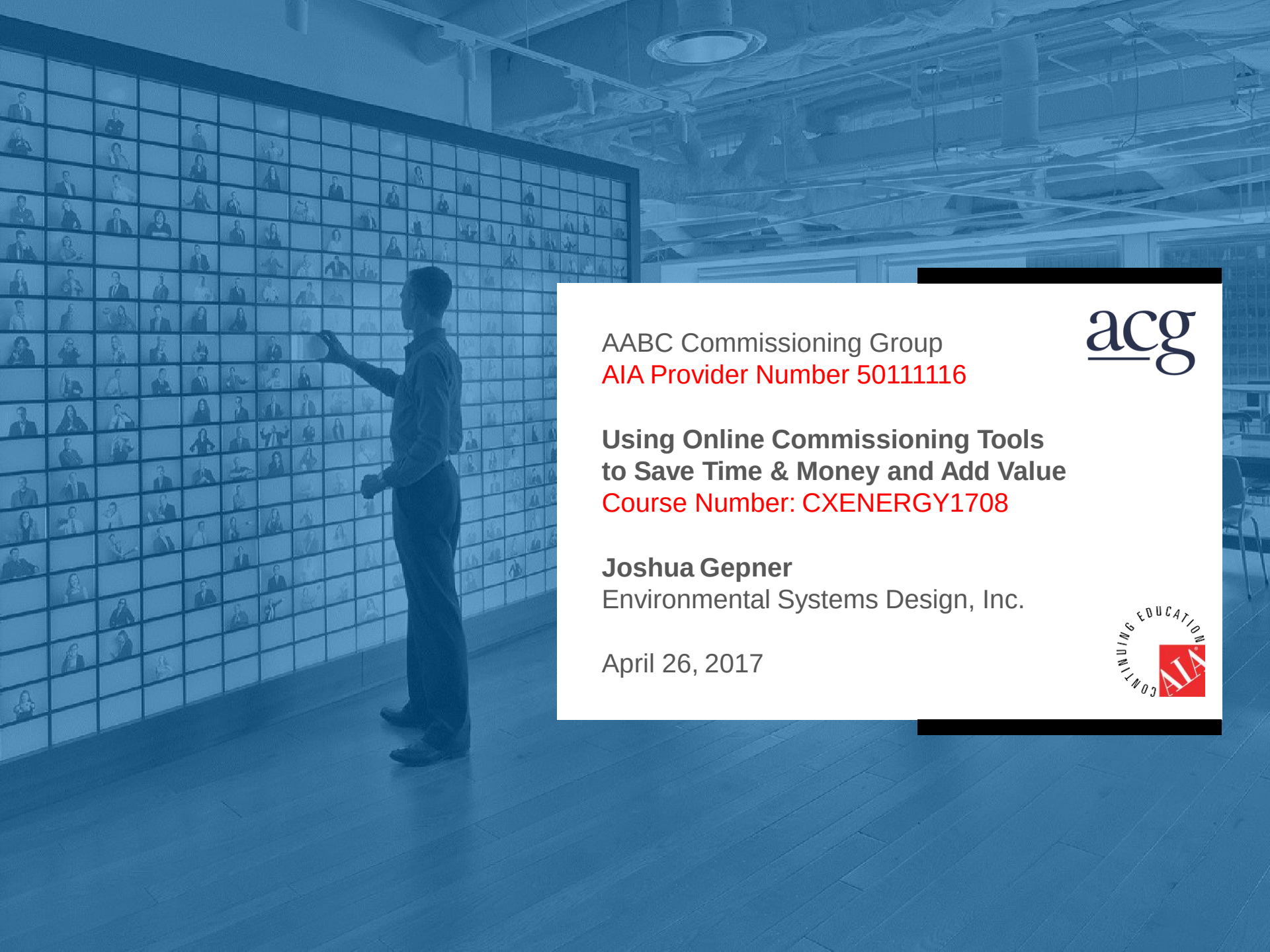

AABC Commissioning Group
AIA Provider Number 50111116

Using Online Commissioning Tools to Save Time & Money and Add Value

Course Number: CXENERGY1708

Joshua Gepner
Environmental Systems Design, Inc.

April 26, 2017

Credit(s) earned on completion of this course will be reported to AIA CES for AIA members. Certificates of Completion for both AIA members and non-AIA members are available upon request.

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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

Copyright Materials

Course Description

Project management, documentation management, and data-transfer activities within the construction industry are continuously becoming more reliant on advanced digital technology. This is especially true in the commissioning sector. This presentation provides information on the selection of an online commissioning tool that matches the intended use, budget and complexity, and rolling it out to internal and external stakeholders.

Learning Objectives

At the end of the this course, participants will be able to:

1. Learn to select an online commissioning tool that matches the intended use with appropriate cost and complexity.

2. Become proficient on the selected online commissioning tool and learn to successfully roll it out to internal and external stakeholders.

3. Know the basic core modules that are incorporated into most online commissioning tools.

4. Learn to establish lines of communication with stakeholders so the data produced by the online commissioning tools create value for the building owner.

Presenter Overview

Joshua J. Gepner
Vice President, Operations Director Commissioning

Education
Boston University, Boston, Massachusetts, Bachelor of Science, Electrical Engineering, 2003

State Licenses
PE (Professional Engineer) – Illinois

Registrations / Accreditations
QCxP (Qualified Commissioning Process Provider) – University of Wisconsin
LEED AP O+M (LEED Accredited Professional Building Operations and Maintenance)

Joshua Gepner joined Environmental Systems Design, Inc. in 2009 bringing over seven years of design engineering, consulting engineering , and commissioning expertise to the company. He is knowledgeable in commercial, residential, and industrial electrical design as well as LEED and Building Energy Code standards. Josh has over nine years of commissioning experience, specializing in mission critical facilities commissioning specifically for data centers and other critical facilities. Josh is currently the Operations Director for the Commissioning team at ESD.

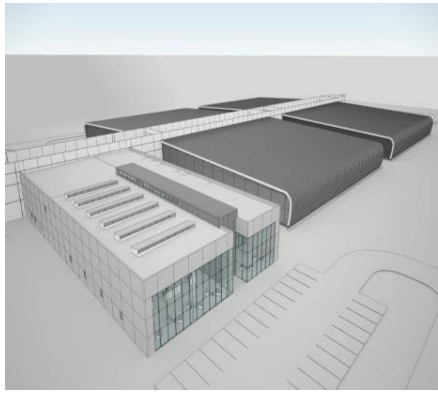
Agenda

Implementing Online Commissioning Tools

- Goals
- Selection Process
- Selling to Stakeholders
- Setting Realistic Implementation Goals
- Capabilities
- Put Lessons Learned Into Practice
- Reconciling Unintended Consequences
- The Future of Online Commissioning Tools
- Questions

Goal of Commissioning



Definition of Commissioning

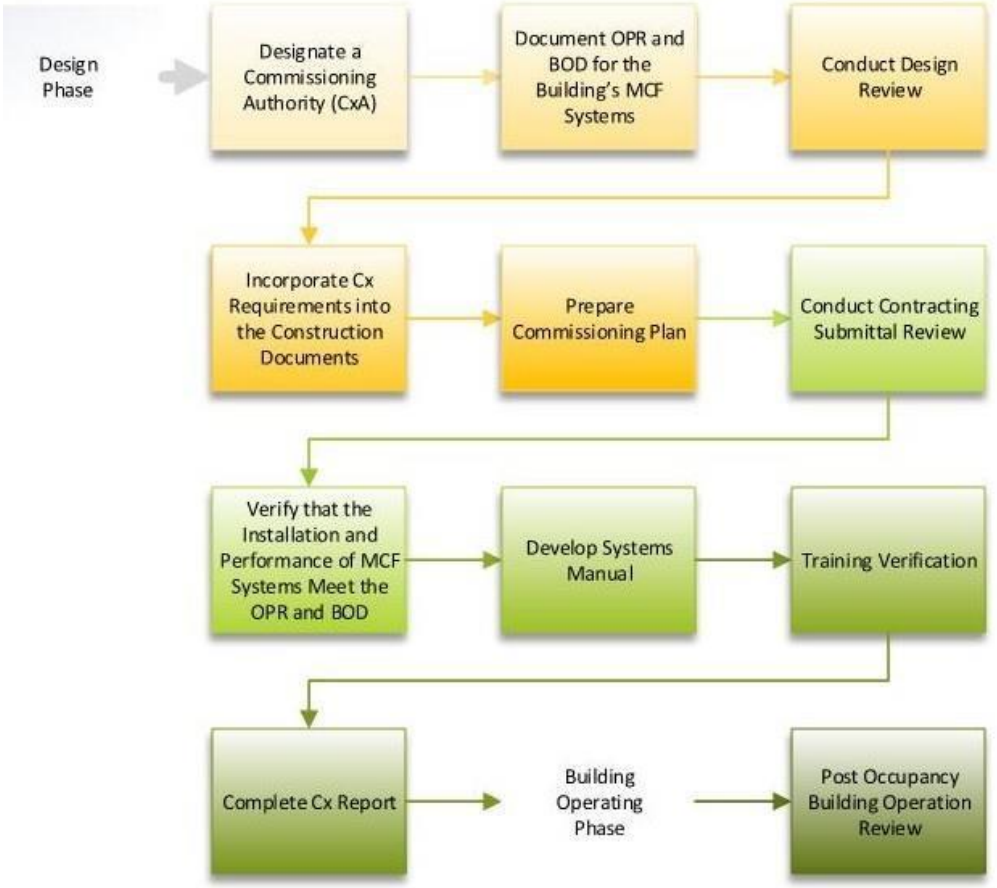
Commissioning is a programmed series of design and construction documentation and testing activities that are performed specifically to ensure that the finished facility operates as intended (defined by The Building Commissioning Handbook)

Primary Goal of Commissioning

Provide functional buildings and systems that meet both the design intent and the owner’s operational needs

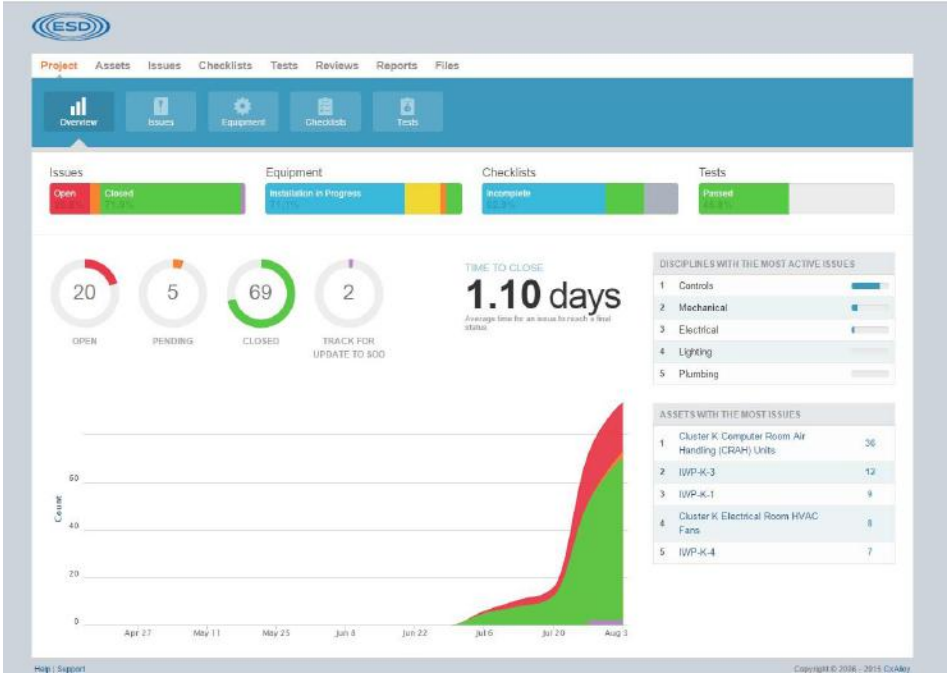
Changing Goals and Demands

- Faster, Stronger, Better
- Cheaper
- Expectations
  - *Current Information*
  - *Anywhere, Any Time*
- Cloud-Based Technology Advancements



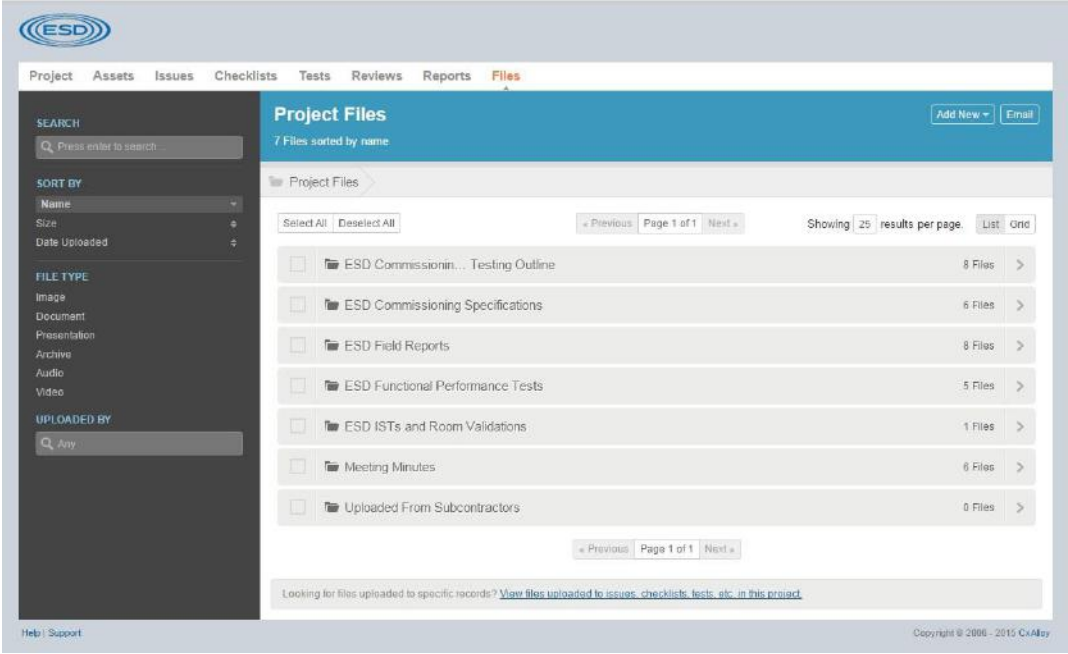
Primary Goals

- Improved Delivery
- Higher Quality Product
- Documentation Management
- Process Management
- Increased Collaboration
- Visibility and Transparency
- Analytics



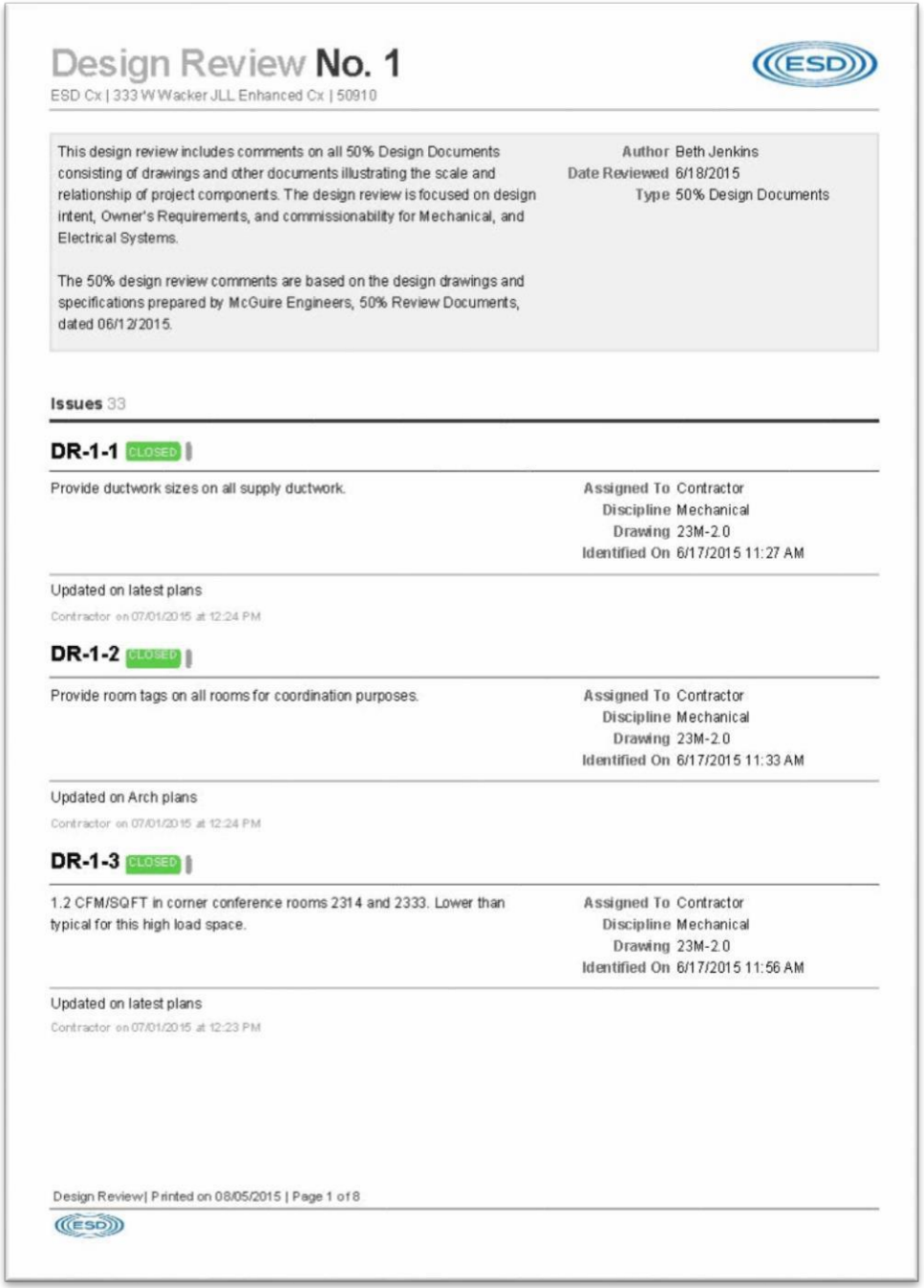
Secondary Goals

- Supports Market Trends
- Differentiation
- Record Keeping
- Data Capture
- Improved Closeout



Selection

- **Dozens of Options**
- **Considerations**
  - Cost
  - Complexity
  - Functionality
  - User Friendliness
    - *Training*
    - *Project Duration*
  - Internal Buy In
  - External Buy In



Design Review **No. 1**

ESD Cx | 333 W Wacker JLL Enhanced Cx | 50910

This design review includes comments on all 50% Design Documents consisting of drawings and other documents illustrating the scale and relationship of project components. The design review is focused on design intent, Owner's Requirements, and commissionability for Mechanical, and Electrical Systems.

The 50% design review comments are based on the design drawings and specifications prepared by McGuire Engineers, 50% Review Documents, dated 06/12/2015.

Author Beth Jenkins
Date Reviewed 6/18/2015
Type 50% Design Documents

Issues 33

DR-1-1 CLOSED

Provide ductwork sizes on all supply ductwork.

Assigned To Contractor
Discipline Mechanical
Drawing 23M-2.0
Identified On 6/17/2015 11:27 AM

Updated on latest plans

Contractor on 07/01/2015 at 12:24 PM

DR-1-2 CLOSED

Provide room tags on all rooms for coordination purposes.

Assigned To Contractor
Discipline Mechanical
Drawing 23M-2.0
Identified On 6/17/2015 11:33 AM

Updated on Arch plans

Contractor on 07/01/2015 at 12:24 PM

DR-1-3 CLOSED

1.2 CFM/SQFT in corner conference rooms 2314 and 2333. Lower than typical for this high load space.

Assigned To Contractor
Discipline Mechanical
Drawing 23M-2.0
Identified On 6/17/2015 11:56 AM

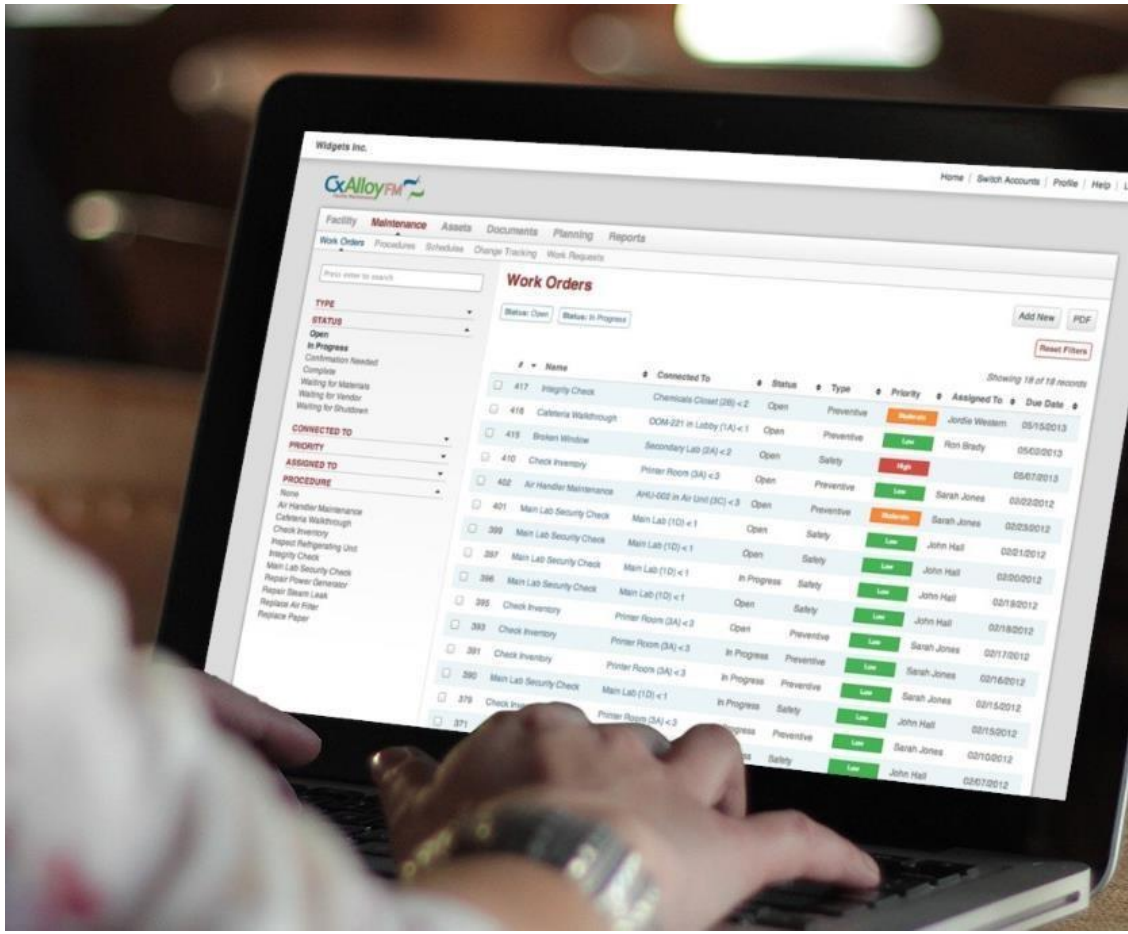
Updated on latest plans

Contractor on 07/01/2015 at 12:23 PM

Design Review| Printed on 08/05/2015 | Page 1 of 8

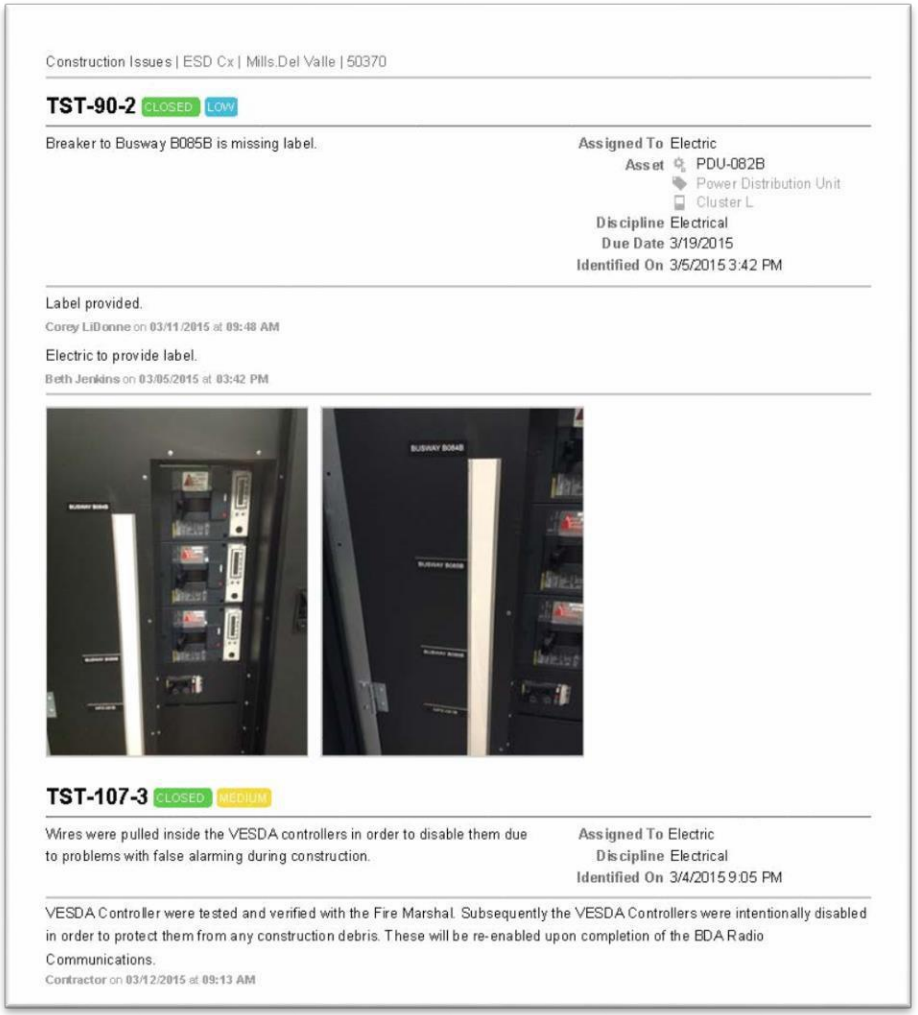
Correct Selection

- Internal Training
- Beta Test!
- Development Projects
- Vendor Support



Selling to Stakeholders

- Demonstrate with Confidence
- Establish Champions
- Suppress Opposition
- Don’t Make Promises
- What Not to Do



Construction Issues | ESD Cx | Mills.Del Valle | 50370

TST-90-2 CLOSED LOW

Breaker to Busway B085B is missing label.

Assigned To Electric
Asset PDU-082B
Power Distribution Unit
Cluster L
Discipline Electrical
Due Date 3/19/2015
Identified On 3/5/2015 3:42 PM

Label provided.
Corey LiDonne on 03/11/2015 at 09:48 AM

Electric to provide label.
Beth Jenkins on 03/05/2015 at 03:42 PM

TST-107-3 CLOSED MEDIUM

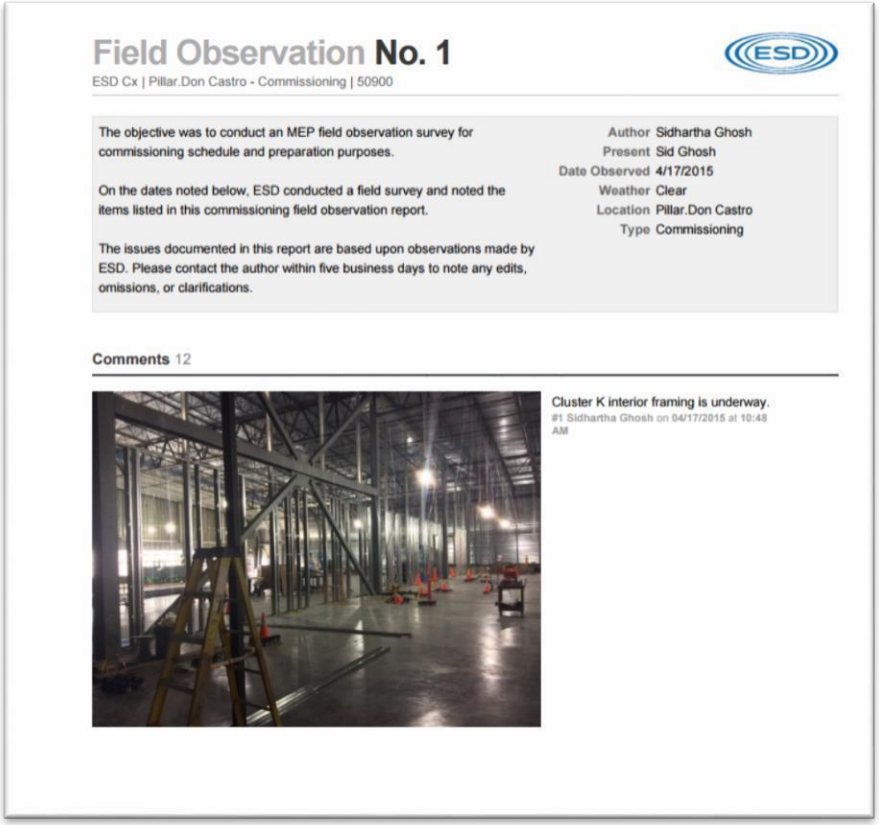
Wires were pulled inside the VESDA controllers in order to disable them due to problems with false alarming during construction.

Assigned To Electric
Discipline Electrical
Identified On 3/4/2015 9:05 PM

VESDA Controller were tested and verified with the Fire Marshal. Subsequently the VESDA Controllers were intentionally disabled in order to protect them from any construction debris. These will be re-enabled upon completion of the BDA Radio Communications.
Contractor on 03/12/2015 at 09:13 AM

Realistic Implementation

- Module Based Introduction
- Proficiency with Roll Out
- Assess Needed Proficiency Level
  - *Internal*
  - *External*
- Assess Project Details
  - *Current Status*
  - *Duration*
  - *Complexity*
- Parallel Processes
- Don’t Bite Off Too Much



Field Observation **No. 1**

ESD Cx | Pillar.Don Castro - Commissioning | 50900

The objective was to conduct an MEP field observation survey for commissioning schedule and preparation purposes.

On the dates noted below, ESD conducted a field survey and noted the items listed in this commissioning field observation report.

The issues documented in this report are based upon observations made by ESD. Please contact the author within five business days to note any edits, omissions, or clarifications.

Author Sidhartha Ghosh
Present Sid Ghosh
Date Observed 4/17/2015
Weather Clear
Location Pillar.Don Castro
Type Commissioning

Comments 12

Cluster K interior framing is underway.
#1 Sidhartha Ghosh on 04/17/2015 at 10:48 AM

Case Study – Implementation Failure

What Went Wrong?

- Lack of Understanding
- Project Already Underway
- Program Selected
  - *Complexity*
  - *Development Stage*

Damages

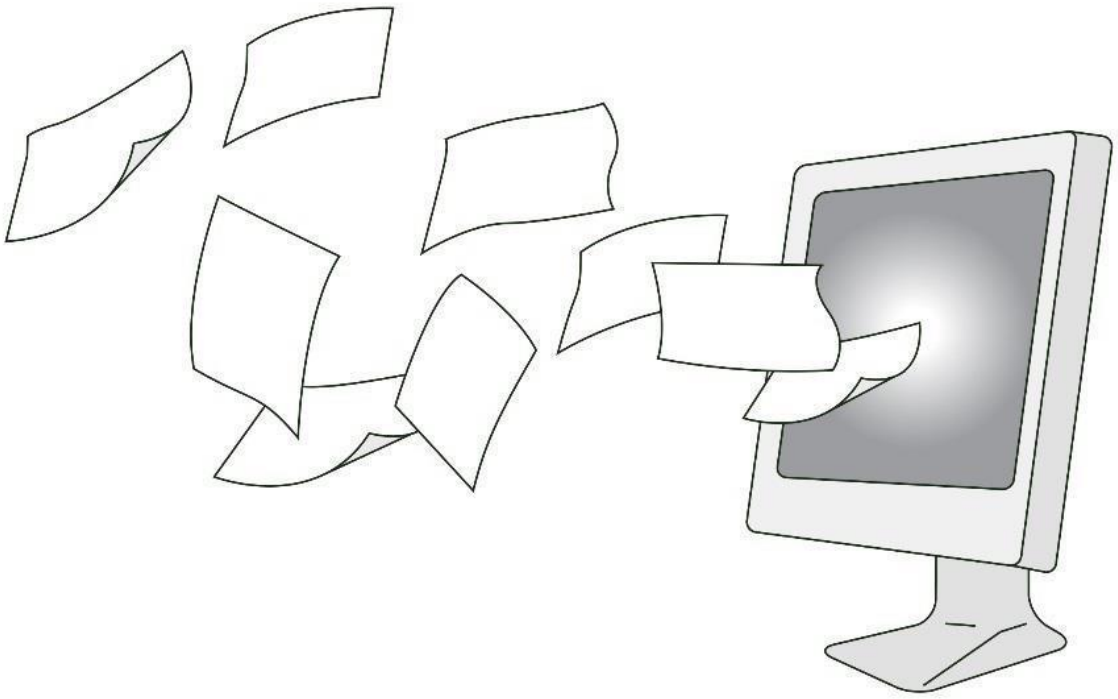
- Time Loss
- Reputation
  - *Contractor*
  - *Vendor*

Capabilities

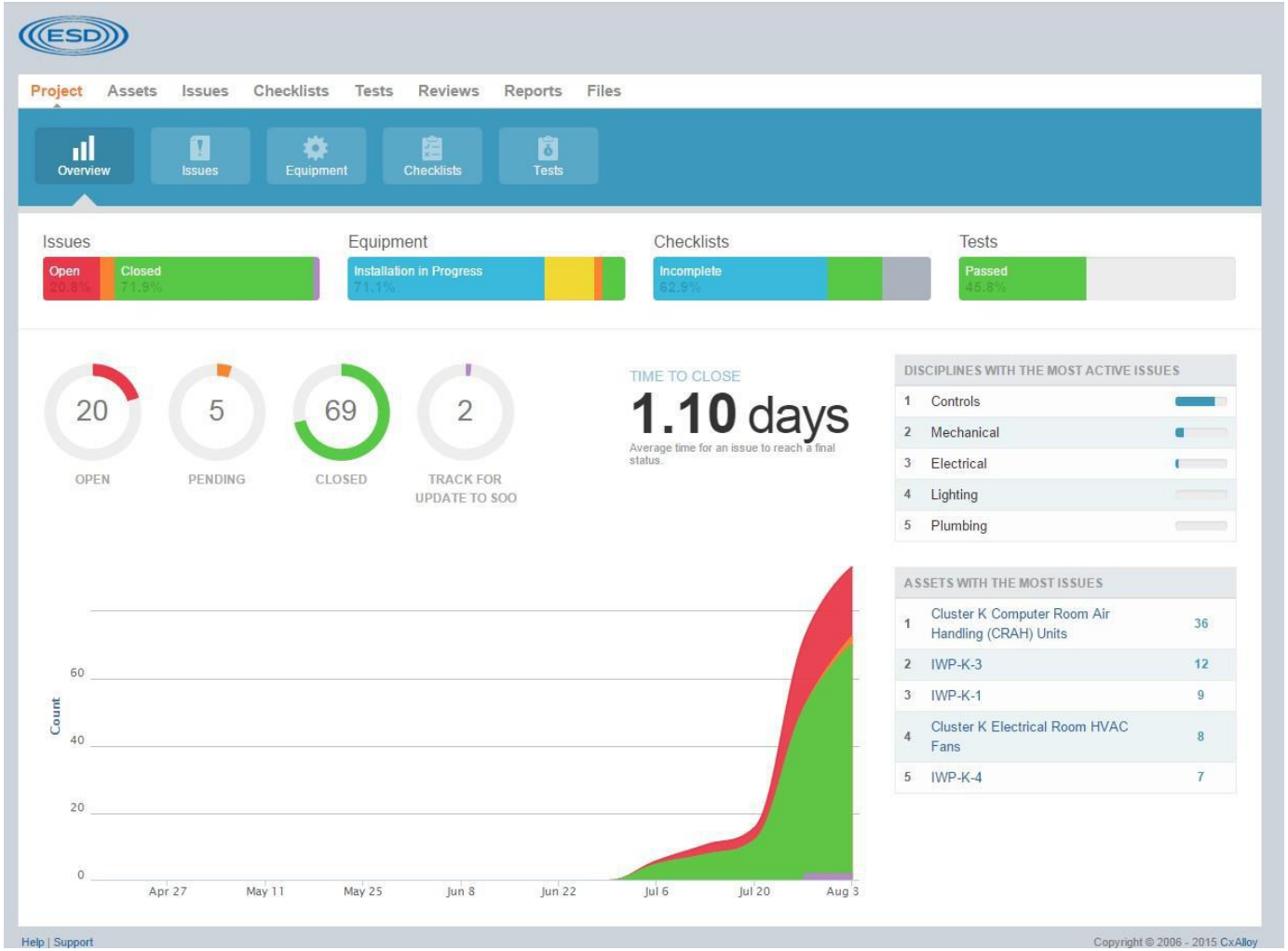
- Project Dashboard
- Field Observation Reports
- Design Reviews
- Checklists
- Tests
- Issues Tracking and Resolution
- Reports
- Online Storage of Cx Documents

Project Dashboard

- High Level Look-in for Project Stakeholders
- Graphical Representation of Project Progress
- Easy to Identify Hold-ups
- Digital Reporting

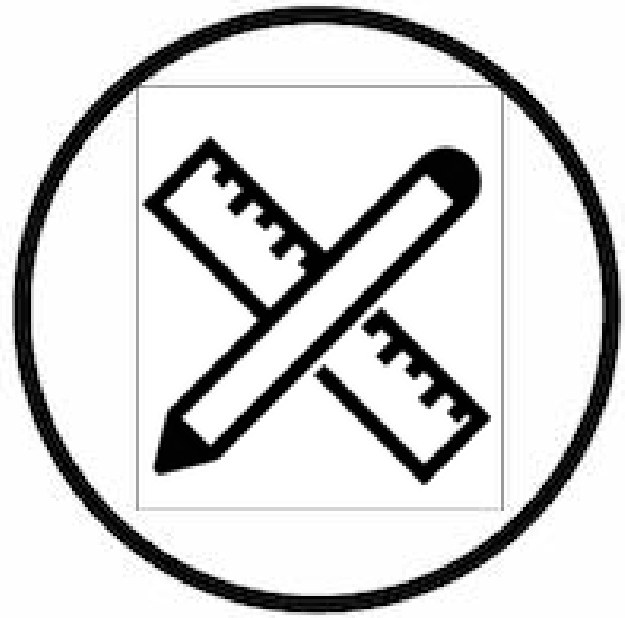


Project Dashboard

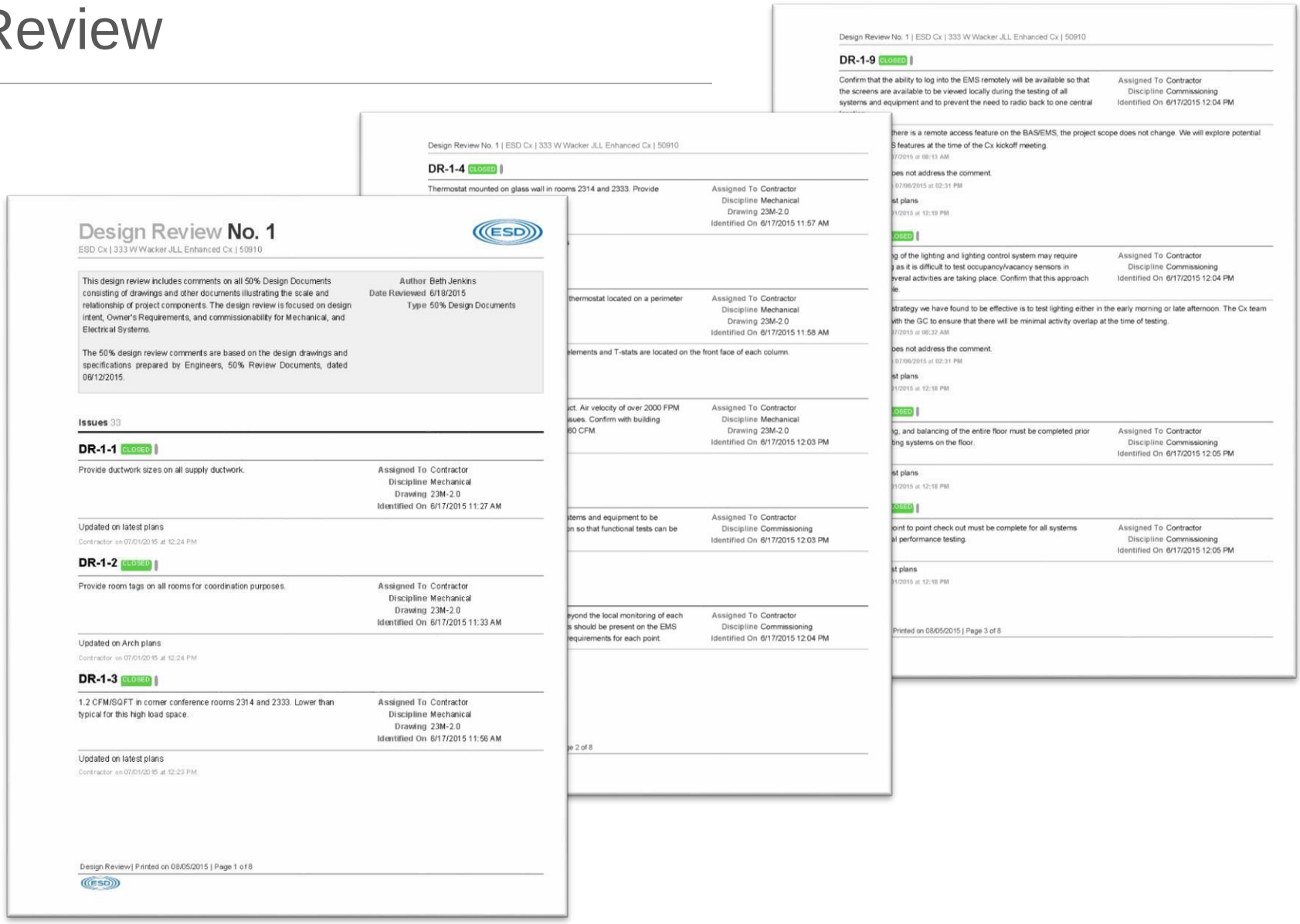


Design Review

- **Collaborative**
  - Real Time Progress
  - Cloud-Based
  - Multi-user Collaboration
- **Documented Decisions**
  - Transparency
  - Easily Delineated
  - Decision Records Visible



Design Review



Design Review No. 1 | ESD Cx | 333 W Wacker JLL Enhanced Cx | 50910

DR-1-9 CLOSED

Confirm that the ability to log into the EMS remotely will be available so that the screens are available to be viewed locally during the testing of all systems and equipment and to prevent the need to radio back to one central

Assigned To Contractor
Discipline Commissioning
Identified On 6/17/2015 12:04 PM

here is a remote access feature on the BAS/EMS, the project scope does not change. We will explore potential
S features at the time of the Cx kickoff meeting.
7/2015 at 08:13 AM

oes not address the comment.
07/06/2015 at 02:31 PM

st plans
1/2015 at 12:19 PM

OSED

g of the lighting and lighting control system may require
as it is difficult to test occupancy/vacancy sensors in
veral activities are taking place. Confirm that this approach
le

Assigned To Contractor
Discipline Commissioning
Identified On 6/17/2015 12:04 PM

strategy we have found to be effective is to test lighting either in the early morning or late afternoon. The Cx team
ith the GC to ensure that there will be minimal activity overlap at the time of testing.
7/2015 at 08:32 AM

oes not address the comment.
07/06/2015 at 02:31 PM

st plans
1/2015 at 12:18 PM

OSED

g, and balancing of the entire floor must be completed prior
ting systems on the floor.

Assigned To Contractor
Discipline Commissioning
Identified On 6/17/2015 12:05 PM

st plans
1/2015 at 12:18 PM

OSED

oint to point check out must be complete for all systems
l performance testing.

Assigned To Contractor
Discipline Commissioning
Identified On 6/17/2015 12:05 PM

st plans
1/2015 at 12:18 PM

Printed on 08/05/2015 | Page 3 of 8

Design Review No. 1 | ESD Cx | 333 W Wacker JLL Enhanced Cx | 50910

DR-1-4 CLOSED

Thermostat mounted on glass wall in rooms 2314 and 2333. Provide

Assigned To Contractor
Discipline Mechanical
Drawing 23M-2.0
Identified On 6/17/2015 11:57 AM

thermostat located on a perimeter

Assigned To Contractor
Discipline Mechanical
Drawing 23M-2.0
Identified On 6/17/2015 11:58 AM

lements and T-stats are located on the front face of each column.

ct. Air velocity of over 2000 FPM
sues. Confirm with building
60 CFM.

Assigned To Contractor
Discipline Mechanical
Drawing 23M-2.0
Identified On 6/17/2015 12:03 PM

stems and equipment to be
n so that functional tests can be

Assigned To Contractor
Discipline Commissioning
Identified On 6/17/2015 12:03 PM

eyond the local monitoring of each
s should be present on the EMS
equirements for each point.

Assigned To Contractor
Discipline Commissioning
Identified On 6/17/2015 12:04 PM

e 2 of 8

Design Review No. 1

ESD Cx | 333 W Wacker JLL Enhanced Cx | 50910

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Author Beth Jenkins
Date Reviewed 6/18/2015
Type 50% Design Documents

Issues 33

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Discipline Mechanical
Drawing 23M-2.0
Identified On 6/17/2015 11:27 AM

Updated on latest plans
Contractor on 07/01/2015 at 12:24 PM

DR-1-2 CLOSED

Provide room tags on all rooms for coordination purposes.

Assigned To Contractor
Discipline Mechanical
Drawing 23M-2.0
Identified On 6/17/2015 11:33 AM

Updated on Arch plans
Contractor on 07/01/2015 at 12:24 PM

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Assigned To Contractor
Discipline Mechanical
Drawing 23M-2.0
Identified On 6/17/2015 11:56 AM

Updated on latest plans
Contractor on 07/01/2015 at 12:23 PM

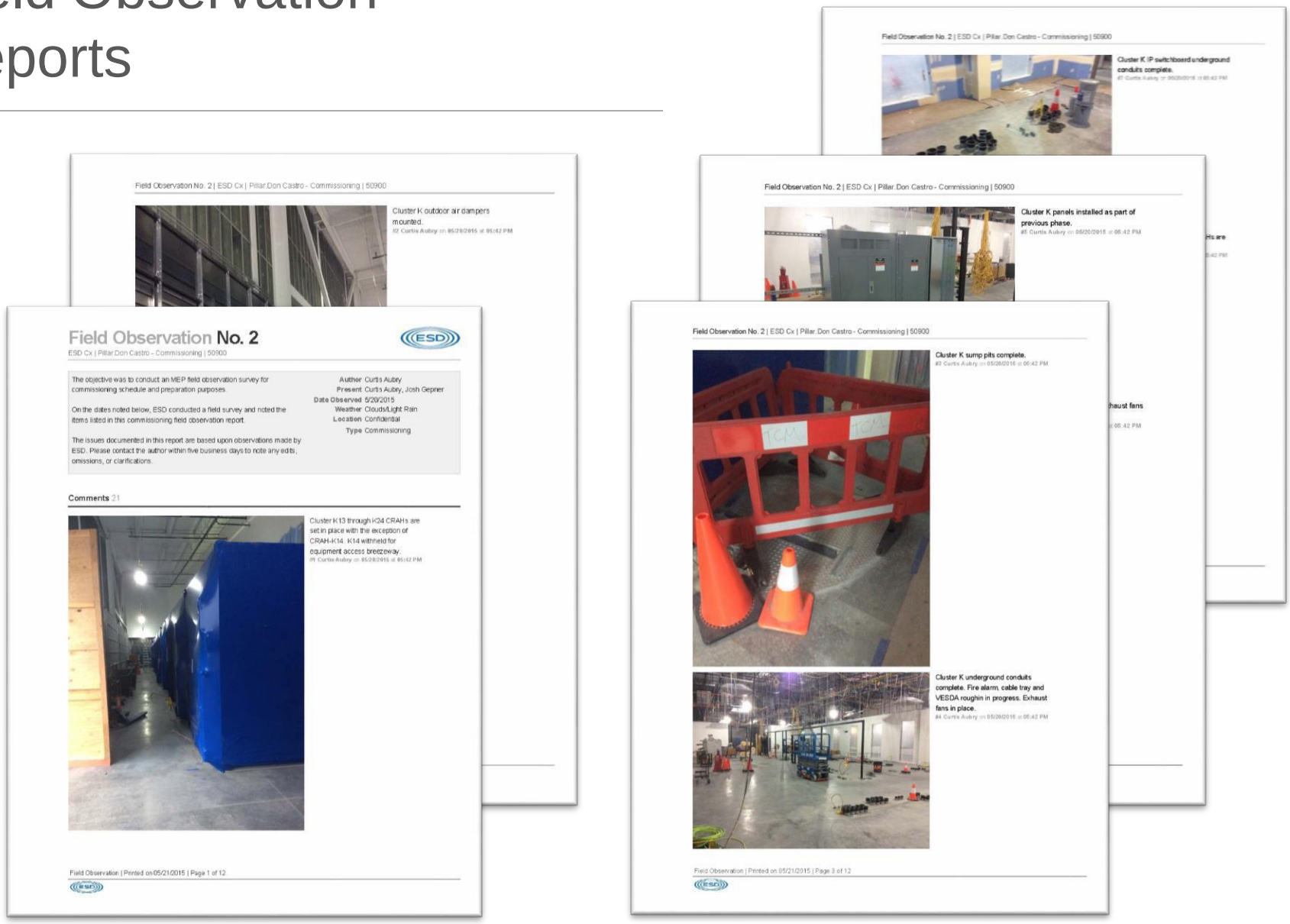
Design Review | Printed on 08/05/2015 | Page 1 of 8

Field Observation Reports

Provide Progress Status Update

- Visual
- Time-stamped
- Multiple Platforms
  - *Computer*
  - *Tablet*
  - *Phone*
- Multi-user Input

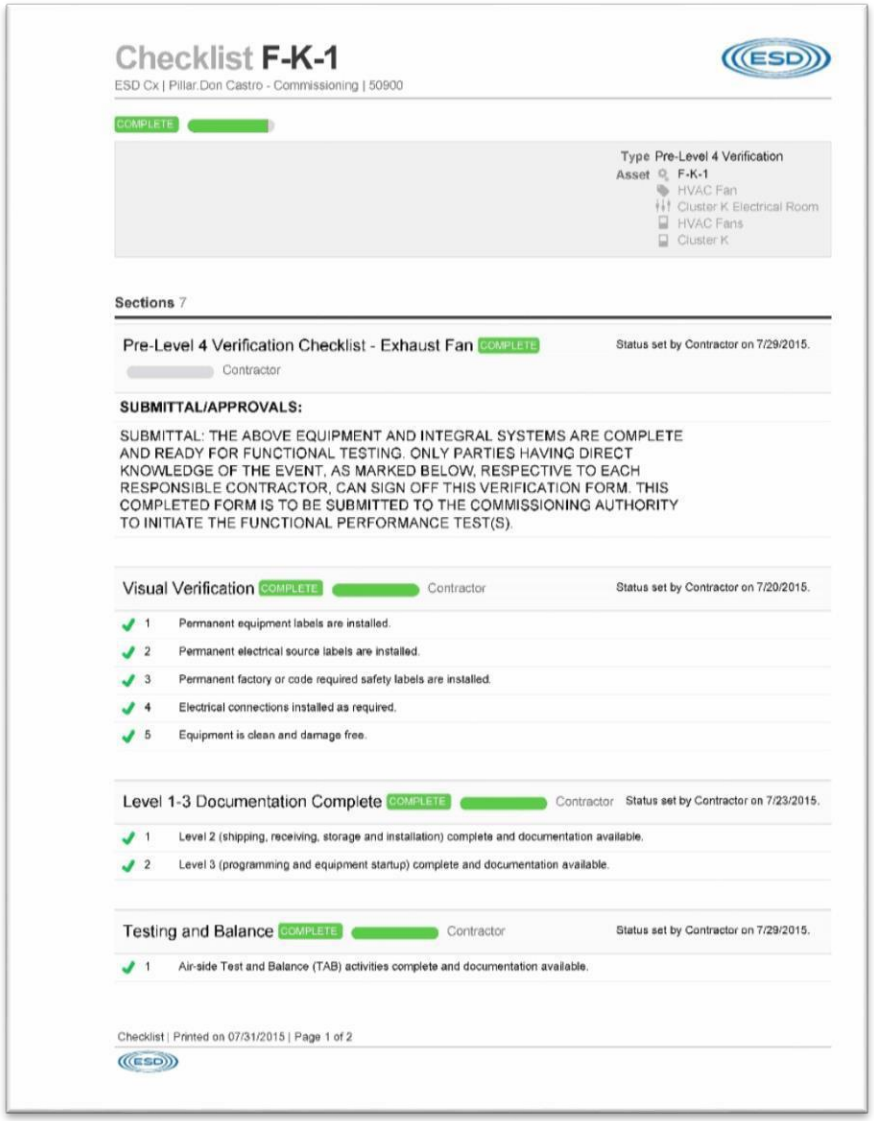
Field Observation Reports



Checklists

- Equipment Status Verification
- Settings Verification
- Photographs
- Maintain Control and Order
- Systems and Equipment on Visible Timeline

Checklists



Checklist F-K-1

ESD Cx | Pillar.Don Castro - Commissioning | 50900

COMPLETE

Type Pre-Level 4 Verification
Asset F-K-1
HVAC Fan
Cluster K Electrical Room
HVAC Fans
Cluster K

Sections 7

Pre-Level 4 Verification Checklist - Exhaust Fan COMPLETE

Contractor

Status set by Contractor on 7/29/2015.

SUBMITTAL/APPROVALS:

SUBMITTAL: THE ABOVE EQUIPMENT AND INTEGRAL SYSTEMS ARE COMPLETE AND READY FOR FUNCTIONAL TESTING. ONLY PARTIES HAVING DIRECT KNOWLEDGE OF THE EVENT, AS MARKED BELOW, RESPECTIVE TO EACH RESPONSIBLE CONTRACTOR, CAN SIGN OFF THIS VERIFICATION FORM. THIS COMPLETED FORM IS TO BE SUBMITTED TO THE COMMISSIONING AUTHORITY TO INITIATE THE FUNCTIONAL PERFORMANCE TEST(S).

Visual Verification COMPLETE Contractor

Status set by Contractor on 7/20/2015.

✓	1	Permanent equipment labels are installed.
✓	2	Permanent electrical source labels are installed.
✓	3	Permanent factory or code required safety labels are installed.
✓	4	Electrical connections installed as required.
✓	5	Equipment is clean and damage free.

Level 1-3 Documentation Complete COMPLETE Contractor

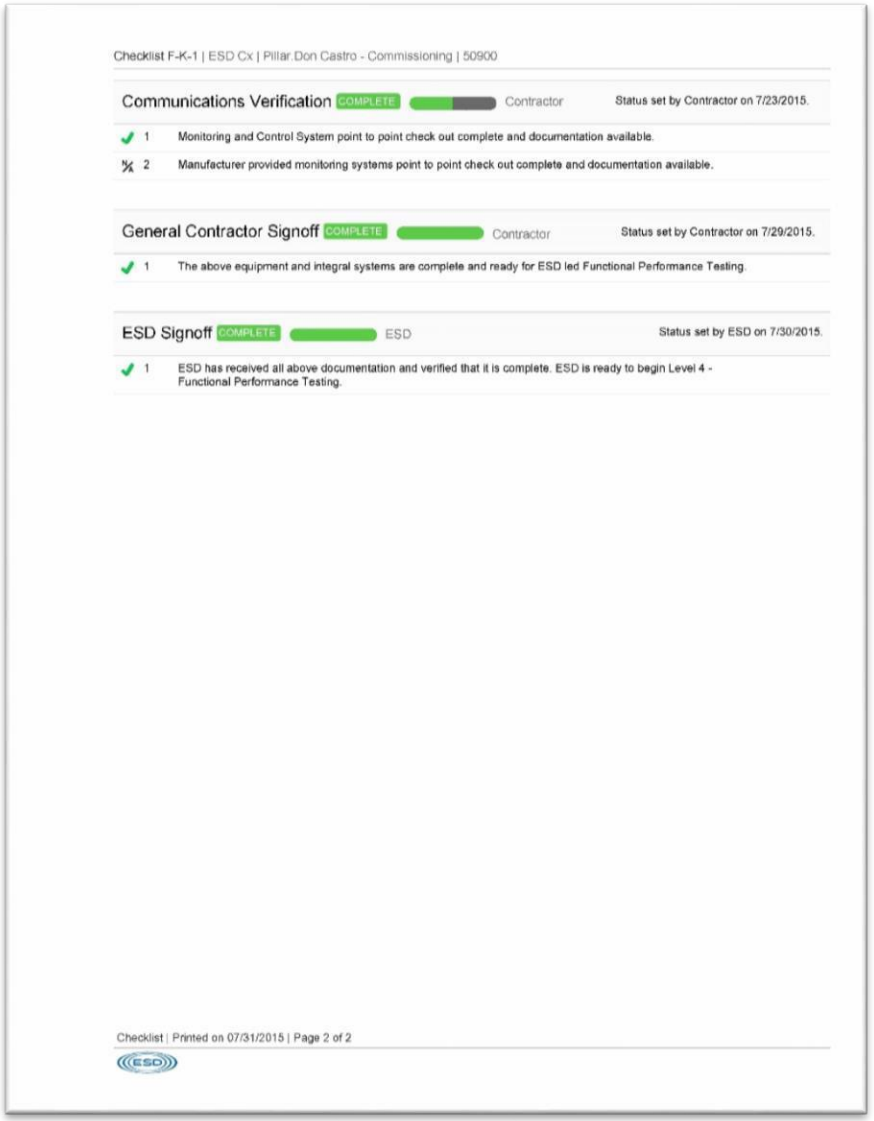
Status set by Contractor on 7/23/2015.

✓	1	Level 2 (shipping, receiving, storage and installation) complete and documentation available.
✓	2	Level 3 (programming and equipment startup) complete and documentation available.

Testing and Balance COMPLETE Contractor

Status set by Contractor on 7/29/2015.

✓	1	Air-side Test and Balance (TAB) activities complete and documentation available.



Communications Verification COMPLETE Contractor

Status set by Contractor on 7/23/2015.

✓	1	Monitoring and Control System point to point check out complete and documentation available.
✂	2	Manufacturer provided monitoring systems point to point check out complete and documentation available.

General Contractor Signoff COMPLETE Contractor

Status set by Contractor on 7/29/2015.

✓	1	The above equipment and integral systems are complete and ready for ESD led Functional Performance Testing.

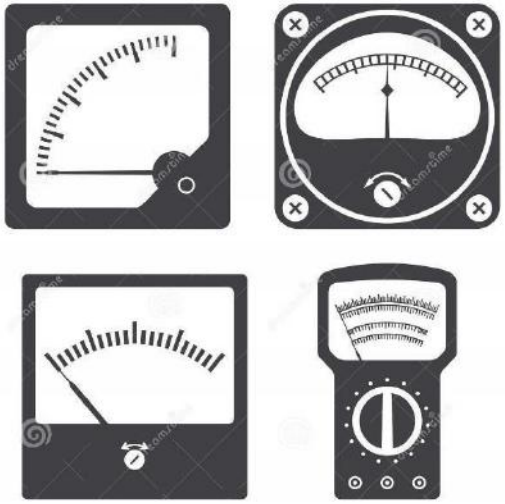
ESD Signoff COMPLETE ESD

Status set by ESD on 7/30/2015.

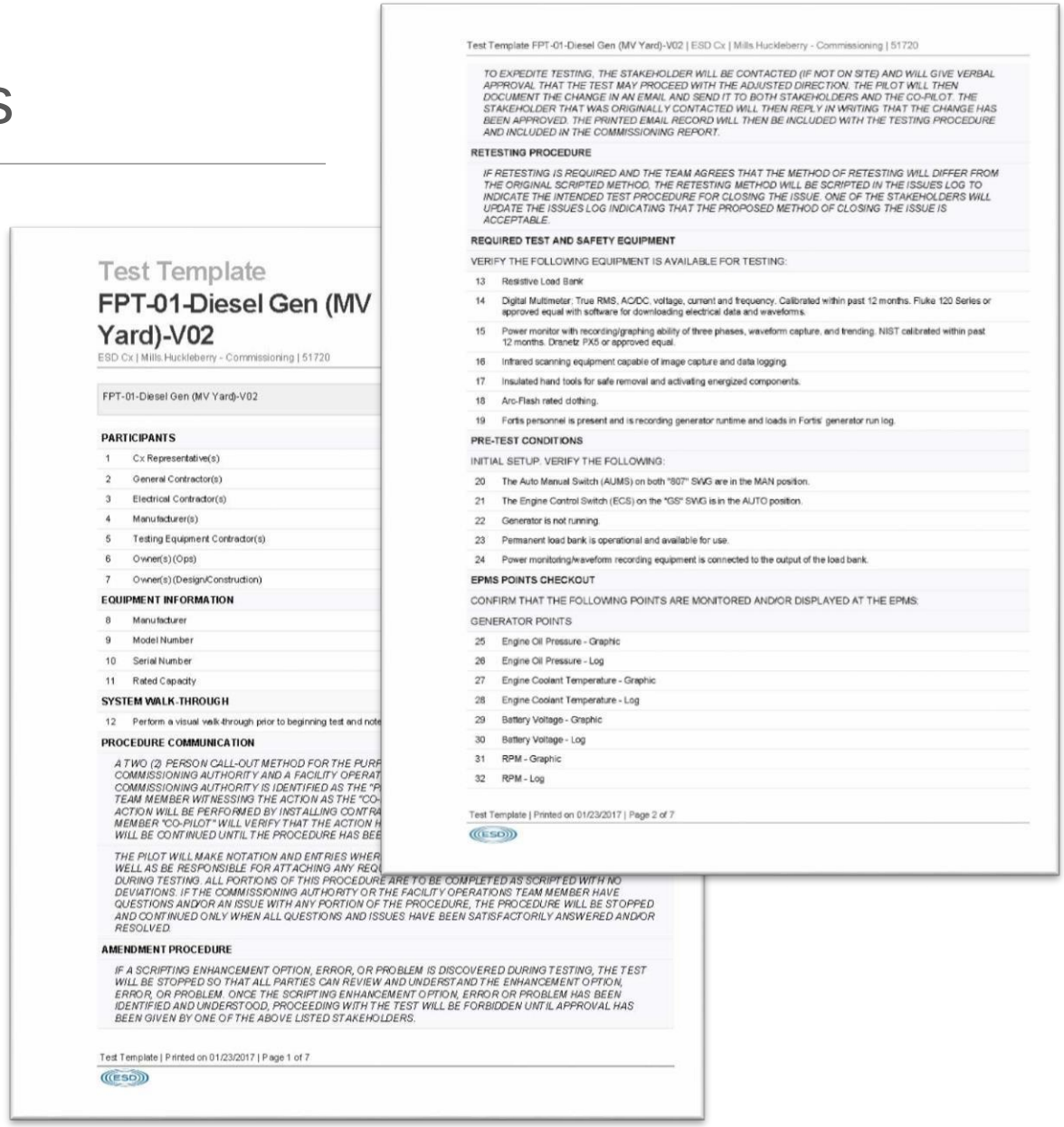
✓	1	ESD has received all above documentation and verified that it is complete. ESD is ready to begin Level 4 - Functional Performance Testing.

Functional Performance Tests

- Visual
- Time-stamped
- Issues Connected to Line Items within Test
  - *Simplifies Resolution*
  - *Simplifies Retesting*
  - *Remote Issue Closure*
- Files and Photos Can be Attached to Line Items or Tests



Functional Performance Tests



Test Template

FPT-01-Diesel Gen (MV Yard)-V02

ESD Cx | Mills.Huckleberry - Commissioning | 51720

FPT-01-Diesel Gen (MV Yard)-V02

PARTICIPANTS

1	Cx Representative(s)
2	General Contractor(s)
3	Electrical Contractor(s)
4	Manufacturer(s)
5	Testing Equipment Contractor(s)
6	Owner(s) (Ops)
7	Owner(s) (Design/Construction)

EQUIPMENT INFORMATION

8	Manufacturer
9	Model Number
10	Serial Number
11	Rated Capacity

SYSTEM WALK-THROUGH

12	Perform a visual walk-through prior to beginning test and note

PROCEDURE COMMUNICATION

A TWO (2) PERSON CALL-OUT METHOD FOR THE PURP
COMMISSIONING AUTHORITY AND A FACILITY OPERAT
COMMISSIONING AUTHORITY IS IDENTIFIED AS THE "P
TEAM MEMBER WITNESSING THE ACTION AS THE "CO-
ACTION WILL BE PERFORMED BY INSTALLING CONTRA
MEMBER "CO-PILOT" WILL VERIFY THAT THE ACTION H
WILL BE CONTINUED UNTIL THE PROCEDURE HAS BEE

THE PILOT WILL MAKE NOTATION AND ENTRIES WHER
WELL AS BE RESPONSIBLE FOR ATTACHING ANY REQ
DURING TESTING. ALL PORTIONS OF THIS PROCEDURE ARE TO BE COMPLETED AS SCRIPTED WITH NO DEVIATIONS. IF THE COMMISSIONING AUTHORITY OR THE FACILITY OPERATIONS TEAM MEMBER HAVE QUESTIONS AND/OR AN ISSUE WITH ANY PORTION OF THE PROCEDURE, THE PROCEDURE WILL BE STOPPED AND CONTINUED ONLY WHEN ALL QUESTIONS AND ISSUES HAVE BEEN SATISFACTORILY ANSWERED AND/OR RESOLVED.

AMENDMENT PROCEDURE

IF A SCRIPTING ENHANCEMENT OPTION, ERROR, OR PROBLEM IS DISCOVERED DURING TESTING, THE TEST WILL BE STOPPED SO THAT ALL PARTIES CAN REVIEW AND UNDERSTAND THE ENHANCEMENT OPTION, ERROR, OR PROBLEM. ONCE THE SCRIPTING ENHANCEMENT OPTION, ERROR OR PROBLEM HAS BEEN IDENTIFIED AND UNDERSTOOD, PROCEEDING WITH THE TEST WILL BE FORBIDDEN UNTIL APPROVAL HAS BEEN GIVEN BY ONE OF THE ABOVE LISTED STAKEHOLDERS.

Test Template | Printed on 01/23/2017 | Page 1 of 7

Test Template FPT-01-Diesel Gen (MV Yard)-V02 | ESD Cx | Mills.Huckleberry - Commissioning | 51720

TO EXPEDITE TESTING, THE STAKEHOLDER WILL BE CONTACTED (IF NOT ON SITE) AND WILL GIVE VERBAL APPROVAL THAT THE TEST MAY PROCEED WITH THE ADJUSTED DIRECTION. THE PILOT WILL THEN DOCUMENT THE CHANGE IN AN EMAIL AND SEND IT TO BOTH STAKEHOLDERS AND THE CO-PILOT. THE STAKEHOLDER THAT WAS ORIGINALLY CONTACTED WILL THEN REPLY IN WRITING THAT THE CHANGE HAS BEEN APPROVED. THE PRINTED EMAIL RECORD WILL THEN BE INCLUDED WITH THE TESTING PROCEDURE AND INCLUDED IN THE COMMISSIONING REPORT.

RETESTING PROCEDURE

IF RETESTING IS REQUIRED AND THE TEAM AGREES THAT THE METHOD OF RETESTING WILL DIFFER FROM THE ORIGINAL SCRIPTED METHOD, THE RETESTING METHOD WILL BE SCRIPTED IN THE ISSUES LOG TO INDICATE THE INTENDED TEST PROCEDURE FOR CLOSING THE ISSUE. ONE OF THE STAKEHOLDERS WILL UPDATE THE ISSUES LOG INDICATING THAT THE PROPOSED METHOD OF CLOSING THE ISSUE IS ACCEPTABLE.

REQUIRED TEST AND SAFETY EQUIPMENT

VERIFY THE FOLLOWING EQUIPMENT IS AVAILABLE FOR TESTING:

13	Resistive Load Bank
14	Digital Multimeter, True RMS, AC/DC, voltage, current and frequency. Calibrated within past 12 months. Fluke 120 Series or approved equal with software for downloading electrical data and waveforms.
15	Power monitor with recording/graphing ability of three phases, waveform capture, and trending. NIST calibrated within past 12 months. Dranetz PX5 or approved equal.
16	Infrared scanning equipment capable of image capture and data logging.
17	Insulated hand tools for safe removal and activating energized components.
18	Arc-Flash rated clothing.
19	Fortis personnel is present and is recording generator runtime and loads in Fortis' generator run log.

PRE-TEST CONDITIONS

INITIAL SETUP. VERIFY THE FOLLOWING:

20	The Auto Manual Switch (AUMS) on both "807" SWG are in the MAN position.
21	The Engine Control Switch (ECS) on the "GS" SWG is in the AUTO position.
22	Generator is not running.
23	Permanent load bank is operational and available for use.
24	Power monitoring/waveform recording equipment is connected to the output of the load bank.

EPMS POINTS CHECKOUT

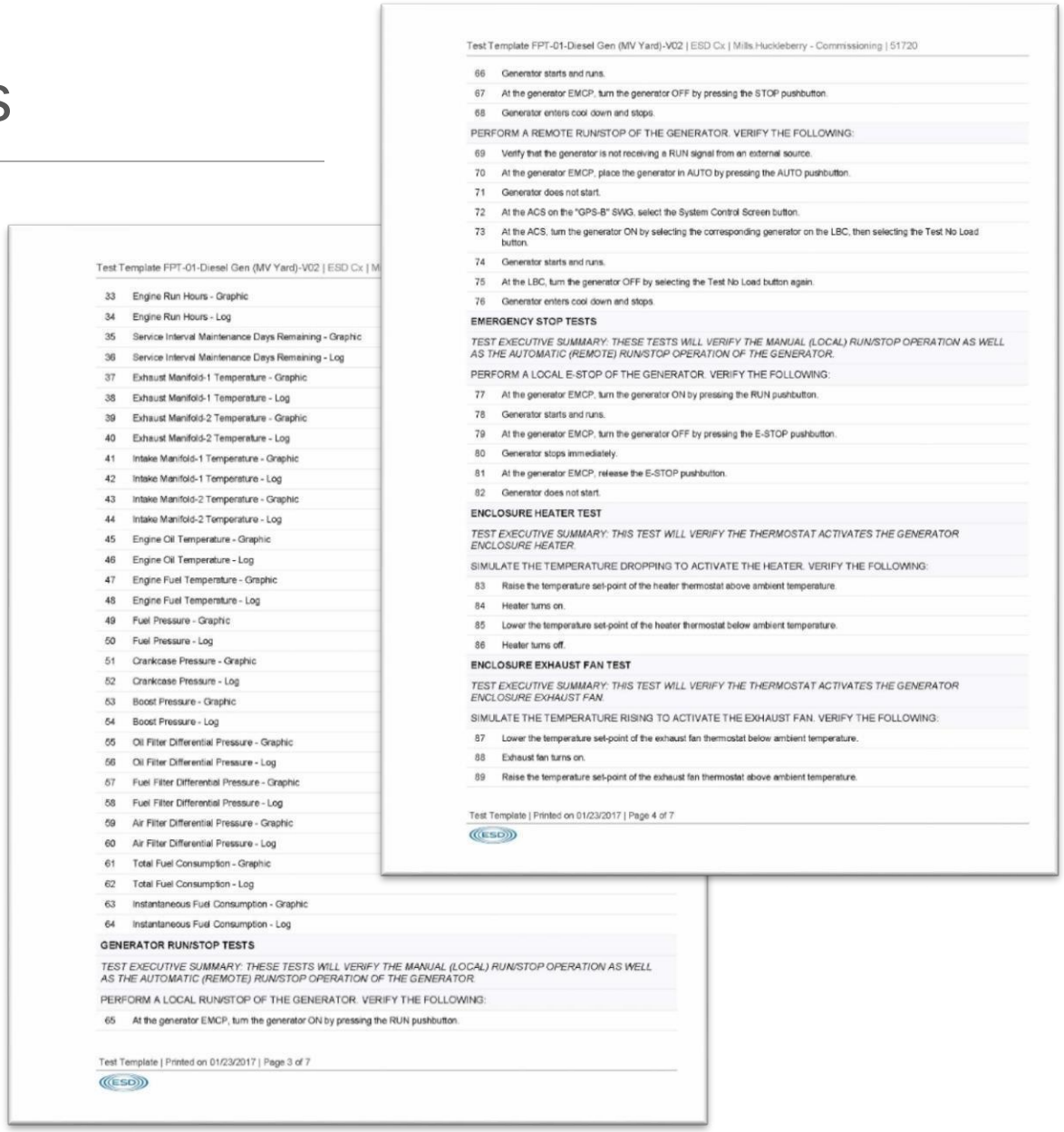
CONFIRM THAT THE FOLLOWING POINTS ARE MONITORED AND/OR DISPLAYED AT THE EPMS:

GENERATOR POINTS

25	Engine Oil Pressure - Graphic
26	Engine Oil Pressure - Log
27	Engine Coolant Temperature - Graphic
28	Engine Coolant Temperature - Log
29	Battery Voltage - Graphic
30	Battery Voltage - Log
31	RPM - Graphic
32	RPM - Log

Test Template | Printed on 01/23/2017 | Page 2 of 7

Functional Performance Tests



Test Template FPT-01-Diesel Gen (MV Yard)-V02 | ESD Cx | M

33	Engine Run Hours - Graphic
34	Engine Run Hours - Log
35	Service Interval Maintenance Days Remaining - Graphic
36	Service Interval Maintenance Days Remaining - Log
37	Exhaust Manifold-1 Temperature - Graphic
38	Exhaust Manifold-1 Temperature - Log
39	Exhaust Manifold-2 Temperature - Graphic
40	Exhaust Manifold-2 Temperature - Log
41	Intake Manifold-1 Temperature - Graphic
42	Intake Manifold-1 Temperature - Log
43	Intake Manifold-2 Temperature - Graphic
44	Intake Manifold-2 Temperature - Log
45	Engine Oil Temperature - Graphic
46	Engine Oil Temperature - Log
47	Engine Fuel Temperature - Graphic
48	Engine Fuel Temperature - Log
49	Fuel Pressure - Graphic
50	Fuel Pressure - Log
51	Crankcase Pressure - Graphic
52	Crankcase Pressure - Log
53	Boost Pressure - Graphic
54	Boost Pressure - Log
55	Oil Filter Differential Pressure - Graphic
56	Oil Filter Differential Pressure - Log
57	Fuel Filter Differential Pressure - Graphic
58	Fuel Filter Differential Pressure - Log
59	Air Filter Differential Pressure - Graphic
60	Air Filter Differential Pressure - Log
61	Total Fuel Consumption - Graphic
62	Total Fuel Consumption - Log
63	Instantaneous Fuel Consumption - Graphic
64	Instantaneous Fuel Consumption - Log

GENERATOR RUN/STOP TESTS

TEST EXECUTIVE SUMMARY: THESE TESTS WILL VERIFY THE MANUAL (LOCAL) RUN/STOP OPERATION AS WELL AS THE AUTOMATIC (REMOTE) RUN/STOP OPERATION OF THE GENERATOR.

PERFORM A LOCAL RUN/STOP OF THE GENERATOR. VERIFY THE FOLLOWING:

65	At the generator EMCP, turn the generator ON by pressing the RUN pushbutton.

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Test Template FPT-01-Diesel Gen (MV Yard)-V02 | ESD Cx | Mills Huckleberry - Commissioning | 51720

66	Generator starts and runs.
67	At the generator EMCP, turn the generator OFF by pressing the STOP pushbutton.
68	Generator enters cool down and stops.

PERFORM A REMOTE RUN/STOP OF THE GENERATOR. VERIFY THE FOLLOWING:

69	Verify that the generator is not receiving a RUN signal from an external source.
70	At the generator EMCP, place the generator in AUTO by pressing the AUTO pushbutton.
71	Generator does not start.
72	At the ACS on the "GPS-B" SWG, select the System Control Screen button.
73	At the ACS, turn the generator ON by selecting the corresponding generator on the LBC, then selecting the Test No Load button.
74	Generator starts and runs.
75	At the LBC, turn the generator OFF by selecting the Test No Load button again.
76	Generator enters cool down and stops.

EMERGENCY STOP TESTS

TEST EXECUTIVE SUMMARY: THESE TESTS WILL VERIFY THE MANUAL (LOCAL) RUN/STOP OPERATION AS WELL AS THE AUTOMATIC (REMOTE) RUN/STOP OPERATION OF THE GENERATOR.

PERFORM A LOCAL E-STOP OF THE GENERATOR. VERIFY THE FOLLOWING:

77	At the generator EMCP, turn the generator ON by pressing the RUN pushbutton.
78	Generator starts and runs.
79	At the generator EMCP, turn the generator OFF by pressing the E-STOP pushbutton.
80	Generator stops immediately.
81	At the generator EMCP, release the E-STOP pushbutton.
82	Generator does not start.

ENCLOSURE HEATER TEST

TEST EXECUTIVE SUMMARY: THIS TEST WILL VERIFY THE THERMOSTAT ACTIVATES THE GENERATOR ENCLOSURE HEATER.

SIMULATE THE TEMPERATURE DROPPING TO ACTIVATE THE HEATER. VERIFY THE FOLLOWING:

83	Raise the temperature set-point of the heater thermostat above ambient temperature.
84	Heater turns on.
85	Lower the temperature set-point of the heater thermostat below ambient temperature.
86	Heater turns off.

ENCLOSURE EXHAUST FAN TEST

TEST EXECUTIVE SUMMARY: THIS TEST WILL VERIFY THE THERMOSTAT ACTIVATES THE GENERATOR ENCLOSURE EXHAUST FAN.

SIMULATE THE TEMPERATURE RISING TO ACTIVATE THE EXHAUST FAN. VERIFY THE FOLLOWING:

87	Lower the temperature set-point of the exhaust fan thermostat below ambient temperature.
88	Exhaust fan turns on.
89	Raise the temperature set-point of the exhaust fan thermostat above ambient temperature.

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Issues Tracking and Resolution

- **Accountability**
  - Time Stamped
  - Assignable
  - Living Documentation
- **Collaborative**
  - Real Time Progress
  - Cloud-Based
  - Multi-user Collaboration
- **Reporting**
  - Construction Team can Export and Manage
  - Sortable

Module Capability Comparison

The Old Archaic Way – Spread Sheets and Word Documents

Module	Real Time	Time Stamped	Assign-able	Multi-User	Export-able	Sortable	Photos	Cloud-Based
Design Reviews		Manual	✓					Manual
Field Observation Reports		Manual	✓				Manual	Manual
Checklists		Manual	✓				Manual	Manual
Functional Performance Tests		Manual	✓				Manual	Manual
Issue Tracking and Resolution		Manual	✓			Manual		Manual

The New Cloud-Based Way – Using Online Commissioning Tools

Module	Real Time	Time Stamped	Assign-able	Multi-User	Export-able	Sortable	Photos	Cloud-Based
Design Reviews	✓	✓	✓	✓	✓	✓	✓	✓
Field Observation Reports	✓	✓	✓	✓	✓	✓	✓	✓
Checklists	✓	✓	✓	✓	✓	✓	✓	✓
Functional Performance Tests	✓	✓	✓	✓	✓	✓	✓	✓
Issue Tracking and Resolution	✓	✓	✓	✓	✓	✓	✓	✓

Lessons Learned

- Start Small
- Roll Out
  - *Include In Kickoff Meeting*
- New Clients First
- Include Links in Distribution
- Live Meetings
- Acknowledge Learning Curve

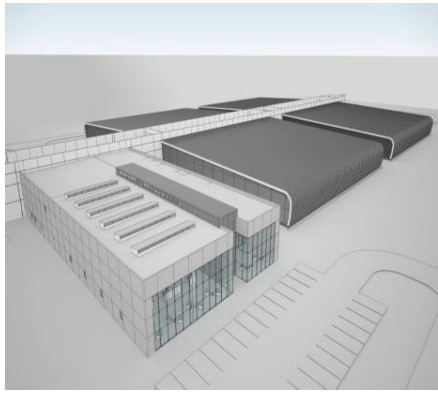
Unintended Consequences

- Highlights CxA Driven Delays
- Instant Upload
  - *Removes Review Capabilities*
- Coordination Gaps
- Notification Settings
  - *Too Much Content*
  - *Too Little Content*

The Future

- Future of Cx Process
- Continuous Improvement
  - Vendor Competition
- Owner Specified
- Engineer Specified
- Tech Savvy Delivery
- Get on Board or Move Over



Questions?

Thank You

This concludes The American Institute of Architects
Continuing Education Systems Course

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