



**AP 116E-1727-1**

**2nd Edition January 1984**  
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dated June 1975)

**HF WIDEBAND  
CONICAL ANTENNAS  
(WB230, WB330 AND WB4530)**

**GENERAL AND TECHNICAL INFORMATION**

**BY COMMAND OF THE DEFENCE COUNCIL**

*Alire Whitmore.*

**Ministry of Defence**

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WARNING  
RADIO FREQUENCY (RF) RADIATION



THE EQUIPMENT COVERED BY THIS PUBLICATION IS ASSOCIATED WITH RF TRANSMITTING DEVICES.

ALL PERSONNEL WORKING ON RF TRANSMITTING EQUIPMENT ARE AT RISK TO RF RADIATION. THE FOLLOWING GENERAL PRECAUTIONS MUST ALWAYS BE TAKEN:

- (1) PERSONNEL MUST AVOID SUBJECTING THEMSELVES OR OTHERS TO SUSTAINED OUTPUT OF FOCUSING AERIALS SUCH AS DISH AERIALS, HONEYCOMB LENSES AND IN PARTICULAR POWER CARRYING WAVEGUIDE FEEDS WHETHER FITTED WITH TERMINATING RADIATORS OR NOT.
- (2) IT IS ESSENTIAL THAT PERSONNEL DO NOT MAKE DETAILED EXAMINATION OF THE RADIATOR, REFLECTOR, WAVEGUIDE OPENING, OR HORN OF ANY RADIO EQUIPMENT IRRESPECTIVE OF POWER OUTPUT DURING PERIODS OF TRANSMISSION.
- (3) CARE MUST BE TAKEN TO AVOID EXPOSURE OF PARTS OF THE BODY SUCH AS THE EYES, FINGERS AND GENITALS TO RF LEAKAGE FROM JOINTS IN WAVEGUIDES CARRYING HIGH POWER.
- (4) WHEN SERVICING HIGH POWER COMMUNICATION TRANSMITTERS OPERATING AT LONGER THAN CENTIMETRIC WAVELENGTHS, PERSONNEL ARE TO AVOID PLACING ANY PART OF THEIR BODY IN THE DIELECTRIC FIELD REGION, i.e. THE INTENSE RF FIELD INSIDE, OR IN CLOSE PROXIMITY TO, THE RADIATING AERIAL(S) STRUCTURE.
- (5) NEVER ENTER RF DANGER AREAS, AND ONLY ENTER RF RESTRICTED AREAS WHEN AUTHORISED TO DO SO. NEVER STAY IN A HAZARD AREA FOR LONGER THAN NECESSARY. IF WHILE TRANSMITTING RF POWER, OTHER UNAUTHORISED PERSONNEL ENTER THE HAZARD AREA, THE EQUIPMENT MUST BE SWITCHED OFF IMMEDIATELY.

REFERENCE SHOULD BE MADE TO THE FOLLOWING DOCUMENTS:

AP 110A-0601-1  
AP 4687A Vol.2 Radiation Safety  
AP 3373 (2nd Edition) Section 7 Chap.9

PREFACE

Each leaf of this publication bears the date of issue and, except for initial issue, the amendment number with which it was issued. New or amended material will be indicated by black triangles positioned in the text in this manner ►----◄ to show the extent of the amended text. When a chapter is re-issued in a completely revised form, the triangles will not appear.

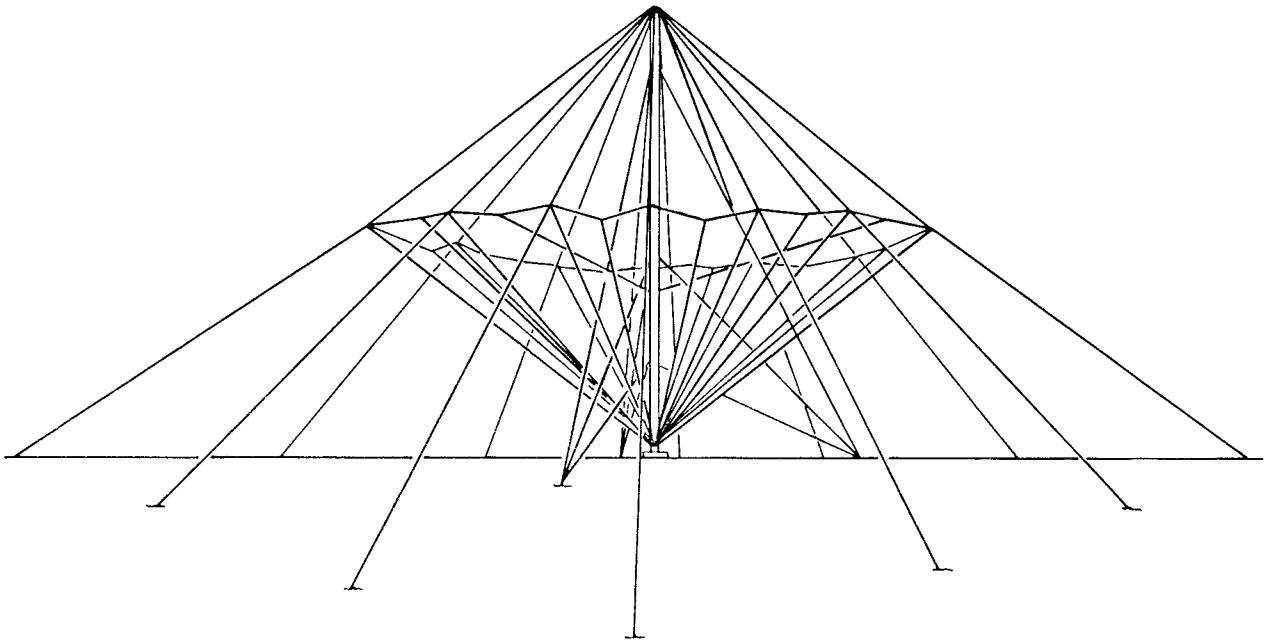
The inclusion of references to items of equipment does not constitute authority for demanding the items.

ASSOCIATED PUBLICATIONS

AP 119K-0625-1  
AP 119K-0625-5F

Chapter 1

LEADING PARTICULARS



<u>Title</u>	HF wideband conical antennas
<u>Ref. No.</u>	
WB230	5985-99-6180841
WB330	5985-99-6269337
WB4530	Not yet available
<u>Purpose</u>	To provide omni-directional ground-to-air coverage in transmission and reception within the following hf bands:
	WB230 2 MHz to 30 MHz
	WB330 3 MHz to 30 MHz
	WB4530 4.5 MHz to 30 MHz

Brief description Each antenna is a vertical conical monopole, formed by 12 copper wires and supported by a central mast. The wires are strained outwards from the mast to form an inverted cone, with its apex at the mast base.

The mast is supported by three sets of stays spaced on 120 degree radials.

An earth mat of 72 copper wires spreads out radially from the mast base.

Site requirements

WB230 160 m (380.5 ft) diameter circle, flat and free from obstructions.

WB330 92 m (302 ft) diameter circle, flat and free from obstructions.

WB4530 58 m (190 ft) diameter circle, flat and free from obstructions.

Physical characteristics

WB230

Height	35 m (115 ft)
Mast sections	9
Straining rope radius	58 m (190 ft)
Stay radius	19 m (62 ft)
Earth mat radius	56 m (184 ft)
Weight	1254 kg (2765 lbs)
Lindaptor height	11.58 m (38 ft)

WB330

Height	23 m (75 ft)
Mast sections	6
Straining rope radius	40 m (131 ft)
Stay radius	12 m (39 ft)
Earth mat radius	46 m (151 ft)
Weight	1019 kg (2246 lbs)
Lindaptor height	11.58 m (38 ft)

WB4530

Height	15.5 m (51 ft)
Mast sections	4
Straining rope radius	27.5 m (90 ft)
Stay radius	7.5 m (25 ft)
Earth mat radius	30.5 m (100 ft)
weight	875 kg (1928 lbs)
Lindaptor height	10 m (32 ft)

Electrical characteristics

Impedance	50 ohms unbalanced
Azimuth radiation pattern	Omni-directional
Polarization	Vertical
Maximum VSWR	2:1
Gain (relative to isotropic)	4 dB
Maximum input power	
WB230	40 kW pep
WB330	40 kW pep
WB4530	40 kW pep
Frequency range	
WB230	2 MHz to 30 MHz
WB330	3 MHz to 30 MHz
WB4530	4.5 MHz to 30 MHz

Chapter 2

TECHNICAL DESCRIPTION

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General

1 Each antenna in the WB range is a conical monopole array, differing however, in frequency coverage, power handling capability and physical dimensions (Chap 1).

2 Each antenna consists of 12 copper cadmium wires, attached at the top and bottom of a steel lattice mast, with straining ropes providing the means for antenna shaping (fig 1). The mast is supported by three sets of stays on 120° radials (fig 2), and the bottom end of the mast is insulated from ground.

3 An earth mat, consisting of 72 copper wires, radiates from the mast base on 5° radials. The earth wires are terminated in a copper frame fitted around the mast foundation block. A lightning arrester is fitted at the mast base.

Electrical

4 The WB range of antennas is designed for the transmission and reception of vertically polarised electromagnetic waves, providing an omni-directional radiation pattern in the horizontal plane and low-angle coverage in the vertical plane. Each antenna is an inverted conical array of twelve antenna wires supported on a mast, which acts as a centre radiator.

5 Variation of cone impedance with frequency depends on the fraction of the wave which is reflected and is, in general, inversely proportional to the angle and length of the cone. The WB range of antennas have cone angles greater than 100° and cone lengths equal to, or greater than, a quarter wave-length of all frequencies in their respective band. These factors produce an antenna system with low-impedance, broadband characteristics.



6 One end of each of the twelve antenna wires is connected to the insulator unit at the base of the mast, and the other end is connected to a head cap which is fitted to the top mast section. Antenna shaping is provided by twelve antenna straining ropes, and a peripheral ring of copper spacing wires is electrically connected at the junction of each antenna wire and its straining rope.

7 Twelve intermediate antenna wires are connected, one each to the mid-points of the spacing wires; their other ends are connected as follows:

7.1 Three wires, spaced  $120^\circ$  apart, are connected to the mast structure by a lindaptor connector.

7.2 The remaining nine wires are connected to the insulator unit at the mast base.

8 RF signals are connected to and from the antenna array via a coaxial connector secured to the mast foundation block.

### Mechanical

9 The antenna mast consists of several steel lattice sections of triangular construction, with climbing steps on one side.

10 The mast is supported on a steel baseplate, secured to a concrete foundation block by four ragbolts. A glazed alumina insulator resting on the baseplate and cushioned top and bottom by lead washers, bears the weight of the erected mast sections and provides the necessary insulation from the ground.

11 The mast is supported by three sets of stays spaced on  $120^\circ$  radials and attached to lugs at the top of the following mast sections.

11.1 WB230 - 2nd, 5th and 8th sections.

11.2 WB330 - 2nd and 5th sections.

11.3 WB4530 - 3rd section only.

12 The lower ends of the mast stays are anchored by rigging screws to steel plates set into concrete anchor blocks. Adjustment of stay tension is provided by the rigging screws.

13 A standing line is left reeved to a pulley at the head cap and is secured to a halyard picket, in order to hold it away from the mast sections.

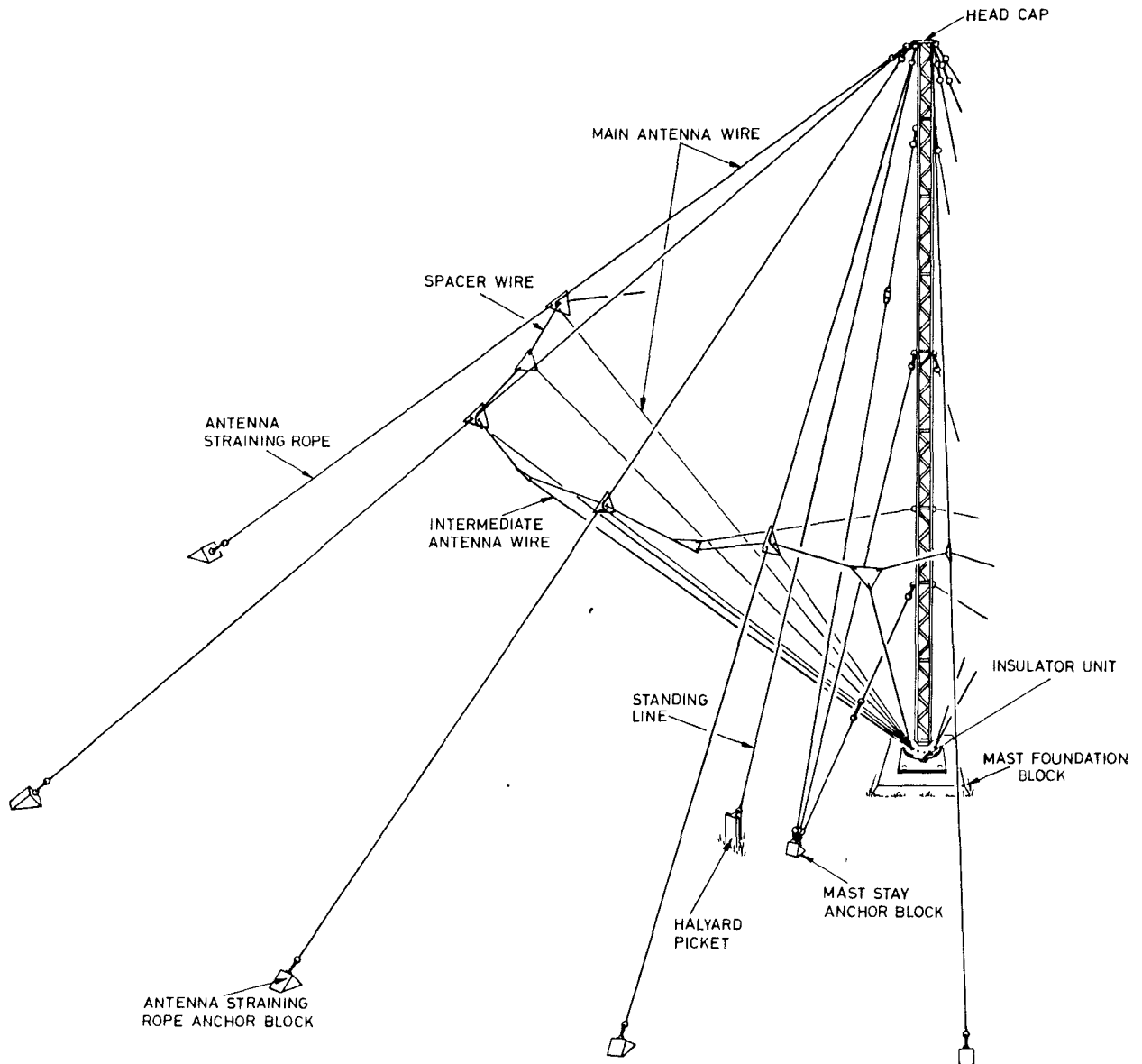


Fig 1 Antenna basic construction

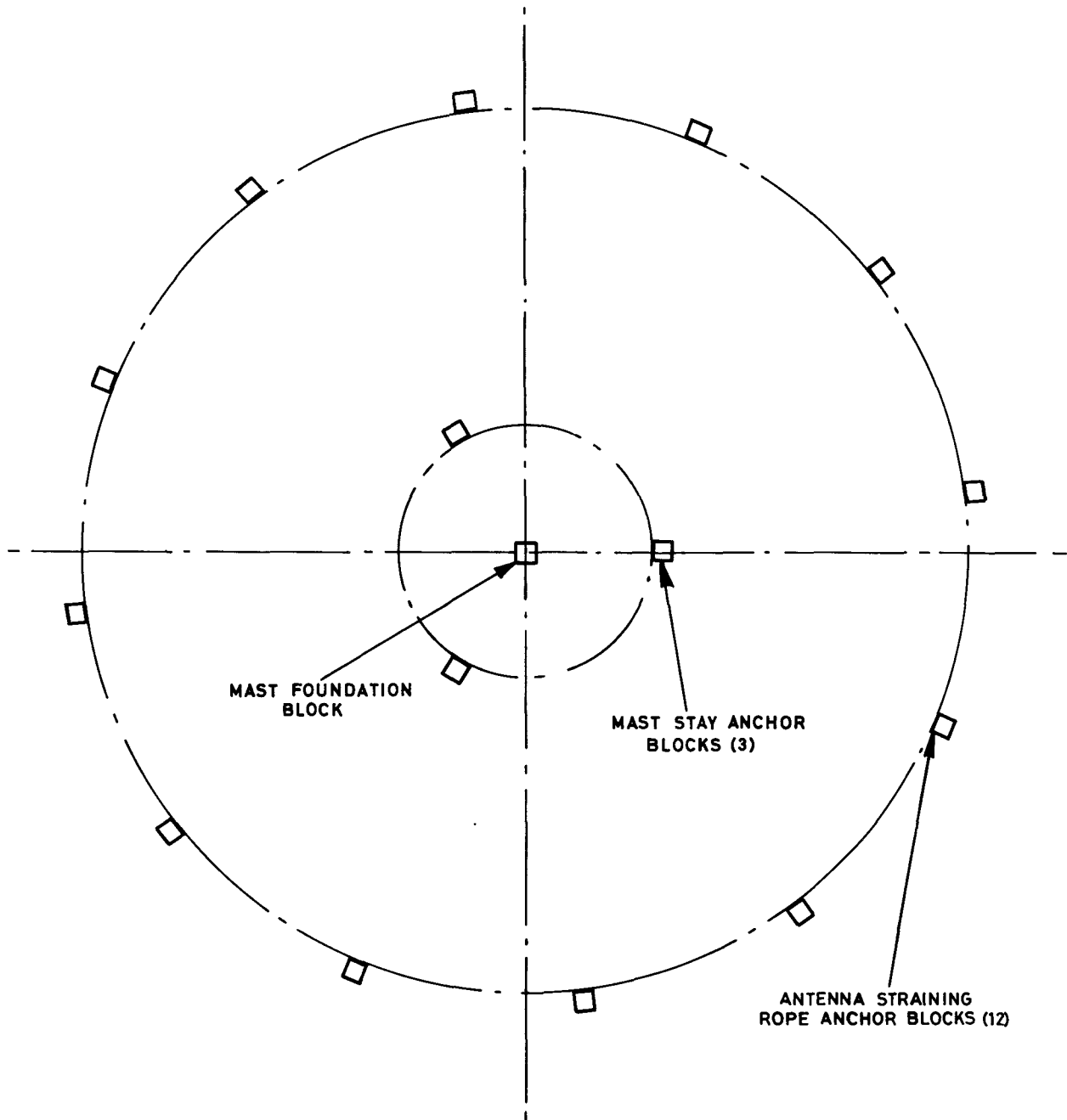


Fig 2 Site layout

Chapter 3

WB230 ERECTING AND DISMANTLING INSTRUCTIONS

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DRAWINGS AND ASSOCIATED PUBLICATIONS

1 These erecting and dismantling instructions are to be read in conjunction with the following drawings and publications:

AP 116E-1717-1J	HF and MF antennas for ground stations: support antennas
AP 119K-0001-1	Lifting equipment: servicing and testing
RAFSC ESI Vol 1 pt. 6a	
OIP 463	Operation of Payne and Baynard handwinch
SCSHQ 118575	WB230 antenna with ten tonne top stays
90G 109920	Assembly of gin pole for WB230 antenna
SCSHQ 116262	Work service details
▶ AP 119K-0625-1 and 5F	Hand Winch Type 306 ◀

2 Parts to be used during the erecting and dismantling of the WB230 antenna are listed in Table 1. Special tools required to carry out these tasks are listed in Table 2. Drawings common to Chapters 3, 4 and 5 are presented in Chapter 8.

SAFETY PRECAUTIONS

3 All relevant safety precautions are to be observed during the mast erection and must not be compromised in any way.

3.1 The mast structure is not to be climbed by more than two men at any time.

3.2 Any person working higher than two metres above ground level must secure himself to the structure using such methods as are approved by the NCO in charge of the fitting party.

3.3 During the mast erection or lowering there is never to be more than four metres projecting above a set of stays when a man is required to climb beyond the stays.

3.4 Care is to be taken during the erection of each section that the verticality of the mast is observed. At each stage that a permanent set of stays is fitted, the mast must be corrected for verticality and checked with theodolites and the stays adjusted to their correct tensions (Chap 6 refers).

3.5 When using the gin pole the hauling rope must always pass through a pulley block at the base of the mast.

3.6 During lifting, the mast section must never be further than one metre from the mast, and only one section is to be lifted at any time.

3.7 The handwinch is to be used as the hauling medium and it must be supported on its stand and securely anchored in position.

### PSA(DOE) RESPONSIBILITIES

4 The mast and stays of the antenna are the responsibility of PSA (DOE) and are not to be adjusted after handover. The PSA (DOE) are to be informed in writing, a minimum of seven days in advance of the dates of mast erection, in order that a PSA (DOE) observer may be present, if required.

### MANPOWER

5 To erect or lower the mast a senior NCO and six men are required. The men will be deployed as follows:

5.1 Two men on the mast.

5.2 Two men on the winch.

5.3 Two men on the fall rope as the sections are raised or lowered.

6 To erect the antenna, after the mast has already been erected, a supervisor (senior NCO) and a minimum of three men are required.

### PRE-ERECTION DETAILS

7 Check that the foundations as supplied by PSA (DOE) are in agreement with figure 2.

Note...

For ease of working, the radial trenches (if required) for the earth mat should not be excavated until the mast has been erected.

8 The co-axial feeder may be laid at this stage and the trench back filled (if required) but the feeder protruding from the ground must be suitably protected against damage.

9 In some locations the mast sections must be painted, for additional corrosion protection. This information is given on the relevant RAFSEE drawing. Any damaged paintwork after final erection is to be repaired, as necessary, using the correct paint.

10 The following items of the antenna kit will have been used to install the foundations. Item numbers refer to drawing SCSHQ 116262.

10.1 4 hole anchor plate (item 1).

10.2 J bolt 5/8 in. BSW galvanised (item 3, 7 & 9).

10.3 J bolt 3/8 in. BSW galvanised (item 2, 6 & 8).

10.4 Hairpin anchor 12 in. x ½ in. dia (item 4).

10.5 Mast foundation template (item 5).

## MAST ASSEMBLY AND ERECTION

### Preparation of mast anchors (fig 3)

11 Fit quantity nine 1 1/8 in. rigging screws (item 7, Table 1), three to each anchor plate at the three mast stay anchor blocks. Adjust the rigging screws to their mid-position.

Note...

The shackles must be fitted in the top three holes of the anchor plates.

12 Attach a preformed dead end (items 11 and 32) to each of the nine rigging screws, together with 1/2 in. score thimbles (item 29) as follows:

12.1 One off item 11 to each bottom rigging screw.

12.2 One off item 11 to each middle rigging screw.

12.3 One off item 32 to each top rigging screw.

13 Fit a 1/2 in. rigging screw (item 56) via a 3/8 in. 'D' shackle (item 40) to each of the twelve antenna straining rope anchor blocks (fig 1, Chap 8). Adjust the rigging screws to their mid-position. Place a preformed dead end (item 57) and an 8 mm dia wire rope thimble (item 58) with each of the rigging screws at the antenna straining rope anchor blocks.

### Erection of first mast section

14 Remove the six nuts and washers from the studs in the mast foundation block. Place the nuts and washers in a safe place for refitting later.

15 Clean the stud threads, using a wire brush if necessary. Clean the top surface of the mast foundation block of all dirt and check it is flat and level. If not, contact the local PSA (DOE) for correction.

16 Lightly oil the six stud threads, protruding from the foundation block.

17 Clean the top and bottom faces of the base plate (item 17) and paint with epoxy pitch in accordance with instructions given in Chap 7. Allow the paint to dry.

18 Fit the base plate over the four main studs in the mast foundation block and check that it sits flat without rocking. If not, contact the PSA (DOE) for correction. Refit the four nuts and washers (removed in para 14) and tighten sufficiently to lightly clamp the base plate.

19 Take one mast section (item 1) and lay it on the ground on a line passing through the mast foundation block and bisecting the angle between two of the mast stay anchor blocks.

Notes...

(1) The end of the mast section with the stay attachment lugs is to be furthest away from the mast foundation block.

(2) The end of the mast section nearest the mast foundation block is to be approximately 300 mm from the edge of the block.

20 Clean the end of the mast section nearest the mast foundation block and attach the insulator top unit (item 23) using 5/8 in. nuts, bolts and washers (items 2, 3 and 4) (fig 2, Chap 8). Clean the free end of the insulator top unit (item 23) and secure a lead washer (item 21) to it using a screw (item 20).

Note...

The two faces of the lead washer must be clean before fitting.

21 Place the second lead washer (item 21) in the centre of the base plate (item 17) and secure in position with a screw (item 20) (fig 3, Chap 8).

Note...

The two faces of the lead washer and the top surface of the base plate must be clean before assembly.

22 Take the insulator (3 in. dia x 3 in. long) (item 22) and stand it on the lead washer fitted to the base plate. Ensure that the insulator sits on the lead washer with the head of the screw (item 20) in the bore of the insulator.

23 Take quantity three type T7 Tirfor winches (item 1, Table 2) and pull the rope through the machine until there is approximately seven metres of rope between hook and machine. Using ½ in. dia shackles attach the hooks of the three Tirfor ropes to the stay attachment lugs of the mast section laid on the ground. Lay the three Tirfor winches at the mast foundation block, with the three Tirfor ropes laid out on the ground parallel to the mast section.

24 Fit a 7/8 in. 'D' shackle in the bottom hole of each of the three stay anchor plates (fig 4, Chap 8).

25 Place a clean piece of wood, at least 100 mm wide x 300 mm long on the ground, between the centre of the insulator top unit (item 23) and the mast foundation block.

26 Two men are to take hold of the mast section, (laid on the ground in para 19) at the end furthest from the mast foundation block, preparatory to standing it upright. In addition, one man is to stand at the mast foundation block to steady the end of the mast section and to ensure that the insulator top unit (item 23) stands on the piece of wood (para 25) after lifting. Three other men are to take hold of the Tirfor ropes to steady the mast section.

27 When all the men are in position, the two men at the mast end furthest from the mast foundation block are to lift the end of the mast section and walk in towards the mast base, pushing upwards as they proceed, until the mast section is vertical, and resting on the piece of wood.

28 The three men with the Tirfor ropes are to keep the mast section steady while the two other men lift the mast section from the piece of wood to the top of the insulator (item 22), ensuring that the screw locating the lead washer fits in the hole of the insulator (item 22) and that the mast steps are on the opposite side of the mast to the two co-axial connector studs (fig 5, Chap 8).



29 Two men are to hold the mast section vertical while the three men with the Tirfor ropes and winches make them off to their respective mast stay anchor block positions, using the 7/8 in. 'D' shackles fitted in para 24.

30 Check that the mast section is central on the insulator and that the stays leave the section on the correct line to prevent twist in the section. Adjust the winches to hold the section vertical and steady (fig 4, Chap 8).

#### Assembly of lightning arrestor (fig 6, Chap 8)

31 Screw the nut (part of item 25) up the bolt (item 25) until approximately 15 mm of thread protrudes beyond the nut. Grease the thread of the bolt, place a washer (item 27) over the end and screw the assembly into the tapped hole in the base plate.

32 Screw a nut (item 26) on to the lightning arrestor upper (item 24) until approximately 30 mm of thread protrudes beyond the nut. Place a washer (item 36) and a bracket (item 28) over the thread of the lightning arrestor upper, ensuring that the bend in the bracket is away from the nut. Grease the thread of the lightning arrestor upper and place it through the hole directly above and one hole to the left of the bolt (item 25) attached to the base plate in para 31. Place a washer (item 27) over the thread protruding through a hole in the flange of the insulator top unit (item 23) and clamp the lightning arrestor upper to the flange with a nut (item 26). Adjust the position of the lightning arrestor upper until it touches the bolt (item 25).

Note...

This action ensures that the mast and antenna are connected to earth whilst the mast is erected.

#### Assembly of gin pole (fig 7, Chap 8)

33 Examine the gin pole assembly and check that the pole slides freely through its clamp assembly. Make certain that the working principle of the gin pole and the method by which it is clamped to the mast are fully understood.

34 Place the bottom end of the gin pole assembly (end without pulleys) against the base of the mast leg nearest the hairpin in the mast foundation block. One man is to steady the base of the gin pole assembly against the mast leg whilst a second man lifts the gin pole head, and walks towards the mast base, pushing upwards as he proceeds, until the gin pole is vertical. The second man is then to climb to the top of the mast section and secure the gin pole to the mast with a loose lashing, using terylene rope.

35 The second man is then to guide the clamp assembly as it travels up the gin pole, when hoisted from the ground. Firmly lock the clamp assembly as near to the top of the mast section as is practicable.

36 Remove the lashing that temporarily secured the gin pole to the mast (para 34). Fit a pulley block to the hairpin in the mast foundation block using a ½ in. dia shackle.

37 Reeve the winch rope first through the pulley block at the base of the mast and then through the pulley block at the gin pole head. Return the end of the winch rope to ground level.

Note...

The handwinch is to be positioned approximately six metres from the mast base and securely picketed in position (fig 8, Chap 8). This winch must be stayed to ground pickets, in a direction away from the mast (ie opposing the pull of the winch).

38 Use the gin pole hauling rope to slide the gin pole through the clamp assembly until it is in the elevated position. Secure in this position with the locking pin.

#### Erection of second mast section

39 Lay a mast section (item 1) on the ground on the opposite side of the mast to the pulley block, with the stay attachment lugs away from the mast base.

40 Assemble the bottom set of stays from items 8, 12 and 14, for stay number one (fig 3). Attach the parafil end (item 14) of the three stays, one each to the three stay attachment lugs of the mast section. Ensure that the split pins are correctly expanded in the two parafil end terminations of each stay, and that the parafil termination in the centre of the stay is greased.

41 Attach the end of the winch rope to a point on the mast section approximately 1.5 m from the end to which the stays are attached. Attach a 30 m long fall rope to the mast section at one of the crossbrace members, approximately one metre from the end furthest from the stays.

42 Begin to lift the mast section, ensuring that the climbing steps are correctly orientated to line up with the steps on the first mast section. The mast section must be nearly vertical during the lift, and the fall rope is to be used to keep the mast section away from the first mast section.

43 Two men are to climb to the top of the first mast section and when the second mast section is above the first, they are to guide it into position, bolting the two sections together with 5/8 in. nuts, bolts and washers (items 2, 3 and 4).

44 Take the mast stays attached to the second mast section and attach their lower ends to the lower of the three rigging screws (para 11) at the mast stay anchor blocks, using dead ends and thimbles (items 11 and 29).

45 Check that the mast is vertical (Chap 6) and adjust the stays to a tension of 5000 N (5KN)  $\pm$  250 N.

#### Erection of third mast section

46 Tie the gin pole head to top of the mast, using a temporary lashing.

47 Release the clamp assembly and remove the locking pin. Raise the clamp assembly to the top of the mast, whilst it is guided by one man on the mast.

48 Firmly lock the clamp assembly as near to the top of the mast as is practicable.

49 Remove the temporary lashing (para 46) and slide the gin pole through the clamp assembly until it is in the elevated position. Secure with locking pin.

50 Lay a mast section (item 1) on the ground on the opposite side of the mast to the pulley block, with the stay attachment lugs away from the mast base. Attach three temporary stays, one to each stay attachment lug, using terylene rope (item 16, Table 2).

51 Attach the end of the winch rope to a point on the mast section approximately 1.5 m from the end to which the stays are attached. Attach a 30 m fall rope to the mast section at one of the crossbrace members, approximately one metre from the end furthest from the stays.

52 Begin to lift the mast section, ensuring that the climbing steps are correctly orientated to line up with the steps on the sections already standing. The mast section must be nearly vertical during the lift, and the fall rope is to be used to keep the mast section away from the part of the mast previously erected.

53 Two men are to climb to the top of the mast and when the mast section is as high as required it is to be guided into position, bolting the two sections together with 5/8 in. nuts, bolts and washers (item 2, 3 and 4).

54 Take the terylene temporary stays attached to the section just lifted and attach their lower ends to their respective stay anchor blocks.

55 Check that the mast is vertical (Chap 6).

#### Erection of fourth to seventh mast sections

56 Continue to erect the mast using the procedure described in para 46 to 55, up to and including mast section number seven. For staying arrangements see figure 4.

Notes...

(1) Number two set of stays is assembled from items 9, 12 and 15.

(2) Tirfor mast stays for mast sections four and seven use the stop and extension as shown in figure 5.

► 57 Adjust the number two set of stays to a tension of 7000 N (7KN) ± 250 N. ◀

#### Erection of eight and ninth mast sections

58 Because of the weight of the top mast stays, section eight of the mast is to be lifted without the permanent stays being attached. A temporary stay arrangement is to be used (fig 5).

59 Attach three link plates (item 19), one to each of the lugs in at the top of section eight (fig 3), using a pin (item 39) and split pin (item 61). Attach three slings (item 15, Table 2) and strops (item 3), one to each Tirfor rope, using shackles (item 9) as shown in figure 5.

60 Lift the mast section as detailed in para 46 to 55. Tension the temporary Tirfor stays lightly to hold the section secure.

61 Lift the permanent top stays using the gin pole, and attach these stays, one to each link plate, (fitted in para 59). Tension each top stay, and remove the temporary stays.

62 Attach the top mast section as detailed in para 46 to 55.

Note ...

The mast will project above its final set of stays by one mast section (fig 9, Chap 8).

▶ 63 Adjust the top stays to a tension of 9000 N (9KN)  $\pm$  250 N. ◀

64 Straighten the mast and check that it is vertical in accordance with Chap 6.

65 Attach a pulley block (item 80) using a shackle (item 83), to one of the stay attachment lugs (near the steps) at the mast head. This pulley block is for use with a Bosun Chair. A standing line is always to be left reeved when a Bosun Chair or safety line is not being used, and should be terminated at the picket (item 82) using a shackle (item 45). The senior NCO IC the party is to decide if the Bosun Chair or safety line is to be used for the remainder of the antenna erection.

66 Use the winch rope to raise the head cap (item 33) to the top of the mast. Fit the head cap using quantity six 5/8 in. bolts 2 in. long (items 2, 3 and 4) (fig 1, Chap 8).

67 Transfer the winch rope and snatch block from the gin pole head to one of the stay attachment lugs at the top of the mast.

68 Lower the gin pole by removing the locking pin and lowering the pole down through the clamp assembly.

69 Tie off the gin pole head to the top mast section, release the clamp assembly and lower it down the gin pole to the section below. Clamp in position and secure the gin pole with the locking pin. Remove the tie at the gin pole head.

70 Shackle the winch rope to the gin pole head and use the winch rope to lower the gin pole assembly to the ground.

### ANTENNA ARRAY ERECTION

#### Erection of the main antenna wires

71 Fit quantity 21 brackets (item 28) around the base of the insulator top unit (item 23) using for each a 3/8 in. by 1 1/4 in. bolt (item 35) with a plain washer (item 27) under the bolt head (fig 6, Chap 8). Fit a spring washer (item 36) under the nut (item 35). Threads must be greased before assembly.

Note ...

The brackets (item 28) are to be fitted on the underside of the insulator top unit (item 23) and are not to be fitted adjacent to the three mast legs.

72 Fit quantity 21 line taps (item 74) one to each bracket.

73 The main antenna wire assemblies, consisting of items 47, 50, 52 and 53 are supplied assembled. To each of these assemblies, fit a straining rope (item 54) to the antenna bracket (item 50), using a 1/4 in. 'D' shackle (item 46) (fig 1, Chap 8).

74 The top end of each main antenna wire assembly is to be made off to the head cap (item 33), as follows:

74.1 Shackle the eye in the antenna wire assembly to a bracket (item 28) using a 1/4 in. 'D' shackle (item 46).

74.2 Place a washer (item 27) over the thread of a 3/8 in. by 1 1/4 in. bolt (item 35), followed by the terminal end of the antenna wire assembly.

74.3 Fit a second washer (item 27) to the bolt (item 35) before passing the screw thread through the bracket (item 28) and then through the head cap (item 33). Secure with a nut and a washer (item 36).

74.4 As each antenna wire assembly is fitted to the head cap it is to be lightly strained away from the mast using the straining rope (item 54).

75 When the twelve antenna wire assemblies have been fitted to the head cap and lightly strained out from the mast, the bottom end of each is to be made off to its appropriate line tap (item 74) at the insulator top unit. Allow 25 mm to project through each line tap.

76 Remove the winch rope and pulley block from the top of the mast (fitted in para 67), lower to the ground and fit to the gin pole assembly. Remove the gin pole assembly, winch and pulley block from the working area.

#### Assembly of the intermediate antenna wires (fig 10, Chap 8)

77 Fit the intermediate antenna wires (item 48), as follows:

77.1 Release the tension in two adjacent main antenna assemblies and allow them to fall in towards the mast until it is possible to work on the antenna brackets (item 50).

77.2 Fit two spacer wires (item 49), one to each antenna bracket (item 50).

77.3 Join the ends of the two spacer wires together between the two main antenna wire assemblies by fitting them to a spacer link plate (item 51) using nuts and bolts (items 52 and 53).

77.4 Also fit an intermediate antenna wire (item 48) to the spacer link plate using nuts and bolts (item 52 and 53).

Note ...

The clamping nuts (item 53) should only be used once and are not to be overtightened.

78 Continue to fit the spacer wires (item 49) and intermediate antenna wires (item 48) round the mast. The bottom ends of the intermediate antenna wires should be left free at this stage. Grease the antenna brackets (item 50) and shackles (item 46) after assembly of the spacer wires (item 49), whilst at a working height.

79 Tension the antenna straining ropes (item 54) to 895N (200 lbs).

80 From baseplate level, measure up the mast and make a mark on each mast leg at a level of 11.6 m. Clean an area 50 mm wide round each leg at this level (ie remove all paint and dirt etc).

81 Assemble a lindaptor (item 31) to each leg (fig 11, Chap 8), together with a bracket (item 28), ensuring good mating contact. Fit a line tap (item 74) through the hole in the bracket (item 28).

82 Terminate the ends of the three intermediate antenna wires opposite the mast legs, to the line taps at the 11.6 m level up the mast. Terminate the remaining nine intermediate antenna wires to their respective line taps at the mast base.

### EARTHING ASSEMBLY

#### Assembly of the earth termination (fig 12, Chap 8)

83 Fit the two base strip connectors (item 41) between two of the base plate studs and the two 3/8 in. coaxial connector studs, which will be found projecting from the mast foundation block.

84 Fit four earth terminals (item 69) to each of the four termination strips (item 65), using screws and washers (item 70 and 71).

85 Dig a trench 150 mm deep around the mast base, exposing the sides of the mast foundation block. The trench must be at least 150 mm wide.

86 Position the four termination strip assemblies round the mast foundation block and secure together with the earth connecting strips (item 66), using bolts and nuts (items 72 and 73). Push the whole assembly to the bottom of the trench.

87 Bend each connecting strip (item 66) over the top surface of the foundation block and onto the four studs projecting through the base plate. Cut the connecting strips to length and drill clearance holes to suit the base plate studs. Remove each base plate nut and washer in turn and secure item 66 with these nuts and washers.

#### Assembly of the termination connector (fig 13, Chap 8)

88 Fit the support bracket (item 37), using the nuts removed in para 14, to the coaxial connector studs in the mast foundation block. Fit the antenna coaxial connector (item 38) to the support bracket. Fit a temporary cover over the open end of the connector.

89 Remove one of the nuts from the wire termination end of the coaxial connector assembly, and the nut securing the bracket (item 28) nearest to the coaxial connector. Fit the copper wire connector (item 42) between the coaxial connector (item 38) and the bracket (item 28). Replace nuts and secure firmly.

90 Lay the coaxial feeder (see also para 8) and terminate to the connector assembly (item 38). Pressurise the coaxial feeder and, if satisfactory, back-fill the cable trench.

#### Laying the earth mat (fig 14, Chap 8)

Note ...

If required on site installation or works service drawings, obtain PSA (DOE) assistance in opening the radial trenches for the earth mat. Ensure that the earth connections around the mast foundation block are not damaged during this operation.

91 Take each copper earth wire (item 67) and bend at right angles 50 mm from its end. Push the bent end of the wire through the end of an earth terminal (item 69). Lay the copper earth wire out along its appropriate radial trench and back-fill.

92 Lay the 72 earth wires as in para 91.

Note ...

The earth terminals (item 69) at the corners of the mast foundation block, each terminate five earth wires whilst those at the sides terminate four wires each.

93 Check that all the earth terminal clamping nuts are tight and holding the earth wires. Grease the earth terminals.

94 Back-fill and level the soil around the mast foundation block.

#### CLEARING THE SITE

95 Remove all erection tackle from the mast. Clear all tools and spare equipment from site and generally tidy up.

96 Grease all shackles, bottle screws etc on the stays and straining ropes. Repair any damage to paintwork.

97 Adjust the position of the lightning arrestor upper, until a gap of 6 mm exists and lock in position. Test the antenna against the relevant test specification.

#### DISMANTLING THE ANTENNA ARRAY

98 Disconnect the main coaxial feeder at the coaxial connector (item 38) and disconnect the copper wire connector (item 42). Remove the connector assembly together with the bracket (item 37)(fig 13, Chap 8). Adjust the position of the lightning arrestor upper until it touches the bolt (item 25).

99 Release all intermediate wires (item 48) from their line taps (item 74) at the lindaptors (fig 11, Chap 8).

100 Remove the snatch block and winch rope from the gin pole. One man is to climb the mast and fit the snatch block and winch rope to an attachment lug at the mast head, using a  $\frac{1}{2}$  in. 'D' shackle. Fit a pulley block to the hair-pin in the mast foundation block, using a  $\frac{1}{2}$  in. 'D' shackle.

101 Reeve the winch rope through the snatch block at the base of the mast. Return the end of the winch rope to ground level.

Note ...

The hand winch is to be used in conjunction with the winch rope and must be positioned approximately six metres from the mast base and securely picketed in position (fig 8, Chap 8). This winch must be stayed to ground pickets, in a direction away from the mast (ie opposing the pull of the winch).

102 Release the tensions in all the antenna straining ropes (item 54) but do not disconnect at this stage.

103 Disconnect any three adjacent antenna straining ropes (item 54). This will facilitate the removal of the link plates (item 51), intermediate wires (item 48) and spacer wires (item 49).

104 Remove the middle one of the three main antenna wire assemblies from the mast by disconnecting from the line tap at the base of the mast and from the head cap, by removing the bolts (item 35). Lower to the ground using the pulley block installed in para 100.

105 Disconnect a further adjacent straining rope (item 54) which will facilitate the removal of the link plates (item 51), intermediate wires (item 48) and spacer wire (item 49). This will leave a main antenna wire free for removal and lowering.

106 Continue around the mast in a similar fashion until all antenna elements have been removed.

## DISMANTLING THE MAST

### Dismantling the ninth and eighth mast sections

107 Remove the mast head cap (item 33). Lower to the ground using the winch rope.

108 Shackle the winch rope to the gin pole head and raise the gin pole assembly until the clamp assembly can be secured to the top of the eighth mast section.

109 Transfer the winch rope and snatch block from the mast attachment lug to the gin pole head.

110 Attach the end of the winch rope to a point on the top mast section approximately 1.5 m from the head of the mast. Attach a 30 m long fall rope to one of the crossbrace members, approximately one metre from the lower end of the mast section.

111 Take the strain on the hauling rope, and release the mast section by removing the 5/8 in. nuts and bolts (item 2, 3 and 4). Raise the mast section with the hauling rope to clear, then lower the mast section to the ground, using the fall rope to keep the section away from the mast.



112 Lower the gin pole to the next position by removing the locking pin, and lowering the pole down through the clamp assembly. Tie off the gin pole head to the mast section, release the clamp assembly and lower it down the gin pole to the section below the one that is to be removed. Clamp in position and secure the gin pole with the locking pin. Remove the tie and gin pole head.

113 Make off three Tirfor temporary stays (fig 5), one to each mast leg just below the permanent stays. Tension these temporary stays.

114 Release the tensions in the top set of permanent stays gradually, until they are slack. Disconnect them from their stay anchor blocks and lower to the ground using the winch rope. Attach and tension a set of terylene temporary stays to the next mast section down.

115 Attach the end of the winch rope to a point on the eighth mast section approximately 1.5 m from the head of the mast. Attach a 30 m long fall rope to one of the crossbrace members, approximately one metre from the lower end of the mast section.

116 Take the strain on the winch rope and release the Tirfor temporary stays. Release the mast section by removing the 5/8 in. nuts and bolts (items 2, 3 and 4). Raise the mast section with the winch rope to clear, then lower the mast section (complete with stays) to the ground, using the fall rope to keep the section away from the mast.

#### Dismantling the seventh to first mast sections

117 Dismantle the remaining sections, down to the first section, in a similar manner to that detailed in paragraphs 112 to 116. Staying arrangements are shown in figure 4.

118 Dismantle and remove the gin pole, winch and pulley blocks from site.

119 The first mast section requires the use of the Tirfor winches as temporary stays. To lower this section, first remove the lightning arrestor upper (item 24) and the lightning arrestor lower bolt (item 25).

120 Remove all line taps (item 74) and brackets (item 28) from the insulator top unit (item 23).

121 Two men are to hold the mast section vertical while three men disconnect the Tirfor ropes and winches from their respective stay block positions. The three men with the Tirfor ropes are to keep the mast section steady while two other men lift the section from the top of the insulator (item 22) and place on to a clean piece of wood, at least 100 mm wide x 300 mm long.

122 The three men with the Tirfor ropes are to steady the mast section while the two men with the mast section walk back away from the mast base, lowering the section as they proceed, until the section is completely lowered.

123 Remove the base insulator, base plate, earth termination assembly and fit a waterproof protective cover over the coaxial connector.

CLEARING THE SITE

124 Remove and stow all spare shackles from the mast stay anchor blocks, and antenna straining rope anchor blocks.

125 Ensure that the site is clear of all parts and tools. Store the antenna and mast sections in accordance with the relevant instructions.

TABLE 1 WB230 PARTS LIST

Item	C&S drg	SCSHQ drg	Description	Qty
1	3391F	SCSHQ/156793	Mast section type HLS	9
2		10AC/6269323	Bolt, 5/8 in. BSW x 2 in. c/w nuts	96
3		10AC/6269313	Washer plain galv 5/8 in.	96
4			Washer spring galv. 5/8 in.	96
5				
6				
7			Rigging screw 1 1/8 in. galv.fork & fork	9
8	4/7473		Lower stay No.1 length 9.14 m	3
9	4/7474		Lower stay No.2 length 6.1 m	3
10		SCSHQ/118577	Lower stay No.3 length 4.88 m	3
11			Preform dead end NWRDE 3/8 in.	6
12		SCSHQ/154313	Egg insulator, porcelain	14
13				
14		SCSHQ/133628	Upper stay No. 1, 3.5T Parafil	3
15		SCSHQ/133629	Upper stay No. 2, 3.5T Parafil	3
16		SCSHQ/188576	Upper stay No. 3, 10T Parafil	3
17	3/4580	SCSHQ/156802	Base plate	1
18				
19		SCSHQ/118595	Link plate	3
20			Screw ch hd galv. 1/4 in. BSW x 3/8 in.	2
21			Packing washer lead 3 1/8 in. o/d	2
22			Insulator, Alumina glazed 3 in. o/d	1
23	2/4584	SCSHQ/156803	Insulator top unit	1
24		SCSHQ/156804	Lightning arrestor upper	1
25			Bolt hex hd 3/8 in. BSW x 1 3/4 in. galv	1
26		10AC/6269319	Full nut hex galv. 3/8 in. BSW	3
27		10AC/6269320	Washer plain galv. 3/8 in.	79
28		90G/109779	Bracket	36
29	4/7397		Thimble ms galv. for 3/4 in. dia rope	10
30				
31		SCSHQ/154166	Lindaptor type F3	3
32		SCSHQ/116640/1	Preform dead end Pt No. 5715824	3
33	4/4585	SCSHQ/156806	Head cap	1
34				
35		10AC/6269324	Bolt hex galv. 3/8 in. BSW x 1 1/4 in. with nut	38

(continued)

TABLE 1 WB230 PARTS LIST (continued)

Item	C&S drg	SCSCHQ drg	Description	Qty
36		10AC/6269325	Spring washer flat 3/8 in. i/d	24
37	3/5405	SCSHQ/156807	Support bracket	1
38	4/4873	SCSHQ/156808	Connector assembly	1
39		SCSHQ/118602	Pin	6
40		29H/6334336	'D' shackle 3/8 in. x 1/2 in. BS3032	12
41	4/4592	SCSHQ/156811	Base strap connector	2
42	3815P	SCSHQ/156812/1	Copper wire connector	1
43			Washer plain galv. 1/2 in. i/d	6
44				
45			'D' shackle 3/8 in. x 3/8 in. galv.	1
46		10AS/6494540	'D' shackle 1/4 in. x 1/4 in. st.st.	29
47	4/4595	SCSHQ/156813	Main antenna wire	12
48	4/4597	SCSHQ/156814	Intermediate antennawire	12
49	4/4596	SCSHQ/156815	Spacer wire	24
50	3/4682	SCSHQ/156816	Antenna bracket	12
51	4/4593	SCSHQ/156817	Spacer link plate	24
52		10AC/6247108	Screw hex 1/4 in. BSW x 3/4 in. st.st.	78
53			Aerotite nuts 1/4 in. BSW st.st.	78
54		90G/109806/2	Straining rope, terylene 3/4 in. circ	12
55				
56			Rigging screw 1/2 in. dia. fork & fork	12
57		90G/109807/6	Preformed dead end 3/4 circ	12
58		29H/4707613	Thimble for 8 mm dia rope galv.	13
59			Bolt hex st.st. 5/16 in. BSW x 3/4 in.	3
60			Washer spring st.st. 5/16 in.	3
61		29E/9440183	Pin cotter split, 1/8 in. dia x 1 1/4 in.	6
62				
63				
64				
65	4/4681	SCSHQ/156818	Earth termination strip	4
66		SCSHQ/156819	Earth connection strip	4
67			Earth wire, copper 14 SWG	4032m
68				
69			Earth terminal 'T' connector	16
70		10AC/6494533	Screw st.st. 1/4 in. BSW x 1/2 in. hex	16

(continued)

TABLE 1 WB230 PARTS LIST (continued)

Item	C&S drg	SCSHQ drg	Description	Qty
71		10AC/6303082	Washer plain st.st. 1/4 in. i/d	16
72		10AC/6494427	Bolt st.st. hex 3/8 in. BSW x 1 in.	4
73		10AC/6494532	Full nut st.st. hex 3/8 in. BSW	4
74			Line tap	52
75				
76				
77				
78				
79				
80		SCSHQ/154165	Swivel block (proof test cert required)	1
81			Rope terylene 3/4 in. circ 240 ft lg	1
82	19035	SCSHQ/156820	'T' stake anchor	1
83		29H/6334336	'D' shackle 3/8 in. x 1/2 in. BS3032	1
84				
85				
86			Bolt galv. hex 5/16 in. BSW x 3/4 in.	3
87			Washer spring galv. 5/16 in. i/d	3

TABLE 2 TOOLS LIST

Item	Ref/Drg No.	Description	Qty
1	4GB/2013244	T7 Tirfor	3
2	4GB/5238369	60 ft Tirfor rope	3
3	90G/110008	Strop	3
4	90G/109920	Gin pole	1
5		Tensiometer model 03C	1
6	10S/1077020	Tensiometer for terylene	1
7	10B/9331564	Preform dead end	12
8	4GB/2046346	T13 Tirfor	1
9	29H/9604348	Shackle 5/8 in. large 'D' BS3032	12
10			
11	28Y/6072	Thimbles 3/4 in. circ rope	12
12	10B/6330325	Preform dead end pt No. 5715808	12
13	10B/6330324	Preform dead end pt No. 5715809	12
14	4L/9424231	Snatch block swl 2 cwt	2
15	4L/4253434	Sling soft eye, 5ft lg swl 15 cwt	3
16	32A/9331563	Rope terylene 1 1/4 in. circ.	1000 ft
17		Theodolite	2
18		Handwinch swl 136 kg	1
19	29H/9604349	Shackle 3/4 in. large 'D'	2
20			
21	90G/SK13313	Winch frame	1
22		Picket	2
23		Shackle large 'D' swl 2 T, 7/8 in. pin	3

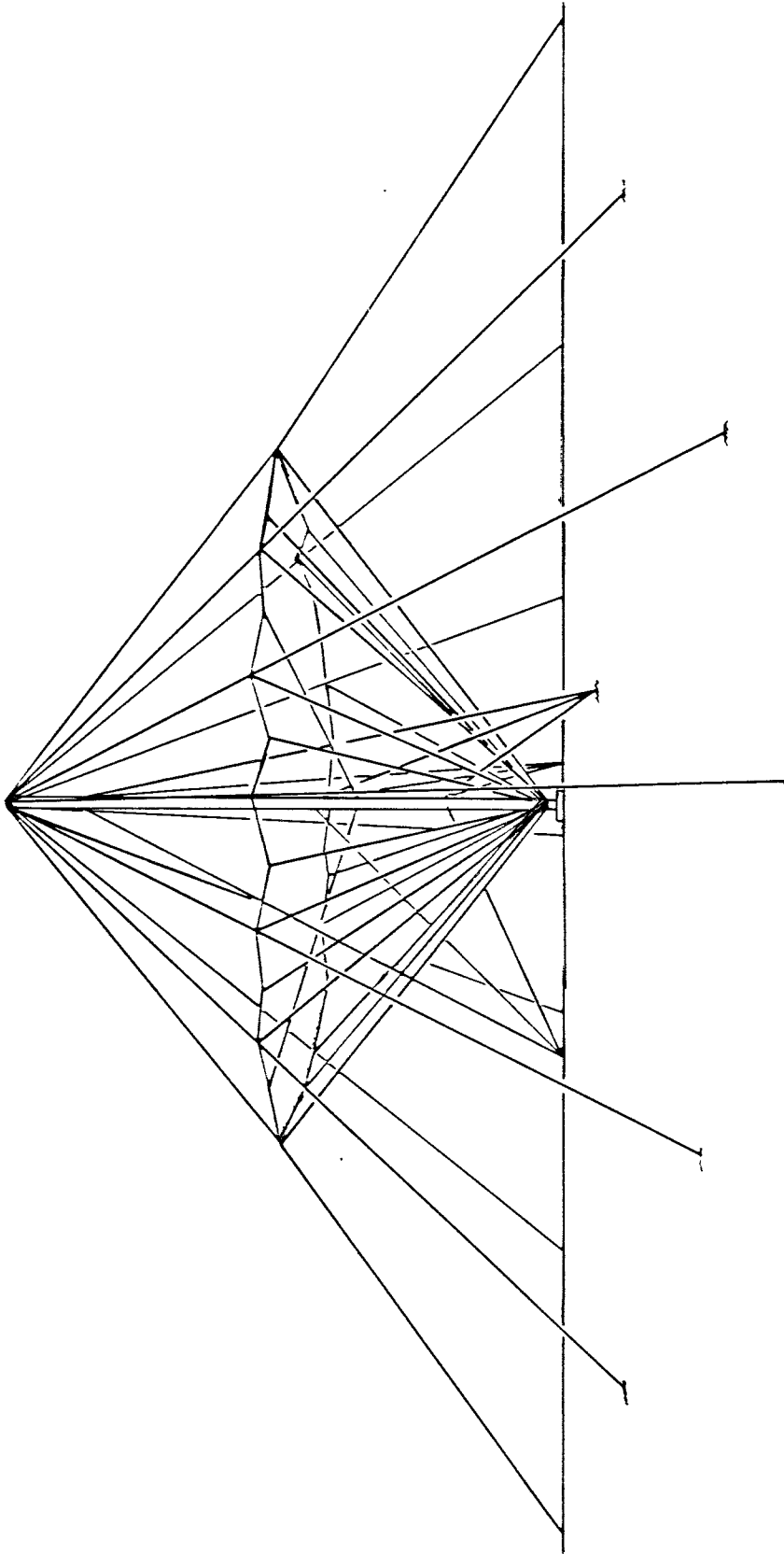
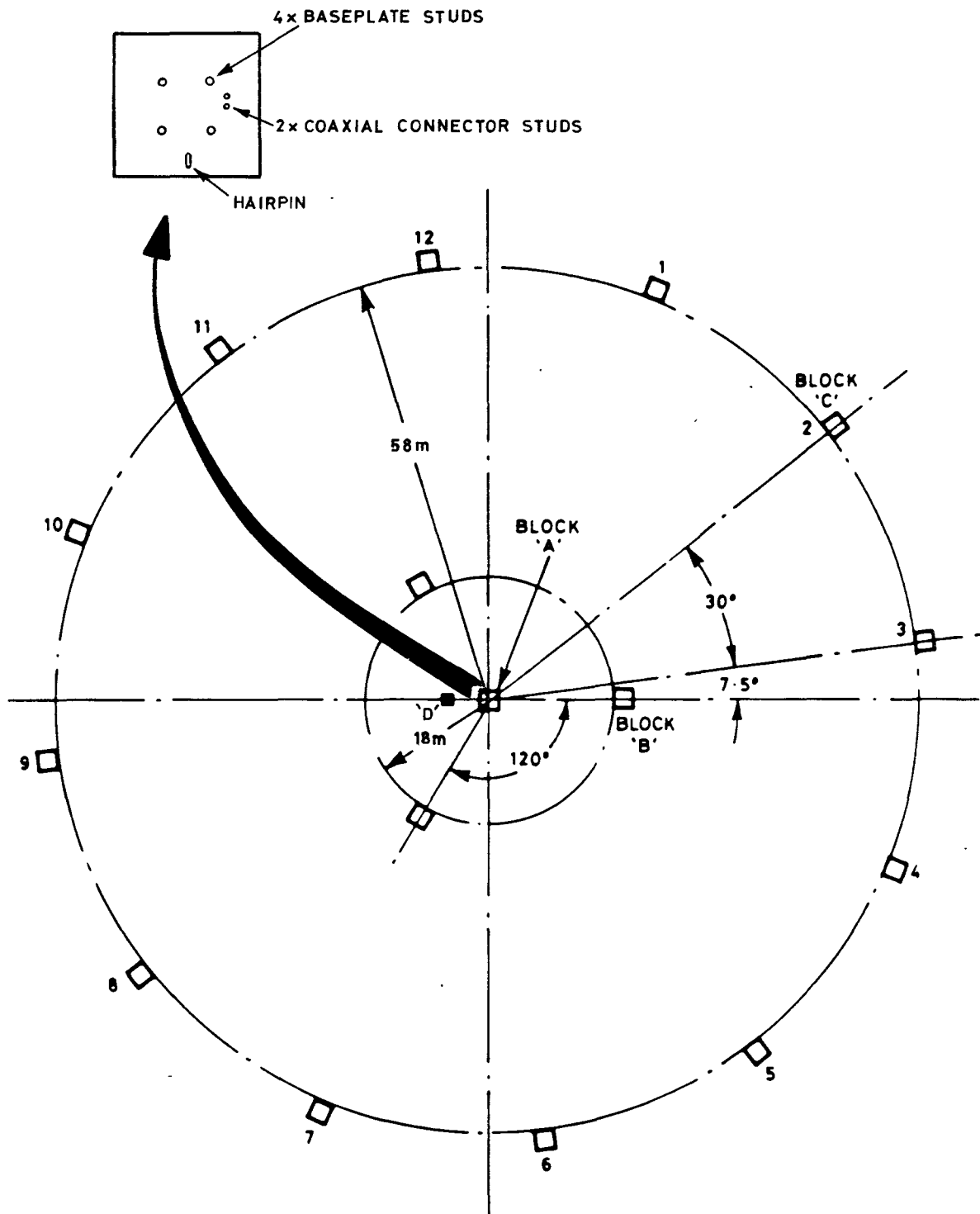


Fig 1 General assembly



NOTES :-  
 BLOCK 'A' - MAST FOUNDATION BLOCK  
 BLOCK 'B' - MAST STAY ANCHOR BLOCKS  
 BLOCK 'C' - ANTENNA STRAINING ROPE ANCHOR BLOCKS  
 POSITION 'D' - HALYARD PICKET

Fig 2 Foundations



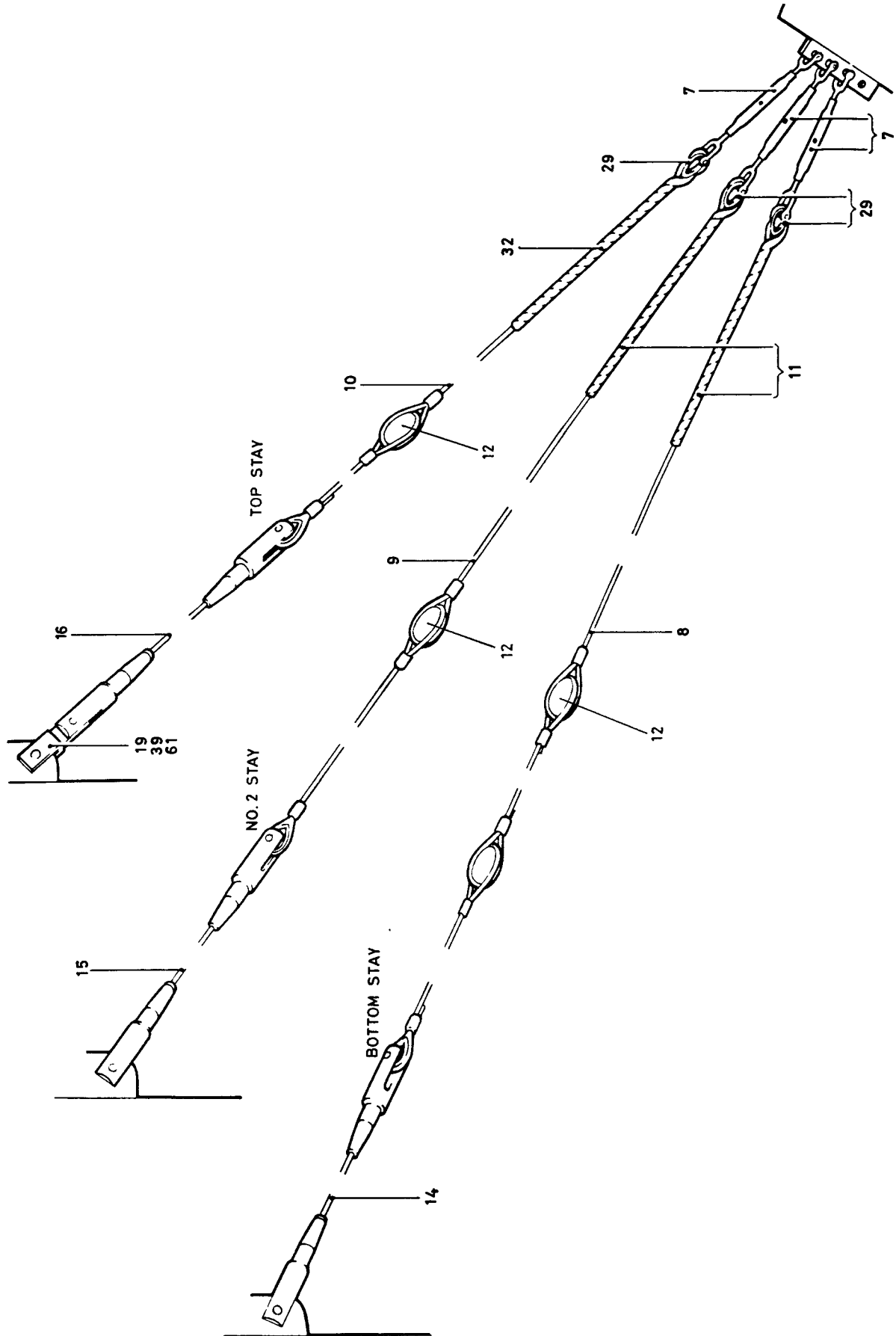


Fig 3 Mast stays

PERMANENT MAST STAYS (FIG 3) —————  
TEMPORARY TERYLENE MAST STAYS - - - - -  
TIRFOR MAST STAYS (FIG 4, CHAP 8) — — — — —  
STROP EXTENSION TO TIRFOR MAST STAYS (FIG 5) — - - - -

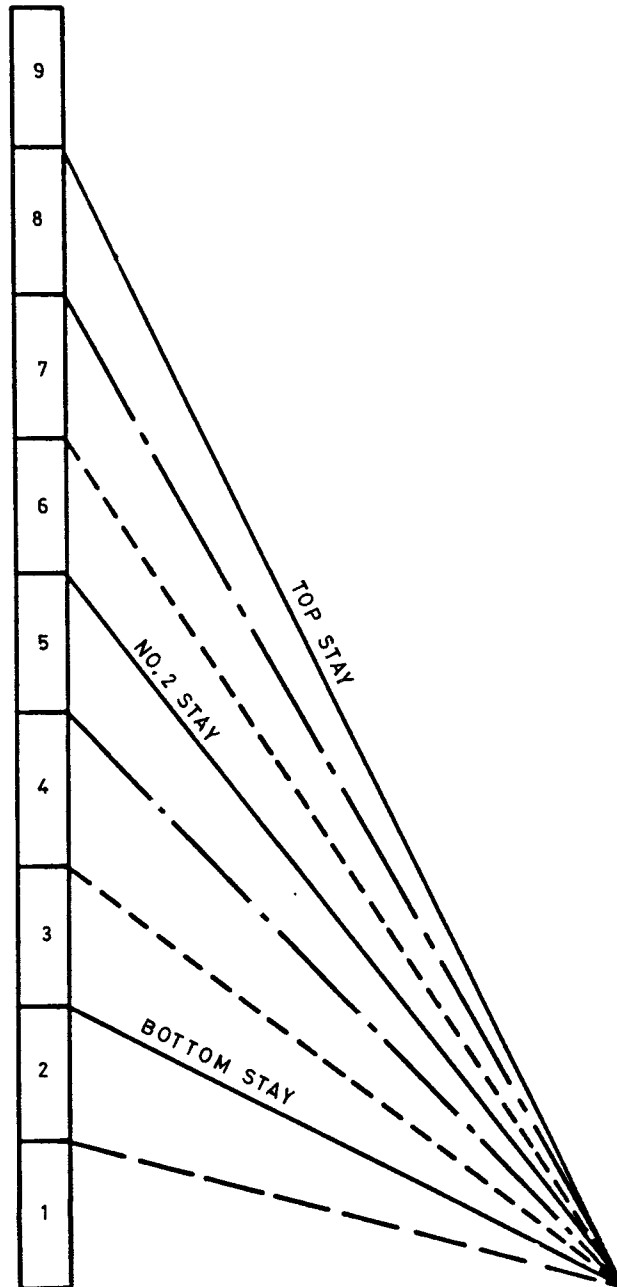


Fig 4 Staying arrangement

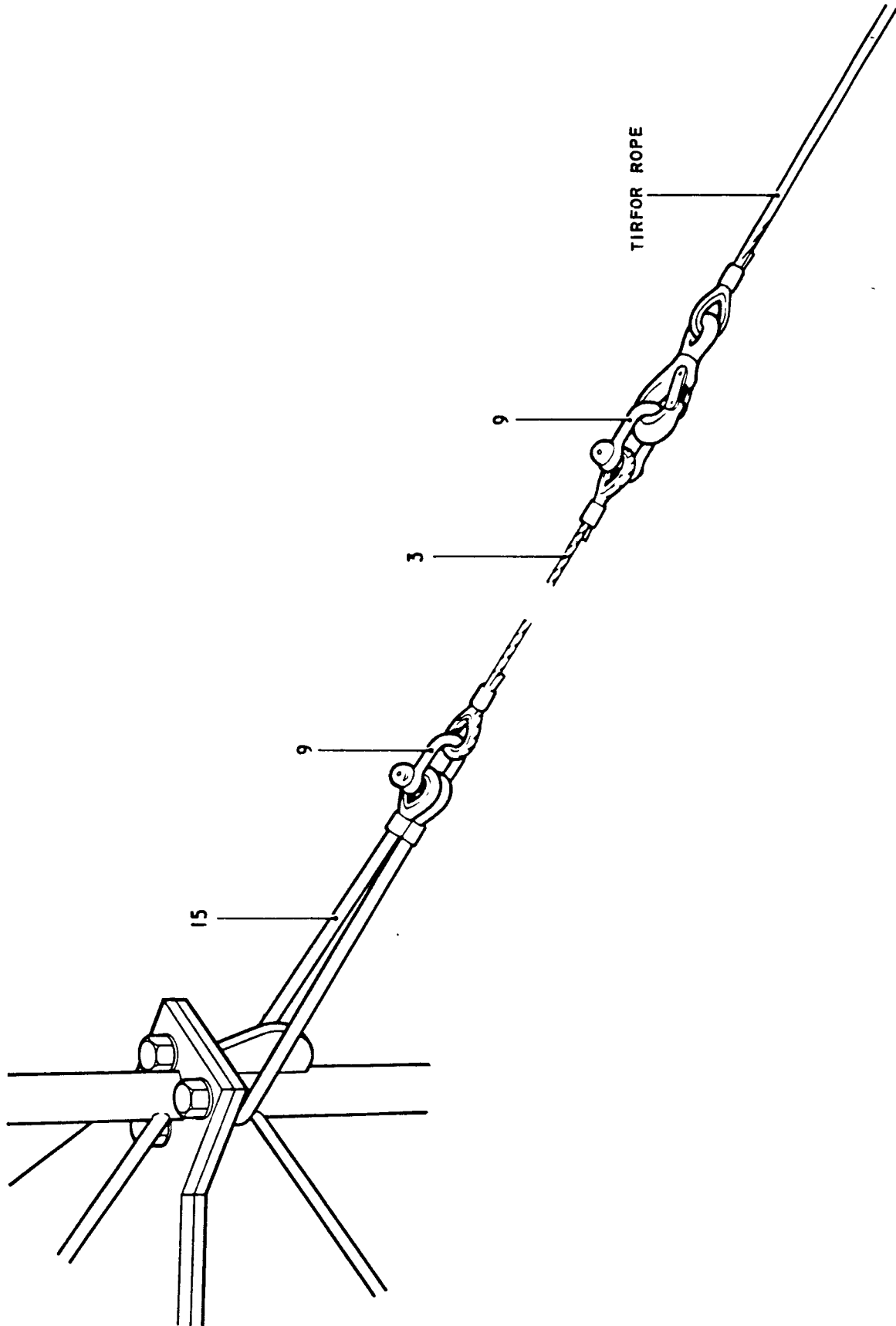


Fig 5 Temporary stays

Chapter 4

WB330 ERECTING AND DISMANTLING INSTRUCTIONS

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1	Drawings and associated publications
3	Safety precautions
4	PSA(DOE) responsibilities
5	Manpower
7	Pre-erection details
	Mast assembly and erection
11	Preparation of mast anchors
14	Erection of first mast section
31	Assembly of lightning arrestor
33	Assembly of gin pole
39	Erection of second mast section
46	Erection of third mast section
56	Erection of fourth to sixth mast sections
	Antenna array erection
65	Erection of the main antenna wires
71	Assembly of the intermediate antenna wires
	Earthing assembly
77	Assembly of the earth termination
82	Assembly of the termination connector
85	Laying the earth mat
89	Clearing the site
92	Dismantling the antenna array
	Dismantling the mast
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DRAWINGS AND ASSOCIATED PUBLICATIONS

1 These erecting and dismantling instructions are to be read in conjunction with the following drawings and publications:

AP 116E-1717-1J	HF and MF antennas for ground stations: support antennas
AP 119K-0001-1	Lifting equipment: servicing and testing
RAFSC ESI Vol 1 pt. 6a	
OIP 463	Operation of Payne and Baynard handwinch
90G 105788	WB330 HF conical monopole antenna
90G 109920	Assembly of gin pole for WB330 antenna
SCSHQ 116308	Work service details

2 Parts to be used during the erecting and dismantling of the WB330 antenna are listed in Table 1. Special tools required to carry out these tasks are listed in Table 2. Drawings common to Chapters 3, 4 and 5 are presented in Chapter 5.

SAFETY PRECAUTIONS

3 All relevant safety precautions are to be observed during the mast erection and must not be compromised in any way.

3.1 The mast structure is not to be climbed by more than two men at any time.

3.2 Any person working higher than two metres above ground level must secure himself to the structure using such methods as are approved by the NCO in charge of the fitting party.

3.3 During the mast erection or lowering there is never to be more than four metres projecting above a set of stays when a man is required to climb beyond the stays.

3.4 Care is to be taken during the erection of each section that the verticality of the mast is observed. At each stage that a permanent set of stays is fitted, the mast must be corrected for verticality and checked with theodolites and the stays adjusted to their correct tensions (Chap 6 refers).

3.5 When using the gin pole the hauling rope must always pass through a pulley block at the base of the mast.

3.6 During lifting, the mast section must never be further than one metre from the mast, and only one section is to be lifted at any time.

3.7 The handwinch is to be used as the hauling medium and it must be supported on its stand and securely anchored in position.

### PSA(DOE) RESPONSIBILITIES

4 The mast and stays of the antenna are the responsibility of PSA (DOE) and are not to be adjusted after handover. The PSA (DOE) are to be informed in writing, a minimum of seven days in advance of the dates of mast erection, in order that a PSA (DOE) observer may be present, if required.

### MANPOWER

5 To erect or lower the mast a senior NCO and six men are required. The men will be deployed as follows:

5.1 Two men on the mast.

5.2 Two men on the winch.

5.3 Two men on the fall rope as the sections are raised or lowered.

6 To erect the antenna, after the mast has already been erected, a supervisor (senior NCO) and a minimum of three men are required.

### PRE-ERECTION DETAILS

7 Check that the foundations as supplied by PSA (DOE) are in agreement with figure 2.

Note...

For ease of working, the radial trenches (if required) for the earth mat should not be excavated until the mast has been erected.

8 The co-axial feeder may be laid at this stage and the trench back filled (if required) but the feeder protruding from the ground must be suitably protected against damage.

9 In some locations the mast sections must be painted, for additional corrosion protection. This information is given on the relevant RAFSEE drawing. Any damaged paintwork after final erection is to be repaired, as necessary, using the correct paint.

10 The following items of the antenna kit will have been used to install the foundations. Item numbers refer to drawing 90G 116308.

10.1 4 hole anchor plate (item 1).

10.2 J bolt 5/8 in. BSW galvanised (item 3, 7 & 9).

10.3 J bolt 3/8 in. BSW galvanised (item 2, 6 & 8).

10.4 Hairpin anchor 12 in. x ½ in. dia (item 4).

10.5 Mast foundation template (item 5).

## MAST ASSEMBLY AND ERECTION

### Preparation of mast anchors (fig 3)

11 Fit quantity six 1 1/8 in. rigging screws (item 7, Table 1), two to each anchor plate at the three mast stay anchor blocks. Adjust the rigging screws to their mid-position.

Note...

The shackles must be fitted in the top two holes of the anchor plates.

12 Attach a preformed dead end (items 11) to each of the nine rigging screws, together with 1/2 in. score thimbles (item 29) as follows:

13 Fit a 1/2 in. rigging screw (item 56) via a 3/8 in. 'D' shackle (item 40) to each of the twelve antenna straining rope anchor blocks (fig 1, Chap 8). Adjust the rigging screws to their mid-position. Place a preformed dead end (item 57) and an 8 mm dia wire rope thimble (item 58) with each of the rigging screws at the antenna straining rope anchor blocks.

### Erection of first mast section

14 Remove the six nuts and washers from the studs in the mast foundation block. Place the nuts and washers in a safe place for refitting later.

15 Clean the stud threads, using a wire brush if necessary. Clean the top surface of the mast foundation block of all dirt and check it is flat and level. If not, contact the local PSA (DOE) for correction.

16 Lightly oil the six stud threads, protruding from the foundation block.

17 Clean the top and bottom faces of the base plate (item 17) and paint with epoxy pitch in accordance with instructions given in Chap 7. Allow the paint to dry.

18 Fit the base plate over the four main studs in the mast foundation block and check that it sits flat without rocking. If not, contact the PSA (DOE) for correction. Refit the four nuts and washers (removed in para 14) and tighten sufficiently to lightly clamp the base plate.

19 Take one mast section (item 1) and lay it on the ground on a line passing through the mast foundation block and bisecting the angle between two of the mast stay anchor blocks.

Notes...

- (1) The end of the mast section with the stay attachment lugs is to be furthest away from the mast foundation block.
- (2) The end of the mast section nearest the mast foundation block is to be approximately 300 mm from the edge of the block.

20 Clean the end of the mast section nearest the mast foundation block and attach the insulator top unit (item 23) using 5/8 in. nuts, bolts and washers (items 2, 3 and 4) (fig 2, Chap 8). Clean the free end of the insulator top unit (item 23) and secure a lead washer (item 21) to it using a screw (item 20).

Note...

The two faces of the lead washer must be clean before fitting.

21 Place the second lead washer (item 21) in the centre of the base plate (item 17) and secure in position with a screw (item 20) (fig 3, Chap 8).

Note...

The two faces of the lead washer and the top surface of the base plate must be clean before assembly.

22 Take the insulator (3 in. dia x 3 in. long) (item 22) and stand it on the lead washer fitted to the base plate. Ensure that the insulator sits on the lead washer with the head of the screw (item 20) in the bore of the insulator.

23 Take quantity three type T7 Tirfor winches (item 1, Table 2) and pull the rope through the machine until there is approximately seven metres of rope between hook and machine. Using ½ in. dia shackles attach the hooks of the three Tirfor ropes to the stay attachment lugs of the mast section laid on the ground. Lay the three Tirfor winches at the mast foundation block, with the three Tirfor ropes laid out on the ground parallel to the mast section.

24 Fit a 7/8 in. 'D' shackle in the bottom hole of each of the three stay anchor plates (fig 4, Chap 8).

25 Place a clean piece of wood, at least 100 mm wide x 300 mm long on the ground, between the centre of the insulator top unit (item 23) and the mast foundation block.

26 Two men are to take hold of the mast section, (laid on the ground in para 19) at the end furthest from the mast foundation block, preparatory to standing it upright. In addition, one man is to stand at the mast foundation block to steady the end of the mast section and to ensure that the insulator top unit (item 23) stands on the piece of wood (para 25) after lifting. Three other men are to take hold of the Tirfor ropes to steady the mast section.

27 When all the men are in position, the two men at the mast end furthest from the mast foundation block are to lift the end of the mast section and walk in towards the mast base, pushing upwards as they proceed, until the mast section is vertical, and resting on the piece of wood.

28 The three men with the Tirfor ropes are to keep the mast section steady while the two other men lift the mast section from the piece of wood to the top of the insulator (item 22), ensuring that the screw locating the lead washer fits in the hole of the insulator (item 22) and that the mast steps are on the opposite side of the mast to the two co-axial connector studs (fig 5, Chap 8).



29 Two men are to hold the mast section vertical while the three men with the Tirfor ropes and winches make them off to their respective mast stay anchor block positions, using the 7/8 in. 'D' shackles fitted in para 24.

30 Check that the mast section is central on the insulator and that the stays leave the section on the correct line to prevent twist in the section. Adjust the winches to hold the section vertical and steady (fig 4, Chap 8).

#### Assembly of lightning arrestor (fig 6, Chap 8)

31 Screw the nut (part of item 25) up the bolt (item 25) until approximately 15 mm of thread protrudes beyond the nut. Grease the thread of the bolt, place a washer (item 27) over the end and screw the assembly into the tapped hole in the base plate.

32 Screw a nut (item 26) on to the lightning arrestor upper (item 24) until approximately 30 mm of thread protrudes beyond the nut. Place a washer (item 36) and a bracket (item 28) over the thread of the lightning arrestor upper, ensuring that the bend in the bracket is away from the nut. Grease the thread of the lightning arrestor upper and place it through the hole directly above and one hole to the left of the bolt (item 25) attached to the base plate in para 31. Place a washer (item 27) over the thread protruding through a hole in the flange of the insulator top unit (item 23) and clamp the lightning arrestor upper to the flange with a nut (item 26). Adjust the position of the lightning arrestor upper until it touches the bolt (item 25).

Note...

This action ensures that the mast and antenna are connected to earth whilst the mast is erected.

#### Assembly of gin pole (fig 7, Chap 8)

33 Examine the gin pole assembly and check that the pole slides freely through its clamp assembly. Make certain that the working principle of the gin pole and the method by which it is clamped to the mast are fully understood.

34 Place the bottom end of the gin pole assembly (end without pulleys) against the base of the mast leg nearest the hairpin in the mast foundation block. One man is to steady the base of the gin pole assembly against the mast leg whilst a second man lifts the gin pole head, and walks towards the mast base, pushing upwards as he proceeds, until the gin pole is vertical. The second man is then to climb to the top of the mast section and secure the gin pole to the mast with a loose lashing, using terylene rope.

35 The second man is then to guide the clamp assembly as it travels up the gin pole, when hoisted from the ground. Firmly lock the clamp assembly as near to the top of the mast section as is practicable.

36 Remove the lashing that temporarily secured the gin pole to the mast (para 34). Fit a pulley block to the hairpin in the mast foundation block using a ½ in. dia shackle.

37 Reeve the winch rope first through the pulley block at the base of the mast and then through the pulley block at the gin pole head. Return the end of the winch rope to ground level.

Note...

The handwinch is to be positioned approximately six metres from the mast base and securely picketed in position (fig 8, Chap 8). This winch must be stayed to ground pickets, in a direction away from the mast (ie opposing the pull of the winch).

38 Use the gin pole hauling rope to slide the gin pole through the clamp assembly until it is in the elevated position. Secure in this position with the locking pin.

#### Erection of second mast section

39 Lay a mast section (item 1) on the ground on the opposite side of the mast to the pulley block, with the stay attachment lugs away from the mast base.

40 Assemble the bottom set of stays from items 8, 12 and 14, for stay number one (fig 3). Attach the parafil end (item 14) of the three stays, one each to the three stay attachment lugs of the mast section. Ensure that the split pins are correctly expanded in the two parafil end terminations of each stay, and that the parafil termination in the centre of the stay is greased.

41 Attach the end of the winch rope to a point on the mast section approximately 1.5 m from the end to which the stays are attached. Attach a 30 m long fall rope to the mast section at one of the crossbrace members, approximately one metre from the end furthest from the stays.

42 Begin to lift the mast section, ensuring that the climbing steps are correctly orientated to line up with the steps on the first mast section. The mast section must be nearly vertical during the lift, and the fall rope is to be used to keep the mast section away from the first mast section.

43 Two men are to climb to the top of the first mast section and when the second mast section is above the first, they are to guide it into position, bolting the two sections together with 5/8 in. nuts, bolts and washers (items 2, 3 and 4).

44 Take the mast stays attached to the second mast section and attach their lower ends to the lower of the two rigging screws (para 11) at the mast stay anchor blocks, using dead ends and thimbles (items 11 and 29).

45 Check that the mast is vertical (Chap 6) and adjust the stays to a tension of 3981 N (895 lbs).

#### Erection of third mast section

46 Tie the gin pole head to top of the mast, using a temporary lashing.

47 Release the clamp assembly and remove the locking pin. Raise the clamp assembly to the top of the mast, whilst it is guided by one man on the mast.

48 Firmly lock the clamp assembly as near to the top of the mast as is practicable.

49 Remove the temporary lashing (para 46) and slide the gin pole through the clamp assembly until it is in the elevated position. Secure with locking pin.

50 Lay a mast section (item 1) on the ground on the opposite side of the mast to the pulley block, with the stay attachment lugs away from the mast base. Attach three temporary stays, one to each stay attachment lug, using terylene rope (item 16, Table 2).

51 Attach the end of the winch rope to a point on the mast section approximately 1.5 m from the end to which the stays are attached. Attach a 30 m fall rope to the mast section at one of the crossbrace members, approximately one metre from the end furthest from the stays.

52 Begin to lift the mast section, ensuring that the climbing steps are correctly orientated to line up with the steps on the sections already standing. The mast section must be nearly vertical during the lift, and the fall rope is to be used to keep the mast section away from the part of the mast previously erected.

53 Two men are to climb to the top of the mast and when the mast section is as high as required it is to be guided into position, bolting the two sections together with 5/8 in. nuts, bolts and washers (item 2, 3 and 4).

54 Take the terylene temporary stays attached to the section just lifted and attach their lower ends to their respective stay anchor blocks.

55 Check that the mast is vertical (Chap 6).

#### Erection of fourth to sixth mast sections

56 Continue to erect the mast using the procedure described in para. 46 to 55, up to and including mast section number six. For staying arrangements see figure 4.

#### Notes...

- (1) The top set of stays is assembled from items 9, 12 and 15.
- (2) Tirfor mast stays for mast section four uses the strop and extension as shown in figure 5.
- (3) The mast will project above the top set of stays by one mast section (fig 9, Chap 8).

57 Adjust the top set of stays to a tension of 10964 N (2465 lbs).

58 Straighten the mast and check that it is vertical in accordance with Chap 6.

59 Attach a pulley block (item 80) using a shackle (item 83), to one of the stay attachment lugs (near the steps) at the mast head. This pulley block is for use with a Bosun Chair. A standing line is always to be left reeved when a Bosun Chair or safety line is not being used, and should be terminated at the picket (item 82) using a shackle (item 45). The senior NCO IC the party is to decide if the Bosun Chair or safety line is to be used for the remainder of the antenna erection.

60 Use the winch rope to raise the head cap (item 33) to the top of the mast. Fit the head cap using quantity six 5/8 in. bolts 2 in. long (items 2, 3 and 4)(fig 1, Chap 8).

61 Transfer the winch rope and snatch block from the gin pole head to one of the stay attachment lugs at the top of the mast.

62 Lower the gin pole by removing the locking pin and lowering the pole down through the clamp assembly.

63 Tie off the gin pole head to the top mast section, release the clamp assembly and lower it down the gin pole to the section below. Clamp in position and secure the gin pole with the locking pin. Remove the tie at the gin pole head.

64 Shackle the winch rope to the gin pole head and use the winch rope to lower the gin pole assembly to the ground.

#### ANTENNA ARRAY ERECTION

##### Erection of the main antenna wires (fig 1, Chap 8)

65 Fit quantity 21 brackets (item 28) around the base of the insulator top unit (item 23) using for each a 3/8 in. by 1 1/4 in. bolt (item 35) with a plain washer (item 27) under the bolt head (fig 6, Chap 8). Fit a spring washer (item 36) under the nut (part of item 35). Threads must be greased before assembly.

Note ...

The brackets (item 28) are to be fitted on the underside of the insulator top unit (item 23) and are not to be fitted adjacent to the three mast legs.

66 Fit quantity 21 line taps (item 74) one to each bracket.

67 The main antenna wire assemblies, consisting of items 47, 50, 52 and 53 are supplied assembled. To each of these assemblies, fit a straining rope (item 54) to the antenna bracket (item 50), using a 1/4 in. 'D' shackle (item 46)(fig 1, Chap 8).

68 The top end of each main antenna wire assembly is to be made off to the top cap (item 33), as follows:

68.1 Shackle the eye in the antenna wire assembly to a bracket (item 28) using a 1/4 in. 'D' shackle (item 46).

68.2 Place a washer (item 27) over the thread of a 3/8 in. by 1 1/4 in. bolt (item 35), followed by the terminal end of the antenna wire assembly.

68.3 Fit a second washer (item 27) to the bolt (item 35) before passing the screw thread through the bracket (item 28) and then through the head cap (item 33). Secure with a nut and a washer (item 36).

68.4 As each antenna wire assembly is fitted to the head cap it is to be lightly strained away from the mast using the straining rope (item 54).

69 When the twelve antenna wire assemblies have been fitted to the head cap and lightly strained out from the mast, the bottom end of each is to be made off to its appropriate line tap (item 74) at the insulator top unit. Allow 25 mm to project through each line tap.

70 Remove the winch rope and pulley block from the top of the mast (fitted in para 61), lower to the ground and fit to the gin pole assembly. Remove the gin pole assembly, winch and pulley block from the working area.

#### Assembly of the intermediate antenna wires (fig 10, Chap 8)

71 Fit the intermediate antenna wires (item 48), as follows:

71.1 Release the tension in two adjacent main antenna assemblies and allow them to fall in towards the mast until it is possible to work on the antenna brackets (item 50).

71.2 Fit two spacer wires (item 49), one to each antenna bracket (item 50).

71.3 Join the ends of the two spacer wires together between the two main antenna wire assemblies by fitting them to a spacer link plates (item 51) using nuts and bolts (items 52 and 53).

71.4 Also fit an intermediate antenna wire (item 48) to the spacer link plate, using nuts and bolts (item 52 and 53).

Note...

The clamping nuts (item 53) should only be used once and are not to be overtightened.

72 Continue to fit the spacer wires (item 49) and intermediate antenna wires (item 48) round the mast. The bottom ends of the intermediate antenna wires should be left free at this stage. Grease the antenna brackets (item 50) and shackles (item 46) after assembly of the spacer wires (item 49), whilst at a working height.

73 Tension the antenna straining ropes (item 54) to 895N (200 lbs).

74 From baseplate level, measure up the mast and make a mark on each mast leg at a level of 11.6 m. Clean an area 50 mm wide round each leg at this level (ie remove all paint and dirt etc).

75 Assemble a lindaptor (item 31) to each leg (fig 11, Chap 8), together with a bracket (item 28), ensuring good mating contact. Fit a line tap (item 74) through the hole in the bracket (item 28).

76 Terminate the ends of the three intermediate antenna wires opposite the mast legs, to the line taps at the 11.6 m level up the mast. Terminate the remaining nine intermediate antenna wires to their respective line taps at the mast base.

#### EARTHING ASSEMBLY

##### Assembly of the earth termination (fig 12, Chap 8)

77 Fit the two base strip connectors (item 41) between two of the base plate studs and the two 3/8 in. coaxial connector studs, which will be found projecting from the mast foundation block.

78 Fit four earth terminals (item 69) to each of the four termination strips (item 65), using screws and washers (item 70 and 71).

79 Dig a trench 150 mm deep around the mast base, exposing the sides of the mast foundation block. The trench must be at least 150 mm wide.

80 Position the four termination strip assemblies round the mast foundation block and secure together with the earth connecting strips (item 66), using bolts and nuts (items 72 and 73). Push the whole assembly to the bottom of the trench.

81 Bend each connecting strip (item 66) over the top surface of the foundation block and onto the four studs projecting through the base plate. Cut the connecting strips to length and drill clearance holes to suit the base plate studs. Remove each base plate nut and washer in turn and secure item 66 with these nuts and washers.

##### Assembly of the termination connector (fig 13, Chap 8)

82 Fit the support bracket (item 37), using the nuts removed in para 14, to the coaxial connector studs in the mast foundation block. Fit the antenna coaxial connector (item 38) to the support bracket. Fit a temporary cover over the open end of the connector.

83 Remove one of the nuts from the wire termination end of the coaxial connector assembly, and the nut securing the bracket (item 28) nearest to the coaxial connector. Fit the copper wire connector (item 42) between the coaxial connector (item 38) and the bracket (item 28). Replace nuts and secure firmly.

84 Lay the coaxial feeder (see also para 8) and terminate to the connector assembly (item 38). Pressurise the coaxial feeder and, if satisfactory, back-fill the cable trench.

##### Laying the earth mat (fig 14, Chap 8)

Note...

If required on site installation or works service drawings, obtain PSA (DOE) assistance in opening the radial trenches for the earth mat. Ensure that the earth connections around the mast foundation block are not damaged during this operation.

85 Take each copper earth wire (item 67) and bend at right angles 50 mm from its end. Push the bent end of the wire through the end of an earth terminal (item 69). Lay the copper earth wire out along its appropriate radial trench and back-fill.

86 Lay the 72 earth wires as para 85.

Note ...

The earth terminals (item 69) at the corners of the mast foundation block, each terminate five earth wires whilst those at the sides terminate four wires each.

87 Check that all the earth terminal clamping nuts are tight and holding the earth wires. Grease the earth terminals.

88 Back-fill and level the soil around the mast foundation block.

#### CLEARING THE SITE

89 Remove all erection tackle from the mast. Clear all tools and spare equipment from site and generally tidy up.

90 Grease all shackles, bottle screws etc on the stays and straining ropes. Repair any damage to paintwork.

91 Adjust the position of the lightning arrestor upper, until a gap of 6 mm exists and lock in position. Test the antenna against the relevant test specification.

#### DISMANTLING THE ANTENNA ARRAY

92 Disconnect the main coaxial feeder at the coaxial connector (item 38) and disconnect the copper wire connector (item 42). Remove the connector assembly together with the bracket (item 37)(fig 13, Chap 8). Adjust the position of the lightning arrestor upper until it touches the bolt (item 25).

93 Release all intermediate wires (item 48) from their line taps (item 74) at the lindaptors (fig 11, Chap 8).

94 Remove the snatch block and winch rope from the gin pole. One man is to climb the mast and fit the snatch block and winch rope to an attachment lug at the mast head, using a ½ in. 'D' shackle. Fit a pulley block to the hairpin in the mast foundation block, using a ½ in. 'D' shackle.

95 Reeve the winch rope through the snatch block at the base of the mast. Return the end of the winch rope to ground level.

Note ...

The hand winch is to be used in conjunction with the winch rope and must be positioned approximately six metres from the mast base and securely picketed in position (fig 8, Chap 8). This winch must be stayed to ground pickets, in a direction away from the mast (ie opposing the pull of the winch).

96 Release the tensions in all the antenna straining ropes (item 54) but do not disconnect at this stage.

97 Disconnect any three adjacent antenna straining ropes (item 54). This will facilitate the removal of the link plates (item 51), intermediate wires (item 48) and spacer wires (item 49).

98 Remove the middle one of the three main antenna wire assemblies from the mast by disconnecting from the line tap at the base of the mast and from the head cap, by removing the bolts (item 35). Lower to the ground using the pulley block installed in para 94.

99 Disconnect a further adjacent straining rope (item 54) which will facilitate the removal of the link plates (item 51), intermediate wires (item 48) and spacer wire (item 49). This will leave a main antenna wire free for removal and lowering.

100 Continue around the mast in a similar fashion until all antenna elements have been removed.

### DISMANTLING THE MAST

#### Dismantling the sixth and fifth mast sections

101 Remove the mast head cap (item 33). Lower to the ground using the winch rope.

102 Shackle the winch rope to the gin pole head and raise the gin pole assembly until the clamp assembly can be secured to the top of the fifth mast section.

103 Transfer the winch rope and snatch block from the mast attachment lug to the gin pole head.

104 Attach the end of the winch rope to a point on the top mast section approximately 1.5 m from the head of the mast. Attach a 30 m long fall rope to one of the crossbrace members, approximately one metre from the lower end of the mast section.

105 Take the strain on the hauling rope, and release the mast section by removing the 5/8 in. nuts and bolts (items 2, 3 and 4). Raise the mast section with the hauling rope to clear, then lower the mast section to the ground, using the fall rope to keep the section away from the mast.

106 Lower the gin pole to the next position by removing the locking pin, and lowering the pole down through the clamp assembly. Tie off the gin pole head to the mast section, release the clamp assembly and lower it down the gin pole to the section below the one that is to be removed. Clamp in position and secure the gin pole with the locking pin. Remove the tie at gin pole head.

107 Make off three Tirfor temporary stays (fig 5), one to each mast leg just below the permanent stays. Tension these temporary stays.



108 Release the tensions in the top set of permanent stays gradually, until they are slack. Disconnect them from their stay anchor blocks and lower to the ground using the winch rope. Attach and tension a set of terylene temporary stays to the next mast section down.

109 Attach the end of the winch rope to a point on the fifth mast section approximately 1.5 m from the head of the mast. Attach a 30 m long fall rope to one of the crossbrace members, approximately one metre from the lower end of the mast section.

110 Take the strain on the winch rope and release the Tirfor temporary stays. Release the mast section by removing the 5/8 in. nuts and bolts (items 2, 3 and 4). Raise the mast section with the winch rope to clear, then lower the mast section (complete with stays) to the ground, using the fall rope to keep the section away from the mast.

#### Dismantling the fourth to first mast sections

111 Dismantle the remaining sections, down to the first section, in a similar manner to that detailed in paragraphs 106 to 110. Staying arrangements are shown in figure 4.

112 Dismantle and remove the gin pole, winch and pulley blocks from site.

113 The first mast section requires the use of the Tirfor winches as temporary stays. To lower this section, first remove the lightning arrestor upper (item 24) and the lightning arrestor lower bolt (item 25).

114 Remove all line taps (item 74) and brackets (item 28) from the insulator top unit (item 23).

115 Two men are to hold the mast section vertical while the three men disconnect the Tirfor ropes and winches from their respective stay block positions. The three men with the Tirfor ropes are to keep the mast section steady while two other men lift the section from the top of the insulator (item 22) and place on to a clean piece of wood, at least 100 mm wide x 300 mm long.

116 The three men with the Tirfor ropes are to steady the mast section while the two men with the mast section walk back away from the mast base, lowering the section as they proceed, until the section is completely lowered.

117 Remove the base insulator, base plate, earth termination assembly and fit a waterproof protective cover over the coaxial connector.

#### CLEARING THE SITE

118 Remove and stow all spare shackles from the mast stay anchor blocks, and antenna straining rope anchor blocks.

119 Ensure that the site is clear of all parts and tools. Store the antenna and mast sections in accordance with the relevant instructions.

TABLE 1 WB330 PARTS LIST

Item	C&S drg	SCSHQ drg	Description	Qty
1	3391F	SCSHQ/156793	Mast section type HLS	6
2		10AC/6269323	Bolt, 5/8 in. BSW x 2 in. c/w nuts	66
3		10AC/6269313	Washer plain galv. 5/8 in.	142
4			Washer spring galv. 5/8 in.	66
5				
6				
7			Rigging screw 1 1/8 in. galv. fork & fork	6
8	4/6197		Lower stay No. 1 length 7.92 m (26 ft)	3
9	4/6199		Lower stay No. 2 length 4.87 m (16 ft)	3
10				
11			Preform dead end NWRDE 3/8 in.	3
12		SCSHQ/154313	Egg insulator, porcelain	10
13				
14		SCSHQ/173296	Upper stay No. 1, 3.5 T Parafil	3
15		SCSHQ/173297	Upper stay No. 2, 7.5 T Parafil	3
16				
17	3/4580	SCSHQ/156802	Base plate	1
18				
19				
20			Screw ch hd st.st. 1/4 in. BSW x 3/8 in.	2
21			Packing washer lead 3 1/8 in. o/d	2
22			Insulator, Alumina glazed 3 in. o/d	1
23	2/4584	SCSHQ/156803	Insulator top unit	1
24		SCSHQ/156804	Lightning arrester upper	1
25			Bolt hex hd 3/8 in. BSW x 1 3/4 in. galv.	1
26		10AC/6269319	Full nut hex galv. 3/8 in. BSW	3
27		10AC/6269320	Washer plain galv. 3/8 in.	79
28		90G/109779	Bracket	36
29	4/7397		Thimble ms galv. for 3/4 in. dia rope	7
30				
31		SCSHQ/154166	Lindaptor type F3	3
32		SCSHQ/116640/1	Preform dead end Pt No. 5715824	3
33	4/4585	SCSHQ/156806	Head cap	1

(continued)

TABLE 1 WB330 PARTS LIST (continued)

Item	C&S drg	SCSHQ drg	Description	Qty
34				
35		10AC/6269324	Bolt hex galv. 3/8 in. BSW x 1 1/4 in. with nut	38
36		10AC/6269325	Spring washer flat 3/8 in. i/d	24
37	3/5405	SCSHQ/156807	Support bracket	1
38	4/4873	SCSHQ/156808	Connector assembly	1
39				
40		29H/6334336	'D' shackle 3/8 in. x 1/2 in. BS3032	13
41	4/4592	SCSHQ/156811	Base strap connector	2
42	3815P	SCSHQ/156812/1	Copper wire connector	1
43			Washer plain galv. 1/2 in. i/d	6
44				
45			'D' shackle 3/8 in. x 3/8 in. galv.	1
46		10AS/6494540	'D' shackle 1/4 in. x 1/4 in. st.st.	29
47	4/6341		Main antenna wire	12
48	4/4597	SCSHQ/156814	Intermediate antenna wire	12
49	4/4596	SCSHQ/156815	Spacer wire	24
50	3/4682	SCSHQ/156816	Antenna bracket	12
51	4/4593	SCSHQ/156817	Spacer link plate	24
52		10AC/6247108	Screw hex 1/4 in. BSW x 3/4 in. st.st.	78
53			Aerotite nuts 1/4 in. BSW st.st.	78
54		90G/109806/2	Straining rope, terylene 3/4 in. circ	12
55				
56			Rigging screw 1/2 in. dia. fork & fork	12
57		90G/109807/6	Preformed dead end 3/4 circ	12
58		29H/4707613	Thimble for 8 mm dia rope galv.	13
59				
60				
61				
62				
63				
64				
65	4/4681	SCSHQ/156818	Earth termination strip	4
66		SCSHQ/156819	Earth connection strip	4

(continued)

TABLE 1 WB330 PARTS LIST (continued)

Item	C&S drg	SCSHQ drg	Description	Qty
67			Earth wire, copper 14 SWG	3240m
68				
69			Earth terminal 'T' connector	16
70		10AC/6494533	Screw st.st. 1/4 in. BSW x 1/2 in. hex	16
71		10AC/6303082	Washer plain st.st. 1/4 in. i/d	16
72		10AC/6494427	Bolt st.st. hex 3/8 in. BSW x 1 in.	4
73		10AC/6494532	Full nut st.st. hex 3/8 in. BSW	4
74			Line tap	52
75				
76				
77				
78				
79				
80		SCSHQ/154165	Swivel block (proof test cert required)	1
81			Rope terylene 3/4 in. circ. 61 m lg	1
82	19035	SCSHQ/156820	'T' stake anchor	1
83		29H/6334336	'D' shackle 3/8 in. x 1/2 in. BS3032	1
84				
85				
86			Bolt galv. hex 5/16 in. BSW x 3/4 in.	3
87			Washer spring galv. 5/16 in. i/d	3

TABLE 2 TOOLS LIST

Item	Ref/Drg No.	Description	Qty
1	4GB/2013244	T7 Tirfor	3
2	4GB/5238369	60 ft Tirfor rope	3
3	90G/110008	Strop	3
4	90G/109920	Gin pole	1
5		Tensiometer model 03C	1
6	10S/1077020	Tensiometer for terylene	1
7	10B/9331564	Preform dead end	12
8	4GB/2046346	T13 Tirfor	1
9	29H/9604348	Shackle 5/8 in. large 'D' BS3032	12
10			
11	28Y/6072	Thimbles 3/4 in. circ rope	12
12	10B/6330325	Preform dead end pt No. 5715808	12
13	10B/6330324	Preform dead end pt No. 5715809	12
14	4L/9424231	Snatch block swl 2 cwt	2
15	4L/4253434	Sling soft eye, 5ft lg swl 15 cwt	3
16	32A/9331563	Rope terylene 1 1/4 in. circ.	1000 ft
17		Theodolite	2
18		Handwinch swl 136 kg	1
19	29H/9604349	Shackle 3/4 in. large 'D'	2
20			
21	90G/SK13313	Winch frame	1
22		Picket	2
23		Shackle large 'D' swl 2T, 7/8 in. pin	3

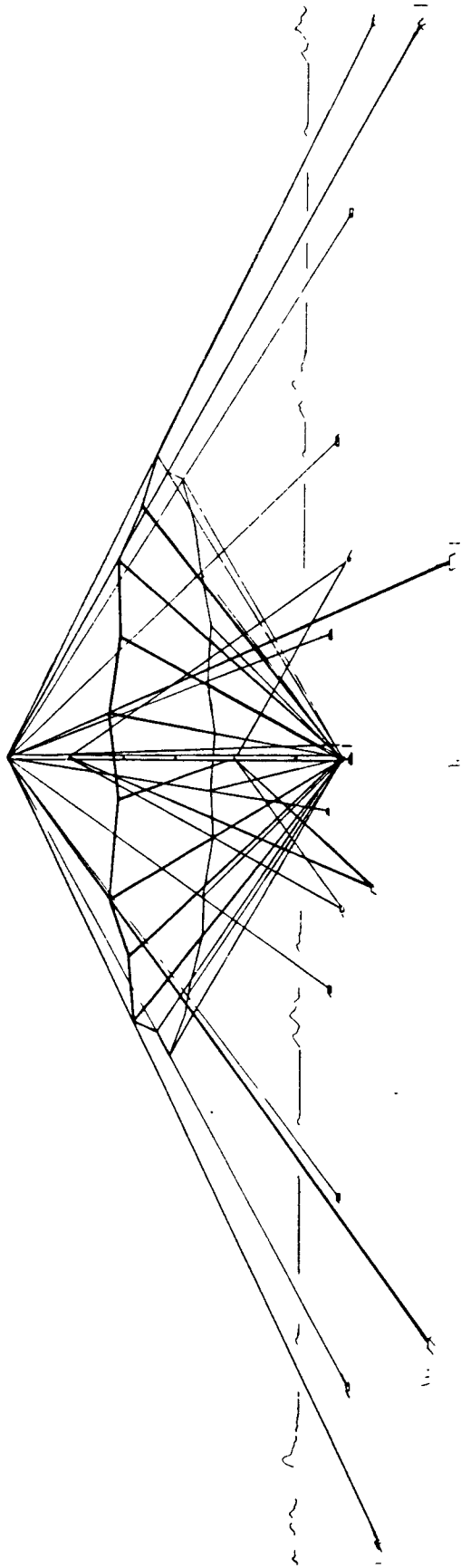
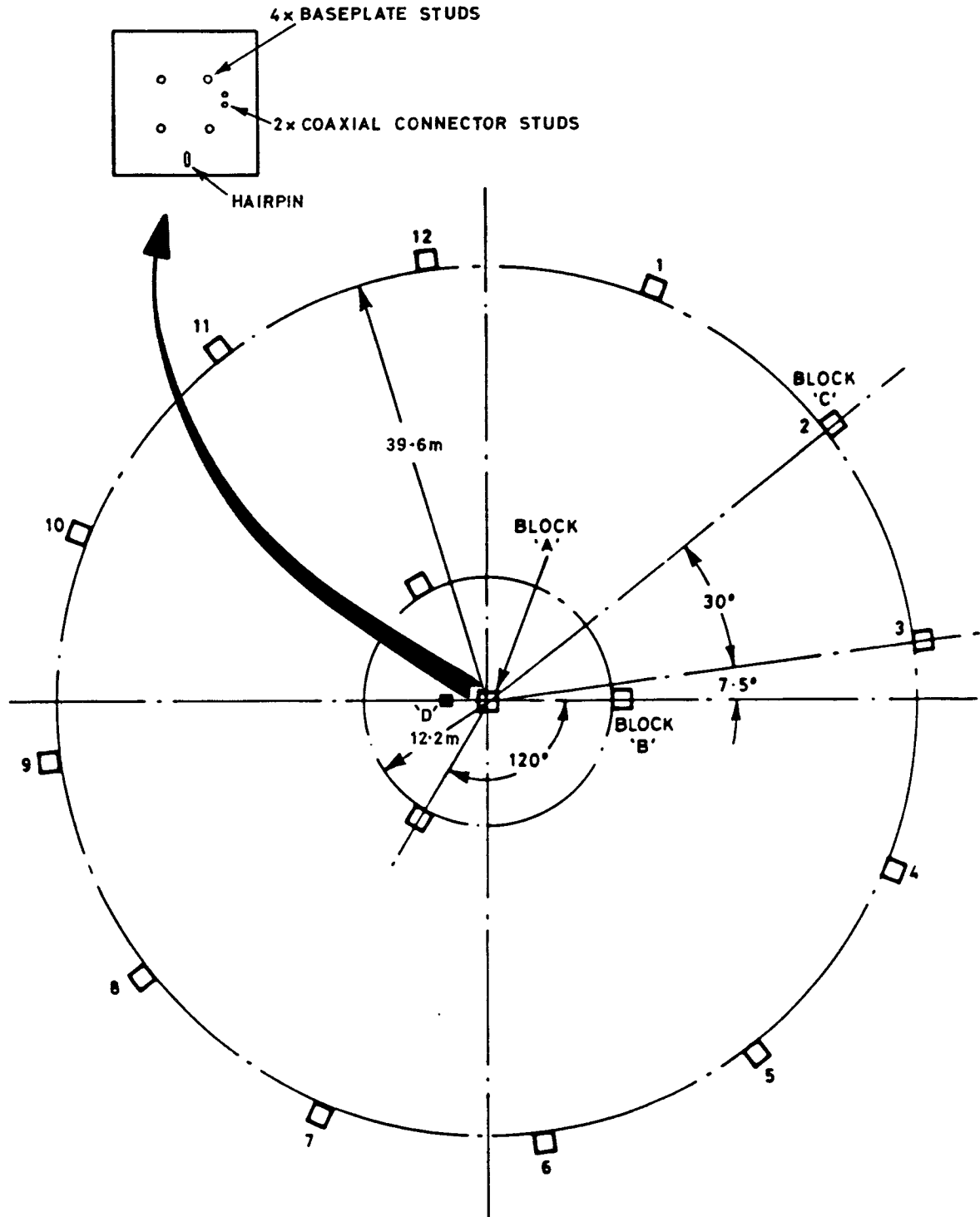


Fig 1 General assembly



NOTES :-  
 BLOCK 'A' - MAST FOUNDATION BLOCK  
 BLOCK 'B' - MAST STAY ANCHOR BLOCKS  
 BLOCK 'C' - ANTENNA STRAINING ROPE ANCHOR BLOCKS  
 POSITION 'D' - HALYARD PICKET

Fig 2 Foundations

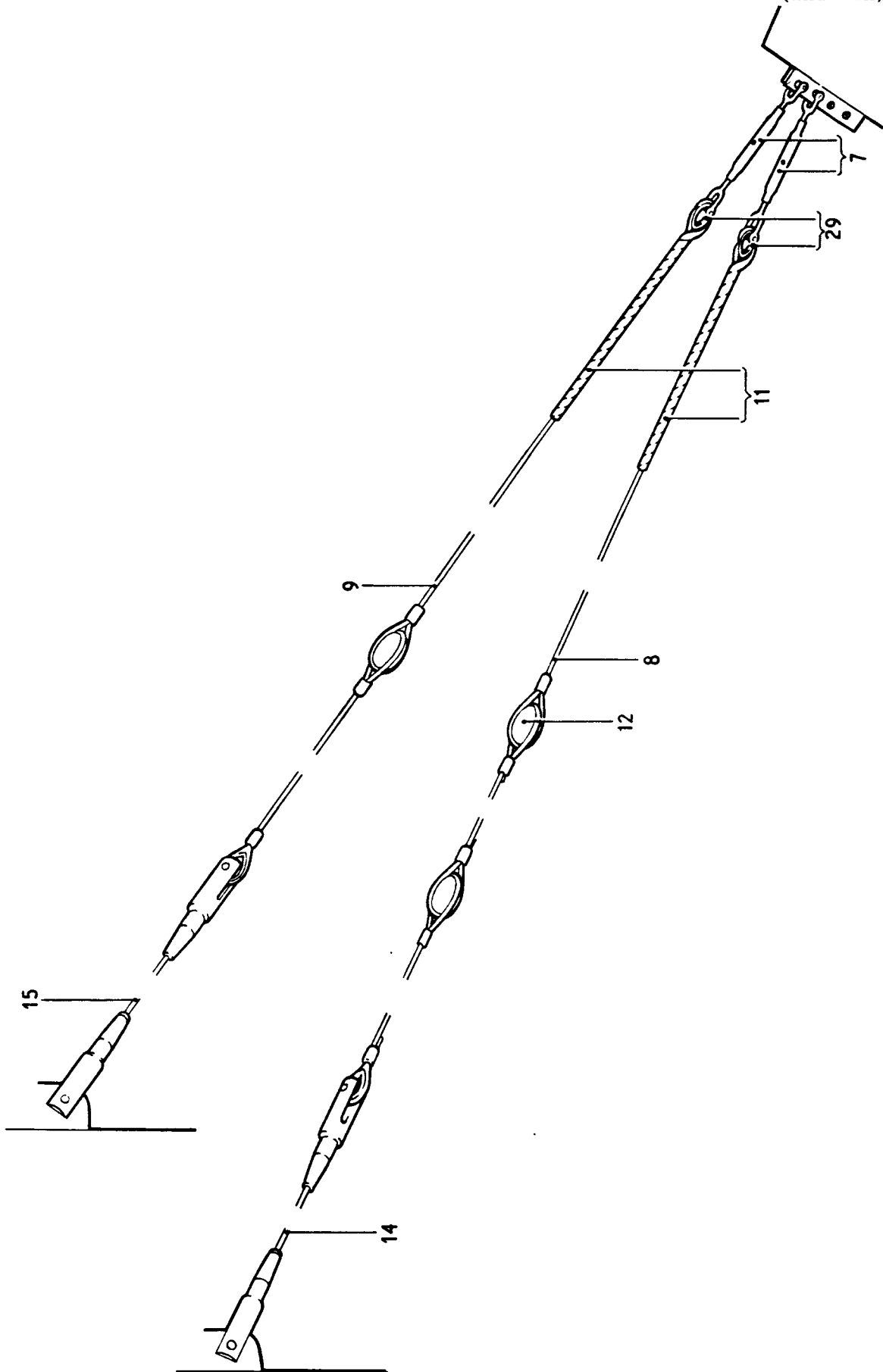


Fig 3 Mast stays



PERMANENT MAST STAYS —————  
TIRFOR MAST STAYS ( FIG 4, CHAP 8 ) - - - - -  
TEMPORARY TERYLENE MAST STAYS - - - - -  
STROP EXTENSION TO TIRFOR MAST STAYS ( FIG 5 ) - - - - -

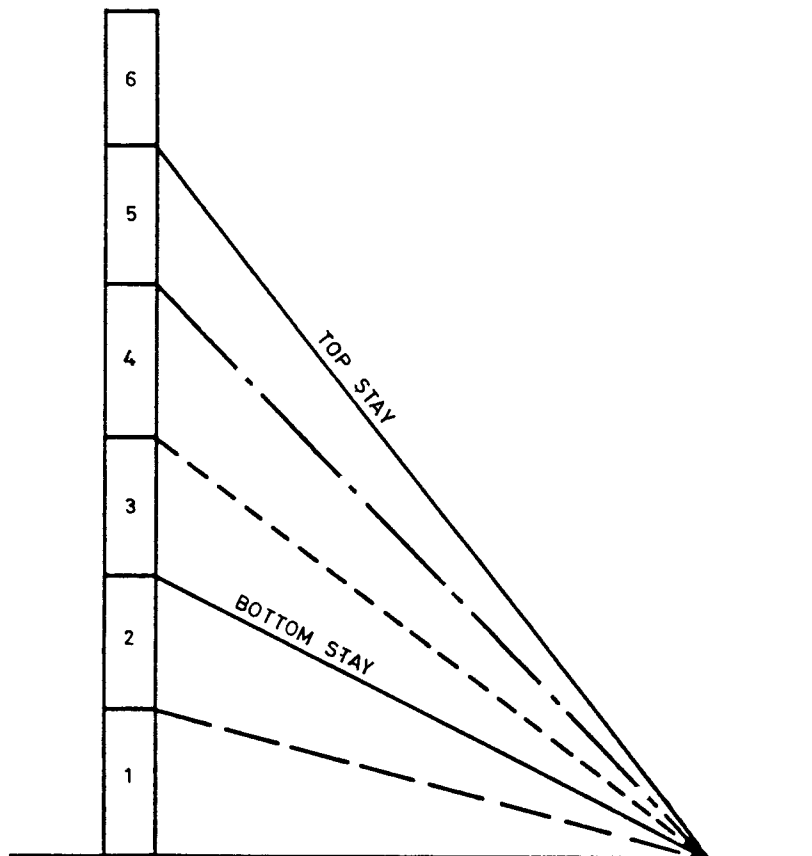


Fig 4 Staying arrangement

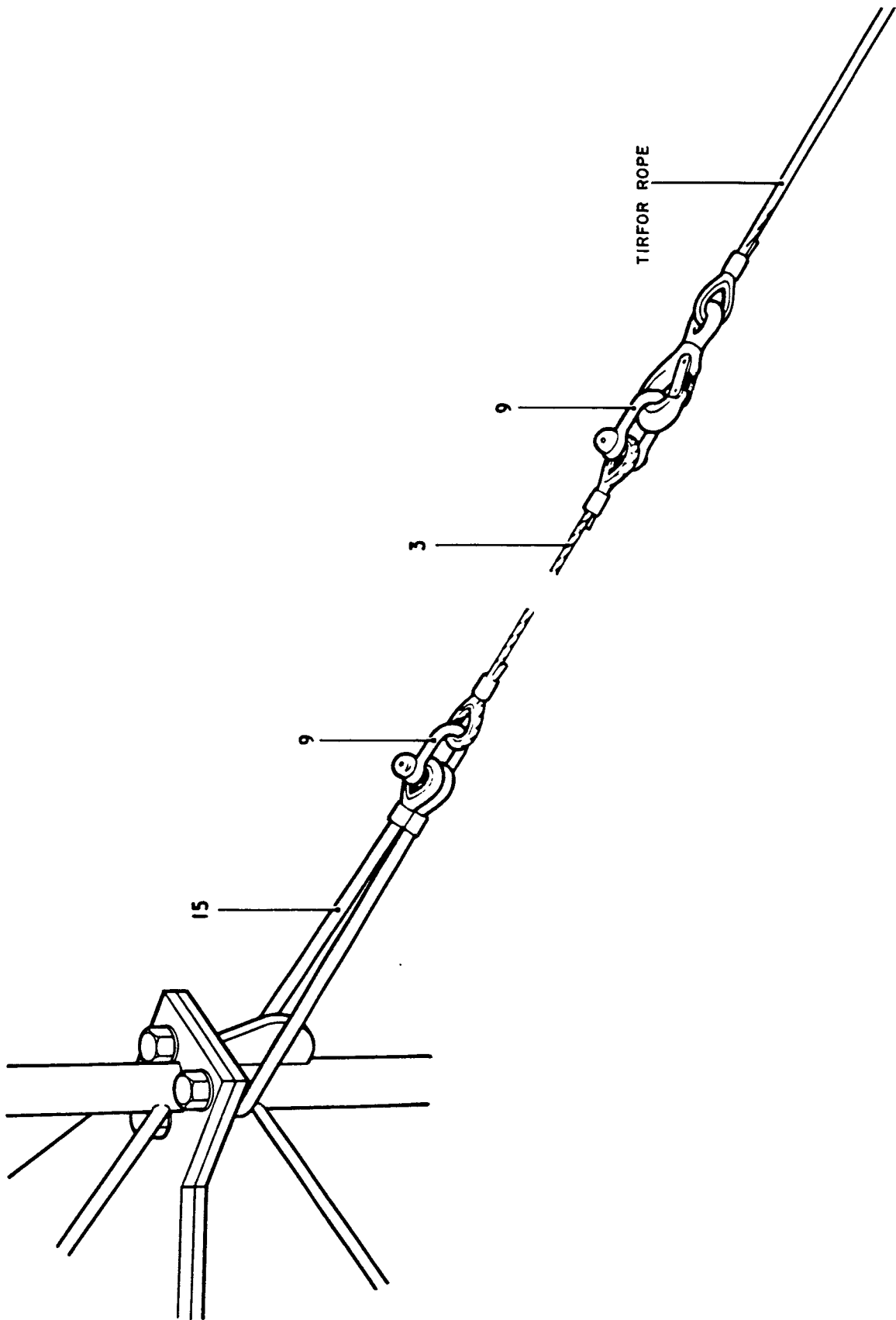


Fig 5 Temporary stays

Chapter 5

WB4530 ERECTING AND DISMANTLING INSTRUCTIONS

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DRAWINGS AND ASSOCIATED PUBLICATIONS

1 These erecting and dismantling instructions are to be read in conjunction with the following drawings and publications:

AP 116E-1717-1J	HF and MF antennas for ground stations: support antennas
AP 119K-0001-1	Lifting equipment: servicing and testing
RAFSC ESI Vol 1 pt. 6a	
OIP 463	Operation of Payne and Baynard handwinch
SCSHQ 162686	WB4530 antenna
90G 109920	Assembly of gin pole
SCSHQ 162722	Work service details

2 Parts to be used during the erecting and dismantling of the WB230 antenna are listed in Table 1. Special tools required to carry out these tasks are listed in Table 2. Drawings common to Chapters 3, 4 and 5 are presented in Chapter 18.

SAFETY PRECAUTIONS

3 All relevant safety precautions are to be observed during the mast erection and must not be compromised in any way.

3.1 The mast structure is not to be climbed by more than two men at any time.

3.2 Any person working higher than two metres above ground level must secure himself to the structure using such methods as are approved by the NCO in charge of the fitting party.

3.3 During the mast erection or lowering there is never to be more than four metres projecting above a set of stays when a man is required to climb beyond the stays.

3.4 Care is to be taken during the erection of each section that the verticality of the mast is observed. At each stage that a permanent set of stays is fitted, the mast must be corrected for verticality and checked with theodolites and the stays adjusted to their correct tensions (Chap 6 refers).

3.5 When using the gin pole the hauling rope must always pass through a pulley block at the base of the mast.

3.6 During lifting, the mast section must never be further than one metre from the mast, and only one section is to be lifted at any time.

3.7 The handwinch is to be used as the hauling medium and it must be supported on its stand and securely anchored in position.

### PSA(DOE) RESPONSIBILITIES

4 The mast and stays of the antenna are the responsibility of PSA (DOE) and are not to be adjusted after handover. The PSA (DOE) are to be informed in writing, a minimum of seven days in advance of the dates of mast erection, in order that a PSA (DOE) observer may be present, if required.

### MANPOWER

5 To erect or lower the mast a senior NCO and six men are required. The men will be deployed as follows:

5.1 Two men on the mast.

5.2 Two men on the winch.

5.3 Two men on the fall rope as the sections are raised or lowered.

6 To erect the antenna, after the mast has already been erected, a supervisor (senior NCO) and a minimum of three men are required.

### PRE-ERECTION DETAILS

7 Check that the foundations as supplied by PSA (DOE) are in agreement with figure 2.

Note...

For ease of working, the radial trenches (if required) for the earth mat should not be excavated until the mast has been erected.

8 The co-axial feeder may be laid at this stage and the trench back filled (if required) but the feeder protruding from the ground must be suitably protected against damage.

9 In some locations the mast sections must be painted, for additional corrosion protection. This information is given on the relevant RAFSEE drawing. Any damaged paintwork after final erection is to be repaired, as necessary, using the correct paint.

10 The following items of the antenna kit will have been used to install the foundations. Item numbers refer to drawing SCSHQ 162722.

10.1 4 hole anchor plate (item 1).

10.2 J bolt 5/8 in. BSW galvanised (item 3, 7 & 9).

10.3 J bolt 3/8 in. BSW galvanised (item 2, 6 & 8).

10.4 Hairpin anchor 12 in. x ½ in. dia (item 4).

10.5 Mast foundation template (item 5).

## MAST ASSEMBLY AND ERECTION

### Preparation of mast anchors (fig 3)

11 Fit quantity three 1 1/8 in. rigging screws (item 7, Table 1), one to each anchor plate at the three mast stay anchor blocks. Adjust the rigging screws to their mid-position.

Note...

The shackles must be fitted in the top hole of the anchor plates.

12 Attach a preformed dead end (item 11) to each of the three rigging screws, together with 1/2 in. score thimbles (item 29).

13 Fit a 1/2 in. rigging screw (item 56) via a 3/8 in. 'D' shackle (item 40) to each of the twelve antenna straining rope anchor blocks (fig 1, Chap 8). Adjust the rigging screws to their mid-position. Place a preformed dead end (item 57) and an 8 mm dia wire rope thimble (item 58) with each of the rigging screws at the antenna straining rope anchor blocks.

### Erection of first mast section

14 Remove the six nuts and washers from the studs in the mast foundation block. Place the nuts and washers in a safe place for refitting later.

15 Clean the stud threads, using a wire brush if necessary. Clean the top surface of the mast foundation block of all dirt and check it is flat and level. If not, contact the local PSA (DOE) for correction.

16 Lightly oil the six stud threads, protruding from the foundation block.

17 Clean the top and bottom faces of the base plate (item 17) and paint with epoxy pitch in accordance with instructions given in Chap 7. Allow the paint to dry.

18 Fit the base plate over the four main studs in the mast foundation block and check that it sits flat without rocking. If not, contact the PSA (DOE) for correction. Refit the four nuts and washers (removed in para 14) and tighten sufficiently to lightly clamp the base plate.

19 Take one mast section (item 1) and lay it on the ground on a line passing through the mast foundation block and bisecting the angle between two of the mast stay anchor blocks.

Notes...

- (1) The end of the mast section with the stay attachment lugs is to be furthest away from the mast foundation block.
- (2) The end of the mast section nearest the mast foundation block is to be approximately 300 mm from the edge of the block.

20 Clean the end of the mast section nearest the mast foundation block and attach the insulator top unit (item 23) using 5/8 in. nuts, bolts and washers (items 2, 3 and 4) (fig 2, Chap 8). Clean the free end of the insulator top unit (item 23) and secure a lead washer (item 21) to it using a screw (item 20).

Note...

The two faces of the lead washer must be clean before fitting.

21 Place the second lead washer (item 21) in the centre of the base plate (item 17) and secure in position with a screw (item 20) (fig 3, Chap 8).

Note...

The two faces of the lead washer and the top surface of the base plate must be clean before assembly.

22 Take the insulator (3 in. dia x 3 in. long) (item 22) and stand it on the lead washer fitted to the base plate. Ensure that the insulator sits on the lead washer with the head of the screw (item 20) in the bore of the insulator.

23 Take quantity three type T7 Tirfor winches (item 1, Table 2) and pull the rope through the machine until there is approximately seven metres of rope between hook and machine. Using ½ in. dia shackles attach the hooks of the three Tirfor ropes to the stay attachment lugs of the mast section laid on the ground. Lay the three Tirfor winches at the mast foundation block, with the three Tirfor ropes laid out on the ground parallel to the mast section.

24 Fit a 7/8 in. 'D' shackle in the bottom hole of each of the three stay anchor plates (fig 4, Chap 8).

25 Place a clean piece of wood, at least 100 mm wide x 300 mm long on the ground, between the centre of the insulator top unit (item 23) and the mast foundation block.

26 Two men are to take hold of the mast section, (laid on the ground in para 19) at the end furthest from the mast foundation block, preparatory to standing it upright. In addition, one man is to stand at the mast foundation block to steady the end of the mast section and to ensure that the insulator top unit (item 23) stands on the piece of wood (para 25) after lifting. Three other men are to take hold of the Tirfor ropes to steady the mast section.

27 When all the men are in position, the two men at the mast end furthest from the mast foundation block are to lift the end of the mast section and walk in towards the mast base, pushing upwards as they proceed, until the mast section is vertical, and resting on the piece of wood.

28 The three men with the Tirfor ropes are to keep the mast section steady while the two other men lift the mast section from the piece of wood to the top of the insulator (item 22), ensuring that the screw locating the lead washer fits in the hole of the insulator (item 22) and that the mast steps are on the opposite side of the mast to the two co-axial connector studs (fig 5, Chap 8).

29 Two men are to hold the mast section vertical while the three men with the Tirfor ropes and winches make them off to their respective mast stay anchor block positions, using the 7/8 in. 'D' shackles fitted in para 24.

30 Check that the mast section is central on the insulator and that the stays leave the section on the correct line to prevent twist in the section. Adjust the winches to hold the section vertical and steady (fig 4, Chap 8).

#### Assembly of lightning arrestor (fig 6, Chap 8)

31 Screw the nut (part of item 25) up the bolt (item 25) until approximately 15 mm of thread protrudes beyond the nut. Grease the thread of the bolt, place a washer (item 27) over the end and screw the assembly into the tapped hole in the base plate.

32 Screw a nut (item 26) on to the lightning arrestor upper (item 24) until approximately 30 mm of thread protrudes beyond the nut. Place a washer (item 36) and a bracket (item 28) over the thread of the lightning arrestor upper, ensuring that the bend in the bracket is away from the nut. Grease the thread of the lightning arrestor upper and place it through the hole directly above and one hole to the left of the bolt (item 25) attached to the base plate in para 31. Place a washer (item 27) over the thread protruding through a hole in the flange of the insulator top unit (item 23) and clamp the lightning arrestor upper to the flange with a nut (item 26). Adjust the position of the lightning arrestor upper until it touches the bolt (item 25).

Note...

This action ensures that the mast and antenna are connected to earth whilst the mast is erected.

#### Assembly of gin pole (fig 7, Chap 8)

33 Examine the gin pole assembly and check that the pole slides freely through its clamp assembly. Make certain that the working principle of the gin pole and the method by which it is clamped to the mast are fully understood.

34 Place the bottom end of the gin pole assembly (end without pulleys) against the base of the mast leg nearest the hairpin in the mast foundation block. One man is to steady the base of the gin pole assembly against the mast leg whilst a second man lifts the gin pole head, and walks towards the mast base, pushing upwards as he proceeds, until the gin pole is vertical. The second man is then to climb to the top of the mast section and secure the gin pole to the mast with a loose lashing, using terylene rope.

35 The second man is then to guide the clamp assembly as it travels up the gin pole, when hoisted from the ground. Firmly lock the clamp assembly as near to the top of the mast section as is practicable.

36 Remove the lashing that temporarily secured the gin pole to the mast (para 34). Fit a pulley block to the hairpin in the mast foundation block using a ½ in. dia shackle.



37 Reeve the winch rope first through the pulley block at the base of the mast and then through the pulley block at the gin pole head. Return the end of the winch rope to ground level.

Note ...

The handwinch is to be positioned approximately six metres from the mast base and securely picketed in position (fig 8, Chap 8). This winch must be stayed to ground pickets, in a direction away from the mast (ie opposing the pull of the winch).

38 Use the gin pole hauling rope to slide the gin pole through the clamp assembly until it is in the elevated position. Secure in this position with the locking pin.

#### Erection of second mast section

39 Lay a mast section (item 1) on the ground on the opposite side of the mast to the pulley block, with the stay attachment lugs away from the mast base.

40 Attach three temporary stays one to each attachment lug, using terylene rope (item 16, Table 2).

41 Attach the end of the winch rope to a point on the mast section approximately 1.5 m from the end to which the stays are attached. Attach a 30 m long fall rope to the mast section at one of the crossbrace members, approximately one metre from the end furthest from the stays.

42 Begin to lift the mast section, ensuring that the climbing steps are correctly orientated to line up with the steps on the first mast section. The mast section must be nearly vertical during the lift, and the fall rope is to be used to keep the mast section away from the first mast section.

43 Two men are to climb to the top of the first mast section and when the second mast section is above the first, they are to guide it into position, bolting the two sections together with 5/8 in. nuts, bolts and washers (items 2, 3 and 4).

44 Take the terylene temporary stays attached to the second mast section and attach their lower ends to the respective mast stay anchor blocks.

45 Check that the mast is vertical (Chap 6).

#### Erection of third mast section

46 Tie the gin pole head to the top of the mast, using a temporary lashing.

47 Release the clamp assembly and remove the locking pin. Raise the clamp assembly to the top of the mast.

48 Firmly lock the clamp assembly as near to the top of the mast as is practicable.

49 Remove the temporary lashing (para 46) and slide the gin pole through the clamp assembly until it is in the elevated position. Secure with locking pin.

50 Lay a mast section (item 1) on the ground on the opposite side of the mast to the pulley block, with the stay attachment lugs away from the mast base. Assemble the three permanent mast stays from items 8, 11 and 14 (fig 3). Attach the parafil end (item 14) of the three stays, one each to the three stay attachment lugs of the mast section. Ensure that the split pins are correctly expanded in the two parafil end terminations of each stay, and that the parafil termination in the centre of the stay is greased.

51 Attach the end of the winch rope to a point on the mast section approximately 1.5 m from the end to which the stays are attached. Attach a 30 m fall rope to the mast section at one of the crossbrace members, approximately one metre from the end furthest from the stays.

52 Begin to lift the mast section, ensuring that the climbing steps are correctly orientated to line up with the steps on the sections already standing. The mast must be nearly vertical during the lift, and the fall rope is to be used to keep the mast section away from the part of the mast previously erected.

53 Two men are to climb to the top of the mast and when the mast section is as high as required it is to be guided into position, bolting the two sections together with 5/8 in. nuts, bolts and washers (items 2, 3 and 4).

54 Take the permanent stays attached to the section just lifted and attach their lower ends to their respective stay anchor blocks, using dead ends and thimbles (items 11 and 29).

55 Check that the mast is vertical (Chap 6), and adjust the stays to a tension of 9954N (2240 lbs).

#### Erection of fourth mast section

56 Erect the fourth mast section as detailed in para 46 to 55.

Note ...

The mast will project above its final set of stays by one mast section (fig 9, Chap 8).

57 Straighten the mast and check that it is vertical in accordance with Chap 6.

58 Attach a pulley block (item 80) using a shackle (item 83), to one of the stay attachment lugs (near the steps) at the mast head. This pulley block is for use with a Bosun Chair. A standing line is always to be left reeved when a Bosun Chair or safety line is not being used, and should be terminated at the picket (item 82) using a shackle (item 45). The senior NCO IC the party is to decide if the Bosun Chair or safety line is to be used for the remainder of the antenna erection.

59 Use the winch rope to raise the head cap (item 33) to the top of the mast. Fit the head cap using quantity six 5/8 in. bolts 2 in. long (item 2, 3 and 4) (fig 1, Chap 8).

60 Transfer the winch rope and snatch block from the gin pole head to one of the stay attachment lugs at the top of the mast.

61 Lower the gin pole by removing the locking pin and lowering the pole down through the clamp assembly.

62 Tie off the gin pole head to the top mast section, release the clamp assembly and lower it down the gin pole to the section below. Clamp in position and secure the gin pole with the locking pin. Remove the tie at the gin pole head.

63 Shackle the winch rope to the gin pole head and use the winch rope to lower the gin pole assembly to the ground.

#### ANTENNA ARRAY ERECTION

##### Erection of the main antenna wires (fig 1, Chap 8)

64 Fit quantity 21 brackets (item 28) around the base of the insulator top unit (item 23) using for each a 3/8 in. by 1 1/4 in. bolt (item 35) with a plain washer (item 27) under the bolt head (fig 6, Chap 8). Fit a spring washer (item 36) under the nut (item 35). Threads must be greased before assembly.

Note ...

The brackets (item 28) are to be fitted on the underside of the insulator top unit (item 23) and are not to be fitted adjacent to the three mast legs.

65 Fit quantity 21 line taps (item 74) one to each bracket.

66 The main antenna wire assemblies, consisting of items 47, 50, 52 and 53 are supplied assembled. To each of these assemblies, fit a straining rope (item 54) to the antenna bracket (item 50), using a 1/4 in. 'D' shackle (item 46) (fig 1, Chap 8).

67 The top end of each main antenna wire assembly is to be made off to the head cap (item 33), as follows:

67.1 Shackle the eye in the antenna wire assembly to a bracket (item 28) using a 1/4 in. 'D' shackle (item 46).

67.2 Place a washer (item 27) over the thread of a 3/8 in. by 1 1/4 in. bolt (item 35), followed by the terminal end of the antenna wire assembly.

67.3 Fit the second washer (item 27) to the bolt (item 35) before passing the screw thread through the bracket (item 28) and then through the head cap (item 33). Secure with a nut and a washer (item 36).

67.4 As each antenna wire assembly is fitted to the head cap it is to be lightly strained away from the mast using the straining rope (item 54).

68 When the twelve antenna wire assemblies have been fitted to the head cap and lightly strained out from the mast, the bottom end of each is to be made off to its appropriate line tap (item 74) at the insulator top unit. Allow 25 mm to project through each line tap.

69 Remove the winch rope and pulley block from the top of the mast (fitted in para 60), lower to the ground and fit to the gin pole assembly. Remove the gin pole assembly, winch and pulley block from the working area.

Assembly of the intermediate antenna wires (fig 10, Chap 8)

70 Fit the intermediate antenna wires (item 48), as follows:

70.1 Release the tension in two adjacent main antenna assemblies and allow them to fall in towards the mast until it is possible to work on the antenna brackets (item 50).

70.2 Fit two spacer wires (item 49), one to each side of an antenna bracket (item 50).

70.3 Join the ends of the two spacer wires together between the two main antenna wire assemblies by fitting them to a spacer link plate (item 51) using nuts and bolts (items 52 and 53).

70.4 Also fit an intermediate antenna wire (item 48) to the spacer link plate, using nuts and bolts (item 52 and 53).

Note ...

The clamping nuts (item 53) should only be used once and are not to be overtightened.

71 Continue to fit the spacer wires (item 49) and intermediate antenna wires (item 48) round the mast. The bottom ends of the intermediate antenna wires should be left free at this stage. Grease the antenna brackets whilst at a working height.

72 Tension the antenna straining ropes (item 54) to 895N (200 lbs).

73 From baseplate level, measure up the mast and make a mark on each mast leg at a level of 10.0 m. Clean an area 50 mm wide round each leg at this level (ie remove all paint and dirt etc).

74 Assemble a lindaptor (item 31) to each leg (fig 11, Chap 8), together with a bracket (item 28), ensuring good mating contact. Fit a line tap (item 74) through the hole in the bracket (item 28).

75 Terminate the ends of the three intermediate antenna wires opposite the mast legs, to the line taps at the 10.0 m level up the mast. Terminate the remaining nine intermediate antenna wires to their respective line taps at the mast base.

EARTHING ASSEMBLY

Assembly of the earth termination (fig 12, Chap 8)

76 Fit the two base strip connectors (item 41) between two of the base plate studs and the two 3/8 in. coaxial connector studs, which will be found projecting from the mast foundation block.

77 Fit four earth terminals (item 69) to each of the four termination strips (item 65), using screws and washers (item 70 and 71).

78 Dig a trench 150 mm deep around the mast base, exposing the sides of the mast foundation block. The trench must be at least 150 mm wide.

79 Position the four termination strip assemblies round the mast foundation block and secure together with the earth connecting strips (item 66) using bolts and nuts (items 72 and 73). Push the whole assembly to the bottom of the trench.

80 Bend each connecting strip (item 66) over the top surface of the foundation block and onto the four studs projecting through the base plate. Cut the connecting strips to length and drill clearance holes to suit the base plate studs. Remove each base plate nut and washer in turn and secure item 66 with these nuts and washers.

#### Assembly of the termination connector (fig 13, Chap 8)

81 Fit the support bracket (item 37), using the nuts removed in para 14, to the coaxial connector studs in the mast foundation block. Fit the antenna coaxial connector (item 38) to the support bracket. Fit a temporary cover over the open end of the connector.

82 Remove one of the nuts from the wire termination end of the coaxial connector assembly, and the nut securing the bracket (item 28) nearest to the coaxial connector. Fit the copper wire connector (item 42) between the coaxial connector (item 38) and the bracket (item 28). Replace nuts and secure firmly.

83 Lay the coaxial feeder (see also para 8) and terminate to the connector assembly (item 38). Pressurise the coaxial feeder and, if satisfactory, back-fill the cable trench.

#### Laying the earth mat (fig 14, Chap 8)

Note ...

If required on site installation or works service drawings, obtain PSA (DOE) assistance in opening the radial trenches for the earth mat. Ensure that the earth connections around the mast foundation block are not damaged during this operation.

84 Take each copper earth wire (item 67) and bend at right angles 50 mm from its end. Push the bent end of the wire through the end of an earth terminal (item 69). Lay the copper earth wire out along its appropriate radial trench and back-fill.

85 Lay the 72 earth wires as para 84.

Note ...

The earth terminals (item 69) at the corners of the mast foundation block, each terminate five earth wires whilst those at the sides terminate four wires each.

86 Check that all the earth terminal clamping nuts are tight and holding the earth wires. Grease the earth terminals.

87 Back-fill and level the soil around the mast foundation block.

### CLEARING THE SITE

88 Remove all erection tackle from the mast. Clear all tools and spare equipment from site and generally tidy up.

89 Grease all shackles, bottle screws etc on the stays and straining ropes. Repair any damage to paintwork.

90 Adjust the position of the lightning arrestor upper until a gap of 6 mm exists, and lock in position. Test the antenna against the relevant test specification.

### DISMANTLING THE ANTENNA ARRAY

91 Disconnect the main coaxial feeder at the coaxial connector (item 38) and disconnect the copper wire connector (item 42). Remove the connector assembly together with the bracket (item 37) (fig 13, Chap 11). Adjust the position of the lightning arrestor upper until it touches the bolt (item 25).

92 Release all intermediate wires (item 48) from their line taps (item 74) at the lindaptors (fig 11, Chap 8).

93 Remove the snatch block and winch rope from the gin pole. One man is to climb the mast and fit the snatch block and winch rope to an attachment lug at the mast head, using a  $\frac{1}{2}$  in. 'D' shackle. Fit a pulley block to the hairpin in the mast foundation block, using a  $\frac{1}{2}$  in. 'D' shackle.

94 Reeve the winch rope through the snatch block at the base of the mast. Return the end of the winch rope to ground level.

Note ...

The hand winch is to be used in conjunction with the winch rope and must be positioned approximately six metres from the mast base and securely picketed in position (fig 8, Chap 8). This winch must be stayed to ground pickets, in a direction away from the mast (ie opposing the pull of the winch).

95 Release the tensions in all the antenna straining ropes (item 54) but do not disconnect at this stage.

96 Disconnect any three adjacent antenna straining ropes (item 54). This will facilitate the removal of the link plates (item 51), intermediate wires (item 48) and spacer wires (item 49).

97 Remove the middle one of the three main antenna wire assemblies from the mast by disconnecting from the line tap at the base of the mast and from the head cap, by removing the bolts (item 35). Lower to the ground using the pulley block installed in para 93.

98 Disconnect a further adjacent straining rope (item 54) which will facilitate the removal of the link plates (item 51), intermediate wires (item 48) and spacer wire (item 49). This will leave a main antenna wire free for removal and lowering.

99 Continue around the mast in a similar fashion until all antenna elements have been removed.

## DISMANTLING THE MAST

### Dismantling the fourth and third mast sections

- 100 Remove the mast head cap (item 33). Lower to the ground using the winch rope.
- 101 Shackle the winch rope to the gin pole head and raise the gin pole assembly until the clamp assembly can be secured to the top of the third mast section.
- 102 Transfer the winch rope and snatch block from the mast attachment lug to the gin pole head.
- 103 Attach the end of the winch rope to a point on the top mast section approximately 1.5 m from the head of the mast. Attach a 30 m long fall rope to one of the crossbrace members, approximately one metre from the lower end of the mast section.
- 104 Take the strain on the winch rope, and release the mast section by removing the 5/8 in. nuts and bolts (items 2, 3 and 4). Raise the mast section with the winch rope to clear, then lower the mast section to the ground, using the fall rope to keep the section away from the mast.
- 105 Lower the gin pole to the next position by removing the locking pin, and lowering the pole down through the clamp assembly. Tie off the gin pole head to the mast section, release the clamp assembly and lower it down the gin pole to the section below the one that is to be removed. Clamp in position and secure the gin pole with the locking pin. Remove the tie at gin pole head.
- 106 Make off three Tirfor temporary stays (fig 5), one to each mast leg just below the permanent stays. Tension these temporary stays.
- 107 Release the tensions in the set of permanent stays gradually, until they are slack. Disconnect them from their stay anchor blocks and lower to the ground using the winch rope. Attach and tension a set of terylene temporary stays to the next mast section down.
- 108 Attach the end of the winch rope to a point on the third mast section approximately 1.5 m from the head of the mast. Attach a 30 m long fall rope to one of the crossbrace members, approximately one metre from the lower end of the mast section.
- 109 Take the strain on the winch rope and release the Tirfor temporary stays. Release the mast section by removing the 5/8 in. nuts and bolts (items 2, 3 and 4). Raise the mast section with the winch rope to clear, then lower the mast section (complete with stays) to the ground, using the fall rope to keep the section away from the mast.

### Dismantling the remaining mast sections

- 110 Dismantle the second mast section in a similar manner to that detailed in paragraphs 105 to 109. Staying arrangements are shown in figure 4.
- 111 Dismantle and remove the gin pole, winch and pulley blocks from site.

112 The first mast section requires the use of the Tirfor winches as temporary stays. To lower this section, first remove the lightning arrester upper (item 24) and the lightning arrester lower bolt (item 25).

113 Remove all line taps (item 74) and brackets (item 28) from the insulator top unit (item 23).

114 Two men are to hold the mast section vertical while the three men disconnect the Tirfor ropes and winches from their respective stay block positions. The three men with the Tirfor ropes are to keep the mast section steady while two other men lift the section from the top of the insulator (item 22) and place on to a clean piece of wood, at least 100 mm wide x 300 mm long.

115 The three men with the Tirfor ropes are to steady the mast section while the two men with the mast section walk back away from the mast base, lowering the section as they proceed, until the section is completely lowered.

116 Remove the base insulator, base plate, earth termination assembly and fit a waterproof protective cover over the coaxial connector.

#### CLEARING THE SITE

117 Remove and stow all spare shackles from the mast stay anchor blocks, and antenna straining rope anchor blocks.

118 Ensure that the site is clear of all parts and tools. Store the antenna and mast sections in accordance with the relevant instructions.



TABLE 1 WB4530 PARTS LIST

Item	C&S drg	SCSHQ drg	Description	Qty
1	3391F	SCSHQ/156793	Mast section type HLS	4
2		10AC/6269323	Bolt, 5/8 in. BSW x 2 in. c/w nuts	50
3		10AC/6269313	Washer plain galv 5/8 in.	50
4				
5				
6				
7			Rigging screw 1 1/8 in. galv.fork&fork	3
8	4/7477		Lower stay No.1 length 9.14 m	3
9				
10				
11		90G/116640/2	Preform dead end NWRDS 7/16 in.	3
12		SCSHQ/154313	Egg insulator, porcelain	8
13				
14		SCSHQ/173648	Upper stay No.1, 7.5T Parafil	3
15				
16				
17	3/4580	SCSHQ/156802	Base plate	1
18				
19				
20			Screw ch hd galv. 1/4 in. BSW x 3/8 in.	2
21			Packing washer lead 3 1/8 in. o/d	2
22			Insulator, Alumina glazed 3 in. o/d	1
23	2/4584	SCSHQ/156803	Insulator top unit	1
24		SCSHQ/156804	Lightning arrestor upper	1
25			Bolt hex hd 3/8 in. BSW x 1 3/4 in.galv	1
26		10AC/6269319	Full nut hex galv. 3/8 in. BSW	3
27		10AC/6269320	Washer plain galv. 3/8 in.	56
28		90G/109779	Bracket	36
29	4/7387		Thimble ms galv. for 3/4 in. dia rope	4
30				
31		SCSHQ/154166	Lindaptor type F3	3
32		SCSHQ/116640/1	Preform dead end Pt No. 5715824	3
33	4/4585	SCSHQ/156806	Head cap	1
34				

(continued)

TABLE 1 WB4530 PARTS LIST (continued)

Item	C&S drg	SCSHQ drg	Description	Qty
35		10AC/6269324	Bolt hex galv. 3/8 in. BSW x 1 1/4 in. with nut	38
36		10AC/6269325	Spring washer flat 3/8 in. i/d	24
37	3/5405	SCSHQ/156807	Support bracket	1
38	4/4873	SCSHQ/156808	Connector assembly	1
39				
40		29H/6334336	'D' shackle 3/8 in. x 1/2 in. BS3032	12
41	4/4592	SCSHQ/156811	Base strap connector	2
42	3815P	SCSHQ/156812/1	Copper wire connector	1
43				
44				
45			'D' shackle 3/8 in. x 3/8 in. galv.	1
46		10AS/6494540	'D' shackle 1/4 in. x 1/4 in. st.st.	30
47	4/4595	SCSHQ/156813	Main antenna wire	12
48	4/4597	SCSHQ/156814	Intermediate antenna wire	12
49	4/4596	SCSHQ/156815	Spacer wire	24
50	3/4682	SCSHQ/156816	Antenna bracket	12
51	4/4593	SCSHQ/156817	Spacer link plate	24
52		10AC/6247108	Screw hex 1/4 in. BSW x 3/4 in. st.st.	66
53			Aerotite nuts 1/4 in. BSW st.st.	66
54		90G/109806/2	Straining rope, terylene 3/4 in. circ	12
55				
56			Rigging screw 1/2 in. dia. fork & fork	12
57		90G/109807/6	Preformed dead end 3/4 circ	12
58		29H/4707613	Thimble for 8 mm dia rope galv.	13
59				
60				
61				
62				
63				
64				
65	4/4681	SCSHQ/156818	Earth termination strip	4
66		SCSHQ/156819	Earth connection strip	4
67			Earth wire, copper 14 SWG	2160m
68				

(continued)

TABLE 1 WB4530 PARTS LIST (continued)

Item	C&S drg	SCSHQ drg	Description	Qty
69			Earth terminal 'T' connector	16
70		10AC/6494533	Screw st.st. 1/4 in. BSW x 1/2 in. hex	16
71		10AC/6303082	Washer plain st.st. 1/4 in. i/d	16
72		10AC/6494427	Bolt st.st. hex 3/8 in. BSW x 1 in.	4
73		10AC/6494532	Full nut st.st. hex 3/8 in. BSW	4
74			Line tap	52
75				
76				
77				
78				
79				
80		SCSHQ/154165	Swivel block (proof test cert required)	1
81			Rope terylene 3/4 in. circ 61 m lg	1
82	19035	SCSHQ/156820	'T' stake anchor	1
83		29H/6334336	'D' shackle 3/8 in. x 1/2 in. BS3032	1
84				
85				
86			Bolt galv. hex 5/16 in. BSW x 3/4 in.	3
87			Washer spring galv. 5/16 in. i/d	3

TABLE 2 TOOLS LIST

Item	Ref/Drg No.	Description	Qty
1	4GB/2013244	T7 Tirfor	3
2	4GB/5238369	60 ft Tirfor rope	3
3	90G/110008	Strop	3
4	90G/109920	Gin pole	1
5		Tensiometer model 03C	1
6	10S/1077020	Tensiometer for terylene	1
7	10B/9331564	Preform dead end	12
8	4GB/2046346	T13 Tirfor	1
9	29H/9604348	Shackle 5/8 in. large 'D' BS3032	12
10			
11	28Y/6072	Thimbles 3/4 in. circ rope	12
12	10B/6330325	Preform dead end pt No. 5715808	12
13	10B/6330324	Preform dead end pt No. 5715809	12
14	4L/9424231	Snatch block swl 2 cwt	2
15	4L/4253434	Sling soft eye, 5ft lg swl 15 cwt	3
16	32A/9331563	Rope terylene 1 1/4 in. circ.	1000ft
17		Theodolite	2
18		Handwinch swl 136 kg	1
19	29H/9604349	Shackle 3/4 in. large 'D'	2
20			
21	90G/SK13313	Winch frame	1
22		Picket	2
23		Shackle large 'D' swl 2 T, 7/8 in. pin	3

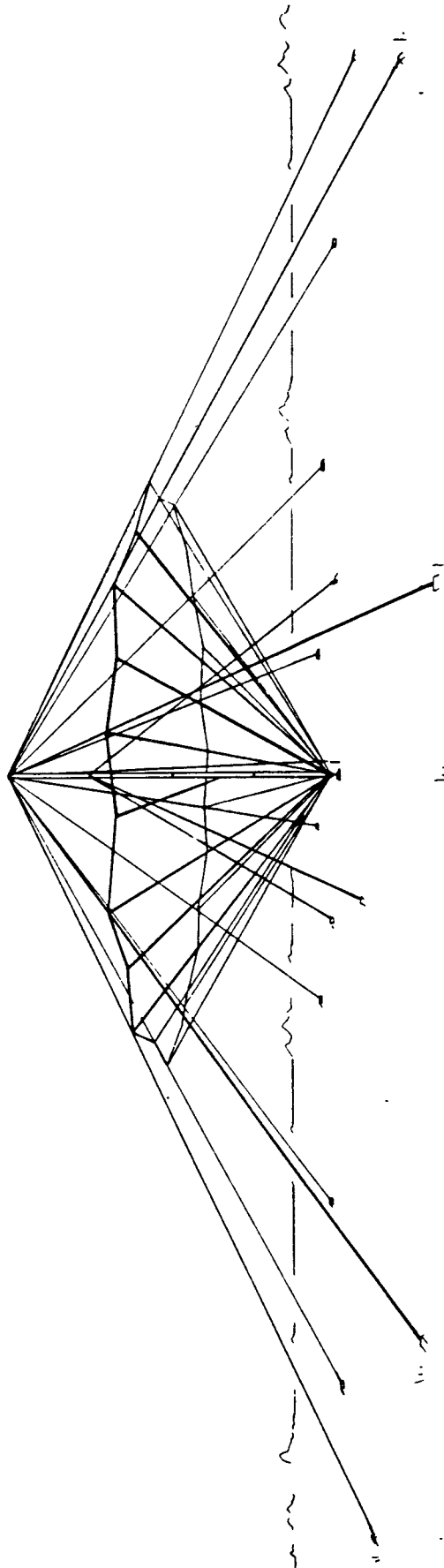
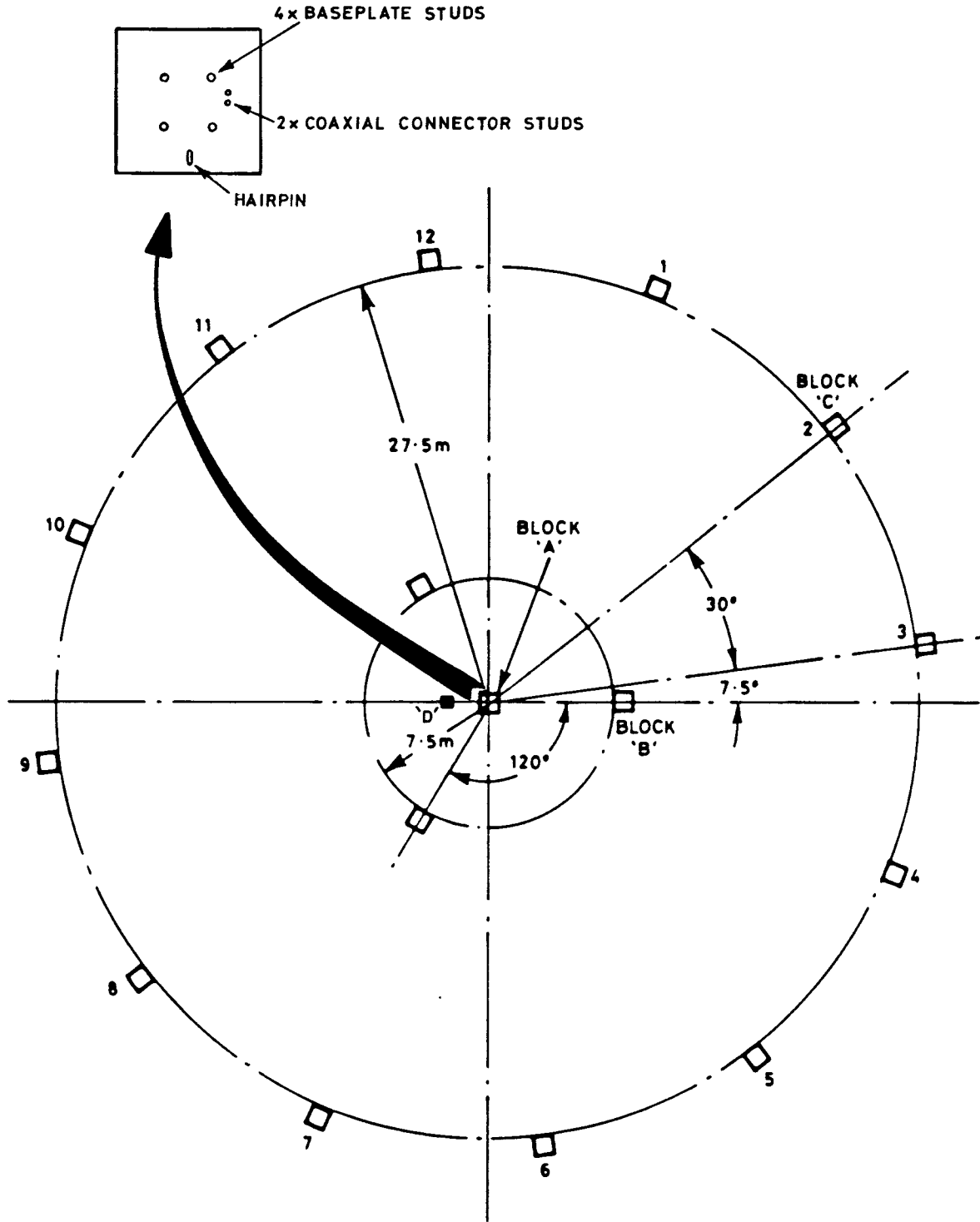


Fig 1 General assembly



NOTES :-  
 BLOCK A - MAST FOUNDATION BLOCK  
 BLOCK B - MAST STAY ANCHOR BLOCKS  
 BLOCK C - ANTENNA STRAINING ROPE ANCHOR BLOCKS  
 POSITION D - HALYARD PICKET

Fig 2 Foundations

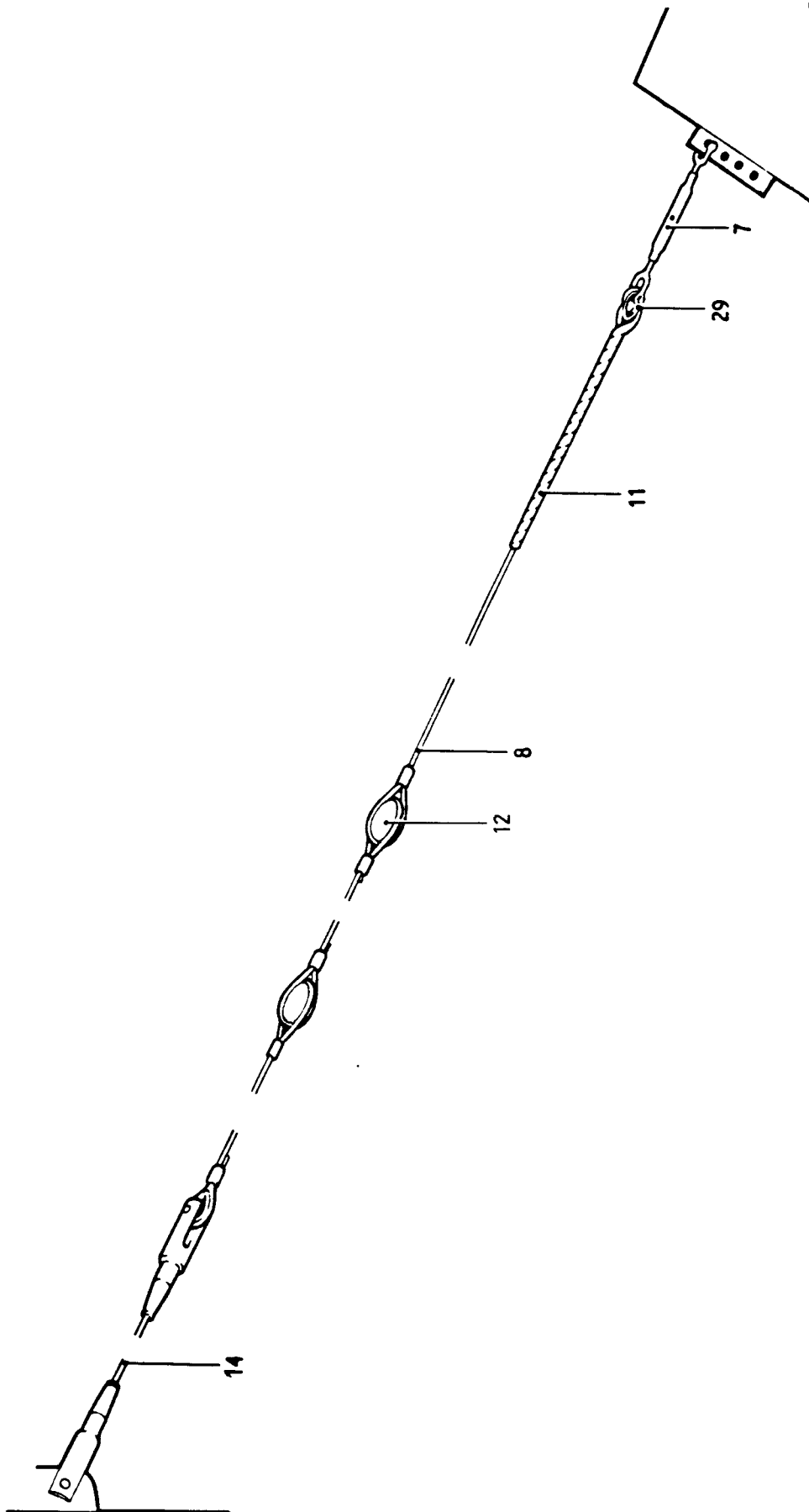


Fig 3 Mast stays

PERMANENT MAST STAYS \_\_\_\_\_  
TIRFOR MAST STAYS ( FIG 4, CHAP 8 ) - - - - -  
TEMPORARY TERYLENE MAST STAYS - - - - -

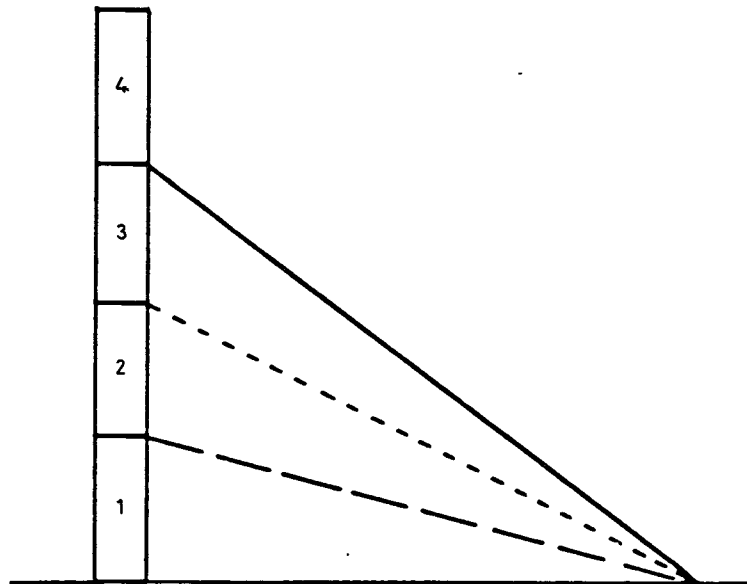


Fig 4 Staying arrangements



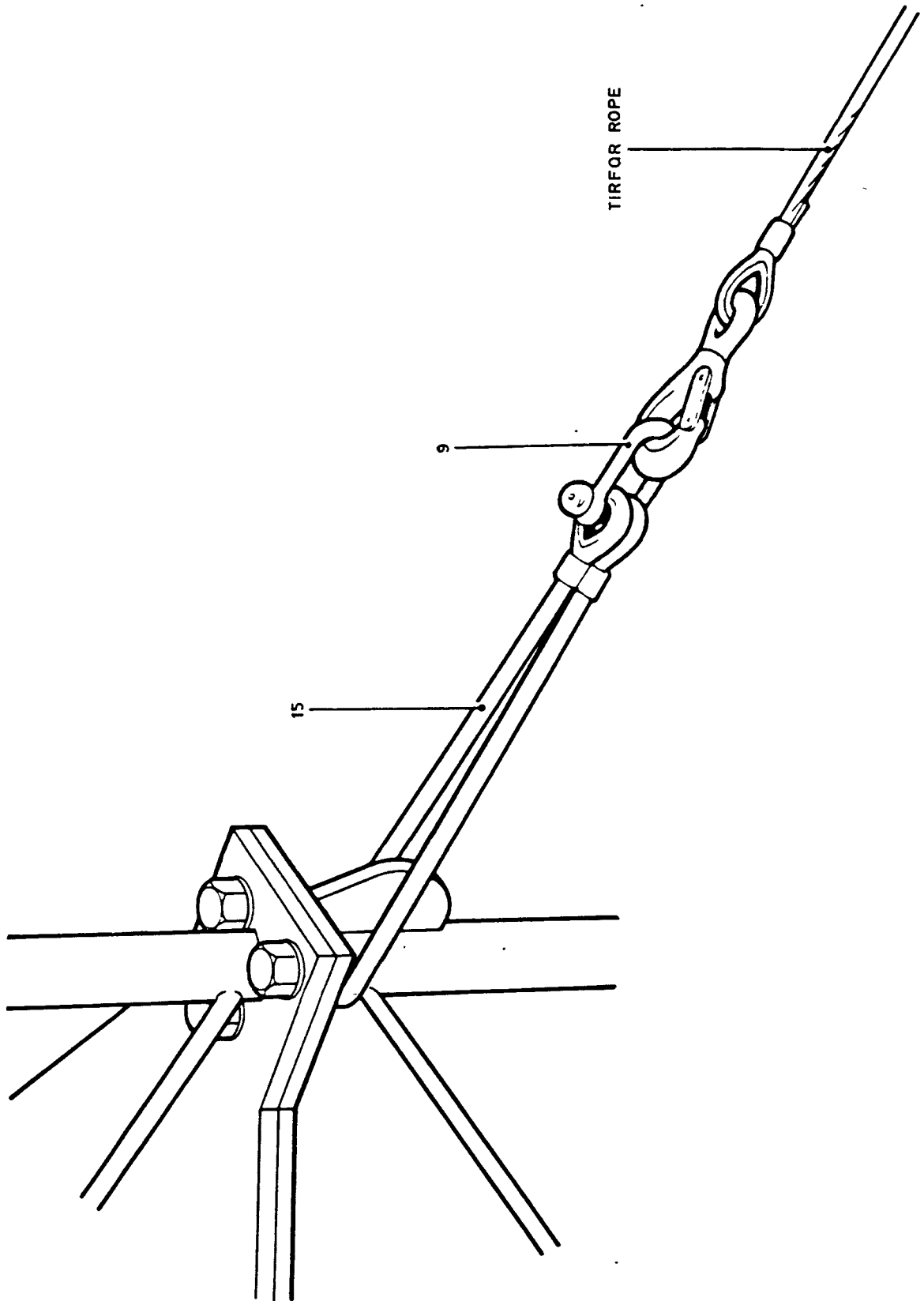


Fig 5 Temporary stays

Chapter 6

METHOD OF STRAIGHTENING A MAST USING TWO THEODOLITES

CONTENTS

Para

- 1 General
- 3 Initial sequence of operations
- 8 Final straightening

General

1 When straightening a mast it is essential to view it from two directions at 90 degrees to each other. Although relative heights of the theodolites are not important the following conditions must be observed:

1.1 The mast must be straightened from the base working upwards. The mast must be vertical and straight.

1.2 The axis of the mast must be vertical to within one inch for every eighty feet of height.

1.3 All stay tensions at any level must be equal and within  $\pm 5\%$  of the given value.

2 The above conditions apply in still air only.

Initial sequence of operations

3 Position the two theodolites so that the mast can be viewed from two directions at approximately 90 degrees to each other, and so that each instrument can cover the whole height of the mast in one sweep.

4 Level the base of each theodolite by adjusting the screws provided, until the bubbles of the spirit levels fixed in the base, are centred.

Note ...

The accuracy of the instrument depends upon the accuracy of this adjustment.

5 Sight the cross wires of the theodolite telescope on the base of the mast.

6 Swing the telescope through vertical, observing the line of the mast.

WARNING ...

CARE MUST BE TAKEN TO ENSURE THAT THE MAST DOES NOT BECOME UNSTABLE DURING THE ADJUSTMENT IN PARA 7.

7 Adjust the mast stays as directed by each theodolite operator, to obtain a preliminary straightening of the mast in the vertical plane.

#### Final straightening

8 Move the theodolite telescope between the lower stay attachment position and the mast base.

#### WARNING ...

DURING THE FOLLOWING PROCEDURE THE SUPERVISOR OF THE PARTY MUST OBSERVE THE WHOLE MAST TO ENSURE A SAFE CONDITION EXISTS AT ALL TIMES.

9 Adjust the mast stays as directed by the theodolite operators to bring the lower stay attachment lug vertically over the mast base.

10 Check that stay tensions are to the figures given in the relevant erecting and dismantling chapter (Chap 3 to 5).

11 Check that the mast is vertical and straight. Re-align if necessary.

12 When satisfied that the lower stay attachment lug is within limits, proceed to the next stay attachment lug.

13 Traverse the telescope between the mast base and the second stay attachment lug.

14 Adjust the mast stays as directed by the theodolite operators to bring the stay attachment lug vertically over the mast base.

15 Check that the stay tensions are to figures given in the relevant erecting and dismantling chapter (Chap 3 to 5).

16 Check that the mast is vertical and straight. Re-align if necessary.

17 Proceed to next attachment lug and align as before.

18 When all positions have been aligned in accordance with the above procedure, finally check all stay tensions.

Chapter 7

ANTI-CORROSION PROTECTION FOR METAL  
FITTINGS USED ON EXTERNAL INSTALLATIONS

CONTENTS

Para

- 1 General
- 2 Extract from specification, drawing no. S.C.59766, sheet 2, issue 5
- 3 Anti-corrosion treatment
- 5 Post-installation servicing

General

1 The following specification extract is included in this Publication for the guidance of personnel involved in the erection of antenna types WB230, WB330 and WB4530.

CAUTION ...

Reference should always be made to the last issue of the actual specification, drawing No. S.C.59766 Sheet 2.

Extract from specification, drawing No. S.C.59766, Sheet 2, issue 5

2 This specification applies to all ferrous and non-ferrous parts employed in external installations for all overseas stations and home stations subject to marine and industrial corrosive atmospheres and should be issued with antenna installation drawings or similar general arrangement drawings.

Anti-corrosion treatment

- 3 Prior to shipping or delivery (preferably at R.E.U.):
  - 3.1 Wash all galvanised surfaces with a mordant solution (lithoform I.C.I. "DETEL" mordant or similar phosphoric acid mordant solution) and allow to dry.
  - 3.2 De-grease all non-galvanised items.
  - 3.3 Paint all metal surfaces with 1 coat of thinned E/P paint (thinning rate 3½ parts paint to 1 part thinners by volume).
- 4 After delivery on site:
  - 4.1 Paint all metal surfaces with a further coat of thinned E/P paint, thinning rates as in para 3.3.
  - 4.2 Paint all metal surfaces with one coat of E/P paint to normal consistency. Where screw threads are involved this final coating is to be made on final assembly to ensure complete coverage of threads etc.

Post-installation servicing

5 After hand-over, the user unit is responsible for maintaining the finish of all metal surfaces and is to ensure that any replacement parts are treated in accordance with para 4 before fitting.

Notes ...

- (1) Exceptions to the specification are copper wire, stainless steel wires and wire ropes flexible and seizing, black bolts and nuts etc.
- (2) The specification does not apply to aluminium poles, crossarms etc., which are covered by a separate specification on drawing No. S.C.59766, Sheet 1.
- (3) Suitable RAF paints for these processes are:
  - (a) 33A/916 Paint DETEL epoxy pitch, with catalyst. Paint must be mixed in the proportion 1 part catalyst to 4 parts resin.
  - (b) 33A/917 Thinners for paint DETEL.
  - (c) 33C/1193 Rust remover, Type E. Inhibited phosphoric acid. DEF 37.
  - (d) With effect from May 1971 33A/916 may bear the description of EVOKOTE PITCH EPOXY ENAMEL MANUFACTURED BY ALWEATHER EVODE LTD.

Chapter 8

ANTENNA ILLUSTRATIONS

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3	Insulator assembly	...	...	...	...	...	...	7/8
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5	Mast and insulator assembly	...	...	...	...	...	...	11/12
6	Lightning arrester assembly	...	...	...	...	...	...	13/14
7	Gin pole assembly	...	...	...	...	...	...	15/16
8	Handwinch installation	...	...	...	...	...	...	17/18
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10	Intermediate antenna wire installation	...	...	...	...	...	...	21/22
11	Lindaptor attachment	...	...	...	...	...	...	23/24
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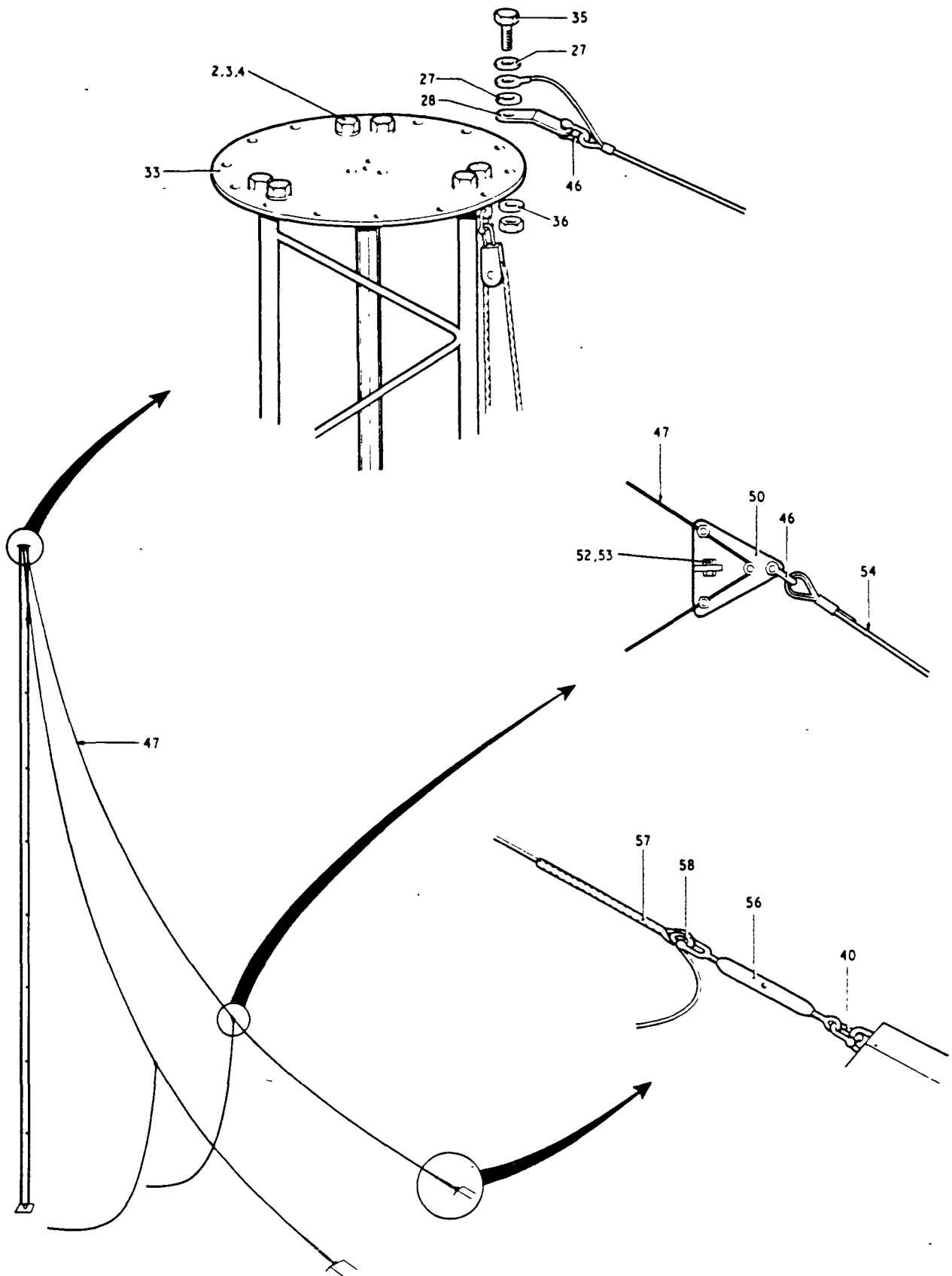


Fig 1 Main antenna wire installation

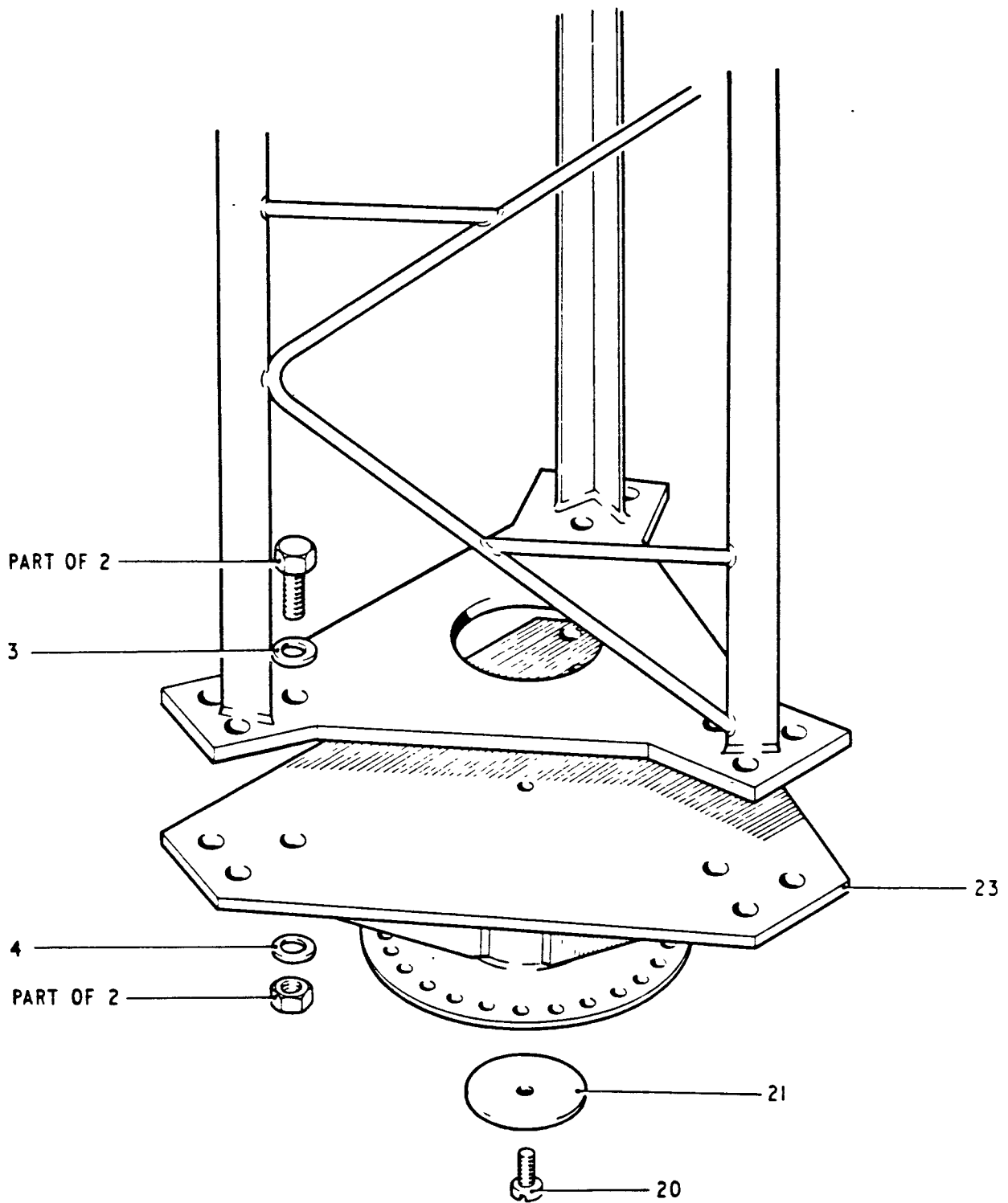


Fig 2 Insulator top unit assembly



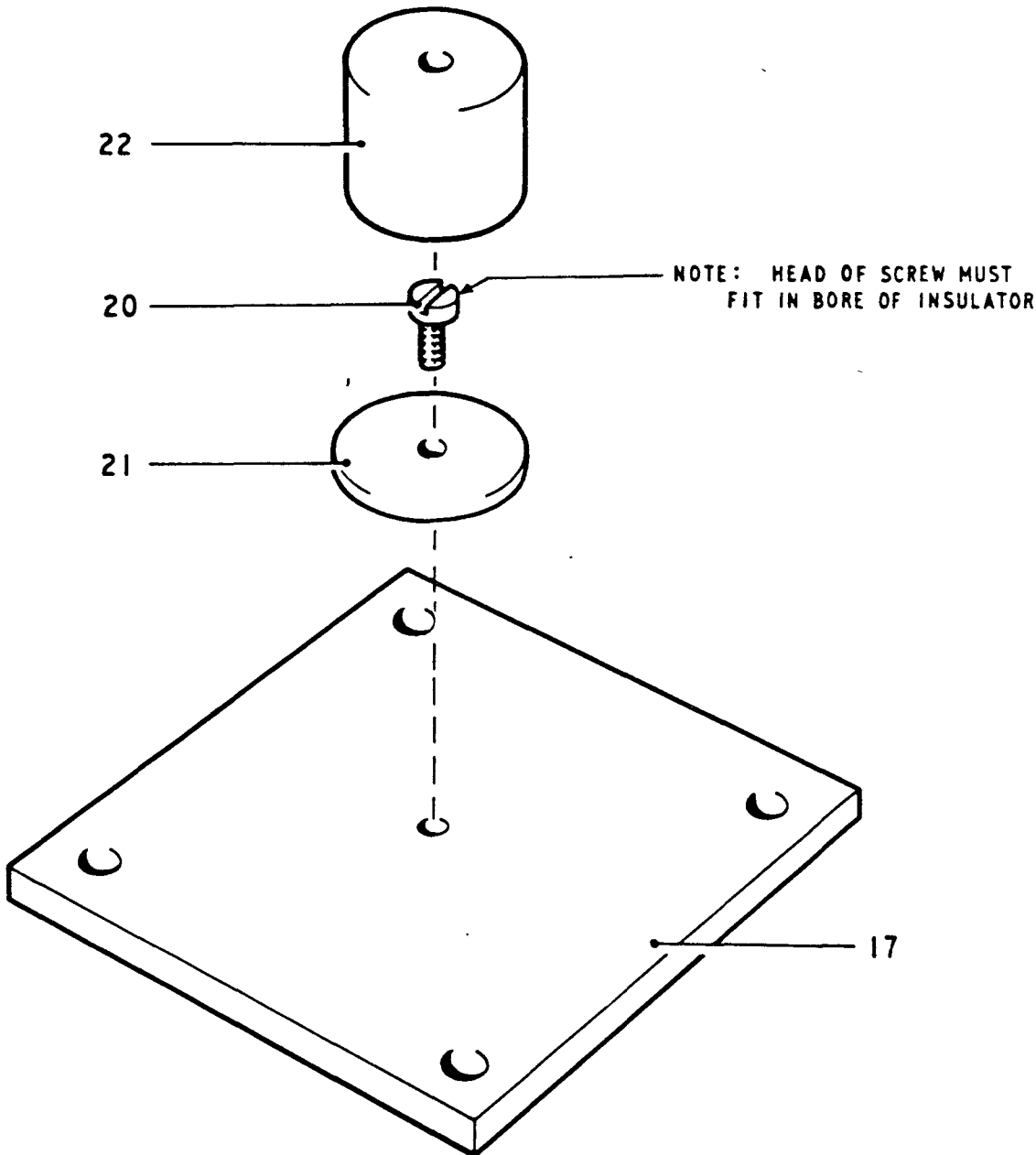


Fig 3 Insulator assembly

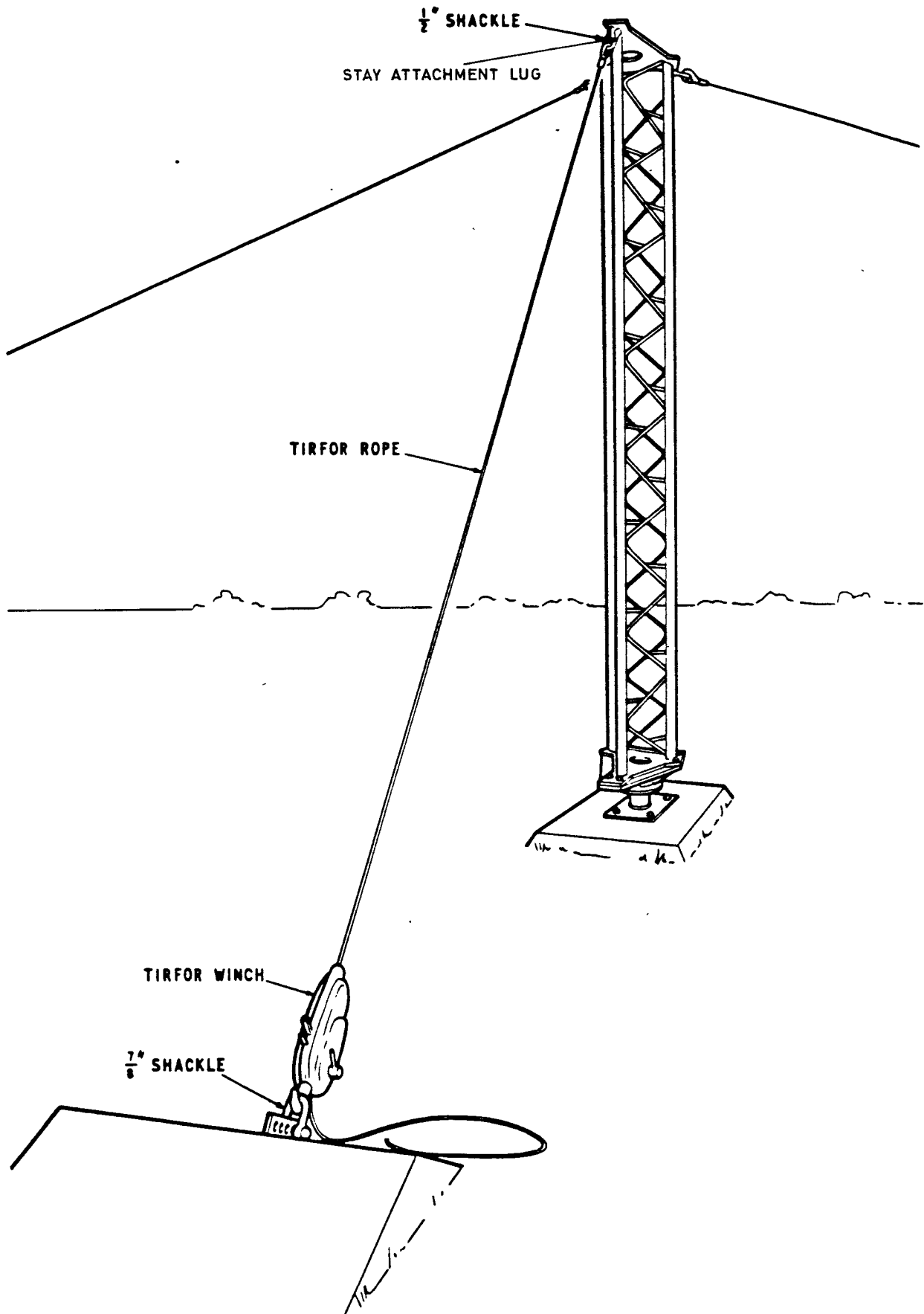


Fig 4 Anchorage of first mast section

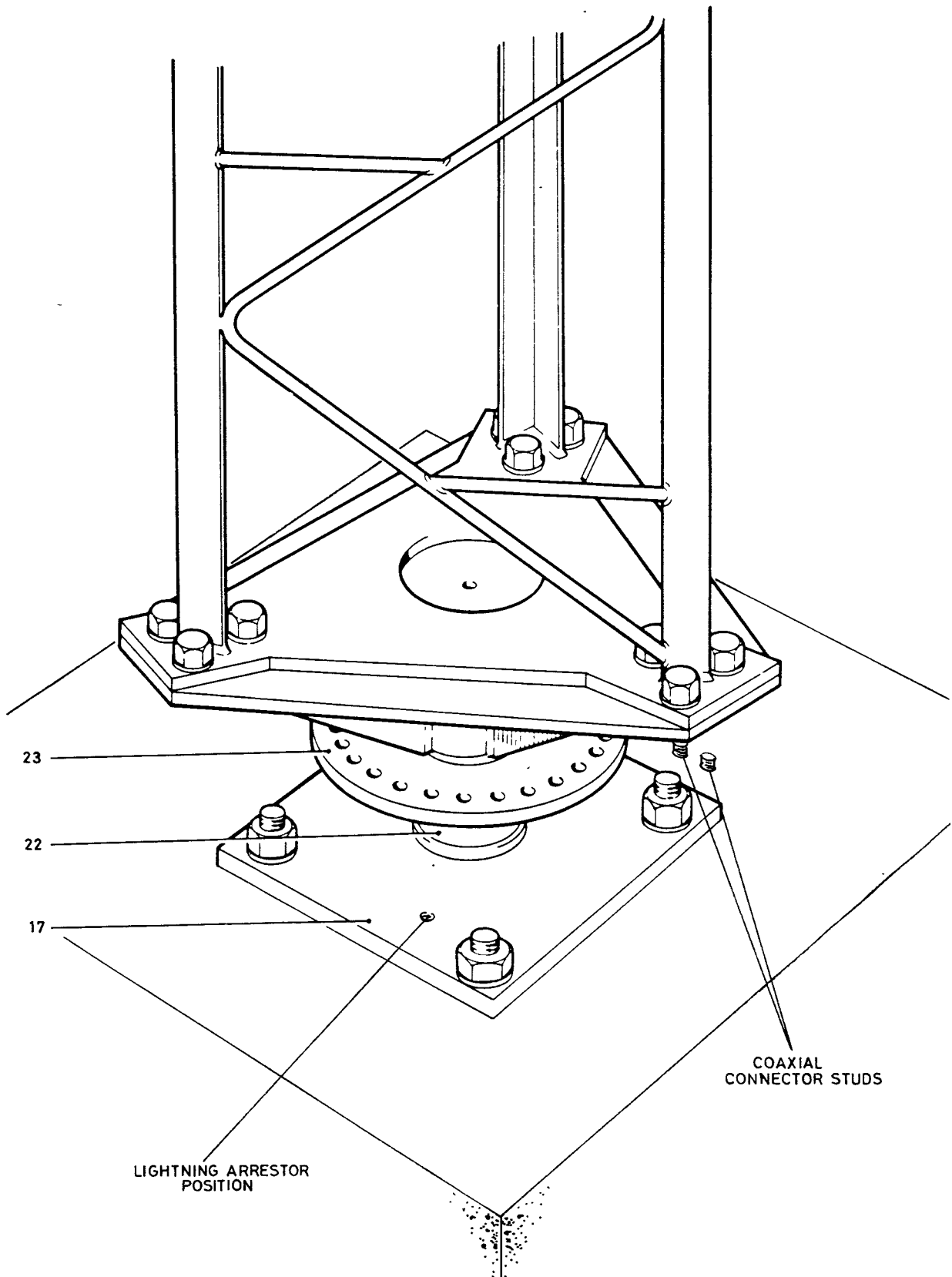


Fig 5 Mast and insulator assembly

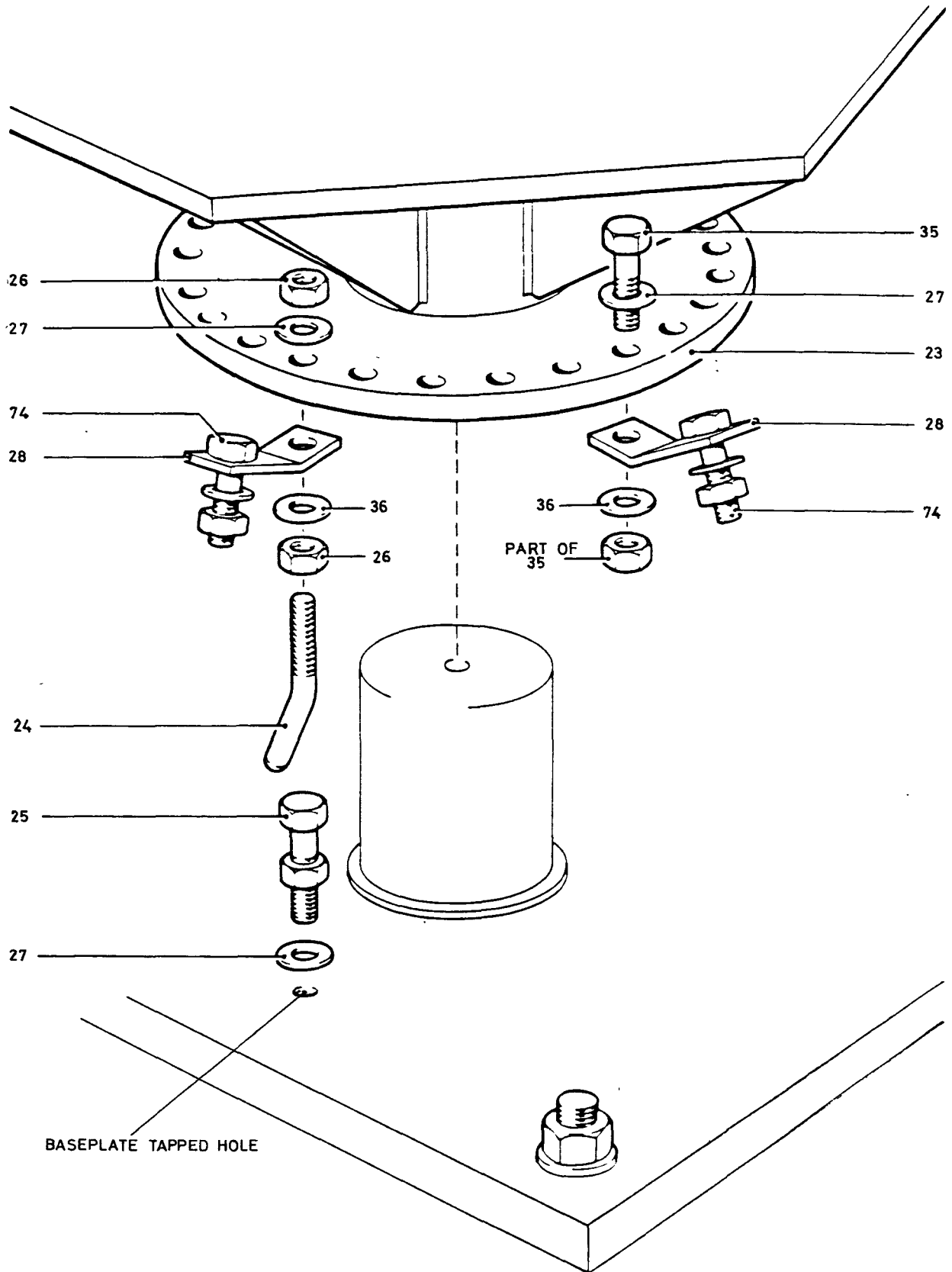


Fig 6 Lightning arrester assembly

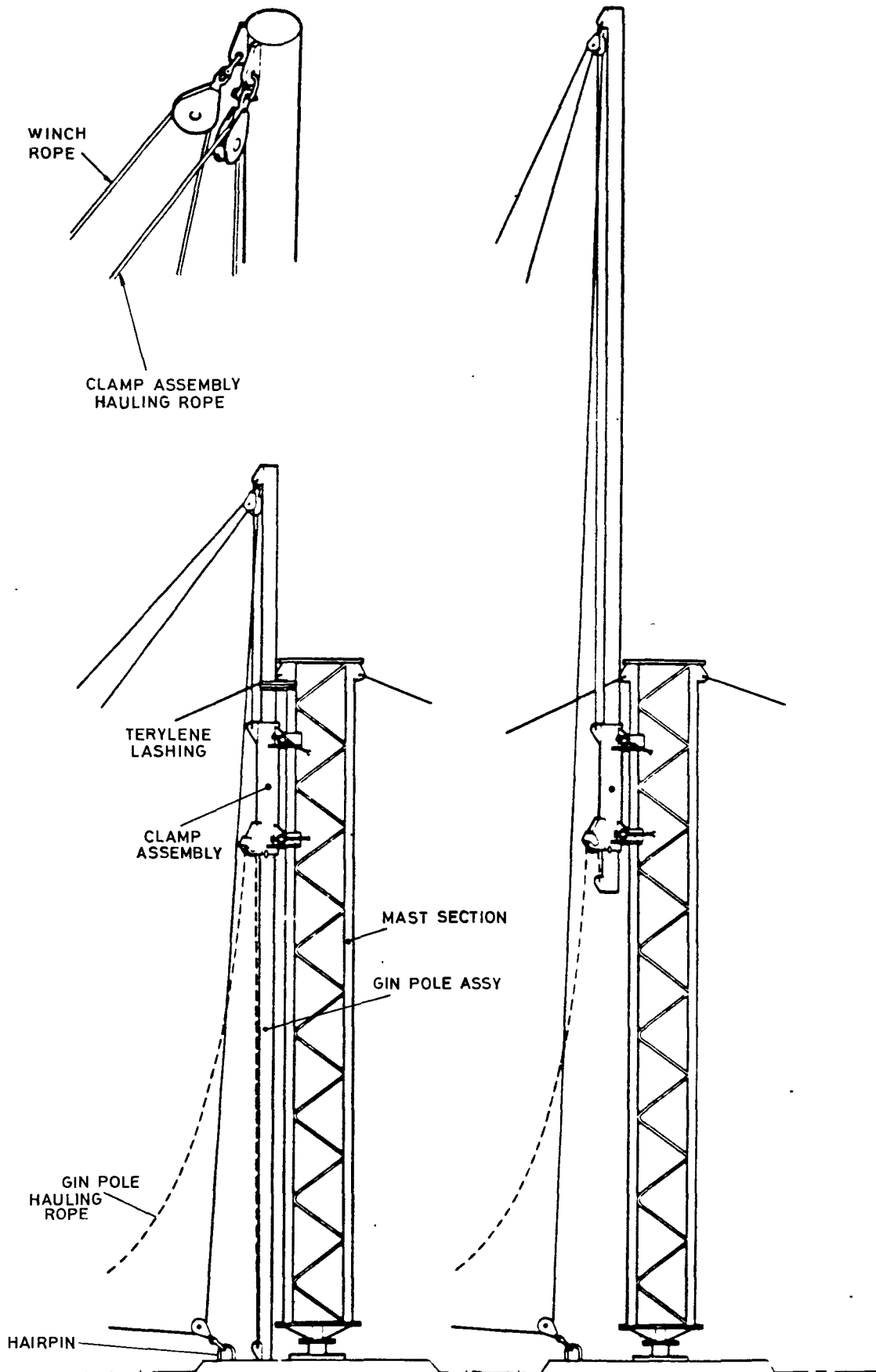


Fig 7 Gin pole assembly

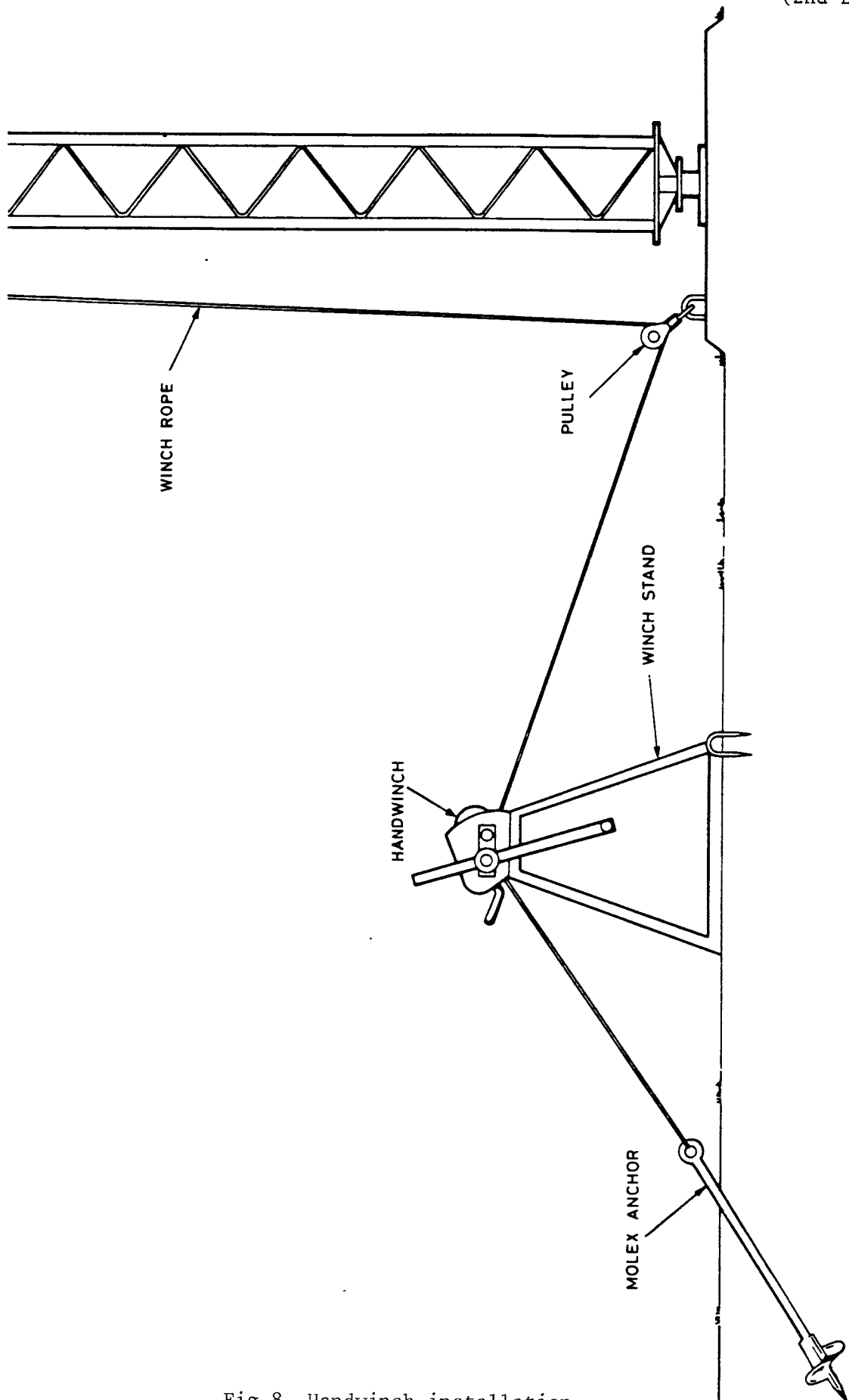


Fig 8 Handwinch installation

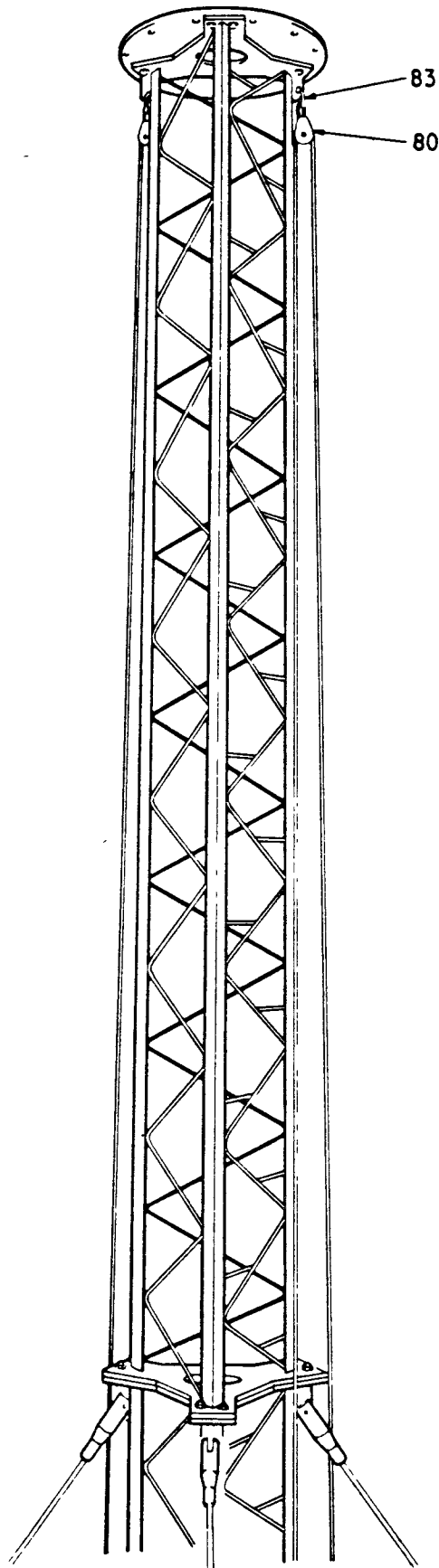


Fig 9 Final mast section

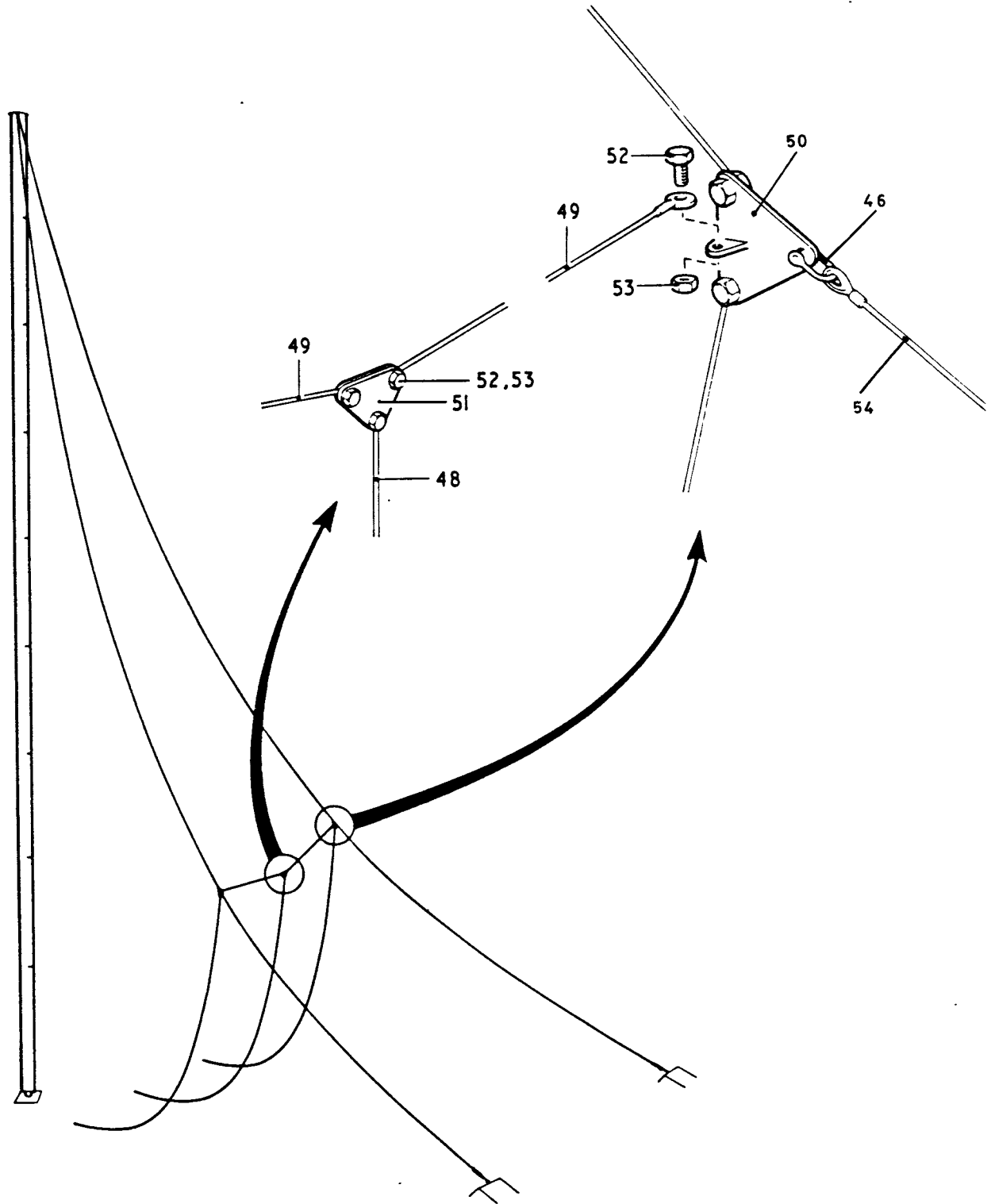


Fig 10 Intermediate antenna wire installation



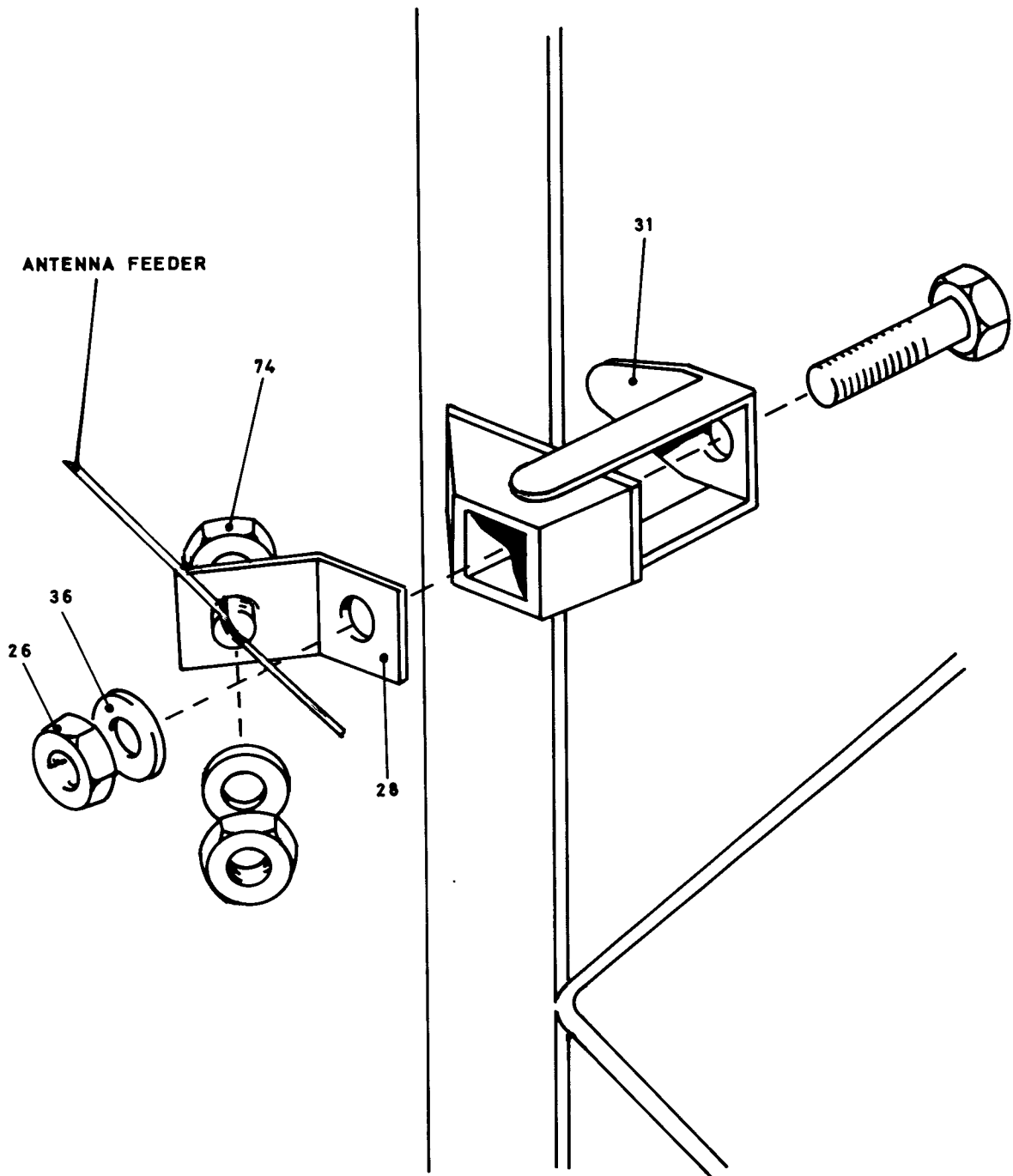


Fig 11 Lindaptor attachment

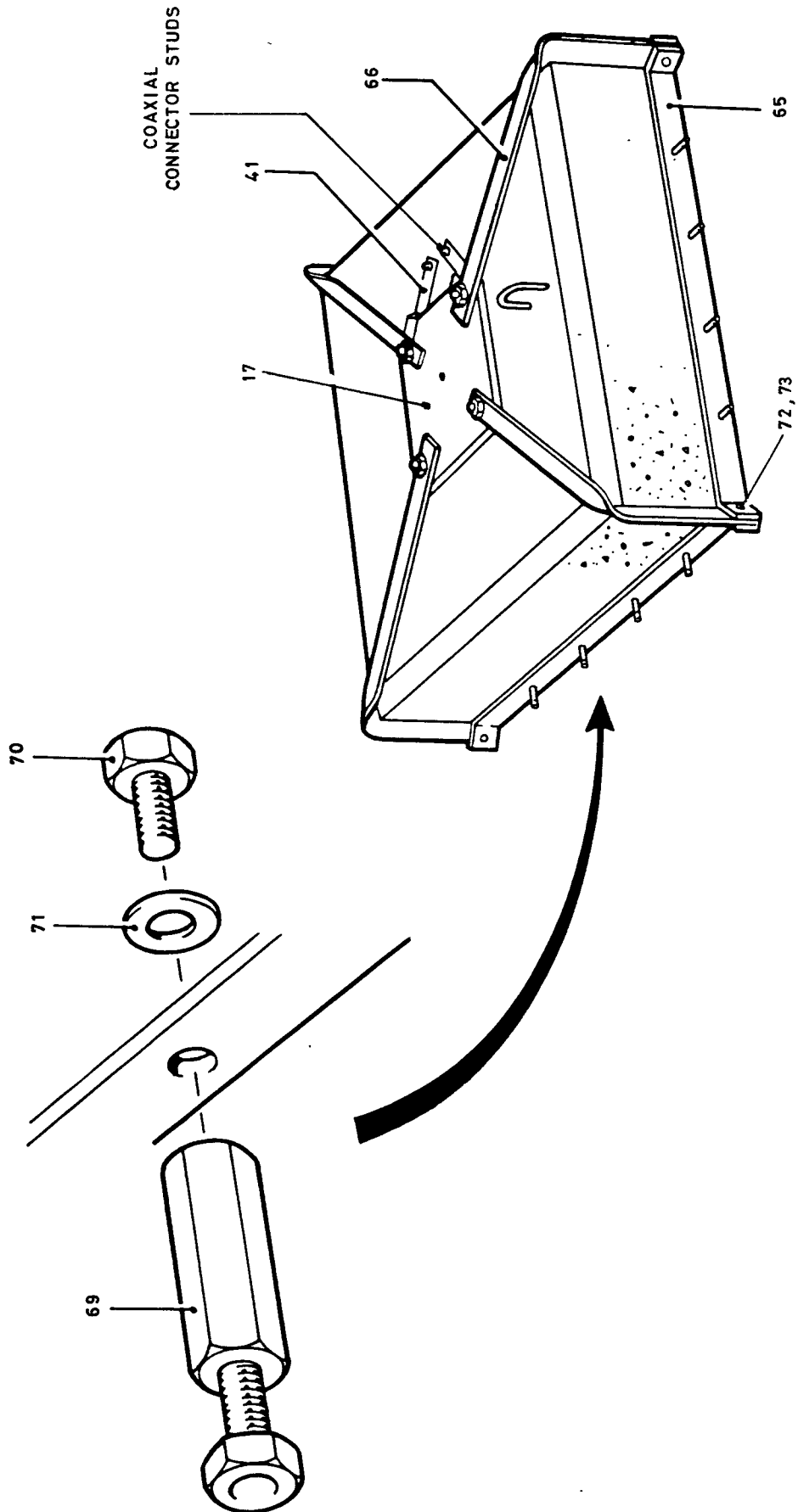


Fig 12 Earth termination assembly

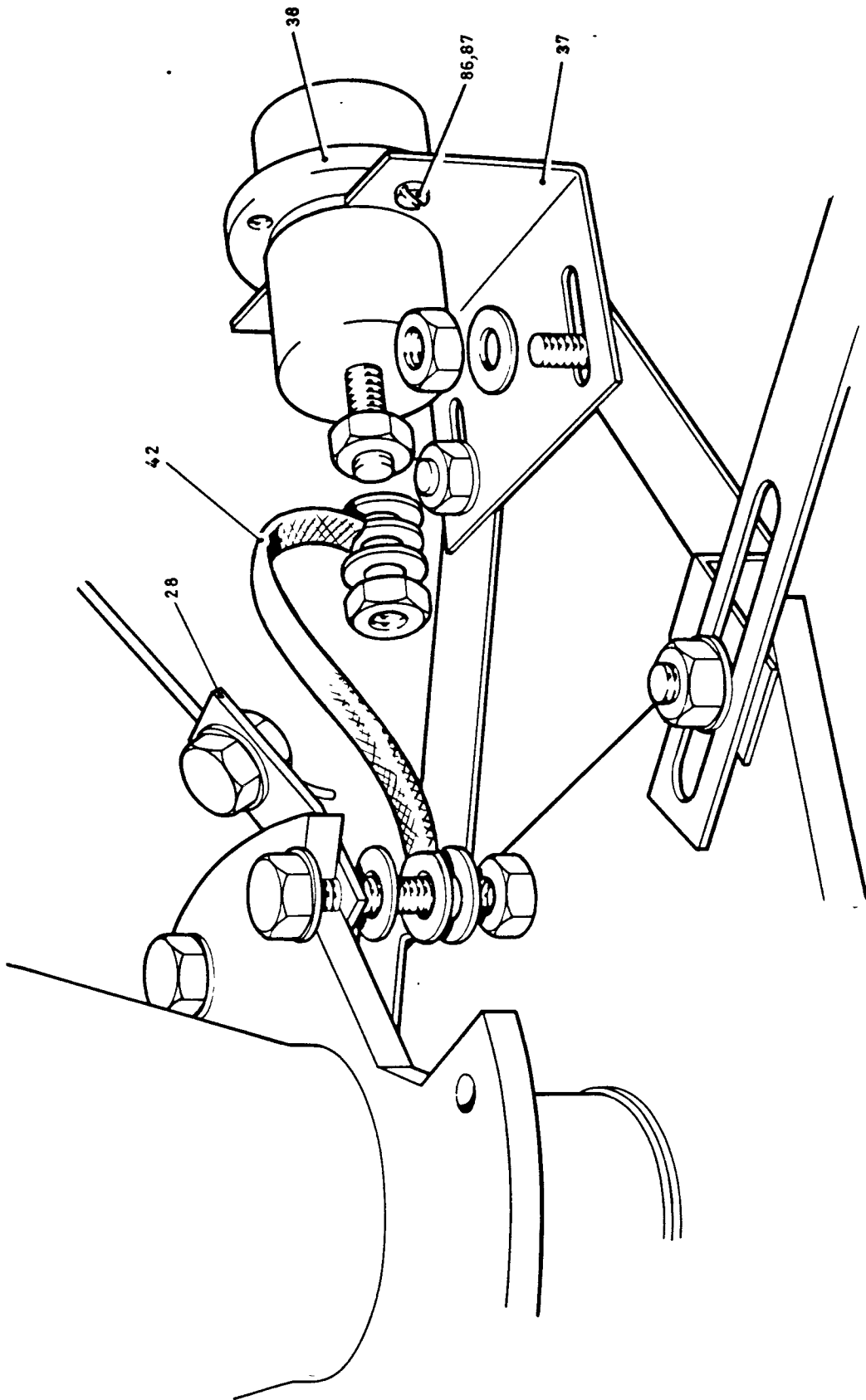


Fig 13 Coaxial connector assembly

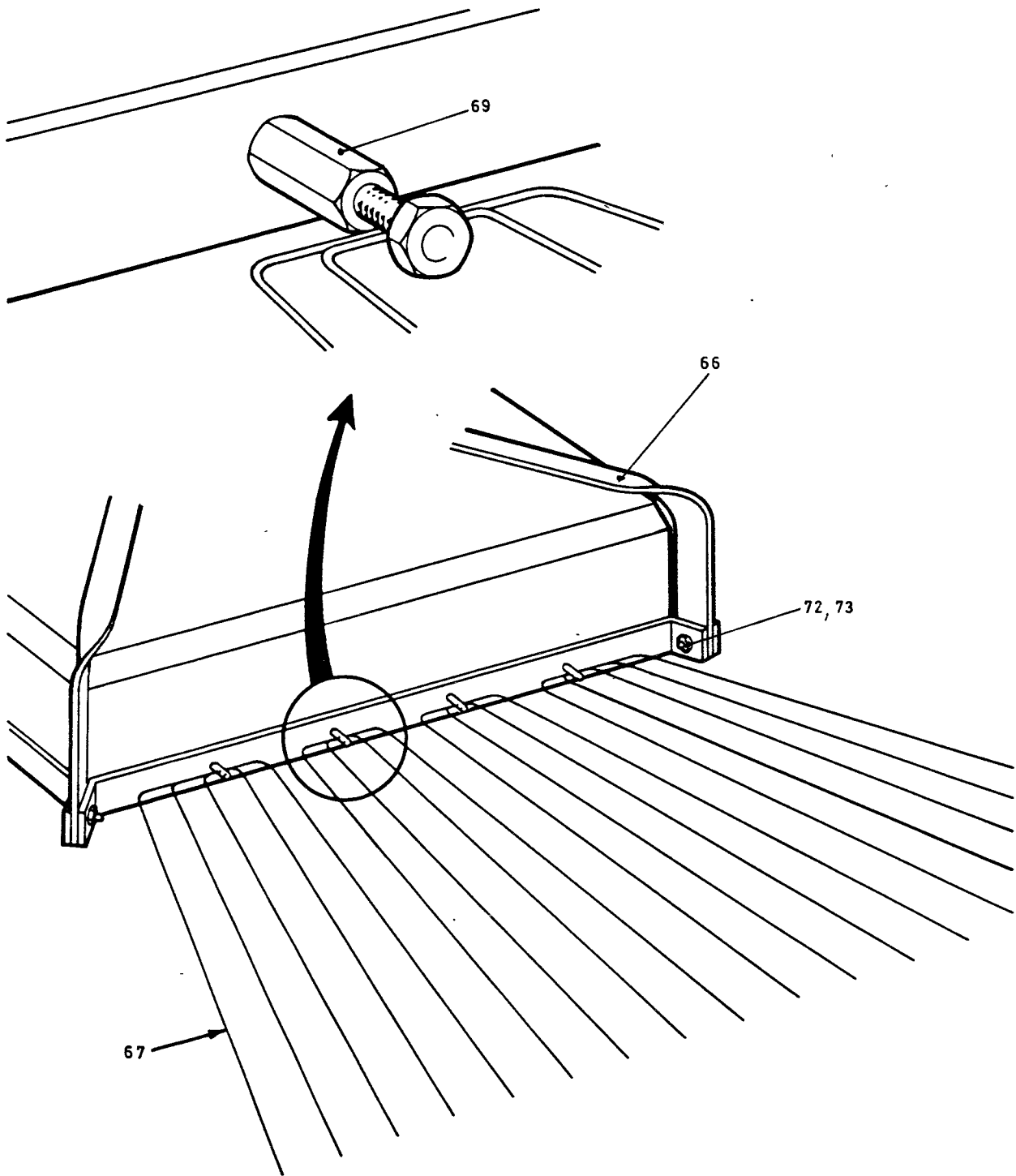


Fig 14 Earth mat assembly