

RESTREPO STANDARD

Sized.
Sited.
Signed.

Pre-Power Rough-In Standard

Battery · Solar · Panels · Ground · Closeout

Power is a framing decision. Sized, sited, and signed before drywall.

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PREFACE

Energy systems do not arrive on a Restrepo project as a surprise. The battery pad, the solar conduit, the smart panel chassis, and the geothermal loop pathways are sized, sited, and signed before drywall closes. This standard codifies what is in the slab, in the wall, in the roof, and at the service entrance before the energy stack ships. Nine sections cover the pre-rough-in pathway: service entry, battery pad, solar pathway, smart panel, geothermal mechanical, EV / generator, monitoring and control bridge, without-written-direction, and the pre-pour checklist. The QC gate is the closeout signature that the home is ready for the energy stack.

This standard does not replace manufacturer instructions, code authorities, or professional licensing. NEC 2023 (NFPA 70) Articles 706, 690, 408, 110.26, 625, NFPA 855, UL 9540 / 9540A / 1741, NJ Successor Solar Incentive program rules, IRA Section 25D, and IGSHPA loop design standards govern. Manufacturer install guides from Tesla, FranklinWH, Enphase, Generac, SPAN, Lumin, Schneider Electric, WaterFurnace, ClimateMaster, and Bosch are the floor. See Citations for primary source URLs.

Power is a framing decision.

Sized, sited, and signed before drywall.

01 SERVICE ENTRY & PATHWAY

Every battery, solar, smart panel, geothermal, and EV pathway is sized and pulled before drywall closes. Restrepo's pre-power discipline includes labeled both-end terminations, spare conduit runs, and working-space verification at every panel and disconnect.

Service entrance upgrade

Confirm 200A or 400A residential service per Manual J + future EV + heat pump load. Coordinate with utility for new meter socket if upgrading. NEC 230 governs.

Battery-to-panel pathway

1-1/4" or 2" EMT from battery location to main panel and from battery to inverter. Two spare runs left in conduit for future bank expansion. NEC 706.

Solar DC-string pathway

3/4" or 1" EMT from roof junction box to inverter location. NEC 690.31 governs interior conductor routing. Label both ends RED 'PV DC'.

Smart panel low-voltage homerun

1" EMT from smart panel to network closet for Cat6A monitoring drop. SPAN, Lumin, and Square D each require dedicated app-side data path.

Geothermal loop entry

4" or 6" PVC sleeve through foundation wall for ground loop supply / return. Sealed to NJ residential code. Loop-to-mech-room pathway pre-poured.

EV charger homerun

1" EMT from main panel or smart panel to garage EV location. NEC 625 + 80% continuous load rule. Pull string for future second EVSE.

Working space

NEC 110.26: 36 in clear in front, 30 in clear width, 6 ft 6 in headroom at every panel, inverter, ATS, and disconnect. Verified at framing.

SPEC · WORKING SPACE

NEC 110.26 requires 36 in clear in front, 30 in clear width, and 6 ft 6 in headroom at every panel, inverter, ATS, and disconnect. Verified by AHJ at framing inspection. Working space is a framing decision before drywall closes.

02 BATTERY PAD & PROVISIONS

Battery selection drives pad size, clearances, and conduit. Tesla Powerwall 3, FranklinWH aPower 2, Enphase IQ Battery 5P, and Generac PWRcell 2 each have distinct mounting and clearance footprints. NFPA 855 governs separation distances regardless of brand.

BRAND	MODEL	CAPACITY / OUT	MOUNTING	BACKUP	NOTES
Tesla	Powerwall 3	13.5 kWh / 11.5 kW cont.	Wall or pad, 4 ft x 2 ft x 6 in tall envelope	Whole-home AC	Integrated solar inverter; up to 4 stackable; -4 F to 122 F operating range.
FranklinWH	aPower 2	15 kWh / 12 kW cont.	Wall or pad, 6 in clearance all sides	Whole-home AC	LFP chemistry; 36 kW peak; works with aGate hub for Vol 16 monitoring.
Enphase	IQ Battery 5P	5 kWh / 3.84 kW cont.	Stacked wall, 6 modules max	Partial / sunlight	LFP; microinverter ecosystem; 100 kg per module; floor or wall.
Generac	PWRcell 2	9-18 kWh modular	Indoor cabinet, 8 in side / 36 in front clearance	Whole-home + gen.	PWRmanager load control; integrates with PWRgenerator for hybrid.

PAD, CLEARANCE, AND POWER DISCIPLINE

- Battery pad: 4 ft x 2 ft level concrete or composite pad, NFPA 855 separation 3 ft from windows / openings / combustibles, 5 ft from egress paths.
- Indoor sites: garage or mechanical room only, dedicated room with 1-hr fire rating where required, no living-space wall-share without engineering.
- Conduit stub-up: 1-1/4" EMT from main panel to battery pad with one spare 3/4" EMT for future communications. NEC 706.
- Disconnect siting: rapid-shutdown switch within sight of ESS, marked per NEC 706.7. Service disconnect at exterior wall meets NJ requirements.
- Surge protection: Type 1 SPD at service panel + Type 2 SPD at smart panel. Both required for inverter warranty and code compliance.
- Spare hardware: minimum 5% spare conduit fittings, terminator boots, and labels delivered + labeled at closeout.

03 SOLAR PATHWAY & ROOF

Roof attachment plan, DC-string conduit, microinverter trunk, AC combiner, and rapid-shutdown initiator are sited before drywall. NEC 690 governs interior pathways; engineer-stamped wind/snow load is on file before the array installs.

ELEMENT	SPEC	QUANTITY / RANGE	PATHWAY	NOTES
Roof attachment plan	Sealed flashing per IRC R905; engineer-stamped wind/snow load	Per array layout	Stamped drawing on file	REC, Maxeon, Q.TRON all require non-penetrating or flashed mount per warranty.
DC-string conduit	3/4" or 1" EMT in attic + chase to inverter	Per string count	Roof JBox to inverter	NEC 690.31; conductor temp rating critical in attic spaces above 140 F.
Microinverter trunk cable	Enphase Q-Cable, 6 AWG IQ8	Per panel count	Roof to AC junction	Per IQ8 install: AC-side trunk; sized per max 13 modules per branch.
AC combiner / disconnect	Enphase IQ Combiner 5C or equivalent	1 per system	Wall-mounted, exterior-rated	Rapid shutdown initiator per NEC 690.12; UL 1741 listed.
Roof penetrations	Sealed to manufacturer + NJ residential code	Per attachment count	Through-roof JBox	Coordinate with roofer; closeout includes warranty assignment.

SOLAR & ROOF DISCIPLINE

- Solar pathway: 1 in EMT roof to inverter, J-box at attic to maintain conductor temp rating, rapid-shutdown initiator near service.
- Module selection: REC Alpha Pure-RX (heterojunction, 25-yr), Maxeon 7 (IBC, 40-yr), Q.TRON (TOPCon, 25-yr). All US-distributed and NJ-eligible.
- Inverter strategy: Enphase IQ8 microinverters by default for shading and per-module monitoring; SolarEdge DC-optimized acceptable for clean-roof builds.
- Snow / wind load: NJ ground snow 25-30 psf typical, basic wind 115 mph; engineer-stamped load calc on file before permit.
- Backup tie-in: Enphase IQ8 with IQ Battery enables Sunlight Backup; Tesla Powerwall 3 ties to PV at integrated DC-coupled inverter.
- NJ Successor Solar Incentive registration filed before energization; IRA Section 25D 30% credit retained per project record.

04 SMART PANEL PROVISIONS

The smart panel sits at the heart of the energy stack. SPAN, Lumin, and Square D differ in strategy: full service replacement vs retrofit overlay. NEC 408 and 110.26 govern. Backup priority list is owner-signed before pour.

Panel selection

SPAN Panel (32 circuit, per-circuit metering), Lumin (retrofit overlay), or Schneider Square D Energy Center. NEC 408 governs. UL 67 listed mandatory.

Service / sub-panel layout

Smart panel either replaces main service panel (SPAN, Square D) or sits downstream of meter (Lumin overlay). Confirm working space NEC 110.26.

Branch circuit accounting

Every circuit named, mapped, and labeled at install. Backup priority list (essential / preferred / non-critical) signed by owner before pour.

Communications drop

Cat6A from smart panel to network closet for cloud / app monitoring. Restrepo posture: owner-controlled monitoring, not vendor cloud-only.

Microgrid Interconnect Device

Square D Energy Center, FranklinWH aGate, Enphase IQ System Controller, or SPAN built-in. Sized per battery + PV output. UL 1741 listed.

Generator interlock

Mechanical interlock or ATS sized per generator output. Square D + Generac PWRcell + PWRgenerator hybrid pre-coordinated at panel layout.

Validation

Each load tested under battery before commissioning. Smart panel app maps every breaker. Owner walkthrough demonstrates load-shed sequence.

INSPECT · BACKUP PRIORITY VALIDATION

Every backed-up circuit tested under battery before commissioning. App map verified breaker-by-breaker. Owner walkthrough demonstrates load-shed sequence and outage simulation. Documented in QC log with timestamps.

05 GEOTHERMAL LOOP & MECHANICAL

Geothermal sizing precedes selection. Manual J governs tonnage; oversized loops disqualify variable-speed efficiency. WaterFurnace 7 Series, ClimateMaster Trilogy 45, and Bosch Greensource CDi all require IGSHPA-stamped loop design before drilling.

Loop selection

Vertical bore or horizontal trench per IGSHPA design. Vertical: 1 borehole per ton typical, 200-400 ft deep.
Horizontal: 1,500-2,000 ft per ton.

Loop fluid

Propylene glycol 20-30% for NJ freeze protection. Flush plan archived. Annual flush schedule documented at closeout.

Heat pump mounting

WaterFurnace 7 Series or ClimateMaster Trilogy 45 mounted on 4-in level concrete pad in mechanical room.
Vibration isolators per manufacturer.

Desuperheater

Hot-water priority loop tied to indirect tank or HPWH. Bosch Greensource CDi + DHW priority pre-piped before rough-in.

Closed-loop vertical

200-450 ft per ton, 15-20 ft pipe spacing per IGSHPA. Grout: thermally enhanced bentonite. Pressure test 100 psi for 30 min.

Manual J on file

Heat loss / heat gain calc matched to system tonnage. 4-8 ton typical luxury install. Oversize disqualifies system from variable-speed efficiency.

06 EV / GENERATOR PROVISIONS

EV and generator provisions are the second-half of resilience. NEC 625 governs EVSE; the 80% continuous-load rule sets circuit ampacity. Generator sizing is fuel-budget driven: 72 hours natural gas plus battery is the documented runtime baseline.

EV charger circuit

NEC 625: dedicated 40-60A circuit per L2 EVSE. Wallbox Pulsar Plus, Tesla Wall Connector, ChargePoint Home Flex acceptable. Load-managed if shared.

EV pathway and load

1" EMT from smart panel or main panel to garage location. 80% continuous load rule applies; 60A circuit yields 48A continuous output.

Generator pad

Generac PWRcell 2 hybrid, Generac Guardian 22-26 kW, or Kohler 14RESA. 5 ft from openings, 18 in clearance front per AHJ.

Generator fuel

Natural gas preferred where available; LP backup tank sized for 72 hr generator runtime + 24 hr battery + 20% reserve.

ATS sizing

Automatic transfer switch sized for backup load: whole-home (200A) or essentials (100A) per panel strategy. Service-rated ATS at exterior.

Documented runtime

8-12 hr battery, 72+ hr generator on natural gas, combined plan for outage of record duration. Owner-signed runtime expectation.

07 MONITORING & CONTROL BRIDGE

Energy data lives on owner devices, not vendor cloud-only. SPAN, FranklinWH aGate, Sense, and Emporia Vue 3 each offer different visibility paths. Crestron and Lutron consume telemetry read-only; no automated load-shed without owner consent.

Sense Energy Monitor

ML disaggregation; main panel CT install; cloud-dependent for full feature set. Optional adjunct for whole-home circuit visibility.

Emporia Vue 3

16 circuit-level CTs; local data option; open API; Restrepo posture for owner-controlled local monitoring.

SPAN dashboard

Native circuit-level monitoring; web + iOS; no third-party CT needed; integrates with SPAN Drive for EV management.

Crestron / Lutron bridge

Read-only Cat6A telemetry from monitoring API (SPAN, FranklinWH, Enphase) into home dashboard. No automated load shed without owner consent.

Owner data posture

Local-first export preferred; vendor cloud accepted only when archive-quarterly export is included in commissioning package.

Alert posture

Anomaly thresholds set at commissioning (battery <20%, panel overload, inverter fault). Owner notification rules signed before closeout.

08 WITHOUT WRITTEN DIRECTION

Seven actions do not occur on a Restrepo Vol 16 project without written direction from the Restrepo principal. Written direction means a signed project record entry, a documented principal authorization, or a formal client contract clause.

We do not commit the energy stack without written direction:

- 1 We do not pour the battery pad without written direction: NFPA 855 separation and pad sizing must be confirmed by manufacturer + AHJ before concrete is placed.
- 2 We do not energize PV without written direction: AHJ rough + final inspection sign-off and utility interconnection approval are required before commissioning.
- 3 We do not commit to a smart panel selection without written direction: SPAN, Lumin, and Square D differ in service-replacement vs overlay strategy; owner approval required.
- 4 We do not size geothermal loops without written direction: IGSHPA-stamped Manual J + loop design must be on file before drilling or trenching begins.
- 5 We do not undersize the EV circuit without written direction: NEC 625 80% continuous load rule governs; load-management hardware needed for shared circuits.
- 6 We do not omit rapid shutdown without written direction: NEC 690.12 module-level shutdown is required for new PV in NJ residential builds.
- 7 We do not skip working space without written direction: NEC 110.26 36 in front, 30 in width, 6 ft 6 in clear is verified at framing inspection.

09 PRE-POUR / PRE-DRYWALL CHECKLIST

Every item below is verified before the energy stack ships to the job site or drywall closes. Any unchecked item holds the milestone until remediated. The pre-pour checklist is the gate.

- ☐ Manual J on file; system tonnage matched; PV array layout stamped; battery model selected with owner sign-off
- ☐ Service entrance: 200A or 400A confirmed; meter socket coordinated with utility; main disconnect sited per NEC 230
- ☐ Battery pad: pad poured level; 4 ft x 2 ft x 6 in tall envelope; NFPA 855 clearances marked; conduit stubbed
- ☐ Solar pathway: roof attachment plan stamped; 1 in EMT roof to inverter; J-boxes set; rapid-shutdown initiator pathway in place
- ☐ Smart panel: chassis set; backup priority list signed; Cat6A to network closet pulled; MID pathway terminated
- ☐ Geothermal: loop bored or trenched; pressure test logged; foundation sleeve sealed; mechanical room pad poured
- ☐ EV / generator: dedicated EV circuit pulled; generator pad poured; gas / LP rough-in coordinated; ATS sited
- ☐ Working space: NEC 110.26 verified at every panel, inverter, ATS, disconnect; 36 in front, 30 in width, 6 ft 6 in headroom
- ☐ Monitoring: SPAN / FranklinWH / Sense / Emporia Cat6A drop confirmed; owner data posture signed
- ☐ Labels and incentives: NJ SuSI registration filed; IRA 25D paperwork archived; AHJ permits posted at panel

QC

QC GATE · 10-ITEM PRE-POWER PASS/FAIL

All 10 items must be PASS before the energy stack ships and before drywall closes. Every item is reviewed by the project lead. Any failed item holds the milestone until resolved.

#	QC GATE ITEM	PASS	FAIL
1	Manual J on file; system sized to load Heat loss/gain calc matches PV output, battery capacity, and heat pump tonnage. Stamped or	PASS / SIGN	FAIL / HOLD
2	Battery pad poured to spec Level 4 ft x 2 ft x 6 in pad. NFPA 855 clearances marked. Conduit stubbed for power + comms.	PASS / SIGN	FAIL / HOLD
3	Solar array stamped and pathway pulled Engineer-stamped wind/snow load. 1 in EMT roof to inverter. J-boxes set. Rapid-shutdown	PASS / SIGN	FAIL / HOLD
4	Smart panel chassis set + circuits mapped Chassis mounted. NEC 110.26 working space verified. Backup priority list signed by owner.	PASS / SIGN	FAIL / HOLD
5	Geothermal loops pressure-tested Loops at 100 psi for 30 min, no drop. Flow rate per ton verified. Foundation sleeve sealed.	PASS / SIGN	FAIL / HOLD
6	EV + generator provisions in place Dedicated EV 40-60A circuit; generator pad poured; gas/LP rough confirmed; ATS sited per	PASS / SIGN	FAIL / HOLD
7	Working space verified at every panel NEC 110.26: 36 in front, 30 in width, 6 ft 6 in headroom at all panels, inverters, ATS, and	PASS / SIGN	FAIL / HOLD
8	Rapid shutdown + disconnects sited NEC 690.12 module-level shutdown installed. Service disconnect at exterior wall. Battery rapid shutdown within	PASS / SIGN	FAIL / HOLD
9	Monitoring drop and posture signed Cat6A from smart panel and battery aGate / IQ to network closet. Owner data posture	PASS / SIGN	FAIL / HOLD
10	Permits and incentives archived AHJ permits posted at panel. NJ Successor Solar Incentive registration filed. IRA Section 25D paperwork archived.	PASS / SIGN	FAIL / HOLD

PROJECT LEAD SIGN-OFF

Signature / printed name

DATEMM/DD/YYYY

PROJECT

REF

CITATIONS & PRIMARY SOURCES

- 1 NEC 2023 (NFPA 70) Article 706 · Energy Storage Systems**
NFPA 70 primary source for ESS installation, listing, disconnect, ventilation, and signage requirements.
<https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=70>
- 2 NEC 2023 (NFPA 70) Article 690 · Solar Photovoltaic Systems**
NFPA 70 primary source for PV systems including rapid shutdown (690.12) and conductor pathway rules.
<https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=70>
- 3 NEC 2023 (NFPA 70) Article 408 · Switchboards and Panelboards**
NFPA 70 primary source for service equipment, working space, and overcurrent ratings at smart panels.
<https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=70>
- 4 NEC 2023 (NFPA 70) Section 110.26 · Working Space**
NFPA 70 primary source for clear working space at panels, inverters, ATS, and disconnects.
<https://up.codes/s/working-space>
- 5 NEC 2023 (NFPA 70) Article 625 · EV Charging**
NFPA 70 primary source for EVSE installation, load calc allowance, GFCI, and disconnect rules.
https://up.codes/viewer/new_jersey/nec-2023/chapter/6/special-equipment
- 6 NFPA 855 · Stationary Energy Storage Systems**
NFPA 855 primary source for ESS separation distances, fire detection, suppression, and commissioning records.
<https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=855>
- 7 UL 9540 · Energy Storage Systems and Equipment**
UL primary source for the listing standard governing battery + inverter energy storage systems.
<https://www.ul.com/services/ul-9540-energy-storage-systems-and-equipment>
- 8 UL 9540A · Test Method for Thermal Runaway Propagation**
UL primary source for the test method establishing fire propagation behavior in ESS.
<https://www.ul.com/services/ul-9540a-test-method>
- 9 UL 1741 · Inverters, Converters, Controllers and Interconnection System Equipment**
UL primary source for the inverter listing standard required for grid interconnection.
<https://www.ul.com/services/ul-1741-inverters-converters-controllers-and-interconnection-system-equipment>
- 10 Tesla Powerwall 3 Datasheet**
Tesla primary source for Powerwall 3 capacity, continuous output, integrated solar inverter, and warranty.
https://www.tesla.com/sites/default/files/pdfs/powerwall/Powerwall_3_Datasheet.pdf
- 11 FranklinWH aPower 2 Product Page**
FranklinWH primary source for aPower 2 LFP battery, aGate hub, and whole-home AC backup.
<https://www.franklinwh.com/storage/products/apower-2>
- 12 Enphase IQ Battery 5P Specifications**
Enphase primary source for IQ Battery 5P modular LFP storage and microinverter integration.
<https://enphase.com/store/storage/iq-battery-5p>
- 13 Generac PWRcell 2 Product Page**
Generac primary source for PWRcell 2 modular DC-coupled storage with PWRmanager load control.
<https://www.generac.com/clean-energy/pwrcell-2>
- 14 REC Alpha Pure-RX Module**
REC Group primary source for Alpha Pure-RX heterojunction module with 25-year product and power warranty.
<https://www.recgroup.com/en/products/alpha-pure-rx>
- 15 Maxon 7 Residential Solar Panel**
Maxeon primary source for IBC architecture residential modules with 40-year warranty.
<https://www.maxon.com/us/products/maxon-7>

REF CITATIONS & PRIMARY SOURCES (CONT.)

Qcells Q.TRON BLK M-G2+ Module

- 16 Qcells primary source for the Q.TRON N-type TOPCon module assembled in the United States.
<https://qcells.com/us/get-started/complete-energy-solution/solar-panel>

Enphase IQ8 Microinverters

- 17 Enphase primary source for IQ8 grid-forming microinverters with Sunlight Backup capability.
<https://enphase.com/microinverters>

SPAN Smart Panel

- 18 SPAN primary source for the 32-circuit smart panel with per-circuit metering and load control.
<https://www.span.io/panel>

Lumin Smart Panel

- 19 Lumin primary source for the retrofit overlay smart panel that prioritizes loads on battery.
<https://www.luminsmart.com/>

Schneider Square D Energy Center

- 20 Schneider primary source for the Square D Energy Center with Microgrid Interconnect Device.
<https://www.se.com/us/en/product-category/50400-residential-and-small-business-load-centers>

WaterFurnace 7 Series Geothermal Heat Pump

- 21 WaterFurnace primary source for 7 Series variable-speed geothermal with IntelliZone2 zoning.
<https://www.waterfurnace.com/residential/products/7-series>

ClimateMaster Trilogy 45 Q-Mode

- 22 ClimateMaster primary source for Trilogy 45 variable-speed geothermal with integrated DHW priority.
<https://www.climatemaster.com/residential/products/Trilogy-Q-Mode-Geothermal-Heat-Pump>

Bosch Greensource CDi Series

- 23 Bosch primary source for the Greensource CDi two-stage geothermal heat pump.
<https://www.bosch-thermotechnology.us/us/us/residential/products/heat-pumps/geothermal/>

IGSHPA · International Ground Source Heat Pump Association

- 24 IGSHPA primary source for ground loop sizing, grout, header, and pressure test specifications.
<https://igshpa.org/>

NJ Successor Solar Incentive (SuSI) Program

- 25 NJ Clean Energy primary source for the SREC-II program and 15-year fixed solar incentive payments.
<https://www.njcleanenergy.com/renewable-energy/programs/successor-program>

IRS Section 25D · Residential Clean Energy Credit

- 26 IRS primary source for the 30% federal credit on solar, battery, and geothermal through 2032.
<https://www.irs.gov/credits-deductions/residential-clean-energy-credit>

IRS Section 30C · Alternative Fuel Vehicle Refueling Property Credit

- 27 IRS primary source for the federal EV charger credit applicable to residential installations.
<https://www.irs.gov/credits-deductions/alternative-fuel-vehicle-refueling-property-credit>