## SECTION 9 – CROSS-CONNECT SYSTEMS

<table>
<thead>
<tr>
<th>CONTENTS</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. GENERAL</td>
<td></td>
</tr>
<tr>
<td>1.1 Introduction</td>
<td>9-2</td>
</tr>
<tr>
<td>2. DISTRIBUTING FRAMES (DF)</td>
<td>9-2</td>
</tr>
<tr>
<td>2.1 Zoning and Spread Complete</td>
<td>9-2</td>
</tr>
<tr>
<td>2.2 Distributing Frame Functions</td>
<td>9-2</td>
</tr>
<tr>
<td>3. DISTRIBUTING FRAME TYPES</td>
<td>9-3</td>
</tr>
<tr>
<td>3.1 Conventional Distributing Frames</td>
<td>9-3</td>
</tr>
<tr>
<td>4. FRAME BLOCKS</td>
<td>9-3</td>
</tr>
<tr>
<td>4.1 General</td>
<td>9-3</td>
</tr>
<tr>
<td>4.2 Connector/Connecting Blocks</td>
<td>9-3</td>
</tr>
<tr>
<td>4.3 Protected Connectors</td>
<td>9-4</td>
</tr>
<tr>
<td>5. MANUAL DIGITAL SIGNAL CROSS-CONNECT (DSX)</td>
<td>9-4</td>
</tr>
<tr>
<td>5.1 DSX-1 CONSIDERATIONS</td>
<td>9-4</td>
</tr>
<tr>
<td>5.2 Interbay Patch Panels</td>
<td>9-4</td>
</tr>
<tr>
<td>5.3 Cross-Aisle Tie Pair Panels &amp; Bridges</td>
<td>9-4</td>
</tr>
<tr>
<td>5.4 DSX-1 Cross-Connect Rules</td>
<td>9-4</td>
</tr>
<tr>
<td>5.5 DSX-3 Considerations</td>
<td>9-5</td>
</tr>
<tr>
<td>6. FIBER DISTRIBUTING FRAMES (FDF)</td>
<td></td>
</tr>
<tr>
<td>6.1 General</td>
<td></td>
</tr>
<tr>
<td>6.2 Satellite Fiber Distributing Frame</td>
<td></td>
</tr>
<tr>
<td>6.3 The FDF</td>
<td></td>
</tr>
<tr>
<td>6.4 Fiber Splitters</td>
<td></td>
</tr>
<tr>
<td>6.5 Optical Terminations and Connectors</td>
<td></td>
</tr>
<tr>
<td>6.6 Attenuators</td>
<td></td>
</tr>
<tr>
<td>7. ETHERNET DISTRIBUTING FRAMES (EDF)</td>
<td></td>
</tr>
<tr>
<td>7.1 General</td>
<td></td>
</tr>
<tr>
<td>7.2 Electrical Ethernet Distributing Frames</td>
<td></td>
</tr>
<tr>
<td>7.3 Electrical EDF Components for the C.O.</td>
<td></td>
</tr>
</tbody>
</table>
TABLE 9-1 – SUMMARY OF CHANGES IN SECTION 9

<table>
<thead>
<tr>
<th>Revision Date</th>
<th>Item</th>
<th>Action</th>
<th>Requirements Change Notification</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/11/2016</td>
<td>Entire Document</td>
<td>Modification</td>
<td>N/A; March 2016 TP76400 Rewrite</td>
</tr>
<tr>
<td>9/4/2018</td>
<td>6.1.8</td>
<td>Modification</td>
<td>ATT-TP-76400-220</td>
</tr>
</tbody>
</table>

1. GENERAL

1.1 Introduction

1.1.1 Changes in this issue of Section 9 are summarized in Table 9-1.

2. DISTRIBUTING FRAMES (DF)

2.1 Zoning and Spread Complete

2.1.1 All MDF’s shall be zoned. Zoning refers to the practice of logically dividing the frame, where practical, into multiple vertical sections, or zones. The vertical and horizontal sides of an MDF are zoned independently of each other. Zoning is utilized to exploit the short jumper concept, in which an assignment algorithm is used to ensure the shortest possible jumper lengths.

2.1.2 Spreading is defined as the placement of related equipment in several locations on the frame, e.g. rather than placing all OE in a concentrated location on the DF, it is spread across the frame. This is done in conjunction with the corresponding spread of OSP terminations on the vertical side of the frame. This keeps the jumper wires that are run on the frame shorter, the frame less congested, and prevents premature exhaustion of the frame hardwire.

2.2 Distributing Frame Functions

2.2.1 Main and Intermediate Distributing Frames. The primary copper facility frame is known as the Main Distributing Frame (MDF). The MDF is the frame that has the standard terminations of the local indigenous switch OE/LEN facilities, cable pairs to the customers and tie pairs to other frames and equipment.

2.2.2 In multiple conventional frame central offices, it is recommended that transport and CLEC terminations be placed on the IDF unless the MDF has sufficient space to support these terminations and still allow for ILEC growth. COSMIC MDF’s are typically associated with switch terminations. Therefore, Transport and CLEC terminations shall not be placed on a COSMIC MDF.

2.2.3 Transport, CLEC and other miscellaneous terminations, located on the Intermediate Distributing Frame (IDF) shall be connected via Inter-Frame Tie cables to the MDF.

2.2.4 Existing MDF’s may be either conventional or modular. If the MDF is modular, a conventional IDF is required and shall be placed to support it.
2.2.5 The primary functions of distributing frames are:
   a) Termination of Facilities/Equipment.
   b) Equipment cross-connect point.
   c) Electrical Protection.
   d) Test and Cable Access

3. DISTRIBUTING FRAME TYPES

3.1 Conventional Distributing Frames

3.1.1 Verticals shall be spaced on 8-inch centers unless otherwise specified by the AT&T Equipment Engineer. Some special application frames have 6 1/2-inch vertical spacing.

3.1.2 Horizontals shall be spaced on 8-inch centers. Older frames may have 10-inch spacing. Current standards call for 8 inch centers for both verticals and horizontals.

3.1.3 Verticals shall be numbered consecutively (usually from the non-growth end to the growth end) starting with number 1. The first vertical is ordinarily not furnished with jumper rings and is not used for terminating facility cable pairs.

3.1.4 The first vertical of a frame is usually reserved for plug-up and test line protectors.

3.1.5 Horizontal levels shall be identified by letter designations starting with the letter A at the bottom, omitting letters I and O. Individual blocks/terminal strips on the horizontal level shall be identified by the associated vertical number. Designation instructions shall be provided to the installer via the engineering spec.

3.1.6 Designations shall be provided at various points to identify the vertical number on both sides of the conventional frame. See Section L of ATT-TP-76300 for details. Designation instructions shall be provided to the installer via the engineering spec.

4. FRAME BLOCKS

4.1 General

4.1.1 Frame assignments shall be provided by the authorized AT&T Engineer, commonly the Frame Planner/COLD (Central Office Layout Design) Planner.

4.1.2 All blocks on the frames shall have wire wrap terminations, unless the embedded base of existing blocks on the frame is made up of Quick-Clip/punch down, type blocks. In that case the quick clip blocks will be allowed.

4.1.3 Bifurcated pins are required for connecting blocks used for line equipment and CLEC CFA terminations. This facilitates half taps for cutovers, cable throws and “from/to” service orders.

4.1.4 Only AT&T approved frame blocks shall be used per drawing ATT-E-00087-E.

4.2 Connector/Connecting Blocks

4.2.1 The standard connecting block for conventional frames is the non-connectorized 89-type block or equivalent.
4.2.2 Only AT&T approved frame blocks shall be used per drawing ATT-E-00087-E.

4.3 Protected Connectors

4.3.1 All outside plant pairs entering AT&T Equipment Space shall have protection at the protector blocks since there is the potential for High Voltage applications to be present. These protectors safeguard personnel, equipment, and the network from hazards such as electrical shock, equipment damage, and fire caused by lightning and AC power faults.

4.3.2 Coil Test devices shall be provided for pre-testing of protectors before use.

5. MANUAL DIGITAL SIGNAL CROSS-CONNECT (DSX)

5.1 DSX-1 CONSIDERATIONS

5.1.1 Planning of the DSX1 lineup will dictate careful consideration of the AT&T Equipment Space layout. It is important to place the DSX1 lineups (if multiple) in a parallel arrangement with appropriate troughs for adequate jumper placements.

5.1.2 The length of a continuous DSX 1 lineup shall follow the AT&T requirements as defined in ATT-TELCO-IS-812-000-003, Section 6.

5.2 Interbay Patch Panels

5.2.1 DSX1 and DSX3 lineups shall reserve (1) panel position space at top of bay for an inter-bay patch panel appearance every fifth bay.

5.3 Cross-Aisle Tie Pair Panels & Bridges

5.3.1 New Cross-Aisle Bridges shall be a preferred alternative to Cross-Aisle Tie Pair Panels.

5.4 DSX-1 Cross-Connect Rules

5.4.1 In order to maintain flexibility, planning of the office size is of primary importance and determines the ultimate size and layout of the DSX1 and should be made according to AT&T requirements.

5.4.2 To alleviate cable congestion between adjacent DSX 1 equipment frames proper spacing requirements shall adhere to appropriate AT&T equipment drawing.

5.4.3 A complete set of rings and troughs shall be required with newly installed DSX 1 bays.

5.4.4 DSX-1 panels shall be located in 7 foot bays for new deployments. Existing lineups with embedded DSX-1 panels placed above the 7 foot level may be completed to the end of the lineup, but all new lineups shall have new deployment of DSX-1 panels located only in 7 foot bays.

5.4.5 Any tie cable panels should be mounted at the top of the DSX-1 bay at the 6-7 foot level.

5.4.6 For new DSX-1 lineups in central offices, bantam type jack panels shall be provided.

5.4.7 All DSX patch panels shall be physically and electrically compatible in the same DSX1 lineup.

5.4.8 Transmit and receive signals shall be in separate cables from the transport equipment to the DSX1 except as manufacturer requirements dictate.
5.5 DSX-3 Considerations

5.5.1 All hardwired cables between the connecting equipment and the DSX-3 shall be 75 ohm coaxial cable with a single tinned copper shielded braid. When hardwired cable length runs are in excess of the transmission range of 735C coaxial cable, use 734C coaxial cable. Use of 734C coaxial cable is required in IXC offices unless written approval for use of 735C coaxial cable is obtained from AT&T Standards.

5.5.2 The maximum hardwired cable length between the DSX-3 and connecting equipment is 427.5 feet for 734C coaxial cable. If 735C cable is used, the maximum cable length between the DSX-3 and connecting equipment is 227.5 feet.

The standard cross-connect cord (735 type) used between two (2) DSX-3 panels will be limited to 45 feet in length, while the longer-range cross-connect cord (734 type) used between two (2) DSX-3 panels will be limited to 88 feet.

The following are length limitations for 735C coaxial cable (from Active Element to Active Element with and without DSX-3 panels.)

1. From Network Element to DACS using direct cabling between the Network Element and DACS – 500 feet (if intermediate DSX-3 panels are placed within this circuit, the length limitation is reduced from 500 feet to 455 feet)
2. From DACS to DACS using direct cabling between the two(2) DACS – 500 feet (if intermediate DSX-3 panels are placed within this circuit, the length limitation is reduced from 500 feet to 455 feet)

5.5.3 To alleviate cable congestion between adjacent DSX 1 equipment frames proper spacing requirements shall adhere to appropriate AT&T equipment drawing.

5.5.4 Vertical rings shall be provided for each bay between the troughs.

5.5.5 Cross-aisle jumper troughs shall be mounted in the rear for rear cross-connect bays and at the front for front cross-connect bays.

5.5.6 The hardwired cables from the connecting equipment to the DSX-3, or from the connecting equipment directly cabled to the DCS, shall be provided in one of the following two ways:

a) One end factory crimped and the OTHER end field crimped, within an AT&T central office, by an AT&T approved Installation Supplier. This is the preferred method.

b) Bulk coaxial cable requiring field crimping, within an AT&T central office, by an AT&T approved installation supplier on BOTH ends.

5.5.7 In large offices, DCS equipment shall be terminated on different DSX-3 bays to provide an even spread of equipment. If multiple line-ups are present at that location an even distribution of terminations shall be provided.

5.5.8 All Network Equipment DS3s originating from an equipment unit should appear on the same DSX-3 bay.

5.5.9 The length of a continuous DSX 3 lineup shall follow the AT&T requirements as defined in ATT-TELCO-IS-812-000-003, Section 6.
5.5.10 DSX3 lineup interconnects should not exceed three parallel adjacent lineups.

6. **FIBER DISTRIBUTING FRAMES (FDF)**

6.1 General

6.1.1 A FDF architecture shall serve as the primary interface between outside plant (OSP) fiber optic facilities entering and leaving a building and the fiber optic equipment installed within a building. The FDF shall provide a centralized point for the organization and administration of the fiber optic facility and intra-building equipment cables, providing a flexible platform for future fiber growth, and providing re-arrangeable connections between any two terminations or appearance.

6.1.2 In smaller legacy POPS (a pre-existing facility typically less than 2000 square feet) fiber may be run directly from the splitter shelf to the NE.

6.1.3 Interbay LAN connections (typically multimode) may be run NE to NE without the use of a FDF.

6.1.4 Connectivity from one Network Element to another within the same Network Equipment footprint shall only be permitted as a permanent arrangement for connectivity of equipment issues.

6.1.5 Passive devices such as Optical Splitters and WDM technologies shall fit within modules developed for use within specified approved modular chassis.

6.1.6 There is no physical diversity requirements for any SPEED or OC rate unless that requirement is requested by the customer, engineer or the equipment OEM. More stringent Levels of diversity may be required due to specific customer requests, marketing product requirements or specific network requirements. Refer to appropriate AT&T document for specific diversity requirement.

6.1.7 Fiber cabling within a Network Element system using one or multiple bays within the same footprint may be cabled directly without termination on a FDF.

6.1.8 Fiber provisioning between the FDF and Network Equipment within AT&T Technical Space shall be accomplished via one of the following methods:

a) In Greenfield applications, fiber jumpers shall utilize Wire Basket Tray

b) In Brownfield applications, fiber jumpers shall continue to utilize Fiber Protection System (FPS from Commscope).

c) In all applications OFNR Cable shall utilize cable rack.

FPS and Wire Basket Tray routing systems shall be contained on the same floor and not separated by a firewall, floor or ceiling.

6.1.9 Only AT&T approved connector types shall be used for FDF terminations.

6.1.10 The full cross-connect architecture provided by the FDF shall be used in the AT&T network.

6.1.11 Fiber cables terminating at the FDF within AT&T Equipment Space intended for OSP use shall adhere to one the following options:
a) Utilization of Preterminated FDF panel equipped with either OFNR cable or indoor/outdoor cable intended for splicing in the cable vault, cable entrance facility or first manhole.

b) Utilization of a single ended preconnectorized OFNR cable or indoor/outdoor cable in conjunction with an FDF panel intended for splicing in the cable vault, cable entrance facility or first manhole.

c) Utilization of a non-connectorized OFNR or indoor/outdoor cable to be spliced within the FDF using an approved splice panel.

6.1.12 Black jacketed outside plant cable shall not exceed 50' within the building unless enclosed in a fire retardent conduit.

6.1.13 Fiber optic connections between network elements shall utilize pre-connectorized cables and terminate at an FDF on the rear of an FOT pane.

6.1.14 OSP and FOT bay placement shall be arranged/staggard in an attempt to minimize fiber jumper length.

Note: Since the NG4 is intended to be a combination bay this rule does not apply.

6.1.15 The FDF shall always utilize the cross-connect methodology. No network element shall be directly terminated on an OSP panel.

6.2 Satellite Fiber Distributing Frame

6.2.1 When an FDF is required to be placed on a different floor or in a non-contiguous equipment area from the primary office FDF, it shall be considered a remote or satellite FDF. This remote or satellite FDF shall be required to be connected back to the primary office FDF via a fiber optic tie cable.

6.2.2 When Satellite FDF's are placed, FPS shall be placed to allow easy access to support each Network Element.

6.2.3 Placement of the overhead FPS shall be relative to the cable management of the terminating equipment.

6.3 The FDF

6.3.1 All passive devices shall conform to the AT&T Company's standard.

6.3.2 New FDF line-ups shall be limited to a 7 foot environment.

6.3.3 The FDF shall be ordered to include storage of excess jumper slack between bays.

6.3.4 In locations with limited FDF line-up growth, the utilization of combination OSP/FOT bays is permitted.

6.3.5 The Generation III FDF shall have a different physical placement requirement of the lineup. The lineup shall be placed to accommodate both front and rear access providing for full 36-inches between parallel lineups on both front and rear. If a new lineup is started using the Generation III bays after an embedded Generation II (standard bay) arrangement is already in service, strive to place the new lineup adjacent to the Generation II lineup, or within the closest
proximity. A transition bay from the NGF to the NG3 will be required to migrate from these two Generation III systems.

6.3.6 Fiber optic patch cords shall be ordered in the near correct lengths in order to interconnect between FDF panels and network elements.

6.3.7 In locations where there is an existing lineup of the old style LGX bays and that lineup still has room to grow it is permitted to continue the lineup with the same style bay until that lineup is maxed out without the need for a waiver.

6.4 Fiber Splitters

6.4.1 Fiber Optic Splitters shall not be directly connected to one another.

6.4.2 No more than three fiber optic splitters shall be placed in the overall circuit path.
6.5 Optical Terminations and Connectors

6.5.1 Fusion splicing is the standard in AT&T and shall be used when required.

6.5.2 For immediate service restoration mechanical splices are allowed but shall not remain in place longer than 30 days.

6.6 Attenuators

6.6.1 Fiber optic attenuators shall only be placed at the receive side of either the network element or the FDF.

7. ETHERNET DISTRIBUTING FRAMES (EDF)

7.1 General

7.1.1 All Operation/Administration/Maintenance (OA&M) connections shall be direct connected to one another and will not utilize the cross-connect architecture/design of the Fiber and Copper Distributing Frames unless otherwise noted in this document, an associated GES Application Drawing or as outlined in ATT-TELCO-IS-002-316-076 Common Systems: Ethernet Architecture Standards

Note: The OAM Direct Connect Application may not apply in all locations due to existing network architecture designs. (i.e. Mobility Network Technology Centers (NTC’s) where the cross-connect architecture is common place and should be maintained)

7.2 Electrical Ethernet Distributing Frames

7.2.1 Ethernet interconnection between network transmission equipment and the EDF will be terminated on the rear of an Ethernet Termination shelf (Patch Panel). This connection will be made using RJ-45 type connectors and Category 5E minimally conforming type cable and shall adhere to AT&T length limitations.

7.2.2 The full cross-connect architecture provided by the EDF shall be used in the AT&T network.

7.2.3 The EDF shall always utilize the cross-connect methodology. No network element shall be directly terminated on the front of the Ethernet patch panel.

7.3 Electrical EDF Components for the C.O.

7.3.1 For detailed information refer to the following drawings:

- ATT-C-20010-E
- ATT-E-01885
- ATT-E-00053-E