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INDOOR CABLE INSTALLATION GUIDELINES

INTRODUCTION

Network designers and planners must check out local building codes or national codes and satisfy these requirements by specifying at the time of ordering the cables. Just as water pipes and power lines run hidden beneath building floors and behind walls, indoor cable performs its vital functions out of sight of the people it serves. And like its invisible cousins, indoor cable`s "out of sight, out of mind" status moves rapidly to the forefront of awareness when service is disrupted. That is why cabling installers must be familiar with the standards governing riser systems--so their finished job conforms to these standards.

Indoor cabling installations typically include: entrance facilities; vertical and horizontal backbone pathways; vertical and horizontal backbone cables; horizontal pathways; horizontal cables; work area outlets; equipment rooms; telecommunications closets; cross-connect facilities; multi-user telecommunications outlet assemblies (MUTOA); transition points; and consolidation points.

In the absence of local or national building standards ANSI/EIA/TIA-568 standard is a useful resource standard. The ANSI/TIA/EIA-568-A standard defines backbone cabling as follows: "The function of the backbone cabling is to provide interconnections between telecommunications closets, equipment rooms, and entrance facilities in the telecommunications cabling system structure. Backbone cabling consists of the backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection. Backbone cabling also includes cabling between buildings."

Interbuilding and intrabuilding are two types of backbone cables. Interbuilding backbone cable handles traffic between buildings. Intrabuilding backbone cable handles traffic between closets in a single building.

This standard identifies two levels of backbone cabling. First-level backbone is a cable between a main cross-connect (MC) and intermediate cross-connect (IC) or horizontal cross-connect (HC). Second-level backbone exists between an IC and HC.

Riser or backbone cable is at the heart of most intra-building cabling jobs. Riser cable is named so because it "rises" between the floors of a multistory building, is also called backbone cable. It is the primary conduit of a premises distribution system carrying voice, data, and video from the point where those communications enter a building--the outside plant interface or service entrance facility. The main requirement of a backbone system is that it be able to support many different user applications, from simple voice transmission to very unforgiving high-speed data and multimedia networks. To meet this requirement, system designers and installers must use foresight when planning a backbone system. Installations today have to anticipate future growth and prospective applications as well as current needs. For this reason, many backbone installations depend on optical fiber, and can include dozens of spare fibers, if not actual cables.

Another recent trend is to install composite fiber-optic cables in the backbone, terminating and using the multimode fibers but leaving the singlemode fibers dark, or unused, to support future needs. Backbone cabling systems that are being installed can usually be classified into one of four different topologies, each of which has its own characteristics. To properly install these systems--Ethernet, token ring, fiber distributed data interface, and asynchronous transfer mode--it is essential to know, at least in a general way, how they function.
The following are acceptable with respect to rating of the optical fiber cables for indoor applications.

– Cables entering the building without extending more than 50 feet beyond the entrance point and are terminated in a metallic or plastic enclosure do not have to be listed or marked.

– Cables entering from outside a building and run in a building race way do not have to be rated or listed.

– Nonconductive optical cables can occupy the same tray or raceway with conductors for electric light, power or class 1 circuits operating at 600V or less. However, these cables cannot be placed in the same enclosure that houses electrical terminations.

– Optical fiber cables can be placed in the same raceway, cable tray or enclosure with cable TV, radio distribution and communications circuits, as well as with power limited fire protective signaling, class 2 and class 3 remote control signaling and power limited circuits.

PRE-INSTALLATION PREPARATION AND PRECATIONS

- Cables should never be allowed to hang freely for long distances or to press against edges in an installation

- When pulling cable in conduit, all transition points, such as those going from conduit to pull box or exiting the conduit, should be kept smooth. Sometimes the addition of a piece of conduit beyond the transition will keep the cable from resting on a sharp edge.

- If the installation requires riser cable to pass over work areas and above ceilings used as heating, ventilating, or air conditioning air returns, it must be plenum-rated.

- Telecommunications closets should not be collocated with electrical closets, since any copper wire used for voice or data may be subject to electromagnetic interference from nearby electrical services

- Do not tie riser cable to vertical steam or water piping, including sprinkler system piping. Riser cable should be snugged to support systems that are firmly toggle-bolted to walls.

- Make sure that conduits, raceways, and innerducts through which cable may be pulled are large enough to accommodate future additions to the network. Remember that installation costs represent a substantial portion of building the network and that ongoing additions, moves, and changes to the network are highly likely.

PROCEDURE

1. Support the cable and avoid crushing, stressing and over-bending it. Every cable will have values for minimum bend radius and maximum tensile loading; do not exceed these values.

2. For 62.5/125-micron optical-fiber cable, for example, the maximum recommended distance between main and intermediate crossconnects is 4920 feet. Also, it is recommended that intermediate and horizontal crossconnects be no further than 1640 feet apart. However, the distance between main and intermediate crossconnects can increase to up to 6560 feet (4920 feet plus 1640 feet) as the intermediate-horizontal crossconnect distances decrease from the maximum recommended value.

3. For singlemode fiber, the maximum distance between main and intermediate crossconnects is 8200 feet, while the maximum intermediate-horizontal distance is 1640 feet. If telecommunications equipment is connected directly to an intermediate or main crossconnect, connecting cables can be no longer than 98 feet

4. Flexible conduit can be placed within boxes or at interfaces to prevent pressure against the cable or scraping on rough edges. Flexible conduit can also be added in areas open to frequent access, such as raised computer-room floors, where there is a higher potential risk to the cable.
5. In tray and rack installations too monitor the minimum bend radius because the cable will be routed around corners or through transitions. Where raceway or rack transitions expose the cable, flexible conduit should be used for protection.

6. Check and verify conduit, pull boxes and joints and ensure the bend radius is not too small. The inside radius of conduit bends for fiber-optic cable should be at least 10 times the diameter of the cable.

7. Pulls through tightly bent elbow fixtures should be backfed; in other words, the cable is not pulled from end to end, but to and out of an opened junction box, then coiled loosely on the ground and fed through the rest of the run.

8. Ensure that the cable is protected from stress while installing. If the work area permits, optical-fiber cable should be lowered from the top floor using winches and rolling hitch knots in conjunction with other protective devices to minimize the stress of weight on the cable. Permanent cable supports should be in place before the cable is lowered.

Horizontal cabling

9. Intrabuilding conduit runs can be in ceilings or walls or under floors, although there are certain limits because conduit systems are very inflexible. Such systems should be used only when workstation outlet locations are permanent, and where no wiring flexibility is required and outlet density is low. In-floor conduits are often embedded in concrete, making it particularly

difficult to make adds, changes and moves. Conduit can be made of metallic tubing or rigid polyvinyl-chloride plastic

10. Conduit runs should be limited to 100 feet, with no more than two 90-degree bends between pull points or boxes. Electronic Industries Association/Telecommunications Industry Association 569, the commercial building standard for tele- communications pathways and spaces, details many of the requirements for conduit installation and sizing, and the NEC lists appropriate conduit types.
11. Pull boxes are installed for several reasons, including fishing the run and looping the cable for the next length of conduit. Pull boxes are not used for splicing cable. Fish tapes or pullcords should always be placed in the conduit to ease installation. Innerduct is an excellent tool for protecting cable and easing future installations

Dropped ceilings and raised floors

12. Plenum runs or runs in dropped ceilings or raised floors can sometimes be the easiest to install. Many dropped ceilings or raised floors have panels that are easily removed or opened to provide fast access. Most new buildings have dropped ceilings, making this a popular method of installing cables. Raised floors are usually found in computer rooms. When the area is used for environmental air handling, the cable must be plenum-rated

13. Suspended ceilings consist of low-weight panels supported by a system of metal frames or grids that are attached to the ceiling using struts or wires. Typically the panels are easily moved; when they are pushed up, they are dislodged from the grid and may be pushed to the side. If there is not much equipment in the air space, there can be ample room to work

14. Cables in these spaces should be supported in some way, ideally in organized, easy-maintenance trays, wireways or racks. At the very least, cables can be supported by I-hooks or bridle rings.

Cable in trays

15. Cable trays or ladder racks provide a convenient, safe, efficient location in which to install optical-fiber cable. Trays can be installed in ceilings, below floors and in riser shafts. Some trays are designed to be aesthetically pleasing, so they can be placed below the ceiling and in the line of vision. Tray installation usually precedes pulling the fiber cable, because trays can be used for many other types of cable. This means that a tray distribution system may already exist. These routes may be used for installing new cable if they run to appropriate locations.

16. Although a tray provides sturdy support and basic protection for cable, there are still stresses to which the cable may be subjected. Optical-fiber cable should always be run in trays to avoid as much tension, crushing and bending as possible. Routes should be inspected for sharp turns, snags (sometimes from other cables) and rough surfaces. Try to run the fiber cable without pulling it under or between heavier cable or multiple cables that may stress the fiber.

17. The same advice holds true for moves and adds. Secure the cable to the tray to avoid damage during changes, and attach it at least every three feet.

Riser cabling

18. The same guidelines should be applied when cable is installed in vertical shafts or risers. If the installation requires that the cable be rated for use in risers, use a cable rated OFNR, at a minimum.

19. Optical-fiber cables intended for vertical applications have a calculated maximum vertical rise value assigned to them. The vertical rise is the distance the cable may be pulled vertically before being supported. It is determined by the weight of the cable and its ability to resist buckling or kinking.

20. To pull cable vertically, use split wire mesh grips. The device works like basket or finger grips, supporting the cable without crushing the core. Cables should be supported by cable ties, straps or clamps in wiring closets. Whenever possible, begin the installation from the top, allowing the weight of the cable to help the pull rather than adding more load.

21. Permanently identify the cables so that there will be no confusion as to what each carries and where it goes.

22. Deliver passing test reports regularly during the construction of the riser cable system. Pay close attention to reports on the performance of optical-fiber splices

23. Deliver complete, accurate, and clear diagrams of the installation--preferably computer-aided design drawings--showing all routes and equipment related to the riser system. This database becomes an ongoing record of the system. It should extend to horizontal wiring and must be kept current by end-user personnel or the independent contractor responsible for adds, moves, and changes. Large systems, especially, should be equipped with computer support to quickly identify problems that develop over time.