

FIELD MANUAL · VOLUME 01

Rough-In Installation Standards.

Performance, longevity, serviceability, and craftsmanship
for luxury residential and commercial integration.

PREPARED FOR

Homeowners · Builders & GCs · Electricians · Owner's Reps & PMs · Low-Voltage Technicians & Lead Installers

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PARTNER

Island Media Systems

Audio · Video · Network · Lighting · Shades
One team. One standard. One execution quality.



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MANIFESTO

This is what we expect, every job, every time.

This manual is the working standard for every Restrepo Innovations and Island Media Systems rough-in. It defines the way we route, support, protect, separate, and document cabling — at a level that exceeds code, that survives twenty years of service, and that represents the brand the moment a wall is opened.

Code is the floor, not the ceiling. The intent of this document is to push craftsmanship past the minimum into the realm of performance, longevity, and serviceability. This is critical infrastructure — it is not “just wires.”

HOW TO USE THIS MANUAL

Read it once cover to cover. Keep a copy on every job. Reference the QC Checklist at every milestone. Photograph and document as you go. If a section in this book conflicts with field improvisation, the book wins until the lead engineer says otherwise in writing.

CALLOUT LEGEND

FIELD RULE	Non-negotiable rule for the field
BEST PRACTICE	Preferred method that exceeds the minimum
DO NOT	Forbidden method — cause for rework
INSPECTION STANDARD	What QC and PMs verify on walkthrough
SPECIFICATION	Technical or manufacturer requirement
NOTE	Reference or supporting context



CONTENTS

Table of Contents

Twenty-eight sections, organized by build phase: philosophy, materials and methods, system-by-system standards, documentation, and quality control.

01	Project Partnership	p. 5
02	Installation Philosophy	p. 7
03	Craftsmanship & Ownership	p. 9
04	Approved Tools	p. 11
05	Prohibited Methods	p. 13
06	Stapling Standard	p. 15
07	Milwaukee M12 Cable Stapler Standard	p. 17
08	Cable Integrity	p. 19
09	Bends & Corners	p. 20
10	Routing Discipline	p. 21
11	Cable Combing	p. 22
12	Cable Stackers	p. 23
13	J-Hooks	p. 24
14	Velcro (Hook-and-Loop) Standard	p. 25
15	HV / LV Separation	p. 27
16	Nail Plates & Physical Protection	p. 28
17	Firestop	p. 29
18	Wiring Standard by System	p. 30
19	Rack & Future Conduits	p. 31

20	Grounding & Bonding	p. 32
21	Power Quality	p. 33
22	Labeling	p. 34
23	As-Built Documentation	p. 35
24	Error & Fix Log	p. 36
25	Photo Documentation	p. 37
26	QC Checklist	p. 38
27	Standards & References	p. 41
28	Field Notes	p. 43

PART 1

Foundations

Sections 01–03 — partnership, philosophy, ownership

§ 01

Project Partnership

RESTREPO INNOVATIONS × ISLAND MEDIA SYSTEMS

Restrepo Innovations and Island Media Systems work as a single execution team across luxury residential and commercial projects. Crestron control, high-end audio and video, structured network, lighting, and shading are designed, rough-installed, terminated, programmed, and commissioned to a single shared standard — the standard documented here.

This is not two companies coordinating in parallel. It is one team, one standard, one execution quality. There are no split standards between trades, no two ways to support a vertical trunk, no two methods to land a Cat6A behind a display. What follows in this book is the way we do it. All technicians on either company's payroll — and any electrician, framer, or sub working alongside us — are expected to align with what's written here.

Operating principles

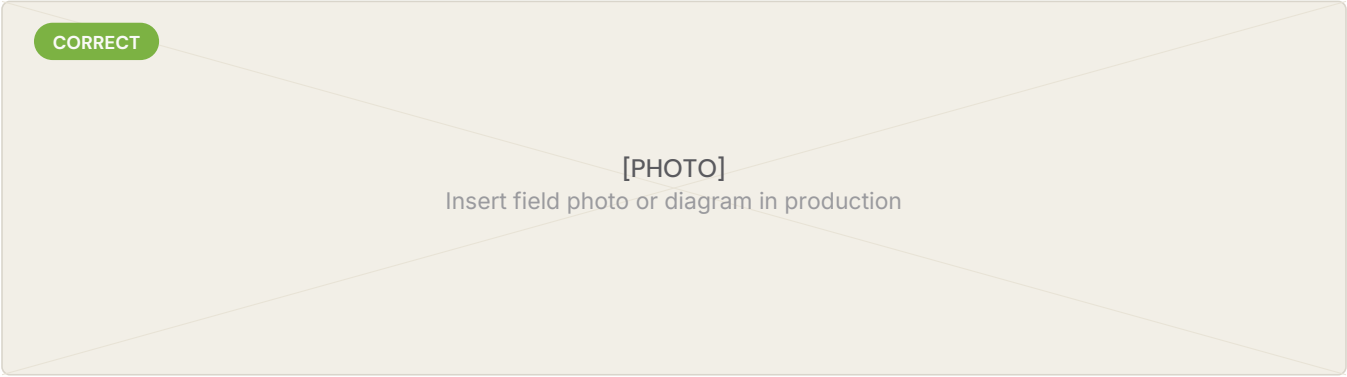
- One team. Restrepo and Island Media share a project plan, a punch list, and a QC checklist.
- One standard. Methods, materials, spacing, separation, and labeling are uniform from project to project.
- One quality. The deliverable is judged at the same level on every property regardless of price tier.
- No conflicting trade methods. If a method differs from this book, the lead engineer signs off in writing or it does not happen.
- Mutual ownership. Both teams own the entire installation as if their name is on it. Because it is.

FIELD RULE

Two logos, one product.

When a homeowner or builder opens a wall in five years, the work should look like it came from a single craftsman with a single signature — even if a dozen technicians were on site. That is the bar.





[PHOTO: Field documentation example — joint Restrepo / Island Media rack handoff]

§ 02

Installation Philosophy

CODE IS THE MINIMUM. STANDARD IS THE GOAL.

Code is the legal floor. It is what the AHJ enforces and what an inspector will pass. It is not what we deliver. Our standard sits above code in the dimensions that matter to the people who own and service these systems for the next two decades — performance, longevity, serviceability, and craftsmanship. A system installed to this manual will be faster to troubleshoot, easier to expand, more resistant to environmental and mechanical stress, and visually inspectable for years.

Why the rough-in defines the system

Most failure modes that show up after move-in are introduced during rough-in: crushed jackets, sharp bends that exceed cable manufacturer specs, kinks at corners, unsupported spans that sag and pinch, and tangled trunks that cannot be re-pulled. Termination quality cannot fix a damaged conductor. The trim cannot hide a poorly managed ceiling. The rough-in is where the signal-quality, network throughput, service life, and serviceability of the system are decided.

Build as if the walls stay open forever

Treat every cable run, every staple, every J-hook, every Velcro wrap as if a drone with a camera will pass through that bay tomorrow. Photograph it. Show it to the next tech. Hand it to the homeowner. If it does not pass that test, redo it before drywall closes. After close-up, the cost of repair is twenty times higher and the appearance can never be recovered.

BEST PRACTICE

Performance, longevity, serviceability, craftsmanship.

Every decision in the field — what staple, what hook, what wrap, what path — is weighed against those four words. If a method gets us to the closeout faster but loses even one of them, we don't use it.



[DIAGRAM: Layout example — code minimum vs. Restrepo / Island Media standard, side by side]

§ 03

Craftsmanship & Ownership

IF YOU SEE IT, YOU OWN IT.

Craftsmanship is the practical expression of caring about the work. On our jobs, ownership is the framework that makes craftsmanship reliable. We expect every technician on site, regardless of title, to operate by three rules.

If you see it, you own it

If you walk past a bad cable, a sagging J-hook, an unprotected conductor, a missing nail plate, an unsealed firestop — and you keep walking — you have just approved that work. Whoever installed it will tell the PM you saw it. The next person to inspect it will assume you signed off on it. The standard is: you fix it, you tag it for the lead, or you call the trade back to fix it. You do not walk past.

Own the work, own the problem

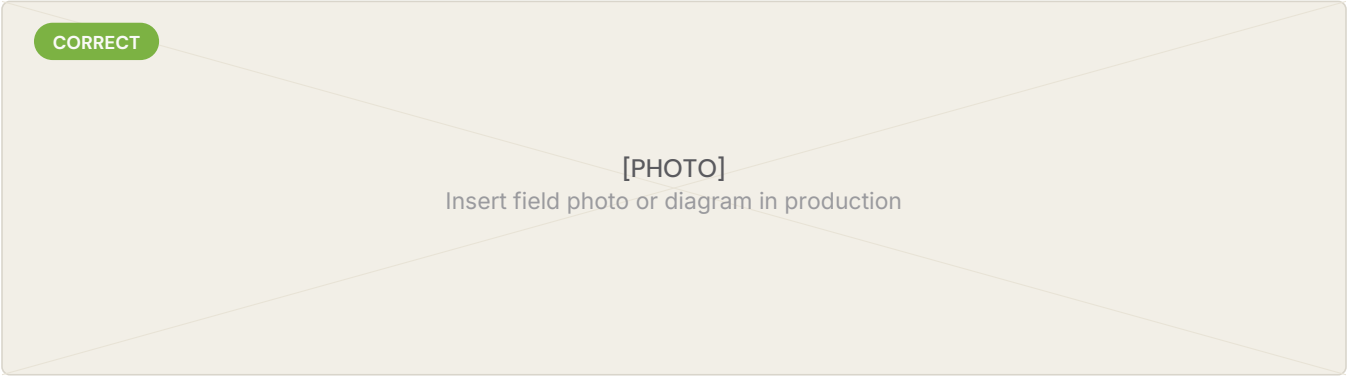
When something goes wrong, the question we ask first is not “whose fault.” It is “what did we miss as a team and how do we keep it from happening again.” But the inverse is also true: the technician closest to the work owns the outcome. If the cable you ran is the cable that fails, you own it — even if ten reasons exist for why. The error log (§24) exists to capture what we learned, not to assign shame.

Do not build over bad work

Never close a wall, button up a rack, terminate a panel, or trim out a room while bad rough-in remains underneath. Stop, fix it, photograph it, and continue. Building over bad work multiplies the cost of every later step, and ultimately it shows.

DO NOT**Do not stage drywall over an unverified rough-in.**

If anything in this manual is incomplete in a bay — supports, separation, protection, labeling, photographs — drywall does not close on that bay until it is.



[PHOTO: Field documentation example — clean, photographed bay ready for close-up]

§ 04

Approved Tools

THE RIGHT TOOL FOR THE RIGHT METHOD.

The following tools are approved for Restrepo Innovations and Island Media Systems rough-in. Any substitute requires written approval from the lead engineer or PM. The reason: these tools, used correctly, support the standards described in the rest of this manual. A different tool may force a different method, and that method is not approved here.

Milwaukee M12 Cable Stapler (2448)	Primary stapling tool for NM-B and small LV groups. Coil-spring depth control. Compatible only with Milwaukee 1" insulated staples. See §07.
Knipex cable shears	Clean, square cuts with no jacket fraying. Used for all power and LV cable cutoffs at termination and dressing.
Knipex strippers and cutters	Precision strippers for category, coax, speaker, and power. Selected to match the conductor; do not strip with a knife.
Oscillating multi-tool	Controlled cuts in finished surfaces, plastic device boxes, mud rings, and adjustments at trim. Not a framing saw.
Brady label printer	Standard for all LV and HV labels. Printed only — handwritten labels are not acceptable on closeout.
Fluke tester	Cable certification, continuity, and basic field troubleshooting. Required before sign-off on any structured cabling.
Fish tape, glow rods, dispensers	Used inside conduit and through wall cavities. Glow rods help locate paths from ceiling to floor without damaging substrates.
J-hooks	Primary horizontal pathway support. Sized to the bundle. See §13.
Cable stackers	For organized straight multi-run segments only. Not a substitute for J-hooks on long horizontal runs. See §12.
Velcro hook-and-loop straps	Only acceptable LV bundle management product on this team. No nylon zip ties on data, AV, control, or shade cables. See §14.
Firestop kit	Listed sealants, putty, collars, and pillows for fire-rated penetrations. If you make the hole, you seal the hole. See §17.





[IMAGE: Tool example — Milwaukee M12 Cable Stapler with 1" insulated staples]

§ 05

Prohibited Methods

CAUSE FOR REWORK, NO EXCEPTIONS.

These methods are not permitted on any Restrepo Innovations or Island Media Systems site. Each one degrades performance, longevity, serviceability, or craftsmanship in a way that cannot be recovered later. If you see one of these in place, document it, fix it, and log it in the error log (§24).

DO NOT**Hammered staples on data, control, or AV cable**

Inconsistent depth, direct mechanical impact on jacket, frequent crushing of conductors. If you must use a hammer, you are on the wrong cable type or with the wrong tool.

DO NOT**Nylon zip ties on LV bundles**

Plastic ties over-cinch, deform geometry, and induce signal degradation on category and coax. They violate AVIXA, BICSI, and TIA cable-management guidance for hook-and-loop on category, coax, and fiber. Use Velcro on LV. See §14.

DO NOT**Diagonal runs**

Diagonals are uninspectable, hard to label, and impossible to predict during future work. All runs are vertical or horizontal. See §10.

DO NOT**Crushed cable**

Any visible flattening, ovalization, jacket whitening, or color change at a support is damage. Damaged cable is replaced, not ignored. See §08.

DO NOT**Hard 90° bends**

Hard 90s exceed manufacturer minimum bend radius and induce return-loss and attenuation problems. Sweep all corners. See §09.

DO NOT

Tangled wire

Tangles cannot be straightened later without removing fasteners. Comb before you secure. See §11.

DO NOT

Mixed HV and LV in the same uncontrolled path

Different voltage levels in the same uncontrolled tray, stacker, or bundle induces noise and is not compliant with NEC 300.3(C). See §15.

DO NOT

Using ceiling grid or ceiling support wires as cable support

Ceiling-grid wires are not engineered for cable load. Cable must be carried by listed pathway hardware (J-hooks, trays, stackers, conduit).

What good looks like	What we reject on QC
Vertical and horizontal runs only.	Diagonal shortcuts across the bay.
Velcro on LV — finger-tight, irregularly spaced.	Zip-tied, over-cinched data trunks.
Sweep bends with supported corners.	Hard 90s, kinks, or jacket whitening.
HV and LV organized into separate paths.	Mixed power and signal in the same stacker.
Cable held by listed hardware only.	Cable lashed to grid wires.

§ 06

Stapling Standard

HOLD THE WIRE. NEVER CRUSH IT.

Stapling is a foundational skill on this team. A staple driven correctly does one thing: it holds the cable in place against framing without changing its physical geometry. A staple driven incorrectly compresses the conductors, deforms the jacket, or pinches a pair — and the consequences appear later in throughput, return loss, or fault.

Standards

- Staples hold the wire — they never crush it.
- Never overfill a staple. One cable per staple unless the staple is rated for stacked cables of equal size and type.
- Cable must keep its round shape and have a small amount of slip movement under the staple — no choking.
- Do not press the stapler aggressively into the framing; let the depth control set the staple.
- Practice on scrap framing first when arriving on a new tool, new staple lot, or new cable type.
- Never staple a knot, a tangle, a corner, or a transition. Staples belong on straight runs.
- If the jacket deforms, whitens, or shows ribbing from the staple, remove and redo.
- Fatigue rule: if the quality of your staples is dropping, stop. Drink water, switch tasks, or hand it off.

INSPECTION STANDARD

QC checks every staple on a sample basis.

Random pull-and-rotate test: at any staple, the inspector must be able to lightly rotate the cable. If the cable is locked in place, the staple is over-driven and the run is rejected for that section.

CORRECT

[IMAGE]

Insert field photo or diagram in production

[IMAGE: Correct example — staple holds cable, jacket round, slight movement]





[IMAGE: Incorrect example — overdriven staple crushing cable, jacket whitening visible]

§ 07

Milwaukee M12 Cable Stapler Standard

SPECIFIC TOOL, SPECIFIC USE, SPECIFIC STAPLE.

The Milwaukee M12 Cable Stapler (model 2448) is the approved cordless stapling tool on every Restrepo and Island Media job. It is precise, fast, and consistent in the right application. It is also commonly misused. The rules below come from Milwaukee's own product guidance combined with our field experience.

Approved staple — Milwaukee 1" Insulated (MNM1-600)

The 2448 is only compatible with Milwaukee 1" Insulated Cable Staples (MNM1-600). Per Milwaukee, these staples are UL/CUL listed for single and double-stacked NM-B cable in the following combinations: 14-2, 14-3, 12-2, 12-3, 10-2, and 10-3 (single only). The same staples are also rated for low-voltage cables including CAT3, CAT5, and coax. Crown is 3/4" wide; length is 1". The coil-spring drive sets the staple to a consistent depth based on the cable beneath the head.

When to use it

- Romex (NM-B) home runs and branch wiring on wood-framed structures.
- Single low-voltage cables — a single Cat6A drop, a single coax run.
- Small LV groupings of two or three cables on straight framing where a single staple is appropriate.
- Vertical or horizontal straight runs where the framing is solid wood and the cable is parallel to the member.

When NOT to use it

- Trunks and large LV bundles. The 2448 is not a trunk-management tool.
- Transitions, bends, and corners. Staples there crush cables and exceed bend radius.
- Anywhere a stacker, J-hook, or Velcro-to-wood is the cleaner solution.
- Mixed-gauge or mixed-type stacks not on the Milwaukee approved list.
- Plastic boxes, metal studs, or any non-wood substrate.

SPECIFICATION

Manufacturer guidance, summarized.

Milwaukee 1" Insulated Cable Staples are used to fasten single or double-stacked 14-2, 14-3, 12-2, 12-3, 10-2, 10-3 (single only) NM-B and low-voltage cable to wood surfaces during the rough-in process. UL/CUL listed.

Depth check and crush test

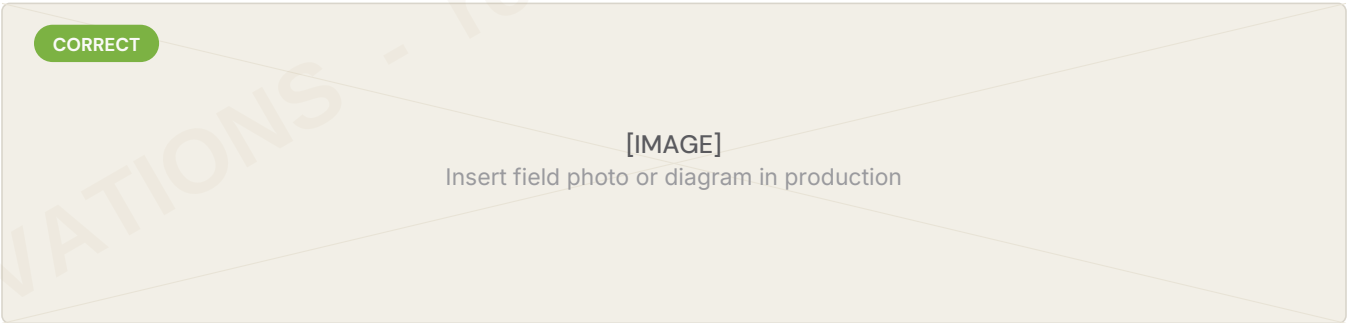


Before any production work each day, drive five staples on a scrap of framing with a piece of the same cable type you are about to install. The cable must still rotate slightly under the staple. The jacket must show no whitening, ribbing, ovalization, or printing transfer. If any one of those is present, stop, change the cable, change the staple, or call the lead.

Training new technicians on this tool

- Practice on scrap until ten consecutive staples pass the rotate-and-inspect test.
- Watch the lead drive five before you take the tool. The orientation, pressure, and follow-through matter.
- Inspect the first ten staples on real production work, then every ten thereafter.
- If the substrate changes — engineered lumber, knot, double stud — slow down and reverify.

USE THE M12 STAPLER FOR	USE A DIFFERENT METHOD FOR
Single Cat6A drop on a stud.	A 24-cable trunk down a chase.
NM-B branch run, parallel to a joist.	Anywhere within 12" of a corner or transition.
Single coax to a TV box.	Mixed gauges or off-list combinations.
Two-cable group within Milwaukee's approved list.	Metal studs or non-wood substrates.



[IMAGE: Correct example — Milwaukee M12 Cable Stapler on Romex, jacket round, depth correct]

§ 08

Cable Integrity

SECURE BUT NOT COMPRESSED.

Cable integrity is the geometric and material condition of a cable from end to end. Cable manufacturers publish electrical performance against an assumption: the cable stays round, the pairs stay paired, the dielectric stays uniform. Compressing, pinching, or tensioning the cable violates that assumption. The cable looks fine to the eye but it underperforms or fails on the bench.

Visible damage indicators

- Jacket whitening — stress on the polymer is permanent. The cable is damaged.
- Flattened geometry — round cables that show oval or D-shaped cross-sections are damaged.
- Imprint or ribbing from a staple, tie, or hook is damage. The pairs underneath are deformed.
- Color or print transfer from a staple onto the jacket is mechanical stress and is damage.
- Excessive tension — any cable held under tension between supports will creep and fail.

FIELD RULE

Replace damaged cable. Do not ignore it.

If the cable is damaged in rough-in, the cost to replace it is low. The cost to chase a performance issue post-trim, in front of the homeowner, is enormous.

INCORRECT

[IMAGE]

Insert field photo or diagram in production

[IMAGE: Incorrect example — flattened, jacket-whitened LV cable at an over-driven staple]



§ 09

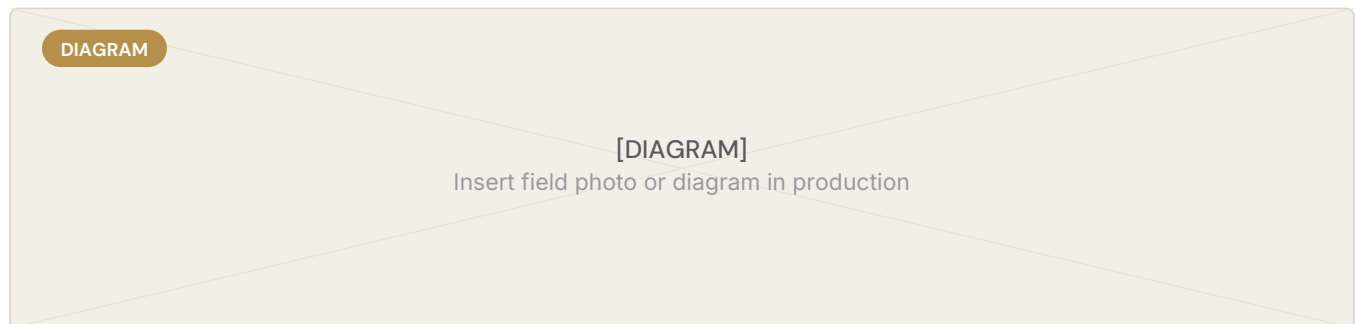
Bends & Corners

SWEEP, SUPPORT, NO TENSION.

Every cable has a manufacturer-published minimum bend radius — typically four times the cable diameter for category cable under tension and ten times for fiber. Hard 90° bends violate that radius and degrade signal. The standard on this team is that cables sweep around corners; they never break around them.

Standards

- No hard 90° bends. Use a smooth supported sweep.
- Use a J-hook, conduit sweep, or curved support to guide a turn.
- Velcro at the entry and exit of a turn — not in the middle of the curve.
- Cable enters and leaves a turn under no tension. Pulling tension is released before securing.
- Where a tight turn cannot be avoided, the corner is supported on both sides and inspected.



[DIAGRAM: Layout example — supported sweep vs. unsupported hard 90°]

§ 10

Routing Discipline

VERTICAL AND HORIZONTAL ONLY.

Every cable on a Restrepo or Island Media project runs vertical or horizontal. There are no diagonal shortcuts across a bay, across a ceiling, or across a chase. Routing discipline is what makes the rough-in inspectable, expandable, and predictable to every trade that follows.

- Trunks and bundles travel along framing — they are never freelance.
- When a trunk turns, it makes a 90° turn at a supported corner; it does not curve diagonally.
- Cabling does not take over the ceiling. Plan with the HVAC, plumbing, sprinkler, and electrical trades — not against them.
- Future expansion is left for. Empty conduit, spare J-hooks, and clean ceiling space are part of the deliverable.
- Every cable can be traced visually from rack to drop without unrolling a single bundle.

BEST PRACTICE

Trunks travel framing lines.

If a trunk path can be drawn on a floor plan as a series of straight lines, rotating only at framing corners, that trunk passes routing discipline.

DIAGRAM

[DIAGRAM]

Insert field photo or diagram in production

[DIAGRAM: Layout example — vertical and horizontal runs only, with planned 90° turns]



§ 11

Cable Combing

COMB BEFORE YOU SECURE.

Combing is the process of pulling a multi-cable group flat and parallel before supporting it. Combed cable is uniform; it accepts hook-and-loop wraps cleanly, stacks neatly in J-hooks, and presents a straight line in the bay.

- Straighten and comb every bundle before you support it.
- No twists or tangles inside a Velcro wrap, J-hook, or stacker.
- Cables are parallel before they are bound, not after.
- If a bundle cannot be combed clean, untangle it. Do not bind a tangled bundle.

CORRECT

[PHOTO]

Insert field photo or diagram in production

[PHOTO: Field documentation example — combed parallel trunk before Velcro wrap]



§ 12

Cable Stackers

APPROVED FOR STRAIGHT, SINGLE-PURPOSE SEGMENTS.

Cable stackers are useful tools for organized, straight, multi-run segments. They are not a universal solution. Used incorrectly, they create the same compression, mixed-system, and bend-radius problems we are trying to eliminate.

- Approved for straight, multi-run segments where cables travel in parallel.
- Do not overfill — leave headroom for service additions and heat.
- Do not mix HV and LV in one stacker. They are separate paths.
- Do not use stackers where they force a sharp turn or compression at a corner.
- Stackers are not a substitute for J-hooks on long horizontal spans.

DO NOT**Mixed HV/LV stacking.**

Power and signal must remain in separate paths. Do not run a single stacker that carries Romex on one row and category cable on another. NEC 300.3(C) and our standard both reject it.

§ 13

J-Hooks

PRIMARY HORIZONTAL PATHWAY SUPPORT.

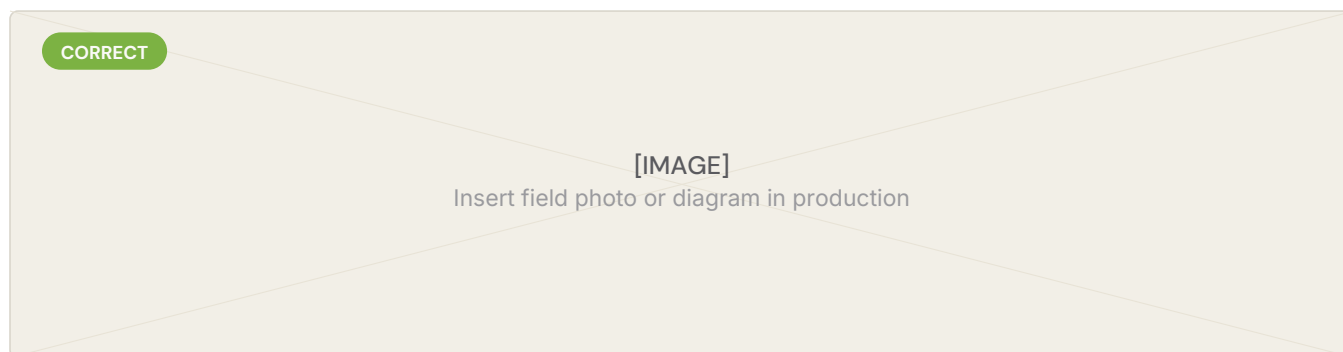
J-hooks are the primary horizontal-span support method on our installations. Promoted in BICSI's TDM manual and aligned with ANSI/TIA-569 pathway guidance, they distribute cable load on a wide, smooth surface and respect bend radius. J-hooks fail when they are undersized, overfilled, or used as a vertical trunk solution.

Standards

- Use J-hooks as the primary horizontal-span support method.
- Keep bundles parallel and combed before laying into the hook.
- Size the hook to the actual bundle, not the planned bundle. Future capacity belongs in the next hook over.
- Avoid overfilling — typical guidance is 40–60% fill so the bundle does not deform.
- Avoid sagging. The cable between two hooks should not visibly bow.
- Spacing is a discipline, not a guess: typical horizontal spacing of 4–5 ft for category cable; tighter for heavier or higher-count bundles. Vertical trunks supported every 16–24 inches, depending on bundle weight.

Vertical J-hooks vs. Velcro trunks

On long vertical chases, a J-hook ladder can be appropriate when the trunk is heavy and continuous. On shorter vertical runs to a rack or a panel, a Velcro trunk anchored to wood is cleaner, more serviceable, and visually superior. Decide based on bundle weight and serviceability, not habit.



[IMAGE: Correct example — J-hooks on a horizontal span, parallel combed bundle, no sag]

§ 14

Velcro (Hook-and-Loop) Standard

THE ONLY LV BUNDLE MANAGEMENT METHOD ON THIS TEAM.

Hook-and-loop straps are the only acceptable LV bundle management product on this team. Industry guidance is unambiguous on this point. AVIXA F502.01 calls for hook-and-loop on all category, coaxial, and fiber cable. BICSI's ITSIMM manual states explicitly that hook-and-loop should be used to prevent the change in cable physical geometry that nylon ties cause. ANSI/TIA-568 calls for loose, unevenly spaced bindings to minimize stress. We follow that guidance.

Why hook-and-loop, not nylon

Nylon zip ties have a single failure mode that disqualifies them on data and AV cabling: they over-cinch. The torque available on a finger or a tensioner exceeds the compressive strength of the LV jacket. The cable looks the same to the eye, but the geometry of the pair underneath has been deformed. Channel return loss rises. PoE thermal performance drops. Fiber loses signal margin. Hook-and-loop cannot apply that level of compression and is the right tool for cabling that carries information.

Standards

- Velcro only — no nylon zip ties — on data, AV, control, and shade cabling.
- Wraps are loose enough to preserve cable shape: a finger should slip under any wrap.
- Wraps are irregularly spaced per AVIXA / TIA guidance — not metronome-uniform.
- Vertical trunks: Velcro around the trunk and anchored to wood at intervals — the trunk stays organized but never crushed.
- Trunks are serviceable. New cable can be added without cutting and re-wrapping the entire trunk.
- Cut tag ends flush. No long flapping tails.

BEST PRACTICE

Loose, irregular, anchored.

A Velcro trunk should look intentionally documented in a photo: parallel cables, irregular wrap spacing, anchored to wood, no compression. That is the deliverable.

CORRECT

[IMAGE]

Insert field photo or diagram in production

[IMAGE: Correct example — vertical trunk with loose Velcro anchored to wood]

INCORRECT

[IMAGE]

Insert field photo or diagram in production

[IMAGE: Incorrect example — zip-tied, compressed trunk with deformed jackets]



§ 15

HV / LV Separation

SEPARATE PATHS. CROSS AT 90°.

Power conductors radiate. Signal conductors receive. Without separation, the result is induced noise on data lines, audible hum on audio runs, and reduced PoE thermal margin on category cabling. NEC 300.3(C) prohibits cables operating at different voltage levels from sharing a tray without a barrier. IEEE Std 1223 recommends a minimum 6" separation between low-voltage cables and 2.4–15 kV circuits in cable trays, more for higher voltages. We design with that intent in mind — even though the residential and light-commercial work we do rarely approaches those voltages, the philosophy of separation is the same.

- Avoid sharing bays between HV and LV where possible. Plan trunk paths in different bays.
- Where a long parallel run is unavoidable, maintain physical separation on the order of inches and use opposing sides of the framing.
- When power and signal must cross, they cross at 90° — never run parallel through a crossing.
- Avoid dimmer banks, HVAC units, motors, transformers, and other noise sources. Route LV through quieter cavities.
- Organize trunks by system: power, network, AV, control, lighting, shading. Separate paths, separate labels, separate stackers.

INSPECTION STANDARD

Crossings are visible and clean.

Inspectors and PMs verify each HV/LV crossing visually: 90° crossing, supported on both sides, no parallel run, no incidental contact. Photographs go in the as-built record.

DIAGRAM

[DIAGRAM]

Insert field photo or diagram in production

[DIAGRAM: Layout example — HV/LV separation in adjacent bays, with 90° crossings]



§ 16

Nail Plates & Physical Protection

PROTECT THE CABLE FROM THE NEXT TRADE.

Once the wall closes, a future drywall screw, picture nail, or shelf-mount fastener is the most common mechanical threat to a cable. NEC 300.4 addresses this directly. Where cable runs through bored holes in wood, the edge of the hole must be at least 1¼ inches from the nearest edge of the framing member. Where that 1¼-inch setback cannot be maintained — and in any notch — the cable must be protected by a steel plate or bushing at least 1/16 inch thick, sized to cover the exposed area. The same 1¼-inch concept applies to cables run parallel to framing members. We treat the rule as a physics statement, not a paperwork requirement.

- Maintain the 1¼-inch concept whenever you bore — keep the cable centered, well behind anything a screw can reach.
- Use a nail plate the moment the 1¼-inch distance can't be held — at notches, at offsets, or at marginal conditions.
- Recess plates flush where drywall will sit on them, so they don't crown.
- Keep the cable centered behind the protection, not pushed off to one side.
- In metal studs, every cable opening gets a listed bushing or grommet — sharp metal edges can cut the jacket as the building moves.
- When in doubt, plate it. The cost of a plate is nothing compared to a service call.

SPECIFICATION

NEC 300.4, applied as policy.

1¼ inch from framing edge in bored holes and parallel runs. 1/16-inch steel plate protection where the setback cannot be maintained, and at every notch. Bushings and grommets at metal-stud cable openings. Treat these as the minimum, not the goal.

CORRECT

[IMAGE]

Insert field photo or diagram in production

[IMAGE: Correct example — recessed nail plate covering bored-hole offset, cable centered]



§ 17

Firestop

IF YOU MAKE THE HOLE, YOU SEAL THE HOLE.

NEC 300.21 requires that electrical installations not substantially increase the spread of fire or products of combustion. In practical terms, every penetration of a fire-rated assembly that we make on the project is sealed with a listed firestop system that restores the rating of that assembly. This includes top and bottom plates of rated walls, floor penetrations, conduit penetrations, and rated trunk penetrations.

- Seal every penetration we make through a fire-rated assembly. No exceptions.
- Use only listed, rated materials matched to the assembly and the penetrant.
- Top plates and bottom plates of rated walls are sealed.
- Conduit and trunk penetrations are sealed at both faces of the assembly where the listing requires it.
- Photograph every firestop with the system tag visible. Add to the as-builts.
- If we make the hole, we seal the hole. If another trade made the hole, we still seal it before drywall covers our work.

FIELD RULE**Document every firestop.**

Each firestopped penetration is photographed with location, system tag, and date captured. Without that record, no penetration is closed.

CORRECT

[PHOTO]

Insert field photo or diagram in production

[PHOTO: Field documentation example — properly firestopped trunk penetration with system tag]



§ 18

Wiring Standard by System

PER-SYSTEM ROUGH-IN EXPECTATIONS.

The following rough-in expectations apply unless project documents specify otherwise. They are designed to give us the headroom needed for upgrades, service, and the realities of luxury integration over the system's life.

Displays	4× Cat6A to each display location, plus a dedicated conduit from the display back box to the head-end, plus a clean dedicated power back box. The conduit lets HDMI, fiber HDMI, or future signal extenders be pulled without opening the wall. The clean power keeps audio and video isolated from kitchen/HVAC loads.
Network drops	Minimum 2× cables per drop. One is the working drop; the second is a spare for service, a future device, or a wireless AP relocation. Cat6A standard. Higher-density rooms get more.
Audio	16/4 minimum on speaker runs; 14/4 preferred for longer runs and high-power amplification to maintain damping factor and power delivery.
Shades	Redundant wiring at every motor location. Where dual shades are possible (blackout + sheer), wire for both even if only one is specified at rough-in.
Touchpads / keypads	Loop in both directions where appropriate. A loop allows daisy-chained control busses and serviceability on a panel-by-panel basis.
Drain wire / shield	Bonded at the source end only, unless the system specifies otherwise. Double-bonded shields create ground loops and audible hum.

NOTE

These are rough-in minimums.

Project drawings can require more. They cannot require less.



§ 19

Rack & Future Conduits

BUILD FOR THE NEXT RENOVATION.

Rack locations are connected to each other and to key device clusters with conduit. We separate HV and LV conduit paths. We leave spare conduits empty for the next remodel — every project on this team owes the next homeowner an upgrade path.

- All rack locations are interconnected by conduit at rough-in.
- Separate HV and LV conduits — same chase is fine, same conduit is not.
- Leave at least one spare conduit empty between every major endpoint pair.
- All bends in conduit are sweep bends. No conduit body 90s where a sweep fits.
- Pull strings included in every conduit. Replace any string consumed by a pull.
- Both ends of every conduit are labeled — origin and destination.



[DIAGRAM: Layout example — rack-to-rack conduit topology with spares and labels]



§ 20

Grounding & Bonding

REFERENCE PLANE FOR THE WHOLE SYSTEM.

A Crestron-grade or AVoIP system depends on a stable, low-impedance ground reference. Without it, you fight intermittent issues for the life of the install. The standard below is non-negotiable.

- Each rack has a dedicated ground bar (TGB-style) bonded back to the building's grounding electrode system.
- All equipment with a ground lug is bonded — no exceptions for convenience.
- Maintain a consistent ground potential strategy: single-point bond per rack; no inadvertent secondary grounds.
- Coax shields bonded per system design — typically at the head-end side only.
- Test bonding with a known-good meter before commissioning. Document the readings.

INSPECTION STANDARD

If it has a ground lug, it is bonded.

QC walks every rack and verifies the ground lug is landed and torqued before the rack closes.



§ 21

Power Quality

PLAN THE LOAD. PROTECT THE RACK.

Power quality is part of the rough-in conversation, not a post-trim afterthought. How circuits are landed, balanced, and protected during electrical rough-in directly affects how the rack performs in summer, under storm conditions, and during whole-house transient events.

- Plan rack and sensitive electronics on appropriate phase distribution. Avoid co-locating large motor loads on the same branch.
- Balance loads across phases at the panel. Document the panel schedule with the as-builts.
- Avoid nuisance trips by pre-calculating worst-case rack draw and headroom.
- Isolate rack circuits from heavy loads — kitchen appliances, HVAC, pool equipment — wherever practical.
- Use online (double-conversion) UPS where the project standard or the equipment requires it.

BEST PRACTICE

Online UPS for control and AV head-ends.

On a properties of any complexity, the head-end runs on online UPS so that transients, brownouts, and grid fluctuations never reach the gear.



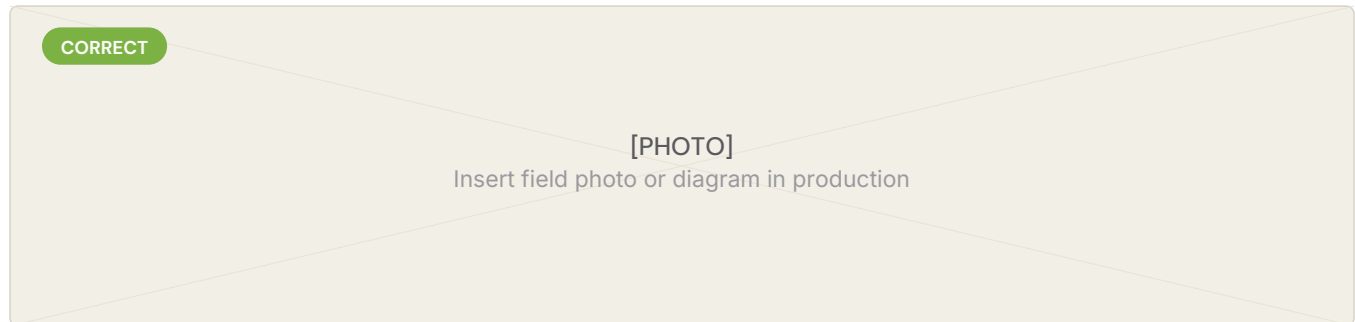
§ 22

Labeling

BOTH ENDS. PRINTED. AS-BUILT MATCH.

A labeled cable is a serviceable cable. An unlabeled cable is a future invoice. The labeling standard is consistent across LV and HV.

- Low-voltage labels include: What / From / To. Example: Cat6A / Rack-1 / Office Drop A.
- High-voltage labels include: Panel / Breaker / Load / Origin. Example: P1 / 14 / Rack-1 / MDP.
- Both ends labeled. No exceptions.
- Brady-printed labels only. Handwriting is not acceptable on closeout.
- Labels match the as-built documentation exactly. If a label changes in the field, the as-built changes the same day.



[PHOTO: Field documentation example — labeled cables at rack and at drop, matching as-builts]

§ 23

As-Built Documentation

MATCH THE FIELD EXACTLY.

As-built documentation is the deliverable that lets a future technician — possibly not us, possibly years from now — service the system without opening every wall. It is not an approximation of the design. It is a record of what is actually installed.

- Wire paths, trunks, and conduit routes documented on the floor plan with revision dates.
- Rack layouts photographed and drawn — cable map, port assignments, equipment list.
- Device locations confirmed by photograph and dimensioned where appropriate.
- Label list exported from the labeler and reconciled against the field.
- As-builts match the field exactly — not “close enough.”

FIELD RULE

If it doesn't match, fix the document or fix the field.

Discrepancies between the as-built and the field are resolved before closeout. We do not hand a homeowner or builder an approximate map.



§ 24

Error & Fix Log

CAPTURE THE LESSON, NOT THE BLAME.

The error and fix log exists for one reason: prevention. We track the issue, where it was, what caused it, what fixed it, and the technician's notes. Over time, the log becomes the institutional memory of the team. New technicians read it. Lead engineers reference it on design reviews. It is not a disciplinary document.

Date	When the issue was found and when it was resolved.
Project / Area	Project name, room, and location within the room.
Issue	What was wrong. One sentence. No editorializing.
Cause	Tool, technique, design, or environment factor.
Fix	What was actually done — products, methods, time.
Photos	Before and after photographs, named and stored in the project folder.
Technician	Who installed and who corrected. For follow-up training, not blame.

BEST PRACTICE

Read the log before every new project.

The PM reviews recent log entries with the install team at kickoff. Recurring patterns become training topics, not repeat invoices.

§ 25

Photo Documentation

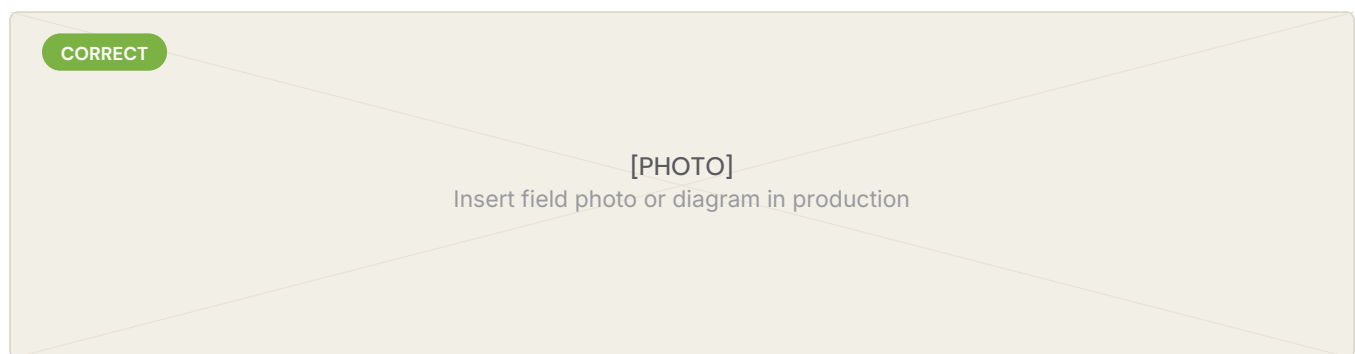
PHOTOGRAPHS ARE PART OF THE DELIVERABLE.

Every rough-in is photographed before drywall closes. Photographs are organized by area and system. The standard is that any technician, two years from now, can open the project folder and see what is behind the wall before opening it.

- Clean rough-in work — bay by bay, in good light, level shots.
- Complex areas where multiple trades intersect.
- Vertical trunks at full length and at every transition.
- Heavy turns and supported corners.
- Racks before and after dressing.
- Grounding lugs and bonding terminations.
- Firestop with the system tag visible.
- Nail plates and protection at every offset.
- Labels at both ends of every run, printed and legible.
- Before / after photos for every error log entry.

Naming and storage

- Filename pattern: Project_Area_System_Description_Date.jpg.
- Stored in the project folder under /Rough-In Photos/[Area]/[System]/.
- Tagged in the as-builts with the photo file reference.



[PHOTO: Field documentation example — full rough-in bay photographed before close-up]

§ 26

QC Checklist

WALKED AT EVERY MILESTONE.

This checklist is walked at the rough-in milestone, before drywall, and again before close-out. Both columns must be satisfied: the YES items present and verified, the NO items absent. The technician of record and the PM/QC sign the bottom of this page on every project.

VERIFY PRESENT	VERIFY ABSENT
☐ VERIFY HV and LV separated into different paths and bays.	☐ ABSENT Hammered staples on data, control, or AV cable.
☐ VERIFY Vertical and horizontal runs only — no diagonals.	☐ ABSENT Nylon zip ties on any LV bundle.
☐ VERIFY All cables held by listed pathway hardware (J-hooks, stackers, conduit, plates).	☐ ABSENT Crushed or jacket-whitened cable anywhere on the run.
☐ VERIFY Velcro on all LV bundles, finger-tight, irregularly spaced.	☐ ABSENT Hard 90° bends or unsupported corners.
☐ VERIFY Bend radius respected at every corner; sweeps supported on both sides.	☐ ABSENT Mixed HV/LV in the same stacker or bundle.
☐ VERIFY Nail-plate protection wherever 1¼-inch setback cannot be maintained.	☐ ABSENT Diagonal runs across bays or ceilings.
☐ VERIFY Bushings or grommets at every metal-stud cable opening.	☐ ABSENT Cable lashed to ceiling grid or grid support wires.
☐ VERIFY Firestop complete and tagged at every rated penetration.	☐ ABSENT Tangled or uncombed bundles inside any wrap or hook.
☐ VERIFY Labels at both ends of every run, Brady-printed.	☐ ABSENT Unsealed penetrations of fire-rated assemblies.
☐ VERIFY Grounding bar landed and bonded at every rack.	☐ ABSENT Handwritten or missing labels at closeout.
☐ VERIFY As-builts match the field 100%.	☐ ABSENT Ungrounded rack hardware or unbonded equipment.
☐ VERIFY Photos captured per §25 and stored per the naming standard.	☐ ABSENT Rough-in covered without photographs and as-built reconciliation.
☐ VERIFY Error log entries reviewed and resolved.	

PROJECT / AREA

DATE

TECHNICIAN OF RECORD · SIGNATURE

PM / QC · SIGNATURE

Status: ☐ Pass ☐ Pass with notes ☐ Fail — rework required

§ 27

Standards & References

WHAT THIS MANUAL ALIGNS WITH.

This standard is designed to align with established codes, industry guidance, and manufacturer documentation. The specific authorities below are referenced throughout the manual; the citations are summarized here for convenience.

NEC 300.4 — Protection from physical damage

Establishes the 1¼-inch setback rule for cables in bored holes and parallel to framing, and the 1/16-inch steel plate alternative when the setback can't be maintained. Also addresses bushings and grommets in metal framing. [ExpertCE summary](#).

NEC 334.30 — Securing and supporting NM cable

NM-B supported within 12 inches of every box and at intervals not exceeding 4½ feet, with cable length to nearest support ≤18 inches. [CircuitIQ summary](#).

NEC 300.21 — Spread of fire and products of combustion

Penetrations of fire-rated assemblies must be sealed using listed firestop systems. [ExpertCE firestop guide](#).

NEC 300.3(C) — Different voltage levels

Cables of different voltage levels shall not occupy the same tray without a physical barrier. We extend the principle to all bays, stackers, and bundles.

IEEE Std 1223 — Industrial cable separation guidance

Recommends minimum HV/LV separation distances on cable trays based on voltage rating; e.g., 6 in. for 2.4–15 kV. We use the philosophy of generous separation in residential and commercial work.

ANSI/TIA-568.0-D — Generic telecommunications cabling

Calls for minimizing cable stress and using loose, irregularly spaced bindings to tie multiple cables. [Accu-Tech summary](#).

BICSI ITSIMM — Information Technology Systems Installation

Hook-and-loop straps are the preferred binding method on category, coax, and fiber to preserve cable geometry. [BICSI guidance via VELCRO Brand](#).

AVIXA F502.01 — AV cable management

Hook-and-loop on all category, coaxial, and fiber cables; spacing irregular and not over-tightened. [AVIXA F502.01 summary](#).

ANSI/TIA-569 — Pathways and spaces

Establishes pathway design including J-hooks as a horizontal support method for telecommunications cable. [MonoSystems J-hook white paper](#).

CEDIA recommended practices

Industry guidance for residential AV and control system installation; we use CEDIA-style thinking throughout the rough-in standard.

Milwaukee M12 Cable Stapler (2448) and 1" Insulated Cable Staples (MNM1-600)

Manufacturer guidance: UL/CUL listed for single and double-stacked 14-2, 14-3, 12-2, 12-3, 10-2, and 10-3 (single only) NM-B cable; suitable for low-voltage cables including CAT and coax. [Milwaukee MNM1-600 product page](#).

NOTE

What this manual is — and isn't.

This document captures our installation standards. It is not a substitute for the National Electrical Code, AHJ requirements, or manufacturer instructions. Where any field condition conflicts with code, code wins. Where any field condition conflicts with this manual, this manual wins until the lead engineer documents an exception.



§ 28

Field Notes

SITE-SPECIFIC NOTES, OPEN ITEMS, SIGN-OFFS.

Use this page on site for project-specific notes, open items, deviations approved by the lead engineer, and end-of-day sign-offs. Photograph this page at each site visit and store it with the as-builts.

FIELD NOTES — CONTINUED

Handwritten field notes area with horizontal lines for writing.