# SECTION I -- IRONWORK

## CONTENTS

<table>
<thead>
<tr>
<th></th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>GENERAL</td>
</tr>
<tr>
<td>1.1</td>
<td>Introduction</td>
</tr>
<tr>
<td>2.</td>
<td>REQUIREMENTS</td>
</tr>
<tr>
<td>2.1</td>
<td>General</td>
</tr>
<tr>
<td>2.2</td>
<td>Auxiliary Framing</td>
</tr>
<tr>
<td>2.3</td>
<td>High Seismic Risk Zone Requirements</td>
</tr>
<tr>
<td>2.4</td>
<td>Cable Racks</td>
</tr>
<tr>
<td>2.5</td>
<td>Frames, Bays, Battery Stands and Equipment Cabinets</td>
</tr>
<tr>
<td>2.6</td>
<td>Rolling Ladders And Tracks</td>
</tr>
<tr>
<td>2.7</td>
<td>Threaded Rods, Bolts, Nuts, Screws And Cotter Pins</td>
</tr>
<tr>
<td>2.8</td>
<td>Unistrut Incorporated Within Auxiliary Framing</td>
</tr>
<tr>
<td>2.9</td>
<td>Ceiling Hanger Rods</td>
</tr>
</tbody>
</table>

## TABLE I-1 – SUMMARY OF CHANGES IN SECTION I

<table>
<thead>
<tr>
<th>Revision Date</th>
<th>Item</th>
<th>Action</th>
<th>Requirements Change Notification</th>
</tr>
</thead>
<tbody>
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<td>Addition</td>
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</tbody>
</table>
1. GENERAL

1.1. Introduction

1.1.1 The Installation Supplier shall ensure, as part of the evaluation of the installation, that all equipment added, rearranged or modified is properly installed and in conformance with AT&T installation specifications.

1.1.2 The Installation Supplier shall ensure, as part of the evaluation of the installation, that all work has been done in accordance with the detail specifications or approved changes to the detail specifications.

1.1.3 This section covers the general requirements for the location, assembly and erection of cable and relay racks.

1.1.4 Changes in this issue of Section I are summarized in Table I-1.

1.1.5 This section delineates workmanship requirements. The following Practices provide additional assembly details:

- ATT-TP-76201 Hardware Products and Materials Specifications
- ATT-812-000-713 Anchoring Requirements
- ATT-812-000-715 Equipment Framework and Cable Design Requirements
- ATT-TP-76305 Cable and Wire Installation and Removal Requirements - Cable Racks and Raceways
- ATT-TP-76408 Auxiliary Framing and Bracing Requirements
- ATT-TP-76409 Network Facility - Cable Rack Requirements

2. REQUIREMENTS

2.1. General

2.1.1 All ironwork installation described in this section shall conform to AT&T seismic requirements. Except when noted otherwise, the requirements stated herein apply to all seismic risk zones.

2.1.2 Cut ends of auxiliary framing, cable racks, bolts, etc., shall have sharp or jagged edges removed.

2.1.3 Cut ends and damaged painted surfaces shall be repainted.

2.2. Auxiliary Framing

2.2.1 Auxiliary framing shall be uniform in length, at the correct height, properly located and level.

2.2.2 Compression type splices shall be utilized only in low seismic areas. Through bolt splices can be utilized in both low and high seismic areas. Compression type and through bolt splices shall not be utilized in the same system. If compression type splices are utilized they shall be:

- a) staggered at alternate runs between supports, horizontally and vertically
b) Limited to one splice between supports.

2.2.3 Where the ends of low level auxiliary framing (first level above the frame work) extends beyond a support, the ends shall be equipped with a rubber finishing cap.

2.2.4 When short sections of auxiliary framing are used below the low level framing, rubber finishing caps shall be installed on the exposed ends.

2.2.5 Superstructure bracing shall be installed within the 30/60 degree slope maximum.

2.2.6 There shall be a minimum 5 inch clearance between the ends (does not include side surfaces) of auxiliary framing and any building structural member or surface (e.g., columns, walls, beams). The purpose of this standard is to prevent the ends of the auxiliary channel from “chiseling” the building structure during a seismic or other event. Building systems that are non-structural (e.g. HVAC ducting) are not included in this standard.

2.2.7 Auxiliary framing shall be supported at intervals not to exceed 6 feet and shall not extend more than 30 inches beyond the last support. Refer to ATT-TP-76408 for more details.

2.2.8 Pipe stanchion floor flange shall be fastened to the floor with a minimum of two 1/4-20 flat head machine screws and associated floor anchors.

2.2.9 Auxiliary framing heights shall be measured from the floor to the bottom of the paired channels.

2.2.10 Auxiliary framing shall be installed in 20-foot lengths whenever possible. Auxiliary framing channels shall be run in pairs of equal length with flat side facing outward.

2.2.11 When through bolt splicing is utilized for auxiliary framing channels, six feet and longer in length, they shall be drilled or punched with splicing holes at both ends before the auxiliary framing is installed into overhead environments.

2.2.12 Holes in auxiliary framing for splice purposes may be enlarged or elongated if, after drilling or punching, the holes do not line up with the splice. When the holes have been enlarged or elongated, flat washers shall be installed on splice bolts. The separation between the ends of spliced auxiliary framing shall not exceed 1/4 inch.

2.2.13 When a square tube floor stanchion system is used, it shall be installed in accordance with instructions given in ATT-TP-76408.

2.2.14 Auxiliary framing splices shall not be made past the last hanger support.

2.2.15 Spliced lengths of auxiliary framing channels that are connected by use of a through bolt splice with a splice plate, as shown in ATT-TP-76408, Figure 3, High Seismic Risk Areas, would be considered a continuous run of auxiliary framing and can be installed and designed to requirements of a continuous run.

2.2.16 The end of the auxiliary framing shall extend at least 3 inches beyond the last point of support. If the distance from the end of the auxiliary framing to the last point of support (e.g.) hanger rod, brace or cable rack attachment, etc.,) is less than 3 inches, a 3/8”-16 or larger bolt shall be installed through the ends of the auxiliary framing.

2.3. **High Seismic Risk Zone Requirements**
2.3.1 Through bolt splices shall be made by use of a splice plate as shown in ATT-TP-76408, Fig 3, High Seismic Risk Areas.

2.3.2 Stiffening clips shall be installed throughout auxiliary framing arrangements no more than 2-foot apart between support rod locations and at the ends of framing runs extending 3-inches or more beyond their last point of support. Stiffening clips may be omitted at locations where an earthquake brace, cable rack, or other clipped fastening, of 1/2 inch or larger, has been located.

2.3.3 Cable racks supported directly by auxiliary framing shall be attached with two J-bolts at each support.

2.3.4 Auxiliary framing supported conduit shall not be extended to wall-mounted switches, lights, outlets, etc. Approved flexible conduit, i.e. LFMC, shall be utilized for this application. For additional criteria see ATT-TP-76300 Section M.

2.4. **Cable Racks**

2.4.1 Where cable racks are directly attached to auxiliary framing, both stringers shall be bolted to the framing at each end of a run:

a) At intermediate points, only one J-bolt shall be required at each auxiliary framing intersection.

b) The J-bolts shall be staggered so that adjacent fastenings along the rack can be made on opposite sides of the rack.

c) When short pairs of auxiliary framing are used to support cable rack extending beyond regular framing, or are used for the support of a frame, two J-bolts shall be used.

2.4.2 Space between ends of cable rack stringer shall not exceed 5/8 inch at splices.

2.4.3 Except for transitions between levels, only one cable rack splice is permitted between any pair of supports and spliced sections are not permitted to extend beyond the last support.

2.4.4 Cable rack should be supported at 5 foot intervals and shall not exceed 6 feet.

2.4.5 Cable rack shall not extend more than 30 inches beyond the last support.

2.4.6 There shall be a minimum 5 inch clearance between cable rack ends (does not include side surfaces) and any building structural member or surface (e.g., columns, walls, beams). This does not include ends of cable racking that are secured or mounted to a wall, column, etc. for support. Only cable rack ends that would result in “chiseling” of the building structure during a seismic or other event. Building systems that are non-structural (e.g. HVAC ducting) are not included in this standard.

2.4.7 Formed fiber tubing shall be placed on all hanger rods directly supporting cable rack from above. The tubes shall be long enough to adequately protect the cabling to the ultimate height of the cable build up.

2.4.8 Cable rack horn and pan shall be installed using the following guidelines:

a) All junctions shall be overlapped a minimum of 3 inches. The bottom section of “pan” shall not extend more than three inches past the common cross member.
b) Pans shall not extend past the end of the cable rack stringer or closing detail.

c) An overlapping arrangement of pans shall be utilized to avoid cutting of pans. The ends of pans that must be cut in the field shall not have burs or sharp edges. Metallic pan, when used, shall be equipped with edge protection. Both metallic and nonmetallic pan cut in the field shall have a 1/4” radius at their corners (refer to Part 8 and Fig. 22 of ATT-TP-76409).

d) Cable retaining horns on “panned” cable rack shall be installed on both sides of the cable rack on 24-inch centers, except at cable rack intersections where they shall be omitted/removed.

e) Pans on inclined cable racks are not permitted.

f) Installed cable rack horns that are not a straight formed wire design shall not be reused.

g) Horns installed on runs of cable rack shall have a common design, except that, straight formed wire horns may be used when extending existing racks that are equipped with a different horn design

h) Horns shall not be mounted on vertically oriented cable rack below the 7-foot height level.

i) Non-metallic cable pans shall be manufactured of a fire resistant material conforming to UL standard 94 v-0 or v-1 rating.

j) Nonmetallic pan shall be secured at its end points to a cable rack rung if the pan can curl or sag due to lack of applied cable weight. This can be accomplished via use of securing lacing cord. The Installation Supplier is to create a small hole at the end of the pan near the cable rack rung so that the lacing cord may pass through said pan. The pan securing lacing cord and its associated hole are to be created/installed using a method that does not negatively impact the functionality of the pan, the associated cabling, or personnel.

2.4.9 Cable rack shall not be extended through a building structural floor. A raised floor system is not considered to be a “floor”.

2.4.10 Distance between cable rack straps shall not exceed 9 inches. Additional support shall be provided as necessary to keep the cable from sagging.

2.4.11 The ends of cable rack sections shall be protected with rubber finishing caps or closing details.

2.4.12 Cable racks shall not be supported by their cross straps.

2.4.13 Vertical racks on walls or columns shall be supported at the floor and shall have intermediate support with a maximum spacing not to exceed 5 feet.

2.4.14 Cable racks placed on floors shall be fastened with Z-clips on the inside of the rack stringers, at intervals not to exceed 5 feet.

2.4.15 For horizontal cable runs, the cable rack shall be placed with the cross-straps upward. A cable rack with solid bar-type stringers, smaller than 25 inches in width, may be inverted to gain necessary cabling heights due to fixed obstructions. Cable rack with reinforced straps shall not be inverted.

2.4.16 The flat bar of a cable rack turn assembly shall be secured to the cable rack.

2.4.17 Cable rack used for switchboard, fiber optic, and power cable runs shall be constructed of solid rectangular stringers.
2.4.18 Cable rack height shall be the measurement between the top of the cable rack side bar down to the finished floor.

2.5. **Frames, Bays, Battery Stands and Equipment Cabinets**

2.5.1 All frames taller than 7'-0" shall be top supported by attachment to the office superstructure. Top supports shall be provided along equipment lineups at each location where a primary run of office superstructure crosses the equipment lineup. A minimum of two top supports is required for each group of frames that do not span two runs of primary office superstructure. A frame group, or group of frames is defined as any number of individual frames that are rigidly bolted or otherwise junctioned together to form a structurally continuous unit of frames.

2.5.2 Frames 9'-0" and taller use a one-inch galvanized pipe to supplement adjacent frame junctioning requirements and for alignment and grounding purposes. One-inch pipes shall be clamped to the underside of each frame's top angle at two locations. The V bolts shall be located to the left and right of frame center a minimum 12 inches apart. Any attachments to overhead framing shall be in addition to the pipe supports. One-inch galvanized pipes will be furnished in 20-foot lengths whenever possible. Extra length not used for current fastening of frames shall be left for future frames. A minimum of 15 inches of pipe shall always extend beyond the last frame installed for future growth unless that last frame is at the end of the lineup. The unused length of pipe shall be fastened to the auxiliary framing with frame support hardware above future frames. Where the pipe extends beyond the end of an existing or planned group of frames, it shall be fastened to the auxiliary framing with U bolts. The junction of the pipes shall be bonded in accordance with Section H of ATT-TP-76300.

2.5.3 When the 1 inch galvanized junction pipe extends beyond the end of the frame a rubber finishing cap is required when:
   a) The end of the pipe can be considered a hazard to personnel.
   b) The end of the pipe could cause a service outage.

2.5.4 A frame taller than 7'-0" installed as an individual frame, i.e. not junctioned to any adjacent frames, or installed with spacers on both sides, shall have at least two points of support to the overhead superstructure.

2.5.5 AT&T policy is for deployment of all new equipment located within Legacy Carrier Grade Technical space to be in high seismic frames or cabinets, seven feet tall, and secured per ATT-812-000-713. Frames or cabinets shall be secured on raised floor applications per ATT-TP-76402. All frames in a common lineup are to be junctioned to each adjacent frame.

2.5.6 7 foot frames, bays or cabinets shall not be mechanically connected to any suspended grid system. This includes ceiling suspended and stanchion suspended system. This does not include stubbed up systems supported from the tops of bays or stanchions.
   a) In lineups where 7'-0" or 9'-0" frames are the primary or only support for overhead cable rack, the equipment frame shall be secured to building floor with four anchors and junction to adjacent frames in accordance to paragraph 2.5.1. Cable rack shall not be considered a top support and cannot be relied upon to provide structural support of equipment frames.
2.5.7 Refer to ATT-812-000-713 AT&T Network Equipment Anchoring Requirements for standard anchoring requirements and alternative anchoring solutions due to site conditions and obstructions.

2.5.8 Unequal flange and network bay equipment frames taller than 7'-0" are secured by bracing to overhead auxiliary framing and floor anchored. Two floor anchors shall be placed as close as possible along centerline of uprights.

2.5.9 The uprights of adjacent frames and cabinets shall be joined together per manufacturer’s specifications to form a continuous lineup.
   a) Adjacent frames shall to be joined together at the top and bottom.
   b) Adjacent cabinets shall be joined together at the top using through bolts or junctioning plates.

2.5.10 All frames, bays and cabinets to be installed shall be measured from reference points as identified on the floor plan.

2.5.11 Frames and cabinets shall be plumb and aligned to adjacent frames and cabinets to within 1/4 inch.

2.5.12 Frames and cabinets shall be level within 1/16 inch per foot. If shims are required, there shall be no more than a 1-inch shim stack.

2.5.13 If more than 50 holes in the floor are to be drilled for the job, the Installation Supplier shall scan for embedded metallic obstructions before drilling.

2.5.14 If an embedded obstruction (e.g., reinforcing bar) is encountered during floor drilling, drill another hole at an alternate location. For more details refer to ATT-812-000-713.

2.5.15 Frames, bays, cabinets, etc. shall be bolted to the floor using approved floor anchors as specified within ATT-812-000-713.

2.5.16 All end of lineup equipment frames 7 feet in height or taller shall have a minimum 7 foot in height end guard installed.

2.5.17 End guards shall be installed as per manufactures guidelines.

2.5.18 End panels or end shields located within an equipment lineup:
   a) An end guard shall be installed on all frame uprights that are not junctioned to another adjacent frame when personnel/cable protection, equipment bay stability, AC service conduit, etc. is a requirement.
   b) An end shield may be installed on all frame uprights that are not junctioned to another adjacent frame when personnel/cable protection is the only requirement.
   c) An end guard / end shield is not a requirement for frame uprights that are not junctioned to another adjacent frame when the separation between the equipment frames is less than 12 inches in width and there is no need for personnel/cable protection, equipment bay stability, AC service conduit, etc.
2.5.19 End guards, end panels or end shields that do not match the same depth or overall foot print of the adjacent bay framework shall require a transition device (guard rail closing detail) in equipment lineups with track type rolling ladders. This transition device shall be required either on the front, rear or both sides of the end guard, end panel or end shield, whichever is appropriate.

2.5.20 In equipment lineups with track type rolling ladders a transition device shall be used when the depths of the frames are different.

2.5.21 End panels and end shields shall be a minimum of 7 feet in height.

2.5.22 An equipment frame spacer and associated guard base filler are to be used when spacers are required between adjacent equipment frames. The alignment and design (UEF, Network, etc.) of the guard base filler is to match that of its adjacent equipment frame(s) and be a minimum of 7 feet in height. All spacers and base fillers are to be installed as per manufactures guidelines.

2.5.23 Hinged doors or covers of cabinets shall not bind with adjacent covers or doors to such an extent that any cover or door cannot be readily opened without causing the adjacent cover or door to move. In addition, hinged doors shall not come in contact with any working equipment.

2.5.24 Where equipment frames / cabinets shall not be side junctioned, a space of 5 inches minimum shall be provided between the frames / cabinets. Frames / cabinets placed near building walls, columns or other structural members shall have a 5 inch minimum space between the frame / cabinet and the building member.

2.5.25 An equipment frame(s) or cabinet(s) is to be anchored to the floor when hot slid to a temporary location so that its service and/or equipment can be transitioned.

2.5.26 All equipment shelves mounted in frames, cabinets, or bays shall have a minimum of four screws used to secure the unit to the frame/cabinet/bay upright for shelves up to 50 pounds. A minimum of two additional screws for each 100 pounds or fraction thereof above the first 50 pounds shall be installed beyond the four screws. Exception: Single mounting space plate units may be mounted with two screws.

2.5.27 Battery stands shall be secured with Hilti 16mm HSL anchors for high seismic risk locations or Hilti HDI ½ anchors for low seismic risk locations in accordance to quantities specified by the equipment manufacturer. Hilti 12mm HSL anchors in high seismic risk locations may be necessary under special circumstances with approval of Seismic Protection Engineer. For more information, refer to Section M of ATT-TP-76300.

2.5.28 BDFBs, DC power distribution bays, rectifiers, and other network power equipment bays shall be anchored with a minimum of 4 Hilti 12mm HSL size anchor.

2.5.29 Distributing frame blocks shall be installed with 4 mounting bolts when the holes on the distributing frame are available.

2.5.30 Equipment frames, BDFB’s and any other network equipment frames installed on a raised access floor system shall be secured in accordance with ATT-TP-76402.
2.5.31 An equipment frame spacer guard box shall be bolted to its adjoining equipment frames or end guard and not anchored to the office floor. Guard box units that are not designed to secure to adjoining equipment frames shall be secured to the building floor with similar floor anchor hardware as used for equipment frame installation.

2.5.32 Modular N+1 UPS systems, including battery cabinets, MBC, and PDUs, shall be anchored to the floor using manufacturer supplied L-brackets, typically along either the side or front and back perimeter, per manufacturer design. When multiple cabinets are located adjacent to one another, and the manufacturer design is for side L-brackets, only the two ends of the aggregate UPS cabinet line-up requires an L-bracket.

2.5.33 L-brackets shall utilize two anchors per bracket, spaced to maximize the space between holes to prevent micro-fractures within the concrete floor. In low seismic zones, use \( \frac{1}{2} \)” Hilti anchors - in high seismic zones, use M12 Hilti anchors.

2.6. Rolling Ladders And Tracks

2.6.1 Hanger rods or bolts used for direct support of ladder track shall be provided with cotter pins or self-locking nuts. Otherwise, the ends of conventional bolts shall be staked.

2.6.2 Ladder track shall be supported at approximately 5 feet intervals and not to exceed 6 feet.

2.6.3 Ladder track shall not exceed a maximum of 4 feet beyond the last track support.

2.6.4 The ladder stop bolt shall be installed a maximum of 3 feet beyond the last track support.

2.6.5 Ladder track supports, splices and handrails shall be free of burrs and sharp edges.

2.6.6 Handrails shall be located or relocated as follows:
   a) When ladder serves distributing frame and other frames - locate to the side away from the frame.
   b) When ladder serves frames on right side only - relocate to the left side.
   c) When ladder serves frames on both sides - leave on the right side.

2.6.7 Rolling ladder shall have correct slant/direction with respect to the equipment lineup. Ladders will typically slant in a direction such that the foot is nearest the main cross aisle.

2.6.8 When a short section of track is required, the section shall be placed at some intermediate location in the track instead of at the end.

2.6.9 The track shall be assembled and aligned to ensure the proper operation of the ladder trolley and brake.

2.6.10 Sections of track shall be spliced as shown in Figure I-1. Figures I-2 through I-5 show additional ladder track details.

2.6.11 Ladder track shall be installed as level as possible.

2.6.12 Ladder stop bolt and bushings shall be installed on all ladder track ends and shall be equipped with a cotter pin or lock nut.
2.6.13 Ladder stop bolts shall be placed or relocated to ensure accessibility of equipment from rolling ladder.

2.6.14 Ladder stop bolts shall be placed or relocated so as to prevent the ladder from hitting anything (e.g., walls, water coolers, alarm panels, etc.).

2.6.15 Non-creep bolts shall be installed, burred and staked on all ladder track ends. If the track is extended, install a new bolt.

2.6.16 Ladder track splice screws shall be equipped with washer, burred and staked or secured with self-locking nut.

2.6.17 Fenders and wheel guards shall be provided on all ladders where they come into contact with the guardrail.

2.6.18 Brake shall be adjusted so that it operates properly.

2.6.19 Brake ropes shall be trimmed and clamped to remove risk of personal injury.

2.6.20 Ladders shall run free and clear of equipment.

2.6.21 Ladder tracks ends shall be equipped with rubber plugs.

2.6.22 A minimum clearance of 15 inches shall be maintained between the end of ladder track and walls, columns, etc., on the end toward which the ladder(s) slope, to facilitate installation and removal of the ladder trolley.

2.6.23 The gap between spliced ends of ladder track shall not exceed 1/8 inch.

2.6.24 Ladder track splicing sleeves shall be assembled with lock washers and locknuts.

2.7. **Threaded Rods, Bolts, Nuts, Screws And Cotter Pins**

2.7.1 Bolts, nuts and screws used to secure parts or units shall be tight.

2.7.2 The appropriate size bolt or rod shall be utilized.

2.7.3 The Installation Supplier shall cut the end of a bolt or rod that extends into the equipment or wiring area, or presents a personnel hazard.

2.7.4 The exposed end of the bolt or rod shall not exceed the diameter of the bolt or rod, except where personnel safety or equipment protection will not be compromised.

2.7.5 Bolts, screws or rods shall not be more than one thread under flush.

2.7.6 Both ends of bolts, screws or threaded rods shall be free of sharp edges and burrs.

2.7.7 The tips of all cotter pins shall be bent back until resting against the rod or bolt to prevent injury.

2.7.8 Self-locking nuts that have been loosened or removed shall not be reused.

2.7.9 Split nuts shall not be used in any auxiliary framing or cable cable rack support applications.

2.7.10 Any threaded rods that are cut shall have cut end(s) covered with grey enamel paint so there would be no bare steel surface exposed.
2.8. **Unistrut Incorporated Within Auxiliary Framing**

2.8.1 Where strut is placed below the regular framing or extends more than three inches beyond a clip or support and could cause harm to personnel and/or service, the strut shall be equipped with a finishing detail.

2.8.2 There shall be a minimum 5-inch clearance between the ends of strut and any building structural obstruction.

2.8.3 Strut sections shall have at least 2 supports unless otherwise specified. The supports shall be at intervals not to exceed 6 feet and shall not extend more than 30 inches beyond the last support.

2.9. **Ceiling Hanger Rods**

2.9.1 Hanger rods shall be inserted into ceiling inserts seven full turns

2.9.2 If ceiling inserts are rusty or filled with concrete, the inserts shall be cleaned out with a 5/8"-11 tap.

2.9.3 A 5/8"-11 hex nut and a 1-3/4 inch outside diameter washer shall be used at the ceiling on all hanger rods and bolts, regardless of ceiling construction.

2.9.4 When hanger rods are installed through ventilating ducts additional 1-3/4 inch washers and 5/8"-11 hex nuts shall be installed at the bottom of the duct. Add sealing compound to seal any air leakage.

2.9.5 Under no circumstances shall more than one splice be installed on a hanger rod. In no case shall threaded rods used for the support of mezzanine platforms be spliced.

2.9.6 Ceiling hanger rods shall be installed vertically plumb to within 2 inches over 5 feet run (2 degrees). Hanger rods shall be installed in a single piece to full length whenever possible. Where splice is necessary only one splice is permitted in a hanger run.

2.9.7 Hanger rods anchored to surface mounted or embedded strut channels shall be secured to inside channel strut nut threaded at minimum to 7 full turns and hanger rod locked in place with an additional nut and washer on outside of strut channel.
FIGURE I-1--SPICING SLEEVES FOR LADDER TRACK

1/4"-20 x 2 1/4" R H M SCR

.255" x .493" x .062 LOCK WASHER & SELF LOCKING NUT

BUTT ENDS OF TRACK TOGETHER WHERE POSSIBLE, BUT IN NO CASE SHALL ENDS OF TRACK BE MORE THAN 1/8" APART

SPLICE SLEEVE

TRACK

1" 2" 2" P" P" 1"
FIGURE I-3--LADDER STOP AT SUPPORT BRACKET

SIDE OF SUPPORT SHALL NOT EXTEND BEYOND END OF TRACK

SOFT RUBBER BUSHING 1 1/4 OD

BRACKET
3/32 X 3/4 COTTER PIN
3/8-16 X 2 3/4 HMM BOLT
3/8-16 HEX NUT

SECT A-A
FIGURE I-4--TRACK SUPPORTED WITH SINGLE BAR DIRECTLY FROM CABLE RACK 2 FEET 1 INCH OR LESS WIDE
FIGURE I-5--TRACK SUPPORTED FROM AND AT RIGHT ANGLES TO AUXILIARY FRAMING - SLOPING TRACK - 2 INCH DIFFERENCE IN AUXILIARY FRAMING LEVEL