1500-0152-202

TECHNICAL MANUAL

for

ROTATABLE
LOG PERIODIC
ANTENNA
TYPE LPH-72A

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INTRODUCTION

This publication was prepared by Antenna Products Corporation, 101 S.E. 25th Ave., Mineral Wells, Texas 76067. The equipment described consists of a horizontally polarized, rotatable, log periodic HF antenna, suited for fixed station installation worldwide.

The Antenna Products type designation of this antenna group is LPH-72A.

Since the antenna group is used for worldwide deployment, various models have been designed to meet the customer's existing input voltage requirements. Chapter 5 contains information applicable to the particular Antenna Pedestal supplied in accordance with the customer order.

Chapter 1 covers general information, specifically, the description and purpose of the equipment.

Chapter 2 describes all installation procedures and data required for planning, assembling, and installing the complete antenna group.

Chapter 3 describes the operational theory of the antenna and the operation of the control.

Chapter 4 contains all maintenance procedures for maintaining the equipment.

Chapter 5 describes the Antenna Control Group and contains all information pertaining to the pedestal, control, and control cables.

Notes, Cautions, and Warnings shall be used in the service instructions as follows:

a. Notes contain operating procedures, conditions, etc., which should be highlighted.

b. Cautions contain operating procedures, practices, etc., which, if not strictly observed, will result in damage to or destruction of equipment.

c. Warnings contain operating procedures, practices, etc., which, if not strictly observed, will result in injury to personnel or loss of life.

CHAPTER 1. GENERAL INFORMATION

1-1. GENERAL. The LPH-72A Rotatable, Log Periodic, HF Antenna, figure 1-1, is designed for fixed station installation and reliable use in medium to long range circuits in the 6.5 to 32 MHz frequency band. Extensively deployed worldwide, the LPH-72A is reliable in a variety of hostile environments. It has a power rating of 50 KW PEP and the low levels of extraneous radiation (side and back lobes) are particularly helpful in rejecting interference from undesired directions.

The high environmental rating and small size of this antenna provide the required diversity for use worldwide, under varied conditions. A plot approximately 120 feet square will accommodate the erected antenna. High reliability is obtained in any climate by the use of corrosion resistant materials and avoiding dissimilar metal joints.

1-2. ANTENNA ARRAY. The antenna array consists of a 66 foot boom supporting 16 element assemblies. Each element connects to and is supported by a square fiberglass tube mounted on each side of the boom, thus insulating the elements from the boom. The elements are constructed of aluminum tubing and rod, insulated at the center by a round fiberglass tube.

1-3. SUPPORT STRUCTURE. The LPH-72A support structure consists of an 80 foot galvanized steel mast that mounts on the antenna pedestal. The antenna pedestal, which pivots between two 80 foot galvanized steel towers, facilitates lowering the mast and antenna separate from the twin tower. The twin tower is mounted on a welded hinged base that is attached to the concrete pier. A bearing assembly joins the towers at the top and 60 foot level (laterally supporting and allowing rotation of the mast).

Four-way guys (not supplied) should be attached at the 80 foot and 60 foot level, and insulated on a maximum of 20 foot spacing. Galvanized steel anchors to be imbedded in concrete are provided for securing the lower ends of the guys.

1-4. ANTENNA PEDESTAL. The antenna pedestal consists of a bearing assembly and an electrically operated gear reducer which mounts on a welded frame and pivots between two towers. Also attached to the frame is the circuitry for operating the electric motor (forward or reverse), a rotary joint, and a transmitting synchro.

1-5. REMOTE CONTROL. The remote control mounts in a standard 19" relay rack. It is used to control the antenna from a remote position. The azimuth position of the antenna is displayed on it's front panel. The antenna may be controlled by a keypad on the front panel or by a computer to position the antenna to any desired azimuth.

1-6. SPECIFICATIONS. Table 1-1 lists the mechanical and electrical characteristics of the antenna.

1-7. EQUIPMENT SUPPLIED. Table 1-2 lists the material supplied.

1-8. EQUIPMENT REQUIRED, BUT NOT SUPPLIED. Table 1-3 lists the material required for initial site preparation, installation, and electrical checkout which is not supplied.

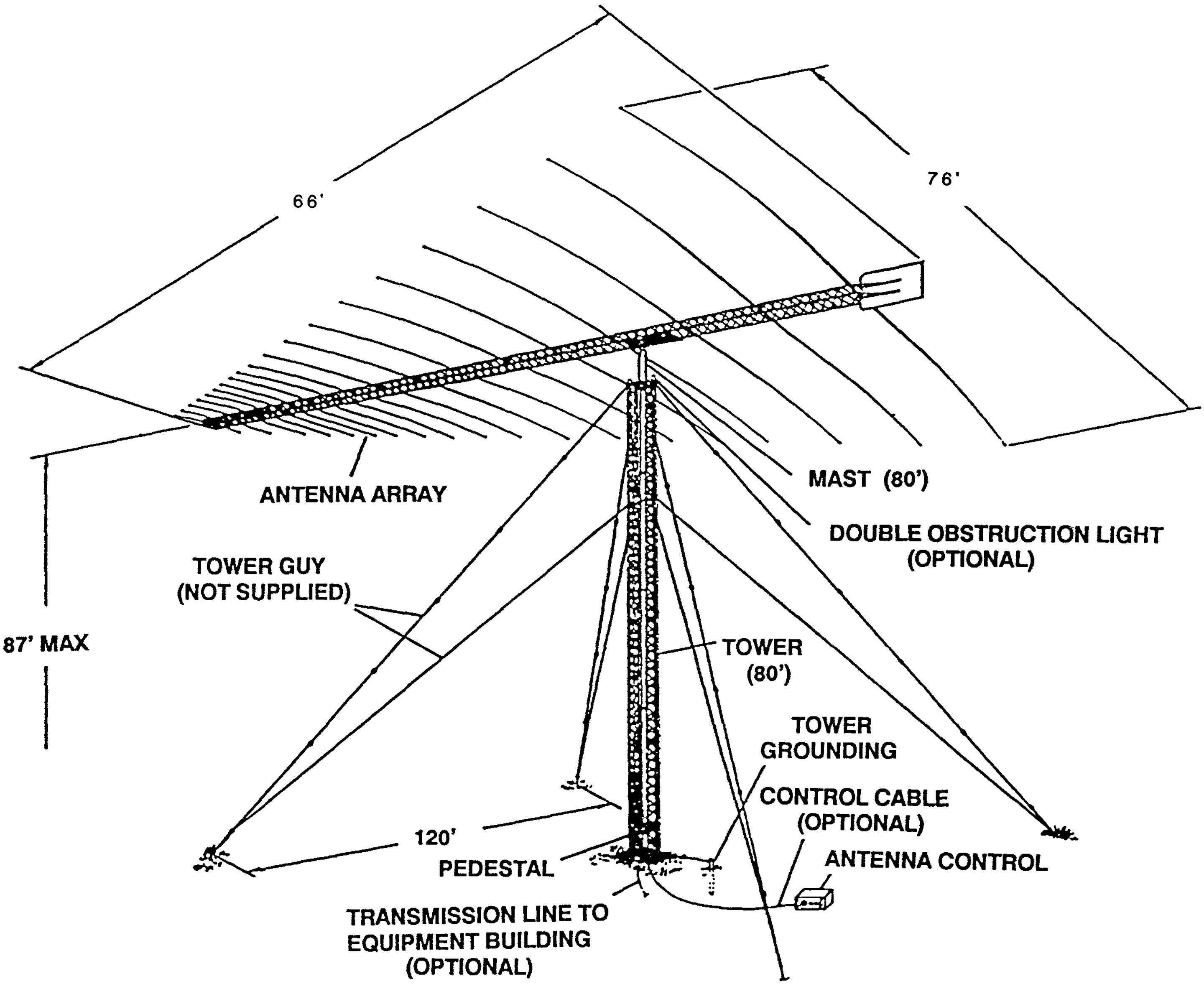


FIGURE 1-1. LPH-72A ROTATABLE ANTENNA

Table 1-1. Specifications

Electrical	
Frequency Range	6.5 to 32 MHz
Application	Transmitting or Receiving
Power Capability	Up to 25 KW average (continuous) 50 KW PEP at any frequency.
Input Impedance	50 Ohms nominal
VSWR	2.0:1 maximum
Gain	14 db over isotropic*
Polarization	Horizontal
Azimuth Beamwidth	65^0 average
Front to Back Ratio	20 db average, 14 db minimum
Side Lobe Suppression	20 db
*Assumes perfect ground plane Site conditions will cause power gain to vary slightly.	
Mechanical	
Wind Loading Capability	120 mph, no ice 80 mph, 1/4" radial ice
Weight	Approximately 7,000 lbs net w/o lighting kit.
Pressurization	A 10 psi purging valve is located at the end of the transmission line. The line may be pressurized through the rotary joint. There are no closed or unpressurized sections.
Equipment Dimensions	
Array Height	86 feet above pier
Tower Height	80 feet above pier
Antenna Boom Length	66 feet, including windsail
Longest Element Length	76 feet
Turning Radius	48 feet
Equipment Weights	
Antenna Array	1100 lbs
Twin Tower	2750 lbs
Antenna Mast	2266 lbs
Pedestal	760 lbs
Control	15 lbs

Table 1-2. Equipment Supplied

Nomenclature	Description	Qty
1500-0152-202	System Kit, LPH-72A C/O:	1
1000-0480-202	Antenna Kit C/O: Antenna array consisting of boom, elements, and transmission line.	1
See Chapter 5	Control Group C/O: Pedestal, remote control, control cable (optional), and rotary joint designed to meet customer's primary power and transmitting requirements.	1
1000-0448-201	Mast Kit C/O: Four 20 foot long sections of mast, each containing a 20 foot section of 1 5/8 inch transmission line.	1
1000-0494-204	Tower Kit C/O: Two 80 foot galvanized steel towers in 20 foot sections having bolted flange joints. Includes top and middle bearing assembly and base assembly.	1
0001-7480-202	Tower Grounding Kit C/O: Ground rod with wire and fitting for electrical ground.	1
1000-0512-204	Erection Kit C/O: Pulley bracket and required hardware.	1
1000-0511-202	Ground Hardware KIt Pier bolts.	1
0002-0269-202	Interface Hardware Kit Connecting hardware for mast to pedestal	1
0002-0269-201	Interface Hardware Kit Connecting hardware for mast to antenna.	1
6701-0004-001	Lighting Kit (optional)	1

Table 1-3. Equipment Required, But Not Supplied

Nomenclature	Description	Qty
Concrete	Refer to figure 2-1, note 2.	14.5 cu. yds.
Reinforcing Steel	1/2 inch dia required. Refer to figure 2-1, note 4.	1140'
Obstruction Marking Paint	Aviation orange and wire for painting towers in seven approximately equal bands per Sub-Part C of Part 17 of FCC Rules and Regulations.	A/R
Obstruction Lighting Kit	A special double obstruction light for 80 foot tower with rotating mast. Can be supplied to meet customer voltage requirements.	1
Primary Power	Refer to table 5-1.	N/A
Control Cable	Cable from remote control to pedestal. Refer to table 5-1. Specify length when ordering.	1
Dry Air Monitor or Nitrogen Generator	Must provide a pressure above 10 psi for purging transmission line and 5 psi for normal operation.	1
Winch	Minimum capacity of 5 tons.	1
Winch Cable	Minimum working load rating of 5 tons.	1
Snatch Block	Minimum working load rating of 5 tons	1
Rope Tag Lines	2000 lbs breaking strength, 130 feet long.	4
Tensionmeter	Pacific Scientific Co. (45402), Anaheim, CA 92803, Model No. T5-8005-110-00, 300 lbs to 1600 lbs.	1
Transit Level	Magnification Power-20x, Horizontal Graduation - 1 degree, Horizontal Vernier - Reading to five minutes Keuffel & Esser Co. (33363), Model No. NP5155.	1
Tripod, Fixed Leg	3 1/2 inch dia, 8 threads per inch, 58 inches long, Keuffel & Esser Co. (33363), Model No. 5174-8.	1
Dry Air Hand Pump	Andrew Corp. (84147), Model No. 878A.	1
Pressure Gauge	0 to 30 psi rating, 1/8 inch male pipe threads, Andrew Corp. (84147), Model No. 3500.	1
Gas Inlet Valve	1/8 inch male pipe threads, Andrew Corp. (84147), Model No. 3017.	1
Street Tee	One male and two female 1/8 inch pipe thread outlets.	3
Gas Barrier	1 5/8 inch EIA flange, gas tight with vent plug and male connections, 50 ohm.	1

2-1. INTRODUCTION. This chapter contains all information pertinent to assembly and installation of the LPH-72A antenna. Section I provides information on antenna installation planning. Section II provides receiving and material handling data. Section III provides detailed instructions for assembly and installation of the antenna.

SECTION I. INSTALLATION PLANNING

2-2. ELECTRICAL CONSIDERATIONS.

2-2.1. R.F. Power. The antenna should be located on a cleared area as large as possible. Obstacles which have an appreciable conductor length in the horizontal plane, such as guy wires, other antennas, power lines, buildings with steel reinforcement, etc., are especially objectionable. Radiation patterns and impedance characteristics of the antenna may be adversely affected or disrupted when such obstacles are in close proximity.

If the antenna is used entirely in low power (less than 1 KW) applications, pressurization of the transmission line is not required.

If the antenna is to be used for transmitting, it is important that some provision be made to pressurize the coaxial transmission line with dry air or nitrogen. If the line is not pressurized, moisture in the line will condense and when transmitting will cause arcing within the line. It is suggested that a reliable dry air monitor or nitrogen generator be utilized in the equipment building. A pop-off purging valve in the antenna transmission line will allow purging the entire transmission line from the equipment building.

2-2.2. Primary Power. Primary power is required for the pedestal motor and when applicable, the obstruction light. Refer to table 5-1.

2-3. MECHANICAL CONSIDERATIONS. The area required for installation is approximately 180 feet long by 120 feet wide. The area should be as level as possible, well drained, cleared of debris and vegetation, and exhibit a minimum load bearing capacity of 2000 pounds per square foot. Firm clay or compact sand normally possess these characteristics. If a selected area does not meet this criteria, the sizes of all concrete piers and anchors must be increased. Antenna Products Corporation engineers can provide additional information on request.

2-4. ERECTION. The towers and antenna may be assembled and erected with a minimum crew of 5 personnel in approximately 3 1/2 days. This does not include site preparation or excavation since that will be dependent on soil conditions and terrain. The assembly time will amount to about 2 1/2 days and erection time 1 day.

SECTION II. LOGISTICS

2-5. RECEIVING DATA. The antenna is disassembled and crated before shipment to the installation site. Refer to packing list attached to each crate for contents, crate dimensions, volumes, and weights. Uncrate the equipment and inspect for any damage due to shipping. All items should be checked against the packing list before proceeding with the installation.

WARNING

STEEL BANDING, CUT UNDER TENSION, CAN SNAP FREE CAUSING SEVERE CUTS. ALWAYS WEAR PERSONAL PROTECTIVE EQUIPMENT CONSISTING OF LEATHER GLOVES AND FACE SHIELD.

2-6. MATERIAL HANDLING. A crane, winch truck, or fork lift will be required for handling the crates. The transmission line sections should be handled with extreme care as not to bend or dent the outer aluminum conductor. Excessive dents in the transmission line will reduce the distance between the inner and outer conductors and may cause arcing when transmitting. Materials should be unloaded and stored in a careful, systematic manner to prevent damage or loss of small pieces, and to allow rapid identification of related parts.

SECTION III. INSTALLATION PROCEDURES

2-7. GENERAL. This section contains installation and erection instructions for the LPH-72A antenna group. These instructions have been prepared with the assumption that the site has been properly prepared and that erection personnel are familiar with structural steel rigging and use of heavy equipment.

2-8. HARDWARE. To insure uniformity, all screw and bolt threads on attaching hardware should face in the same direction, wherever possible, that is, all outward, all inward, all up, or all down, etc., unless otherwise specified. The antenna boom must be completely straight without angular twist. Proper tightening of attaching hardware should be accomplished with calibrated torque wrenches; however, socket or spud wrenches may be used instead. When using socket or spud wrenches, tighten the bolts by fully compressing the lock washer plus metal to metal contact of structural parts being joined, then turn the nut an additional one half turn. Follow the above procedure for tightening, unless otherwise specified. Refer to table 2-1 for recommended torque values for threaded fasteners.

2-9. PREINSTALLATION. Clear the selected site of all debris and vegetation that may interfere with assembly of the antenna. Layout the tower pier and anchor locations with a transit to the dimensions shown in figure 2-1. Excavate pier and anchor holes as shown and install reinforcing steel and anchors. If existing soil conditions do not meet the requirements of paragraph 2-3, the sizes of the pier and anchors must be enlarged. Antenna Products Corporation engineers will offer advice if it is needed.

Prior to pouring concrete, make a wooden template to hold the pier bolts to the correct dimensions. Pour the concrete (see note 2, figure 2-1), level the pier surface with a spirit level and float a fine-grained surface on the top.

Position pier bolts into the pier before the concrete begins to set. Allow a minimum of seven days for the concrete to cure before erecting towers. If a crane is used for erection of the towers, the erection screw anchor may be omitted.

2-10. TOWER ASSEMBLY. Assemble the 80 foot twin tower as follows:

a. Set the tower base on the concrete pier and check for a level condition. If the base is not level, grout must be used to ensure a level condition.

Note

GROUT MUST BE USED TO FILL ALL SPACES UNDER THE TOWER BASE TO ENSURE A FLUSH FIT TO THE CONCRETE PIER. FAILURE TO DO SO WILL ALLOW THE TOWER TO TWIST DUE TO ANTENNA OSCILLATIONS WHEN STARTING OR STOPPING ROTATION.

b. Attach the base assembly to the pier with four 3/4 inch pier bolts and two hinge clamps, allowing base assembly to pivot. See figure 2-2.

c. Layout the two 80 foot towers along the ground, parallel to each other. The bottom tower sections contain the pedestal pivot mount which must face each other, the large holes for pivot tube down.

d. Attach these two tower sections to the base with the hardware shown. Note that a beveled washer is used in four places where the tower leg flange bolts to the beveled lip of the tower base.

e. Assemble and attach two intermediate tower sections to each of the two bottom tower sections, figure 2-3.

f. Attach intermediate guy plates to the top of each intermediate tower section with hardware shown, figure 2-3.

g. Attach middle bearing assembly and erection brackets to intermediate guy plate assemblies with hardware shown, figure 2-6. The erection brackets should extend upward.

Note

OPENING OF BEARING ASSEMBLY MUST FACE DOWNWARD.

h. Assemble one intermediate tower section on top of each intermediate guy plate assemblies with hardware shown, figure 2-3.

i. Attach pulley bracket assembly to the top two intermediate towers just above intermediate guy plate assemblies with clamps and hardware shown, figure 2-6.

j. Swing out the outer bearing assembly half and tighten with one bolt. This will allow the middle bearing to receive the mast when erected.

k. Attach a guy bracket to the top of each tower section.

l. Attach the top bearing assembly and the erection brackets between the guy brackets, figure 2-5, with the detachable half of the bearing facing down. The erection brackets should extend downward.

m. Swing out the outer bearing half and tighten with one bolt as shown. This will allow the top bearing to receive the mast when erected.

n. Attach top tower guys (not supplied) at this time.

2-11. ERECTION FIXTURE. Assemble the erection fixture components and install them as follows:

Note

THE TOWERS MAY BE ERECTED USING THE PROCEDURE AND EQUIPMENT DETAILED IN AIR PUBLICATION NO. AP116E-1737-1 OR BY FOLLOWING THE ALTERNATE PROCEDURE HEREIN.

Table 2-1. Recommended Torque Value For Fasteners

Galvanized		
	Torque Value	
Dia. Inches	Hi-Strength	Standard
1/4	9 ft-lbs	6 ft-lbs
5/16	17 ft-lbs	11 ft-lbs
3/8	30 ft-lbs	19 ft-lbs
7/16	47 ft-lbs	30 ft-lbs
1/2	69 ft-lbs	45 ft-lbs
9/16	103 ft-lbs	66 ft-lbs
5/8	145 ft-lbs	93 ft-lbs
3/4	234 ft-lbs	150 ft-lbs
7/8	372 ft-lbs	202 ft-lbs
1	551 ft-lbs	300 ft-lbs

Stainless Steel	
Dia. Inches	Torque Value
1/4	79 in-lbs
5/16	138 in-lbs
3/8	21 ft-lbs
7/16	33 ft-lbs
1/2	45 ft-lbs

Saddle Bolts	
Description	Torque Value
Element Bolts #1-7	90 in-lbs
Element Bolts #8-13	110 in-lbs
Element Bolts #14-16	150 in-lbs

a. Bolt the erection mount to the tower base with two U-bolts. See figure 2-2.

b. Hoist a 20 foot section of mast to be used as a falling gin pole, above the towers and attach one end to the erection mount with the 3/4 inch hardware. Support the other end of the gin pole with a wooden 4 x 4 between the mast and towers. See figure 2-2.

c. Bolt the lifting strap to the end of the gin pole. See figure 2-7.

d. Connect the shackle, at the center of the lifting sling, to the lifting strap on the gin pole end.

e. The other two ends of the lifting sling must be connected to the towers. Connect each end of the sling to a guy tab as shown in figure 2-7.

Note

LOWER GUYS (NOT SUPPLIED) MAY BE ATTACHED AFTER TOWER ERECTION WHEN SLING IS REMOVED.

f. Position the winch and connect the winch cable through a block, attached to the screw anchors, and to the erection tab. See figure 2-7.

CAUTION

THE WINCH, WINCH CABLE, AND TAG LINE MUST HAVE A STRENGTH AS SHOWN IN TABLE 1-3.

g. Raise the gin pole by hand until the winch has enough leverage to take hold. With the winch, raise the gin pole to a vertical position. The twin tower is now ready for erection.

2-12. TOWER ERECTION.

a. Loosely attach the two top back guys to their anchors to prevent tower from passing the vertical position.

b. Begin raising the tower, carefully observing that the tower does not swing sideways due to excessive wind forces. Tag lines secured from towers to the ground on an extension of the pivot axis will assist in preventing unwanted sidesway. Temporary anchors or a vehicle such as a truck may be used as deadmen.

c. Attach the front guys to their respective anchors as soon as the tower is vertical. It is suggested that a cable hoist be used between the guys and anchors. This will allow frequent adjustment of the guys while plumbing the tower and prevent excessive wear on the guy grip dead ends due to taking up or letting out slack.

CAUTION

DO NOT TRY TO PLUMB THE TOWER BY TENSIONING THE WINCH CABLE. THIS WILL PUT EX- CESSIVE LOAD ON THE ERECTION STRAP.

d. Remove erection sling and attach four lower guys to guy tabs and to respective anchors.

e. Plumb the tower by use of the cable hoist at each anchor putting 1800 to 2000 pounds tension in each cable.

f. Connect the guy grip dead ends and remove the cable hoist. Tighten the turnbuckles to regain any tension lost when the cable hoists are removed. Tighten locknuts on turnbuckles after adjustment is complete. It is recommeded that turnbuckles be safety wired to prevent them from loosening.

g. Position tie down straps as shown in figure 2-8. Tighten all bolts securely including the four 3/4 inch dia bolts. This completes the erection of the twin towers.

h Remove the falling gin pole.

2-13. PEDESTAL. Installation of the pedestal is as follows:

a. Attach the RH and LH pedestal mount brackets to the respective tower base sections as shown in figures 2-3 and 2-4.

b. Attach the cable of a crane or winch truck "A" frame to the lifting eyes provided on the pedestal, hoist it from the crate and remove both halves of the pedestal housing.

c. Hoist pedestal into position between the pedestal mount brackets and secure with hardware shown in figure 2-9.

d. Position the antenna pedestal so that the mast flange pivots toward the mast erection site as shown in figure 2-9, block in position with flange perpendicular to ground.

e. Remove the lifting eye nut from the mast flange and store for future use. Refer to chapter 5 for pedestal specifications, component identification, operation, and maintenance instructions.

2-14. MAST AND TRANSMISSION LINE. Assemble the mast and transmission line sections to the pedestal as shown in figures 2-10, 2-11,and 2-12 as follows:

Note

POSITION ALL TRANSMISSION LINE AND MAST SECTIONS WITH THEIR SPRING TABS TOWARD THE TOP OF THE MAST.

a. Position a section of mast near the antenna pedestal supported at the desired height, and slide a 20 foot section of transmission line through the mast. This 20 foot section will have a clamp and two tabs for attaching the supporting springs.

CAUTION

TAKE CARE NOT TO DAMAGE THE TRANSMISSION LINE BULLETS.

b. Pull the inner conductor out of the transmission line in the antenna pedestal and insert the bullet as shown.

c. Lubricate the O-ring with silicone grease provided and position it over the inner conductor.

d. Pull the inner conductor from the 20 foot section and slip it onto the other end of the bullet.

e. Slide the outer conductor of the 20 foot section against the short transmission line section, carefully positioning the O-ring in its proper groove, and secure with the 5/16 inch bolts, lockwashers, and nuts.

CAUTION

THE TRANSMISSION LINE O-RING MUST BE PROPERLY SEATED TO PROVIDE AN AIRTIGHT CONNECTION.

f. Using silicone grease, stick the washer seals over the holes on the rainshield. This will hold them in place until the mast can be positioned and the bolts inserted.

g. Slide the mast section against the pedestal and bolt the flange to the pedestal with the 5/8 inch hardware shown.

Note

AS SHOWN IN FIGURE 2-11, THE TWELVE 5/8 INCH WASHER SEALS (FLAT WASHER AND RUBBER SEAL) MUST BE POSITIONED BETWEEN THE MAST FLANGE AND PEDESTAL. THESE FLAT WASHERS ACT AS SPACERS TO ALLOW WATER ENTERING THE MAST TO DRAIN.

h. Tighten the mast bolts and connect the four springs inside the upper end of the mast section, thus supporting the transmission line. Follow this same procedure as shown in figure 2-12 for the completion of the assembly of the mast sections and transmission line. The washer seals are used only at the antenna pedestal.

i. Position and connect the mast top section with the two headplate pivot holes facing down as shown in figure 2-22.

j. Run the winch cable over the sheave attached to the middle bearing assembly and wrap it around and through the eye welded on the mast six feet below the mast headplate. This is shown in figure 2-23.

k. Support the mast a sufficient height above ground to allow assembly of the antenna beneath the mast, or erect the mast to a vertical position and secure during antenna assembly.

2-15. BOOM. Refer to figures 2-13 through 2-18 and assemble the boom sections as follows:

a. Boom section 1 is to be completely assembled as shown in figure 2-14.

b. Boom sections 2, 3, and 4 are to be assembled in half sections, then match the half sections and assemble as shown in figures 2-15 through 2-18.

Note

THE TOTAL WEIGHT OF THE BOOM IS APPROXIMATELY 400 POUNDS AND THAT OF THE ELEMENTS IS APPROXIMATELY 600 POUNDS. TO ELIMINATE HAVING TO LIFT THE COMPLETE BOOM ASSEMBLY INTO POSITION FOR ERECTION, THE BOOM MAY BE ASSEMBLED IN POSITION BEGINNING WITH SECTION 3 SO THAT THE PIVOT POINT OF SECTION 3 COINCIDES WITH THE MAST HEADPLATE PIVOT BOLT. REFER TO FIGURE 2-22. THE BOOM IS ASSEMBLED UPSIDE DOWN WITH THE REAR FACING THE TOWERS. IT IS ALSO SUGGESTED THAT THE BOOM BE SUPPORTED OFF THE GROUND PROVIDING ACCESS TO THE FOUR SIDES DURING ASSEMBLY. DO NOT ASSEMBLE THE WINDSAIL TO THE BOOM AT THIS TIME.

c. Assemble, but do not attach windsail at this time.

2-16. ELEMENTS. Elements 1 through 6 are completely assembled. Refer to the following steps for assembly and installation.

CAUTION

POSITION EACH ELEMENT SECTION WITH THE DRAIN HOLE FACING UP DURING ASSEMBLY. IF THE DRAIN HOLES FACE UP AFTER ERECTION THE ELEMENT MAY FILL UP WITH WATER, FREEZE, AND BURST.

a. Position the center section of elements 1 through 16 into the boom and attach them to the square fiberglass bars with the saddles shown in figure 2-20. Do not tighten the saddle bolts until the transmission line has been centered and is straight.

b. Attach two feedstraps to each element starting with element 16 and alternate their positions on the remaining elements. Refer to figure 2-20 for the connecting hardware.

Note

THE FEEDSTRAPS, CONNECTING THE TRANSMISSION LINE TO THE ELEMENT, MUST ALTERNATE FROM ELEMENT #1 TO ELEMENT #16. THAT IS, THE FEEDSTRAPS AT ELEMENT #1 MUST CONNECT TO THE TOP LEFT AND LOWER RIGHT AS VIEWED FROM THE FRONT OF THE ANTENNA. THOSE AT ELEMENT #2 CONNECT TO THE TOP RIGHT AND LOWER LEFT. THIS MUST BE DONE FOR THE ELEMENT TO TRANSMISSION LINE CONNECTION TO BE TRANSPOSED AS SHOWN IN FIGURE 3-1.

c. Assemble elements 7 through 16 as shown in figure 2-19, positioning drain holes of all sections up.

d. Attach shorting coil to element 16 with the feedstrap hardware. See figure 2-21.

2-17. TRANSMISSION AND FEEDLINE. Assemble the transmission line and feedline as follows:

a. Position the transmission line adapter into the boom from the center toward the rear of the boom with the elbow of the adapter facing up and positioned in the center of the boom a distance of 13 5/16 inches from a line through the pivot holes. See figure 2-22. Refer to figure 2-10 for the assembly of the transmission line.

b. To the adapter, attach a 20 foot section of transmission line and an elbow. See figure 2-21, sht 2.

c. Attach this length of transmission line to the corner of the boom with five clamps and spacers equally spaced. See figure 2-21.

Note

FOR ASSEMBLY OF THE INNER CONDUCTOR AND TRANSMISSION LINE CONNECTORS, REFER TO PARAGRAPH 2-17 AND FIGURE 2-12.

d. To this elbow, attach elbow also shown in figure 2-21 as item 5.

e. At this point, the transmission line becomes a transformer in three sections running from element 16 to element 1. Assemble the three sections of transformer above the elements beginning with section 3 (item 4, figure 2-10).

f. Attach them, as shown in figure 2-20, to the element feedstraps with clamps as shown.

g. The other feedline (having no inner conductor) consists of three 20 foot and two short sections. It mounts below the elements. Assemble the feedline and position the short section with the strap at element 1 below the elements, figure 2-21, and attach it to each element as previously mentioned.

h. Connect the strap to transformer section as shown in figure 2-21.

CAUTION

IN ORDER TO PREVENT DAMAGE, TORQUE NUTS AS SHOWN IN TABLE 2-1.

i. Position each element such that the transmission line is straight and tighten all element saddle bolts and feedstrap clamps.

2-18. ANTENNA ERECTION. The antenna array may now be erected as follows:

a. Lower the mast into position and insert the 22 inch long 5/8 inch bolt through the pivot holes of the mast headplate and the boom. See figure 2-22. If the pivot holes are not in line, rotate the mast by turning the motor flywheel or by applying power and operating the pedestal as described in paragraph 2-26.

CAUTION

DO NOT ASSEMBLE THE CENTER CONDUCTOR BULLET INTO THE TRANSMISSION LINE AT THIS TIME. AFTER THE ANTENNA HAS PIVOTED TO A POSITION PERPENDICULAR TO THE MAST AND BOLTED SECURELY, THE BULLET MAY BE INSERTED.

b. Attach two tag lines to the mast assembly, as shown in figure 2-23, for the purpose of controlling the mast during erection.

c. As the antenna is erected, pivot the antenna until it is perpendicular to the mast.

d. Lower the antenna so that the rear of the boom may set on blocks.

CAUTION

DO NOT ALLOW FULL WEIGHT OF ANTENNA AND MAST TO BEAR AGAINST REAR OF BOOM. POSITION BLOCKS TO AVOID DAMAGE TO THE SHORTING COIL.

e. Keeping some tension in the winch cable, climb the boom and attach the twelve bolts that secure the boom to the mast headplate. See figure 2-23, sht 2. Insert the braces, item 11, under bolt heads inside the boom.

f. In order to connect the transmission line at the boom-to-mast joint, first, loosen the hose clamps holding the adapter to the side of the boom as needed to pull the flanges apart.

g. With the O-ring over the bullet, insert the bullet into each inner conductor.

h. Push the flanges of the outer conductor together and attach with hardware provided. Refer to figure 2-12.

i. Raise the antenna off the ground sufficiently to attach the windsail assembly as shown in figure 2-23, sht 3. This completes assembly of the antenna array.

j. Continue erecting the antenna using the tag lines to keep the mast from leaning sideways, and to aid positioning the mast into the top and middle bearings when it reaches the vertical position. See figure 2-23, sht 1.

k. When the mast is positioned into the bearing assembly, climb the tower and secure the mast with the outer bearing half. This completes the erection of the antenna system. The tag lines and winch cable may now be removed.

2-19. TOWER GROUNDING. The support structure should be electrically grounded to prevent lightning from splitting the concrete pier. Refer to figure 2-8. Position the ground rod approximately 4 to 6 feet from the tower pier and drive it a minimum of 6 inches below the ground level as shown.

CAUTION

IT IS VERY IMPORTANT THAT THE MATERIALS PROVIDED BE USED SINCE CORROSION WILL OCCUR BETWEEN INCOMPATIBLE MATERIALS.

a. Connect the ground wire between the ground rod and tower base. A cable clamp is provided on the side of the tower base for attaching the wire. See figure 2-8.

2-20. GEAR REDUCER. Remove the gear reducer vent pin, as indicated by the attached tag, before full operation.

2-21. ROTARY JOINT. Insert the rotary joint center conductor into the transmission line inner conductor at the bottom side of the pedestal. Bolt flanges together with the 5/16-18 x 1 inch stainless steel hardware. See figure 5-2.

CAUTION

THE CUSTOMER TRANSMISSION LINE SHOULD COME STRAIGHT INTO THE BOTTOM OF THE ROTARY JOINT TO PREVENT SIDE PRESSURE ON THE JOINT.

2-21.1. The large upper rotary joint flange must bolt to the pedestal housing after it is installed to prevent the outer portion of the joint from rotating. Use the 1/4-20 hardware shown in figure 5-2. The access cover may be removed to accomplish this.

2-22. PEDESTAL HOUSING. Reinstall the two halves of the pedestal housing with the gaskets between the two halves at the top as shown in figure 5-3.

2-23. PRESSURIZATION. Refer to paragraph 2-2.1 for pressurizing criteria The system is pressurized through the input transmission line. A purging valve, located on the transmission line at the front of the antenna, is designed to relieve at approximately 10 psi. Normal system pressure is approximately 5 psi. It is strongly suggested that the transmission line be pressure checked for leaks prior to erection. After the transmission line is completely assembled in the antenna array, pressure test the assembly. Refer to table 1-3. A maximum pressure of 20 psi may be applied to the transmission line when checking for leaks. By unscrewing the purging valve in the end of the transmission line and replacing it with a plug, the transmission line in the antenna array may be pressure tested prior to raising.

Repeat the pressure test for the transmission line in the mast. If the rotary joint is installed, a 3 1/8" EIA gas barrier will be required.

CAUTION

PRESSURES GREATER THAN THE MAXIMUM DESIGN PRESSURE OF 20 PSI SHALL NOT BE USED UNDER ANY CIRCUMSTANCES.

2-24. ELECTRICAL CONNECTIONS. The three phase plus neutral mains supply cable must be connected to the Local Control leaving sufficient slack to allow lowering of the antenna. The mains cable should enter via the left cable gland. The three line wires should be connected to the circuit breaker 2CB1. The neutral wire should be connected to terminal block 2TB2.

a. The control cable should be brought into the Local Control via the right hand cable gland, again leaving sufficient slack for lowering of the antenna. The control cable should be connected to terminals 1 to 8 of terminal block 2TB1.

b. The control cable should be connected to the Remote Control at plug P2 in accordance with the following table:

Local Control 2TB1 Terminal	Remote Control Connector 1P4 Terminal
9	I
8	B
7	C
6	A
5	D
4	G
3	H
2	E
1	F

2-25. LUBRICATION. See paragraph 5-4.

2-26. INITIAL ROTATION CHECK. Apply power to the pedestal and operate the circuit breaker. With the Local/Remote switch in the Local position, operate the CCW/CW switch in the CW position and check that the antenna rotates in a clockwise direction (as viewed from above). If the rotation is incorrect, switch off the power and interchange any two of the incoming three phase line wires.

2-27. AZIMUTH CORRECTION. To enable the remote control to display the correct heading for the antenna, an azimuth correction angle must be set into the controller at the time of installation. The correction angle is the clockwise angle from the bearing indicated to the actual true bearing of the antenna. This angle must be between 0 and 360 degrees.

a. Turn the controller power off. On the interface board, set switches U8 1-8 and U9 1-2 to produce the desired azimuth correction. The values are selected by opening the switches for the desired values that add up to the total correction. See chapter 5.

Note

THE CORRECTION IS ENCODED IN BINARY CODED DECIMAL (BCD). A FUNCTION OF THIS CODING IS THAT THE UNITS DIGIT OF THE CORRECTION IS ADDED SEPARATELY FROM THE TENS DIGIT AND THE TENS DIGIT IS ADDED SEPARATELY FROM THE HUNDREDS DIGIT. NUMBERS WILL NOT CARRY FROM ONE COLUMN TO THE NEXT AS IN SIMPLE ADDITION. THEREFORE, CHOOSE THE SWITCHES FIRST FOR THE UNITS DIGIT DESIRED, THEN CHOOSE SWITCHES FOR THE TENS DIGIT ETC., IF SWITCHES ARE OPENED THAT CAUSE THE UNITS DIGIT TO EXCEED NINE, AN ERROR IS INTRODUCED.

ed by opening the switches for the desired values that add up to the total correction. See chapter 5.

SWITCH	CORRECTION DEGREES	DEGREES SETTING	SELECTED
U8-1	200	Closed	---
U8-2	100	Open	100
U8-3	80	Closed	---
U8-4	40	Open	040
U8-5	20	Open	020
U8-6	10	Open	010
U8-7	8	Closed	---
U8-8	4	Open	004
U9-1	2	Open	002
U9-2	1	Closed	---
	TOTAL		176

2-28. MISCELLANEOUS. If maintenance on the antenna is required, lower antenna, remove windsail and set boom on blocks to prevent damage to square fiberglass element mounts. Attach side tag lines for stability. The boom may now be climbed.

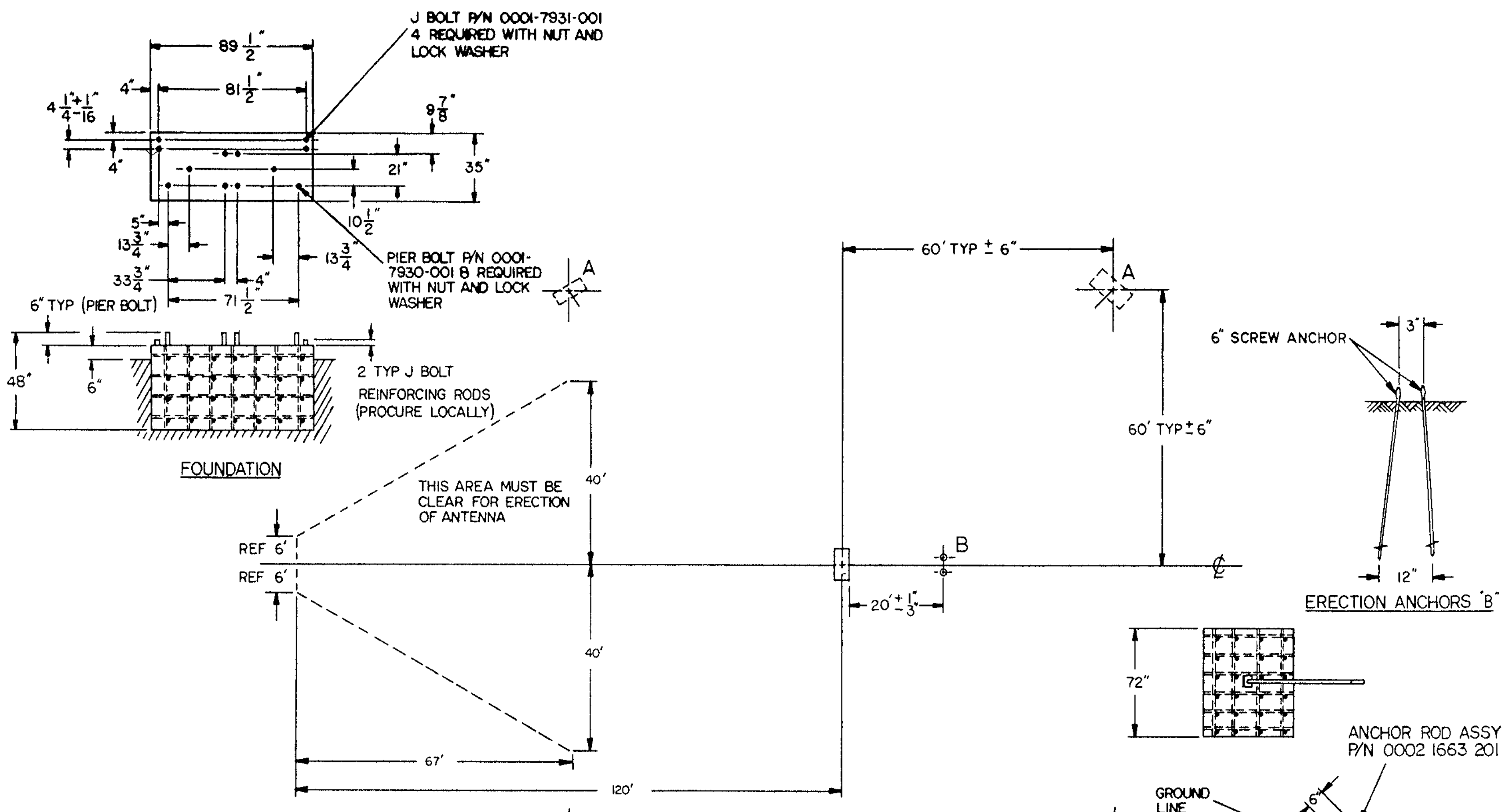
2-29. OBSTRUCTION LIGHTING (OPTIONAL). Refer to figure 2-24 for obstruction lighting (optional) installation instructions and schematic diagram.

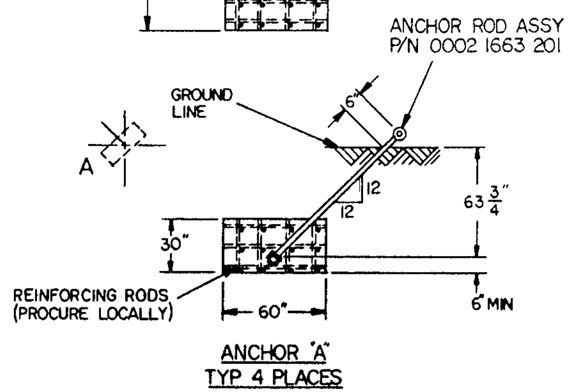
a. Assemble the lighting kit as shown, with the double obstruction light positioned above the twin tower so that the light will be visible from all directions. Attach the conduit or exposed wire to the tower with the wraplock tape provided. The photocell should face the north sky so that no direct sunlight is permitted to reach the face of the photocell. Also, artifical illumination of more than a few foot-candles must be avoided in order to prevent undesired turn-off operation.

b. Each unit is factory adjusted to turn the tower lights on at approximately 35 foot-candles and off at approximatley 58 foot-candles.

c. Apply power to the unit as shown in figure 2-24. Cover the photocell window with your hand or a dark object. The tower lights should come on. When the covering is removed, the lights should go off after a few seconds delay.

This completes the installation of the LPH-72A antenna system.

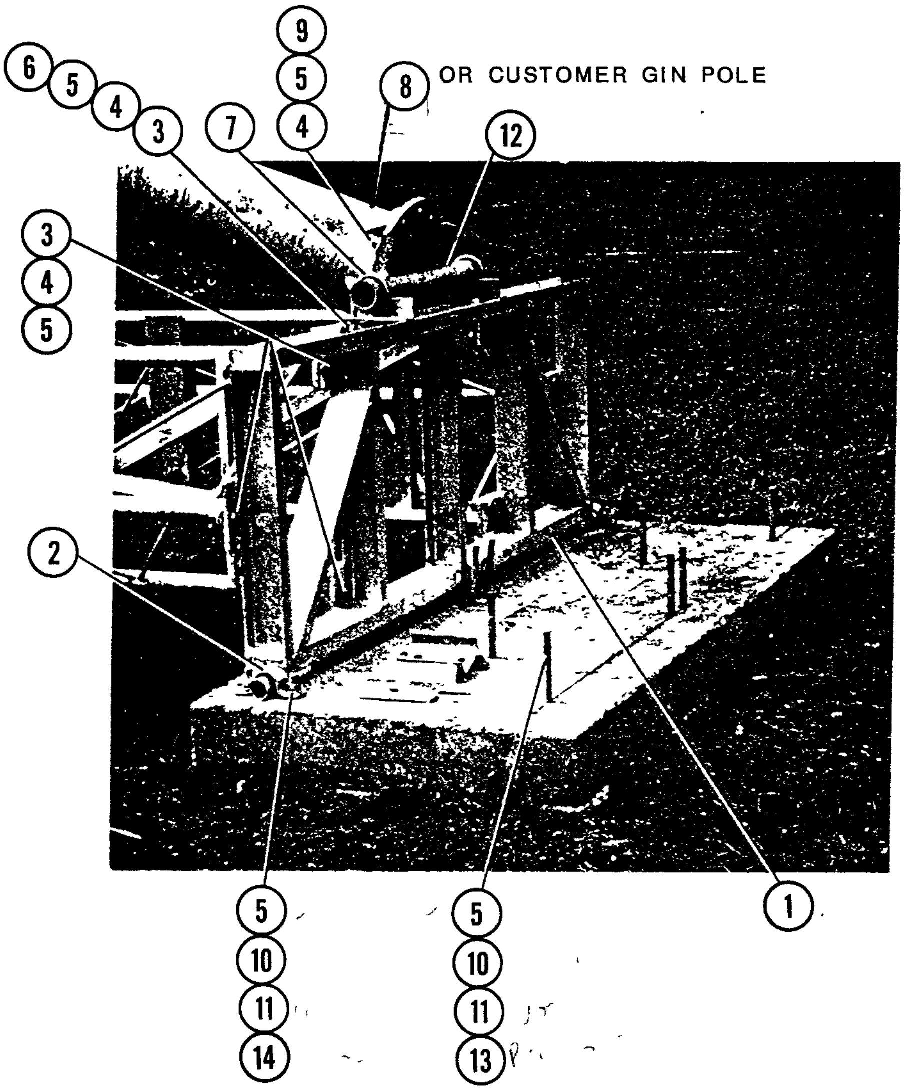




NOTES:

1. OVERALL DIMENSIONS OF ERECTED ANTENNA 122' X 122'.
2. CONCRETE TO BE 1:2:4 MIX (CEMENT:SAND:GRAVEL) 14.4 CUBIC YARDS REQUIRED.
3. FOUNDATION AND ANCHORS DESIGNED FOR AVERAGE (2000 PSF) SOIL (FIRM CLAY, COMPACT SAND).
4. REINFORCING RODS ARE RECOMMENDED TO BE USED IN CONCRETE PIER AND ANCHORS. RODS SHOULD HAVE A MINIMUM DIAMETER OF 1/2 WITH MAXIMUM SPACING OF 12".
5. OVERALL CONCRETE DIMENSIONS ARE MINIMUM.
6. ALL TOLERANCE TO BE ± 1/8" UNLESS OTHERWISE SPECIFIED.
7. ANCHOR "B" NEEDED ONLY FOR FALLING BOOM METHOD OF ERECTION WHERE CRANE IS NOT AVAILABLE.

FIGURE 2-1. PIER AND ANCHOR LAYOUT



Item No.	Part Number	Description	Qty
1	0001-7934-002	Base Assembly, Hinged	1
2	0001-7933-001	Clamp, Base Hinge	2
3	2076-4374-001	Bolt, HxHd, 3/4-10 x 2 3/4 Galv	18
4	2100-0878-001	Nut, Hex, 3/4-10 Galv	18
5	2300-0159-001	Washer, Splitlock, 3/4 Galv	18
6	2349-0092-001	Washer, Square, Beveled, 3/4 Galv	4
7	2450-0191-001	U-Bolts w/Nuts	2
8	0001-3978-001	Mast Section, Intermediate	1
9	2076-4372-001	Bolt, HxHd, 3/4-10 x 2 1/4 Galv	4
10	2310-0153-001	Washer, Flat, 3/4 Galv	12
11	2100-0133-001	Nut, Hex, 3/4-10 Galv	12
12	0001-4168-002	Erection Mount	1
13	0001-7930-001	Pier Bolt	8
14	0001-7931-001	J-Bolt	4

FIGURE 2-2. BASE AND GIN POLE INSTALLATION

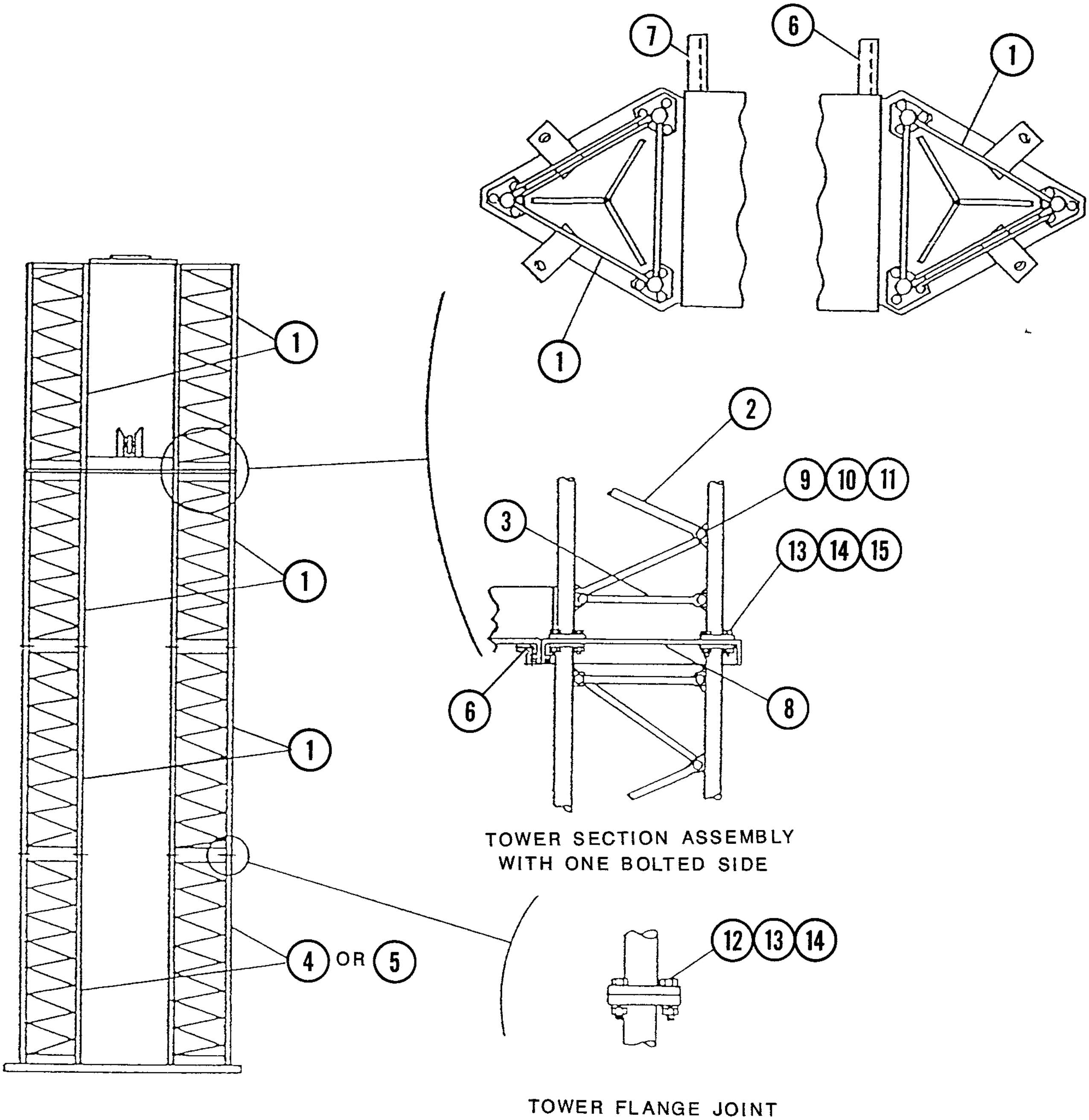
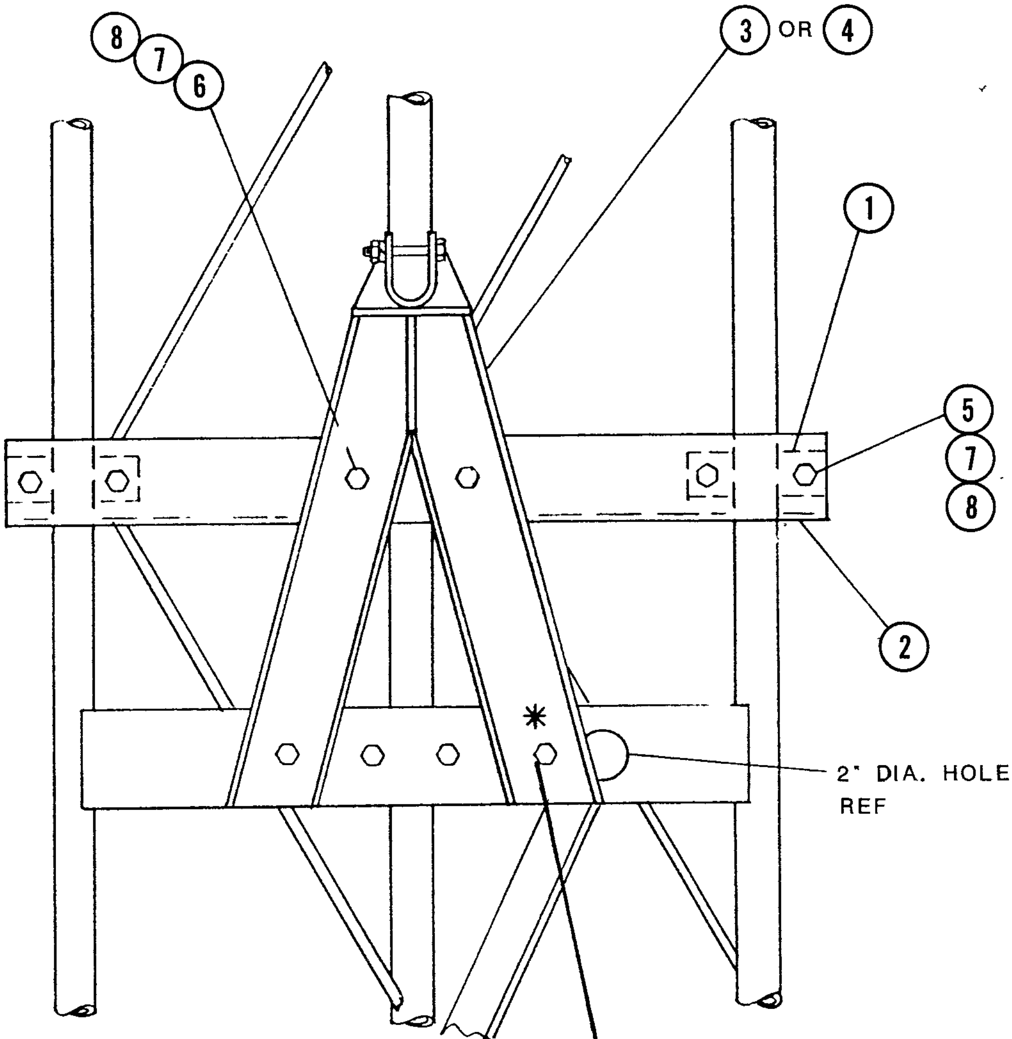


FIGURE 2-3. TOWER ASSEMBLY (SHT 1 OF 2)

Item No.	Part Number	Description	Qty
1	0001-7920-001	Tower Section, Intermediate	6
2	0001-7922-001	Brace, Diagonal	84
3	0001-7921-001	Brace, Horizontal	12
4	0001-7898-001	Tower Section, Bottom LH	1
5	0001-7997-001	Tower Section, Bottom RH	1
6	0002-8866-301	Erection Bracket	2
7	0002-8866-302	Erection Bracket	2
8	0002-1604-407	Intermediate Guy Plate Assembly RH	1
*(1) 9	2077-6810-001	Bolt, HxHd, 3/8-16 x 1 1/2 Galv	102
*(1) 10	2100-0123-001	Nut, Hex, 3/8-16 Galv	102
*(1) 11	2300-0153-001	Washer, Splitlock, 3/8 Galv	102
*(2) 12	2076-4316-001	Bolt, HxHd, 1/2-13 x 1 1/2 Galv HS	54
*(2) 13	2100-0876-001	Nut, Hex, 1/2-13 Galv HS	72
*(2) 14	2300-0155-001	Washer, Splitlock, 1/2 Galv	72
*(2) 15	2076-4320-001	Bolt, HxHd, 1/2-13 x 2 Galv HS	18

*NOTES:
(1) These items packed as part of Tower Section Hardware Items P/N 0002-4677-201.
(2) These items packed as part of Tower Hardware Items P/N 0002-4729-201.

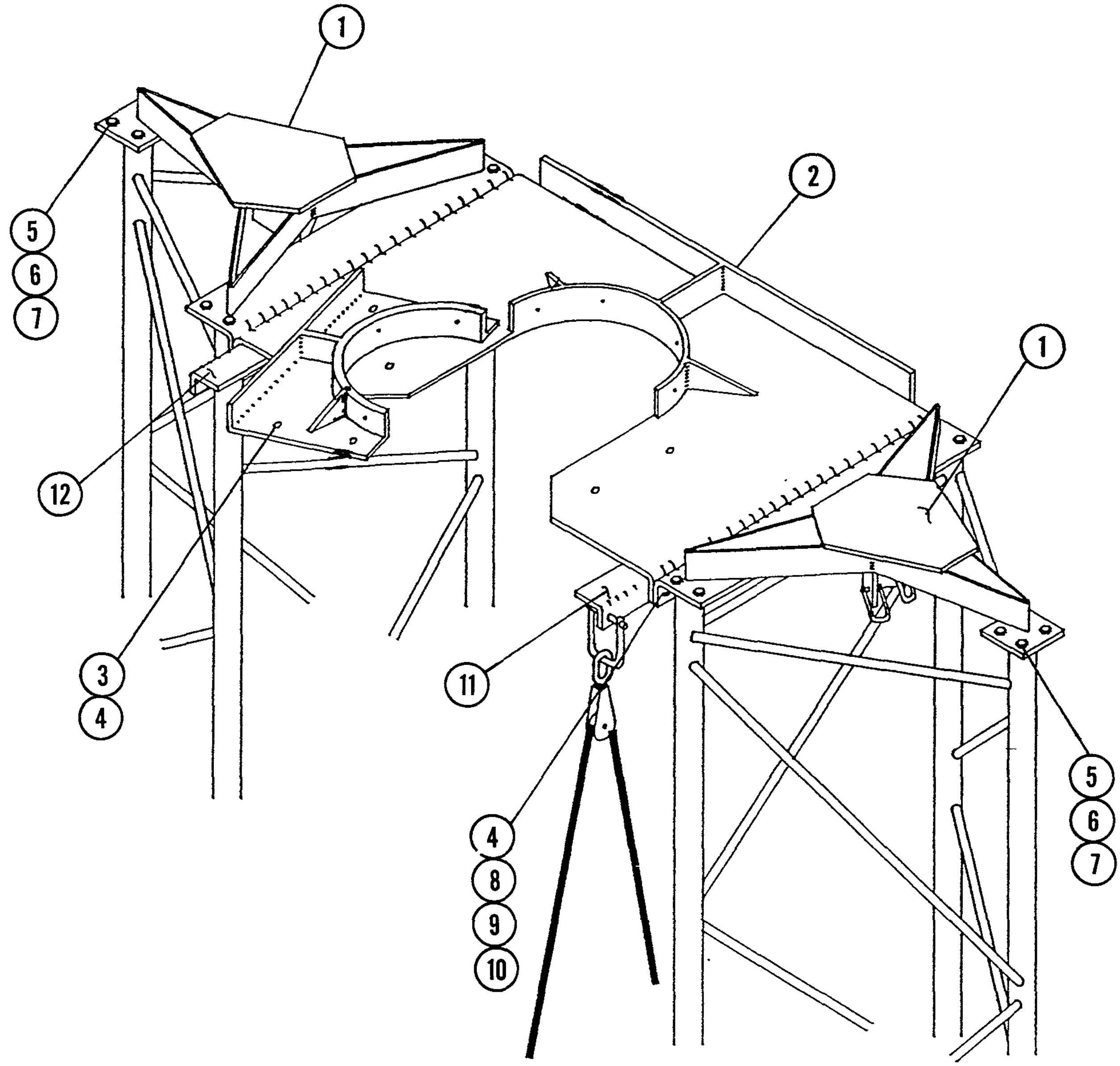
FIGURE 2-3. TOWER ASSEMBLY (SHT 2 OF 2)



Item No.	Part Number	Description	Qty
1	0002-1625-301	Clamping Bracket, Support Angle	4
2	0002-1624-301	Bearing Bracket, Support Angle	2
3	0002-1623-401	Bearing Bracket, Pedestal LH	1
4	0002-1623-402	Bearing Bracket, Pedestal RH	1
*(1) 5	2076-4341-001	Bolt, HxHd, 5/8-11 x 1 3/4 Galv HS	8
*(1) 6	2076-4344-001	Bolt, HxHd, 5/8-11 x 2 1/2 Galv HS	12
*(1) 7	2100-0877-001	Nut, Hex, 5/8-11 Galv HS	20
*(1) 8	2300-0157-001	Washer, Splitlock, 5/8 Galv	20

*NOTES:
(1) These items are packed as part of Tower Hardware Items P/N 0002-4729-201.

FIGURE 2-4. PEDESTAL BEARING BRACKET INSTALLATION



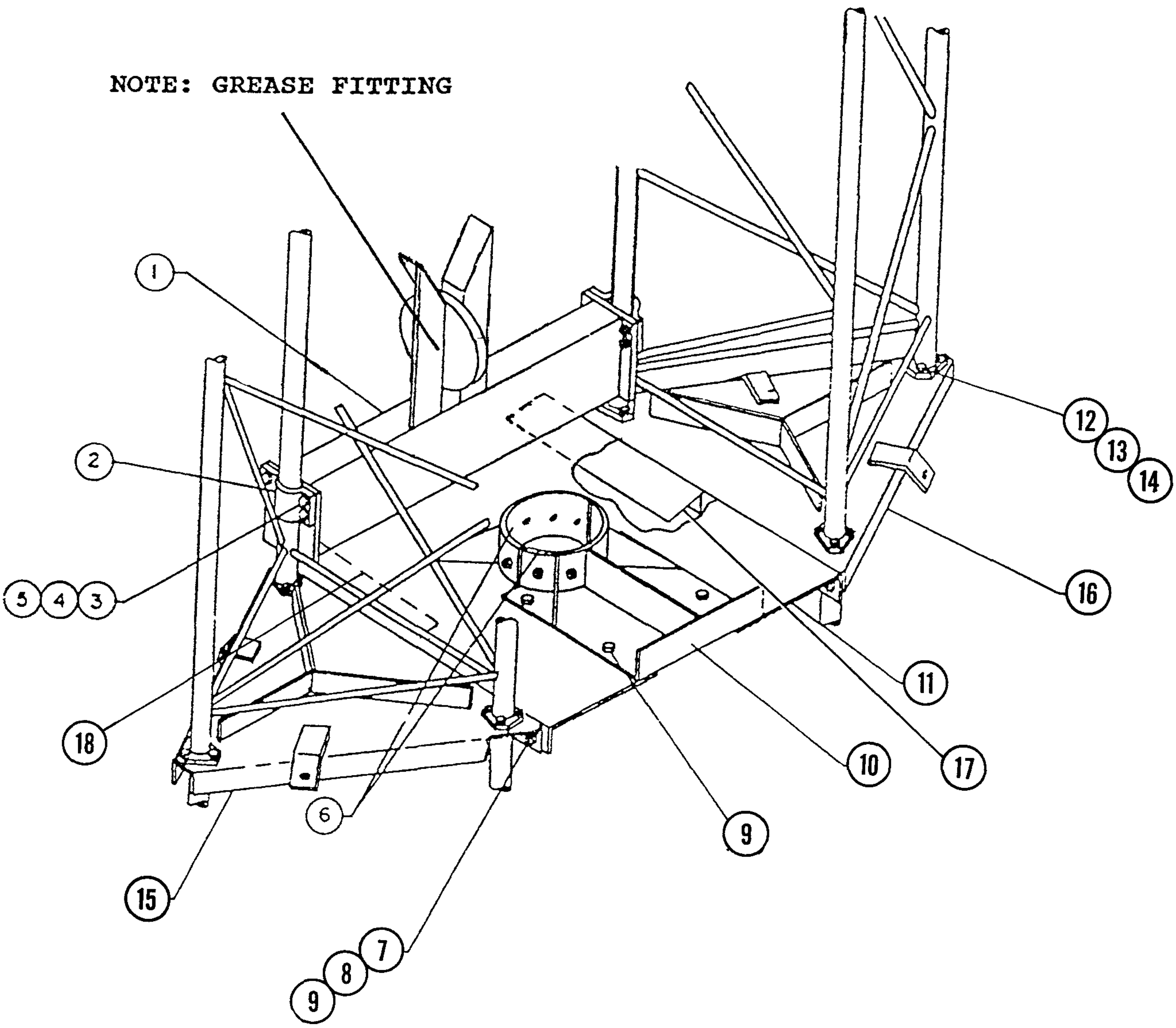
NOTE: Part numbers 0001-7926-001, 0001-4250-001, 0001-4259-001, and associated hardware are factory assembled and shipped as an unit under part number 0001-7946-001.

FIGURE 2-5. TOP TOWER INSTALLATION (SHT 1 OF 2)

Item No.	Part Number	Description	Qty
1	0001-7913-001	Guy Bracket	2
2	0001-7926-001	Bearing Plate Assembly	1
3	0001-4250-001	Outer Welded Assembly	1
*(1) 4	2300-0157-001	Washer, Splitlock, 5/8 Galv	8
*(1) 5	2076-4316-001	Bolt, HxHd, 1/2-13 x 1 1/2 Galv	18
*(1) 6	2100-0876-001	Nut, Hex, 1/2-13 Galv	18
*(1) 7	2300-0155-001	Washer, Splitlock, 1/2 Galv	18
*(1) 8	2076-4341-001	Bolt, HxHd, 5/8-11 x 1 3/4 Galv	8
*(1) 9	2100-0877-001	Nut, Hex, 5/8-11 Galv	8
*(1) 10	2076-4344-001	Bolt, HxHd, 5/8-11 x 2 1/2 Galv	4
11	0002-8866-301	Erection Bracket	1
12	0002-8866-302	Erection Bracket	1

*NOTES:
(1) These items are packed as part of Tower Hardware Items P/N 0002-4729-201.

FIGURE 2-5. TOP TOWER INSTALLATION (SHT 2 OF 2)



NOTE: Part numbers 0001-7926-001, 0001-4250-001, 0001-4259-001, and associated hardware are factory assembled and shipped as an unit under part number 0001-7946-001.

FIGURE 2-6. MIDDLE BEARING ASSEMBLY (SHT 1 OF 2)

Item No.	Part Number	Description	Qty
1	0002-1616-301	Pulley Bracket Assembly	1
2	0002-1608-201	Clamp	2
*(1) 3	2077-6453-005	Bolt, HxHd, 3/8-16 x 1 1/2 Galv	8
*(1) 4	2300-0153-001	Washer, Splitlock, 3/8 Galv	8
*(1) 5	2100-0123-001	Nut, Hex, 3/8-16 Galv	8
6	0001-4259-001	Bearing Half, Mast Top	2
*(2) 7	2076-4341-001	Bolt, HxHd, 5/8-11 x 1 3/4 Galv HS	4
*(2) 8	2100-0877-001	Nut, Hex, 5/8-11 Galv HS	8
*(2) 9	2300-0157-001	Washer, Splitlock, 5/8 Galv	8
10	0001-4250-001	Outer Welded Assembly	1
11	0001-7926-001	Bearing Plate Assembly	1
*(2) 12	2076-4320-001	Bolt, HxHd, 1/2-13 x 2 Galv	18
*(2) 13	2100-0876-001	Nut, Hex, 1/2-13 Galv	18
*(2) 14	2300-0155-001	Washer, Splitlock, 1/2 Galv	18
15	0002-1604-401	Intermediate Guy Plate Assembly, LH	1
16	0002-1604-407	Intermediate Guy Plate Assembly, RH	1
17	0002-8866-301	Erection Bracket	1
18	0002-8866-302	Erection Bracket	1
*(2) 19	2076-4344-001	Bolt, HxHd, 5/8-11 x 2 1/2 Galv HS	4

*NOTES:
(1) These items packed as part of Erection Hardware P/N 0002-4695-201.
(2) These items packed as part of Tower Hardware Items P/N 0002-4729-201.

FIGURE 2-6. MIDDLE BEARING ASSEMBLY (SHT 2 OF 2)

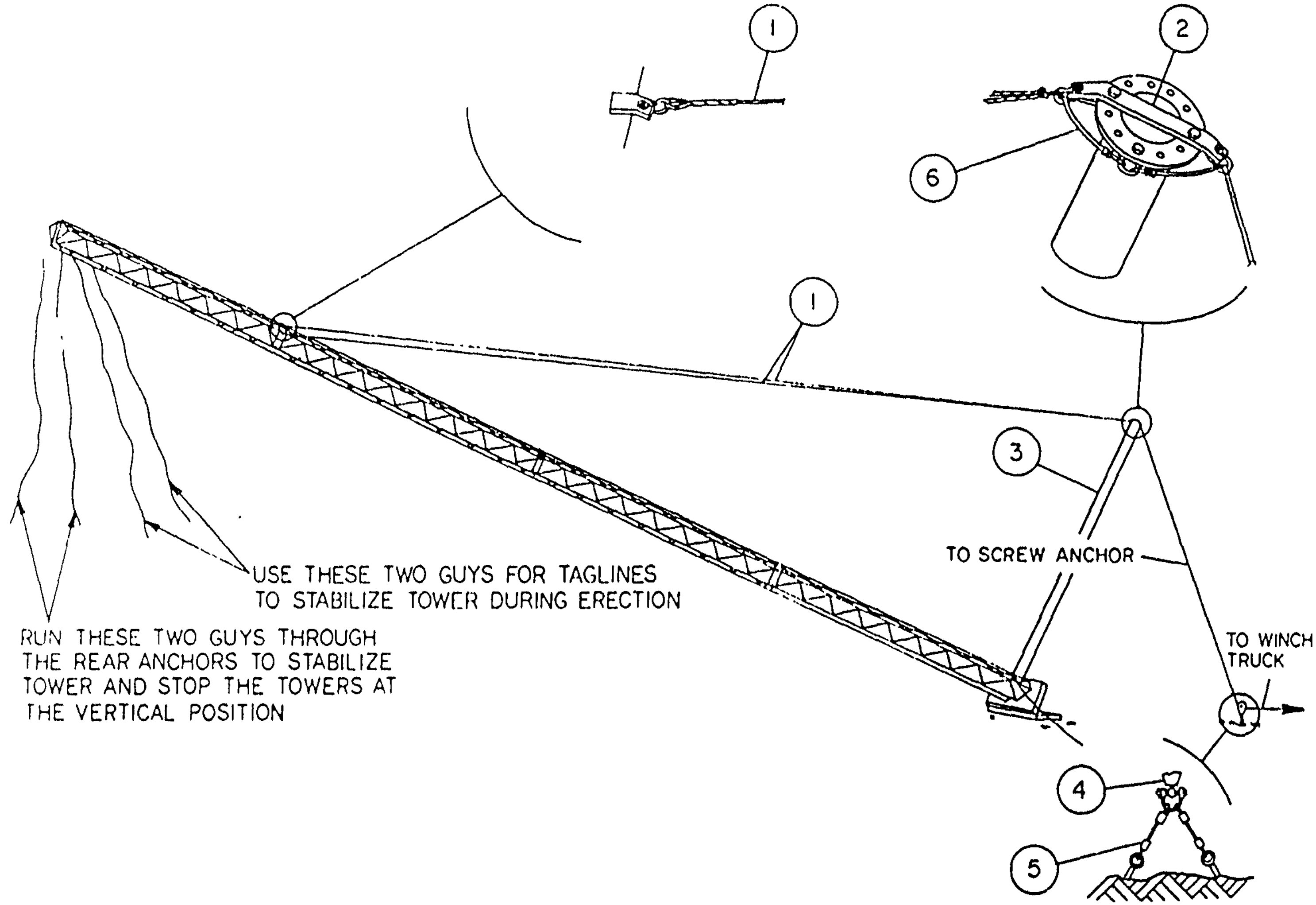
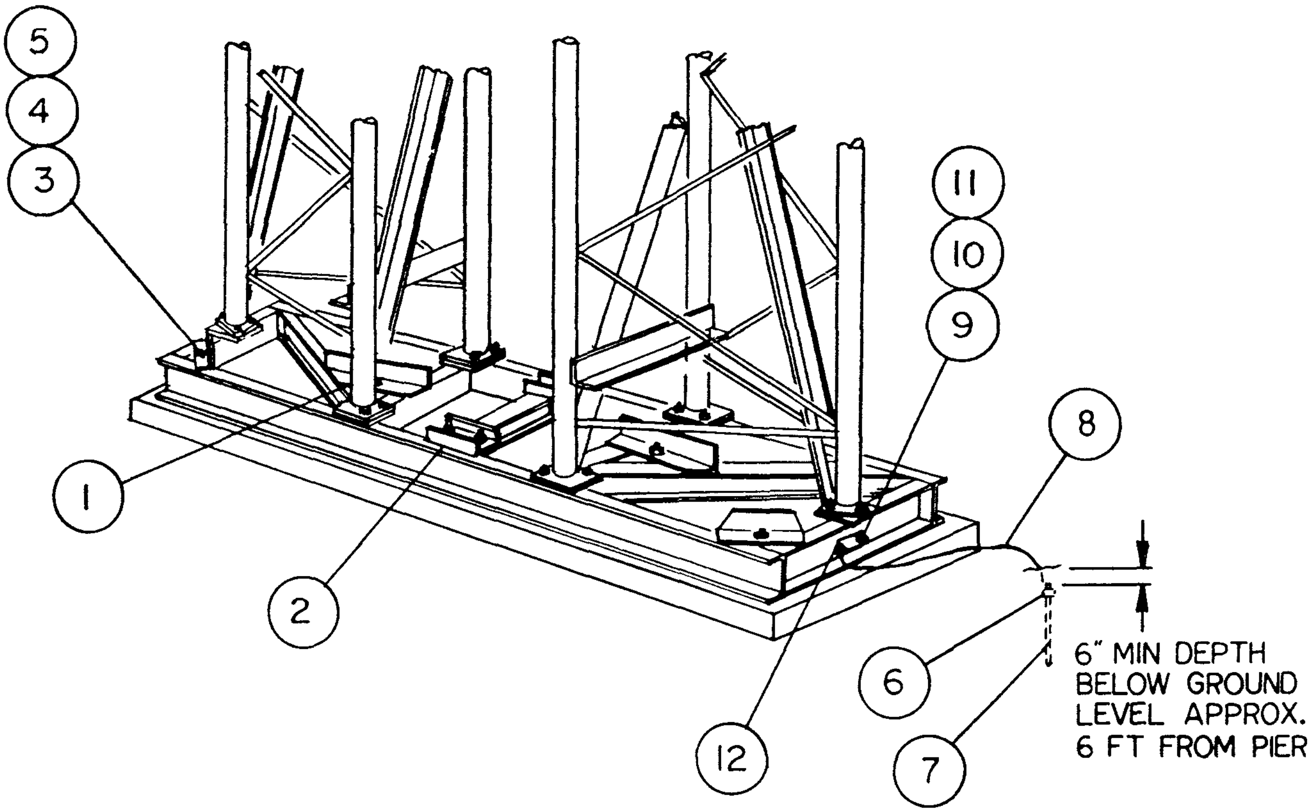


FIGURE 2-7. TOWER ERECTION (SHT 1 OF 2)

Item No.	Part Number	Description	Qty
1	0001-8166-001	Sling, Lifting	1
2	0001-4240-001	Strap, Lifting	1
3	0001-3978-001	Mast Section, Intermediate	1
4	2450-0271-001	Snatch Block	1
5	0002-1717-201	Screw Anchor Assembly	2
6	0002-1714-202	Cable, Safety	1

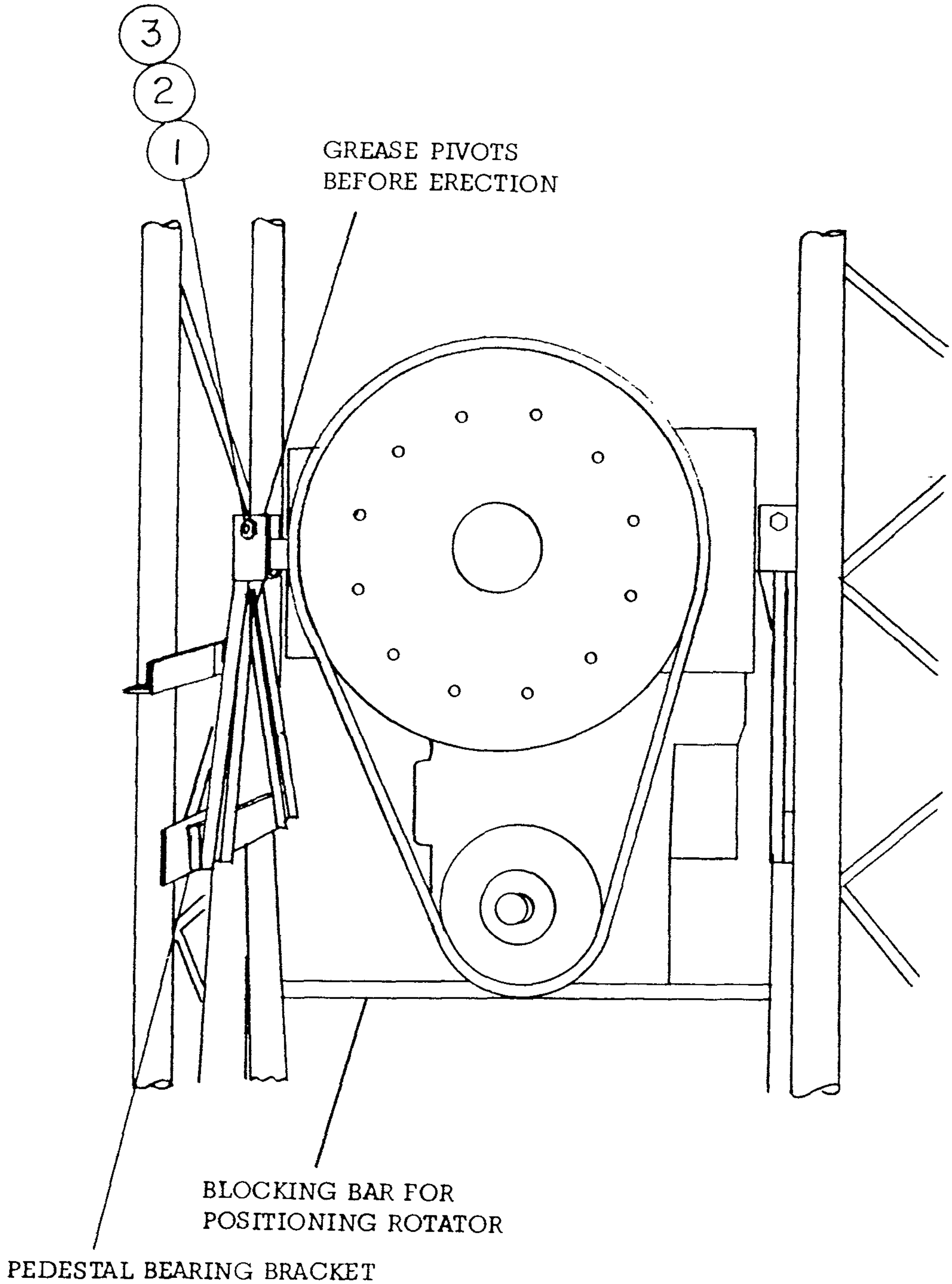
FIGURE 2-7. TOWER ERECTION (SHT 2 OF 2)



Item No.	Part Number	Description	Qty
1	0001-7935-001	Angle, Tie Down	4
2	0001-7945-001	Channel, Tie Down	2
*(1) 3	2300-0159-001	Washer, Spliltock, 3/4 Galv	12
*(1) 4	2310-0153-001	Washer, Flat, 3/4 Galv	12
*(1) 5	2100-0133-001	Nut, Hex, 3/4-10 Galv	12
*(2) 6	8900-0250-001	Clamp, Ground Rod	1
7	8900-0298-001	Ground Rod	1
8	0001-5755-001	Ground Wire	1
*(2) 9	2009-2861-001	Screw, HxHd, 1/4-20 x 1 SST	1
*(2) 10	2300-0151-001	Washer, Splitlock, 1/4 Galv	1
*(2) 11	2100-0119-001	Nut, Hex, 1/4-20 Galv	1
*(2) 12	2450-2171-001	Connector, Cable	1

*NOTES:
(1) These items packed as part of Ground Hardware Items P/N 0002-4671-201.
(2) These items packed as part of Grounding Hardware Items P/N 0002-4672-201.

FIGURE 2-8. TOWER BASE TIE DOWN AND GROUNDING



Item No.	Part Number	Description	Qty
*(1) 1	2077-7323-001	Bolt, HxHd, 1/2-13 x 3 1/2 Galv	2
*(1) 2	2100-0127-001	Nut, Hex, 1/2-13 Galv	2
*(1) 3	2300-0155-001	Washer, Splitlock, 1/2 Galv	2

*NOTES:
(1) These items packed as part of Tower Hardware Items P/N 0002-4681-201.

FIGURE 2-9. TYPICAL PEDESTAL INSTALLATION

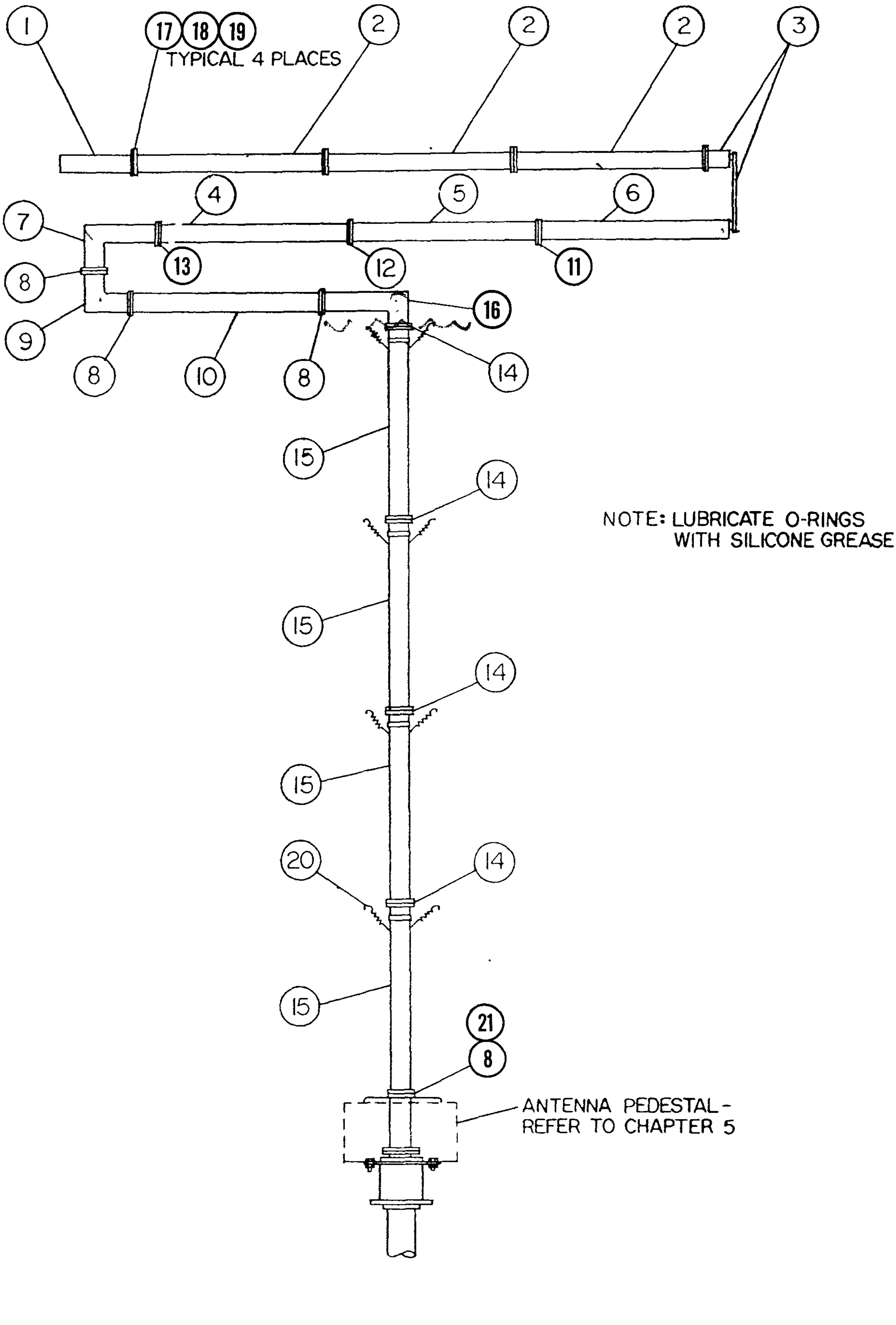
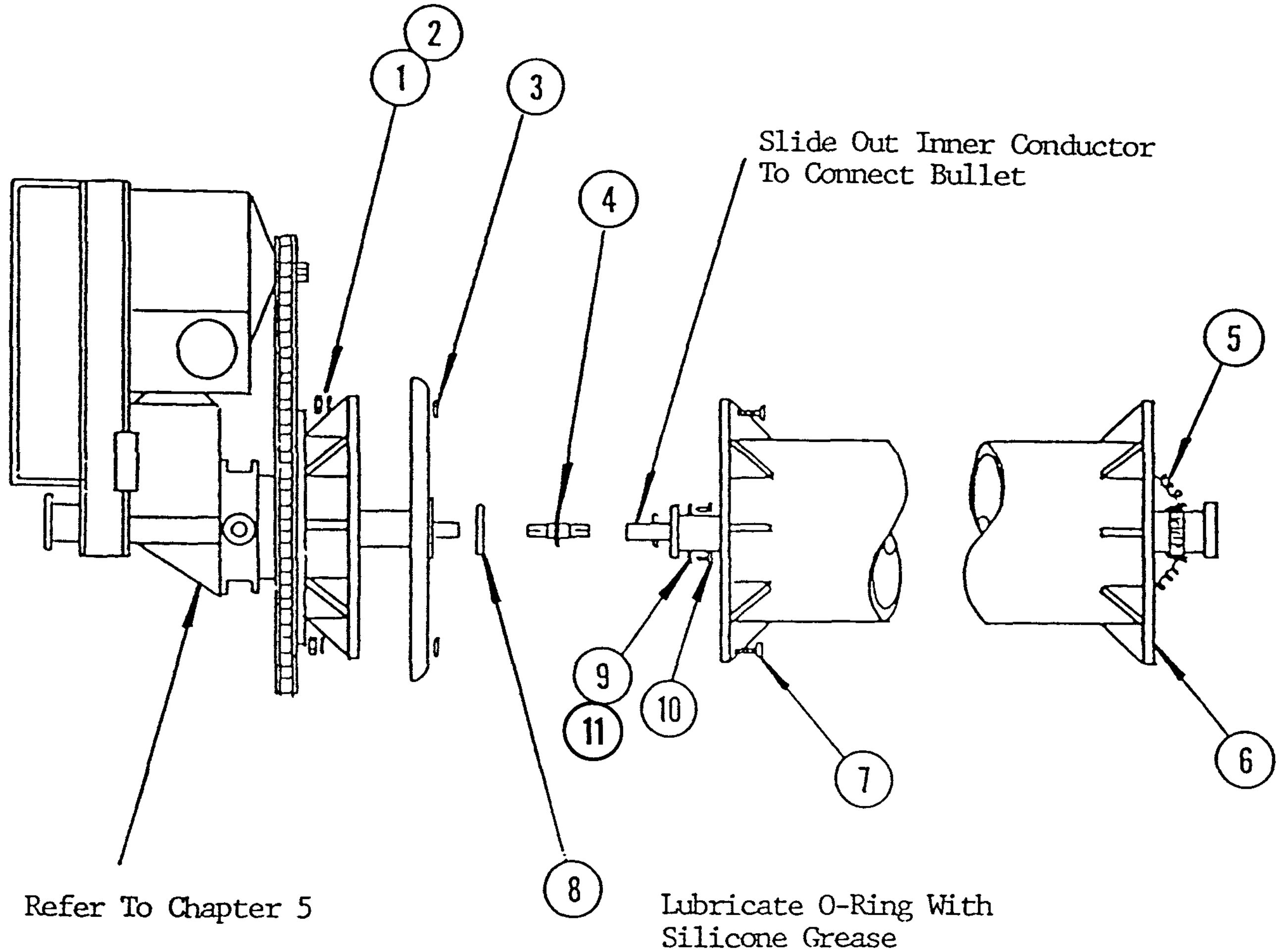


FIGURE 2-10. TRANSMISSION AND FEEDLINE INSTALLATION (SHT 1 OF 2)

Item No.	Part Number	Description	Qty
1	0001-4260-001	Feedline Assembly, 20'	1
2	0001-4084-001	Feedline Assembly, 20'	3
3	0001-4111-001	Section Assembly, Feedline, Short	1
4	0001-4099-001	Transformer Assembly Section #3	1
5	0001-4098-001	Transformer Assembly Section #2	1
6	0001-4097-001	Transformer Assembly Section #1	1
7	0001-4100-001	Elbow, Transformer Line	1
8	0001-4007-001	Transmission Line Hardware Items	4
9	0001-4045-001	Elbow, Transmission Line	1
10	1000-0185-001	Transmission Line, 1 5/8 Air Dielectric	1
11	0001-4104-001	Transformer Section #1 Hardware Kit	1
12	0001-4105-001	Transformer Section #2 Hardware Kit	1
13	0001-4106-001	Transformer Section #3 Hardware Kit	1
14	0001-4006-001	Transmission Line, Spring Loaded Hdw Items	3
15	1000-0184-001	Transmission Line, Spring Loaded	4
16	0001-4055-001	Adapter, Transmission Line	1
*(1) 17	2078-2608-001	Bolt, HxHd, 5/16-18 x 1 1/4 SST	16
*(1) 18	2100-0221-001	Nut, Hex, 5/16-18 SST	16
*(1) 19	2310-0910-001	Washer, Splitlock, 5/16 SST	16
20	2400-0005-001	Spring, Extension	16
21	3510-0017-001	O-Ring	1

NOTE:
*(1) These items are packed as part of Antenna Hardware Kit P/N 0002-0267-201.

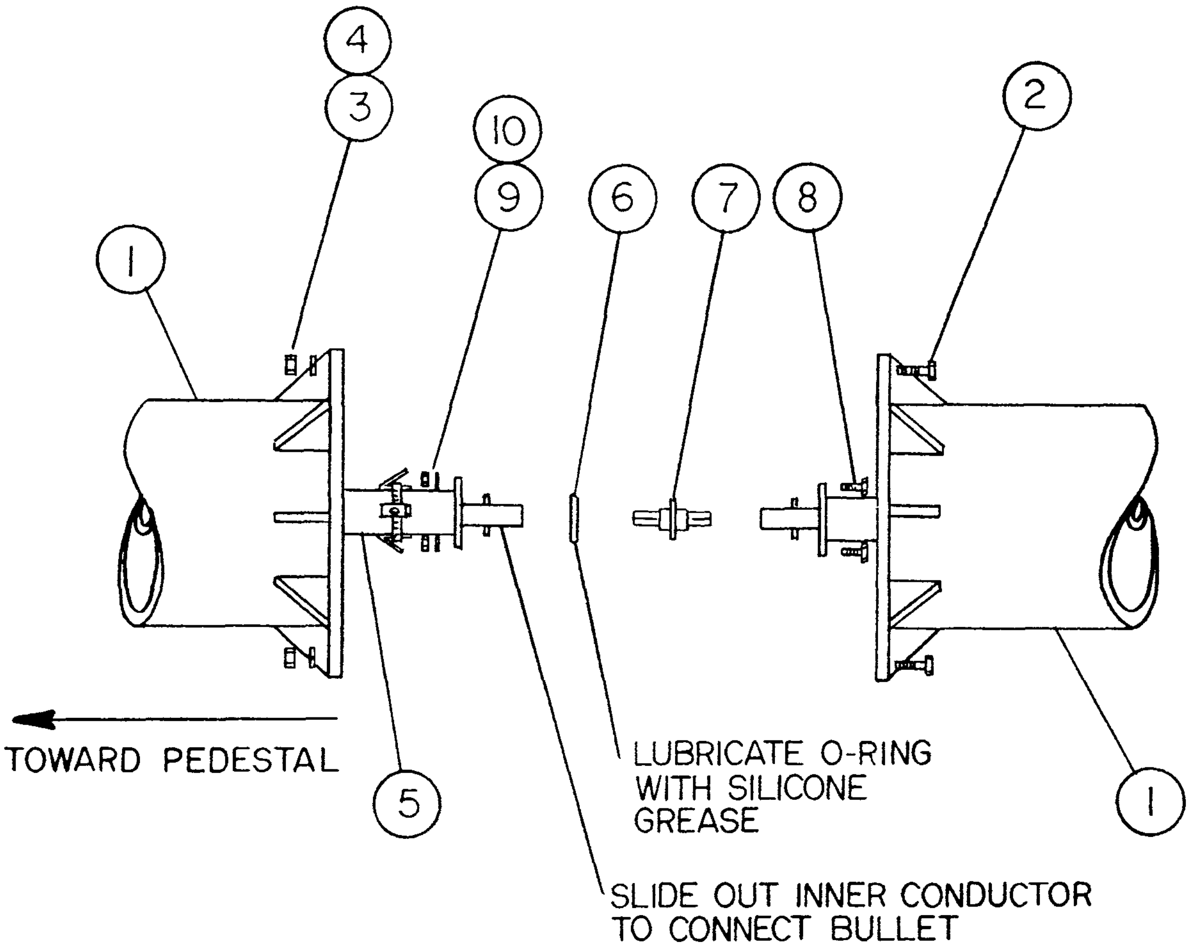
FIGURE 2-10. TRANSMISSION AND FEEDLINE INSTALLATION (SHT 2 OF 2)



Item No.	Part Number	Description	Qty
*(1) 1	2300-0157-001	Washer, Splitlock, 5/8 Galv	12
*(1) 2	2100-0131-001	Nut, Hex, 5/8-11 Galv	12
3	3530-0023-001	Threadseal	12
4	0001-3985-001	Bullet Assembly, Transmission Line	1
5	2400-0005-001	Spring, Extension	4
6	0001-3978-001	Mast Section, Intermediate	1
7	2077-7909-001	Bolt, HxHd, 5/8-11 x 2 Galv	12
8	3510-0017-001	O-Ring	1
*(2) 9	2300-0910-001	Washer, Splitlock, 5/16 SST	4
*(2) 10	2078-2608-001	Bolt, HxHd, 5/16-18 x 1 1/4 SST	4
*(2) 11	2100-0221-001	Nut, Hex, 5/16-18 SST	4

*NOTES:
(1) These items are packed as part of Interface Hardware Items, Mast to Rotator P/N 0002-4812-201.
(2) These items are packed as part of Transmission Line, Spring Loaded Hardware Items P/N 0001-4006-201.

FIGURE 2-11. MAST TO PEDESTAL INSTALLATION



Item No.	Part Number	Description	Qty
1	0001-3978-001	Mast Section, Intermediate	2
*(1) 2	2077-7909-001	Bolt, HxHd, 5/8-11 x 2 Galv	36
*(1) 3	2100-0131-001	Nut, Hex, 5/8-11 Galv	36
*(1) 4	2300-0157-001	Washer, Splitlock, 5/8 Galv	36
5	1000-0184-001	Transmission Line, Spring Loaded, 20'	2
6	3510-0017-001	O-Ring	1
7	0001-3985-001	Bullet Assembly	1
*(2) 8	2078-2608-001	Bolt, HxHd, 5/16-18 x 1 1/4 SST	4
*(2) 9	2100-0221-001	Nut, Hex, 5/16-18 SST	4
*(2) 10	2300-0910-001	Washer, Splitlock, 5/16 SST	4

*NOTES:
(1) These items packed as part of Mast Hardware Items P/N 0002-4796-201.
(2) These items packed as part of Transmission Line Spring Loaded Hardware Items P/N 0001-4006-001.

FIGURE 2-12. MAST TO MAST INSTALLATION

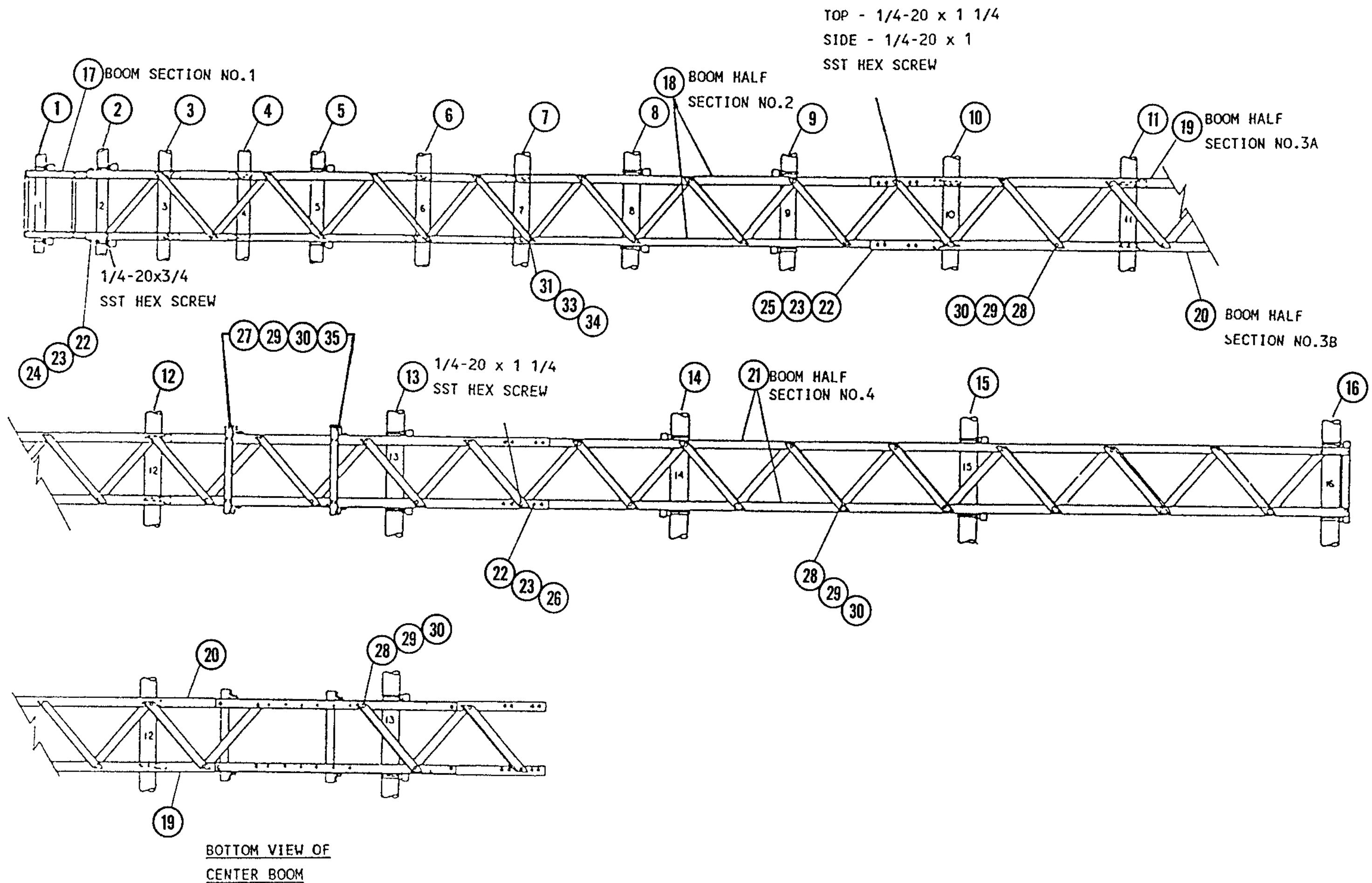
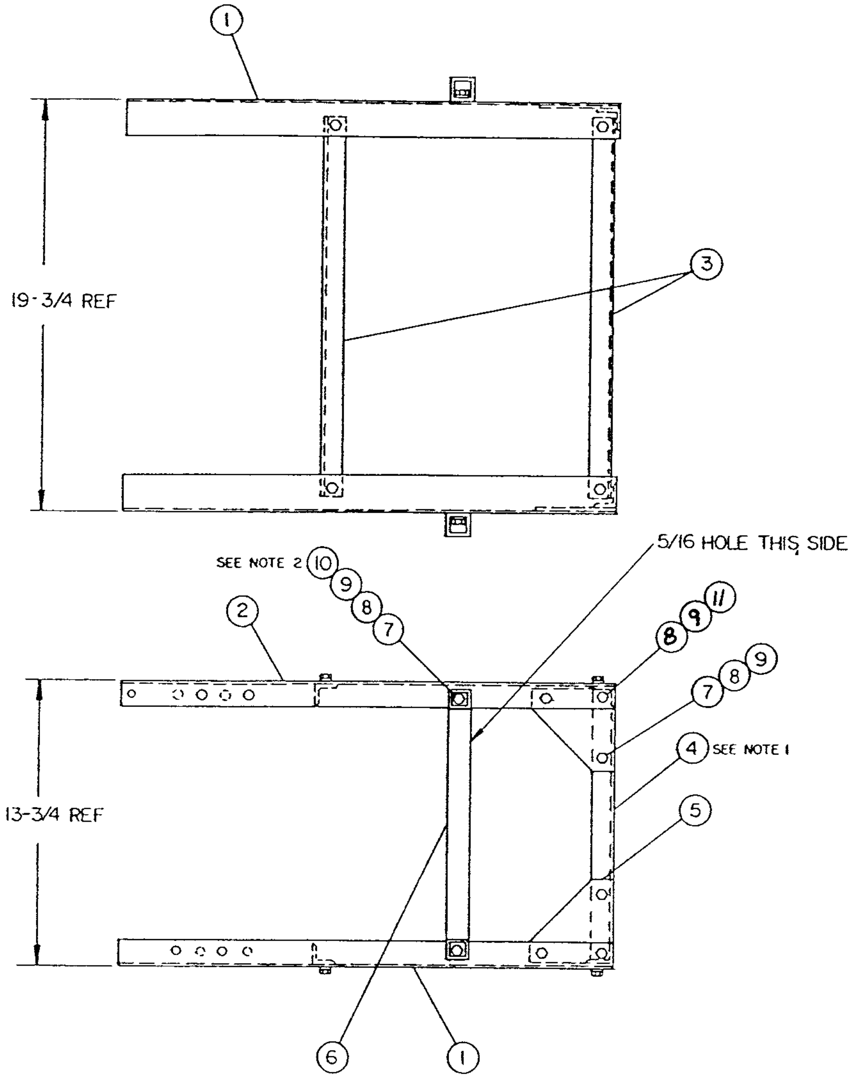


FIGURE 2-13. BOOM ASSEMBLY, TOP VIEW (SHT 1 OF 2)

Item No.	Part Number	Description	Qty
1	0001-4127-001	Element Assembly #1	1
2	0001-4128-001	Element Assembly #2	1
3	0001-4129-001	Element Assembly #3	1
4	0001-4130-001	Element Assembly #4	1
5	0001-4131-001	Element Assembly #5	1
6	0001-4132-001	Element Assembly #6	1
7	0001-4158-001	Center Section, Element #7	1
8	0001-4162-001	Center Section, Element #8	1
9	0001-4164-001	Center Section, Element #9	1
10	0001-4165-001	Center Section, Element #10	1
11	0001-4161-001	Center Section, Element #11	1
12	0001-4160-001	Center Section, Element #12	1
13	0001-4159-001	Center Section, Element #13	1
14	0001-4157-001	Center Section, Element #14	1
15	0001-4149-001	Center Section, Element #15	1
16	0001-4155-001	Center Section, Element #16	1
17	0001-3992-001	Boom Assembly #1	1
18	0001-3994-001	Boom Assembly, Half Section #2	2
19	0001-3995-001	Boom Assembly, Half Section #3A	1
20	0001-4203-001	Boom Assembly, Half Section #3B	1
21	0001-3996-001	Boom Assembly, Half Section #4	2
*(1) 22	2100-0123-001	Nut, Hex, 3/8-16 Galv	72
*(1) 23	2300-0153-001	Washer, Splitlock, 3/8 Galv	72
*(1) 24	2077-6805-001	Bolt, HxHd, 3/8-16 x 7/8 Galv	8
*(1) 25	2077-6806-001	Bolt, HxHd, 3/8-16 x 1 Galv	32
*(1) 26	2077-6808-001	Bolt, HxHd, 3/8-16 x 1 1/4 Galv	32
*(1) 27	2009-9160-001	Screw, HxHd, 5/16-18 x 1 SST	8
*(1) 28	2009-9164-001	Screw, HxHd, 5/16-18 x 1 1/4 SST	38
*(1) 29	2100-0221-001	Nut, Hex, 5/16-18 SST	48
*(1) 30	2300-0910-001	Washer, Splitlock, 5/16 SST	48
*(1) 31	2009-8858-001	Screw, HxHd, 1/4-20 x 3/4 SST	16
*(1) 32	2009-8860-001	Screw, HxHd, 1/4-20 x 7/8 SST	8
*(1) 33	2100-0219-001	Nut, Hex, 1/4-20 SST	24
*(1) 34	2300-0909-001	Washer, Splitlock, 1/4 SST	24
35	0001-4156-001	Brace, Horizontal, Centroid	2

*NOTES:
(1) These items packed as part of Antenna Hardware Items P/N 0002-0267-201.

FIGURE 2-13. BOOM ASSEMBLY, TOP VIEW (SHT 2 OF 2)



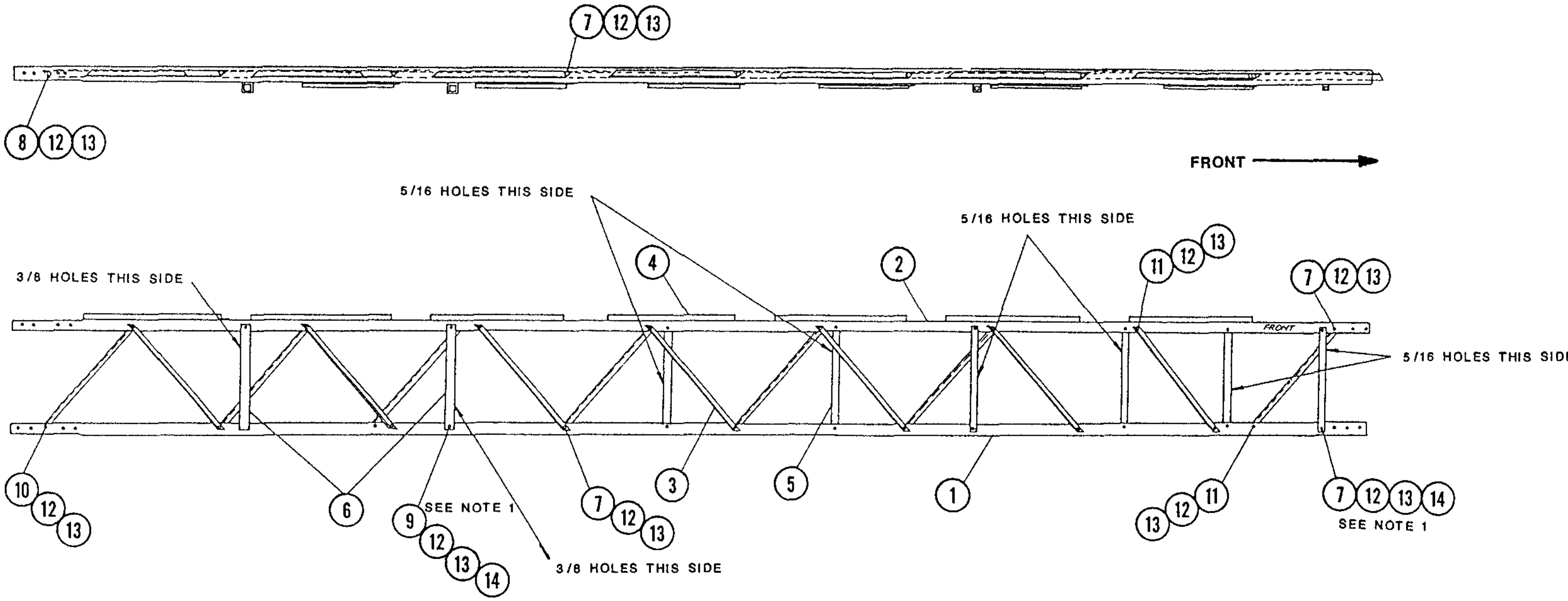
2. INSTALL FLAT WASHERS, ITEM 10, UNDER HEAD OF HEX SCREW, ITEM 7, TYP 4 PLACES.
1. INSTALL VERTICAL BRACE #2, ITEM 4, PRIOR TO INSTALLING HORIZONTAL BRACE #2, ITEM 3.

NOTES:

Item No.	Part Number	Description	Qty
1	0001-3970-001	Leg "A", Section 1	2
2	0001-3971-001	Leg "B", Section 1	2
3	0001-3969-001	Brace, Horizontal, #2	4
4	0001-3968-001	Brace, Vertical, #2	2
5	0001-3991-001	Gusset	4
6	0001-6158-001	Tube, Element Mount, #1-7	2
*(1) 7	2009-8856-001	Screw, HxHd, 1/4-20 x 5/8 SST	20
*(1) 8	2009-8858-001	Screw, HxHd, 1/4-20 x 3/4 SST	4
*(1) 9	2100-0219-001	Nut, Hex, 1/4-20 SST	24
*(1) 10	2300-0909-001	Washer, Splitlock, 1/4 SST	24
*(1) 11	2310-0433-001	Washer, Flat, 1/4 SST	4

*NOTES:
(1) These items packed as part of Boom Hardware Section 1 Items P/N 0002-4857-201.

FIGURE 2-14. BOOM ASSEMBLY, SECTION NO. 1



NOTES:

1. PLACE FLAT WASHER, ITEM 14, UNDER THE NUT, ITEM 12, WHEN USED WITH INSIDE ELEMENT MOUNTS OR UNDER HEX HD SCREW, ITEM 7 OR 9, WHEN USED WITH OUTSIDE ELEMENT MOUNTS.

FIGURE 2-15. BOOM ASSEMBLY, HALF SECTION NO. 2 (SHT 1 OF 2)

Item No.	Part Number	Description	Qty
1	0001-3986-001	Leg "A", Section 2	1
2	0001-4147-001	Leg "B", Section 2	1
3	0001-3972-001	Brace, Vertical, #1	14
4	0001-3974-001	Brace, Horizontal, #1	15
5	0001-6158-001	Tube, Element Mount, #1-7	6
6	0001-6159-001	Tube, Element	2
*(1) 7	2009-8858-001	Screw, HxHd, 1/4-20 x 3/4 SST	29
*(1) 8	2009-8865-001	Screw, HxHd, 1/4-20 x 1 1/4 SST	1
*(1) 9	2009-8860-001	Screw, HxHd, 1/4-20 x 7/8 SST	4
*(1) 10	2009-8861-001	Screw, HxHd, 1/4-20 x 1 SST	1
*(1) 11	2009-8854-001	Screw, HxHd, 1/4-20 x 1/2 SST	8
*(1) 12	2100-0219-001	Nut, Hex, 1/4-20 SST	43
*(1) 13	2300-0909-001	Washer, Splitlock, 1/4 SST	43
*(1) 14	2310-0433-001	Washer, Flat, 1/4 SST	16

*NOTES:
(1) These items packed as part of Boom Hardware, Half Section #2 P/N 0002-4859-201.

FIGURE 2-15. BOOM ASSEMBLY, HALF SECTION NO. 2 (SHT 2 OF 2)

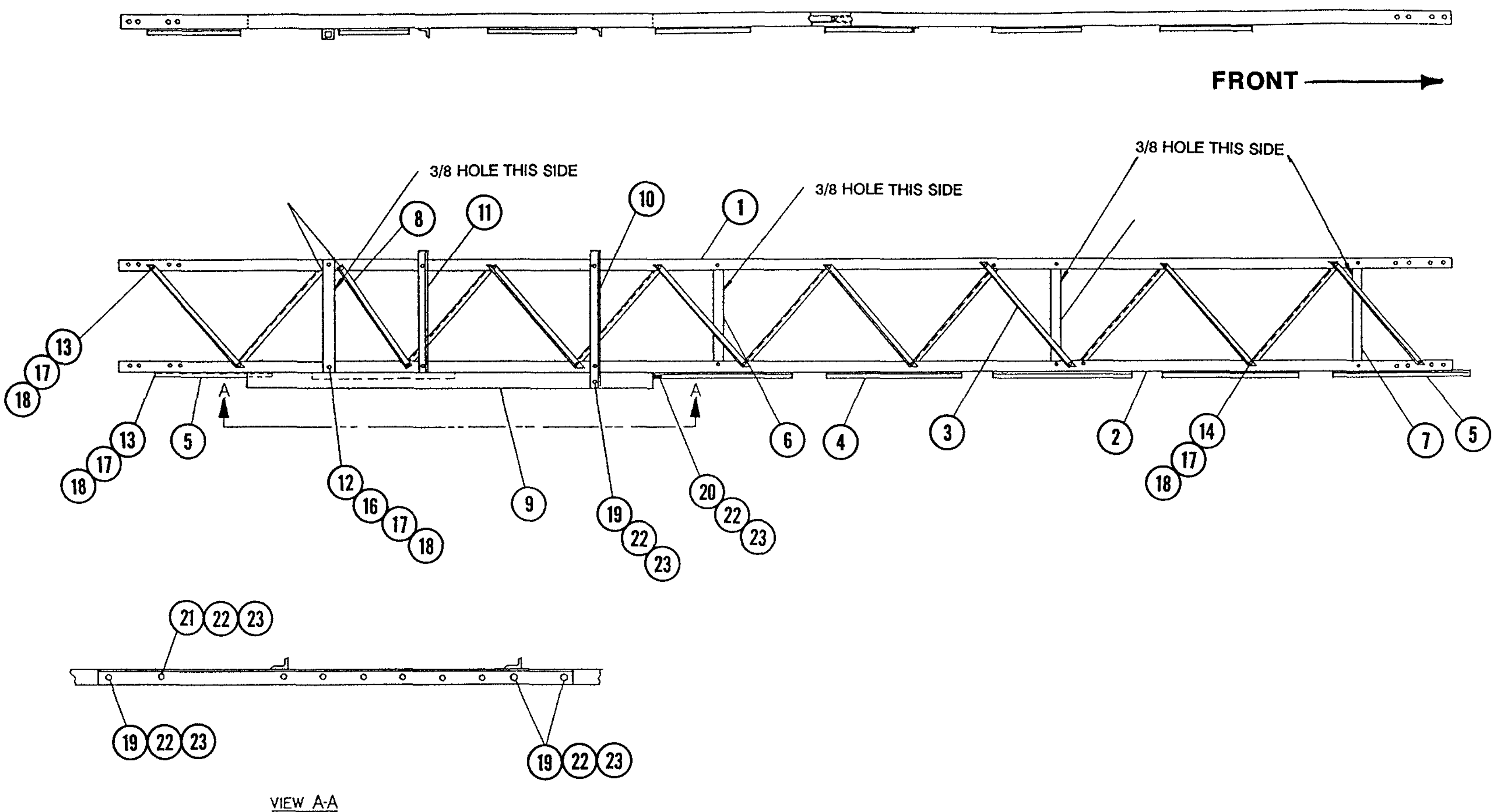


FIGURE 2-16. BOOM ASSEMBLY, HALF SECTION NO. 3A (SHT 1 OF 2)

Item No.	Part Number	Description	Qty
1	0001-3987-001	Leg "A", Section 3	1
2	0001-4078-001	Leg "C", Section 3	1
3	0001-3990-001	Brace, Vertical, #3	14
4	0001-3988-001	Brace, Horizontal, #3	11
5	0001-3998-001	Brace, Horizontal, #5	2
6	0001-6160-001	Tube, Element Mount	3
7	0001-6159-001	Tube, Element	1
8	0001-4075-001	Brace, Vertical, #4	1
9	0001-4090-001	Brace, Mast to Boom, #1	1
10	0001-4082-001	Brace, Vertical, Centroid, #2	1
11	0001-4081-001	Brace, Vertical, Centroid, #1	1
*(1) 12	2009-8861-001	Screw, HxHd, 1/4-20 x 1 SST	8
*(1) 13	2009-8865-001	Screw, HxHd, 1/4-20 x 1 1/4 SST	2
*(1) 14	2009-8860-001	Screw, HxHd, 1/4-20 x 7/8 SST	11
*(1) 15	2009-8858-001	Screw, HxHd, 1/4-20 x 3/4 SST	6
*(1) 16	2310-0433-001	Washer, Flat, 1/4 SST	8
*(1) 17	2300-0909-001	Washer, Splitlock, 1/4 SST	27
*(1) 18	2100-0219-001	Nut, Hex, 1/4-20 SST	27
*(1) 19	2009-9160-001	Screw, HxHd, 5/16-18 x 1 SST	8
*(1) 20	2009-9164-001	Screw, HxHd, 5/16-18 x 1 1/4 SST	5
*(1) 21	2009-9168-001	Screw, HxHd, 5/16-18 x 1 1/2 SST	1
*(1) 22	2100-0221-001	Nut, Hex, 5/16-18 SST	14
*(1) 23	2300-0910-001	Washer, Splitlock, 5/16 SST	14

*NOTES:
(1) These items packed as part of Boom Hardware, Half Section #3A P/N 0002-4861-201.

FIGURE 2-16. BOOM ASSEMBLY, HALF SECTION NO. 3A (SHT 2 OF 2)

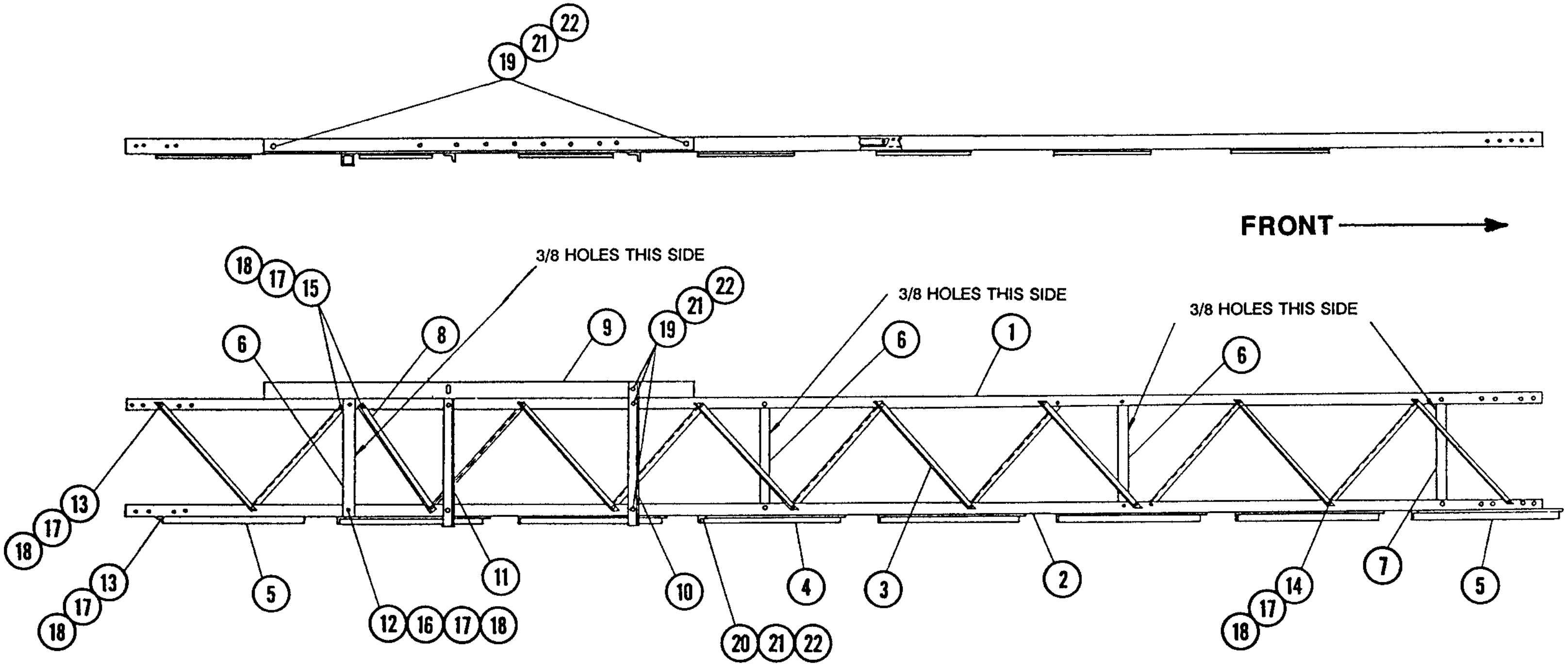


FIGURE 2-17. BOOM ASSEMBLY, HALF SECTION NO. 3B (SHT 1 OF 2)

Item No.	Part Number	Description	Qty
1	0001-4079-001	Leg "D", Section 3	1
2	0001-4076-001	Leg "B", Section 3	1
3	0001-3990-001	Brace, Vertical, #3	14
4	0001-3988-001	Brace, Horizontal, #3	13
5	0001-3998-001	Brace, Horizontal, #5	2
6	0001-6160-001	Tube, Element Mount	3
7	0001-6159-001	Tube, Element	1
8	0001-4075-001	Brace, Vertical, #4	1
9	0001-4091-001	Brace, Mast to Boom, #2	1
10	0001-4085-001	Brace, Vertical, Centroid, #3	1
11	0001-4086-001	Brace, Vertical, Centroid, #4	1
*(1) 12	2009-8861-001	Screw, HxHd, 1/4-20 x 1 SST	8
*(1) 13	2009-8865-001	Screw, HxHd, 1/4-20 x 1 1/4 SST	2
*(1) 14	2009-8860-001	Screw, HxHd, 1/4-20 x 7/8 SST	11
*(1) 15	2009-8858-001	Screw, HxHd, 1/4-20 x 3/4 SST	6
*(1) 16	2310-0433-001	Washer, Flat, 1/4 SST	8
*(1) 17	2300-0909-001	Washer, Splitlock, 1/4 SST	27
*(1) 18	2100-0219-001	Nut, Hex, 1/4-20 SST	27
*(1) 19	2009-9160-001	Screw, HxHd, 5/16-18 x 1 SST	7
*(1) 20	2009-9164-001	Screw, HxHd, 5/16-18 x 1 1/4 SST	7
*(1) 21	2100-0221-001	Nut, Hex, 5/16-18 SST	14
*(1) 22	2300-0910-001	Washer, Splitlock, 5/16 SST	14

*NOTES:
(1) These items packed as part of Boom Hardware, Half Section #3B P/N 0002-4865-201.

FIGURE 2-17. BOOM ASSEMBLY, HALF SECTION NO. 3B (SHT 2 OF 2)

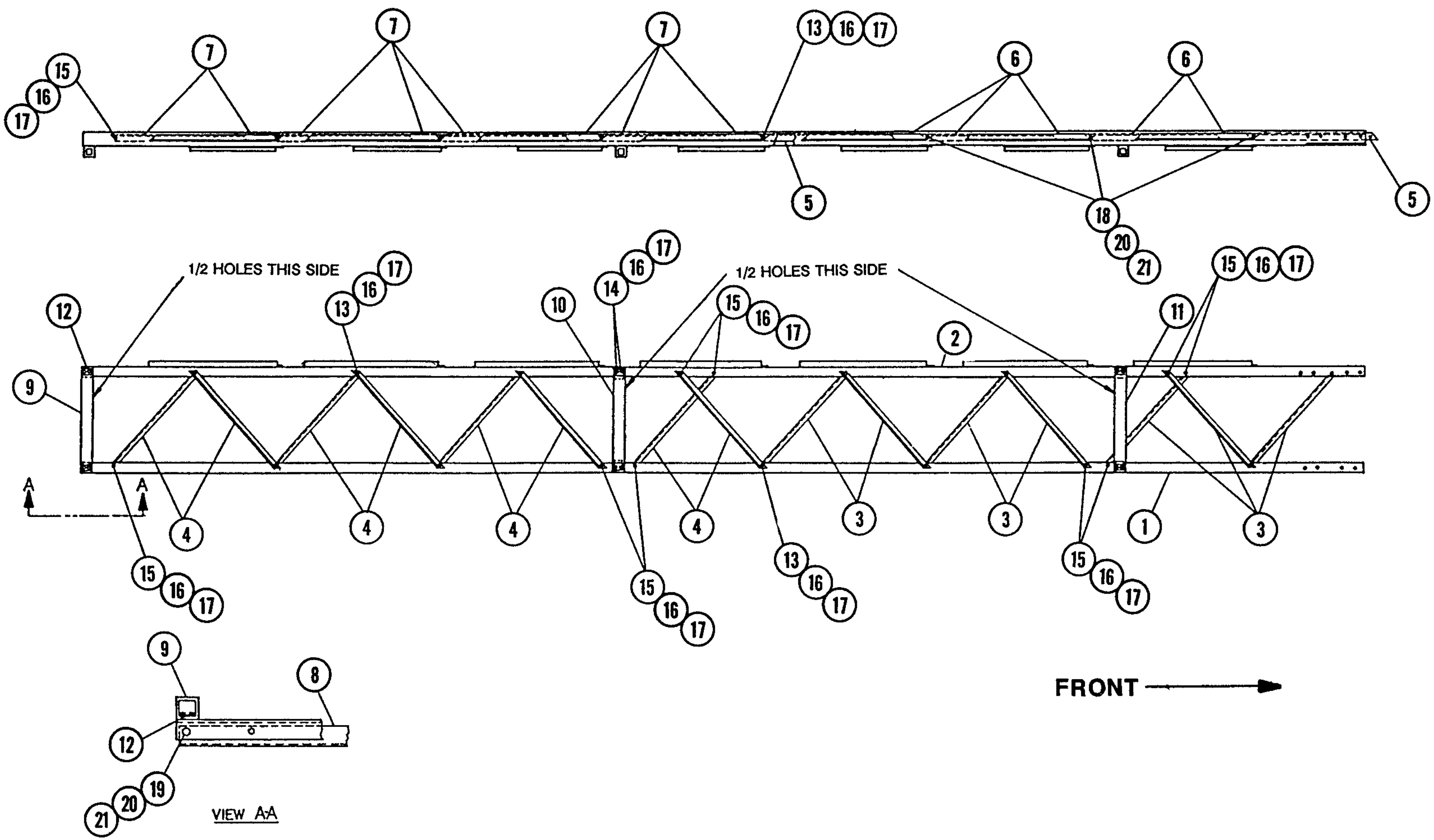


FIGURE 2-18. BOOM ASSEMBLY, HALF SECTION NO. 4 (SHT 1 OF 2)

Item No.	Part Number	Description	Qty
1	0001-4073-001	Leg "A", Section 4	1
2	0001-4074-001	Leg "B", Section 4	1
3	0001-3990-001	Brace, Vertical, #3	7
4	0001-3972-001	Brace, Vertical, #1	8
5	0001-3998-001	Brace, Horizontal, #5	2
6	0001-3988-001	Brace, Horizontal, #3	5
7	0001-3974-001	Brace, Horizontal, #1	8
8	0001-3989-001	Brace, Horizontal, #4	1
9	0001-6163-001	Tube, Element Mount	1
10	0001-6162-001	Tube, Element Mount	1
11	0001-6161-001	Tube, Element Mount	1
12	0001-6172-001	Plate, Washer	6
*(1) 13	2009-8860-001	Screw, HxHd, 1/4-20 x 7/8 SST	14
*(1) 14	2009-8861-001	Screw, HxHd, 1/4-20 x 1 SST	12
*(1) 15	2009-8858-001	Screw, HxHd, 1/4-20 x 3/4 SST	10
*(1) 16	2100-0219-001	Nut, Hex, 1/4-20 SST	36
*(1) 17	2300-0909-001	Washer, Splitlock, 1/4 SST	36
*(1) 18	2009-9164-001	Screw, HxHd, 5/16-18 x 1 1/4 SST	3
*(1) 19	2009-9160-001	Screw, HxHd, 5/16-18 x 1 SST	1
*(1) 20	2100-0221-001	Nut, Hex, 5/16-18 SST	4
*(1) 21	2300-0910-001	Washer, Splitlock, 5/16 SST	4

*NOTES:
(1) These items packed as part of Boom Hardware, Half Section #4 P/N 0002-4863-201.

FIGURE 2-18. BOOM ASSEMBLY, HALF SECTION NO. 4 (SHT 2 OF 2)

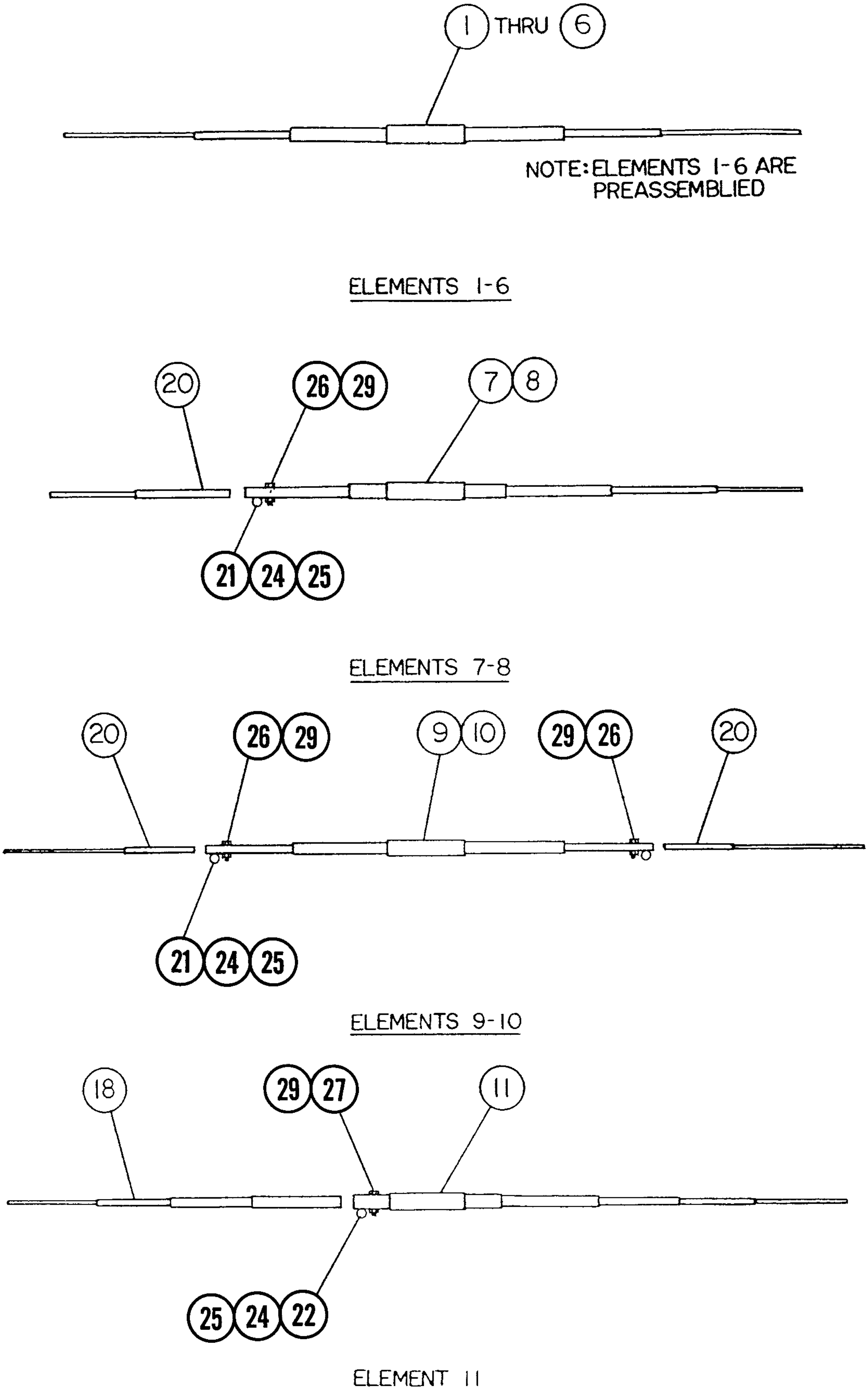
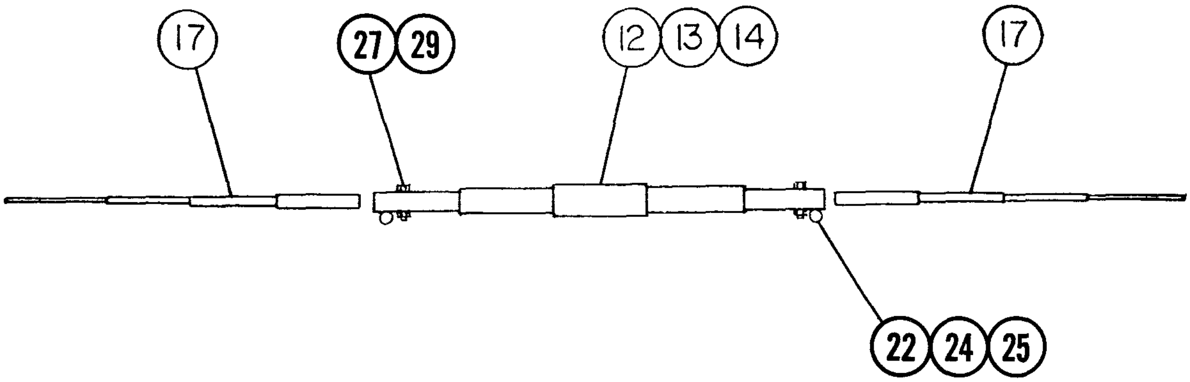
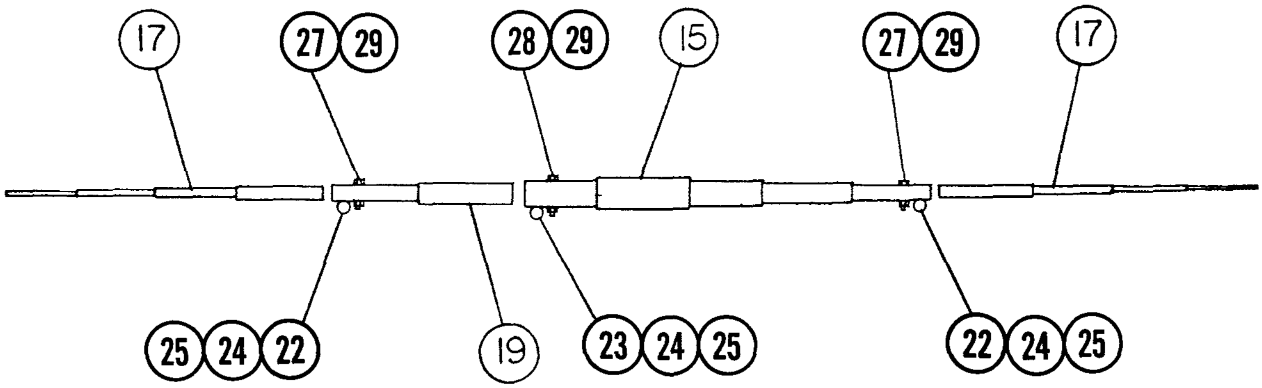


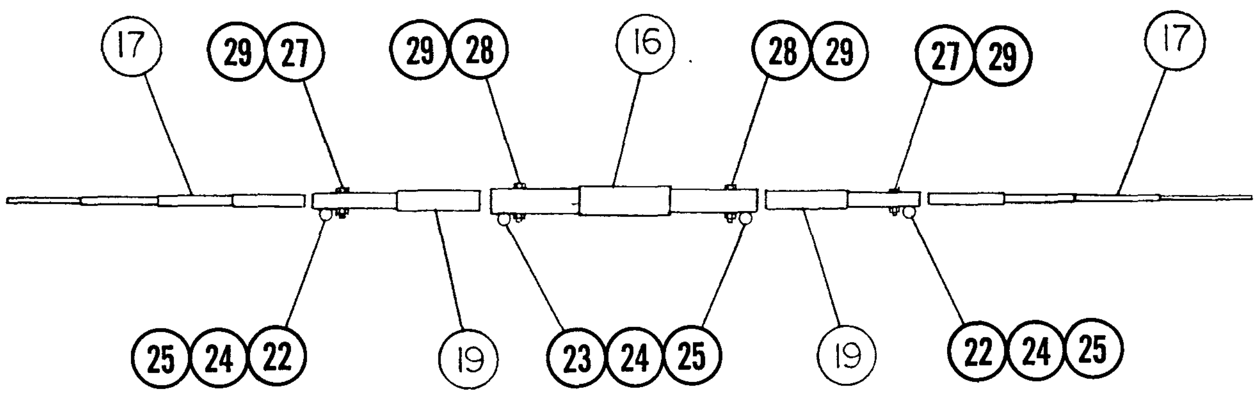
FIGURE 2-19. ELEMENT ASSEMBLY (SHT 1 OF 3)



ELEMENTS 12-14



ELEMENT 15



ELEMENT 16

FIGURE 2-19. ELEMENT ASSEMBLY (SHT 2 OF 3)

Item No.	Part Number	Description	Qty
1	0001-4127-001	Element Assembly #1	1
2	0001-4128-001	Element Assembly #2	1
3	0001-4129-001	Element Assembly #3	1
4	0001-4130-001	Element Assembly #4	1
5	0001-4131-001	Element Assembly #5	1
6	0001-4132-001	Element Assembly #6	1
7	0001-4158-001	Center Section, Element #7	1
8	0001-4162-001	Center Section, Element #8	1
9	0001-4164-001	Center Section, Element #9	1
10	0001-4165-001	Center Section, Element #10	1
11	0001-4161-001	Center Section, Element #11	1
12	0001-4160-001	Center Section, Element #12	1
13	0001-4159-001	Center Section, Element #13	1
14	0001-4157-001	Center Section, Element #14	1
15	0001-4149-001	Center Section, Element #15	1
16	0001-4155-001	Center Section, Element #16	1
17	0001-4118-001	Section, Element, Long End	10
18	0001-4163-001	Section, Long, Element #11	1
19	0001-4148-001	Section, Inner Element	3
20	0001-4119-001	Section, Element	6
*(1) 21	2078-2812-001	Bolt, HxHd, 3/8-16 x 1 3/4 SST	6
*(1) 22	2078-2816-001	Bolt, HxHd, 3/8-16 x 2 1/4 SST	11
*(1) 23	2078-2822-001	Bolt, HxHd, 3/8-16 x 3 SST	3
*(1) 24	2100-0233-001	Nut, Hex, 3/8-16 SST	20
*(1) 25	2300-0911-001	Washer, Splitlock, 3/8 SST	20
*(1) 26	2078-2410-001	Bolt, HxHd, 1/4-20 x 1 1/2 SST	6
*(1) 27	2078-2416-001	Bolt, HxHd, 1/4-20 x 2 1/4 SST	11
*(1) 28	2078-2426-001	Bolt, HxHd, 1/4-20 x 3 1/2 SST	3
*(1) 29	2100-6310-001	Nut, Flexlock, 1/4-20 SST	20

*NOTES:
(1) These items packed as part of Element Hardware Kit P/N 0002-4824-201.

FIGURE 2-19. ELEMENT ASSEMBLY (SHT 3 OF 3)

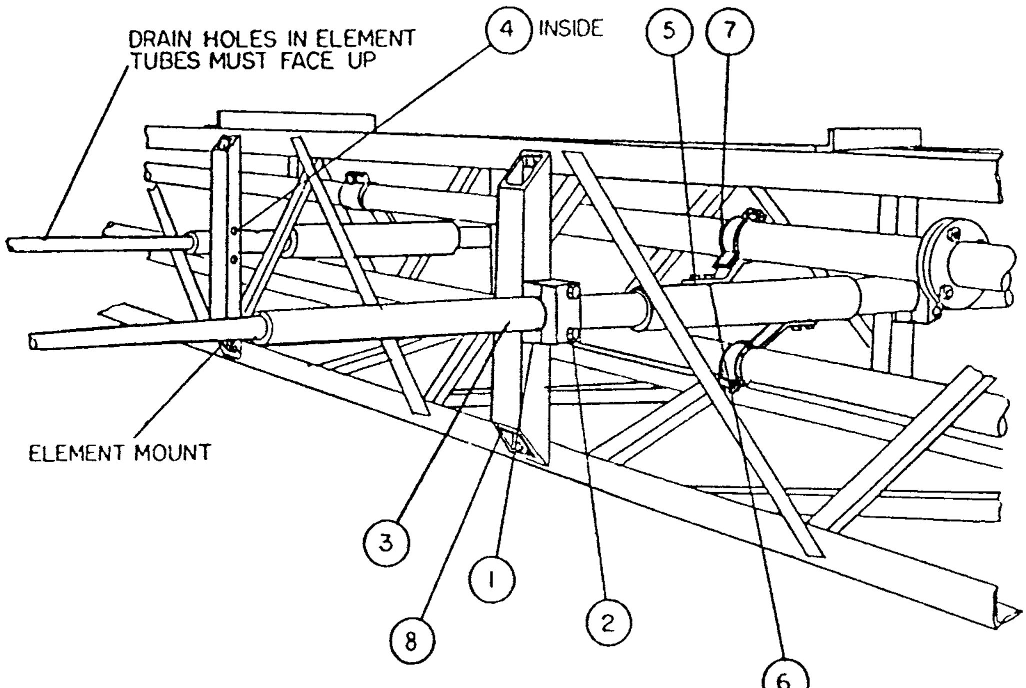
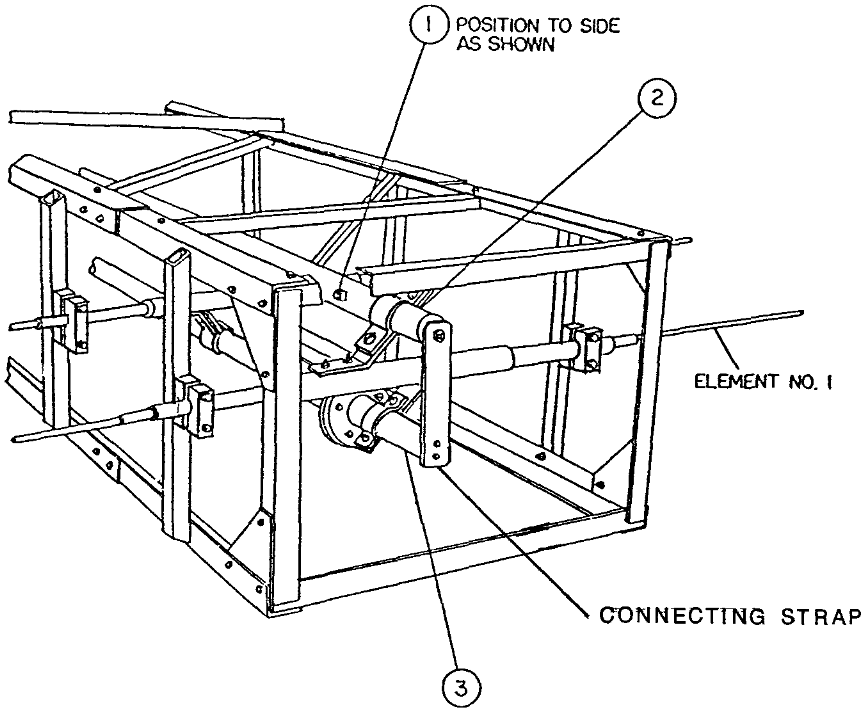


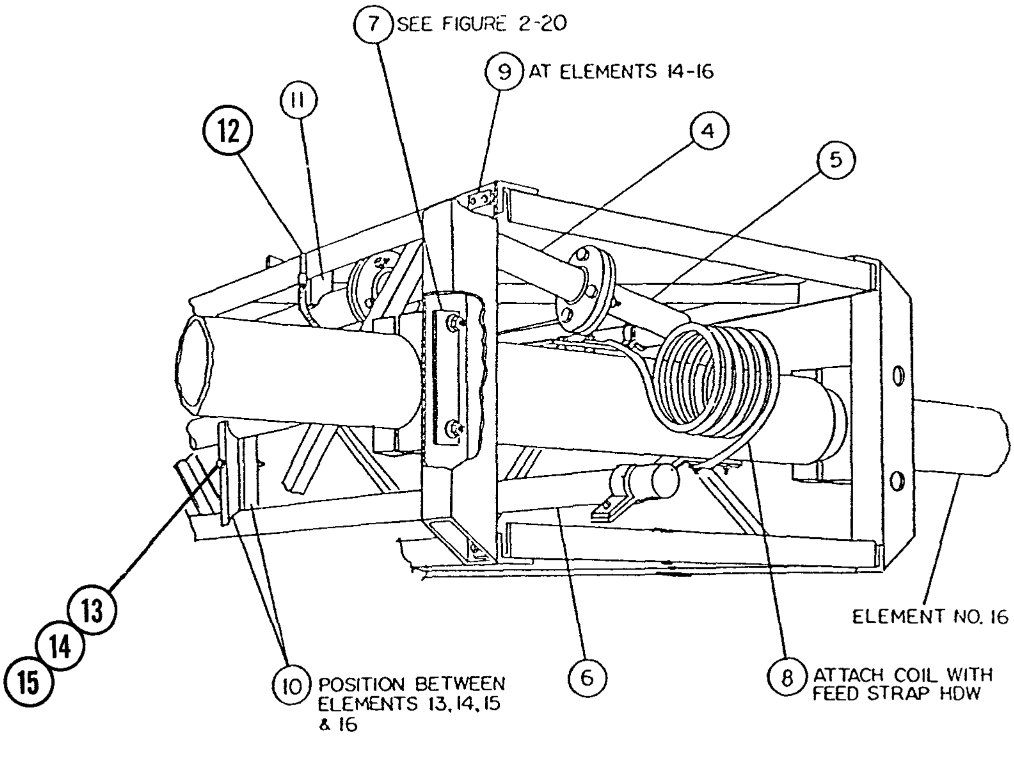
FIGURE 2-20. TYPICAL ELEMENT INSTALLATION (SHT 1 OF 2)

FIGURE 2-20. TYPICAL ELEMENT INSTALLATION (SHT 2 OF 2)

Item No.	Part Name	Element 1-7	Element 8-10	Element 11-13	Element 14	Element 15	Element 16
1	Saddle	0002-3323-401	0002-3323-402	0002-3323-403	0002-3323-404	0002-3323-405	0002-3323-406
2	Bolt w/Locknut	1/4-20 x 2 1/2	5/16-18 x 3 1/2	5/16-18 x 4 1/2	7/16-14 x 6	7/16-14 x 7	7/16-14 x 7 1/2
3	Element Tube	1"	1 1/2"	2"	2 1/2"	3"	3 1/2"
4	Reinforcing Plate	0001-6165-001	0001-6166-001	0001-6167-001	0001-6168-001	0001-6169-001	0001-6170-001
5	Screw, Nut and Lockwasher	1/4-20 x 2	1/4-20 x 2 1/2	1/4-20 x 3	1/4-20 x 3 1/2	1/4-20 x 4	1/4-20 x 4 1/2
6	Spacer	0001-4150-001	0001-4150-001	0001-4150-001	0001-4150-001	0001-4150-001	0001-4150-001
7	Feedstrap	0001-4138-001	0001-4139-001	0001-4140-001	0001-4141-001	0001-4142-001	0001-4142-001
8	Element Mount	0001-6158-001	0001-6159-001	0001-6160-001	0001-6161-001	0001-6162-001	0001-6163-001



FRONT BOOM

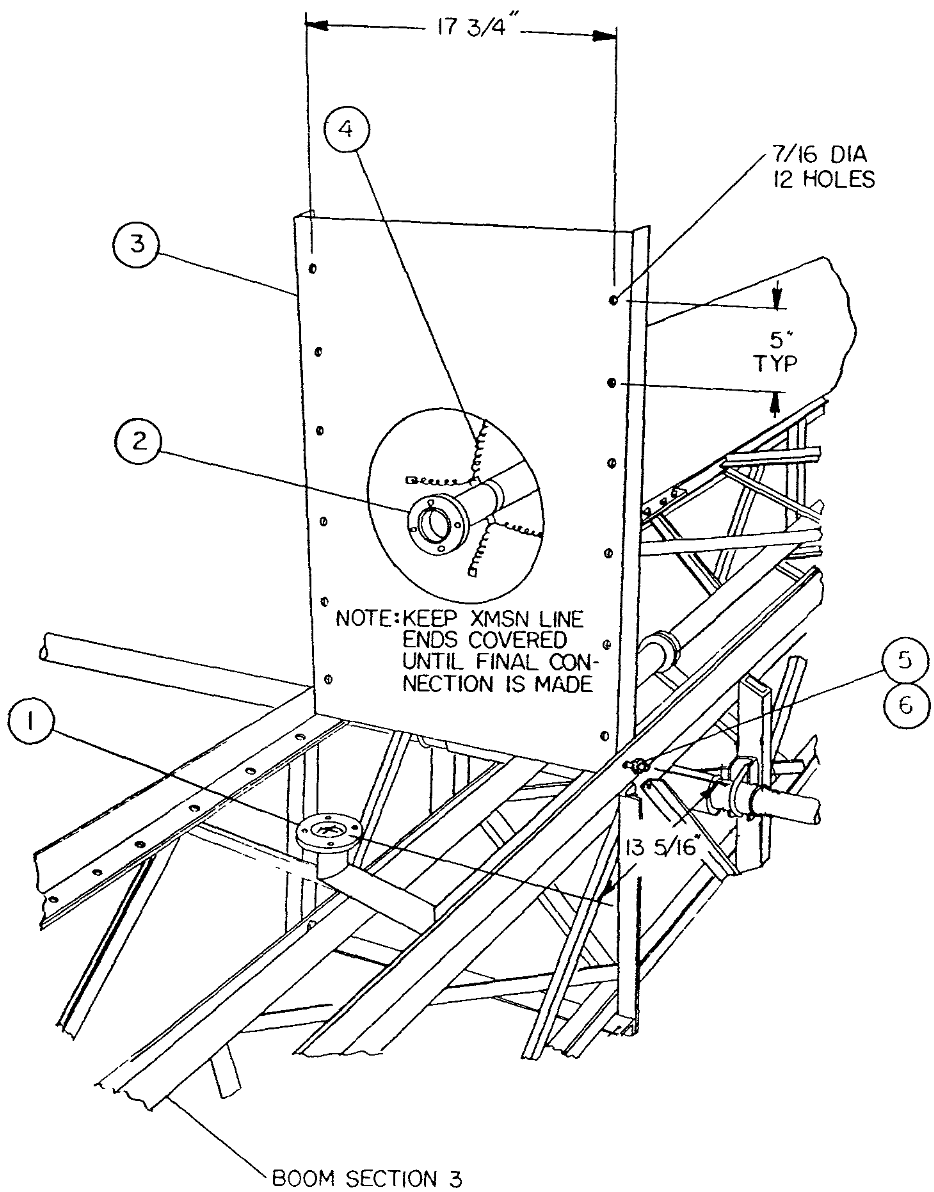


REAR BOOM

FIGURE 2-21. FRONT AND REAR BOOM INSTALLATION (SHT 1 OF 2)

Item No.	Part Number	Description	Qty
1	6900-0014-001	Valve, Relief, Pop-off	1
2	0001-4097-001	Transformer Assembly, Section 1	1
3	0001-4111-001	Section Assembly, Feedline, Short	1
4	0001-4045-001	Elbow, Transmission Line	1
5	0001-4100-001	Elbow, Transformer Line	1
6	0001-4260-001	Feedline Assembly, 20'	1
7	0001-6170-001	Plate, Reinforcing	2
8	0001-4283-001	Coil, Shorting	1
9	0001-6172-001	Plate, Washer	12
10	0001-4291-001	Block, Dampner, Vibration	6
11	0001-6990-001	Spacer	5
12	2450-2126-001	Clamp, Hose	5
13	2009-8893-001	Screw, HxHd, 1/4-20 x 3 1/2 SST	3
14	2300-0909-001	Washer, Splitlock, 1/4 SST	3
15	2100-0219-001	Nut, Hex, 1/4-20 SST	3

FIGURE 2-21. FRONT AND REAR BOOM INSTALLATION (SHT 2 OF 2)



Item No.	Part Number	Description	Qty
1	0001-4055-001	Adapter, Transmission Line	1
2	1000-0184-001	Transmission Line, Spring Loaded	4
3	0001-3979-001	Mast Section, Top	1
4	2400-0005-001	Spring, Extension	4
*(1) 5	2078-7983-001	Bolt, HxHd, 5/8-11 x 22 Galv	1
*(1) 6	2100-0131-001	Nut, Hex, 5/8-11 Galv	1

*NOTES:
(1) These items packed as part of Interface Hardware, Mast to Antenna P/N 0002-4811-201.

FIGURE 2-22. MAST TO BOOM INSTALLATION

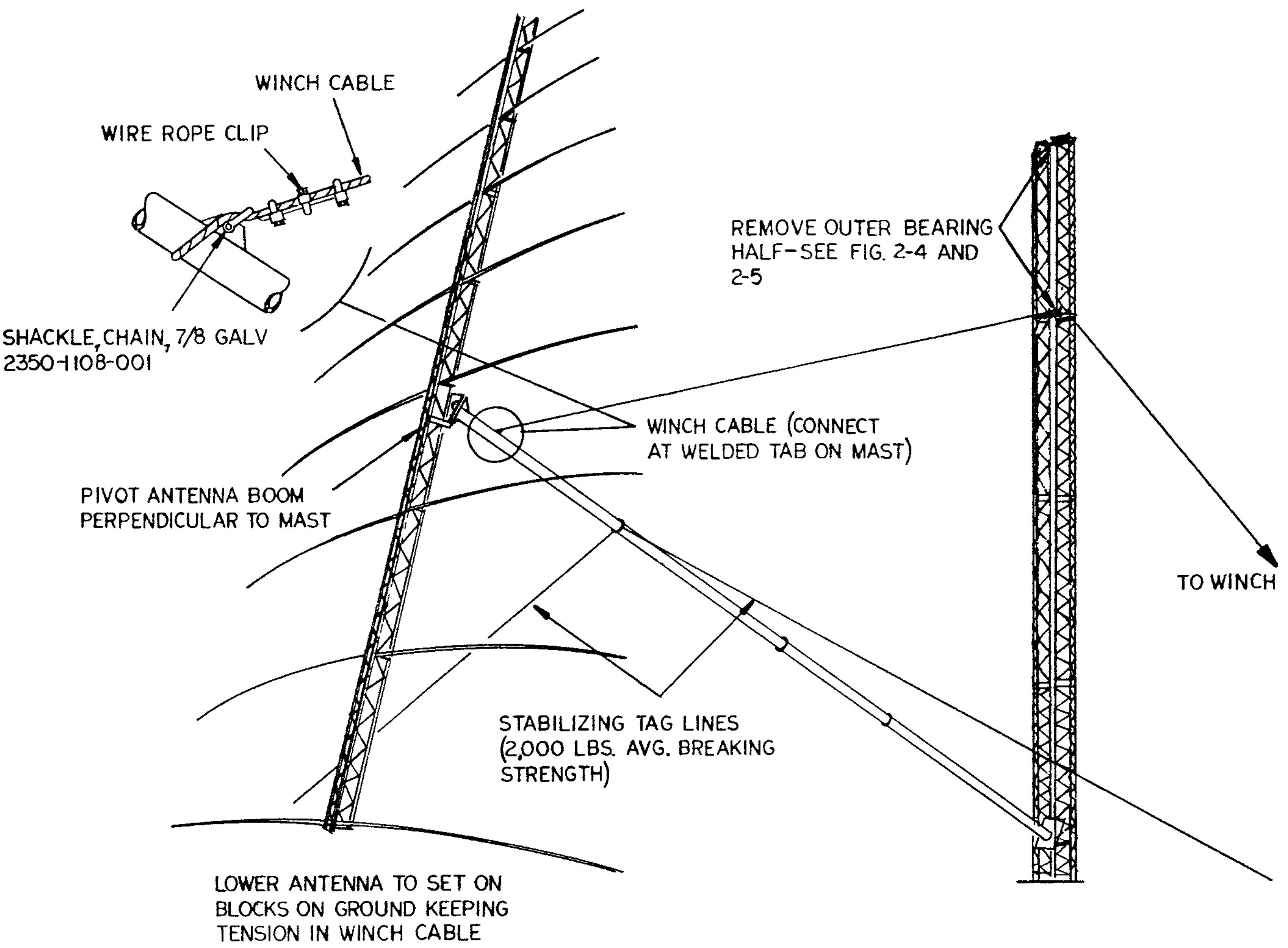


FIGURE 2-23. ANTENNA ERECTION (SHT 1 OF 4)

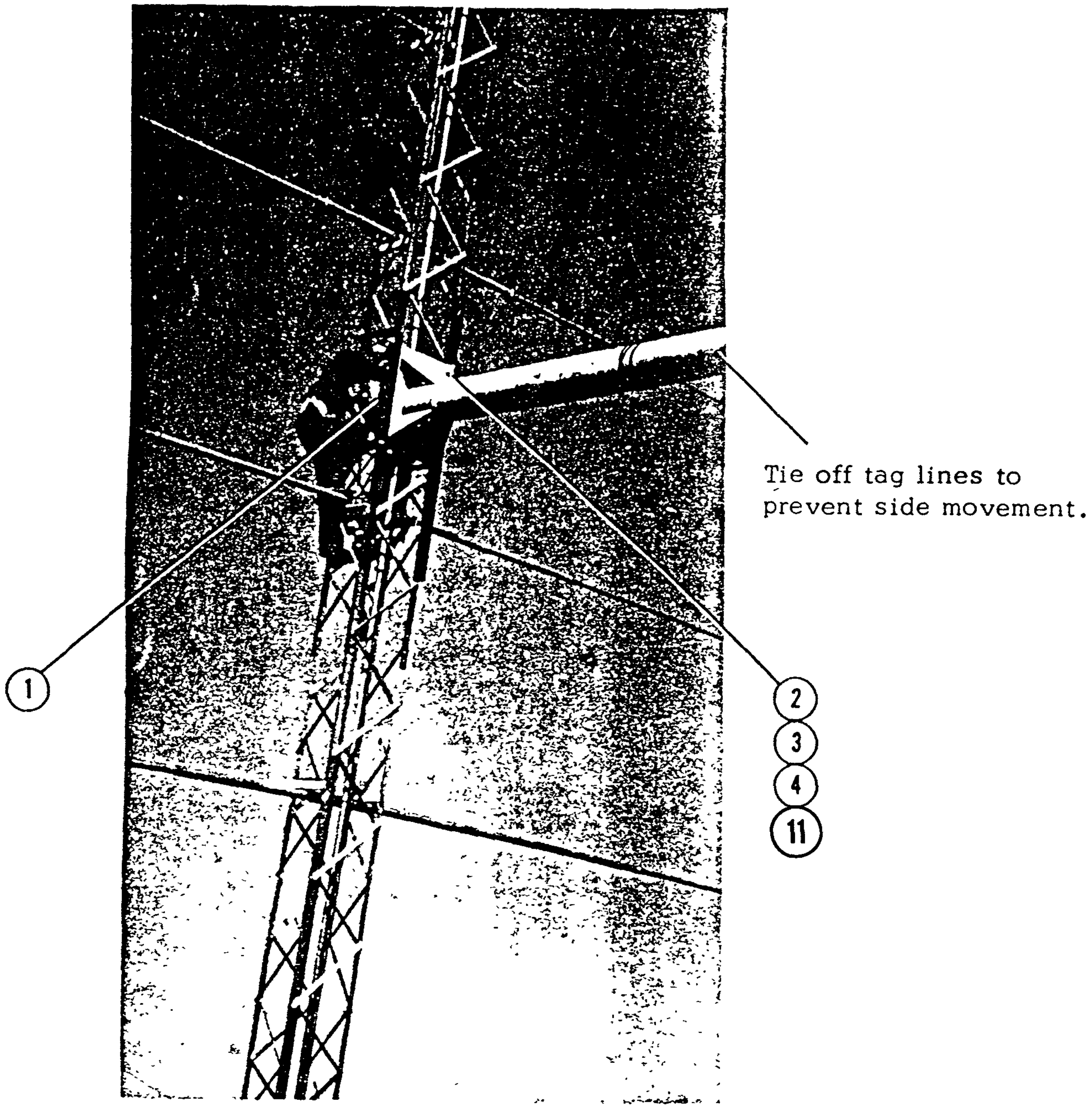


FIGURE 2-23. ANTENNA ERECTION (SHT 2 OF 4)

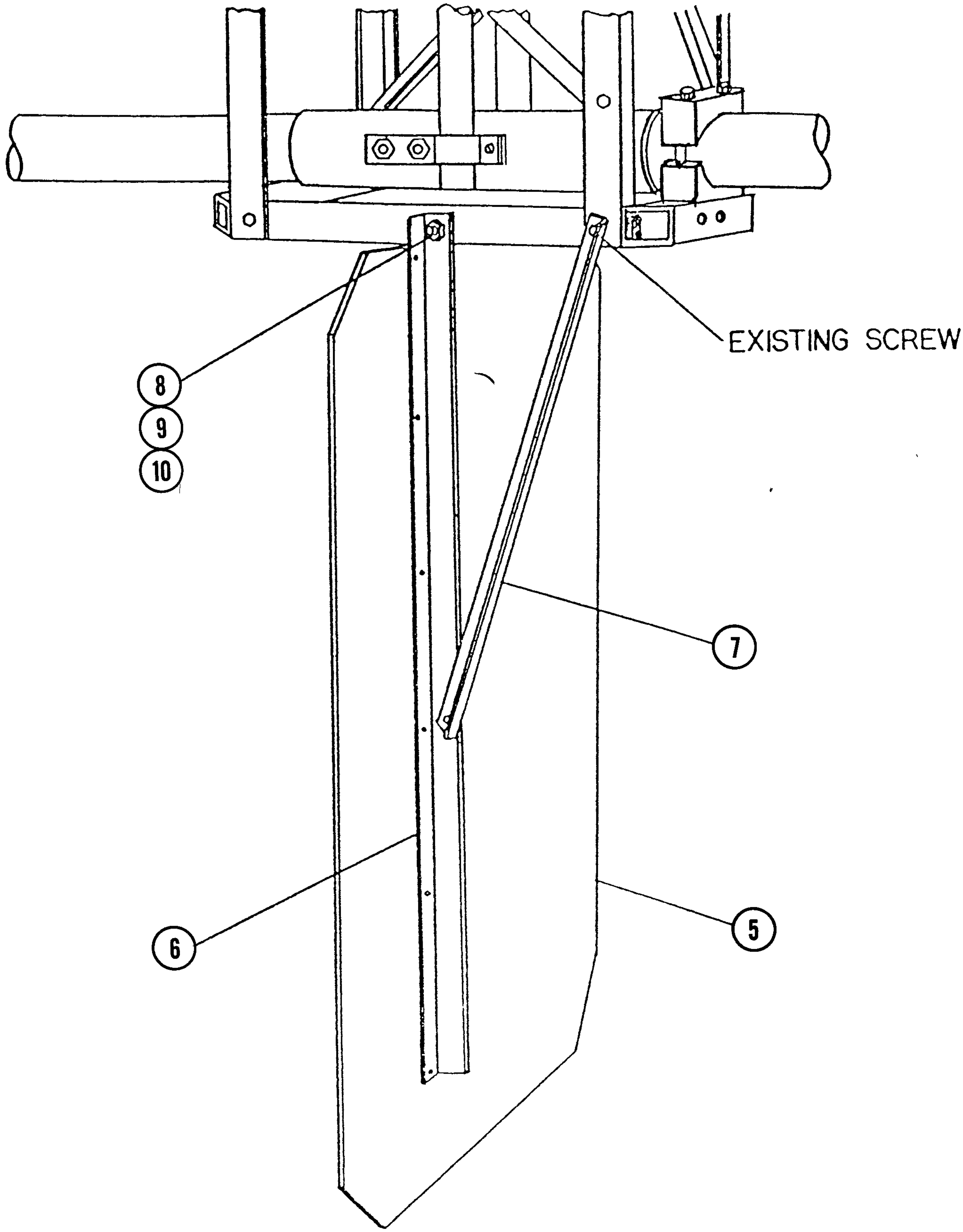


FIGURE 2-23. ANTENNA ERECTION (SHT 3 OF 4)

Item No.	Part Number	Description	Qty
1	0001-4006-001	Transmission Line, Spring Loaded Hardware	1
*(1)2	2009-3470-001	Screw, HxHd, 3/8-16 x 1 3/4 Galv	12
*(1)3	2100-0123-001	Nut, Hex, 3/8-16 Galv	12
*(1)4	2300-0153-001	Washer, Splitlock, 3/8 Galv	12
5	0003-3724-301	Windsail	1
6	0001-4191-001	Angle, Support	2
7	0001-4190-001	Brace	2
8	MS35307-333	Screw, HxHd, Cap, 5/16-18 x 7/8 SST	2
9	MS35649-2314	Nut, Hex, 5/16-18 SST	2
10	MS35338-140	Washer, Splitlock, 5/16 SST	2
11	0002-8852-301	Brace	2

*NOTES:
(1) These items packed as part of Interface Hardware, Mast to Antenna P/N 0002-4811-201.

FIGURE 2-23. ANTENNA ERECTION (SHT 4 OF 4)

3-1. GENERAL. The LPH-72A Antenna is a log periodic dipole array. The theory of such an antenna is described in paragraph 3-2. Refer to figure 3-1 for a better understanding of this discussion. Refer to paragraph 5-2 for operation of the antenna control.

3-2. ANTENNA THEORY. The LPH-72A Log Periodic Antenna array consists of sixteen dipole elements, each being of different length. The elements are connected to a balanced transmission line ascending by order of length from the feedpoint. The elements are designed and arranged so that each element is equal to 88 percent in length of the next larger element. The space between any two elements on the transmission line is equal to 88 percent of the next larger space. Considering the foregoing, any portion of the antenna is a scale model of any other portion.

Optimum operation of the antenna requires that each element is resonant only once as the frequency is varied through the desired range. The LPH-72A antenna elements operate in the 1/2 wave mode.

A tapered coaxial transformer is used to match the balanced feedpoint impedance of 80 ohms to the desired 50 ohm input impedance. This transformer is a tapered center conductor inserted in the coaxial line, extending from the rear of the antenna to the feedpoint. Its design provides an impedance match over the entire frequency range of the antenna.

The flow of RF energy through the antenna is as follows: RF energy is contained in the coax line until it reaches the front of the antenna. At this point, the coax center conductor is connected to the outer conductor of the upper feedline. The total current on the inside of the lower feedline outer conductor folds over and flows back down the outside of the outer conductor. Thus, a non-frequency sensitive unbalanced to balanced transformation takes place.

Energy is transmitted from the front of the antenna to the radiating elements by the balanced line. Because the phase is reversed between each element pair (by criss-cross connection) the direction of radiation is directed toward the front of the antenna. The elevation and azimuth radiation patterns can be seen in figure 3-2. VSWR vs frequency over the full frequency band is shown in figure 3-3.

3-3. ANTENNA CONTROL. Refer to paragraph 5-2 for operation of the antenna control.

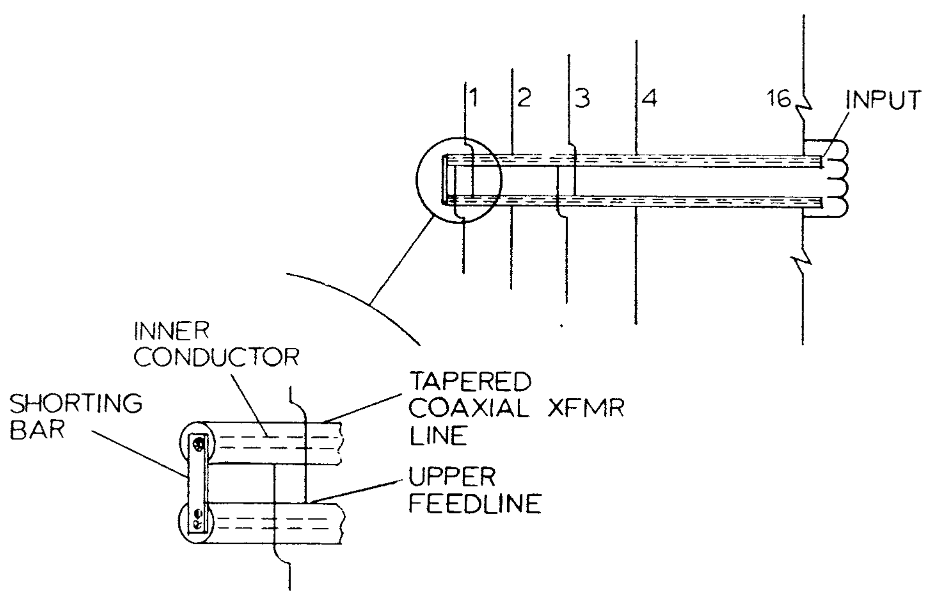


FIGURE 3-1. ANTENNA THEORY

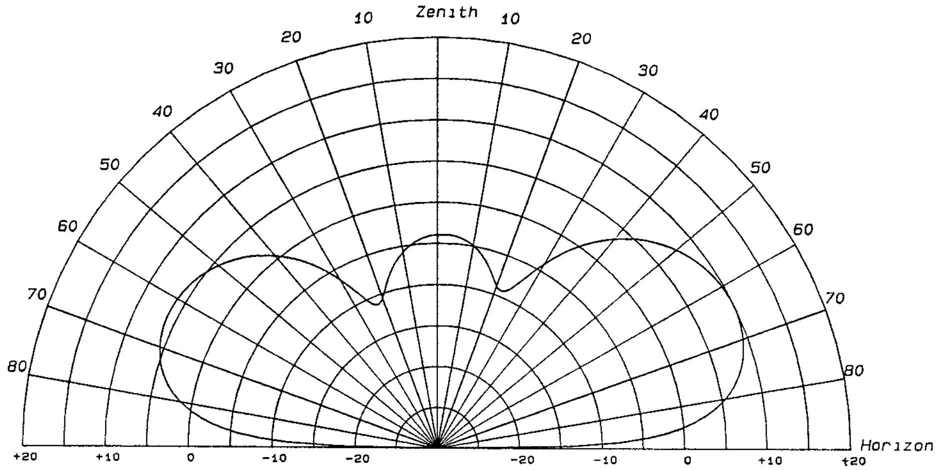


FIGURE 3-2. ELEVATION PATTERN, 6.5 MHz

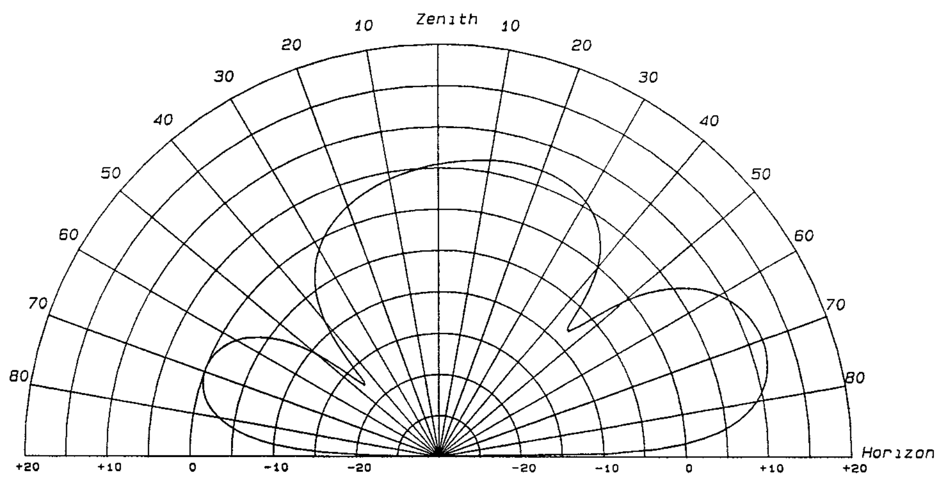


FIGURE 3-3. ELEVATION PATTERN, 8 MHz

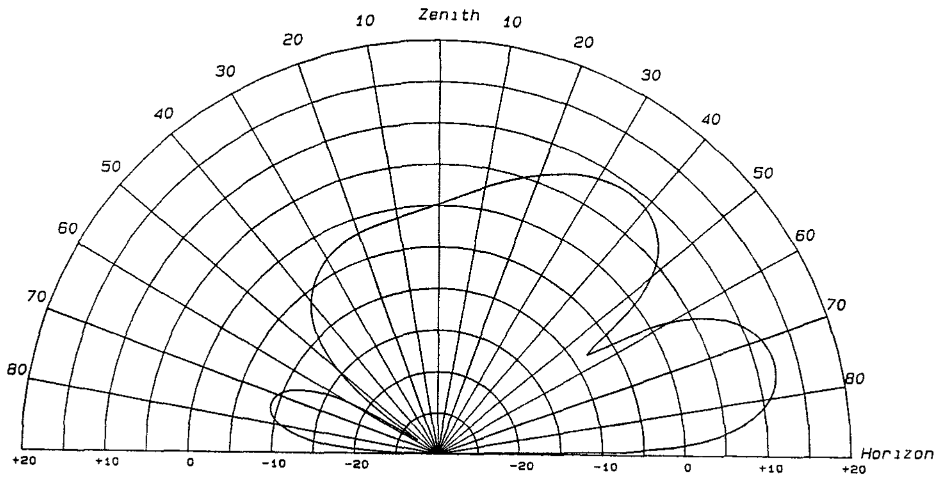


FIGURE 3-4. ELEVATION PATTERN, 10 MHz

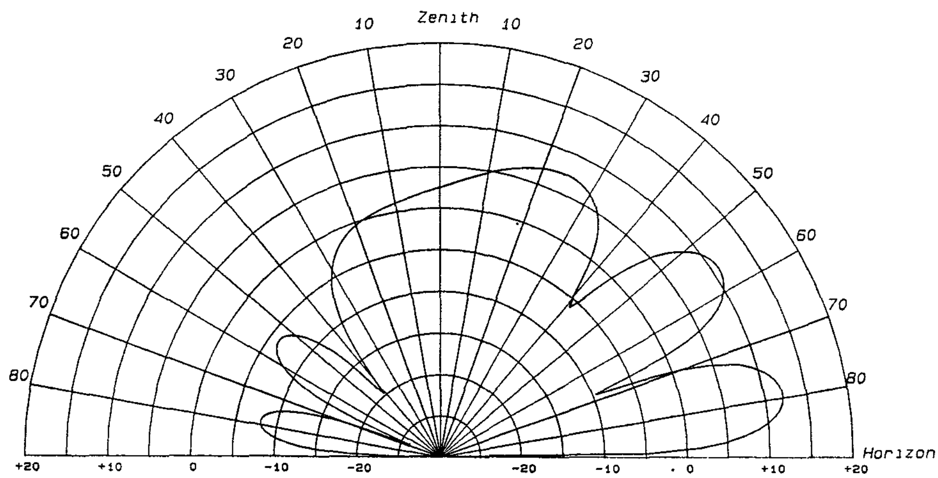


FIGURE 3-5. ELEVATION PATTERN, 15 MHz

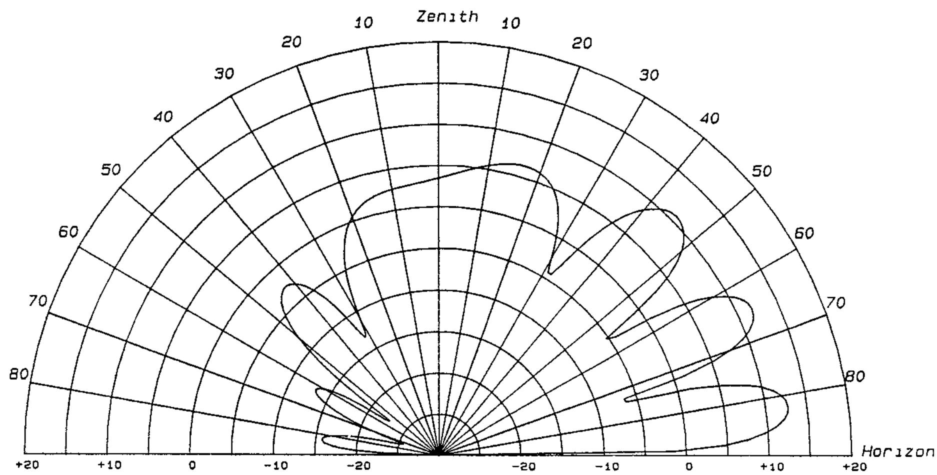


FIGURE 3-6. ELEVATION PATTERN, 20 MHz

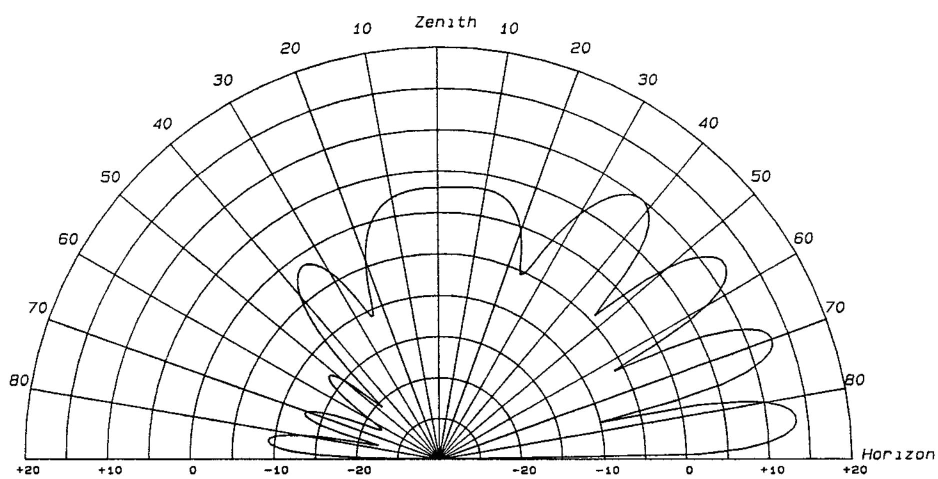


FIGURE 3-7. ELEVATION PATTERN, 25 MHz

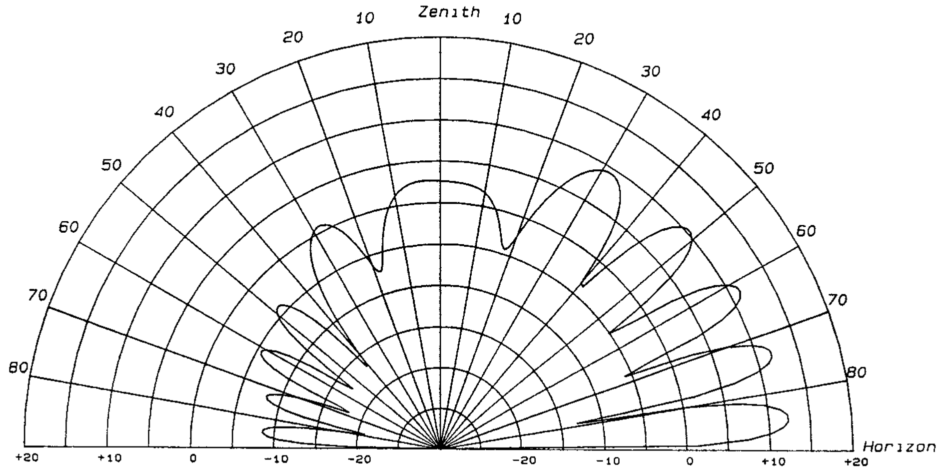


FIGURE 3-8. ELEVATION PATTERN, 32 MHz

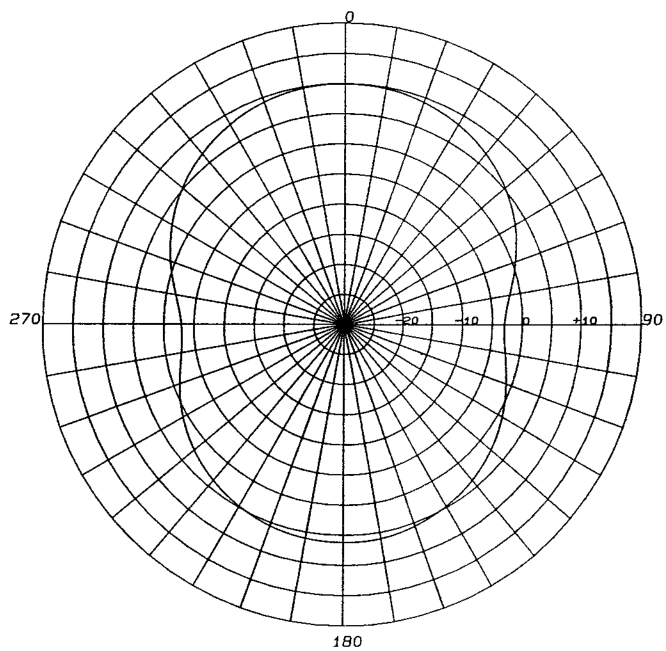


FIGURE 3-9. AZIMUTH PATTERN, 6.5 MHz

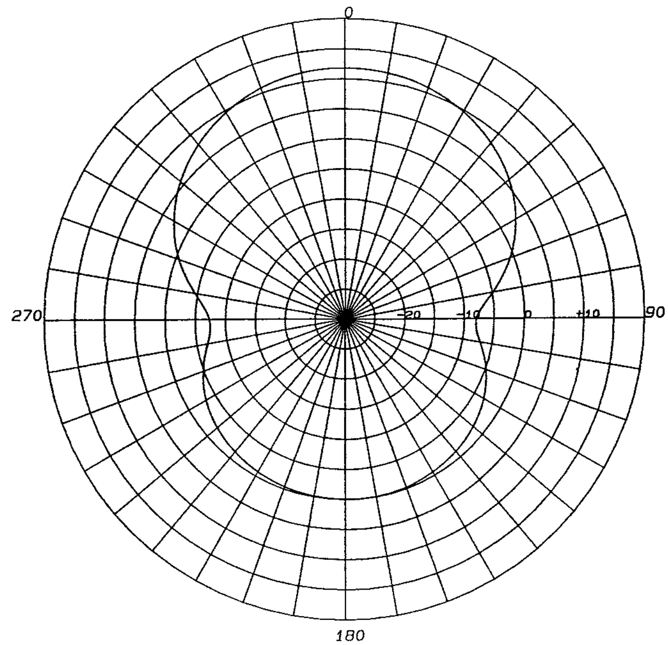


FIGURE 3-10. AZIMUTH PATTERN, 8 MHz

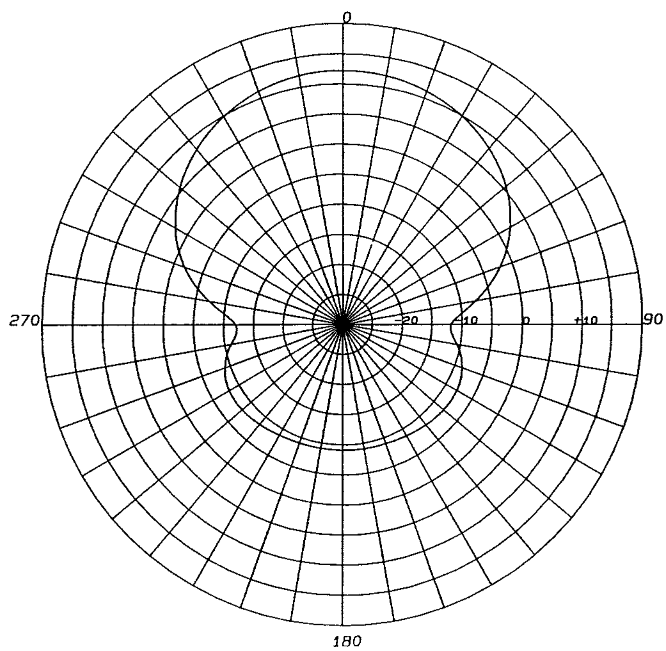


FIGURE 3-11. AZIMUTH PATTERN, 10 MHz

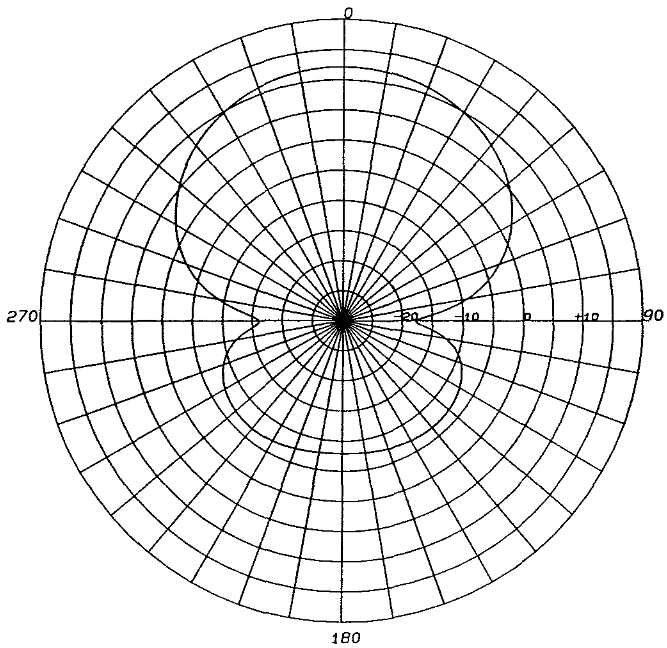


FIGURE 3-12. AZIMUTH PATTERN, 15 MHz

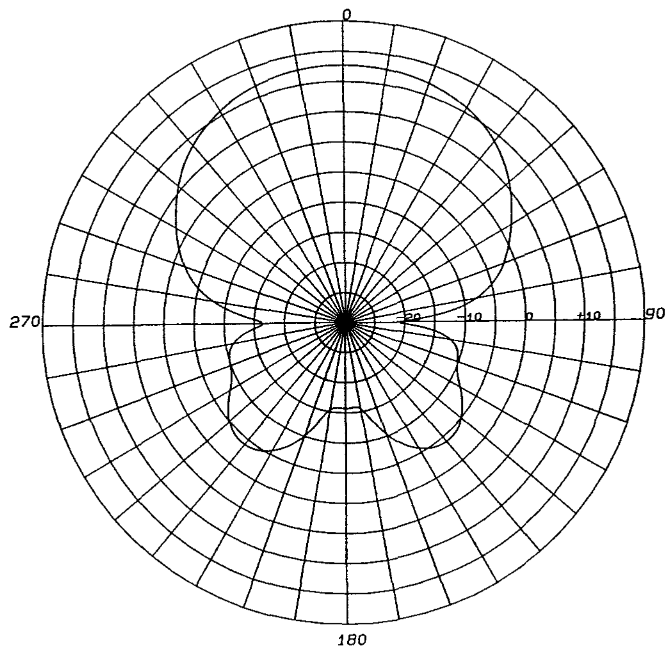


FIGURE 3-13. AZIMUTH PATTERN, 20 MHz

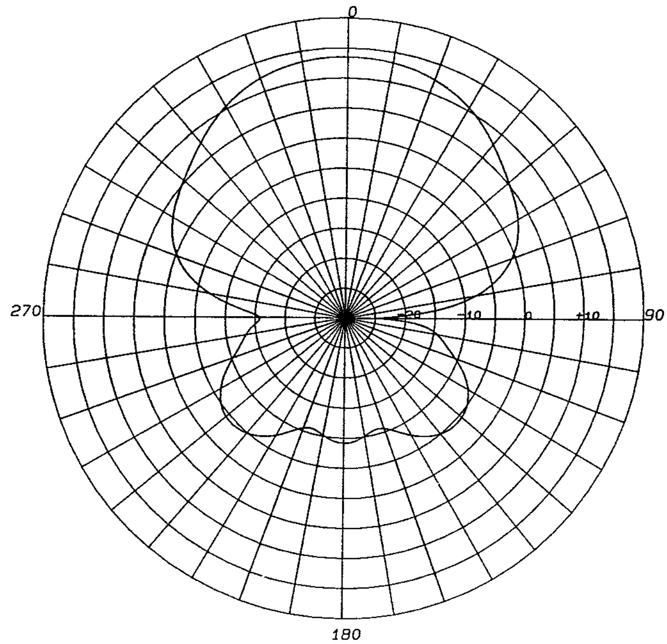


FIGURE 3-14. AZIMUTH PATTERN, 25 MHz

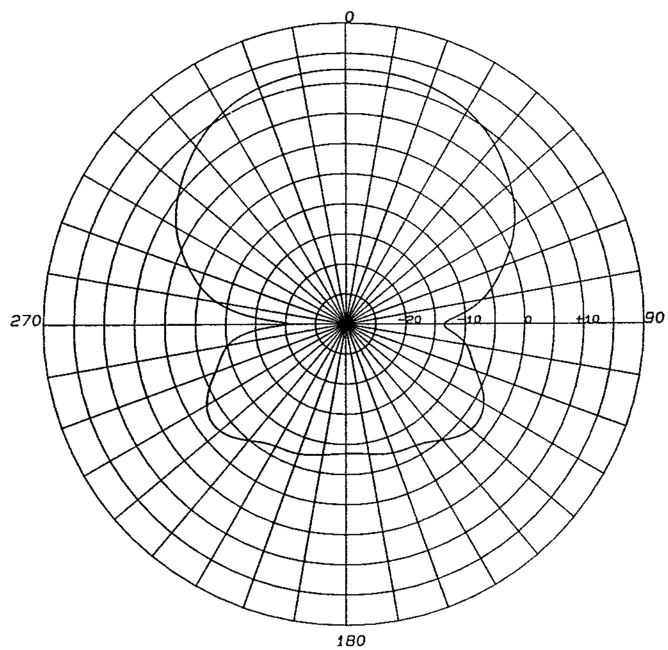


FIGURE 3-15. AZIMUTH PATTERN, 32 MHz

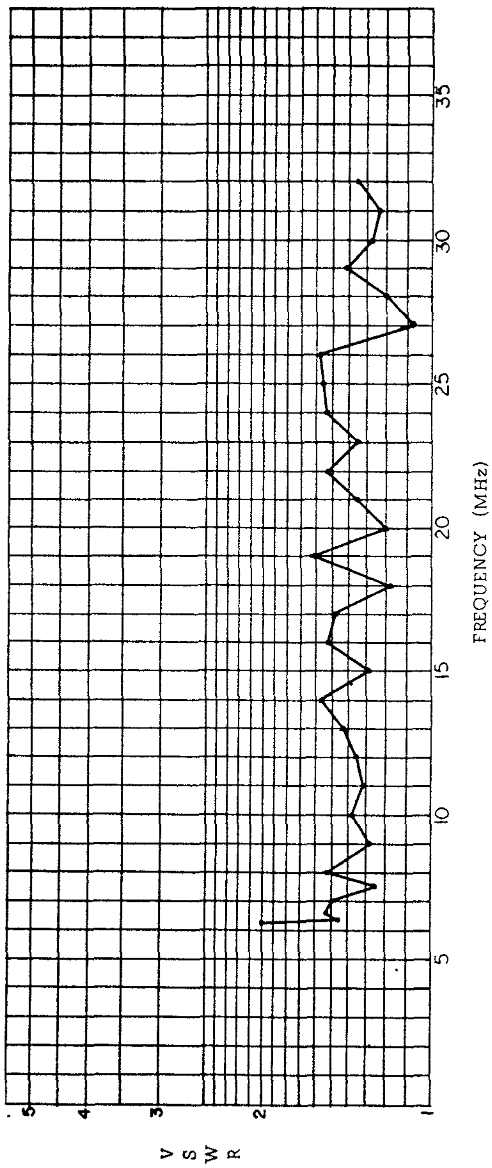


FIGURE 3-16. VSWR VS FREQUENCY

CHAPTER 4. MAINTENANCE

4-1. GENERAL. Corrosion resistant materials and joints of similar metals minimize potential corrosion and provide high reliability for this antenna in extreme corrosive atmospheres. A monthly visual inspection is suggested for detecting obvious damage to the antenna. The antenna should be lowered annually to perform necessary inspection and preventive maintenance actions recommended as follows.

4-2. GUYS AND ANCHORS. Guys should be inspected for proper tensioning (1800 to 2000 pounds), broken insulators, and possible mechanical or corrosion damage. Anchors should be inspected for corrosion above the ground line and any evidence of slippage. Slippage can often be indicated by loose guys and a ground line mark can often be detected on the anchor rod itself. Loose guys should be retensioned as required. If excessive anchor slippage is evident, additional anchors must be installed to replace or supplement the existing anchors.

4-3. TOWER. The tower should be inspected for evidence of corrosion, flexing due to improper guy tensions, or settling of the base pier. Corrosion should be thoroughly cleaned, then coated with a good grade of zinc rich paint. Flexing of the towers due to improper guy tensions should be inspected at once since eccentric loading increases the chances of failure under high wind conditions. If the tower base shows evidence of settling, the guy tensions should be rechecked and the frequency of inspection increased to determine if it has stabilized or if a new tower pier will be necessary.

4-4. ANTENNA. The antenna boom and element assemblies should be inspected for corrosion and tightness of all connections. Particular attention should be paid to the tightness of all bolts and hose clamps making electrical connection between the air line, dummy line, and the element assemblies. The insulators, such as the fiberglass tubes used as element mounts and the fiberglass tubes in the center of the element assemblies should be inspected for accumulation of conductive debris such as soot, smoke, dirt, or salt.

Evidence of destructive corrosion should be corrected by cleaning and coating with a suitable preservative. A clear lacquer should be used on all conductors or aluminum paint on structural metals.

CAUTION

DO NOT APPLY PRESERVATIVE TO THE INSULATORS.

Evidence of accumulation of conductive debris should be corrected by cleaning. If possible, this debris should be removed with plain water. If this will not loosen the debris, solvents may be used which are in themselves nonconductive. Conductive cleaners, such as soap or compounds containing acids or alkalies which will become an electrolyte when wet and should be avoided.

4-5. MAINTENANCE. The gear reducer is serviced with the proper lubricant when shipped; however, the oil level should be checked prior to operation. New units, after 240 hours of operation or six months, should have the oil completely drained, flushed with a light flushing oil, and refilled with the proper grade lubricant specified in table 5-1. Under abnormal operating conditions, such as extreme temperature changes, exceptionally humid or dusty conditions, or in a chemical fume environment, the oil change interval should be decreased depending upon the severity of the condition.

The pedestal has two grease fittings for bearing lubrication. Under normal conditions, a six month lubrication interval is recommended using a short fiber grease. Refer to table 5-1.

The set screws in the motor flywheel, small sprocket, and the bolts holding the large sprocket should be checked periodically for tightness.

If the drive chain has excessive slack, loosen the gear reducer mount bolts, tighten the tensioning bolt against the gear reducer, and retighten the mounting bolts.

5-1. GENERAL. Control Group type CG-46 consists of antenna pedestal type AR-72, control type CP-43, and control cable (cable length dependent on customer requirements). The control group operates on the primary voltage specified in table 5-1. Specifications, operation, maintenance, and parts identification of the control group are contained in this chapter.

5-2. OPERATION.

5-2.1. Local Control. The antenna may be rotated manually from the local control unit. Apply power to the antenna by operating the circuit breaker on the panel of the local control. With the Local/Remote switch in the "local" position, the CCW/CW toggle switch may be used to rotate the antenna in the appropriate direction. This has a central "off" position. Following rotation of the antenna, "off" must be selected and the antenna allowed to come completely to rest before selecting the reverse rotation. When local operations have been completed, the Local/Remote switch should be set to the "remote" position.

5-2.2. Remote Control. The controller has two operating modes, Remote and Computer. Figure 5-8 is a block diagram of the antenna controller. The front panel switch on the controller is used to select the desired mode of operation. In either case, the Local/Remote switch at the antenna must be in the "remote" position. When the Local/Remote switch is in the "remote" position and the On/Off switch is in the "on" position, the remote indicator on the face of the controller will be illuminated. The display on the face of the controller will display the current antenna azimuth independent of the operating mode selected and independent of whether the antenna is in the "local" or "remote" condition.

When the controller is in the "remote" mode of operation, all operations are controlled from the keyboard located on the controller. To enter a new azimuth from the keypad, the user presses the desired keys on the keypad. The entered data will be indicated on the display in place of the current azimuth. The data will be scrolled to the left and leading zeros suppressed. Errors are corrected by continuing to enter data until the desired azimuth is indicated by the display. When the desired azimuth is indicated, the user presses the "enter" key and the controller will then rotate the antenna to the desired azimuth. If the desired azimuth is within 5 degrees of the current azimuth, the antenna will not be rotated. After the "enter" key is pressed, the display will return to a display of the antenna azimuth. During rotation and for 11 seconds after rotation stops, the controller will not accept a new azimuth. Azimuths greater than 359 degrees will be ignored.

To operate the controller from the computer interface, the baud rate straps and address straps must be installed as shown in table 5-2. The controller will generate an output message only in response to a valid input message. All messages to and from the controller are composed of six ASCII characters. The controller ignores the parity bit of each character and will return even parity. Two types of input messages are accepted by the controller, a status request and an azimuth command. The responses to these input messages are shown in table 5-3.

The controller will begin sending the output message within one character time after the end of the input message. Any errors in the input message to the controller will result in the controller not producing an output message. The formats of the input and output messages are shown in table 5-4. The encoding of the unit address is shown in table 5-2.

5-3. REMOTE CONTROL UNIT.

5-3.1. Hardware Description. The microcomputer is a single board computer which utilizes the 6502 microcomputer. A simplified schematic of the microcomputer board is illustrated in figure 5-9. The computer board contains 1024 bytes of Random Access Memory (RAM), 2048 bytes of Read Only Memory (ROM), four 6522 Versatile Interface Adapters (VIA), a Universal Asynchronous Receiver Transmitter (UART), and the necessary circuitry to produce an RS-232C interface. Each VIA provides two eight-bit Input/Output (I/O) ports and two timers. Each bit of each I/O port may be individually defined as an input or an output. Thus, the four VIAs provide a total of 64 I/O lines. The assignment of these 64 I/O lines is given in table 5-5. The operation of the computer board is controlled by the program instructions contained in the ROM and is described in the section on Program Operation. The baud rate of the RS-232C interface is controlled by one of the timers in the A5 VIA. The clocking signal produced by this timer is supplied to the UART and is 16 times the baud rate. The frequency of this signal may be measured at test point TP1 on the computer board.

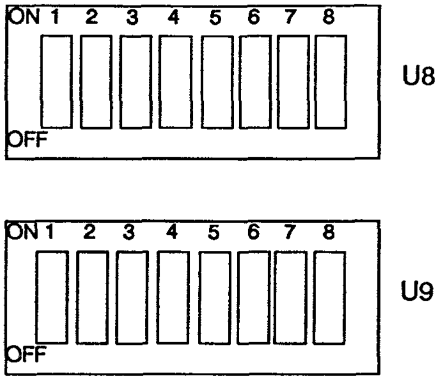
Figure 5-10 is a simplified schematic of the display used in the controller. The output to the display is Binary Coded Decimal (BCD). The display is an assembly of three seven-segment LED displays. Contained in the rear of each display is a decoder which converts the BCD format into the seven-segment format required by the display. The decoder also provides the necessary

Table 5-1. Specifications

Electrical	
Primary Power	415 VAC, 50/60 Hz, 3 Phase
Cable Requirements	
Power Cable (4 conductor)	Up to 500 feet - #14 AWG 1000 feet - # 10 AWG 2000 feet - # 8 AWG
Control Cable (10 conductor)	Up to 2000 feet - #18 AWG
Mechanical	
Antenna Pedestal Weight	760 lbs gross
Control	Continuous in local or remote
Lubrication	
Gear Reducer	Above +20°F - SAE Grade 30 20°F and lower - Automatic Transmission Fluid, Mobil ATF 200 or equal
Pedestal Gear and Bearing	Mobil Grease No. 5 Type A, Grade 2 or equal
Rotation Speed	0.5 rpm

Table 5-2. Azimuth Correction, Unit Address, and Baud Rate Strapping

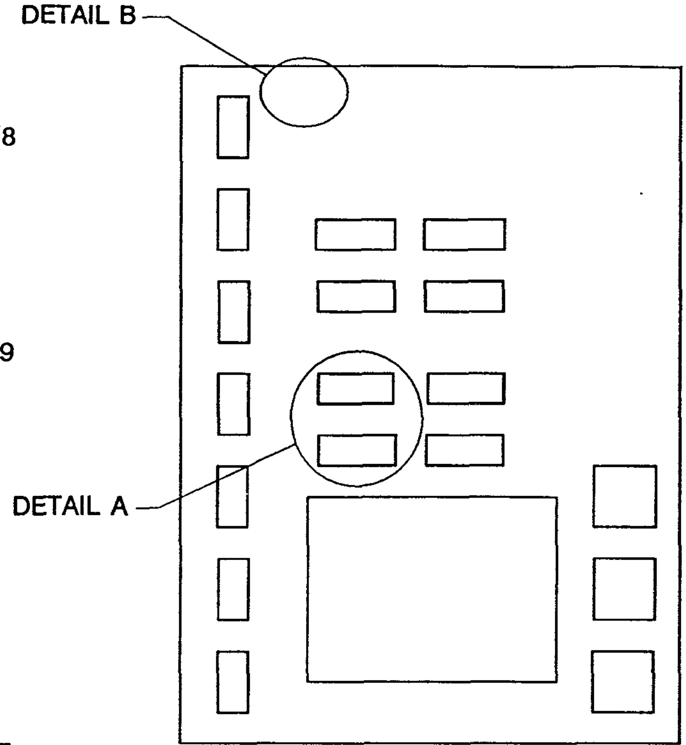
AZIMUTH CORRECTION AND
UNIT ADDRESS (SEE PARA 2-27)



DETAIL A

	STRAP G	STRAP H	STRAP J
110 Baud	L	L	L
150 Baud	L	L	K
300 Baud	L	K	L
600 Baud	L	K	K
1200 Baud	K	L	L

DETAIL B



INTERFACE BOARD
TOP VIEW

Address Character	Address Code	Switch Positions U9-3	U9-4	U9-5	U9-6
@	0	Closed	Closed	Closed	Closed
A	1				Open
B	2			Open	
C	3			Open	Open
D	4		Open		
E	5		Open		Open
F	6		Open	Open	
G	7		Open	Open	Open
H	8	Open			
I	9	Open			Open
J	10	Open		Open	
K	11	Open		Open	Open
L	12	Open	Open		
M	13	Open	Open		Open
N	14	Open	Open	Open	
O	15	Open	Open	Open	Open

Table 5-3. Message Input and Response

Input Message Received	Output Message Returned	Antenna Condition When Input Message Was Received
Status Request	Current Azimuth	Not rotating - no faults
	Rotating	Antenna rotating
	Fault 10	Antenna exceeded maximum rotate time the last time it was commanded to rotate. See note1.
Azimuth Command	Rotating	Antenna not rotating
	Busy	Antenna rotating or 11 second time-out after rotation stops.
	Rotating	Any fault condition (next status request will return the fault indicator).
NOTE 1: The rotate time is reset by the next azimuth command.		

Table 5-4. Message Formats

Input Message

Character Number	Character (ASCII)	Hex Equivalent
1	STX	X'02
2	Address	See Table 5-2
3	Command	
4	Command	
5	Command	
6	ETX	X'03

The command string for a rotate request is three ASCII characters in the range of 000 to 359.
The command string for a status request is three ASCII characters of SSS (S=X'53).

Output Message

Character Number	Character (ASCII)	Hex Equivalent
1	STX	X'02
2	Address	See Table 5-2
3	Response	
4	Response	
5	Response	
6	ETX	X'03

The response string is as follows:

Azimuth	000 to 359	Azimuth in Degrees
Busy	BBB	Controller Cannot Accept Azimuth Command
Rotating	RRR	Antenna Currently Rotating
Local	LLL	Controller in Local Mode
Fault	F10	Rotate Time-out Fault

Table 5-5. I/O Assignments

Function		I/O	Connector	Description	
VIA A1					
Port A	PA7	I	J1-8	S/D Output MSB	180 Degrees
	PA6	I	J1-7	"	90 Degrees
	PA5	I	J1-6	"	45 Degrees
	PA4	I	J1-5	"	22.5 Degrees
	PA3	I	J1-4	"	11.3 Degrees
	PA2	I	J1-3	"	5.6 Degrees
	PA1	I	J1-2	"	2.6 Degrees
	PA0	I	J1-1	"	1.4 Degrees
Port B	PB7	O	J2-8	Display Digit #1	800 Degrees
	PB6	O	J2-7	"	400 Degrees
	PB5	O	J2-6	"	200 Degrees
	PB4	O	J2-5	"	100 Degrees
	PB3	O	J2-4	"	80 Degrees
	PB2	O	J2-3	"	40 Degrees
	PB1	O	J2-2	"	20 Degrees
	PB0	O	J2-1	"	10 Degrees
VIA A2					
Port A	PA7	I	J3-8	S/D Output Bit 9	0.7 Degrees
	PA6	I	J3-7	S/D Output Bit 10	0.4 Degrees
	PA5	O	J3-6	Converter Inhibit	
	PA4	I	J3-5	Motion	
	PA3	I	J3-4	Motor Fault	
	PA2	I	J3-3	EM Limit	
	PA1	I	J3-2	CW Limit	
	PA0	I	J3-1	CCW Limit	
Port B	PB7	O	J4-8	Display Digit #3	8
	PB6	O	J4-7	"	4
	PB5	O	J4-6	"	2
	PB4	O	J4-5	"	1
	PB3	O	J4-4	Not Used	
	PB2	O	J4-3	Not Used	
	PB1	O	J4-2	Not Used	
	PB0	O	J4-1	Not Used	
VIA A3					
Port A	PA7	I	J5-8	Remote	
	PA6	I	J5-7	Bus Control	
	PA5	I	J5-6	Azimuth Correction	200 Degrees
	PA4	I	J5-5	Azimuth Correction	100 Degrees
	PA3	I	J5-4	Unit Address MSB	8
	PA2	I	J5-3	"	4
	PA1	I	J5-2	"	2
	PA0	I	J5-1	"	1
	CA2	O	J5-10	CW Rotate Output	

Table 5-5. I/O Assignments-Continued

Function		I/O	Connector	Description	
VIA A3					
Port B	PB7	I	J6-8	Azimuth Correction	80 Degrees
	PB6	I	J6-7	"	40 Degrees
	PB5	I	J6-6	"	20 Degrees
	PB4	I	J6-5	"	10 Degrees
	PB3	I	J6-4	"	8 Degrees
	PB2	I	J6-3	"	4 Degrees
	PB1	I	J6-2	"	2 Degrees
	PB0	I	J6-1	"	1 Degrees
	CB2	O	J6-10	CCW Rotate Output	
VIA A5					
Port A	PA7	I	J7-8	Key 0	
	PA6	I	J7-7	Key 1	
	PA5	I	J7-6	Key 2	
	PA4	I	J7-5	Key 3	
	PA3	I	J7-4	Key 4	
	PA2	I	J7-3	Key 5	
	PA1	I	J7-2	Key 6	
	PA0	I	J7-1	Key 7	
Port B	PB7	I	J8-8	UART Clock Output	
	PB6	I	J8-7	Key 8	
	PB5	I	J8-6	Key 9	
	PB4	I	J8-5	Key Enter	
	PB3	I	J8-4	Not Used	
	PB2	I	J8-3	Baud Rate Strap 4	
	PB1	I	J8-2	Baud Rate Strap 2	
	PB0	I	J8-1	Baud Rate Strap 1	

drivers to drive the display segments. The decoder is connected to suppress leading zeros.

Figure 5-11 is a simplified schematic of the Syncho/Digital (S/D) converter interconnection. The S/D converter receives 115 VAC at the reference input. It also receives a three phase signal from the synchro transmitter in the antenna. The S/D converter converts these AC signals to a ten-bit digital output. The computer generates an inhibit signal to the S/D converter whenever the S/D output is sampled. The inhibit input to the S/D converter is taken low prior to the computer reading the output from the converter. At the conclusion of the read cycle, the inhibit is returned to a high state.

Figure 5-12 is a simplified schematic of the keyboard interconnection. The keyboard is composed of eleven normally open switches. Each switch is connected to an individual output line. The other side of all switches is connected to ground. Pull-up resistors are used to maintain the keyboard outputs at a high state when keys are not depressed.

The interconnection of the input and output couplers is illustrated in figure 5-13. The input coupler is provided +5 VDC and ground. When 115 VAC is applied to the input terminals of the coupler, the output of the coupler is switched from a high state to a low state. Pull-up resistors on the inputs maintain the outputs at a high state in the absence of an input. The output couplers are connected to the computer through line drivers U4C and U4D. The line drivers provide the necessary current drive to the output couplers. The output from the computer is normally a high state signal. The line drivers invert this signal and provide a low state signal to the output couplers. When the antenna is to be rotated, the computer switches one of these output signals from a high state to a low state. The signal is inverted by the line driver and a high state signal is provided to the output coupler. This high state input causes the output coupler to switch the AC circuit at its output terminals, thus providing rotating signal to the antenna.

Figure 5-14 is a simplified schematic of the azimuth correction switches, the address switches, and the baud rate strapping. Both the azimuth correction and address switches are wired to place ground on the associated output line. Pull-up resistors are used to maintain the output lines at a high state if the associated switch is open. Ten lines are used for azimuth corrections and four lines are used for unit address. The ten lines used for azimuth correction are encoded in a BCD format with two lines being used for each of the tens and units digits. The baud rate utilizes three output lines. These lines are strapped to either ground or +5 VDC.

5-3.2. Program Operation. The microcomputer operation is controlled by a program contained in the Read Only Memory (ROM). The inputs to the microcomputer are the indicators from the antenna rotator and the outputs of the keyboard. The outputs from the microcomputer are the display data and the control signals to the antenna rotator.

On application of power to the microcomputer, the microcomputer accesses the azimuth correction information, the unit address, and the baud rate information which are provided by switches on the interface board. This data is stored in the memory of the microcomputer for use. The baud rate information is used to preset timers in the microcomputer to provide the proper baud rate from the serial interface. Also at this time, all of the parallel I/O lines to and from the microcomputer are initialized. The display is loaded with 000 and the serial interface is cleared.

Figure 5-15 is a simplified flow chart of the operation of the program after the initialization sequence. In operation, the synchro transmitter in the antenna rotator produces a three phase AC signal which indicates the antenna position. This three phase AC signal is applied to the Synchro/Digital (S/D) converter on the interface board. The S/D converter digitizes this three phase AC signal and provides a ten-bit digital signal to the microcomputer. The azimuth of the antenna is a relative azimuth. The difference in actual bearing and the indicated bearing is entered on the azimuth correction switches. This angle is then added to the azimuth from the S/D converter, adjusted to the range of 000 to 359 degrees and output to the display. Thus, the display will indicate the true heading of the antenna. The microcomputer continuously scans the remote indicator from the antenna to determine if control of the antenna is extended to the controller. If the remote indicator is "on", the microcomputer then scans the Remote/Computer switch to determine if keyboard service is necessary. If the Remote/Computer switch is in the "remote" position, the microcomputer then scans the keyboard for input. If no keys are depressed, the microcomputer then repeats the above described cycle.

If a key on the keyboard is depressed, the microcomputer will blank the display and then decode the keyboard output to determine which key is depressed. If the key is not the "enter" key, this digit is scrolled into the right hand digit of the display. A flag is set in memory to inhibit the reading and display of the current antenna azimuth. The keyboard continues to be scanned and upon receipt of another digit is scrolled to the left and the new digit is placed in the right hand position. When the "enter" key is depressed, the azimuth is recalled from the display and checked to assure that it is in the range of 000 to 359. If it is not, the azimuth is discarded and the display of the antenna azimuth is resumed. If the azimuth is acceptable, the azimuth is converted from a true heading to a relative heading by subtracting the azimuth correction. The resulting azimuth is adjusted to the range of 000 to 359 degrees and compared to the current antenna azimuth to determine which direction the antenna is to be turned. The relation between the current and requested azimuth is used to determine which direction to rotate the antenna. If the requested azimuth is within 5 degrees of the current antenna azimuth, the antenna is not rotated. The requested azimuth is adjusted by 3 degrees to allow for antenna drift and the output command is issued to the output coupler for the desired rotation direction.

At this time, the microcomputer again displays the antenna heading on the display. While the antenna is rotating, the microcomputer compares the antenna azimuth to the requested azimuth. When the two azimuths are equal, the microcomputer removes the rotate signal from the output coupler, thus stopping antenna rotation. During the time the antenna is rotating, the microcomputer times the rotation. If the antenna does not rotate to the desired azimuth in the maximum time allowed, the rotating command is reset and the rotate fault flag is set. The maximum rotate time is factory set to 3 minutes. When the rotating command is removed from the antenna, the microcomputer starts an eleven-second timer. This timer inhibits the controller from attempting to rotate the antenna until all rotating members have come to rest. During the eleven-second time-out period, keyboard entry is inhibited.

If the microcomputer finds the Remote/Computer switch in the "computer" position, the keyboard is not scanned. Each pass through the program, the microcomputer scans the serial interface for incoming characters. All characters are examined and discarded until an STX character is received. The buffer which will receive the incoming message is initialized and the next five characters are stored in the buffer. If an ETX character is received prior to the sixth character, the contents of the buffer are discarded and scanning for an STX character is resumed. When six characters are received, the contents of the buffer are examined to determine that the STX, ETX, and address characters are correct. The address must match the address set into the switches on the interface board. If this test is met, the three command are examined to determine if the command is a status request or an azimuth command. If the three characters are not either a status request or an azimuth command, the message is ignored and the controller reverts to its normal scanning. If the command is a status request, the indicators from the antenna are examined. If the remote indicator is not on or if the Remote/Computer switch is in the "remote" position, the microcomputer generates a local message. Next, the rotate time fault flag is examined. If no fault exists, a rotating message is generated. If the antenna is not rotating, the current antenna heading is obtained from the display and encoded into an azimuth message.

If the incoming message is an azimuth command, the azimuth is examined to determine if it is in the range of 000 to 359 degrees. If the azimuth is outside this limit, the request is ignored and no response is sent. If the azimuth is acceptable, the rotating and time delay timers are examined. If either timer is not zero, a busy message is sent and the request discarded. If both timers are zero, the azimuth is corrected by the subtraction of the azimuth correction and adjusted to the range of 000 to 359 degrees. A rotating message is generated and the antenna is rotated as described in a previous paragraph.

The output message is then placed in the output buffer and the first character delivered to the serial interface. As each character is sent from the serial interface, the next character is fetched from the buffer output. This continues until all characters have been output.

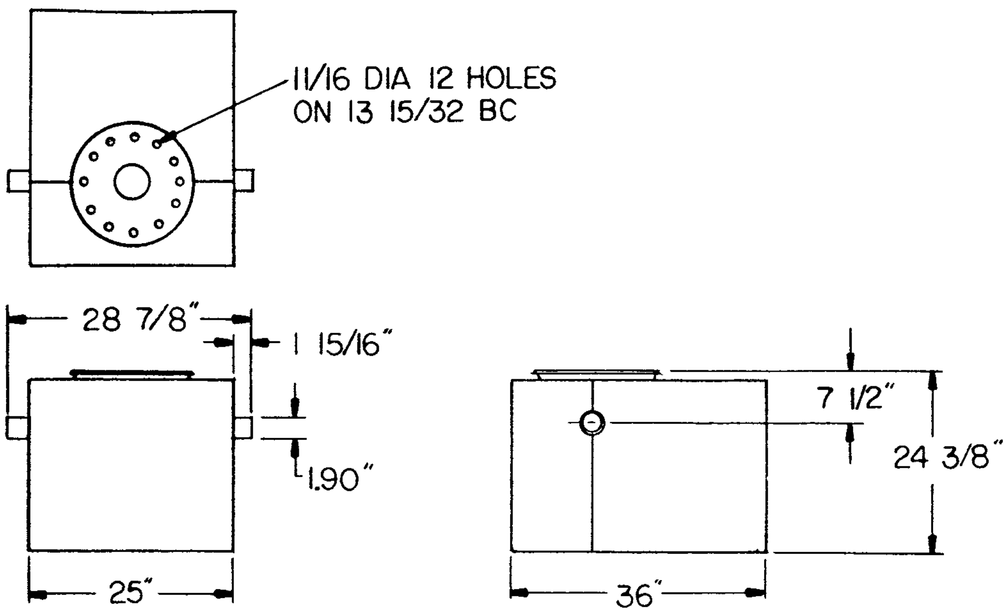
5-4. <u>MAINTENANCE.</u> The gear reducer is serviced with the proper lubricant when shipped, however the oil level should be checked prior to operation. New units, after 240 hours of operation or six months, should have the oil completely drained, flushed with a light flushing oil, and refilled with the proper grade lubricant specified in table 5-1. Under abnormal operating conditions, such as extreme temperature changes, exceptionally humid or dusty conditions, or in a chemical fume environment, the oil change interval should be decreased depending on the severity of the condition.

The pedestal has a grease fitting for bearing lubrication. Under normal conditions, a six month lubrication interval is recommended using a short fiber grease. Refer to table 5-1.

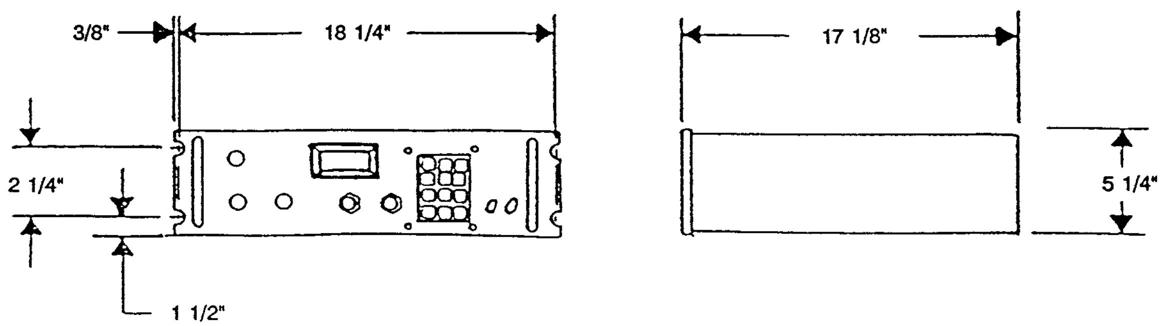
The antenna drive gears should be cleaned and greased annually to prevent rusting. The following discussion describes the procedures for this maintenance routine. Remove the hose clamp holding the boot and slide the boot up the mast. Remove the screws holding the cover and support the cover sufficiently to allow access to the gears. Clean and grease the gears as required to remove the rust and apply sufficient grease where the gears mesh. Grease external gear bearing through four (4) grease fittings located at 90^0 around bearing, figure 5-2. A hole is provided in bearing flange assembly for access to grease fittings. Rotate antenna until access hole is over grease fitting. Replace the cover and boot. Apply silicone grease where boot contacts mast and cover and replace hose clamp.

The set screws in the motor flywheel and gear reducer drive gear should be periodically checked for tightness.

If the antenna drive gears are found to have excessive backlash, the following procedure should be followed for tightening. Loosen the gear reducer mount bolts and move the gear reducer in toward the mast center line. Retighten the mount bolts and the gear reducer drive gear set screw.

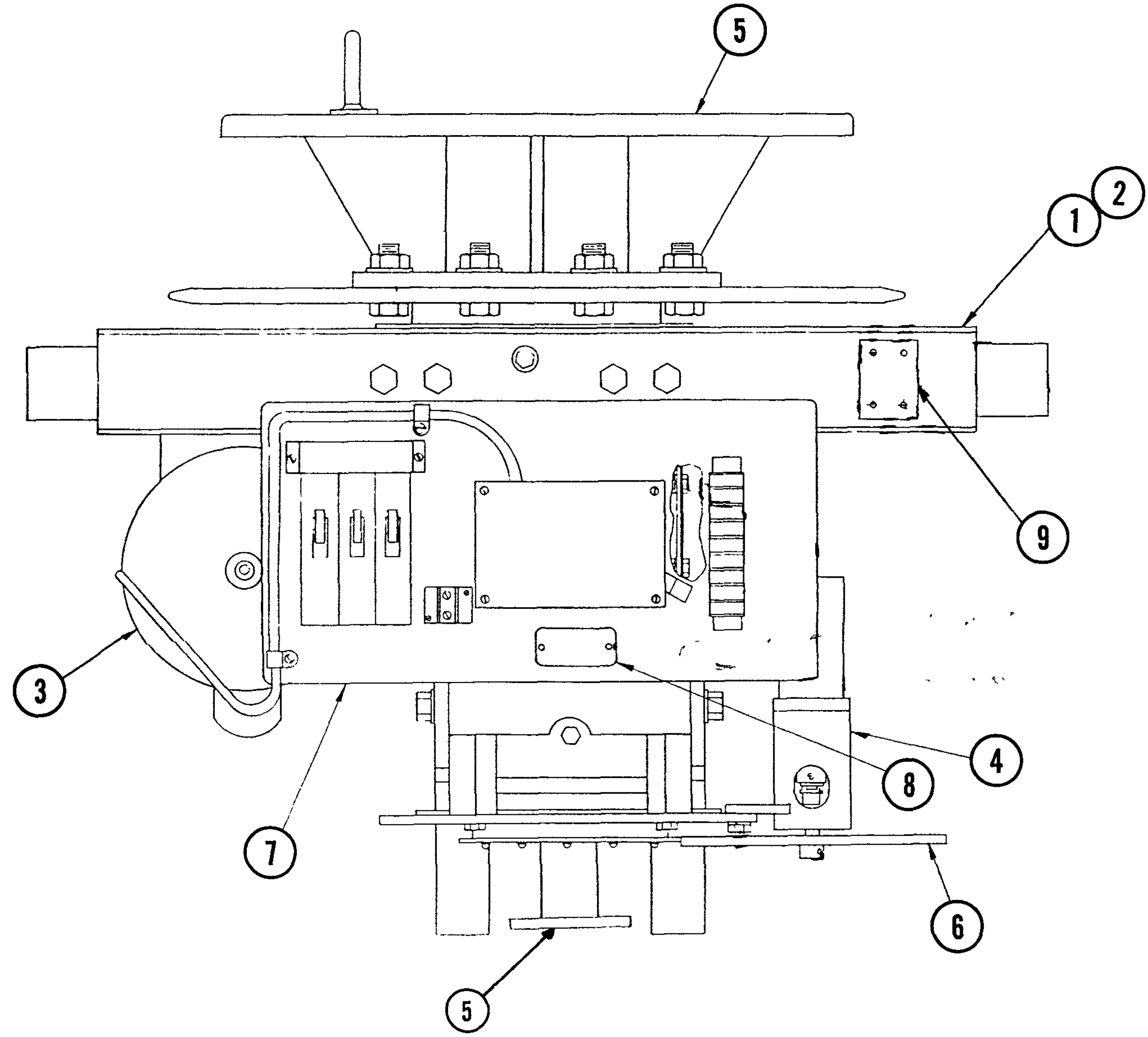


ANTENNA PEDESTAL



ANTENNA CONTROL

FIGURE 5-1. ANTENNA CONTROL GROUP ENVELOPE DIMENSIONS



Item No.	Part Number	Description	Qty
1	1000-0522-402	Pedestal Assembly, AR-72	1
2	0002-0270-501	Rotator Subassembly	1
3	0002-0277-201	Motor, Modified	1
4	0001-7194-302	Synchro Mount Assembly	1
5	0001-4008-001	Transmission Line, Short Section	1
6	0001-5374-001	Synchro Gear	1
7	0003-3739-401	Relay Panel Assembly	1
8	0080-0251-201	Nameplate	1
9	99-942-9507	Plate, Mod Record	1

FIGURE 5-2. PEDESTAL ASSEMBLY

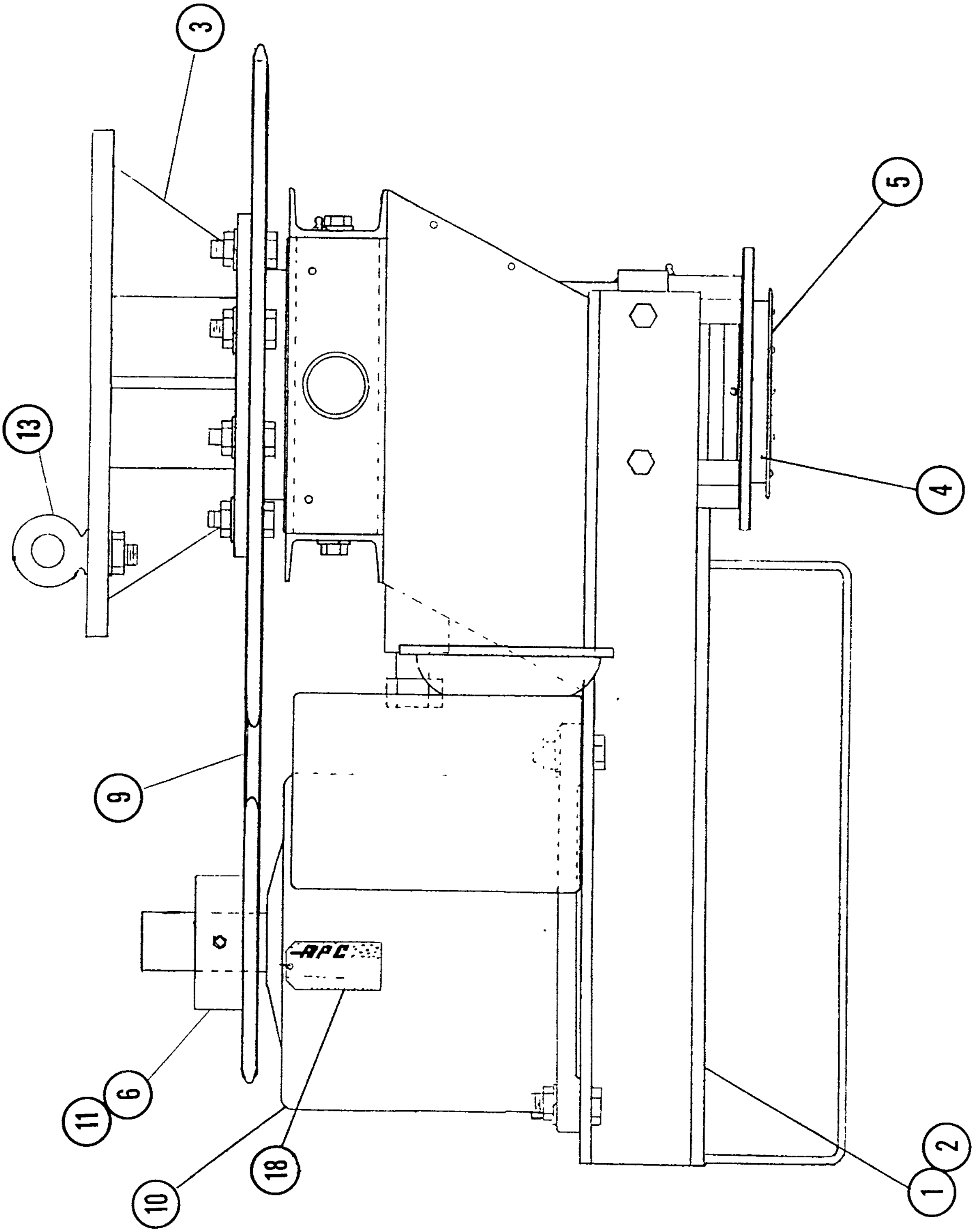


FIGURE 5-3. PEDESTAL SUBASSEMBLY (SHT 1 OF 4)

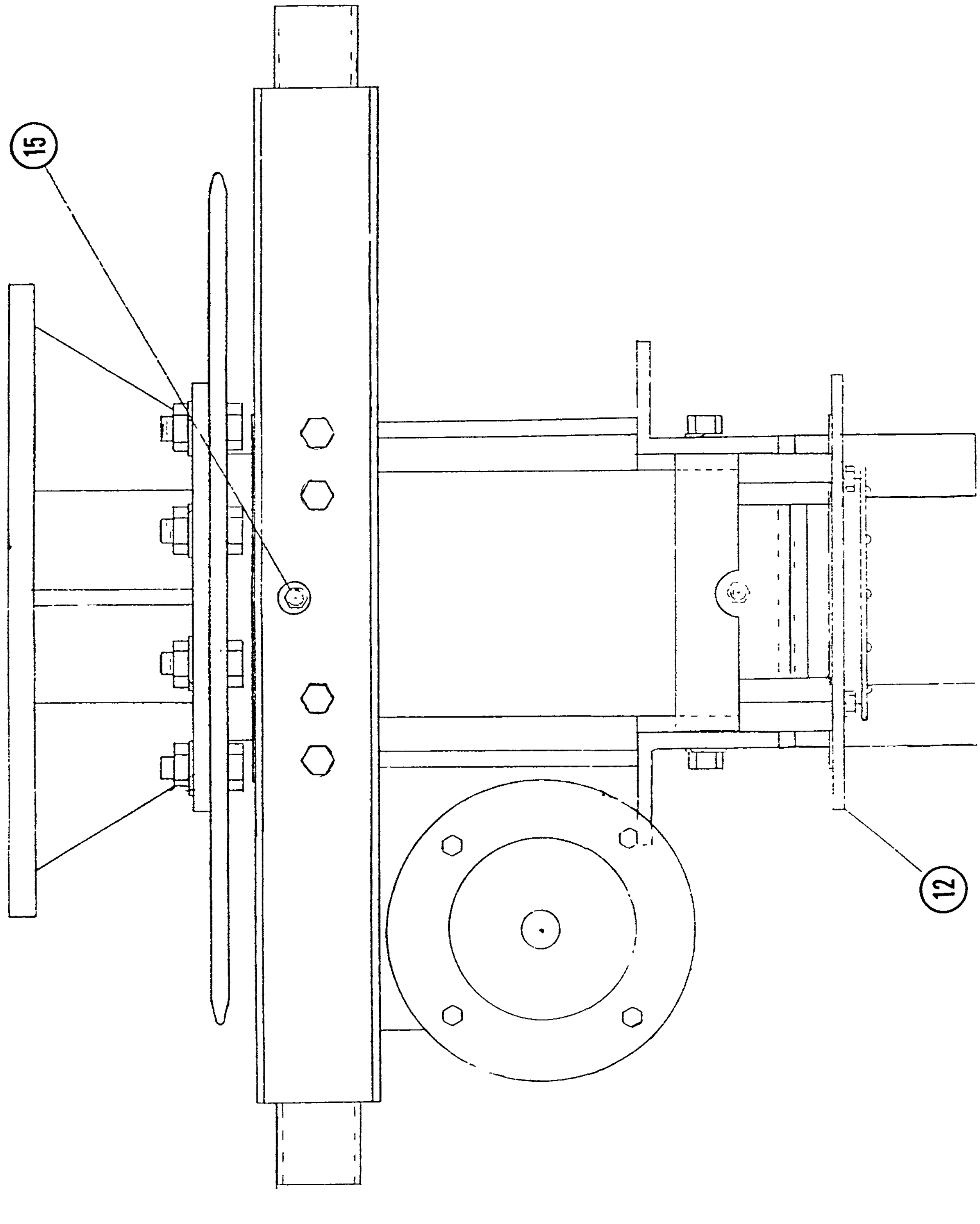


FIGURE 5-3. PEDESTAL SUBASSEMBLY (SHT 2 OF 4)

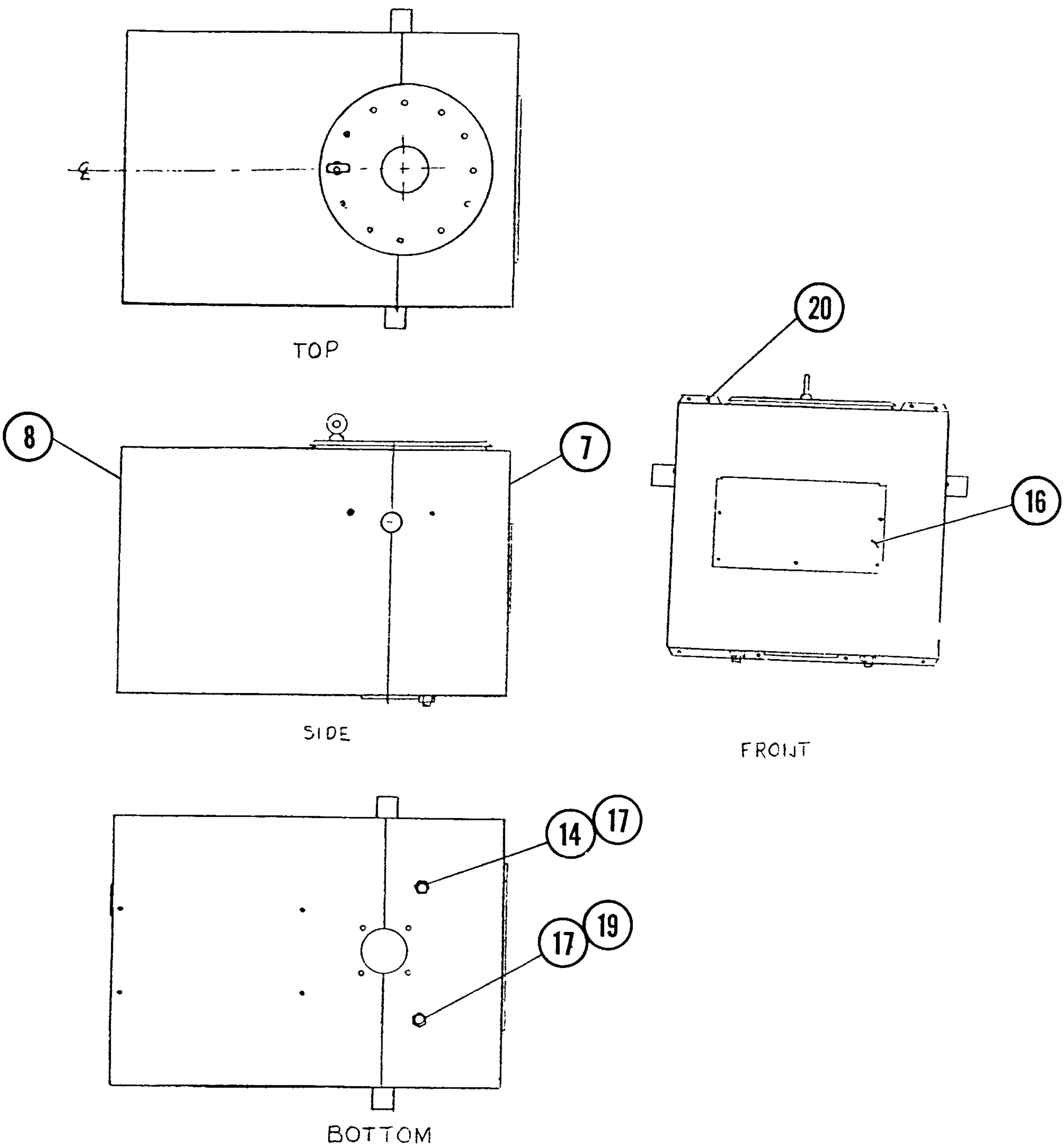


FIGURE 5-3. PEDESTAL SUBASSEMBLY (SHT 3 OF 4)

Item No.	Part Number	Description	Qty
1	0002-0270-501	Rotator Subassembly	1
2	0001-4236-101	Frame Assembly, Rotator	1
3	0001-5325-001	Bearing Assembly, Support Mast	1
4	0001-5317-001	Gear Hub	1
5	0001-5321-001	Gear, Spur	1
6	3970-0065-001	Sprocket	1
7	0001-4297-001	Housing, Rotator Front	1
8	0001-4296-001	Housing, Rotator Rear	1
9	3970-0052-001	Chain, Roller, Single Width	1
10	3960-0016-001	Gear Reducer, 600:1	1
11	0001-4293-001	Key, Square	1
12	0001-7092-001	Synchro Bracket	1
13	2450-0522-001	Eyebolt w/Nut Shoulder	1
14	8900-0197-001	Connector, Strain Relief	1
15	2450-0791-001	Fitting, Grease, 1/8 NPT	1
16	0001-4299-001	Panel, Access	1
17	8900-0127-001	Locknut, Conduit	2
18	0001-5384-001	Tag, Gear Box	1
19	8900-0194-001	Connector, Conduit	1
20	0001-5806-001	Gasket	2

FIGURE 5-3. PEDESTAL SUBASSEMBLY (SHT 4 OF 4)

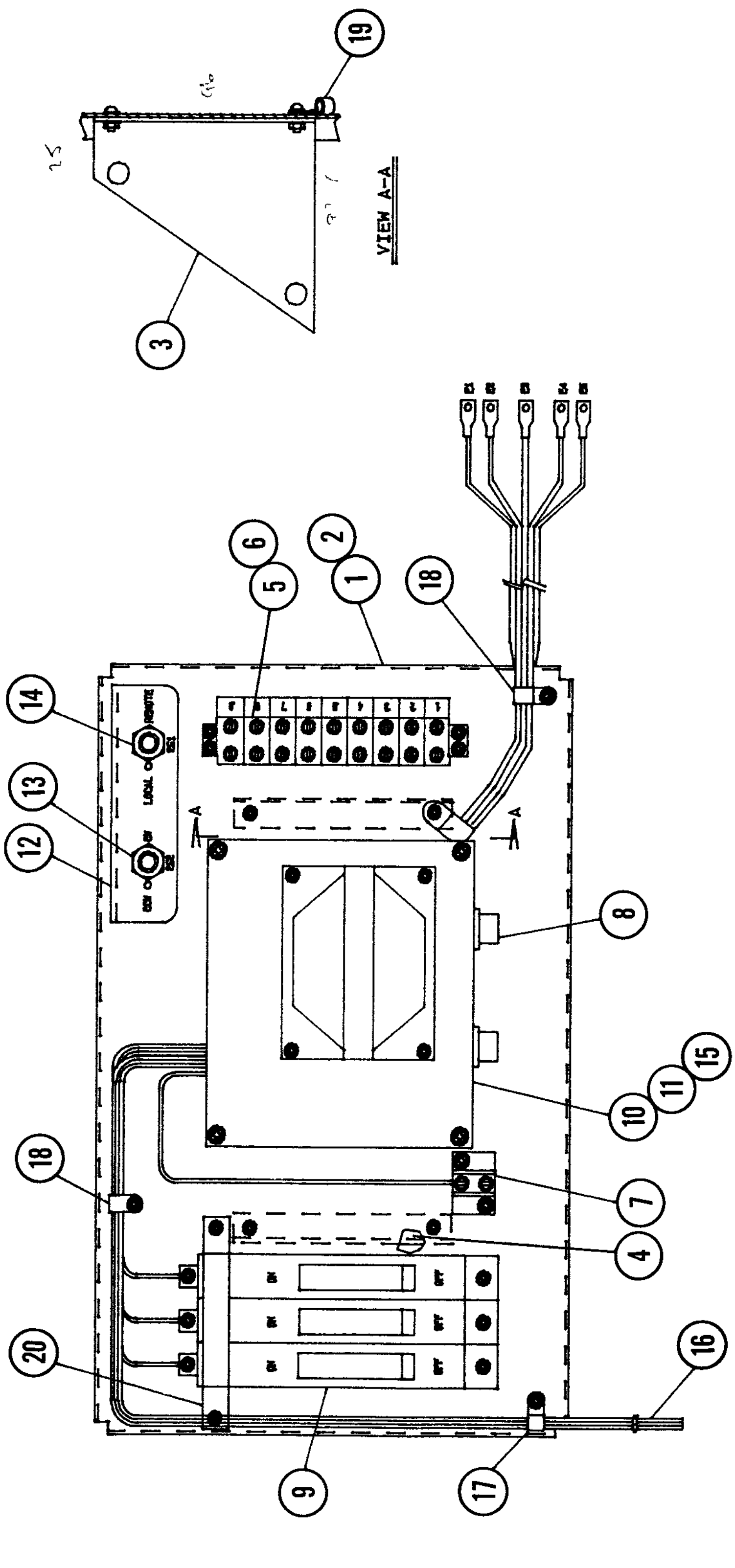
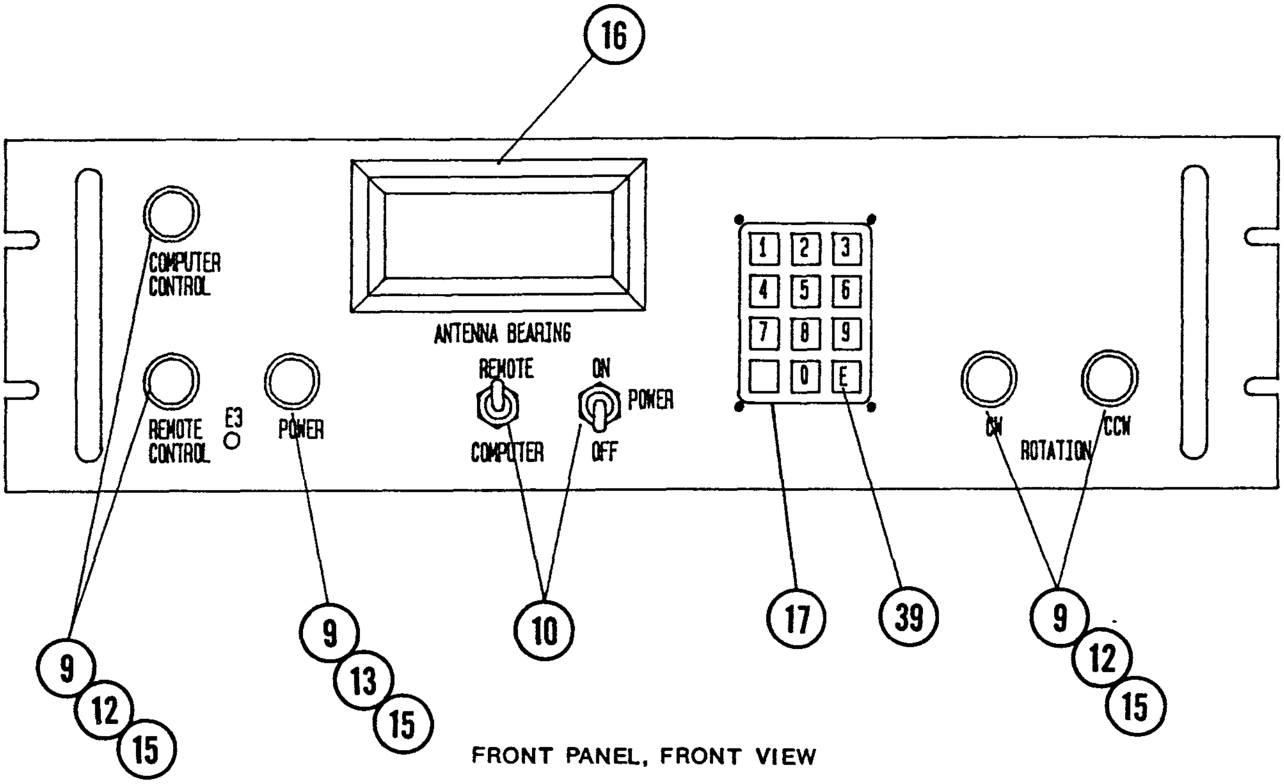


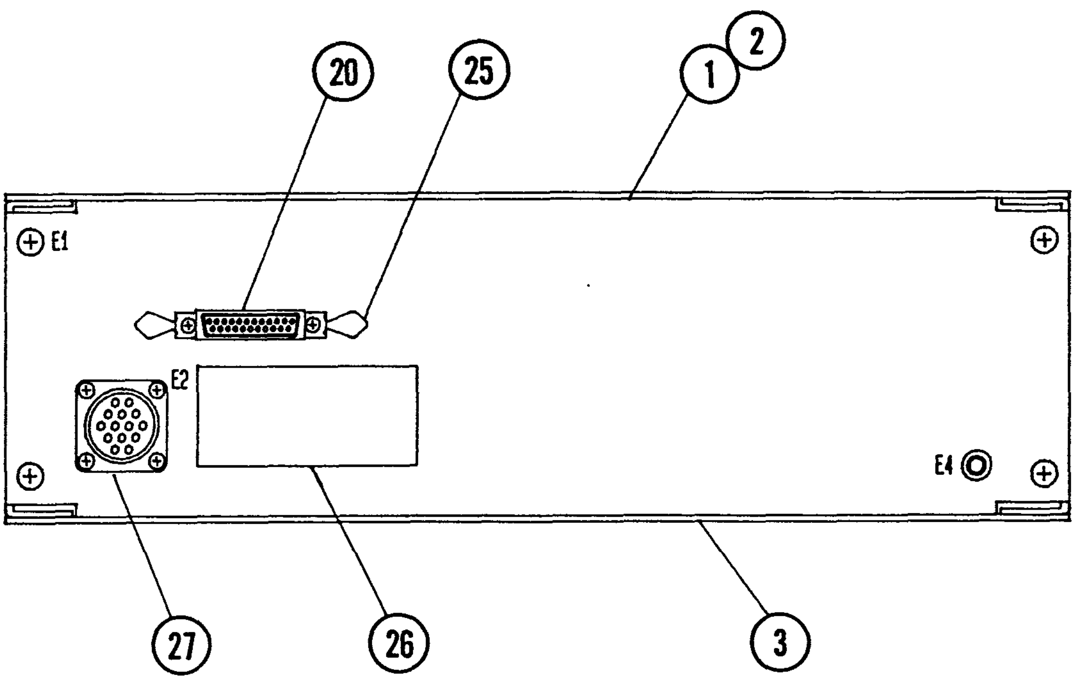
FIGURE 5-4. RELAY PANEL ASSEMBLY (SHT 1 OF 2)

Item No.	Part Number	Description	Qty
1	0003-3739-401	Relay Panel Assembly	1
2	0003-3738-401	Plate, Mount Relay	1
3	0001-4284-001	Mount, Relay Plate LH	1
4	0001-4284-002	Mount, Relay Plate RH	1
5	8000-0176-001	Terminal Strip	1
6	8000-0358-009	Marker, Terminal Strip	1
7	8000-0050-001	Terminal Strip	1
8	7000-0031-002	Contactor, Reversing, 115 VAC	1
9	6900-0091-001	Circuit Breaker, 20 Amp	1
10	8200-0067-019	Transformer	1
11	0001-8848-002	Mount, Transformer	1
12	0003-3737-301	Bracket, Switch	1
13	MS35058-27	Switch, Momentary	1
14	MS35058-23	Switch	1
15	0001-8847-001	Rod, Support	4
16	0960-0194-101	Wire Harness Kit	1
17	8900-0267-001	Clamp, Cable, 3/16	1
18	8900-0269-001	Clamp, Cable, 5/16	2
19	8900-0270-001	Clamp, Cable, 3/8	1
20	0001-5513-001	Clamp, Circuit Breaker	1

FIGURE 5-4. RELAY PANEL ASSEMBLY (SHT 2 OF 2)

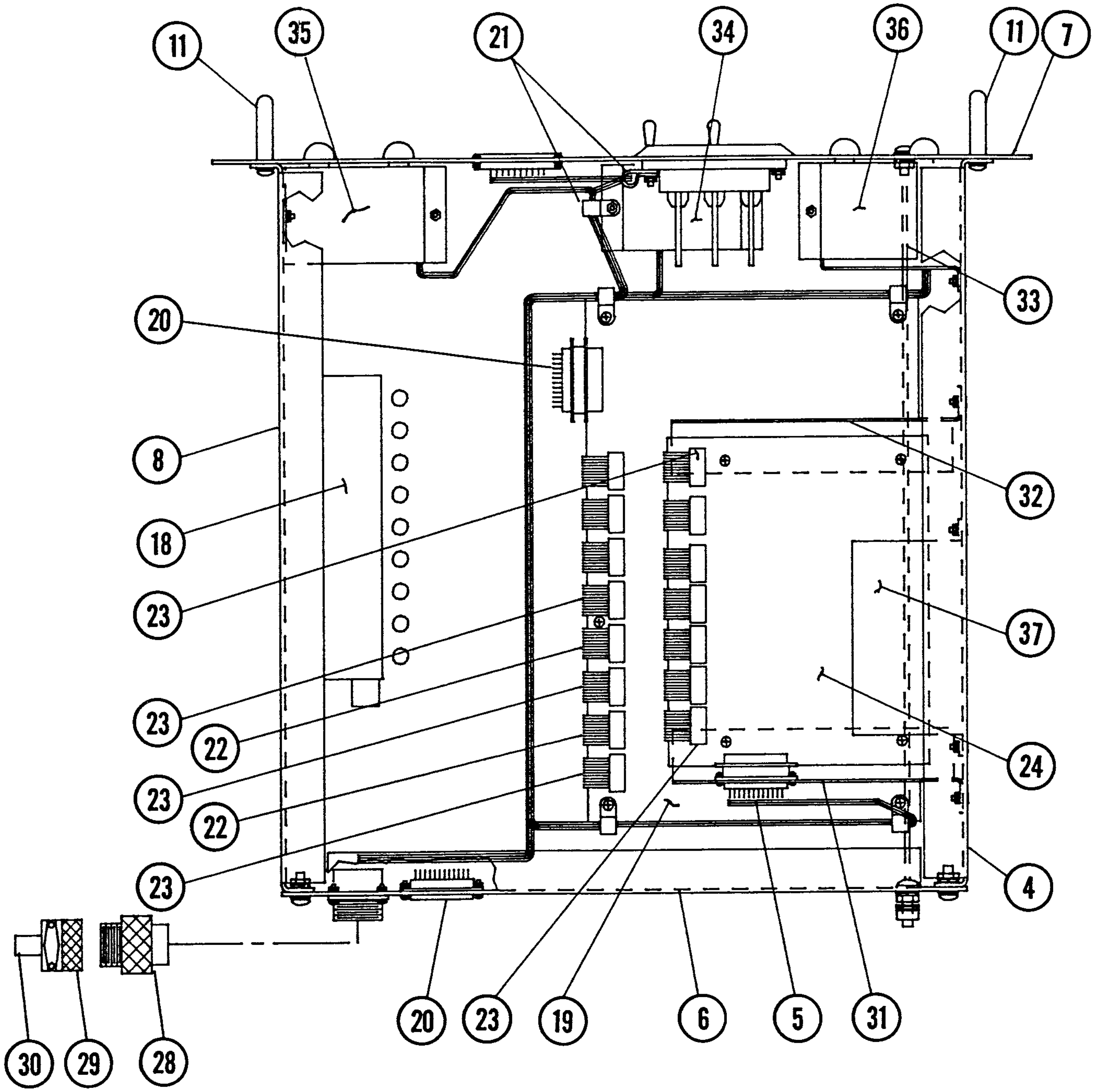


FRONT PANEL, FRONT VIEW



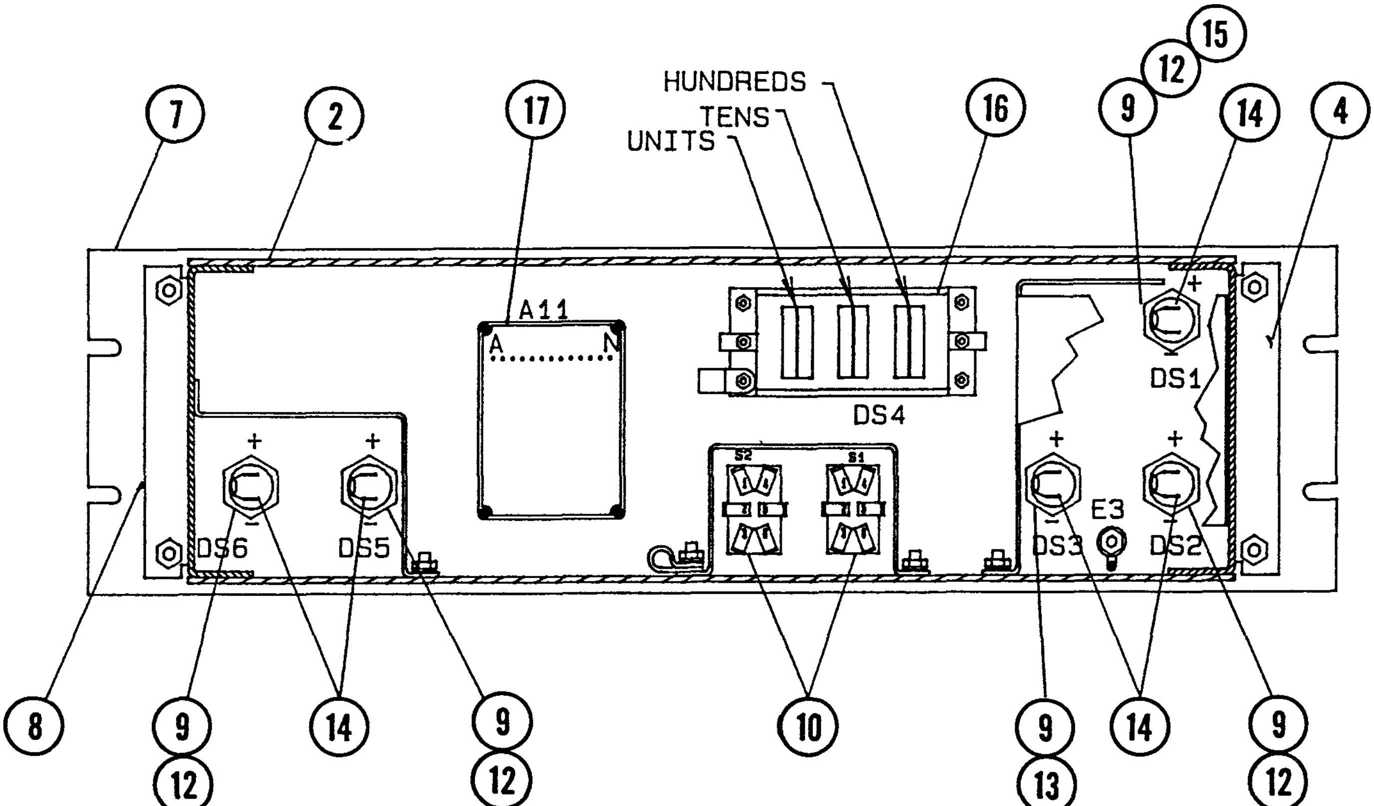
REAR PANEL, FRONT VIEW

FIGURE 5-5. COMPUTER CONTROL UNIT (SHT 1 OF 5)

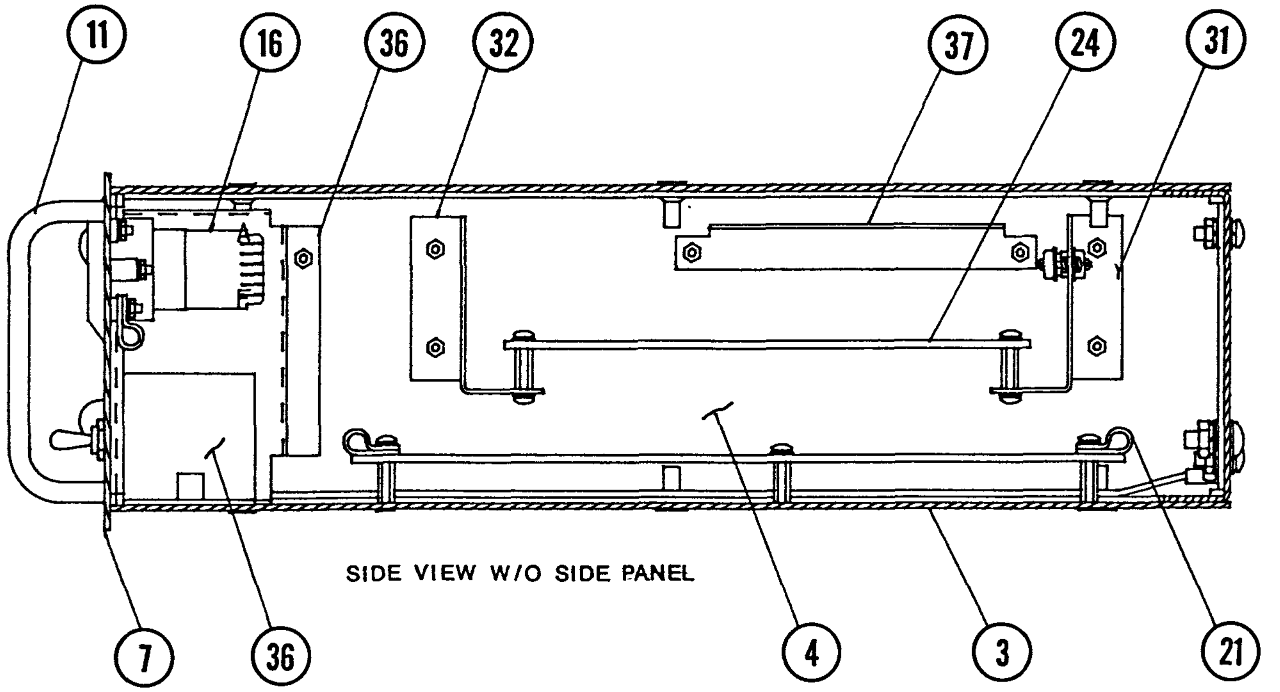


TOP VIEW W/O LID

FIGURE 5-5. COMPUTER CONTROL UNIT (SHT 2 OF 5)

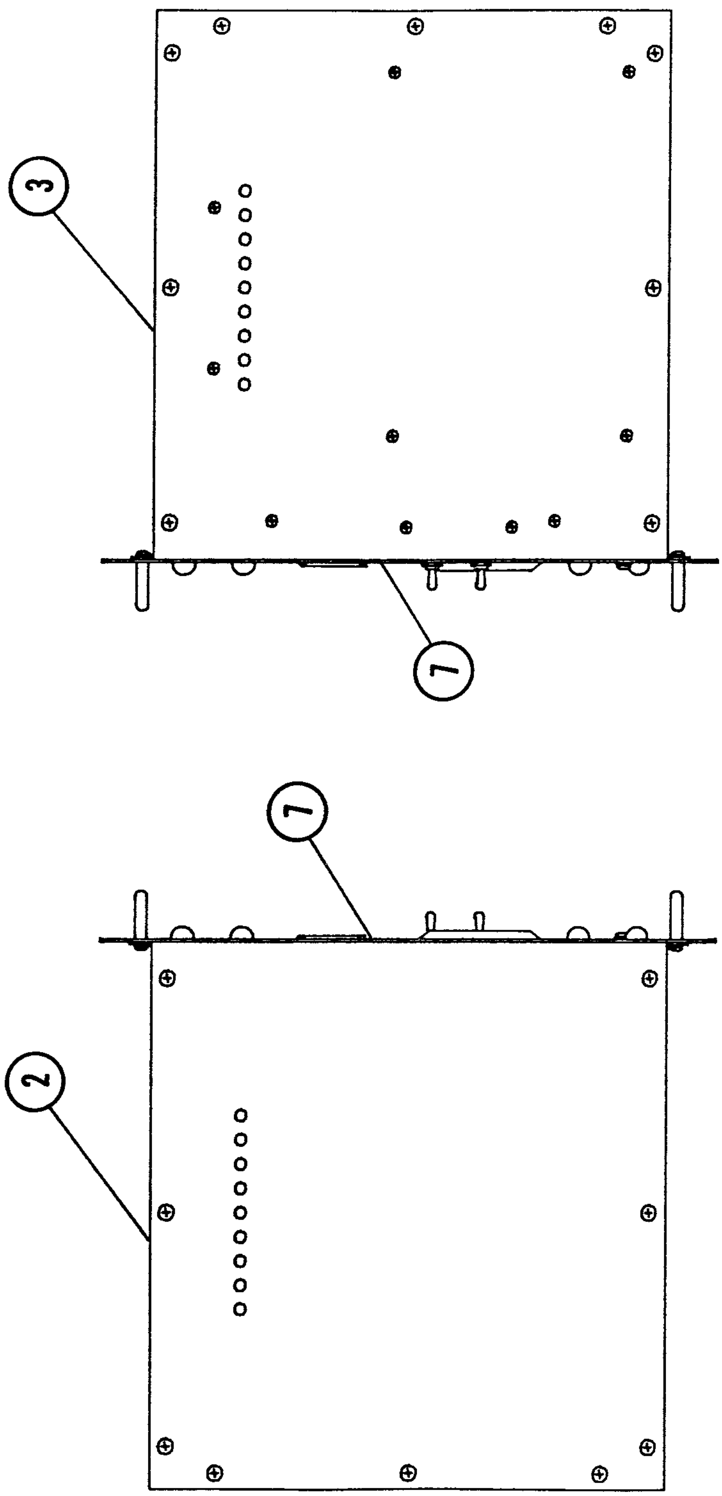


FRONT PANEL, REAR VIEW



SIDE VIEW W/O SIDE PANEL

FIGURE 5-5. COMPUTER CONTROL UNIT (SHT 3 OF 5)



SIDE PANELS

FIGURE 5-5. COMPUTER CONTROL UNIT (SHT 4 OF 5)

Item No.	Part Number	Description	Qty
1	1000-1408-401	Computer Control Unit, CG-43	1
2	0003-3198-401	Panel, Top	1
3	0003-3199-401	Panel, Bottom	1
4	0003-3741-402	Panel, Subassembly, Side, LH	1
5	5000-0416-001	Connector	1
6	0003-3741-401	Panel, Subassembly, Rear	1
7	0003-3194-401	Panel, Front	1
8	0003-3741-403	Panel, Subassembly, Side, RH	1
9	6700-0119-001	Lampholder	5
10	MS35059-23	Switch, DPDT, Toggle	2
11	MS39087-105CP	Handle, Bow	2
12	6700-0120-003	Lens, Amber	4
13	6700-0120-001	Lens, Red	1
14	4350-0027-085	Capacitor, .01 MFD	5
15	6700-0010-001	Lamp	5
16	0002-9122-301	Display Assembly	1
17	8100-0004-001	Keyboard	1
18	8100-0006-006	Power Supply	1
19	0002-9124-301	Board Assembly, Modified	1
20	5000-0148-001	Connector	2
21	8900-0270-001	Clamp, Cable, 3/8 Nylon	6
22	8100-0009-001	Cable, 16 DIP, One End, 24"	3
23	8100-0010-001	Cable, 16 DIP, Two Ends, 12"	6
24	0003-3208-301	Board, Interface w/Connector	1
25	5000-0170-001	Latch, Spring, D Shell	2
26	0080-0254-201	Nameplate	1
27	MS3102R18-1P	Connector, Receptacle	1
28	MS3102R18-1S	Connector, Plug	1
29	MS3057-10A	Clamp, Cable	1
30	MS3420-10	Adapter, Cable	1
31	0003-3213-401	Bracket, Interface, Rear	1
32	0003-3213-402	Bracket, Interface, Front	1
33	0003-3205-201	Ground Wire Assembly	1
34	0003-3203-301	Guard, Switch	1
35	0003-3201-301	Guard, Lamp	1
36	0003-3202-301	Guard, Lamp	1
37	0003-3204-301	Cover, Board	1
38	8100-0004-002	Legend Card	1

FIGURE 5-5. COMPUTER CONTROL UNIT (SHT 5 OF 5)

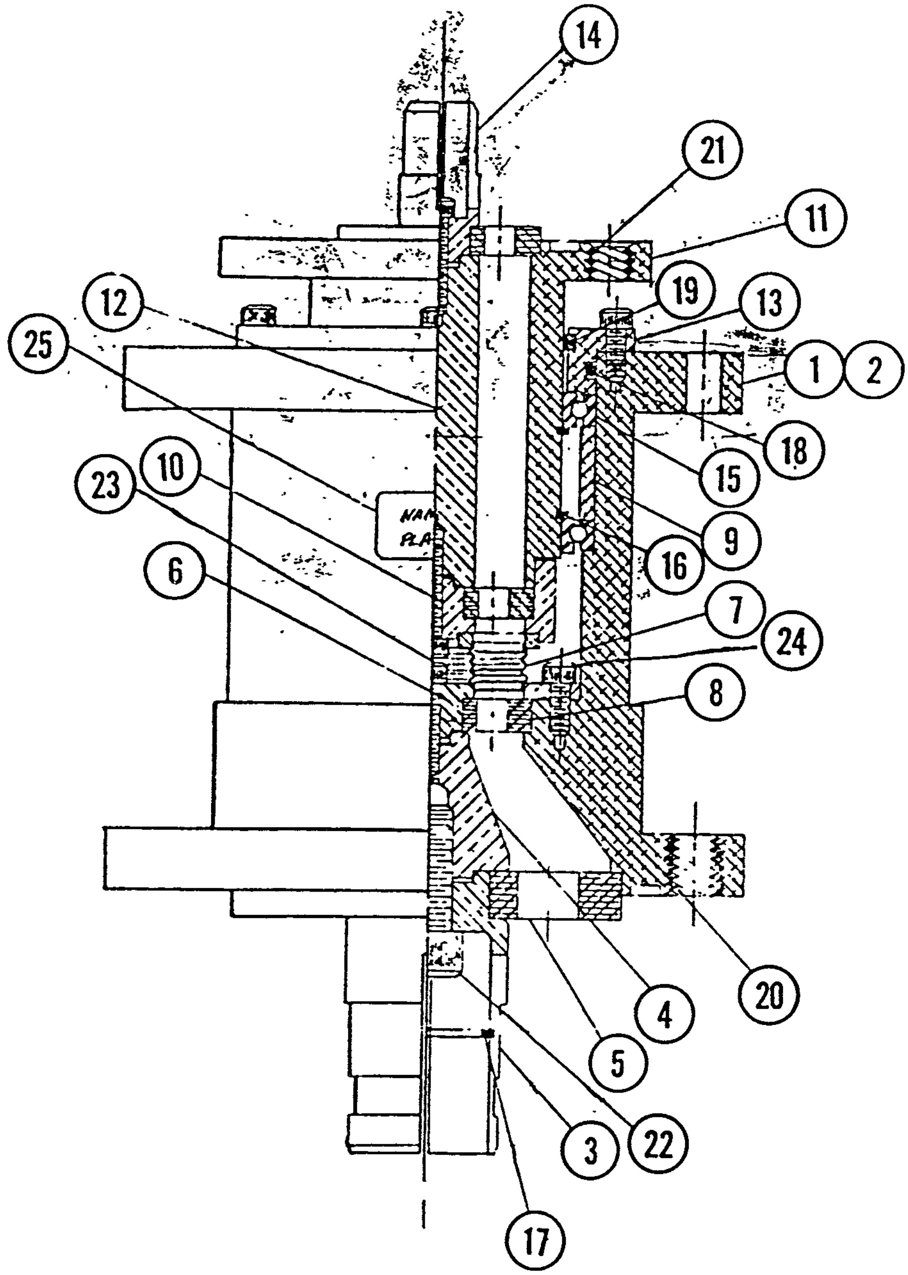
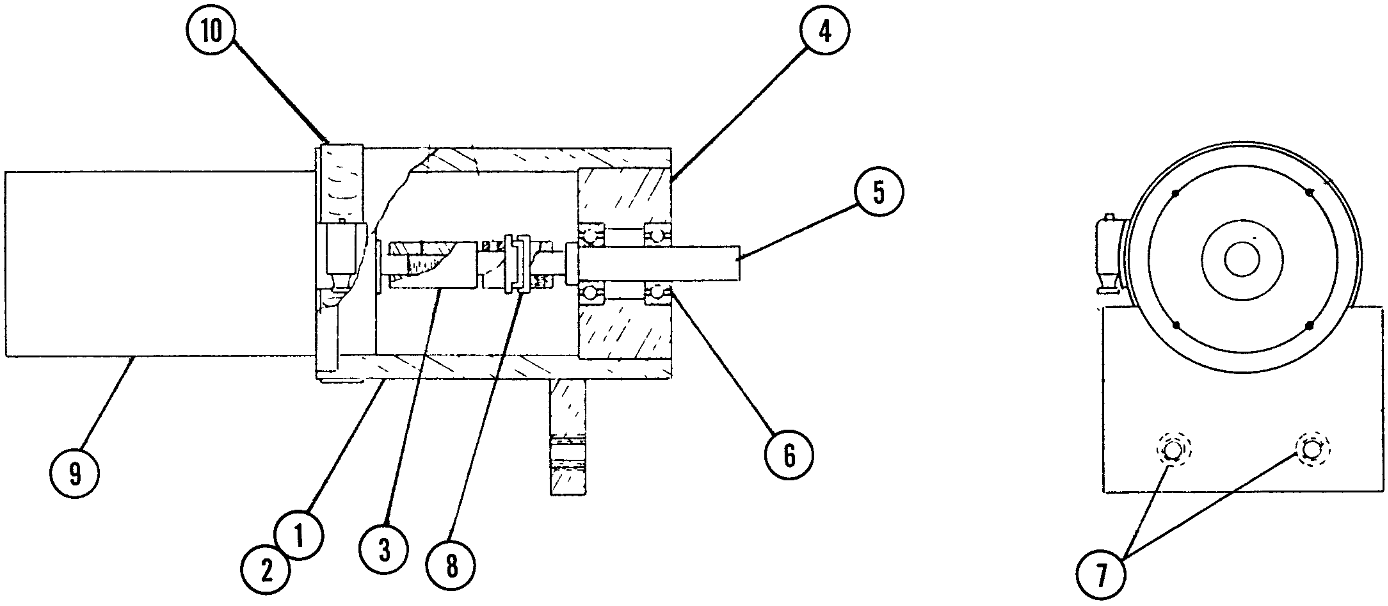


FIGURE 5-6. ROTARY JOINT (SHT 1 OF 2)

Item No.	Part Number	Description	Qty
1	1000-0356-001	Rotary Joint, 3 1/8 to 1 5/8	1
2	0001-8073-001	Body	1
3	0001-8074-001	Bullet, 3 1/8	1
4	0001-8076-001	Center Conductor, Transition	1
5	0001-8075-001	Insulator, 3 1/8	1
6	0001-8080-001	Bellows, Inner Assembly	1
7	0001-8083-001	Bellows, Outer	1
8	0001-8077-001	Insulator	2
9	0001-7328-001	Spacer	1
10	0001-8087-001	Contact, Rotating Inner	1
11	0001-8098-001	Outer Conductor Assembly	1
12	0001-8101-001	Conductor, Center	1
13	0001-8099-001	Clamp	1
14	0001-8103-001	Bullet, 1 5/8	1
15	3550-0065-001	Bearing	2
16	2450-2136-001	Retaining Ring	2
17	2450-2154-001	Ring, Retaining	1
18	3510-0034-001	O-Ring	1
19	3510-0060-137	O-Ring	1
20	2099-7166-001	Helicoil, 3/8-16 x 3/8 SST	6
21	2099-7152-001	Insert, Threaded, 5/16-18 x 5/16 SST	4
22	2027-0183-001	Screw, Skt, Cap, 3/8-16 x 7/8 SST	1
23	2027-0054-001	Screw, Skt, Cap, 8-32 x 3/4 SST	3
24	2027-0051-001	Screw, Skt, Cap, 8-32 x 3/8 SST	10
25	0080-0203-201	Nameplate	1

FIGURE 5-6. ROTARY JOINT (SHT 2 OF 2)



Item No.	Part Number	Description	Qty
1	0001-7194-302	Synchro Mount Assembly	1
2	0001-7191-201	Mount, Synchro	1
3	0001-7188-201	Adapter, Synchro	1
4	0001-5307-201	Bearing, Seat, Synchro	1
5	0001-5319-201	Shaft	1
6	3550-0035-001	Bearing	2
7	2099-7152-001	Insert, Threaded, 5/16-18 x 5/16 SST	2
8	6500-0019-001	Coupling	1
9	6500-0008-001	Synchro, Transmitter	1
10	2450-1122-001	Clamp, Hose	1

FIGURE 5-7. SYNCHRO MOUNT ASSEMBLY

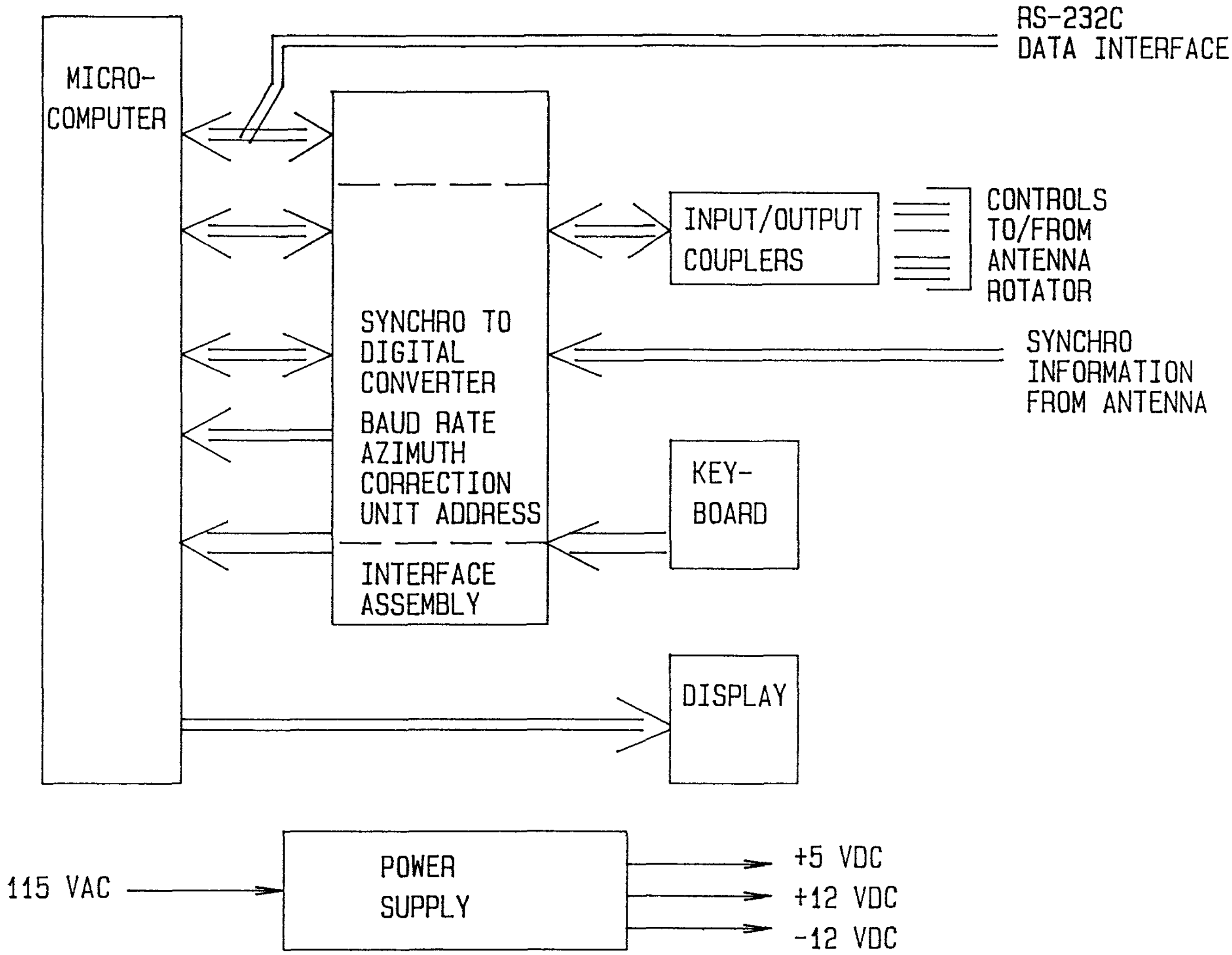


FIGURE 5-8. BLOCK DIAGRAM ANTENNA CONTROLLER

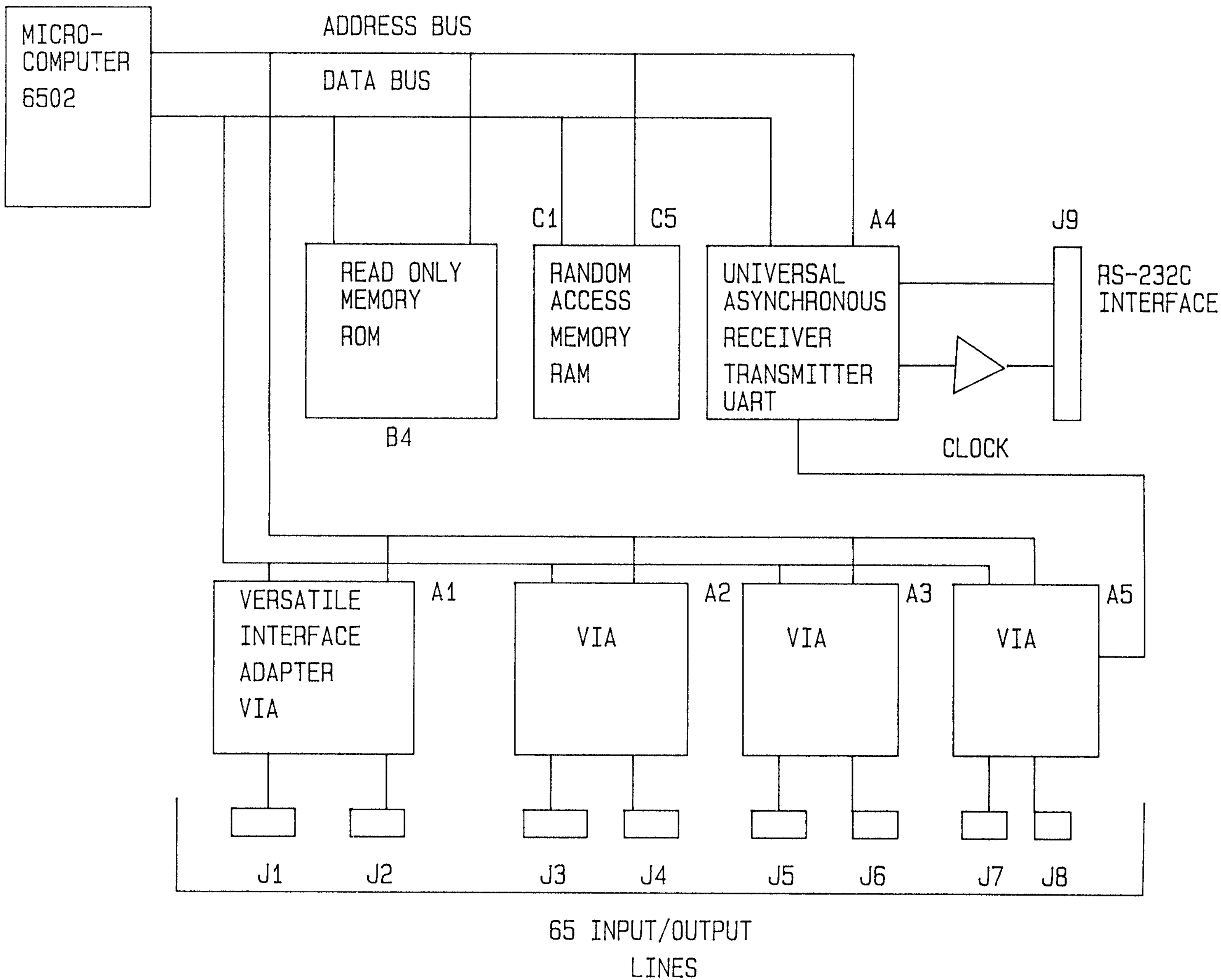


FIGURE 5-9. SIMPLIFIED SCHEMATIC MICROCOMPUTER BOARD

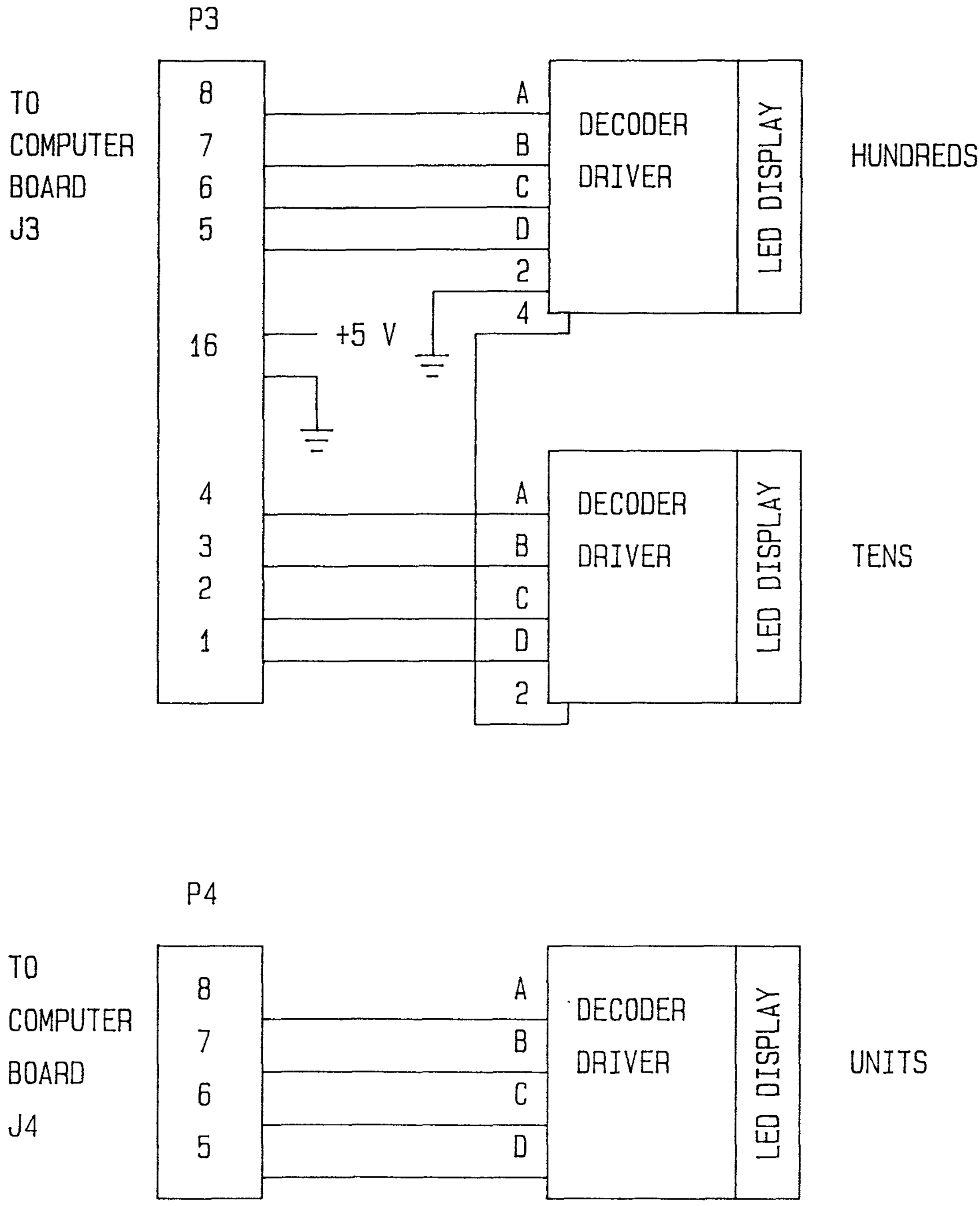


FIGURE 5-10. SIMPLIFIED SCHEMATIC DISPLAY

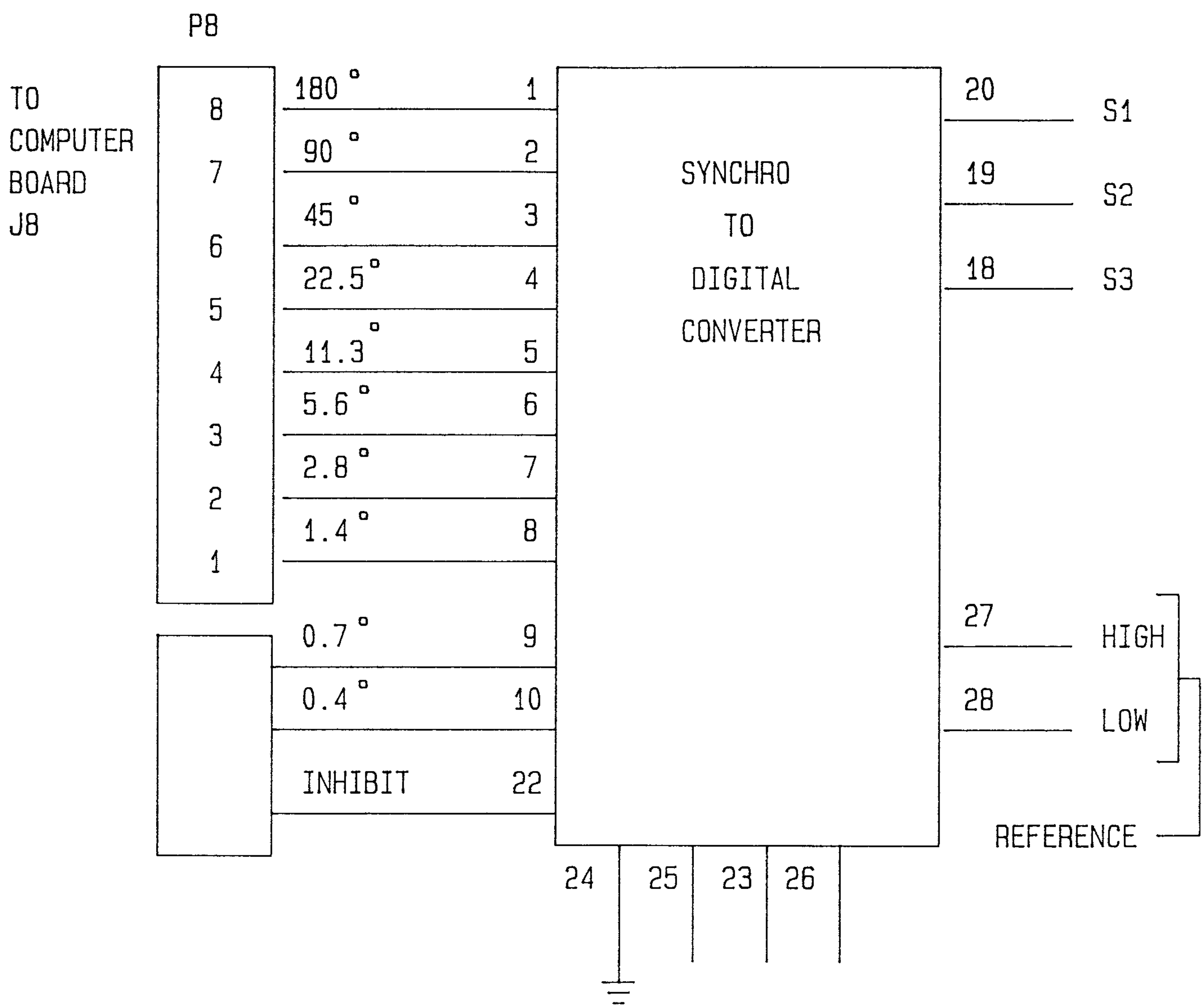


FIGURE 5-11. SYNCHRO TO DIGITAL CONVERTER

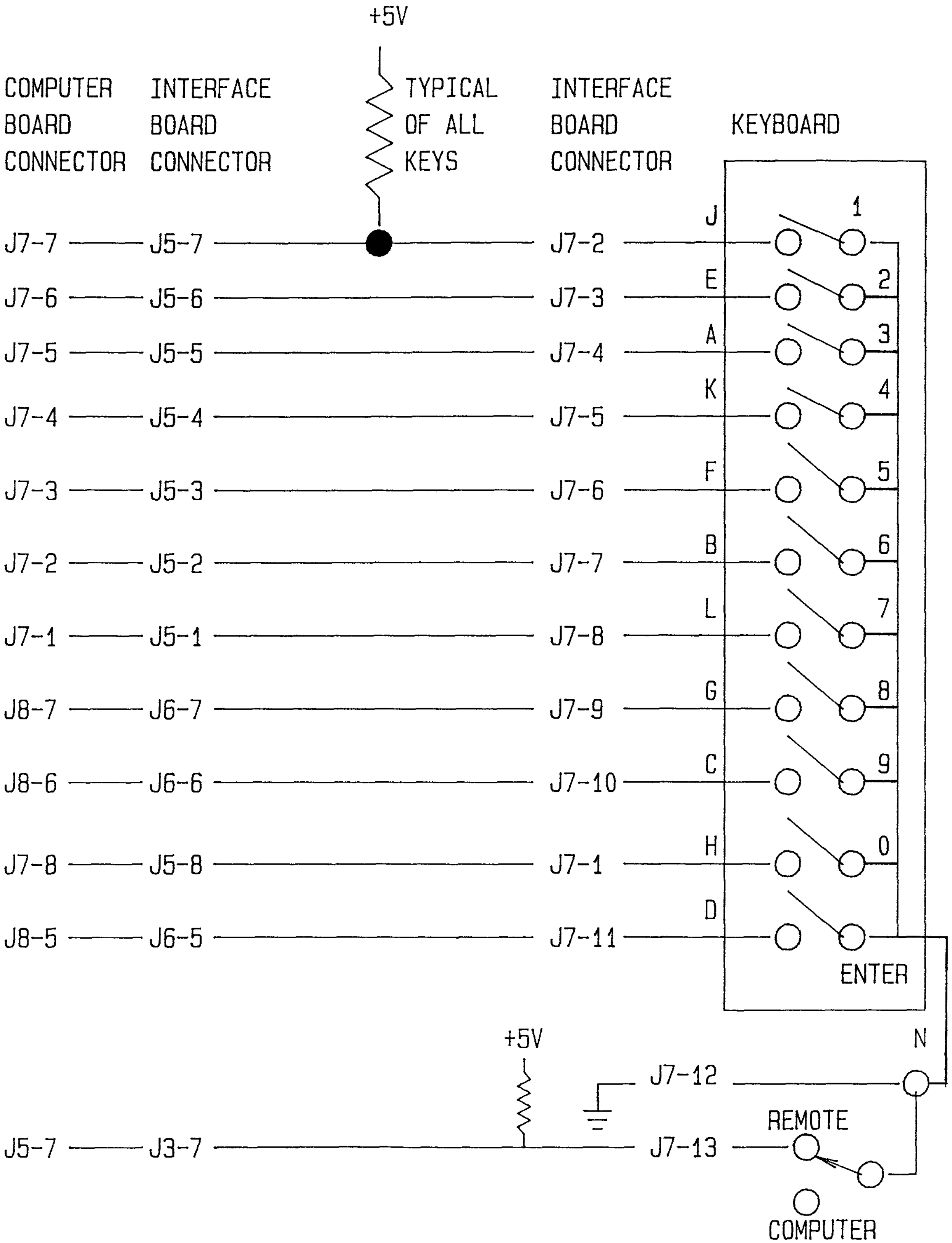


FIGURE 5-12. SIMPLIFIED SCHEMATIC KEYBOARD

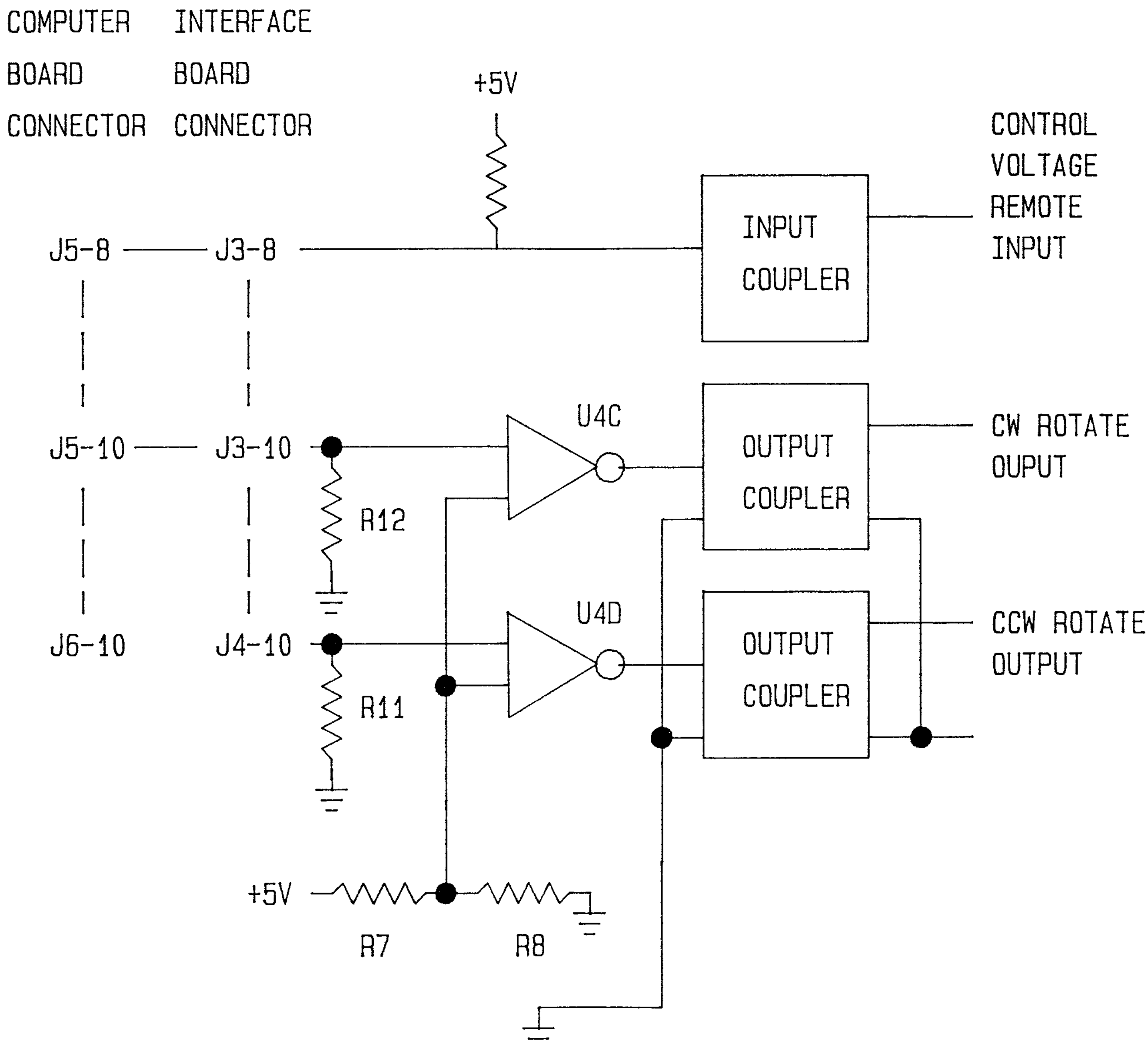


FIGURE 5-13. SIMPLIFIED SCHEMATIC INPUT/OUTPUT COUPLERS

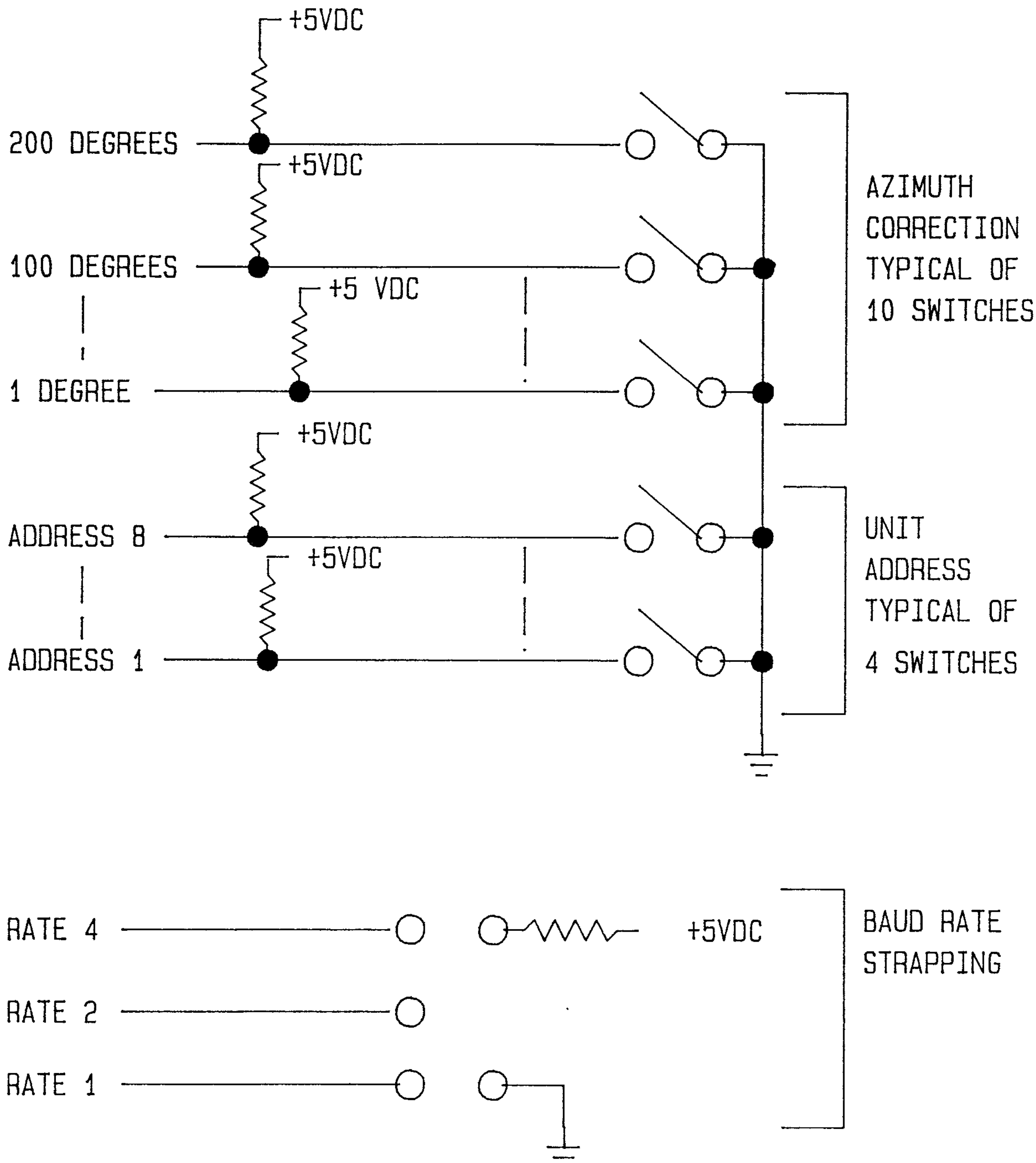


FIGURE 5-14. AZIMUTH CORRECTION, BAUD RATE AND UNIT ADDRESS SELECTION

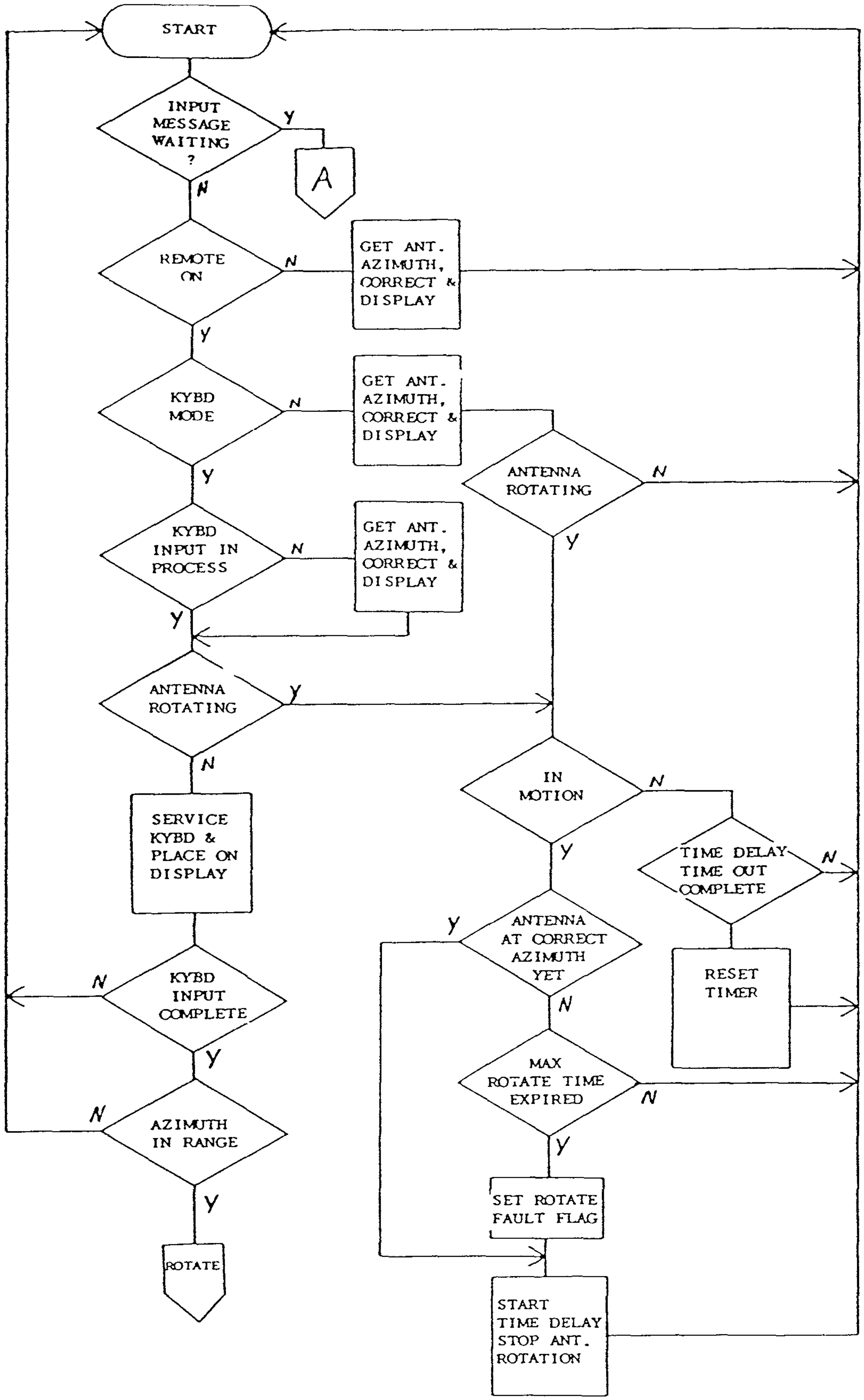


FIGURE 5-15. PROGRAM LOGIC (SHT 1 OF 3)

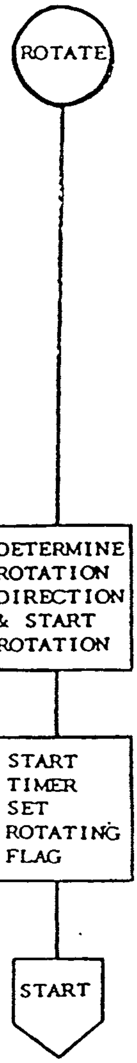


FIGURE 5-15. PROGRAM LOGIC (SHT 2 OF 3)

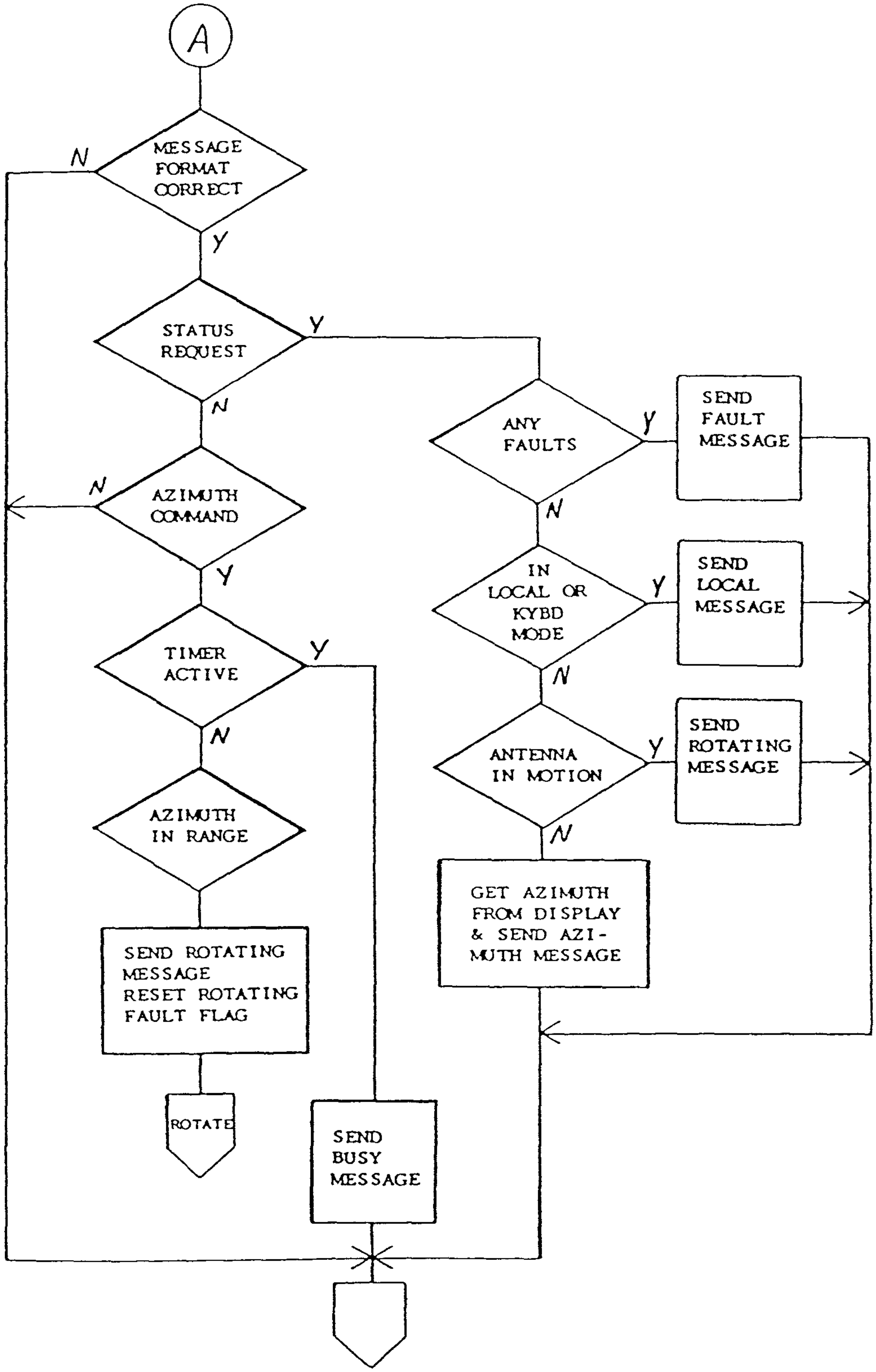


FIGURE 5-15. PROGRAM LOGIC (SHT 3 OF 3)

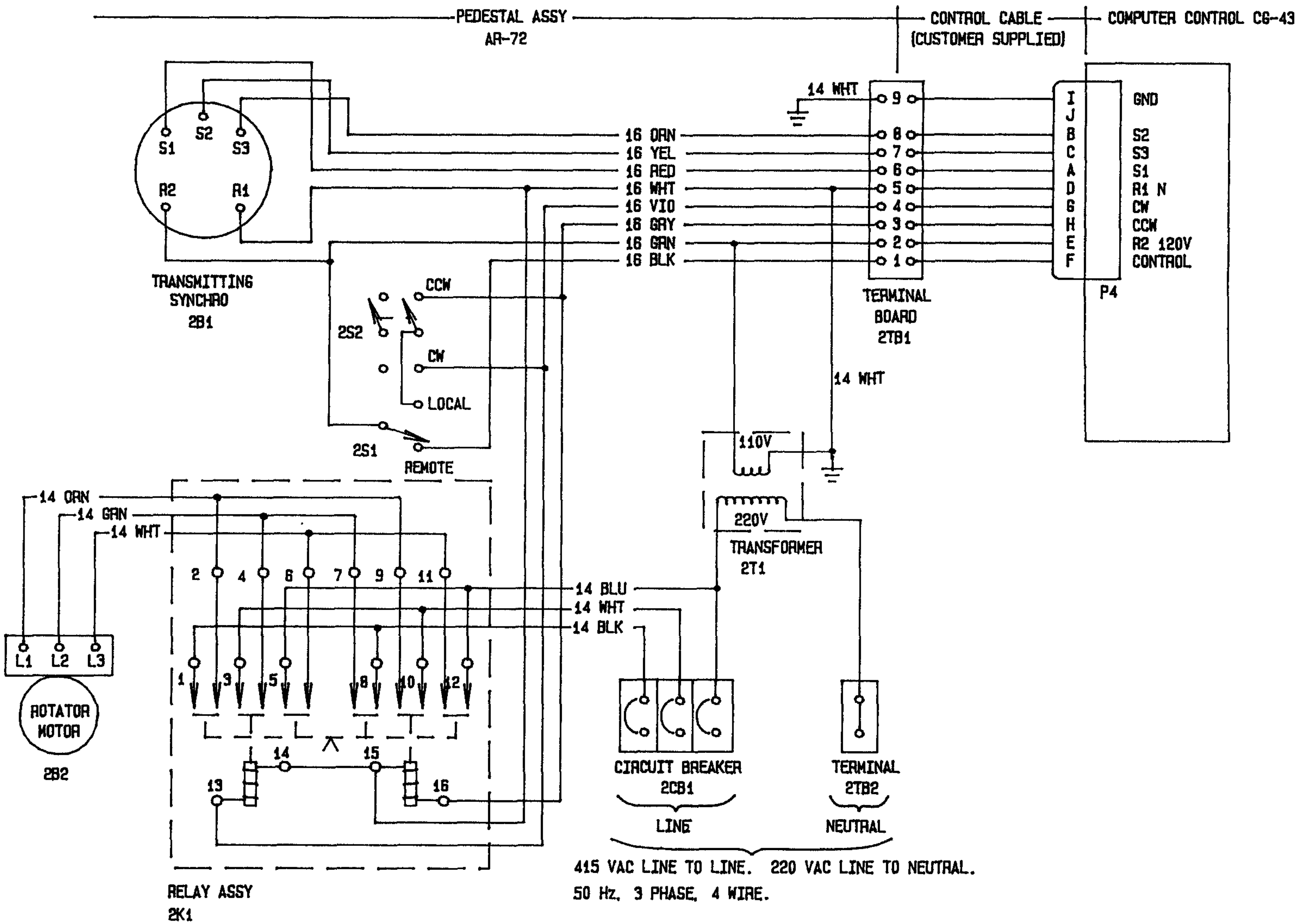
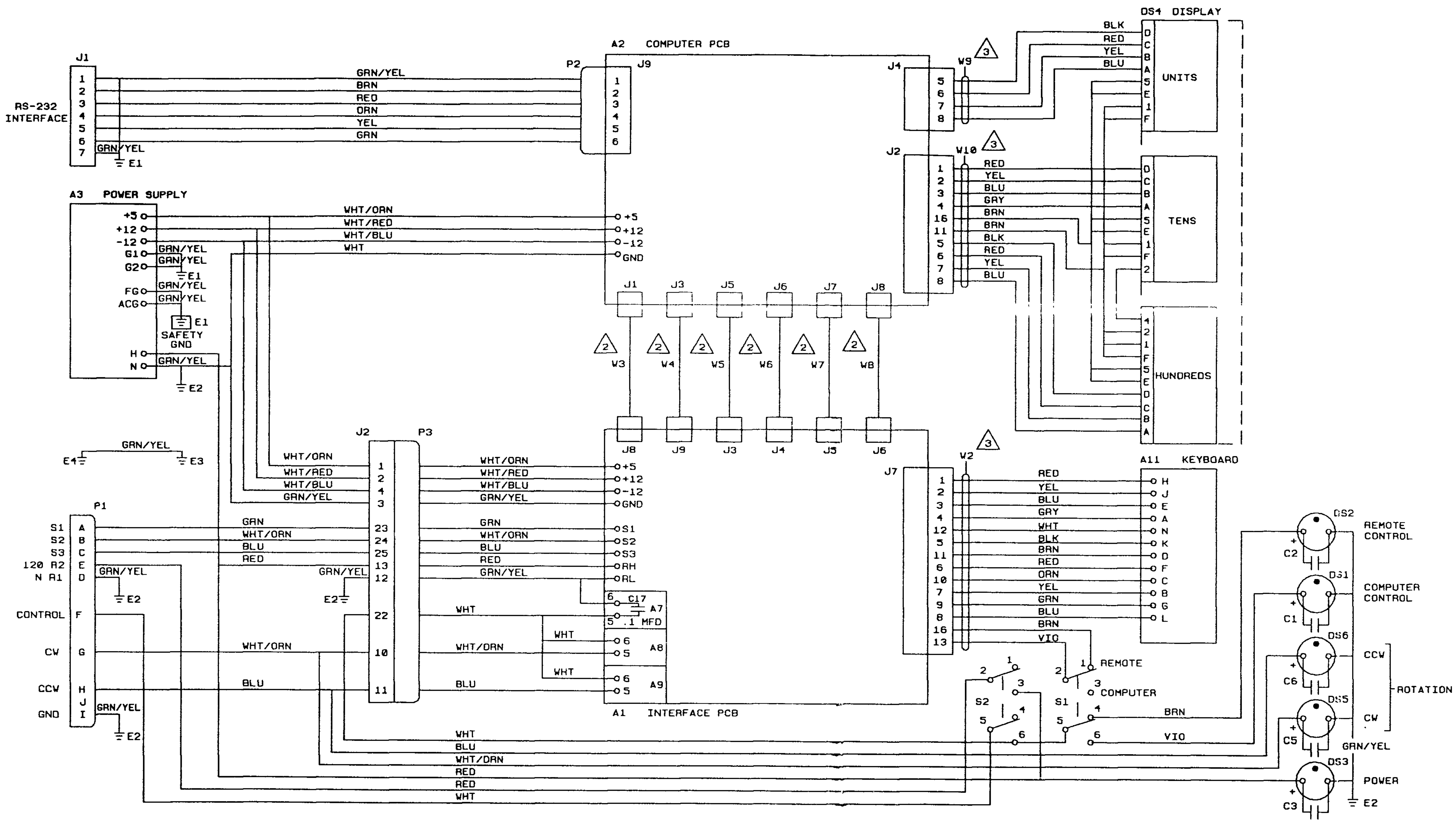


FIGURE 5-16. SCHEMATIC, CONTROL GROUP



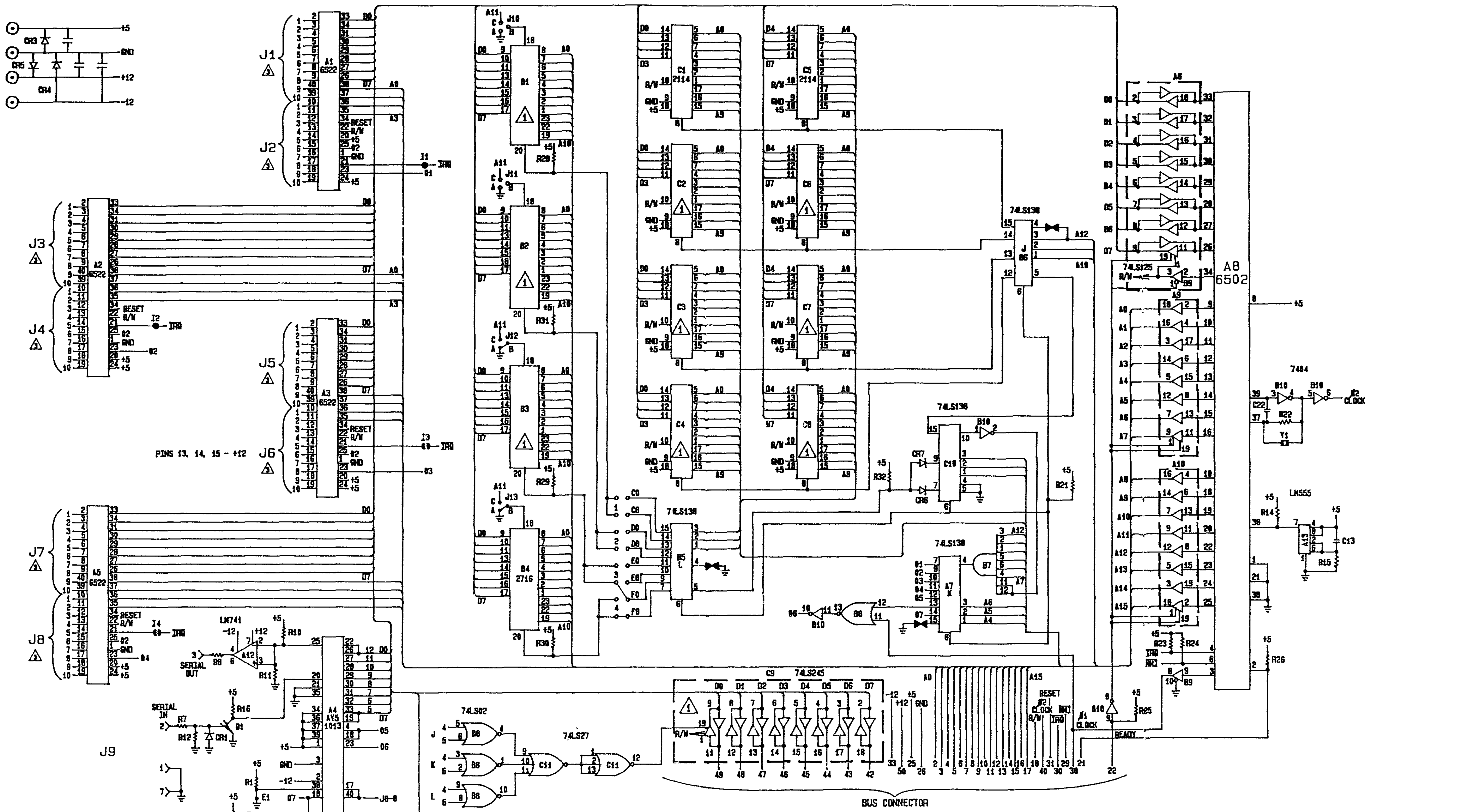
$\triangle 3$ W2, W9 & W10 ARE RIBBON CABLES, 16 CONDUCTORS, 28 AWG WITH 16 PIN DIP CONNECTORS ONE END ONLY

$\triangle 2$ W3 THRU W8 ARE RIBBON CABLES, 16 CONDUCTORS, 28 AWG WITH 16 PIN DIP CONNECTORS EACH END.

1. ALL CAPACITORS ARE .01 MICROFARADS EXCEPT AS NOTED.

NOTES:

FIGURE 5-17. SCHEMATIC, COMPUTER CONTROL



3. J1 THRU J8: PIN 16 - +5, PINS 11 & 12 - GND.
2. COMPONENTS NOT USED: C14, C15, R2, R3, R4, R5, R6, R18, R19, R20, & S1.
1. I.C.'S NOT USED: A11, A14, B1, B2, B3, C2, C3, C4, C6, C7, C8, & C9.
NOTES:

FIGURE 5-18. SCHEMATIC, COMPUTER BOARD

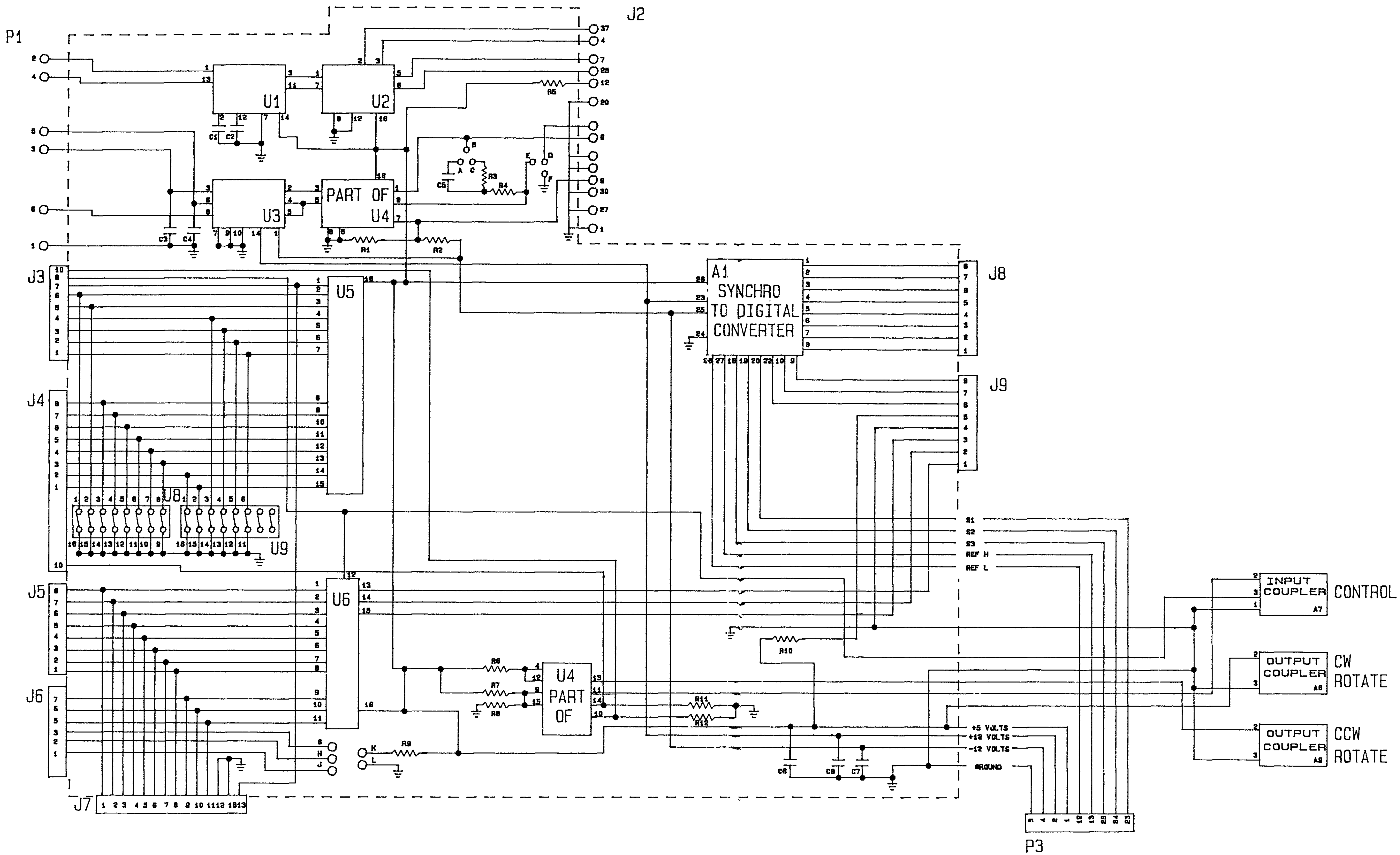


FIGURE 5-19. SCHEMATIC, INTERFACE BOARD