

RESTREPO STANDARD

Tight. Tested. Tagged.

Pre-Foam Wiring Standard

Smurf · Box · Pull · Loop · Photo · Seal · Window

The envelope is poured once. Wire it like it cannot be opened.

00

PREFACE

Spray foam closes a wall once. Whatever cable, conduit, or box is set before the applicator pulls the trigger is what the home will live with for the next thirty years. This standard codifies the pre-foam wiring discipline that makes that one-shot moment survivable: smurf tube strategy, box depth, pull strings, service loops, photo documentation, penetration sealing, and the coordination meeting that locks the spray window. Seven domain sections plus without-written-direction, the pre-foam checklist, the QC gate, and citations. The envelope is poured once.

This standard does not replace manufacturer instructions, code authorities, or professional licensing. NEC 2023 (NFPA 70) Articles 334, 362, 300, IRC R316 (foam thermal/ignition barrier), IRC M1505 (mechanical ventilation), ASHRAE 62.2-2019, and NJ Uniform Construction Code govern. Manufacturer install guides from Carlon, Huntsman/Icynene, BASF, Johns Manville, ProClima, and SIGA are the floor. See Citations for primary source URLs.

The envelope is poured once.

Wire it like it cannot be opened.

01 SMURF TUBE STRATEGY

Every smart-device location, every speaker pre-wire, every network drop is run in ENT (smurf tube) before foam closes the wall. Carlon Resi-Gard 3/4 in is the Restrepo standard. Color-coded by system, terminated in deep boxes, capped with pull strings.

ENT conduit selection

Carlon Resi-Gard 1/2 in or 3/4 in flexible non-metallic tubing per NEC 362. 3/4 in standard for AV homeruns to allow Cat6A + future drop. Color-code by system: blue for network, orange for AV, gray for lighting.

Smurf homeruns

Every smart-device location stubs back to AV closet or rack room with at least one 3/4 in ENT. Speaker pre-wires, network drops, and Crestron CresNet runs land at AV closet J-box with 12 in service loop coiled.

Bend radius

Minimum bend radius 6× conduit ID. 3/4 in ENT requires 4.5 in inside radius. Sweeping bends always; no kinks. Sharp 90s replaced with two 45s wherever framing permits.

Support spacing

ENT supported every 3 ft horizontal, 4 ft vertical per NEC 362.30. Plastic conduit straps to studs; staples permitted only where listed for ENT.

Penetration discipline

Top and bottom plate penetrations drilled centered, 5/8 in min hole for 3/4 in ENT. Nail plates installed per NEC 300.4 wherever conduit is within 1.25 in of stud face.

Future drops

Every ENT terminates in deep box (4 11/16 sq) with mud ring sized to finish material. Pull string capped at both ends with electrical tape labeled 'PULL'.

Future-proofing budget

5% of project low-voltage cost reserved for unused ENT runs to high-probability future locations: media room, primary suite, kitchen island, garage, mechanical room.

SPEC · CONDUIT AND BEND RADIUS

NEC 362 governs ENT installation. 6× conduit ID minimum bend radius. 3-ft horizontal support spacing. Nail plates per NEC 300.4 wherever conduit is within 1.25 in of stud face. Verified at framing inspection.

02 BOX SETTING & DEPTH

Foam fills behind the box, never inside it. Deep boxes give the device installer room to coil cable and dress connections post-foam. Box mounting, mud ring sizing, and strain relief are locked at rough-in.

BOX TYPE	USE	DEPTH	MUD RING	NOTES
4 11/16 sq deep	Smart switch / dimmer	3-1/2 in	1/2 in or 5/8 in	Lutron Caseta, Crestron CSC-DIM, Ketra D4 wallstation. Service loop room critical.
Single-gang deep	Single keypad / occupancy sensor	3-1/2 in	Flat or 1/4 in	Use deep gang for any device with rear-mounted module or transformer.
Low-voltage ring	AV rough-in (HDMI, speaker, Cat6A)	Open-back	1-gang or 2-gang	Caddy / Arlington open-back ring, no electrical box. Cable enters via top knockout.
Round 4 in deep	Recessed light / pendant box	2-1/8 in	Per fixture	Rated for fixture weight. Foam-rated when in foam-encapsulated assembly.
Wet-location FSC	Bath fan / steam shower control	2-1/2 in	Gasketed	Code requires gasketed cover for high-humidity locations per NEC 314.27.
Floor box deep	Floor outlet / network drop	3 in min	Recessed brass	Floor box conduit stubs through subfloor; foam never enters box volume.

BOX MOUNTING & STRAIN RELIEF DISCIPLINE

- Box depth philosophy: foam fills behind the box, never inside it. Deep boxes give the device installer room to coil cable and dress connections post-foam.
- Mud ring sizing: matches finish material thickness. 1/2 in for standard drywall; 5/8 in for fire-rated assemblies; 3/4 in or thicker for shiplap, stone, or paneling.
- Box mounting: secure to stud or furring, never floating in foam. Foam can torque a free-floating box and crack the cable jacket at the strain relief.
- Cable strain relief: every cable terminated at the box with a listed connector. NM-B uses the integral clamp; low-voltage uses Heyco bushings or grommets.
- Box-fill calculations: NEC 314.16 governs. Smart-device boxes fill faster than legacy switches; deep boxes preserve fill margin.
- Spare hardware: minimum 5% spare boxes, mud rings, and connector hardware delivered at closeout with serialized labels.

03 PULL STRINGS & SERVICE LOOPS

Pull strings are mandatory in every ENT run. Service loops are mandatory at every box, speaker, and network termination. Foam locks position; loops absorbed in foam are unrecoverable. Coil flat, secure with Velcro, photograph before spray.

ELEMENT	SPEC	QUANTITY / RANGE	PATHWAY	NOTES
Pull string type	1,800 lb test polyester pull line (jet line)	Per ENT run	Both ends	Ratchet-tested at 50% of rated load. Capped with electrical tape, labeled at both ends.
Service loop length	Minimum 12 in coiled at every device box	Per AV / network drop	At box	Coiled flat against box, secured with Velcro tie. Foam locks position; no second pull.
Speaker pre-wire loop	Minimum 18 in coiled at every speaker location	Per speaker	At ceiling rough-in	Extra length for trim adjustment, coverage variance, and final mounting position.
Network homerun loop	Minimum 24 in at AV closet termination	Per Cat6A drop	At closet J-box	Allows panel re-arrangement, future patch panel install, trim height adjustment.
Crestron CresNet loop	Minimum 18 in at every keypad and processor	Per keypad	At box	Daisy-chain bus loops require slack at every device for future device swaps.
Lutron QS loop	Minimum 12 in at every QSE-IO and keypad	Per device	At box	QS bus topology is daisy-chain; service loops permit field reconfiguration.

PULL STRING & LOOP DISCIPLINE

- Pull strings are mandatory: every ENT conduit gets a jet line, every jet line is labeled at both ends, every label survives the foam encapsulation.
- Service loop discipline: coiled and secured with Velcro before insulator arrives. Loose cable absorbs foam and becomes unrecoverable.
- Strain relief: at every box, every termination, every transition from conduit to free-pull. Foam stress concentrates at unsupported transitions.
- Loop placement: against the box, never floating in cavity. A floating loop becomes a foam-encased lump with no service access.
- Documentation: every loop measured and photographed pre-foam. Loop length archived with rough-in photo doc package.
- Replacement budget: 5% spare cable on every reel-cut run. If a foam-encased cable fails, the spare allows a same-spec replacement pull.

04 PHOTO DOCUMENTATION

Every wall, every elevation, every penetration photographed before insulator arrives. The photo doc package is the contract that allows foam to spray. No package, no spray. Drone walkthrough archives the envelope as it was, signed by GC and Restrepo PM.

Pre-foam wall scan

Every wall, every elevation, photographed before insulator arrives. Camera 6 ft from wall, parallel to surface, full-cavity in frame. Archive at 1080p minimum.

Penetration close-ups

Every drilled top plate, bottom plate, blocking penetration. Macro shot of nail plate and cable. Geo-tagged with room and elevation.

Box-by-box detail

Every smart device, AV rough-in, speaker location, network drop. Cable, label, and service loop visible. Box fill verified.

Conduit and pull string

Every ENT run end-to-end. Pull string label visible at both ends. Bend radius verified. Support spacing documented.

Drone walkthrough

Slow-walk video of entire framed envelope before foam. 4K minimum. Voiceover identifies room, elevation, and special features.

Floor-by-floor archive

Photo set indexed by floor, room, elevation. PDF compiled and signed by GC + Restrepo PM before insulator arrives.

Owner archive

Final photo doc package delivered to owner at closeout. Stored in project knowledge base under Pre-Foam Documentation.

INSPECT · SIGN-OFF DISCIPLINE

Photo doc package signed by GC superintendent and Restrepo PM before insulator is released to spray. Owner archive delivered at closeout. Floor-by-floor index in project knowledge base under Pre-Foam.

05 PENETRATION SEALING

Every cable, conduit, pipe, and fixture penetration through the envelope is sealed before foam. Top plate, bottom plate, rim joist, and box-to-drywall transitions are the four highest-leak locations. Smoke-tested at pre-drywall blower door.

Top plate penetrations

Every cable or conduit through top plate sealed with low-expanding foam (Froth-Pak or Great Stuff Pro) at sheathing. Fire-rated sealant where assembly requires.

Bottom plate penetrations

Identical treatment to top plate. Critical air-seal location; every penetration smoke-tested at pre-drywall blower door.

Rim joist

Closed-cell spray foam at rim joist creates vapor + air seal. Wiring through rim joist gets ENT sleeve before foam application.

Conduit duct-seal

Every ENT and EMT crossing the envelope sealed with mastic at exterior face. Manufacturer-specified duct seal product. NEC 300.7 governs.

Electrical box sealing

Box-to-drywall airtight gasket on every device box at envelope. Lessco AVB or equivalent. Backed by foam at sheathing side.

Recessed fixture seal

IC-rated, AT-rated (airtight) housings at envelope. Halo H7ICAT or equivalent. Foam applied around housing per fixture instructions.

Plumbing penetrations

Fire-rated putty pad on every floor and ceiling pass. Intumescent caulk at pipe-to-pad interface. Coordinate with plumber pre-foam.

06 FOAM COORDINATION MEETING

The foam coordination meeting is the contract that opens the spray window. GC, Restrepo PM, electrician, low-voltage lead, and insulator foreman walk the building floor by floor. Hold-and-fix protocol enforced. Owner notified 48 hours in advance.

Attendees

GC superintendent, Restrepo PM, electrician of record, low-voltage lead, insulator foreman, framer (if remediation needed). Architect optional but invited.

Pre-meeting deliverables

Photo doc package signed. ASHRAE 62.2 sizing on file. ERV/HRV ducting layout reviewed. Spray foam product ESR archived. Spare hardware delivered.

Walk-through agenda

Floor-by-floor wall scan with insulator. Every penetration confirmed sealed. Every box confirmed mounted and serviceable. Every conduit confirmed pulled and labeled.

Foam window confirmation

Spray date, applicator certification, batch number archived. Re-entry timing confirmed (24 hr min). Ventilation plan during cure confirmed.

Hold-and-fix protocol

Any unphotographed wall, unsealed penetration, or floating box holds the spray window. Issues logged in project record with sign-off when remediated.

Owner notification

Owner notified 48 hr before spray. Building closed to non-essential trades during spray and cure window. Air quality plan briefed.

Post-foam re-entry

Restrepo PM re-walks every wall within 48 hr of foam cure. Visual scan for cable damage, box displacement, or pathway compromise. Photo doc archived.

07 FOAM WINDOW & SCHEDULE

The spray window is scheduled only after every rough trade is signed. Closed-cell sprays first, open-cell second. 24-hour cure minimum. IRC R316 thermal barrier within 30 days. 72-hour buffer between cure and drywall start.

Schedule trigger

Insulator scheduled only after framing pass + electrical rough + low-voltage rough + plumbing rough + HVAC rough are inspected and signed.

Pre-spray hold

All trades clear of building during spray and 24-hr cure. HVAC system off; all ductwork sealed. Negative pressure ventilation if available.

Spray sequence

Closed-cell first (rim joists, basement, roof deck). Open-cell second (interior partitions, attic). Each substrate primed dry per applicator instructions.

Cure verification

Surface tack-free at 1 hr, structural at 24 hr, full cure 48-72 hr depending on temp + humidity. Re-entry per applicator certification.

Thermal barrier install

1/2 in gypsum or DC315 intumescent coating applied within 30 days of foam per IRC R316. Critical path item; do not omit.

Quality assurance

Applicator-certified post-spray inspection. Voids, separations, and over-thickness logged. Remediation per BASF/JM/Huntsman SDS.

Schedule contingency

72-hr buffer between foam cure and drywall start. Critical for moisture control + HVAC commissioning + low-voltage post-foam scan.

08 WITHOUT WRITTEN DIRECTION

Seven actions do not occur on a Restrepo Vol 17 project without written direction from the Restrepo principal. Written direction means a signed project record entry, a documented principal authorization, or a formal client contract clause.

We do not commit the envelope without written direction:

- 1 We do not commit to BX/MC in foam-encapsulated assemblies without written direction: default is ENT conduit or rigid raceway path through any foam-bound cavity.
- 2 We do not omit pull strings without written direction: every ENT run gets a labeled jet line; absence of pull string disqualifies the run from final acceptance.
- 3 We do not let the insulator spray without written direction: photo doc package must be signed by GC + Restrepo PM before foam window opens.
- 4 We do not commit to NM-B sized to circuit minimum in continuous foam without written direction: NEC 334.80 ampacity de-rating applies; upsize or sleeve.
- 5 We do not skip the pre-drywall blower door without written direction: diagnostic test before insulation closes is required on every Restrepo project.
- 6 We do not omit the IRC R316 thermal barrier without written direction: 15-minute barrier (gypsum or DC315) is mandatory over all exposed spray foam.
- 7 We do not allow open-cell foam in below-grade walls or rim joists without written direction: closed-cell required by NJ residential code in those locations.

09

PRE-FOAM CHECKLIST

Every item below is verified before the spray window opens. Any unchecked item holds the foam schedule until remediated. The pre-foam checklist is the gate.

- ☐ Photo doc package complete; every wall, every elevation, signed by GC and Restrepo PM
- ☐ Every box mounted, labeled, and dressed; deep boxes for smart devices; mud rings sized to finish
- ☐ Every ENT run terminated at deep box; pull string labeled at both ends with 'PULL' tape
- ☐ Every service loop coiled, Velcro-secured, photographed; minimum 12 in at boxes, 18 in at speakers
- ☐ Every penetration sealed: top plate, bottom plate, rim joist, conduit duct-seal at exterior
- ☐ Spray foam product confirmed: ESR report on file, batch number archived, applicator certified
- ☐ ASHRAE 62.2 sizing on file; ERV/HRV ducting reviewed; thermal barrier strategy documented
- ☐ Pre-drywall blower door scheduled; smoke pencil + IR camera ready for diagnostic walk
- ☐ Foam coordination meeting complete; spray window confirmed; owner notified 48 hr in advance
- ☐ Spare hardware delivered: 5% conduit, boxes, mud rings, connector hardware, labeled at closeout

QC QC GATE · 10-ITEM PRE-FOAM PASS/FAIL

All 10 items must be PASS before the spray window opens. Every item is reviewed by the project lead. Any failed item holds the foam schedule until resolved.

#	QC GATE ITEM	PASS	FAIL
1	Photo doc package complete and signed Every wall, every elevation, archived at 1080p minimum. PDF compiled and signed by GC + Restrepo PM. Drone	PASS / SIGN	FAIL / HOLD
2	Every box mounted, deep, dressed Smart devices in 4 11/16 sq deep boxes. Mud rings sized to finish. AV rings open-back. Cable	PASS / SIGN	FAIL / HOLD
3	Every ENT run pulled and labeled ENT homeruns to AV closet with deep box termination. Pull string at both ends, labeled with 'PULL' tape. Bend radius and	PASS / SIGN	FAIL / HOLD
4	Service loops coiled and Velcro-secured Minimum 12 in at boxes, 18 in at speakers, 24 in at AV closet. Each loop photographed pre-foam. Coiled flat against	PASS / SIGN	FAIL / HOLD
5	Every envelope penetration sealed Top plate, bottom plate, rim joist sealed with low-expanding foam at sheathing. Conduit duct-seal at exterior. Box-to-drywall AVB	PASS / SIGN	FAIL / HOLD
6	ASHRAE 62.2 sizing and ERV/HRV plan archived Dwelling-unit ventilation calc on file. ERV/HRV product confirmed. Ducting layout reviewed. CFM matched to floor	PASS / SIGN	FAIL / HOLD
7	Spray foam ESR + applicator cert archived ESR/ICC report on file for closed-cell and open-cell products. Applicator certification current. Batch numbers archived for project	PASS / SIGN	FAIL / HOLD
8	Pre-drywall blower door scheduled Diagnostic test scheduled before insulation closes. Smoke pencil + IR camera available. Target ≤ 2.0 ACH50 at	PASS / SIGN	FAIL / HOLD
9	Foam coordination meeting complete GC, Restrepo PM, electrician, LV lead, insulator foreman walked the building. Hold-and-fix protocol signed. Owner notified	PASS / SIGN	FAIL / HOLD
10	Spare hardware + thermal barrier confirmed 5% spare conduit, boxes, mud rings, connectors delivered. IRC R316 thermal barrier strategy documented (gypsum or DC315 schedule)	PASS / SIGN	FAIL / HOLD

PROJECT LEAD SIGN-OFF

Signature / printed name _____ DATE _____ PROJECT _____
MM/DD/YYYY

REF

CITATIONS & PRIMARY SOURCES

- 1 **NEC 2023 (NFPA 70) Article 334 · Nonmetallic-Sheathed Cable**
NFPA 70 primary source for NM-B installation and ampacity de-rating in continuous thermal insulation including spray foam.
<https://nassaunationalcable.com/blogs/blog/a-complete-guide-to-nec-article-334-on-nm-b-nonmetallic-sheathed-cable>
- 2 **NEC 2023 (NFPA 70) Article 362 · Electrical Nonmetallic Tubing (ENT)**
NFPA 70 primary source for ENT (smurf tube) installation, support spacing, and bend radius requirements.
<https://www.ledestube.com/everything-you-need-to-know-about-ent-conduit-a-comprehensive-guide/>
- 3 **ECM Web · Thermal Effects of NM-B in Spray Foam**
Industry analysis of heat retention and ampacity considerations for Romex encased in residential spray foam.
<https://www.ecmweb.com/national-electrical-code/article/20902953/thermal-effects-of-residential-installed-type-nm-b-...>
- 4 **Carlton Resi-Gard ENT Specification**
Carlton primary source for Resi-Gard 1/2 in and 3/4 in flexible non-metallic conduit residential applications.
<https://carlonsales.com/techinfo/specifications/Spec-2EP01-ENT.pdf>
- 5 **IRC 2021 R316 · Foam Plastic Thermal Barrier**
ICC primary source for the 15-minute thermal barrier requirement over exposed spray polyurethane foam.
https://www.nmcoa.org/wp-content/uploads/2020/01/2018-IRC-Spray-Foam-Thermal-Ignition-Barriers_RT-DS.pdf
- 6 **IRC 2021 Section M1505 · Mechanical Ventilation**
ICC primary source for whole-house mechanical ventilation requirement; NJ adoption September 6, 2022.
<https://codes.iccsafe.org/content/IRC2021P1/chapter-15-exhaust-systems>
- 7 **ASHRAE Standard 62.2 · Residential Ventilation**
ASHRAE primary source for the dwelling-unit ventilation rate procedure and minimum residential IAQ.
<https://www.ashrae.org/technical-resources/bookstore/standards-62-1-62-2>
- 8 **ASHRAE 62.2-2019 Addendum H**
ASHRAE primary source for the 2019 edition addendum updates to residential ventilation rates.
<https://www.ashrae.org/file%20library/technical%20resources/standards%20and%20guidelines/standards%20addenda/...>
- 9 **NJ DCA Uniform Construction Code**
New Jersey Department of Community Affairs primary source for current NJ code adoptions.
<https://www.nj.gov/dca/codes/codereg/current.shtml>
- 10 **Huntsman Icynene FL2000 ESR-4501**
ICC-ES primary source for the FL2000 closed-cell SPF evaluation report for residential applications.
https://huntsmanbuildingsolutions.com/en-US/sites/en_us/files/2021-01/ESR-4501_FL2000%203G.pdf
- 11 **BASF Walltite Specifications**
BASF primary source for Walltite closed-cell spray foam product line specifications and compliance data.
<https://spf.basf.com/resource-center/downloads/specifications>
- 12 **Johns Manville JM Corbond IV**
JM primary source for Corbond IV closed-cell SPF data sheet with renewable-content blowing agent.
<https://www.jm.com/content/dam/jm/global/en/building-insulation/Files/BI%20Data%20Sheets/Resi%20and%20Commer...>
- 13 **DC315 Intumescent Thermal Barrier**
International Fireproof Technology primary source for DC315 15-minute thermal barrier coating over SPF.
<https://painttoprotect.com/fireproof-coatings-products/dc315-thermal-barrier-ignition-barrier-spray-polyurethane-foam-spf/>
- 14 **DC315 ESR-3375**
ICC-ES primary source for DC315 evaluation report establishing thermal barrier compliance over foam.
https://painttoprotect.com/wp-content/plugins/matrix/files/es_reports/ESR-3375.pd.pdf
- 15 **3M 8067 All Weather Flashing Tape**
3M primary source for the 8067 self-adhered window/door rough-opening flashing tape technical data.
<https://multimedia.3m.com/mws/media/816485O/8067-all-weather-flashing-tape-technical-data-sheet.pdf>

REF CITATIONS & PRIMARY SOURCES (CONT.)

SIGA Wigluv 60 Exterior Tape

- 16 SIGA primary source for Wigluv 60 exterior airtight tape for sheathing seams and weather-resistant joints.
https://www.siga.swiss/us_en/products/wiglurv/wiglurv-60

ProClima Intello System

- 17 ProClima primary source for the Intello smart vapor retarder system documentation and air-tight sealing.
<https://proclima.com/products/internal-sealing/intello>

OSI Quad Max Sealant TDS

- 18 Henkel primary source for the OSI Quad Max paintable elastomeric sealant for window/door perimeters.
https://datasheets.tdx.henkel.com/OSI-QUAD-en_US.pdf

CertainTeed MemBrain Smart Vapor Retarder

- 19 CertainTeed primary source for the MemBrain Class II variable-permeance vapor retarder.
<https://www.certainteed.com/products/building-insulation-products/membrain>

Henry Blueskin VP100 Self-Adhered WRB

- 20 Henry primary source for the Blueskin VP100 self-adhered vapor-permeable weather-resistant barrier.
<https://www.henry.com/residential/products/housewrap-and-wrb/self-adhered-wrb/blueskin-vp100/>

Huber ZIP System Wall Sheathing

- 21 Huber Engineered Woods primary source for ZIP System structural sheathing with factory-bonded WRB.
<https://www.huberwood.com/zip-system/wall-sheathing>

EPA Indoor airPLUS Program

- 22 EPA primary source for the Indoor airPLUS construction specification package for healthy luxury homes.
<https://www.epa.gov/indoorairplus/indoor-airplus-program-documents>

PHIUS Airtightness Standard

- 23 PHIUS primary source for Passive House airtightness target of 0.6 ACH50 and methodology.
<https://www.phius.org/sites/default/files/2022-04/201508-Airtightness-Karagiozis.pdf>

Smurf Tube Future-Proofing Guide

- 24 Industry primary source on the discipline of running ENT for low-voltage future-proofing in residential.
<https://freemansconstruction.com/how-to-future-proof-low-voltage-home-wiring-with-smurf-tube/>

Building Science Vapor Retarder Guide

- 25 Building Science Corporation primary source for Class II vapor retarder requirements in mixed-humid climates.
<https://buildingscience.com/documents/guides-and-manuals/irc-faqs/irc-faq-insulating-sheathing-vapor-retarder-requir...>