INSTRUCTION MANUALS

The Preliminary Installation manual for this base radio is provided. Upon request, final manuals will be sent to the commission and/or telecommunication certification body (TCB) as soon as they become available. All of the descriptions and schematics in this filing are up to date and will be included in the instruction and/or service manuals.

INSTRUCTION MANUALS

Draft copy of the of the front matter of the following instruction manual is enclosed with this submission:

68P81003Y71-O ..... 6.2 First Draft for Simulcast Hardware Installation

Other system and radio / configuration service software manuals are available to support the product and system in operation. They can be provided to the Commission upon request.

6.2 First Draft for Simulcast Hardware Installation

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November 2002

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Model and Options selection Procedure

GENERAL INFORMATION

- 700 MHz STR 3000 (Tx 764.00625 – 775.99375, Rx 794.00625 – 805.99375)
- 6 Channels per Rack
- 6 Base Radios per Rack, 30 Base Radios per Site
- 100 Watt RF Power Amplifier
- Cabinet Height: 43 RU, 83.5 inches (212 cm)
- Temperature Range: -30° to +60° C (-22°F to 140°F)
- Manual Tuned Cavity Combiners (2, 4 or 6 ports, 150 kHz minimum spacing)
- Antenna Connectors: Receive: N-Female, Transmit: 7/16 Female

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700 MHz STR 3000 Ordering Matrix

Super Model and Option Description	Nomenclature
STR 3000 Radio Subsystem	SQM02SUM0011A
Orderable Options: Choose only one required BR option from the following list.	
Add: (1) 100 Watt DC Base Radio	X301AD
Add: (2) 100 Watt DC Base Radios	X302AD
Add: (3) 100 Watt DC Base Radios	X303AD
Add: (4) 100 Watt DC Base Radios	X304AD
Add: (5) 100 Watt DC Base Radios	X305AB
Add: (6) 100 Watt DC Base Radios	X306AB
REQUIRED: Choose a Software Option in the same quantity as BRs ordered above	
Add: ASTRO 25 700 MHz Simulcast Trunking Software	CA00025AB
Add: ASTRO 25 700 MHz ISR Software	CA00158AA
Add: ASTRO 25 700 MHz P25 Limited Digital Conventional Software	CA00242AA
REQUIRED: Choose one Receiver Multicoupler option from the following list:	
Add: Primary Receiver Multicoupler	X679AF
Add: Primary Receiver Multicoupler with Tower Top Amp Capability	X679AG
Add: Expansion Receiver Multicoupler	
REQUIRED: Choose one Hardware/Cabling option from the following list:	
Add: 700 MHz Primary Cabinet Hardware/Cabling	X550BE
Add: 700 MHz Expansion Cabinet Hardware/Cabling	X687AG
Add: 700 MHz TX only Expansion	CA00159AA Need price update
Add: 700 MHz Primary/800 MHz in the field	CA00160AA
REQUIRED: Choose one Transmitter Combiner option from the following list:	
Add: 700 MHz 2 Port Cavity Combiner	CA00161AA
Add: 700 MHz 4 Port Cavity Combiner	CA00162AA
Add: 700 MHz 6 Port Cavity Combiner	CA00163AA
The following options can be used to enhance the basic system:	
Add: Doors, cabinet, four	CA00027AA
Enh: Open cabinet space with tuned combiner port	CA00028AA

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Field Replacement Units (FRUs):	
700 MHz STR 3000 Base Radio	T6724A
Add: ASTRO 25 700 MHz Simulcast Trunking Software	CA00025AB
Add: ASTRO 25 700 MHz ISR Software	CA00158AA
Add: ASTRO 25 700 MHz P25 Limited Digital Conventional Software	CA00242AA
FRU: STR3000 EXCITER MODULE 700 MHZ	DLN6520A
FRU: STR3000 RECEIVER MODULE 700 MHZ	DLN6521A
FRU: 100W 700 MHZ LINEAR PA	DLN6522A
FRU: POWER SUPPLY BOARD	DLN1102B
FRU: SIMULCAST 4 and 6 WAY TRAY	CLF1775A
FRU: SIMULCAST 4 and 6 WAY TRAY w/TTA	CLF1776A
FRU: SIMULCAST 6 WAY TRAY EXPANSION	CLF1777A
FRU: STR 3000 CONTROL MODULE	DLN1269A
FRU: Configuration Service Software	DLN6455A

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PRELIMINARY 700 MHZ STR 3000 SPECIFICATIONS

GENERAL PERFORMANCE

Supermodel Number	SQM02SUM0011A		
Number of Channels	1-6 channels		
Number of Cabinets	1		
Cabinet Height	43 RU, 83 in. (210 cm)		
Footprint * (WxD)	24x24 in. (60 x 60 cm)		
System Weight	795 lbs (361 kg)		
Power Requirements	-48 VDC (43-60 VDC)		
Temperature Range	-30° to +60° C (-22°F to 140°F)		
EBTS thermal loading: (Preliminary)	BRs	Typ. (BTU)	Max.(BTU)
	1	1780	2160
	2	3459	3190
	3	5120	6210
	4	6830	8200
	5	8500	10220
	6	10170	12240
Power Consumption* (Preliminary)	**Typical**	**Maximum**	
	3180W	3840 W est.	
Antenna Connectors			
Transmit	7/16 Female		
Receive	N-Female		

* NOTE: The number of cabinets, footprint and system weights are stated for a 6 channel system including the RFDS without options. Some STR 3000 features require the use of additional equipment.

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BASE RADIO	
Dimensions	8.75x19x16.5 in. (222x483x419mm)
Weight	73 lbs
Power Reqts	-48 VDC (42-60 VDC)
# of Frequencies	1
Freq Generation	Synthesized
Digital Channel Spacing	12.5 kHz
Mode of Operation	Duplex
Digital Modulation	
Transmit	Linear Simulcast Modulation, C4FM
Receive	C4FM
Antenna Connectors	
Transmit	SMA Female
Receive	SMA Female

Preliminary

TRANSMITTER	
Frequency Range	764-776 MHZ
Average Power Output (6 Ch Cavity Combiner)	
150 kHz	6W-19W per carrier
250 kHz (Preliminary)	8W-27W per carrier
Occupied Bandwidth	8.7 KHZ
RF Output Impedance	50 Ohm
Frequency Stability	External Reference
Modulation Fidelity	10% maximum error
Spurious and Harmonic Emissions Attenuation	85 dB
Symbol Rate Accuracy	10 PPM

NOTE: These specifications were taken at the sub-system (cabinet) level

Preliminary

RECEIVER	
Frequency Range	794-806 MHz
Sensitivity Static Bit Error Rate (BER) 5%	-121dBm**
Intermodulation Rejection (Per TIA methods of measurement)	80 dB
Adjacent Channel Rejection Digital Reference	60 dB
Spurious and Image Response Rejection	100 dB***
Preselector Bandwidth	30 MHz
Bit Error Rate Floor	
Signal Displacement Bandwidth	0.01%
Frequency Stability	1 kHz
Intermediate Stability	
1st	External Reference Required
2nd	73.35 MHz 450 kHz
RF Input Impedance	50 Ohm

** With Multicoupler Installed

*** 90 dB at +/- 2.1 MHz

NOTE**:** These specifications were taken at the sub-system (cabinet) level

Preliminary

TRANSMIT COMBINER SYSTEM

Transmitter Combiner	700 MHz	
Frequency Range	764-776 MHz	
Insertion Loss (includes isolator)	**Typical**	**Maximum**
2 port Cav Combiner @ 150KHz	4.0 dB	5.1 dB
2 port Cav Combiner @ 250KHz	3.0dB	3.6dB
4 port Cav Combiner @ 150KHz	4.1 dB	5.2 dB
4 port Cav Combiner @ 250KHz	3.1 dB	3.7 dB
6 port Cav Combiner @ 150KHz	4.2 dB	5.3 dB
6 port Cav Combiner @ 250KHz	3.2 dB	3.8 dB
8 port Cav Combiner @ 150KHz		
8 port Cav Combiner @ 250KHz		
10 port Cav Combiner @ 150KHz	Will provide when available	
10 port Cav Combiner @ 250KHz		
12 port Cav Combiner @ 150KHz		
12 port Cav Combiner @ 250KHz (Preliminary)		
RF Connector Type		
Input	N-Female	
Output	7/16 Female	
Tx-Tx Isolation (Preliminary)	32dB	

Note: on 700 MHz STR 3000 TX filter or diplexer is required

Preliminary

RECEIVER MULTICOUPLER

Frequency Range	794-824 MHz	
Noise Figure	**Typical**	**Maximum**
	3.5 dB	4.9 dB
Gain	**Typical**	**Minimum**
	11dB	8 dB
3rd Order Input Intercept	**Typical**	**Minimum**
	14 dBm	13 dBm
Output RF Connector Type	BNC Female	

Chapter

1

Understanding the Installation Process

This chapter provides a general mechanical installation process and some general guidelines when installing an equipment cabinet or rack.

The following topics are included in this chapter:

- "Mechanical Installation Process" on page 1-1
- "Mechanical Installation Guidelines" on page 1-3

Mechanical Installation Process

Process 1-1 provides guidelines for installing hardware components into a rack in a simulcast subsystem.

Process 1-1 Installing Hardware Components

1	Place each piece of equipment carefully in the area designated on the site plan. Verify that the equipment rack is bolted to the floor and ready for equipment installation. See "Verifying Proper Installation of the Equipment Cabinet or Rack" on page 1-5.
2	**NOTE** If your system was racked and tested by Motorola CCSI, continue with step 7.
3	Identify the rack space or Rack Unit (RU) location where the hardware component is to be mounted. **NOTE** An RU is the standard smallest rack panel height. Its standard definition is 4.45 cm (1.75 in.).
4	Locate the hardware component near the rack. **NOTE** Observe all safety precautions when lifting heavy equipment. See "Lifting STR 3000 Simulcast Base Radio Racks" on page 2-3 for more information on these precautions.
5	Lift and slide the component into the rack. See "Installing Equipment in the Equipment Cabinet or Rack" on page 1-6.
6	Attach the chassis to the rack with the recommended type and size screws or bolts.
7	Verify that all boards are properly seated into the chassis, if applicable.
8	Cable the component to the system components. For the installation of each component, see: • Chapter 3,"Installing the Prime Site (10Base-2)." • Chapter 4,"Installing the Prime Site (10Base-T)." • Chapter 5,"Installing the Digital Simulcast Remote Site (10Base-2)." • Chapter 6,"Installing the Digital Simulcast Remote Site (10Base-T)."

Mechanical Installation Guidelines

Hardware components are typically installed into a equipment cabinet or a standard 48.26 cm (19-in) rack. This section provides the following descriptions and guidelines for performing an install with the equipment cabinet:

- "Description of an Equipment Rack" on page 1-3
- "Installing Equipment in the Equipment Cabinet or Rack" on page 1-6

Description of an Equipment Rack

Figure 1-1 shows the front view of the equipment rack and identifies mounting locations for installing components. The cage nut and slide rail location numbers are determined by counting the blank hole locations (starting from the rack bottom). The callouts represent the hole numbers.

Figure 1-1 Front View of the Equipment Cabinet

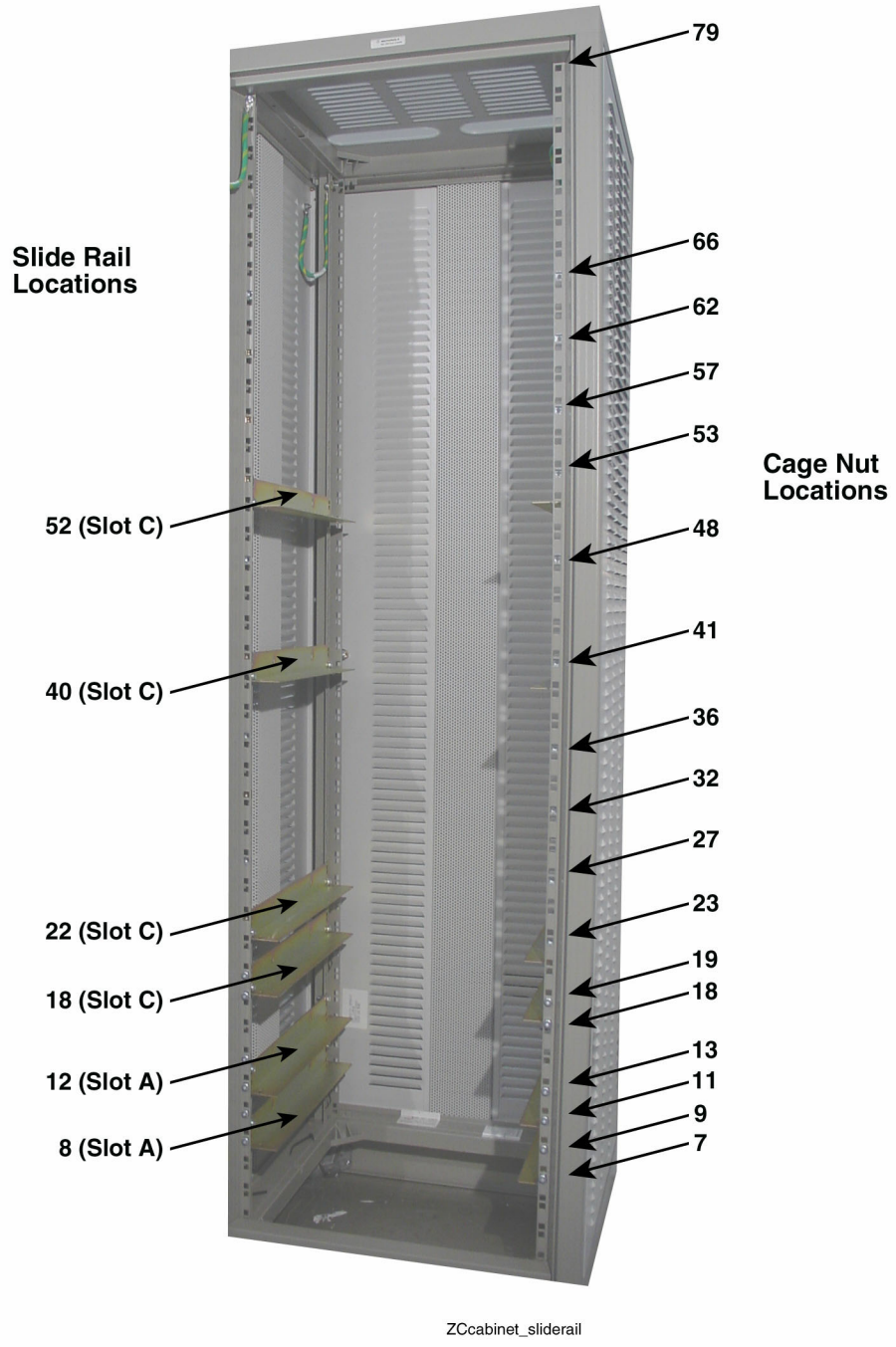
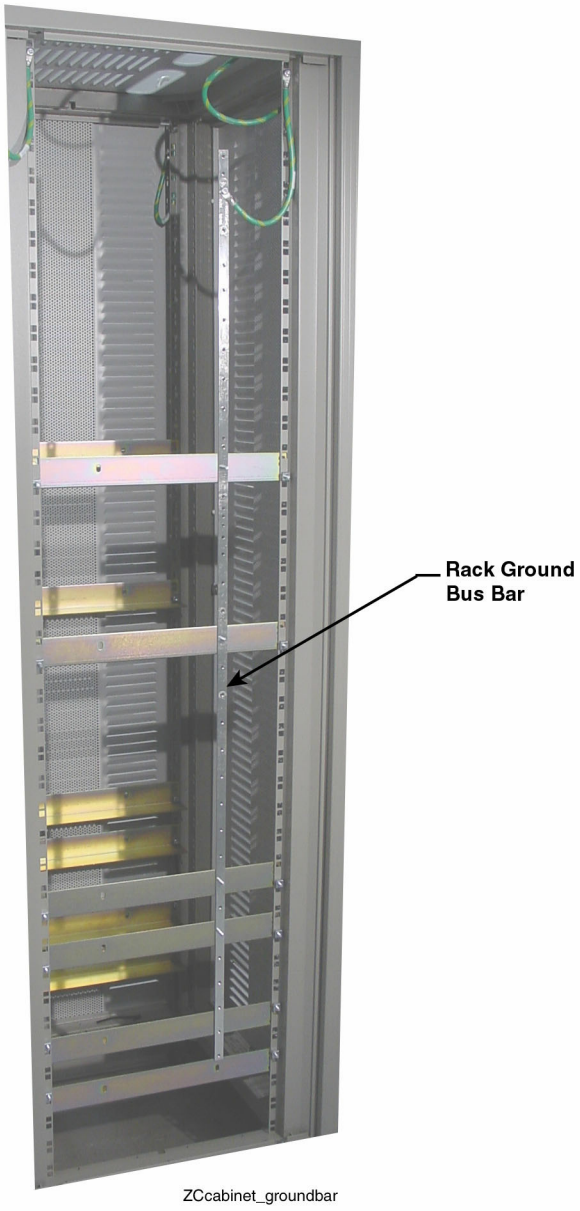


Figure 1-2 shows the Rack Ground Bus (RGB) bar in the equipment cabinet, which is used to ground the components.

Figure 1-2 Rack Ground Bus Bar in the Equipment Cabinet



Verifying Proper Installation of the Equipment Cabinet or Rack

Procedure 1-1 explains how to verify that the equipment cabinet or rack is ready for hardware component installation.

Procedure 1-1 How to Verify Proper Equipment Cabinet or Rack Installation

1	Verify that the equipment cabinet is properly bolted to the floor.
2	Verify that slide rails and cage nut screws on the left and right sides of the cabinet or rack are installed at the proper bracket hole locations, as shown for the equipment cabinet in Figure 1-1.
3	Verify that the grounding straps of all panels are security fastened to the cabinet at bracket hole 78 or 79, as shown in Figure 1-1.

Installing Equipment in the Equipment Cabinet or Rack

Procedure 1-2 explains how to install the components into the equipment cabinet or rack.

Procedure 1-2 How to Install a Component into the Equipment Cabinet or Rack

1	Remove the component from its shipping box and closely inspect it for any physical defects or damage.
2	Affix any front and rear card location decals to their proper place on the chassis.
3	Mark the bracket holes where the component will be attached.
4	Insert the component into the cabinet or rack between the marked bracket holes. **Result:** The chassis should rest on the installed slide rails near the marked bracket holes.
5	Fasten the component to the cabinet or rack using mounting screws through the marked bracket holes. **Result:** This fastens the component securely to the cabinet or rack.
6	Fasten a grounding strap between the component grounding terminal and the rack ground bus bar (RGB).
7	Attach one end of the power cable to the component and the other end to the appropriate AC outlet, or the UPS power supply (if used).

Chapter

2

Installing the Simulcast Subsystem Hardware

This chapter provides general information for installing an ASTRO® 25 digital simulcast subsystem.

The following topics are included in this chapter:

- "General Safety Precautions" on page 2-2
- "Lifting STR 3000 Simulcast Base Radio Racks" on page 2-3
- "Installation Process Overview" on page 2-6
- "Site Preparation" on page 2-7
- "General Installation Guidelines" on page 2-8
- "FCC Requirements" on page 2-14
- "Electromagnetic Safety Requirements" on page 2-14
- "List of Required Tools" on page 2-16
- "Technical Support" on page 2-18

NOTE

The Motorola Customer Center for Solution Integration (CCSI) facility stages most ASTRO® 25 simulcast systems. This staging process ensures that the system is assembled correctly and tested to meet customer specifications. Use this manual in conjunction with Motorola documentation specific to your site.

General Safety Precautions

Observe the following general safety precautions during all phases of operation, service and repair of the equipment described in this manual. The safety precautions listed below represent precautions regarding certain known hazards. Follow these warnings and all other safety precautions necessary for the safe operation of the equipment.

NOTE

The installation process requires preparation and knowledge of the site before installation begins. Review installation procedures and precautions in the *Standards and Guidelines for Communications Sites* (68P81089E50) manual before performing any site or component installation.

Also, all applicable safety procedures, such as Occupational, Safety, and Health Administration (OSHA) requirements, National Electrical Code (NEC) requirements, local code requirements, safe working practices, and good judgment must be used by personnel.

These general safety precautions include the following:

- Read and follow all warning notices and instructions marked on the product or included in this manual before installing, servicing, or operating the equipment. Retain these safety instructions for future reference.
- Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modifications of equipment.
- If troubleshooting the equipment while power is on, be aware of the live circuits.
- Do not operate the radio transmitters unless all RF connectors are secure and all connectors are properly terminated.
- All equipment must be properly grounded in accordance with the *Standards and Guidelines for Communications Sites* (68P81089E50) manual and specified installation instructions for safe operation.
- Slots and openings in the cabinet are provided for ventilation. These slots and openings must not be blocked or covered.
- Only a qualified technician familiar with similar electronic equipment should service equipment.
- Some equipment components can become extremely hot during operation. Turn off all power to the equipment and wait until sufficiently cool before touching.
- Maintain emergency first aid kits at the site.
- Have personnel call in with their travel routes to help ensure their safety while traveling between remote sites.
- Establish a communications routine during certain higher risk procedures where the on-site technician continually updates management or safety personnel of the progress so that help can be dispatched if needed.

- Never store combustible materials in or near equipment racks. The combination of combustible material, heat and electrical energy increases the risk of a fire safety hazard.

Maintenance Requiring Two People

Identify maintenance actions that require two people to perform the repair. Two people are required when:

- A repair has the risk of injury that would require one person to perform first aid or call for emergency support. An example would be work around high voltage sources. A second person may be required to remove power and call for emergency aid if an accident occurs to the first person.
- Use the National Institute of Occupational Safety and Health (NIOSH) lifting equation to determine whether one or two person lift is required when a system component must be removed and replaced in its rack.

Lifting STR 3000 Simulcast Base Radio Racks

Equipment racks should only be lifted without the use of lifting equipment when there are sufficient personnel available to ensure that regulations covering health and safety are not breached.

Motorola recommends the use of an appropriate powered mechanical lifting apparatus for moving and lifting the equipment racks.

In addition to these points, refer to and comply with any local regulations that govern the use of lifting equipment.

WARNING

Crush hazard could result in death, personal injury, or equipment damage. Equipment racks can weigh up to 545kg (1200 lb). Follow the instructions below for proper lifting procedures.

Lifting Equipment Racks

Lifting Equipment Racks Horizontally

In some cases, the equipment racks are laid down horizontal to facilitate the shipping process. Use the appropriate lifting apparatus to lift the racks upright to comply with all applicable health and safety regulations, and any other regulations applicable to lifting heavy equipment.

Do not use the eyenuts mounted on the top of the rack to lift the rack upright from horizontal position. The eyenuts are designed **only** to support and lift equipment in its normal vertical position.

WARNING

Crush hazard could result in death, personal injury, or equipment damage. Do not use the eyenuts mounted on the top of the rack to lift the rack upright from horizontal position. Eyelets could fail, resulting in the equipment dropping.

Lifting Equipment Racks Vertically

Each equipment rack comes with four M10 eyenuts mounted in the top of the rack. Use these eyenuts to lift the equipment rack vertically. Before using these eyenuts, visually check them and the rack hardware for any damage that may have occurred during shipping. If any damage is apparent, **do not use.** Contact Motorola for replacement parts or material.

WARNING

Do not use the eyenuts if damage is apparent. Eyenuts could fail, resulting in the equipment dropping. Contact Motorola for replacements.

Use all four eyenuts when lifting the equipment rack. When lifting from a center point, the distance from each eyenut to the lifting point must be a minimum of 1 m (40 in.) to ensure that the proper lifting angle is maintained. Using a shorter length than that specified could cause the eyenuts to fail. Figure 2-1 shows the minimum lengths and proper 45 degree lifting angles using the eyenuts.

If eyenuts are removed or become loose, install them properly before lifting the equipment rack. Tighten the eyenuts and bolt assembly by hand. Turn the bolt clockwise an additional 45 degrees. Eyenuts must be aligned to point towards the center lifting point of the cabinet and tightened to 10.2 to 13.6 Nm (90 to 120 lb-in.) of torque. Proper eyenut tightness and alignment are crucial to ensure the eyenut assembly performs to its intended lifting capacity.

Figure 2-2 shows the proper alignment of the eyenuts.

Process 2-1 Installing Equipment within a Digital Simulcast Subsystem

1	Prepare each site to comply with the Motorola requirements and specifications for the equipment, as listed in the *Standards and Guidelines for Communication Sites* (68P81089E50) manual. Other codes and guidelines that may apply to the location must also be met.
2	Inspect and inventory all racks, cabinets, cables, and other equipment with a Motorola representative to ensure that the order is complete.
3	Install all equipment using the site drawings and other documents provided by the Field Engineer. Use the installation standards and guidelines for placing and installing equipment.
4	Install all groundings for the racks and cabinets to protect against ground faults, electrical surges, and lightning in accordance with R56 standards..
5	Connect all cables within each rack and between multiple racks (where required). Connect the subsystem to the overall facility system.
6	Run a preliminary check of all sites before applying power and starting the initial software installations.

Site Preparation

Perform the activities listed in Table 2-1 to ensure proper site preparation. The table also references specific chapters in the *Standards and Guidelines for Communication Sites* (68P81089E50) manual for more information.

Table 2-1 Activities for Site Preparation

Activity	Description of Activity	Chapter Reference in the Standards and Guidelines Manual
Review the site plan.	• Prevents potential on-site and off-site interference by local trunked systems. • Minimizes cable lengths between the RF equipment. • Determines the location of telecom equipment.	Chapter 4, “Site Design and Development”
Determine site access and security.	Develop outlines of site access and security measures.	
Review safety considerations.	Develop outlines of general, installation, and environmental safety guidelines and requirements as well as OSHA related considerations.	• Chapter 2, “Safety Summary” • Chapter 5, “Communications Site Building Design and Installation”
Schedule installation of telephone service.	Ensures options and functions of on-site, two-way communications for personnel safety and maintenance.	Chapter 4, “Site Design and Development”
Review grounding specifications.	Ensures the site meets or exceeds the Compliance Audit Checklist in Appendix F as well as the Power and Grounding Checklist (sub-appendix D in Appendix C).	• Chapter 6, “External Grounding” • Chapter 7, “Internal Ground” • Chapter 8, “Power Sources” • Chapter 9, “Transient Voltage Surge Suppression”
Schedule installation of site power.	Provides grounding, power sources, and surge protection.	• Chapter 6, “External Grounding” • Chapter 7, “Internal Ground” • Chapter 8, “Power Sources” • Chapter 9, “Transient Voltage Surge Suppression”

General Installation Guidelines

This section provides several guidelines to ensure a quality install. Review these guidelines before unpacking and installing the system. Review the installation information in the *Standards and Guidelines for Communication Sites* (68P81089E50) for more details.