

FIELD MANUAL · VOLUME 21

Stubbed. Sealed. Signed.

The slab is poured once.

Stub the conduit before the concrete sets.

PREPARED FOR

Operators · Project Managers · Designers · Integrators · Owner's Reps

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MANIFESTO

The slab is poured once. Stub the conduit before the concrete sets.

Vol 21 governs the complete build-out of a luxury three-car residential garage and integrated EV workshop in Franklin Lakes, New Jersey. The scope encompasses six tightly coordinated pillars: EV charging infrastructure, garage subpanel and service sizing, vehicle lift and equipment power, compressed air and dust collection, workshop HVAC and make-up air, and slab, drain, and polyaspartic floor systems. Smart-home integration via Crestron Home, Lutron RA3, and Control4 governs all five locked operational scenes. Every conduit stub-up, trench drain, lift anchor zone marking, and ground rod location must be set in the slab formwork, photographed, and approved before the concrete truck arrives. The polyaspartic topcoat is an irreversible surface. Core-drilling after the Penntek PT 300 coat is a maintenance patch, not an invisible repair. The garage is not a technology layer added after construction — it is infrastructure from the first footing stake.

SCOPE

Residential-only. Applies to new luxury garage and EV workshop construction and major renovations within Restrepo Innovations projects in the NJ/NY metro corridor (IECC Climate Zone 4A). NJ Bergen County frost depth: 36 inches. Winter design temperature: 13°F (ASHRAE 99th percentile). Governing codes: NEC 2023 Articles 110, 210.8(A)(2), 210.12, 215, 220, 225, 230, 240, 250, 300, 408, 422, 511 (excluded — residential, not commercial), 590, 625; IRC 2021 R302.5/R309/R314/R315/R506; NJ UCC NJAC 5:23; ANSI/ALI ALCTV-2017 (lift certification); ASTM F2170 (slab moisture); ICRI Technical Guideline 310.2R (surface prep); UL 2202/2231/2594. The manifesto: the slab is poured once. Stub the conduit before the concrete sets.

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PART 1

Charge & Subpanel

Sections 01–03 — Operating Principles, EV Charging Equipment, Garage Subpanel & Load

Operating Principles

PART I — CHARGE & SUBPANEL

The luxury residential garage has evolved from a vehicle-storage bay into a precision technology suite requiring the same sequencing discipline as the home's electrical rough-in. Six interdependent pillars — EV charging, subpanel and load management, vehicle lift power, compressed air and dust collection, workshop HVAC and make-up air, and slab and floor coordination — each carry a one-shot rough-in gate tied to the concrete pour. The conduit stub under a future EV charging position cannot be added after the polyaspartic topcoat is applied. The lift anchor zone cannot be relocated without full demolition of the slab. The slab is poured once. Stub the conduit before the concrete sets.

THE FOUR PARTS OF THIS VOLUME

Part	Sections	Primary Disciplines
I — Charge & Subpanel	01–03	EV charging equipment, EVSE specs, NEC 625 circuit sizing; garage subpanel 200A, NEC 250.32(B) grounding, SPD, AFCI/GFCI
II — Lift & Air	04–06	Vehicle lift power, NEC 422.31 disconnect, ANSI/ALI ALCTV-2017; compressed air, dust collection; workshop HVAC, IRC R302.5.1 separation
III — Slab & Surge	07–10	Slab, trench drain, Penntek PT 300 epoxy; conduit pre-slab discipline; workshop lighting, Cat6A, security; smart-home scenes
IV — Discipline & Closeout	11–13	Without written direction; pre-slab and pre-epoxy checklist; QC audit and closeout signoff

THE SIX PILLARS

Pillar	Scope	One-Shot Gate
1 — EVSE	Tesla TWC Gen 3, ChargePoint CPH50, Wallbox Pulsar Plus; three individual 60A circuits at 48A continuous per NEC 625.42	Conduit stub-ups at each parking position before slab pour
2 — Subpanel	200A Square D QO130M200PG or Eaton CH200L200P; NEC 250.32(B) 4-wire feeder; NEC 230.67 Type 2 SPD; NEC 220.83/220.87 load calc	Feeder conduit (2-inch Schedule 80 PVC) stub through slab before pour
3 — Lift/Air	BendPak HD-9XW 9,000 lb ANSI/ALI ALCTV-2017; Quincy QGS-5 rotary screw compressor; NEC 422.31 lockable disconnect; NEC 511 excluded	Lift anchor zone marked on formwork; compressor conduit stub before pour
4 — Dust/HVAC	Oneida V-System 3000 3HP HEPA; Mitsubishi MSZ-FH24NA operates to 14°F; IRC R302.5.1 fire-rated garage separation	HVAC line-set penetration location set before exterior envelope closes

5 — Slab/Epoxy	IRC R506 4-inch slab 3,000 PSI; ASTM F2170 RH test; ICRI 310.2R CSP 3–4; Penntek PT 300 93% solids polyaspartic; NDS Mini Channel	All conduit flush, trench drain set, vapor barrier inspected before pour
6 — Lighting/Net	Lithonia ZL1D 5000K 90 CRI DLC Premium; Ubiquiti U7 Pro Wall Wi-Fi 7; Cat6A; 4K PoE cameras; Aiphone IXG; IRC R314/R315 heat/CO	Conduit raceways set before slab; network conduit from MDF to IDF before walls close

FIELD RULE

Stub before slab. There is no corrective access after the pour.

All conduit stub-ups, trench drain formwork, lift anchor zone markings, vapor barrier laps, and ground rod locations must be set, photographed, and approved before the concrete truck arrives. The pre-slab gate is signed by the GC project manager, MEP lead, and Restrepo AV/smart-home lead. No exceptions are granted after the slab pours; corrections require demolition of the finished surface.

SPECIFICATION

Residential-only discipline throughout.

Every provision in Vol 21 is residential. NEC Article 511 hazardous-location classification applies only to commercial garages with fuel-dispensing equipment and to in-ground hydraulic lift cylinder pits. NEC 511 is explicitly out of scope for attached residential garages and for all surface-mount and pit-style above-grade BendPak lifts specified here. NJ UCC NJAC 5:23 governs AHJ enforcement. Spare hardware at ≥5% of installed equipment value is delivered and labeled at every project closeout per Restrepo policy.

NOTE

NJ Climate Zone 4A — winter design, slab moisture, and EVSE cold-weather.

Northern NJ (Bergen County, Franklin Lakes): 36-inch frost depth, 13°F winter design temperature (ASHRAE 99th percentile), humid soil (Class II vapor retarder required under slab per IRC R506.2.3). All EVSE specified here operate to –22°F or colder, well below the NJ design temperature. Mitsubishi MSZ-FH24NA mini-split maintains rated heating to 14°F outdoor. Penntek PT 300 polyaspartic can be applied as low as –20°F with the X-treme Heat formulation. Slab moisture testing per ASTM F2170 is performed no sooner than 28 days after pour and after HVAC is operational in the garage.¹

SOURCES

¹ [NJ Uniform Construction Code — NJAC 5:23 \(NJ DCA\)](#)



§ 02

EV Charging Equipment

PART I — CHARGE & SUBPANEL

Electric vehicle supply equipment (EVSE) for a luxury three-car garage is sized for maximum overnight charging performance: three individual 60A dedicated two-pole circuits, one per bay, each supporting a 48A continuous load per NEC 625.42 (80% continuous load rule). The North American EVSE connector ecosystem standardized around SAE J3400 (NACS) in 2023; Restrepo Innovations specifies J3400-native or J3400-compatible equipment for all new construction to ensure any combination of Tesla and non-Tesla vehicles charges at full rated power without owner-supplied adapters.²

PRIMARY EVSE SPECIFICATION — THREE-CAR GARAGE

Model	Output	Circuit	Wire	Enclosure	Notes
Tesla TWC Gen 3 ² (P/N 1457768-00-E)	48A / 11.5 kW 240V	60A 2-pole d edicated	#6 AWG THHN Cu	NEMA 3R –40°F–122 °F	SAE J3400 (NACS); Group Power Mgmt up to 6 units; Dynamic Power Mgmt EMS; NEC 625.42(A); NJBPU Charge Up \$250
ChargePoint CPH50 ³ (CPH50-NACS-L23)	50A / 12 kW 240V adj. 16–50A	60A 2-pole d edicated	#6 AWG THHN Cu	NEMA 3R –22°F–122 °F	UL 2594/2231; ENERGY STAR; 20 mA CCID satisfies NEC 625.47; non-GFCI breaker required (external GFCI conflicts with CCID); NJBPU \$250
Wallbox Pulsar Plus 48A ⁴	48A / 11.5 kW 240V adj. 16–48A	60A 2-pole d edicated	#6 AWG max 105°C	Type 4 IP55	7-position rotary switch; UL 2594/2231; ENERGY STAR; J1772 + Tesla-to-J1772 adapter P/N 1800778-00-A; NJBPU \$250
Emporia Classic 48A ⁵	48A / 11.5 kW 240V adj. 16–48A	60A 2-pole d edicated	#6 AWG Cu	NEMA Type 4 –2 2°F–122°F	UL 2594/2231/991; ENERGY STAR; J1772 or NACS per SKU; NJBPU \$250 eligible; NEMA 4 (superior to 3R)
FLO Home X8 ⁶	80A / 19.2 kW 240V adj. 6–80A	100A 2-pole d edicated	#4 AWG Cu	Type 4X aluminum	Hardwire only; J1772; 25 ft cable; daisy-chain capable; for Rivian R1T/R1S (Gen2) or high-acceptance-rate platforms

NEC ARTICLE 625 — KEY CIRCUIT RULES

NEC Article	Requirement	Application
625.40	Each EVSE >16A or 120V on an individual branch circuit; exception only with listed EMS per 750.30	One dedicated 60A circuit per EVSE position; no shared circuits without TWC Dynamic Power Management

625.42	EVSE loads are continuous; circuit at 125% of EVSE output amperage (80% rule)	48A EVSE → 60A circuit; 40A EVSE → 50A circuit; confirm wire and breaker sizing against NEC 310
625.42(A)	EMS per Article 750.30 may allow multiple EVSE on a shared feeder sized to EMS permitted load	Tesla Dynamic Power Management is a listed EMS; enables NEC 220.87 actual-demand load calc for service sizing
625.47	EVSE must include listed CCID (Charging Circuit Interrupting Device) for personnel protection	20 mA CCID built into all listed Level 2 chargers satisfies GFCI requirement for EVSE circuits; no panel GFCI needed on 240V EVSE circuit
210.8(A)(2)	GFCI on all 125V/15A and 20A receptacles in attached garages of dwelling units	Workshop convenience receptacles, bench outlets, and all 120V general-use outlets require GFCI; 240V EVSE circuits exempt

SPECIFICATION**NEC 625.42 — 80% continuous load rule applies to every EVSE circuit.**

An EVSE drawing 48A continuously is a continuous load per NEC 625.42 and NEC 210.19(A)(1). The branch circuit must be sized at 125% of the continuous load before applying derating factors: $48A \times 1.25 = 60A$ minimum circuit ampacity. Wire: #6 AWG THHN copper minimum for a 60A circuit (75°C rating). Breaker: 60A two-pole dedicated. Any deviation — using a 50A breaker on a 48A unit, or reducing wire to #8 AWG — is a code violation. Confirm with the Bergen County AHJ that the load calculation and circuit schedule are accepted before permit is issued.⁷

BEST PRACTICE**Three individual 60A circuits — not Group Power Management for primary charging.**

Tesla Group Power Management allows up to six Wall Connectors on a single 60A circuit; when all three vehicles charge simultaneously, each receives a maximum of 16A (3.8 kW). For a luxury three-car garage, the preferred standard is three individual 60A circuits — one per bay — guaranteeing each vehicle charges at the full 48A / 11.5 kW rated rate whenever plugged in. Group Power Management on a shared circuit is appropriate only as a secondary lift-bay or valet charging position, not the primary overnight charging configuration.

FIELD RULE**NJBPU Charge Up \$250 rebate and federal IRS Form 8911 credit.**

The NJ Board of Public Utilities Charge Up NJ program provides a \$250 residential rebate for purchase and installation of an ENERGY STAR listed Level 2 EVSE. Apply within 14 days of installation at njcleanenergy.com/ev. Tesla TWC Gen 3, ChargePoint CPH50, Wallbox Pulsar Plus, and Emporia Classic 48A are all NJBPU eligible. The federal IRS Form 8911 Alternative Fuel Refueling Property Credit provides 30% of total hardware plus installation cost, with a \$1,000 residential cap. PSE&G; Smart Charge NJ adds up to \$1,500 bill credit for qualifying installs. File all three before the installation permit closes.⁸

SOURCES

² [Tesla Wall Connector Gen 3 Installation Guide \(Tesla Support\)](#) ³ [ChargePoint Home Flex CPH50 Datasheet \(PDF\)](#) ⁴ [Wallbox Pulsar Plus NA Installation Guide \(PDF\)](#) ⁵ [Emporia EV Charger Technical Spec Sheet \(PDF\)](#) ⁶ [FLO Home X8 Spec Sheet \(PDF\)](#) ⁷ [NEC 625.42 Rating — 80% Continuous Load Rule \(ElectricalLicenseRenewal\)](#) ⁸ [NJ Clean Energy — Charge Up NJ Residential EVSE Rebate](#)

§ 03

Garage Subpanel & Load

PART I — CHARGE & SUBPANEL

A three-car luxury garage with EV charging, vehicle lift, compressor, dust collection, and workshop lighting represents the largest new electrical load most residential services will encounter. The baseline specification is a 200A main-breaker garage subpanel fed by a 4-wire feeder from the main residential service per NEC 250.32(B). Two load-calculation methods govern feeder sizing: NEC 220.83 (standard demand method) and NEC 220.87 (actual-demand monitoring). When Tesla Dynamic Power Management (an EMS per NEC 625.42(A)) is deployed, NEC 220.87 consistently validates the existing 200A residential main service without upgrade for this garage load profile.⁹

SUBPANEL SELECTION — 200A RESIDENTIAL GARAGE

Model	Rating	Spaces	Key Features	Notes
Square D QO130M200PG ⁹	200A main breaker	30 spaces	Plug-on Neutral; ground bar included; QO 3/4-in pitch; UL E8460	Accepts QO AFCI+GFCI combo breakers (QO115CAFGN); NEC 250.32(B) — remove green bonding screw
Eaton CHSUR200P ¹⁰	200A main breaker	30 spaces	Factory SPD (SUR suffix); split neutral/ground bars; CH 3/4-in pitch; UL E8741	Factory SPD satisfies NEC 230.67 at subpanel; AFCI+GFCI combo breakers (CHFAFGF115) available; NEC 250.32(B) compliant
Siemens PL4040B200PG	200A main breaker	40 spaces	Ground bar included; QP breakers; AFCI+GFCI combo available	More spaces for three-car garage with multiple dedicated circuits; confirm Siemens availability with local supplier

LOAD CALCULATION — THREE-CAR EV GARAGE (NEC 220.83)

Load	Demand (VA)	Circuit	Wire
Three 48A EVSE (NEC 220.57 — at nameplate) 3 × (48A × 240V × 1.25)	43,200 VA (43.2 kVA)	3 × 60A 2-pole	#6 AWG Cu each

BendPak HD-9XW lift (220V / 1Ph)	4,800 VA (20A motor)	30A 2-pole	#10 AWG Cu
Quincy QGS-5 rotary screw compressor (230V / 25A FLA)	6,000 VA	30A 2-pole	#10 AWG Cu
Oneida V-System 3000 dust collector (240V / 13A)	3,120 VA	20A 2-pole	#12 AWG Cu
Mitsubishi MSZ-FH24NA mini-split (240V / 15A MCA)	3,500 VA	15A 2-pole	#14 AWG Cu
Workshop lighting and 120V receptacles (est.)	3,000 VA	Multiple 20A	#12 AWG Cu
TOTAL (nameplate sum before demand factors)	≈63.6 kVA ≈265A @ 240V	200A subpanel recommended	2/0 AWG Cu feeder or 4/0 AWG Al

SPECIFICATION**NEC 250.32(B) — 4-wire feeder, floating neutral, separated EGC.**

In an attached garage subpanel, NEC 250.32(B) requires: (1) 4-wire feeder (two hots, one neutral, one equipment grounding conductor); (2) remove the green bonding screw from the neutral bar at the garage subpanel; (3) neutral bar floats — not bonded to panel enclosure; (4) EGC bar bonds to enclosure and runs back to the main panel EGC. A floating neutral prevents neutral current from appearing on the equipment grounding path. Bergen County AHJs enforce this requirement on all 4-wire garage feeders. Minimum EGC: #4 AWG copper per NEC Table 250.122 for a 200A overcurrent device.¹¹

INSPECTION STANDARD**Type 2 SPD at garage subpanel per NEC 230.67.**

NEC 230.67 requires a surge-protective device (SPD) at all new dwelling unit services. Practical recommendation: install a Type 2 SPD at the garage subpanel in addition to the main house SPD. Square D HEPD80 (80 kA, panel-mount, QO compatible) or Eaton CHSPCMF (CH panel) are the specified devices. SPD indicator status is monitored annually; a faded or open indicator triggers replacement before the next lightning season. The Eaton CHSUR200P includes a factory-installed SPD module that satisfies NEC 230.67 without a separate panel-mount device.¹²



BEST PRACTICE**NEC 220.87 actual-demand method with Tesla Dynamic Power Management.**

If the existing 200A residential service has no headroom for the nameplate EVSE sum, deploy Tesla Dynamic Power Management (EMS per NEC 625.42(A)). Wire a CT meter to the main residential panel per Tesla cable P/N 1133339-00-A. The EMS caps total EVSE load when home demand spikes. With NEC 220.87 actual-demand data from PSE&G; smart meter history, the practical feeder calculation typically lands at 150–200A, validating the existing service without an expensive upgrade. Submit the EMS documentation to Bergen County AHJ with the permit application.¹³

NOTE**NEC 110.26 working clearance — label and maintain.**

Minimum 36 inches of working clearance in front of the panelboard per NEC 110.26. Minimum width: 30 inches or the panel width, whichever is greater. Height: 6 ft 6 in. Post a working-clearance label on or near the panel. No storage in the clearance zone. A vehicle parked adjacent to the panel must not reduce the 36-inch clearance; locate the subpanel on the side wall, not the back wall behind a parking position, on projects where this applies.

SOURCES

⁹ Square D QO Load Centers Product Family (Schneider Electric) ¹⁰ Eaton Type CH Loadcenter and Circuit Breaker Catalog (PDF) ¹¹ NEC 250.32 Grounding at Separate Buildings (EC&M Magazine) ¹² NEC 230.67 Surge Protection — DITEK Understanding 2023 NEC Rules ¹³ Calculating Electric Service Needs — NEC 220.83 and 220.87 (GreenBuildingAdvisor)

PART 2

Lift & Air

Sections 04–06 — Vehicle Lift & Equipment, Compressed Air & Dust Collection, Workshop HVAC &

§ 04

Vehicle Lift & Equipment

PART II — LIFT & AIR

Vehicle lifts for a luxury residential three-car garage require a concrete slab of minimum 4 inches at 3,000 PSI (28-day cure) per ANSI/ALI ALCTV-2017, a lockable disconnect within sight per NEC 422.31, and clear ceiling height of at least 10 ft 6 in for the BendPak HD-9XW extra-tall four-post lift with a vehicle elevated to 82-inch max rise. NEC Article 511 — hazardous-location classification and explosion-proof wiring — applies only to commercial garages with fuel-dispensing equipment and to in-ground hydraulic lift cylinder pits. This project is residential-only; NEC 511 is explicitly out of scope for all surface-mount and pit-style above-grade BendPak lifts specified here.¹⁴

BENDPAK LIFT SELECTION — RESIDENTIAL GARAGE APPLICATIONS

Model	Capacity	Circuit	Rise	Column Height	Notes
HD-9XW ¹⁴ (SKU 5175863)	9,000 lb 4-post	30A 2-pole 240V / 1Ph	82 in (extra-tall)	100 in (req. 10 ft 6 in ceiling)	ETL/CE; ANSI/ALI ALCTV-2017; 220 VAC 1Ph; pneumatic safety locks (30 PSI / 3 CFM req.); primary luxury garage spec
HD-9ST ¹⁴ (SKU 5175860)	9,000 lb 4-post	30A 2-pole 240V / 1Ph	70 in (standard)	Same electrical as HD-9XW	Narrower overall width; standard-height version; same ALI certification; use where ceiling clearance is limited
HD-7P	7,000 lb 4-post storage	30A 2-pole 240V / 1Ph	Per model	Lower height	Second-tier storage platform; park one vehicle elevated; drive second vehicle below; same 30A circuit
P-9000LT ¹⁵	9,000 lb pit-style above-grade	25A fuse min 208–240V / 1Ph / 1.5 HP	24 in (low-rise)	Surface-mount hydraulic above grade	NOT an in-ground lift; NEC 511 hazardous-location requirements DO NOT apply; 11A operating amps; 30 PSI / 10 CFM min for safety lock

LIFT BAY SUPPORTING EQUIPMENT

Equipment	Specs	Circuit	Notes
Lockable disconnect Eaton DH321FGK	30A 240V fusible safety switch; NEMA 1	Fed from lift circuit	NEC 422.31 — within sight of lift motor, ≤50 ft; lockable in open position; fuse ratings matched to motor FLA

LiftMaster 8500W ¹⁶ jackshaft opener	115V / 60 Hz DC brushless; 1,500-lumen LED; MyQ Wi-Fi; battery backup	120V 15A dedicated outlet per bay	Wall-mount frees ceiling for 4-post lift rise clearance; Control4/Crestron Home integration via MyQ; requires high-lift track for 8 ft+ doors
E-stop button mushroom-head	Per ANSI/ALI ALCTV-2017; in series with lift power	Lift branch circuit	One at each lift bay; stops all movement; required accessible from operator position and from lift structure

SPECIFICATION

NEC 511 EXCLUDED — residential garage; no hazardous-location classification.

NEC Article 511 hazardous-location wiring requirements apply to commercial garages with Class I flammable vapor hazards from fuel-dispensing equipment, and to in-ground hydraulic lift cylinder pits where the below-grade space constitutes a Class I Division 1 zone per NEC 511.3. This project is a residential attached private garage. No fuel-dispensing equipment is present. All BendPak 4-post and P-9000LT lifts are surface-mounted or pit-style with the hydraulic system entirely above grade. NEC 511 does not apply. Explosion-proof wiring is not required. This exclusion must be documented in the permit package submitted to the Bergen County AHJ.

FIELD RULE

ANSI/ALI ALCTV-2017 — concrete, anchor zone, and slab age.

ANSI/ALI ALCTV-2017 requires minimum 4-inch concrete at 3,000 PSI (28-day cure) for a four-post lift column anchor. The lift footprint for the HD-9XW (12 ft × 24 ft minimum) must be free of control joints and expansion joints within the column anchor footprint — saw-cut control joints must be outside column locations. Slab age minimum 28 days before lift installation. Mark the anchor zone on the slab formwork before the pour and photograph the marked formwork as a pre-pour QC gate item.¹⁴

INSPECTION STANDARD

NEC 422.31 — lockable disconnect within sight of every motor-driven appliance.

NEC 422.31 requires a lockable disconnecting means visible from and within 50 feet of each fixed motor-driven appliance: the BendPak lift power unit, the Quincy QGS-5 compressor, and the Oneida V-System 3000 dust collector. Eaton DH321FGK (30A 240V NEMA 1 fusible safety switch) is the specified device at lift and compressor; a matching 20A fusible switch at the dust collector. Each disconnect is labeled with the circuit ID, panelboard location, and fuse rating. A field tag identifies each circuit served.

SOURCES



¹⁴ [BendPak HD-9XW Four-Post Extra-Tall Lift \(SKU 5175863\)](#) ¹⁵ [BendPak P-9000LT Low-Rise Pit Style Lift \(Product Page\)](#) ¹⁶ [LiftMaster 8500W Elite Series Jackshaft Opener \(Garaga\)](#)

§ 05

Compressed Air & Dust Collection

PART II — LIFT & AIR

A luxury three-car workshop with a vehicle lift, tire changer, and woodworking capability requires a rotary screw air compressor for near-100% duty cycle operation and a HEPA cyclone dust collector sized for the combined extraction load of all connected tools. The Quincy QGS-5 rotary screw compressor delivers 16.6 CFM at 90 PSI with 64 dB noise and 100% duty cycle — 14 dB quieter and indefinitely sustainable vs. the Ingersoll Rand SS5L5 reciprocating alternative at 78 dB and 50% duty cycle. Both compressor and dust collector require lockable disconnects within sight per NEC 422.31.¹⁷

AIR COMPRESSOR COMPARISON

Model	Type	HP / Voltage	CFM @ 90 PSI	Noise	Circuit	Notes
Quincy QGS-5 ¹⁷	Rotary screw	5 HP / 230V 1Ph	16.6 CFM	64 dB	30A 2-pole 240V #10 AWG Cu	100% duty cycle; 60-gal tank; integrated refrigerated dryer; 25A FLA; primary luxury workshop spec
Quincy QGS-7.5 ¹⁷	Rotary screw	7.5 HP / 230V 1Ph	21.2 CFM	64 dB	40A 2-pole 240V #8 AWG Cu	Higher output for heavy tool use; same noise signature; 60-gal; specify where >16 CFM sustained required
Ingersoll Rand SS5L5 ¹⁸	Reciprocating	5 HP / 230V 1Ph	18.1 CFM	78 dB	30A 2-pole 240V #10 AWG Cu	50% duty cycle only; 60-gal vertical tank; 21.5A; cast iron pump; adequate for occasional-use workshops only

DUST COLLECTOR SELECTION

Model	HP / Voltage	Actual CFM	Filter	Connect or	Circuit	Notes
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Oneida V-System 3000 ¹⁹ (SKU XXVM003)	3 HP / 220–240V 1Ph / 13A	1,349 actual CFM @ 2.3" WC	E12 HEPA-grade ePTFE FlameGuard	NEMA 6-20 (25 0V/20A)	20A 2-pole 240V dedicated	cETLus; NFPA Compliance Ready; 15-in non-sparking impeller; 74 dBA @ 10 ft; 35-gal drum; RF remote; primary spec
Laguna P Flux 3 ²⁰	3 HP / 220V 1Ph / 22A	2,718 free fan CFM; 1,624 shop	HEPA cartridge 102 sq ft	Hardwire	30A 2-pole 240V (22A × 1.25)	46-gal octagon drum; 8-in inlet; RF remote; 30A circuit required for 22A running amps per NEC 430
JET DC-1100VX-CK ²¹	1.5 HP / 115V or 230V / 5.5A	1,100 CFM @ 4" inlet	98% at 2-micron canister	Cord-and -plug 120V std.	20A 1-pole 120V or 15A 240V	Light-duty single-tool option; 70–80 dB; prewired 115V; rewire 230V for quieter single-phase operation

SPECIFICATION**Compressed air distribution — 3/4-inch black iron loop with coalescing filter.**

Main 3/4-inch Schedule 40 black iron compressed air loop around the workshop perimeter; 1/2-inch drops to each workstation. Downstream of the Quincy QGS-5 integrated refrigerated dryer: one coalescing filter rated to 0.01 ppm oil aerosols (critical for paint work), one particulate filter at 1-micron minimum. Electronic auto-drain valve with timer on the tank. Pressure regulator at each use point. The BendPak HD-9XW requires minimum 30 PSI / 3 CFM for pneumatic safety lock release — confirm shop air pressure at the lift bay is maintained above 30 PSI before lift use begins.



FIELD RULE**Dust duct bonding and static dissipation per NEC 250.116.**

6-inch spiral steel main trunk from the Oneida V-System 3000 outlet; 4-inch drops with Y-transitions to each machine. Maximum two blast gates open simultaneously per Oneida V-3000 rating. Metallic spiral duct is bonded to the equipment grounding conductor at each section per NEC 250.116. PVC duct sections receive a continuous copper bonding wire inside the duct. The V-System 3000 cyclone body is static-dissipative polyethylene; connect the motor chassis to the EGC at the NEMA 6-20 outlet. Wood dust is combustible; HEPA filtration keeps fine particulate below LEL in the workshop air.¹⁹

NOTE**NEC 430 motor branch circuits for dust collector and compressor.**

Oneida V-3000 3 HP / 230V / 13A: conductor at 125% FLA = 16.25A → 12 AWG (20A circuit).
 Dual-element time-delay fuse at 175% FLA = 22.75A → 25A fuse or 20A breaker per NEC 430.52.
 Quincy QGS-5 25A FLA at 230V: 30A breaker, #10 AWG. Laguna P|Flux 3 at 22A: 30A breaker (22A × 1.25 = 27.5A → 30A per NEC 430), #10 AWG. NEC 422.31 lockable disconnect within sight of each motor-driven appliance required for all three.

SOURCES

- ¹⁷ [Quincy QGS Rotary Screw Compressors — Northern Tool](#) ¹⁸ [Ingersoll Rand SS5L5 Single Stage Reciprocating Compressor](#)
¹⁹ [Oneida V-System 3000 HEPA Cyclone Dust Collector \(Oneida Air Systems\)](#) ²⁰ [Laguna P|Flux 3 Cyclone Dust Collector \(Laguna Tools\)](#) ²¹ [JET DC-1100VX-CK Dust Collector \(JET Tools\)](#)

§ 06

Workshop HVAC & Make-up Air

PART II — LIFT & AIR

The workshop mini-split serves four year-round functions: maintaining the garage at 50°F minimum in winter for EV battery pre-conditioning and hydraulic lift fluid viscosity; cooling the workshop below 85°F in summer for personnel comfort; keeping the garage IDF (network rack) below 104°F ambient for Ubiquiti switch operation; and expanding the window for polyaspartic floor application and curing. The Mitsubishi MSZ-FH24NA maintains rated heating to 14°F outdoor — covering all but the coldest Bergen County design days — with the Daikin Aurora as the cold-weather alternative at -13°F rated.²²

MINI-SPLIT HVAC COMPARISON — WORKSHOP 24,000 BTU/H

Model	Capacity	Voltage / Circuit	Min Heating Temp	SEER / HSPF	Notes
Mitsubishi MSZ-FH24NA ²² / MUZ-FH24NA	24,000 BTU/H	208–230V / 1Ph 240V 15A dedicated	14°F outdoor (-10°C)	SEER 22+ HSPF 12+	R410A (transitioning to R454B on WX series); ~79% rated capacity at 17°F; Crestron two-way driver via MelCloud bridge; primary spec
Daikin Aurora ²³ FTXB24WVJU / RXB24AXVJU	24,000 BTU/H	240V / 1Ph 240V 15–20A dedicated	-13°F outdoor (-25°C)	Per model sheet	Superior cold-weather heating vs. MSZ-FH for worst NJ winter nights; alternate spec when peak low-temp heating is critical

SPECIFICATION**IRC R302.5.1 — fire-rated garage separation from dwelling.**

IRC R302.5.1 requires fire-rated separation between an attached garage and the dwelling: 1/2-inch Type X gypsum board on the garage side of all walls and ceiling shared with the house (IRC R302.6). Openings between the garage and dwelling require self-closing, tight-fitting solid-wood or solid-steel doors per IRC R302.5.1. In an all-electric attached garage with no combustion appliances, dedicated make-up air supply is not required. If a gas heater is later added, coordinate with Vol 09 HVAC for dedicated outdoor air per IRC M1503 to prevent depressurization of the dwelling.

FIELD RULE**Vehicle exhaust ventilation — 1.5 air changes per hour minimum.**

Install a through-wall exhaust fan (Broan-Nutone QTXE110S equivalent, 110 CFM, 120V) for warm-up cycles and EV battery-conditioning exhaust. Minimum 1.5 air changes per hour for an attached garage. Wire to a 120V 15A circuit with wall switch at the vehicle entrance. Do not rely on mini-split airflow for combustion gas dilution. IRC R302.5.1 fire-rated separation must be maintained at all penetrations; use fire-caulk or listed through-penetration assemblies at any new exhaust fan opening through the garage-to-dwelling separation wall.

BEST PRACTICE**Garage IDF thermal management — coordinate mini-split position with network rack.**

A wall-mount network rack in an unconditioned or semi-conditioned garage bay can reach 100°F ambient in August. The Ubiquiti UniFi USW-Pro-24-PoE switch is rated to 104°F — a 4°F margin provides no thermal buffer. Coordinate the mini-split circuit location and IDF rack position so the rack is within the mini-split cooling zone. Mount the IDF on the same wall as the mini-split indoor unit or on an adjacent wall, not on the exterior wall across from the cooling discharge. Verify ambient temperature at rack location under summer conditions before commissioning the network equipment.²²

NOTE**Crestron Home HVAC integration via MelCloud bridge.**

Mitsubishi MSZ-FH series supports Crestron two-way driver via MHK2 wireless controller or Mitsubishi MelCloud cloud bridge. Scene Workshop Mode activates the mini-split to 65°F cooling target. Scene Departure Mode sets the mini-split to 55°F standby. All scenes execute locally on LAN without cloud dependency. Daikin Aurora integrates via Daikin ONE+ thermostat and Control4 or Crestron driver. Confirm driver revision and firmware compatibility at commissioning.

SOURCES

²² [Mitsubishi MSZ-FH Series HVAC Guide Specifications \(PDF\)](#) ²³ [Daikin Aurora Series Cold-Climate Heat Pump Performance Data](#)

PART 3

Slab & Surge

Sections 07–10 — Slab · Drains · Epoxy, Conduit & Pre-Slab Discipline, Lighting · Network · Security

§ 07

Slab, Drains & Epoxy Coordination

PART III — SLAB & SURGE

The garage slab is the platform for every other system in this volume: conduit stub-ups, trench drain, lift anchor zones, vapor barrier, and the polyaspartic floor finish. Get it wrong and the correction costs weeks and thousands of dollars. The specification is locked at four inches of 3,000 PSI concrete over a 10-mil polyethylene vapor retarder (IRC R506) over four inches of compacted gravel. The finish is Penntek PT 300 aliphatic polyaspartic polyurea, 93% solids, applied after ASTM F2170 moisture testing and ICRI 310.2R CSP 3–4 diamond grinding.²⁴

SLAB SPECIFICATION — IRC R506 AND NJ CLIMATE ZONE 4A

Element	Specification	Code Authority	Notes
Slab thickness	4 inches minimum unreinforced concrete	IRC R506.1	IRC minimum is 3.5 in; 4 in is Restrepo standard and ALI lift requirement; thickened 8-in edge at door thresholds for frost protection
Concrete strength	3,000 PSI at 28 days minimum	ANSI/ALI ALCTV-2017	28-day cure required before lift anchor installation; specify 3,500 PSI for lift bay column anchor footprint
Vapor retarder	10-mil virgin polyethylene, Class II	IRC R506.2.3	IRC min is 6-mil; 10-mil is Restrepo standard for Bergen County clay-rich soils; 12-in lap seams sealed with Tyvek tape; turned up 6 in at perimeter walls
Base course	4-inch compacted gravel or crushed stone	IRC R506.2.4	Probed for uniform depth before pour; supports vapor barrier and prevents differential settlement
Floor slope	1/4 in per foot preferred; 1/8 in per foot minimum	IRC R309.3	24-ft deep garage: 3-in total drop to threshold at 1/4 in/ft; slopes to trench drain or door threshold
Trench drain	NDS Mini Channel 3-inch HDPE (Part 500); brass or cast-iron grate	IRC R309.3	62.8 GPM at 1% slope; set formwork at finished-floor elevation accounting for coating build; connected to floor drain plumbing before pour

PENNTEK PT 300 POLYASPARTIC FLOOR SYSTEM

Property	Value	Test Method
Chemistry	Aliphatic polyaspartic polyurea, 93% solids	Penntek TDS

Tensile strength	6,000 PSI	ASTM D412
Compressive strength	9,400 PSI	ASTM D695
UV stability	100% (FadeLock — no yellowing)	Accelerated UV
VOC	Zero VOC	Manufacturer certification
RH tolerance	Up to 95% internal RH (vs. 75–80% for standard epoxy)	ASTM F2170
Vehicle traffic return	24 hours at 70°F	Penntek cure schedule
Formulations	Summer / Winter / X-treme Heat (to –20°F)	NJ climate selection

SPECIFICATION**ASTM F2170 moisture test — mandatory before any floor coating.**

Drill at 40% of slab depth (1.6 in for a 4-in slab); insert humidity probe sleeves; cap and seal; equilibrate 24 hours; measure with calibrated RH probe. Minimum 3 probes per first 1,000 sq ft; one probe within 3 ft of each exterior wall. Test no sooner than 28 days after pour. Acceptable threshold: $\leq 75\%$ internal RH for standard epoxy; Penntek PT 300 polyaspartic tolerates up to 95% RH. All probe readings, calibrated hygrometer serial number, and calibration date are recorded on the signed test report filed before the coating crew mobilizes.²⁵

FIELD RULE**ICRI 310.2R CSP 3–4 — diamond grind with 600+ lb walk-behind grinder.**

Diamond grind to ICRI Technical Guideline 310.2R CSP 3–4 using a 600+ lb walk-behind diamond grinder with 30–40 grit diamonds: peak-to-valley profile 0.04–0.08 inches. CSP 3–4 is required for Penntek polyurea/polyaspartic systems (4–10 mils DFT). CSP 2 (handheld grinder or acid etch) is not adequate. After grinding, fill cracks up to 1/4 inch with Roklin PolyFlex DS polyurea crack filler (rapid-set, color-matched); re-grind repairs flush before base coat. Floor flatness: FF 35 minimum before first coat.²⁶



BEST PRACTICE**Three-coat Penntek system — one-day application in NJ climate.**

Step 1: diamond grind to CSP 3–4. Step 2: ASTM F2170 moisture test passed. Step 3: Penntek polyurea basecoat with silane adhesion promoter. Step 4: full-broadcast decorative flake chip. Step 5: Penntek PT 300 aliphatic polyaspartic topcoat (UV-stable, 93% solids). Total DFT: approximately 10–20 mils. Entire system applied in one day; 24-hour return to vehicle traffic. Select Winter or X-treme Heat formulation for applications below 55°F ambient or below dew point. Select Summer formulation for applications above 90°F.

SOURCES

²⁴ [IRC R506 Garage Slab Thickness Guide \(R&R Painting\)](#) ²⁵ [ASTM F2170 Concrete Relative Humidity Testing \(Protimeter\)](#) ²⁶ [ICRI Technical Guideline 310.2R — Concrete Surface Profiles \(TCC Materials PDF\)](#)

§ 08

Conduit & Pre-Slab Discipline

PART III — SLAB & SURGE

Pre-slab conduit discipline is the single most consequential coordination event in a garage build. Every conduit penetration through the slab must be set in the formwork before concrete is placed. Core-drilling through a poured and finished polyaspartic slab creates a maintenance patch that is visible under raking light and is never invisible. Conduit type, fill, and pull string requirements are governed by NEC Chapter 9 and NEC 300.5; the conduit schedule is an as-built deliverable at project closeout.

PRE-SLAB CONDUIT SCHEDULE

System	Conduit Size / Type	Quantity	Location	Notes
EVSE circuit — each parking position	1-in Sch 80 PVC	3 stubs	At each parking bay	Pull string installed; cap flush with finished slab; EVSE wires pulled after pour per circuit schedule
Subpanel feeder	2-in Sch 80 PVC	1 stub	Chase / exterior penetration to panel location	Sized for 2/0 AWG Cu hots + #4 AWG Cu EGC + neutral; sealed at both ends and at slab penetration
Lift power	1-in Sch 80 PVC	1 stub	Lift bay column position	30A circuit for BendPak HD-9XW; stub at correct column location per lift footprint drawing
Compressor / dust collector	1-in Sch 80 PVC	2 stubs	Equipment positions	30A and 20A circuits respectively; stubs located at compressor pad and dust collector wall position
Network — IDF to MDF	3/4-in non-metallic	3 stubs	Garage IDF location	Pull 3 Cat6A + 1 OS2 fiber from house MDF; 2-in EMT conduit inside wall from slab to IDF enclosure
Network — EV positions	3/4-in non-metallic	3 stubs	Each EVSE position	1 Cat6A drop per EV position for diagnostic laptop and charger Ethernet management interface
Camera homeruns	1/2-in non-metallic	4 stubs	Exterior camera mounting positions	PoE camera runs; separate from line-voltage conduits in separate raceways per NEC 800

FIELD RULE**Conduit type by location — Schedule 80 in slab, EMT above.**

Schedule 80 PVC for all in-slab stub-ups and slab penetrations (vehicle traffic areas require Schedule 80, not Schedule 40). Schedule 40 PVC in non-traffic underground runs. EMT in conditioned interior wall and ceiling runs above the slab. LFNC (Sealtite) at final 2–3 feet to motorized equipment (lift, compressor, mini-split) for vibration isolation. All conduit penetrations through the slab sealed per NEC 300.5 to prevent moisture and gas migration upward from subgrade.²⁷

SPECIFICATION**Conduit fill $\leq 40\%$ and pull string in all sleeves.**

$\leq 40\%$ fill for two or more conductors per NEC Chapter 9 Tables 1 and 4. Pull string or mule tape installed in all conduit sleeves during rough-in. Conduit ends capped at stub-out. The conduit schedule — listing conduit size, route, system, wire fill, and percent fill — is documented on as-built drawings and archived at project closeout. A copy is filed with the permit record at the Bergen County construction office.

INSPECTION STANDARD**Lift anchor zone — no control joints within column footprint.**

The BendPak HD-9XW column anchor footprint (12 ft × 24 ft minimum) is marked on the slab formwork before the pour. No control joints or expansion joints are placed within the column anchor footprint per ANSI/ALI ALCTV-2017. Saw-cut control joints must be outside all four column positions. The marked formwork and the lift power conduit stub are photographed together as a single pre-pour QC record. Slab age minimum 28 days before lift anchor installation.

SOURCES

²⁷ [NEC Table 300.5 Minimum Cover Requirements \(ElectricalLicenseRenewal\)](#)

§ 09

Lighting, Network & Security

PART III — SLAB & SURGE

A luxury three-car garage workshop demands 75 foot-candles general illumination and 100 fc at the lift bay and workbench, delivered at 5000K and 90+ CRI for color-accurate paint, finish, and material assessment. Lithonia ZL1D 8-ft LED strip fixtures provide up to 1,500 lm per foot, DLC Premium certification, and 0–10V dimming for Lutron RA3 scene integration. Ubiquiti U7 Pro Wall Wi-Fi 7 APs and Cat6A structured cabling deliver garage-grade networking. Security is four-layer: 4K PoE cameras, Aiphone IXG video intercom, LiftMaster MyQ door status, and Kidde HD135F heat detection interconnected to the dwelling alarm per IRC R314.

LIGHTING SPECIFICATION — LITHONIA ZL1D SERIES

Catalog Format	Length	Max Output	CCT / CRI	Dimming	Application
ZL1D L96 3000LM FST MVOLT 50K 90CRI WH ²⁸	96 in (8 ft)	Up to 1,500 lm/ft; 9,000 lm/fixture	5000K / 90 CRI	0–10V; DLC Premium	General workshop rows — 75 fc at 36-in work height; row-aligner for continuous installation
ZL1D L96 (same) — lift bay application	96 in (8 ft)	Same	5000K / 90 CRI	0–10V	Two additional 8-ft strips over lift bay — 100 fc service level at floor; aimed downward with 45° lens option
RAB SHARK LED ²⁹ high-bay supplement	Fixed luminaire 60–200W options	Per wattage	5000K / 80–90 CRI	Per driver	High-bay mounting in garages with 14+ ft ceiling; 5-year warranty; DLC listed

FIXTURE LAYOUT — THREE-CAR GARAGE (24 FT × 36 FT = 864 SQ FT)

Zone	Fixture Count	Target FC	Circuit
General workshop rows	4 rows × 8-ft ZL1D 5000K/90CRI; spaced 8–10 ft	75 fc general workshop level	Separate 20A circuit per row for Lutron RA3 scene control
Lift bay service zone	2 additional 8-ft ZL1D strips over lift	100 fc service level	Dedicated 20A circuit; scene-linked to Workshop Mode
Workbench task lighting	Articulating arm LED (RAB or Waldmann MACH 80, 97 CRI) at each bench position	100 fc at bench surface	Switched 20A circuit at each bench position; local switch + Lutron RA3

NETWORK AND SECURITY SPECIFICATION

System	Specified Equipment	Specs / Standard	Notes
Wi-Fi AP ³⁰	Ubiquiti UniFi U7 Pro Wall	Wi-Fi 7 (802.11be); 2.5 GbE; PoE+ 22W; -1°F–131°F; 1,500 sq ft coverage	Mount at far interior wall; Cat6A from IDF switch; add second U7 Pro at lift bay wall in larger garages
Structured cabling	Cat6A + OS2 fiber MDF to IDF	Cat6A to 100 m; 10 GbE; 24-port patch panel; USW-Pro-24-PoE switch	3 Cat6A + 1 OS2 fiber from house MDF to garage IDF in 2-in EMT conduit; PoE++ switch for 90W camera runs
Security cameras ³¹	Ubiquiti UniFi G5 Pro or Axis M3106-L Mk II	4K 8MP IP dome; PoE; IR night vision; one per door bay + 1 interior + pedestrian entry	DITEK DTK-MRJPOEX NEMA 4X outdoor SPD on every outdoor PoE camera run
Video intercom ³²	Aiphone IXG or DoorBird D21x	IP-based; mobile app; two-way audio/video; remote door release; PoE	Crestron Home driver for IXG; DoorBird integrates with Apple Home, Control4; PoE; outdoor SPD required
Heat / CO detection ³³	Kidde HD135F heat detector + CO alarm	UL 521; fixed-temp 135°F; hardwire interconnect	IRC R314.2.3 heat detector (NOT smoke detector) in garage; IRC R315 CO alarm in dwelling with attached garage; 4-wire interconnect to dwelling alarm system

SPECIFICATION

IRC R314 and R315 — heat detector and CO alarm required; smoke detector not appropriate.

IRC R314.2.3 requires a heat detector (not a smoke detector) in each attached garage, interconnected to the dwelling smoke alarm system. IRC R315 requires a CO alarm in any dwelling with an attached garage. Photoelectric or ionization smoke alarms in a garage will nuisance-trip on vehicle exhaust, paint fumes, and workshop dust — the code-correct technology is a fixed-temperature heat detector. Kidde HD135F: 135°F fixed-temperature, UL 521, hardwire interconnected. Connect via 4-wire hardwire interconnect to the residential alarm system panel.³³



FIELD RULE**DITEK DTK-MRJPOEX on every outdoor PoE camera run.**

Every outdoor PoE camera homerun requires a DITEK DTK-MRJPOEX NEMA 4X outdoor surge protector (20 kA/pair, 10GbE PoE pass, 144W PoE, UL 497B, liquid-tight cord grips) at the camera mounting point. Lightning-induced surges on an unprotected Cat6A homerun will destroy the camera and the PoE switch port simultaneously. Field-replaceable module reduces maintenance cost. The outdoor SPD is a QC gate item: the closeout checklist confirms installation at every exterior camera position before commissioning.

SOURCES

²⁸ [Lithonia ZL1D LED Strip Light Specification Sheet \(Alcon Lighting PDF\)](#) ²⁹ [RAB Lighting SHARK Series LED Area Light](#) ³⁰ [Ubiquiti UniFi U7 Pro Wall — Tech Specs](#) ³¹ [Ubiquiti UniFi U7 Pro Wall — Store Page](#) ³² [Aiphone IXG System — IP Video Intercom](#) ³³ [IRC R314 and R315 — Smoke Alarms, Heat Detectors, CO Alarms \(MyBuildingPermit PDF\)](#)

§ 10

Smart-Home Integration & Scenes

PART III — SLAB & SURGE

Crestron Home, Lutron RadioRA 3, and Control4 govern all smart-home automation for the garage and EV workshop. All scene sequences execute locally on the LAN processor without cloud dependency — a cloud outage at any device manufacturer does not interrupt garage automation. Five locked scenes are programmed and tested at commissioning on every project. Geofencing is a secondary trigger only; calendar-based schedules with driveway camera detection are primary triggers. The notification matrix covers every critical garage system.

INTEGRATION PATHS BY GARAGE SYSTEM

System	Primary Platform	Protocol / Driver	Notes
Lithonia ZL1D fixtures	Crestron Home (CP4/MC4)	Lutron RA3 Plug-on Neutral 0–10V dimmer; Crestron Home via RA3 bridge	ZL1D 0–10V dimming wired to Lutron RA3 ELV+ or 0–10V dimmer per fixture driver spec; RA3 VCRX visor control enables in-car scene trigger
Tesla TWC Gen 3 EMS	Crestron Home	Tesla Dynamic Power Management API; TCP/IP; Crestron load-monitoring driver	CT clamp at main panel (cable P/N 1133339-00-A); session state, energy delivered, fault alerts to Crestron; Charge Schedule scene activates off-peak window
ChargePoint CPH50	Crestron Home	ChargePoint Energy API poll; Crestron module	Session data, energy delivered, fault alerts; EVSE load shed sequence confirmed in Crestron program notes
Mitsubishi MSZ-FH	Crestron Home or Control4	MeiCloud cloud bridge or MHK2 wireless controller; Crestron two-way driver	Workshop Mode: 65°F cooling; Departure Mode: 55°F standby; Arrival Mode: 65°F preheat; all execute locally on LAN
LiftMaster 8500W (MyQ)	Control4 (driverCentral)	LiftMaster MyQ API; driverCentral Control4 driver	Garage door open/close/fault status on Crestron touch panel; push notification on open >30 min; Lockdown scene sends MyQ close command
Aiphone IXG / DoorBird	Crestron Home	IXG: Crestron Home driver IP; DoorBird: PoE, Apple Home, Control4	Video intercom driver in Crestron Home; remote door release from touch panel; camera feed to TSW-770

Oneida V-3000 dust collector	Crestron Home	Current sense relay or iVAC Pro Wi-Fi blast gate interlock; circuit fault alert	Workshop Mode arms dust collector interlock; notification on circuit fault; blast gate status to Crestron over Wi-Fi
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FIVE LOCKED SCENES — REQUIRED ON ALL PROJECTS

Scene	Trigger	Sequence of Operations
Departure Mode	Lutron RA3 VCRX visor trigger from driveway, or Crestron keypad, or calendar schedule	Lights to 100% 5000K; EVSE charge schedule set; mini-split to 55°F standby; all garage doors confirmed closed via MyQ; exterior cameras armed and recording; push notification: Departure Mode active
Arrival Mode	Driveway camera detection + calendar pre-condition; geofencing secondary only	Lights to 80% 5000K; EVSE ready (confirm no active fault); mini-split to 65°F; MyQ garage door open on arrival detection; push notification: Arrival Mode active
Workshop Mode	Crestron keypad button or Touch Panel (TSW-770)	Lights to 100% 5000K at full workshop level; mini-split to 68°F; Oneida dust collector interlock armed; EVSE in economy mode (load shed active); EV charging paused if shop load peaks; notification on interlock arm
Charge Schedule	Crestron scheduler: 11 PM trigger or manual override	Off-peak charging window 11 PM–7 AM activates; EV load shed if home demand spikes per TWC Dynamic Power Management EMS; ChargePoint CPH50 app schedule set to match; notification at schedule start and end; energy usage logged
Lockdown	Crestron keypad hold or CO alarm trigger or push-button initiation	All garage doors confirmed closed via MyQ close command; exterior cameras set to continuous recording; EVSE sessions paused; CO alarm status confirmed (no active fault); push notification: Lockdown active; 30-min reopen confirmation required

SPECIFICATION

Crestron Home + Lutron RA3 — LAN-local execution, no cloud dependency.

Crestron CP4/MC4 communicates with Lutron RadioRA 3 Processor over the local area network. Lutron RA3 Cesta keypad button presses bridge to Crestron via the published Crestron/Lutron integration. Control4 uses driverCentral modules for LiftMaster MyQ and Mitsubishi MelCloud. All five scene sequences execute locally on the LAN. A cloud outage at Tesla, ChargePoint, or Mitsubishi does not interrupt local scene execution. Cloud connectivity is required only for owner remote access via the Crestron Home app and for EVSE energy reporting.

BEST PRACTICE**Notification matrix — push alerts for every critical garage system.**

Crestron Home pushes alerts for: EVSE session fault or CCID trip; subpanel SPD indicator change; CO alarm trigger; heat detector trigger; garage door open >30 minutes; Oneida dust collector circuit fault; mini-split alarm code; outdoor PoE camera offline; Crestron LAN loss to any garage IP device. Each notification includes the device name, fault type, and recommended action. Notification recipients (owner, service manager, Restrepo service team) are configured at commissioning and documented in the owner closeout package.

FIELD RULE**EVSE load management — Charge Schedule and Workshop Mode coordination.**

The Charge Schedule scene activates the off-peak charging window at 11 PM via Crestron scheduler. Tesla TWC Dynamic Power Management CT clamp monitors total home load and throttles EV charging to prevent service entrance overcurrent. Workshop Mode places EVSE in economy mode and pauses EV charging if shop load (compressor + dust collector + lift) peaks simultaneously. The EVSE load shed sequence is confirmed in Crestron program notes and tested at commissioning with a simulated peak load event.

SOURCES

[Tesla Wall Connector Power Management Overview \(Static/Dynamic/Group\)](#) [Crestron Documentation — Pair and Configure Lutron System with Crestron Home](#)

PART 4

Discipline & Closeout

Sections 11–13 — Without Written Direction, Pre-Slab & Pre-Epoxy Checklist, QC · Audit · Closeout

§ 11

Without Written Direction

PART IV — DISCIPLINE & CLOSEOUT

This section catalogs the practices Restrepo Innovations does not perform on a garage and EV workshop installation without written direction from the engineer of record, the architect of record, or the AHJ. None are universally wrong — many are common practice under different project conditions or in other markets. They require explicit, documented written direction in advance. Verbal direction does not satisfy this requirement.

FIELD RULE

BX/MC cable in any in-slab or buried garage conduit — without written direction.

Schedule 80 PVC is the default for all slab penetrations, in-slab stub-ups, and underground runs in the garage. Armored cable (BX or MC) in any buried or slab-encased conduit is without written direction from the engineer of record. NEC 300.5 permits wiring methods appropriate for the burial condition; MC cable is not listed for direct burial in standard residential slab conditions. Above grade, in dry exposed conditioned interior locations, MC cable may be acceptable with AHJ direction; document the written direction before any MC cable is used in a slab or below-grade application.

FIELD RULE

EVSE circuit shared with any other load — without written direction.

Restrepo Innovations standard is one dedicated circuit per EVSE position. Sharing an EVSE circuit with lighting, receptacles, lift, compressor, or any other load is without written direction and inconsistent with NEC 625.40 (individual branch circuit requirement). The only exception is a Tesla Group Power Management configuration, which requires a listed EMS per NEC 625.42(A) and written documentation of the load sharing arrangement in the permit package. Group Power Management on a shared circuit is a secondary valet or service bay configuration, not the primary overnight charging standard.

FIELD RULE**Neutral bonded to ground at garage subpanel — without written direction.**

NEC 250.32(B) requires the green bonding screw to be removed and the neutral bar to float at a subpanel in an attached garage on a 4-wire feeder. Bonding neutral to ground at the garage subpanel with a 4-wire feeder is without written direction and creates a code-non-compliant parallel path for neutral current on the equipment grounding conductor. This is a common installation error; the Bergen County AHJ will reject a subpanel where the neutral and EGC are bonded together on a 4-wire feeder. Test at commissioning: neutral-to-ground voltage at garage subpanel must be $\leq 0.1V$; must be $> 0V$ at main panel.

FIELD RULE**In-ground lift installed without NEC 511 evaluation — without written direction.**

Any true in-ground hydraulic lift with a below-grade cylinder pit constitutes a Class I hazardous location per NEC 511.3. Installing an in-ground lift in a residential attached garage without a formal NEC 511 classification study, explosion-proof wiring, and AHJ approval is without written direction. This volume covers surface-mount and pit-style above-grade BendPak lifts only, where NEC 511 does not apply. If the owner later requests a true in-ground lift, a separate engineering review and AHJ pre-approval are required before any excavation.

FIELD RULE**Floor coating applied without ASTM F2170 moisture test — without written direction.**

Applying polyaspartic, polyurea, or epoxy coating on a slab that has not been tested per ASTM F2170 and confirmed below the coating manufacturer's RH threshold (95% for Penntek PT 300; 75–80% for standard epoxy) is without written direction and voids the manufacturer warranty. Bergen County clay-rich soils produce high ground moisture; skipping the ASTM F2170 test is the single leading cause of coating delamination within 12 months of installation.

FIELD RULE**Conduit stub-ups added after slab pour — without written direction.**

Core-drilling through a poured and finished polyaspartic slab to add conduit penetrations omitted during pre-slab coordination is a maintenance patch, not an invisible repair. The diamond drill creates micro-fractures in the surrounding slab; the penetration seal is visible under raking light; color-matched patch topcoat does not match the original broadcast flake pattern. Proceeding without written direction from the project architect or engineer of record acknowledging the patch quality impact.

FIELD RULE**Workshop 120V receptacles on circuits without GFCI — without written direction.**

NEC 210.8(A)(2) requires GFCI protection on all 125V, 15A and 20A receptacles in attached garages of dwelling units. Installing workshop bench receptacles, door receptacles, or any 120V general-use outlets in the garage on circuits without GFCI protection is without written direction and a code violation. Dual-function AFCI+GFCI combo breakers (Square D QO115CAFGN or Eaton CHFAFGF115) satisfy both NEC 210.8(A)(2) and NEC 210.12 on 120V workshop circuits.

§ 12

Pre-Slab & Pre-Epoxy Checklist

PART IV — DISCIPLINE & CLOSEOUT

Two sequential gates govern the garage floor: the pre-slab gate (before concrete is placed) and the pre-epoxy gate (before the Penntek PT 300 polyaspartic coating is applied). Both gates are signed by the GC project manager, MEP lead, and Restrepo AV/smart-home lead. All items are documented with timestamped photographs filed in the project cloud archive the same day the gate is cleared. The slab is poured once. The coating cannot be invisibly repaired. Both gates are contractual Restrepo requirements.

PRE-SLAB GATE — BEFORE CONCRETE TRUCK ARRIVES

- ☐ **VERIFY** EVSE conduit stubs (3) photographed and filed — three 1-inch Schedule 80 PVC stubs at parking positions; pull strings installed; conduit ends capped flush with finished slab plane; labeled by bay (Bay 1, Bay 2, Bay 3) on formwork; timestamped photo set filed in closeout archive
- ☐ **VERIFY** Subpanel feeder conduit stub photographed — 2-inch Schedule 80 PVC from exterior penetration or chase to subpanel location; sized for 2/0 AWG Cu or 4/0 AWG Al hots + #4 AWG Cu EGC + neutral; sealed at both ends; pull string installed; photo filed
- ☐ **VERIFY** Lift power conduit stub photographed — 1-inch Schedule 80 PVC stub at lift bay column position; correct location per HD-9XW footprint drawing; plumb; pull string installed; labeled LIFT; photo filed
- ☐ **VERIFY** Compressor and dust collector conduit stubs photographed — two 1-inch Schedule 80 PVC stubs at equipment pad locations; labeled COMP and DUST; pull strings installed; photo filed
- ☐ **VERIFY** Network conduit stubs photographed — 3/4-inch non-metallic stubs at IDF location, each EV position, and camera homerun positions; pull strings installed; labeled by system; photo filed
- ☐ **VERIFY** Trench drain formwork verified and photographed — NDS Mini Channel 3-inch HDPE formwork set at finished-floor elevation accounting for coating build; drain slope confirmed at 1% minimum; drain outlet connected to floor drain plumbing; formwork edges sealed; photo filed
- ☐ **VERIFY** Lift anchor zone marked on formwork and photographed — BendPak HD-9XW footprint (12 ft × 24 ft min) marked; no control joints within column anchor footprint per ANSI/ALI ALCTV-2017; rebar or wire mesh clear of anchor bolt locations; photo filed
- ☐ **VERIFY** Vapor barrier inspected and photographed — 10-mil polyethylene vapor retarder placed; 12-inch lap seams sealed with Tyvek tape; perimeter turn-up 6 inches secured; 4-inch compacted gravel base probed for uniform depth; photo filed
- ☐ **VERIFY** Ground rod location staked and photographed — ground rod driven or location staked outside slab at foundation; location documented on as-built drawing; 4-wire feeder EGC path confirmed; photo filed before pour
- ☐ **VERIFY** Sleeve schedule signed — conduit schedule form (size, route, system, fill, percent fill) reviewed; all fills ≤40% per NEC Chapter 9; signed by Restrepo MEP lead and GC project manager; original filed in project record before concrete truck departs site

PRE-EPOXY GATE — BEFORE COATING CREW MOBILIZES

- ☐ **VERIFY** ASTM F2170 moisture test passed and signed — minimum 28 days after pour; 3+ probes placed per ICRI protocol at 40% slab depth; 24-hour equilibration; all probe readings below 75% RH (standard epoxy) or 95% RH (Penntek PT 300 polyaspartic); calibrated hygrometer serial number and calibration date on test report; signed and filed
- ☐ **VERIFY** Diamond grinding to ICRI CSP 3–4 verified — 600+ lb walk-behind diamond grinder with 30–40 grit diamonds; peak-to-valley profile 0.04–0.08 inches confirmed; no acid-etch or handheld grinder accepted; photographic evidence of grinder type and grinding pattern filed
- ☐ **VERIFY** Crack repairs cured and re-ground flush — Roklin PolyFlex DS crack repairs applied, cured, and re-ground flush with slab surface; no proud repairs above grinding plane; conduit stub-up caps flush with grinding plane (not proud); re-grind confirmation photo filed
- ☐ **VERIFY** No standing moisture or surface contamination — slab surface dry, clean, and above dew point at time of coating; no oil, curing compound residue, or concrete form oil on surface; sweep test confirms no loose aggregate; photo of cleaned surface filed same day
- ☐ **VERIFY** Floor flatness FF 35+ verified — FF flatness confirmed by straightedge measurement or laser level; no low spots deeper than 1/4 inch; low spots filled and re-ground; flatness report filed before first coat
- ☐ **VERIFY** Conduit stub-up caps confirmed flush — all conduit stub-up caps are flush with the ground slab surface, not proud of the grinding plane; caps are temporary plugs that can be removed to pull wire; positions documented on slab plan
- ☐ **VERIFY** ≥5% spare Penntek PT 300 and Roklin PolyFlex DS ordered — minimum 5% of installed coating area in color-matched PT 300 patch kit ordered and in transit before coating begins; Roklin PolyFlex DS crack repair cartridges (minimum 2) on site at coating day; delivered and labeled at project closeout

INSPECTION STANDARD**Pre-slab gate sign-off — GC + Restrepo lead before pour.**

The pre-slab gate sign-off form is signed by the GC project manager, MEP lead, and Restrepo AV/smart-home lead before the concrete truck departs the staging area. The signed form is filed in the project record. Timestamped photographs of all pre-slab items are uploaded to the project cloud folder the same day. No concrete truck arrives without the completed gate record on file. This is a contractual requirement on every Restrepo Innovations garage project regardless of scope.

SPECIFICATION**Spare hardware ≥5% delivered + labeled at closeout.**

The spare hardware order for all garage consumables must be confirmed before the slab gate closes corrective access. Items: EVSE mounting hardware set (one per unit); spare subpanel breakers (one 60A two-pole per EVSE, one 30A two-pole for lift); conduit fittings (PVC Schedule 80 1-in and 2-in couplings); lift disconnect fuses (30A); Penntek PT 300 color-matched patch kit; Roklin PolyFlex DS crack repair cartridges; Ubiquiti AP spare (one U7 Pro Wall). All items delivered in labeled bins at project completion.



§ 13

QC · Audit · Closeout

PART IV — DISCIPLINE & CLOSEOUT

Commissioning bridges the installed garage and EV workshop to a warranted, measured, owner-operated environment. Every Vol 21 project passes through the same closeout sequence: verify, document, register, train, deliver. The slab is stubbed, sealed, and signed. Nothing leaves Restrepo's hands until all QC gates are closed and the owner receives the complete documentation package.

QC AUDIT GRID — GARAGE & EV WORKSHOP CLOSEOUT

- ☐ **VERIFY** EVSE installer test report filed — each EVSE circuit verified at rated amperage; NEC 625.42 80% continuous load compliance confirmed (48A EVSE on 60A circuit); installer test report (circuit ID, breaker size, wire gauge, EVSE model and serial number, CCID trip test result, operating temperature) filed in owner closeout archive
- ☐ **VERIFY** NEC 625.42 80% continuous load verified per circuit — 48A EVSE on 60A circuit confirmed; EMS per NEC 625.42(A) documented if Tesla Dynamic Power Management is deployed; ChargePoint CPH50 external GFCI breaker conflict confirmed absent (non-GFCI breaker at panel for CPH50 circuits)
- ☐ **VERIFY** Subpanel ground/neutral separation verified per NEC 250.32(B) — green bonding screw confirmed removed; neutral bar floating (neutral-to-ground voltage $\leq 0.1V$ at subpanel, $>0V$ at main panel); EGC continuity reading (calibrated ohmmeter) from main panel EGC bar to subpanel EGC bar documented and filed
- ☐ **VERIFY** Type 2 SPD installed per NEC 230.67 — Square D HEPD80 or Eaton CHSPCMF at garage subpanel; indicator green; installation certificate filed; Eaton CHSUR200P factory SPD module confirmed if that panel model was installed
- ☐ **VERIFY** GFCI on all 125V receptacles per NEC 210.8(A)(2) — every 125V / 15A and 20A garage receptacle tested with calibrated GFCI tester; trip current and response time logged; AFCI+GFCI combo breakers tested on 120V workshop circuits per NEC 210.12; results filed in closeout archive
- ☐ **VERIFY** Lockable disconnect within sight per NEC 422.31 — Eaton DH321FGK 30A fusible switch at BendPak HD-9XW lift, Quincy QGS-5 compressor, and Oneida V-3000 dust collector; each visible and ≤ 50 ft from motor; lockable in open position confirmed; fuse ratings matched to motor FLA; field tag on each disconnect
- ☐ **VERIFY** ASTM F2170 moisture test report filed — all probe readings below coating system threshold; calibrated probe serial number and calibration date on signed test report; Penntek PT 300 application log (ambient temperature, formulation selected, coat sequence, cure times) filed in closeout archive
- ☐ **VERIFY** Smoke/CO per IRC R314/R315 — Kidde HD135F heat detector in garage confirmed interconnected to dwelling alarm system; CO alarm confirmed installed at ceiling or high wall; 4-wire hardwire interconnect tested and verified; smoke/CO test date documented
- ☐ **VERIFY** One-line diagram and as-built conduit schedule archived — electrical one-line diagram (service entrance, feeder, subpanel, circuit schedule) and as-built conduit schedule (size, route, system, fill) delivered to owner before final payment; filed in project record



- ☐ **VERIFY** Spare hardware ≥5% delivered + labeled — EVSE mounting hardware, subpanel breakers (60A two-pole per EVSE; 30A two-pole for lift), conduit fittings, lift disconnect fuses (30A), Penntek PT 300 color-matched patch kit, Roklin PolyFlex DS crack repair cartridges, and Ubiquiti AP spare delivered in labeled bins at closeout; owner walkthrough complete and signed

INSPECTION STANDARD

Final QC gate — all items verified and signed before handover.

All QC items are verified, documented, and signed before project handover. No item is waived without written direction from the Restrepo project manager. The commissioning report is delivered in writing with copies of all test results: GFCI logs, SPD indicator photographs, NEC 250.32(B) neutral-to-ground voltage reading, ASTM F2170 probe reports, EVSE circuit test reports, and spare parts delivery photographs. The signed commissioning report is filed in the project record.

BEST PRACTICE

Owner handoff package — complete documentation discipline.

The owner handoff package includes: (1) Crestron Home scene programming documentation for all five locked scenes; (2) Lutron RA3 Designer file and cloud backup; (3) as-built conduit schedule and one-line electrical diagram; (4) EVSE registration confirmations (warranty and NJBPU Charge Up rebate application); (5) ASTM F2170 moisture test report and Penntek application log; (6) equipment list with model numbers, serial numbers, and warranty registration; (7) spare parts inventory with labeled bin location; (8) emergency procedures: EVSE CCID reset, subpanel SPD indicator check, MyQ garage door emergency release, CO alarm reset, Restrepo service contact.

CLOSING

The slab is poured once. Stub the conduit before the concrete sets. Every conduit was set and photographed before the pour. Every EVSE circuit is dedicated, sized at 125% of continuous load, and NEC 625.42 compliant. Every subpanel neutral floats per NEC 250.32(B), and every SPD indicator is green per NEC 230.67. Every lift disconnect is within sight per NEC 422.31, and every lift anchor zone was marked before the slab poured. Every slab was ASTM F2170 moisture-tested before the Penntek PT 300 coat. Every heat detector is interconnected per IRC R314 and every CO alarm is in place per IRC R315. Every scene was programmed, tested, and committed to the owner archive. Vol 21 is the standard. Vol 21 is the discipline.

Stubbed. Sealed. Signed.

Restrepo Innovations · Island Media Systems

