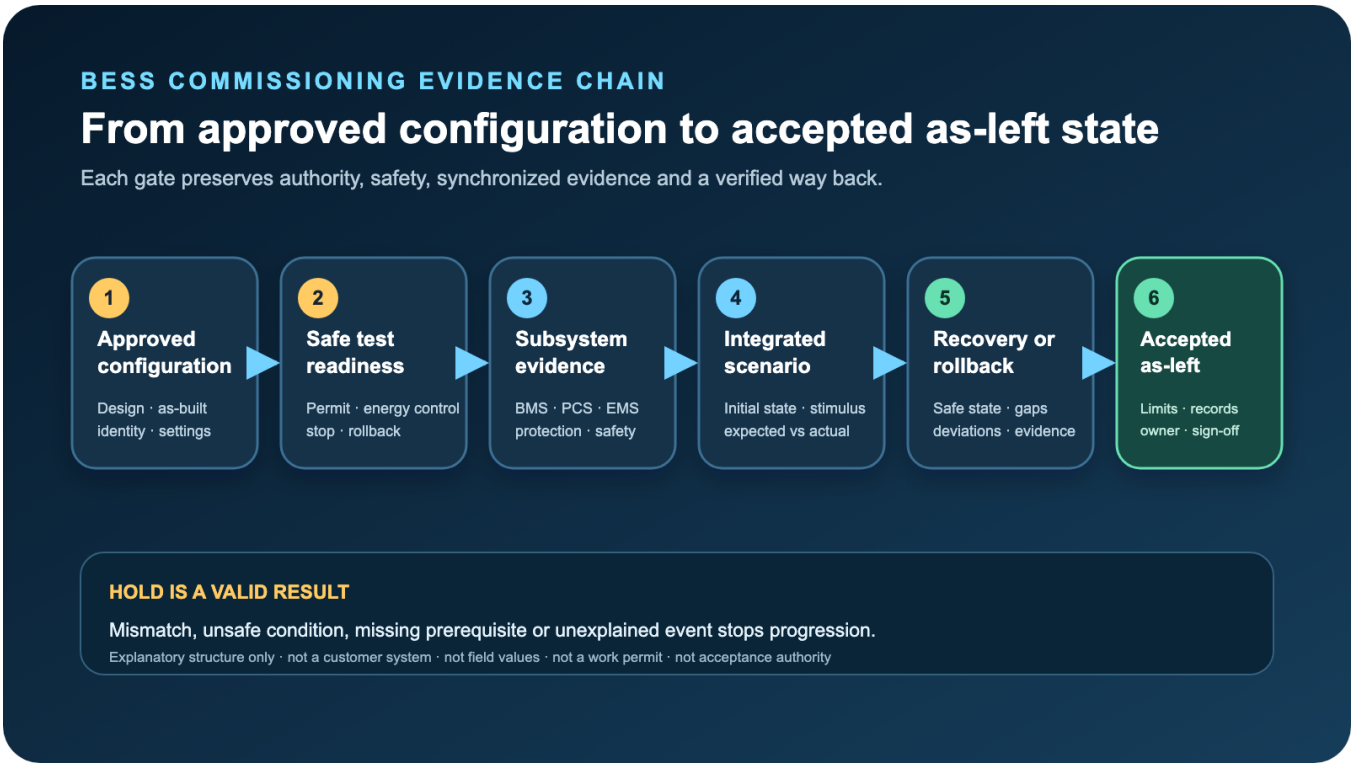
EN-GUIDE-05 | BESS COMMISSIONING EVIDENCE

BESS Commissioning Test Readiness, Integrated Scenarios & As-left Handover

Installed equipment and isolated subsystem passes do not prove readiness for an integrated test or operational release. Reconcile the approved design and active configuration, prove safe test readiness, execute one bounded scenario at a time, demonstrate recovery or rollback, and hand over the accepted as-left state.

Reviewed	23 July 2026	**Audience**	Owner, EPC, OEM, commissioning team
System	BESS, PCS, BMS, EMS and safety systems	**Output**	Commissioning and as-left evidence pack



Decision summary

Approve the configuration. Prove test readiness. Witness the integrated response. Accept the as-left state.
Missing prerequisites, unexplained events or open release authority are hold conditions - not passes.

OBSERVABLE SYMPTOMS

Reopen commissioning readiness when any of these appear

- Approved design, as-built drawings and active settings do not reconcile.
- BMS, PCS, EMS, SCADA, protection, HVAC and fire systems pass separately while integrated transitions remain unproven.
- The test plan lacks an initial state, stimulus, expected response, stop condition, rollback or required record.
- Emergency shutdown, auxiliary loss, communications loss or protection-trip paths have not been observed end to end.
- Alarms, events and physical indications disagree in time or sequence.
- Punch-list items, temporary bypasses, unvalidated changes or operating limits are hidden at release.

STOP-WORK CONDITIONS

Hold when the system, boundary, prerequisite or event record is not trustworthy

Configuration mismatch	Approved design, as-built identity or active configuration does not match the equipment.
Unsafe condition	Damage, abnormal heat, smoke, off-gas, fire, water or contamination is present.
Safety boundary unclear	Isolation, stored energy, LOTO, emergency response, exclusion zones or AHJ boundary is open.
Critical path unverified	Protection, interlock, emergency shutdown, fire, ventilation, auxiliaries or rollback is unverified.
Scenario incomplete	Prerequisites, expected response, stop, witness, record or recovery plan is missing.
Event unexplained	Alarm, event gap, time mismatch or unstable state remains unexplained.

Stop means preserve and escalate

Maintain or restore the approved safe state, preserve the as-found evidence and return the decision to the named authority. This guide does not authorize energization, charge/discharge, bypass, emergency response, restart or acceptance.

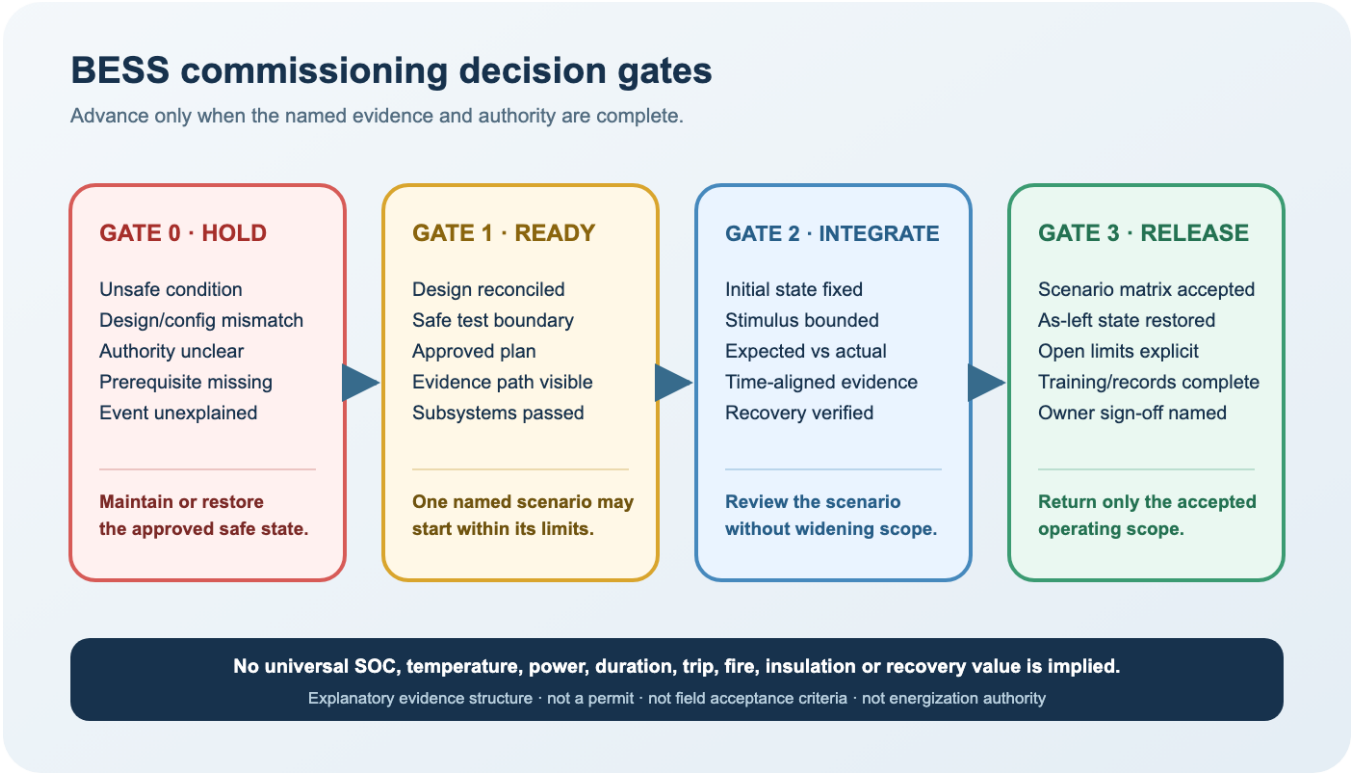
DATA TO COLLECT

Make every scenario traceable to an approved system and recoverable state

Evidence group	Minimum record	Decision supported
Authority and boundary	Country, AHJ, utility/interconnection, permits, owner/EPC/OEM roles, witnesses and release owner	Fixes who may approve each gate.
Approved design	Single-line, network, protection, control, fire/safety and emergency-response documents with revision	Establishes the accepted design basis.
Active configuration	Battery/BMS, PCS, switchgear/protection, EMS/SCADA, HVAC, fire, auxiliaries and communications identity/settings	Reconciles the system under test.
Installation readiness	Inspection, terminations, labels, grounding, barriers, housekeeping, pre-energization and unresolved defects	Prevents testing an incomplete installation.
Test safety	Energy control, permits, safe initial state, calibrated instruments, communications, exclusion zones and emergency response	Proves the test can start and stop safely.
Subsystem evidence	Approved battery/BMS, PCS, protection, EMS/SCADA, HVAC, fire, auxiliary and communications results	Shows prerequisites are available.
Scenario contract	Initial state, stimulus, expected sequence, observations, stop, rollback, witnesses and record format	Makes one integrated test bounded.
Event evidence	Synchronized alarms, SOE/events, physical indications, command/results, protection records and witness notes	Tests response on one timeline.
As-left handover	Final settings/backups/drawings, temporary states, open items, limits, training, OEM actions and acceptance	Defines the state actually released.

DECISION GATES

Advance on complete evidence - not schedule pressure or a cleared alarm



Gate	Required evidence	Result
Hold	Unsafe condition, design/configuration mismatch, unclear authority, missing prerequisite or unexplained event.	Maintain or restore safe state.
Ready	Reconciled design/as-built/configuration, safe boundary, approved plan, visible evidence path and passed prerequisites.	One named scenario may proceed.
Integrated test	Initial state, stimulus, expected/actual response, synchronized evidence, stop/rollback and verified recovery.	Review without expanding scope.
Release	Accepted scenario matrix, as-left configuration, open-item limits, training, records and named owner approval.	Return only the documented scope.

SIX-STEP COMMISSIONING PROCEDURE

Run a bounded scenario, then prove the way back

01	**Fix the system boundary and authorities.** Name grid/PCC, switchgear, PCS, battery/BMS, EMS/SCADA, auxiliary/HVAC, fire and communications boundaries and each gate owner.
02	**Reconcile design, as-built identity and active configuration.** Record revisions, serials, firmware, settings, point maps, protection values, temporary changes and mismatches.
03	**Prove safe test readiness.** Confirm energy control, permits, emergency response, exclusion zones, calibrated instruments, initial state, witnesses, stop and rollback.
04	**Verify subsystem prerequisites.** Review approved battery/BMS, PCS, protection, EMS/SCADA, HVAC, fire, auxiliary and communications evidence.
05	**Execute one integrated scenario at a time.** Use an approved matrix for applicable normal, loss, alarm, trip, shutdown and recovery states. Record expected and actual sequence.
06	**Recover, reconcile and hand over.** Demonstrate rollback/recovery, explain gaps, restore accepted configuration, preserve raw records and transfer limits with sign-off.

EXPERT REVIEW

Questions before a scenario result becomes release evidence

- Does equipment identity and installed topology match the approved design and certification scope?
- Are subsystem results current, traceable and valid for the integrated configuration?
- Does each scenario define initial state, stimulus, expected response, stop, rollback, witness and evidence?
- Are protection, BMS, PCS, EMS/SCADA, auxiliary, HVAC and fire responses visible on a synchronized timeline?
- Does recovery prove the intended safe or operating state instead of only clearing an alarm?
- Are bypasses, temporary settings, punch-list items, training, warranties and restrictions explicit?

AS-LEFT HANDOVER

Transfer the state that actually exists

Configuration and readiness	Integrated proof and ownership
- Approved and as-left drawings - Asset, firmware, settings and point-map inventory - Installation and pre-energization evidence - Permit, energy-control, emergency-response and instrument records	- Subsystem packages and scenario matrix - Alarms, SOE/events, trends and witness notes - Stop, rollback, recovery and final-state evidence - Open limits, training, OEM actions and acceptance

Release record

Name the accepted operating scope, unresolved limitation, owner, required monitoring, rollback state and next review. Do not hide uncertainty behind a generic pass field.

OFFICIAL PRIMARY SOURCES

Use each source within its published system, product, country and site scope

1. **IEC 62933-5-1:2024**
   https://webstore.iec.ch/en/publication/72239
   Safety considerations, hazard identification, risk assessment and mitigation for grid-integrated EES systems.

2. **IEC 62933-2-1:2017**
   https://webstore.iec.ch/en/publication/27124
   EES system unit parameters and testing methods.

3. **U.S. DOE FEMP - Lithium-ion Battery Storage Technical Specifications**
   https://www.energy.gov/cmei/femp/articles/lithium-ion-battery-storage-technical-specifications
   Customizable U.S. federal procurement specification and checklist.

4. **UL Solutions - ESS Testing and Certification**
   https://www.ul.com/services/energy-storage-system-testing-and-certification
   UL 9540 system scope includes charging/discharging, protection, controls and device communications.

5. **NFPA 855:2026**
   https://link.nfpa.org/all-publications/855/2026
   U.S. stationary ESS installation standard; confirm local adoption and AHJ interpretation.

6. **OSHA 29 CFR 1910.333**
   https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.333
   U.S. electrical work practices, de-energization, verification and re-energization.

Application limit

IEC publications provide international system-level structures. DOE FEMP, NFPA, UL and OSHA sources describe United States procurement, code, certification or workplace scopes. They do not create one universal commissioning value. Confirm country, AHJ, utility/grid code, fire/building requirements, site permits, exact OEM instructions, certification scope, qualified-person requirements and responsible engineering/operations authority before testing or energization.

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