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FIELD MANUAL · VOLUME 20

Sleeved.
Sealed.
Signed.

The yard is wired before the hardscape sets.

Sleeves before stone. Conduit before concrete.

PREPARED FOR

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

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MANIFESTO

The yard is wired before the hardscape sets. Sleeves before stone. Conduit before concrete.

Vol 20 governs the outdoor low-voltage lighting, landscape audio, display and television, pergola and heat, irrigation and water feature tie-in, weatherproof power distribution, conduit and sleeve discipline, surge and grounding, and smart-home integration of Restrepo Innovations luxury residential outdoor living environments across the NJ/NY metro corridor. Every conduit sleeve, duct bank, and wire way serving the exterior must be set, photographed, and approved before any hardscape — concrete, pavers, stone, or asphalt — is placed. Rough-in corrects at framing. Sleeves correct before the pour. The outdoor environment is not a technology layer added to a finished landscape — it is infrastructure from the first footing stake.

SCOPE

Residential-only. Applies to new luxury outdoor living 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. Freeze-thaw cycles: 60–90 annually, November through March. Winter design temperature: 13°F (ASHRAE 99th percentile). Shore-adjacent sites: salt-air protocols, solid brass fixtures, IP68 connectors, and 316 SS enclosures. Governing codes: NEC 2023 Articles 110, 210.8, 225, 300, 411, 590, 640, 680; NJ UCC NJAC 5:23; IDA DarkSky criteria; UL 1838 (LV landscape lighting), UL 1480 (speakers), UL 1951 (irrigation). The manifesto: the yard is wired before the hardscape sets. Sleeves before stone. Conduit before concrete.

CONTENTS

PART 1

Light & Sound

Sections 01–04 — Why Outdoor Living Now, Outdoor LV Lighting, Landscape Audio, Outdoor Displ

§ 01

Operating Principles

PART I — LIGHTING & AUDIO

The luxury residential outdoor environment has evolved from a decorative addition into a precision technology suite requiring the same sequencing discipline as the home's electrical rough-in. Six interdependent pillars — low-voltage lighting, landscape audio, outdoor displays, pergola and heat, irrigation, and weatherproof power — each carry a one-shot rough-in gate. The conduit sleeve under a future patio cannot be added after the pavers are set. The duct bank under the driveway cannot be recored without full demolition. The yard is wired before the hardscape sets.

THE FOUR PARTS OF THIS VOLUME

Part	Sections	Primary Disciplines
I — Lighting & Audio	01–03	LV lighting platforms, voltage drop, IDA compliance; landscape audio, 70V vs. 8-ohm, satellite geometry
II — Displays & Comfort	04–06	Outdoor TV nit selection, circuit discipline; pergola/heat/fan; irrigation and water feature integration
III — Power & Infrastructure	07–09	Weatherproof power, NEMA enclosures, generators; conduit and sleeve discipline; surge and grounding
IV — Integration & Closeout	10–13	Crestron/Lutron/Control4 scenes; without written direction; pre-hardscape checklist; QC/audit/closeout

FIELD RULE

Sleeve before stone. There is no corrective access after the pour.

All conduit homerun paths, duct bank sleeves, and wire ways must be installed, pull-stringed, capped, photographed, and approved before any hardscape is placed. Concrete, pavers, stone, asphalt, and decorative aggregate are all hardscape. The pre-hardscape gate is signed by the GC project manager, MEP lead, and Restrepo AV/smart-home lead before the concrete truck arrives. No exceptions are granted after hardscape pours; corrections require demolition.

SPECIFICATION

Residential-only discipline throughout.

Every provision in Vol 20 is residential. We do not reference commercial or multifamily standards as primary authority. NEC 2023 is the electrical floor; NJ UCC NJAC 5:23 governs AHJ enforcement. NJ Bergen County municipalities enforce NEC 2017 as of 2024 — confirm current AHJ adoption before permit submittal on each project. IDA DarkSky criteria govern all exterior luminaires regardless of AHJ adoption status. Spare hardware at ≥5% of installed equipment value is delivered and labeled at every project closeout.

NOTE

NJ Climate Zone 4A — frost depth, freeze-thaw, and salt-air protocol.

Northern NJ (Bergen County, including Franklin Lakes): 36-inch frost depth, 13°F winter design temperature (ASHRAE 99th percentile), 60–90 freeze-thaw cycles November through March. All burial depths, footing depths, backflow preventer specifications, and irrigation blow-out deadlines in this manual are calibrated for these conditions. Shore-adjacent projects within one mile of tidal water require solid brass or 316 SS fixtures, Coastal Source IP68 Plug+Play connectors in the landscape field, and Hoffman nVent 316 SS or Stahlin FRP enclosures at all outdoor electrical equipment locations.[1]

SOURCES

[1] NJ DCA Construction Code Communicator Fall 2023 — Frost Depth Table R301.2

§ 02

Outdoor LV Lighting

PART I — LIGHTING & AUDIO

Outdoor low-voltage landscape lighting operates at 12 VAC nominal (10–15 V operating range) from a listed Class 2 power supply per NEC Article 411 and UL 1838. The FX Luminaire Luxor ZD/ZDC platform is the primary specification for smart landscape lighting control: up to 250 independent zone groups, 0–100% dimming in 1% increments, and — on LZDC transformers — 30,000 RGBW color options per zone. Coastal Source Premier Edition is specified for all coastal and salt-air sites. IDA DarkSky criteria govern CCT selection and optics on every project regardless of AHJ adoption status.[2]

FX LUMINAIRE LUXOR ZD/ZDC TRANSFORMER CONTROLLERS

Model	Watts	Zones	Technology	Finish	Notes
LZD-150[3]	150	250	ZD zone/dim	Matte Gray or SS	ETL, UL 1838, UL-379; astronomical timing; WIFIMOD2 for iOS/Android + Crestron Home LAN
LZD-300[3]	300	250	ZD zone/dim	Matte Gray or SS	Same feature set as LZD-150; 300 W capacity for larger zone counts
LZDC-150[4]	150	250	ZDC zone/dim/color	Matte Gray or SS	Full RGBW per zone; 40 custom themes; calendar scheduling; WIFIMOD2
LZDC-300[4]	300	250	ZDC zone/dim/color	Matte Gray or SS	300 W RGBW; for estates with 40+ addressable color zones

FX LUMINAIRE SPECIFIED FIXTURE FAMILIES

Fixture	Technology	Input	Lumens / Output	Rating	Notes
M-PL MosaicPath[5]	Integrated LED; ZD or ZDC RGBW	10–15 V	73 lm (1LED) / 36 lm RGBW (ZDC)	IP65, L70 50,000 hr	Two-layer marine anodization; 10-yr warranty; ships with 30-in conduit stub
NP Newport Up[6]	LED 3LED/6LED/9LED or ZDC RGBW	10–15 V	290–770 lm std; 115–390 lm ZDC	L70 72,000 hr std	ProAim adjustable aiming; 35° or 60° beam; two-layer marine anodization

FC FluxColor Well[7]	LED 1LED–9LED or ZDC RGBW	10–15 V	Per lamp count; brass or aluminum	0°F–140°F; IP rated	Multiple faceplate options; ring, cowling, louver, groundwash; 10-yr warranty
Coastal Source Brass Path[8]	Replaceable LED module 2700K/3000K	12 V LV	Per 3 W LED module	IP68 solid brass	Salt-air spec; IP68 Plug+Play IFSCCF/IFSCCM connectors; triple-jacketed cable
Coastal Source Well[9]	MR16 LED 9 W option	12 V LV	Per lamp	IP68 solid brass	All screws concealed; SS spike anchor; Premier Edition coastal spec
WAC EN-1260[10]	LED landscape step/path	12 V LV	Per fixture	IP65 outdoor listed	Specify where FX brass not required; ETL-listed UL 1838 compliant

VOLTAGE DROP AND WIRING DISCIPLINE

Zone	Run Length	Wire Gauge	Max Load	Multi-Tap Setting	Notes
Close Zone	0–40 ft from transformer	12 AWG	160 W (12 Ga)	12 V tap	Most residential path light runs; voltage verified under full load at zone end
Mid Zone	40–80 ft from transformer	12 AWG / 10 AWG	120 W (12 Ga) / 140 W (10 Ga)	13 V or 14 V tap	Compensate for drop with higher tap; measure at fixture ≥10 V under load
Far Zone	80–120 ft from transformer	10 AWG / 8 AWG	Reduce ≈25% from mid zone	14 V or 15 V tap	Hub wiring method preferred; daisy-chain risks under-voltage at far fixture
Out There Zone	120–160 ft from transformer	8 AWG required	Per FX voltage drop table	15 V tap	Consult FX Luxor installation manual; consider second transformer homerun

SPECIFICATION

NEC 411 Class 2 compliance — listed transformer, GFCI supply, 12-inch mount.

NEC 411.4 requires all components of a low-voltage lighting system to be listed. The FX Luxor LZD/LZDC transformers carry ETL listing per UL 1838 and UL-379. Output: ≤30 V AC, ≤25 A (NEC 411.3). Supply circuit: 120V GFCI-protected per NEC 210.8(A)(3).[11] Transformer mounting: minimum 12 inches above finished grade. LV landscape conductors at 30 V or less: direct-buried minimum 6 inches per NEC Table 300.5 Column 5. Transformer load must not exceed 80% of rated capacity under full zone load.

BEST PRACTICE

Hub wiring method for runs with 20 or more fixtures.

Daisy-chain wiring delivers progressively lower voltage to distant fixtures as cumulative resistance builds along the run. For zones with 20 or more fixtures or runs exceeding 60 feet, use the hub method: a single homerun from the transformer to a burial-rated hub in the landscape field, then individual spurs of equal length to each fixture group. Voltage at the hub tap is measured under full load to confirm 10–15 V delivery at each fixture. Coastal Source IP68 Plug+Play connectors at every hub junction eliminate wire-nut oxidation in burial conditions.[8]

FIELD RULE

IDA DarkSky compliance — CCT, cutoff, and schedule.

All exterior luminaires on Restrepo projects conform to IDA DarkSky criteria: CCT ≤3000 K (2700 K preferred for warm residential ambiance); full-cutoff or shielded optics on all up-lights and path lights; no light trespass across property lines; FX Luxor ZD dims output to 20–40% after 10 PM via astronomical clock. ASHRAE 90.2 exterior LPD budget is met by FX LED efficacy of 36–81 lm/W. The WIFIMOD2 module enables astronomical schedule management through the Luxor app or Crestron Home driver.[12]

INSPECTION STANDARD

Coastal Source IP68 connectors — no wire nuts in direct-burial landscape.

At every field splice on a Coastal Source Plug+Play run, use IFSCCF (female) and IFSCCM (male) connectors rated IP68. These accept 12 AWG conductors and replace traditional wire nuts with a mechanically secured, gasket-sealed, submersion-rated connection. Open wire nuts in a buried landscape are a maintenance failure point — oxidation, water ingress, and high-resistance connections cause lamp flicker, premature LED failure, and nuisance GFCI trips. Coastal Source connectors are a QC gate item: the closeout checklist confirms all field splices on Coastal Source runs use IP68 connectors with no open wire nuts in burial.

SOURCES

[2] DarkSky International — DarkSky Approved Program [3] FX Luminaire Luxor ZD/ZDC Transformer Resource Guide (FXLIT187) [4] FX Luminaire Luxor Color Technology (ZDC RGBW) [5] FX Luminaire M-PL MosaicPath Specification Sheet [6] FX Luminaire NP Newport Up Light Product Page [7] FX Luminaire FC Well Light Specification Sheet [8] Coastal Source IP68 Plug+Play Connector System [9] Coastal Source In-Grade Well Lights Product Page [10] WAC Lighting EN-1260 Landscape Fixture [11] NEC Article 411 Low-Voltage Lighting Requirements [12] IDA/RASC Guidelines for Low-Impact Outdoor Lighting

§ 03

Landscape Audio

PART I — LIGHTING & AUDIO

Landscape audio for luxury residential sites resolves around two complementary architectures: Sonance Landscape Series buried satellites and in-ground subwoofers for invisible audio integration; and Coastal Source Ellipse Bollard line-source speakers for above-grade architectural integration where visual presence is acceptable. 70V distribution is specified when run length exceeds 100 feet from amplifier to speaker, when zone count reaches three or more pairs, or when future expansion is anticipated. 8-ohm direct drive is used for short runs with two or fewer pairs where maximum fidelity is the priority.[13]

SONANCE LANDSCAPE SERIES — SPECIFIED PRODUCTS

Model	Type	Power (70V Tap)	Frequency	Sensitivity	Notes
SLS Satellite[13]	2-way stake speaker	70V/8-ohm select; LCT 300/150/75 W taps	Per model	IP66	30–40 ft spacing; angle 20–30° inward toward seating; 14 AWG 4-conductor burial cable
LS12T SUB[14]	In-ground 12-in sub	300/150/75 W 70V tap	22–100 Hz	Per MFR	BMK burial kit required; LDPE enclosure; single LS12T covers ≤2,000 sq ft
LS15T SUB[14]	In-ground 15-in sub	70V tap; high SPL	20–100 Hz	94 dB	Single LS15T covers ≤3,500 sq ft when EQ'd through DSP 2-150 MKIII
HS12T SUB[14]	Hardscape 12-in sub	300/150/75 W 70V	22–100 Hz	Per MFR	Flush-mount alternative to LS12T for patio and deck applications
SR1SUB[14]	Surface rock sub	70V tap	Per MFR	Per MFR	Above-grade disguised as landscape boulder; for sites restricting ground penetration

DSP 2-150 MKIII[15]	Stereo DSP amplifier	150W×2 (8Ω); 473W bridged	20 Hz–20 kHz	SonARC v2 IP	24-bit/96 kHz; Class-D 93% efficient; 10-band parametric EQ; Crestron driver via IP

COASTAL SOURCE BOLLARD AND SUPPLEMENTAL SPEAKERS

Model	Drivers / Config	Power	SPL / Dispersion	Rating	Notes
CS 10.0 Ellipse Bollard[16]	2-way rotomolded composite	Per MFR	Per MFR; wide dispersion	IP68	Above-grade bollard; architectural integration; 70V/8-ohm selectable
CS 12.0 Line Source Bollard[16]	12 ribbon tweeters + 6 mid-bass + 10-in sub	1,000W RMS	94 dB / 120° dispersion	IP68	35 Hz–20 kHz; line-source vertical coverage; covers large outdoor entertainment area
Origin OS60DTB[17]	6.5-in 2-way pendant	Per MFR	IPX66	IPX66 outdoor	Pendant or surface for pergola/covered patio underside; 70V/8-ohm
SpeakerCraft OE6 One[17]	6.5-in 2-way outdoor	Per MFR	Per MFR	IP54 outdoor	Compact supplemental speaker; pergola column or wall mount
Q-SYS AD-DWL[18]	Landscape stake; IP55	Native Q-SYS output	Per MFR	IP55; −40°C listed	Q-SYS AD-DWL channels addressed natively in Q-SYS Core audio; no external amplifier

70V VS. 8-OHM DECISION TREE

Condition	Recommended Architecture	Rationale
Run length ≥100 ft amplifier to speaker, or zone count ≥3 pairs	70V distribution with LCT tap	Line losses at 8 ohm over long runs cause frequency response degradation; 70V minimizes resistive loss
Run length ≤80 ft with ≤2 pairs, maximum fidelity priority	8-ohm direct drive	Shorter runs do not impose significant line loss; direct coupling preserves transient detail
Future zone expansion anticipated	70V from the outset	70V permits unlimited zone addition without rewiring; 8-ohm expansion requires dedicated amplifier outputs per new pair
Sonance SLS satellite specified with buried LS12T/LS15T sub	70V 300/150/75 W tap on SLS and sub	SLS Laminated Core Transformer supports both bus architectures; 70V tap matches Sonance DSP 2-150 MKIII output

SPECIFICATION

NEC 640 and UL 1480 — outdoor audio wiring methods and listing.

NEC 640 governs all audio system wiring. Class 3 wiring methods apply for 70V audio circuits at ≤100 W per NEC 640.9. Outdoor speaker cable runs in Schedule 40 PVC conduit at 18-inch minimum depth per NEC 300.5 when crossing under hardscape. UL 1480 impact-testing at −40°C is required for all outdoor-rated loudspeakers.[19] Abandoned cable must be removed per NEC 640.6. Sonance SLS satellites and Coastal Source Bollards carry equivalent environmental listing. 14 AWG 4-conductor direct-burial cable minimum for SLS satellite runs; 12 AWG for sub homerun.

FIELD RULE

Satellite geometry — 30–40 foot spacing at ear level.

Sonance SLS satellite stake heights are set so drivers project at ear level for seated listeners (approximately 36–42 inches above grade for seated outdoor dining). Center-to-center satellite spacing: 30–40 feet. Driver axis angled 20–30 degrees inward toward the primary seating area for focused coverage. A single buried LS12T sub covers up to 2,000 sq ft when EQ'd through the Sonance DSP 2-150 MKIII with SonARC v2. Bury the sub per the BMK burial kit at center of the listening field; canopy elevation above grade as specified in the BMK instructions.[13]

BEST PRACTICE

Sonance DSP 2-150 MKIII — IP control and Crestron Home integration.

The Sonance DSP 2-150 MKIII amplifier (SKU 93542) carries 150W×2 at 8Ω, 473W bridged, 24-bit/96 kHz processing, and Class-D efficiency of 93%. SonARC v2 IP control module enables Crestron Home driver communication over the local area network: zone volume, source selection, and EQ preset recall from the Crestron touch panel. Q-SYS integration uses native Q-SYS Core output channels to AD-DWL speakers without a discrete amplifier. IP address for the DSP 2-150 MKIII is static-assigned and documented in the owner closeout package.[15]

SOURCES

[13] Sonance Landscape Series Collection (SLS Satellites and Subwoofers) [14] Sonance SLS Subwoofers LS12T, LS15T, HS12T Specifications [15] Sonance DSP 2-150 MKIII Amplifier Product Page (SKU 93542) [16] Coastal Source Ellipse Bollard Speakers (10.0 2-Way, 12.0 Line Source) [17] Q-SYS AcousticDesign AD-DWL Landscape Loudspeaker [18] Q-SYS AD-DWL Product Page [19] Intertek UL 1480/ULC-541 Standards Update Notice

PART 2

Heat & Water

Sections 05–07 — Pergola & Heat, Irrigation & Water Feature, Weatherproof Power

§ 04

Outdoor Displays

PART II — DISPLAYS & COMFORT

Outdoor television specification begins with the solar exposure of the mounting location and the ambient brightness of the environment. Shade enclosures require 700–1,000 nits; partial-sun exposures require 750–1,000 nits minimum; full-sun and direct-sun locations require 1,500–4,000 nits. Every outdoor display receives a dedicated 20A 120V GFCI circuit per NEC 210.8(F) and an extra-duty WP in-use cover per NEC 406.9(B)(1). No outdoor television is installed on a shared multi-load circuit without written direction.[20]

OUTDOOR TV SPECIFICATION — NIT COMPARISON BY EXPOSURE

Model	Nits	IP	Op. Temp.	Smart Platform	Notes
SunBriteTV Veranda 3[21]	1,000	IP55	−24°F–104°F	Android TV; Google Asst.; Chromecast	4x HDMI 2.1 (eARC HDMI 3); Dolby Vision/Atmos; RS-232 + IP control; shade specification
SunBriteTV Pro 2[22]	1,000–1,500	IP55	−24°F–122°F	No (RS-232 + IP/HDBaseT)	Full-sun rated; Crestron two-way IP control and RS-232; two-way feedback driver available
SunBriteTV Solis[22]	1,500	IP55	−24°F–122°F	Android TV	Mid-range full-sun; IP + RS-232 control; specify where full-sun with smart platform required
SunBriteTV Marquee[23]	Up to 4,000	IP55+	−40°F–122°F	No	EST technology; direct-sun readable; flagship specification for uncovered south/west exposures
Furrion Aurora Partial-Sun 2[24]	750	IP55	−24°F–122°F	Yes (RangeXtend Wi-Fi)	Partial-sun covered pergola spec; IK09 rated glass; HDR10+; 3x HDMI (1 ARC)
Furrion Aurora Full-Sun Pro[24]	2,500	IP66	−24°F–140°F	Yes (RangeXtend Wi-Fi)	XtremeShield IK09 impact glass; IP66; RS-232; for direct west/south exposures

Séura Shade Series 2[25]	700	IP56	−24°F–140°F	No	Shade/indoor-outdoor; 4K; 43–75 inch; Crestron RS-232 or IP driver
Séura Full Sun Series[26]	2,000	IP55	−40°F–140°F	No (Adaptive Picture Tech.)	Active cooling; 55–86 inch; Adaptive Picture Technology for variable light; full-sun spec

CIRCUIT AND MOUNTING REQUIREMENTS

Requirement	Specification	Code Authority
Dedicated circuit per display	20A 120V GFCI-protected branch circuit; one circuit per outdoor TV; no shared loads	NEC 210.8(F); Restrepo field standard
WP in-use cover	Listed extra-duty weatherproof in-use cover at all cord-connected display outlets in wet locations	NEC 406.9(B)(1)
Back-box enclosure	NEMA 3R or better for hardwire installations; conduit entry sealed; IP maintained	NEC 406.9; NEC 225
Mount articulation	VESA-compatible articulating mount for sun-angle optimization; rated for display weight with 2x minimum safety factor	Manufacturer installation requirement
LV stub-out	1-inch PVC conduit stub adjacent to display location for HDMI, control, and speaker cabling; pull string installed during rough-in	Restrepo rough-in standard
Control integration	SunBriteTV Pro 2: Crestron two-way IP or RS-232 driver; Veranda 3: Android TV IP; Séura: RS-232 or IP; HDBaseT for distances ≥60 ft	Crestron integration requirement

SPECIFICATION

NEC 210.8(F) — GFCI on all outdoor outlets at dwellings.

NEC 210.8(F) (2023 NEC) requires GFCI protection on all outdoor outlets at dwellings supplied by single-phase branch circuits rated 150V or less to ground and 50A or less. This applies to all outdoor TV supply circuits, outdoor heater convenience outlets, landscape audio amplifier outlets, and any outdoor receptacle regardless of proximity to the primary display.[27] Weather-resistant tamper-resistant (WR TR) receptacles are required at all outdoor locations per NEC 406.9 and 406.12. The GFCI breaker at the panel is the preferred implementation; a GFCI receptacle substitution for a hardwired display circuit is not acceptable.

FIELD RULE

Nit selection guide — match exposure to minimum luminance.

The human eye in bright sunlight requires approximately 400–500 nits to perceive a usable image. Full-sun direct exposure demands 1,500 nits or more for comfortable viewing at typical outdoor distances. A 1,000-nit display in direct afternoon sun will appear washed out and unusable. Specify 1,500+ nits for any exposure without a pergola or shade structure. Covered pergola with solid roof: 700–1,000 nits is sufficient. Louvered pergola (StruXure, Renson): specify 1,000–1,500 nits to account for variable shade. Document the mounting orientation and shade analysis in the specification record.

NOTE

HDBaseT for HDMI distribution over 60 feet.

Native HDMI 2.1 cable is reliably certified to 16 feet; passive cables to approximately 25 feet for 4K/60Hz. For outdoor display installations where the source equipment is in an interior AV rack or outdoor head-end enclosure more than 25 feet from the display, specify HDBaseT extender (100-meter Cat6A) or a fiber HDMI extender. The LV conduit stub adjacent to the display location accommodates the HDBaseT receiver. SunBriteTV Pro 2 accepts HDBaseT native input for rack-to-display integration in Crestron-driven AV systems.

SOURCES

[20] Leviton Captain Code — NEC 406.9(A)(B) While-in-Use Cover Requirements [21] SunBriteTV Veranda 3 Series Product Page [22] SunBriteTV Pro 2 Full Sun Outdoor TV [23] SunBriteTV Marquee Series Direct Sunlight Readable Launch [24] Furrion Aurora Full-Sun Pro Series Outdoor TV [25] Séura Shade Series 2 Spec Sheet [26] Séura Full Sun Series Spec Sheet [27] Eaton — NEC 210.8(F) GFCI Protection for Outdoor Outlets (2023 NEC)

§ 05

Pergola & Heat

PART II — DISPLAYS & COMFORT

Motorized louvered pergolas, infrared heaters, ceiling fans, and mist cooling systems collectively define the all-season comfort envelope of the Restrepo outdoor living environment. Each element carries dedicated circuit requirements, vibration-isolation conduit connections, and smart-home integration paths. Pergola footing depth in northern NJ is 36 inches minimum below finished grade per NJ frost line (Bergen County, NJAC 5:23 Table R301.2). Conduit sleeves to each column base are set before the footing concrete is placed.[28]

MOTORIZED LOUVERED PERGOLA COMPARISON

System	Louver	Drive / Control	Integration
StruXure Pergola X[29]	140° motorized; Somfy RTS; UL/CE certified	Local HTTP API + Modbus; driverCentral Control4 driver; Renson Connect app	Aluminum frame; 36-in NJ frost footing; rain/wind/sun sensors optional
Renson Camargue[30]	150° rotation; IO Homecontrol + S-Drive	Somfy TaHoma bridge for Crestron/Control4; Renson Connect app	Integrated LED lighting; column drainage; rain/wind/freeze sensors; full-retract option
Renson Skye[30]	Full fabric retract; IO Homecontrol	Somfy TaHoma bridge; Renson Connect app	Full open-air option for seasonal use; wind sensor standard

ELECTRIC RADIANT HEATER SURVEY — SPECIFIED PRODUCTS

Model	Watts	Voltage	FLA	Circuit	Integration Notes
Bromic Platinum 2300W[31]	2,300	220–240V	9.6A	20A dedicated	304 SS + glass-ceramic fascia; Affinity Dimmer (0–10V); Lutron RA3 via EPC-2-D
Bromic Platinum 3400W[31]	3,400	220–240V	14.2A	20A dedicated	Same series; 65–108 sq ft coverage; 0–10V dimmer for Lutron RA3 App Note 587
Bromic Platinum 4500W[31]	4,500	220–240V	18.8A	30A dedicated	Largest Platinum; 143 sq ft coverage; 30A circuit required
Bromic Tungsten 2000W[32]	2,000	240V	8.3A	15A dedicated	Tungsten series; quartz lamp; pendant or wall mount; 0–10V via EPC-2-D

Bromic Tungsten 6000W[32]	6,000	240V	25.0A	30A dedicated	Large covered patio; dual-zone control recommended for Hi/Lo staging
Infratech W-1512 CD[33]	1,500	120V	12.5A	20A dedicated	Single element; INF-CD-CONTROL 0–10V module; Lutron RA3 compatible
Infratech WD-3024[33]	3,000	240V	12.5A	20A dedicated	Dual element Hi/Lo staging; INF-CD-CONTROL; marine SS (CD4024SS) for coastal
Infratech WD-6024[33]	6,000	240V	25.0A	30A dedicated	Maximum dual element; 30A circuit; Hi/Lo or proportional via INF-CD-CONTROL
Schwank ESD 3000W[34]	3,000	240V	12.5A	20A dedicated	Dual bulb 2-stage; 20A; specify as alternative to Infratech WD on coastal NJ sites

CEILING FANS AND MIST COOLING

Product	CFM / Coverage	Power	Rating	Integration	Notes
Big Ass Fans Haiku Outdoor 84″[35]	17,369–19,292 CFM / 900 sq ft	53.7W; 359.3 CFM/W	Wet-rated; covered	Apple HomeKit (Matter); Alexa; Google Home; 7-speed	Downrod 7–60 in options; reverse rotation recirculates warm pergola air in winter

Big Ass Fans Haiku Outdoor 60″[35]	Per spec / 400 sq ft	Per spec	Wet-rated; covered	HomeKit; Alexa; Google Home	6-blade carbon fiber; brushless DC motor; dedicated 15A or 20A circuit
Hunter Elements Outdoor[36]	Per model	Per model	Wet-rated	Hunter app; Alexa	Specify as secondary option when BAF is over specification for project scope

Mistcooling 200 PSI System[37]	Per zone; 3°F–20°F drop	200 PSI pump; per zone	Stainless misting nozzles	Relay or 0–10V pump control	Winterize at October 15 with irrigation blow-out; drain all misting lines completely

SPECIFICATION

Dedicated heater circuits — NEC 210.8(F) GFCI, NEC 406.9(B)(1) in-use cover.

Each electric heater receives a dedicated circuit: 20A for all Bromic Platinum 2300W and 3400W; 30A for Bromic Platinum 4500W and all 6000W Infratech/Bromic Tungsten models; 20A for all Infratech CD/WD through WD-4024. All 240V heater circuits present 120V to ground on each leg, meeting the NEC 210.8(F) GFCI threshold. GFCI breakers required at panel. Extra-duty WP in-use cover on any heater convenience outlet within the covered area per NEC 406.9(B)(1).[27] Bromic Affinity 0–10V dimmer integrates with Lutron RA3 via EPC-2-D + Outdoor Heater Relay Module per Lutron Application Note 587.

FIELD RULE

LFNC at final connection to all motorized pergola and fan equipment.

Motorized pergola motors (StruXure, Renson), ceiling fan canopies, and mist pump motors all generate vibration that will stress rigid conduit connections. Use liquid-tight flexible nonmetallic conduit (LFNC, Sealtite) for the final 2–3 feet of each flexible connection to motorized equipment. LFNC seals against condensation migration per NEC Article 225 guidance. Above-grade exposed conduit risers from the pergola footing to the column distribution enclosure: RGS or IMC for mechanical protection where physical damage is a risk.

BEST PRACTICE

Weather-forecast pre-condition for heater scenes.

Crestron Home integrates a third-party weather API to retrieve the next-day forecast. When the predicted low temperature is below 50°F, the Dinner Party and Evening Garden scenes pre-activate the Bromic or Infratech heater at low output 30 minutes before the scheduled scene start. This eliminates the cold-start discomfort of a heater energized simultaneously with the scene. The weather forecast trigger is a primary condition; geofencing is a secondary trigger only. Heater pre-conditioning is always governed by scheduled scenes, not location data from smartphones.

SOURCES

[28] NJ DCA Uniform Construction Code NJAC 5:23 [29] StruXure Pergola X PDF Specification [30] Renson Camargue Motorized Pergola Product Page [31] Bromic Platinum Smart-Heat Electric Product Page [32] Bromic Tungsten Smart-Heat Electric Product Page [33] Infratech WD Series Dual Element Outdoor Heaters [34] Schwank ESD Series Outdoor Heaters [35] Big Ass Fans Haiku Outdoor Ceiling Fan Product Page [36] Hunter Elements Outdoor Ceiling Fan [37] Mistcooling 200 PSI Residential Misting System

§ 06

Irrigation & Water Feature

PART II — DISPLAYS & COMFORT

Irrigation and water feature control integrates two disciplines that share conduit infrastructure but are governed by separate code authorities: NEC 300 for all buried wiring, and NJAC 7:10-10.3 plus NJ DCA Bulletin 99-2 for backflow prevention. Hunter Hydrawise HCC is the primary controller for residential projects; Rain Bird ESP-LXIVM two-wire is specified for estates with ten or more zones requiring two-wire decoder architecture. Freeze blow-out must be completed by October 15 annually in Bergen County.[38]

IRRIGATION CONTROLLER SURVEY — SPECIFIED PRODUCTS

Controller	Zones / Arch.	Connectivity	IP Rating	Warranty	Notes
Hunter Hydrawise HCC (metal)[39]	54 stations; 2-wire decoder (EZ)	2.4 GHz Wi-Fi; REST API	IP55	5 yr	3.25-in touchscreen; UL 1951 listed; Crestron driver via REST API 60-sec poll minimum
Hunter Hydrawise HCC (plastic)[39]	38 stations; 2-wire decoder (EZ)	2.4 GHz Wi-Fi; REST API	IP55	5 yr	Outdoor rated; IP55; WR-CLIK wireless rain/freeze sensor required on every installation
Hunter Hydrawise Pro-HC[40]	36 stations; conventional	2.4 GHz Wi-Fi; REST API	Indoor	5 yr	Conventional wired; for interior controller locations with exterior sensor

Rain Bird ESP-LXIVM[41]	60–240 stations; 2-wire IVM	No Wi-Fi; IQ Central Software	Indoor panel	2 yr	Self-Healing 2-wire; FloWatch; FloManager; SimulStations; estate spec ≥10 zones
Rachio 3[42]	4–16 zones; conventional	2.4 GHz Wi-Fi; REST API	Indoor	1 yr	Alexa/Google native; developer API at rachio.com; for simpler systems ≤16 zones
Toro Tempus Pro Outdoor[43]	16 zones; conventional	No Wi-Fi	IP54	2 yr	Weatherproof outdoor mounting; specify where Hydrawise cloud not desired

BACKFLOW PREVENTION AND FREEZE DISCIPLINE

Requirement	Specification	Authority
Backflow preventer type	RPZ (Reduced Pressure Zone) or double check valve assembly per contamination risk classification; RPZ required for systems with chemical injection or reclaimed water connection	NJAC 7:10-10.3; NJ DCA Bulletin 99-2[44]
RPZ installation	Above grade; insulated enclosure for NJ winter survival; permit and inspection required	NJAC 5:23 Plumbing Subcode; NJ DCA Bulletin 99-2
Annual backflow test	Tested by licensed backflow tester annually; certificate filed in owner service record	NJAC 7:10-10.3
Freeze blow-out deadline	October 15 or at first sustained below-32°F forecast; 50 CFM compressor minimum for rotary heads at ≤50 PSI; 20–25 CFM for drip at ≤30 PSI; 2–3 passes per zone	Restrepo field standard; Bergen County frost timeline
WR-CLIK wireless sensor	Hunter WR-CLIK (433 MHz, 800-ft range, freeze shutoff at 37°F, 5-yr warranty) required on every installation; pairs with Hydrawise HCC; push alert active via Hydrawise cloud	Restrepo specification standard

Blow-out tee	Quick-connect tee and valve installed in main supply line and accessible above grade; location documented on as-built; blow-out adapter stored with owner	Restrepo standard

SPECIFICATION

Two-wire vs. conventional decision — 10+ zones defaults to two-wire.

For projects with ten or more irrigation zones, two-wire decoder architecture (Hunter Hydrawise HCC with EZ Decoder or Rain Bird ESP-LXIVM with IVM decoders) provides significant advantages: a single two-wire path serves all decoders on a zone, eliminating home-run wiring for each solenoid. Fault recovery (Self-Healing on Rain Bird; mA fault detection on Hunter EZ decoder) identifies individual decoder failures without taking down the entire system. Decoder burial: 6–8 inches in landscape, 18 inches in hardscape conduit per NEC 300.5. Two-wire cable continuity tested at controller before hardscape pours close access.

FIELD RULE

Water feature VS pump — 0–10V or relay control from Crestron.

Decorative water features (fountains, pondless waterfalls, sheet waterfalls) with variable-speed pumps integrate with Crestron Home via a 0–10V analog output module driving the pump's external speed input, or via a relay module controlling a VS pump's run/stop input. Pool-adjacent water features comply with NEC 680.26 equipotential bonding and NEC 680.22 GFCI (cross-reference Vol 19 Pool/Spa). Each water feature pump receives a dedicated GFCI circuit per NEC 422.31 with an accessible, labeled disconnect. Pump stub-out conduit is sized for future VS drive wiring upgrade.

NOTE

Freeze blow-out tee — installed at rough-in, not after.

The blow-out tee and quick-connect valve must be installed in the main irrigation supply line during rough-in, not as a retrofit. The tee is located adjacent to the backflow preventer at a height accessible with a blow-out adapter. The location is documented on the as-built irrigation drawing and a copy is placed in the owner closeout package. The blow-out adapter is stored in the equipment room with the spare hardware bin. Omission of the blow-out tee at rough-in typically requires supply line excavation for a retrofit installation.

SOURCES

[38] NJ DCA Bulletin 99-2 Backflow Preventer Testing Guidance [39] Hunter HCC Hydrawise Smart Controller Product Page [40] Hunter Hydrawise Pro-HC Smart Controller Specifications [41] Rain Bird ESP-LXIVM Two-Wire Controller (60-Station) [42] Rachio 3 Smart Sprinkler Controller Product Page [43] Toro Tempus Pro Outdoor Controller [44] Cornell Law — NJAC 7:10-10.3 Backflow Preventer Code

PART 3

Sleeve & Surge

Sections 08–10 — Conduit & Sleeve Discipline, Surge & Grounding, Smart-Home Integration

§ 07

Weatherproof Power

PART III — POWER & INFRASTRUCTURE

Outdoor power distribution begins at the outdoor subpanel and flows through a network of weatherproof enclosures, GFCI-protected branch circuits, and transient-protected feeders to every load on the property. NEMA 4 is the minimum enclosure rating for outdoor residential subpanels; NEMA 4X 304 SS is standard for coastal projects; NEMA 4X FRP (Stahlin) is specified where pool chemical proximity creates corrosion risk. NEC 230.67 requires a Type 1 SPD at the outdoor subpanel feeding all exterior loads on new installations.[45]

NEMA ENCLOSURE RATINGS — IP EQUIVALENTS AND APPLICATION GUIDE

NEMA Type	IP Equiv.	Material Options	Application	Specified Products
NEMA 3R	IP14	Steel, aluminum, fiberglass	Outdoor subpanel; indoor/outdoor transition; rain-tight	Square D QO series NEMA 3R; standard residential outdoor subpanel
NEMA 4	IP66	Steel, aluminum	Standard outdoor equipment; rain and hose-down rated	Hoffman A-series; Square D NEMA 4 enclosures; pergola column NEMA 4 distribution box
NEMA 4X 304 SS	IP66	304 stainless steel	Corrosive environments; coastal NJ standard for outdoor AV head-end	Hoffman nVent CSD30248SS[46]; NEMA 4X 304 SS for subpanel and AV distribution
NEMA 4X 316 SS	IP66	316 stainless steel	Shore-adjacent (≤1 mile tidal); severe salt-air	Hoffman nVent 316 SS series; specify when within 1 mile of tidal water
NEMA 4X FRP	IP66	Fiberglass-reinforced polymer	Chemical proximity (pool); non-conductive requirement	Stahlin J series FRP NEMA 4X[47]; pool equipment pad outdoor AV enclosures
NEMA 6P	IP68	Steel, stainless	Temporary submersion; flood zone outdoor equipment	Hoffman 6P series; specify for below-grade outdoor utility vaults

OUTDOOR SUBPANEL AND SPD REQUIREMENTS

Element	Specification	Code Reference

Subpanel enclosure	NEMA 4 minimum; NEMA 4X 304 SS at coastal sites; main breaker sized for total outdoor load + 25% growth headroom	NEC 225; NEC 230
Type 1 SPD	NEC 230.67 requires SPD at all new service entrances; Square D FSPD140 (140 kA/phase, NEMA 4X) or listed equivalent at outdoor subpanel[45]	NEC 230.67 (2020/2023)
GFCI branch circuits	GFCI breakers for all outdoor circuits ≤150V to ground and ≤50A per NEC 210.8(F); WR TR receptacles per NEC 406.9 and 406.12	NEC 210.8(F); 406.9; 406.12
Intersystem bonding block	NEC 250.94(A) intersystem bonding termination block accessible within 3 ft of service equipment; coax, LV landscape, and speaker shield drains terminate here	NEC 250.94(A)
Load schedule label	Every breaker labeled: equipment, voltage, amperage, zone; verified against load schedule at commissioning	NEC 408.4; Restrepo standard
Feeder sizing	Total connected load + 25% growth headroom; sized per NEC 220.87 actual load or NEC 220 load calculation; documented in project record	NEC 220; NEC 310

GENERATOR AND BACKUP POWER

Product	Output	Transfer	Control	Rating	Notes
Kohler 14RCA[48]	14 kW LP/NG	RXT ATS 100–400A; UL 1008	RDC2 controller; OnCue Plus remote monitoring	UL 2200; cUL	Specify for full outdoor circuit coverage including heaters and irrigation pump

Generac Power Inlet 6338[49]	50A NEMA 3R	Manual transfer switch per NEC 702	None	NEMA 3R	Portable generator connection; NEC Article 702 compliant; 50A inlet box
Generac Power Inlet 6347[49]	50A	Manual transfer switch per NEC 702	None	Corrosion-resistant aluminum	Coastal NJ site; corrosion-resistant housing; portable generator option

SPECIFICATION

NEC 230.67 Type 1 SPD — required at all new outdoor subpanels.

NEC 230.67 (adopted 2020 and 2023 NEC) mandates a surge protective device at all new service entrances. For outdoor subpanels downstream of the main service, the SPD is installed at the subpanel as the next downstream distribution point. A Type 1 SPD (listed for installation before the main breaker) at the outdoor subpanel protects landscape audio amplifiers, irrigation controllers, outdoor TV electronics, and pergola motor drive boards from transient overvoltages generated by lightning events. DITEK DTK-MRJPOEX (NEMA 4X outdoor, 20 kA/pair, UL 497B) is installed at every outdoor PoE-powered camera, access point, and AV distribution node.[45]

FIELD RULE

NEC Article 225 outdoor branch circuits — weatherproof fittings mandatory.

NEC 225 governs all outside branch circuits and feeders. Key requirements: weatherproof fittings at all outdoor boxes; raceway sealed at every conduit entry into a heated enclosure to prevent condensation migration; minimum wire size per calculated load; all outdoor circuits on GFCI or AFCI breakers as required by NEC 210.8 and 210.12. Outdoor subpanel feeder is sized for total connected load plus 25% growth headroom. All outdoor service equipment is mounted on a concrete footing or equipment pad; no wood mounting blocks on exterior walls for enclosures weighing more than 15 lbs.

NOTE

NEC 480.10 and outdoor battery storage — NEMA 3R+ and ventilation.

Any outdoor battery storage system (LFP or lead-acid) installed as part of a generator or backup power system requires a NEMA 3R minimum enclosure, ventilation per NEC 480.10, and a listed disconnecting means. Battery storage in an outdoor equipment enclosure adjacent to the outdoor subpanel must be labeled per NEC 706 (energy storage systems). Coordinate with the AHJ before specification — some Bergen County municipalities have adopted specific energy storage provisions under NJAC 5:23 that exceed the base NEC requirement.

SOURCES

[45] DITEK — Understanding the 2023 NEC Rules for Surge Protection [46] nVent Hoffman NEMA 4X 304 Stainless Steel Enclosures [47] Stahlin FAQ Technical Library (NEMA Rating Maintenance) [48] Kohler 14RCA/RCAL Residential Generator [49] Generac Power Inlet Boxes 6338 and 6347

§ 08

Conduit & Sleeve Discipline

PART III — POWER & INFRASTRUCTURE

The single most consequential quality gate on an outdoor living project is the pre-hardscape sleeve verification. Every conduit homerun path, duct bank sleeve, and wire way under any hardscape surface must be set, pull-stringed, capped, and photographed before the concrete truck arrives. Red-line PVC Schedule 80 duct bank with detectable warning tape and tracer wire is the standard under all hardscape. This section defines conduit type by location, naming convention, fill discipline, and the locked sleeve schedule that travels with every project from rough-in through closeout.[50]

CONDUIT TYPE BY LOCATION — NEC 300.5 TABLE 300.5(A) COMPLIANCE

Wiring Method	Min. Cover	Application	Notes
UF cable (LV ≤30V direct burial)	6 in	LV landscape lighting conductors	NEC Table 300.5 Column 5; no conduit required; detectable tape 12 in above
PVC Schedule 40 in landscape	18 in	All conductors above 30V in landscape	Default for line-voltage, audio, data, and irrigation control in open soil
PVC Schedule 40 under concrete slab	12 in	General in-slab under hardscape	Standard for patio, sidewalk, and non-traffic hardscape transitions
PVC Schedule 80 in duct bank	18–24 in	Vehicle traffic crossings; hardscape duct bank	Red-line concrete-encased duct bank; 3-in spacers center-to-center; detectable warning tape 12 in above; tracer wire
RGS / IMC exposed above grade	N/A (above grade)	Exposed risers and conduit above hardscape; mechanical damage risk	RGS or IMC for mechanical protection; LFNC final 2–3 ft at equipment
LFNC (Sealtite)	18 in if buried	Final flexible connection to motorized equipment	Pergola motors, fans, heater conduit tails; ≤3 ft per NEC 356.60; listed fittings
EMT	18 in	Buried per NEC 358; exposed interior pergola wiring	18-in minimum per 2023 NEC; not for concrete-encased application
Concrete-encased duct bank (RGS/IMC)	0 in to top of concrete	Driveway and vehicle traffic crossings only	Minimum 2-in concrete envelope around conduit; PVC Sched 80 preferred inside bank

SLEEVE NAMING CONVENTION AND SCHEDULE

Sleeve ID	System	Conduit Size	Contents	Location / Route
SL-01-LV	LV Landscape Lighting	1 in PVC Sched 40	12 AWG or 10 AWG LV cable + pull string	Transformer pad to front landscape zone hub
SL-02-AUDIO	Landscape Audio	1.5 in PVC Sched 40	14 AWG 4-conductor + sub homerun 12 AWG; pull string	Equipment room to satellite field; LS12T sub to amp
SL-03-IRRIG	Irrigation two-wire	1 in PVC Sched 40	14 AWG 2-wire decoder cable + pull string	Controller to irrigation field; 6–8 in landscape; 18 in hardscape
SL-04-LV-DATA	Data / Control LV	1 in PVC Sched 40	Cat6A + class 2/3 control wiring + pull string	AV head-end to pergola column distribution box
SL-05-LINE	Line Voltage 120/240V	1 in PVC Sched 80	12 AWG or 10 AWG + pull string	Outdoor subpanel to heater, fan, and outdoor TV circuits
SL-06-GEN	Generator / ATS feeder	2 in PVC Sched 80	Feeder conductors per load calc + pull string	Main panel to ATS; ATS to outdoor subpanel

SPECIFICATION

Red-line duct bank standard — concrete-encased under all hardscape.

Under all hardscape surfaces (driveways, patios, pool decks, and pavers), the duct bank consists of PVC Schedule 80 conduit(s) encased in minimum 2-inch concrete envelope. Conduit center-to-center spacing: 3 inches minimum with PVC spacers. Duct bank top: minimum 18 inches below finish grade at standard hardscape; minimum 24 inches under vehicle traffic areas (driveways). Detectable warning tape (red 'ELECTRIC') embedded 12 inches above the top of the duct bank. 12 AWG orange tracer wire in each conduit for future locating. All conduit locations photographed with timestamp and filed in the pre-hardscape gate record.[50]

FIELD RULE

Conduit fill — ≤40% for two or more conductors.

Per NEC Chapter 9 Tables 1 and 4, conduit fill must not exceed 40% of the conduit's cross-sectional area when two or more conductors are present (NEC 300.17, 352.22, 358.22). A pull string or mule tape is installed in all sleeves during rough-in. Conduit ends are capped at stub-out to prevent concrete intrusion. The sleeve schedule (conduit size, route, system, wire fill, and percent fill calculation) is archived with the as-built drawings and delivered to the owner at closeout. No sleeve is closed without the schedule entry complete.

INSPECTION STANDARD

Pre-hardscape verification — field walk before concrete truck.

Before concrete placement, the Restrepo lead and GC project manager conduct a joint field walk to verify: all sleeves are in place with pull strings and caps; duct bank concrete envelope forms are set; tracer wire is installed and continuous; irrigation decoder cable depth is confirmed by probe measurement; pergola footing conduit stubs are plumb and projecting above the footing top; and all sleeve locations are marked on the pour drawings. The field walk is documented with a timestamped photo set uploaded to the project cloud folder the same day.

SOURCES

[50] NEC Table 300.5 Minimum Cover Requirements

§ 09

Surge & Grounding

PART III — POWER & INFRASTRUCTURE

Surge and grounding discipline in the outdoor environment extends beyond the service panel SPD to every data path, PoE device, and metallic outdoor element within the bonding zone. DITEK MRJ Series protectors are installed at every outdoor PoE-powered device. The intersystem bonding block at the outdoor subpanel ties telephone, coax, LV landscape, and speaker shield drains to a common ground reference per NEC 250.94. Pool-adjacent metallic elements require NEC 680.26 equipotential bonding coordination with the pool contractor.[51]

DITEK MRJ SERIES — OUTDOOR NETWORK SURGE PROTECTION

Model	Ports / Speed	Surge Rating	Enclosure	Listing	Application
DTK-MRJPOE[52]	10GbE PoE; 144W PoE pass	20 kA/pair	Indoor	UL 497B	Indoor network switch PoE port protection; surge on Cat6A homerun before exterior device
DTK-MRJPOEX[53]	10GbE PoE; 144W PoE pass	20 kA/pair	NEMA 4X; liquid-tight cordgrips	UL 497B	Outdoor PoE camera, access point, outdoor AV node; field-replaceable module; NEMA 4X rated
DTK-MRJPOES[54]	10GbE PoE; shielded Cat6A	20 kA/pair	Indoor	UL 497B	Shielded Cat6A environments; drain wire terminated at bonding block end only

SPD COORDINATION AND GROUNDING MATRIX

Element	SPD / Protection	Grounding Requirement

Outdoor subpanel	Type 1 SPD (Square D FSPD140, 140 kA/phase) per NEC 230.67	EGC to service ground; intersystem bonding block within 3 ft per NEC 250.94
Indoor main panel SPD	Type 2 SPD at indoor panel for coordination with outdoor Type 1	Common grounding electrode system per NEC 250.50
Outdoor PoE camera / AP	DTK-MRJPOEX at each device endpoint	EGC continuity on Cat6A conduit; bonding block for shielded drain
Pergola structural steel	No SPD; bonding to NEC 680.26 grid if within 5 ft of pool; EGC continuity at all metallic column connections	Equipotential bond to 680.26 grid where applicable; EGC at all line-voltage circuits
Landscape irrigation pipe (metallic)	No SPD; bond to NEC 680.26 grid if within 5 ft of pool inside wall	Equipotential bond where within pool bonding zone per NEC 680.26
NFPA 780 lightning protection	Consult licensed lightning protection designer; NFPA 780 governs design; not installed by Restrepo without engineer of record direction	Ground ring electrode and bonding connections designed per NFPA 780

SPECIFICATION

NEC 250.94 intersystem bonding — one block, all LV shields.

NEC 250.94(A) requires an intersystem bonding termination block at the service equipment (or accessible within 3 feet of the outdoor subpanel) with not fewer than three listed terminals. All LV landscape cable shield drains, coaxial cable shields, telephone pairs, and speaker cable shield drains terminate at this block. The block is bonded to the grounding electrode system at the outdoor subpanel. Its location is photographed and documented on the as-built electrical one-line diagram. The intersystem bonding block photo is a QC gate item at closeout.

FIELD RULE

EGC continuity — calibrated ohmmeter at commissioning.

An insulated copper equipment grounding conductor (EGC), green or green/yellow, sized per NEC Table 250.122, runs with every circuit feeding outdoor equipment. EGC continuity is verified with a calibrated ohmmeter at commissioning: test point to test point at each outdoor circuit, end-to-end. Result is logged and filed in the closeout record. Typical passing value for a 12 AWG EGC on a 20A circuit run of 100 feet: less than 0.5 ohm. Any result above 1 ohm triggers inspection of the conduit and connector continuity before energizing the circuit.

NOTE

Pool-zone bonding coordination — coordinate with pool contractor.

All metallic outdoor systems within 5 feet of the pool inside wall require connection to the NEC 680.26 equipotential bond grid. This includes: irrigation metallic pipe, pergola structural aluminum or steel columns, speaker stakes, outdoor light fixture brackets, conduit, and any decorative metallic elements. The coordination sign-off from the pool contractor must be on file before the patio or pool deck pour. Cross-reference Vol 19 Pool/Spa for the complete bond grid documentation requirements.

SOURCES

[51] Fibox USA — NEMA Ratings and IP Equivalents [52] DITEK DTK-MRJPOE Technical Specification Sheet (10GbE PoE, UL 497B) [53] DITEK DTK-MRJPOEX Technical Specification Sheet (NEMA 4X outdoor PoE) [54] DITEK MRJ Series Product Page (MRJ PoE Surge Protectors)

PART 4

Discipline & Closeout

Sections 11–13 — Without Written Direction, Pre-Hardscape & Pre-Pour Checklist, QC · Audit · Clos

§ 10

Smart-Home Integration & Scenes

PART IV — INTEGRATION & CLOSEOUT

Crestron Home, Lutron RadioRA 3, and Control4 are the integration platforms for luxury outdoor living automation on Restrepo projects. All three execute scene sequences locally on the LAN processor without cloud dependency — a cloud outage at any outdoor device manufacturer does not interrupt scene execution. Five locked scenes are programmed at commissioning on every project. Geofencing is a secondary trigger only; scheduled calendar events with sunset offsets and weather forecast pre-conditions are the primary triggers for all outdoor scenes.

INTEGRATION PATHS BY OUTDOOR SYSTEM

System	Primary Platform	Protocol / Driver	Notes
FX Luxor ZD/ZDC	Crestron Home (CP4/MC4)	IP LAN via WIFIMOD2 LAN port; Crestron Home driver	Up to 250 zones controllable from Crestron; scene recall by zone group and dimmer value
Lutron RadioRA 3	Crestron Home (primary); standalone (secondary)	Cesta keypad button press bridged to Crestron; Lutron Designer file archived	RA3 Cesta keypad provides scene-level LV control; Crestron handles cross-system coordination
StruXure Pergola X	Control4 (driverCentral) or Crestron Home	HTTP API + Modbus; driverCentral driver for Control4	Open/close louver, speed control, and status feedback; weather sensor integration
Renson Camargue	Control4 (driverCentral) or Crestron Home	IO Homecontrol bridged via Somfy TaHoma; driverCentral driver	TaHoma bridge required; rain/wind/freeze sensor status to Crestron/Control4
Hunter Hydrawise HCC	Crestron Home or Control4	REST API; 60-sec minimum poll; Crestron driver or Control4 module	Zone status, schedule, flow alerts; API key and endpoint documented in program notes
Bromic / Infratech heater	Lutron RA3 (primary); Crestron Home (secondary)	0–10V via EPC-2-D + Outdoor Heater Relay Module; Lutron App Note 587[55]	Dimmer level mapped to heater output 0–100%; status fed back to Crestron via RA3 bridge
Sonance DSP 2-150 MKIII	Crestron Home or Q-SYS	SonARC v2 IP; Crestron driver; Q-SYS native output	Volume, source, EQ preset from Crestron TSW touch panel or Q-SYS UCI

FIVE LOCKED SCENES — REQUIRED ON ALL PROJECTS

Scene	Trigger	Sequence of Operations

Evening Garden	Scheduled at local sunset −15 min or Cesta keypad	Luxor ZD at 60%; path + up-lights warm white 2700K; pergola louvers to 50% closed for ambient shade; landscape audio ON at background level; heater OFF (weather forecast condition: heater pre-on if <55°F forecast); irrigation pause; outdoor TV OFF; push notification to owner app
Dinner Party	User-initiated — Cesta keypad or Crestron TSW-770	Luxor ZDC at 80% amber RGBW; landscape audio UP to dining level; Bromic/Infratech heater ON High if temperature sensor <65°F; pergola 50% open for ventilation; outdoor TV ON if owner-assigned display zone; Hydrawise rain delay active if raining
Watch Party	User-initiated — keypad or Crestron touch	Luxor ZD at 20% (minimal ambient); outdoor TV ON at owner display zone; landscape audio routed to TV zone; pergola closed for shade; heater ON Low if <60°F; no irrigation during watch party
Storm Lockdown	Weather alert integration or Cesta keypad hold	Pergola louvers CLOSED immediately; outdoor TV OFF; landscape audio OFF; Hydrawise rain delay activated; all outdoor GFCI circuit status confirmed ON via Crestron status monitor; Renson Camargue retracted; heater OFF; push notification: Storm Lockdown activated
Winter Off	Owner-initiated or calendar trigger (November 1)	Irrigation controller winter mode: blow-out confirmed; Hydrawise schedule suspended; heaters OFF; Luxor lighting schedule suspended; pergola closed; freeze-protect active via WR-CLIK sensor; outdoor TV powered OFF at circuit; push notification: Winter Off mode active; outdoor equipment audit scheduled

SPECIFICATION

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

Crestron CP4/MC4 communicates with FX Luxor ZD/ZDC via IP LAN using the WIFIMOD2 LAN port. Lutron RadioRA 3 Processor bridges Cesta keypad button presses to Crestron via the Crestron/Lutron integration published in Crestron documentation.[56] Control4 uses driverCentral modules for Hunter Hydrawise, StruXure Pergola X, and Renson Camargue via Somfy TaHoma bridge. All scene execution occurs locally on the LAN. A cloud outage at FX, Hunter, StruXure, or Renson does not interrupt local scene execution. Cloud connectivity is required only for owner app remote access and weather forecast pre-conditioning.

FIELD RULE

Geofencing is a secondary trigger only.

GPS geofencing events from smartphones are unreliable in NJ suburban tree cover and multi-dwelling proximity. A false geofence exit or entry can trigger unnecessary heater-on cycles or irrigation interruption. Geofencing is appropriate only as a confirmatory secondary trigger paired with a time-of-day or sunset-offset component: 'if home + 30 minutes to sunset, activate Evening Garden scene.' Heater pre-conditioning is always governed by the weather forecast integration with a scheduled scene, not location data. Storm Lockdown is triggered by weather forecast API or manual Cesta keypad hold — never by geofence alone.

BEST PRACTICE

Notification matrix — push alerts for every critical outdoor system.

Crestron Home pushes alerts for: Luxor transformer GFCI trip; outdoor TV circuit GFCI trip; Hydrawise wire fault or flow alert; freeze sensor trigger (<37°F); Bromic/Infratech heater contactor fault; pergola rain/wind sensor trigger; StruXure/Renson motor stall; and Crestron LAN loss to any outdoor 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.

SOURCES

[55] Lutron Support — RadioRA 3 Integrating Outdoor Heaters (App Note 587) [56] Crestron Documentation — Pair and Configure Lutron System with Crestron Home

§ 11

Without Written Direction

PART IV — INTEGRATION & CLOSEOUT

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

FIELD RULE

BX/MC cable in direct-burial or hardscape conduit — without written direction.

PVC Schedule 40 is the default for all underground and in-slab outdoor wiring. Type BX (MC armored cable) in any buried or hardscape-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 as a permitted method for direct burial in standard landscape conditions. Above grade, in dry exposed interior pergola locations, MC cable may be acceptable with AHJ direction; document the written direction before any MC cable is used in an outdoor application.

FIELD RULE

Armored Cat6A in any buried or hardscape conduit — without written direction.

Armored Cat6A cable (Cat6A with metallic braid or foil/braid shield) in a buried or hardscape-encased PVC conduit is without written direction from the engineer of record. The preferred method is standard unshielded or foil-shielded Cat6A in a dedicated PVC conduit with the shield drain terminated at one end only (the indoor bonding block). Installing armored cable in conduit creates an unintended metallic path that can interfere with the grounding system and create ground loops in the data network.

FIELD RULE

Any LV, audio, data, or irrigation control crossing hardscape without a conduit sleeve — without written direction.

No line-voltage, audio, data, or irrigation control wiring may cross a hardscape pour without a properly buried conduit sleeve in place before the pour. After the slab or pavers are set, there is no corrective access without full demolition. The cost of adding a sleeve during rough-in is a few dollars and minutes. The cost of sleeve omission discovery after pour is measured in thousands of dollars and weeks of schedule. The pre-hardscape gate exists precisely to prevent this outcome. No sleeve omission is authorized without written direction.

FIELD RULE

FX Luxor transformer supply circuit without GFCI — without written direction.

NEC 210.8(A)(3) requires GFCI protection on all outdoor 120V receptacles at dwellings. Any FX Luxor or Coastal Source transformer supplied from a non-GFCI-protected branch circuit is without written direction. The 120V supply circuit to the transformer feeds through a GFCI breaker at the outdoor subpanel or a GFCI receptacle at the transformer mounting location. Transformer load: ≤80% of rated VA capacity confirmed under full zone load before commissioning.

FIELD RULE

Outdoor TV on a shared multi-load circuit — without written direction.

Restrepo Innovations standard is one dedicated 20A GFCI circuit per outdoor display. Sharing an outdoor TV circuit with heaters, audio amplifiers, fans, or any other load is without written direction from the engineer of record. A shared circuit creates GFCI nuisance trip risk from leakage current accumulation across multiple devices. A heater or fan motor fault on a shared circuit will take down the outdoor TV display simultaneously.

FIELD RULE

Irrigation backflow preventer omitted — without written direction.

NJAC 7:10-10.3 and NJ DCA Bulletin 99-2 require a testable backflow preventer on all residential irrigation systems in New Jersey. Omission of the required RPZ or double check valve assembly is without written direction and is code non-compliant. No irrigation system is commissioned without the backflow preventer installed, tested, and the test certificate filed in the owner closeout record.[44]

FIELD RULE

Bonding omitted on metallic outdoor elements within 5 feet of pool — without written direction.

NEC 680.26 requires all metal within the pool bonding zone (within 5 feet of the pool inside wall) to be connected to the equipotential bond grid. Omission of the bond connection on pergola structural posts, metallic irrigation pipe, speaker stakes, conduit, or any metallic outdoor element within this zone is without written direction. The bond connection is made during rough-in; after hardscape pours, corrective access is limited or impossible.

FIELD RULE

Signal cabling outside without UV-rated jacket — without written direction.

All signal cables installed in exposed outdoor locations (not in conduit) must carry a UV-rated jacket listed for outdoor direct-burial or outdoor exposure. Standard indoor-rated cables (CMR/CMP) degrade rapidly in UV exposure. Standard direct-burial landscape cables without UV rating are not acceptable for overhead or surface-exposed outdoor runs. Any signal cable in an exposed outdoor application without UV-rated jacket listing is without written direction.

§ 12

Pre-Hardscape & Pre-Pour Checklist

PART IV — INTEGRATION & CLOSEOUT

The pre-hardscape gate is the single most consequential quality control event in the Restrepo outdoor living project sequence. No concrete truck arrives, no paver is set, and no asphalt is placed without this gate signed off. All items are documented with timestamped photographs uploaded to the project cloud folder the same day the gate is cleared. The yard is wired before the hardscape sets.

PRE-HARDSCAPE GATE — SLEEVE AND ROUGH-IN VERIFICATION

- ☐ VERIFY Sleeve red-line photographed — all conduit duct bank sleeves captured in timestamped photo set before any hardscape is placed; photos labeled by location and system (LV lighting, audio, data, line voltage, irrigation) and filed in closeout archive; red-line stripe location marked on pour drawings
- ☐ VERIFY Conduit sleeves capped with pull string installed — all sleeves have pull string or mule tape installed; conduit fill verified ≤40% per NEC Chapter 9; conduit ends capped with removable plugs; sleeve schedule reconciled against as-built drawings before pour
- ☐ VERIFY Detectable warning tape installed 12 inches above each conduit — red 'ELECTRIC' tape confirmed at 12-inch minimum depth above duct bank top surface; orange tracer wire in each conduit; tape and wire continuity documented
- ☐ VERIFY Transformer pad poured with elevation signed — outdoor subpanel and LV transformer mounting pad at correct finished height; conduit stubs projecting above pad at correct height; elevation confirmed on as-built drawing and signed by Restrepo lead
- ☐ VERIFY Outdoor receptacle box rough-mounted at proper height with WP in-use cover — all outdoor GFCI receptacle boxes at correct mounting height; extra-duty WP in-use covers installed; conduit entry sealed; NEMA rating maintained at all conduit entries
- ☐ VERIFY Outdoor subpanel mounted in NEMA 3R+ enclosure — subpanel enclosure type confirmed for exposure condition (NEMA 4 or 4X at coastal sites); conduit stubs to panel set in form; AHJ pre-inspection scheduled; panel location documented
- ☐ VERIFY Sleeve schedule signed by integrator + GC — sleeve schedule form (conduit size, route, system, fill, percent fill) signed by Restrepo AV/smart-home lead and GC project manager; original filed in project record; copy in owner closeout archive
- ☐ VERIFY LV transformer load mock-up calculated at <80% rated — full-zone load calculation for each FX Luxor LZD/LZDC and Coastal Source LV-300/LV-600 transformer documented; total VA per zone group confirmed ≤80% rated capacity; calculation signed by lighting designer
- ☐ VERIFY Freeze blow-out tee installed and accessible — quick-connect tee and blow-out valve in main irrigation supply line accessible above grade; location marked on as-built irrigation drawing; blow-out adapter stored in owner equipment room with spare hardware bin
- ☐ VERIFY Pool-zone bonding coordination complete — all metallic outdoor elements within 5 ft of pool inside wall identified, bond connections made to NEC 680.26 grid, and photographed; pool contractor sign-off on coordination document filed before patio/pool deck pour

INSPECTION STANDARD

Pre-hardscape gate sign-off — GC + Restrepo lead before pour.

The pre-hardscape gate sign-off form is signed by the GC project manager, MEP lead, and Restrepo AV/smart-home lead before any hardscape is placed. The signed form is filed in the project record. Timestamped photographs of all pre-hardscape 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 Restrepo requirement on every outdoor living project regardless of scope.

SPECIFICATION

Spare hardware — ordered before hardscape pours.

The spare hardware order for all outdoor living consumables (≥5% of installed equipment value) must be placed before the hardscape pours close corrective access. Items: FX Luminaire replacement lamps (2700K/3000K), Coastal Source IFSCCF/IFSCCM IP68 connectors (10 pair minimum), Sonance 70V tap boards (one per SLS satellite pair installed), irrigation solenoids (one per zone type installed), controller fuses, pergola motor remote/receiver, DITEK DTK-MRJPOEX field-replaceable modules, and transformer fuses. Delivered and labeled at project completion per Restrepo spare hardware policy.

§ 13

QC · Audit · Closeout

PART IV — INTEGRATION & CLOSEOUT

Commissioning is the bridge between an installed outdoor living system and a warranted, measured, owner-operated environment. Every Vol 20 project passes through the same closeout sequence: verify, document, register, train, deliver. The yard is sleeved, sealed, and signed. Nothing leaves Restrepo's hands until all ten QC gates are closed and the owner receives the complete documentation package.

TEN QC GATE ITEMS — ALL REQUIRED AT CLOSEOUT

- ☐ VERIFY Sleeve red-line photographed and filed — timestamped photos of all conduit sleeves under hardscape in closeout archive; conduit schedule reconciled against as-built; AHJ rough-in inspection certificate on file; no open sleeve entries under any hardscape surface
- ☐ VERIFY GFCI verified on all outdoor circuits — every outdoor GFCI breaker and receptacle tested with calibrated GFCI tester; trip current and response time logged per NEC 210.8(F); results filed; all WR TR receptacles confirmed installed with extra-duty WP in-use covers
- ☐ VERIFY Type 1 SPD installed at outdoor subpanel — Square D FSPD140 or listed equivalent installed at outdoor subpanel; status indicator GREEN; AHJ inspection certificate accepted; NEC 230.67 compliance confirmed; DITEK DTK-MRJPOEX at all outdoor PoE devices confirmed installed
- ☐ VERIFY Sonance BMK sub buried per spec — LS12T or LS15T buried per Sonance Buried Mount Kit instructions; canopy elevation above grade confirmed; 70V tap setting documented; DSP 2-150 MKIII SonARC v2 IP address static-assigned and documented in program notes
- ☐ VERIFY Coastal Source IP68 connectors used at all field splices — all landscape field splices on Coastal Source Plug+Play runs confirmed with IFSCCF/IFSCCM connectors; no open wire nuts in direct-burial landscape; connector inventory confirmed against takeoff
- ☐ VERIFY Transformer load <80% rated capacity — FX Luxor LZD-150/300 and Coastal Source LV-300/600 VA load measured under full zone load and confirmed ≤80% rated capacity; measurement and load calculation filed in closeout record; Luxor app zone display screenshot archived
- ☐ VERIFY NEC 411 compliance confirmed — UL 1838 transformer listing verified; supply circuit GFCI confirmed; output ≤30V/≤25A; all transformers mounted ≥12 inches above finished grade; NEC 411.4 listed system compliance documented
- ☐ VERIFY FX Luxor scenes archived — all zone groups, dimmer levels, color values (ZDC), schedule programs, and astronomical settings exported from Luxor controller; backup on cloud account and local USB media; Lutron RadioRA 3 firmware version and keypad assignments in Lutron Designer file archived at closeout
- ☐ VERIFY Freeze blow-out date scheduled with owner — irrigation blow-out contracted for October 15 or earlier; Hunter WR-CLIK freeze sensor tested and push alert confirmed active at 37°F threshold; blow-out tee location walked through with owner; blow-out date logged in service record
- ☐ VERIFY Spare hardware ≥5% delivered + labeled — FX Luminaire lamps (2700K/3000K), Coastal Source IFSCCF/IFSCCM connectors, Sonance 70V tap boards, irrigation solenoids, controller fuses, pergola motor remote, DITEK field-replaceable modules, and transformer fuses all in labeled bins delivered to equipment room; list signed by owner at handoff

INSPECTION STANDARD

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

All ten QC items are verified, documented, and signed before project handover. No QC item is waived without written direction from the Restrepo project manager. The commissioning report is delivered to the homeowner in writing with copies of all test results, GFCI logs, SPD indicator photographs, transformer load calculations, and spare parts delivery photographs. The signed commissioning report is filed in the project record. Owner training covers all five locked scene controls, lighting zone management via the Luxor app, irrigation schedule management via the Hydrawise app, emergency heater shutoff, and freeze blow-out procedures.

BEST PRACTICE

Owner handoff package — complete documentation discipline.

The owner handoff package includes: (1) Luxor app account credentials and zone map; (2) Hydrawise/Rachio cloud account credentials transferred to owner email; static IP assignments for all outdoor IP devices with switch port assignments; (3) as-built conduit sleeve schedule and one-line electrical diagram; (4) complete equipment list with model numbers, serial numbers, and warranty registration confirmations; (5) scene programming documentation for all five locked scenes; (6) spare parts inventory with labeled bin location in equipment room; (7) annual service schedule — blow-out date, transformer lamp check, IP68 connector inspection, Sonance BMK canopy check, DITEK module status; (8) emergency procedures: heater manual shutoff, irrigation emergency shutoff valve location, GFCI reset map, emergency contacts.

CLOSING

The yard is wired before the hardscape sets. Sleeves before stone. Conduit before concrete. Every sleeve was set and photographed before the pour. Every LV circuit is GFCI-protected and transformer-loaded at 80% or less. Every outdoor display is on a dedicated circuit. Every heater circuit is dedicated and GFCI-protected. Every backflow preventer is installed, tested, and certified. Every scene was programmed, tested, and committed to the owner archive. Vol 20 is the standard. Vol 20 is the discipline.

Sleeved.
Sealed.
Signed.

Restrepo Innovations · Island Media Systems