THE OHIO STATE UNIVERSITY COMMUNICATIONS WIRING STANDARD

The objective of the standard wiring plan for the University is to provide an acceptable outlet for any communication device that requires connection to other devices, networks, or information services serving general University needs. The establishment of a standard wiring plan will support most communication devices and provide a standard by which buildings should be wired. Renovations and network upgrades should be developed following this standard to provide a uniform connectivity guideline for the whole campus community.

The purpose of this document is to provide guidelines by which the communications needs of the University can be met. These guidelines are to be used as a means to provide minimum requirements. Specific requirements for each project will be coordinated with the using agency and a OIT Telecommunications and Networking representative during project development.

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SECTION I

Guidelines for Communication Outlets

GENERAL

Guidelines concerning the number of communication outlets by room type are outlined below. Specific requirements for each room and each project shall be coordinated with the using agency at the onset of design for renovation and new construction projects and prior to the initiation of work orders, contracts, or other installation action for other types of projects. The architect/engineer for major renovation and new construction projects should be aware that the Program of Requirements might not be all-inclusive regarding communication facilities. Therefore, the project architect/engineer must work very closely with the appropriate using agency, Academic Technologies Service, Classroom Support, and a OIT Telecommunications and Networking representative during initial planning to ensure total coordination and minimize the need for revisions during the design development phase. Sections IV and V also contain data of concern to the project architect/engineer. This guideline is limited to the wiring and wiring path only. Ancillary devices such as (but not limited to) phones, modems, ethernet hubs, baluns, and electronic devices are the responsibility of the user.

TERMINATIONS

1. Faculty/Administrative Offices, Clerical/Staff Offices, Secretary/Administrative Assistant Offices

Two duplex communications outlets (jacks) for offices with fixed walls of 75 square feet or more are required. One additional duplex outlet for each additional 75 square feet of office space or each additional occupant is required. For offices designed with modular furniture each cubicle or workstation will be provided with one duplex communication outlet per designated occupant. Additionally, a set of station wires (one voice and one data) will be installed as spare to each cluster of 6 office cubicles.

2. Classrooms/Lecture Halls/Auditoriums

In Classrooms, Lecture Halls and Auditoriums four communication outlets **(**one on each wall**)** are required**.** The need for a cable TV outlet will be considered during the planning process. The cable TV outlet is not intended to solve all audio/video needs in Classrooms Lecture Halls and Auditoriums. Specialized audio/video needs should be coordinated with Academic Technologies Service, Classroom Support. Classrooms may be designed to be subdivided, by adding or removing walls, in the future. If this is a design consideration, the number and location of communication outlets will be adjusted accordingly.

The recommended location for outlets is as follows:
1) Chalkboard area
2) Projection booth/rear wall
3) Lectern area
4) Remaining sides

3. Laboratories

One single wall phone outlet and one duplex communication outlet.

4. Graduate Student Offices

One duplex communication outlet for every 75 square feet of space. Above 200 square feet one duplex communication outlet on each wall is required.

5. Residence Halls

One voice jack per room, one data jack per student, and one cable TV outlet in each room.

6. Patient Care Rooms

One duplex communication and one cable TV outlet for each occupant.

7. Conference Rooms

One duplex communication and one cable TV outlet in each room. Rooms with more than 500 square feet should have two duplex communication outlets.

8. Storage Areas

One wall-phone communication outlet for each room over 500 square feet and one additional outlet for each additional 2000 square feet are required.

9. Libraries

Libraries will be wired in accordance with the size of the room and need for communication. A minimum of 1 duplex communication outlet is recommended.

SECTION II

CABLE AND WIRE FACILITIES (*see exhibits A-E*)

GENERAL

1. Cable facilities (conduit, cable trays, raceways etc.) are required for connecting laboratory, classroom, and office pod areas with building communications equipment rooms (IDFs and MDFs). Cable facilities are furnished by project funding.

2. OIT should be consulted before removal of telephone wire and equipment, i.e., when office partitions are relocated. All wiring must be removed all the way to the source.

3. All communication outlets will have conduit, wire mold, or other suitable path provided to the nearest IDF/MDF or to a cable tray that provides a path back to the nearest IDF/MDF.

4. The electrical contractor will provide a pull string in all empty conduits.

5. All work specified shall be UL listed and in accordance with the most current versions of the following codes and agencies:

A. The National Electrical Code, Article 800
B. National Fire Code (N.F.P.A. 72A)
C. Life Safety Code (N.F.P.A. 101)
D. National Electronic Manufacturer's Association (NEMA)
E. Institute of Electronic and Electrical Engineers (IEEE)
F. EIA/TIA 568, Commercial Building Telecommunications Wiring Standard which includes EIA/TIA 568A, 569, 607, and TSB 75.

Electrical Facility Relationships

Although the electrical load is minimal (most devices draw less than 1 amp), every component requires electrical service: modems, terminals, printer, etc. Each communication outlet should be in proximity to a duplex electric outlet in addition to present design requirements to accommodate the need to "plug in" electronic equipment.

BUILDING CONDUIT AND CABLE TRAY SYSTEMS

1. Conduits to communication outlets are to be a minimum of one inch. A dedicated conduit will serve each outlet box. Pull boxes, if needed, must be accessible. Do not place pull boxes above fixed ceilings, HVAC ducts or piping.

2. No conduit run, without a pull box, is to be longer than 100 feet and no more than two 90-degree bends.

3. Communication outlet boxes will be H-4 11/16" X W-4 11/16" X D-2 1/8", equipped with a 2-gang cover/plaster ring. Wall-phone outlets will be equipped with a single-gang cover/plaster ring. The height of these boxes will be determined by the use of the box, keeping in mind that wheelchair access heights vary from project to project and close contact with OIT will eliminate moving the box.

4. A cable wire tray may be placed above drop ceilings with the 1-inch communication outlet conduits stubbed to the cable tray from individual room outlets. This tray will provide a path back to the IDF or MDF. The tray will have a maximum of 8-inch spacing between cable

supports and 4-inch sides. Width of the tray will be determined by the quantity of cables in the tray, and projected growth. Cable Trays and conduits must be properly grounded. All NEC codes for grounding of cable trays will be adhered to. Basket Tray is now acceptable, as long as, it has 4 inch sides.

6. Access to the IDF or MDF is acceptable by either extending the cable tray or providing conduit.

7. A path from the MDF to IDF(s) and IDF to IDF is required. Cable tray, conduit(s), or sleeved holes that provide this path are acceptable. The volume of cable and predicted expansion determines the size and quantity of the OIT that make up the path. (See Exhibit A)

8. Approved UL fire stop must be used when penetrating fire rated walls or floors.

OUTSIDE PLANT

1. All new building construction planning must include a cable path into existing tunnels or manholes. The size of the cable path will be based on the requirements of the facility. This path will be used exclusively for data, voice, low voltage control/alarms, and video cables.
2. All cable that is to be connected to, or disconnected from, the campus communication network must be reported to OIT Telecommunication and Networking for approval. This must be submitted in writing so that accurate records and databases can be maintained.
3. OIT Telecommunication and Networking is the control entity for campus telecommunication facilities. OIT will review drawings and specifications on construction and renovation projects for compliance with University standards and user specifications.
4. Any project that requires moving or rerouting of telecommuication cables, will bear the cost of said moves.

ELEVATOR PHONES: The following are the procedures for elevator phones.

1. It should be written into the contract documents that the Electrical Contractor is responsible for the installation costs of the elevator phone line(s).
2. The Electrical Contractor shall send OIT a letter requesting service be activated to the specific elevator equipment room(s). Indicating the date of service is also required. NOTE: Normal installation time for OIT is 5 working days from the date of receipt of the request.
3. Physical Facilities shall send OIT a requisition form 1303 requesting that monthly service fees for the elevator phone lines at the specific location be charged to them on the account number provided.
4. The University Architects representative will solicit the above documents from the Electrical Contractor and Physical Facilities, attach them together and forward them to OIT.

EMERGENCY PHONES

Cable shall be equal to Essex F-04P24BPN-5.

1. Transmission Performance of 100MHz.
2. Metallic shielded to facilitate grounding according to NEC requirements.
3. Fully filled to prevent intrusion of moisture.
4. Materials suitable for -40o C to +80o C operation range.
5. Must be suitable for direct burial applications.
6. Meets Category 5 transmission requirements of ANSI/TIA/EIA 568-A.
7. Lightning protectors must be provided for both ends of cable, on at least two of the four pairs. Marconi 042227 multi-station gas protector or OIT approved equal

SECTION III

MAIN AND INTERMEDIATE DISTRIBUTION FRAMES

GENERAL

OIT personnel should be consulted during the planning stages of any building construction or building renovation. In some cases, present MDFs and IDFs may have to be enlarged to accommodate changes in the use of building space.

MAIN DISTRIBUTION FRAME (*See Exhibit F*)

1. Space for connection of the building communication cable to the outside plant should be provided as a separate room and not shared with other utility services, particularly the electrical service. When possible, this room will not be adjacent to the electrical distribution room.

2. Room size will be determined by the size and use of the building. Room size should be large enough to mount electronic equipment to support Local Area Networks (LANs) such as relay racks, hubs, multiport repeaters, or paging. For major renovations and new building projects, a size may or may not be included in the Project Program of Requirements. In either event the project Architect/Engineer must, during the initial (Schematic, Preliminary) planning stage, engage the coordinated efforts of OIT Telecommunication and Networking, Office of Facilities Planning and Development, and the using agency to ensure appropriate size and arrangement of the communications equipment room(s). These room(s) will need to be environmentally controlled to insure proper reliability of sensitive electronic equipment.

3. Backboards for MDFs and IDFs are to be 3/4" plywood good on one side and painted with flat light colored fire-retarding paint on all sides. All usable walls of MDF/IDF's will have backboards.

4. At all MDF locations a double duplex electric outlet will be **provided on a dedicated circuit** on each usable wall. A 48-inch double tube fluorescent light should be placed above the MDF/IDF panel. Incandescent lights may be used as long as a 50-foot candle lighting can be obtained at the MDF/IDF panel.

5. A "ring run" will be provided at all MDFs to keep jumper (crosscut) wire organized. This will be accomplished by the use of 4-inch wide aluminum "D" rings screw-mounted above the top of the 66 blocks. The bottom of the "D" ring will be mounted two inches above and centered over the space between each vertical row of blocks. "D" rings should be open or split to allow placement of crosscut wire.

DATA CONNECTIVITY

1. Data connectivity shall be on 19 inch racks which will be located either in a communication closet or a designated area set aside for network systems equipment. Such as, but not limited to, routers, hubs, switches, fiber terminations, patch panels, and shelves.

2. Open style data racks shall be 19 inches wide, 84 inches high, and shall meet EIA standards. Racks shall be listed to the UL 1863 Standard for Communication Circuit Accessory. International Connectors and Cable Corporations ICCMSCMRH7 or Hubbell CS1976 are strongly recommended for university data connectivity.

Under no circumstances shall flush mounted or surface mounted phone panels be used for data connectivity.

3. Any racks that are floor mounted will be provided with tip bars and all additional accessories as required for a complete functional system. Both vertical and horizontal cable management systems must be provided on all relay racks. There must be enough space in the MDF/IDFs to accommodate 31-inch isle-ways. All racks must be grounded to the building ground or bonded to the cable tray system.

4. Provide a multi-outlet AC plug strip. Provide enough outlets to accommodate all electronic devices in the relay rack. The strips shall be mounted on standoff brackets so as to provide 6 inches of separation from the cable management system. Strips shall be mounted on the rear of the rack. If UPS systems are being used AC power must be evenly distributed between UPS and other source of AC power.

5. Patch panels for relay racks shall be sized to accommodate current project requirements plus 30% growth capacity. Patch panels shall not exceed 4 x 48 port (maximum total of 192 connections) in a relay rack. Recommended Hubbell UDX48E or OIT approved equal.

6. Enclosed cabinets shall have a rack mount width of 19 inches and an overall height of at least 76 inches. Enclosed cabinets shall have a roof mounted cable fan and cable entry, enclosed cabinets must be at least 32 inches deep to accommodate a rack mounted UPS. Enclosed cabinets shall be firmly secured as to be unmovable. Recommended enclosed cabinet is Rittal Universal PS Networking Cabinet # 9968086.

7. Wall mounted racks shall be 19 inches in width and 48 inches in height. All wall mounted racks will be mounted on ¾ inch plywood backboards.

INTERMEDIATE DISTRIBUTION FRAMES (*See Exhibit G)*

1. IDFs will be a secure room, closet, or space directly accessible from a hallway, public access space, or within a mechanical room. Janitor's closets and electrical closets are not acceptable as IDF spaces. A duplex electric outlet will be **provided on a dedicated circuit**. A 48-inch double tube fluorescent light should be placed above the IDF panel. Incandescent lights may be used as long as a 50-foot candle lighting can be obtained at the IDF panel.

2. In large buildings, more than one IDF per floor may be required. A large building is defined as any building in which the physical layout of a floor would require cable "runs" (IDF/MDF to outlet) in excess of 300 feet (90 meters).

GROUNDING

A #6 insulated wire will be provided from the building service entrance ground to all MDFs and IDFs terminated on a ground bar. All cable tray systems and relay racks will have the same ground as MDF/IDFs. The DC resistance from the MDF/IDF to the building earth ground shall not exceed 0.5 ohms on the longest run.

SECURITY

Access to all rooms or closets containing voice or data equipment will be through one uniform key system. Physical Facilities has established the NET keys are to be used. Any card access to communications closets must include OIT personnel.

CABLE, WIRE and OUTLET INSTALLATION

COMMUNICATION OUTLETS (*SEE exhibit L*)

A statement shall be included in all specifications on renovation and construction projects, to read as follows; Cable, wire, and outlet installation shall be performed by personnel that have been certified by an organization such as BICSI (Building Industry Consulting Service International) or have at least 5 years experience in the telecommunication industry.

1. Minimum Requirements for communication outlets, except wall phone outlets, will be duplex, ivory for phone and black for data, flush mount. Jack mounting plates will be designed for installation of interchangeable modules, manufactured by Hubbell, Leviton, or OIT approved equal. Floor mounted outlets will be coordinated with the architect, user, and OIT during the planning stages of each project. Approval of any outlets (jacks) on shop drawings must be handled through the University Architect and OIT.

2. The top opening of the faceplate mounting will be equipped with a six pin ivory module, manufactured by Hubbell (catalog # HXJUTI), Leviton, or OIT approved equal. The opening in the module will accommodate a standard male telephone plug.

3. The bottom opening of the faceplate mounting will be equipped with a 8 pin, Category 6, black module, manufactured by Hubbell (catalog # HXJ6BK), Leviton, or OIT approved equal. The 8 pins will be wired in accordance with ISDN, T568A standard.

4. The faceplate will be stainless steel or plastic in accordance with architectural design (Hubbell IFP26TI). The faceplate shall have four or six modular openings designed to accommodate the jacks listed above. Openings without jacks installed, will have blank inserts installed (Hubbell SFBI10). Stainless steel covers (Hubbell SSF206) should be used in auditoriums and classrooms, where frequent use or abuse is more likely.

5. Wall phone outlets will be plastic, ivory, 6-conductor, and designed for modular mounting of wall phones. Suttle SE 630AC6 44. The highest operable part of the telephone shall be 54".

6. Any configurations beyond this minimum standard will be handled on a per job basis.

STATION WIRE

1. Each communication faceplate will be wired with a minimum of two 4-pair unshielded (**Category 6**) station wires. Each wall phone outlet will be wired with one 4 pair unshielded (**Category 6**) station wire. All station wire will be 24-gauge, twisted, solid annealed copper conductor, individually insulated with high density color-coded PVC. All communication wire and cable installed in a building must meet the requirements of ARTICLE 800 of the National Electrical Code. Splicing in station wire is not permitted; wire must be continuous from IDF or MDF to the outlet (jack).

2. One of the 4 pair (**Category 6**) station wires will be terminated on the top module of the faceplate in accordance with the color-coding on the module. The fourth pair of the wire will be folded back at the jack, and punched down on the blocks at the IDF/MDF.
3. One of the 4 pair (**Category 6**) station wires will be terminated on the bottom module of the faceplate in accordance with the color coding on the module. ***CAUTION***: **Very close**

attention must be paid in maintaining the twist of the pairs at both ends of the cable! The twist must be within 1/2 inch of any termination.

4. Each communication faceplate will be numbered as follows with a 4-digit number: Each faceplate must have numbers for every outlet on that faceplate. The first digit of the number will be the floor. That is, 0 will be used for ground floor or basement, 1 will be the first floor, and 2 will be the second floor, continuing through the appropriate number. The next three digits will be sequential numbers starting with 001 if there is only one IDF on a floor. If the building has more than one IDF on a floor, each IDF will have a block of 250 numbers assigned to it. That is, 001 through 250 for IDF number 1, 251 through 500 for IDF number 2, and so on, as required.

5. The numbering of the blocks in the MDF or IDF's must be sequential numbers starting at the top left of the block and continuing straight down the block or row of blocks. All voice jacks will have odd numbers only, example (001, 003, 005, etc.) All data jacks will have even numbers only example (002, 004, 006, etc.) In MDF/IDF locations on renovation projects where the numbering is already established check with OIT on the next sequential number to be used.

6. After each communication outlet is wired and the IDF is punched down, every conductor must be checked for shorts, crosses, reversals, and continuity. Cat 6 data jacks should also be checked for attenuation, capacitance, impedance, resistance, near-end cross talk, cable length, ELFEXT, return loss delay, delay skew, and ambient noise. Tests shall follow TIA-568-A-5 specifications and be witnessed by a Representative of OIT and shall be monitored by a recorder where appropriate. Utilize a Micro Test OmniScanner Model 8220-00 or OIT approved equal. Provide a hard copy of test results to OIT, or a disk with the test results in Microsoft word format.

COLOR CODES:

Pair 1 - White Blue, Blue White
Pair 2 - White Orange, Orange White
Pair 3 - White Green, Green White
Pair 4 - White Brown, Brown White

IDFs (*See Exhibit H*)

1. At the IDF, 66M150 type blocks are to be used with an 89B standoff bracket for the riser cable and the telephone station wire. Separate blocks or rows of blocks will be used for riser cables and for telephone wire terminations. Relay racks may be used for 4 pair Data cable termination's. Riser cable blocks will be mounted to the left, station wire blocks will be mounted to the right at the IDF. The 4 pair Data cabling may be mounted on relay racks. Patch panels are to have 48 ports, and use a standard 8 pin module for data cabling. ***CAUTION***: **Very close attention must be paid in maintaining the twist of the pairs on patch panels. The twist must be within 1/2 inch of the termination.**
2. Terminate the riser cable following the standard telephony color code (see Exhibit H) using the first row of pins on the left and the last row of pins on the right of the block. The riser cable will be fed up through the bottom of the 66 block standoff brackets. ***CAUTION***: **Very close attention must be paid in maintaining the twist of the pairs in all riser cables. The twist must be within 1/2 inch of the termination.**
3. The 4 pair station wire will be punched down using the first row of pins on the left and the last row of pins on the right of the 66M150 blocks and identified by a jack number. Station wire will be fed through the bottom of the 66 block standoff brackets. ***CAUTION***: **Very close**

attention must be paid in maintaining the twist of the pairs in all station cables. The twist must be within 1/2 inch of any termination.

4. The size of the IDF will determine how the 66 blocks and relay racks are to be arranged. The 66 blocks are to be stacked no more than four blocks high with a 2-inch space between the rows of blocks. The Relay Racks are to be arranged to allow at least 31 inches of clearance on three sides of the rack.

MDF (*See Exhibit F*)

1. All punch down blocks are to start from left to right. Space is to be reserved at the far left for the underground cable and the protectors to be mounted and terminated. The underground cable and protectors will be installed and punched down by OIT Telecommunication and Networking.

2. The riser cables' 66M150 blocks will be stacked no more than four high. The top of the 66M150 blocks are to be no more than 72 inches from the floor and the bottom of the lowest block shall be no lower than 30 inches from the floor.

3. All cables and station wire will be fed from the bottom of the 66M150 block through the 89B brackets and terminated. The standard telephony color code is to be followed.

4. The first row of riser cable blocks would be the ground floor or basement IDF riser cable. The next row would be the first floor riser cable, and so on throughout the building.

5. If station wires are installed at the MDF, they will be terminated on 66M150 blocks, to the right side of the riser cables. The 4 pair station wire for telephones will be terminated immediately to the right of the riser cable.

6 All the blocks are to be mounted with a 2-inch space between each row. This allows room for crosscuts to be run.

RISER CABLE

1**.** Riser cables will be 24 gauge, Category 3, twisted solid annealed copper conductors, individually insulated and color coded in accordance with telephone industry standards. Cables having more than 25 pairs will be assembled in individual color-coded binders. All communications wire or cable installed in a building must meet requirements of Article 800 of the National Electric Code.

2. The riser cable will be sized by the number of communication outlets plus 30%, rounding off the riser cable to the nearest standard size. Minimum size is 100 pairs.

3. In addition to the multi-pair copper riser cables, a minimum of 1 six strand multi-mode, 1 six strand single mode fiber cable (riser rated), and one Category 6 unshielded twisted pair cable for each 23 data cables, will be run from the MDF to each IDF. The path for these cables will be directly from the MDF to each IDF. Both the fiber and the data cables will be terminated in relay racks.

SPLICING DEVICES

During renovation projects where an MDF or IDF is being created or relocated splicing the riser cables shall be reviewed by OIT. Upon approval splicing may be permitted in the copper riser cables only. Modular splicing devices that are to be used must also be approved.

SPLICE CASES

An approved cover for splices in a riser system must be used where any two or more cables are spliced together.

PUNCH DOWN BLOCKS

66M150 type blocks are to be used with an 89 B standoff brackets at both MDF and IDFs to terminate the riser cables and the station wires.

CABLE TV. CABLING

1. All cable TV. runs will be routed directly from the IDF to the outlet. Splitters and Amplifiers will be mounted at the IDF.

2. The connectors will be a "F" type. Compression type fittings are the only acceptable “F” connectors to be used. ***CAUTION***: **Proper tools must be used to install the "F" connectors to insure the proper fit and also to insure there is no RF signal leakage.** The CATV outlet shall be a 75 ohm female “F” to female “F” wall plate adaptor.

3. For runs of less than 200 feet, drop cable shall be 6 Series quad-shield 75 ohm coaxial cable. The core shall be 18-gauge copper covered steel center conductor with a gas expanded polyethylene dielectric. The shield shall be aluminum-polypropylene-aluminum laminated tape with overlap bonded to dielectric, a 60% braid of 34 AWG bare aluminum wire, a aluminum-polypropylene-aluminum laminated tape, and a 42% braid of 34 AWG bare aluminum wire. The jacket shall be made of flame retardant polyvinyl chloride. The Series 6 drop cable shall be Commscope #5781 (Plenum #2227) or OIT approved equivalent. The connector for the Series 6 drop cable shall be Gilbert #GF-UE-6Q (Plenum GF US 6).

4. For runs of 201-350 feet in length drop cable shall be 11 Series quad-shield 75 ohm coaxial cable. Any run exceeding 350 feet in length, OIT must be contacted for technical consultation. The core shall be 14-gauge copper covered steel center conductor with a gas expanded polyethylene dielectric. The shield shall be aluminum-polypropylene-aluminum laminated tape with overlap bonded to dielectric, a 60% braid of 34 AWG bare aluminum wire, a aluminum-polypropylene-aluminum laminated tape, and a 40% braid of 34 AWG bare aluminum wire. The jacket shall be made of flame retardant polyvinyl chloride. The Series 11 drop cable shall be Commscope #5940 (Plenum #2287) or OIT approved equivalent. The connector for the Series 11 drop cable shall be Gilbert #GAF-US-11Q (Plenum GF-11 300P).

5. Riser cable for RF distribution shall be 0.500” aluminum sheathed 75 ohm distribution cable. The core shall have a fully bonded copper clad center conductor with a high compression, micro cellular foam dielectric. The outer tube shall be solid aluminum. The riser cable shall be Commscope #P3 500 CA or OIT approved equivalent.

FIBER OPTIC CABLE

Multimode Fiber: Cable shall be all glass, graded index, dual window, multimode fiber optic wave guides. Fiber shall be coated with a cladding material, which is concentric with the

core. Cable to be reinforced with Kevlar yarn and contain no metallic elements. Protect fiber with a protective tube, a jacketed nonmetallic strength member, and an exterior jacket. Cable shall have transmission window centered at 850 and 1300 greater than 1.0 dB/Km. Multimode fiber shall be color coded Orange. The fiber cable shall meet the following specifications:

Fiber Dimensions:
62.5 μm core, or 50 μm core
125 μm cladding
250 μm coating
900 μm buffering
Cable Minimum Bending Radius
During Installation: 20 times cable diameter
After Installation: 10 times cable diameter
Buffered Fiber Minimum Bend Radius: .75 inch (1.91 cm)
Operating Temperature Range: 32° F to 122° F (0° C to 50° C)
Storage Temperature Range: -40° F to 149° F (-4° C to 65° C)
Optical Specifications:
Maximum Fiber Loss: 4.0 dB/km at 850 nm (typical range 3.0 to 3.5 dB/km)
Maximum Fiber Loss: 1.5 dB/km at 1300 nm (typical range 0.5 to 0.8 dB/km)
Minimum Bandwidth: 160 MHz at 850 nm and 500 MHz at 130nm
Numerical Aperture: 0.257
UL Listed

Single Mode Fiber: Cable shall be all glass, graded index, single mode fiber optic wave guides. Fiber shall be coated with a cladding material that is concentric with the core. Cables to be reinforced with Kevlar yarn and contain no metallic elements. Protect fiber with a protective tube, a jacketed nonmetallic strength member, and an exterior jacket. Single mode fiber shall be color coded Yellow.
The fiber cable shall meet the following specifications:
Fiber Dimensions:
Single mode 8.2 μm core
125 μm cladding
250 μm coating
900 μm buffering
Cable minimum bending radius during installation; 20 times cable diameter. After installation: 10 times cable diameter.
Buffered Fiber Minimum Bend Radius: .75 inch (1.91 cm)
Operating Temperature Range: -76° F to 185° F (-60° C to 85° C)
Storage Temperature Range: -40° F to 149° F (-4° C to 65° C)
Optical Specifications:
Maximum Fiber Loss: .3dB/km at 1550 nm
Maximum Fiber Loss: .4dB/km at 1310 nm
Numerical Aperture: 0.14. Fiber must be UL Listed
Dispersion: 0ps/(nm*km) at 1310 nm
Dispersion: ≤ 18ps/(nm*km) at 1550 nm
Polarization Dispersion (PMD): ≤ .2ps/√km
Refractive Group Index: 1.4677 at 1310 nm
Refractive Group Index: 1.4682 at 1550 nm
Tensile Strength: ≥ 200kpsi (1.4GPa)
Mechanical Stress: Mechanical stress present in the cable shall not be transmitted to the optical fibers.

Protective Covering: Provide continuous covering on a single length cable with same material, and shall be free from holes, splits, blisters, and other imperfections. Single mode fiber shall have a *yellow* cable sheath and multimode fiber shall have an *orange* cable sheath.
Strength Members: Strength members shall be an integral part of the cable construction.
Tensile Strength: Cables of 12 fibers or less shall withstand an installation tensile load of not less than 400 Newtons and not less than 200 Newtons continuous tensile load. Cables with more than 12 fibers shall withstand an installation load of not less than 1300 Newtons and a long term tensile load of not less than 300 Newtons.

Rack Modules and Termination Boxes
The modules shall:

1. Provide cross-connect, inter connect, splicing capabilities and contain the proper troughs for supporting and routing the fiber cables and jumpers.
2. Consist of a modular enclosure with retainer rings in the slack storage section to limit the bending radius of fibers.
3. Have a window section to insert connector panels for mounting of connectorized fibers (ST or SC).
4. Single mode shall utilize SC connectors and adapters. Multimode shall utilize ST connectors and adapters. All connectors shall meet the following; operating temperature of –40° to 185° F (-4° C to 85° C) and an maximum loss of 0.3 dB for multimode and 0.01 dB for single mode.
5. Provide grommet kits, which consist of gauge steel grommet plates and flexible rubber grommets, where fiber enters the module.

All Fiber Optic cables shall be run from the MDF to each IDF without splices. **All Fiber Optic Cable inside of buildings will be run in innerducts or be Armored for protection.** These innerducts will be placed in cable trays, in riser sleeves, or any conduits that share fiber and copper. Innerducts will be sized with 50% fill capacity upon initial use.

Fiber Optic in Ducts and Conduits:
Provide cable lubricant compatible with the cable sheathing material when pulling cable. Attach pulling fixtures to the cable strength members. When indirect attachments are used, match the grip diameter and length to the cable diameter and characteristics. When indirect attachment is used on cables having only central strength members, reduce pulling forces to ensure that fibers are not damaged from forces being transmitted to the strength member. During pulling of the cable, continuously monitor pull line tension, and shall not exceed maximum tension given by the cable manufacturer. Mechanical stress placed upon the cable during installation shall be such that cable in not twisted or stretched. Provide cable feeder guide between cable reel and face of duct or conduit to protect and guide cable into the duct or conduit as it is played off of the reel. As cable is played off of the reel, carefully inspect the jacket for defects. Take precautions during installation to prevent the cable from being kinked or crushed and that the minimum bend radius is not exceeded at anytime. Hand feed and guide cable through each junction box and apply additional lubricant at intermediate junction boxes. When practicable, use the center pulling technique to lower pulling tension. When the cable is pulled out of a junction box protect from dirt and moisture.

Fiber Optic testing:

1. Verify complete operation of data transmission system during field testing. Perform tests on 100 percent of the fibers of each circuit.

2. The following tests shall be done after installation of cable. Replace cable that has failed with new segment of cable and test new segment of cable to demonstrate acceptability.
3. Insertion loss testing shall be performed.
4. These tests shall be measured in dB.
5. These tests shall be conducted with an LED light source and optical power meter.
6. These tests shall use 850 nm and 1300 nm light sources for multimode fiber and 1300 and 1550 nm for single mode fiber.
7. Test shall be documented for all wavelength attenuation tests as noted above.
8. Test results shall be documented on paper and on disk when possible and shall be turned over to OIT after testing is complete.

(see exhibit N)

SECTION V : DEFINITIONS

COMMUNICATION OUTLET

Any outlet designated for voice, data, or video. The termination point of the station wire will have an RJ11, RJ41, RJ45, BNC, F connector, or any other modular jack assembly installed. This outlet will be used for the connection of telephone, modem, data path, balun, or other device used to establish voice , data, or video communications.

DATA TERMINATION JACK (*SEE* Communication Outlet)

TELEPHONE JACK (*SEE* Communication Outlet)

UNDERGROUND CABLE
The cable that enters the building from the Campus Distribution Network.

ENTRANCE CABLE (*SEE* Underground Cable)

OUTSIDE PLANT CABLE (*SEE* Underground Cable)

INTERMEDIATE DISTRIBUTION FRAME (IDF)
That point where the riser cables and the station wire (ISW) come together. There can be more than one IDF in a building or on a floor.

MAIN DISTRIBUTION FRAME (MDF)
That point in the building where the underground cable is terminated on 66M150 type blocks. The riser cable is also terminated on 66M150 blocks at this location. The underground cable is cross-connected to the riser cable by a jumper.

RISER CABLE
The cable that runs between the IDF and the MDF.

JUMPERS
Two wires (1 pair) that connect the underground cable pairs to the riser cable on the 66M150 blocks at the MDF and the station wire to the riser cable at the IDF.

CROSS-CUT WIRE (*SEE* Jumpers)

SPLICE
A point where two cables are mechanically connected to each other.

STATION WIRE
A wire or cable used to connect the communication outlet to the IDF. This is to be a 3 pair wire without shield, 4 pair wire without shield, coaxial, or other as required.

INSIDE WIRE (ISW) (See Station Wire)

" OR OIT APPROVED EQUAL"
Whenever the term " or OIT approved equal" appears in this document it means the product must be the same size, shape, color and function as the product specified.

CATV Specifications for 75 Ohm Coaxial Cable

Series 6 Cable P/N= F6ssvv (non-plenum type)

All cable shall be "Quad Shield."
Minimum SRL shall be –20 dB 5 to 950 MHz and -15 dB 950 to 2200 MHz.
Minimum Velocity of Propagation shall be 85%.
Maximum attenuation for non-plenum type cable at 68 degrees F (20 degrees C) is listed in the following table:

Frequency in MHz	dB/100ft	dB/100m
5	0.58	1.90
55	1.60	5.25
83	1.95	6.40
187	2.85	9.35
211	3.05	10.00
250	3.30	10.82
300	3.55	11.64
350	3.85	12.63
400	4.15	13.61
500	4.66	15.09
600	5.10	16.73
750	5.65	18.54
865	6.10	20.01
1000	6.55	21.49
1450	7.89	30.14
1800	8.79	33.58
2200	9.72	37.12

Maximum attenuation for plenum type cable at 68 degrees F (20 degrees C) is listed in the following table:

P/N= 2227V series 6 (Plenum type)

Frequency in MHz	dB/100ft	dB/100m
1	0.25	0.82
10	0.71	2.33
50	1.47	4.82
100	2.01	6.59
200	2.62	8.59
400	4.13	13.55
700	5.85	19.19
900	6.87	22.53
1000	7.36	24.14
1450	8.86	33.86
1800	9.87	37.73
2200	10.92	41.71

Series 11 Cable P/N= F11ssvv (Non-plenum type)

All cable shall be "Quad Shield."
Minimum SRL shall be –20 dB 5 to 950 MHz and -15 dB 950 to 2200 MHz.
Minimum Velocity of Propagation shall be 85%.
Maximum attenuation for non-plenum type cable at 68 degrees F (20 degrees C) is listed in the following table:

Frequency in MHz	dB/100ft	dB/100m
5	0.38	1.25
55	0.96	3.15
83	1.18	3.87
187	1.75	5.74
211	1.90	6.23
250	2.05	6.73
300	2.25	7.38
350	2.42	7.94
400	2.60	8.53
500	2.90	9.51
600	3.18	10.43
750	3.65	11.97
865	3.98	13.05
1000	4.35	14.27
1450	5.24	20.01
1800	5.84	22.30
2200	6.45	24.65

Maximum attenuation for plenum type cable at 68 degrees F (20 degrees C) is listed in the following table:

P/N= 2287K Series 11 (Plenum type)

Frequency in MHz	dB/100ft	dB/100m
1	0.15	0.49
10	0.47	1.54
50	1.09	3.58
100	1.59	5.22
200	2.35	7.71
400	3.52	11.55
700	4.95	16.24
900	5.79	18.99
1000	6.19	20.30
1450	7.45	28.48
1800	8.30	31.73
2200	9.18	35.08

Fiber Wiring Tests Sample

Building Name _____

MDF/IDF Floor _____

Fiber Type Multi Mode _____ Single Mode _____

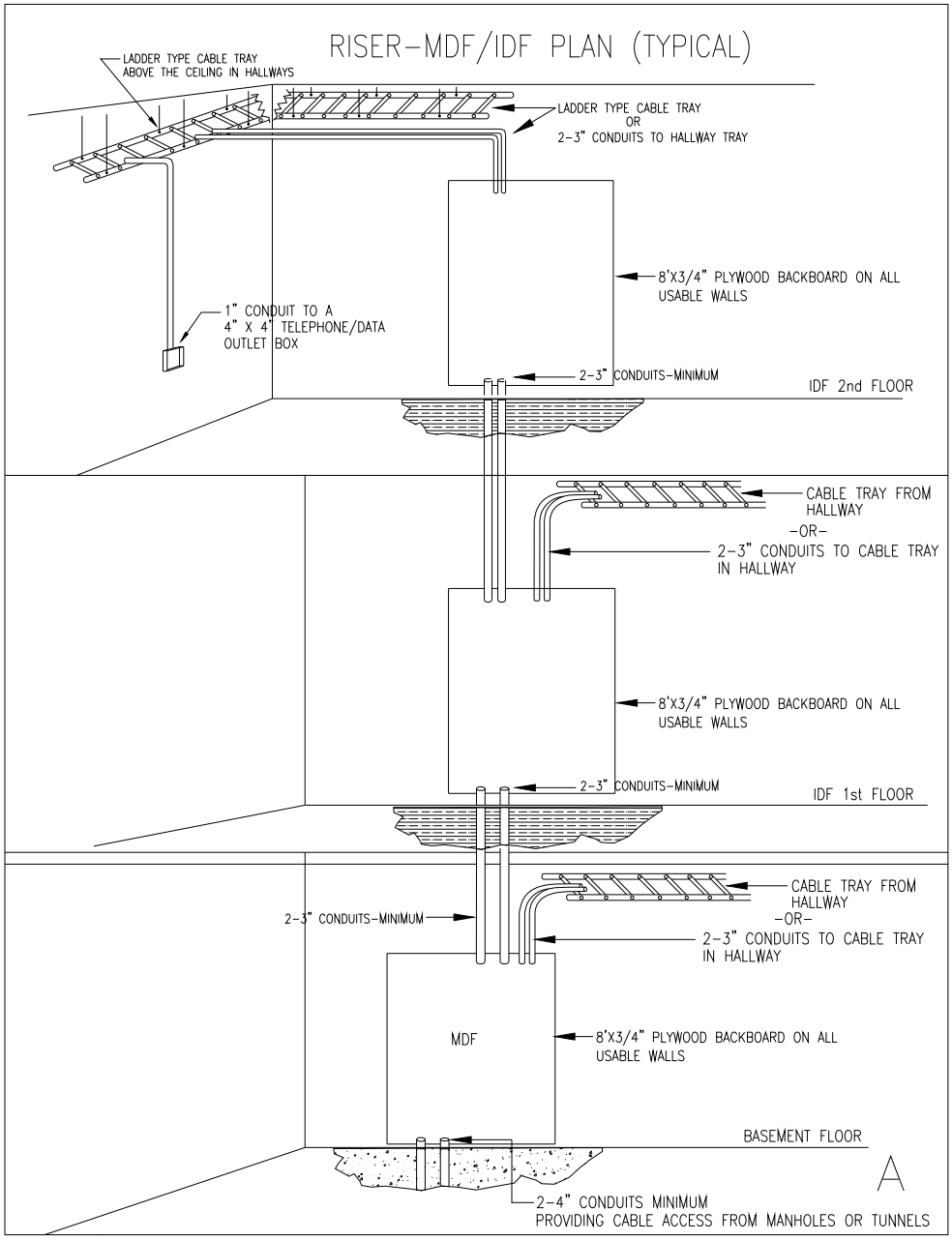
Strand No.	Location/ Room#	850nm dB Loss	1300nm dB Loss	1550nm dB Loss
1-Blue				
2-Orange				
3-Green				
4-Brown				
5-Slate				
6-White				
7-Red				
8-Black				
9-Yellow				
10-Violet				
11-Rose				
12-Aqua				

Name _____

Signature _____

Date _____

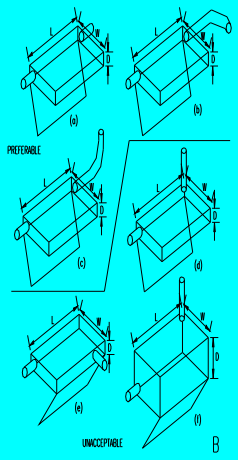
N


RISER–MDF/IDF PLAN (TYPICAL)
LADDER TYPE CABLE TRAY ABOVE THE CEILING IN HALLWAYS
LADDER TYPE CABLE TRAY OR 2–3" CONDUITS TO HALLWAY TRAY
8'X3/4" PLYWOOD BACKBOARD ON ALL USABLE WALLS
1" CONDUIT TO A 4" X 4" TELEPHONE/DATA OUTLET BOX
2–3" CONDUITS–MINIMUM
IDF 2nd FLOOR
CABLE TRAY FROM HALLWAY
–OR–
2–3" CONDUITS TO CABLE TRAY IN HALLWAY
8'X3/4" PLYWOOD BACKBOARD ON ALL USABLE WALLS
2–3" CONDUITS–MINIMUM
IDF 1st FLOOR
CABLE TRAY FROM HALLWAY
–OR–
2–3" CONDUITS–MINIMUM
2–3" CONDUITS TO CABLE TRAY IN HALLWAY
MDF
8'X3/4" PLYWOOD BACKBOARD ON ALL USABLE WALLS
BASEMENT FLOOR
A
2–4" CONDUITS MINIMUM PROVIDING CABLE ACCESS FROM MANHOLES OR TUNNELS

Pull and Splice Boxes

A pull box should be placed where conduit runs exceed 100 feet in length or contain the equivalent of more than two 90-degree bends. Conduit should enter and leave through opposite ends of the box. No bends should be made inside the box. If a 90-degree turn is required at a box, it is preferable to place it adjacent to the box, as illustrated in (b) and (c). Do not place them as illustrated in (d), (e), and (f).

These same considerations apply to splice boxes placed at turns.



B

MINIMUM RECOMENDED SIZES OF PULLBOXES AND SPLICE BOXES

If slip sleeves, gutters, or open sections of conduit are used instead of pull boxes, the opening should be as long as the pull box specified below.

PULL BOX SIZES FOR TWO CONDUITS (IN.)

Nominal Conduit Size (in.)	Configurations (a) or (b) or (c)			Configurations (e)			Configurations (f)			For each additional conduit add (in)
	W	L	D	W	L	D	W	L	D	
3/4	4	12	3	6	12	3	4	12	6	2
1	4	16	3	8	16	3	4	16	8	2
1-1/4	6	20	3	10	18	3	6	18	10	3
1-3/8	8	27	4	12	24	4	8	24	12	4
2	8	36	4	14	30	4	10	30	14	5
2-3/8	10	42	5	16	36	5	12	36	16	6
3	12	48	5	18	42	5	15	42	18	6
3-3/8	12	54	6	21	48	6	15	48	21	6

SPLICE BOX SIZES FOR TWO CONDUITS (IN.)

	Configurations (a) or (b)			Configurations (d) or (e)						
	W	L	D	W	L	D				
3/4	10	30	3	10	30	6				3
1	12	32	4	12	32	8				4
1-1/4	14	36	5	14	36	10				6
1-3/8	18	39	6	18	39	12				8
2	20	42	7	20	42	14				9
2-3/8	24	48	8	24	48	16				10
3	30	54	9	30	54	18				12
3-3/8	36	60	10	36	60	21				12
4	42	66	11	42	66	24				12

C

MINIMUM BEND RADIUS OF CONDUITS

SIZE OF CONDUIT INCHES	CROSS SECT AREA SQ. INCHES	MINIMUM RADIUS OF CONDUIT BEND NON-LEAD SHEATH INCHES
0.75	0.53	5
1	0.86	6
1.25	1.5	8
1.5	2.04	10
2	3.36	12
2.5	4.79	15
3	7.38	18
3.5	9.9	21
4	12.72	24
4.5	15.94	27
5	20	30
5.5	28.89	35

D

Conduit Fill Capacities

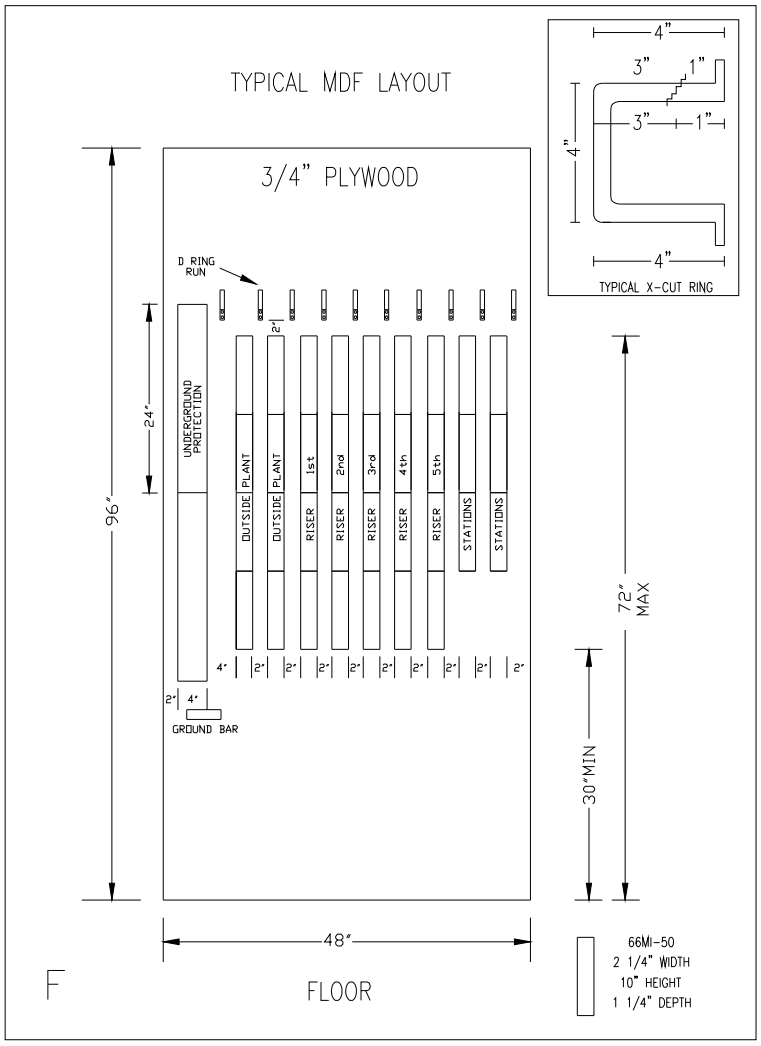
Riser Cable

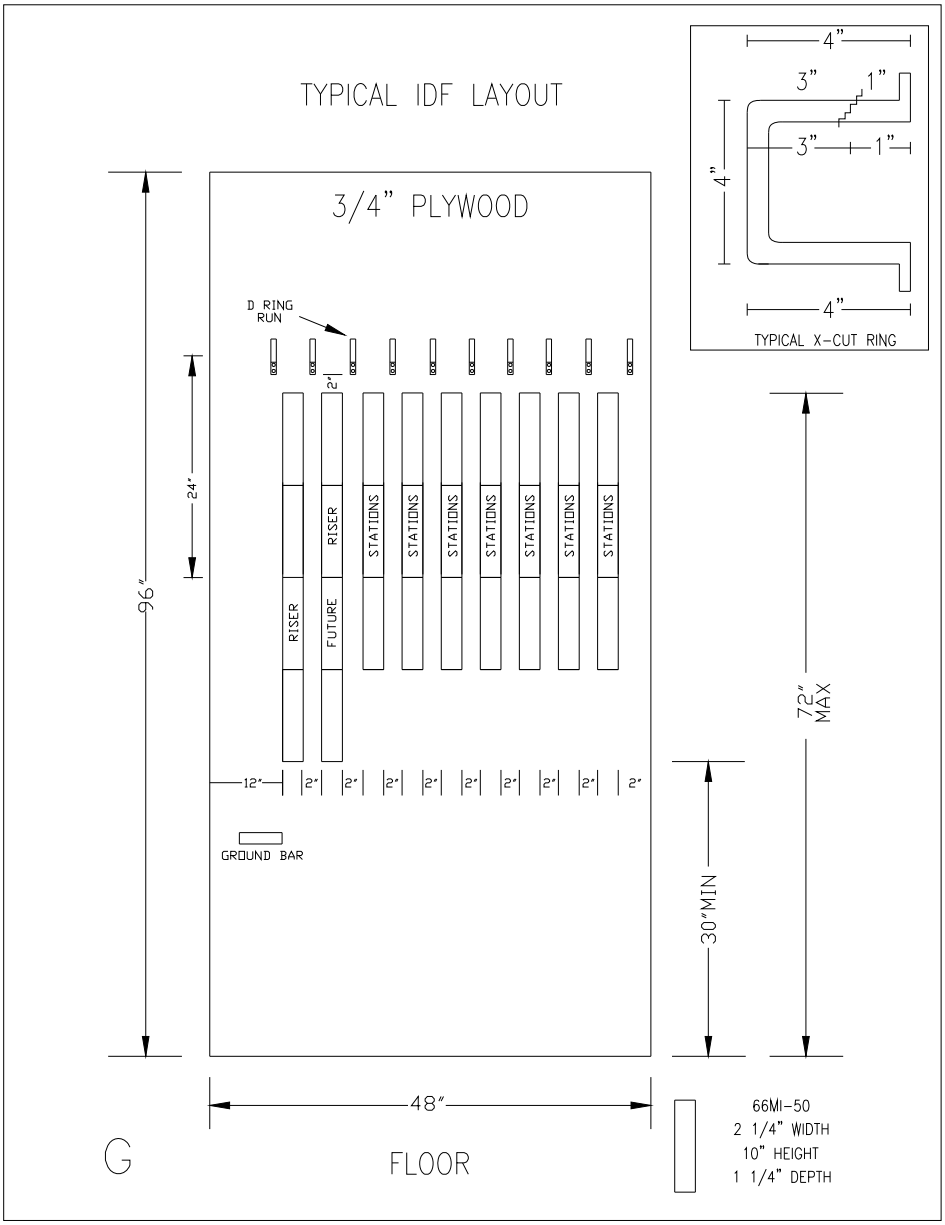
Size	Diameter Inches	Weight Per foot	Minimum Conduit Size
25 Pair	0.54	0.13	1.5
50 Pair	0.68	0.22	1.5
100 Pair	0.8	0.39	2
150 Pair	0.89	0.48	2
200 Pair	1.17	0.73	2
300 Pair	1.39	1.06	2
400 Pair	1.61	1.41	2.5
600 Pair	1.92	2.06	3
900 Pair	2.29	3.03	3
1200 Pair	2.61	4	4
1500 Pair	2.89	4.95	4
1800 Pair	3.15	5.92	4

Station Wire

No. of Wires	Conduit Size
4	0.75
7	1
12	1.5
20	2
27	2.5
35	3

E


TYPICAL MDF LAYOUT
3/4" PLYWOOD
D RING RUN
UNDERGROUND PROTECTION
OUTSIDE PLANT
OUTSIDE PLANT
1st
2nd
3rd
4th
5th
STATIONS
STATIONS
RISER
24"
96"
2"
4"
GROUND BAR
48"
FLOOR
F
72" MAX
30" MIN
66M1-50
2 1/4" WIDTH
10" HEIGHT
1 1/4" DEPTH
TYPICAL X-CUT RING
4"
3"
1"


TYPICAL IDF LAYOUT
3/4" PLYWOOD
D RING RUN
2"
24"
96"
RISER
RISER
FUTURE
STATIONS
STATIONS
STATIONS
STATIONS
STATIONS
STATIONS
STATIONS
12"
2"
GROUND BAR
30"MIN
72" MAX
48"
FLOOR
G
4"
3"
1"
3"
1"
4"
4"
TYPICAL X-CUT RING
66MI-50
2 1/4" WIDTH
10" HEIGHT
1 1/4" DEPTH

PAIR COLOR CODE

Pair	TIP COLOR	RING COLOR
1	White-Blue	Blue-White
2	White-Orange	Orange-White
3	White-Green	Green-White
4	White-Brown	Brown-White
5	White-Slate	Slate-White
6	Red-Blue	Blue-Red
7	Red-Orange	Orange-Red
8	Red-Green	Green-Red
9	Red-Brown	Brown-Red
10	Red-Slate	Slate-Red
11	Black-Blue	Blue-Black
12	Black-Orange	Orange-Black
13	Black-Green	Green-Black
14	Black-Brown	Brown-Black
15	Black-Slate	Slate-Black
16	Yellow-Blue	Blue-Yellow
17	Yellow-Orange	Orange-Yellow
18	Yellow-Green	Green-Yellow
19	Yellow-Brown	Brown-Yellow
20	Yellow-Slate	Slate-Yellow
21	Violet-Blue	Blue-Violet
22	Violet-Orange	Orange-Violet
23	Violet-Green	Green-Violet
24	Violet-Brown	Brown-Violet
24	Violet-Slate	Slate-Violet

H

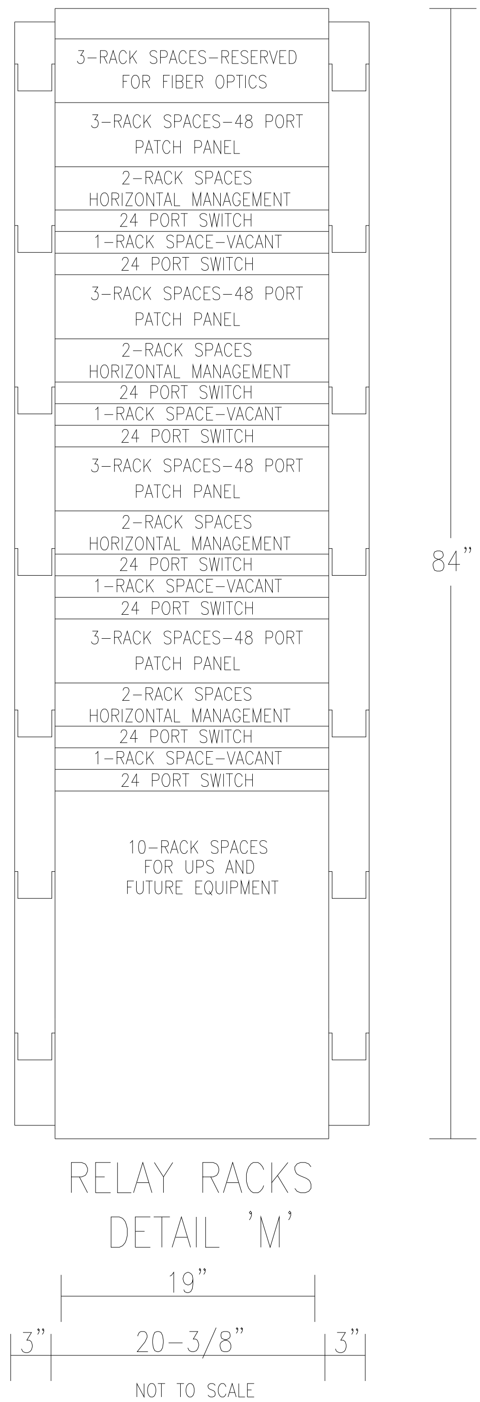
BINDER GROUP COLOR CODE

Group No.	Binder Group
1	Blue-White
2	Orange-White
3	Green-White
4	Brown-White
5	Slate-White
6	Blue-Red
7	Orange-Red
8	Green-Red
9	Brown-Red
10	Slate-Red
11	Blue-Black
12	Orange-Black
13	Green-Black
14	Brown-Black
15	Slate-Black
16	Blue-Yellow
17	Orange-Yellow
18	Green Yellow
19	Brown-Yellow
20	Slate-Yellow
21	Blue-Violet
22	Orange-Violet
23	Green-Violet
24	Brown-Violet
25	Slate-Violet

JACK COLOR CODE

JACK WIRE CODE	INSIDE WIRE COLOR
RED	BLUE-WHITE
GREEN	WHITE-BLUE
BLACK	ORANGE-WHITE
YELLOW	WHITE-ORANGE
BLUE	GREEN-WHITE
WHITE	WHITE-GREEN

J


3-RACK SPACES-RESERVED
FOR FIBER OPTICS
3-RACK SPACES-48 PORT
PATCH PANEL
2-RACK SPACES
HORIZONTAL MANAGEMENT
24 PORT SWITCH
1-RACK SPACE-VACANT
24 PORT SWITCH
3-RACK SPACES-48 PORT
PATCH PANEL
2-RACK SPACES
HORIZONTAL MANAGEMENT
24 PORT SWITCH
1-RACK SPACE-VACANT
24 PORT SWITCH
3-RACK SPACES-48 PORT
PATCH PANEL
2-RACK SPACES
HORIZONTAL MANAGEMENT
24 PORT SWITCH
1-RACK SPACE-VACANT
24 PORT SWITCH
3-RACK SPACES-48 PORT
PATCH PANEL
2-RACK SPACES
HORIZONTAL MANAGEMENT
24 PORT SWITCH
1-RACK SPACE-VACANT
24 PORT SWITCH
10-RACK SPACES
FOR UPS AND
FUTURE EQUIPMENT
84"
RELAY RACKS
DETAIL 'M'
19"
3"
20-3/8"
3"
NOT TO SCALE

L