

SECTION 27 08 00 COMMUNICATIONS TESTING, DOCUMENTATION, AND CLOSEOUT

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS (TESTING AND CLOSEOUT)

A. Provide all testing, documentation, and closeout deliverables as a condition of acceptance. Deliverables shall be complete, accurate, and consistent with labeling and as-built records.

B. Provide test instruments and reference cords in current calibration in accordance with manufacturer recommendations. Submit calibration certificates with closeout.

C. Provide test results in the tester's native electronic format and in a commonly readable export (CSV/Excel and/or PDF summary) as specified below.

D. Acceptance in stages (general): Acceptance of the Division 27 Work proceeds in three stages so that the Contractor's completion is not held to Owner activation of Owner-furnished active equipment. The stages are (1) Installation acceptance (Paragraph E), (2) Documentation acceptance (Paragraph F), and (3) Operational turnover (Paragraph G). Stages 1 and 2 together constitute the Contractor's completion gate for the Division 27 cabling Work; Stage 3 is performed by or with KU IT and, except where expressly stated as a condition of acceptance, is not a precondition to Stage 1 or Stage 2 acceptance (see Section 27 05 00 §1.11.E).

E. Stage 1 — Installation acceptance: Physical installation complete and compliant, including labeling installed and reconciled across faceplate, patch-panel/port, cable ID, and records (Section 27 05 53); copper and fiber acceptance (pass/fail) test results (§1.7); pathway, rack, and workmanship review; and delivery of spare materials / attic stock (§1.8). The pathway review shall verify that Division 27 pathways, sleeves, runway, and telecommunications rooms contain only permanent cabling of the Work that is labeled and recorded per Section 27 05 53 and §1.4 (permanent cabling of the Work is defined in Section 27 05 28 §3.2.D: all cabling installed under Division 27 regardless of the system it serves, together with any other cabling the Drawings show in these pathways); that pull strings remain in place and spare capacity is as required by Section 27 05 28; and that firestop systems at Division 27 penetrations are restored to their listed condition per Section 27 05 28 §3.3. Cabling found in Division 27 pathways, sleeves, or telecommunications rooms that is not part of the Division 27 Work and is not shown on the Drawings — including temporary construction cabling — shall be identified by location, pathway, and apparent system in the closeout record per §1.4 and reported to KU IT and the Project Manager for resolution under Division 01. Identifying and reporting such cabling is the extent of the Division 27 Contractor's obligation with respect to cabling installed by others; removal of another party's cabling is not Division 27 Work, and its presence shall not by itself delay acceptance of the Division 27 Contractor's Work (Section 27 05 00 §1.11.A and §1.11.E).

F. Stage 2 — Documentation acceptance: Complete, accurate, and consistent closeout deliverables submitted and accepted (§1.4) — the electronic closeout index, native test-result files and their PDF/CSV exports, as-built drawings and the as-built label schedule, cable records, and the manufacturer system warranty registration/certification package (§1.2 and §1.5).

G. Stage 3 — Operational turnover: KU IT patching and configuration of Owner-furnished active equipment (for example, network switches and analog voice gateways) and functional verification (for example, dial-tone / line operation per Section 27 32 26 §3.1). This stage depends on Owner-furnished-equipment activation and is not a precondition to Stage 1 or Stage 2 acceptance; where cabling is disturbed or damaged after acceptance, KU IT may require a new physical cable test within the warranty period. Stage 3 confirms Owner operational readiness; it does not constitute Contractor final acceptance and does not create a second or open-ended acceptance period, unless the Contract Documents expressly require a Contractor functional test.

H. Basis of Division 27 acceptance (Owner-furnished and network-connected devices): Except where the Contract Documents expressly assign device installation, configuration, or operation to this Division, acceptance of the Division 27 Work is based on the tested, documented passive cabling infrastructure (the terminated links and their pass/fail test results and records), not on the installation, configuration, or operation of the active or end devices those links serve — including network switches, wireless access points, cameras, building-automation controllers, and access-control panels. Placing such devices in service, and any device-level functional verification, is an Owner or other-division activity (consistent with the staged acceptance above and the audio-video and specialty-system boundaries of this Division), and does not delay or condition acceptance of the Division 27 passive Work unless the Contract Documents expressly provide otherwise.

1.2 WARRANTY PACKAGE

- A. Where a manufacturer-registered structured cabling system warranty is required, provide the complete warranty registration package including proof of Installer authorization/certification, bill of materials, and complete electronic test results per the manufacturer's program requirements. KU Campus Standard: Legrand/Ortronics nCompass registered structured cabling system warranty package (Premium Performance tier or current equivalent) (where required by the Contract Documents).
- B. Warranty Submittals: Include manufacturer warranty registration confirmation (or proof of submission), bill of materials, Installer authorization/certification evidence required for registration, and complete electronic test results required by the manufacturer. C. Warranty Scope Consistency: Warranty registration shall match the installed system family and the approved project submittals and warranty registration package.

1.3 PRODUCT DEVIATIONS AND WARRANTY IMPACT

A. Product deviations from the KU campus-standard structured cabling products identified in this Division are not part of this master specification unless expressly identified in the project Contract Documents before bid or procurement.

B. Where a project-specific deviation is included in the Contract Documents, the changed product shall not compromise the required manufacturer-registered structured cabling system warranty, warranty eligibility, labeling scheme, testing requirements, closeout documentation, maintainability, or compatibility with the University's existing infrastructure.

C. Submit documentation for each documented project-specific deviation in accordance with Division 01 procedures. Documentation shall identify the manufacturer, system family, part number, and the technical basis for use of the changed product.

D. Submittal review, coordination comments, field discussions, and Contractor preference do not authorize product deviations unless the Contract Documents are formally revised under the applicable project procedures.

1.4 CLOSEOUT SUBMITTALS (ELECTRONIC) – CONDITION OF ACCEPTANCE

A. As a condition of project acceptance (Stage 2 — Documentation acceptance; see §1.1.F), the Contractor shall submit the following for review and approval. All documentation shall be provided electronically unless the Owner requests otherwise.

A.1 Closeout index: Provide a single electronic index (PDF) listing each deliverable file name, file type, and a brief description. Use a consistent naming convention that references building/closet identifiers and cable IDs as labeled in the field.

B. Records (minimum):

1. Cable records: identifier, cable type, length, termination positions at both ends, manufacturer, and part number.
2. Connecting hardware records: identifier, hardware type, and number of positions.
3. Connecting hardware position records: identifier, position type, and the cable identifier attached to it.
4. Test documentation: original tester file format for all cable types, plus Excel/CSV export. If Excel/CSV is not available, PDF is acceptable.
5. As-built drawings: Provide AutoCAD electronic files in a format compatible with Owner and project CAD standards. Confirm the required file format and version with the Owner's Representative prior to issuance, consistent with the project-specific requirements.

6. Voice cross-connect/patching scheme (where analog voice service is provided): the final port-to-port voice patching/cross-connect mapping and a simple connection diagram, per Section 27 11 19 §2.3.D.
 7. Pathway occupancy record: For each Division 27 riser sleeve, telecommunications-room sleeve, and dedicated communications conduit or innerduct provided or used by the Work, record the location/identifier, the cable identifiers occupying it at turnover, approximate fill and remaining spare capacity, whether a pull string is in place, and the listed firestop system used at the penetration. Identify separately any cabling occupying the pathway that is not part of the Division 27 Work per §1.1.E. This record establishes the turnover baseline for pathway capacity and occupancy.
- C. Reports: Submit copies of complete reports of all testing performed to the General Contractor, with copies to the Professional prior to job completion, including: (1) cable reports, (2) cross-connect / patching reports, and (3) connecting hardware reports.
- D. As-built label schedule: provide in Excel format.

1.5 WARRANTY – PROJECT REQUIREMENTS (MANUFACTURER-REGISTERED)

- A. Where the project requires a manufacturer-registered structured cabling system warranty, provide the manufacturer's registered warranty package applicable to the installed system. KU Campus Standard: Legrand/Ortronics nCompass Premium Performance (or current equivalent tier) registered warranty package. For an alternate-product system family, provide an equivalent manufacturer-registered system warranty issued to the Owner/end user.
- B. Warranty qualification is dependent on use of approved components and installation by qualified personnel in accordance with manufacturer requirements.

1.6 FIBER END-FACE INSPECTION (INSPECT / CLEAN / RE-INSPECT)

- A. Inspect and clean, as necessary, all fiber connector end-faces (including test reference cords and adapters) prior to mating and prior to testing. Re-inspect after cleaning and replace damaged connectors.
- B. End-face inspection shall follow a recognized inspection criteria (e.g., IEC 61300-3-35) to determine whether connectors are fit for use. End-face inspection and cleaning are a required installation practice; the optical loss (Tier 1) test results required by Paragraph 1.7 are the required acceptance deliverable for installed fiber links, and separate end-face inspection images/captures are not a required closeout deliverable except where KU IT requests captures for a representative sample. Visual inspection is in addition to, and does not replace, optical loss testing.

1.7 ACCEPTANCE TESTING – COPPER AND FIBER (PASS/FAIL)

A. Copper (Category 6A): Test each link as a Permanent Link and provide PASS results in accordance with the ANSI/TIA-568 series (edition in effect on the Bid Date) and connecting hardware manufacturer requirements.

A.1 Copper test equipment: Use a field tester appropriate for Category 6A permanent link certification and current ANSI/TIA test requirements. Tester shall be within current calibration. Provide native test files and an export summary showing PASS results for each link.

B. Fiber Tier 1 (required): Perform end-to-end loss, length, and polarity testing using an OLTS (optical loss test set). Provide PASS/FAIL results for each fiber strand at appropriate wavelengths. Test wavelengths shall be as follows (minimum): OS2 single-mode at 1310 nm and 1550 nm; OM1/OM3/OM4 multimode at 850 nm and 1300 nm (or the applicable wavelengths required by the installed fiber type and ANSI/TIA-568).

B.1 Fiber test equipment: Perform Tier 1 testing using an OLTS with appropriate launch/receive reference cords. Test reference cords and adapters shall be inspected/cleaned prior to testing. Provide native test files and an export summary for each fiber strand. Provide launch/receive cords and adapters rated for the wavelengths used for the installed fiber type.

C. Fiber Tier 2 (OTDR) — Campus OSP / Manhole Runs (required): Provide Tier 2 OTDR testing (traces) for all campus outside-plant (OSP) fiber installed through campus duct bank / manholes (and similar underground conduit/vault pathways). Provide OTDR traces in both directions, at appropriate wavelengths for the installed fiber type, and include event tables. KU IT will confirm the specific Tier 2 scope (runs/strands) prior to installation; however, bidders shall anticipate Tier 2 testing on all campus OSP/manhole fiber runs. Tier 2 testing does not replace Tier 1 testing.

D. Failures: Correct and re-test until passing results are achieved prior to Owner acceptance.

E. Owner verification and audit of test results: The native (original tester-format) test files required by Paragraphs A.1 and B.1 and Section §1.4 are the record of acceptance testing, and PASS results are accepted on the basis of those native files, not on a PDF or printed summary alone. KU IT may open and audit the native files in the tester manufacturer's software. The following are grounds for rejection of the affected results and re-testing at no additional cost to the Owner: test-result cable identifiers that do not match the labeled cable identifiers and the as-built cable schedule (Section 27 05 53 §3.2.A and §3.2.F); results duplicated across multiple cable identifiers or otherwise showing evidence of copied or reused test data; tests run with the tester out of current calibration, or without the calibration date and tester identity present in the file; and tests run against an autotest standard, limit, or configuration other than the Category 6A permanent-link (copper) or Tier 1 OLTS (fiber) requirements of this Section.

F. Owner right to witness and re-test: KU IT reserves the right to witness acceptance testing and, independently or through a testing agent, to re-test a random sample of up to ten percent (10%) of the installed links using the Owner's or the Contractor's calibrated equipment. Where a witnessed or Owner re-test of a link does not reproduce the PASS result in the Contractor's submitted results for that link, or where audited results are rejected under Paragraph E, the Contractor shall investigate and correct the cause and re-test the affected links; and where the failure rate of the sample exceeds five percent (5%) of the links sampled, the Contractor shall re-test one hundred percent (100%) of the installed links of the affected type and resubmit complete native results, at no additional cost to the Owner. Where fewer than twenty (20) links of the affected type are sampled, the five percent (5%) trigger does not apply automatically; instead KU IT may direct expanded sampling or one hundred percent (100%) re-testing of that type where one or more discrepancies indicate a systemic condition (for example, a common termination, component lot, tester configuration, or crew), at no additional cost to the Owner. Owner verification, witnessing, or re-testing under this Paragraph does not relieve the Contractor of responsibility for providing complete, accurate, and conforming test results, and is not a precondition to the Contractor's obligation to do so. Administration of Owner verification and re-testing shall follow this protocol: (1) Sample selection: KU IT selects the links to be re-tested at random after the Contractor has submitted its proposed testing sequence/schedule and the link inventory; the Contractor shall not pre-select or influence the sample. (2) Records: Each Owner or witnessed re-test shall record the link identifier(s) tested, the tester manufacturer, model, and serial number, the tester software/firmware version, the tester calibration status and date, the adapters and launch/receive reference cords used (where applicable), the operator, and the autotest standard/limit and test configuration used. (3) Timing: Re-testing shall be performed promptly after the original test and, where feasible, before ceilings, walls, or pathways that contain the links become inaccessible. (4) Affected type: For the purpose of the 100% re-test threshold, "affected type" means the media/test class of the failed sample evaluated separately — at minimum, copper permanent-link results, OS2 fiber Tier 1 results, OM4 fiber Tier 1 results, and OM1 fiber Tier 1 results are each their own affected population, and a failure rate in one class does not by itself trigger 100% re-testing of another class. (5) Discrepancy resolution: Where an Owner or witnessed re-test result differs from the Contractor's submitted result for a link, the original native test record shall be preserved, and the installation, the labeling/identifier, the instrument configuration (autotest standard and limit), and the reference-cord/adaptor setup shall be investigated before the link is declared a workmanship failure; a difference attributable to test configuration or reference-cord setup rather than the installation is not, by itself, a Contractor workmanship failure but shall be corrected and the link re-tested and documented. KU IT may issue a short project-specific verification procedure consistent with this Paragraph at or before the pre-installation meeting (Section 27 05 00 §1.5); such a procedure administers, and does not enlarge, the requirements of this Paragraph.

1.8 SPARE MATERIALS / ATTIC STOCK

A. Provide new spare materials (attic stock) matching the installed structured cabling system family and colors used on the project.

B. Minimum attic stock (unless otherwise directed by KU IT): 1. Modular jacks: 5% of installed quantity for each jack color used (GREEN data, BLUE AV, WHITE voice), minimum ten (10) of each color used. 2. Faceplates and inserts: ten (10) spare faceplates of each type used, plus twenty (20) blank inserts. 3. Patch cords: Provide attic-stock spare copper patch cords equal to ten percent (10%) of the project-use copper patch cord quantity by color and length, minimum two (2) of each length/color used. Provide attic-stock spare fiber optic patch cords equal to ten percent (10%) of the project-use fiber patch cord quantity by fiber type, connector, and length, minimum two (2) of each fiber type/connector/length used. Attic-stock patch cords are in addition to the TR / switch patch cords provided for all installed Category 6A copper data patch-panel ports, work-area / station patch cords, AP device patch cords, and analog gateway interface cords specified in Section 27 15 00 §2.5. AV work-area patch cords are not included in this Division's attic stock; AV patch-cord attic stock is provided under the audio-video systems section (see Section 27 15 00 §2.5.C). Note: If AP outlet ("biscuit box") terminations use a distinct jack style, adapter, or mounting interface different from standard wall outlets, provide matching attic stock quantities for those specific components.

C. Deliver attic stock to KU IT in labeled cartons/totes. Deliver attic stock no later than the date of Substantial Completion unless otherwise directed in the Contract Documents. Do not withhold attic stock pending final punch list completion. Provide an inventory list (Excel) identifying item description, manufacturer/system family, part number, color, length (where applicable), and quantity.