

FIBER OPTIC GENERAL REQUIREMENTS

THE FOLLOWING PROVIDES THE MINIMUM STANDARDS AND QUALIFICATIONS NECESSARY TO PROVIDE A FIBER OPTIC COMMUNICATION LINK BETWEEN INTERSECTIONS IN AN INTERCONNECTED TRAFFIC SIGNAL SYSTEM.

MATERIALS AND EQUIPMENT SHALL BE THE STANDARD PRODUCTS OF A MANUFACTURER REGULARLY ENGAGED IN THE MANUFACTURING OF PRODUCTS USED FOR OUTDOOR FIBER OPTIC SYSTEM INSTALLATIONS. ALL MATERIALS AND EQUIPMENT FURNISHED SHALL BE NEW, OF FIRST QUALITY, OF LATEST DESIGN AND BE COMPLETELY FREE FROM DEFECTS IN MATERIAL AND POOR WORKMANSHIP. ALL LIKE PIECES OF EQUIPMENT SHALL BE OF THE SAME TYPE AND MANUFACTURER TO ASSURE UNIFORMITY, INTERCHANGEABILITY OF COMPONENTS, SINGLE RESPONSIBILITY, AND MOST SATISFACTORY SERVICE.

EACH MAJOR COMPONENT OF EQUIPMENT SHALL HAVE THE MANUFACTURER'S NAME, ADDRESS, TYPE OR STYLE, MODEL OR SERIAL NUMBER AND CATALOG NUMBER ON A PLATE SECURED TO THE EQUIPMENT.

THE FIBER OPTIC INSTALLATION SHALL BE IN ACCORDANCE WITH OR EXCEED ALL MINIMAL REQUIREMENTS OF STATE CODES, NATIONAL CODES AND MANUFACTURER CODES AS APPLICABLE. CONSTRUCTION TECHNIQUES SHALL CONFORM TO THE FOLLOWING IN ORDER OF PRECEDENCE. (1) THESE STANDARDS AND SPECIFICATIONS; (2) CABLE MANUFACTURER; (3) ACCEPTED INDUSTRY PRACTICES.

THE CONTRACTOR SHALL FURNISH AND INSTALL ALL NECESSARY MISCELLANEOUS EQUIPMENT TO MAKE A COMPLETE AND OPERATING SYSTEM. THE COST FOR ALL MATERIALS AND LABOR NOT SPECIFICALLY ITEMIZED SHALL BE CONSIDERED INCIDENTAL TO THE VARIOUS ITEMS OF WORK.

FIBER OPTIC APPLICABLE STANDARDS

MATERIALS AND EQUIPMENT SUPPLIED AS PART OF THE FIBER OPTIC SYSTEM SHALL COMPLY WITH THE LATEST ISSUE OF THE FOLLOWING DOCUMENTS:

RUS RURAL UTILITY SERVICE MATERIAL ACCEPTANCE LIST

REA SPECIFICATIONS FOR FILLED FIBER OPTIC CABLES

EIA-STD-RS-455 STANDARD TEST PROCEDURES FOR FIBER OPTIC FIBERS, CABLES, TRANSDUCERS, CONNECTING AND TERMINATING DEVICES

MIL-STD-202 TEST METHODS FOR ELECTRONIC AND ELECTRICAL COMPONENT PARTS

MIL-STD-454 STANDARD GENERAL REQUIREMENTS FOR ELECTRONIC EQUIPMENT

MIL-STD-810 ENVIRONMENTAL TEST METHODS AND ENGINEERING GUIDELINES

EIA/TIA-598 TUBE AND FIBER COLOR CODE

EIA-568-A FIBER OPTIC CABLE TESTING PROCEDURES

NFPA-70-1993 NATIONAL ELECTRICAL CODE ARTICLE 770, OPTICAL FIBER CABLE

REQUIREMENTS FOR SUPERVISING FIBER OPTIC TECHNICIAN

IN ADDITION TO THE PRE-QUALIFICATION REQUIREMENTS SET FORTH IN THE STATE OF OHIO CONSTRUCTION MATERIAL SPECIFICATIONS (CMS), SECTION 102.01, THE FOLLOWING QUALIFICATION REQUIREMENTS SHALL APPLY TO THE FIBER OPTIC CONTRACT WORK. ALL BIDDERS SHALL SUBMIT DOCUMENTATION WITH THEIR BIDS SHOWING THEIR ABILITY TO COMPLY WITH THE FOLLOWING SUPERVISING FIBER OPTIC TECHNICIAN PERSONNEL REQUIREMENTS. FAILURE TO SUBMIT THIS DOCUMENTATION WITH BIDS WILL RESULT IN THE BIDDER BEING CONSIDERED NON-RESPONSIVE AND MAY BE GROUNDS FOR THE BIDDER BEING DISQUALIFIED AT THE DISCRETION OF THE TRAFFIC ENGINEERING DEPARTMENT. TECHNICIANS OTHER THAN THE SUPERVISING FIBER OPTIC TECHNICIAN SHALL SHOW PROOF OF MEETING THEIR PERSONNEL REQUIREMENTS PRIOR TO THE BEGINNING OF ANY FIBER OPTIC RELATED INTERCONNECTION WORK. FAILURE TO PROVIDE THIS PROOF TO THE ENGINEER WILL RESULT IN A HALT BEING PLACED UPON INTERCONNECTION WORK UNTIL SUCH A TIME THAT PROOF OF MEETING TECHNICIAN PERSONNEL REQUIREMENTS IS MET.

ANY PROJECT REQUIRING THE OPENING OF THE FIBER OPTIC CABLE JACKET, INSTALLATION OF FIBER OPTIC CONNECTORS, SPLICING FIBERS, OR THE TESTING OF ANY FIBER OPTIC CABLE, DROP CABLE, OR PATCH CORDS SHALL HAVE AT LEAST ONE SUPERVISING FIBER OPTIC TECHNICIAN (SFOT) ASSIGNED TO IT. SUPERVISING FIBER OPTIC TECHNICIANS SHALL MEET THE FOLLOWING MINIMUM REQUIREMENTS.

(1) SUPERVISING FIBER OPTIC TECHNICIANS (SFOT) SHALL HAVE ATTENDED AND SUCCESSFULLY COMPLETED AT LEAST ONE COMPREHENSIVE "INSTALLATION OF FIBER OPTIC PRODUCTS SCHOOL". THIS SCHOOL WILL BE CONDUCTED BY A MAJOR MANUFACTURER OF FIBER OPTIC PRODUCTS OR AN APPROVED INDEPENDENT SCHOOL THAT ENCOMPASSES ALL ASPECTS OF FIBER OPTIC TECHNICIAN CERTIFICATION.

(2) SFOT'S SHALL BE ABLE TO DOCUMENT A MINIMUM OF ONE YEAR OF WORK EXPERIENCE WHERE THE SPLICING, TERMINATION, AND TESTING OF FIBER OPTIC CABLE WITH AN OPTICAL TIME DOMAIN REFLECTOMETER (OTDR) AND POWER METER WAS A PRIMARY JOB RESPONSIBILITY.

(3) THE SFOT SHALL BE ON THE JOB SITE SUPERVISING OTHER TECHNICIANS AT LEAST THE FIRST THREE DAYS OF EACH OF THE FOLLOWING ACTIVITIES: CABLE PULLING; REMOVAL OF CABLE JACKETS; CABLE SPLICING; INSTALLATION OF FAN-OUT KITS AND CONNECTORS. THE SFOT SHALL SUPERVISE A MINIMUM OF THE FIRST THREE DAYS ACTIVITIES OF EACH OF THE ABOVE LISTED ACTIVITIES TO MAKE SURE THE OTHER TECHNICIANS ARE PERFORMING THEIR WORK ASSIGNMENTS CORRECTLY.

THE SFOT SHALL ALSO BE PRESENT TO REVIEW THE ENTIRE INSTALLATION BEFORE COMPLETION.

(4) TECHNICIANS, OTHER THAN THE SFOT, PERFORMING FIBER OPTIC WORK SUCH AS CABLE CLEANING, SPLICING, CONNECTORIZING AND TERMINATIONS SHALL HAVE SUCCESSFULLY COMPLETED A MINIMUM OF ONE 16 HOUR FIBER OPTIC CABLE INSTALLATION COURSE FROM A MAJOR CABLE MANUFACTURER OR APPROVED INDEPENDENT SCHOOL.

(5) ALL FIBER OPTIC TECHNICIANS SHALL CARRY EVIDENCE OF THEIR QUALIFICATIONS ON THEIR PERSON AT ALL TIMES WHEN WORKING ON THE PROJECT.

GENERAL SYSTEM CONSTRUCTION

ENTRY INTO CONTROLLER CABINETS FROM THE TRUNK CABLE SHALL BE MADE VIA THE SPECIFIED DROP CABLE. THE DROP CABLE WILL BE SPLICED TO THE TRUNK CABLE IN A SPECIFIED SPLICE ENCLOSURE. THE DROP CABLE INSIDE OF THE CABINET SHALL BE FITTED WITH A FAN-OUT KIT AND THE FAN-OUT KIT SHALL BE CONNECTORIZED AND TERMINATED IN THE SPECIFIED TERMINATION PANEL. A FOUR (4) FIBER PATCH CORD SHALL CONNECT THE DROP CABLE FIBERS IN THE TERMINATION PANEL TO THE FIBER OPTIC TRANSCEIVER.

FIBER OPTIC CABLE INSTALLATION

1. BOTH AERIAL AND CONDUIT INSTALLATIONS SHALL COMPLY WITH NO LOAD AND APPLIED LOAD BEND RADII SPECIFIED BELOW.

MINIMUM BEND RADIUS

10 X CABLE DIAMETER UNDER NO LOAD (0-180LBS) (0-82KGS)

20 X CABLE DIAMETER UNDER APPLIED LOAD (181 LBS - 400 LBS)(83KGS-182KGS) MINIMUM BEND DIAMETER IS 2 X MINIMUM BEND RADIUS

2. NO FIBER OPTIC CABLE SHALL BE INSTALLED PRIOR TO THE ENGINEER ACKNOWLEDGING THE CABLE DELIVERED TO THE PROJECT IS ACCEPTABLE BASED UPON THE CONTRACTOR COMPLETING THE PRE-INSTALLATION TESTING GIVEN IN THESE SPECIFICATIONS.

3. FIBER OPTIC CABLE INSTALLED IN CONDUIT SHALL BE IN ACCORDANCE WITH THE FOLLOWING:

- A. NO MORE THAN TWO 90 DEGREE CHANGES IN DIRECTION PER CABLE PULL.
B. CIRCUITOUS PULLS AND PULLS EXCEEDING 1000 FEET (300 METER) SHALL BE MADE BY BACK FEEDING OR CENTER FEEDING OF CABLE.
C. AFTER INSTALLATION THERE SHALL BE NO TENSION EXCEPT DUE TO CABLE WEIGHT.
D. TENSION OF CABLE SHALL BE MONITORED WITH A TENSIMETER DURING INSTALLATION.
E. THE APPLIED TENSION SHALL NOT EXCEED 400 POUNDS (182KGS).
F. THE CENTRAL STRENGTH MEMBER AND THE ARAMID YARN SHALL BE DIRECTLY ATTACHED TO THE PULLING EYE. "BASKET GRIP" OR "CHINESE FINGER" TYPE ATTACHMENTS TO THE OUTER JACKET OF THE CABLE WILL NOT BE PERMITTED. A BREAKAWAY SWIVEL SHALL BE USED ON ALL PULLS.

4. FIBER OPTIC CABLE INSTALLED AERIALY SHALL BE PROVIDED WITH A SAG OF 3% - 5% UNLESS EXISTING CABLES WILL BE SHARING THE POLE IN WHICH CASE A SAG MATCHING THE EXISTING CABLES SHALL BE PROVIDED.

5. SPLICING REELS OF CABLE - THE METHOD OF JOINING TWO REELS OF FIBER OPTIC CABLE SHALL BE FUSION SPLICING ALL OF THE TRUNK CABLE FIBERS OF ONE REEL TO THE CORRESPONDING FIBERS IN THE SECOND REEL. ALL SPLICES FOR JOINING TWO FIBER REELS OF TRUNK CABLE TOGETHER SHALL BE MADE IN THE SPLICE ENCLOSURE AT THE LAST INTERSECTION THE INTERCONNECT CABLE PASSED THROUGH. IN OTHER WORDS, WHEN A REEL RUNS OUT OF CABLE, ANY EXCESS BEYOND THE LAST TRAFFIC SIGNAL INTERSECTION SPLICE POINT SHALL BE CUT OFF AND DISPOSED OF BY THE CONTRACTOR. THE SPLICE JOINING THE TWO CABLE REELS TOGETHER SHALL BE MADE IN THE INTERSECTION SPLICE ENCLOSURE THAT CONTAINS THE DROP CABLE TO TRUNK CABLE SPLICE. COST FOR THE QUANTITY OF CUT OFF FIBER OPTIC CABLE AND FOR THE ADDITIONAL 16 SPLICES BEYOND THE FOUR SPLICES REQUIRED TO INSTALL THE DROP CABLE SHALL BE INCIDENTAL TO THE COST OF THE FIBER OPTIC CABLE. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO CALCULATE HIS COST TO JOIN FIBER OPTIC REELS ON THE PROJECT BASED UPON THE REEL LENGTHS THAT HE ORDERS. WHERE INTERCONNECT SYSTEM LENGTH PERMITS, THE CONTRACTOR CAN AVOID THE COST OF JOINING CABLE REELS TOGETHER BY ORDERING A SINGLE REEL OF SUFFICIENT LENGTH TO EXTEND FROM ONE END OF PROJECT TO THE OTHER.

THE ONLY PLACE WHERE FIBERS THAT ARE NOT USED FOR INTERCONNECTION CAN BE CUT IS WHERE IT IS NECESSARY TO SPLICED TWO REELS OF CABLE TOGETHER. THIS PRACTICE OF CUTTING UNUSED FIBERS SHALL BE KEPT TO A MINIMUM AND SHALL NOT OCCUR MORE THAN ONCE PER EVERY MILE (1600 METERS).

CABLE CLEANING

LOOSE TUBE CABLE WILL REQUIRE THE CONTRACTOR TO USE A DE-GEL SOLVENT TO REMOVE WATER BLOCKING GEL FROM EXPOSED FIBERS AND/OR BUFFER TUBES PRIOR TO PLACEMENT OF FAN-OUT KITS, SPLICING OR TERMINATION OF EACH FIBER. THE SOLVENT CHOSEN FOR THIS TASK SHALL DISSOLVE THE GEL AND ALLOW FOR A COMPLETE REMOVAL OF ALL SOLVENT RESIDUE. THE SOLVENT SHALL NOT REMOVE ANY OF THE COLOR FROM INDIVIDUAL FIBER OR BUFFER TUBES AND SHALL NOT PROVE HARMFUL TO THE OUTER PE JACKET OF THE CABLE ITSELF. 3M'S PART NUMBER 4414 "FILLED CABLE CLEANING KIT" OR APPROVED EQUAL SHALL BE UTILIZED AT EVERY OPENING OF THE CABLE. COST FOR DE-GEL SOLVENT AND CLEANING OF FIBERS SHALL BE INCIDENTAL TO THE COST OF THE CABLE.

ITEM 632 INTERCONNECT MISC.: TRUNK CABLE BY COUNT

(BY TYPE REFERS TO : SINGLE MODE, MULTI-MODE OR HYBRID; ARMORED IF REQUIRED; INTEGRAL MESSENGER WIRE IF REQUIRED)

1. THE FIBER OPTIC CABLE SUPPLIED SHALL BE AN 24 FIBER SINGLE MODE (SM), AS SPECIFIED. SINGLE-MODE CABLE SHALL HAVE A 8.3 µm NOMINAL CORE DIAMETER.

2. ALL FIBER OPTIC CABLE SUPPLIED SHALL BE AN ACCEPTED CABLE WITH THE RURAL UTILITY SERVICE (RUS). A LIST OF ACCEPTABLE CABLE CAN BE FOUND ON THE RUS WEB SITE: (HTTP://WWW.USDA.GOV/RUS/TELECOM/MATERIALS/SEC-1_LOMA.HTM)

3. ALL FIBER OPTIC CABLE GLASS SHALL BE SUPPLIED BY THE SAME MANUFACTURER AND SHALL BE PART OF A FIBER OPTIC CABLE UTILIZING LOOSE TUBE CONSTRUCTION WITH THE FOLLOWING PROPERTIES: SINGLE MODE CLADDING DIA. 125+/-1.0 µm COATING DIA. 245+/-10 µm NUMERICAL APERTURE 0.275+/-0.015 N/A MAX. ATTENUATION 0.4/0.3 DB/KM@1300/1550NM PROOF TENSILE TEST 0.7 GPA

4. WHERE ARMORED CABLE IS SPECIFIED IT SHALL BE ON THE RUS ACCEPTABLE MATERIAL LIST.

5. WHERE SELF SUPPORTING CABLE IS SPECIFIED THE MESSENGER CABLE SHALL BE 0.25 INCH (6 MM) AND SHALL BE ON THE RUS ACCEPTABLE MATERIAL LIST.

6. DOCUMENTATION SHALL BE PROVIDED SHOWING RUS ACCEPTANCE.

7. CABLES SHALL BE PACKAGED WOUND ON NON-RETURNABLE WOOD SPOOLS OR REELS. THE DIAMETER OF THE DRUM SHALL BE A MINIMUM OF 20 TIMES THE DIAMETER OF THE CABLE. EACH REEL SHALL CONTAIN ONLY ONE CONTINUOUS LENGTH OF CABLE. LABELS SHALL BE ATTACHED TO THE REEL SHOWING LENGTH, CABLE IDENTIFICATION NAME AND NUMBER, AND DATE OF MANUFACTURE. THE OUTER ENDS OF THE CABLE SHALL BE SECURELY FASTENED TO THE REEL HEAD SO AS TO PREVENT THE CABLE FROM BECOMING LOOSE DURING TRANSIT. BOTH ENDS OF THE CABLE SHALL EXTEND A MINIMUM OF 10 FEET (3M) INTO THE INSIDE OF THE CABLE REEL TO PROVIDE ACCESS FOR TESTING. TEST TAILS SHALL BE SECURED TO THE INSIDE OF THE REEL IN SUCH A MANNER THAT THEY WILL NOT BECOME LOOSE DURING TRANSPORTATION. END SEALS SHALL BE APPLIED TO EACH END OF THE CABLE TO PREVENT THE INTRUSION OF MOISTURE INTO THE CABLE. DOCUMENTATION SHALL ACCOMPANY EACH REEL DOCUMENTING THE ATTENUATION OF EACH CABLE FIBER IN DB/KM.

8. ALL FIBER OPTIC CABLE TO BE USED AS PART OF THE TRAFFIC SIGNAL SYSTEM SHALL BE RATED FOR OUTDOOR USE UNLESS SPECIFICALLY NOTED IN THE PLANS.

9. FIBER OPTIC CABLE RIP CORDS SHALL BE PROVIDED AND MADE FROM EITHER STANDARD TELCO NYLON MATERIAL OR FROM BRAIDED KEVLAR. NO UN-BRAIDED KEVLAR WILL BE ACCEPTED.

10. CABLE JACKETING SHALL BE PERMANENTLY LABELED APPROXIMATELY EVERY TWO FEET WITH THE CABLE MANUFACTURER'S NAME, CABLE TYPE, FIBER COUNT, MANUFACTURING DATE, AND INCREMENTAL CABLE LENGTH. CABLE LENGTH SHALL REFER TO THE CABLE SHEATH LENGTH.

ALL COSTS TO INSTALL FIBER OPTIC CABLE, EITHER AERIALY OR UNDERGROUND, SHALL INCLUDE THE COSTS FOR EQUIPMENT, LABOR, AND MISCELLANEOUS MATERIALS AT THE BID PRICE OF ITEM 632 INTERCONNECT MISC.: 24 FIBER, LOOSE TUBE, BY TYPE UNLESS ITEMIZED SEPARATELY.

Vertical sidebar containing: DATE 08-2007, CHECKED NKS, REVISIONS, AMEND SPECIFICATIONS, FIBER OPTIC SPECIFICATION NOTES, CITY OF AKRON TYPICALS, CITY OF AKRON DEPARTMENT OF PUBLIC SAFETY/SERVICE TRAFFIC ENGINEERING DIVISION, and a circular stamp with the number 3/11.

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