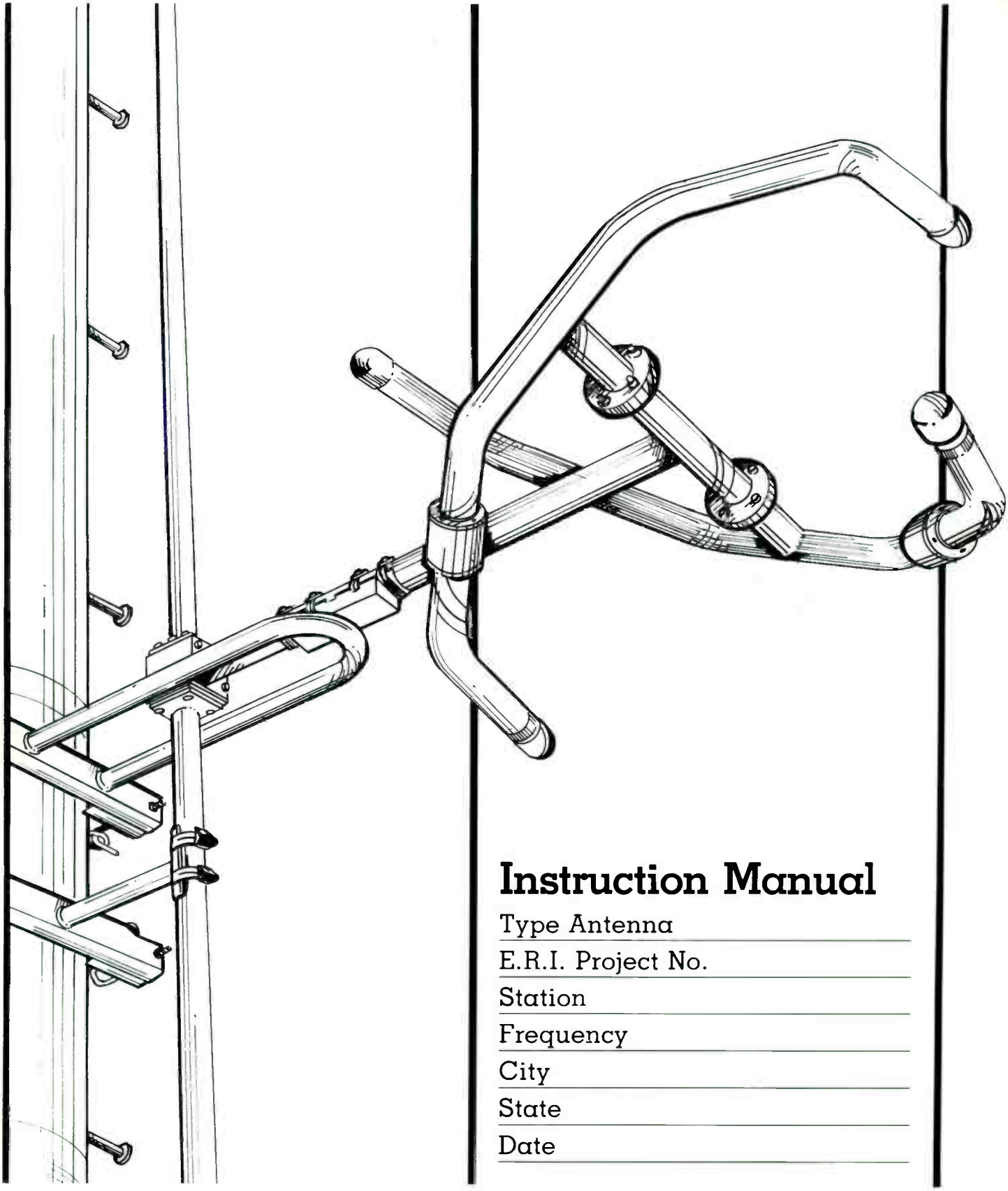
Electronics Research, Inc.



Instruction Manual

Type Antenna

E.R.I. Project No.

Station

Frequency

City

State

Date

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In-Plant Tests

Your antenna array has been completely assembled at the factory for electrical matching adjustments and an air pressurization test. If your station specified a tower mounted antenna, the factory adjustments are done with the antenna mounted on a tower. Antennas specified as pole mount are factory matched on a six inch o.d. pole. The individual elements are then physically adjusted to achieve electrical resonance at the design frequency with a 50 ohm input impedance for every antenna element in the array. The individual bay impedance is then transformed from 50 ohms to a high impedance at the antenna harness connection using identical custom made transformers installed in each element.[1] This results in an array input VSWR of 1.6:1 or better as well as an individual antenna element impedance of 50 ohms. During the factory tests, the electrical connection to each individual antenna element in the array is checked by short circuiting the element feeds one at a time. Fine matching of the antenna input impedance is accomplished by placing steatite matching slugs in the six foot matching section located at the input to the antenna array. After fine matching, the input VSWR of the array is 1.1:1 or better at carrier frequency minus 100 kilohertz and plus 400 KHz.[2] By matching the array on the high side of resonance we provide increased tolerance to high VSWR problems that can be caused by icing conditions. Your antenna system is pressurized to 10 psi with dry air for two hours while it is assembled at the factory to assure a leak-free system prior to shipping. At the factory, the pressure must have zero drop in two hours to meet factory specifications. The antenna pressurization specification after proper installation on your support structure is 1 pound of pressure drop in 24 hours from an initial pressure of 5 psi.

Note 1:

As a result of our antenna design and test procedure, all of the elements in an ERI antenna array are interchangeable. Also, any element in the array can be used as a single bay standby antenna by replacing the custom made inner conductor in its feed stem with an identical length of standard 50 ohm 3⅛" coax inner conductor.

Note 2:

If your antenna array has thermal deicers, then it is matched at your carrier frequency so that the array VSWR is 1.1:1 or better at carrier frequency plus and minus 200 KHz.

Uncrating Your Antenna System

When uncrating the antenna system, open each crate carefully so that the crates may be used to return merchandise in case of shipping damage. Separate all parts from packing materials and check the packing list to make certain that all items are accounted for. If any parts are missing, notify Electronics Research and the company from whom you purchased your antenna prior to assembling the antenna array. If any parts are damaged through shipment or missing, PROMPTLY notify the shipping carrier.

The elements are crated individually and shipped fully assembled. Each element should be inspected to make sure that none of the inner conductor connectors attached to the line blocks are damaged.

The interbay transmission line sections and the input matching section are crated with more than one section of coax in each box. And, if the antenna array is center fed, the center feed is crated in a separate box. All the necessary mounting and assembling hardware for the array is included in one of the transmission line crates. When uncrating the transmission line, inspect each section for external damage. The mounting brackets are bundled together and shipped without a crate. Open the bracket bundles after checking to make sure that you have received the correct number of brackets.

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WARNING
It is the purchaser's responsibility to determine if the supporting structure (tower, mast, pole, etc.) can safely support this antenna array. The weight and windload of your antenna are listed in these instructions. These weights and windloads were calculated assuming no ice buildup on the array with a constant wind velocity of 112 miles per hour.

Installation of Antenna
Before installing the antenna on the support structure, attach the element bracket to the feed stem and attach the line bracket to the interbay coax, one foot below the flange. Brackets are secured to the interbay coax and the element stem with the hose clamps supplied with the antenna system. Note that these brackets are usually installed below the element. The element bracket can be installed upside down to facilitate mounting when necessary to avoid obstructions on the support tower. Also, the interbay line support bracket can be installed above the element when necessary to avoid obstructions.

We recommend that the antenna be installed one bay level at a time. This can be accomplished by hoisting an element bay support bracket, line support bracket and interbay coax section as demonstrated on the back cover of these instructions. Hoisting more than one element at a time can cause structural damage to the interbay transmission line.

When installing the antennas, care should be exercised in assembling the inner conductor of the coaxial line to the inner conductor connector (bullet) attached to the antenna element. The inner conductor should be perfectly centered on the bullet as it is being installed in order to prevent damage to the bullet. The bullet should fit firmly in the inner conductor in order to assure a very low resistance r.f. connection. Care should be taken to insure that an "O" ring is included at each flange connection when the antenna array is assembled.

WARNING
This antenna system, when energized by an R.F. transmitter, will present a high intensity R.F. field. Care should be taken to not touch the antenna system when energized unless performing touch test under factory supervision. It is not advisable to remain in the antenna aperture for extended periods of time while the antenna system is energized. All maintenance or repairs should be done with the primary voltage to the transmitter disconnected and all transmitter remote controls disabled.

On center fed antennas, make sure that the elbow and matching section are positioned close to the support structure and away from the radiating elements as far as possible. Also, make sure that the bottom section of the antenna below the center feed section is aligned with the upper section. The center feed "tee" is equipped with swivel flanges to facilitate alignment.

The elements and their support brackets should be installed so that the interbay transmission line is not in any type of mechanical bind. If Heliax, Wellflex or other continuous air dielectric cable is installed as your antenna feed line, make certain that the feed line gas barrier is at the transmitter end of the line and not the antenna end. The gas barrier is usually built into the connector on the end of the feed line that comes off the shipping reel last. If the antenna is not pressurized, condensation can occur inside the antenna harness resulting in possible failure of the antenna. The proper Heliax or Wellflex transmission line end fitting attaching to the antenna will have holes in the teflon insulator permitting the passage of gas to the antenna. We recommend an internal pressure of 5 psi in our antenna harness for safe operation.

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If flexible transmission line is used, make sure a turnbuckle (or other supporting device) is permanently attached to the flexible cable hoisting grip at the top of the feed line. The weight of the flexible feed line should be taken by this combination of hoisting grip and turnbuckles every 200 feet. The weight of the feed line should never be supported by your FM antenna. Do not allow flexible line "hangers" to hold the weight of the feed line. They are not designed for this purpose. A small amount of flexibility in the form of an "S" bend should be left at the antenna input end of the continuous feed to allow for ease of removal, should inspection or field matching become necessary.

The transmission line and the antenna should be purged prior to placing the system in service and at any other time when moist air could have entered the system. Purging may be accomplished by pressurizing the transmission line from the transmitter end to approximately 5 to 10 pounds per square inch. Because water vapor will rise above the nitrogen in the system, purge at the highest point in the system first. Bleed or vent the system by temporarily loosening the four bolts in the brass plate on the top of the highest antenna line block to allow slow leakage. If the antenna is center fed, the lower half of the array should also be bled by loosening the four bolts in the brass plate on the bottom of the lowest antenna line block, to allow slow leakage.

Allow one full tank of dry nitrogen to be used for this purging, or flushing, of the transmission line and antenna. If a dry air compressor is used, allow it to purge the system slowly for an hour or more. In the event that there has definitely been water in the transmission line and/or antenna, the use of several tanks of dry nitrogen for purging is recommended. Following the purging process, tighten the four bolts in the brass plate on the top line block (and also the brass plate on the bottom line block in the case of center fed antennas) and pressurize the system.

Failure to keep the transmission line and antenna pressurized may result in damage to the system, with resultant lost air time to the station. If unpressurized, changes in temperature can permit the system to breathe, bringing in moisture laden air, which will cause condensation inside the antenna. Such moisture will accumulate and result in the failure of the system. Such failures are not covered by warranty. The system must be pressurized at the time of installation and kept pressurized at all times to avoid this type of system failure.

Leaks in a transmission line or antenna are often audible if the leak is large and the line is under sufficient pressure. A pressure of up to 10 pounds per square inch is recommended when searching for leaks. Small leaks may be located by the use of soap and water, or bubble liquid, which may be brushed on the suspected leak areas. The bubble liquid will produce bubbles if a leak is present and the system is properly pressurized. The cause of such leaks should then be corrected.

The antenna system should be tested before the erector leaves the premises, to ensure that the complete antenna system is functioning properly. This is important in order to detect any installation errors, which might have been made during the installation. A low VSWR of less than 1.5 to 1 at the operating frequency is to be expected. Should a higher VSWR be observed, there may be a mechanical defect in the transmission line or antenna, and any defects found should be corrected before placing the antenna system in regular service. Generally a VSWR of less than 1.2 to 1 may be expected.

The antenna elements and interbay transmission line do not require painting since the components are 85/15 brass. The steel mounting hardware used is stainless steel and also does not require painting.

If you need to paint the antenna, DO NOT paint the two melamine insulators on each antenna element.

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Assembly Of Center Fed Antennas

Center fed antennas are normally supplied with one six foot transformer section made of 3⅛ inch coaxial line. This transformer section is supplied with two 50 ohm EIA 3⅛ inch female flanges. At one end of this transformer section a red band has been wrapped around the outer conductor. This indicates the input, or lower, end of the section. The other end of the transformer section also has a 50 ohm EIA flange; however, this end attaches to the 90 degree elbow supplied which in turn attaches to the center feed "tee". The inner conductor of the transformer section may have a ceramic slug attached. Care should be taken to not remove or relocate the position of this slug. Relocating this slug will change the antenna input VSWR. A red band is fastened around the inner conductor which indicates the input (or lower) end.

Care must be taken to see that all the antenna elements are attached in the same manner. One end of the radiating section of each element has a red band attached and each end with the red band must face down. This positioning is necessary in order to assure the proper phasing of all the elements.

Each interbay line coaxial section has a number written near the flange which attaches to the line block. As the antenna is assembled, the numbers on the coaxial line flanges should be matched to the numbers written on the line block. The antenna element having the smallest number should be mounted at the top position in the array, and the numbers should run consecutively from the smallest number to the largest number, starting at the top of the antenna.

Stainless steel hardware and "O" rings in sufficient quantity are supplied with each antenna. Make certain that gasket grooves in the line flanges and line blocks are clean before assembly. A small quantity of non-melting silicon dielectric lubricant (such as Dow Corning number 4 compound) may be applied to the "O" ring gaskets during assembly to aid in holding the "O" ring in place in the gasket groove.

Before installing the antenna on the support structure, attach the element bracket to the feed stem and attach the line bracket to the interbay coax, one foot below the flange. Brackets are secured to the interbay coax and the element stem with the hose clamps supplied with the antenna system.

The antenna system has a 50-ohm impedance. If 51.5 ohm transmission line is to be used to feed the array, a special adaptor inner connector will be required to match the 51.5 ohm feed line to the ohm antenna array. This is required because 51.5 ohm transmission line uses a smaller diameter inner conductor than is used for 50 ohm coax. However, 51.5 ohm transmission line is normally encountered only in older installations.

Two stainless steel matching section brackets are supplied with each center fed antenna. These brackets are attached approximately one foot from each end of the six foot matching section for support and are normally secured to the interbay line on the lower portion of the antenna array with hose clamps.

On special order center fed antennas a 1⅝ inch center feed section is supplied instead of the normal 3⅛ inch center feed section. This six foot matching section has a 1⅝ inch 50 ohm EIA female flanged input to accommodate 50 ohm feed line.

The input end of the matching section is identified by the red band wrapped around the outer conductor, which coincides with the input or down end. A ceramic slug may be attached to the inner conductor and should not be removed or relocated, as its position has been determined at the factory to provide a 50 ohm match at the input.

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Assembly Of End Fed Antennas

End fed antennas are supplied with one six foot transformer section. On one end of this 3⅛"-coaxial section is a square flange, which attaches to the line block of the bottom element of the array. The other end of this transformer section is equipped with a standard 50 ohm EIA female flange and has a red band around the outer conductor. This red band signifies the input (or lower) end.

A ceramic slug may be attached to the inner conductor of this transformer section. A red band is fastened around the inner conductor which indicates the input (or lower) end. No attempt should be made to remove or relocate this slug, as its position has been properly set at the factory to obtain a correct 50 ohm impedance match of the antenna.

Care must be taken to see that all the antenna elements are attached in the same manner. One end of the radiating section of each element has a red band attached. And, each end with the red band must face down. This positioning is necessary in order to assure the proper phasing of all the elements.

Each interbay line coaxial section has a number written near the flange, which attaches to the line block. As the antenna is assembled, the numbers on the coaxial line flanges should be matched to the numbers written on the line blocks (blocks are factory attached to the elements). The antenna element having the smallest number should be mounted at the top position in the array, and the numbers should run consecutively from the smallest number to the largest number, starting at the top of the antenna.

Stainless steel hardware and "O" rings in sufficient quantity are supplied with each antenna. Make certain the gasket grooves in the line flanges and line blocks are clean before assembly. A small quantity of non-melting silicon dielectric lubricant (such as Dow Corning number 4 compound) may be applied to the "O" ring gaskets during assembly to aid in holding the "O" ring in place in the gasket groove.

A stainless steel matching section bracket is supplied with each end fed antenna. This bracket connects to the lower end of the transformer section approximately one foot above the input line flange.

The antenna system has a 50 ohm input impedance. If 51.5 ohm transmission line is to be used to feed the array, a special adaptor inner connector will be required to match the 51.5 ohm feed line to the 50 ohm antenna array. This is required because 51.5 ohm transmission line uses a smaller diameter inner conductor than is used for 50 ohm coax. However, 51.5 ohm transmission line is normally encountered only in older installations.

Mounting Brackets

Mounting brackets are made of type 403 stainless steel and they are machine welded with a wire welder. The specification on the wire is AWS A5.9-ASME SFA5.9.

These brackets are designed to flex in order to avoid excessive tension on antenna components and subsequent structural damage. Brackets attach to the elements and the transmission line sections with stainless steel clamps to provide uniform loading on tubular components. This prevents excessive stress in the coaxial transmission line, which can cause possible shell pipe failure. All hardware supplied with the mounting brackets is made of stainless steel.

Antenna Warranty

Electronics Research, Incorporated warrants to the ultimate purchaser that each antenna manufactured in its factory is free from defects in material or workmanship (1) existing at the time of delivery from the factory or (2) that develop under normal use in a properly installed and maintained system for a period not to exceed twenty-four (24) months following date of shipment from the factory. Further, unless Electronics Research,

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Incorporated supervises the actual installation of the antenna, or ERI Installations erects said antenna, Electronics Research, Incorporated does not warrant the installation of and is not responsible for subsequent damage resulting from incorrect or improper installation of said antenna.

Electronics Research, Incorporated does not guarantee signal strength or coverage resulting from the use of our antenna arrays.

Any defective component parts will be repaired or replaced at the place of manufacture without charge, provided all parts showing such defects are returned by the customer to Electronics Research, Incorporated, after receiving factory authorization, and provided that factory inspection discloses that such defects are as claimed, and providing, also that the antenna has not been repaired without factory authorization, altered by others, or subjected to misuse, negligence, accident or damaged by lightning, excessive power or improper maintenance.

Electronics Research, Incorporated will pay transportation charges on such parts authorized for return within a period not to exceed twenty-four (24) months from the date of shipment of such antenna. Electronics Research, Incorporated will also pre-pay the shipment of such replacement parts (to the ultimate purchaser) as covered under this warranty. No other warranty is given or applies, and in no event shall Electronics Research, Incorporated be liable for consequential damages.

Under some circumstances, continuity of service may necessitate immediate shipment of repair parts before return of damaged parts. Under these conditions, Electronics Research, Incorporated will require that all damaged parts be packaged and returned for factory inspection.

Electronics Research, Incorporated shall not be liable for any expense, whether for repairs, replacement parts, service or otherwise incurred by the ultimate purchaser, or modifications made by the ultimate purchaser to the said antenna without prior authorization from Electronics Research, Incorporated.

The antenna system must be pressurized immediately following installation and the station is responsible for providing a source of dry nitrogen or dry air to initially check for installation leaks, and to maintain the antenna under a positive pressure of approximately 2 to 5 pounds per square inch at all times, using either dry nitrogen or dry air. This amount of pressure is usually sufficient to prevent breathing during normal environmental temperature changes. Under no circumstances should the antenna be pressurized above 20 pounds per square inch. In the event an isolation transformer is included in the system, the pressure should not exceed 10 pounds per square inch.

Failure to maintain pressurization on the antennna system will impair the electrical efficiency of the antenna, and may result in possible damage to the antenna. Such damage is not covered under this warranty.

The foregoing warranty is and shall be in lieu of all other warranties, expressed or implied, including *ANY IMPLIED WARRANTY OF MERCHANTABILITY AND ANY IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR APPLICATION*, and there are no warranties, representations of fact or promise with respect to signal coverage. The liability of Electronics Research, Incorporated shall be limited to the performance of the foregoing warranty. And, under no circumstances, shall Electronics Research, Incorporated be obligated or liable for special, incidental, indirect, consequential or other damages, losses or expenses in connection with, or by reason of the foregoing warranty, or by reason of some other type of expressed warranty or implied warranty found to exist, notwithstanding the foregoing disclaimers.

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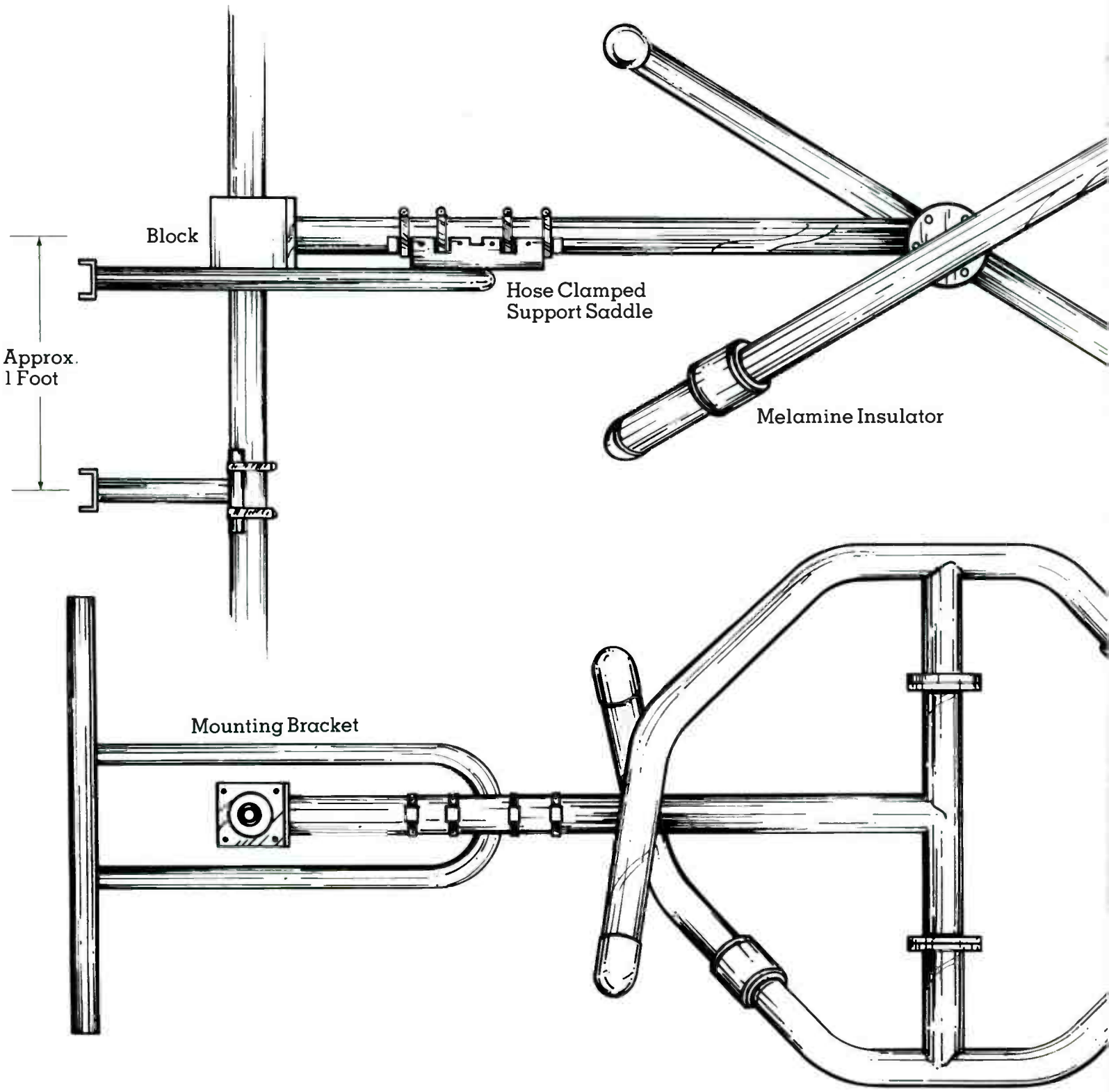

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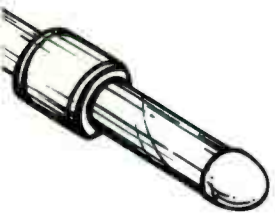
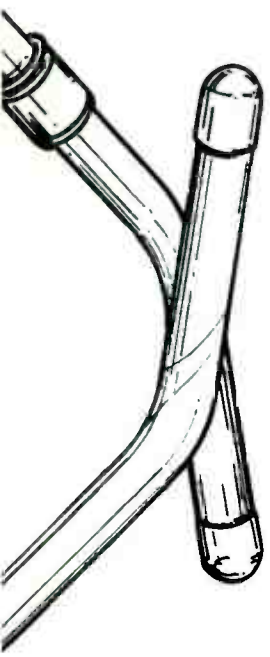
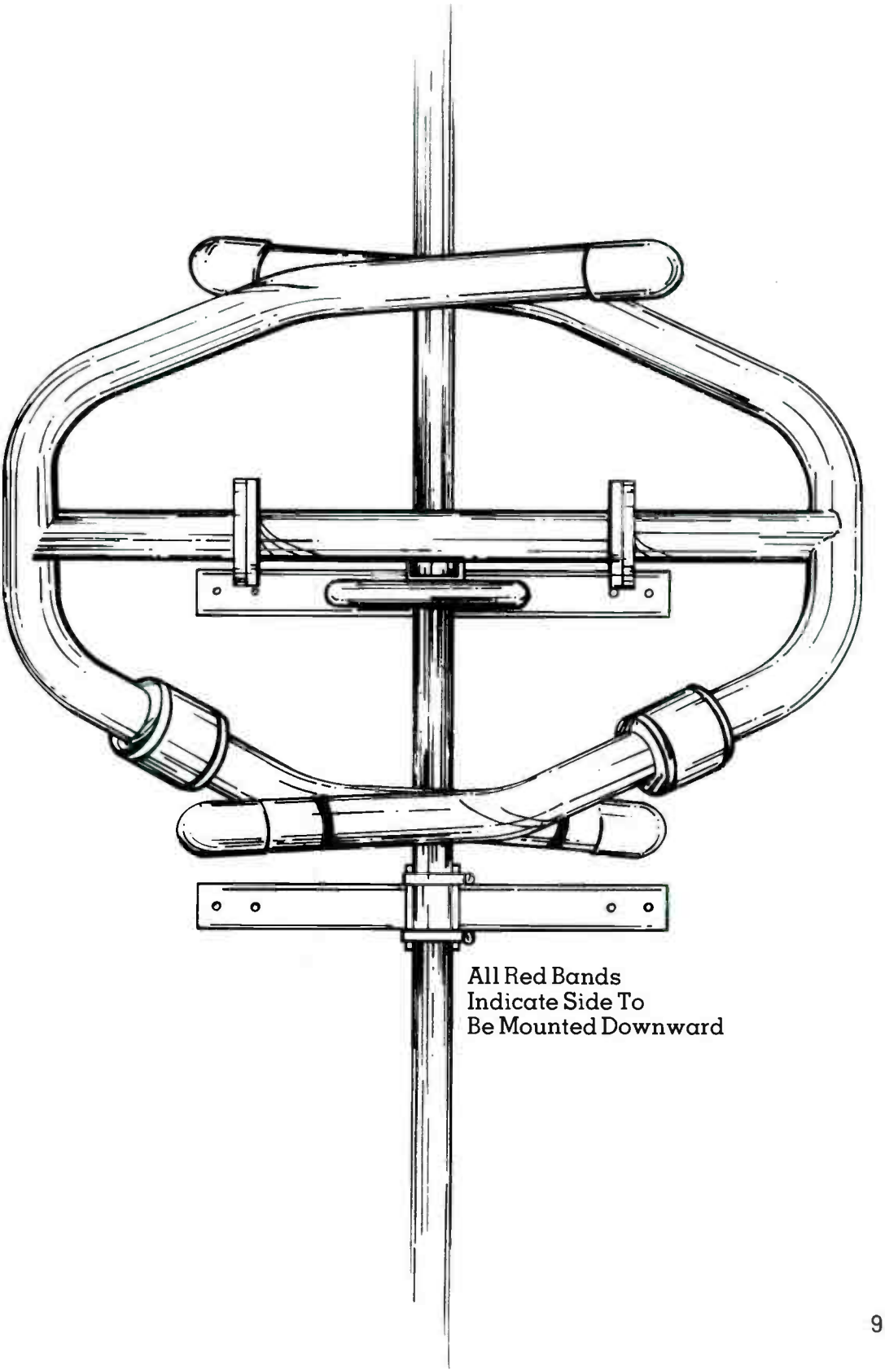
Antenna Bay
Radiating Element







All Red Bands
Indicate Side To
Be Mounted Downward

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Specifications and Ordering Information for FMXL and FML Antennas

No. of Bays	Power[1] Gain	db[1] Gain	Type Feed	50 Ohm Input	Input[2] Rating	FML And FMXL Without Radomes or Heaters		FML With Radomes		FMXL With Radomes	
						Lbs.[4] Weight	Lbs.[3] Wind Load	Lbs. Weight	Lbs.[3] Wind Load	Lbs. Weight	Lbs.[3] Wind Load
1E	0.4611	−3.3632	End	1⅝"	9 kw	57	102	83	224	109	344
2E	0.9971	−0.0128	End	1⅝"	9 kw	114	212	166	457	218	697
2C	0.9971	−0.0128	Center	3⅛"	12 kw	152	302	199	533	256	773
3E	1.5588	1.9278	End	1⅝"	9 kw	170	323	248	689	326	1049
3C	1.5588	1.9278	Off Center	3⅛"	12 kw	207	412	282	766	363	1126
4E	2.1332	3.2903	End	1⅝"	9 kw	227	433	331	922	435	1402
4C	2.1332	3.2903	Center	3⅛"	12 kw	260	509	364	998	468	1478
5E	2.7154	4.3384	End	1⅝"	9 kw	283	543	413	1154	543	1754
5C	2.7154	4.3384	Off Center	3⅛"	12 kw	317	620	447	1231	577	1831
6E	3.3028	5.1888	End	1⅝"	9 kw	340	654	496	1387	652	2107
6C	3.3028	5.1888	Center	3⅛"	12 kw	373	730	529	1463	685	2183
7E	3.8935	5.9034	End	1⅝"	9 kw	396	764	578	1619	760	2459
7C	3.8935	5.9034	Off Center	3⅛"	12 kw	430	840	612	1696	794	2536
8E	4.4872	6.5197	End	1⅝"	9 kw	453	874	661	1852	869	2812
8C	4.4872	6.5197	Center	3⅛"	12 kw	486	950	694	1928	902	2888
9C	5.0826	7.0608	Off Center	3⅛"	12 kw	543	1060	777	2160	1011	3240
10C	5.6800	7.5435	Center	3⅛"	12 kw	599	1171	859	2393	1119	3593
11C	6.2783	7.9785	Off Center	3⅛"	12 kw	656	1281	942	2626	1228	3946
12C	6.8781	8.3747	Center	3⅛"	12 kw	712	1391	1024	2858	1336	4298
13C	7.4785	8.7381	Off Center	3⅛"	12 kw	769	1501	1107	3090	1445	4653
14C	8.0800	9.0741	Center	3⅛"	12 kw	825	1612	1189	3323	1553	5003

[1]Horizontal and vertical power gain and dB gain are the same.

[2]Power input capability up to 2,000 ft. above mean sea level. Derating required above 2,000 ft.

[3]Wind load based on 112 mph wind velocity (50/33 psf) and the wind blowing normal to the side of the antenna. Weight and wind load calculations include brackets, interbay line and the transformer section. Calculations based on the frequency of 95 MHz.

[4]Heaters add 4 lbs. to each half loop for a single bay. Heater box, hardware, interbay connecting A.C. cable, and copper conduit add a total of 7 lbs. to each bay. The total effect of adding heaters is 15 lbs. per bay level.

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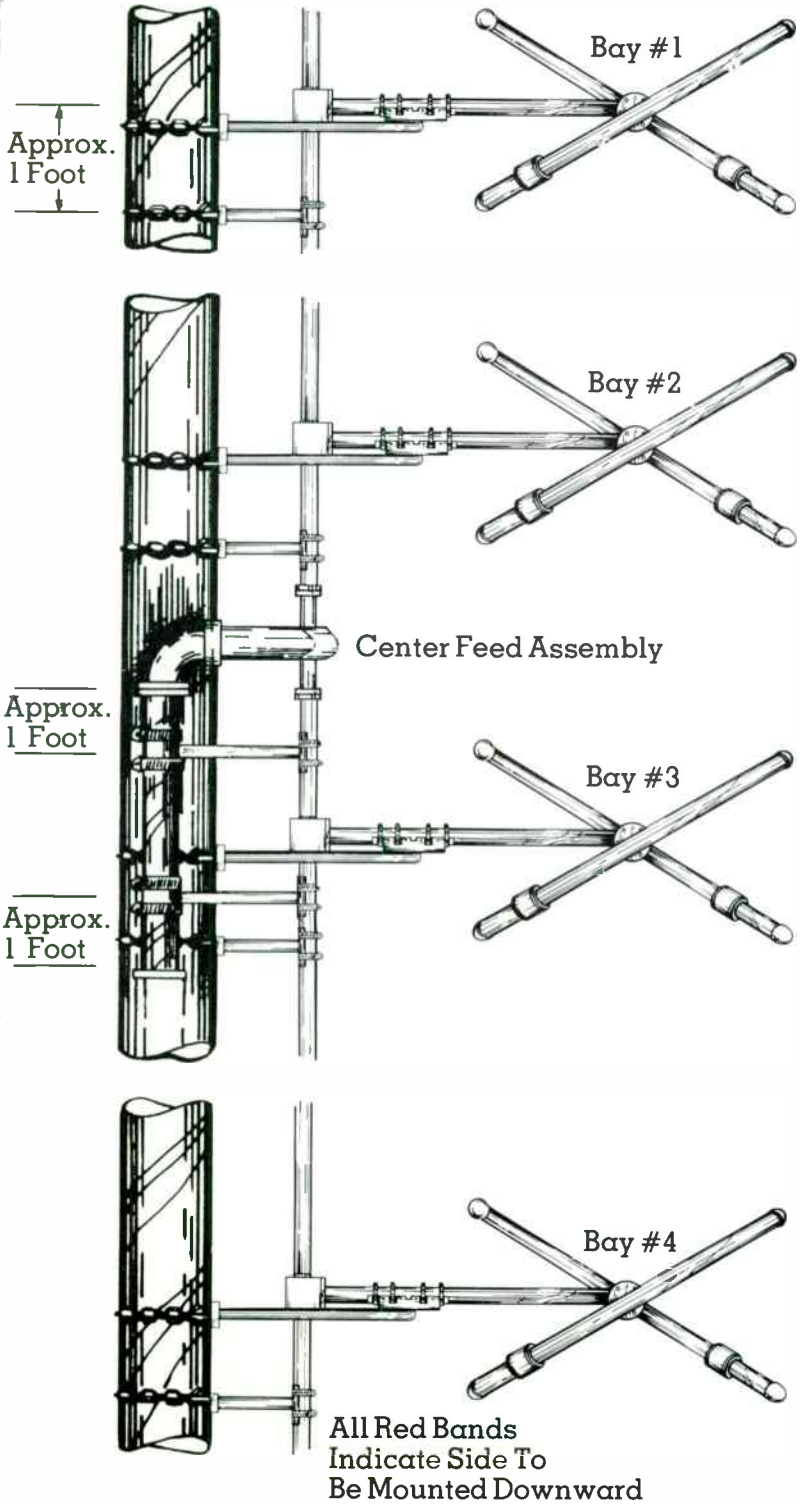
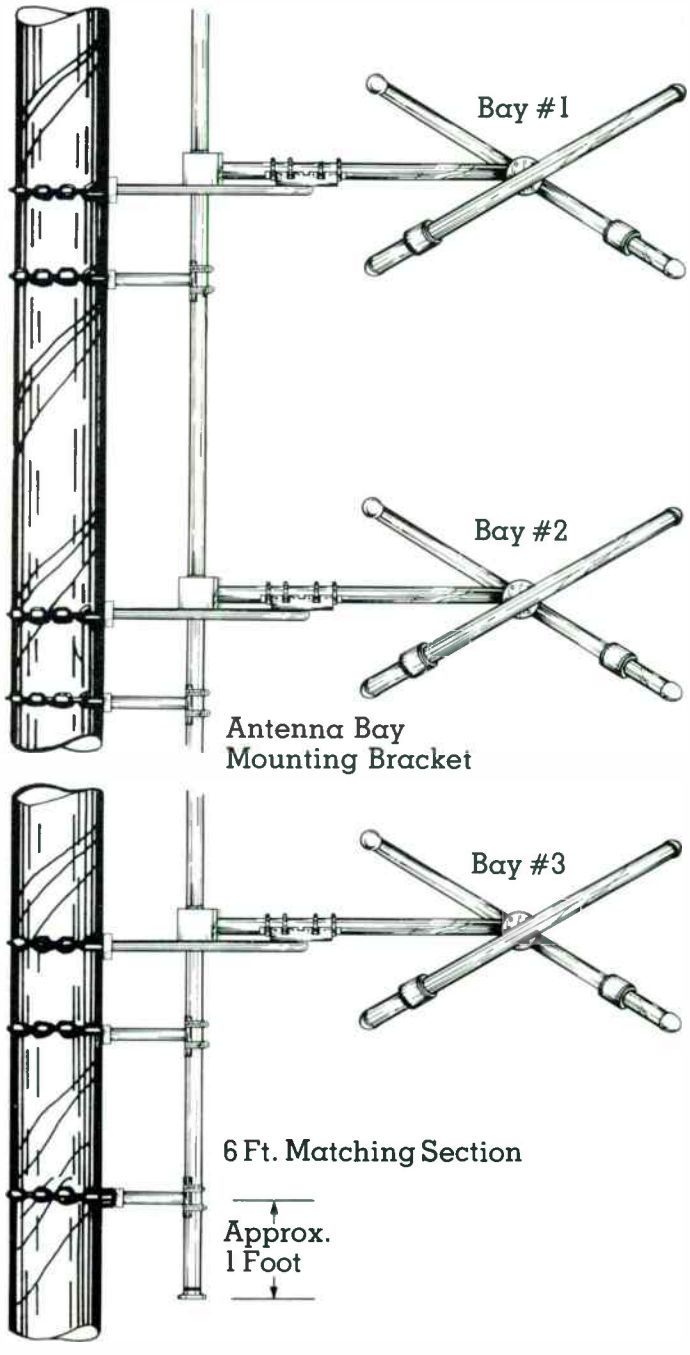
Typical Center Fed Antenna Array



Typical End Fed Antenna Array

Flanges Are Numbered Consecutively From Top Of Antenna Array



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