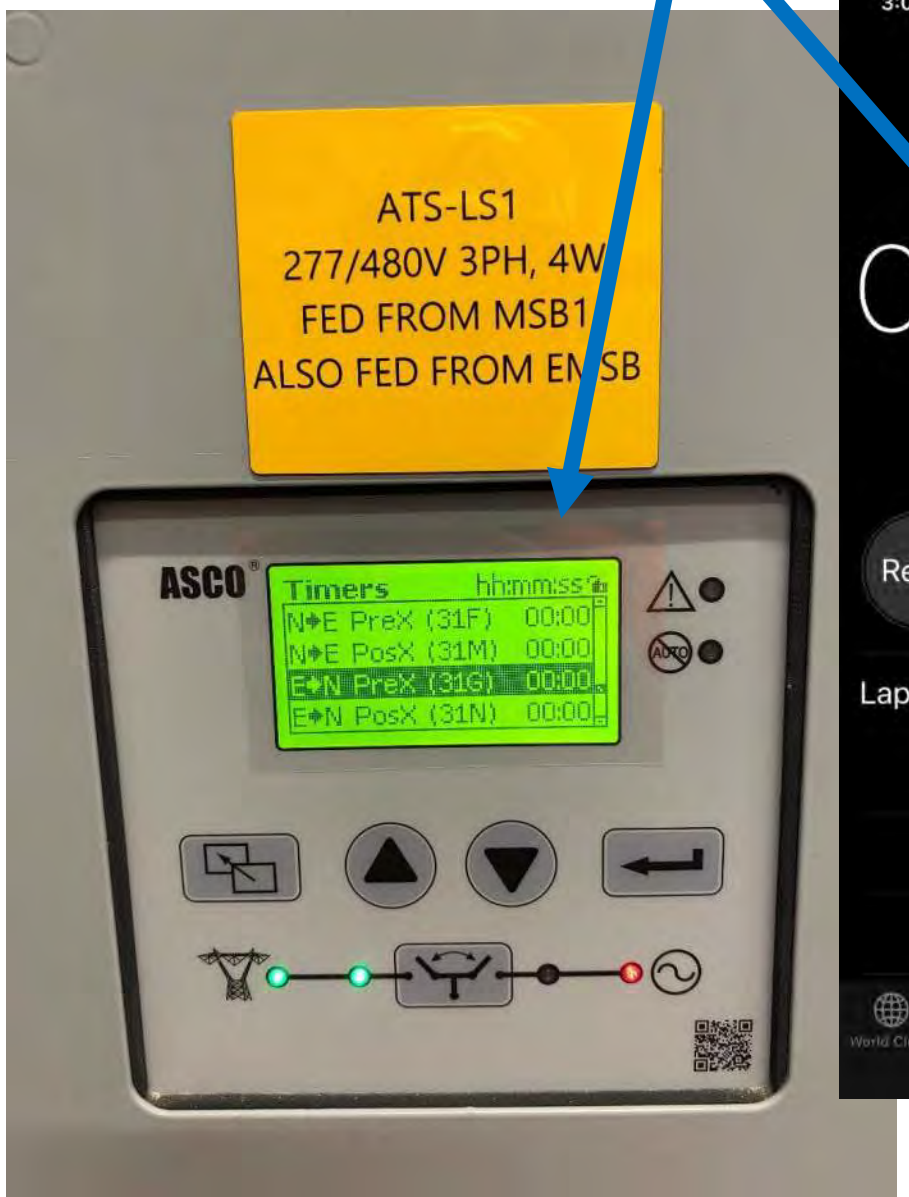
10. Commissioning Specifications / Testing Requirements
9. Equipment Naming / Labeling
8. Unclear / Boiler Plate Documents
7. Lighting Controls Placement
6. Fuel System
5. Heating / Reheat
4. Phasing / Constructability Issues
3. Working Clearances
2. Maintenance Access
1. ***SEQUENCE OF OPERATIONS***



What Happens When There's No Sequence of Operations



What Happens When There Is

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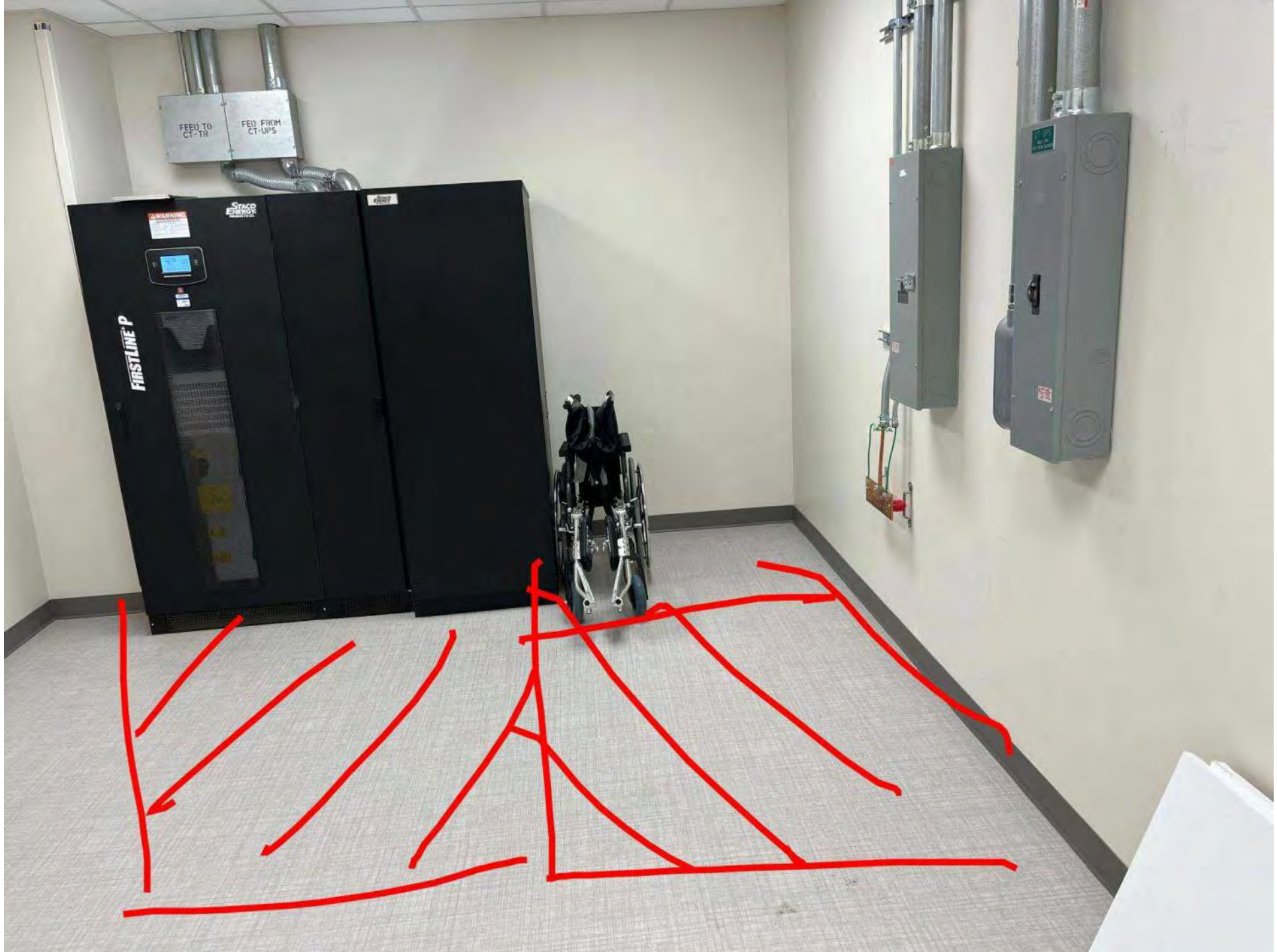
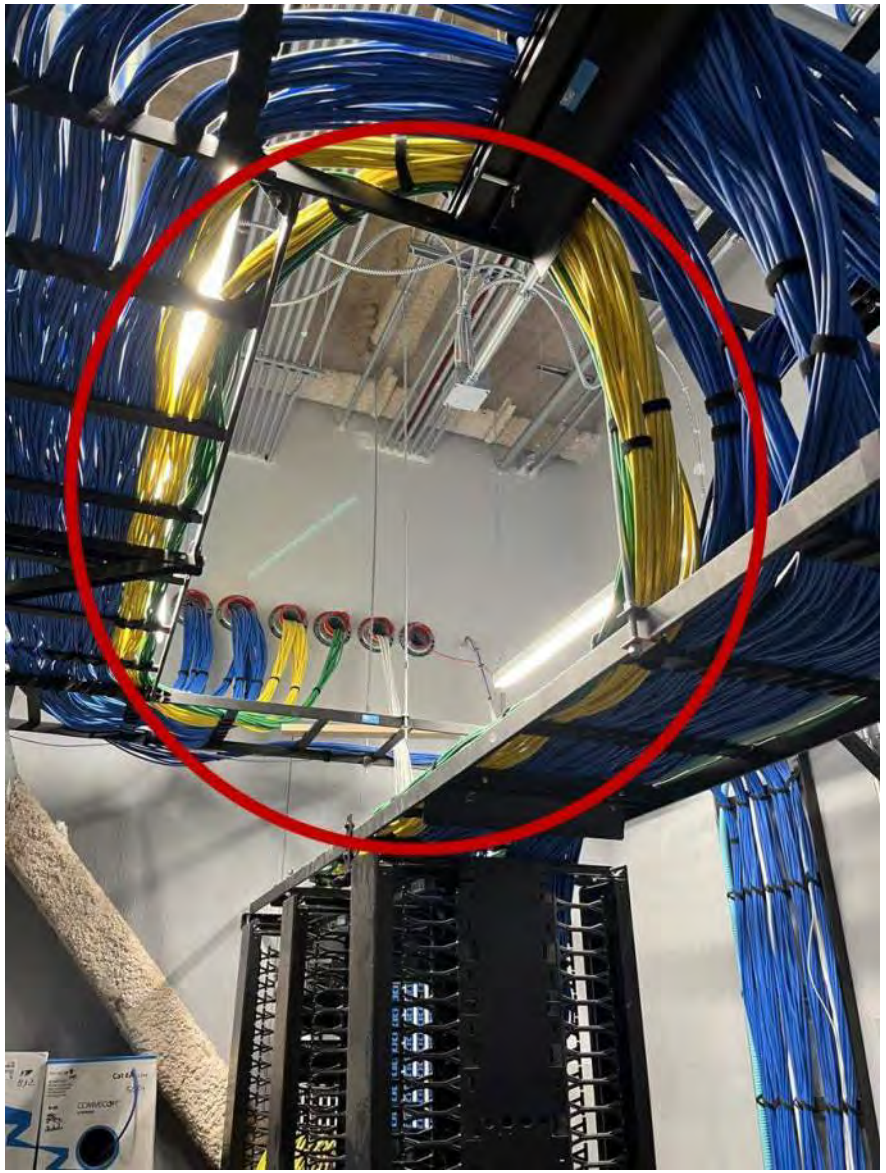
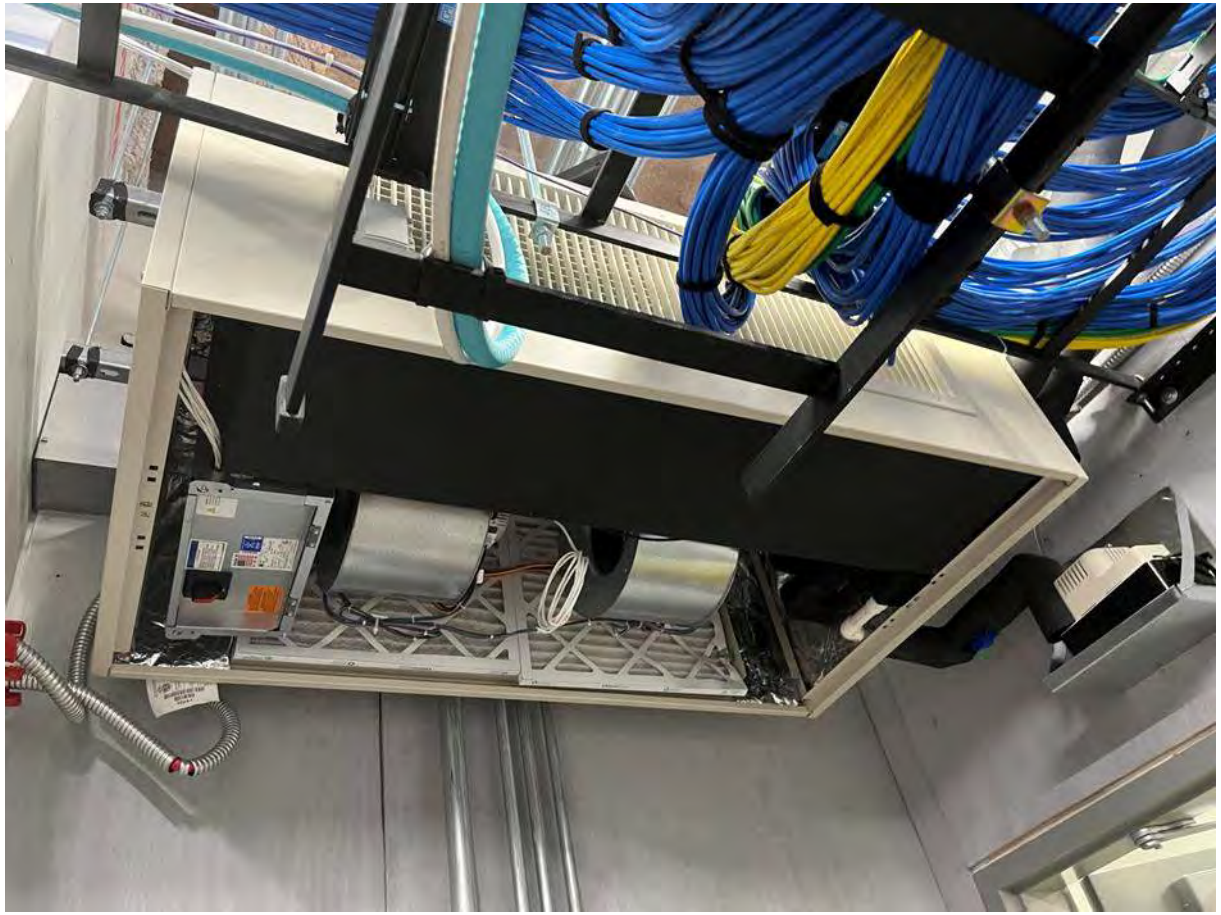
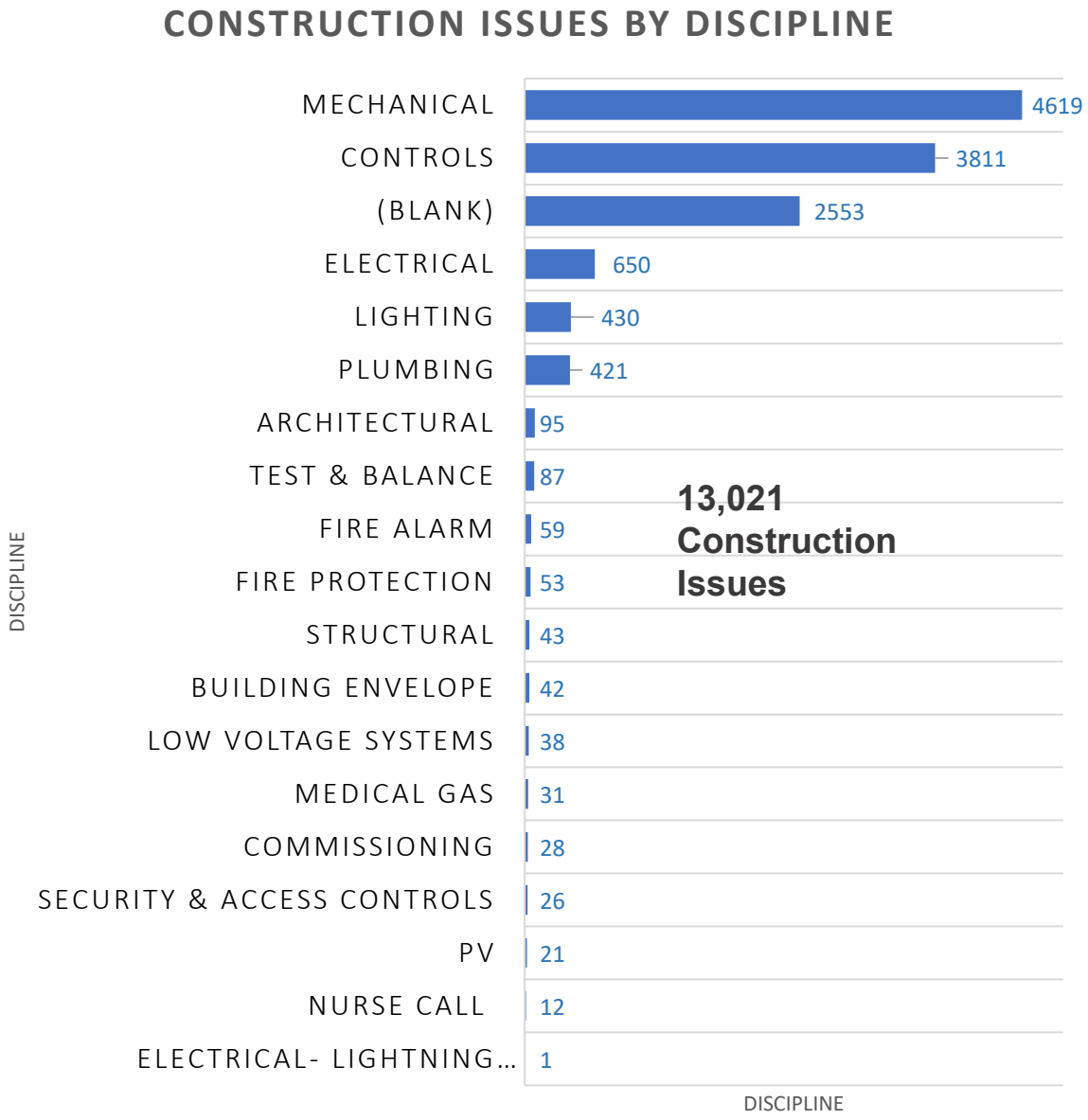

FEED TO
CT-TR
FEED FROM
CT-UPS
FIRSTLINE P

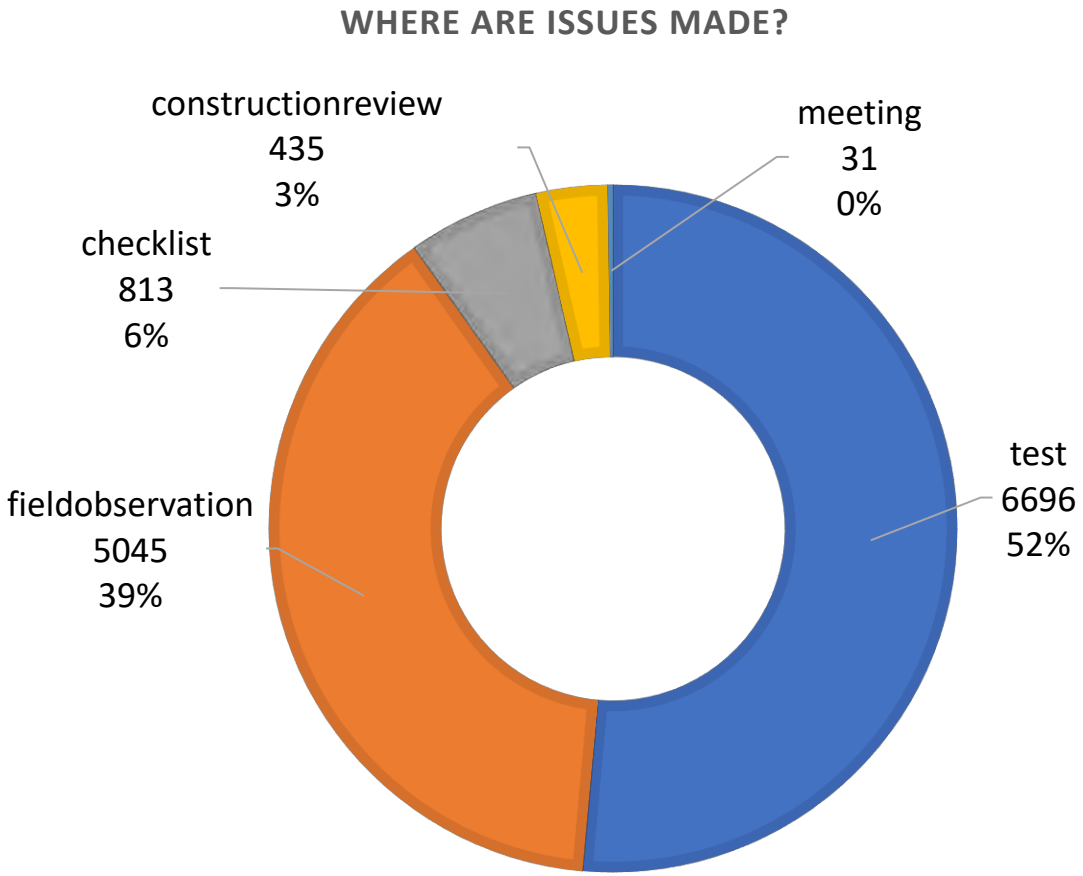





WHEN IS READY READY?

Some Data Analytics (300+ Cx Projects)



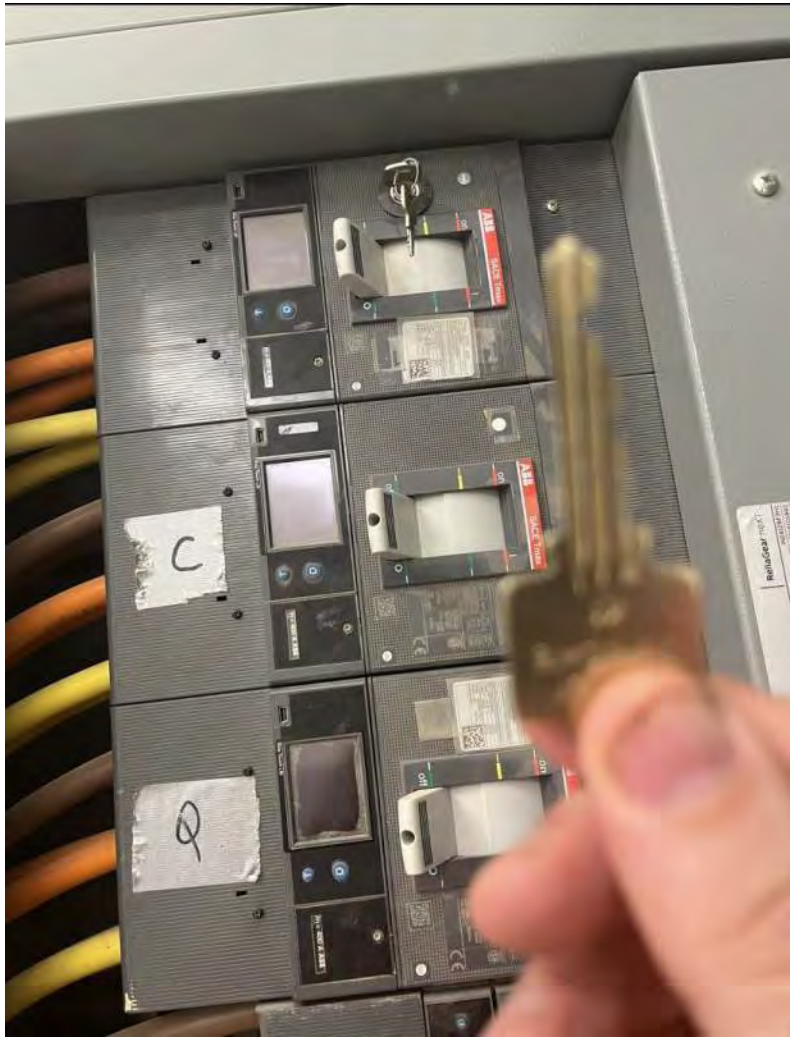



TLC
ENGINEERING
SOLUTIONS


DOAS-1
480V 3PH 3W
BROWN, ORANGE, YELLOW
FED FROM: EDP8
35K AIC
ON
OFF
WARNING

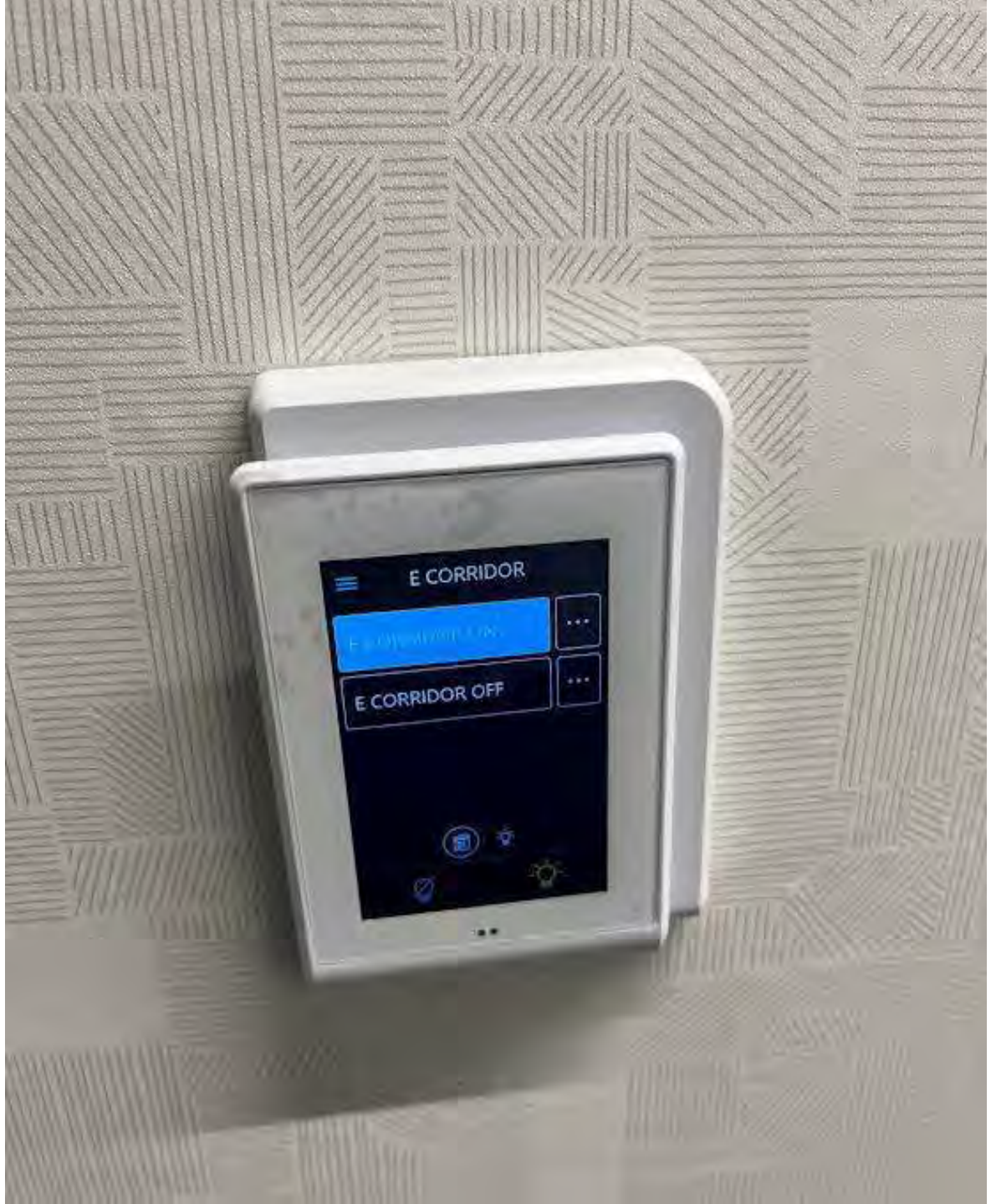

ON
OFF
ON
OFF
ON
OFF
ON
OFF


NESHK
7,9,11
ON
DANGER
OFF
NESHK
13,15,17
ON
OFF
NESHK
1,3,5
ON
OFF

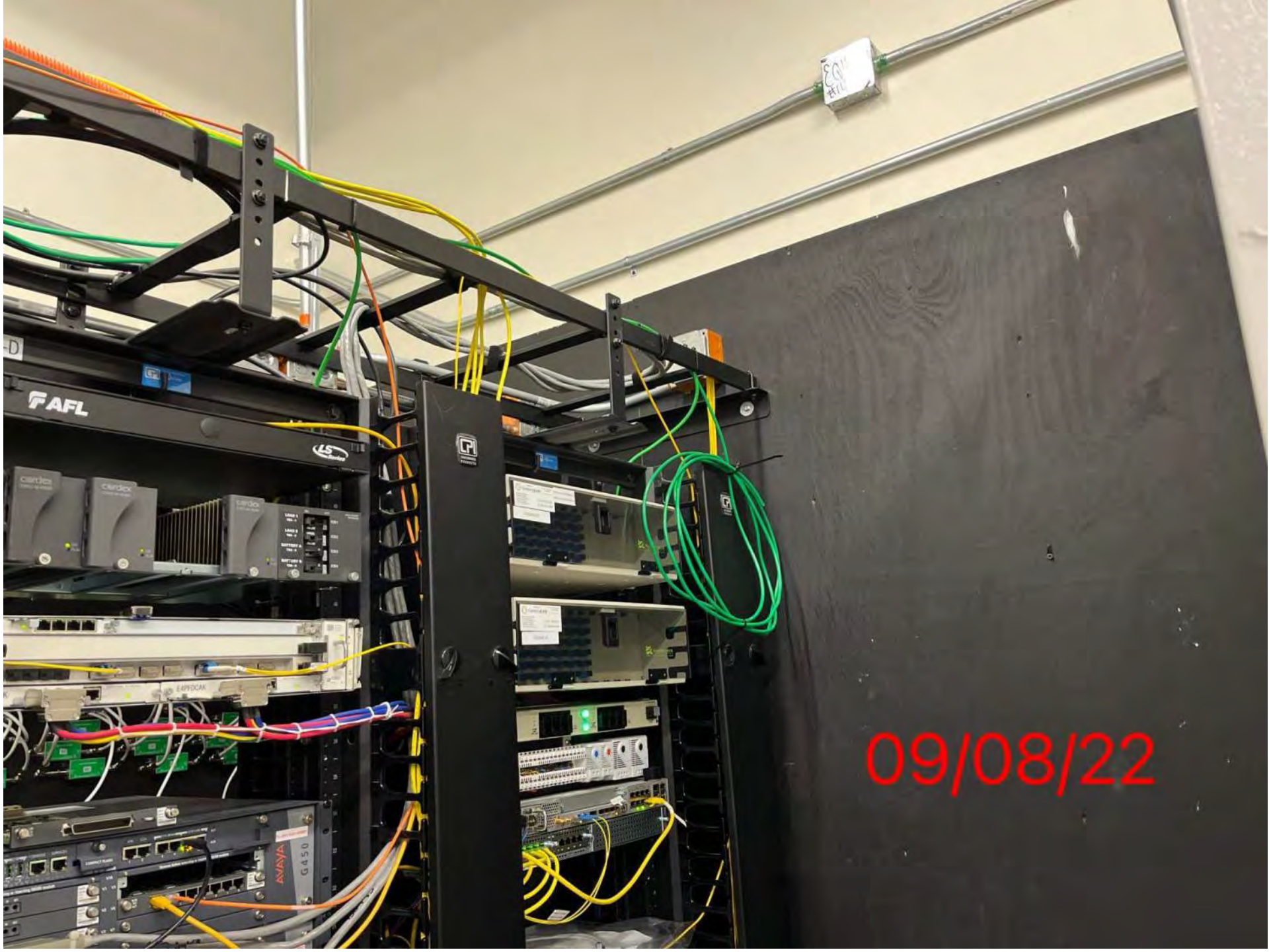

C
Q


SERVICE DISCONNECT
THIS CIRCUIT IS PROVIDED WITH GROUND FAULT INDICATION ONLY
POWER PLUGS BEHIND THIS DOOR


MRI TRAILER
DATA
NURSE CALL
MRI TRAILER
FIRE ALARM


E CORRIDOR
E CORRIDOR OFF


E CORRIDOR
N CORRIDOR OFF

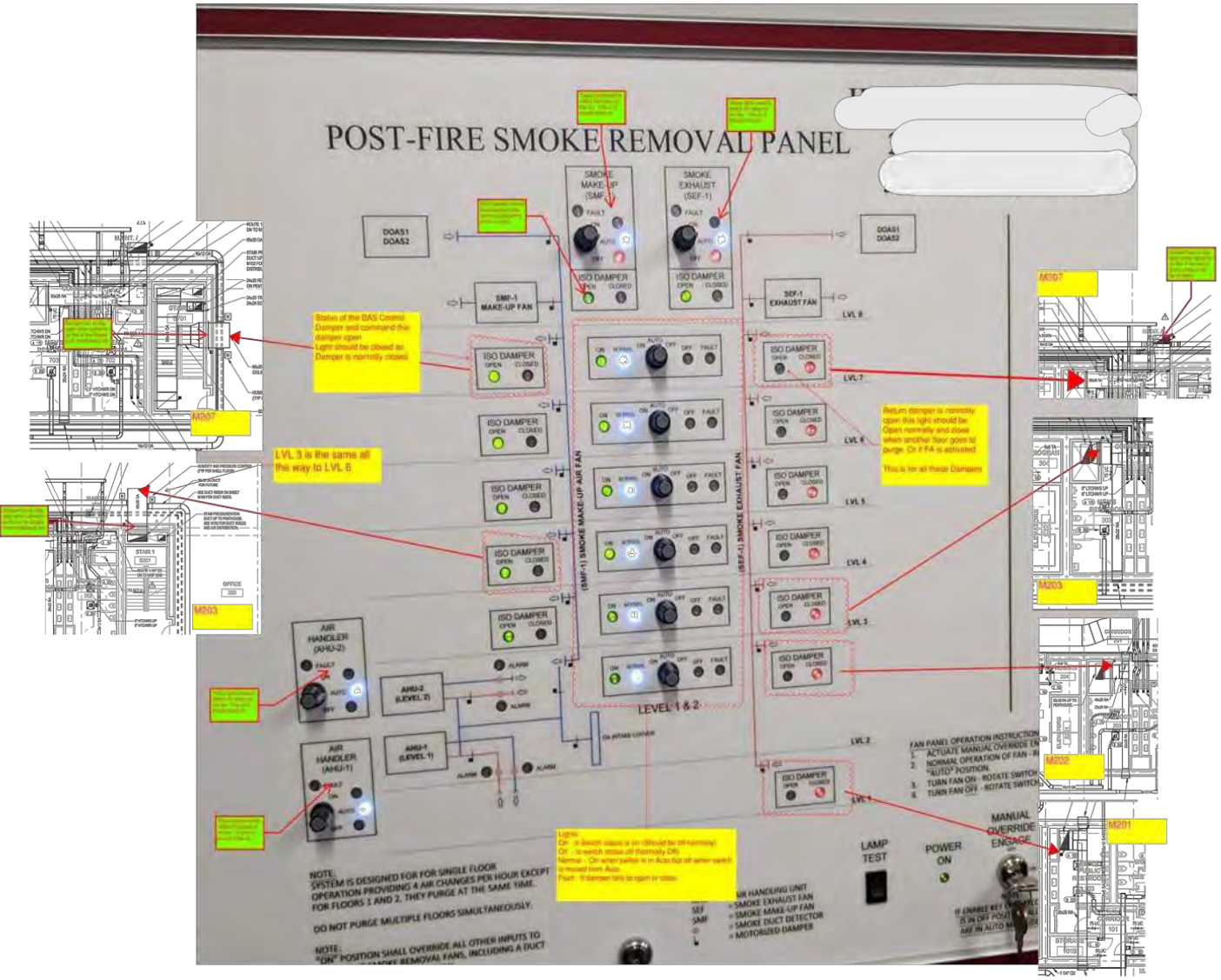

AFL
AVAYA
G450
09/08/22


Micro-Lok HP


SOFTWARE HOUSE


SIEMENS
Healthineers


SIEMENS
Healthineers


POST-FIRE SMOKE REMOVAL PANEL
SMOKE MAKE-UP (SMF-1)
SMOKE EXHAUST (SEF-1)
DOAS1
DOAS2
SMF-1 MAKE-UP FAN
SEF-1 EXHAUST FAN
ISO DAMPER
OPEN
CLOSED
LVL 8
LVL 7
LVL 6
LVL 5
LVL 4
LVL 3
LVL 2
LVL 1
(SMF-1) SMOKE MAKE-UP AIR FAN
(SEF-1) SMOKE EXHAUST FAN
LEVEL 1 & 2
AIR HANDLER (AHU-2)
AHU-2 (LEVEL 2)
AIR HANDLER (AHU-1)
AHU-1 (LEVEL 1)
ALARM
FAULT
AUTO
OFF
LAMP TEST
POWER ON
MANUAL OVERRIDE ENGAGE
NOTE:
SYSTEM IS DESIGNED FOR FOR SINGLE FLOOR OPERATION PROVIDING 4 AIR CHANGES PER HOUR EXCEPT FOR FLOORS 1 AND 2, THEY PURGE AT THE SAME TIME.
DO NOT PURGE MULTIPLE FLOORS SIMULTANEOUSLY.
NOTE:
"ON" POSITION SHALL OVERRIDE ALL OTHER INPUTS TO
Status of the BAS Control Damper and command this damper open
Light should be closed as Damper is normally closed
LVL 3 is the same all the way to LVL 6
Return damper is normally open this light should be Open normally and close when another floor goes to purge. Or if FA is activated
This is for all these Dampers
M207
M203
M202
M201
= SMOKE EXHAUST FAN
= SMOKE MAKE-UP FAN
= SMOKE DUCT DETECTOR
= MOTORIZED DAMPER


1503
1504


1302:2 Code Blue
00:22
1302:1 Staff Assist
00:33
08-22-2023 12:30:05
Need PCT
Need Nurse
Night
Mute Tones
1
2
3
4
5
6
7
8
9

When Is Ready Ready?

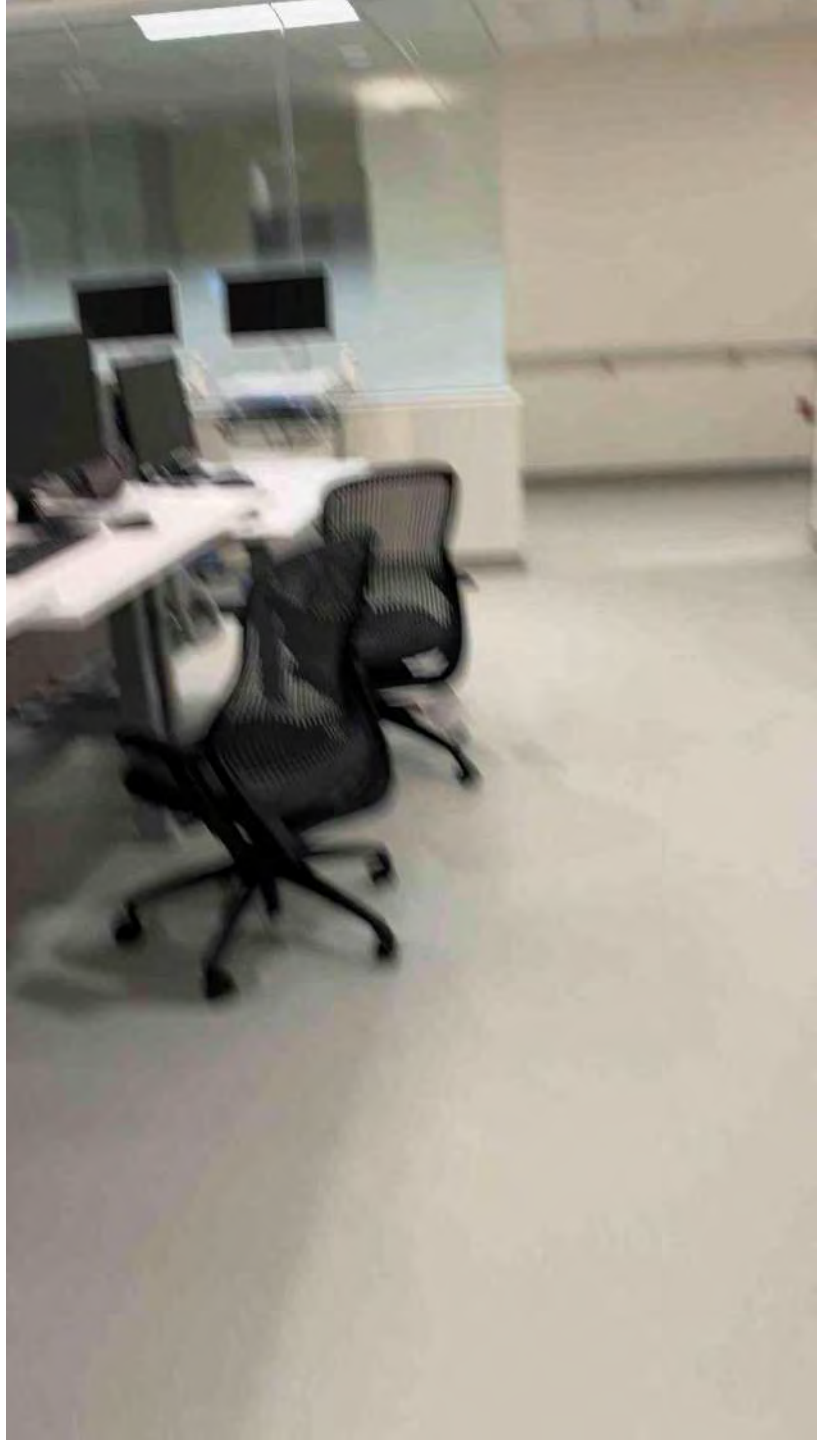
When is Ready Ready: System Cx

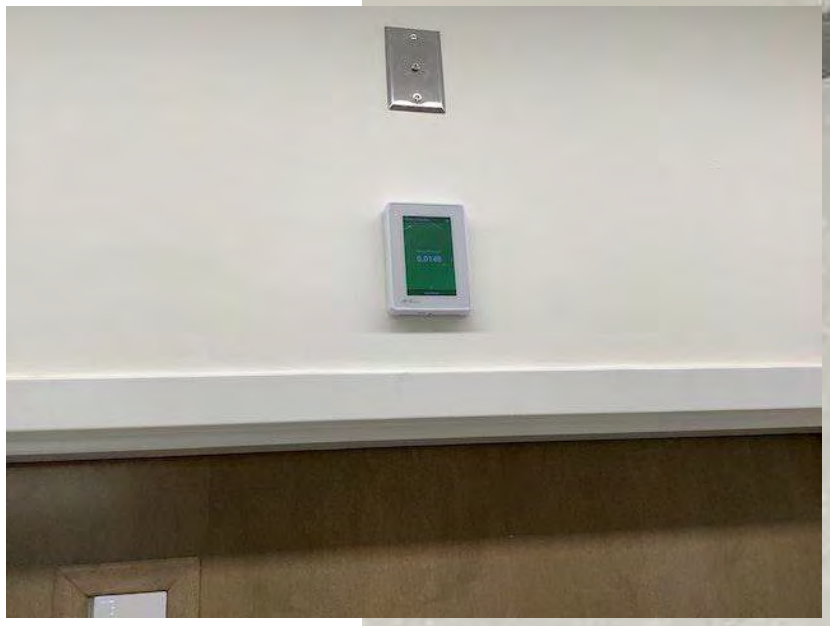
- Controls Integration Meeting
- Red Zone Meeting
- All Checklists are Complete
- Start-Up is Complete:
  - TAB
  - Load Bank
  - Manufactures Reports
- Controls are Complete

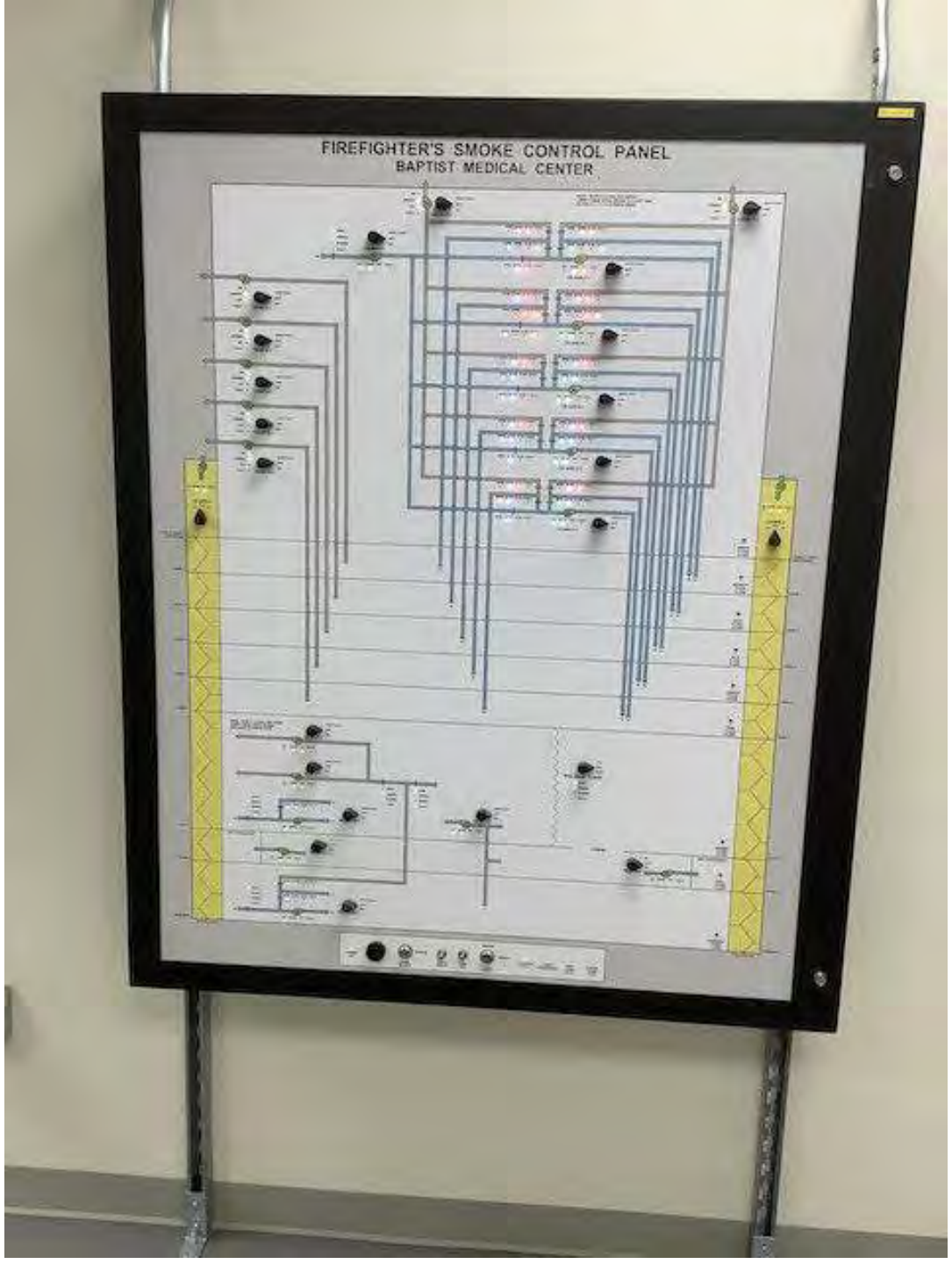
When is Ready Ready: IST

- O/E/C Team Bought into IST Plan
- IST Prep Meeting
- All Tests Passed


THESE WERE THE DROIDS
WE WERE LOOKING FOR !!



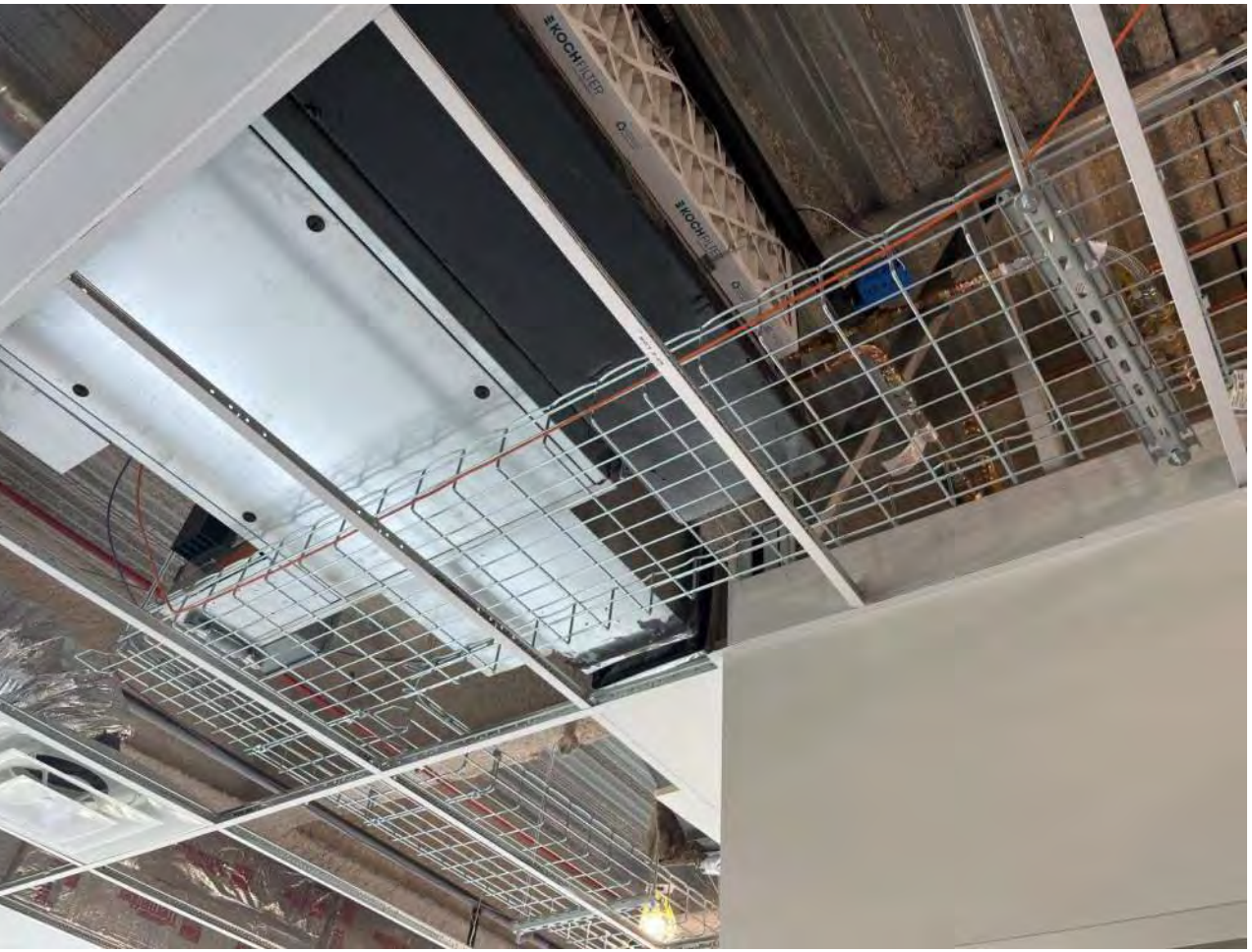



FIREFIGHTER'S SMOKE CONTROL PANEL
BAPTIST MEDICAL CENTER


Amico
MEDICAL VACUUM
LOW
MEDVAC
11
inHg
LOW
MEDICAL AIR
51
PSI
NORMAL
OXYGEN
53
PSI
NORMAL
ROOM#C601-C604,C621-C626
CE-LSL5A-8


Amico
OXYGEN
LOW
OXYGEN
38
PSI
LOW
MEDICAL AIR
27
PSI
LOW
MEDVAC
11
inHg
LOW
CE-LSL7A-9


28359
MEDICAL VACUUM
PLANT FACILITIES DIVISION
28360


KOCH FILTER

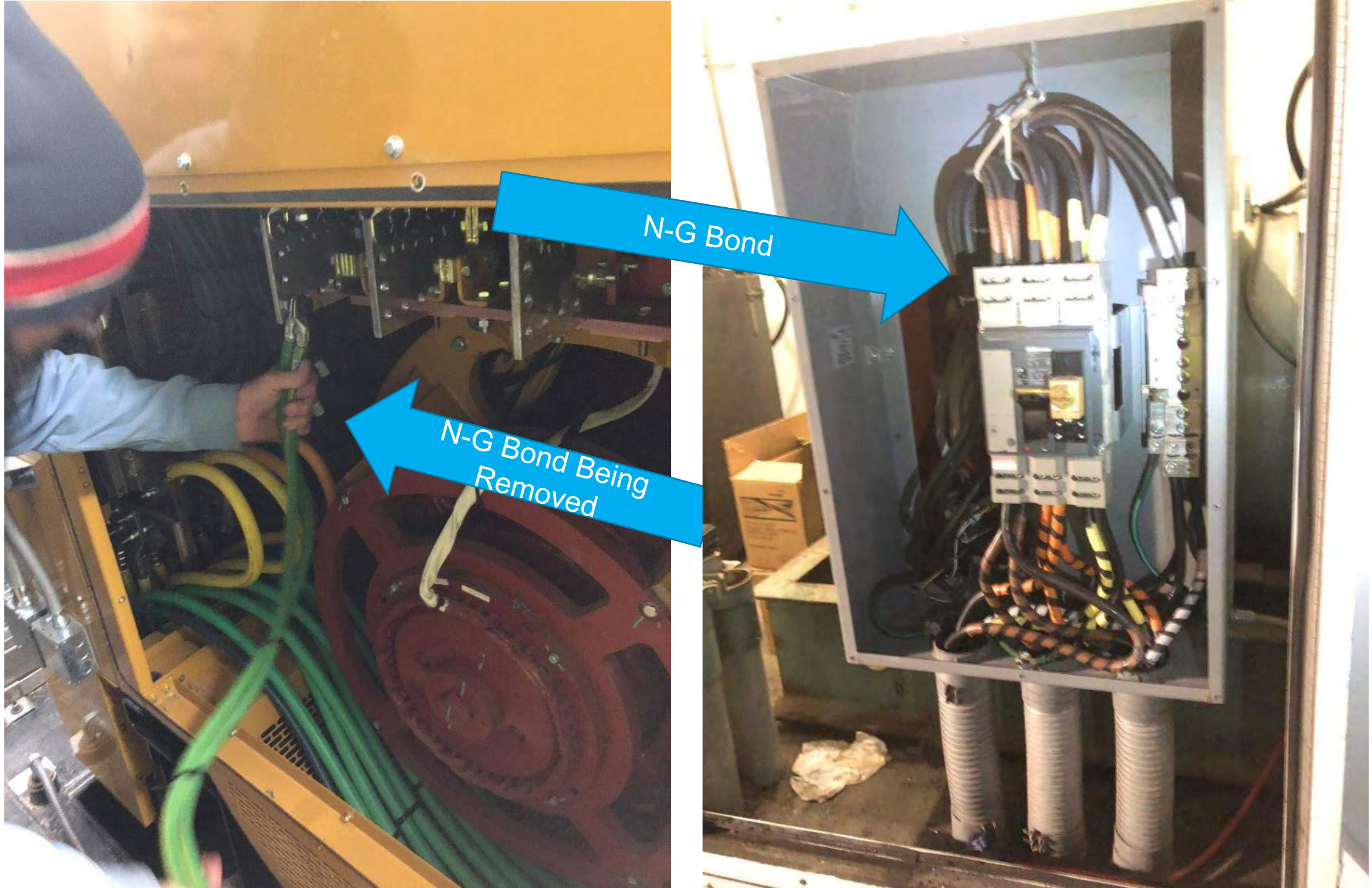

WERNER

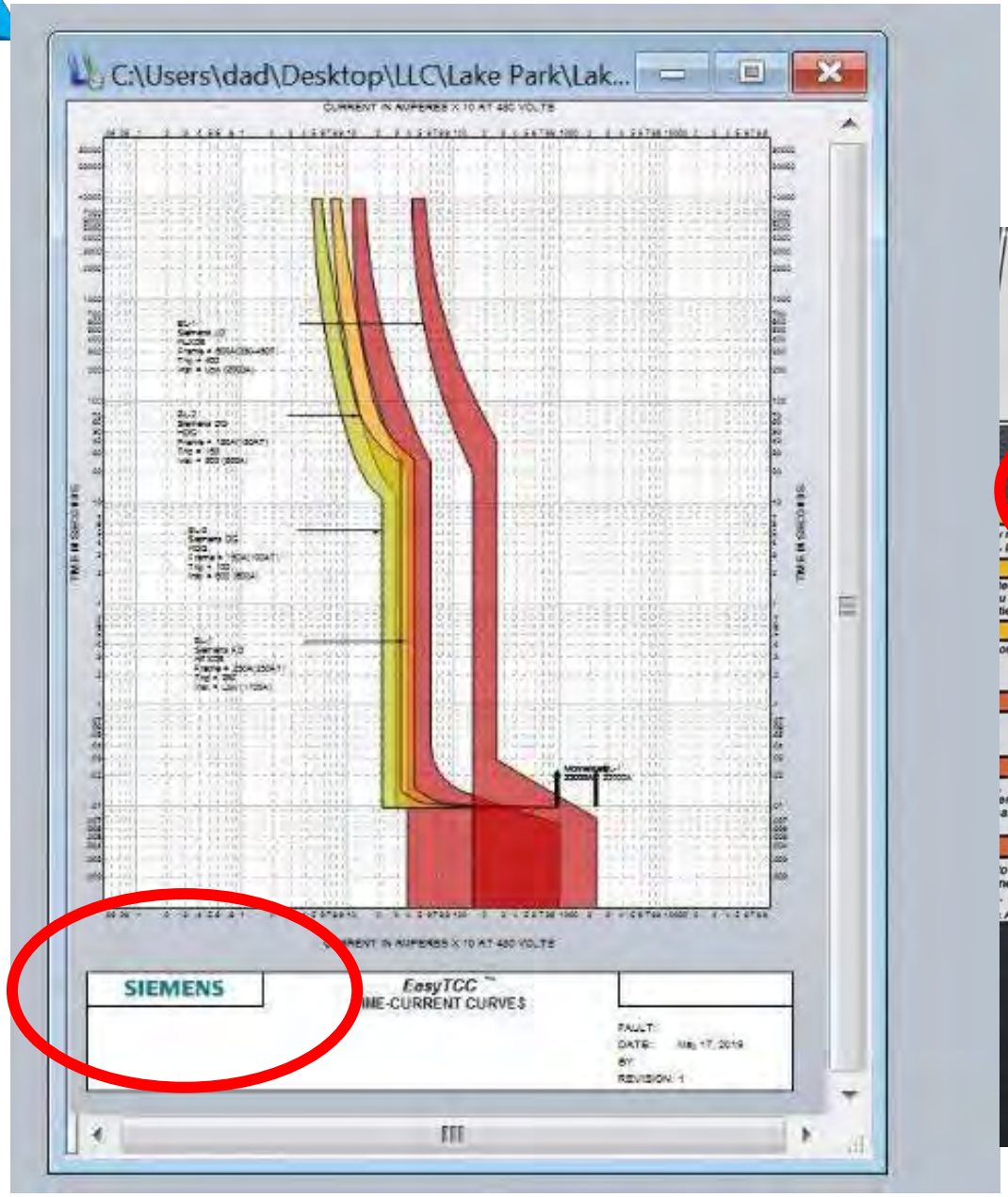

ON
OFF


Thermax


DIESEL FUEL ONLY
This Tank Is Provided With An Integral Steel Foundation And Is Intended For STATIONARY INSTALLATION ONLY
Maximum Leakage Test Gauge Pressure of 3 psi
CLOSED TOP DIKE
(Double Wall)
110% Containment Of Primary Tank
Pressurize Primary (Inner) Tank When Pressure Testing Annular Space (Double Wall Area – Outer Tank)


Flanders
PREpleat
AIR FLOW
AAF
PerfectPleat
with DuraFlex® Media
AAF Flanders
24" • 20" • 4"


N-G Bond
N-G Bond Being Removed


C:\Users\dad\Desktop\LLC\Lake Park\Lak...
SIEMENS
EasyTCC
FAULT:
DATE:
BY:
REVISION: 1


À L'INTÉRIEUR
ADENTRO,
CONEXIONES
DE ALTO VOLTAJE
PELIGRO
Alto voltaje.
Es imprescindible que vuelva a colocar la tapa antes de hacer funcionar el generador. No hacerlo puede ocasionar lesiones personales o la muerte.
EATON
Industrial Circuit Breaker Frame
NGS-C
1200 AMPS MAX
600 VAC
3 POLE
40°C
Off/O
Push to Trip
BREAKER IS UL489
LISTED SUITABLE FOR USE WITHIN
SERVICE RATED EQUIPMENT

SINGLE POINTS OF FAILURE

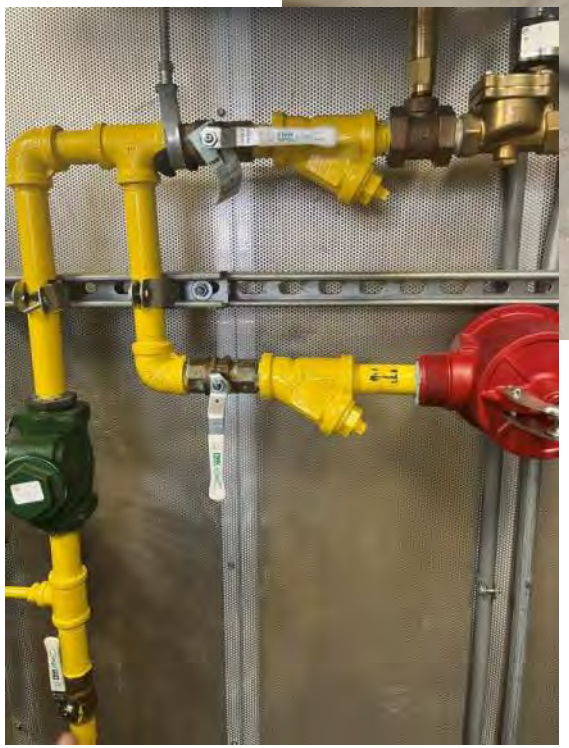

Johnson Controls
YORK


YORK®
SMART EQUIPMENT
Johnson Controls
FM50005188
YORK® YMC² CENTRIFUGAL CHI

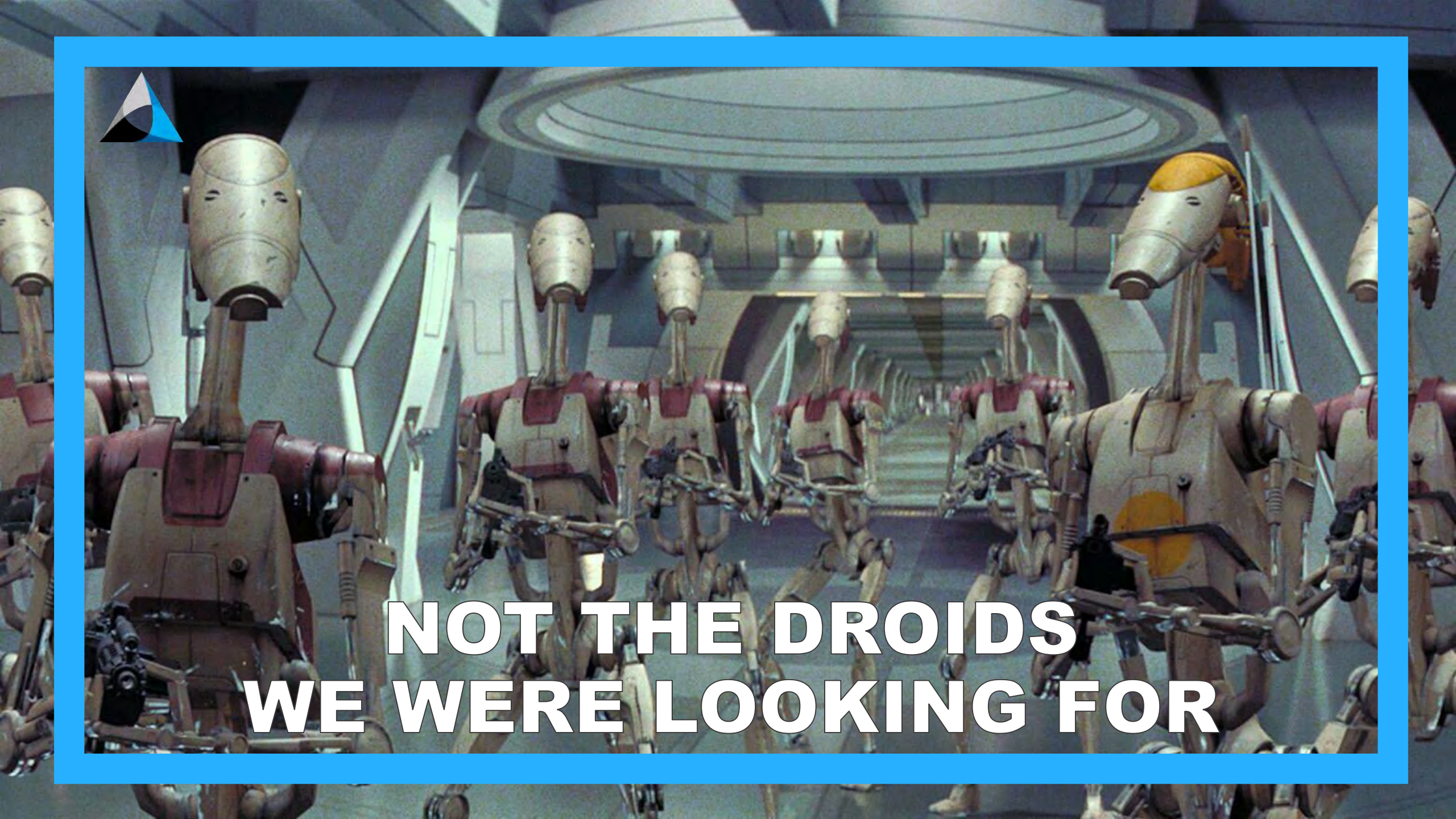

Power Generation
Oneline
LCM
09/08/22 05:31:29
Gen-1
Gen-2
258 kW
0 kW
ATS-CRA
ATS-CRB
ATS-LS
ATS-EQA
ATS-EQB
ATS-EQCH
ATS-FP
ADVANTECH


Power Generation
Alarm/Event History
08/29/22 10:58:48
Time ID ACK Cleared Message
05:17:48 Load Level 1 Added
04:42:27 Generator Set 2 Genset Running
05:17:47 Generator Set 1 Genset Running
19:35:18 Generator Set 2 Load Demand
18:12:28 Generator Set 2 Breaker Open
19:35:16 Load Level 2 Added
18:12:28 Generator Set 2 Genset Supplying Load
19:35:15 Generator Set 1 Breaker Open
19:35:16 Load Level 1 Added
19:35:15 Generator Set 1 Genset Supplying Load
18:15:28 Generator Set 2 Genset Running
19:35:15 Generator Set 1 Genset Running
11:15:49 Generator Set 2 Common Alarm
11:15:49 Generator Set 2 Charger AC Failure
11:16:36 Generator Set 1 Common Alarm
11:16:36 Generator Set 1 Charger AC Failure
09:38:40 Generator Set 2 Breaker Open
09:38:41 Generator Set 2 Genset Supplying Load
09:38:40 Load Level 2 Added
09:38:40 Generator Set 1 Genset Supplying Load
ADVANTECH

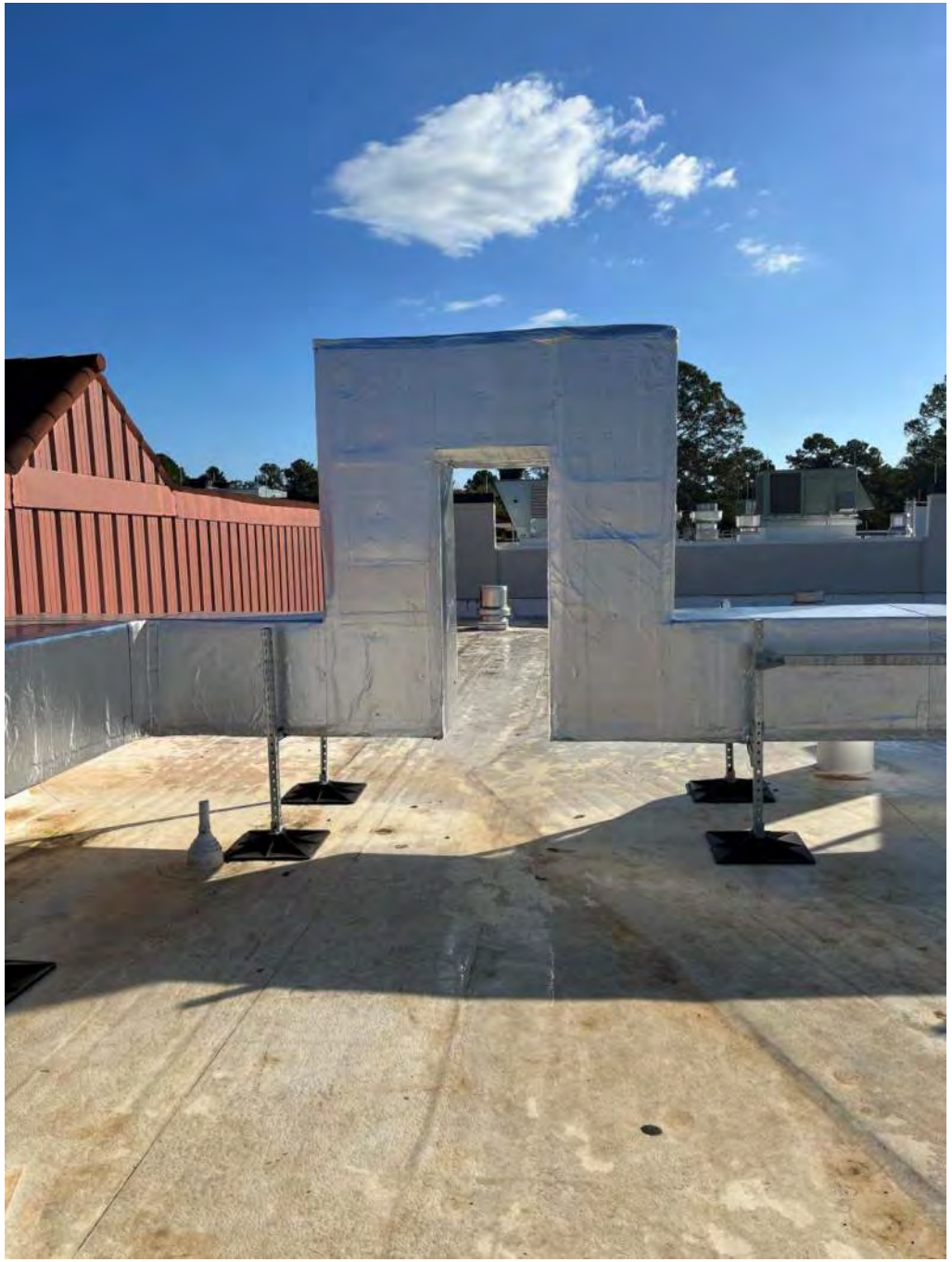

EXIT
ASCO 7000 SERIES
BYPASS SWITCH HANDLE
BYPASS SWITCH POSITION
EMERGENCY
NORMAL

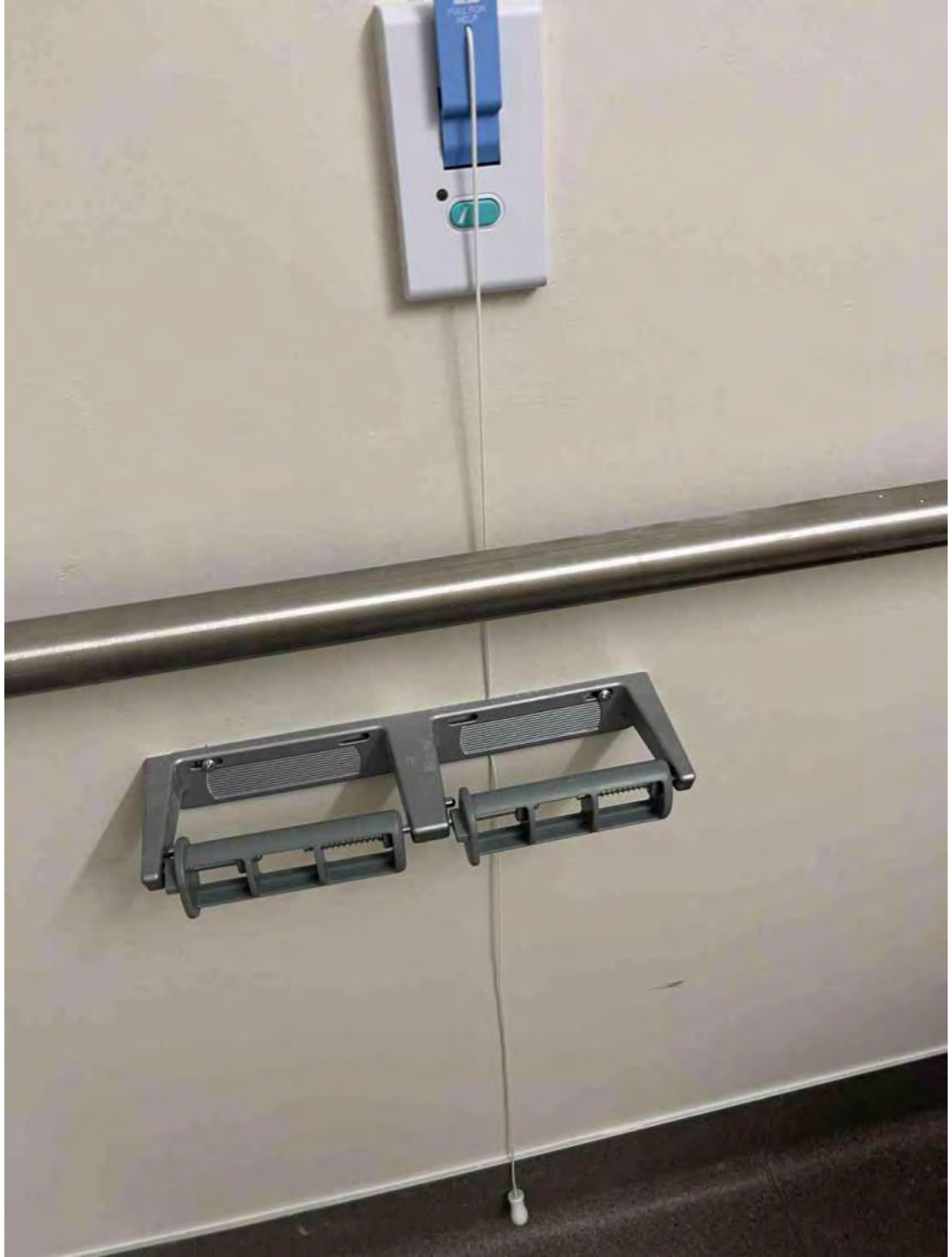



FUEL OIL SUP
Fuel Oil
Supply Pump
FOP-2
Manually starting supply pumps at this location will NOT open solenoid valve in supply piping. Prolonged manual starting of pumps here may cause damage to the system.
DANGER
SIMPLEX


NOT THE DROIDS
WE WERE LOOKING FOR


EXIT

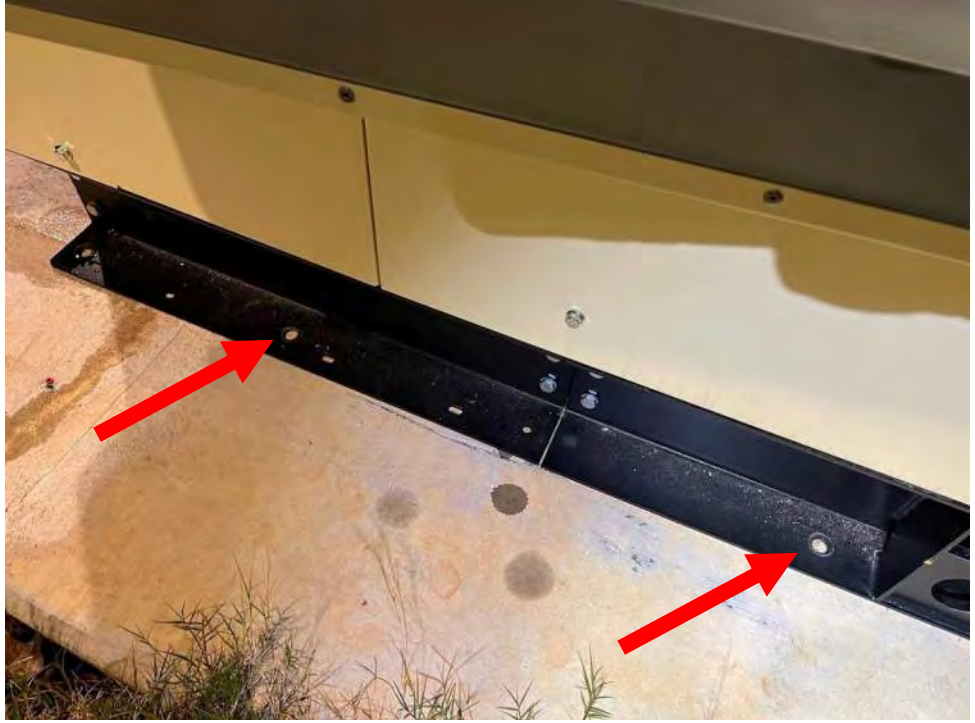





ROTATION
460 V


ROTATION
460 V


KOHLER
KOHLER
180
KOHLERPower.com
NO PARKING FIRE LANE

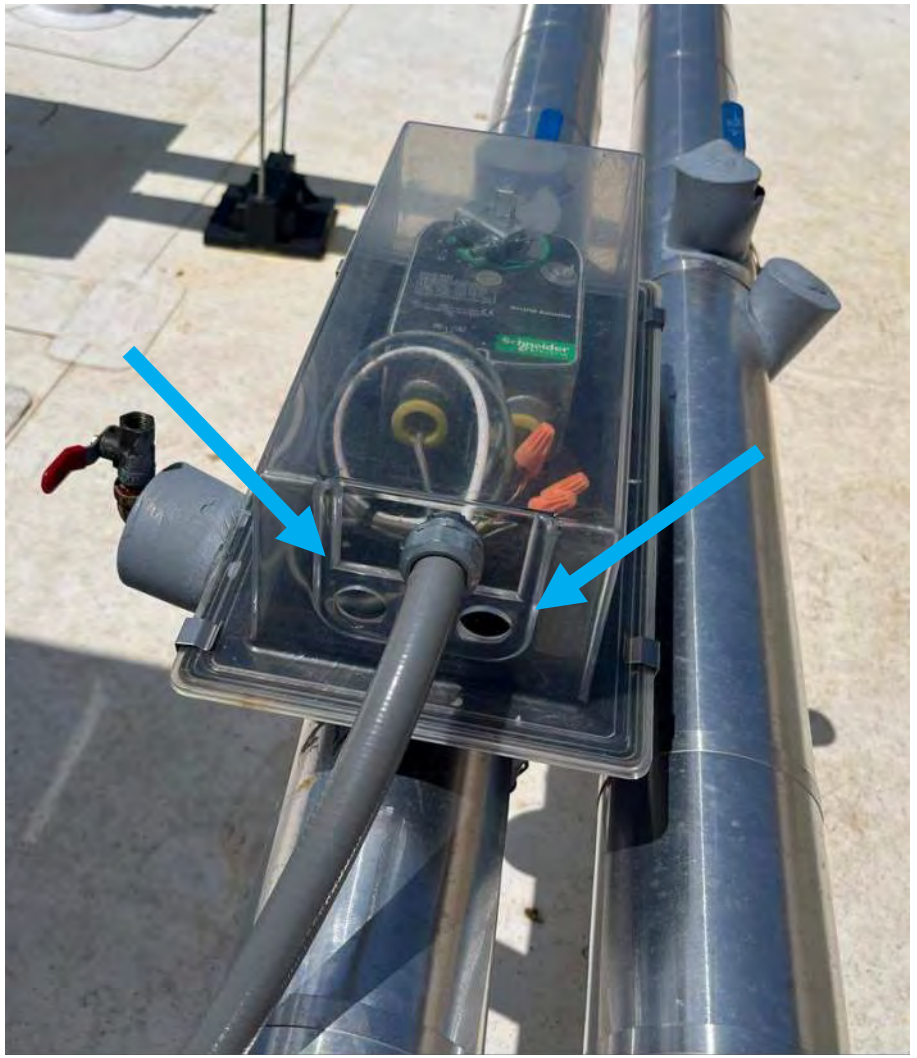



180


ASCO
ATS-HOSITAL2
480/277V 3PH,4W
NORMAL FED FROM MSB1C
ESSENTIAL FED FROM EMSB
PRIORITY 3
WARNING
Arc Flash and Shock Risk
Appropriate PPE Required
LOAD SHED
FROM EMERG
POWER-UP INHIBIT
SRCs NOT ACCEPTABLE


FUEL OIL SUPPLY
VENT
FUEL OIL SUPPLY
FUEL OIL RETURN
FUEL OIL RETURN

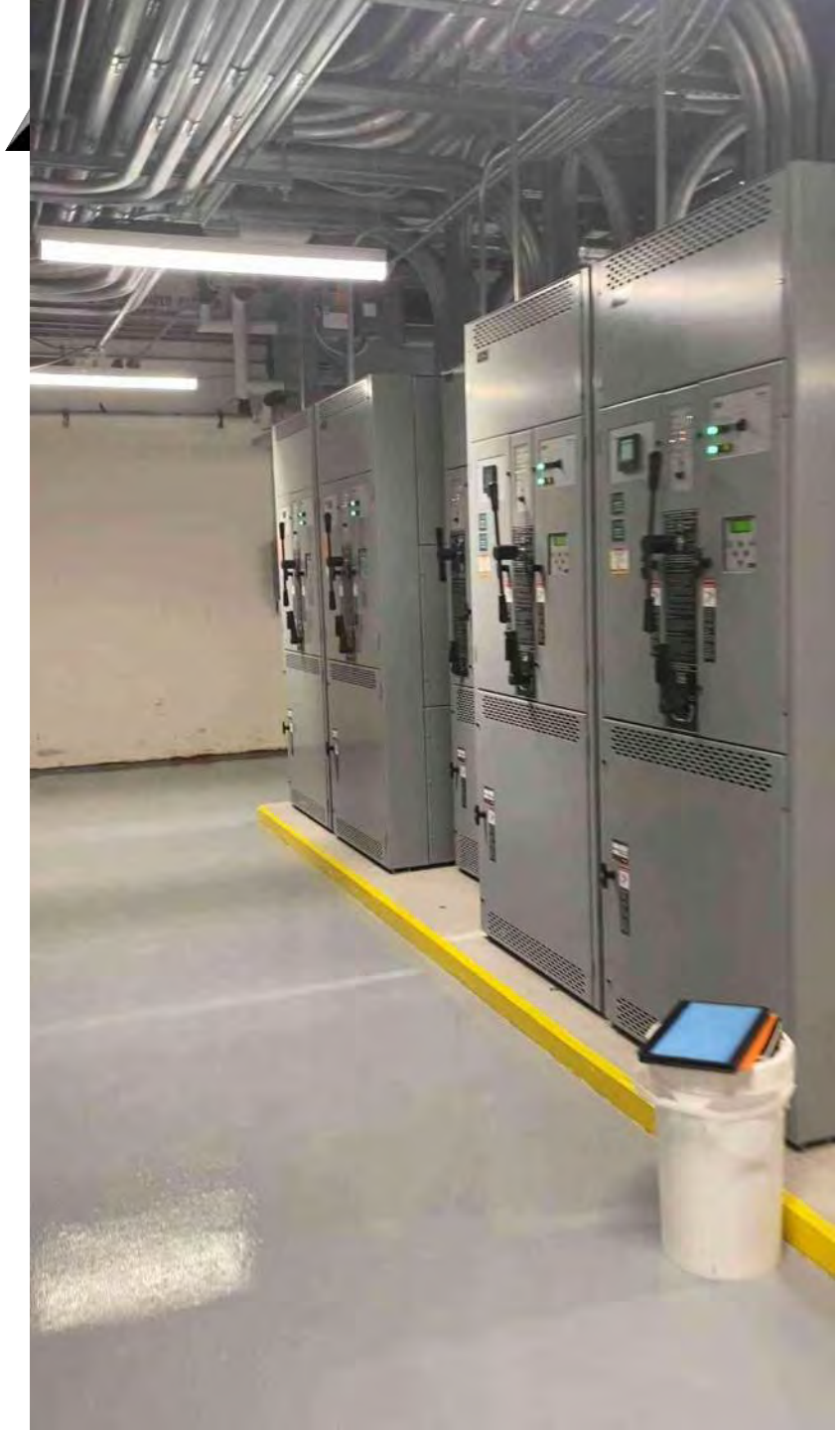
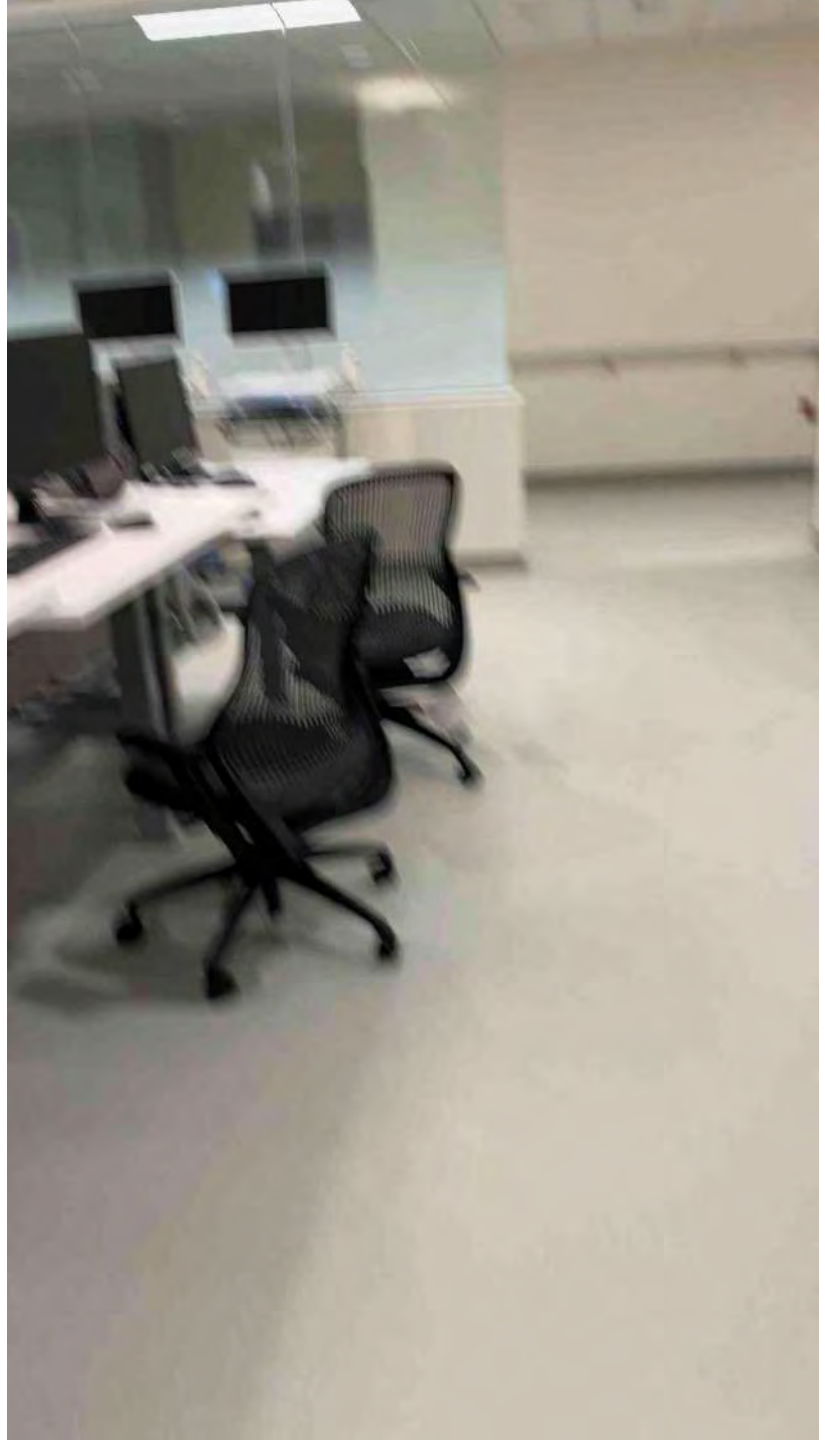

FUEL OIL RETURN
FUEL OIL RETURN




I was always here, Obi-Wan.
You just were not ready to see.

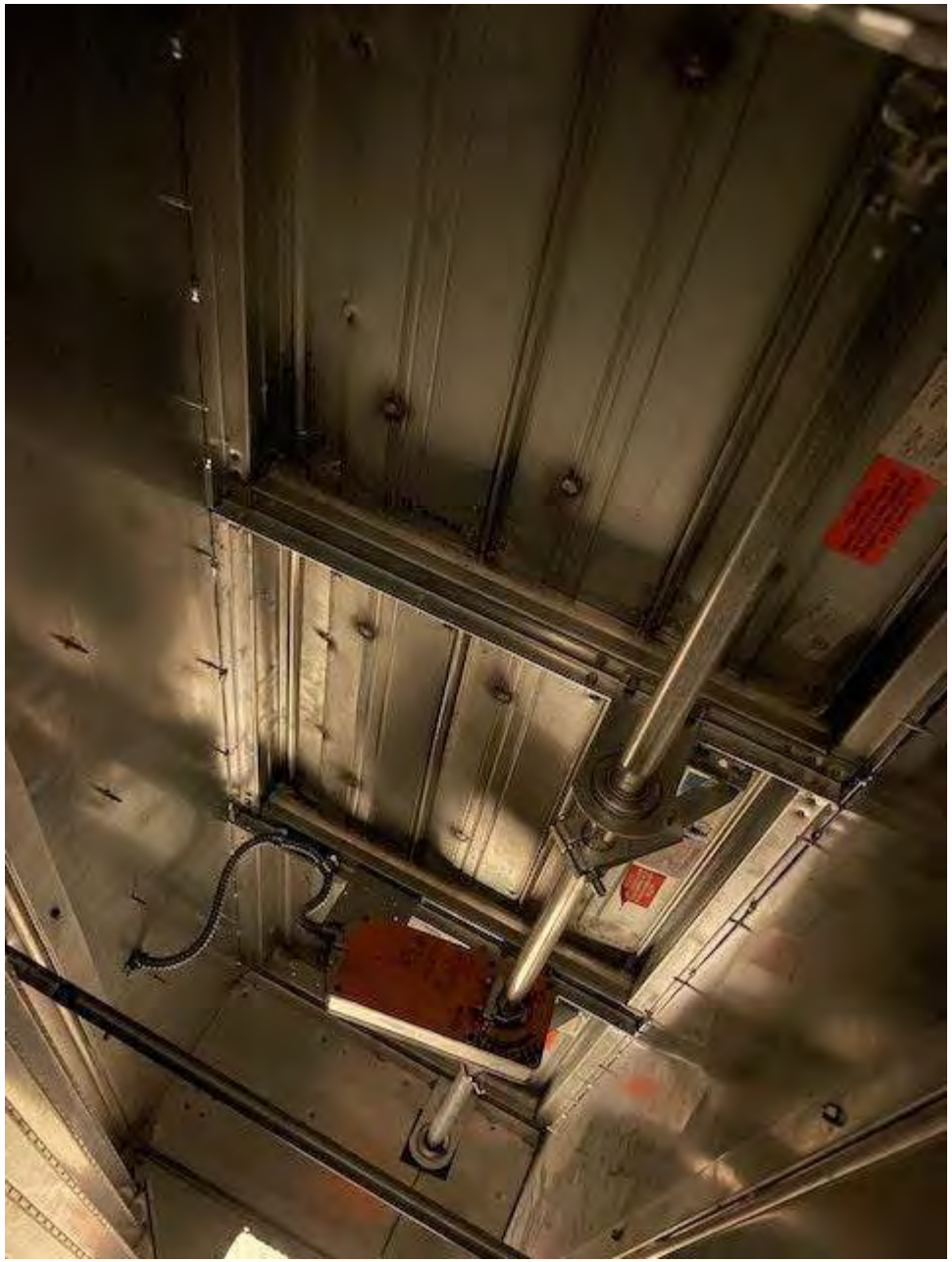
IST CASE STUDY EXAMPLE #1

New Critical Care Tower Addition to
Existing Hospital
7 Stories, 200,000 sf
Mechanical / Electrical Penthouse
Added Generator & Chiller in CEP

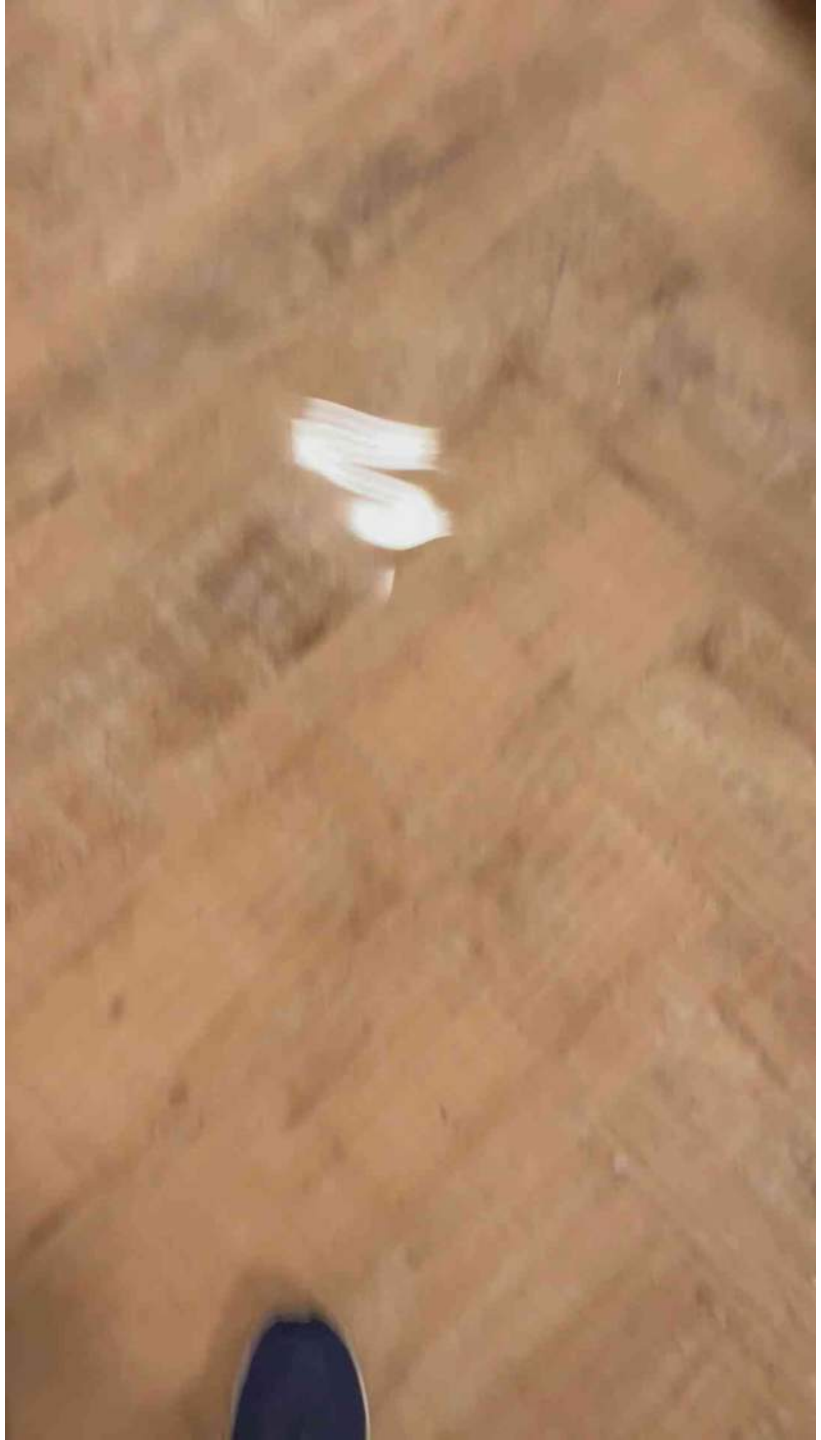


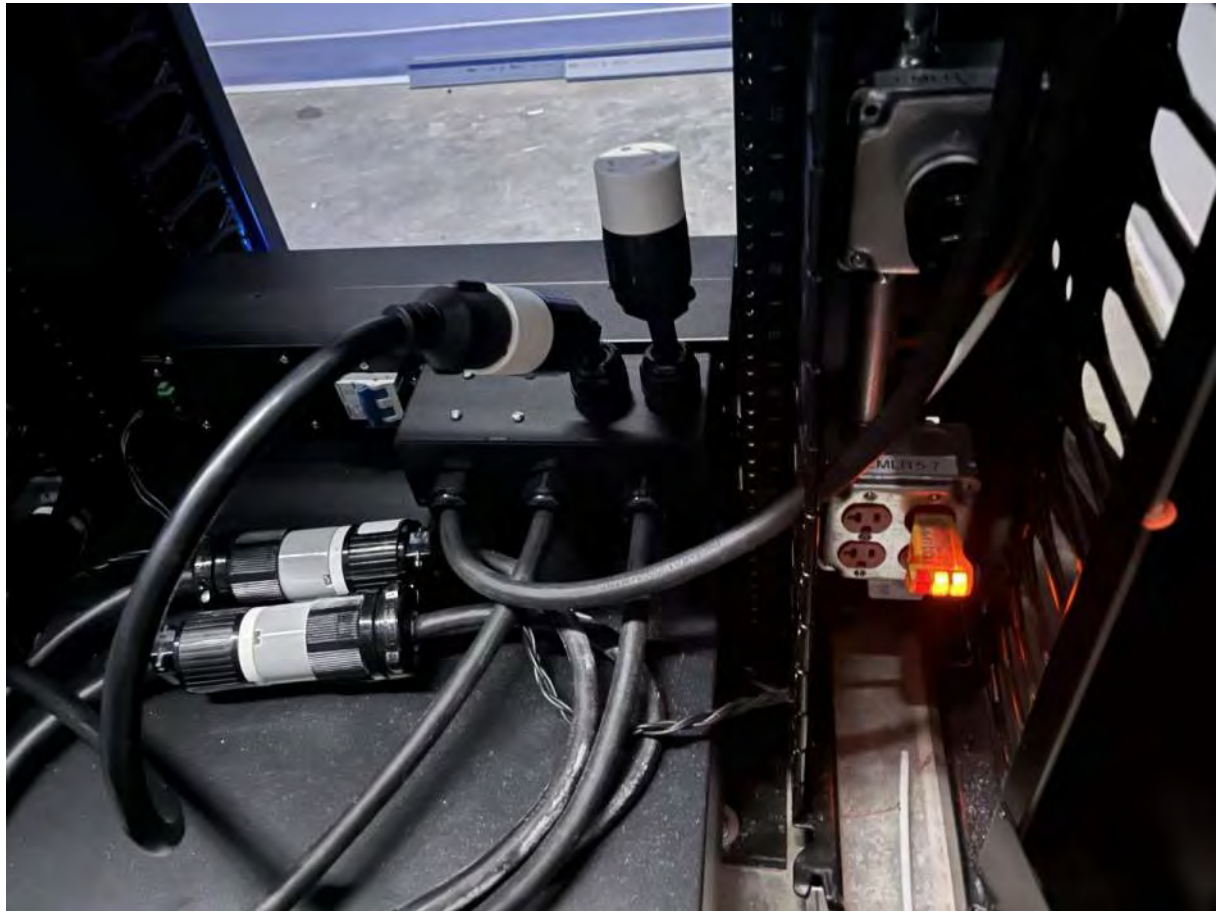
DANGER
ENERGIZED EQUIPMENT
DO NOT TOUCH
YASKAWA

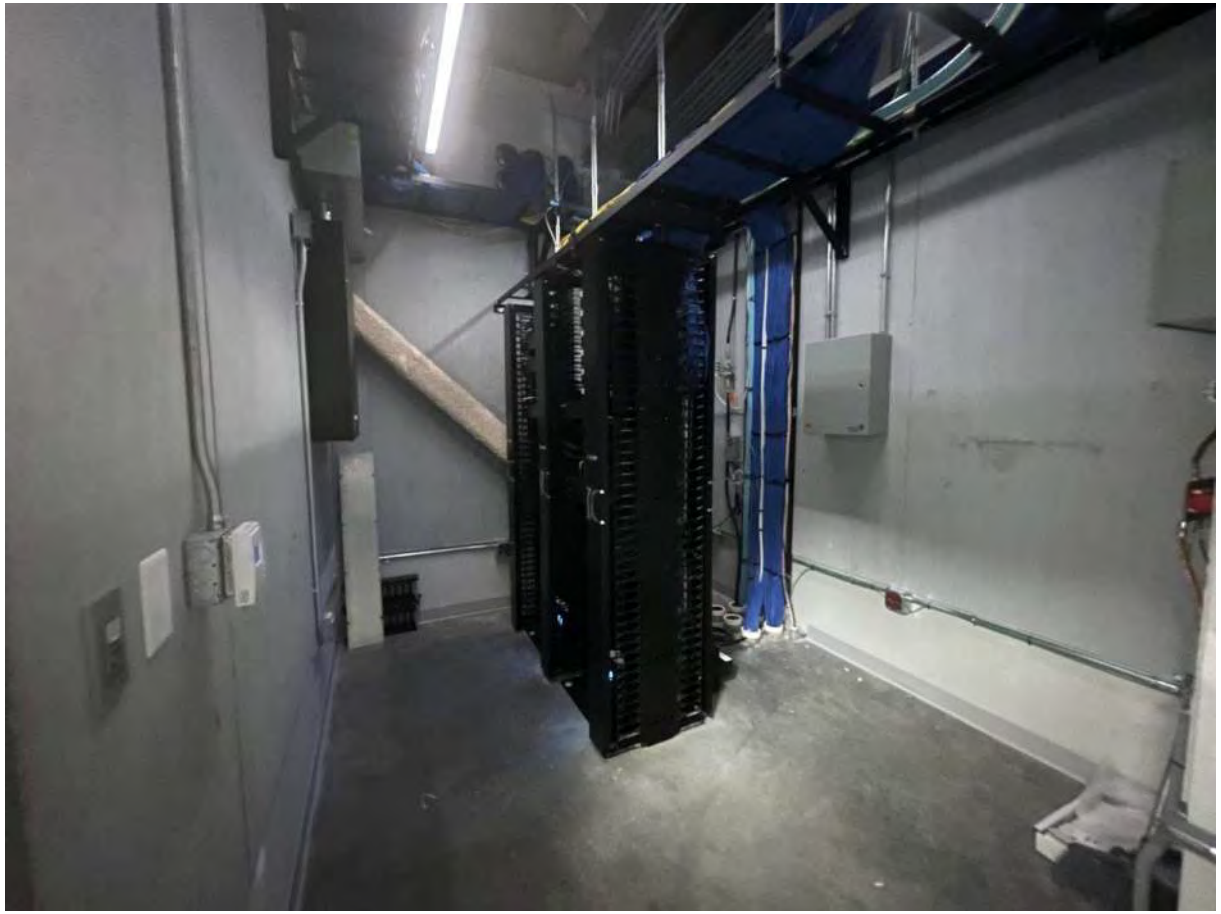


IST CASE STUDY EXAMPLE #2

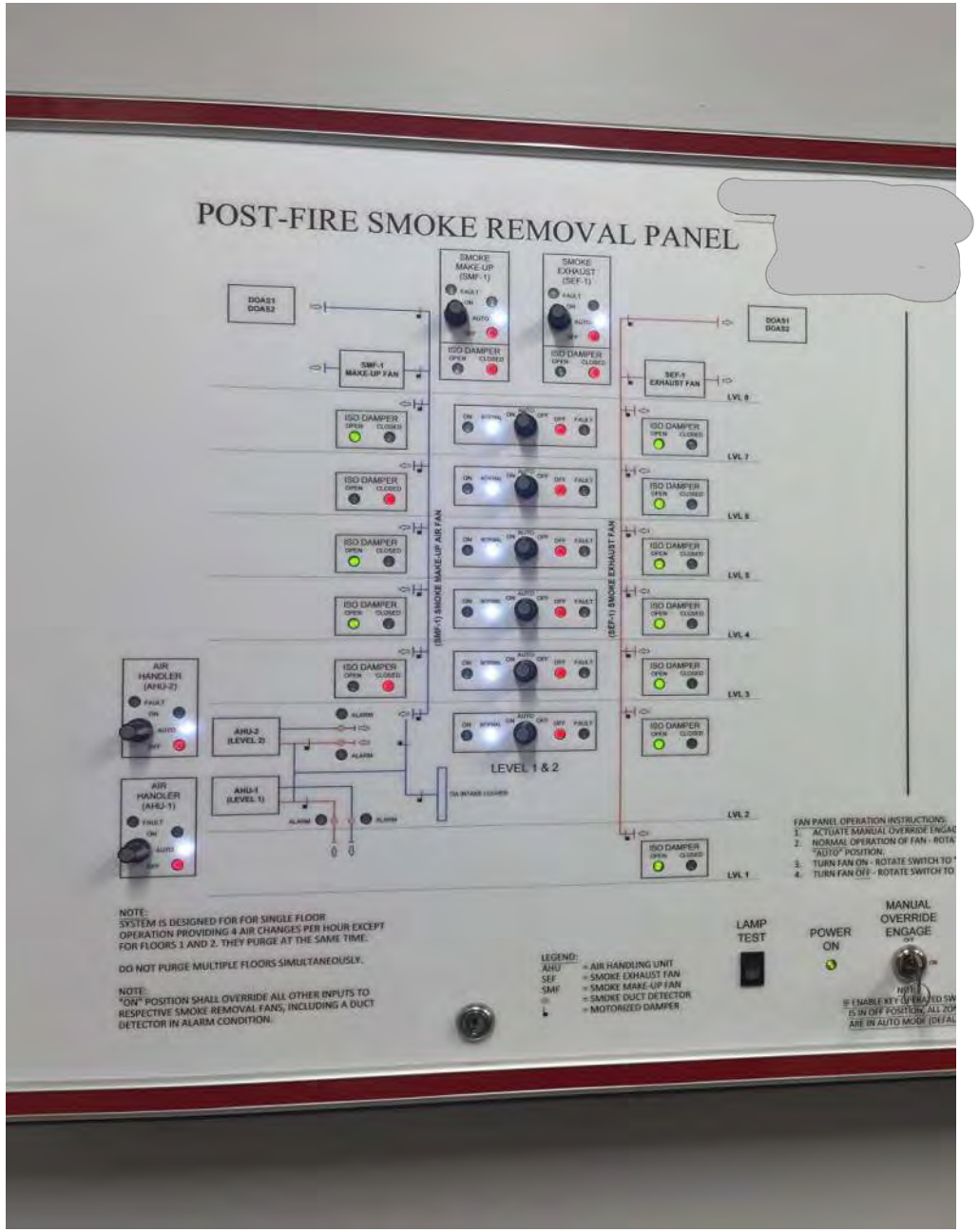
New Corporate HQ Office Building
7 Stories, 160,000 sf
Mechanical Penthouse
2nd Floor Electrical
8 Story Parking Garage

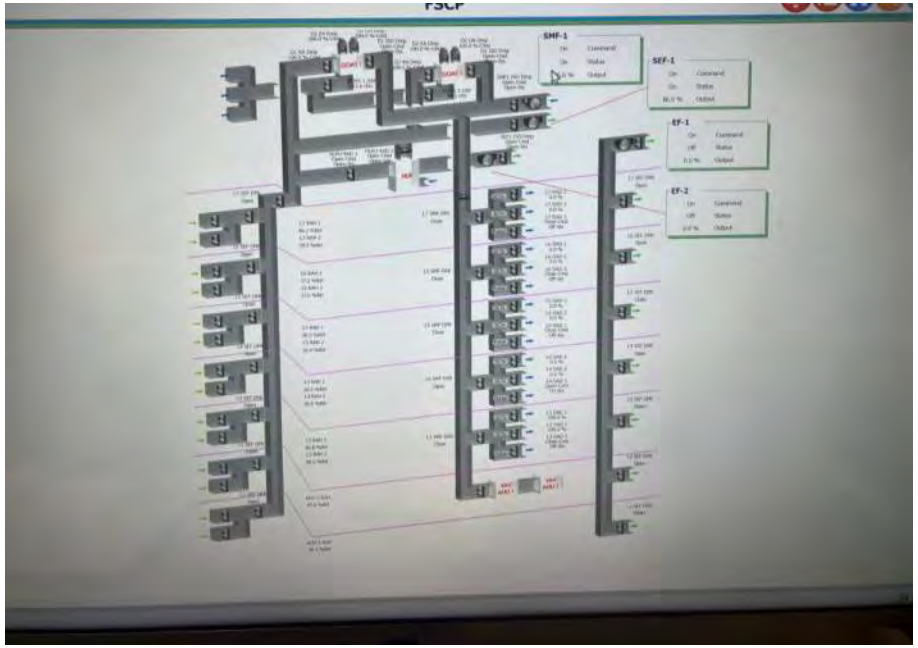


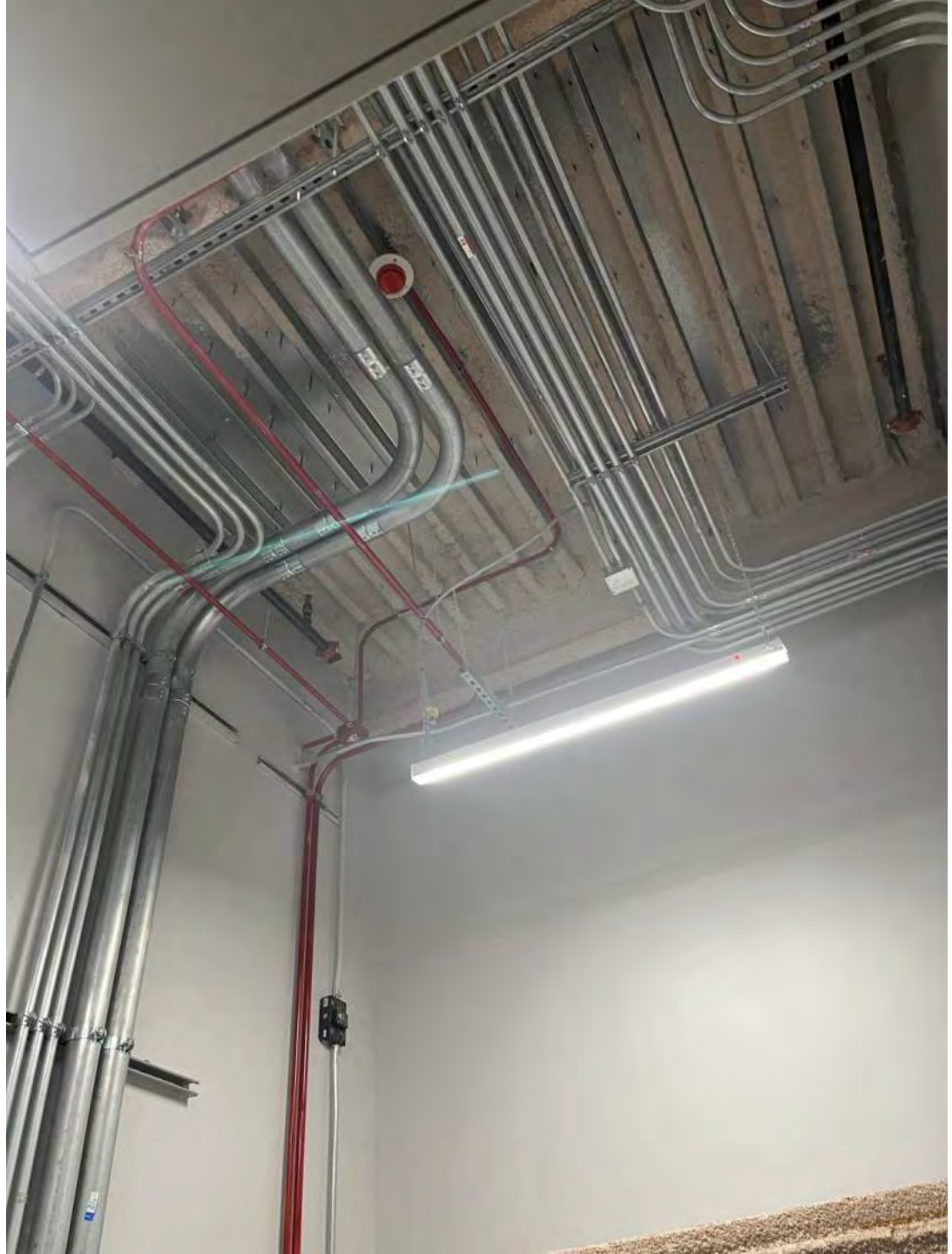





NL2-57/59


POST-FIRE SMOKE REMOVAL PANEL
SMOKE MAKE-UP (SMF-1)
SMOKE EXHAUST (SEF-1)
DOAS1 DOAS2
SMF-1 MAKE-UP FAN
SEF-1 EXHAUST FAN
ISO DAMPER
OPEN
CLOSED
LVL 8
LVL 7
LVL 6
LVL 5
LVL 4
LVL 3
LVL 2
LVL 1
(SMF-1) SMOKE MAKE-UP AIR FAN
(SEF-1) SMOKE EXHAUST FAN
AIR HANDLER (AHU-2)
AHU-2 (LEVEL 2)
AIR HANDLER (AHU-1)
AHU-1 (LEVEL 1)
LEVEL 1 & 2
FAN PANEL OPERATION INSTRUCTIONS:
1. ACTUATE MANUAL OVERRIDE ENGAGE
2. NORMAL OPERATION OF FAN - ROTATE SWITCH TO "AUTO" POSITION.
3. TURN FAN ON - ROTATE SWITCH TO
4. TURN FAN OFF - ROTATE SWITCH TO
NOTE:
SYSTEM IS DESIGNED FOR FOR SINGLE FLOOR OPERATION PROVIDING 4 AIR CHANGES PER HOUR EXCEPT FOR FLOORS 1 AND 2. THEY PURGE AT THE SAME TIME.
DO NOT PURGE MULTIPLE FLOORS SIMULTANEOUSLY.
NOTE:
"ON" POSITION SHALL OVERRIDE ALL OTHER INPUTS TO RESPECTIVE SMOKE REMOVAL FANS, INCLUDING A DUCT DETECTOR IN ALARM CONDITION.
LEGEND:
AHU = AIR HANDLING UNIT
SEF = SMOKE EXHAUST FAN
SMF = SMOKE MAKE-UP FAN
= SMOKE DUCT DETECTOR
= MOTORIZED DAMPER
LAMP TEST
POWER ON
MANUAL OVERRIDE ENGAGE


FSCP
SMF-1
SEF-1
EF-1
EF-2

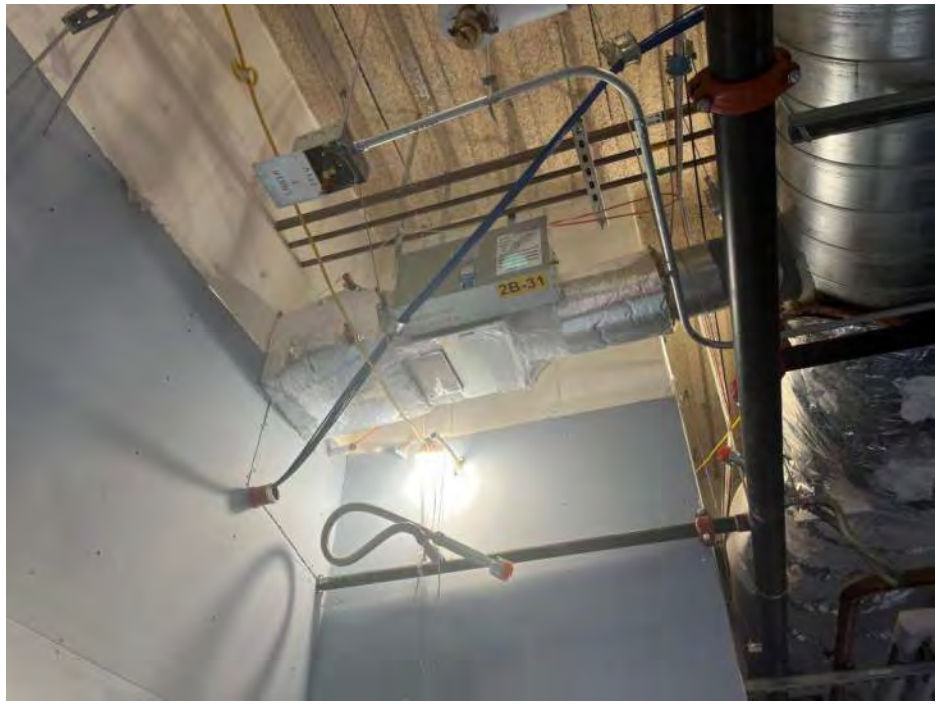



DANGER
PV SYSTEM
COMBINER BOX
740 VDC NOMINAL
890 VDC STARTUP
DC PHOTOVOLTAIC
METER OUTPUT
DISPLAY


RS
OFF
FLUKE 323
TRUE RMS CLAMP METER

IST CASE STUDY EXAMPLE #3

New Patient Tower Addition & CEP Addition
to Existing Hospital
6 Stories, AHU on each floor
Added Generator, Chillers, Boilers in CEP


2B-31


-19


SIMPLEX


CAT

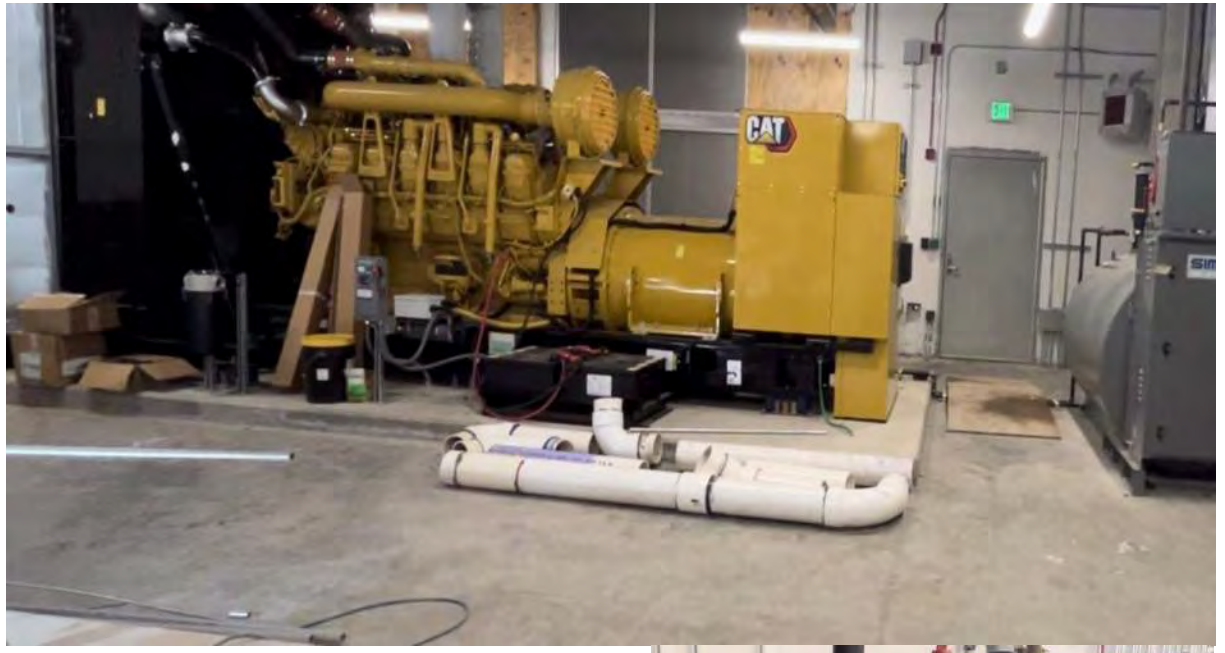

LOUISVILLE


YASKAWA
YASKAWA
YASKAWA

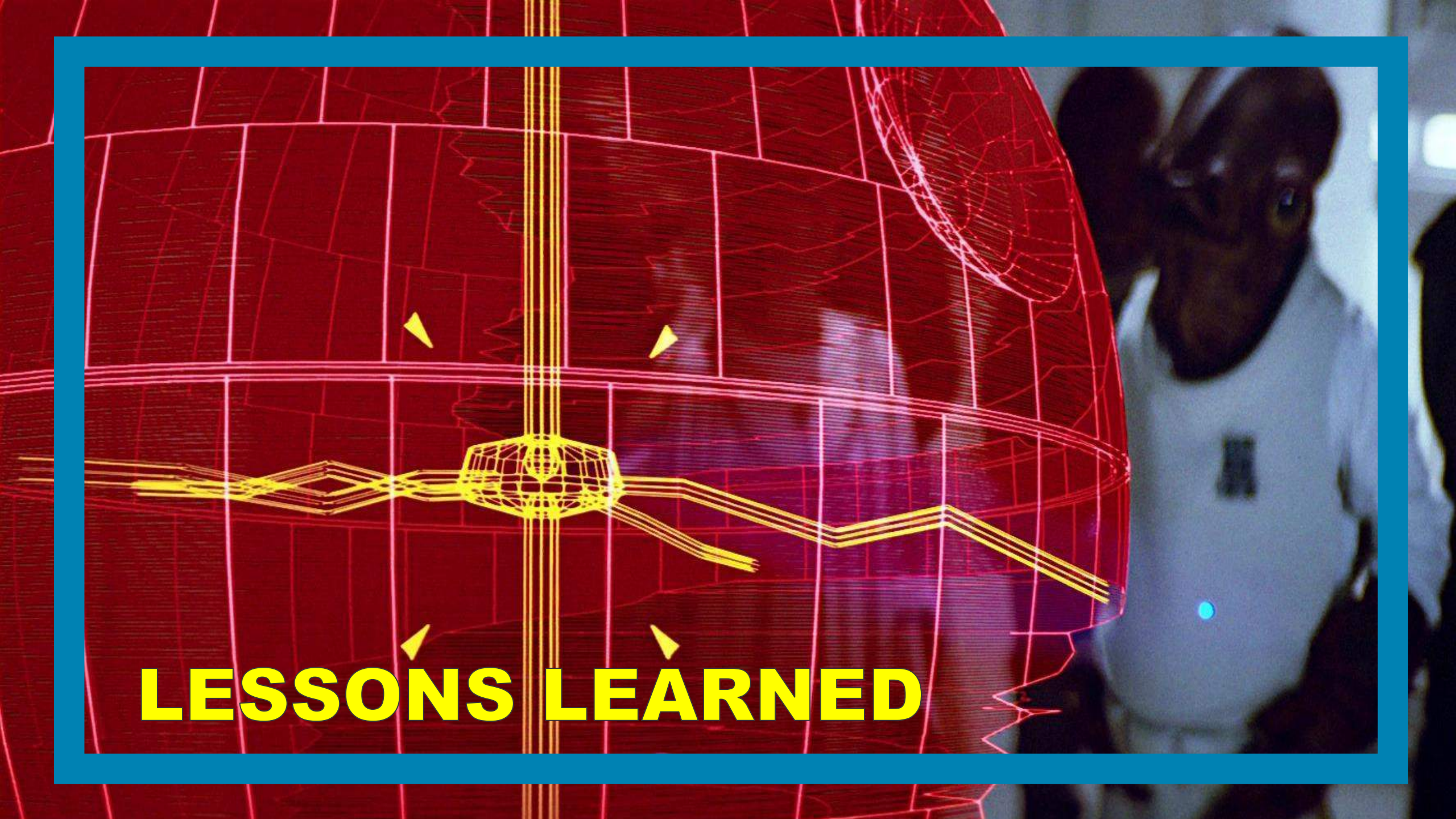

JEA RESPONDER
GENERATOR-JEA
ISOLATION
POINT
MSB1C
TLC
ENGINEERING


YORK
YK CENTRIFUGAL CHILLER


CAT

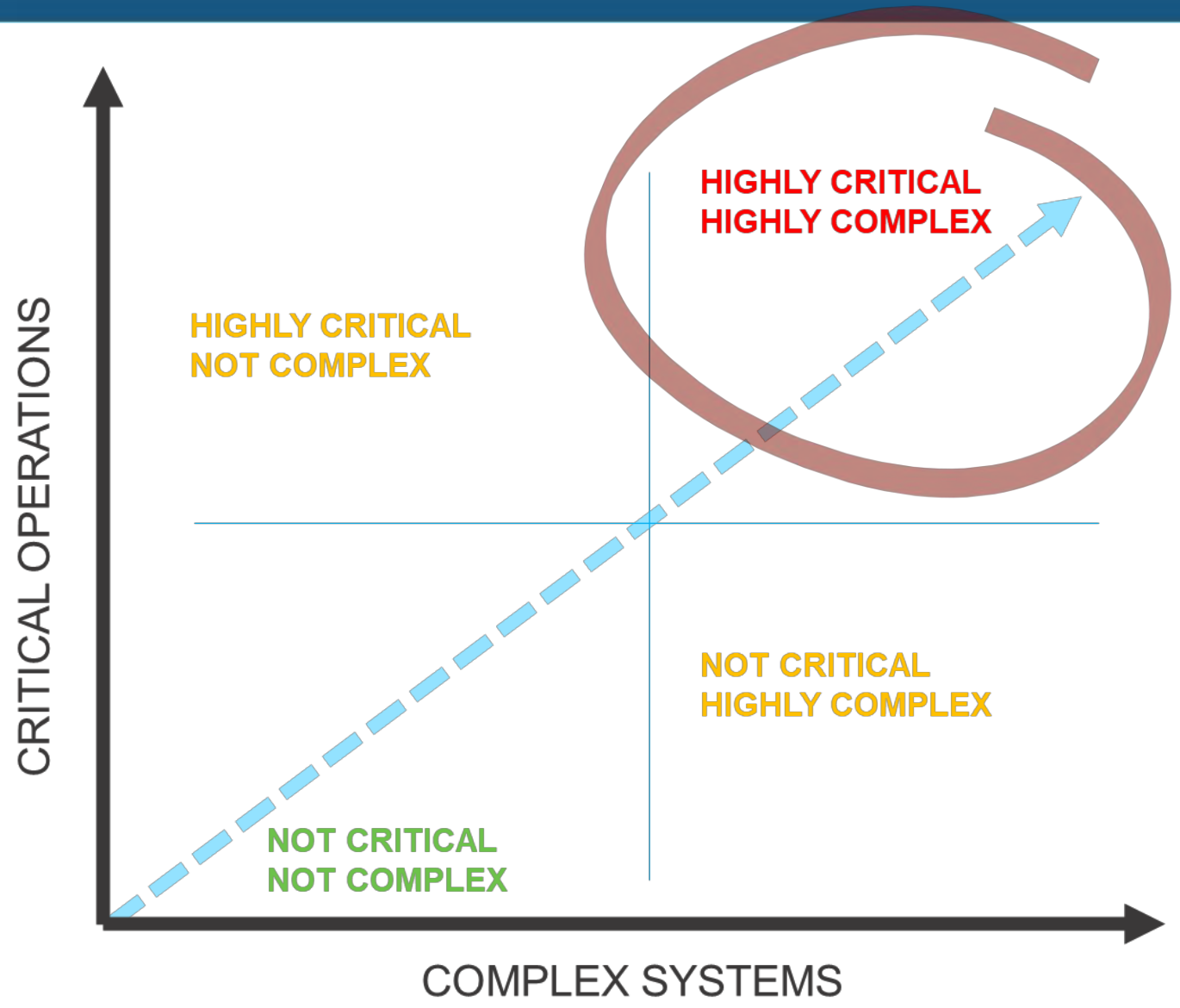

CAT


NO SMOKING
1993
NO SMOKING
1993


LESSONS LEARNED

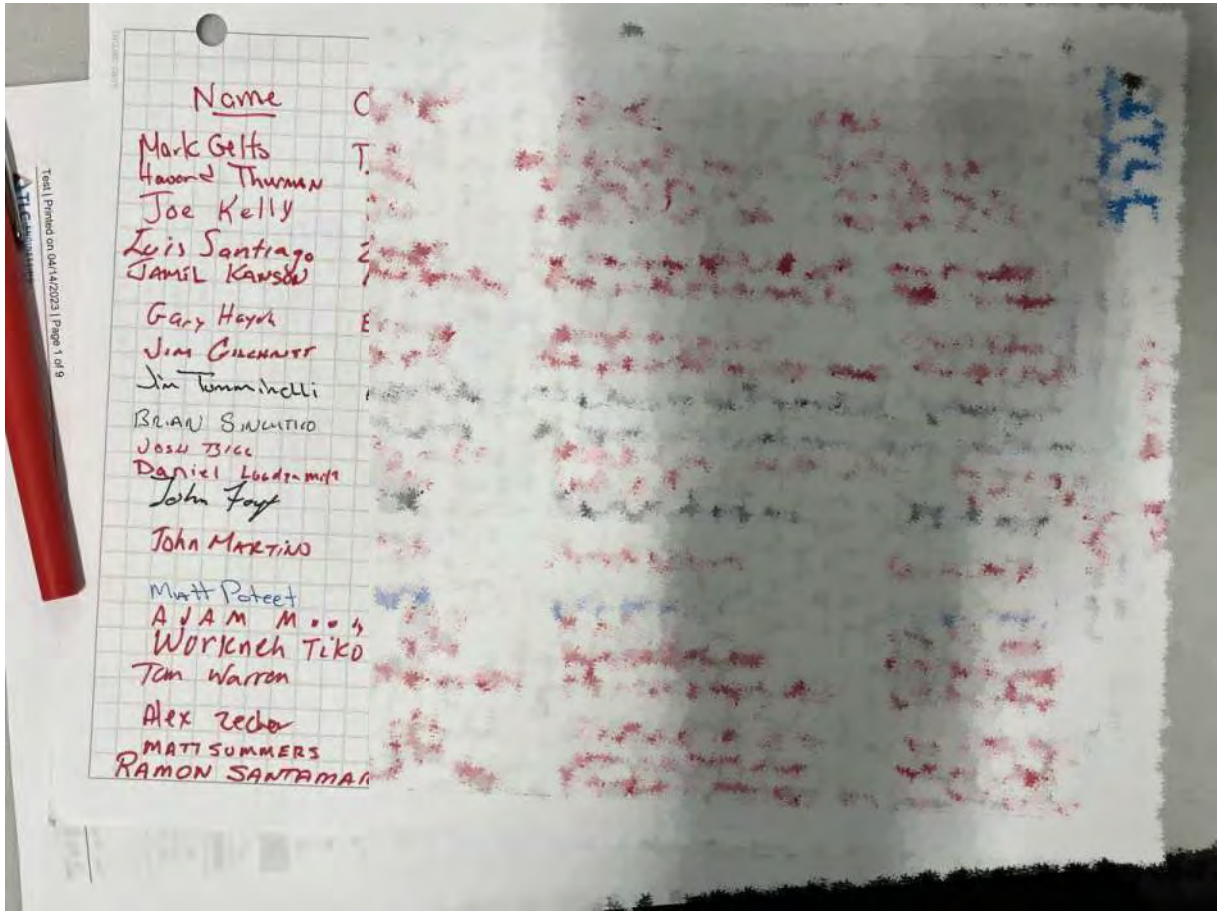
Who Should Do IST ?

- Mission Critical
- Healthcare
- Large / Complex Buildings
- Public / Life Safety
- Any Building You Want



Kickoff & Safety Briefing

Coffee and Sign In (and Clipboard)



Fire Alarm Matrix

Key Notes:

RUN Indicates Shutdown of HVAC Unit Not Required; Normal Operating Condition.
SHUTDOWN Indicates Shutdown of HVAC Unit Required, Unit Serves Zone in Alarm
ADJ-SHUTDOWN Indicates Shutdown of HVAC Unit Required, unit serves zone ADJACENT to Zone in Alarm
S-RUN Indicates Specific Shutdown of HVAC Unit in Zone of Alarm NOT REQUIRED; ie ISOLATION FANS, HOOD EXHAUST, ETC
A-RUN Indicates Specific Shutdown of HVAC Unit in Adjacent Compartment NOT REQUIRED due to presence of Critical Care Patient Function, i.e. CATH LAB, SURGERY, E

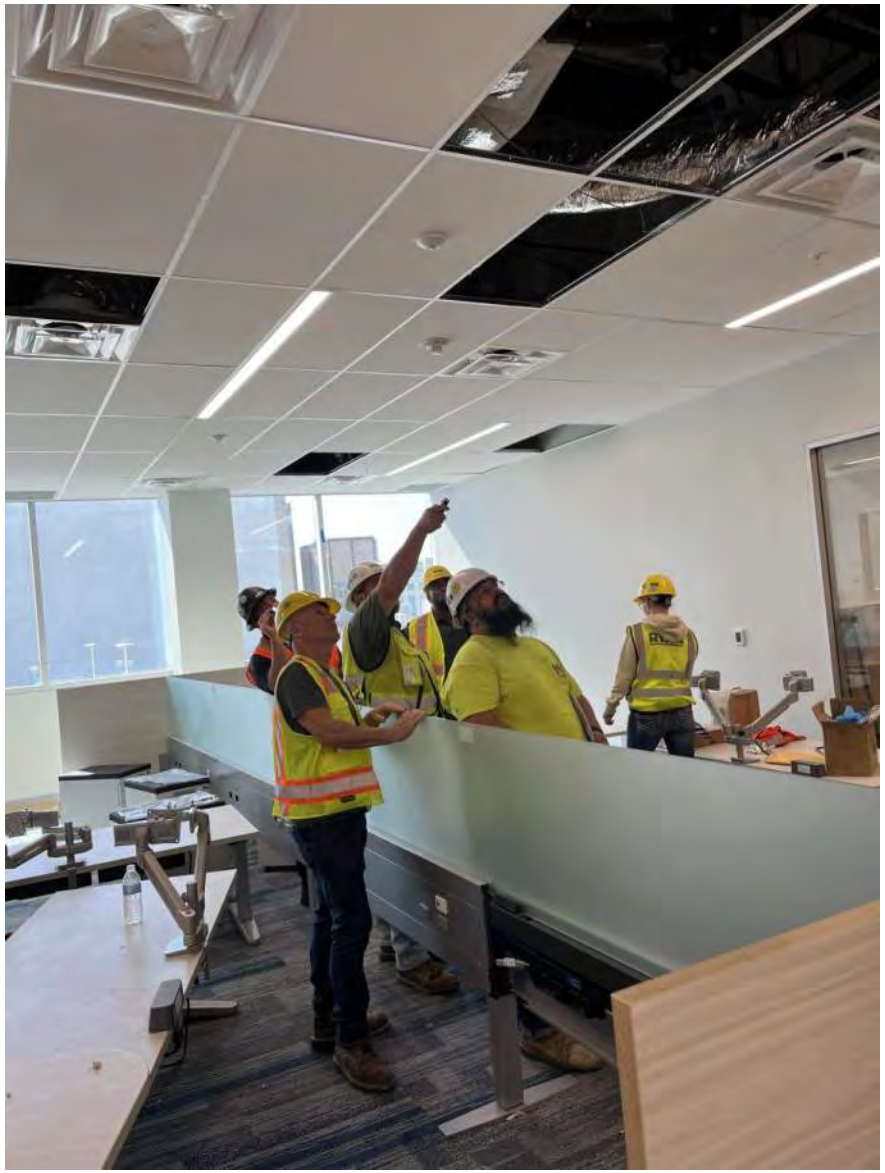
Fire Alarm System Requirements:

1) Fire Alarm configuratio is designed for Relocation and Partial Evacuation in accordance with NFPA 72 (Fire Alarm Code), Section 24.4.2.8 (2016 Edition)
2) Manual Devices, i.e pull stations, do not activate HVAC shutdown. Only automatic devices initiate HVAC shutdown. Refer to specification section 284621.11 for further information.
3) Automatic Devices, i.e. Heat Detectors, Smoke detectors, and Flow Switches, all initiate this HVAC shutdown sequence.
Typical shutdown sequence, as identified in this matrix, is that upon the activation of an automatic device in any smoke compartment.
4) Duct smoke detectors shall initiate a TROUBLE ALARM but shall not shut down the unit or initiate audible/visual alarm

				FiRE ALARM						
		Area Description	EVACUATION ZONE	Fire Alarm Audible / Visual Annunciation	Door Closure in SC Walls	RTU-01 F-01-4 Emergency Dept	F-01-1 (ED Lobby) F-01-2 (ED Decon) F-01-3 (ED ISO)	RTU-2 F-02-2 F-02-3 Radiology / Admin	F-[illegible]
AUTOMATIC DEVICE ACTIVATION IN SMOKE COMPARMENT	FIRST FLOOR								
	SC 1.01	Lobby, Conf, Chapel	ZONE 1	Hosp Wide	Entire 1st FL	A-RUN	A-RUN	ADJ-SHUTDOWN	
	SC 1.02	Radiology / Admin	ZONE 2	Hosp Wide	Entire 1st FL	A-RUN	A-RUN	SHUTDOWN	
	SC 1.03	Emergency Dept	ZONE 3	Hosp Wide	Entire 1st FL	SHUTDOWN	S-RUN	ADJ-SHUTDOWN	
	SC 1.04	PACU / Prep Recov	ZONE 1	Hosp Wide	Entire 1st FL	A-RUN	A-RUN	RUN	
	SC 1.05	Cath / Surgery / SPD	ZONE 4	Hosp Wide	Entire 1st FL	A-RUN	A-RUN	RUN	
	SC 1.06	Kitchen / Dining	ZONE 5	Hosp Wide	Entire 1st FL	RUN	RUN	RUN	
		Kitchen Hood Fire Suppresion (Ansul)		Hosp Wide	Entire 1st FL	RUN	RUN	RUN	
	SC 1.07	Engineering & CEP (RTU8) / Lab & Pharm (RTU6)	ZONE 6	Hosp Wide	Entire 1st FL	RUN	RUN	RUN	
	SECOND FLOOR								
	SC 2.01	2nd FL Sector 1 South	ZONE 7	Hosp Wide	Entire 2nd FL	RUN	RUN	RUN	
	SC 2.02	2nd FL Sector 2 North	ZONE 7	Hosp Wide	Entire 2nd FL	RUN	RUN	RUN	
	THIRD FLOOR								
	SC 3.01	3rd FL Sector 1 South	ZONE 7	Hosp Wide	Entire 3rd FL	RUN	RUN	RUN	
	SC 3.02	3rd FL Sector 2 North	ZONE 7	Hosp Wide	Entire 3rd FL	RUN	RUN	RUN	

RTU-10 [illegible]nd & 3rd FL North	RTU-9 & RTU-10 Dampers: 2nd FL FSD-9-2S, FSD-9-2R, FSF-9-2E FSD-10-2S, FSD-10-2R, FSD-10-2E	RTU-9 & RTU-10 Dampers: 3rd FL FSD-9-3S, FSD-9-3R, FSF-9-3E FSD-10-3S, FSD-10-3R, FSD-10-3E	F-10-1 (ISO) F-10-2 (ISO) F-09-1 (ISO) 2nd & 3rd FL ISO Rms	ALL FCUs AND CRUs
RUN	OPEN	OPEN	RUN	RUN
RUN	OPEN	OPEN	RUN	RUN
RUN	OPEN	OPEN	RUN	RUN
RUN	OPEN	OPEN	RUN	RUN
RUN	OPEN	OPEN	RUN	RUN
RUN	OPEN	OPEN	RUN	RUN
RUN	OPEN	OPEN		
RUN	OPEN	OPEN	RUN	RUN
				RUN
S-RUN	CLOSE	OPEN	S-RUN	RUN
S-RUN	CLOSE	OPEN	S-RUN	RUN
				RUN
S-RUN	OPEN	CLOSE	S-RUN	RUN
S-RUN	OPEN	CLOSE	S-RUN	RUN

Owner Involvement

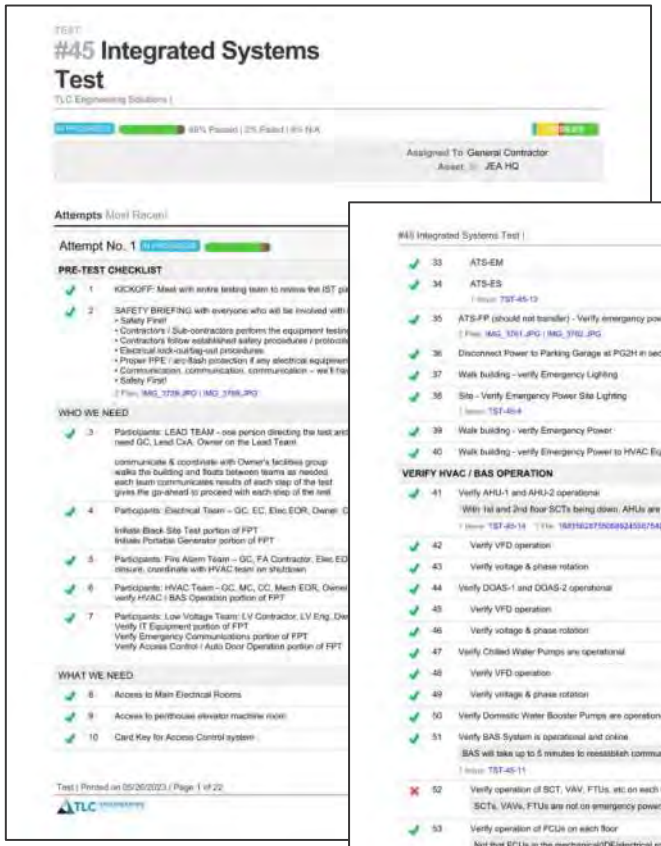


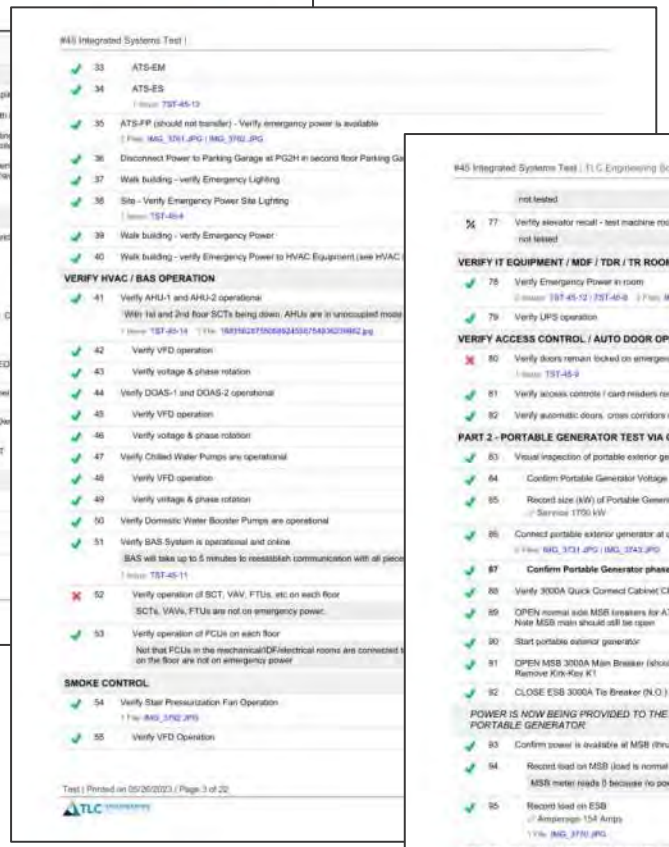
Waiting Around

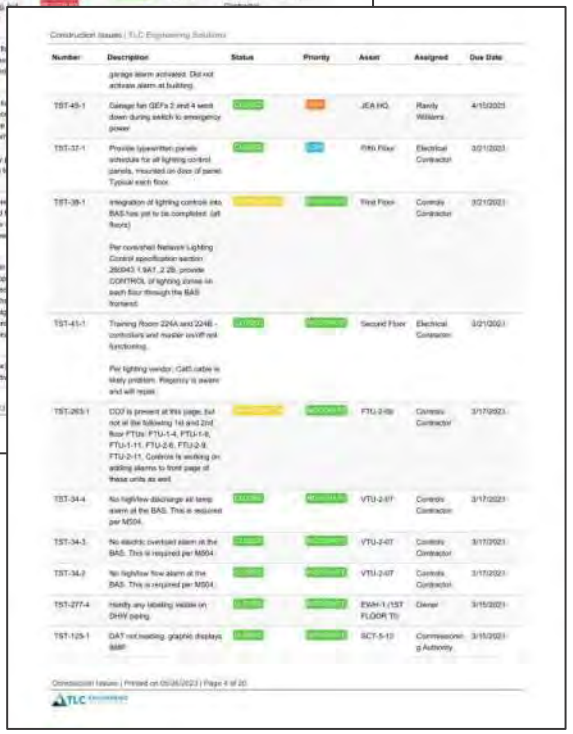
Be Prepared to Repair… But Not If It Holds Up Testing

Debrief – Action Items and Next Steps

Document, Document, Document!







Issues Logs

Issues Logs

Construction Issues | TLC Engineering Solutions | ZZ Southwell Medical Hospital | 819002

Lighting 16 issues

Number	Description	Status	Priority	Asset	Assigned	Due Date
TST-268-6	Skilled Nursing Exterior Lighting - Verify operation of exterior lighting with roof mounted photocells and contactors - exterior lighting did not operate when photocell was covered	CLOSED	MEDIUM	Area G - Skilled Nursing 1		9/26/2019
TST-262-2	Hospital exterior lighting: Verify operation of exterior lighting with roof mounted photocells and contactors - exterior lighting did not operate when photocell was covered	CLOSED	MEDIUM	Area A - ER	Electrical Contractor	10/10/2019
TST-268-5	Patient room over bed light (typical): fixer specified with direct/ indirect component controlled by wall switch and pull chain. Per Valdosta electric, pull chain switch was rated for 120 V (fixture is 277V) therefore Owner elected to use only direct down light component of fixture Noted here for record only.	CLOSED	LOW	Area G - Skilled Nursing 1	Electrical Contractor	10/10/2019
TST-268-3	Occupancy Sensor General Comment Skilled Nursing Areas: Design documents call for Vacancy Sensors - Manual on / Auto off, however wall mounted occupancy sensors appear to be installed with are installed with factory default settings.	CLOSED	LOW	Area G - Skilled Nursing 1	Electrical Contractor	9/26/2019
TST-268-1	One of the pendant fixtures at ND 2403 is not operational	CLOSED	LOW	Area G - Skilled Nursing 1		10/10/2019
TST-262-1	Occupancy Sensor General Comment All Areas: Design documents call for Vacancy Sensors - Manual on / Auto off, however wall mounted occupancy sensors appear to be installed with are installed with factory default settings. Refer to photos.	CLOSED	MEDIUM		Electrical Contractor	9/7/2019
FO-6-13	Area B ORs - emergency battery fixtures appear to be "switched" outside of room. Emergency battery lights should not be	CLOSED	MEDIUM		Electrical Contractor	7/2/2019

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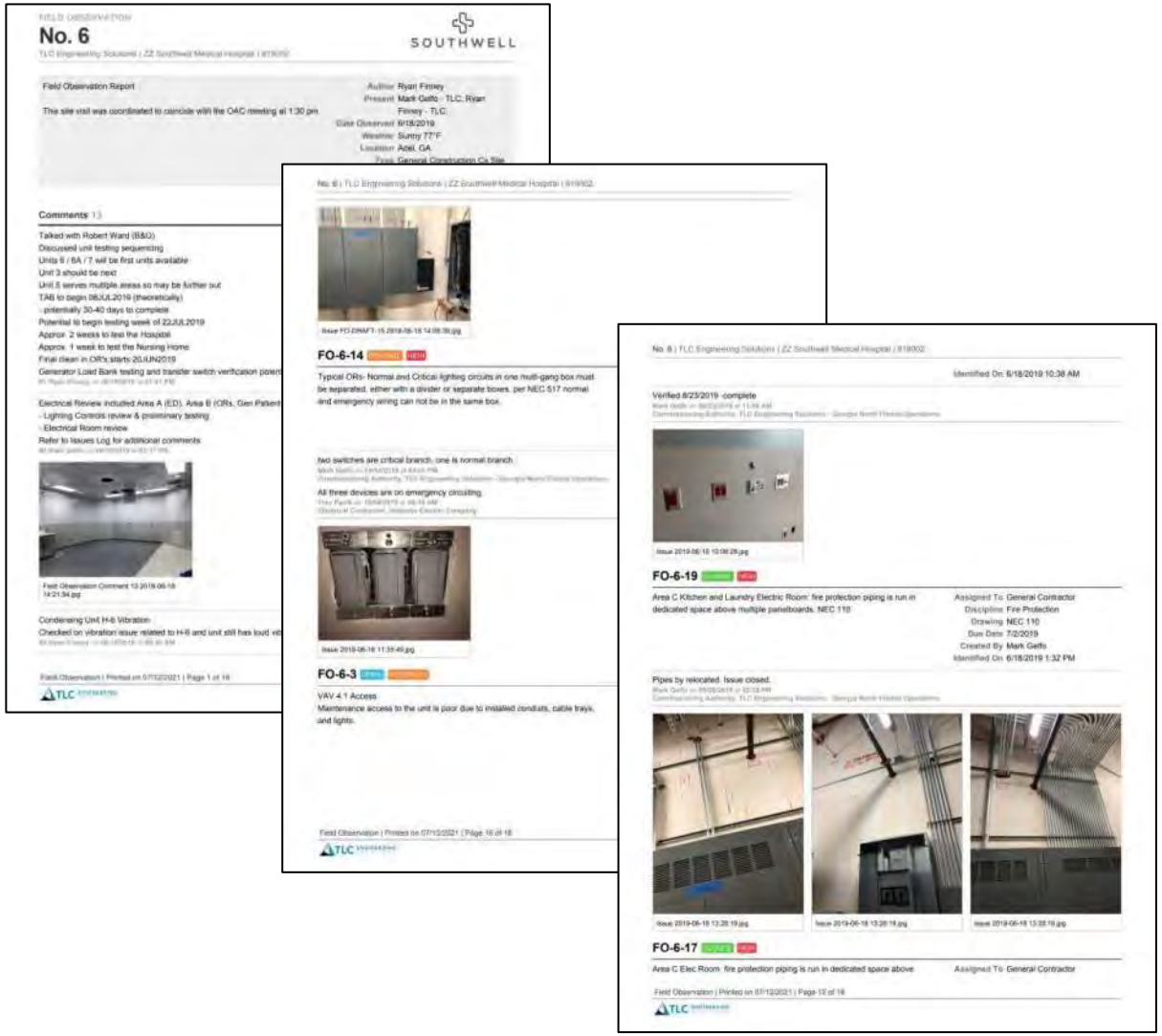
Reports



THANK YOU

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