MIRAGE
COMMUNICATIONS EQUIPMENT, INC.

20M-6

13453

I. SPECIFICATIONS AND PERFORMANCE CHARACTERISTICS

Your new KLM antenna is a unique professional design especially engineered for broad-band operation without sacrifice of gain, VSWR, and front-to-back ratio.

These characteristics are achieved through the use of two driven elements, similar to a two-element log periodic design, coupled with a single reflector and three directors.

All elements are insulated from the boom. This feature means that even with slight unbalances due to proximity of the beam to other energy absorbers, no currents flow in the boom to distort radiation patterns, as is the case where elements are forced to be at the same center potential by connection to the boom.

The injection-molded high-strength lexan insulators are also designed with a slight upward tilt to compensate for normal element sag, to absorb vibrational forces and reduce strain on the elements, and to securely hold the elements horizontally as well as vertically.

Specifications: KLM 20M-6 20 Meter "BIG STICKER"

F/B Ratio:	35.0 dB typical
Gain:	11.0 ± 0.3 dB vs. a dipole at same height
Bandwidth:	13.9 - 14.4 MHz
Feed Impedance:	200 ohms balanced; 50 ohms with KLM 4-60-4:1 balun
Wind Area:	12.84 square feet (1.19 square meters)
Turning Radius:	34 feet (10.39 meters)
Boom Length:	57 feet 8 inches
Weight:	125 pounds including full 120° bracing
Mast Size:	2" standard (other mast size available on special order)
Element Length:	37.33 feet (11.4 meters) maximum tip to tip
Elements:	Six (6)

Electrically, you will find that this beam design has a low and fairly uniform VSWR across the entire 20-meter amateur band. Outside the band, the VSWR rises rapidly so that in effect the beam acts somewhat like a bandpass filter. There is, accordingly, less noise than with ordinary beams having a less-sharp impedance characteristic.

You will also find that the KLM 20M-6 beam has no side lobes in the forward direction and only two tiny ones to the rear, dropping to a near-perfect (30-35 dB front-to-back) null in the back direction. Mounted in the clear, this beam shows better discrimination against QRM than most parasitic arrays.

P.O. BOX 1000 MORGAN HILL, CALIFORNIA 95037 (408) 779-7363

PLANNING THE PLACEMENT

Good advance planning is essential to a smooth beam placement. If the beam is to be "stacked" over or under other beams, the following general considerations will be found useful.

a. Only radiators which approach a half wavelength in length will couple into an antenna. Furthermore, such radiators have to be in the same plane (e.g., parallel in space). A parasitic element which is a quarter-wave or a full-wave long will have relatively little effect.

b. The most difficult stacking problem is between 10 and 15 meter beams. The directors of the 15 meter beam tend to approach the length of reflectors of the 10 meter beam, and will upset performance of the latter. In this situation, the beams should be at least a half wavelength apart at the highest frequency (10 meters), or else should be oriented 90° from each other.

The KLM 20M-6 beam may be stacked over or under, say a 40 meter beam or a 10 meter beam without difficulty with spacing as close as 8 feet. With a 15 meter beam, recommended spacing is at least 12 feet to avoid problems with the 15 meter beam, or else the beams can be mounted 90° apart.

As with any beam, the higher and the more in the clear, the better the performance.

HOISTING THE BEAM TO TOWER OR MAST

A 24-foot nylon web sling of the type used for hand hoists, with leather reinforced eyes (available from W.W. Grainger as Cat. #2Z097) will be found most useful in hoisting beams and even towers. This sling is capable of supporting 5000 pounds and it can be wrapped flat around the boom to distribute the stress, and rigged to receive the lifting hook.

With all three bracing guys attached and taut, the beam may be hoisted with any orientation. If the side bracing must be removed for clearance reasons, then the beam should be hoisted only with the elements horizontal, although the beam may be tipped. For other orientations, as for example with the elements vertical, all three bracing guys must be attached and tensioned.

The most common hoisting arrangement in the case of guyed towers is to slide the beam up a guy wire. Using a gin pole and a block and tackle at the top, the beam can be pulled up and then raised above the point of mounting and swung into place to that the U-bolts can be attached between the mounting plate and the mast.

Quarter inch (¼") plastic ropes looped once around Element 1, and another around Element 6, ends brought back to the center will be found useful as tag lines to control the beam orientation during hoisting. When installation is complete, the tag lines can be untied at the center and simply pulled off the elements. (Do not knot them on the elements for obvious reasons).

Be careful in hoisting the beam not to snag the elements severely enough to bend them or rotate the insulators about the boom.

There are no adjustments to be made to the beam. All lengths and spacings have been carefully determined and the basic bandwidth of the beam is such that with normal variations of height above ground the beam will give good performance in gain, VSWR, and front-to-back ratio. DO NOT ATTEMPT TO "TUNE" THE BEAM BY CHANGING ANY ELEMENT LENGTH OR SPACING. The double driven element arrangement permits the beam to be optimized for maximum forward gain, maximum front-to-back ratio, and uniform VSWR over the entire band, all simultaneously. Changing any element length or spacing will only upset one or more of these factors.

OPERATION

The most critical indicator of beam performance will be found in the front-to-back ratio. If the beam is in the clear and at least a half wavelength high off the ground, the specified F/B of 30-35 dB should be obtained. If there are spurious re-radiators coupled into the antenna such as power or telephone lines, guy wires, buildings, etc., closer than about a half wavelength to the antenna the F/B ratio will decrease; however, the beam may still give good forward gain and impedance matching performance. Even the F/B in such a circumstance may improve in other directions.

The beam will be quite "sharp" compared to other beams especially on DX stations arriving at low angles of radiation. For higher angle signals such as within 3000 miles the apparent sharpness will decrease as it does for any antenna receiving high-angle signals. However, the F/B ratio even for high-angle signals will be found superior to most beam designs.

H.F. ANTENNA ASSEMBLY GUIDE:

BEFORE YOU BEGIN .....

1. Select an assembly area large enough to comfortably accommodate overall antenna dimensior A shallow box is handy for holding and sorting the smaller hardware, as is a marking pen for identifying components.

2. Some simple tools are required: A tape measure, screwdriver, and a set of spin-tite, and socket or end wrenches. Common nut sizes are:

3/8" .... 10-32 Hdwe	½" .... 5/16-18 Hdwe
7/16" .... ¼-20 Hdwe	9/16 .... 3/8-16 Hdwe

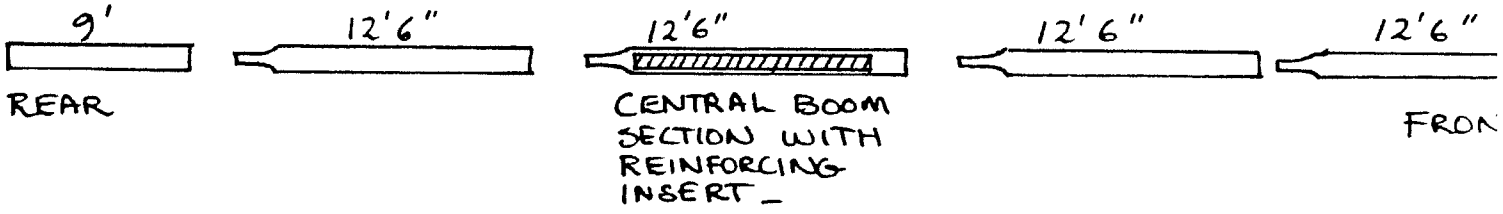
   To avoid damage to antenna components, be aware that most hardware need only be moderately hand tightened with screwdriver or spintite to be secure. When using tools with mechanical leverage such as socket or end wrenches, care must be taken not to over-torque nuts and damage components.

3. Thoroughly unpack shipping box and check components and hardware against the Parts List. If there is a difference, look for a "Factory Update/Change" sheet accompanying the assembly instructions prior to contacting KLM.

4. For easiest and fastest assembly, take a few moments before starting to familiarize yourself with the assembly guide and the antenna components.

BOOM ASSEMBLY

1. Lay out 3" O.D. boom sections on the ground as shown in the sketch below:



2. One 12' 6" section contains an 11' 6"x 2.85"O.D. reinforcing insert and will be heavier than the others. This section becomes the the middle of the boom and provides additional strength in the area of the boom to mast plate.

3. To assemble, insert the swaged (necked-down) end of the boom sections into the appropriate straight section end and align the bolt holes. Each joint is cross-bolted with two ¼-20 x 3½" bolts, lockwashers, and nuts. Nuts may be torqued to 10 ft/lbs.

4. Slide one 3"I.D. cast aluminum ring clamp about 4½' onto the rear of the boom and the other about 7½' from the front. If clamps do not slide easily, spread them gently with two nuts inside split on a 5/16 or 3/8 bolt.

H.F. ELEMENT CONSTRUCTION:

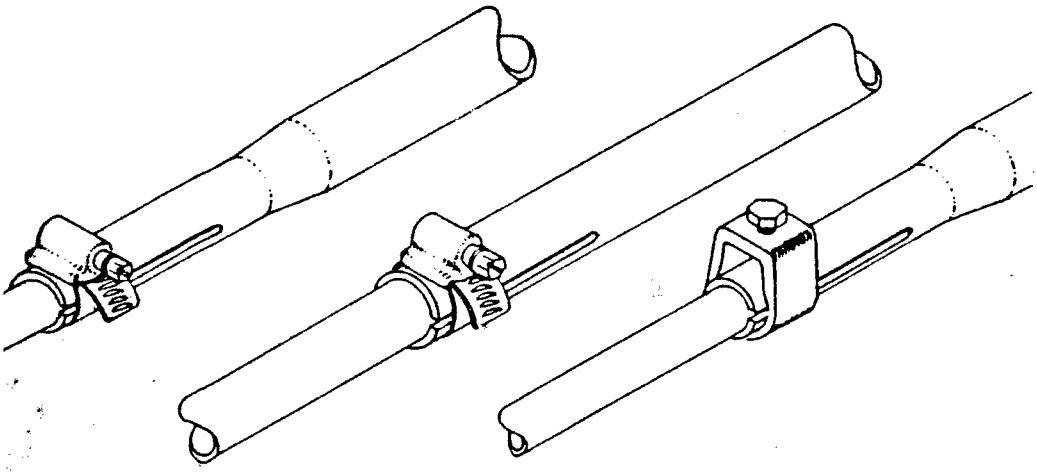
Each complete antenna element is composed of two halves of telescoping aluminum tubing secured in the middle by a Lexan insulator. Reflector/director element halves are electrically joined by a short jumper strap. The driven elements are interconnected by phasing straps and the front driven element provides the feedpoints, via an appropriate balun, for the antenna.

1. Assembly of Element Halves

A. Inner tubing sections on each element half are telescoped (or overlapped) three inches. Overlap of the tip sections will vary slightly because the over-all element half length is the critical electrical dimension and the tip section is adjusted as necessary to achieve it.

B. The smaller inside section of each telescoping joint is always coated lightly with Penetrox "A" (a conductive zinc paste) to promote good long lasting electrical connections.

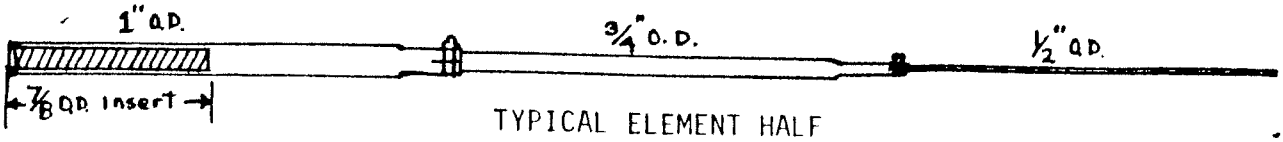
C. Each telescoping section is secured with a specified band or compression clamp located 1/16" back from slit end of larger tubing. See the sketch below.



D. The chart below lists the tubing lengths supplied for each element half, the proper band clamp for each overlap, and the correct element half length (adjust the tip section!) Remember to use Penetrox at each overlap and securely tighten clamps until tubing cannot be pulled out or rotated. Pair up element halves as they are completed to avoid mixups.

ELEMENT NUMBER	1"O.D. SUPPLIED	CLAMP	3/4"O.D. SUPPLIED	CLAMP	1/2"O.D. SUPPLIED	ELEMENT HALF-LENGTH
#1 Reflector	6'	M-8/M-10	6'	M-6 Comp.	6' 11½"	18' 5½"
#2 Rear Driven	6'	"	6'	"	5' 1½"	16' 7 3/8"
#3 Front Driven	6'	"	6'	"	3' 2"	14' 8"
#4 Director	6'	"	6'	"	5' 1½"	16' 2 1/8"
#5 Director	6'	"	6'	"	5' 1½"	16' 4 3/4"
#6 Director	6'	"	6'	"	5' 1½"	15' 10 1/4" (tubing only

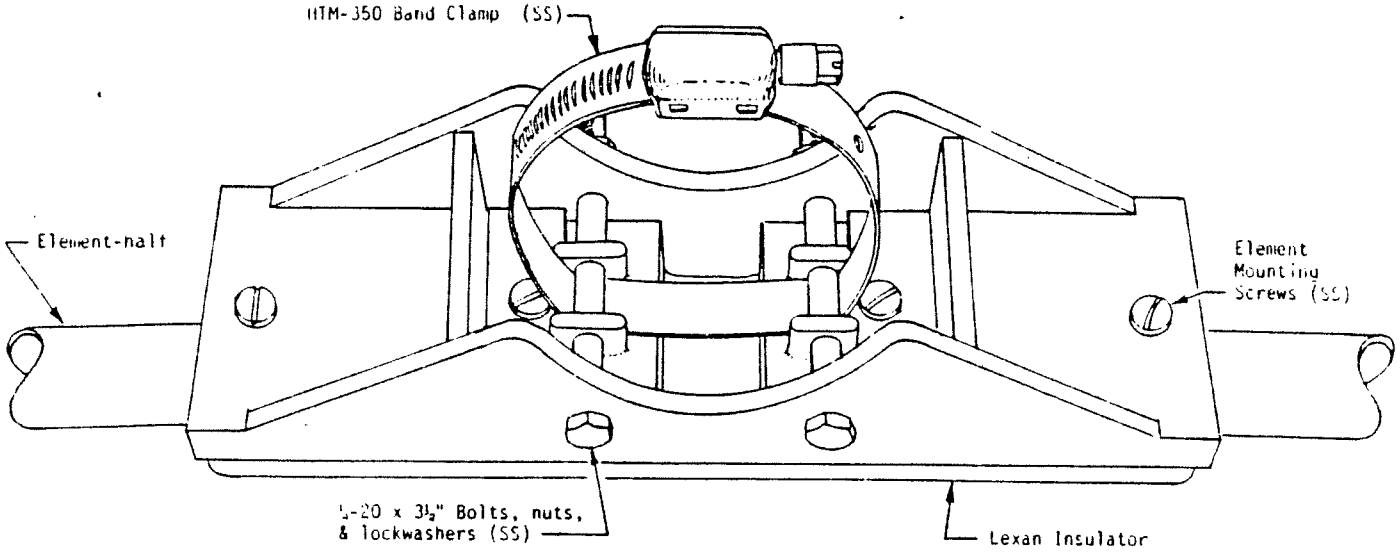
Note: All 1"O.D. sections are butt reinforced with 7/8"O.D x 34" inserts. Check that they are in place and mounting screw holes are aligned.



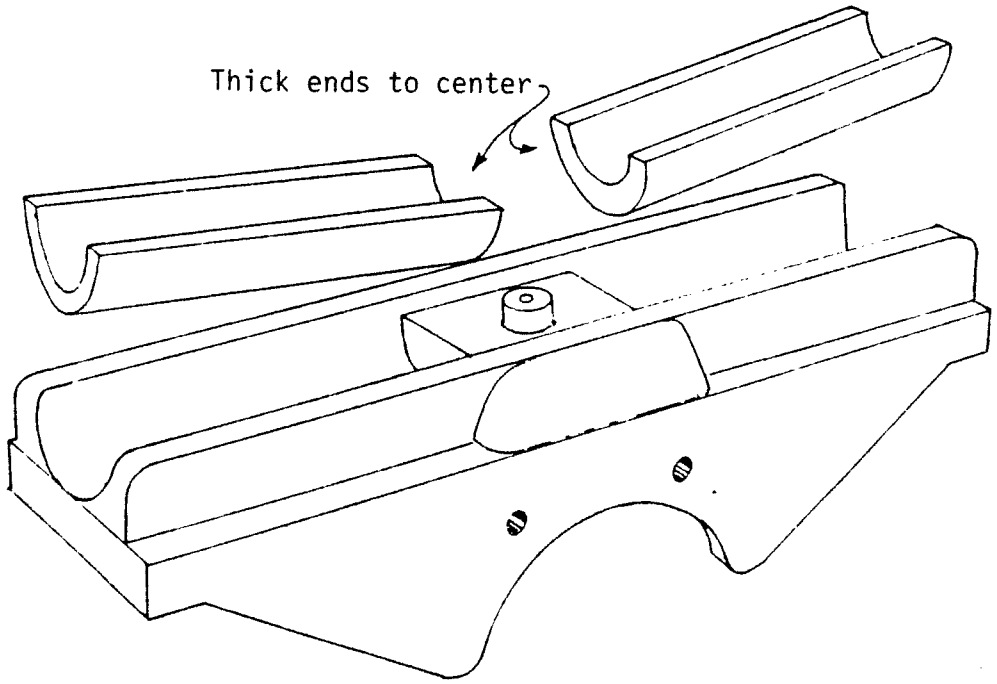
TYPICAL ELEMENT HALF

2. Preparing the Insulator

A. The large HTM-350 band clamps are bolted into the underside of the Lexan insulators with ¼-20 x 3½" bolts, lockwashers, and nuts (stainless steel) as shown in the drawing below. Install in all the insulators.



B. The KLM Lexan insulator has been designed to accommodate up to 1½" o.d. elements. Antennas using smaller o.d. elements are supplied with half-round reduction sections. These are placed in the two element channels on the top of the insulator with the thicker ends toward center as shown in the drawing below. Prepare all insulators.

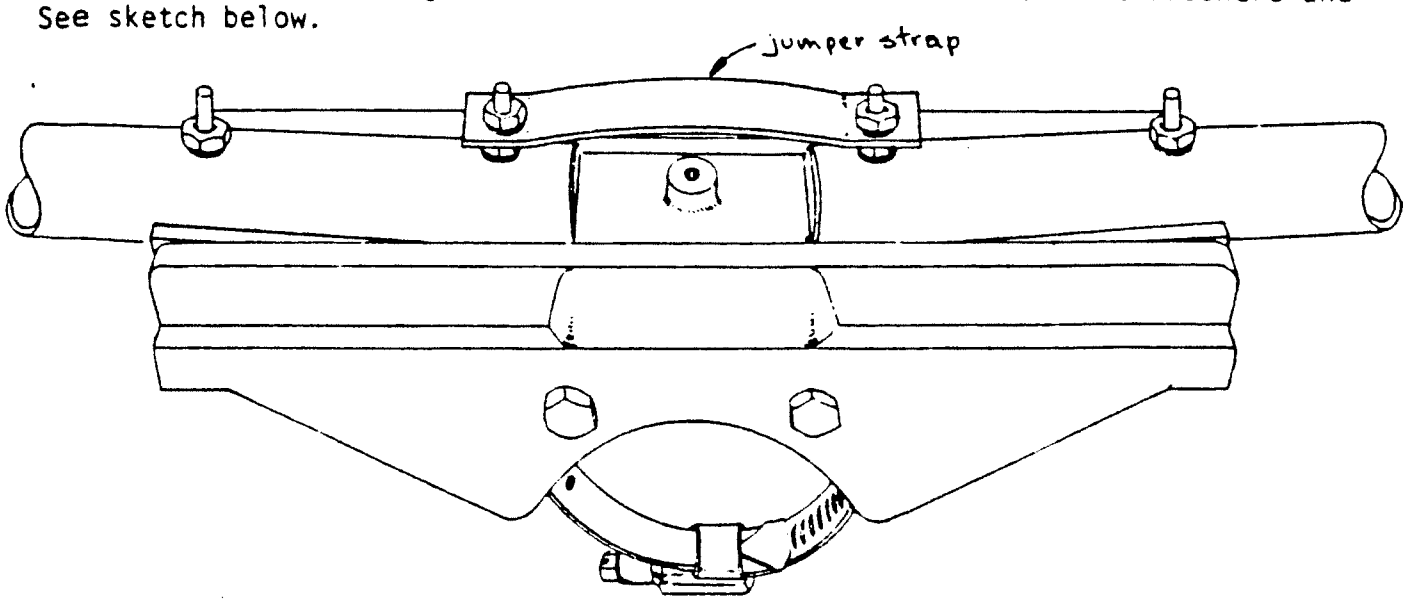


3. Mounting the Element Halves

A. Take each pair of element halves, in sequence, and attach them to insulators. Check that reinforcing inserts in element half butts are flush and mounting holes are aligned. Lay the element half butt into the insulator channel. Insert 10-32 x 2½" screws from bottom of insulator and secure above element butt with 10-32 nuts and lockwashe Holes in element half butt will align one way only (drilled slightly off square to compensa for element "lift" designed into insulator). If screws are not an easy fit, rotate element half but 180 degrees and repeat.

B. Assemble all element halves to insulators and set each completed element aside, in order.

C. The reflector and director elements (#1, 4, 5, 6) each require a ½ x 3 7/8" jumper strap between element halves. Bow the strap slightly, as needed, to fit the two inner most element mounting screw studs and secure with additional lockwashers and nuts. See sketch below.



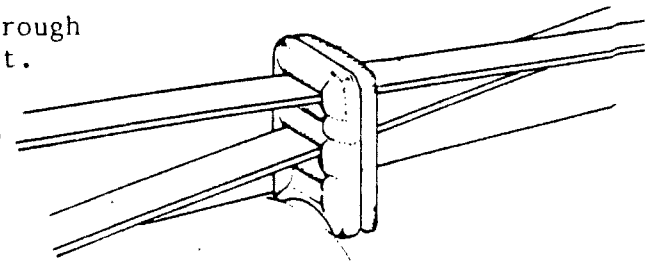
4. Mounting the Element to the Boom

A. Roll the boom until assembly bolts are 45° from vertical with bolt heads "up." Center element #1 at two inches from the rear of the boom (about ½" of boom should extend beyond insulator) and securely tighten the HTM-350 clamp. Install the remainder of the elements on the boom according to the dimensions on the drawing. Align each element to element #1, with the help of another person if possible, by sighting down boom from rear end. When each element is aligned and properly spaced, tighten the clamp.

B. Leave the front driven element (#3) clamp loose to allow for fitting phasing straps.

5. Driven Element Connections

A. Driven elements are linked by a crossed pair of 1/2" x 84-5/8" phasing straps. Slide the straps through two stand-offs until centered. See the sketch at right.

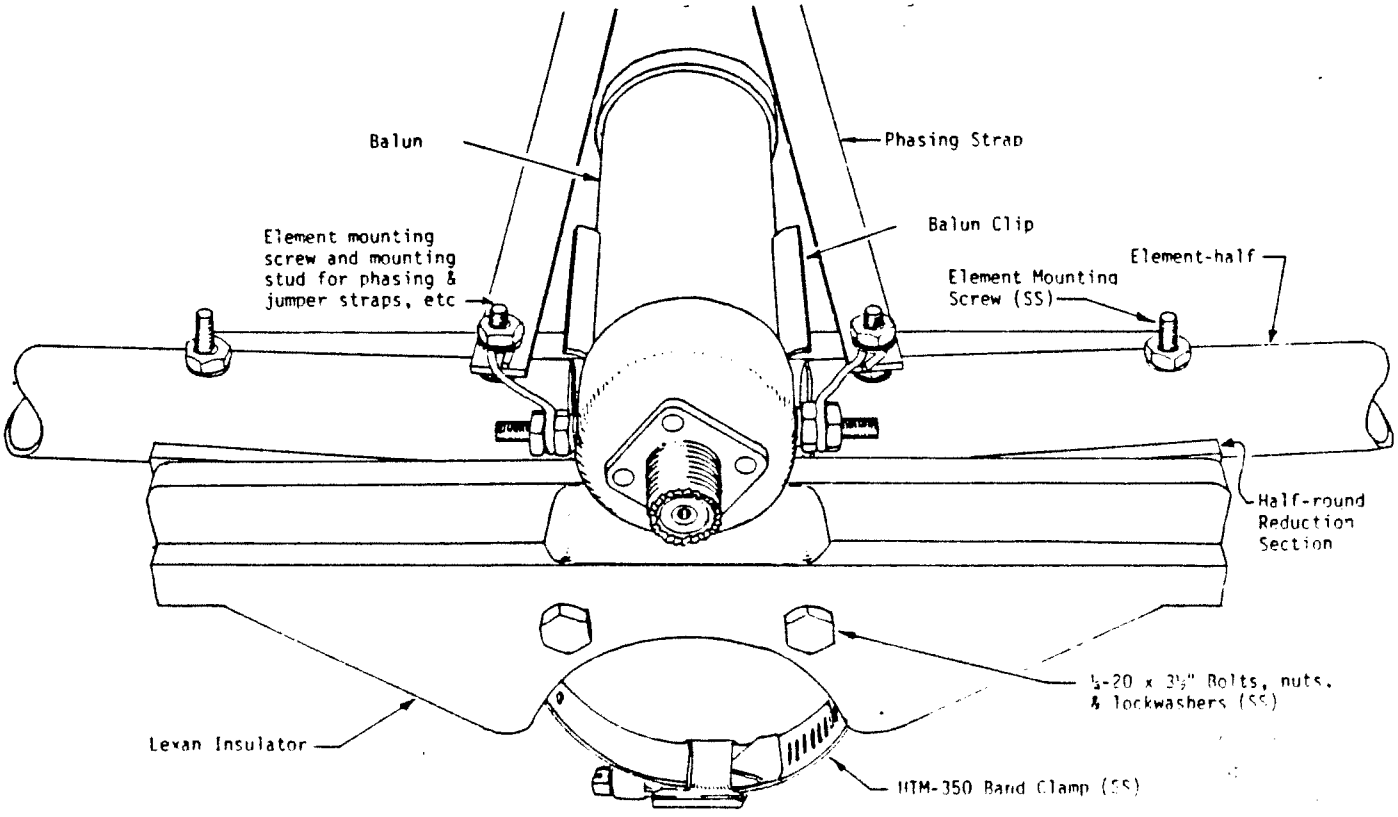


B. Support boom so area between driven elements is as straight as possible. Penetrox strap ends and mount on innermost screw studs on element #2. Secure with 10-32 lockwashers and nuts. Run straps, crossed to the studs on element #3.

C. Attach balun clip to top center of element #3 with a #6 x 3/8 sheet metal screw. Place balun in clip, connector pointing to boom center. Keep balun terminals as close as possible to feedpoints but a minimum of 3/8" from balun clip. (See last page for details on making your own coax balun)

Penetrox balun leads and place over phasing straps. Secure with #10-32 flatwashers lockwashers, and nuts.

See sketch below for correct assembly of hardware.



D. Take up any slack in phasing straps by tapping element #3 away from #2. When straps are taut, align element #3 with the rest and tighten clamp.

E. Referring to the Dimension Sheet (P.2), recheck all elements for correct half lengths and spacing.

E. BOOM-TO-MAST MOUNTING PLATE AND 120° GUY BRACING (see sketch - next page)

The antenna is attached to mast via a boom-to-mast plate at the physical balance point. The boom is braced in three planes (120° intervals) by three adjustable cable assemblies. The cable assembly center plates are attached to 2" O.D. tubing sections that radiate from the mounting plate area. The cable ends tie to a single cast aluminum clamp near each end of boom. Supporting the boom as straight as possible will make adjustments to the guy system easier.

1. Center the boom-to-mast plate at the physical balance point of the antenna (with feedlin attached). Lightly secure with two 3" U-bolts. Be sure off-center holes for mounting vertical riser are "up" and forward of mast.

2. Mount the 2" O.D. x 4 ' vertical riser to the mounting plate with the bottom end 1/8" above top of the boom. Secure with two 2" U-bolts.

3. Using the riser as a guide, sight along beam from one end and rotate mounting plate until riser is perpendicular to element plane. Tighten the 3" U-bolts until boom just begins to deform.

4. Attach the side guy mounting plate (edges diagonal) on the "inner" side of the vertical riser with two 2" U-bolts, butting it on the boom to mast plate.

5. Mount the two 2" O.D. x 5' sections on the side guy mounting plate, angling them down on either side of the boom. Secure with 2" U-bolts.

6. Even up all turnbuckle eyebolts on the guy cable harnesses and unscrew until 1/8" of threads show inside.

7. Use 2" U-bolts to attach cable assembly center plates to outer end of vertical riser and side guy tubing sections.

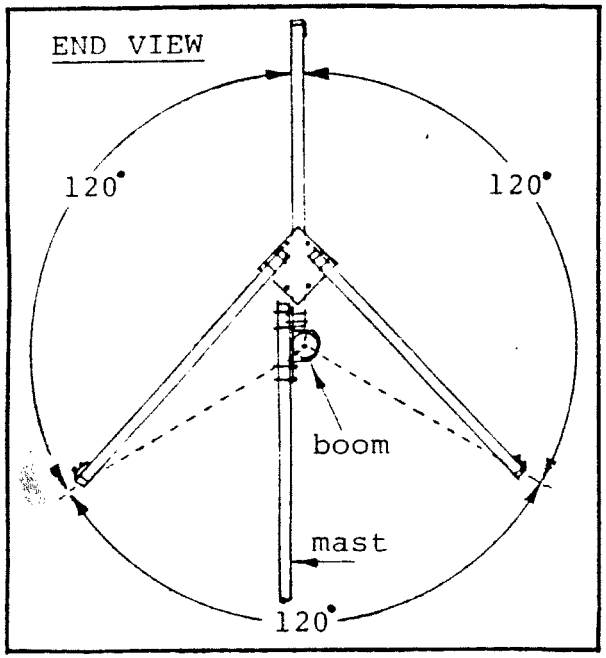
8. Route cables to their respective cast ring clamps near front and rear of boom. Place looped ends into the clamp split and secure with 3/8-20 x 2" bolts, lockwashers, and nuts. Leave bolts loose for Step 9.

9. Make initial boom straightening and support adjustments by a combination of (1) moving the cast ring clamps along the boom and (2) changing the point of attachment of center plates on the riser and side guy tubing sections. Be sure tension is even from front to rear and tubes are not pulled off center. Resecure ring clamp bolts and center plate U-bolts.

10. With the assistance of another person, balance the antenna on the mounting plate and sight the boom end-to-end to check straightness.

Final adjustments and balancing of tension are accomplished adjusting turnbuckles. Block the eyebolts to prevent twisting of cables. When boom is straight, safety-wire the turnbuckles. See that phasing straps remain taut. Adjust element #3 as necessary

120° GUY ASSEMBLY



TYPICAL
HARDWARE
ARRANGEMENT
ONLY
(not to scale)

SAFETY WIRE ALL TURNBUCKLES AFTER FINAL STRAIGHTENING AND TENSIONING ADJUSTMENTS.

ELEMENTS ARE OMITTED AS POSITION AND SPACING VARIES WITH ANTENNA MODEL. SEE DIMENSION SHEET SUPPLIED WITH YOUR KIT.

COMPLETING THE ANTENNA

1. If possible, allow the antenna to sit assembled overnight. The hardware will temperature cycle and various nuts and bolts may require further tightening. Check all nuts, bolts, clamps, etc, and make sure they are all tight and secure. This is a very easy operation on the ground, and very difficult once the antenna has been installed.

2. If you live in an area of severe weather, or if it is likely the antenna elements will snag on trees, guy wires, etc., during installation, it is recommended that the elements be additionally secured in the following manner:

   Drill a small pilot hole into the boom through the existing hole in the HTM 350 clamp band and screw in a #6 x 3/8" sheet metal screw. Repeat for all elements (screws are supplied).

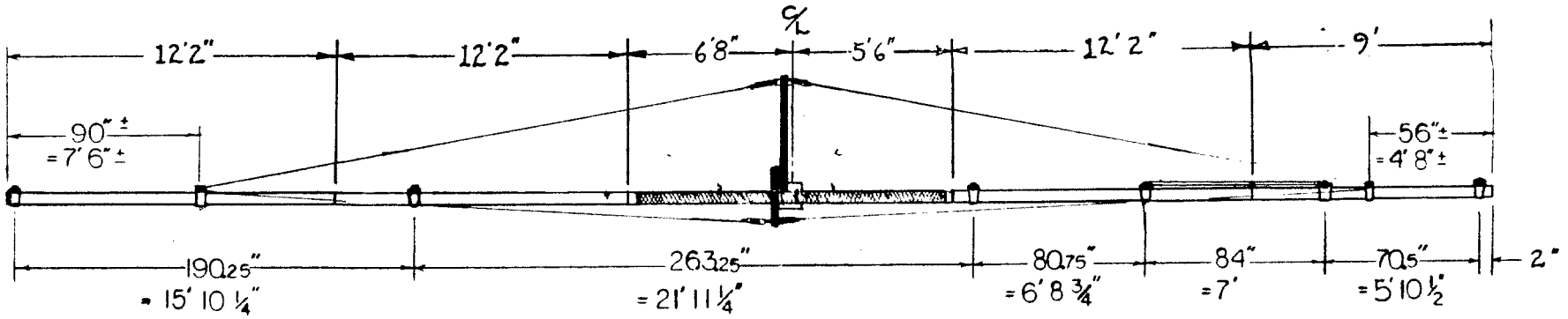
3. Plastic plugs are supplied for the boom ends. They keep out birds and reduce wind noise. Cut or drill a small drain hole in each near the bottom edge before installing.

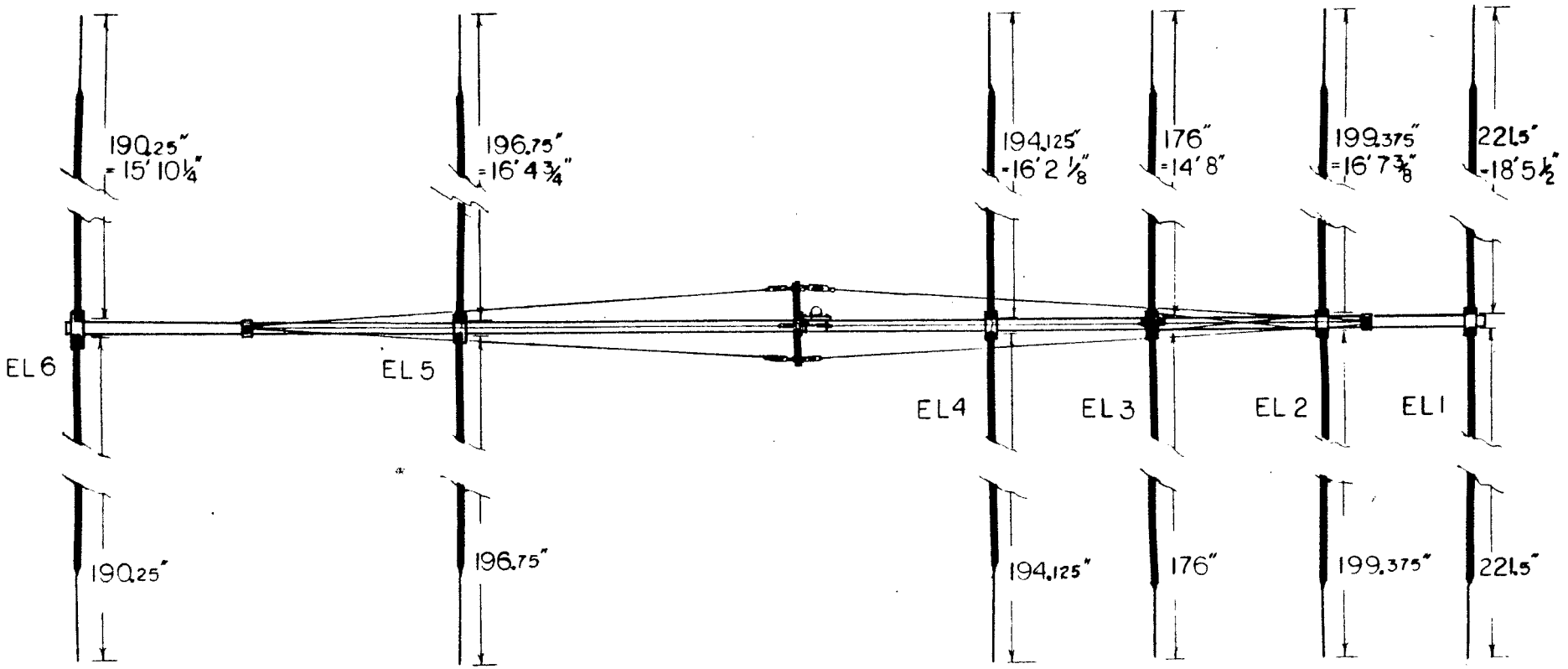
4. Connect 50 ohm coax to balun and route back under boom to the mounting plate. Tape or strap every 3 to 4 feet. To avoid problems, use only quality coax of known 50 ohm impedance (such as Times FM-8, Belden 8214, Columbia 1198, RG 213, RG 214, etc).

5. The antennas boom to mast plate is drilled for a 2"O.D. mast. Install with four 2" U-bolts.

6. See the following pages for details on placement and operation.

DIMENSION DRAWING





KLM "BIG STICKER"

BALUNS

4:1 COAX BALUN CONSTRUCTION

1. Use only high quality 50 ohm coax. KLM research indicates some coax currently marketed will exhibit variable impedance, R.F. leakage, or other defects when in use. KLM uses only Times FM-8 or Belden 8214 for its cable assemblies.

2. Cut coax three inches longer than the electrical half-wavelength to allow for feedpoint leads. Use the formula and table below to determine the correct length with frequency and coax you intend using.

   $$\frac{\text{(constant) } 5904}{\text{freq. in MHz.}} = \text{free space } \tfrac{1}{2} \text{ wavelength} \times \text{velocity factor in coax} = \text{electrical } \tfrac{1}{2} \text{ wavelength in inches}$$

   Example:

   $$\frac{5904}{28\text{MHz}} \times .80 \text{ (TIMES FM-8)} = 168.69\text{"}$$ (28 Mhz ½ wavelength in Times FM-8 coax)

3. Fabricate balun leads as shown in sketch. Carefully solder joints. Check for shield to center conductor shorts.

4. Crimp or solder lugs are recommended for the two 4:1 leads.

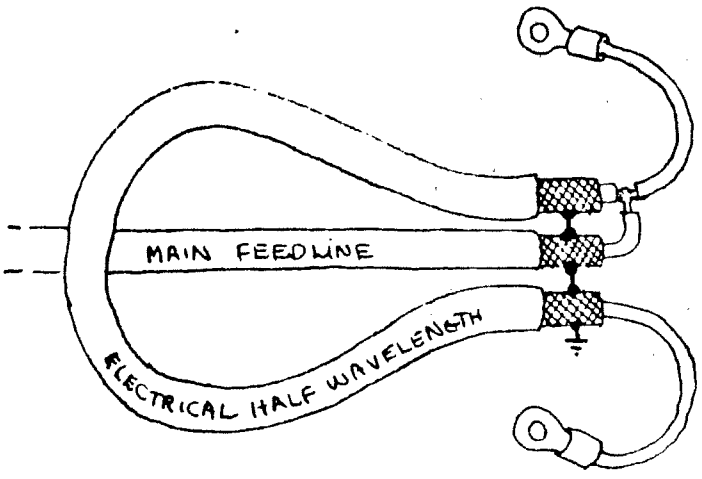
5. Waterproof the exposed coax ends with RTV (or equivalent) sealant.

6. Attach leads to the antenna feedpoints. Tape balun loop and main feedline to boom.

7. Coax shielding may be grounded to boom (optional).

Coax Type	Typical Velocity Factor
RG-213	.66
RG-214	.66
RG-58	.66
Belden 8214	.78
Times FM-8	.80

Consult manufacturers spec.s for other types of coax.



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20M-6

PARTS LIST

ITEM DESCRIPTION	KLM PN	QUANTITY
Boom, 3" OD x .065" x 12'6", Swaged, Drl	69097	1
Boom, 3" OD x .065" x 12'6", Swaged, Drl both ends	69098	2
Boom, 3" OD x 12'6", Swaged	69098	1
Inserts, 2.85" x 11'6"	69502	1
Boom, 3" OD x 9'2", Straight, Drilled 1	69101	1
Riser, 2" OD x 5'	69503	2
Riser, 2" OD x 4'	69499	1
Element, 1" OD x 72", Swaged	69049	12
Inserts, 7/8" x 34"	69501	12
Element, 3/4" OD x 72", Swaged	69043	12
Element, 1/2" OD x 6'11-1/2"	69058	2
Element, 1/2" OD x 5'1-1/2"	69059	8
Element, 1/2" OD x 3'2"	69060	2
Phasing Straps, 1/2" x 84-5/8"	69465	2
Guy Cable Plate Assy (w/2 Turnbuckles)	69703	3
Side Guy Plate, 11-1/2" x 11-1/2"	64726	1
Boom-to-Mast Plate, 11-1/2" x 11-1/2" x 1/2"	64725	1
Hardware:		
Hose Clamps, M-10	28488	12
Clamp, HTM-350	28487	6
M-6 Clamp	28200	12
Insulator Inserts, 1-1/2" to 1"	66135	12
Cast Clamps, 3" ID	28482	2
U-Bolts & Cradles, 3"	28410	2
U-Bolts & Cradles, 2"	28402	15
Insulators, 1-1/2" x 3"	66139	6
Conductive Paste, 1 oz.	16133	1
End Caps, 3"	66131	2
Balun & Clip, 3-60 4:1	97311	1
Bolts, 1/4-20 x 3-1/2"	28526	20
Nuts, 1/4-20	28204	20
Lockwashers, 1/4"	28354	20
Nuts, 5/16-18	28206	30
Lockwashers, 5/16	28356	30
Bolts, 3/8-16 x 2"	28545	2
Nuts, 3/8-16	28205	6
Lockwashers, 3/8"	28355	6
Screws, 10-32 x 2-1/2"	28025	24
Nuts, 10-32	28203	50
Lockwashers, #10	28353	38

ITEM DESCRIPTION	KLM PN	QUANTITY
Hardware - cont'd:		
Flatwashers, #10	28303	2
Sheet Metal Screws, #6 x 3/8"	28000	8
Phasing Strap Spacers, 1" x 1-1/2"	66121	2
Jumper Straps, 1/2" x 3-3/4"	69010	4
Assembly Manual	84018	1

MIRAGE/KLM
COMMUNICATIONS EQUIPMENT
P.O. BOX 1000
MORGAN HILL, CA 95037

WARRANTY CARD

PLEASE RETURN WITHIN 10 DAYS AFTER DATE OF PURCHASE

MODEL # 20m-6 SERIAL # 13453

NAME: _____

ADDRESS: _____

CITY: _____ STATE _____ ZIP _____

DEALER: _____

CITY: _____

DATE PURCHASED: _____