QMS4-8.5.1-7 EE Testing Checklist

Project No: 61778 Project Name: DUKE AICHOLTZ Date: 3/10/2025 Project Manager: Brian Byers

Building Wiring Pre-Test: Please initial each task once completed; enter any unresolved issues as a Write-Up

TG 1. Review Issue Board for missing materials / open issues and write any applicable items on comments sheet.

TG 2. Review Assembly/Wire QC 18 for correct wire lugs and any special notes.

___ 3. Review L1, L2, L3, L4, L5 prints. Verify all building wiring items and all boxes/conduits needed for integration are installed.

TG 4. Visually inspect Battery Charger, DC Main Panel, DC Breaker Panel(s). Verify Charger input matches building AC power/phase. Verify DC output power (48V/125V/250V) matches panel requirements and AC breaker matches charger requirements.

TG 5. Verify fuses are installed in disconnects and fused breakers per drawing.

TG 6. Check AC and DC breakers for a tight connection of the conductor - also breaker to the panel board bus.

TG 7. Ring out all beakers AC & DC for shorts to ground or neutral or phase to phase.

8. Perform a visual inspection of the following components for physical or paint damage / defects; Initial each line when complete (or N.A.):

TG	Battery Charger(s)	TG	Switches/Recepts.	N/A	Net Shelter
TG	DC Panel Board(s)	TG	Interior Lights	N/A	DC Monitor Box
TG	AC Panel Board(s)	N/A	DC Lights	N/A	Telco Board
N/A	Transfer Switch	TG	Exit Lights	TG	HVAC Unit
TG	DC Disconnects	TG	Exterior Lights	TG	HVAC Disconnect
TG	AC Disconnects	TG	Exterior GFCI Recepts.	TG	HVAC Thermostat
N/A	AC Switch Gear	TG	Timers	N/A	Heater(s)
TG	J Boxes / Wireway	TG	Exhaust Fan / Louvers		
TG	Cable Tray	TG	Fire Alarms / RIB Relays		

TG 9. Check all J boxes, wireways, receptacles, light switches, for correct box grounds, loose wirenuts, cut wire strands, and loose or pinched wires.

TG 10. Check for proper bonding of all wall mounted panels and boxes, battery chargers, transfer switches, disconnects, fuse panels, cable tray, penetrations to outside ground pads and pigtails if applicable

TG 11. Verify AC breaker(s) for HVAC unit(s) meet requirements shown on HVAC plate/label

TG 12. Verify that the bonding screws for the AC dist. panels and AC disc. switches are secured in the panels (or installed if needed).

	Serial number	Wall A, B, C or D
HVAC	406J2341092H2-01	B
HVAC	406T2341092H3-01	D
HVAC		
HVAC		
Battery Charger	466212-1 (0625)	EB
Battery Charger		
Battery Charger		
Battery Charger		
Transfer Switch		
Transfer Switch		

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Integration Pre-Test: Please initial each task once completed; enter any unresolved issues as a Write-Up

GW 1. If panels were tested prior to installation to the building, review the individual QC-18s for completeness. Address all open items, or transfer them onto this checklist. Place QC 18 back into the Packet when complete

2. Review Integration QC 18 for correct wire lugs and any special notes

3. Inspect integration cabling/wiring to wall mounted devices previously inspected. (Battery charger alarms, ATS alarms, rib relay/fire alarm connections, telco board cables, net shelter, Positron etc.)

4. Inspect all panels and termination cabinets for:

GW a. Proper insertion of stripped wire into lugs,
GW b. Proper crimps
c. Proper connection of lugs to terminals,
d. Tightness of lugs
e. Wires on correct side of terminal blocks in term cab
f. Panels bolted together
g. No loose wire strands at compression fittings
h. Correct lugs/ferrules used
i. Correct cable / wire size (gauge)
j. Correct cable color-coding used (panels, term cabs, wall-mounted devices)

GW 5. Check all panel and term cab wire diagrams for missing cables and missing or damaged components

6. Verify communication cables have been run and terminated

_____ Coax _____ IRIG _____ SEL _____ Fiber _____ Cat 5

N/A 7. Verify GPS clock antenna and surge suppressor are installed

GW 8. Ring out all breakers AC & DC for shorts to ground or neutral or phase to phase.

Torque Verifications & Post-Test: Please initial each task once completed; enter any unresolved issues as a Write-Up

1. Verify torque on the following compression connections; initial each item below when complete, and record torque tool(s) used. Apply a stripe across torqued bolts / nuts, or a dot for smaller wires, to indicate that torque has been verified.

GW	Battery Charger(s)	GW	DC Disconnects	Torque Tool Type & Serial Number(s) used:
GW	DC Panel Board(s)	GW	AC Disconnects	3/8 Torque 04176023 3/8
GW	AC Panel Board(s)	N/A	AC Switch Gear	screw Driver 18042160
GW	Transfer Switch	GW	HVAC Disconnect	

GW 2. Verify torque on all panel and term cabinet compression connections; indicate that torque has been verified by placing your initials and "LT2" notation on the WD's. Initial and record torque tool(s) used below:

Torque Tool Type & Serial Number(s) used:

screw Driver 03154/020009

_____ 3. Gather Stickset(s); return to Project Manager or designee for scanning

_____ 4. Scan a copy of the Test Sheet and save to the Test Dept. file location under the job name

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Test: Please initial each task once completed; enter any unresolved issues as a Write-Up

BH 1. Review the Pre-Test checks above. Ensure that all items are completed, or documented as a Write-Up.

2. Review the QC-18 for testing requirements. Put a check below by the test(s) required. (If IHB building, tests b,c,e,f are required

____ a. Wiring Diagram Pt-to-Pt Test. If required, perform wire continuity check by following the individual panel wiring diagrams and using a Fluke Multi-meter.

✓ b. Functional Schematic Pt-to-Pt Test. If required, perform test by following the individual panel schematic diagrams and using a Fluke Multi-meter and Omicron Test Set as required.

X c. Dielectric Test. If required, test all AC utility circuits to NEC 550.17a with the Hipot-Megohmeter. Initial GW / Date 7/7/25

____ d. Polarity Testing: _____

____ e. Continuity Bonding required: _____

____ f. Review QC18 for any special Tests or Requirements; mark N.A. or Initial below if applicable

_____ AEP pre commissioning document _____ Factory Acceptance Testing (FAT)

_____ Install customer provided relay settings _____ Other _____

3. If the panels/racks were <u>not</u> tested prior to installation in the building, perform the following tests:

____ a. Check all devices for freedom of moving parts. Remove any shipping material that may prevent operation.

____ b. Check relays to ensure that the AC and DC voltage taps are at the proper settings. Use the individual schematics

____ c. Apply specified DC voltage to the individual panels/racks through the DC panel boards with a Sorensen DC power supply c battery charger

____ d. Install customer provided relay settings.

____ e. Check all relays for proper operation of the specified voltage range as shown on the schematics or the device manual.

____ f. Apply voltage and current with an Omicron test set to simulate field conditions causing the devices to trip/function as designed. See device function specifications in the manual to determine acceptable operation tolerances.

_____ Accept _____ Reject

____ g. Verify timing relays for correct sequence and operation as shown on the schematics.

____ h. Record readings and outputs of meters, recorders, and transducers on schematics. See device manual for tolerances.

____ i. Record firmware for any relays that were missing during PANEL TEST _____

N/A 4. For split buildings that require field work, repeat steps 5 through 9 for cables / wires pulled back for travel

BH 5. Make sure there is no back feeding of power from the HVAC or lighting circuits

6. Apply AC voltage to the AC panel boards using the AC test plug. Use the AC schematic drawing to determine rated voltage and phasing requirements. (Please intial tasks once completed)

✓ a. Turn the AC breakers on individually to verify correctness of branch circuits including main breaker

✓ b. Verify correctness of wiring of all receptacles (indoor & outdoor) with a Fluke Multi-meter and circuit tester

✓ c. Verify correct operation of all lights. (indoor and outdoor)

✓ d. Verify correct operation of the exhaust fan circuit

✓ e. Verify correct operation of HVAC circuit; Test to ensure Heating functions are operational

✓ f. Verify correct operation of HVAC circuit; Test to insure Cooling functions are operational

✓ g. Verify correct operation of the fire alarm circuit. Confirm shutdown of HVAC and exhaust fan during any alarm condition

— h. Verify correct operation of the Automatic Transfer Switch (Load settings for ATC)

✓ i. Verify ATS position contacts to the schematic with a Fluke Multi-meter

Test (continued):

7. Apply DC voltage to the DC panel boards with a Sorensen power supply or battery charger. Use the DC schematic drawing to determine the rated voltage value. Verify polarity to NEC 550.17b at the panel boards with a Fluke Multi-meter.

- ✓ a. Turn DC breakers on individually and verify voltage magnitude and polarity to NEC 550.17b with a Fluke Multi-meter. Use the schematics and wiring diagrams to determine the test points.
- ✓ b. Allow sufficient time for the devices to reach normal operating temperatures. Use the device manual to determine the time.
- ✓ c. Check all devices for abnormal heating.
- ✓ d. Where an OCB or other external device is shown on the schematics, connect an Electro switch series 24 LSR switch to simulate the OCB or other external device.
- ✓ e. Verify relay targets, coils, contacts etc., for correct operation as shown on the schematics.

8. Perform AC Cabling verifications for C.T.s and P.T.s from furthest point or term cab.

- ✓ a. Using the schematics, apply AC voltage and current to the P.T. and C.T. circuits using an Omicron test set.
- ✓ b. Verify current polarity with an Arbiter Systems Multi-meter. Confirm current magnitude and phase angle.
- ✓ c. Verify voltage points with an Arbiter Systems Monitor. Confirm voltage magnitude and phase angle.
- ✓ d. Verify relay targets, coils, contacts etc., for correct operation as shown on the schematics.
- ✓ e. Verify single point ground

9. Verify communication cabling. Check the method used below:

- ✓ Continuity check with a Fluke Multi-meter
- ✓ Tx/Rx interruption method
- ✓ Light method
- ____ Establish relay communication

N/A 10. Identify all extra cables and tag with circuit number or panel number. Cap all conductors.

BH 11. Verify certification labels, data plates, and CT circuit labels are installed where applicable

____ 12. Verify AC and DC panelboard circuit cards and/or labels are correctly installed where applicable

BH 13. If nameplates weren't installed prior to testing, verify the correctness of the building nameplates.

Test Equipment Used:

- ✓ Omicron Test Set Serial No.____
- ✓ Fluke Multi-meter Serial No.____
- ____ Sorensen power supply Serial No.____
- ____ Phase Angle meter Serial No.____
- GW Hipot-Megohmeter Serial No. 38550096 Fluke
- ✓ Receptacle Tester Serial No.____
- ✓ CAT5/6 Cable Tester ____

Enter all Pre-Test and Test Comments and/or Discrepancies on Page 7

Engineering and Post Test Instructions

INSTRUCTIONS: Please complete this section with legible, concise statements.		Dept.		Completed
		Eng.	Mfg.	Initials / Date
Panel Engineering Instructions:				
1.	Prepare a Ship Loose List for Crate, listing any loose items required such as: extra hardware, extra devices, touch-up paint, tech manuals, drawings, etc...	X		
2.	Inspect the wired Panels - note here if any special bracing should be added.	X		
3.	Review QC-18 to verify that the correct crimpers were used. This is not necessary for any crimps made in the Wire Processing cell.	X		
Building Engineering Instructions:				
1.	Prepare a Ship Loose List for Crate, listing any loose items required such as: extra hardware, extra devices, touch-up paint, tech manuals, drawings, etc...	X		
2.	For split-construction jobs, ensure that copies of all the Test Sheet and Schemes are sent with the building	X		
3.	For AEP jobs, ensure that copies of all the Test Sheet and Schemes are sent with the building	X		
4.	For ATC jobs, ensure that copies of the "as-built" W.D.'s are sent with the building	X		
5.	Review QC-18 to verify that the correct crimpers were used. This is not necessary for any crimps made in the Wire Processing cell.	X		
6.	Complete circuit cards for the AC and DC distribution panels.	X		
7.	Make an 11x17 copy of the final HVAC wiring detail (generally on the "E3" drawing); stamp as "Information Only" and place inside a clear protective sleeve inside the main HVAC cover plate	X		

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Panel Specific Write-ups

	Write Up		INSTRUCTIONS: Please transfer any unresolved panel issues to this form before beginning building test. **Only missing nameplates and missing defective material may be unresolved to move a panel to the EE (unless approved by Test Supervisor or Quality Manager).**	Dept.			Corrected	Retested	
	By	Date		Eng	Test	Mfg	Date	By	Date
1	Hm	6-13	missing (qty 4) NPS00044 Custom escutcheon nameplates / install in EE PANEL 101 RTU	✓ X		✓	BMB 6/12		
2	Hm	6-13	missing (qty 23) NPS00001 (nameplates) / install in EE PANEL 101 RTU	✓ X		✓			
3	Hm	6-10	missing (qty 1) NP.S00001 / install in EE PANEL 102	✓ X		✓			
4	Cyh	5-30	Nameplates missing / install in EE PANEL 103	✓ X		✓			
5	Cyh	5-30	Nameplates missing / install in EE PANEL 104	✓ X		✓			
6									
7									
8									
9									
10									
11									
12									

Test Comments and/or Rework Required

	Write Up By	Write Up Date	INSTRUCTIONS: Please complete this section with **legible**, concise statements.	Dept. Eng	Dept. Test	Dept. Mfg	Corrected Date	Retested By	Retested Date
1	TG	6-11	FINISH INSTALLING DOOR ALARMS, CABLES WIRES, HARDWARE, CONTACTS. (WANS A+B) See # 31			X	BB 7-11	NF	7/13
2	TG	6-11	FINISH WIRING INTAKE MOTOR (WALL C)			MW X	Pete	BH	1-12
3	TG	6-11	MISSING (3) BOLTS FOR EXHAUST FAN MOTOR - ON MOTOR - (WAN D)			X	7-17 PETE	NF	7/13
4	TG	6-11	FINISH LANDING CABLES ON MANUAL TRANFER SWITCH (NEUTRALS) E13 MISSING NEUTRAL BUS (WALL C) BLACK 4/0	X		MW X	MP 1/12 Done	BH	1-13
5	TG	6-11	PUT COVERS ON ALL LIGHTS. (CEILING)			X	DONE NF 9-9	BH	1-12
6	GW	7/10	INSTALL ALL COMS TO ALL PANELS			X	BB 7-11	NF	7/14
7	GW	7/10	ALL PANEL QC18s ARE transfer over to the test sheet					GW	
8	NF	7/14	AC PNL CKT'S 15-17 & 39-41 (HVAC FEEDS) ARE SWAPPED			X	7-17 PETE	NF	7/13
9	NF	7/14	SCHEME E-11 SAYS CKT 22&24 E-13 SHOWS 15-17 UPDATED	X			MP 1/12	BH	1-12
10	NF	7/14	OUTSIDE DISCONNECTS HAVE NEUTRAL & GROUND BONDED .. CUSTOMERS 54110-W7 DWG DOES NOT SHOW THIS .. E13 SHOWS NOTHING UPDATED, REMOVE BOND	X		X	MP 1/13	BH	1-13
11	NF	7/14	E-10 SAYS CKT 15 & 17 .. E13 SHOWS 39 - 41 UPDATED	X			MP 1/12	BH	1-12

Test Comments and/or Rework Required

	Write Up By	Write Up Date	INSTRUCTIONS: Please complete this section with **legible**, concise statements.	Dept. Eng	Dept. Test	Dept. Mfg	Corrected Date	Retested By	Retested Date
12	NF	7/14	E10 & E11 DONT SHOW R TO RT JUMPER UPDATED	X			TP 1/12	BH	1-2
13	NF	7/14	REWIRE ALL RELAYS IN ALARM JBOX.. THEY ARE NOT INSTALLED AS E-12 DRAWING SHOWS YOU MUST LOOK AT THE NUMBERS ON THE TERMINALS			X	7-17 PETE	NF	7/23
14	NF	7/14	THE TERMINALS ON R1 THRU 4 ON DWG E12 ARE NOT SHOWN IN THE CORRECT PHYSICAL LOCATION.. IF THEY WERE SHOWN IN THE CORRECT LOCATION THEY WOULD BE WIRED CORRECTLY BY MANUFACTURING... SEE WRITE UP # 13 ? THEY MATCH WHAT IM SEEING ON THE ICE CUBE	X			TP 1/12		—
15	NF	7/14	BOTH DOOR ALARMS NEED TO BE ADJUSTED.. BRACKET ON DOOR NEEDS TO BE SPACED OUT (NOT LINING UP WITH PART OF JAMB)			X	DONE 7-17	NF	7/23
16	NF	7/14	E13 SHOWS CKT 27 AS EMERGENCY LIGHTS.. BUILDING HAS NONE REMOVED	X			TP 1/12	BH	1-12
17	NF	7/14	NO NAMEPLATES ON PANELS.. OR ANYTHING ELSE MISSED ORDER	✓ X			DMB 1/11		
18	NF	7/14	E14 DWG SHOWS 60A NON FUSED DISC. SW... 100A FUSED INSTALLED 100A FUSED Correct	X			TP 1/9	BH	1-12
19	NF	7/14	DC PANELBOARD HAS + ON LEFT ALL DISC. SWITCHES HAVE IT ON RIGHT.. IS THIS OK.. WIRING TO MATCH PRINT	X		X	TP 1/9	BH	1-12
20	NF	7/14	E14 DWG SHOWS 100A NON FUSED DISC. SW... FUSED INSTALLED PLUS A TERMINAL BLOCK THAT IS NOT SHOWN ON DWG OK AS WIRED	X			TP 1/9	BH	1-12

Test Comments and/or Rework Required

	Write Up By	Write Up Date	INSTRUCTIONS. Please complete this section with **legible**, concise statements.	Dept. Eng	Dept. Test	Dept. Mfg	Corrected Date	Retested By	Retested Date
21 of	NF	7/14	DWG E13 SHOWS CKT 18-20 AS MAINTENANCE RECEPT.... BUILDING INC NONE WILL ADD TO WALL A; ITS A SWITCH, ADD AND WIRE PER L3	X		X	TP 1/12 JDW	BH	1-13
22 of	NF	7/14	INSTALL SPLIT CORE CT WIRING PER DWG 54110-W1			X		CS	1/8/20
23 EL	NF	7/14	Panel 61778-0001 Nova Tech Comp. has broken thumb screw on HV Power Supply Need to order – ORDER REPLACEMENT PLATE & SEND TO DUKE	X	✓		BMB 1/12		
24	NF	7/21	BOND BATTERY RACK 4/0 BOND			SJP X	JS 1/9	BH	1-12
25	NF	7/21	FIRE SEALANT IN BATTERY ROOM BOND THRU WALL			HW X	EK 1-12	—	
26	NF	7/21	BATTERY ROOM DOOR (INTERNAL) INSTALL THRESHOLD CHK ALL DOORS – FOR CLOSING & COMPLETE			ASM X		BH	1-13 *
27	NF	7/21	INSTALL FILTER FRAME TRIM OUT BRACKET			ASM X		BH	1-13 *
28	NF	7/21	BATTERY ROOM HVAC RETURN GRILL FLIP TO (UPSIDE DOWN) REINSTALL			X	JS 1-8	BH	1-12
29	NF	7/13	KIDDE RELAY DEFECTIVE NEED REPLACE MENT EXTRA / REPLACEMENT BEING MARKED	X	✓	HW X	BMB 1/14 EK 1-12	BH	1-12
30	NF	7/17	E16 DWG CAYS CKT 9... EB CAYS CKT 25 ALSO CLOSE E12 CKT 25	X			JD 1/12	BH	1-12
31	NF	7/13	PLACE WHITE SPACER FOR DOOR ALARMS BETWEEN DOOR AND BRACKET (BOTH DOORS)			X	JS 1-8	BH	1-12

Test Comments and/or Rework Required

	Write Up By	Write Up Date	INSTRUCTIONS: Please complete this section with **legible**, concise statements.	Dept. Eng	Dept. Test	Dept. Mfg	Corrected Date	Retested By	Retested Date
32	BH	1-12	YELLOW WIRE FROM AC CKT-19 NOT CONNECTED AS SHOWN ON E1+2 DWG.S			X	BH 1-12	BH	1-12
33			BOND NEUTRAL TO GROUND PER E13 DWG.			X	BH 1-12	BH	1-12
34			MOVE BLUE WIRE FROM ALARM BOX TB1-19 TO 20 PER E12		X			BH	1-12
35	BMB	1/12	INSTALL CORE GRIP IN BOTTOM OF CT-JBOX IN BATT RM.			HW ✓	LW Done	BH	1-13 *
36	JA	1/12	Install exterior disconnect switch per redline			HW X	Done	BH	1-13 *

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Note: The following tasks must be completed and signed-off in order.

Building & Integration Testing By (Test Engineer): Bob Harris

Was all required in-house Testing able to be Completed?: [ ] Yes [X] No Date: 1-13-26

If "No" above, Project Manager approval is required here: _____
(Does not include Reconnect Testing for Split EEs)

Date: _____

If "No" above, record open Test Sheet items and/or a Description of remaining Open Issues below:

_____

_____

_____

Torque Verifications & Post-Test completion (Quality or Test): Shirley Walker

Date: 7/19/25

Released from Test / Ok to split (Project Manager): _____

Date: _____

Ship Prep Sheet Completion verified by (Lead or Supervisor): _____

Date: _____

*Note: The building schematic stick set(s) and test sheet MUST be sent with all split buildings

Final Inspection / Approved to Ship (Project Manager): _____

Date: _____

Note: The above Final Inspection line **MUST be signed before building can be shipped*

_____

Field Work and Post Test Completed by: _____
(Split buildings)

Date: _____

Final Verification / Approval of Site Work: _____
(any open items from above, and any items found at the jobsite)

Date: _____