QMS4-8.5.1-7 EE Testing Checklist

Project No: 61353 Project Name: RWE-BUFFALO Date: 7/24/2024 Project Manager: Bridget Becker

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

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

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

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

GM 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.

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

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

GM 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.):

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

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

GM 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

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

GM 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	433D223958342-02	B right
HVAC	433D223958340-02	B left
HVAC		
HVAC		
Battery Charger	0104876/1161000	C
Battery Charger		
Battery Charger		
Battery Charger		
Transfer Switch	US1150240600000567	A
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

GW Coax GW IRIG GW SEL _____ Fiber GW Cat 5

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	1/4 Torque 101 6800834
GW	AC Panel Board(s)	N/A	AC Switch Gear	3/8 Torque 04176023 48
GW	Transfer Switch	GW	HVAC Disconnect	Screw Driver 1804260

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 0315 4020009

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.

Initial Date

X c. Dielectric Test. If required, test all AC utility circuits to NEC 550.17a with the Hipot-Megohmeter. GW / 10/22

____ 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.

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

BH 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._____
- GLS Hipot-Megohmeter Serial No. 38550096
- ✓ Receptacle Tester Serial No._____
- ✓ CAT5/6 Cable Tester _____

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

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Engineering and Post Test Instructions

	INSTRUCTIONS: Please complete this section with legible, concise statements.	Dept. Eng.	Dept. Mfg.	Completed 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		BB 1/8
2.	Inspect the wired Panels - note here if any special bracing should be added.	X		BB 1/8
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		BB 1/8
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		BB 1/8
2.	For split-construction jobs, ensure that copies of all the Test Sheet and Schemes are sent with the building	X		N/A
3.	For AEP jobs, ensure that copies of all the Test Sheet and Schemes are sent with the building	X		N/A
4.	For ATC jobs, ensure that copies of the "as-built" W.D.'s are sent with the building	X		N/A
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		BB 1/8
6.	Complete circuit cards for the AC and DC distribution panels.	X		BB 1/8
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		BB 1/8

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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	BGm	8/20	missing (miSW2643) LEXAN - Qty 1 / INSTALL IN EE PANEL 1			X	RA RD SB	HH	12-17
2	BGm	8/19	missing lexan (miSW2643) - Qty 1 / INSTALL IN EE PANEL 2			X	RB SB 12/9	HH	12-17
3	MD	8/24	missing the lexan cover (Bom item MISW 2643) / INSTALL IN EE PANEL 4			X	RB SB 12/9	HH	12-17
4	HM	8/27	missing (qty 1) miSW2643 LEXAN DRAWING shows promise DATE 8/16/24 / INSTALL IN EE PANEL 5			X	RB SB 12/9	HH	12-17
5									
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	GM	9/5	Exterior light lens cover missing screw CREATE NCN WALL-A exterior	✓		HW. X ✓	TP 3/18 LW 1-8	BH	1-8
2	GM	9/10	Install cell booster WALL-A			HW. ✓	done 1-6	BH	1-7
3	GM	9/10	Install fire extinguisher & Indicator Arrow WALL-A & C			S.P. ✓			
4	GM	9/10	Install no smoking sign WALL-C			HW. ✓	done 1-6	BH	1-7
5	GM	9/10	Install 2" pvc & pipe to battery rack, pull cable WALL-C			HW. ✓	done	BH	1-7
6	GM	9/10	Install fiber panels to telco board WALL-C			✓		10/29 GW	
7	GM	9/10	Install missing breakers to DC panel WALL-C	X		✓	done 1-6	BH	1-7
8	GM	9/10	Install Cell & GPS antennas interior Pete 12-6 WALL-B exterior ← bracket new			HW ✓	LW 1-8		
9	GM	9/10	Install camera with flex pipe Field Install WALL A & B exterior			✓			
10	10/29 GW		finish Installing ground wires PANELS 1 & 2			X	MD 1-22	HH	12-17
11	10/29 GW		Block 2TB18 - 2,3 RD + BU are flip rewire PANEL 2			K	MD 1-22	HH	12-17

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	GW	10/29	ON BLOCK 4/TB12 NEED A LABLE ALSO A MARKER STRIP WITH RIGHT INFO PANEL 4			X	MJ 3-11	HH	12-17
13	GW	10/29	NEED TO FINISH LANDING CABLES A15 AND A16 Not on W/D - field? ALSO PNL-1 (BA) CKTS -13-18 NOT NEEDED REMOVE 15 + 16 PANEL 4	X		X	JP 1R/2 RF 1-7	BH	1-7
14	GW	10/29	finish wiring Lighting Contactor WALL A			X	BB 3-11	BH	3-18
15	GW	10/29	After Installing missing Breakers in DC PANEL finish LANDING Need 2 - 30 amp	X		X	PB done 1-6	BH	1-7
16	GW	10/29	DC PANEL BOARD is wire wrong			X	MJ 3-11	BH	3-18
17	GW	10/29	RUN ALL COMS TO ALL PANELS Need 12' + 30' RS232	X		X		BH	1-7
18	BW	10/29	ALL PANEL QC18's are transfer over to test sheet					GW	
19	BH	3-18	DS-AC-1 IS WIRED TO SOURCE-2 ON TRANSFER SWITCH SWAP SOURCE 1 & 2 CONNECTIONS (SOURCE 2 DWG. -E11 LANDS ON THE FRONT LUGS)	X		H.W. X	JP 3/18 1-6 Panel	BH	1-7
20			AC PANEL NEEDS A SINGLE (20A) BREAKER ON CKT.-36 DWG. -E11			X	BB 4-10	HH	12-17
21			COMM CAB-2 HAS AC CKTS -16&18 WITH RED AS A GROUND, PNL. BRD. HAS GREEN CHANGED TO GREEN, RE-LAND	X		X	JP 3/18 BB 4-9	HH	12-17
22			MOUNT EXHAUST FAN TIMER TO WALL LOOSE			HW X	P.F. 1-8	BH	1-8

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
23	BH	3-18	WIRE (J3) IN HYDROGEN SENSOR ON E6 DWG. SCH. - CS-52 & 51			X	BB 4-9	HH	12-17
24			RUN + LAND ALARM CABLE TO HVAC CONTROLER SCH. - CS-52 & 51 Ran, can't land till Hvac disconnected			X	BB 1-6	BH	1-7
25	TP	3/18	DS-AC-2 LINE CURRENT/4 WIRED TO JB-GEN, SHOULD BE DS-AC3 PER E11, REWIRE			H.W. X	JG 1-6	BH	1-7
26	BH	3-18	UN-SHIP PREP EXTERIOR PHOTO-EYE SO IT CAN BE TESTED NEW one on PIPE BROKEN, REMOVED, NCN ISSUED E9 DWG.	P		X	LW 1-8		
27			INSTALL GROUND BAR IN LIGHTING CONTACTOR BOX & WIRE & BOND E9 - DWG.			X	SB RB 12-10	HH	12-17
28			WIRE DOOR ALARMS ~~WIRE in field per T.P~~ E10 - DWG. & SCH.-51			X	CM 12-16	HH	12-17
29			DC PANEL BOARD HAS BROKEN PLASTIC BREAKER MOUNTING TABS FOR CKT. -14 NCN DC PANEL GUTS	X		H.W. X	LW 1-8	BH	1-8
30			WHERE DO BUILDING HI & LO TEMP CABLES LAND IN PNL-4 THEY DO NOT COIL FOR FUTURE USE	X			TP 3/20	BH	3-20
31	BH	3-20	ARE THERE UPDATED SCHEMES & W.D.s THAT NEED TO BE TESTED TOO AFTER WIRE REWORK YES	X			TP 1/7	BH	1-7
32			PNL-5 MISSING (2) 2A FUSES (FU-5)			X	BB 4-9	HH	12-17
33			SCH.-51 SHOWS (7) CHARGER ALARMS E-12 SHOWS (6) UPDATED IN SCHEMES	X			TP 1/7	BH	1-8

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
34	B-S	5-22	Please address layout mark ups on L4A, B, D, L2. Complete	X		X	BB 1/8	BH	1-8
35	HH	12-16	PNL 2: Add jumper from HA-64 to EC-A03			X	BB 12-30	BH	1-7
36	HH	12-16	PNL 2: Land cable 13C1 on TB16			X	SB 12/23	BH	1-7
37	HH	12-17	Dwg CS-07: Drawing does not show 86/TP and 86/TIB block close contacts but reference dwg CS-27 does and W/Os to UPDATED ON CS-07	X			TP 1/7	BH	1-7
38	TP	1/6	ADD. IN 6X6 BOX NEAR HVAC CONTROLLER AND WIRE IN AC/DC CONVERTER PER UPDATED E7 run cable to #12 TB1-6 ?			X	PF 1-7	BH	1-8
39	BH	1-7	FIBER-17 IS BROKEN IN PNL-4	X		X	PF 1-7	BH	1-7
40	↓		PNL-1 411L RELAY DO NOT HAVE RJ45 PORTS FOR COMM CABLES UPDATED EHT 2 & 3 TO BECOME FIBER	X		X	TP 1/7 PF 1-8	BH	1-8
41	↓		RUN SERIAL CABLES SER(1+2) NEED 273A	X		X	TP 1/7	BH	1-8
42	TP	1/7	ADD FIB 19 & FIB 20 PER RUNLIST ST SR 1 BROUGHT OUT NEED NEW	X		X		BH	1-8
43	TP	1/7	REMOVE OLD FIB19 - FIB22 PER RUN LIST			X	PF 1-7	BH	1-7
44	BH	1-7	NEED CLARIFICATION ON PNL-4 RTU-RTAC COMMS CUSTOMER QUESTION SENT 1/7	X			TP 1/7		

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
45	BH	1-7	TURN HYDROGEN SENSOR 90° SO ITS UP & DOWN			X	TP 1-7	BH	1-7
46	↓		BOTH HVACS KICKING OUT ON LOW PRESSURE Sikora fixed	X		X	BB 1/8	BH	1-8
47	TP	1/7	PANEL 4, SWAP BLACK & BLU PER MARK UP ON HVAC CABLE			X	DEJ 1-7	BH	1-8
48	BB	1/8	Panel 4 Feeder 4 Nameplate & Data Plate need install			X			

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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: 1-8-26

If "No" above, Project Manager approval is required here: Budgit Burk

(Does not include Reconnect Testing for Split EEs)

Date: 1/8/26

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

SEE TEST SHEET

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

Date: 12/10/24

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

Date: 1/8/26

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): Budgit Burk

Date: 1/8/26

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: _____