MAN-SAT 150   042

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PEDESTAL

WARNING

VOLTAGES USED IN THIS EQUIPMENT CAN ENDANGER LIFE.

ISOLATE THE EQUIPMENT FROM POWER SUPPLIES BEFORE MAKING INTERNAL ADJUSTMENTS.

IF IT IS ESSENTIAL TO WORK ON LIVE EQUIPMENT, THE WORK MUST ONLY BE PERFORMED BY QUALIFIED PERSONNEL WHO ARE AWARE OF THE RISKS INVOLVED AND WHO HAVE TAKEN ADEQUATE PRECAUTIONS.

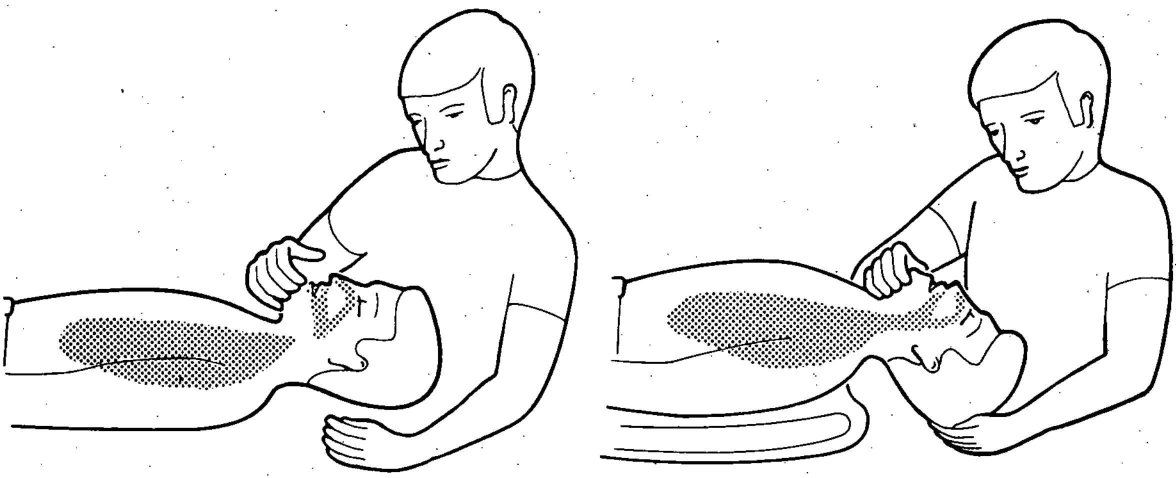
THE PROCEDURE TO BE ADOPTED IN CASES OF ELECTRICAL SHOCK IS GIVEN ON PAGE (iv).

THE 'KISS OF LIFE' RESUSCITATION

WHEN BREATHING HAS STOPPED DUE TO ELECTRIC SHOCK

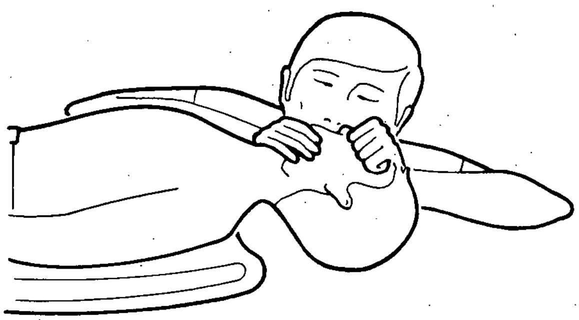
1. INITIAL PROCEDURE

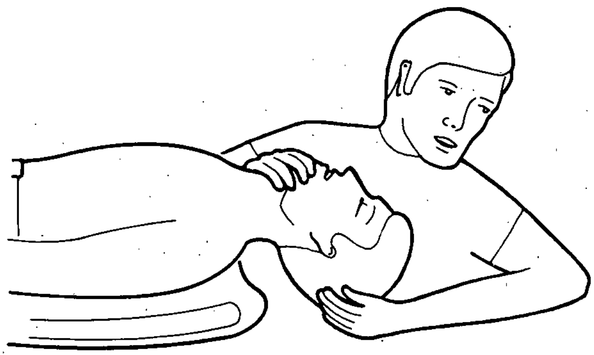
Switch off the current. If this is impossible free the person using something made of rubber, cloth or wood or a folded newspaper; use the casualty's own clothing if dry. Do not touch his skin before the current is switched off. If the victim's breathing has stopped IMMEDIATE EFFORT to restart it is essential. EVERY SECOND COUNTS.



2. STARTING POSITION

Victim face up. Tilt head back and pull chin forward to open air passages.





3. INFLATION

Seal victim's nose by pinching nostrils. Open your mouth wide and inflate the victim's lungs by blowing air into his mouth.

4. EXHALATION

When you see the victim's chest rise remove your mouth to allow the air to escape from his lungs, and turn your head to one side. Continue with 3 & 4 until natural respiration returns.

Do not exceed 10-12 breaths per minute. If stomach contents are regurgitated, turn the victim's head to one side and clean out his mouth. When there are signs of natural respiration returning adjust your breathing to coincide with the victim.

CORRECTION SHEET

E.C.O.'s

The following E.C.O.'s are applicable to the subject of this handbook:

E.C.O.	
0026 0616 0768 0771	Noted but do not affect the handbook content
0390 0669 0711 0741 0745 0748 0766 0797 0623 0740 0770 0808 0815	Incorporated in handbook

* 5

E.C.O.'s

The following E.C.O.'s are applicable to the subject of this handbook:

0026 0268 0616 0768 0771	Noted but do not affect the handbook content
0390 0647 0669 0711 0741 0745 0748 0766 0797 0807	Incorporated in handbook
0623 0740 0770 0808 0815	Not yet incorporated in handbook

PEDESTAL

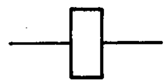
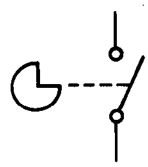
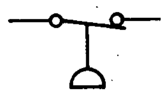
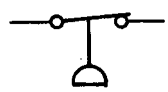
RECORD OF REVISIONS

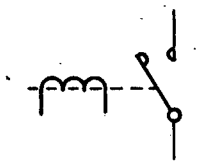
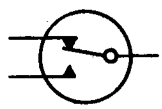
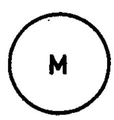
Revision Number	Insertion Date	Signature

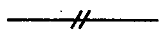
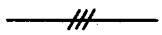
Revision Number	Insertion Date	Signature

CIRCUIT SYMBOLS

The following symbols are used in this handbook:

Circuit Reference	Function	Symbol
d	Relay coil	
d	Relay contacts	
	Auxiliary switch contacts	
b	Pushbutton switch (break)	
b	Cam-operated switch	
b	Rotary switch	
e	Pressure-operated switch (break on falling pressure)	
e	Pressure-operated switch (break on rising pressure)	
a	Isolating fuse-switch	

Circuit Reference	Function	Symbol
c	Contactor	
	Circuit breaker	
S	Switch (Cabling diagram representation)	
e	Thermostat	
r	Heating element	
h	Indicator lamp	
LP	Lamp for illumination	
SK	Socket	
Z	Plug and socket connector	
m	Motor	

Circuit Reference	Function	Symbol
	Two conductors (single line representation)	
	Three conductors (single line representation)	
	Four conductors (single line representation)	
m	Single-phase transformer	
	Screened cable	
	Earth point	
VE	Junction box	

PEDESTAL

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Pedestal

PART ONE

TECHNICAL DETAILS

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PART ONE

SECTION ONE

INTRODUCTION

The pedestal (see Frontispiece) is a steel structure which supports the antenna assembly and contains the necessary servo controlled drive units to position the antenna in both elevation and azimuth. The pedestal is mounted on a concrete support column which extends through the roof of the electronic equipment building.

The moving structure of the pedestal has an elevation over azimuth axes arrangement which, together with the servo, drive and control system, provides a facility to point the antenna accurately to any part of the sky in manually or automatically controlled modes. A tracking receiver provides control signals to the servo and drive system for precise automatic tracking of satellites.

Normally both the pedestal and the antenna are protected from the weather by a radome; but they are designed, constructed and controlled so as to be fully operational, without the radome, in adverse weather conditions with wind velocities up to 96 km/h (60 mile/h).

In addition the antenna is capable of being driven to its stow position in winds gusting to 112 km/h (70 mile/h) and the whole antenna sub-system and mounting is capable of withstanding, when in the stow position, wind speeds up to 192 km/h (120 mile/h) without suffering permanent damage.

PART ONE

SECTION TWO

TECHNICAL DESCRIPTION

1. GENERAL (Figure 2.1-1)

The pedestal consists of the following major components:

a. Base ring (integral with concrete support column).

b. Tower and azimuth toothed ring.

c. Rotary column.

d. Azimuth yoke and platform.

e. Elevation yoke and elevation toothed segment.

f. Cabins for the transmit and receive equipment.

g. Azimuth and elevation bearings.

h. Cable wrap.

j. Drive assemblies (two azimuth and two elevation).

k. Data pick-up units.

m. Cabin air conditioning plant.

The tower and base ring form a fixed structure which serves as the mounting for the moving structure of the pedestal.

The rotary column, to which the whole of the moving structure is secured, is supported on bearings within the tower and is driven in the azimuth plane by the azimuth drive assemblies secured to the azimuth yoke. The drive is effected by gear wheels on the drive assemblies engaging the azimuth toothed ring secured to the top of the tower.

The elevation yoke, which carries the antenna reflector assembly, is supported on bearings in the azimuth yoke and is driven in the vertical plane by the elevation drive assemblies. These drive assemblies are secured to the azimuth yoke and engage the toothed segment of the elevation yoke.

Transmit and receive equipment cabins are located over the platform formed by the roof of the azimuth yoke. These cabins, designated azimuth and elevation cabins respectively, are air conditioned by air conditioning plant sited on the platform.

Cables and cooling water hoses between the fixed moving structures of the pedestal are supported by the cable wrap which also provides take-up of the cables and hoses as the reflector assembly rotates.

Data relating to the azimuth and elevation positions of the reflector assembly are supplied to the servo and drive sub-system by an azimuth data pick-up unit and an elevation data pick-up unit respectively.

The reflector assembly can be turned through a total angle of 400° in azimuth, i.e. -20° to $+380^{\circ}$ referred to the north marking on the base ring, and 94° in elevation, i.e. -2° to $+92^{\circ}$ referred to horizontal. It is possible to lock the reflector assembly at $+180^{\circ}$ (South) in azimuth and at 0° or $+90^{\circ}$ in elevation for maintenance or for safety in adverse weather conditions.

The reflector assembly can be positioned either automatically from the tracking receiver, or, in a variety of modes from the station control console in the electronic equipment building and the control panel in the elevation cabin. Handwheels are provided on the drive assemblies to enable the reflector assembly to be moved by hand cranking.

Pre-limit and emergency limit switches are provided on both the elevation and azimuth movements to prevent the reflector assembly being driven to the mechanical limits of movement under power. (Refer to the Antenna Servo, Drive and Control Sub-system Handbook No. 601). Buffers on the elevation axis prevent the reflector assembly from contacting the pedestal structure.

For lightning protection and discharge of static electricity, the pedestal is securely earthed, via its base ring, to the station earthing system. The elevation bearings are bridged with low resistance, braided copper strips and the azimuth bearings by three heavy duty brushes which make contact with a copper ring fitted around the top of the tower.

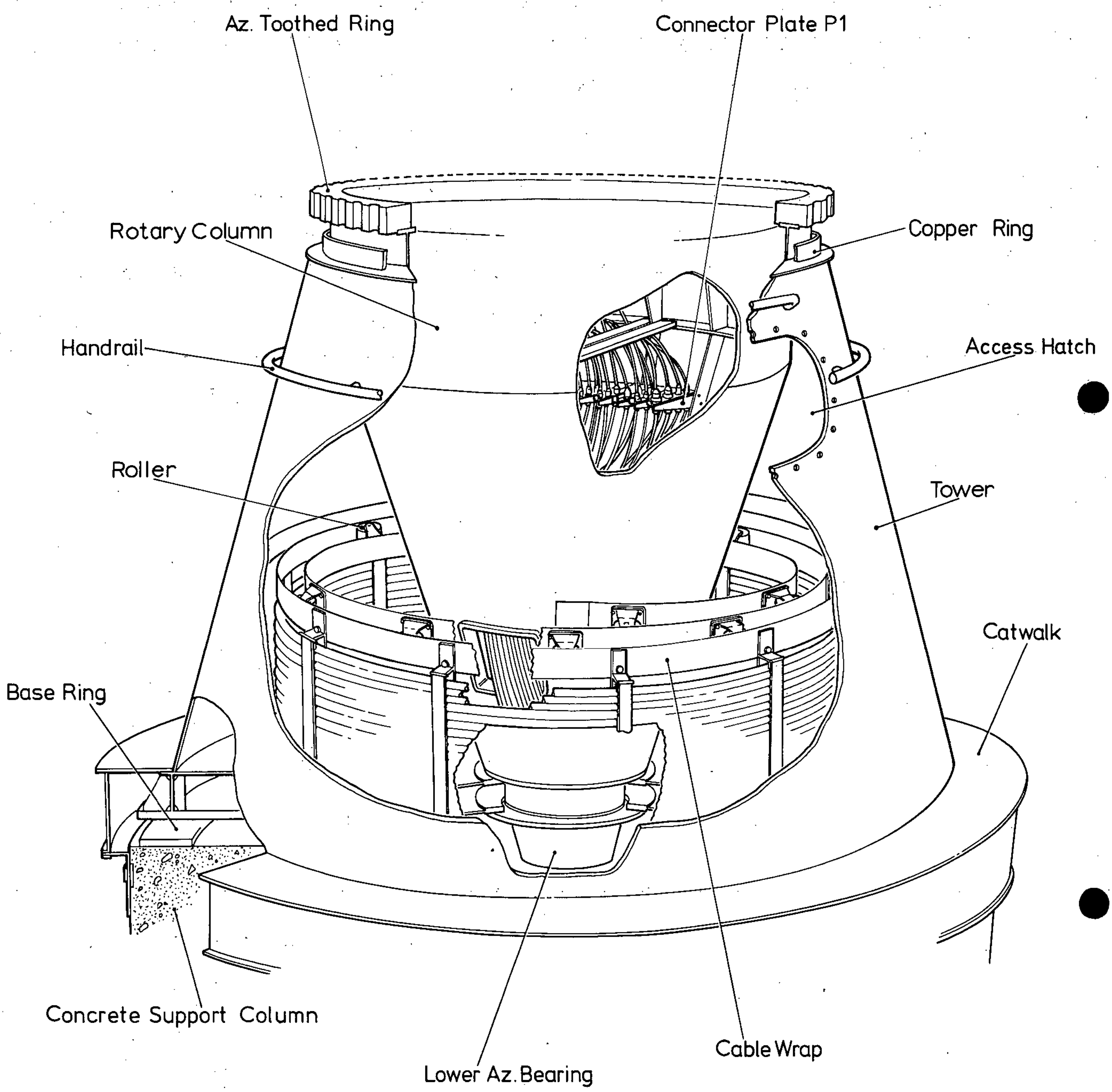
2. <u>FIXED STRUCTURE</u> (Figures 2.2-1 and 2.2-2)

The fixed structure comprises the steel base ring which is embedded in the top of the concrete support column and the steel tower for which the base ring forms the anchorage. The base ring must be levelled to an accuracy of ±2 mm (±0.078 in) and orientated to within $\pm 1^{\circ}$ of true north when the concrete is poured during construction of the support column (tolerance of equipment building axis with reference to true north is $\pm 15^{\circ}$).

The tower, which houses the cable wrap and rotary column, is constructed in truncated, hollow cone form with a steel spider base by which it is secured to the base ring at six equi-spaced positions. At each position there are two anchor bolts and one jacking screw (Figure 2.2-1). The jacking screws provide a means of levelling the pedestal, after which the nuts on the anchor bolts are tightened to a prescribed torque so as to obtain a defined pre-stressing of the anchoring arrangement.

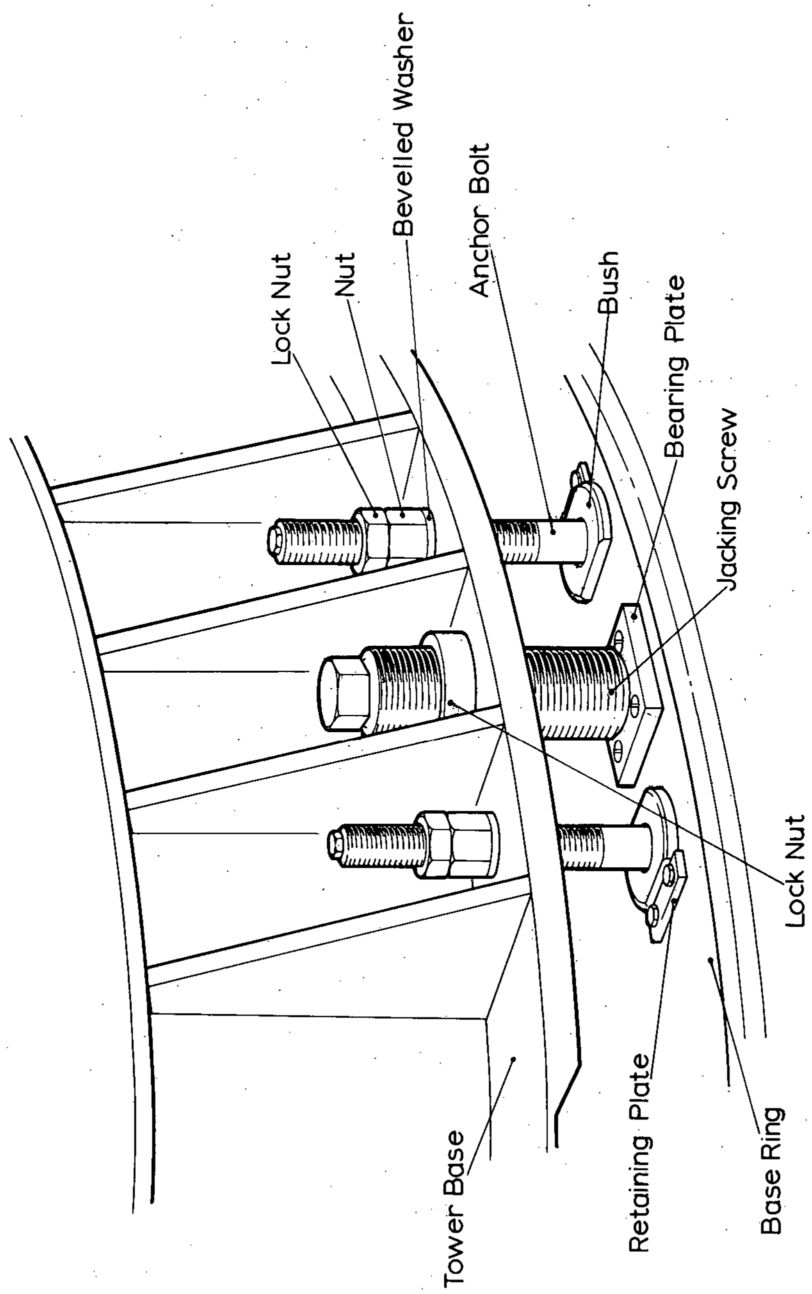
A bearing housing, secured to the underside of the steel spider, houses the lower azimuth bearing. This bearing is attached to the lower end of the rotary column and supports the full vertical load imposed on the column and contributes towards supporting the column against horizontal forces.

The azimuth toothed ring is mounted on the top of the tower; the inner surface of the ring is machined to provide the runrace for the 12 rollers mounted on the rotary column, which form the upper azimuth bearing. The outer face of the ring meshes with the output pinions of the azimuth drive assemblies. A copper ring, secured to the tower beneath the azimuth toothed ring, is provided for lightning protection, (refer to Sub-section 12).



Tower, Cable Wrap and Rotary Column

Fig. 2.2-1



Tower Jacking Screw and Anchor Bolts

Fig. 2.2-2

To prevent twisting of the tower anchoring under torsional loading, two pairs of screws are located at the tower base and bear against plates which form part of the tower structure (refer to Section 4, Sub-section 2).

Two azimuth range switches and two azimuth emergency limit switches are located on the inner face of the tower, above the hatch opening, and are operated by strikers on the rotary column (refer to Sub-section 8).

A handrail is provided around the outside of the tower, approximately 1.4 m (4 ft) above the base ring. A hatch in the side of the tower gives access to the cable wrap.

3. MOVING STRUCTURE

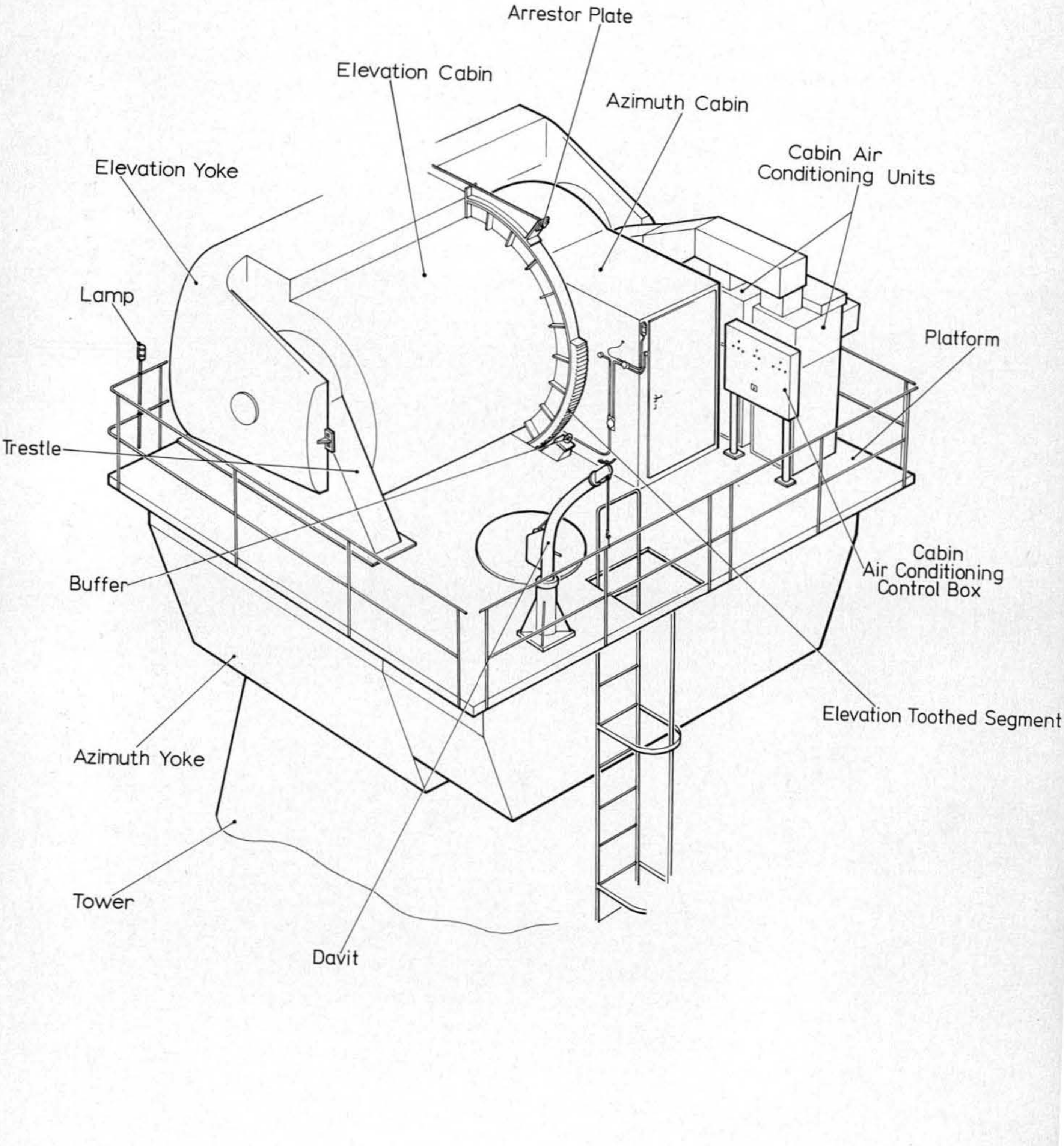
3.1 ROTARY COLUMN (Figure 2.2-1)

The rotary column, constructed in the form of an inverted, truncated, hollow cone, is supported within the tower by the lower and upper azimuth bearings. The rollers of the upper azimuth bearing, which maintain the rotary column central about the vertical axis of the pedestal, are adjustable (refer to Sub-section 4.1). The rotary column provides the azimuth pivot axis for the whole of the moving structure of the pedestal.

The azimuth position data pick-up unit is mounted on an extension of the lower azimuth bearing shaft, its reference lever being secured to the concrete support column.

3.2 AZIMUTH YOKE (Figure 2.3-1)

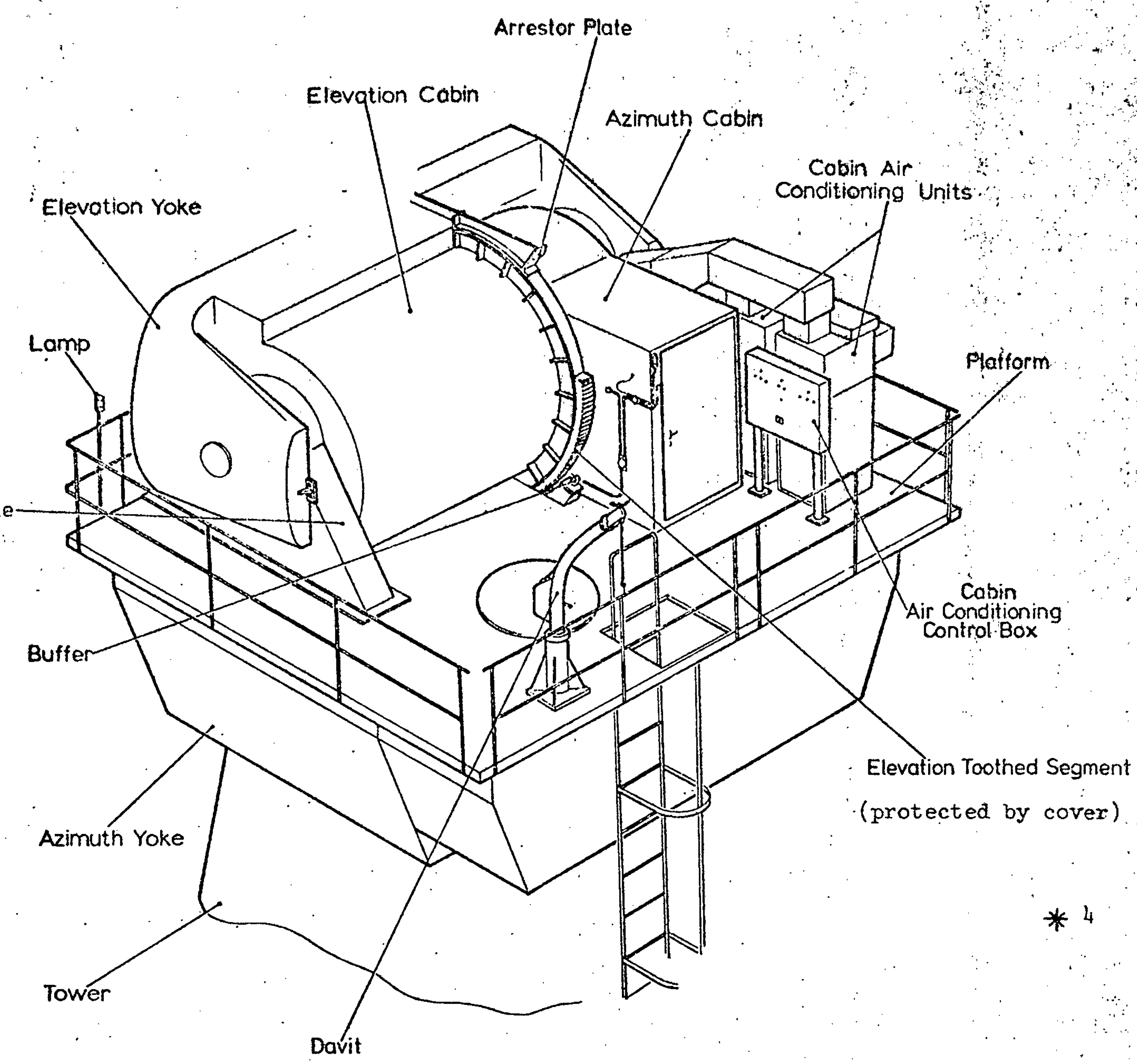
The azimuth yoke is secured to the top of the rotary column and houses the motors and gearboxes through which the antenna assembly is turned. Movement in azimuth is limited to between -20° and $+380^{\circ}$ (referred to the north mark of the base ring) by the pre-limit and emergency limit switches located in the tower.



Azimuth and Elevation Yokes

Fig. 2.3-1

CORRECTION SHEET



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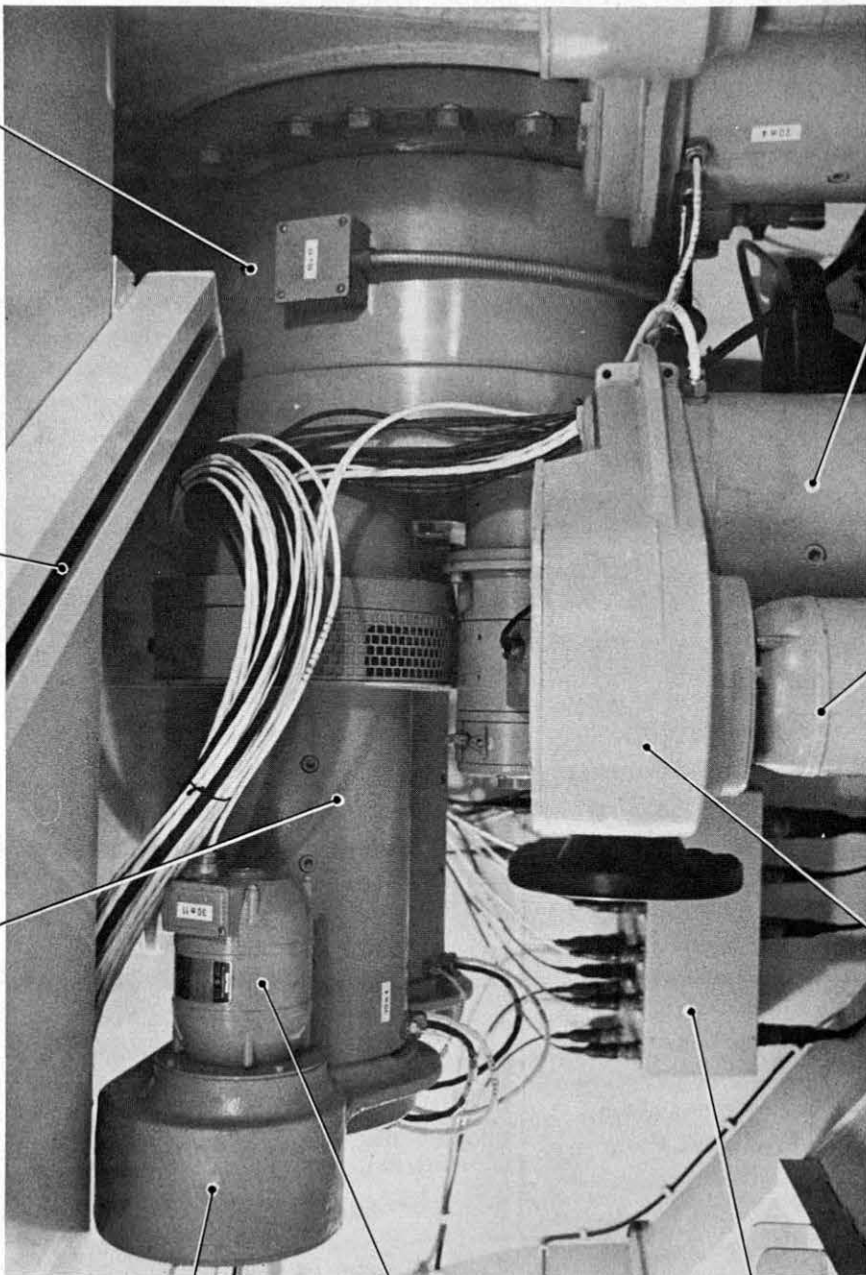
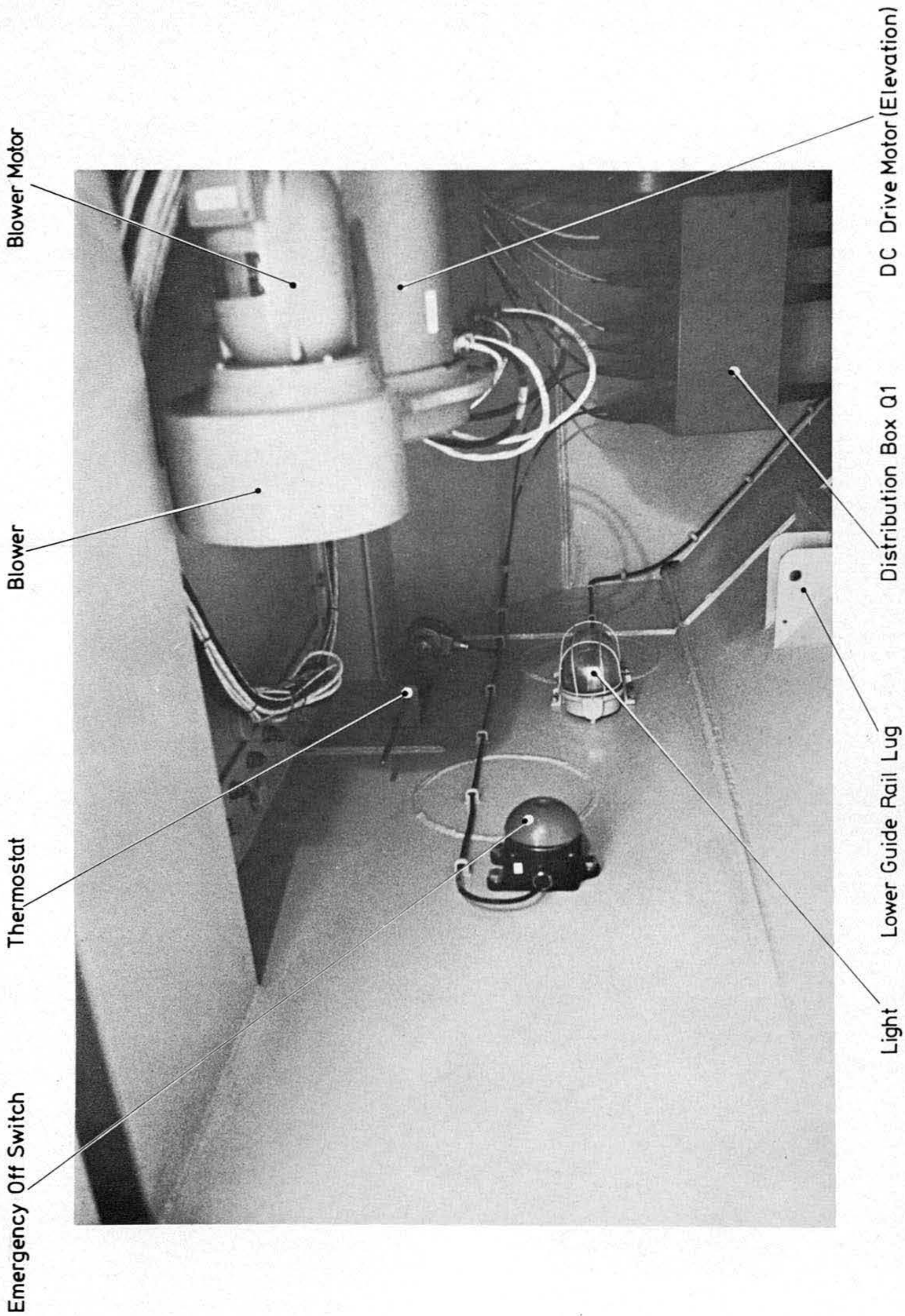
Azimuth and Elevation Yokes

Fig. 2.3-1



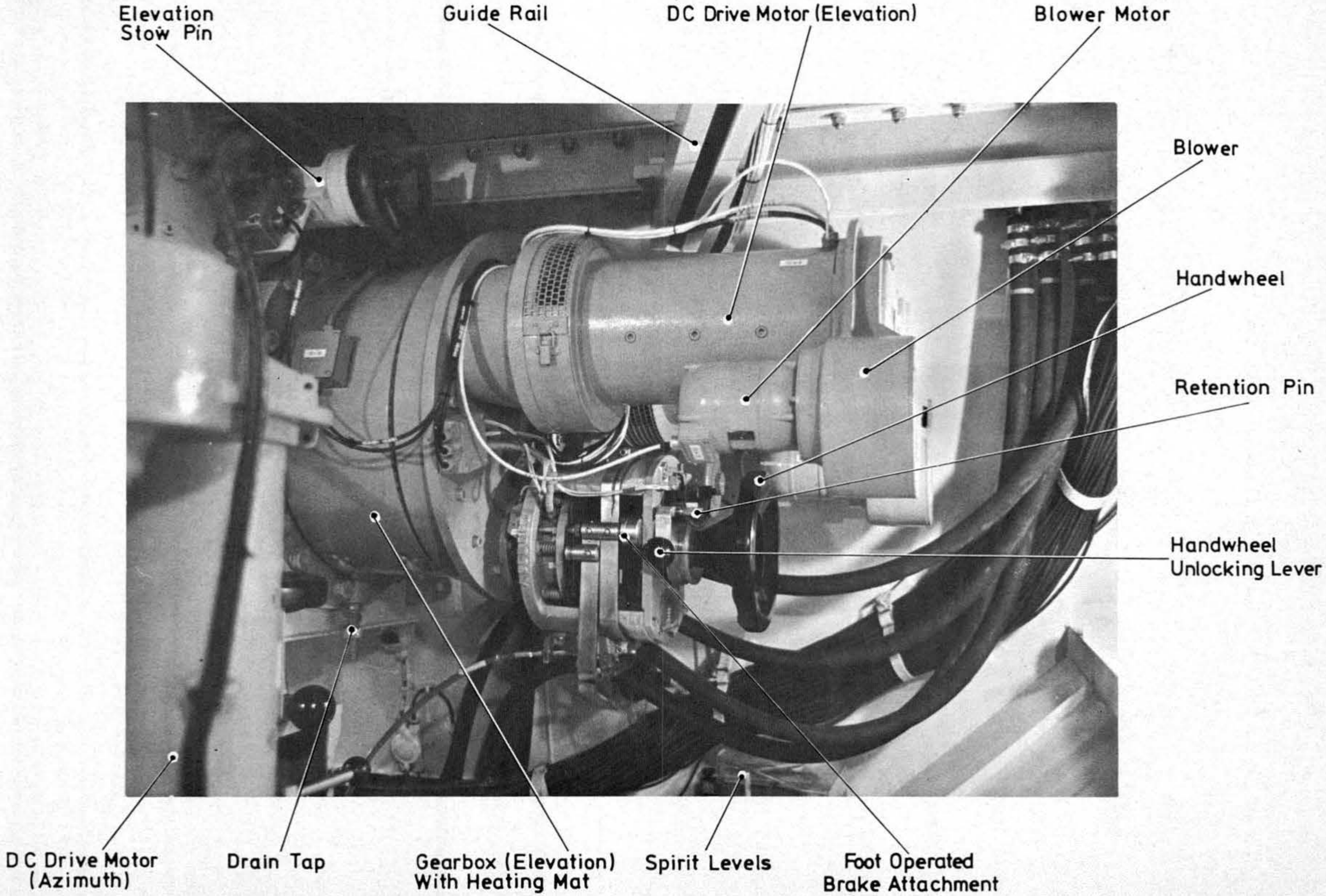
Left-Hand Chamber, Gearbox Room

Fig. 2.3-2



Left-Hand Chamber, Gearbox Room

Fig. 2.3-3



Right-Hand Chamber, Gearbox Room

Fig. 2.3-4

The interior of the azimuth yoke, designated the gearbox room, is partially divided into two chambers by the casing of the elevation toothed segment. The left-hand chamber (Figures 2.3-2 and 2.3-3 houses distribution boxes Q1 and Q3, drive assemblies ABI and ABIII, a thermostat and a self-locking EMERGENCY OFF switch for the servo drive system. The switch must be released, after operation, before servo power can be restored.

The thermostat may be set to operate at a desired room temperature between 0°C and 20°C. Recommended temperature is 10°C. When the air temperature in the gearbox room falls below the preset level, heating mats around the gearboxes are switched on automatically and the d.c. drive motor fields and blower motors are energized. (Refer to the Antenna Servo, Drive and Control Sub-system Handbook No. 601).

The right-hand chamber (Figure 2.3-4) contains drive assemblies ABII and ABIV and distribution boxes Q2 and Q4.

The distribution boxes supply the drive assemblies as follows:

Distribution Box	Drive Assemblies	Axis
Q1 Q2	ABI ABII	Elevation
Q3 Q4	ABIII ABIV	Azimuth

Two stow pins, one for elevation and one for azimuth, are located in the right-hand chamber (refer to Sub-section 7); also a pair of spirit levels, mounted in a common case, which are used during levelling of the pedestal.

Guide rails, bolted to the roof of the gearbox room, enable the motors and gearboxes to be moved during assembly, maintenance and dismantling. Special lifting equipment is provided for use with the guide rails.

A drainage channel through the front wall of the azimuth yoke, drains away any water which enters the elevation toothed segment casing.

A telephone pick-up point is provided in the gearbox room.

3.2.1 Platform (Figure 2.3-1)

The roof of the azimuth yoke projects beyond the rear of the yoke and is extended at the sides by side members to form a platform.

The platform provides access to the cabins and supports the air conditioning equipment and a davit. A ladder at the rear gives access to the platform. A circular servicing hatch, located adjacent to the davit, allows access to the gearbox room. The platform is fitted with a safety rail, part of which, adjacent to the davit, can be lowered to facilitate hoisting and lowering equipment to or from the platform.

Two trestles, forming part of the azimuth yoke, are mounted on the platform and house the elevation bearings which support the elevation yoke.

3.3 ELEVATION YOKE (Figure 2.3-1)

The elevation yoke supports the antenna assembly and also carries the elevation cabin. A toothed segment, attached to the elevation cabin, is driven by the output pinions of the two elevation gearboxes. The elevation yoke can be rotated through an angle of 94^{o} (-2^{o} to $+92^{o}$ referred to horizontal).

Arrestor plates, secured to the elevation yoke, contact buffers on the azimuth yoke if the antenna reflector rotates beyond the emergency limit switch positions. This protects the reflector from being damaged by the pedestal structure. Electric drive of the reflector in elevation is limited by the pre-limit switches, located in the data pick-up unit, and the emergency limit switches, located in the elevation cabin.

CORRECTION SHEET

A drainage channel through the front wall of the azimuth yoke, drains away any water which enters the elevation toothed segment casing.

A telephone pick-up point is provided in the gearbox room.

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The roof of the azimuth yoke projects beyond the rear of the yoke and is extended at the sides by side members to form a platform.

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The elevation yoke supports the antenna assembly and also carries the elevation cabin. A toothed segment, attached to the elevation cabin, is driven by the output pinions of the two elevation gearboxes. The elevation yoke can be rotated through an angle of 94^{o} (-2^{o} to $+92^{o}$ referred to horizontal).

Arrestor plates, secured to the elevation yoke, contact buffers on the azimuth yoke if the antenna reflector rotates beyond the emergency limit switch positions. This protects the reflector from being damaged by the pedestal structure. Electric drive of the reflector in elevation is limited by the pre-limit switches, located in the data pick-up unit, and the emergency limit switches, located in the elevation cabin.

3 The EL tooth segment is protected by a cover. For maintanance purpose the front of the cover can be removed.

CORRECTION SHEET

3.4 CABINS (Figures 2.3-1 and 2.3-5)

Two inter-connected cabins, designated azimuth cabin and elevation cabin, are positioned between the arms of the elevation yoke. Access to the cabins is from the platform, through a door in the azimuth cabin. A microswitch, actuated by the cabin door, operates a level 2 alarm (ANCILLARY EQUIPMENT) at the station control console if the cabin door is not closed. (Refer to the Ground Station Control Console Handbook No. 700). If required, the alarm can be removed by pulling the microswitch operating plunger down and out.

The cabins contain transmitting and receiving equipment for the communications system and are air conditioned to provide optimum operating conditions.

Access between the cabins is through a rectangular opening in the azimuth cabin which is adjacent to a circular opening in the elevation cabin.

3.4.1 Azimuth Cabin

The azimuth cabin is attached to the roof of the azimuth yoke and contains the following equipment:

a. Two second-up converters.

b. Two intermediate power amplifiers.

c. Two high power amplifiers.

d. Associated waveguide and coolant piping.

e. Power distribution box.

f. Thermostat.

The thermostat is positioned in front of the air conditioning exhaust air grille and the power distribution box is mounted above the grille.

A telephone connection point is provided in the azimuth cabin.

The AZ-cabin entrance is protected by a roof against wind, rain and snow. * 2

3.4 CABINS (Figures 2.3-1 and 2.3-5)

Two inter-connected cabins, designated azimuth cabin and elevation cabin, are positioned between the arms of the elevation yoke. Access to the cabins is from the platform, through a door in the azimuth cabin. A microswitch, actuated by the cabin door, operates a level 2 alarm (ANCILLARY EQUIPMENT) at the station control console if the cabin door is not closed. (Refer to the Ground Station Control Console Handbook No. 700). If required, the alarm can be removed by pulling the microswitch operating plunger down and out.

The cabins contain transmitting and receiving equipment for the communications system and are air conditioned to provide optimum operating conditions.

Access between the cabins is through a rectangular opening in the azimuth cabin which is adjacent to a circular opening in the elevation cabin.

3.4.1 Azimuth Cabin

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a. Two second-up converters.

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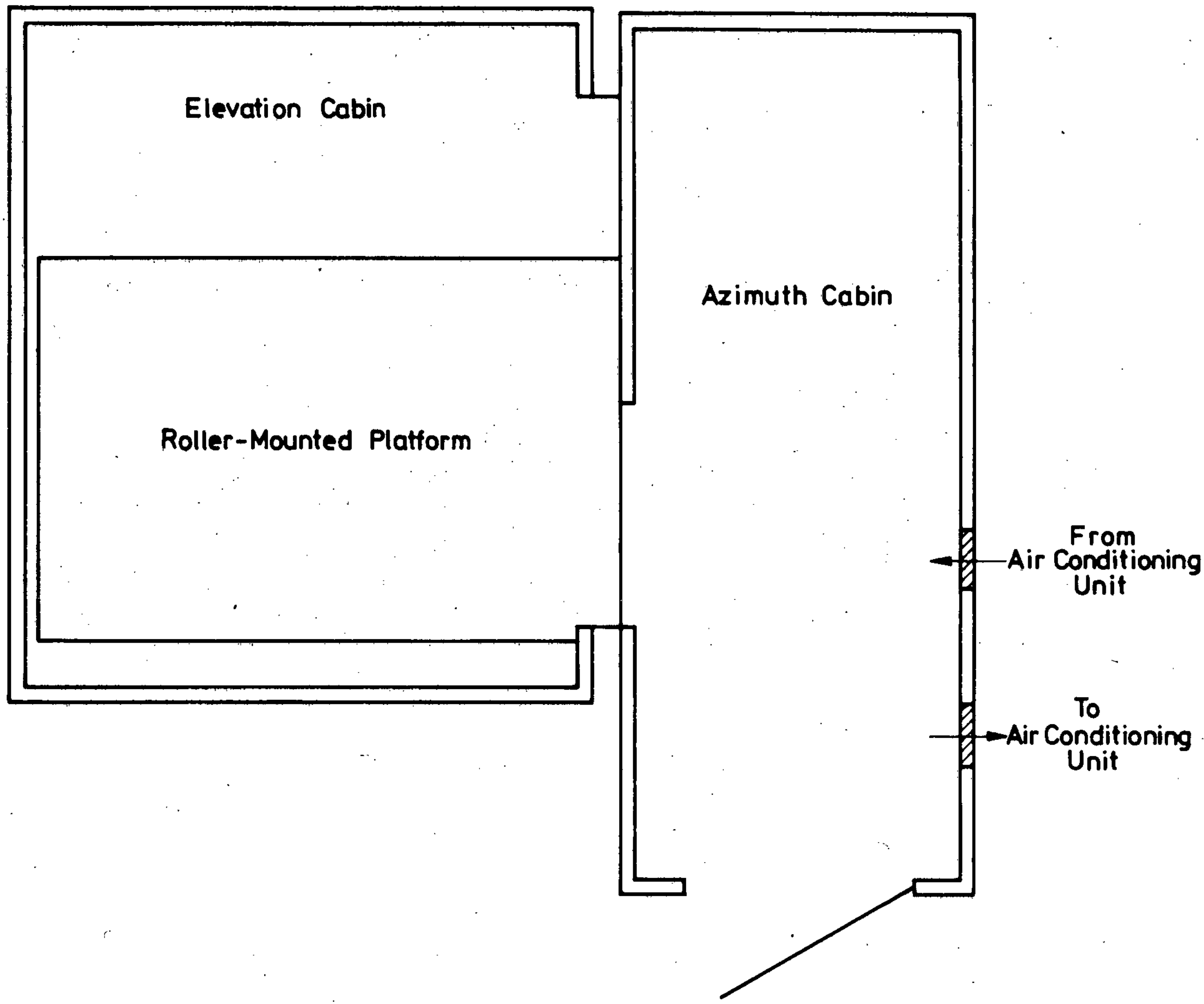
The thermostat is positioned in front of the air conditioning exhaust air grille and the power distribution box is mounted above the grille.

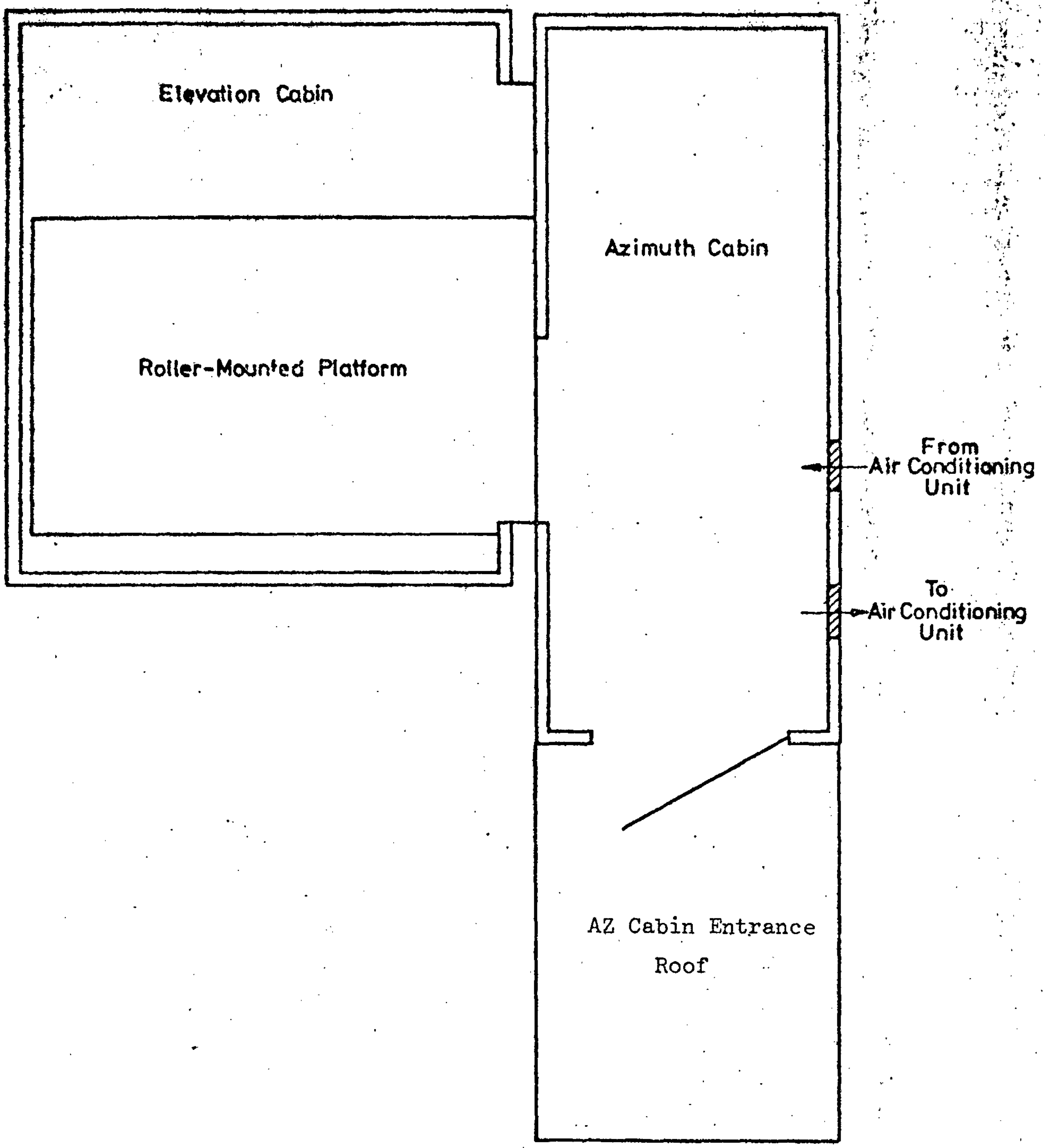
A telephone connection point is provided in the azimuth cabin.



Cabins-Plan View

Fig. 2.3-5

CORRECTION SHEET



* 1

Cabins-PlanView

Fig. 2.3-5

3.4.2 Elevation Cabin

The elevation cabin is attached to the reflector support frame of the elevation yoke and therefore moves with the antenna.

A roller-mounted platform is provided inside the elevation cabin. One end of the platform is secured to the azimuth cabin wall, the other end is supported on two rollers which, as the elevation cabin moves, run on a curved track attached to the side of the elevation cabin. The platform is thereby held horizontal for any angle of antenna elevation.

The following equipment is contained in the elevation cabin:

a. Two low-noise receivers.

b. Four down-converters.

c. Test loop translator.

d. Associated waveguides and waveguide filters.

e. Waveguide pressurization unit.

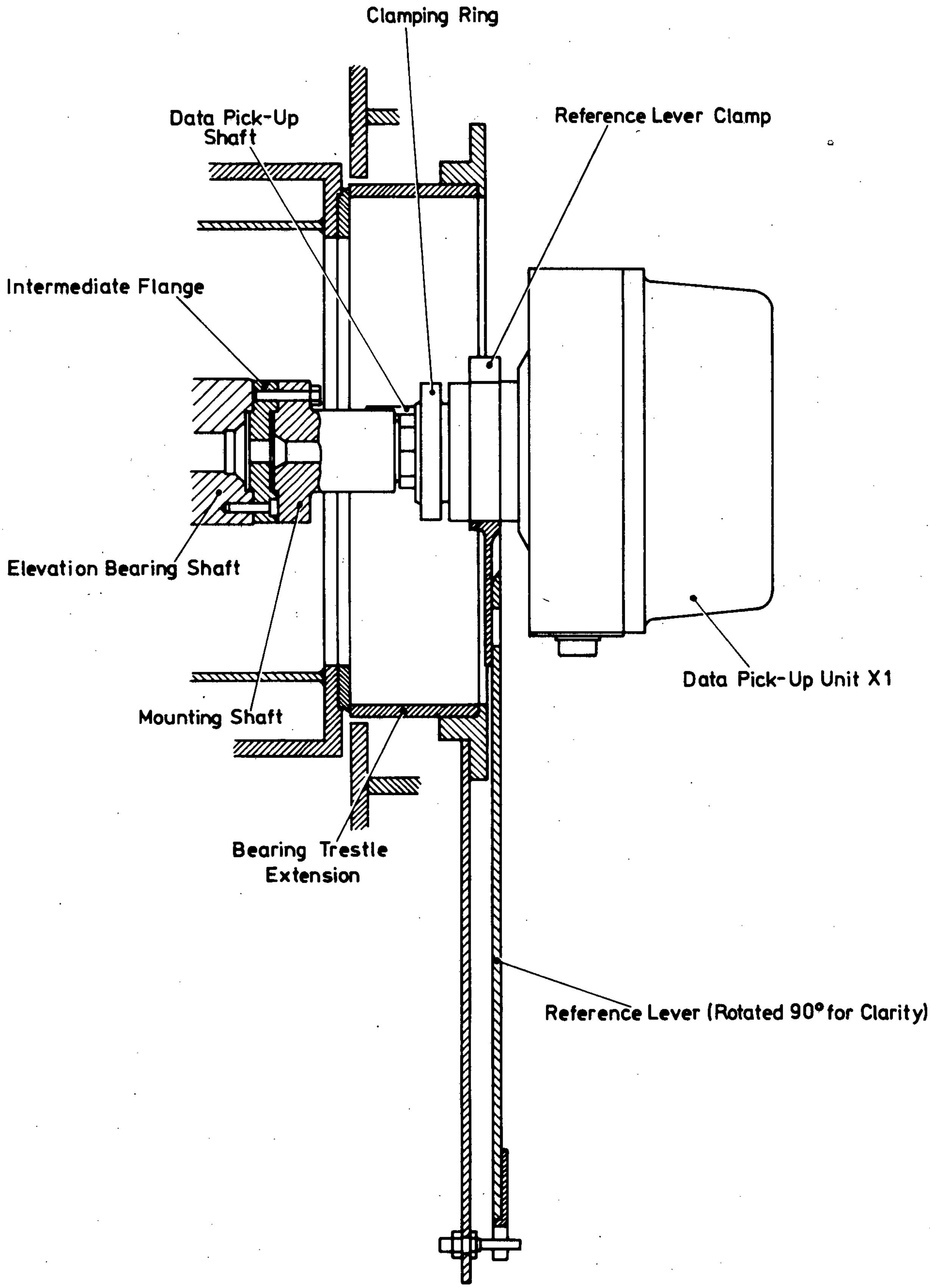
f. Elevation data pick-up unit.

g. Cabin control panel (for servo and drive).

h. Two elevation emergency limit switches.

The waveguide pressurization unit (described in Handbook No. 909) is mounted on the cabin ceiling adjacent to the cabin entrance. The down-converters low-noise receivers and test loop translator are mounted on angle-iron frames attached to the cabin wall. All these rotate with the cabin and yoke.

The elevation position data pick-up unit (X1) is mounted on the inner end of the left elevation bearing shaft. The reference lever of the data pick-up unit is fixed to an extension of the left elevation bearing trestle which protrudes into the cabin (refer to Figure 2.3-6). The two elevation emergency limit switches are also mounted on this extension and are operated by a common striker attached to the cabin wall (refer to Sub-section 8, Table 2.8-1).



Elevation Data Pick-Up Unit

Fig. 2.3-6

The cabin control panel, for manual control of the servo and drive sub-system, is supported on a column on the roller-mounted platform.

A telephone headset pick-up point is provided in the elevation cabin.

4. BEARINGS

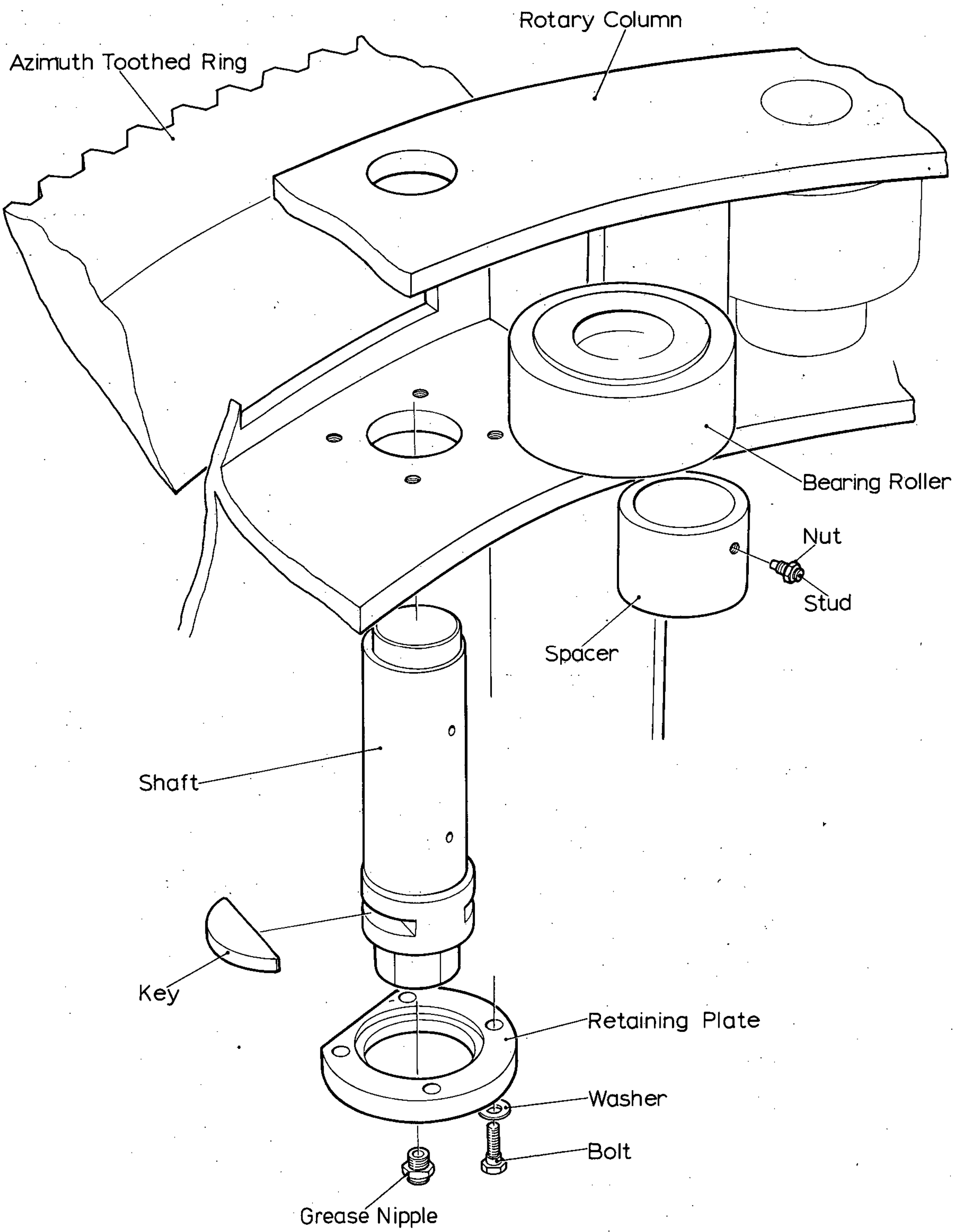
4.1 UPPER AZIMUTH BEARING (Figure 2.4-1)

The upper azimuth bearing, which supports the rotary column against horizontally acting forces, comprises 12 rollers equi-spaced around the top of the rotary column. The double flange construction at the top of the column serves to house the rollers while permitting them to protrude through the column to bear upon the machined inner face of the azimuth toothed ring at the top of the tower. This machined inner face provides the runrace for the bearing rollers.

Each roller is mounted on an eccentric pivot shaft which permits adjustment of the roller to ensure true vertical alignment of the rotary column during installation, and, approximately equal pressure on all rollers.

Two half-round (Woodruffe) keys locate in grooves machined at the lower end of each pivot shaft. The semi-circular profiles of the keys protrude from the grooves and are clamped in position by a retaining plate, the straight edges of the keys thereby restraining the shaft against any tendency to revolve and so maintaining the correct position of the roller in the rotary column.

The bearing design permits the replacement of one roller during operation.



Upper Azimuth Bearing-Exploded View

Fig. 2.4-1

4.2 LOWER AZIMUTH BEARING (Figure 2.4-2)

The lower azimuth bearing supports the full vertical load of the pedestal moving structure and also assists the upper azimuth bearing in supporting the rotary column against horizontally acting forces. The lower azimuth bearing comprises two bearings; a double spherical roller bearing which is located at the top of the pivot shaft and an axial grooved ball bearing which is located at the bottom of the pivot shaft.

The pivot shaft is secured by screws to the base of the rotating column. The whole bearing assembly is enclosed in a bearing housing which is secured by nuts and bolts to the spider base of the tower.

The end of the pivot shaft which extends through the end plate is provided with tapped holes to facilitate the mounting of the azimuth data pick-up unit.

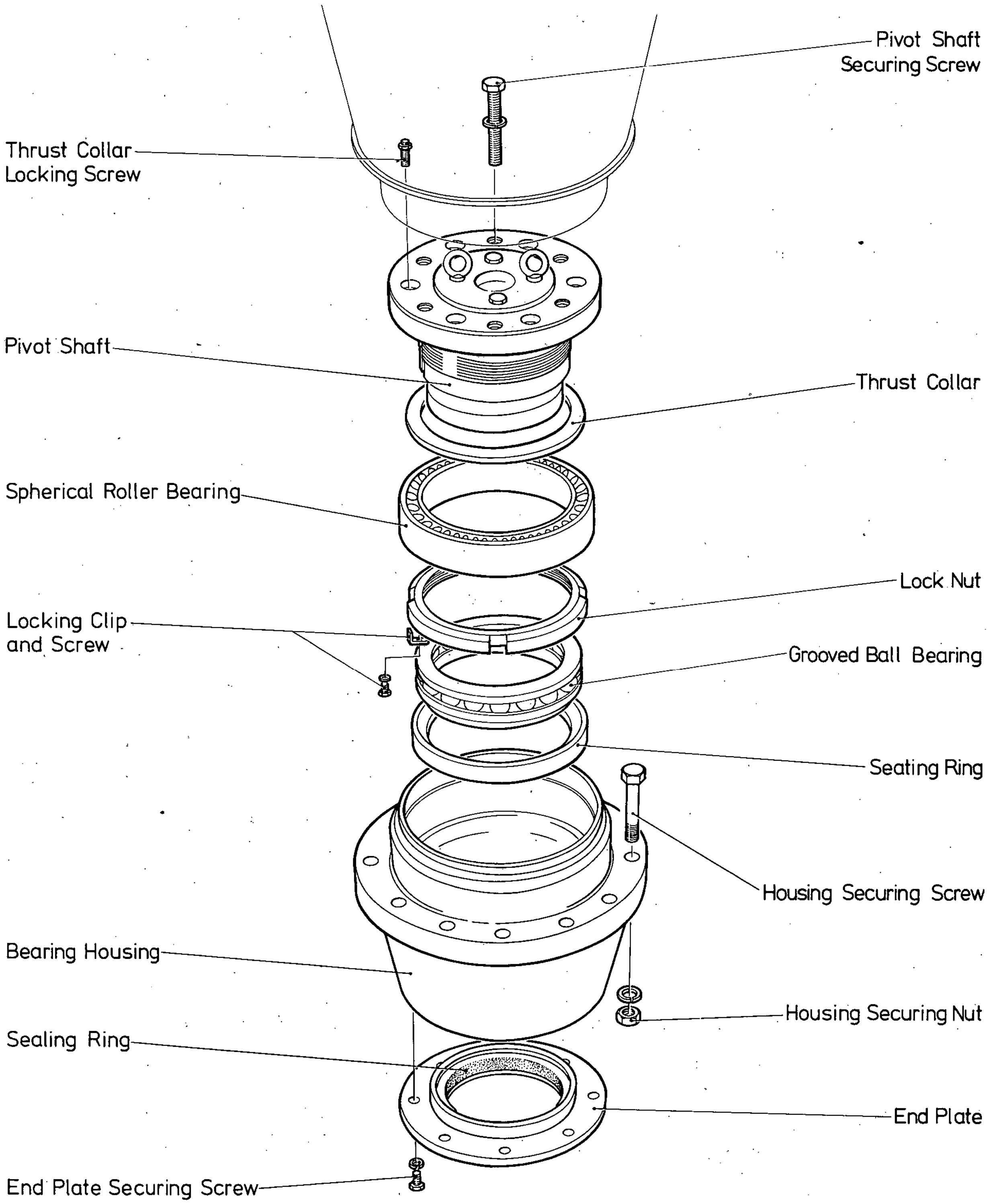
4.3 ELEVATION BEARINGS (Figure 2.4-3)

The two elevation bearings are of similar construction and provide the horizontal pivot axes for the elevation yoke.

Each elevation bearing comprises a double spherical roller bearing, sleeve mounted on a pivot shaft. The sleeve is tapered on its outer diameter and fitted with a hydraulic connection to facilitate easy removal of the spherical roller bearing.

Each pivot shaft is secured, via an end plate, to the elevation yoke and each bearing is supported in its housing which is secured to the respective bearing trestle mounted on the azimuth yoke.

The pivot shaft of the left-hand bearing extends through its associated end cover and is provided with tapped holes to facilitate the mounting of the elevation data pick-up unit.



Lower Azimuth Bearing-Exploded View

Fig. 2.4-2

5. CABLE WRAP (Figure 2.2-1)

The cable wrap, located between the tower and the rotary column, provides a support for the various cables and cooling water hoses leading from the electronic equipment building to the equipment mounted on, and in, the moving structure of the pedestal.

Cables and hoses are passed from the electronic equipment building, through openings in the concrete support column, to the cable wrap via a connector plate P2 located inside the concrete support column. From the cable wrap the supply cables are passed through an opening in the rotary column to a second connector plate P1 located in the rotary column. Cables are connected between P1 and distribution boxes from which connections are made to the various items of equipment. Refer to Sub-section 11 and to the As-Built Documentation for details of cables and water hoses and their routeing.

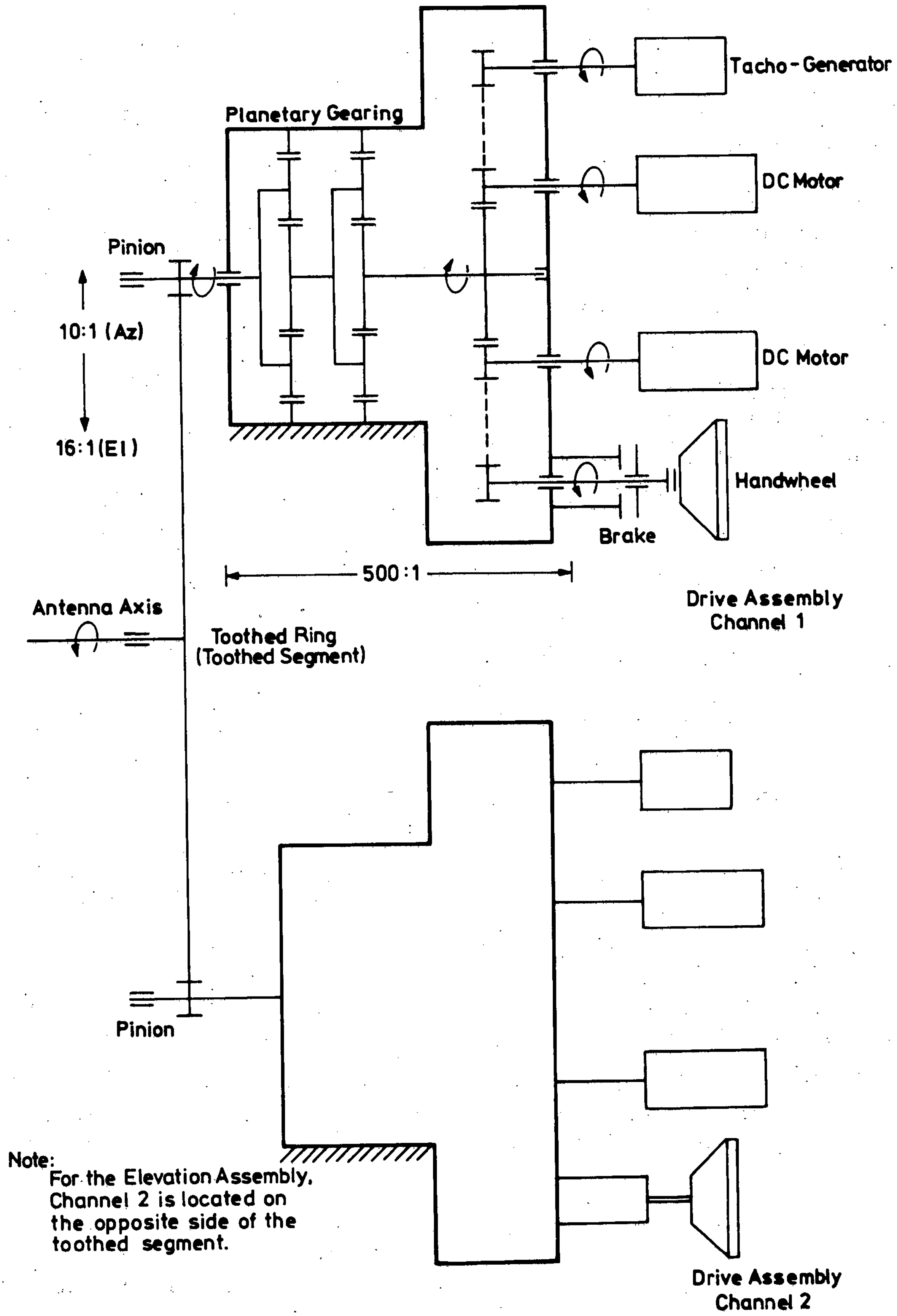
The cable wrap is a spring steel structure comprising two steel bands connected together by a series of vertical brackets. The steel bands are wound in a spiral around the rotary column, the turns of the spiral being spaced by means of rollers on the brackets. The cable wrap is supported by the brackets, the ball rollers of which permit movement of the wrap over a plate covering the spider base structure of the tower. As the column rotates, the cable wrap expands or contracts, depending on the direction in which the column is rotating. This arrangement avoids any torsional stress to the cables and coolant hoses when the antenna is rotated.

6. DRIVE ASSEMBLIES (Figure 2.6-1)

The antenna is driven in azimuth and elevation by four drive assemblies. There are two drive assemblies for each axis of movement; one drive assembly provides positive drive, while the other counteracts backlash through the gear train. Each drive assembly comprises the following:

a. One planetary gearbox with a 500:1 reduction ratio.

b. Two 220 V d.c. shunt-wound, drip-proof motors of approximately 5 kW nominal rating, fitted with blower assemblies.



Drive Assembly-Schematic Diagram

Fig. 2.6-1

c. One fail-safe, electro-magnetic brake and handwheel assembly.

d. One tacho-generator.

The drive assemblies are designed to operate in an ambient temperature range of $-40^{\circ}C$ to $+65^{\circ}C$.

6.1 GEARBOX

The gearbox comprises a primary parallel shaft train driving a double reduction epicyclic gear, the second stage of which is directly coupled to an output pinion. The output pinion meshes with the toothed ring (or segment) of the associated axis.

Lubrication is by wet sump and the gearbox holds approximately 23 litres (40.5 pints) of oil.

All shafts which pass through the gearbox walls are fitted with mechanical lip seals and circlips.

A heating mat is wrapped around the outside of the gearbox and is switched on automatically at a preset temperature to prevent an increase in the viscosity of the oil in cold weather (refer to Sub-section 3.2).

6.2 MOTORS

The two d.c. motors, which are electrically connected in series, drive the relevant yoke, and hence the antenna, through the gearbox. The shafts of the motors are mechanically paralleled by the gearbox.

Blowers are provided to maintain the body temperatures of the motors at a sufficiently low value when the fields of the motors are energized (absolute peak winding temperature permissible is $+135^{\circ}C$).

Thermal switches fitted in the field and interpole windings of the motors are set to open at a temperature below the safe value for the insulation of the motors and, via interlock circuitry, inhibits the drive after a short delay period.

Speed control of the motors is effected by controlling the armature current. The drive voltage at full speed reaches approximately 450 volts. Refer to the Antenna Servo, Drive and Control Sub-system Handbook No. 601 for details of the thermal switch circuitry and motor speed control.

6.3 <u>BRAKE AND HANDWHEEL ASSEMBLY</u> (Figure 2.6-2)

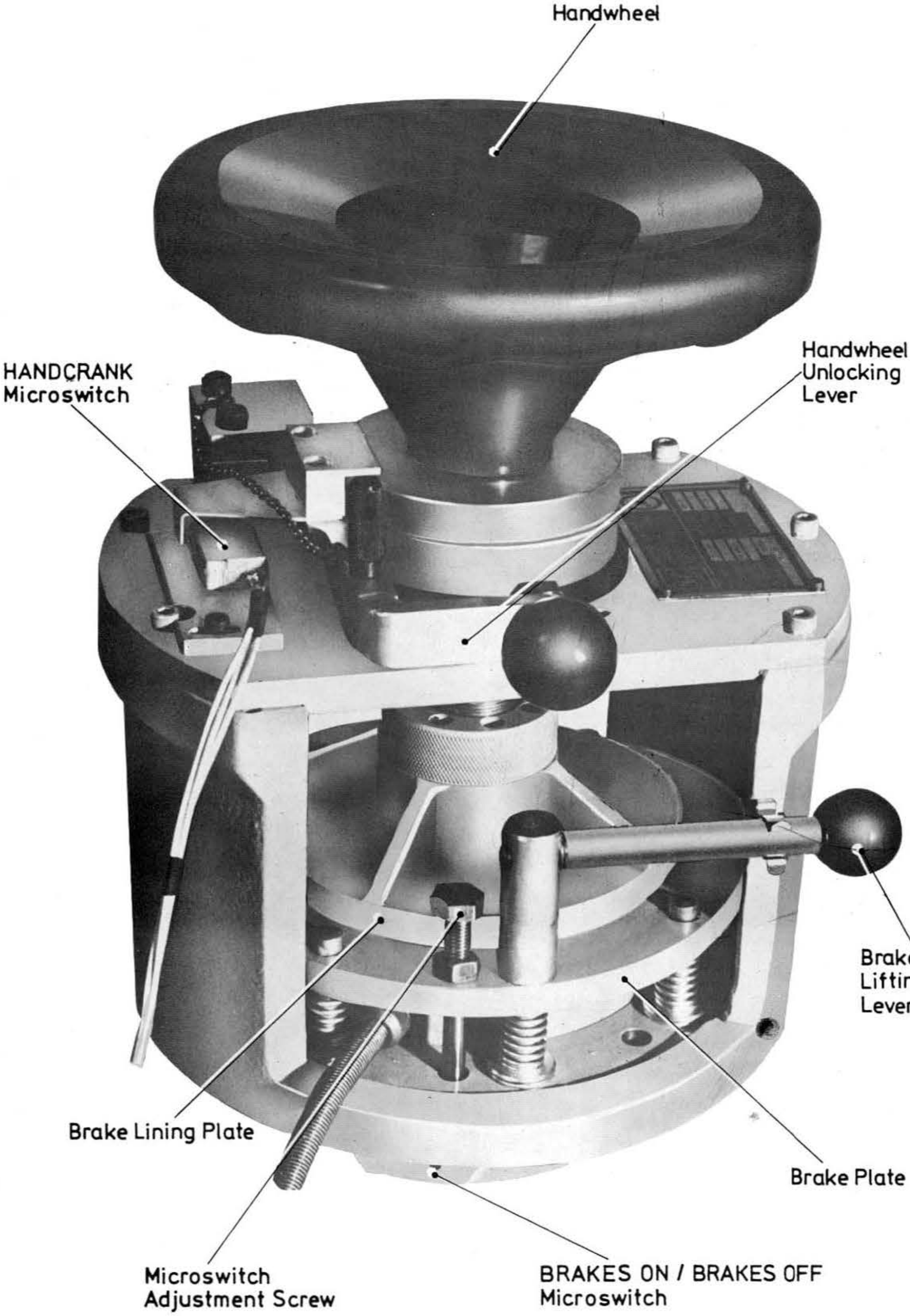
The brake and handwheel assembly incorporates a fail-safe electro-magnetic brake together with a handwheel and drive by which the antenna can be moved by hand cranking. The assembly also incorporates a mechanical arrangement for lifting the brake plate to release the brakes when necessary.

The brake is a spring-loaded disc brake which is lifted (released) electrically by energization of a solenoid. During normal operation the brake is applied after the drive motors have reached standstill, but for an emergency stop the brake is applied immediately. Since the brake elements are primarily designed for heavy duty, dynamic braking, there is, in normal operation, no wear of the brake lining.

The brakes also act as fail-safe devices in that, if the power supply to the servo, drive and control sub-system fails, the brakes are automatically applied by spring pressure to prevent the antenna from running away, either under its own weight in elevation, or due to wind force in azimuth. One brake is sufficient to hold the peak load, therefore permitting the complete loss of one brake for one axis of movement while still retaining full operational use of the antenna.

During normal electrical operation of the antenna, the handwheel of each brake and handwheel assembly is held dis-engaged from its associated drive by a lever. When hand cranking is required, this lever is lifted and the handwheel pushed into mesh with the input gear of the drive assembly.

A microswitch, actuated by the handwheel unlocking lever, operates a relay to provide HANDCRANK indication at the station control console and cabin control panel and to electrically isolate the associated d.c. drive motors.



Brake and Handwheel Assembly (Azimuth)

Fig. 2.6 - 2

For hand cranking, the brakes on the azimuth drive assemblies can be released by turning two brake lifting levers on each azimuth brake assembly. The brakes on the elevation drive assemblies can be similarly released, for handcranking, by the operation of foot pedals connected to brake attachments on the elevation brake assemblies (refer to Figure 2.3-4).

A microswitch, actuated by each brake, operates a relay to provide BRAKES ON or BRAKES OFF indication at the station control console and cabin control panel and enables electronic drive control in the BRAKES OFF condition.

6.4 TACHO-GENERATOR

The tacho-generator is driven by the gearbox and is geared in the same ratio as the motor, thus producing an actual speed pick-off signal to the antenna servo and drive control unit. This output is used as a feedback signal for the control of the gearbox input speed. It is also used to operate an ANGULAR RATE meter on the station control console.

7. STOW PINS

Two stow pins, both of similar construction, are fitted on the moving structure of the pedestal; one for the elevation axis and one for the azimuth axis.

The elevation stow pin is located near the roof of the right-hand chamber of the gearbox room (refer to Figure 2.3-4) and the azimuth stow pin is located on the floor of the same chamber adjacent to the azimuth drive assembly.

The stow pins provide a means of locking the reflector assembly, in both elevation and azimuth, for maintenance or for safety in adverse weather conditions. The stow pins are inserted or withdrawn by manual rotation of their respective handwheels. The elevation stow pin can be inserted at two different positions of antenna elevation i.e. 0° and $+90^{\circ}$. The azimuth stow pin can only be inserted when the antenna is pointing South ($+180^{\circ}$ azimuth).

A switch, mounted on each stow pin assembly, is actuated by operation of the stow pin. When either stow pin is inserted, indicator lamps (INTERLOCK and ENGAGED) on both the station control console and the cabin control panel are illuminated, and a stow pin interlock prevents operation of the drive motors for the respective axis of rotation (refer to Antenna Servo, Drive and Control Sub-system Handbook No. 601). Stow pin INTERLOCK is effected and indicated as the stow pin is moved towards the moveable structure before engagement is made. Stow pin ENGAGED is indicated at full engagement of the stow pin.

8. LIMIT, RANGE AND INTERLOCK SWITCHES

Limit, range and interlock switches are fitted to the pedestal and pedestal equipment to limit antenna movement, to give positional information to the servo and drive sub-system, to provide interlock and to give indication on the station control console and the cabin control panel of set conditions. The location and a brief description of the function of these switches is given in Table 2.8-1. For further information on the operation of the switches and the indicator lamps refer to Antenna Servo, Drive and Control Sub-system Handbook No. 601 and Ground Station Control Console Handbook No. 700.

Table 2.8-1

Limit, Range and Interlock Switches

Switch	Location	Function
Azimuth pre-limit switches (two)	Azimuth data pick-up unit.	Operate at approximately -14° and $+374^{\circ}$ azimuth respectively to limit electrical drive towards limits in azimuth.
Elevation pre-limit switches (two)	Elevation data pick-up unit.	Operate at approximately $+3.5^{\circ}$ and $+86.5^{\circ}$ elevation respectively to limit electrical drive towards limits in elevation.

Table 2.8-1 (Cont'd.)

Switch	Location	Function
Azimuth emergency limit switches. (2 fitted)	Inside tower, adjacent to servicing hatch.	Operate at approximately -19° and $+379^{\circ}$ azimuth to cut drive power of azimuth drive motors and to provide emergency braking.
Elevation emergency limit switches. (2 fitted)	Inside elevation cabin, adjacent to elevation data pick-up unit.	Operate at approximately -1° and $+91^{\circ}$ elevation to cut drive power of elevation drive motors and to provide emergency braking.
Azimuth range switches. (2 fitted)	Inside towers, adjacent to servicing hatch.	Operate at approximately 30° either side of 0° to provide pre-selection of azimuth emergency limit switches and allow approximately 400° rotation in azimuth.
Handwheel micro-switches.	On top of brake and handwheel assembly. (One switch per assembly).	Operated by handwheel unlocking lever to provide HANDCRANK indication at the station control console and cabin control panel. Also electrically disconnects the associated drive motors when handwheel is not fully disengaged.
Brake micro-switches.	On underside of brake and handwheel assembly. (One switch per assembly).	Operated by brake mechanism to provide BRAKES ON or BRAKES OFF indication at the station control console and cabin control panel and enables electronic drive control in BRAKES OFF condition.
Stow pin switches.	On stow pin assemblies. (One switch per assembly)	Operated by stow pin mechanism to provide stow pin ENGAGED and INTERLOCK indication at the station console and cabin control panel. Also provides drive interlock.

8.1 AZIMUTH EMERGENCY LIMIT SWITCHES (Figure 2.8-1)

The two azimuth emergency limit switches are of the roller lever type. They are bracket-mounted to the inside of the tower and are operated mechanically by a common cam-type striker secured to the rotary column. The switches operate electrically, in conjunction with the azimuth range switches, to perform the functions stated in Table 2.8-1.

8.2 AZIMUTH RANGE SWITCHES (Figure 2.8-1)

The two azimuth range switches are fitted with V-shaped toggle operating arms instead of the roller lever type. The switches are bracket-mounted to the inside of the tower and are operated mechanically by a common pin-type striker secured to the rotary column. Cover plates are fitted over the switches to prevent accidental operation of the switches.

Refer to Table 2.8-1 for electrical function.

8.3 ELEVATION EMERGENCY LIMIT SWITCHES (Figure 2.8-2)

The two elevation emergency limit switches are identical to the azimuth emergency limit switches. They are mounted on brackets secured to an extension of the left-hand elevation bearing trestle which protrudes into the elevation cabin and are operated by a common cam-type striker. The switches are therefore stationary,but the striker is secured to the wall of the cabin and moves with the cabin when the elevation yoke is rotated. Cover plates are fitted over the switches to prevent accidental operation of the switches.

Refer to Table 2.8-1 for electrical function.

9. DATA PICK-UP UNITS

Two data pick-up units are installed in the pedestal. These units supply the servo and drive system with data relating to the azimuth and elevation positions of the antenna.

The azimuth pick-up unit P3 (refer to Figure 2.9-1) is mounted on an extension of the lower azimuth bearing shaft and is therefore located within the concrete support column below the pedestal. Its reference lever is secured to a reference point in the tower structure. The mounting of the elevation pick-up unit X1 is described in Sub-section 3.4-2.

Both pick-up units are similar in construction and operation. The watertight housings of the units are provided with thermostatically controlled heating and contain very accurate position pick-up devices which resolve the position of the antenna, in azimuth and elevation, in steps of $1/1000^{\circ}$. The housings also contain the pre-limit switches. The azimuth unit incorporates an additional three-turn potentiometer which operates in conjunction with a CABLE WRAP meter on the station control console to provide a coarse indication of the azimuth position of the antenna and hence of the position of the cable wrap. The meter dial is scaled from -200° to $+200^{\circ}$.

The data pick-up units are delicate and highly sensitive devices which must be handled with extreme care.

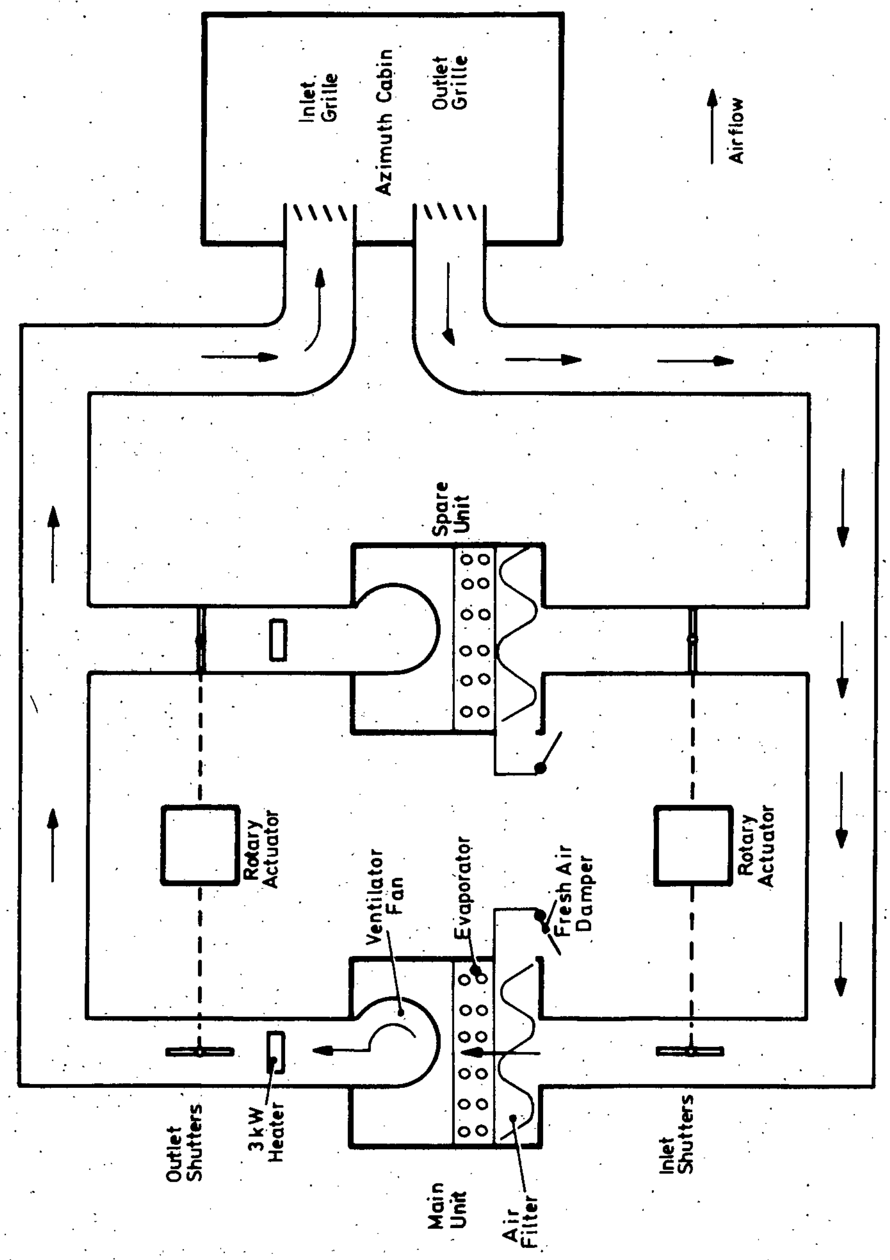
Refer to the Antenna Servo, Drive and Control Sub-system Handbook No. 601, for a full technical description of the data pick-up units.

10. CABIN AIR CONDITIONING PLANT

10.1 GENERAL (Figures 2.10-1, 2.10-2 and 2.10-3)

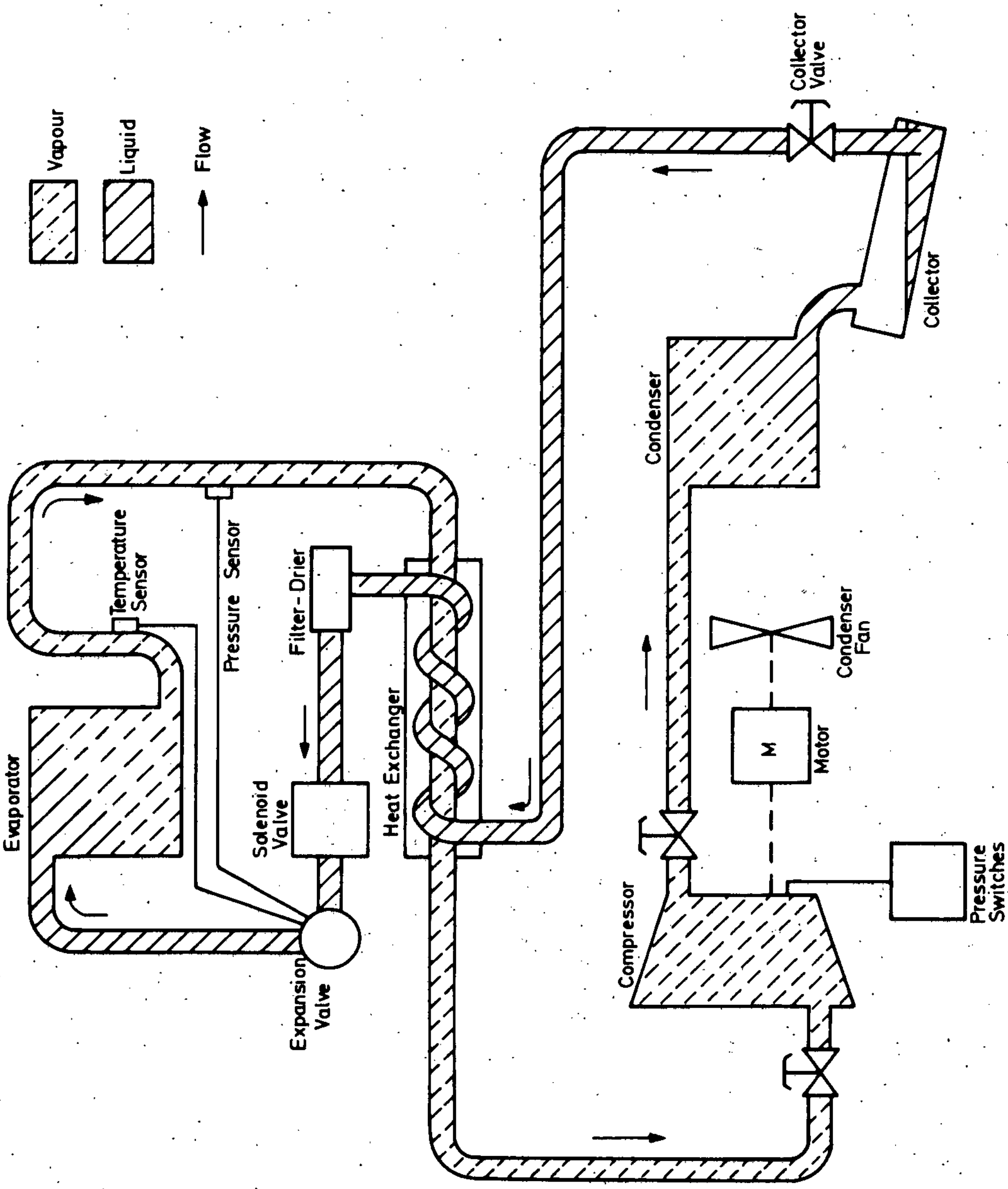
Due to widely varying ambient temperatures, an air conditioning plant is installed to keep the temperature in the azimuth and elevation cabins at a pre-set value. The arrangement, which is installed on the antenna platform, consists of two similar units with a common air ducting system and a control box. One of the units is referred to as the MAIN unit and is programmed, by a time switch, to run for six days each week. The other unit is referred to as the SPARE unit, and is brought automatically into service in the event of a failure of the MAIN unit. The SPARE unit is also automatically run for one day each week to ensure that it is in good condition.

The complete air conditioning plant will maintain an approximately constant air temperature in the azimuth and elevation cabins within the range $0^{\circ}C$ to $+40^{\circ}C$ for an outside temperature range of $-40^{\circ}C$ to $+70^{\circ}C$, with all cabin equipments operating.



Air Conditioning Plant, Block Diagram

Fig. 2.10-1



Cooling Circuit, Block Diagram

Fig. 2.10-2

10.1.1 Duct Shutters for Automatic Changeover

To avoid the loss of circulating air through the non-operating air conditioning unit, ganged shutters are fitted in the air ducts at the inlet and outlet of each unit. The shutters are operated by rotary actuators driven by electric motors supplied from the automatic changeover circuit.

10.1.2 Air Conditioning Units

Each air conditioning unit has a radial ventilation fan and equipment to either heat or cool the circulating air. The heating equipment consists of a 3 kW heater mounted in the unit outlet duct.

The cooling equipment (Figure 2.10-2) consists of a compressor-condenser-evaporator circuit using Tetrafluordichlorethylene, Type R114, for the coolant. The coolant is compressed so that in the condenser it becomes a liquid. The liquid coolant passes through a collector and heat exchanger to a filter-drier which removes any moisture carried in the coolant. The coolant passes to the evaporator via a solenoid valve, and an expansion valve. The solenoid valve is electrically closed by the automatic control circuit when the cooling equipment is not operating; the expansion valve automatically controls the pressure in the cooling circuit. The coolant passes through the evaporator coils extracting heat from the circulating air which is being drawn over the coils by the ventilation fan. The liquid coolant evaporates; and the temperature of the vapour is lowered by the heat exchanger before being returned to the compressor.

Condensation, produced when the cooling circuit is in operation, is drained into a plastic container which must be emptied daily.

Two pressure switches are controlled by the pressure in the compressor; if either switch operates, the control circuit stops the compressor. The switches are set to the maximum and minimum pressures acceptable for safe working of the cooling circuit.

Outside air can be mixed with the air circulating round the plant by opening a hand-operated fresh air damper on each unit. Filters are fitted to trap dirt and foreign particles.

10.1.3 Thermostats

Two thermostats control the automatic operation of the air conditioning plant. A cabin thermostat (in the azimuth cabin) is set to the required cabin temperature. An outside thermostat (on the side of the control box) switches off the cooling circuit if the outside air temperature falls below +10°C, to prevent freezing of the evaporator.

10.1.4 Time Switches

A time switch which runs continuously, repeating a 7-day cycle, controls the weekly changeover of MAIN and SPARE unit operation. A delay time switch (set to 3 min.) delays operation of the breakdown circuit to allow time for the automatic shutter changeover to take place.

10.1.5 Interlocks

Interlocks are incorporated in the control circuits to ensure correct operation under all conditions. They ensure that:

a. It is not possible to run both units at the same time, nor to operate a unit in both heating and cooling modes.

b. Limit switches on the shutter rotary actuators prevent operation of a unit until its associated shutters are open.

c. Heaters and compressors cannot operate unless the ventilation fan is running.

10.1.6 Maintenance Switches

Maintenance switches inside the control box override certain interlocks for the following conditions:

a. To disconnect the automatic control circuits.

b. To switch off the MAIN or SPARE unit.

c. To switch a unit to heating or cooling, as required.

10.1.7 Auxiliary Heaters

Heaters are fitted under each compressor crankcase oil sump. They are supplied with power when the compressor is not operating, to separate, by evaporation, coolant from the compressor oil. Heaters are also fitted in the rotary actuators which drive the shutters, to ensure reliable operation at low ambient temperatures.

10.1.8 Alarms

Failures in the air conditioning plant are indicated by lamps on the control box door. An alarm indication is also relayed to the station control console.

10.2 CIRCUIT DESCRIPTION (Figures 2.10-4 to 2.10-7)

10.2.1 Mains Supplies

Power is supplied to the air conditioning plant from the three-phase supplies at distribution box RO2 in the azimuth cabin. The control circuits and auxiliary heaters are supplied via a single-phase transformer Om3 in the control box. All connections to the three-phase supplies are protected by isolating fuse-switches in the control box, interlocked with contactors; therefore the isolating fuse-switch must be closed before the associated contactor can be energized.

Except for emergency switch-off, or during major maintenance work, the MAIN SWITCH on distribution box R02 must always remain ON to maintain the supply to the compressor crankcase heaters. The 220 V supplies to the control circuits can be disconnected by the DISTRIBUTION switch on the control box door.

10.2.2 MAIN Unit

NOTE: The following description applies to automatic operation of the air conditioning plant except where otherwise stated.

a. Ventilation. The ventilation fan contactor 2c2 is energized via interlock contacts of isolating fuse-switch 2a2 and contacts of the main unit working relay 0d4. If the SPARE unit selector switch 1b1 is set to 0, contactor 2c2 can also be energized by setting the MAIN unit selector switch 2b1 to HEATING or to COOLING. When contactor 2c2 is energized, VENTILATOR ON - MAIN UNIT lamp 2h2 is lit.

b. Cooling. Compressor motor contactor 2c1 is energized via interlock contacts of isolating fuse-switch 2a1, over-pressure switch 2e2, under-pressure switch 2e1, interlock contacts of the ventilation fan contactor 2c2 (which prevent operation of the compressor if the fan is not running), contacts of main unit working relay 0d4 and contacts of 'cooling' relay 0d1 (closed when 0d1 is energized). 0d1 is energized via cabin thermostat 0e1 and the outside thermostat 0e2. If the outside air temperature is above +10°C and the cabin temperature is higher than the cabin thermostat setting, 0d1 is energized and the compressor motor is started. When contactor 2c1 is closed, auxiliary contacts 31, 32 open and the supply to the crankcase heater, 2r1, is disconnected; auxiliary contacts 13, 14 close and connect power to solenoid valve 2s1 which opens the cooling circuit. With power applied to 2s1, the COMPRESSOR ON - MAIN UNIT lamp 2h1 is lit.

If the SPARE unit selector switch 1b1 is set to O, the compressor can be started by setting the MAIN unit selector switch 2b1 to COOLING, thus by-passing the contacts of relays Od4, Od1 and 2c2.

c. Heating. The heater contactor 2c3 is energized via interlock contacts of isolating fuse-switch 2a3, limit switches Ob4 and Ob6 in the outlet and inlet rotary actuators (Ob4 and Ob6 are closed only when the MAIN unit shutters are fully open), interlock contacts of contactor 2c2 (which prevent operation of the heater if the ventilation fan is not running), contacts of main unit working relay Od4 and contacts of heating relay Od2. Od2 is energized whenever the temperature in the cabin falls below the setting on the cabin thermostat Oe1.

When contactor 2c3 is energized, the HEATING ON - MAIN UNIT lamp 2h3 is lit via auxiliary contacts 13, 14. If the SPARE unit selector switch 1b1 is set to O and the MAIN unit selector switch 2b1 is set to HEATING, the contacts of relays Od2 and Od4 are by-passed and the heater contactor 2c3 is energized if the interlock contacts are closed.

d. Breakdown Indication. If a fault opens ventilation fan isolating fuse-switch 2a2, auxiliary contacts of 2a2 open which opens ventilation fan contactor 2c2. Auxiliary contacts 41, 42 of 2c2 close and the delay time switch 2d1 is energized via contacts 53, 54 of the MAIN unit working relay Od4 (closed when the MAIN unit is working).

After the time set by 2d1 (normally 3 minutes), 2d1 closes and contacts of 2d1 close to energize the breakdown relay 2d2. Contacts 23, 24 of 2d2 complete a latching circuit for 2d1 via the BREAKDOWN OUT switch 0b2, and 2d1 remains closed. Contacts 13, 14 of 2d2 close to light the MAIN UNIT BREAKING DOWN lamp 2h4. Relay 2d2 remains energized via contacts of 2d1, and contacts 51, 52 of 2d2 open, de-energizing the MAIN unit working relay 0d4 and the MAIN UNIT WORKING lamp, 0h3. is extinguished. Contacts 43, 44 of 2d2 complete an alarm circuit on the station control console.

After the fault condition has been corrected, the breakdown indication circuit is reset by pressing the BREAKDOWN OUT pushbutton switch which de-energizes relays 2d1 and 2d2.

Similarly, if a fault condition causes compressor motor contactor 2c1 to open, delay time switch 2d1 is energized via auxiliary contacts 41, 42 of 2c1, contacts 43, 44 of the cooling relay 0d1 and contacts 53, 54 of the MAIN unit working relay 0d4. If the heater contactor 2c3 opens, 2d1 is energized via auxiliary contacts 21, 22 of 2c3, contacts 33, 34 of the 'heating' relay 0d2 and contacts 53, 54 of the MAIN unit working relay 0d4.

10.2.3 <u>SPARE Unit</u>

The circuit description for the SPARE unit is similar to that for the MAIN unit.

10.2.4 <u>Changeover Circuit</u>

a. Time switch changeover. When the contacts of the 7-day time switch 0d5 change over from 2 to 1, MAIN unit working relay 0d4 is de-energized and contacts 33, 34 of 0d4 open, de-energizing MAIN unit ventilation fan contactor 2c2. Auxiliary contacts 51, 52 and 23, 24 of 2c2 change over, rotary actuator motor 0m2 is energized via contacts 51,52 until the rotary actuator limit switches Ob5 and Ob6 operate; which is after the unit inlet shutters have moved through 90°, when the circuit is broken by contacts of Ob5.

The changeover of Od5 contacts completes the energizing circuit of the SPARE unit working relay Od3 (contacts 61, 62 of relay Od4 are closed when Od4 is de-energized, thus contacts 61, 62 of relays Od3 and Od4 form an interlock which prevents simultaneous operation of both MAIN and SPARE units). Auxiliary contacts 33, 34 of Od3 close to complete the energizing circuit for the SPARE unit ventilation fan contactor 1c2. Auxiliary contacts 23, 24 and 51, 52 of 1c2 changeover, and rotary actuator motor Om1 is energized via contacts 23, 24 until the rotary actuator limit switches Ob3 and Ob4 operate; which is after the unit outlet shutters have moved through 90°, when the circuit is broken by contacts of Ob3.

Heater resistors Or1 and Or2 are fitted in the rotary actuators to ensure reliable operation at low ambient temperatures.

b. Breakdown Changeover. With the MAIN unit working, if the breakdown relay 2d2 is energized, contacts 51, 52 of 2d2 open, de-energizing MAIN unit working relay Od4. Contacts 61, 62 of Od4 close (normally open when Od4 is energized) and SPARE unit working relay Od3 is energized via the closed contacts 33, 34 of MAIN unit breakdown relay 2d2.

The operation of relays Od3 and Od4 starts the shutter changeover described in Sub-section 10.2.4a and the SPARE unit is switched into operation, as previously described.

11. ELECTRICAL INSTALLATIONS (Figures 2.11-1 and 2.11-2)

Connections between installations on the moving structure of the pedestal and installations on the fixed structure or in the equipment building are made via connector plates P1 and P2 and the cable wrap. The connector plates support the plug and socket connections of the interconnecting cables and provide convenient positions for disconnecting or isolating the cables if necessary. Figures 2.11-1 and 2.11-2 show cross sections of the cables at these connector plates and in the cable wrap. The water cooling hoses have also been shown, for convenience, in these figures.

The numbers of the cables and hoses given in Figures 2.11-1 and 2.11-2 are B.B.C. numbers. The corresponding SEL numbers are given in the cable schedules in Volume 1, Telecommunications and Power, of the As-Built Documentation.

11.1 COMMUNICATION EQUIPMENT

The cabin-mounted units of the various communication sub-systems are electrically connected to their associated installations in the electronic equipment building by interconnecting cables which are run through, and supported by, the cable wrap. Details of these interconnecting cables are given in the respective equipment handbooks and in Volume 1, Telecommunications and Power, of the As-Built Documentation.

11.2 SERVO AND DRIVE SYSTEM

Details of the interconnecting cables of the servo and drive sub-system are given in the Antenna Servo, Drive and Control Sub-system Handbook No. 601 and in Volume 1, Telecommunications and Power, of the As-Built Documentation.

11.3 PEDESTAL LIGHTING AND ANCILLARY POWER SUPPLIES

11.3.1 50 Hz Stations (Figures 2.11-3 and 2.11-4)

The lighting and sockets (test equipment and emergency light) fitted to the moving structure of the pedestal are supplied at 220 V, 50 Hz from the no-break mains via an isolating transformer P6, located in Room 28, and a distribution box R02 located in the azimuth cabin. The lighting and socket on the platform is supplied via a plug and socket connector Z06 fitted to the azimuth cabin wall.

The 4KVA, single-phase isolating transformer provides magnetic separation of the lighting and sockets from the station lighting system (i.e. there is no direct electrical connection between the two circuits). The primary of the transformer is protected by an automatic fuse on the electronic equipment main distribution board.

The lighting on the fixed structure of the pedestal (cable wrap bay) is supplied at 220 V, 50 Hz from a general lighting distribution box in the support column.

Location of the lamps, switches and sockets is shown in Figure 2.11-3. For cabling details refer to Figure 2.11-4.

A 380 V, three-phase, 50 Hz supply is provided for the cabin air conditioning units from the short break mains and is routed via distribution box R02 and a plug and socket connector Z04 in the azimuth cabin wall. The thermostat associated with the air conditioning units is connected via plug and socket connector Z07. The air conditioning alarm circuit cable, connected between the air conditioning control box Z5 and telephone box R01, is routed via plug and socket connector Z03.

A second 380 V, three-phase, 50 Hz supply from the short break mains is routed via distribution box R02 and provides single-phase supplies for the feed cone heater and pressurization unit (refer to Reflector Feed and System Waveguide Interconnections Handbook No. 603).

All lighting and power circuits on the moving structure incorporate circuit breakers fitted with signal contacts which open on failure of supply to provide alarm indications in the control room.

The alarm indications are CABIN FUSE BOX on SSR L4 and ANCILLARY EQUIPMENT (a summing alarm) on Bay 4 of the control console. The signal contacts are connected in series and the opening of any one will cause the alarm relay to be de-energized.

11.3.2 <u>60 Hz Stations</u> (Figures 2.11-4 and 2.11-5)

The lighting and sockets (test equipment and emergency light) circuits for the 60 Hz Stations are similar in all respects to those for the 50 Hz Stations except that the supply voltage is 120 V, 60 Hz.

The circuits for supplying the feed cone heater and pressurization unit are also similar to those for the 50 Hz stations differing only in that the single-phase supplies for these units are obtained from a 208 V, three-phase, 60 Hz input to distribution box R02.

The cabin air conditioning units are supplied from the short break mains at 208 V, three-phase, 60 Hz via two cables which are linked at the terminals in distribution box R02. From R02 the supply is routed via two cables which are also linked at the terminals in the air conditioning control box Z5. These two cables pass through plug and socket connectors Z04 and Z05 in the azimuth cabin wall.

Connections to the air conditioning cabin thermostat are made via plug and socket connector Z07. The air conditioning alarm circuit cable, connected between the control box Z5 and telephone box R01, is routed via plug and socket connector Z03.

All lighting and power circuits on the moving structure incorporate circuit breakers fitted with signal contacts which open on failure of supply to provide the control room alarm indications detailed in Sub-section 11.3.1. The signal contacts are connected in series and the opening of any one will cause the alarm relay to be de-energized.

11.4 EMERGENCY LIGHTING

Emergency lighting is provided by a portable, battery-operated hand lamp located in the azimuth cabin. The hand lamp is normally connected via socket ST7 (refer to Figures 2.11-3 and 2.11-5) to the no-break mains which provides a trickle charge to the nickel-cadmium battery. In this condition the hand lamp is switched off, failure of the charging supply automatically switches on the lamp. On restoration of the supply, the hand lamp circuit is automatically switched back to the trickle charge condition and the lamp is switched off.

The hand lamp can be disconnected from its trickle charging supply and used as a portable lamp to provide illumination wherever required. A three-position switch on the hand lamp permits selection of either of the two lamps (5 W and 1.5 W), with which the hand lamp is equipped, or an 'OFF' position.

11.5 ALARM AND INDICATION CIRCUITS

Visual and audible alarms are provided at the station control console to enable malfunctioning or failures of equipment mounted in, or on, the pedestal to be quickly detected and localized.

In addition to the equipment malfunctioning and failure alarm circuits, alarm indication is also given at the station control console and SSR L4 if the azimuth cabin door is open and at the station control console in the event of fire in the cabins. The control console indications are the ANCILLARY EQUIPMENT summing alarm in Bay 4 for the cabin door open condition, and the FIRE ANTENNA alarm in Bay 4 in the event of a fire in the cabins. The ANCILLARY EQUIPMENT alarm in this instance is derived from the CABIN DOOR alarm on SSR L4 via the summing network.

A complete list of the alarm and indication circuits is given in the As-Built Documentation, Volume 1, Telecommunications and Power.

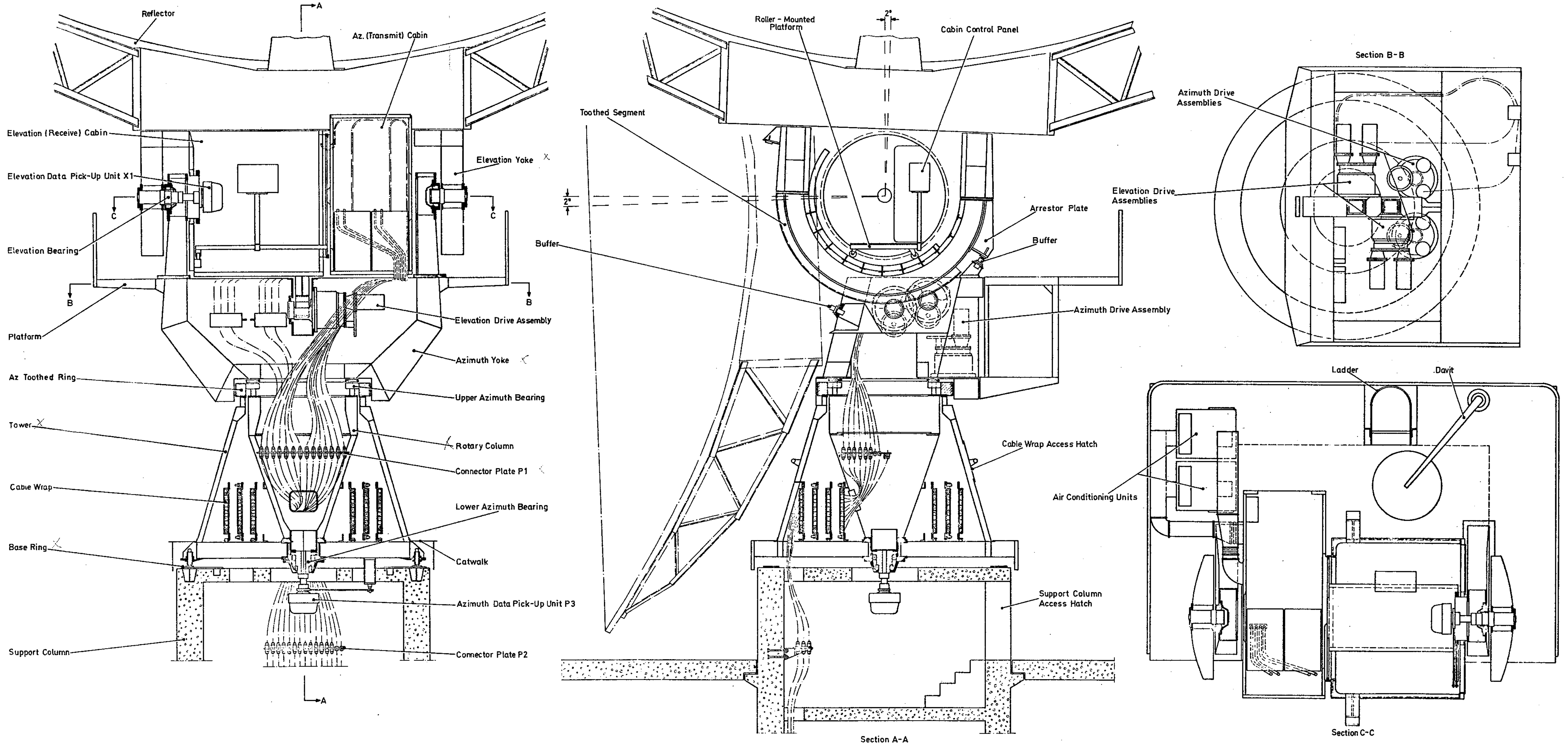
For detailed information on the servo and drive alarm circuits refer to the Antenna Servo, Drive and Control Sub-system Handbook No. 601.

12. LIGHTNING PROTECTION AND EARTHING

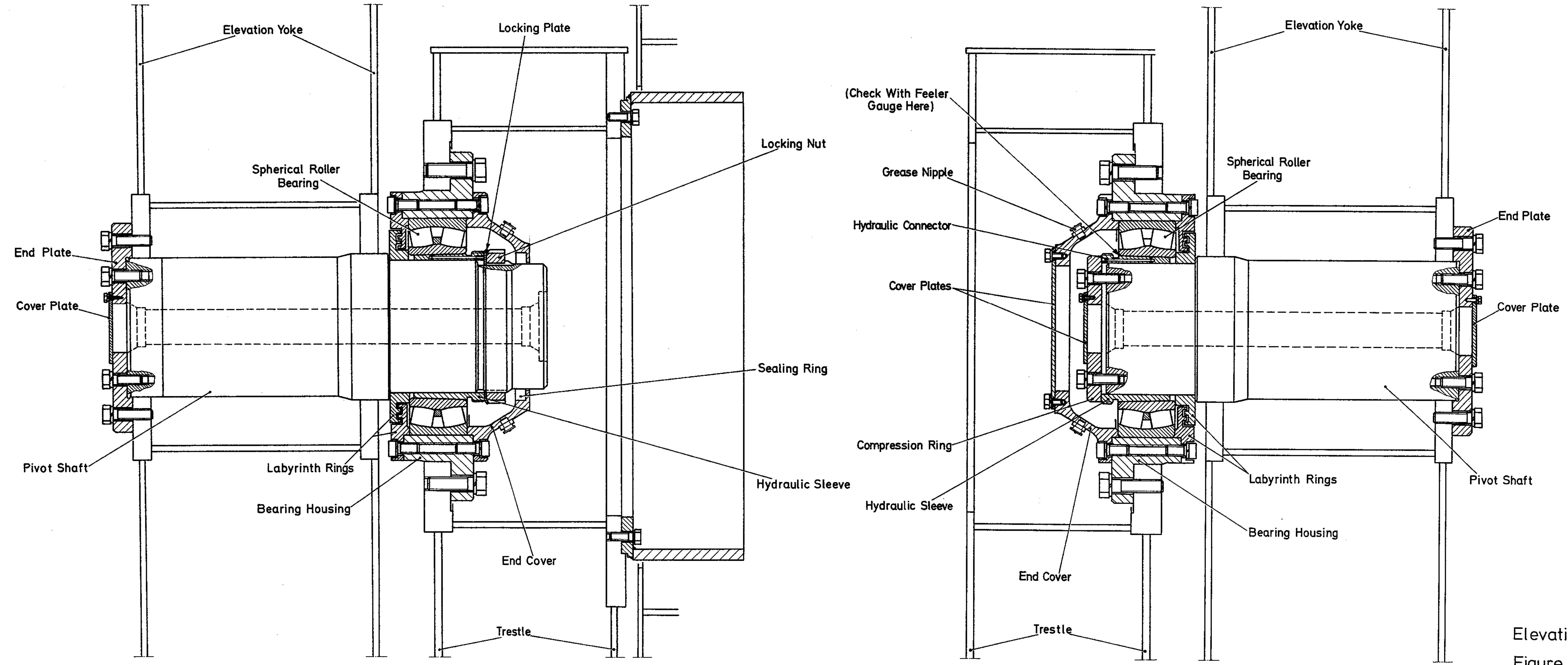
The pedestal is securely earthed, via the base ring of the fixed structure, to the station earthing system. Galvanized metal strips connect the base ring to a metal ring around the concrete support column, just above the flat roof of the equipment building. Galvanized metal rods, connected to this ring, radiate out to the radome base ring which is also connected to the station earthing system. In stations fitted with a radome, lightning protection is provided for the pedestal by the radome structure. In stations not fitted with a radome, additional earthing rods are provided between the pedestal support column and the radome base ring. In circumstances where a radome is removed from a station it is essential that these additional earthing rods are fitted. Refer to the As-Built Documentation for details of the earthing and lightning protection systems.

Flexible, low resistance, braided copper strips, connected between the bearing trestles on the azimuth yoke and the arms of the elevation yoke, bridge the elevation bearings.

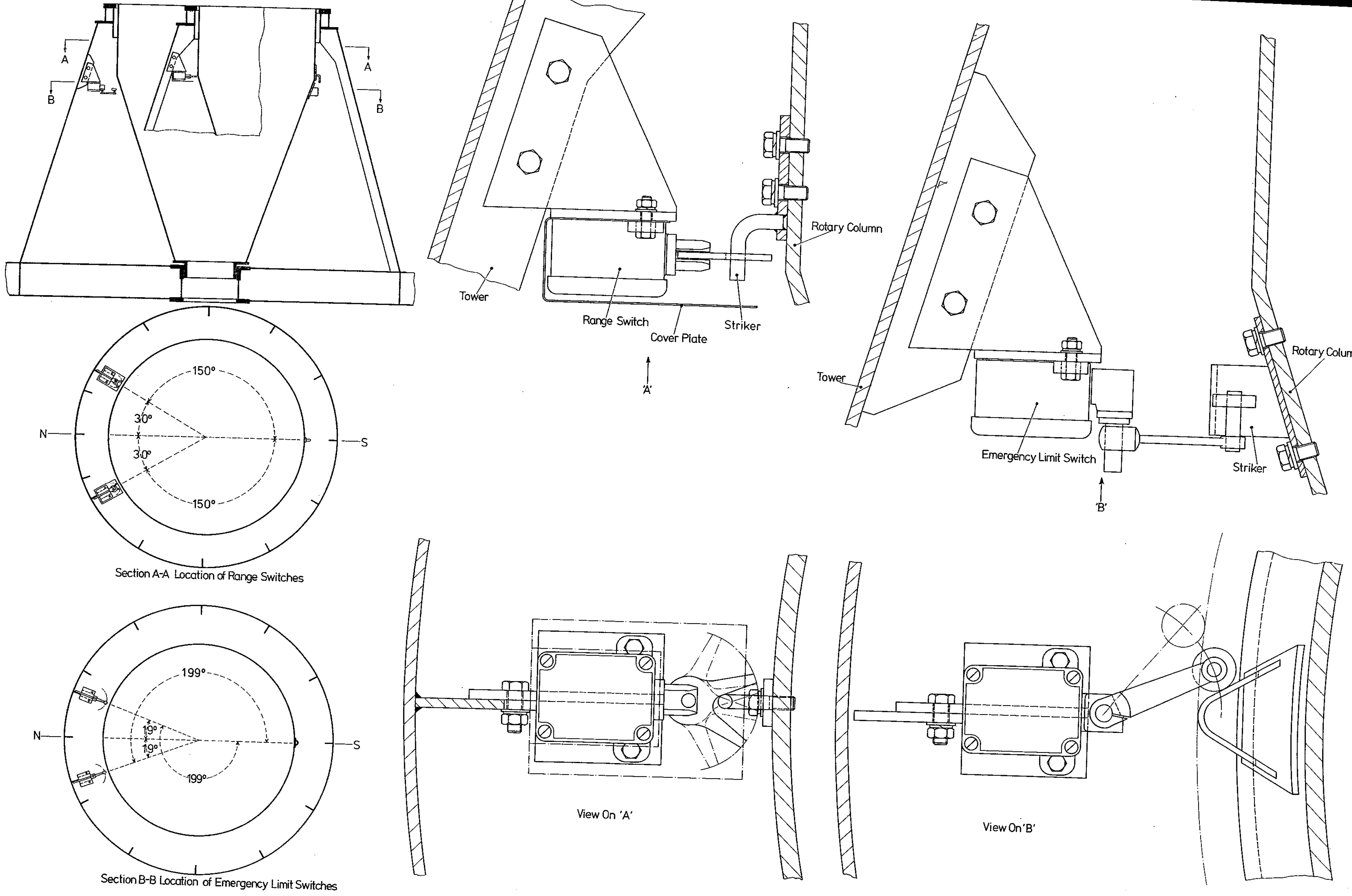
The azimuth bearings are bridged by three heavy duty brushes which bear on to a copper ring secured around the top of the tower (refer to Figure 2.2-1) and provide a by-pass path between the moving structure and the fixed structure. The brushes are mounted in brush holders secured to the bottom of the azimuth yoke.



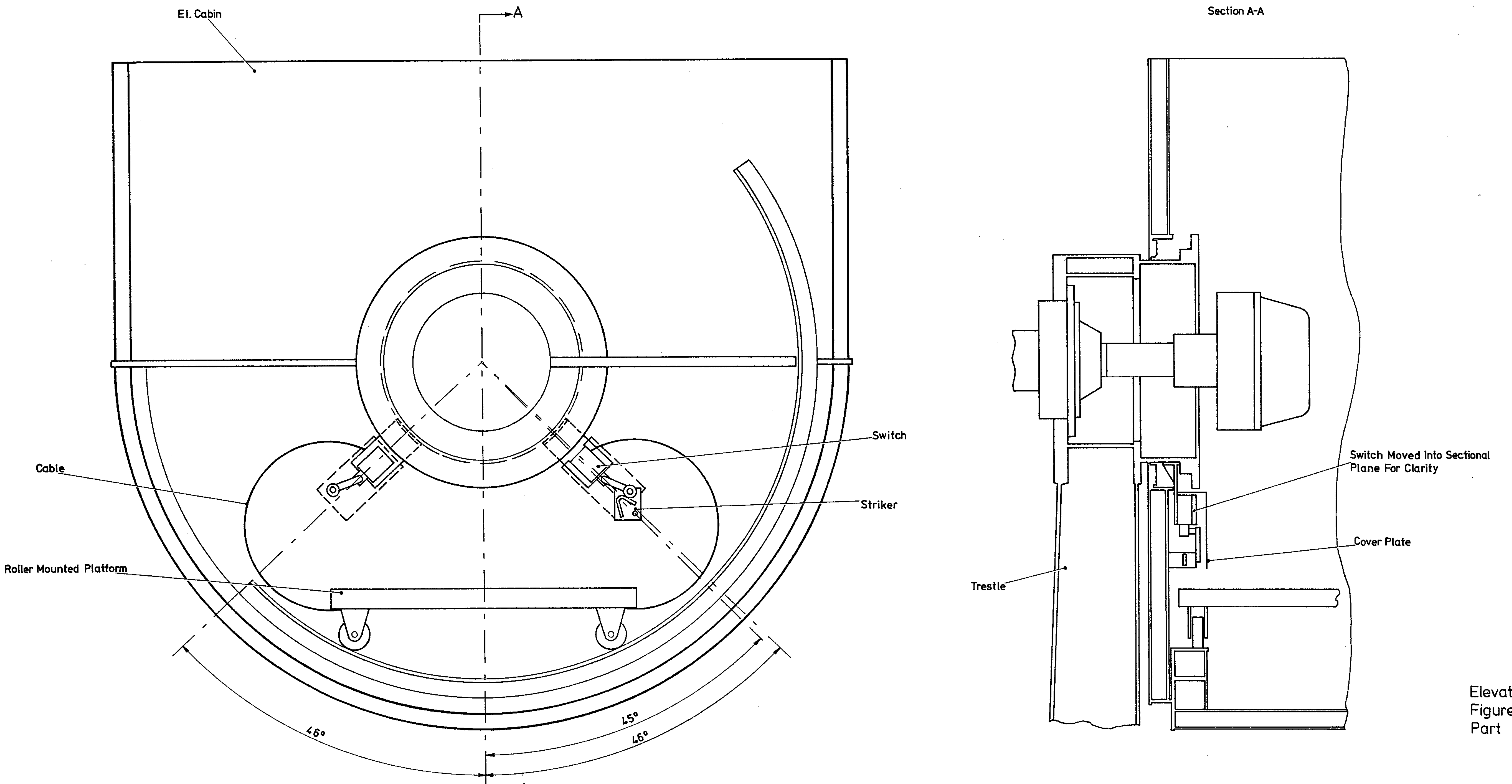
Pedestal General-Assembly
Figure 2.1-1
Part 1



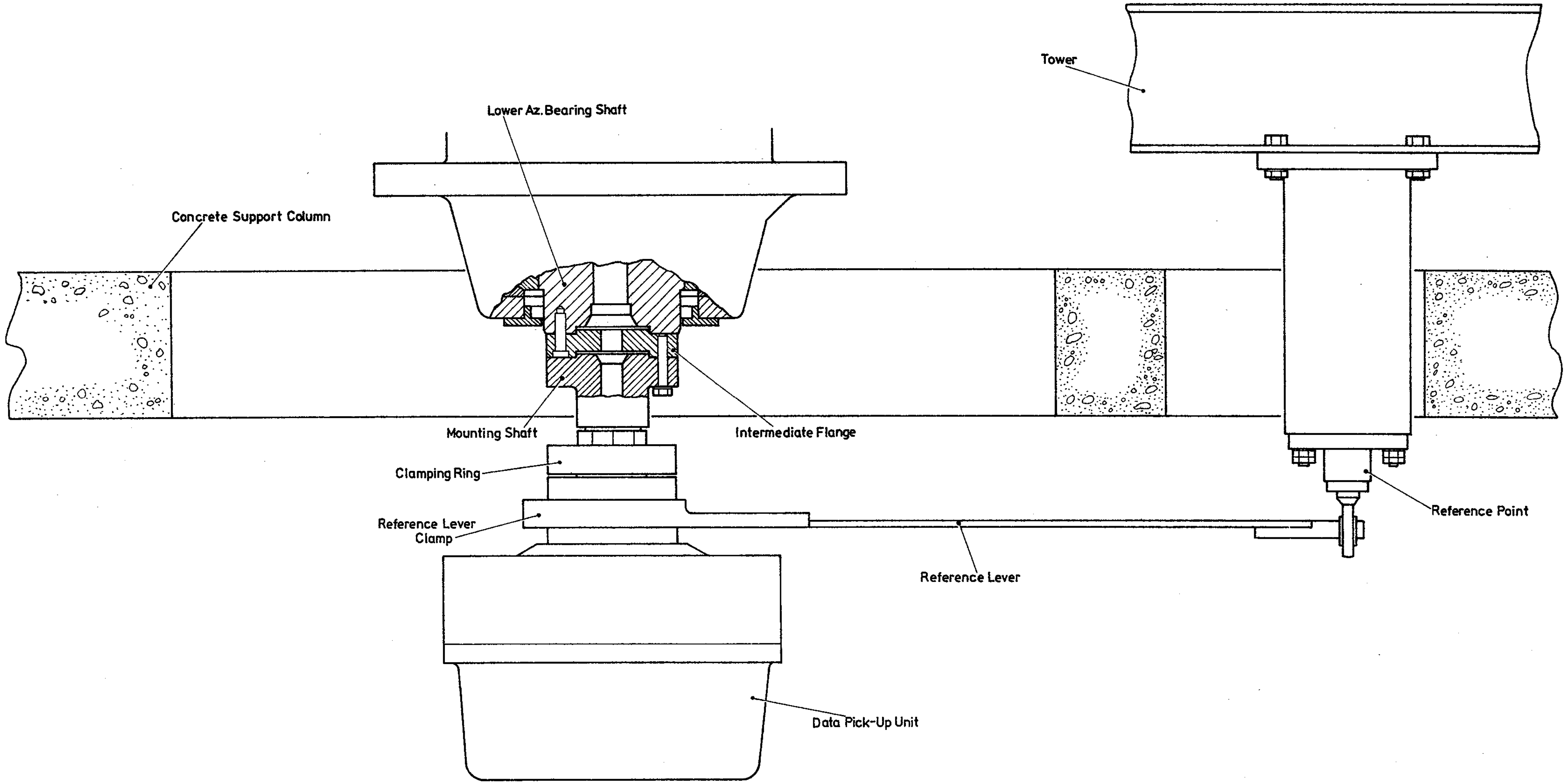
Elevation Bearings
Figure 2.4-3
Part 1



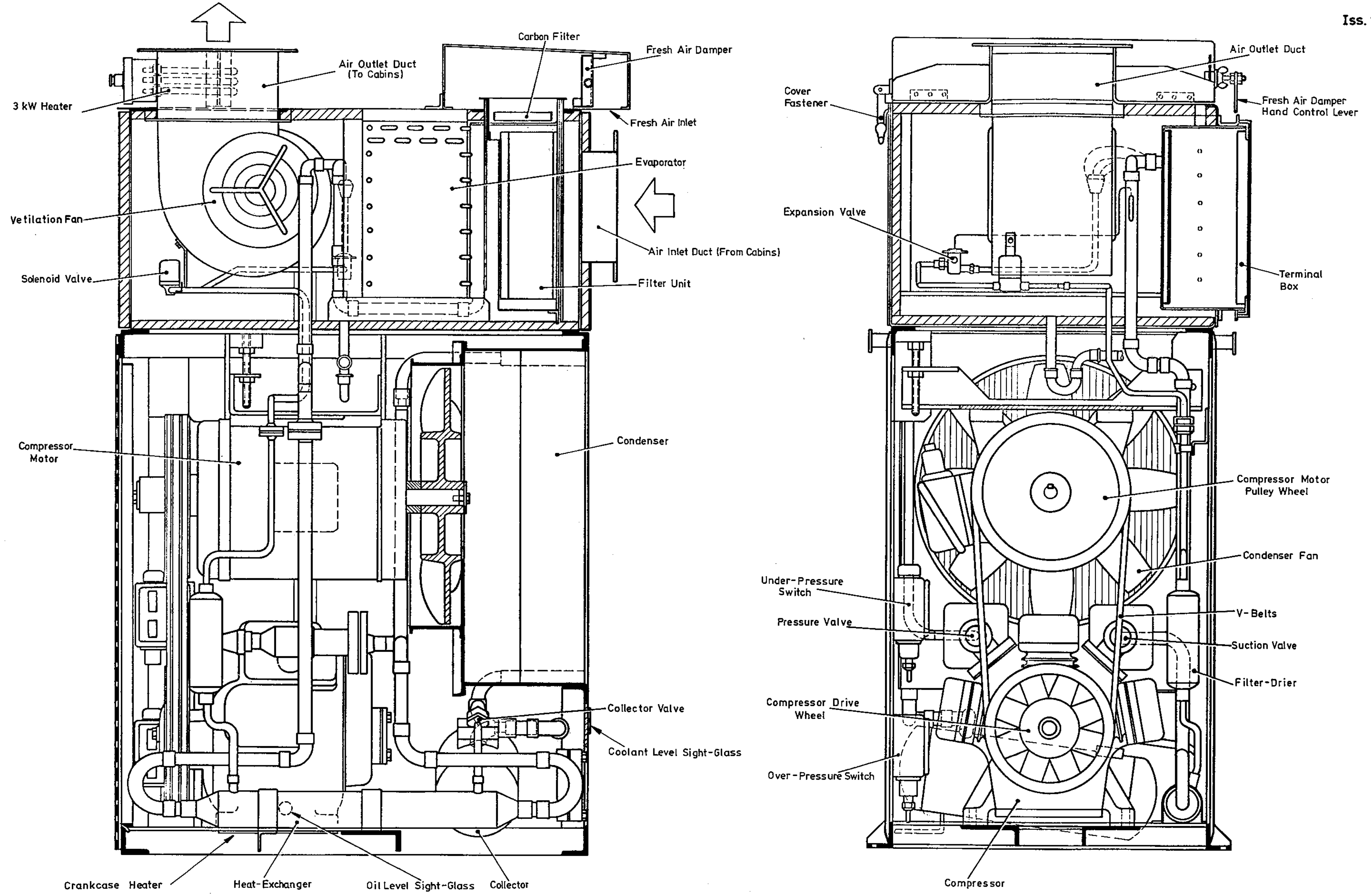
Azimuth Range and Limit Switches
Figure 2.8-1
Part 1



Elevation Emergency Limit Switches
Figure 2.8-2
Part 1



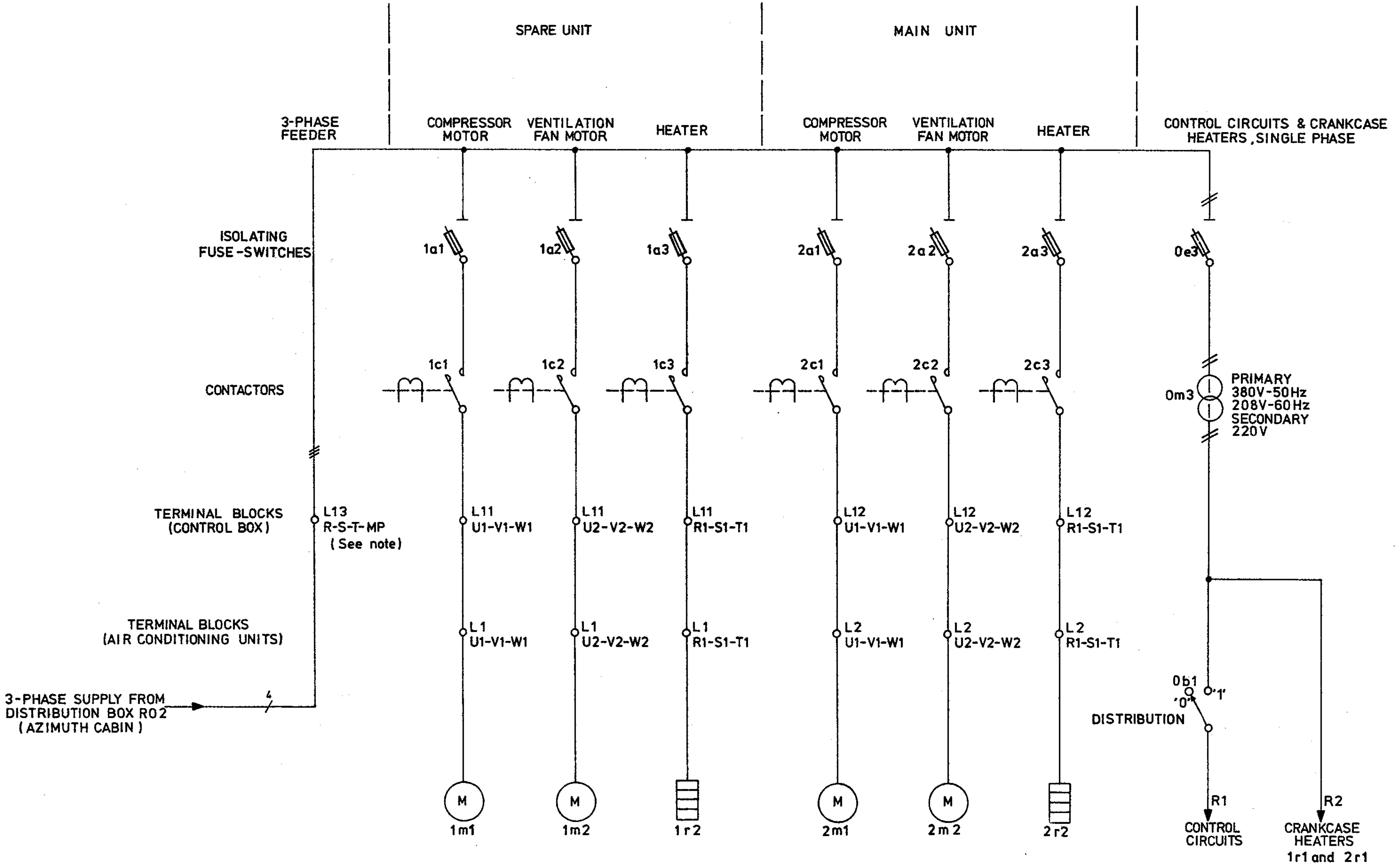
Azimuth Data Pick-Up Unit
Figure 2.9-1
Part 1



Air Conditioning Units

Figure 2.10-3

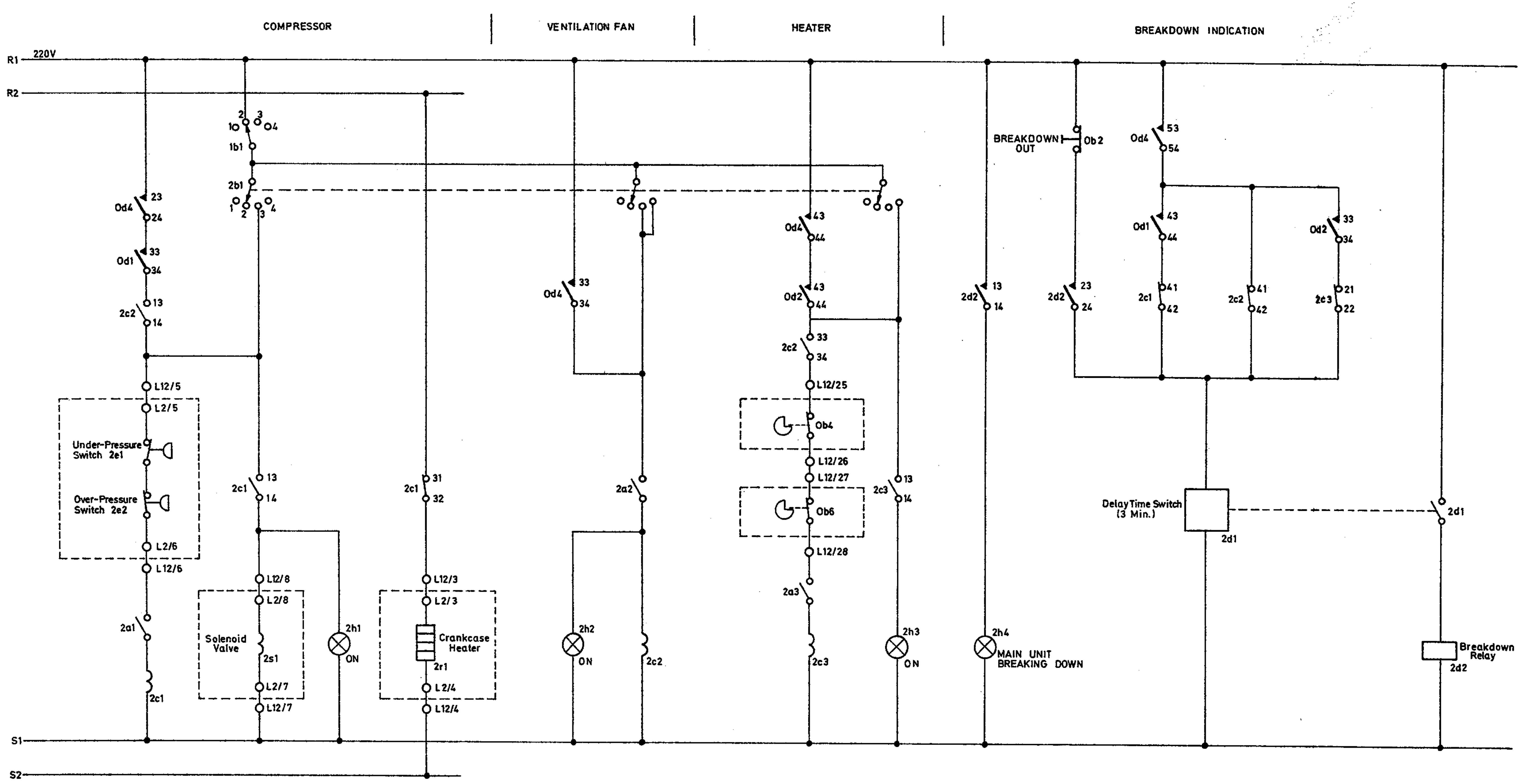
Part 1



NOTE:
The 3-phase neutral line MP is connected directly to the 3 phase loads via terminal blocks L11 and L12, L1 and L2.

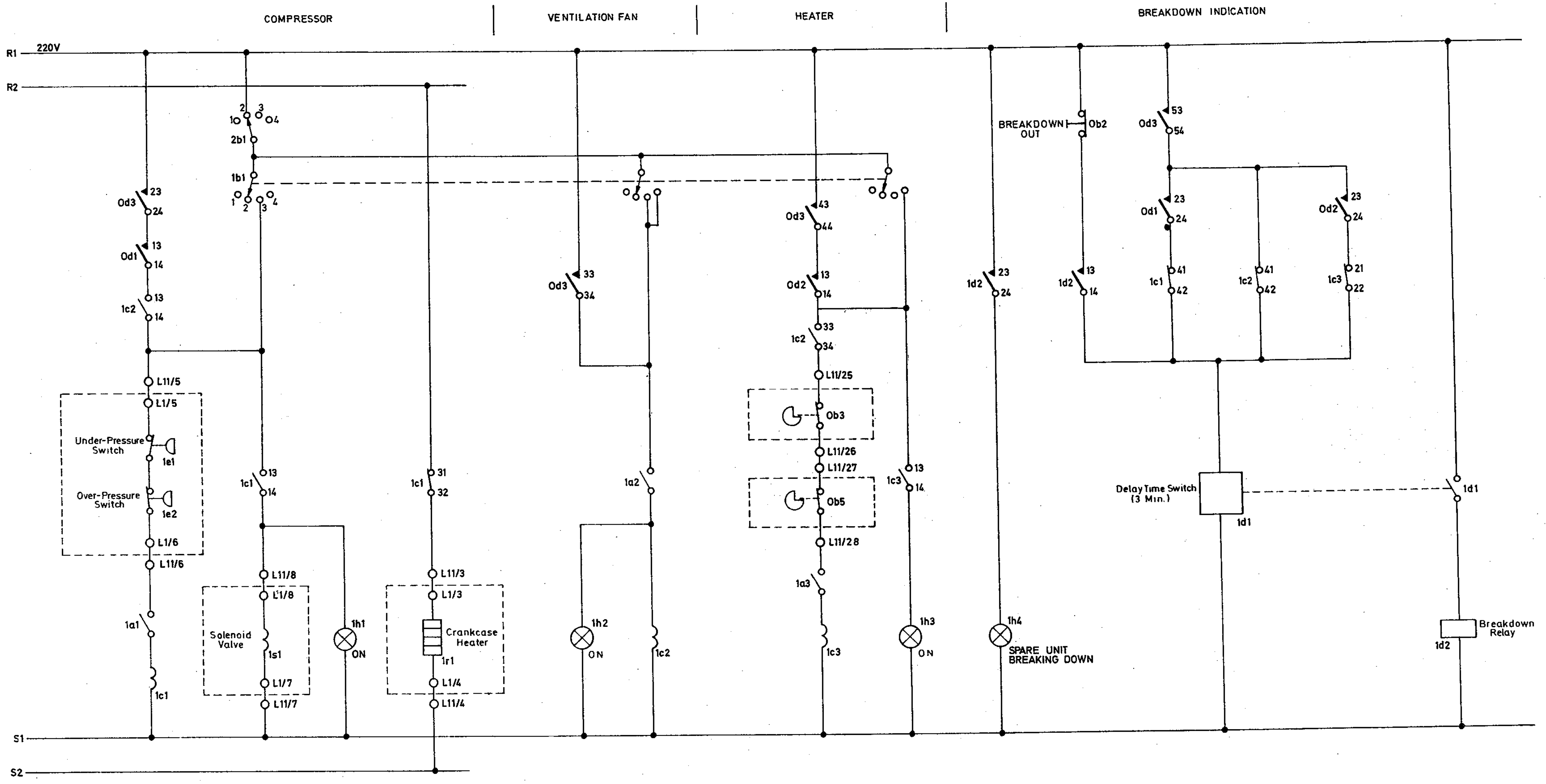
EUROPEAN SITES	380V-50Hz	22.5A	0.85A	3kW-4.5A	22.5A	0.85A	3kW-4.5A	220V-50Hz
N. AMERICAN SITES	208V-60Hz	41.5A	1.87A	3kW-8.3A	41.5A	1.87A	3kW-8.3 A	220V-60Hz

Air Conditioning Plant, Mains Supplies
Figure 2.10-4
Part 1



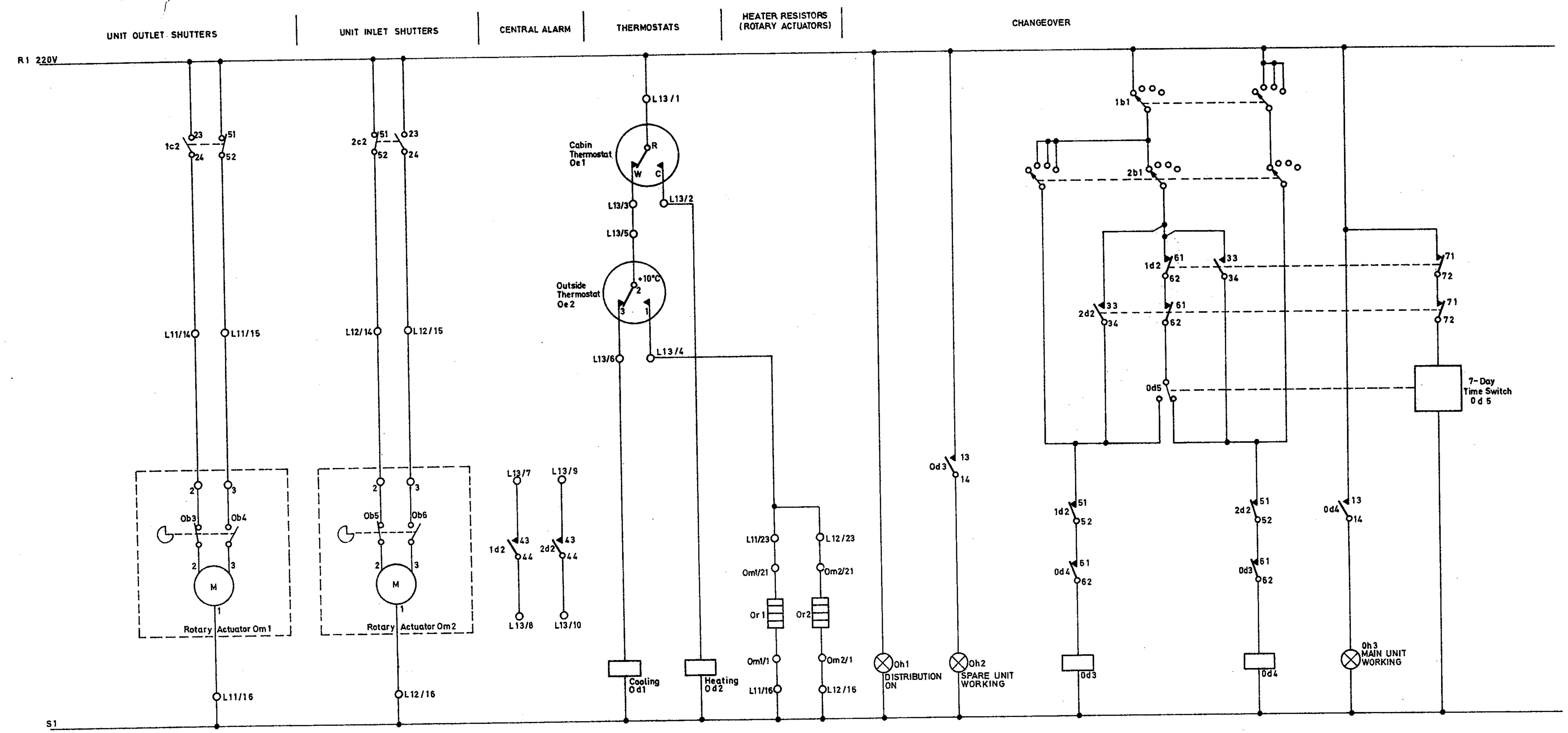
Switches 1b1 & 2b1
1=Automatic
2=Off
3=Cooling
4=Heating

Air Conditioning, MAIN Unit-Circuit Diagram
Figure 2.10-5
Part 1

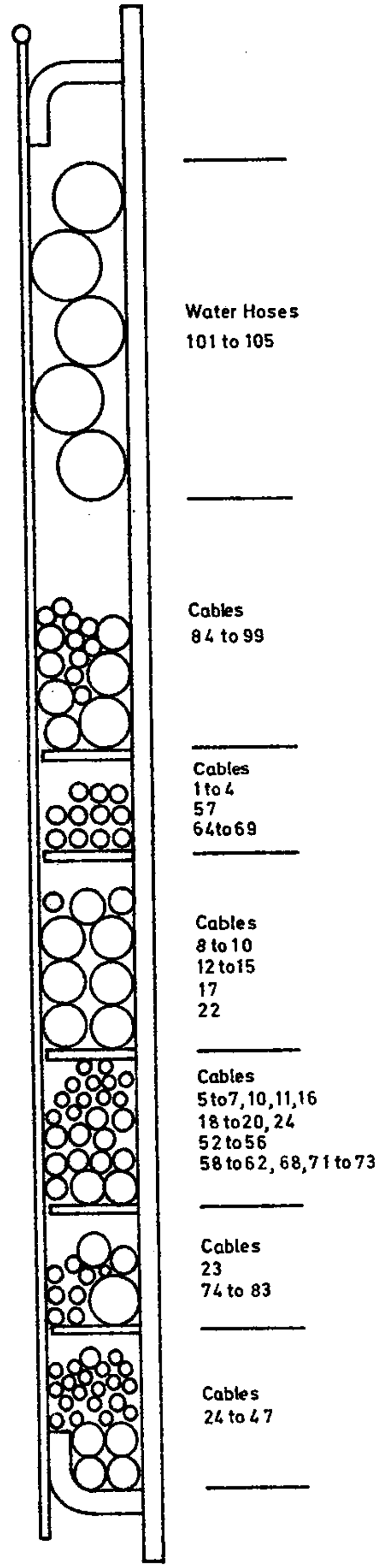


Switches 1b1 & 2b1
1 = Automatic
2 = Off
3 = Cooling
4 = Heating

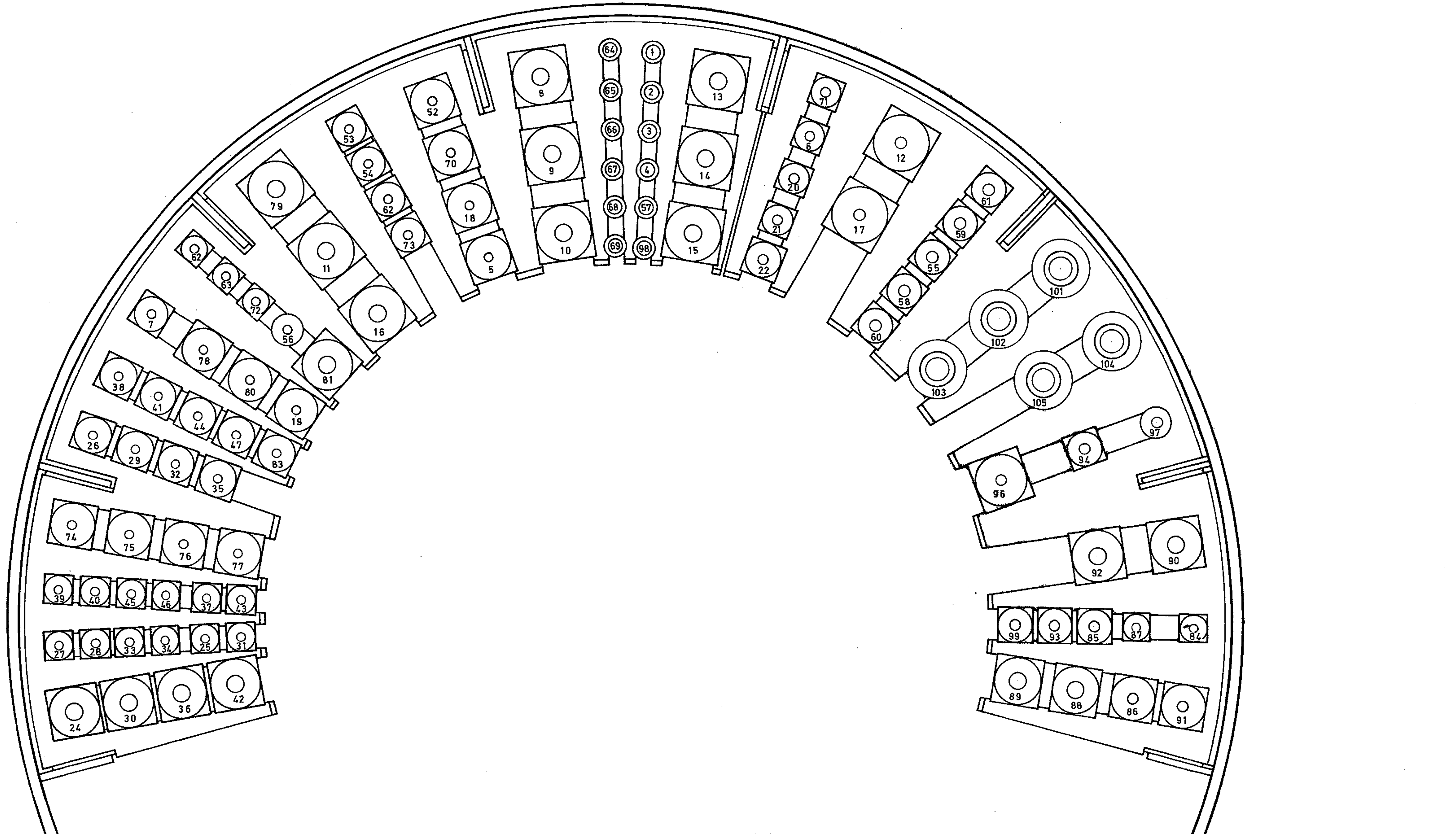
Air Conditioning, SPARE Unit - Circuit Diagram
Figure 2.10-6
Part 1



Air Conditioning, Control-Changeover-Circuit Diagram
Figure 2.10-7
Part 1

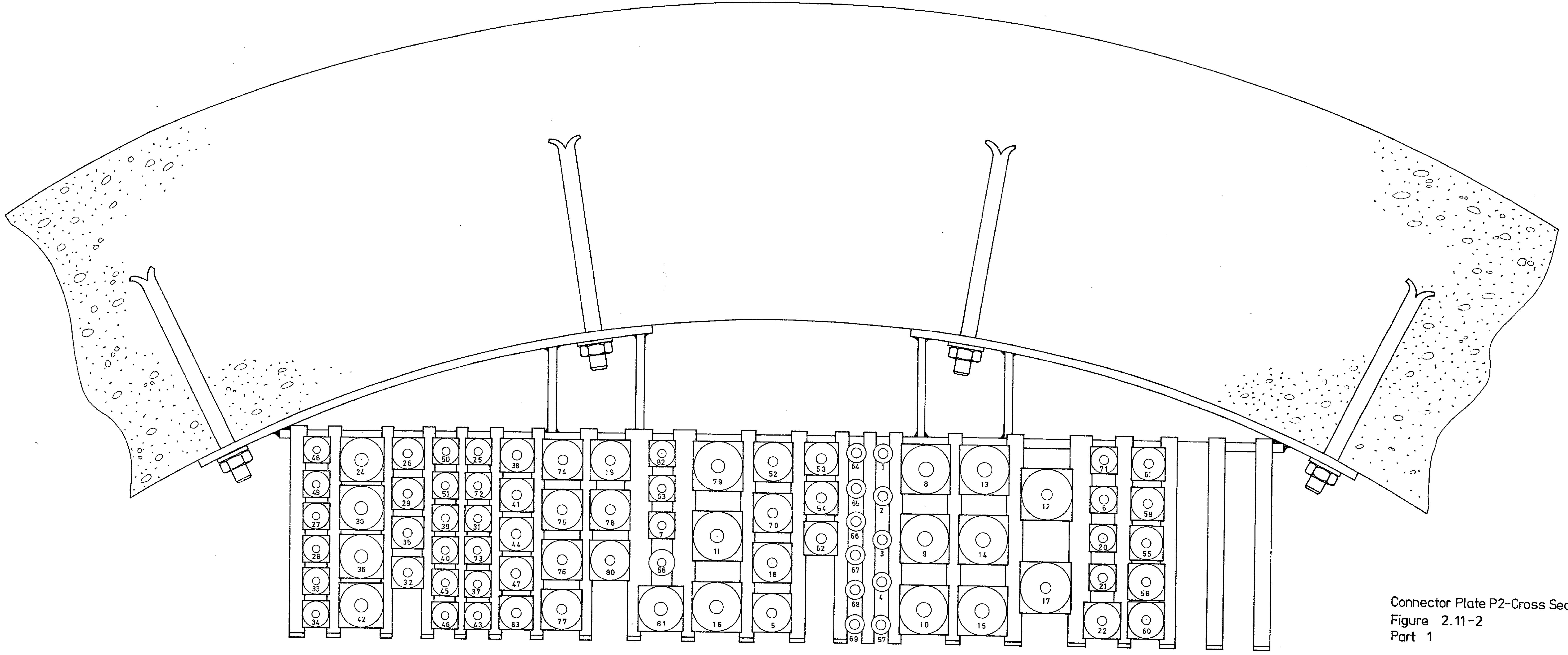


Section Through Cable Wrap

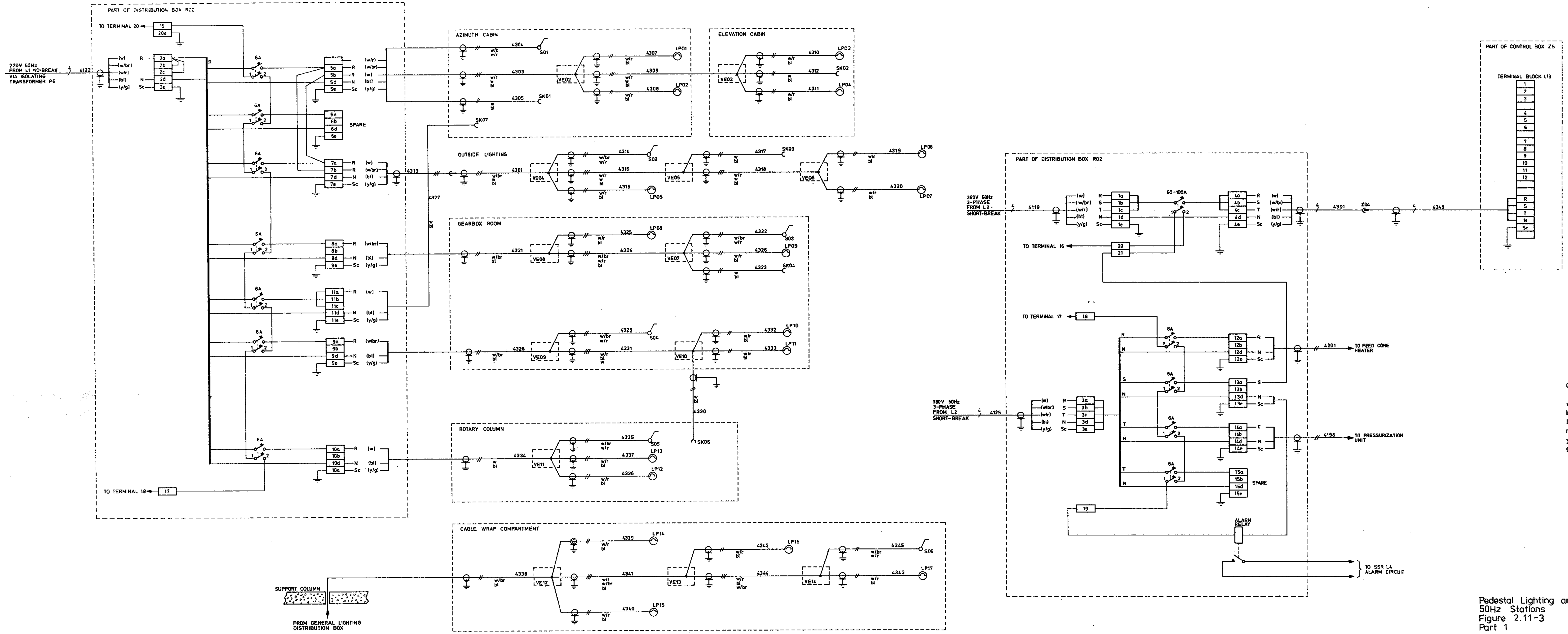


Section Through Cables at Connector Plate 'P1'

Connector Plate P1 and Cable Wrap
Figure 2.11-1
Part 1



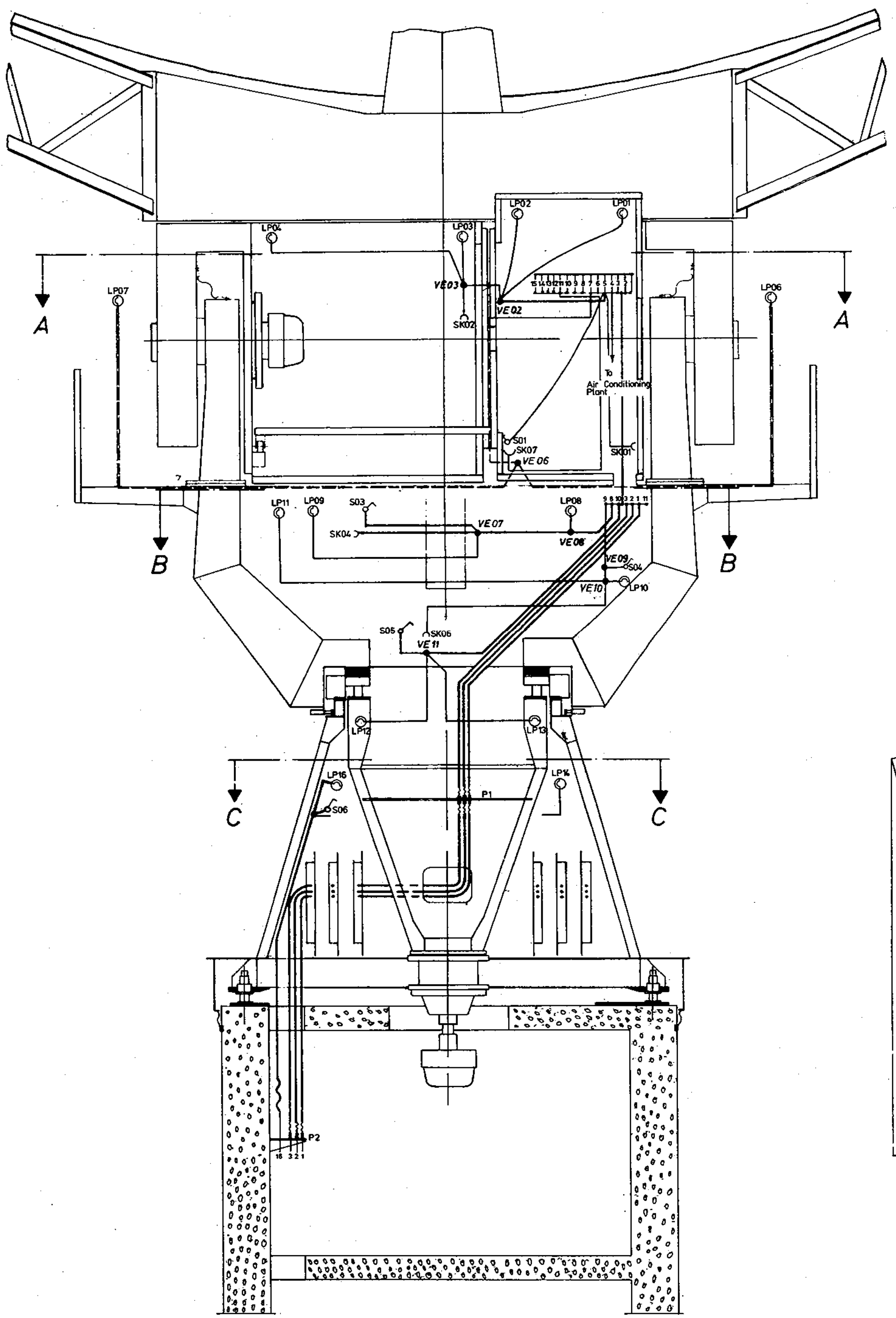
Connector Plate P2-Cross Section of Cables
Figure 2.11-2
Part 1

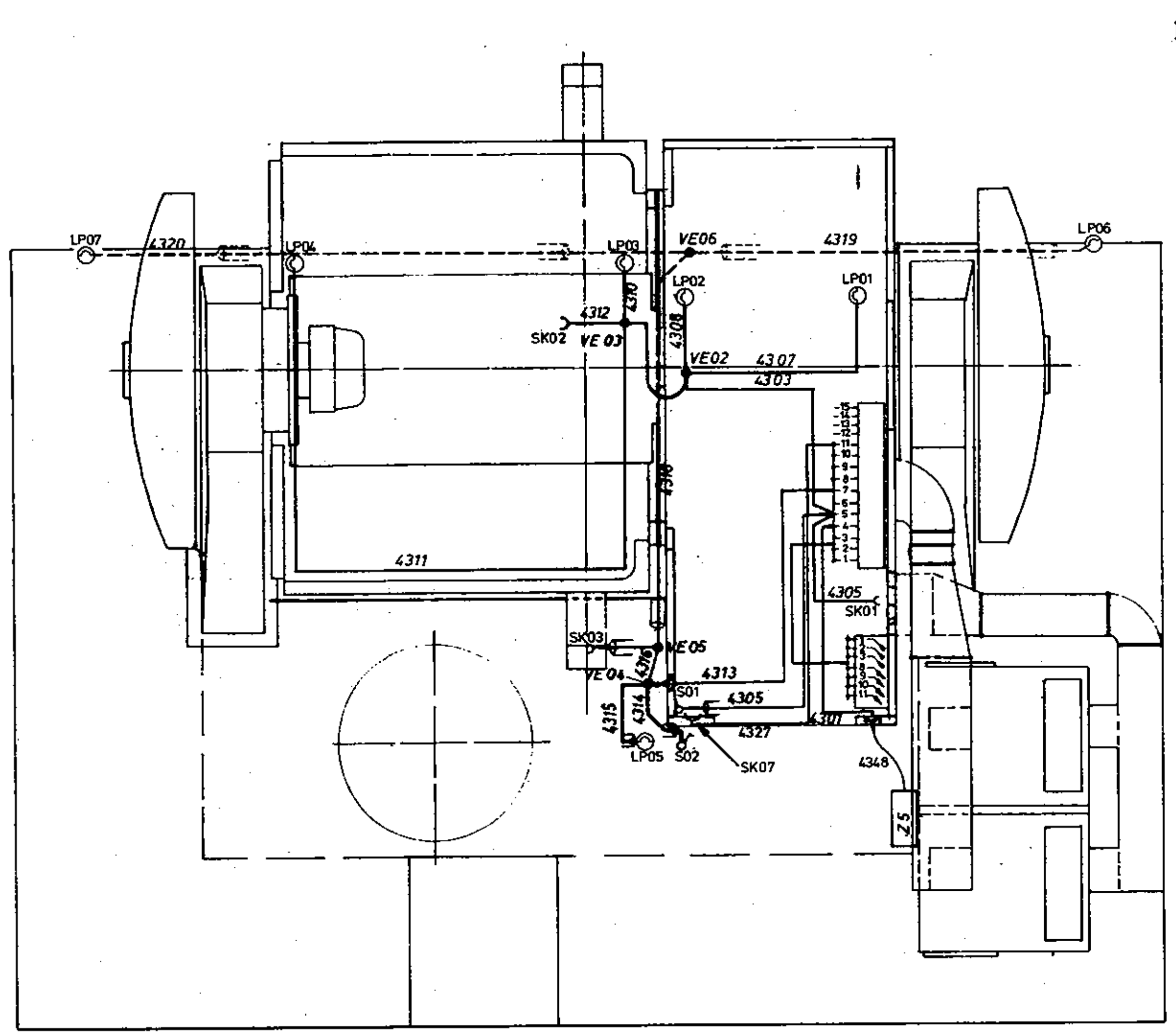


COLOUR CODE

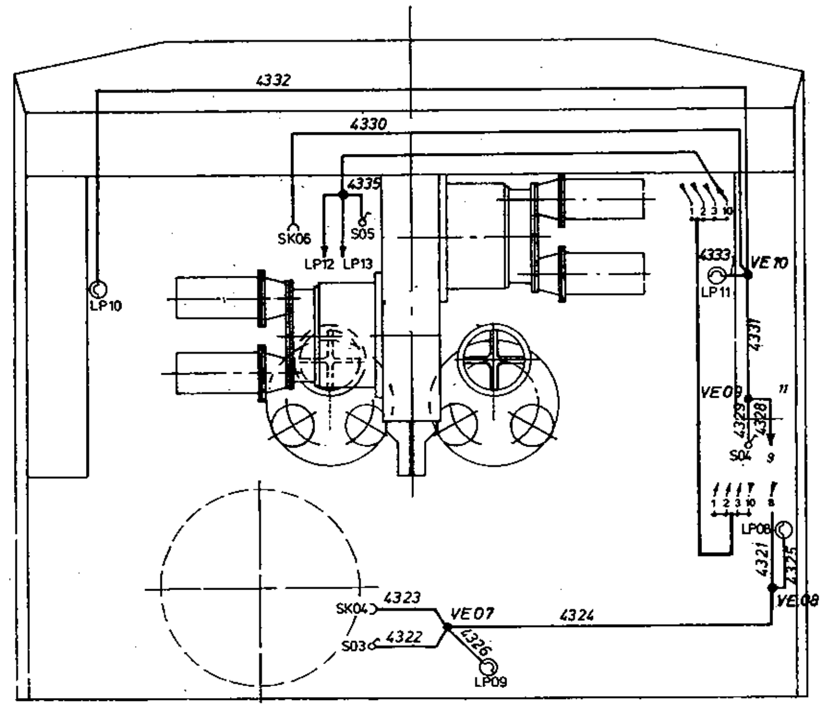
w	=	White
bl	=	Blue
br	=	Brown
r	=	Red
y	=	Yellow
g	=	Green

Pedestal Lighting and Ancillary Power Supplies - 50Hz Stations
Figure 2.11-3
Part 1

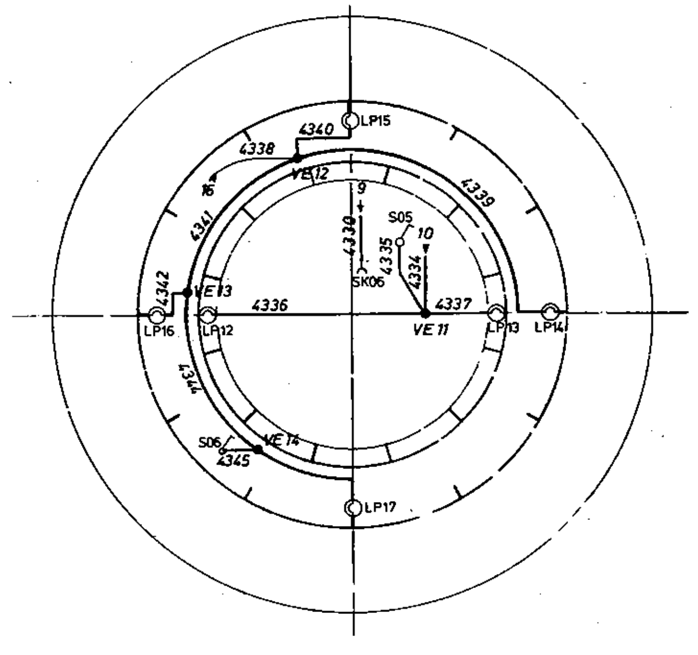




Section A-A

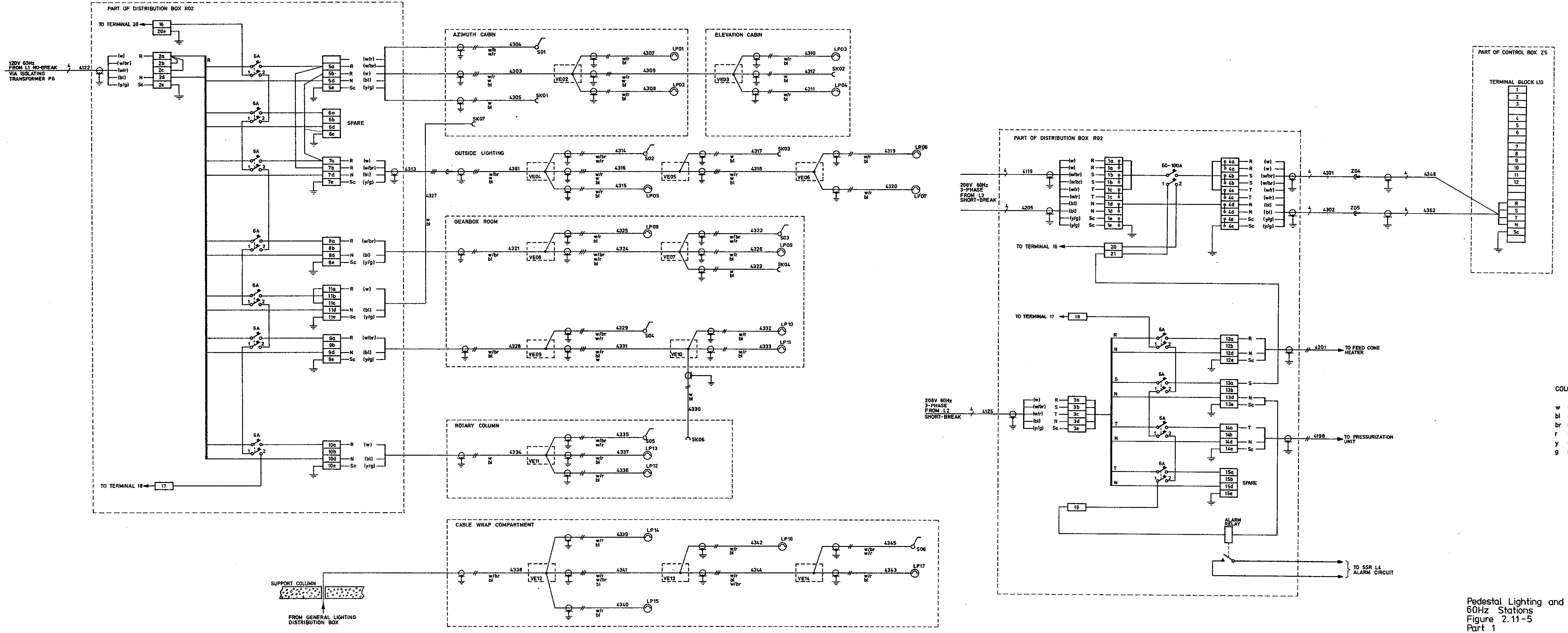


Section B-B



Section C-C

Pedestal Lighting and Ancillary Power Supplies -
Cabling Diagram
Figure 2.11-4
Part 1



COLOUR CODE

w = White
bl = Blue
br = Brown
r = Red
y = Yellow
g = Green

Pedestal Lighting and Ancillary Power Supplies - 60Hz Stations
Figure 2.11-5
Part 1

PART ONE

SECTION THREE

PERFORMANCE SPECIFICATIONS

1. PEDESTAL

1.1 TYPE

Elevation over azimuth

1.2 RANGE

1.2.1 Azimuth

Rotation range	: -20° to $+380^{\circ}$
Pre-limit switches	: -14°, $+374^{\circ}$
Emergency limit switches (in conjunction with range switches)	: -19°, $+379^{\circ}$
Range switches	: 30° either side of North
Stow pin position	: $+180^{\circ}$

All angles relative to North marking on base ring.

1.2.2 Elevation

Rotation range	: -2° to $+92^{\circ}$
Pre-limit switches	: $+3.5^{\circ}$, $+86.5^{\circ}$
Emergency limit switches	: -1°, $+91^{\circ}$
Stow pin positions	: 0°, 90°

All angles relative to Horizontal.

1.3 TRANSMISSION RATIOS

Elevation gearbox output to elevation toothed segment	: 16:1
Azimuth gearbox output pinion to azimuth toothed ring	: 10:1

1.4 ALIGNMENT

Adjustment range for verticallity of azimuth axis	: ±2°

1.5 WEIGHT (Approx)

Base ring	: 1,280 kg (2828.8 lb)
Tower, each section	: 2,400 kg (5304.0 lb)
Azimuth toothed ring	: 1,400 kg (3094 lb)
Cable wrap, equipped	: 1,700 kg (3757.0 lb)
Rotary column, without bearing	: 1,600 kg (3536.0 lb)
Lower azimuth bearing	: 400 kg (884 lb)
Azimuth yoke, without equipment	: 4,900 kg (10,829.0 lb)
Azimuth yoke annexe	: 2,000 kg (4420.0 lb)
Gearbox, with heater and oil but excluding motors and tacho-generator	: 730 kg (1640.0 lb)
Drive motor	: 85 kg (172.0 lb)
Blower assembly	: 11 kg (24.2 lb)
Tacho-generator	: 8.3 kg (18.3 lb)
Elevation yoke with elevation cabin and toothed segment	: 5,900 kg (13,090.0 lb)
Elevation bearings	: 320 kg (707.2 lb) and 380 kg (804.8 lb)

Azimuth cabin, without equipment	: 1,500 kg (3315.0 lb)
Air conditioning unit, each	: 560 kg (1237.6 lb)
Air duct system	: 450 kg (994.5 lb)
Davit	: 200 kg (442.0 lb)

1.6 OVERALL DIMENSIONS (Approx)

Base ring	: Diam. 3650 mm (12 ft) Thickness 30 mm (1.2 in)
Tower, including catwalk, excluding azimuth ring	: Height 2610 mm (8 ft 7 in) Diam. 4020 mm (13 ft 2 in)
Azimuth ring	: Diam. 2012 mm (6 ft 7 in) Thickness 200 mm (7.9 in)
Rotary column	: Height 2560 mm (8 ft 5 in) Diam. 1650 mm (5 ft 5 in)
Azimuth yoke, including bearing trestles	: 3455 mm x 4800 mm x 2500 mm (11 ft 4 in x 15 ft 9 in x 8 ft 3 in)
Azimuth yoke annex, excluding platform side members	: 1850 mm x 4240 mm x 2167 mm (6 ft 1 in x 13 ft 11 in x 7 ft 2 in)
Elevation yoke with elevation cabin and toothed segment	: 2600 mm x 4800 mm x 3380 mm (8 ft 7 in x 15 ft 9 in x 11 ft 1 in)
Azimuth cabin	: 2430 mm x 3104 mm x 1283 mm (8 ft x 10 ft 2 in x 4 ft $2^1/_2$ in)

Air Conditioning, one unit	:	1575 mm x 900 mm x 740 mm (5 ft 2 in x 2 ft 11$^1/_2$ in x 2 ft 5 in)
Drive Assembly	:	1423 mm (4 ft 8 in) long x 930 mm (3 ft 2$^5/_8$ in) max. width with blower fans in elevation position.

1.7 CORROSION PROTECTION

Structure	:	3 layers of corrosion protective epoxy coating. Primer, Elgol 734 First coat, Elgol 735 Second coat, Elgol 737 - colour code RAL 7035
Temperature range	:	Stable to 100°C.
Life	:	With radome 7 years. Without radome 3-4 years.
Accessories and small components	:	Hot dip zinc galvanized or stainless steel construction.

1.8 LIGHTNING PROTECTION

Pedestal	:	Bridging of elevation bearings. Brush contacts across upper azimuth bearing at top of tower.

1.9 LIGHTING AND ANCILLARY POWER SUPPLIES

1.9.1 50 Hz Stations

Input to isolating transformer	:	220 V, 50 Hz, single-phase from no-break supply, 4 kVA.
Lighting and sockets on moving structure	:	220 V, 50 Hz, single-phase from no-break supply via isolating transformer.

Lighting on fixed structure	:	220 V, 50 Hz, single-phase from general lighting distribution box in support column.
Air Conditioning	:	380 V, 50 Hz, 3-phase from short-break supply, 12 kW max. per unit.
Feed cone heater and pressurization unit	:	220 V, 50 Hz, single-phase from short-break supply.

Permitted limits of variations of mains input, phase to phase, are 323 V to 427 V, 42.5 Hz to 57.5 Hz.

1.9.2 60 Hz Stations

Input to isolating transformer	:	120 V, 60 Hz, single-phase from no-break supply, 4 kVA.
Lighting and sockets on moving structure	:	120 V, 60 Hz, single-phase from no-break supply via isolating transformer.
Lighting on fixed structure	:	120 V, 60 Hz, single-phase from general lighting distribution box in support column.
Air conditioning	:	208 V, 60 Hz, 3-phase from short-break supply, 12 kW max. per unit.
Feed cone heater and pressurization unit	:	120 V, 60 Hz single-phase from short-break supply.

Permitted limits of variation of mains input, phase to phase, are 176.8 V to 239.2 V, 51 Hz to 69 Hz.

1.10 TEST EQUIPMENT

Spirit Levels (2 in number)	: Stiefelmayer, Type 220 HEHE Sensitivity 0.02 mm/m

2. D.C. DRIVE MOTORS

2.1 RATINGS

Type	: Scott Special K112
Operating Ambient Temperature Range	: -40^{o} to $+65^{o}C$
Full Load Torque (continuous rating)	: From 5 to 500 rev/min 2.25 kg.m (16.28 lb ft)
Full Load Torque (15 minute rating)	: From 500 to 2,500 rev/min 2.25 kg.m (16.28 lb ft)
Overload Torque (3 minute rating)	: At 2,500 rev/min 2.7 kg.m (19.54 lb ft)
Maximum Torque (continuous rating)	: At 2,500 rev/min 1.25 kg.m (9.04 lb ft)
Maximum Torque (continuous rating)	: At 500 rev/min 2.25 kg.m (16.28 lb ft)
Peak Current Rating	: 53 Amperes maximum

NOTE: The ratings are subject to the following restrictions:

a. The field windings must remain energized and blowers running at temperatures below $0^{o}C$, thus acting as a heater at low temperature.

b. In the event of the field windings being switched off for any length of time at ambient temperatures below $0^{o}C$, the fields and blowers should be switched on, as early as possible before the motor is required to operate again.

c. Operating at ambient temperatures in excess of $+55^{\circ}C$ will only be required under a radome, when the output torque required will be reduced to 30% of the rated torque (no wind load).

2.2 VOLTAGE SUPPLIES

Armature supply voltage	: 220 V ±10% d.c. for 2,500 rev/min
Field supply excitation	: 110 V ±10% d.c.

2.3 WINDINGS

Main field winding resistance	: 22.4 Ω (Nominal value at $20^{\circ}C$)
Interpole winding resistance	: 0.158 Ω (Nominal value at $20^{\circ}C$)
Armature resistance	: 0.2 Ω (Nominal value at $20^{\circ}C$)

2.4 INSULATION

Class F in accordance with BS2613, 1957.

2.5 BRUSH TYPES

Type	Recommended Operating Temperatures
Le Carbone Ltd EG 7098 (10 mm x 20 mm x 32 mm)	: -40 to $+10^{\circ}C$
Le Carbone Ltd EG 25SP/T (10 mm x 20 mm x 32 mm)	: -10 to $+65^{\circ}C$

NOTE: The low-temperature type brushes must be used with special stronger springs.

2.6 THERMAL SWITCHES

Location	Type
a. In one interpole winding of each d.c. drive motor	Normally closed thermostatic switch, 'Microtherm' Type, opening at 132°C ±3%.
b. In one field winding of each d.c. drive motor	

2.7 RADIO FREQUENCY INTERFERENCE

Amount generated and radiated : Within maximum limits stated in BS 800/1954.

2.8 INERTIA

Armature shaft assembly : 0.165 kg.cm sec^2

2.9 SPEED

Range : 5 to 2,700 rev/min continuously variable.

2.10 MOUNTING DETAILS

Flange mounted. May be operated horizontally or vertically with output shaft downwards.

2.11 BEARINGS

Location	Type
Commutator end	: R & M Type LJ 25, open type with special sealed plate (I.S.O. type 6205).
Drive end	: R & M Type LJ 40D, half-sealed to motor side (I.S.O. type 6206).

NOTE: Grease used in both bearings is Midland Silicone Ltd., Grade MS 33.

3. BLOWER MOTORS

Type	: Parvalux SD 18B/76460/9G Three-phase alternating, brushless.
European Sites	: 220/380 V a.c. ±10%, 50 Hz, 3-phase, 2800 rev/min continuous rating at 100 watts input.
N. American Sites	: 120/208 V a.c. ±10%, 60 Hz, 3-phase, 3300 rev/min continuous rating at 100 watts input.
Fan motor output	: Continuous within a temperature range of $-40^{\circ}C$ to $+65^{\circ}C$.
Fan capacity	: 2.83 m^3/min (96 ft^3/min)
Insulation	: Class E (3-phase a.c.) to BS 2713.

4. GEARBOXES

4.1 RATIOS

Overall	: 500.47 : 1
1st Reduction	: 9.8125 : 1
1st Epicyclic	: 8.368 : 1
2nd Epicyclic	: 6.095 : 1

4.2 OUTPUT PINION

Output pinion/antenna axis ratio is 16 : 1 Elevation
10 : 1 Azimuth

4.3 BACKLASH

With the input shafts held stationary, the output pinion has a maximum angular movement of 10 minutes of arc due to backlash in the gearbox.

4.4 BREAKAWAY TORQUE

With motors and tachometer removed, and the handwheel disengaged, the breakaway torque is 0.138 kg.m (1 lb ft) at the input shaft.

4.5 ELECTRO-MAGNETIC BRAKES

Each brake can hold an input torque of at least 6.22 kg.m (45 lb ft).

Solenoid voltage and current : 24 V d.c., 2.1 A maximum at 20°C

Brakes can be mechanically lifted (released) by hand levers on the azimuth gearboxes or by a pedal, connected to brake attachment linkage, on the elevation gearboxes.

4.6 STIFFNESS

With the input shafts held, the stiffness of the gearbox is not less then 1.6×10^6 kg.m/radian (11.6×10^6 lb ft/radian) at the output pinion.

4.7 REVERSIBILITY

With the motors removed and the handwheel disengaged, a torque of not more than 138 kg.m (1000 lb ft) applied to the output shaft is sufficient to reverse the gearbox.

4.8 INERTIA

The inertia of the gearbox about the high speed input shaft does not exceed 0.26 kg.m sec^2.

4.9 EFFICIENCY

The static efficiency of the gearbox is not less than 80%, and the dynamic efficiency approaches 90%.

4.10 TEMPERATURE RANGE AND OILS

The gearbox is capable of operating between temperature extremes of -40°C to +65°C. Recommended lubricating oils are as follows:

-40°C to +10°C - Shell TELLUS T17

-20°C to +65°C - Shell TELLUS T27

At the colder sites e.g. Norway and Canada, it is recommended that only grade T17 be used during the winter if the thermostatically controlled heating cannot keep the oil temperature permanently above -20°C. The grease used in the gearbox is Shell ALVANIA R.A., which is suitable for the full temperature range.

Oil capacity of gearbox	: 23 litres (40.5 pints)

4.11 HEATERS

The heater ratings are as follows:

North American sites	: 120 V a.c. single-phase, 680 watts at $+20^{\circ}$C.
European sites	: 220 V a.c. single-phase, 580 watts at $+20^{\circ}$C.

5. TACHO-GENERATORS

Type	: Georgi-Kobold, KPX 506
Scaling	: 60 Volts/1000 rev/min
Maximum output current	: 250 mA
Linearity	: ±0.5%
Brushes	: Type AG35, Dimensions 6.4 x 6.4 x 20 mm

6. LIMIT, RANGE AND INTERLOCK SWITCHES

6.1 EMERGENCY LIMIT SWITCHES; AZIMUTH:

Type	: Schmersal, TD 441-11Yt
Setting	: $+379^{\circ}$ -19°. (Referred to North marking on base ring.
Rating	: 15 A, 220 V Max.

6.2 RANGE LIMIT SWITCHES; AZIMUTH:

Type	: Schmersal, M2C 441-11Yt
Setting	: 30° either side of 0° (Referred to North marking on base ring).
Rating	: 15 A,220 V Max.

6.3 EMERGENCY LIMIT SWITCHES; ELEVATION:

Type	: Schmersal, TD 441-11Yt
Setting	: $\simeq -1^{\circ}$, $\simeq +91^{\circ}$. Referred to horizontal.
Rating	: 15 A,220 V Max.

6.4 STOW PIN SWITCHES; AZIMUTH AND ELEVATION:

Type	: Schmersal, TK 441-11Yt Spez. 879
Rating	: 15 A,220 V Max.

6.5 HANDWHEEL MICROSWITCHES

Type	: Burgess, V9/715
Rating	: 10 A,250 V a.c.

6.6 BRAKE MICROSWITCHES

Type	: Burgess, V9/715
Rating	: 10 A,250 V a.c.

7. GEARBOX ROOM SWITCHES

7.1 EMERGENCY OFF SWITCH, 00b7

Type	: BBC Mannheim, FAK1a-v
Rating	: 15 A,220 V Max.

7.2 THERMOSTAT, 10e3

Type	: Eberle and Co. Nürnberg 712-09.45/599.5
Setting	: 0°C to $+10^{\circ}$C depending on site.
Rating	: 10 A,250 V

8. DATA PICK-UP UNITS

Refer to Antenna Servo, Drive and Control Sub-system Handbook No. 601, Part One, Section Three.

9. CABIN AIR CONDITIONING PLANT

Manufacturer	: Brown Boveri-York 6800 Mannheim 1 West Germany
Manufacturer's type number	: XKK 6,5A (MAIN unit) XKK 6,5B (SPARE unit)
Supply voltage	: 380 V a.c. 3-phase, 50 Hz, (European sites) 208 V a.c. 3-phase, 60 Hz, (N. American sites)
Maximum Power requirement (cooling mode)	: Approx. 12 kW
Type of coolant	: FRIGEN R114 (also known as F114 in N. America) Tetrafluordichlorethene $C_2F_4Cl_2$
Quantity of coolant per unit (2 units)	: 8 kg ±2 kg when in operation (new units are shipped with 10 kg from the factory).
Type of compressor oil	: Dried Shell CLAVUS 933, supplied in water-vapour proof containers of 0.5 and 1 litre.
Quantity of compressor oil per unit (2 units)	: Approx. 2.5 kg (3 to 4 litres)
Air duct size at inlet and outlet	: 230 mm x 230 mm (0.053 square metres)
Volume of air exchanged by compressor motor fan for condenser cooling	: 6000 cubic metres/h against 100 mm water gauge.

Volume of air exchanged by ventilation fan	: 1100 cubic metres/h against 20 mm water gauge plus 30 to 50 cubic metres/h, depending on the setting of the fresh air dampers and the condition of the air filters.
Pressures in coolant circuit (pressure switch settings)	
Inlet (suction) side of compressor	: OFF $-15^{\circ}C$ = 0.47 ata ON $-5^{\circ}C$ = 0.73 ata
Outlet (pressure) side of compressor	: ON $+100^{\circ}C$ = 14.1 ata OFF $+110^{\circ}C$= 17.1 ata
Idle pressure in coolant circuit	: See Part Two, Table 3.19-1
Compressor manometer connections	: Hole in compressor suction and pressure valve assemblies with R 1/2 in thread (BSP or tapered Whitworth). Nozzle on coolant collector shut-off valve, with 7/16 UNF thread.
Outside thermostat setting	: $+10^{\circ}C$
Recommended cabin thermostat setting	: $+22^{\circ}C$
Condensation water container, connection tube	: Steel pipe with R 1/2 in thread (BSP or tapered Whitworth).
Compressor drive motor, rated power	: 11 kW at $+85^{\circ}C$ 5.5 kW at $+40^{\circ}C$

Compressor drive belts
(3 per unit) : Conti 12.5 x 1850 mm heat-resistant.

Air heater rating : 3 kW

10. DAVIT

Type : Adler, WH 15

Maximum load : To be in accordance with local regulations.

11. ENVIRONMENTAL CATEGORIES

11.1 PEDESTAL, DAVIT AND AIR CONDITIONING PLANT

Category 1 as defined in ICB, Part V, Section 1, Sub-section 1.1.3.

11.2 DRIVE ASSEMBLIES AND DATA PICK-UP UNITS

Category 2 as defined in ICB, Part V, Section 1, Sub-section 1.1.3.

PART ONE

SECTION FOUR

CONSTRUCTIONAL DETAILS

1. GENERAL

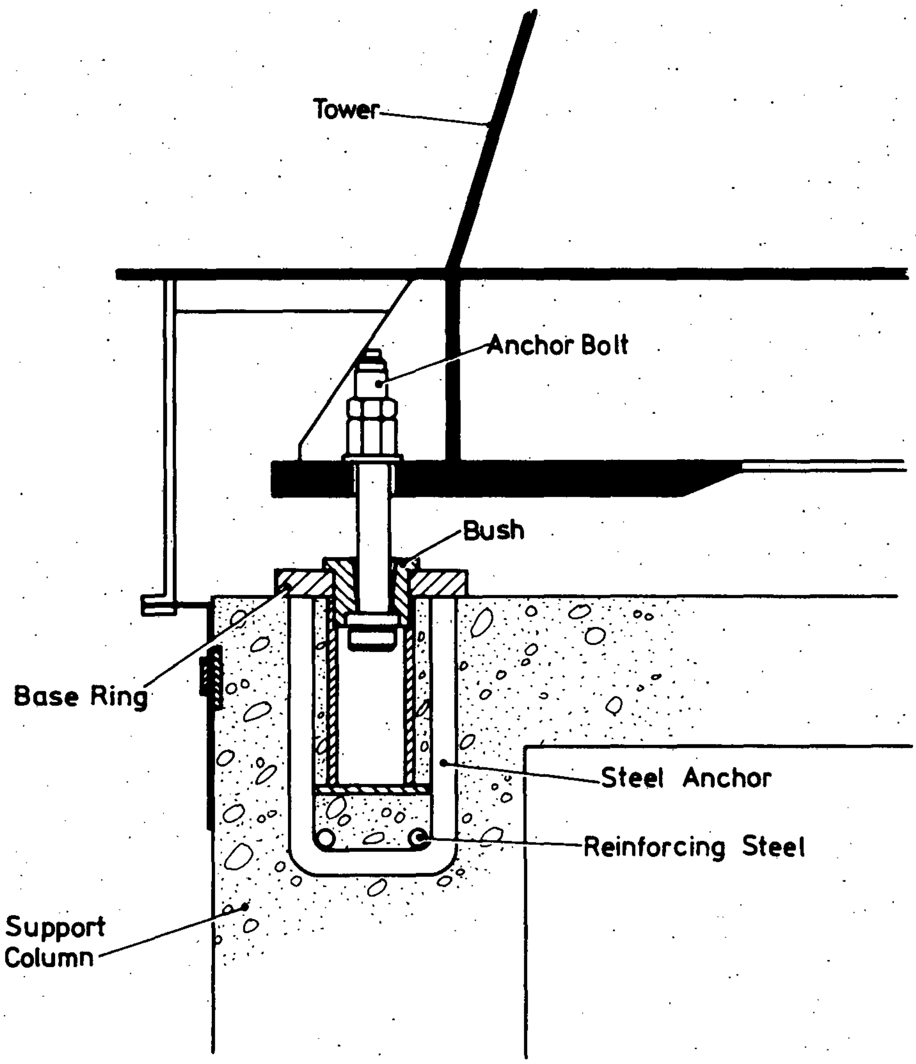
The pedestal can be dismantled into a number of sub-units to facilitate transportation by land, sea or air. The breakdown into sub-units will vary depending on the method of transportation to be used.

This section describes the construction of the major items comprising the pedestal as individual units, without necessarily referring to the inter-relation between them. For information on their inter-relation and functions refer to Part One, Section Two.

Structural elements which are connected together to form enclosed compartments are sealed at their interfaces with flat rubber jointing. The interface sealing of the azimuth and elevation cabins consists of specially formed rubber (refer to Sub-section 12). Yoke openings and the interface between the elevation cabin and reflector are sealed with sponge rubber. The gap between the tower base and the base ring is sealed with eight zinc plate segments.

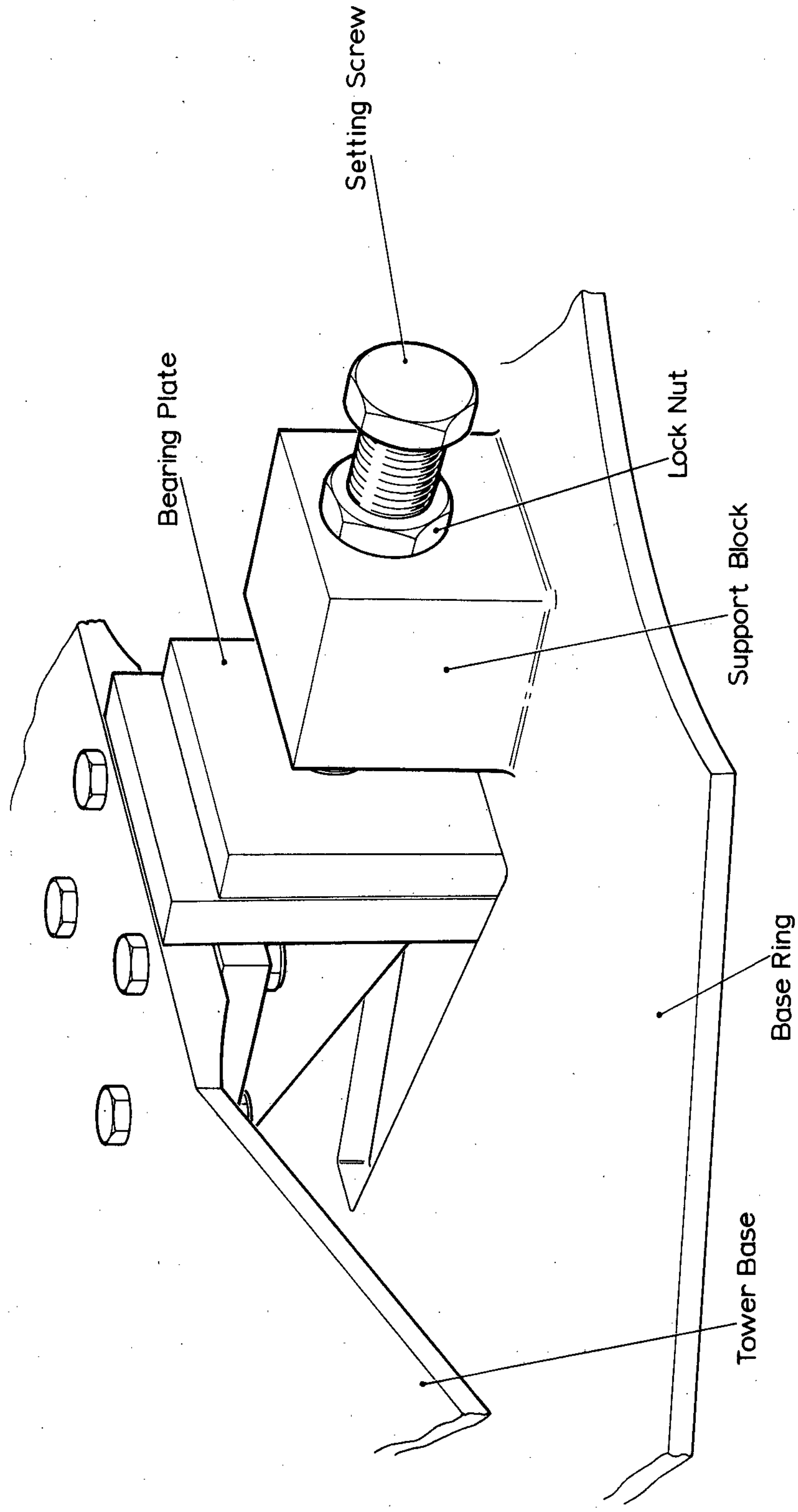
2. BASE RING (Figures 2.2-2, 4.2-1 and 4.2-2)

The base ring is a steel construction comprising four segments connected together by butt straps. On the underside of the base ring are welded U-shaped steel anchors by which the base ring is linked and secured to the reinforcing steel rods of the concrete support column (Figure 4.2-1).



Base Ring Anchoring

Fig. 4.2-1



Tower Setting Screws

Fig. 4.2-2

Six plates, secured by screws to the top face of the base ring, provide the bearing points for the tower jacking screws (Figure 2.2-2). Tapped holes in the base ring, adjacent to the bearing plates, accept the bushes through which the tower anchor bolts are inserted. The jacking screws are pressure screws and the anchor bolts are tension screws thereby achieving a rigid connection between the tower and the base ring.

Four steel blocks, welded to the top face of the base ring at diagonally opposite points, carry the setting screws which bear against plates bolted to the tower base to prevent twisting of the tower anchor under torsional loading (Figures 4.2-2 and 5.3-1).

3. TOWER AND AZIMUTH TOOTHED RING (Figure 4.3-1)

The tower is constructed in two halves, from formed steel plates welded to internal vertical ribs, and bolted together to form a truncated, hollow cone structure. The base of the tower is formed by a steel spider, also constructed in two halves which are welded to the tower halves. The radial arms of the spider converge at the centre of the tower, to form the ring flanges to which the housing of the lower azimuth bearing is secured. Two semi-circular steel plates are secured to the top facings of the spider to form a floor to the tower on which the cable wrap is supported.

Holes located at six equi-spaced positions around the base of the tower, accept the 12 anchor bolts and the six jacking screws (Figure 2.2-2).

Four bearing plates are bolted to the tower base, in pairs, at two diagonally opposite points on the inner circumference of the base. These bearing plates are used in conjunction with the tower setting screws (refer to Sub-section 2).

Two openings, one in each half of the tower, are fitted with cover plates and give access to the inside of the tower. The larger opening permits entry, by a man, into the inside of the tower. The smaller opening gives hand access only, for work on the cable wrap securing bolts which are located inside the tower adjacent to the opening.

Two guide rails, each extending over a sector of approximately 120°, are secured to the inside of the southern half tower. These rails provide the securing positions for the cable wrap as well as serving to guide the cable wrap rollers (Figure 4.6-1).

A guide ring, welded to the vertical ribs of the tower just below the upper guide rail, prevents the outer brackets of the cable wrap from fouling the vertical ribs.

The azimuth toothed ring is constructed in one piece and has its inner surface accurately machined to provide a bearing surface for the rollers of the upper azimuth bearing. It is mounted on top of the upper flange of the tower and secured to it by 24 screws which enter the ring from underneath. Four tapped holes are provided for transportation eyebolts.

A copper ring, constructed in two sections, is secured to the top of the tower beneath the azimuth toothed ring. The copper ring provides a contact surface for the lightning protection brushes.

A handrail is welded around the outside of the tower.

4. CATWALK (Figure 4.3-1)

The catwalk comprises six segments, manufactured in steel plate, bolted together at their flanged ends and secured around the tower base.

The lower flange of the catwalk is drilled at intervals around its circumference to secure the zinc plate sealing strips which, together with the catwalk, enclose the gap between the tower base and the base ring.

5. ROTARY COLUMN AND CONNECTOR PLATE P1 (Figure 4.5-1)

The rotary column is constructed from formed steel plates welded to internal vertical ribs to form an inverted, truncated, hollow cone surmounted at its larger end by an open cylinder.

The cylindrical upper end of the rotary column is strengthened at the top by two ring flanges stiffened by equi-spaced vertical struts, between which are located the rollers of the upper azimuth bearing (refer to Sub-section 15).

Welded to the lower end of the rotary column are the ring flanges to which the pivot shaft of the lower azimuth bearing is secured. These flanges also serve to stiffen the lower end of the rotary column and to carry a support ring to which the inner, lower end of the cable wrap is secured. A second support ring, for securing the inner, upper end of the cable wrap, is screwed to welded blocks around the rotary column at approximately half the height of the conical section.

An opening, stiffened by steel bushing and lined with rubber on its lower edge to minimize rubbing of the cables, is located adjacent to the inner securing point of the cable wrap and affords entry for the cables and hoses of the cable wrap into the rotary column. A clamp, secured by two long screws to the upper edge of the opening, holds the cables at the point of entry.

NOTE: The water hoses are not held by the clamp but are laid over the bracket between the two long screws. The screws are covered with insulating tubing to protect the hoses from chafing.

Connector Plate P1 is secured to the inside of the rotary column, near the top of the conical section. This connector plate is a galvanized metal plate, semi-circular in shape and provided with slots of various dimensions to accommodate the plugs of the cables and the hoses in the cable wrap (refer to Figures 2.2-1 and 2.11-1).

Annular strengthening ribs are welded to the inside of the rotary column at the transition from conical to cylindrical section. Lugs welded to these ribs support two quarter-circular lattice gratings which form a platform to enable work to be done on the upper azimuth bearing.

Two plates, to which are welded the operating strikers for the azimuth range and limit switches, are bolted to the outside of the rotary column, one above the other, at the level of the gratings.

6. CABLE WRAP (Figure 4.6-1)

The cable wrap comprises two steel bands connected together by a series of vertical brackets. The wrap is spirally formed and is anchored to the inside of the tower at the outer end, and to the outside of the rotary column at the inner end.

The brackets are of four types, as follows:

Type 1: Fitted with a ball roller at the lower end and a roller at the upper end.

Type 2: Fitted with a roller at each end.

Type 3: Fitted with a ball roller at the lower end.

Type 4: No rollers fitted.

The ball rollers make contact with the floor of the rotary column and serve to support the wrap. The rollers make contact with the steel bands to maintain a set spacing between the turns of the spiral.

The cables and water hoses are loosely placed in the brackets of the assembled wrap and separated into associated groups by metal divider struts welded to the brackets. For details of the cable and hose numbers and groupings refer to Section Two, Sub-section 11.

Bars, slotted to engage pins at each end of the brackets, enclose the cables and hoses in the brackets.

Quick release belts are fitted to the cable wrap to give additional support to keep the cables and hoses in the correct position. These belts are of three types.

Type 1 - 350 mm long (15 in number). Fitted to all even numbered brackets e.g. brackets 2, 4, 6 etc.

Type 2 - 2300 mm long (1 in number). Fitted around the cables and steel bands between brackets 1 and 2.

Type 3 - 2600 mm long (1 in number). Fitted around the cables and the upper support ring between securing point A and the cable opening in the rotary column.

7. CONNECTOR PLATE P2 (Figure 2.11-2)

Connector plate P2 is located in the concrete support column. It is a galvanized, rectangular metal plate, slotted to accommodate the plugs and connectors of the lower ends of the cables and hoses of the cable wrap. The plate is secured by brackets to special studs embedded in the concrete wall.

8. AZIMUTH YOKE AND PLATFORM (Figures 4.8-1 and 4.8-2)

The azimuth yoke comprises two main, separate structures, the yoke and the yoke annexe, and two bearing trestles.

The yoke is a box girder and welded steel plate construction, the side members of which form a U-shaped structure enclosed at the front and open at the rear. Steel plates, secured by screws to the girder cross members form the roof of the yoke. A circular flange is located at the bottom of the yoke by which the yoke is bolted to the top flange of the rotary column.

A central, double-walled partition divides the yoke into two chambers and forms a casing in which the elevation toothed segment locates. The partition is welded to girder cross members at the top of the yoke and has specially strengthened walls which are provided with flanged openings for securing the two elevation drive assemblies, two flange rings (for the elevation pinion bearings), and the elevation stow pin. Similar flanged openings are located on the floor of the yoke for mounting the two azimuth drive assemblies and the azimuth stow pin. Two flange rings are provided on the underside of the structure for locating the azimuth pinion bearings.

In the right-hand, front corner of the right-hand chamber, a rectangular opening permits the passage of hoses through the top of the yoke to equipment sited above.

Specially strengthened positions on the yoke structure, at the front and top, accept the two buffers for the elevation toothed segment. The front buffer is inserted through a hole in the yoke structure, from outside the yoke, and screwed into a nut welded to the back of the structure. A locking nut secures the buffer to the yoke. The top buffer is assembled in a similar way in a block which is then bolted to the yoke structure. A small hinged door, sited at the bottom of the yoke beneath the front buffer, gives access to the azimuth toothed ring. A drainage outlet, from the elevation toothed segment casing, is also provided on the front of the yoke.

Three brush holders which carry the lightning protection brushes are equi-spaced around the circular opening on the underside of the yoke, each being secured by two bolts.

The yoke annexe is a welded steel construction bolted to the rear end of the yoke to enclose the two chambers and complete the main structure of the azimuth yoke. A seal interposed between the mating faces of the yoke and annexe renders the joint weather proof. The top of the annexe together with two steel side members form the platform. The side members are bolted to the yoke and annexe structures and are provided with handrails. Another handrail at the rear of the platform is hinged to facilitate use of the davit in raising or lowering equipment onto, or from, the platform.

Access to the inside of the yoke is by a circular hatch, located in the top of the annexe, which has a fitted steel cover provided with a seal and fitted with an eyebolt for removal and replacement. Provision of slotted brackets on the wall of the hatch permits location of a section of guide rail, as required, to link up with the overhead guide rails bolted to the underside of the girder cross members in the yoke annexe. Adjacent to the hatch is the mounting position for the davit.

A rectangular opening is provided in the top of the annexe for leading the cables into the azimuth cabin.

Access to the platform from the flat roof of the equipment building is by a vertical steel ladder bolted to the rear of the yoke annexe.

The two bearing trestles are of similar, welded steel construction and are bolted to the tops and the arms of the U-shaped side members of the yoke. Circular flanged openings, at the top of each trestle, accept the elevation bearing housings. A steel extension ring is secured by screws to the inner face of the left-hand trestle, this ring serves to support the two elevation emergency limit switches. Two drilled blocks, one on the outer face of each trestle, are provided to accept the four interlocking bolts used to interlock the elevation yoke to the trestles when installing the elevation bearings.

9. AZIMUTH CABIN (Figure 4.9-1)

The azimuth cabin is a welded, double-walled construction of steel plate on a framework of angle iron and steel strengthening straps. It is of rectangular box formation with a semi-circular enlargement at its front end. A circular steel ring, welded to the outside of the cabin at the semi-circular section, provides a seating for the inter-cabin sealing (refer to Sub-section 12). Thermal insulation of the cabin is achieved by filling the space between the inner and outer walls with basalt wool.

At the rear of the cabin a watertight door is fitted which provides access to the cabin from the platform. An opening on the left side of the cabin gives access to the elevation cabin with which the azimuth cabin is interfaced.

Other openings are cut on the right side of the cabin for connection of the air conditioning ducting and for access to the elevation bearing. The two rectangular holes for the air conditioning ducting are fitted with grilles and a cover plate is provided for the bearing access opening. Provision is made for the entry of cables and hoses into the cabin by holes cut in the base of the cabin. These holes are lined with rubber strips to prevent the cables and hoses being chafed.

The cabin is secured to the top of the azimuth yoke and for this purpose four mounting feet are welded, one in each corner, to the rectangular base of the cabin. The mounting feet are internally threaded to accept the securing screws.

Four recesses, at the top of the semi-circular part of the cabin, are fitted with lifting bars to facilitate transportation.

10. ELEVATION YOKE (Figure 4.10-1)

NOTE: Directional references e.g. front, rear, etc., which are given in Sub-sections 10 and 11 are referenced to the elevation yoke in its 0^{o} position.

The elevation yoke is a steel, box girder construction, comprising two main parts bolted together at the centre of the cross members of the structure. Two arms extending from the ends of the structure are fitted with circular flanges which accept the pivot shafts of the elevation bearings.

The front surface of the structure forms the interface to the reflector. An extension at the rear of the structure forms the centre part of the elevation cabin to which the half cylindrical rear part is bolted (refer to Sub-section 11). The space between the elevation cabin and the right-hand arm of the structure accommodates the azimuth cabin.

Stainless steel interface pads are inserted between the front surface of the yoke structure and the aluminium reflector hub to prevent the reaction which would otherwise occur due to contact of the dissimilar metals of the yoke and reflector. Holes in the pads accept the reflector securing bolts, these holes are sufficiently large, in relation to the securing bolts, to allow for differential thermal expansion. For the same reason, one of the guide bolt holes is elongated. Openings, fitted with cover plates, are located in the yoke structure adjacent to the securing bolts to which they give access.

The rear ends of the yoke arms are strengthened and have pads welded to them which provide jacking points for supporting the yoke when necessary. Centrally located between the jacking pads on each arm is an interlocking plate. Oblong holes in these plates accept the square shanks of the interlocking bolts which are inserted when it is required to lock the elevation yoke to the azimuth yoke for repair or maintenance purposes.

An arrestor plate, used in conjunction with the buffer at the front of the azimuth yoke, is bolted to the flanged joint of the two parts of the elevation yoke, on the underside.

11. ELEVATION CABIN AND ELEVATION TOOTHED SEGMENT (Figure 4.9-1)

The elevation cabin comprises three parts; the front part is formed by the hollow part of the reflector hub (hub cavity), the centre part is formed by an extension at the rear of the elevation yoke and the rear part is a half-cylindrical structure bolted to the centre part. The double-walled structure of the elevation cabin is of similar construction to that for the azimuth cabin and is thermally insulated in the same way (refer to Sub-section 9).

A circular opening on the right-hand side of the elevation cabin gives access to the azimuth cabin. A metal rim welded round the opening provides a seating for the inter-cabin sealing (refer to Sub-section 12). A smaller circular opening on the left-hand side of the cabin is provided for entry of the bearing trestle extension ring on which the elevation emergency limit switches and the reference lever for the elevation data pick-up unit are mounted. The gap between the elevation cabin and the extension ring is sealed with a rubber seal. The reflector interface, is sealed with a sponge rubber seal.

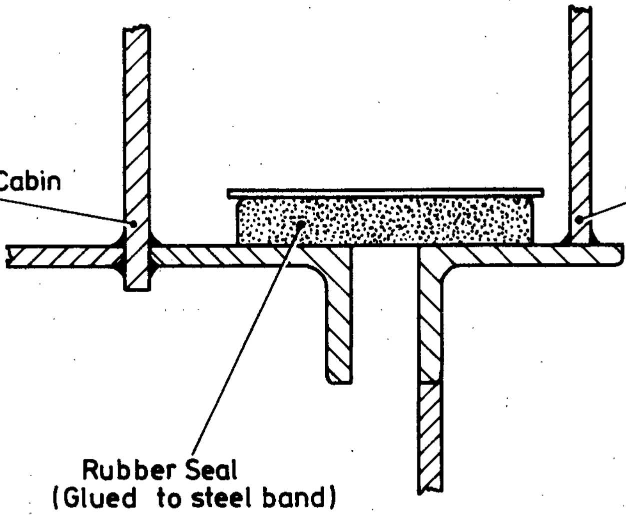
The rear part of the elevation cabin has a reinforced flange to which the elevation toothed segment is secured. Steel blocks, welded to the flange in two positions, are accurately bored to accept the elevation stow pin. The toothed segment extends over a sector of 120^{o}.

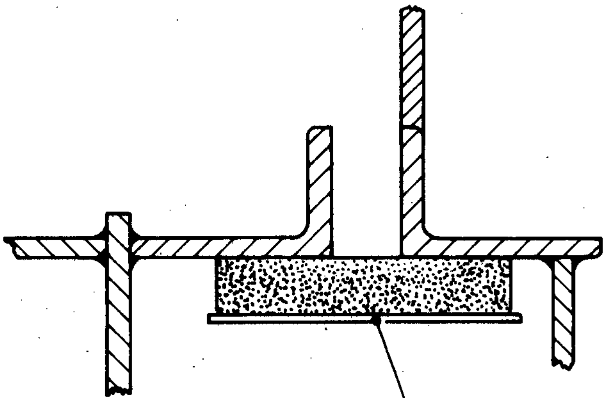
An arrestor plate, used in conjunction with the buffer on the top of the azimuth yoke, is welded to a support block which is bolted to the reinforced flange of the cabin.

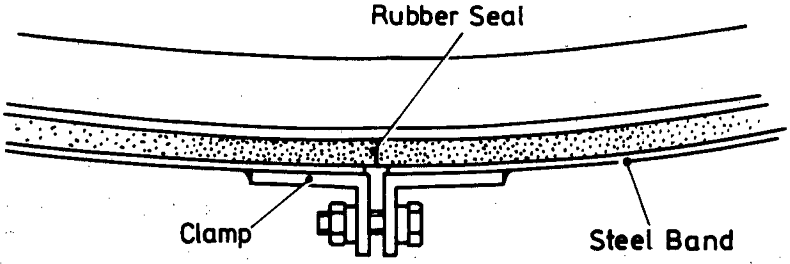
A section of angle iron, shaped to follow the curve of the rear of the cabin, is welded to the cabin structure and serves as a guide track for the rollers of the roller-mounted platform (refer to Sub-section 13).

12. CABIN INTERFACE SEALING (Figure 4.12-1)

The interface between the elevation and azimuth cabins is sealed by means of a flat rubber seal glued to a steel band, the ends of which are clamped together to retain the seal in position. The rubber seal seats on to the two steel rings welded to the mating faces of the cabins.







Clamping Detail

Cabin Interface Sealing

Fig. 4.12-1

13. ROLLER-MOUNTED PLATFORM (Figure 4.13-1)

The roller-mounted platform is located in the elevation cabin and provides a fixed platform about which the elevation cabin moves. The platform is a welded construction of angle iron with steel plates screwed to its top face. One end of the platform extends through the circular access opening of the elevation cabin and is secured to the side of the azimuth cabin. The opposite end of the platform has two rollers secured on its underside which are supported on a guide track welded to the inside of the elevation cabin. The guide track is concentric about the axis of movement in elevation and moves under the rollers when the elevation yoke is rotated in elevation.

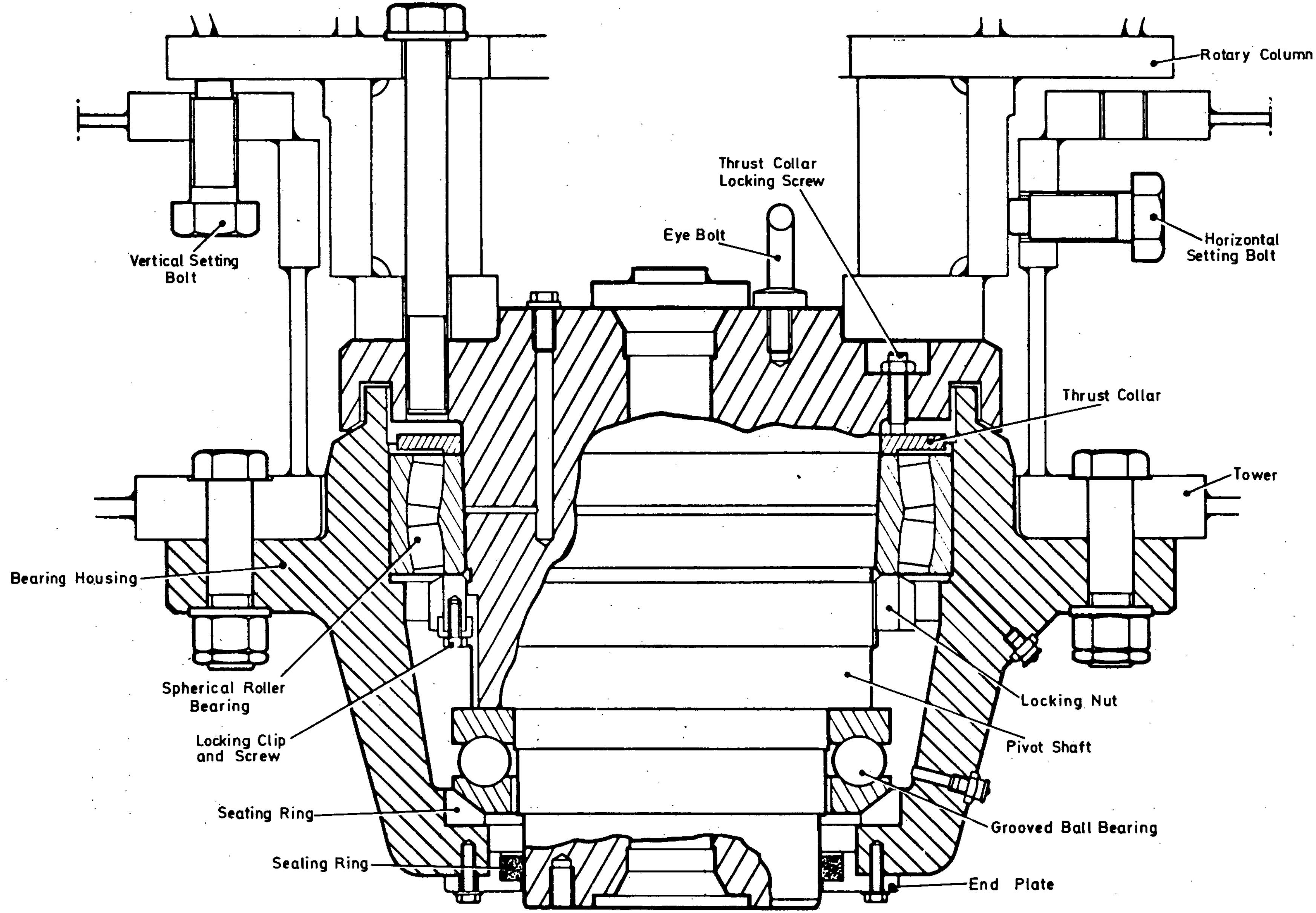
A tubular support post of approximately 1 m (39.3 in) height is secured to the rear edge of the platform and provides a mounting for the cabin control panel. A spigot on the control panel is inserted into the tubular support and locked in position by a clamping device at the top of the tubular support post.

14. LOWER AZIMUTH BEARING (Figure 4.14-1)

The lower azimuth bearing is a combined bearing comprising an axial grooved ball bearing and a double spherical roller bearing. It is designed for a horizontal loading of 102 tons and a vertical loading of 100 tons. The horizontal safety factor is approximately 8 and the vertical safety factor approximately 2.5.

The bearing pivot shaft is secured by its flange to the bottom of the rotary column and locates the roller bearing at its top end and the ball bearing at its lower end. The roller bearing is held in place against a thrust collar by a lock nut which is itself secured by a locking clip which engages in slots in the pivot shaft and lock nut. The thrust collar is locked against the roller bearing by locking screws in the flange of the pivot shaft.

The ball bearing is located between a shoulder on the pivot shaft and a seating ring supported by the bearing housing. The bearing housing is secured by nuts and bolts to the tower spider, its upper end locates in a groove in the flange of the pivot shaft thereby creating a baffle against the ingress of dust.



Lower Azimuth Bearing

Fig.4.14-1

The pivot shaft extends through an end plate, secured to the bottom of the bearing housing, in which a sealing ring is located. The lower end of the shaft is drilled and tapped for securing the azimuth data pick-up unit. A hole bored through the centre of the shaft is provided for use with the bearing pulling device, when removing the azimuth bearing. The end of the shaft is protected during transportation by a transportation plate. Two eyebolts screwed to the top end of the pivot shaft are also provided to facilitate transportation.

Lubrication facility is provided by two grease nipples in the bearing housing. Horizontal and vertical setting screws located in the tower spider are for alignment purposes during installation.

15. <u>UPPER AZIMUTH BEARING</u> (Figure 2.4-1)

The upper azimuth bearing comprises 12 separate rollers which are located between the two ring flanges at the top of the rotary column. Each roller is mounted on an eccentric pivot shaft by which its position can be adjusted to ensure that the axis of rotation of the rotary column is vertical. The rollers protrude through openings in the rotary column to make contact with the inner surface of the azimuth toothed ring and are positioned vertically by spacers which are locked to the pivot shafts by screwed studs and locking nuts.

Each pivot shaft is held in position by a retaining plate screwed to the underside of the lower ring flange. Grooves milled in the pivot shaft accept two semi-circular keys which, in conjunction with the retaining plate, lock the pivot shaft to prevent it rotating out of adjustment.

Lubrication of each roller unit is by means of a grease nipple sited at the lower end of the pivot shaft.

The design of the bearing is such that it is possible to replace one roller during operation without impairing the efficiency of the whole bearing.

16. ELEVATION BEARINGS (Figure 2.4-3)

Both elevation bearings are of similar design, differing mainly in that the pivot shaft of the left-hand bearing extends through the end cover and is drilled and tapped at its inner end for mounting the elevation data pick-up unit.

Each elevation bearing comprises a double, spherical roller bearing which is located on a tapered sleeve on the inner end of the pivot shaft. The outer race of the roller bearing is held between the end cover and a labyrinth ring, both of which are secured by screws to the bearing housing.

A second labyrinth ring, held between the inner race of the bearing and a shoulder of the pivot shaft, mates with the first labyrinth ring to provide a baffle to prevent ingress of dust into the bearing. The bearing housing is secured to the ring flange of its respective trestle and is supported by that trestle.

The pivot shaft of each elevation bearing extends outwards and is secured by an end plate to a ring flange in the elevation yoke. A hole bored through the centre of the shaft facilitates installation of the elevation bearing.

The tapered sleeve of the left-hand elevation bearing is secured in the tapered inner race of the roller bearing by a locking nut which is itself secured by a locking plate. The same purpose is served, on the right-hand elevation bearing, by a compression ring secured by screws to the inner end of the pivot shaft.

Both tapered sleeves are drilled axially and grooved circumferentially, the threaded ends of the axial drillings being for the connection of hydraulic equipment when dismantling the bearing.

A sealing ring located in the end cover of the left-hand elevation bearing prevents the ingress of dust to the bearing.

Two greasing nipples are fitted to the end covers of each bearing.

17. DRIVE ASSEMBLIES (Figure 4.17-1)

The principal components of each drive assembly are as follows:

a. One two-stage, planetary gearbox.

b. Two d.c. drip-proof motors (fitted with blowers).

c. One brake and handwheel assembly.

d. One tacho-generator.

The constructional details of the azimuth drive assemblies are similar to those of the elevation drive assemblies, but, the arrangement for lifting the brake, for hand cranking, is different. The brake on each elevation brake and handwheel assembly is lifted by an attachment connected to a foot pedal whereas, on each azimuth brake and handwheel assembly, the brake is lifted by two hand operated lifting levers. The constructional details for one drive assembly (azimuth) only are given with the appropriate information detailing the differences where they occur.

17.1 GEARBOX (Figure 4.17-1)

The gearbox is of the flange-mounted type having a cylindrical casing which encloses the gears and contains the oil in which the gears run.

An end plate, at the opposite end to the mounting flange, provides mounting positions for the two d.c. drive motors, the brake and handwheel assembly and the tacho-generator. A heating mat, fitted with quick release clips, is clamped around the outside of the casing (refer to Antenna Servo, Drive and Control Sub-system Handbook No. 601, for details of the heating mat and its control).

All shafts and drives passing through the gearbox end plates are provided with mechanical lip seals fitted with garter springs and all internal/external interfaces and spigots are sealed with 'O' rings. A fibre gasket is fitted between the gearbox end plate and the casing.

The gearbox contains three gear trains; one parallel shaft train and two epicyclic trains connected in series. The overall reduction produced by the gear trains is 500.47 : 1. For the ratios of the three reduction stages refer to Part One, Section Three, Sub-section 4.

The drive pinions of the two d.c. drive motors, in the parallel shaft train, engage the first reduction gearwheel which is directly coupled to the sunwheel of the first epicyclic gear train. The planet carrier of the first epicyclic gear train is directly coupled to the sunwheel of the second epicyclic gear train, the planet carrier of which is directly coupled to the gearbox output pinion. The planet gears of each epicyclic train mesh with gear rings cut internally on the cylindrical casing of the gearbox.

The drive between each d.c. drive motor shaft and its associated drive pinion shaft is transmitted through a Nylicon coupling. This coupling comprises two steel hubs with external teeth, keyed to the two shafts and a nylon ring with internal teeth. The nylon ring locates between, and meshes with, the two steel hubs thereby providing a flexible coupling which permits a small amount of axial shift and misalignment. The steel hubs are a light fit on their respective shafts.

The two pinion drive shafts and the first reduction gearwheel are mounted on ball bearings press fitted to their respective shafts and retained in position by circlips. Fibre gaskets are interposed between the mechanical garter type seal housings of the pinion drive shafts and the motor mounting.

The ball bearing for the first reduction gearwheel is located on a spigot shaft of a bearing support secured to the gearbox end plate by cap screws. A threaded hole in this bearing support facilitates transportation of the drive assembly.

The output pinion is mounted at its outer end on a double, spherical roller bearing located in the gearbox end housing and held in position between a bearing retainer and a labyrinth ring, this bearing is grease packed. The inner end of the output pinion is hydraulically pressed into the planet carrier of the second epicyclic gear train which is mounted on a roller bearing located in a bearing housing secured to the inner face of the gearbox end housing. A retaining ring secured to the bearing housing and a circlip on the planet carrier, holds the roller bearing in position.

The planet wheels of both planet carriers are mounted on needle bearings, held in position by internal and external circlips, and are located between thrust washers at each end of the planet spindle.

Provision is made on both planet carriers for fitting an oil pump connection when using hydraulic equipment for dismantling the output pinion or sunwheel from the carriers.

The output pinion, together with the second epicyclic planet carrier and the gearbox end housing, forms one sub-assembly of the gearbox designated the output assembly. The output assembly can be secured to the gearbox casing in either of two positions, depending on whether the gearbox is for use in an azimuth or an elevation drive assembly. These two positions, 180° apart, are indicated by alignment marks (A or E respectively) on the gearbox casing which are aligned against an embossed arrow on the mounting flange.

Plugs are fitted to the gearbox end plate and to the gearbox casing to provide filling, level and breathing positions.

For an elevation assembly the plug in the casing is a filler/breather plug and is located at the top when the assembly is installed. The plug in the end plate is a blank plug which serves as an oil level indication.

For an azimuth assembly the plug in the casing is a blank plug and is not used. The plug in the end plate is a filler/breather plug which also serves as a position for checking the oil level. A drain cock is fitted to the gearbox end housing.

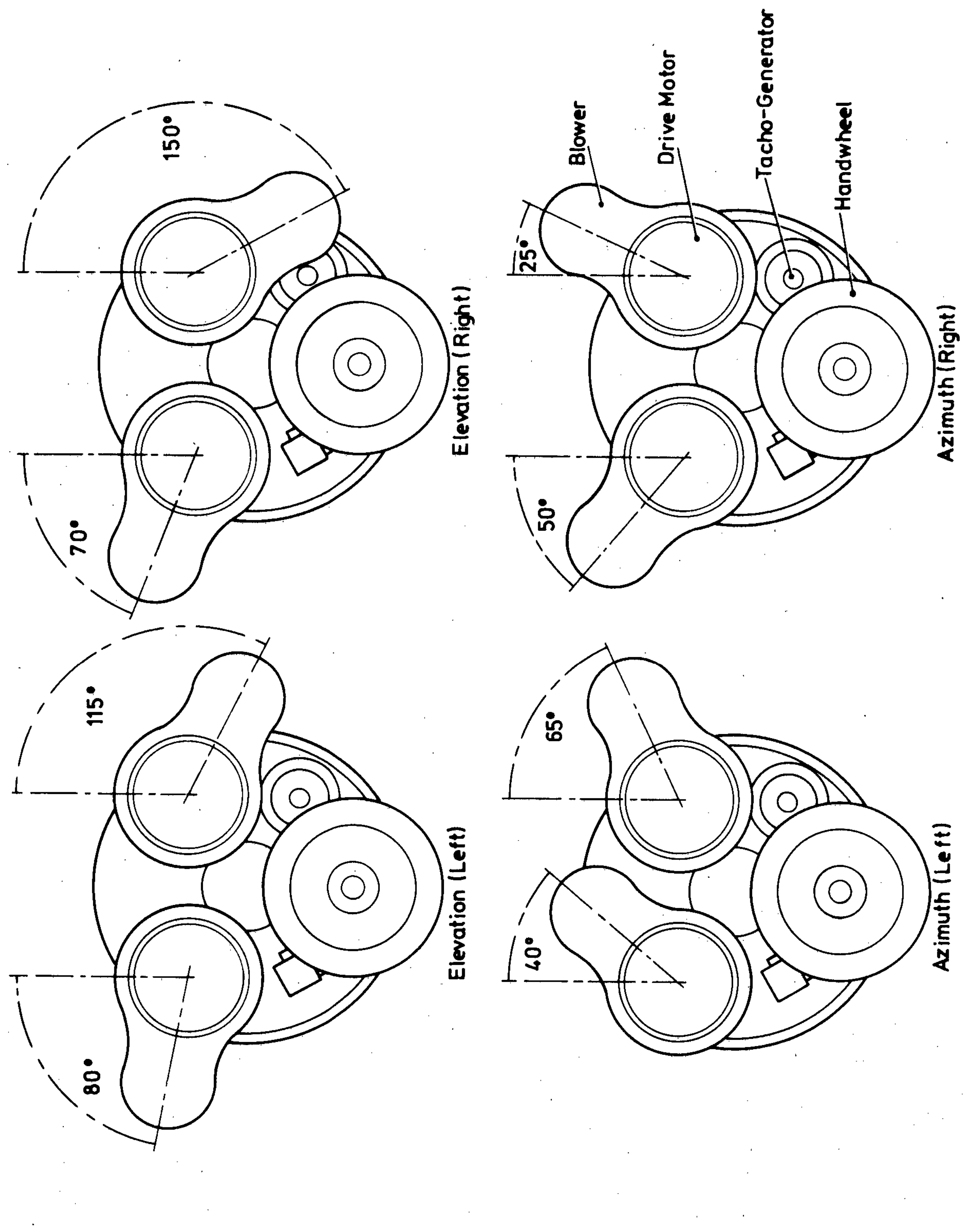
17.2 D.C. DRIVE MOTORS AND BLOWERS (Figures 4.17-1 and 4.17-2)

The two d.c. drive motors are each flange-mounted to a separate motor mounting assembly on the gearbox, the four securing screws for each being accessible via a grilled band cover at the drive end of the motor. The motors are suitable for vertical or horizontal mounting and vary only in their orientation in relation to the gearbox flange (refer to Figure 4.17-2).

Each d.c. drive motor is provided with a blower which is located on the end cover at the commutator end. The end cover is secured in position by tangential clamping bolts. Correct positioning is necessary to ensure a correct flow of cooling air through the motor. An arrow on the blower casing indicates the direction of rotation of the blower. The blower motor is itself flange-mounted to the blower casing.

The armature of each d.c. drive motor and blower motor is mounted on ball bearings which are prepacked with grease, sufficient for the life of the bearings under normal service conditions.

The d.c. drive motors are shunt wound and are electrically connected in series. Thermal switches are fitted in both the field and interpole windings, both switches are of the same type, comprising a single, normally closed contact of five ampere capacity. The switches are set to break at a temperature below the safe value for the insulation of the machine. For further detailed information on the d.c. drive motors and blower motors, refer to Part One, Section Three.



Orientation of Drive Motors

Fig. 4.17-2

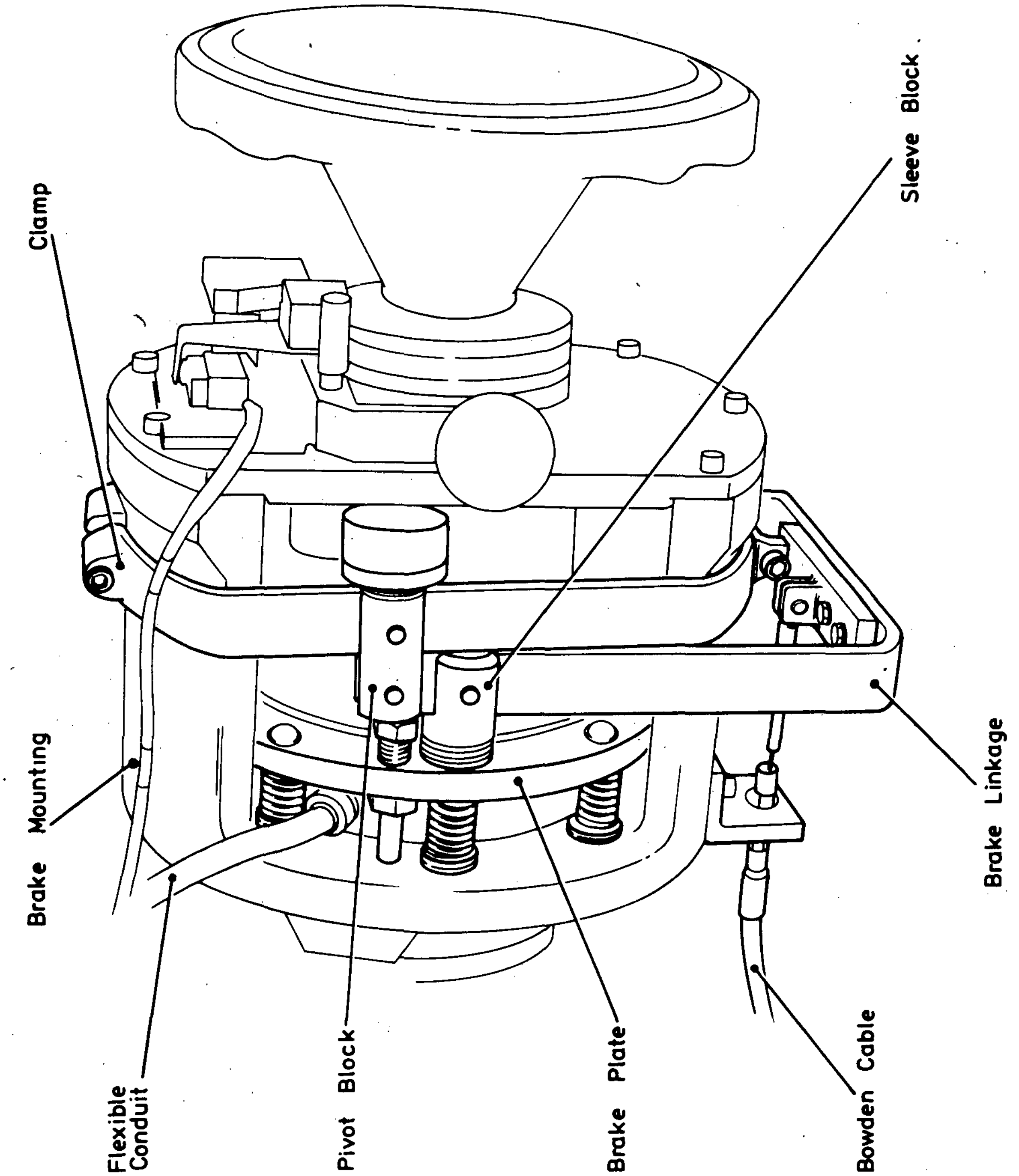
17.3 BRAKE AND HANDWHEEL ASSEMBLY (Figures 4.17-3 and 4.17-4)

The brake elements of the brake and handwheel assembly are housed in an open sided brake mounting which is flange-mounted to the gearbox. A back plate, secured to the open end of the brake mounting, carries the handwheel assembly. A pinion, which meshes with the first reduction gearwheel in the gearbox, is integral with a pinion shaft mounted on two ball bearings within the brake mounting.

The pinion shaft passes through the centre of a solenoid housing secured to the inside face of the brake mounting, and a brake plate which locates on spigots secured to the brake mounting. The brake plate forms the armature of the brake assembly. A brake lining plate, keyed to the pinion shaft where it protrudes through the brake plate, is positioned axially on the pinion shaft by a knurled nut screwed on to the pinion shaft. The knurled nut is secured to the brake lining plate by two Allen screws. Additional tapped holes in the brake lining plate permit its resecuring to the knurled nut after partial rotation of the nut for brake adjustment.

The brake plate is free to slide axially along the pinion shaft and, when the solenoid is energized, the plate is attracted towards the solenoid with sufficient force to overcome the pressure of the spigot springs and to move it clear of the brake lining.

A hole, bored axially in the outer end of the pinion shaft, accepts an Oilite sleeve bearing in which the handwheel spindle locates. External teeth, cut in a boss midway along the handwheel spindle, mesh with internal teeth in the bore of the pinion shaft when the handwheel is engaged. The handwheel spindle is held axially in the engaged or disengaged position by the handwheel unlocking lever, which is itself held by a retaining pin.



Brake Attachment Linkage (Elevation Assembly)

Fig. 4.17-4

A tongue on the lever engages a groove on the outside of an interlocking drum when the handwheel spindle is pushed into mesh in the engaged position. In the disengaged position, the tongue engages a tangential slot on the outside of the interlocking drum which prevents the drum and handwheel rotating due to drag. A flanged housing, which carries the outer pinion shaft bearing, is secured to the back plate and provides a mounting for a bush on which the interlocking drum is located. The handwheel is keyed to the handwheel spindle and secured by a cap screw in the end of the spindle.

An oil seal, through which the pinion shaft passes, is located in the bore at the mounting flange end of the brake mounting. The annular space surrounding the pinion shaft, between the seal and the pinion shaft inner bearing, is packed with grease.

Internal and external circlips retain the inner bearing in position. The outer pinion shaft bearing is retained by one external circlip and a shoulder on the shaft. Both bearings are grease packed. A wiper shield, fitted to the inner face of the inner bearing, prevents ingress of small metallic particles which may be attracted to the pinion shaft by magnetisation when the solenoid is energized.

A microswitch, which operates a relay to provide HANDCRANK indication, is secured to the brake mounting back plate and is operated by an arm secured to the handwheel unlocking lever. Operation is effected by the arm being tilted due to the annular groove in the interlocking drum being shallower than the tangential slot.

A second microswitch, mounted on a bracket secured to the outside face of the brake mounting, operates a relay to provide BRAKES ON/BRAKES OFF indication. It is operated by an adjusting screw secured to the brake plate by a locking nut.

A facility to mechanically release the brake for handcranking is provided; on an azimuth drive assembly brake, by two brake lifting levers and, on an elevation drive assembly brake, by brake attachment linkage connected by Bowden cable to a foot pedal.

The brake lifting levers are located at diametrically opposite points of the brake plate and each comprises a bottle nut (one left-hand thread and one right-hand thread) which screws on to an extended spigot. The nuts can be rotated approximately half a turn by their respective levers to bear on the brake plate and move it against the pressure of the spigot springs until it is clear of the brake lining. Spring clips secure the levers in their normal position.

The brake attachment linkage comprises a clamp, constructed in two halves, secured around the outside of the brake mounting carrying two pivot blocks at diametrically opposite points, in which the brake linkage is pivotted. The Bowden cable is secured to this linkage, and when the foot pedal is depressed, the linkage is moved towards the brake plate. Sleeve blocks on the linkage, located over the ends of two extended spigots, bear on the brake plate to move it clear of the brake lining (refer to Figure 4.17-4).

Flexible conduit, connected to the solenoid housing, carries the solenoid wiring.

17.4 <u>TACHO-GENERATOR</u> (Figure 4.17-1)

The tacho-generator is flange-mounted to a separate mounting secured to the gearbox end plate. The driving shaft is mounted in two ball bearings located in the mounting, with the driving pinion meshing with the first reduction gearwheel of the gearbox. The driving shaft is provided with a mechanical garter type spring seal located in a housing secured to the mounting. The coupling between the driving shaft and the tacho-generator is similar to that for the d.c. drive motor drive pinion shafts (refer to Sub-section 17.1).

18. STOW PINS (Figure 4.18-1)

The two stow pins are of similar construction comprising a flanged mounting which houses the stow pin bolt and the handwheel spindle. An internally threaded bush, located in the bored end of the stow pin bolt, accepts the threaded handwheel spindle which is supported at its other end on a bearing. The handwheel is keyed to the spindle and secured by a bolt.

The hub of the mounting locates in an eccentric bush inserted in the opening at the respective mounting position in the gearbox room. The eccentric bush facilitates alignment of the stow pin bolt with its mating hole (or holes) in the azimuth toothed ring (or elevation toothed segment).

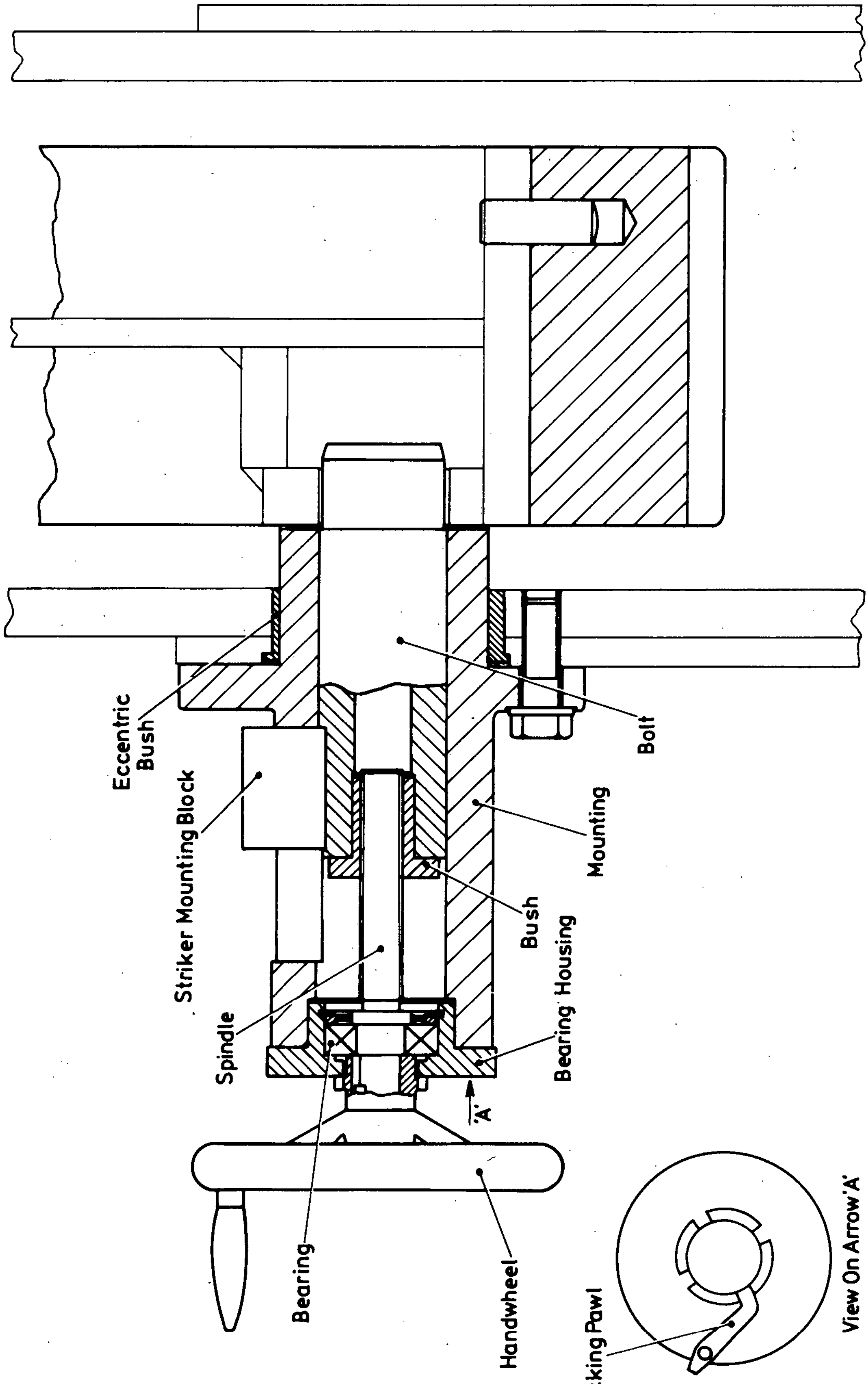
A block, secured to the stow pin bolt, protrudes through a slot in the side of the mounting and carries a stepped, cam striker for operating the stow pin switch. The first step of the cam striker effects interlock and INTERLOCK indication, and the second step effects stow pin ENGAGED indication.

A locking pawl, located on a pivot pin secured to the bearing housing, engages a notched part of the handwheel boss to prevent the stow pin being operated accidentally.

19. BUFFERS

The two buffers are of similar design, each comprising a housing in which is located a piston cylinder filled with Elastomere under pressure. When a shock pressure is applied to the buffer, the piston is moved against the Elastomere which absorbs a high percentage of the shock pressure.

The buffer housings are each secured by locknuts, one directly to the azimuth yoke structure and the other to a bearing block which is secured to the top of the azimuth yoke.



Stow Pin

Fig. 4.18-1

20. LADDER

The ladder, which gives access to the platform from the flat roof of the equipment building, is a steel construction comprising angle bar sides to which are welded the step bolts. A flat steel framework welded to the angle bars forms a back safety rail. Four brackets are also welded to the angle bars for securing the ladder to the azimuth yoke. The part of the ladder which extends above the platform is a removable, tubular handrail, located on welded spigots at the top of the angle bar and secured by bolts.

Extra support is given to the ladder by a tubular bracing frame which extends between the ladder and the underside of the azimuth yoke.

21. DATA PICK-UP UNITS

Constructional details of the azimuth and elevation data pick-up units are given in Part One, Section Four of the Antenna Servo, Drive and Control Sub-system Handbook No. 601.

22. SPIRIT LEVELS (Figure 4.22-1)

The two spirit levels are mounted at right-angles to each other on a common triangular base plate. The base plate is mounted on three supports, each of which is secured by bolts to a datum plate welded to the floor of the right-hand gearbox room chamber. Each support houses four balls which permit the base plate to be adjusted without distortion.

The support at the apex of the triangular base plate is non-adjustable, serving only as a pivot point about which adjustment is made by the two knurled screws in the other corners. These adjusting screws are provided with lock nuts and are screwed to the base plate with their ends making contact with the balls in the support.

The spirit levels are pinned to the base plate and are enclosed in a plexiglass cover held lightly in place by a felt-tipped arm which is screwed to the datum plate.

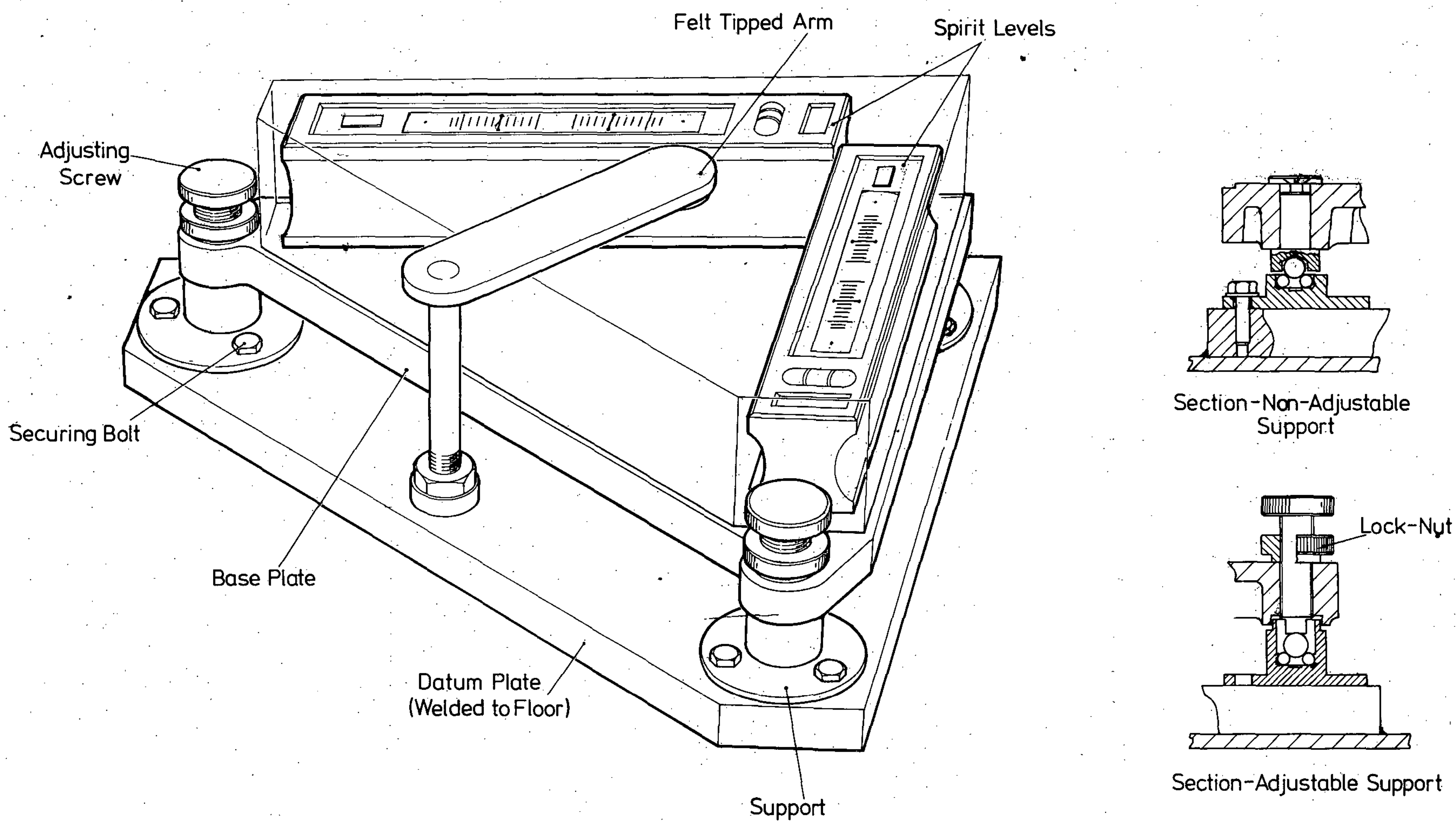


Fig. 4.22-1
Spirit Levels

23. CABIN AIR CONDITIONING PLANT

23.1 AIR CONDITIONING UNITS (Figures 4.23-1 and 4.23-2)

The MAIN and SPARE air conditioning units are contained in steel-framed cabinets mounted on a common steel frame on the antenna platform. 'Barrymount' mountings are used between the frame and the platform to absorb vibrations from the compressors and motors.

Each unit consists of a lower compartment containing the cooling equipment, which includes the compressor motor, compressor and condenser, and an upper compartment containing the air conditioning equipment, which includes the ventilation fan, the 3 kW heater and the evaporator. The location of components in each lower compartment is similar, but the upper compartments are arranged to be a mirror-image of each other.

At the front of each unit (control box side) the lower compartment is covered with a grille (13) secured by two bolts. Access to the cooling equipment, for maintenance purposes is obtained by removing the grille. A steel housing (28) above the front grille can be removed to give access to the ventilation fan (35, 36), the expansion valve (39) and the solenoid valve (37, 38).

The 3 kW heater assembly (34, 97) is in the ducting above the ventilation fan compartment. The power cable to the heater passes through a waterproof lid secured by two screws. Access to the air filters (32), at the top rear of each unit is obtained by releasing two rubber fasteners and lifting a hinged cover. A shutter, inside the cover, acting as a fresh air damper, is operated by a short hand-lever (101) on the side of the cover. Each unit has a terminal box for electrical connections to the control box. The terminal boxes on the outside of each upper compartment are protected from the weather by water-tight steel cover plates, each secured with four screws.

Condensation, which forms on the cooling equipment in each air conditioning unit, is collected and drained away through steel pipes and plastic hoses into a plastic container on the platform in front of the air conditioning units.

23.2 AIR DUCTING (Figures 4.23-1, 4.23-3 and 4.23-4)

Air is circulated between the azimuth cabin and the air conditioning plant via double-walled ducting manufactured from galvanized sheet steel. The joints are welded and cold-galvanized. The space between the inner and outer walls, which is approximately 5 cm wide, is filled with an insulating foam. The end sections of ducting are fitted with flanges which are bolted to the air conditioning units and to the wall of the azimuth cabin, the other sections of ducting are held together by quick-release fasteners. To prevent the transmission of vibrations, rubber strips are fitted between the flanges and sealing compound is used to make the joints air-tight.

The cabin inlet and outlet grilles are each fitted with horizontal and vertical louvres which can be adjusted to deflect the airflow in both horizontal and vertical directions. Each grille is also fitted with a honeycomb grid which screens radio interference up to approximately 10,000 MHz; each hole in the honeycomb behaves as a waveguide which attenuates frequencies below its limit frequency.

To prevent loss of circulating air through the non-operational air conditioning unit, ganged shutters are fitted in the ducting at the inlet and outlet of each unit. The shutters are arranged so that (for example), when the MAIN unit shutters are fully open, the SPARE unit shutters are fully closed. The fresh air intakes, at the top rear of each air conditioning unit, allow outside air to mix with the air in the cabin inlet air ducting.

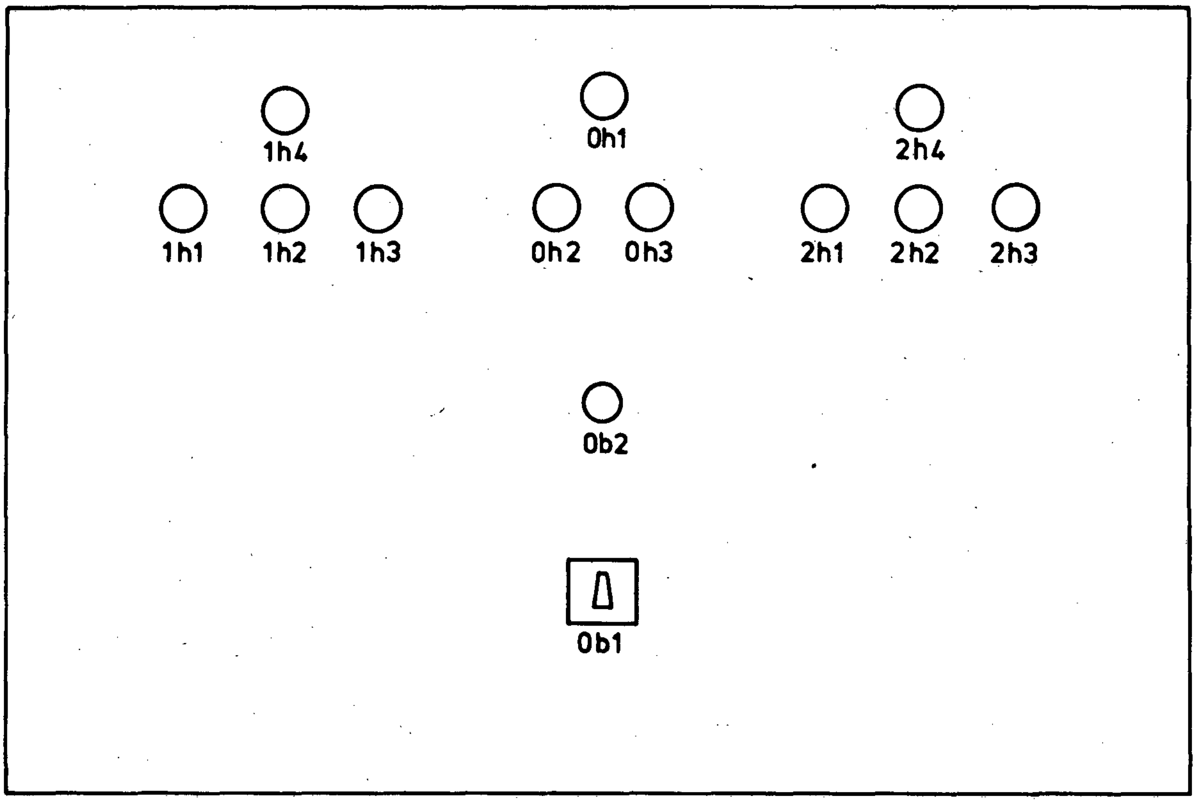
The unit outlet shutters are operated by a motor-driven rotary actuator connected to the shutters by cranks. The rotary actuator is fixed to the underside of the cabin inlet air ducting. A similar arrangement operates a pair of shutters in the unit inlet ducting, with the rotary actuator mounted on the ducting between the cabin outlet air ducting and the air conditioning units.

23.3 CONTROL BOX (Figures 4.23-5 to 4.23-7)

The air conditioning control box is mounted with a steel frame on two cylindrical supports in front of the MAIN and SPARE air conditioning units. The outer support acts as a pivot so that, after releasing two locking screws, the control box may be swung outwards to give access to the air conditioning units for maintenance purposes.

The front of the control box is a door secured by two quick-release fasteners, the indicating lamps and switches for the control of the air conditioning plant are fitted on the door. Within the control box are isolating fuse switches, relays, time switches, selector switches and terminal blocks, which are accessible for maintenance and fault location procedures. Cables are routed through sealed glands in the base of the control box. To prevent condensation forming on the switchgear, the control box is ventilated by holes in the base, each hole is covered with a special sponge which permits 'breathing' and absorbs moisture.

The outside thermostat is mounted on the right-hand side of the control box and secured by four nuts and bolts. Rubber sealing strips are used between the thermostat and the control box and around the control box door to prevent the ingress of water.



SWITCHES

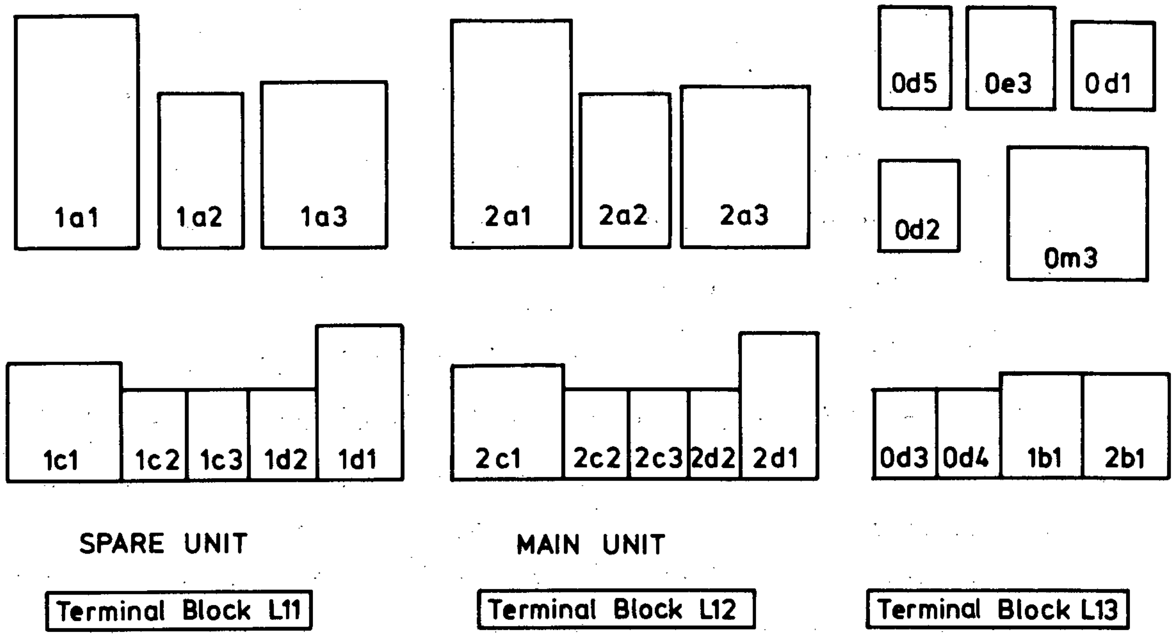
0b1 DISTRIBUTION
0b2 BREAKDOWN OUT

LAMPS

0h1 DISTRIBUTION ON
0h2 SPARE UNIT WORKING
0h3 MAIN UNIT WORKING
1h1 COMPRESSOR ON - SPARE UNIT
1h2 VENTILATOR ON - SPARE UNIT
1h3 HEATING ON - SPARE UNIT
1h4 SPARE UNIT BREAKING DOWN
2h1 HEATING ON - MAIN UNIT
2h2 VENTILATOR ON - MAIN UNIT
2h3 COMPRESSOR ON - MAIN UNIT
2h4 MAIN UNIT BREAKING DOWN

Control Box Door, Component Location

Fig. 4.23-6



SPARE UNIT

1a1	Compressor motor isolating fuse-switch
1a2	Fan motor isolating fuse-switch
1a3	Heater isolating fuse-switch
1c1	Compressor motor contactor
1c2	Fan motor contactor
1c3	Heater contactor
1d1	Delay time switch
1d2	Breakdown relay
0d3	SPARE UNIT WORKING relay
1b1	AUTO-O-COOLING-HEATING selector switch

MAIN UNIT

2a1	Compressor motor isolating fuse-switch
2a2	Fan motor isolating fuse-switch
2a3	Heater isolating fuse-switch
2c1	Compressor motor contactor
2c2	Fan motor contactor
2c3	Heater contactor
2d1	Delay time switch
2d2	Breakdown relay
0d4	MAIN UNIT WORKING relay
2b1	AUTO-O-COOLING-HEATING selector switch

COMMON

0d1	Cooling relay
0d2	Heating relay
0d5	7-day time switch
0e3	Isolating fuse-switch for transformer 0m3
0m3	Single-phase 220 V transformer

Control Box, Component Location

Fig. 4.23-7

24. SPECIAL TOOLS

The following special tools are provided for installing the drive assemblies and bearings in the pedestal:

a. Installation device for azimuth drive assembly.

b. Installation device for elevation drive assembly.

c. Installation device for lower azimuth bearings.

d. Installation device for elevation bearings.

24.1 INSTALLATION DEVICE (AZIMUTH DRIVE ASSEMBLY) (Figure 4.24-1)

The installation device for the azimuth drive assembly comprises a turnbuckle screw assembly having a forked block pinned to one end which is pivotted to a suspension block on which two rollers are mounted.

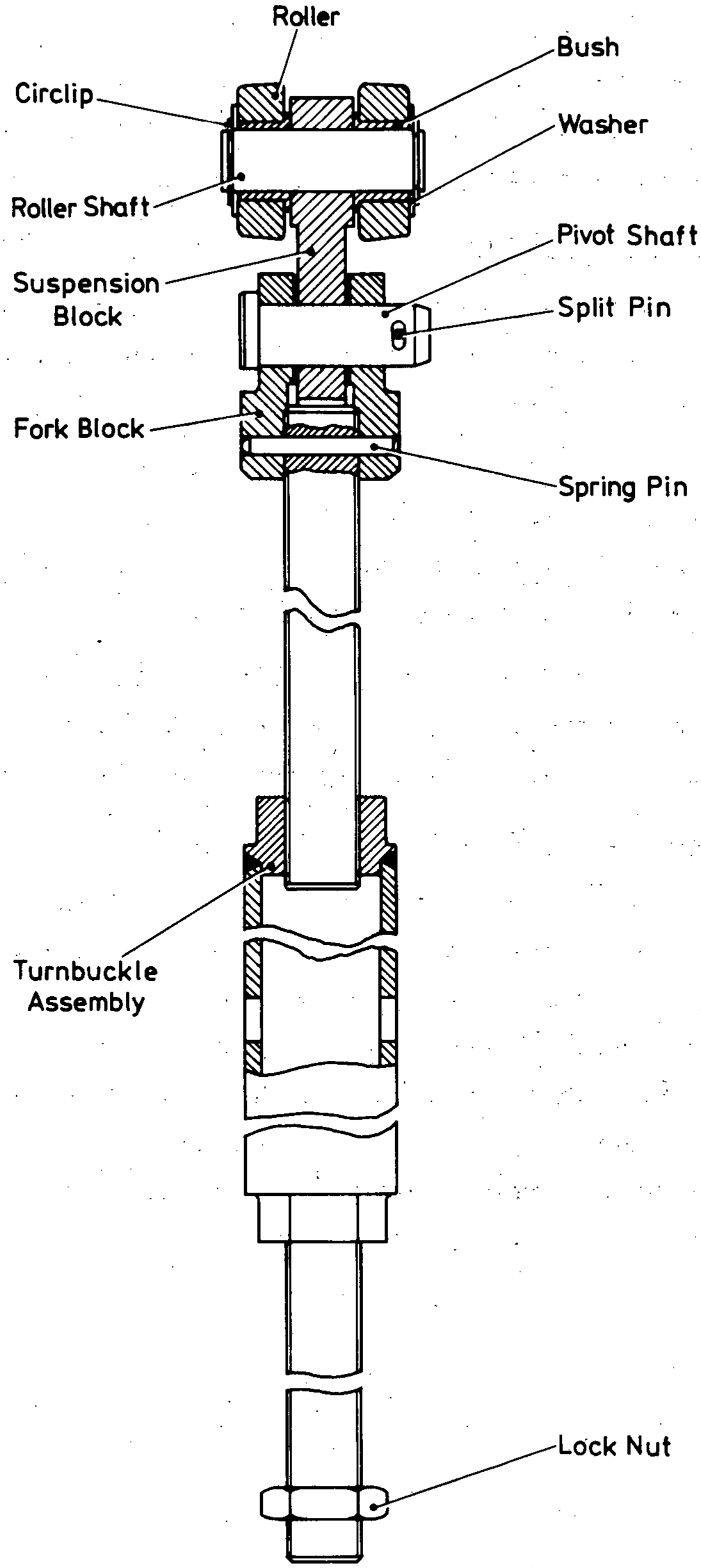
The rollers are located on bushes on the roller shaft and engage overhead rails bolted to the cross-members of the azimuth yoke, from which the drive assemblies are suspended during installation and removal.

The lower end of the turnbuckle assembly screws into the bearing support of the gearbox and is secured by a lock nut.

24.2 INSTALLATION DEVICE (ELEVATION DRIVE ASSEMBLY) (Figure 4.24-2)

The installation device for the elevation drive assemblies is a steel construction comprising a cradle in which the gearbox is supported and a trolley which runs on the upper guide rails. A chain, attached to hooks on the cradle, secures the gearbox in the cradle and permits the cradle to be suspended from the trolley.

Two threaded sleeves screwed into the cradle, one on each side, engage threaded spindles secured to roller blocks on the underside of the cradle. The sleeves have hexagonal heads which allow them to be rotated by a socket spanner for raising or lowering the cradle on the roller blocks.



Installation Device - Azimuth Drive Assembly

Fig. 4. 24-1

The roller blocks, each housing four ball rollers, are attached to the cradle by two linking plates pivotted to the roller blocks at one end, and are bush-mounted, in a slot in the cradle, at the other end. The rollers locate on the lower guide rails secured by pins to lugs in the gearbox room.

24.3 <u>INSTALLATION DEVICE (LOWER AZIMUTH BEARING)</u> (Figure 4.24-3)

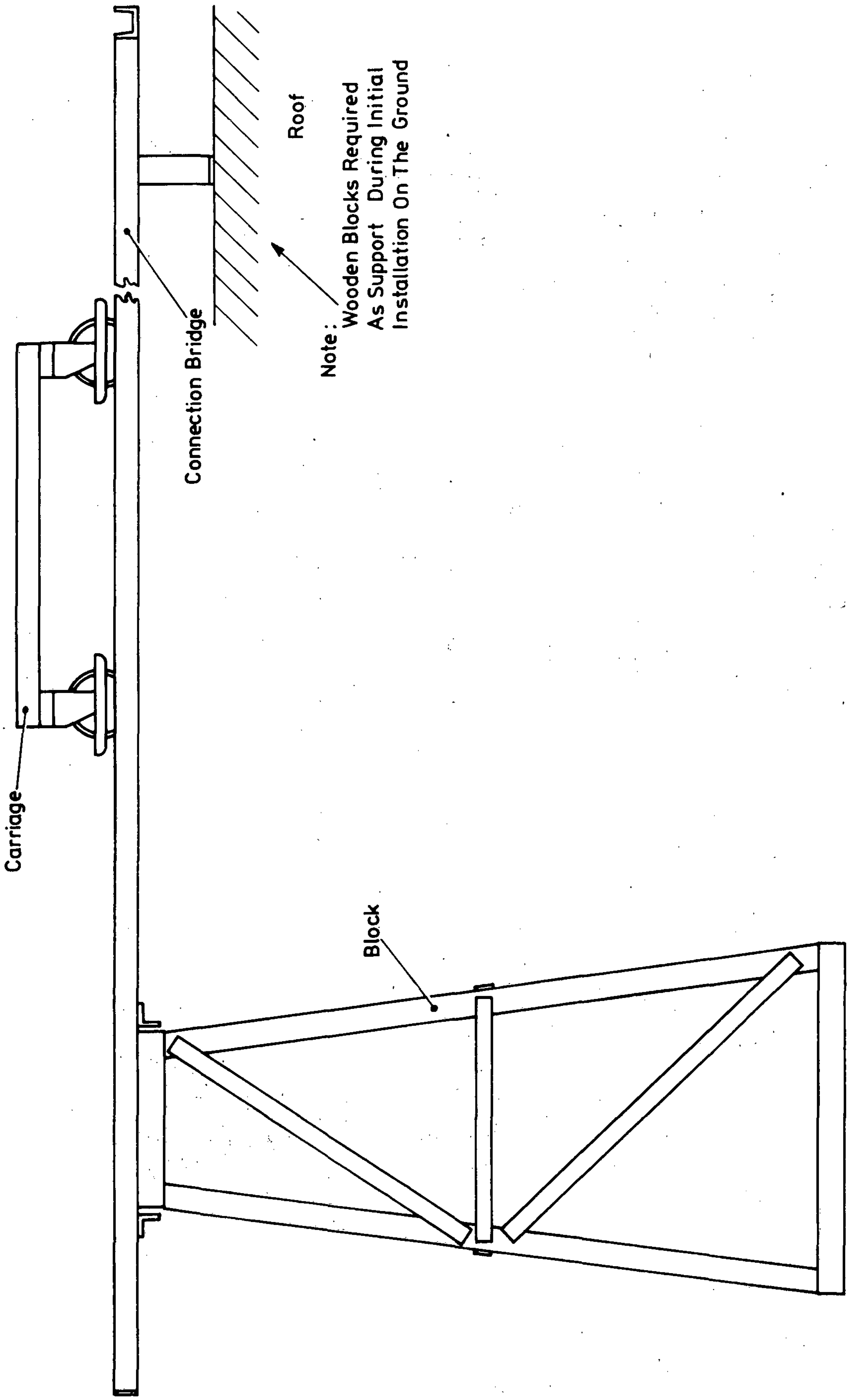
The installation device for the lower azimuth bearing is a steel construction comprising a support block, connection bridge and four-wheeled carriage.

One end of the connection bridge locates on the top of the support block and the other end rests on the roof of the equipment building (or on suitable wooden blocks during initial installation on the ground).

During use the support block is located under the rotary column and the carriage is positioned on the connection bridge so that its wheels engage the rails of the bridge.

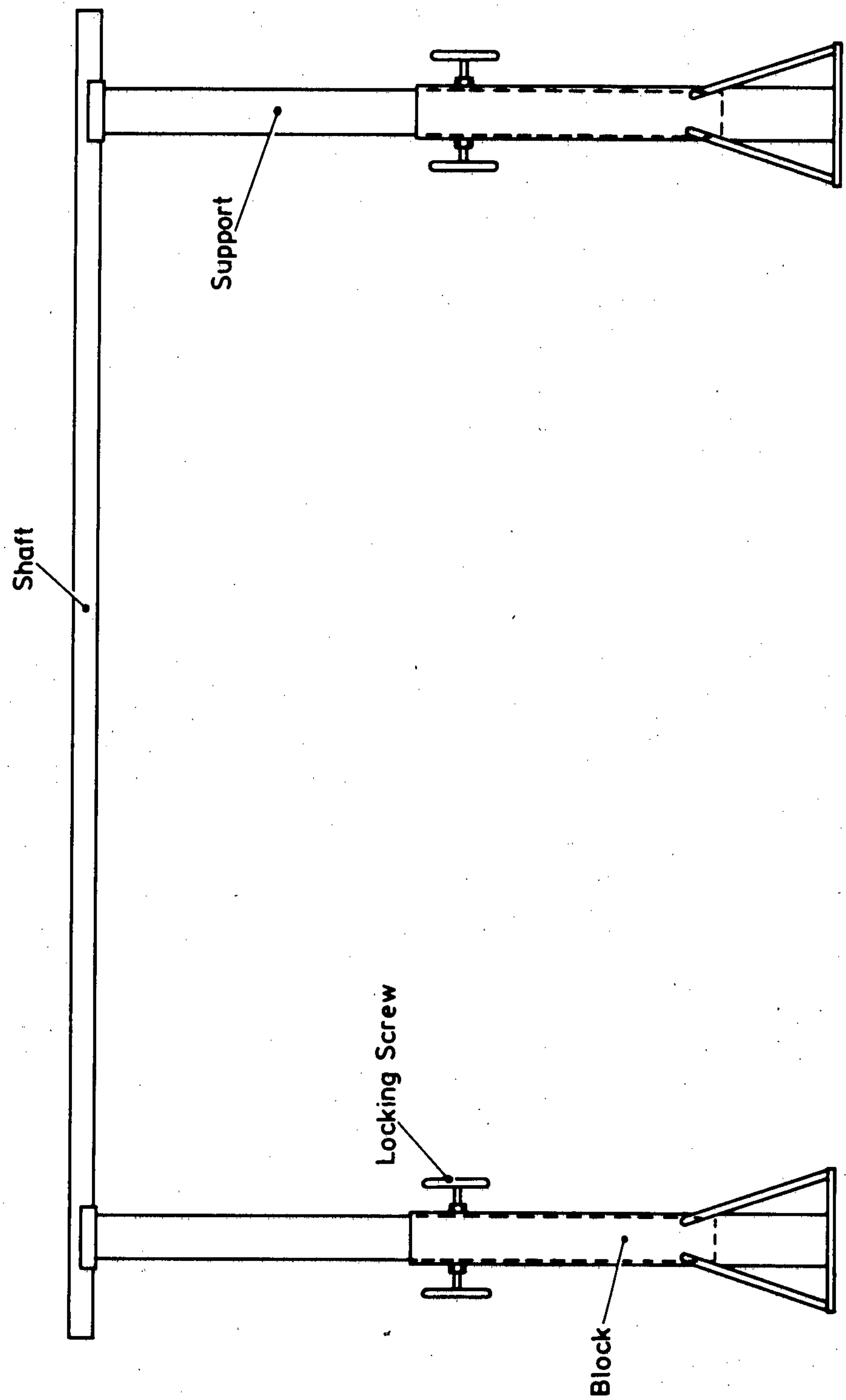
24.4 <u>INSTALLATION DEVICE (ELEVATION BEARINGS)</u> (Figure 4.24-4)

The installation device for the elevation bearings is a steel construction comprising a shaft and two supporting blocks. The shaft rests on the ends of the column supports which locate in the tubular blocks. Each support is free to move within its block to enable the height of the shaft to be adjusted. When the correct height is obtained each support can be locked by two locking screws located in the tubular blocks.



Installation Device-Lower Azimuth Bearing

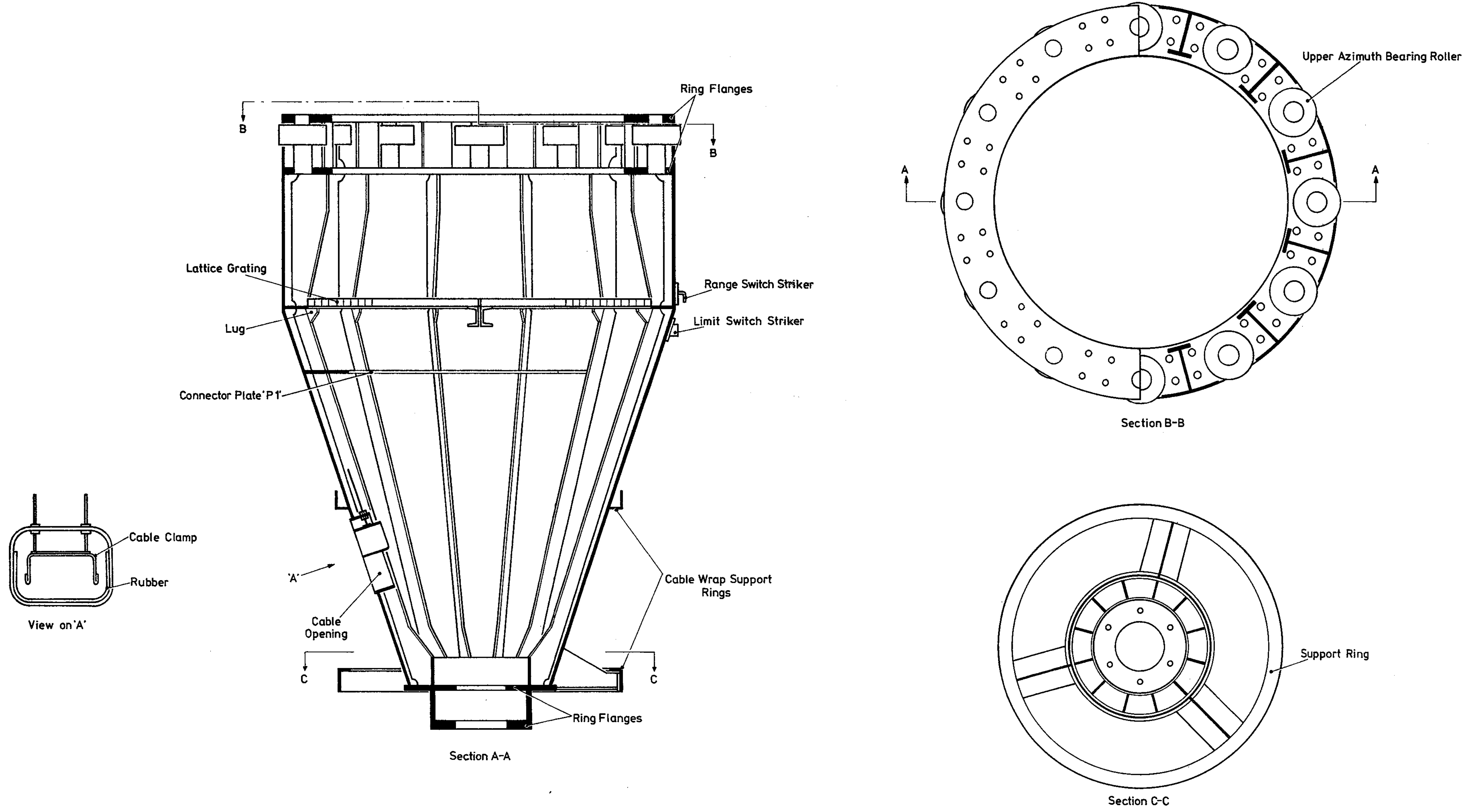
Fig. 4.24-3



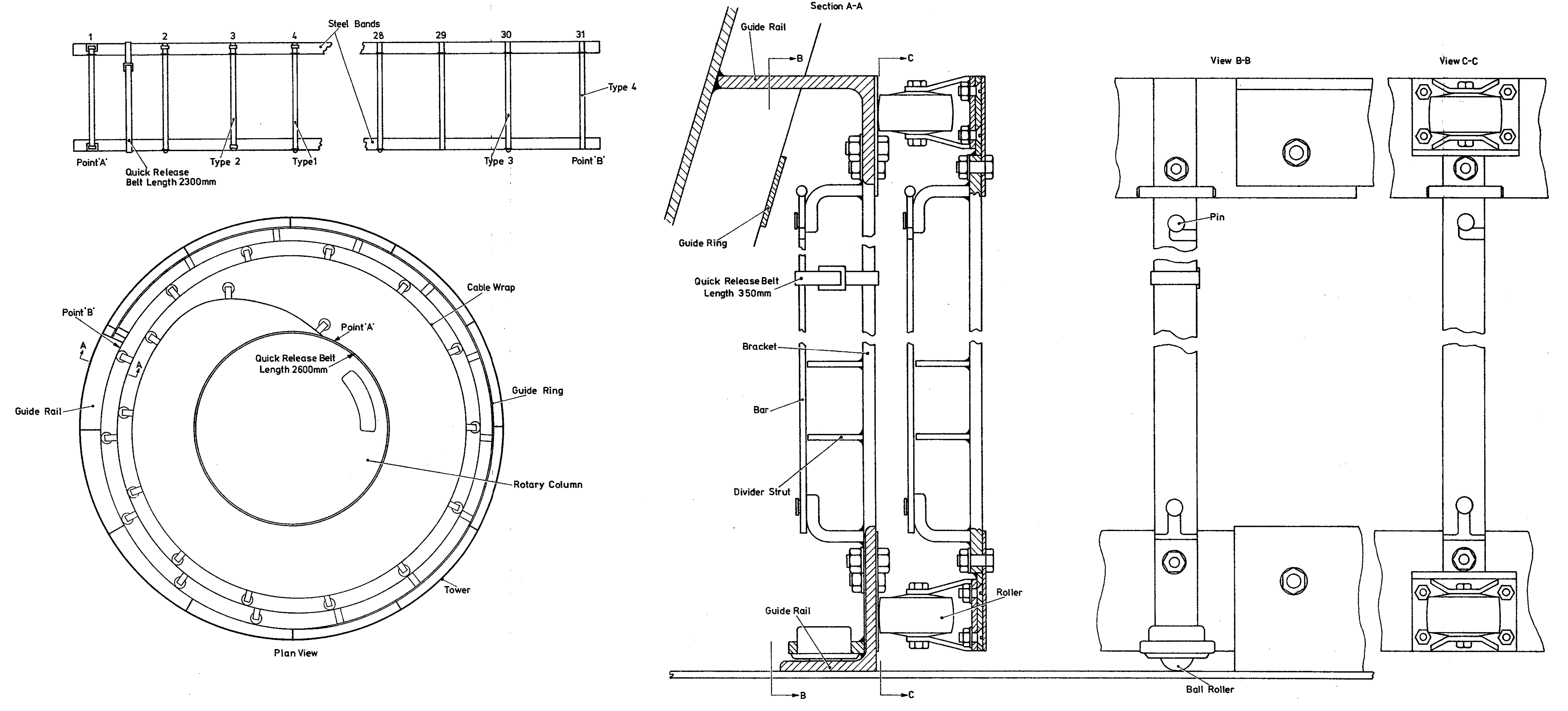
Installation Device - Elevation Bearings

Fig. 4.24.-4

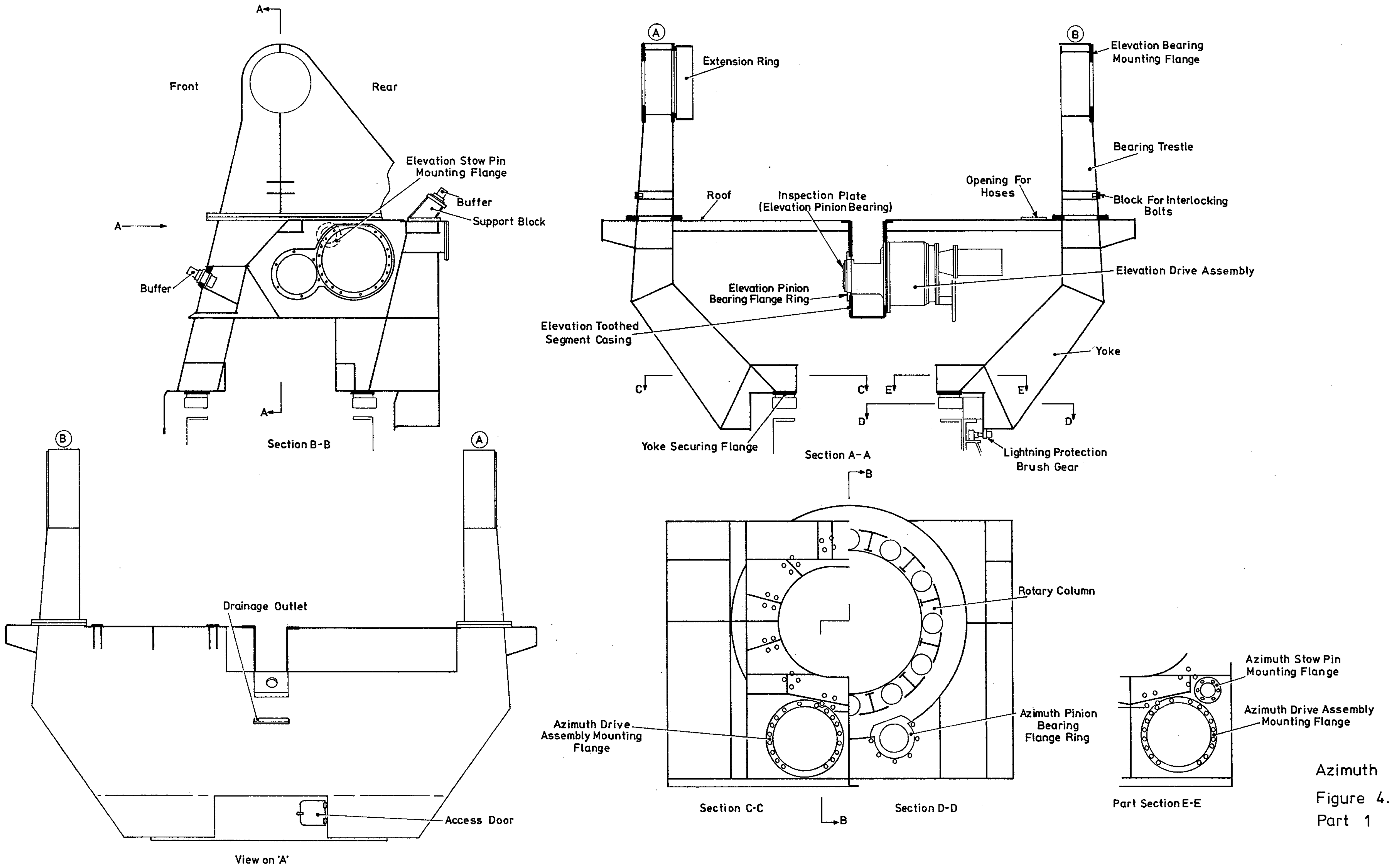
Tower
Figure 4.3-1
Part 1



Rotary Column
Figure 4.5-1
Part 1



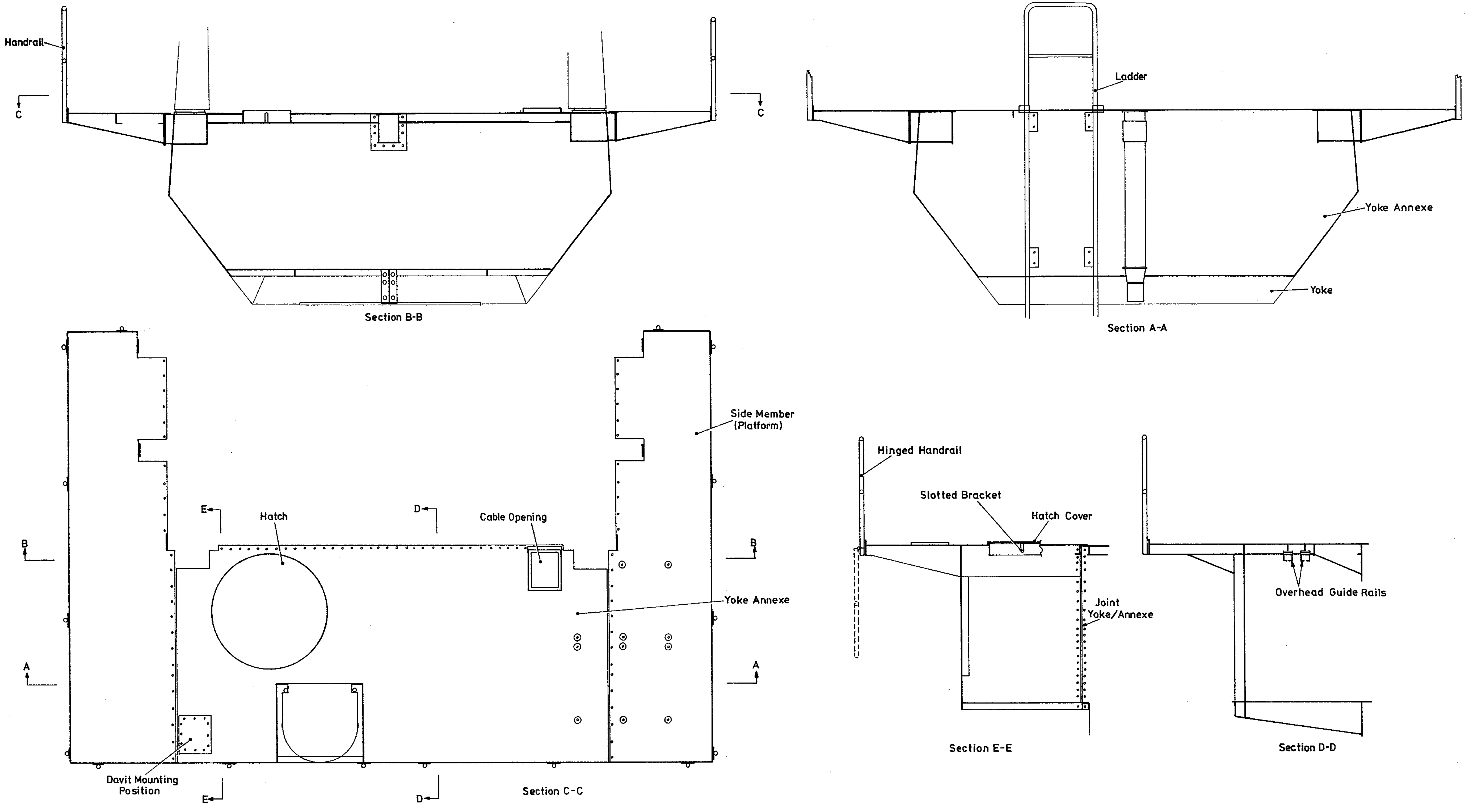
Cable Wrap
Figure 4.6-1
Part 1



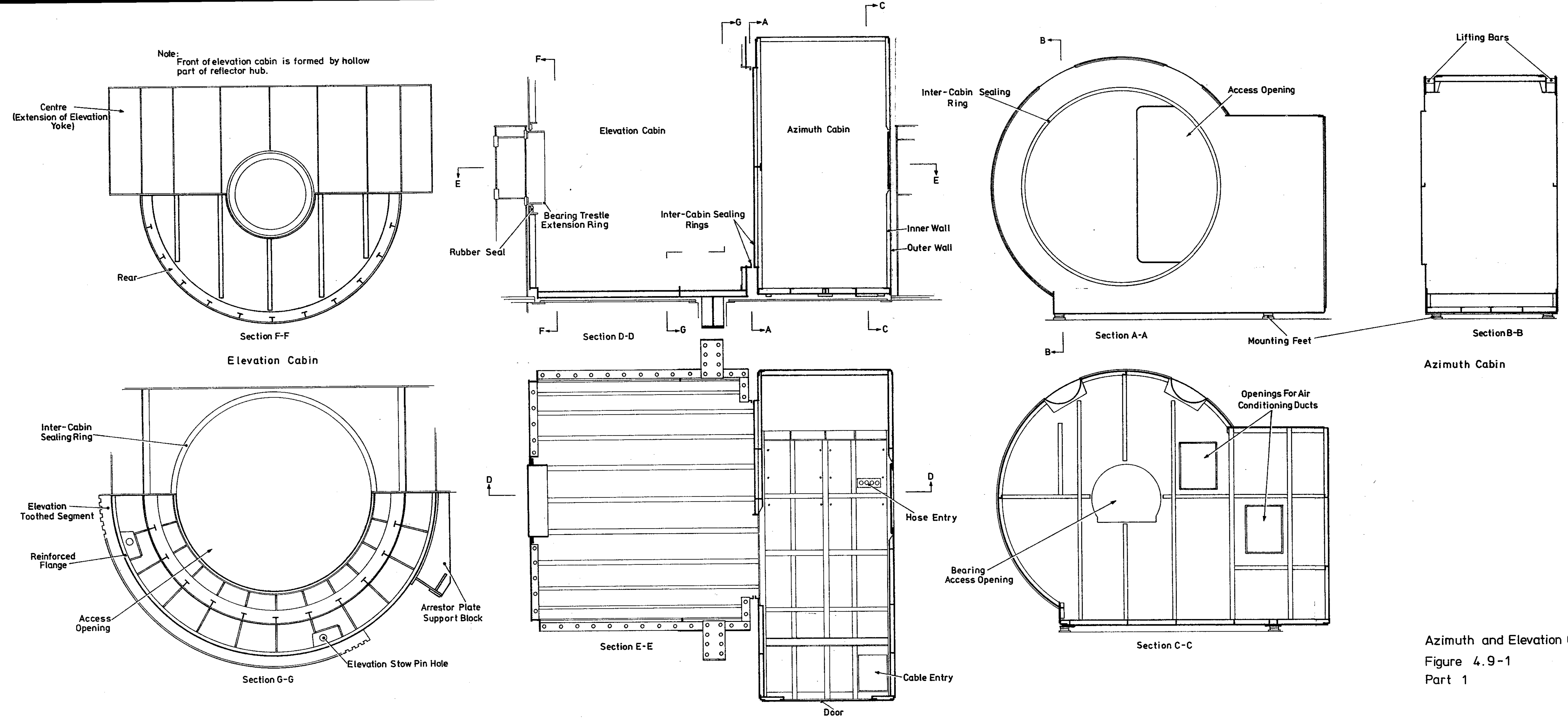
Azimuth Yoke

Figure 4.8-1

Part 1

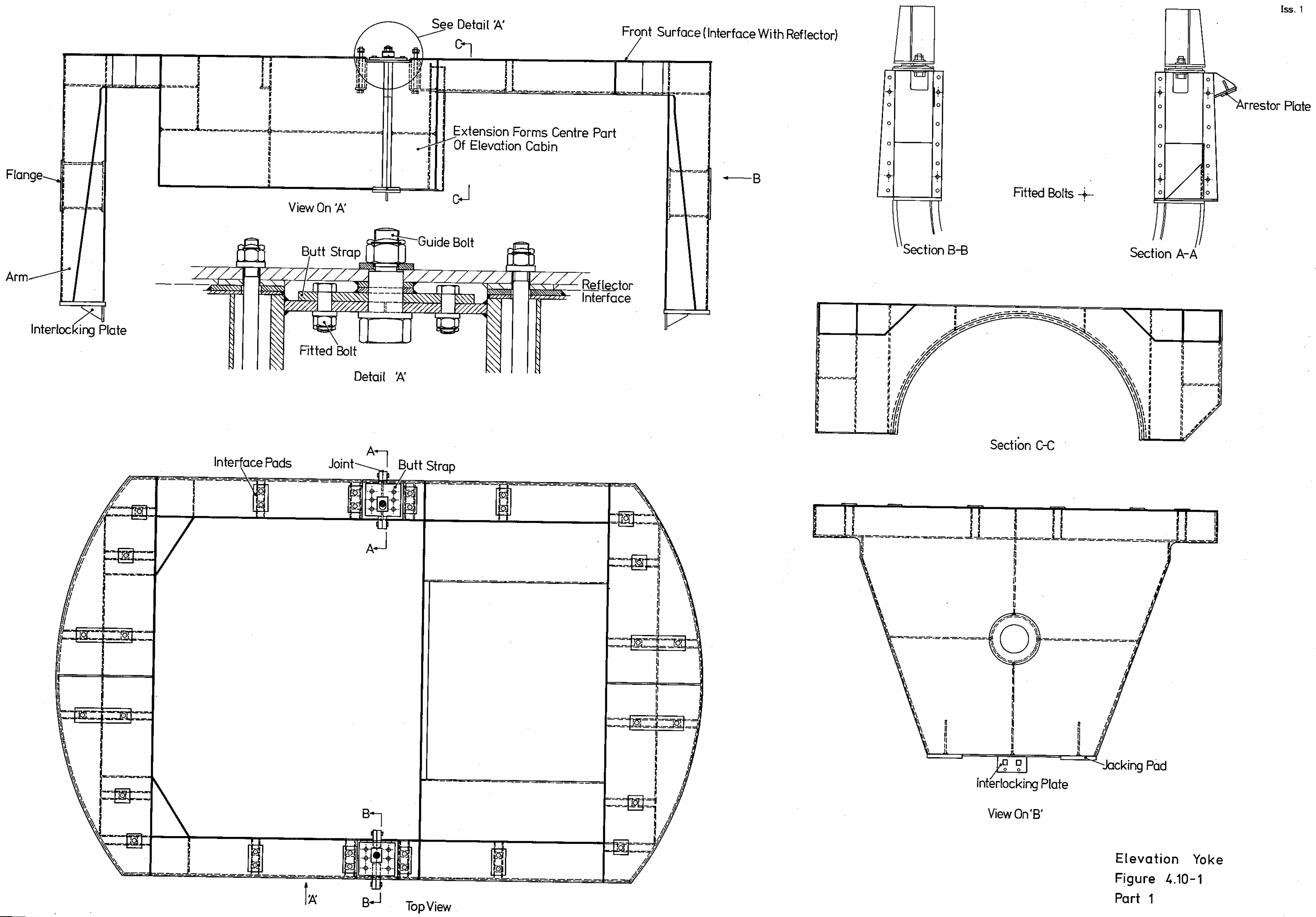


Yoke Annexe and Platform
Figure 4.8-2
Part 1

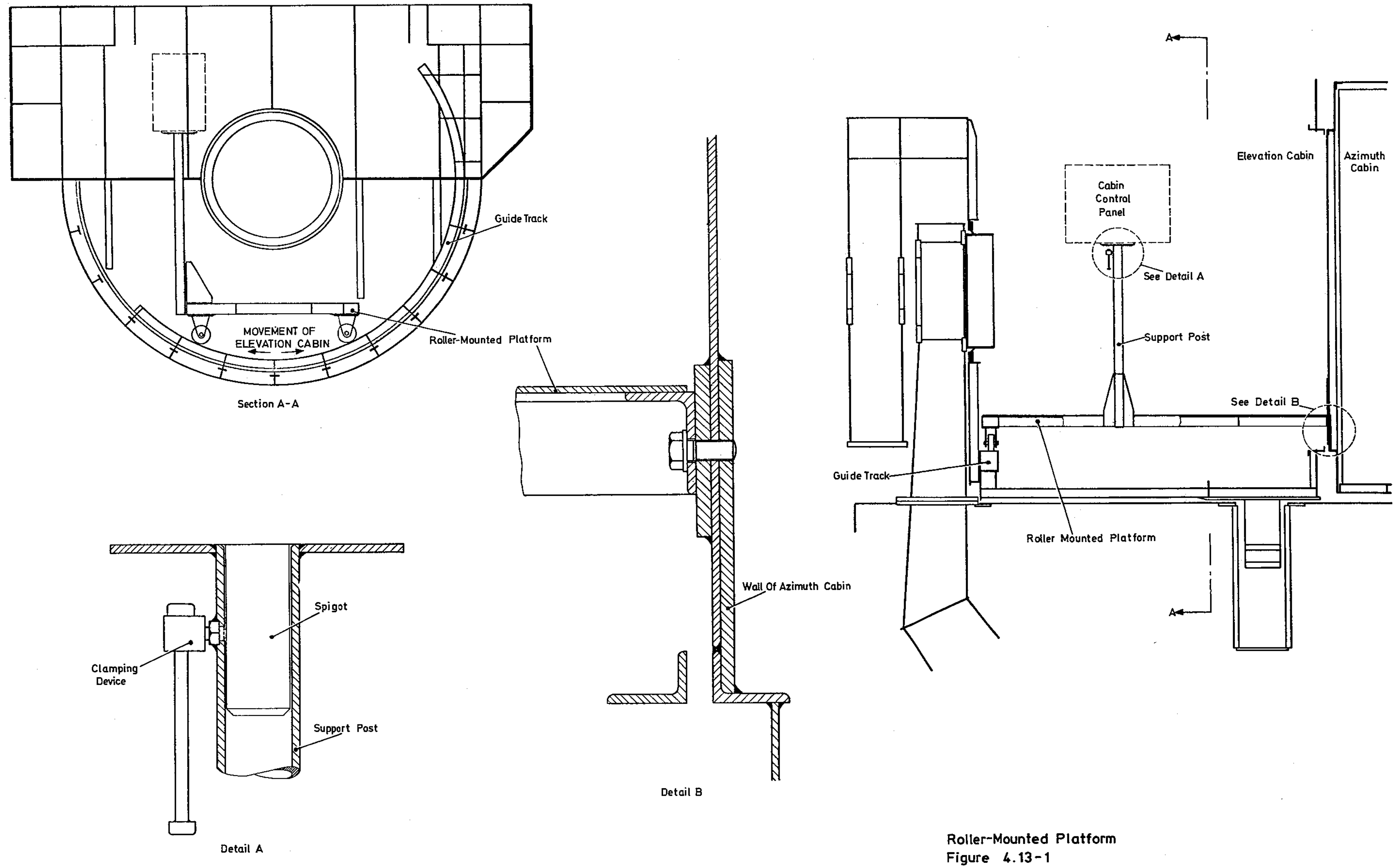


Azimuth and Elevation Cabins
Figure 4.9-1
Part 1

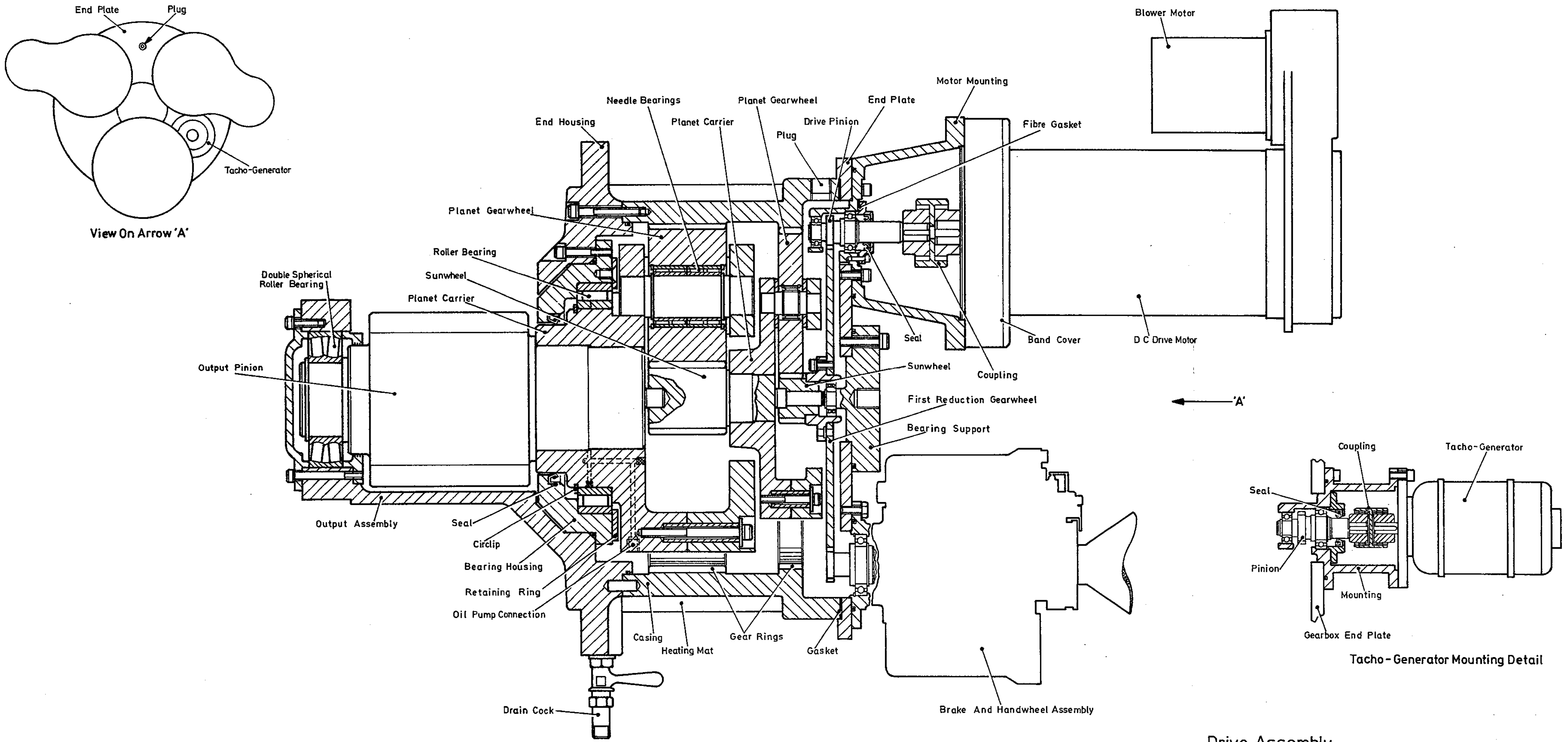
Iss. 1



Elevation Yoke
Figure 4.10-1
Part 1



Roller-Mounted Platform
Figure 4.13-1
Part 1

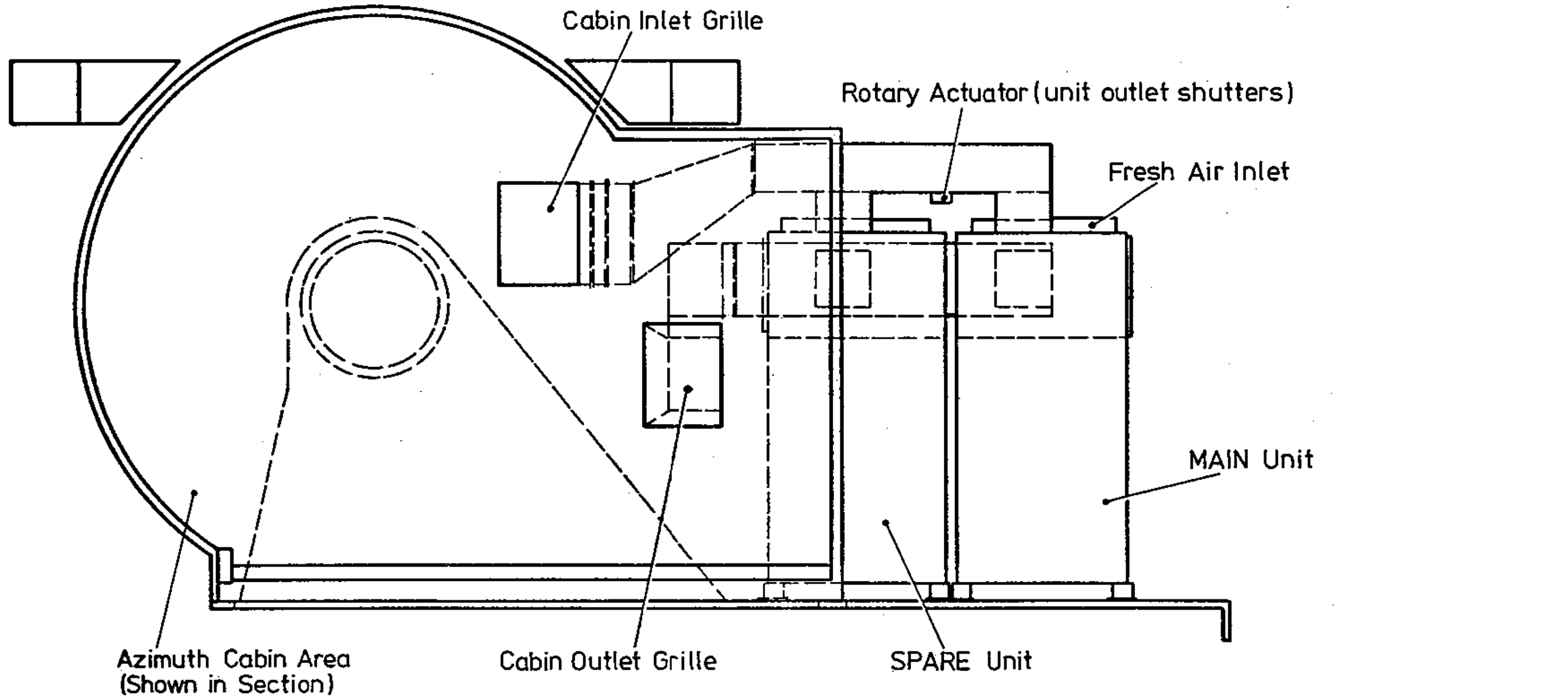


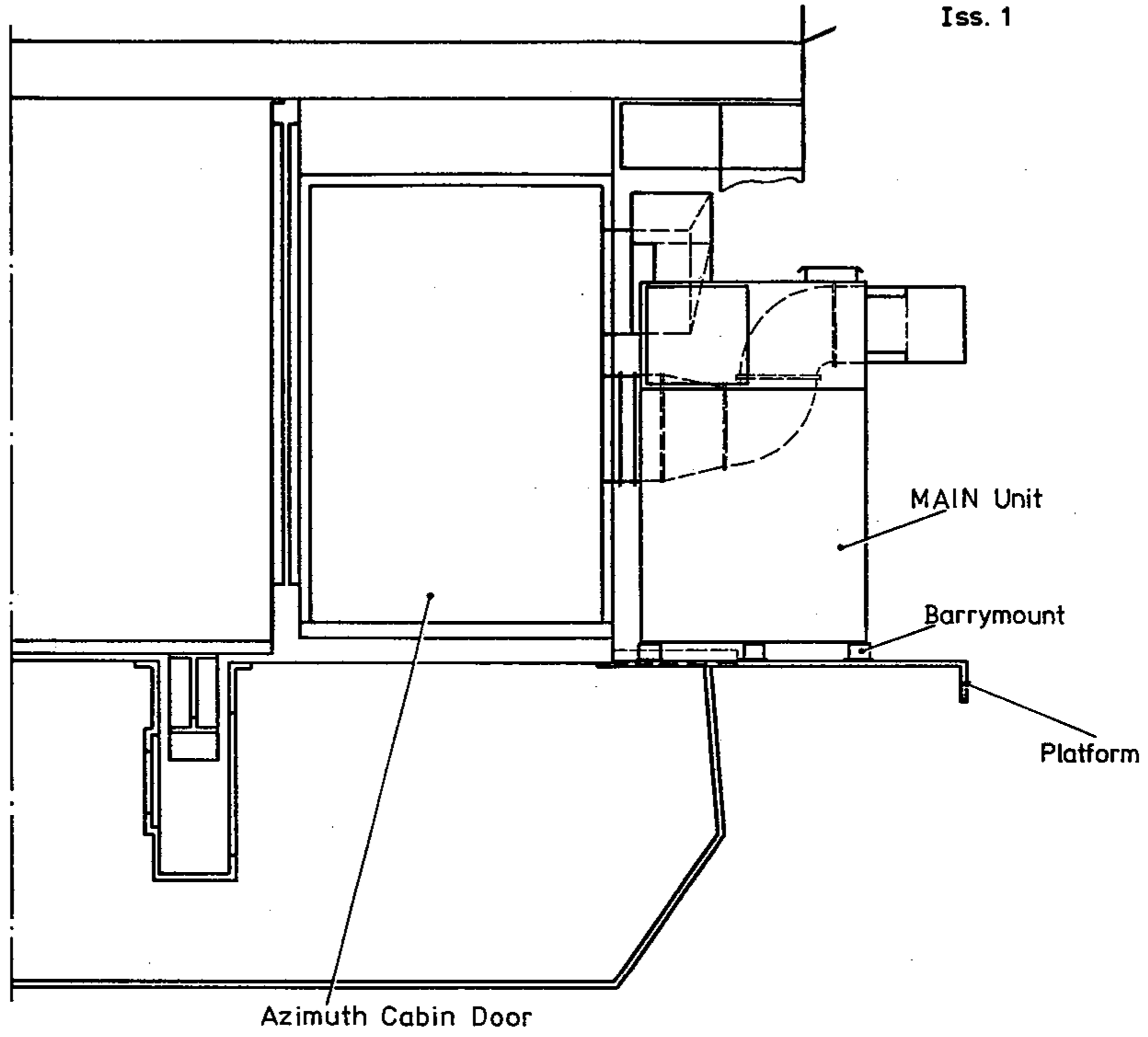
Drive Assembly

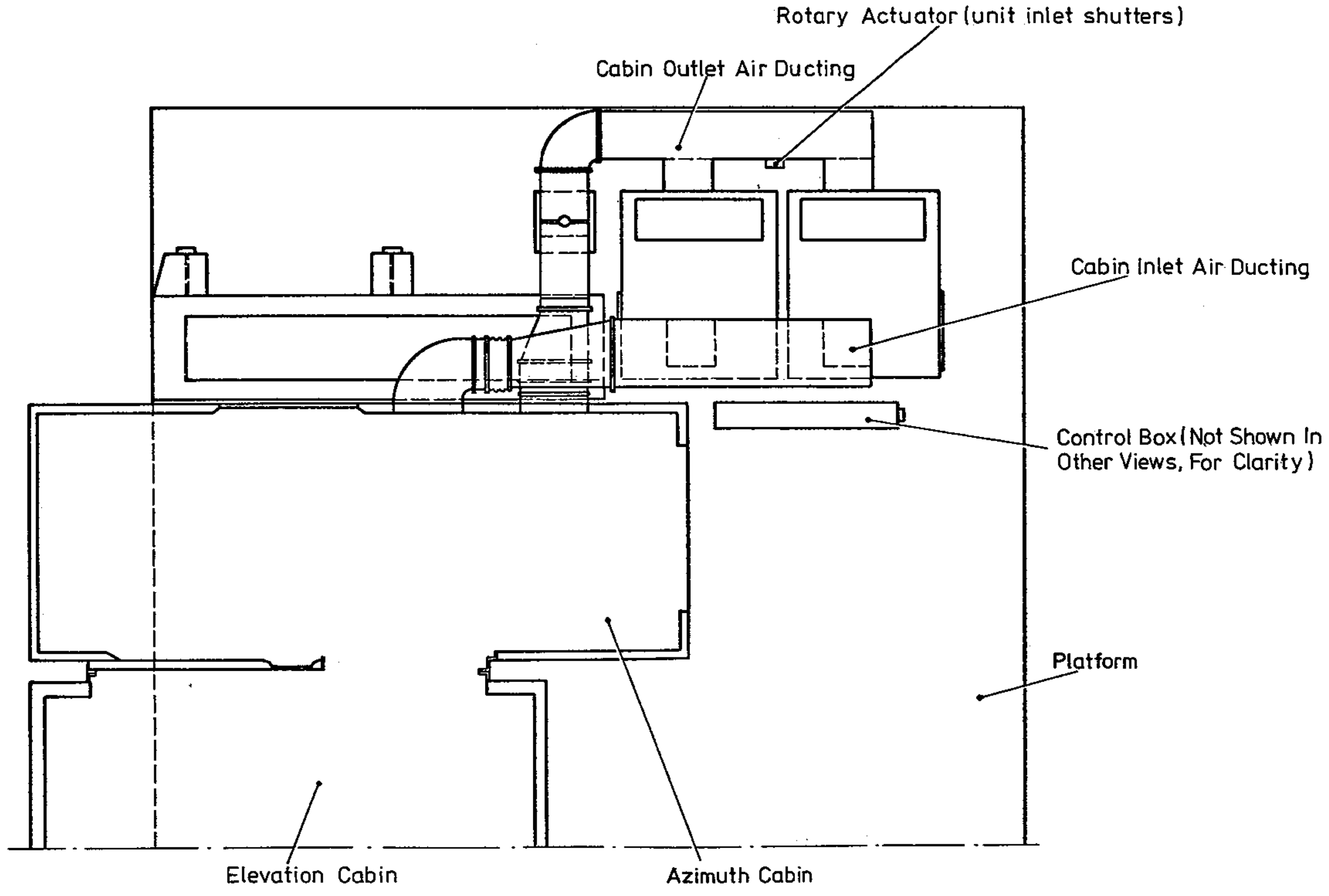
Figure 4.17-1

Part 1

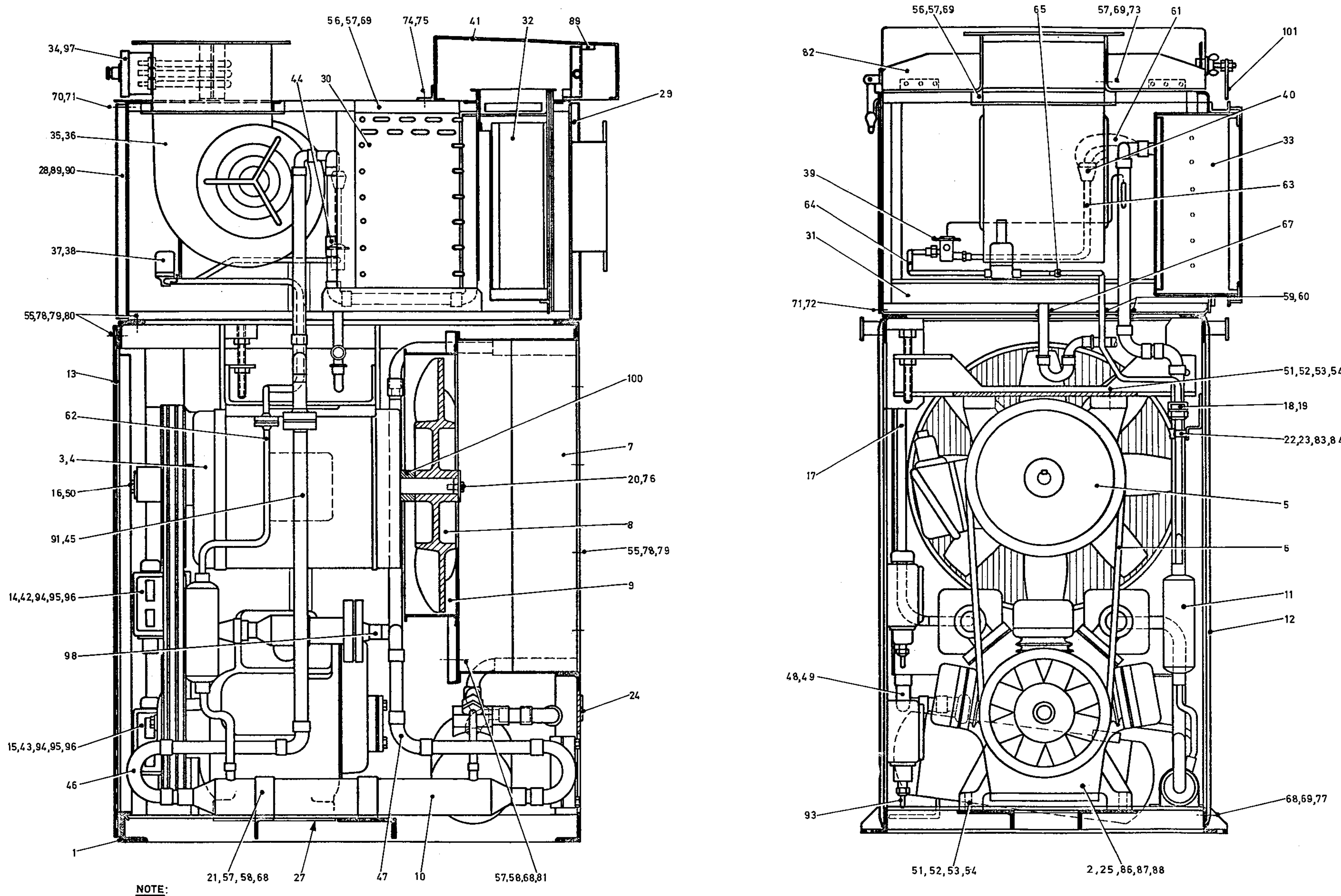
Brake And Handwheel Assembly (Azimuth)
Figure 4.17-3
Part 1





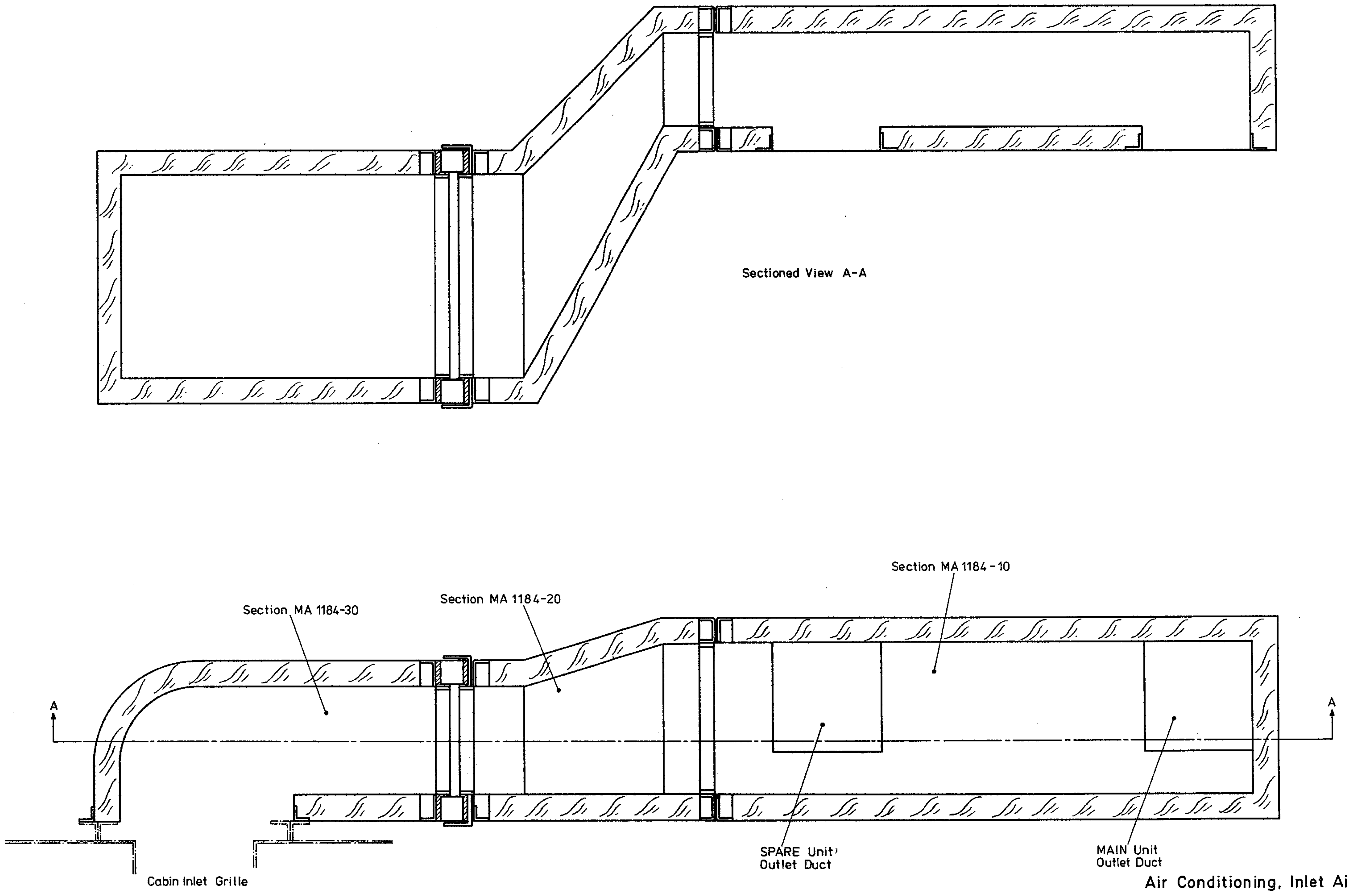


Air Conditioning - Plant Location
Figure 4.23-1
Part 1

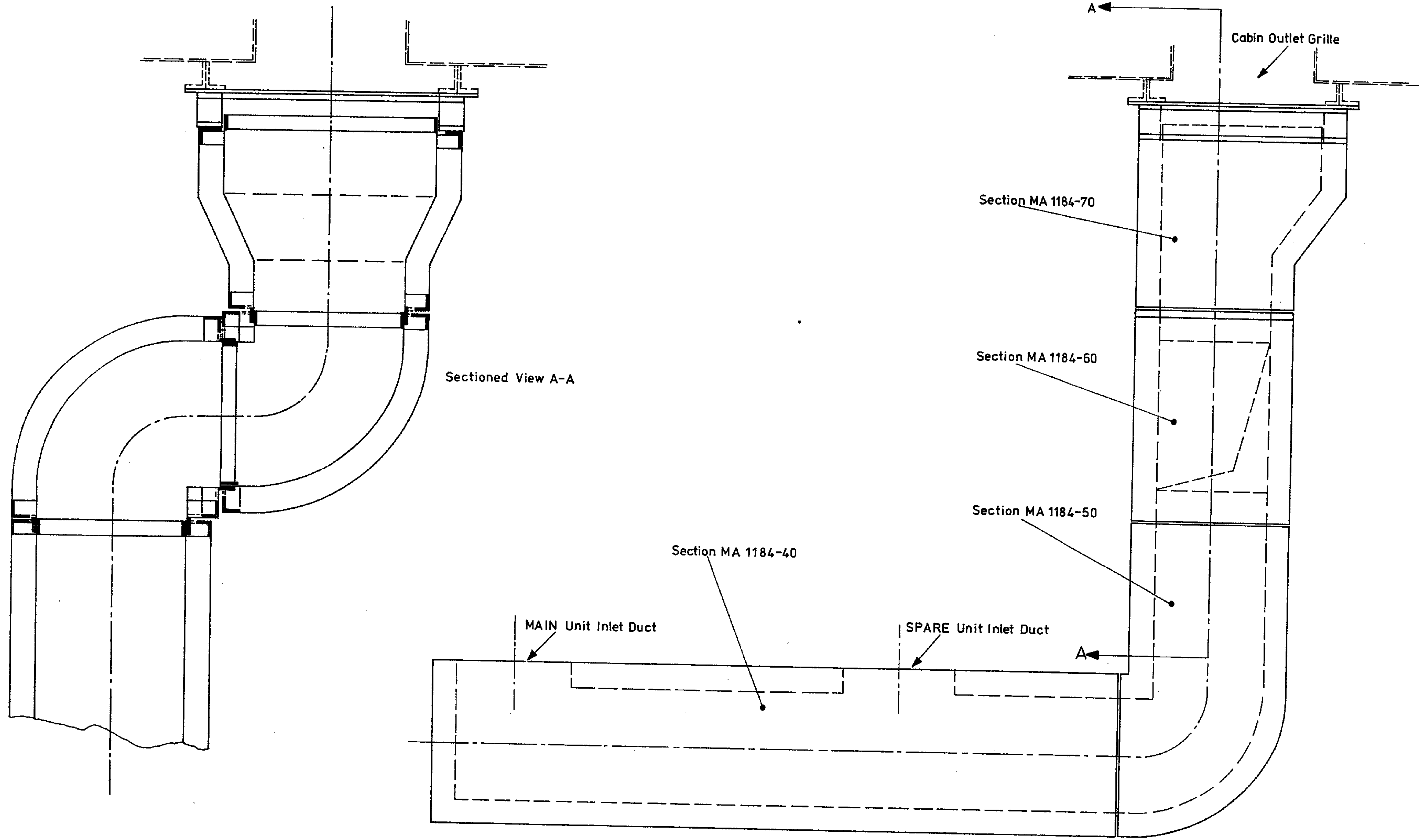


NOTE:
The item numbers in the figure are keyed to the item numbers in the components list

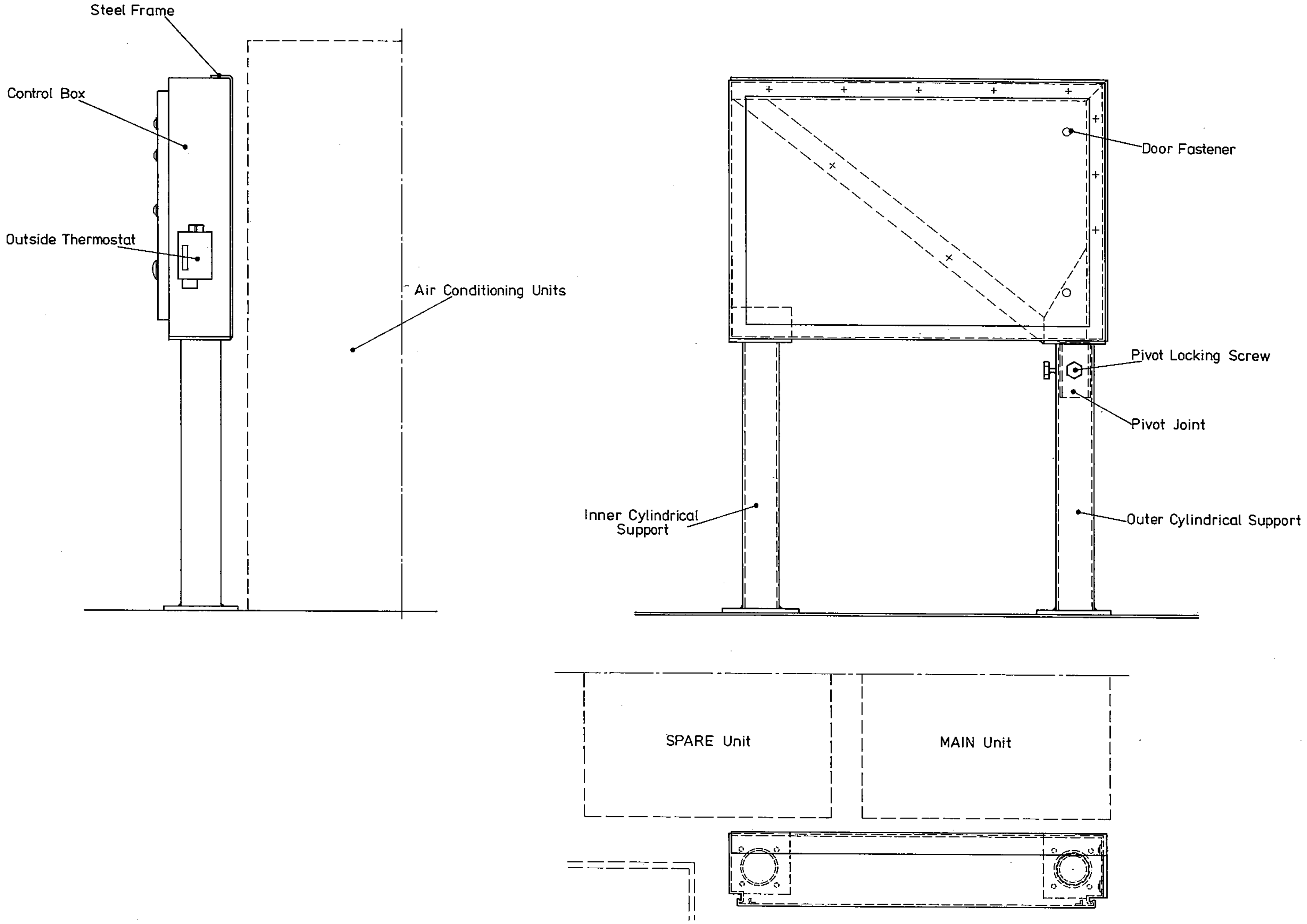
Air Conditioning Units-Component Location
Figure 4.23-2
Part 1



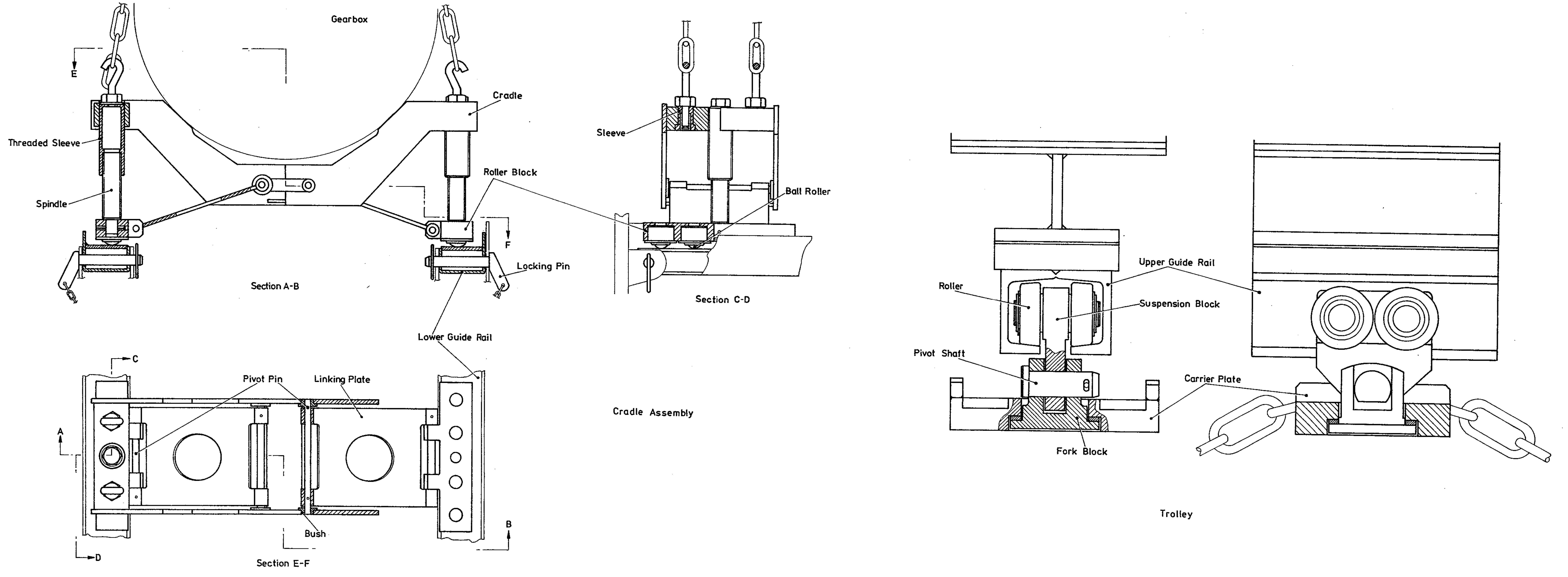
Air Conditioning, Inlet Air Ducting
Figure 4.23-3
Part 1



Air Conditioning, Outlet Air Ducting
Figure 4.23-4
Part 1



Air Conditioning, Control Box Construction
Figure 4.23-5
Part 1



Installation Device-Elevation Drive Assembly
Figure 4.24-2
Part 1

PART ONE

SECTION FIVE

INSTALLATION AND COMMISSIONING

1. GENERAL

This section details the procedure for the initial erection of the pedestal. It is assumed that:

a. The concrete support column has been prepared.

b. The base ring has been set in the concrete, levelled to an accuracy of ±2 mm and aligned to within $\pm 1^\circ$ of True North.

c. The concrete has hardened as required by the specification and as detailed by the site's civil engineer.

d. Connector plate P2, located within the concrete support column, has been fitted and all external connections made to it.

e. All cranes, mounting equipment and special tools are available and serviceable.

1.1 ORDER OF ASSEMBLY

The order of assembly of the various sub-assemblies comprising the pedestal is as follows, but for detailed instructions refer to Sub-sections 3 to 22.

a. Install anchoring bolts and setting screws.

b. Erect tower (position cable wrap during erection and secure outer end).

c. Secure copper ring to top of tower.

d. Secure azimuth toothed ring to top of tower.

e. Install rotary column.

f. Install lower azimuth bearing.

g. Adjust upper azimuth bearing rollers.

h. Lift assembled tower into position and secure to base ring.

j. Fit jacking screws to tower base.

k. Secure inner end of cable wrap.

m. Install azimuth yoke and annexe.

n. Fit and secure ladder to annexe.

p. Fit and secure platforms to azimuth yoke.

q. Fit and secure safety rails to platform.

r. Install davit.

s. Fit buffer and support block.

t. Connect cables and hoses of cable wrap to connector plates P1 and P2.

u. Install elevation drive assemblies.

v. Install azimuth drive assemblies.

w. Mount the azimuth cabin on azimuth yoke.

x. Assemble two halves of elevation yoke and secure to bearing trestles with interlocking bolts.

y. Install elevation bearings.

z. Assemble elevation cabin and toothed segment to elevation yoke.

aa. Mount the elevation yoke on the azimuth yoke.

bb. Install cabling and hoses from connector plate in rotary column to elevation cabin.

cc. Position and secure the roller-mounted platform.

dd. Install cabin air conditioning plant.

ee. Set the buffers.

ff. Level the pedestal.

gg. Mount the reflector on elevation yoke.

hh. Fit tower catwalk and sealings.

jj. Fit lightning protection brushes.

kk. Check and connect electric cabling in accordance with Cabling Schedules.

mm. Check water hoses.

nn. Install electronic equipment in the cabins.

pp. Install data pick-up units.

2. PACKING

The azimuth yoke and the two tower halves are each enclosed in separate packing frames for protection during transport. The remaining sub-assemblies of the pedestal, with the exception of the four drive assemblies and the azimuth cabin, are contained in four packing cases the contents of which are as follows:

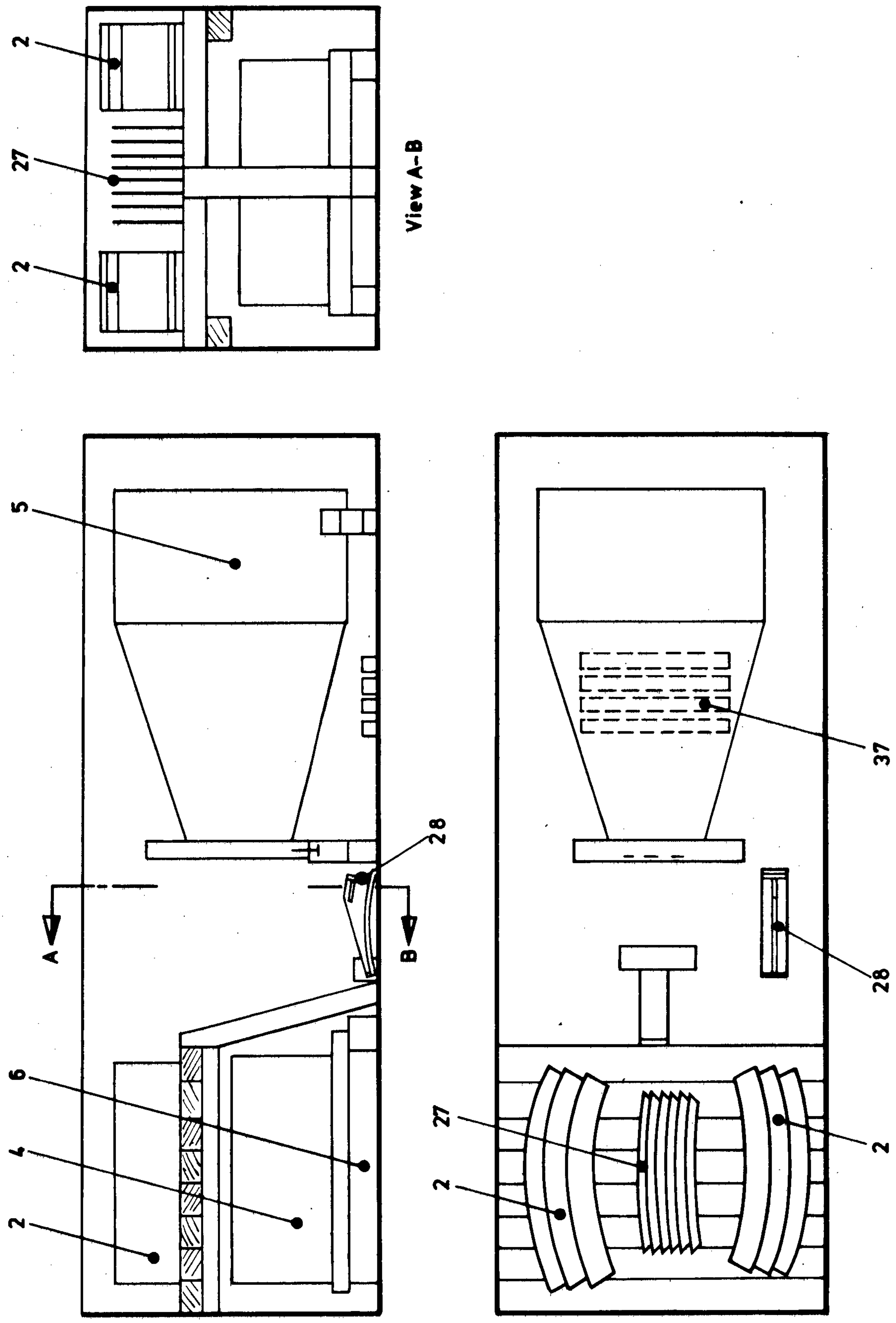
2.1 PACKING CASE No. 1 (Figure 5.2-1)

Item	No. of units	Description
2	6	Catwalk.
4	1	Cable wrap.
5	1	Rotary column (complete with upper azimuth bearing and connector plate P1).
6	1	Azimuth toothed ring.
27	8	Zinc plate sealing segments.
28	1	Arrestor plate support block.
37	4	Upper guide rails.

Dimensions : 6 m x 2.4 m x 2.4 m (19.7 ft x 8 ft x 8 ft).

Gross weight : 6610 kg (14,575 lb).

Colour marking : Black.



Packing Case - 1

Fig. 5.2-1

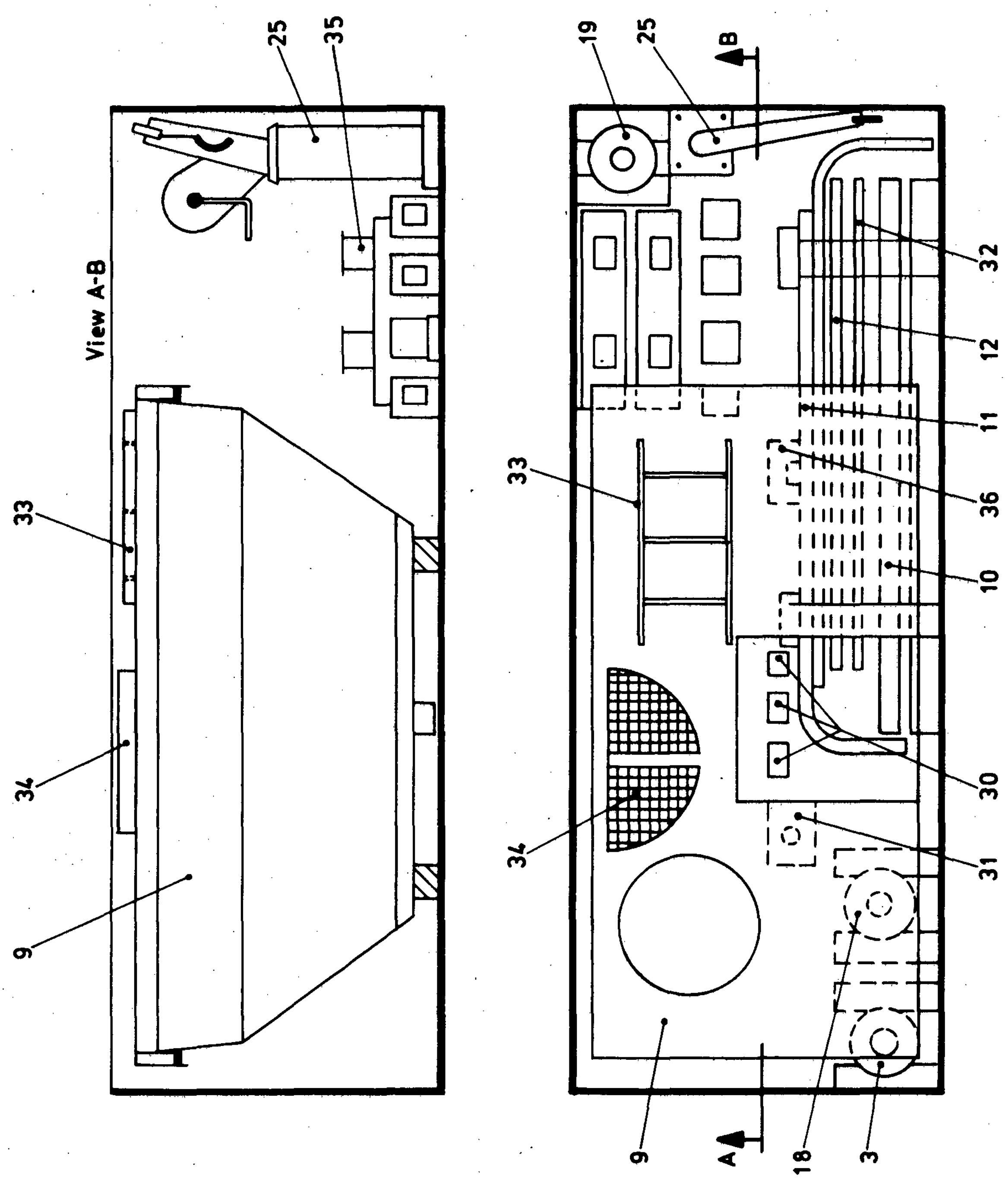
2.2 PACKING CASE No. 2 (Figure 5.2-2)

Item	No. of units	Description
3	1	Lower azimuth bearing.
9	1	Azimuth yoke annexe.
10	2	Platform (side members).
11	2	Handrail.
12	2	Handrail.
18	1	Elevation bearing.
19	1	Elevation bearing.
25	1	Davit.
30	1 set	Installation devices for drive assemblies.
31	1	Buffer with bearing block.
32	1	Aluminium ladder for gearbox room.
33	1	Base for air conditioning equipment.
34	2	Grating for rotary column.
35	2	Air conditioning ducts.
36	1	Support for air conditioning ducts.

Dimensions : 6 m x 2.4 m x 2.4 m (19.7 ft x 8 ft x 8 ft).

Gross weight : 6195 kg (13,660 lb).

Colour marking : Green



Packing Case-2

Fig. 5.2-2

2.3 PACKING CASE No. 3 (Figure 5.2-3)

Item	No. of units	Description
13	1	Ladder
14	1	Bracing support for ladder.
15	1	Elevation yoke.
16	1	Elevation yoke.
23	1	Roller-mounted platform.
38	1	Control box with frame (for air conditioning system).

Dimensions : 7 m x 2.85 m x 2.44 m (23 ft x 9.4 ft x 8 ft).

Gross weight : 5740 kg (12,657 lb).

Colour marking : Blue

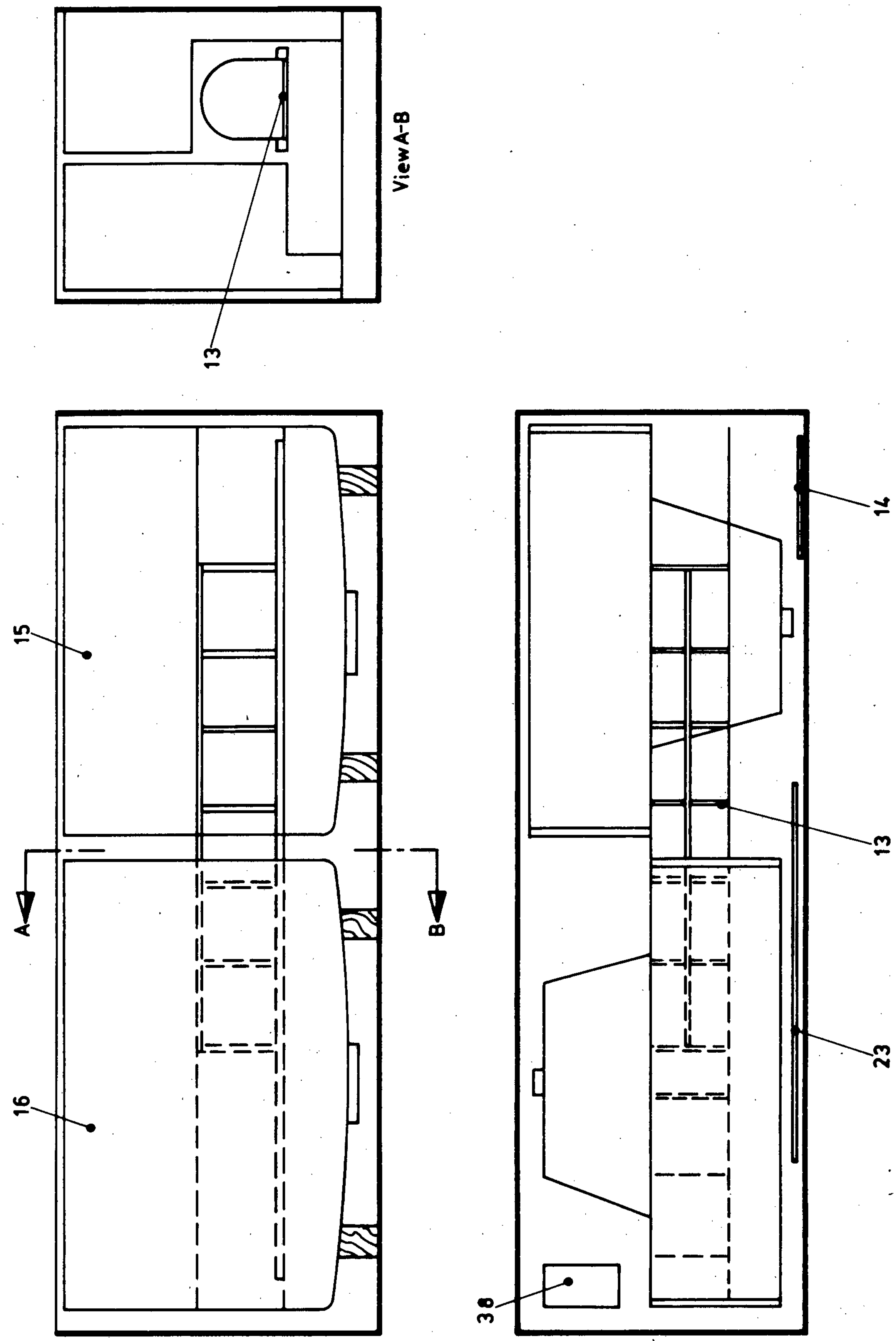
2.4 PACKING CASE No. 4 (Figure 5.2-4)

Item	No. of units	Description
8	1	Bearing trestle.
8/24	1	Bearing trestle (with extension ring).
17/20	1	Elevation cabin (with elevation toothed segment).
22	2	Air conditioning unit.
26	1 set	Steel band and seals for azimuth and elevation cabins.

Dimensions : 6 m x 2.47 m x 2.4 m (19.7 ft x 8.1 ft x 8 ft).

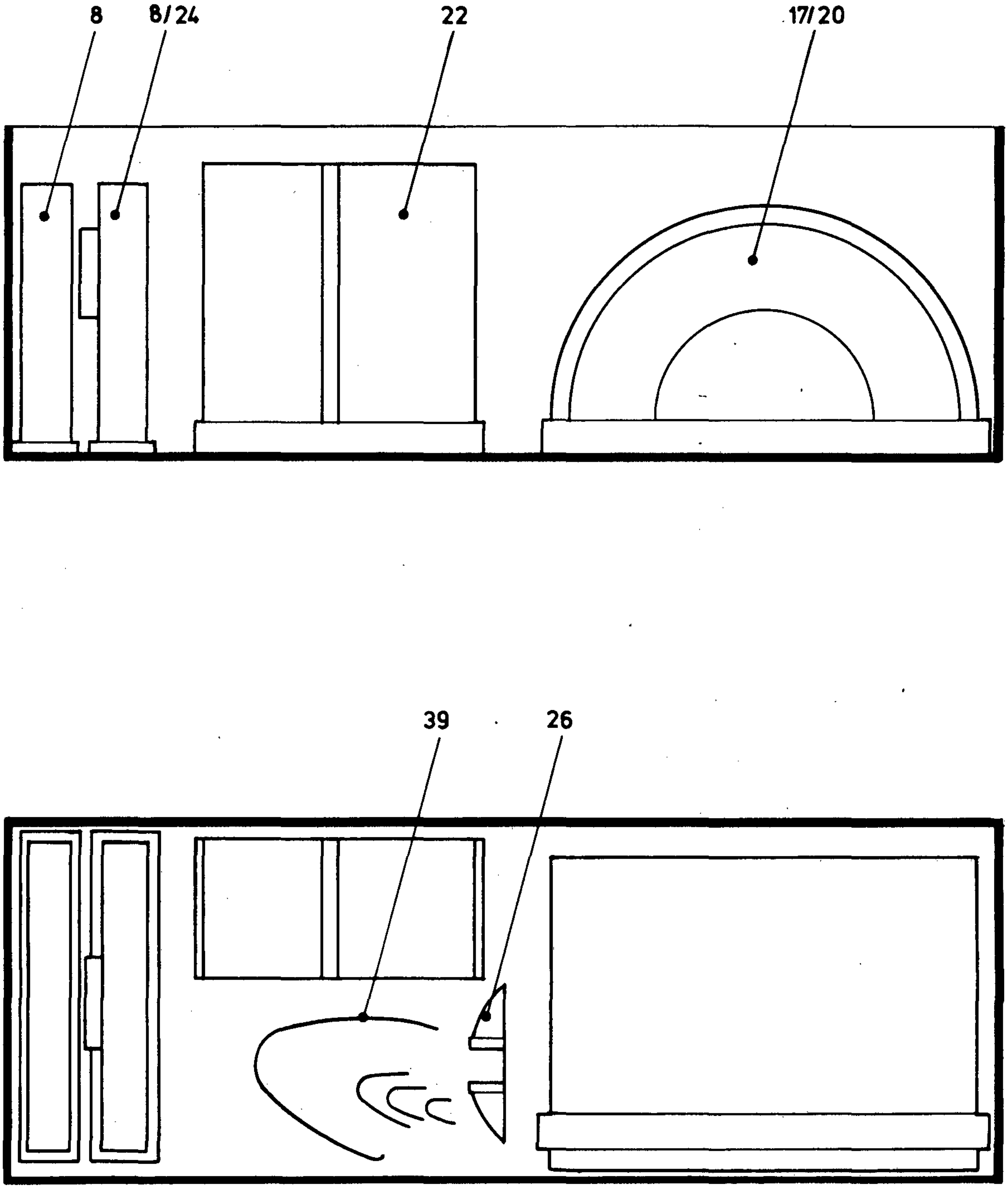
Gross weight : 5960 kg (13,142 lb).

Colour marking : Red.



Packing Case-3

Fig. 5.2-3



Packing Case – 4

Fig. 5.2-4

An additional partitioned packing case carries the nuts and bolts for securing the sub-assemblies. All cases are provided with lists, both inside and outside, stating the contents.

The four packing cases containing the sub-assemblies are marked with coloured lines for easy identification.

NOTE: When fitting the lids of the packing cases, ensure that the coloured lines on the lid and case correspond.

When unpacking the parts from the cases it is only necessary to remove the red-marked screws. All parts must be cleaned before installation and bare machined surfaces, including the azimuth toothed ring and the elevation toothed segment, are to be coated with Mobil Spray TAC D. After unpacking, replace all supports, braces and square timbers in the appropriate positions in the packing cases.

Each of the four drive assemblies is packed in its own packing case. Care must be taken to remove all packing material and dust from the assemblies before installation. After removal from the packing cases, inspect the assemblies for damage, especially to flanges and covers.

3. INSTALLING THE ANCHORING BOLTS AND SETTING SCREWS (Figure 5.3-1)

Install the anchoring bolts and setting screws as follows:

a. Assemble the anchor bolts (2) and lower washers (7) so that the bevel on the bolt shank mates with the counter-sink in the washer.

b. Insert the anchor bolts and washers into the bushes (1) so that the washer enters the recess in the bush.

c. Screw the nuts (8) onto each of the anchor bolts to prevent the bolts separating from the bushes.

d. Screw the bushes (1) into the threaded holes in the base ring and fully tighten.

e. Fit the retaining plates (10) and secure with bolts (11) and washers (12).

f. Screw the nuts (6) fully onto the setting screws (5) and insert the setting screws into the support blocks (13). Ensure that bearing plates (14) are firmly secured to their brackets.

g. Fit the jacking screw bearing plates (15) to the base ring and secure with counter-sunk screws (16).

4. ERECTING THE TOWER (Figure 4.3-1)

Using lengths of timber, prepare an erection foundation to one side of the concrete support column. This foundation should be approximately 1 m (3.3 ft) high and should be levelled with a spirit level. The structure, used to support the tower and rotary column during assembly, must be capable of supporting a weight of 10,160 kilograms (10 tons) and must be so constructed that the block and connection bridge, used during installation of the lower azimuth bearing (refer to Sub-section 6), can be erected beneath the tower.

With the erection foundation prepared and using cranes or other suitable lifting gear, proceed as follows:

a. Locate one half of the tower on the foundation and secure in place using guy lines or timber.

b. Position the cable wrap on the floor plate of the tower half and secure it temporarily to prevent it moving.

c. Locate the second half of the tower on the foundation and align the two halves. Connect together the two parts of the tower floor.

d. Bolt the two halves of the tower and spider together, having first checked that the sealing gasket is in position. Ensure that clamping sleeves are used in the positions indicated in Figure 4.3-1.

e. Ensure that the cables are protected during any work in the vicinity of the cable wrap. Loosen the transportation supports on the wrap and bolt the outer end of the wrap to the connecting points on the guide rails (Figure 4.3-1, Section D-D). Open the spiral and check that the cable wrap moves smoothly over the tower floor.

f. Secure the two copper ring segments to the top of the tower so that the joints are approximately at 90° to the North/South line of the tower. Any gaps between the segments are to be filled with solder and the joints filed to a smooth finish.

g. Inspect the guide set pins at the top of the tower. Any damaged pins must be replaced with new pins of a slightly larger size and the locating holes must be reamed out to accept the new pins. The new pins must be of a sufficiently large size to ensure that any damage to the locating holes is removed when the holes are reamed out.

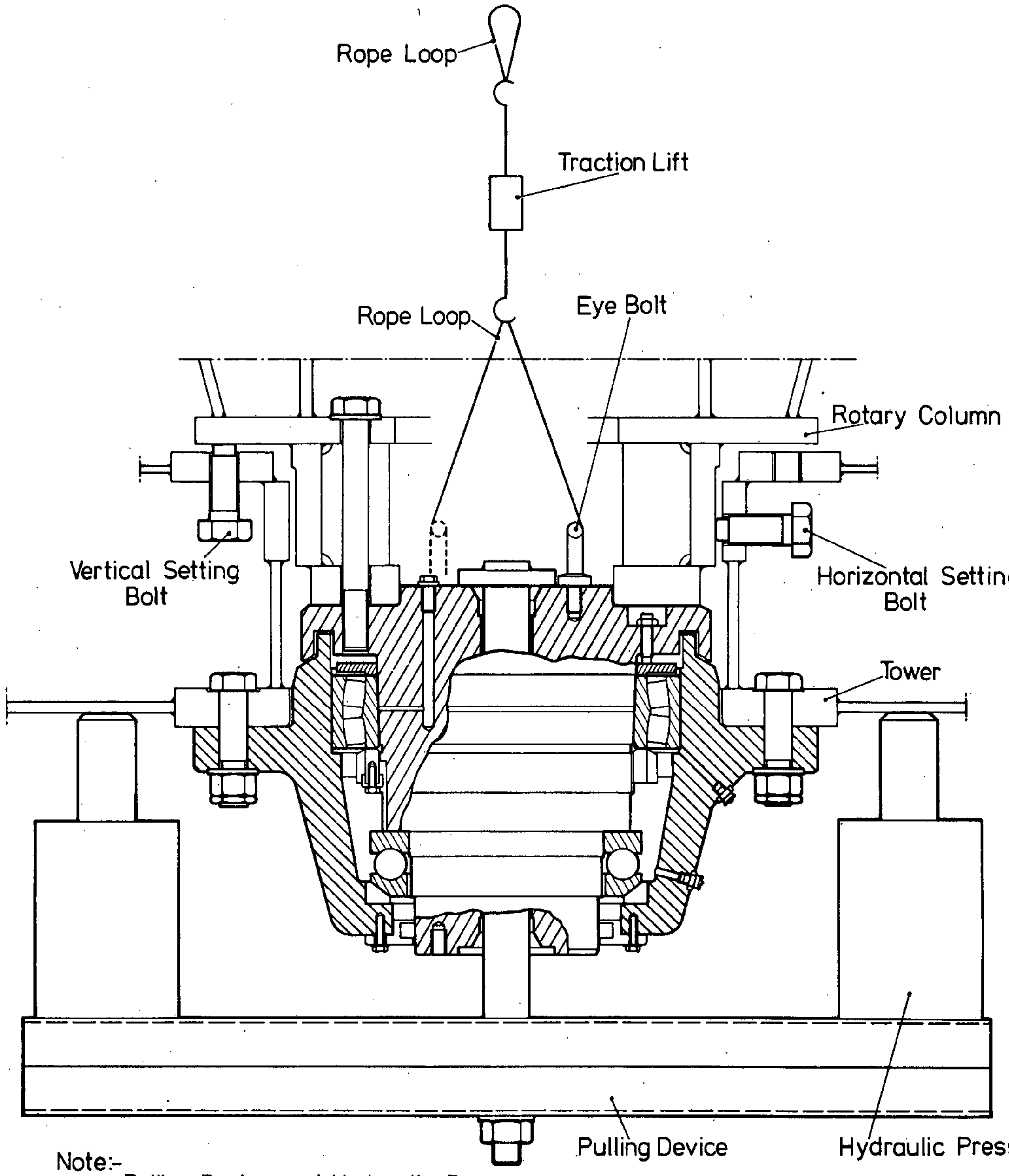
h. Assemble the azimuth toothed ring to the top of the tower, engaging the guide set pins in the corresponding holes in the ring. Secure the ring in position using bolts and spring washers.

<u>NOTE:</u> When positioning the azimuth toothed ring, the azimuth stow-pin hole must be located at approximately the North-East point on the tower top.

5. <u>INSTALLING THE ROTARY COLUMN</u> (Figure 5.5-1)

a. Using a crane, lift the rotary column into position in the tower. Take care that the lower end of the column does not foul the cable wrap.

b. Fit the vertical and horizontal setting bolts and tighten all bolts by an equal amount to support the rotary column.



Note:-
Pulling Device and Hydraulic Presses Only Required For Removal of Lower Azimuth Bearing. (Refer Part Two - Section Three)

Installation and Removal of Lower Azimuth Bearing

Fig. 5.5-1

NOTE: To facilitate the installation of the lower azimuth bearing, the base of the rotary column must be raised to a level above that to be occupied by the upper face of the bearing.

6. INSTALLING THE LOWER AZIMUTH BEARING (Figures 4.24-3 and 5.5-1)

a. Assemble the block and connection bridge as shown in Figure 4.24-3 and mount the carriage on the connection bridge.

b. Insert the eye bolts into the threaded holes in the top face of the bearing. Using suitable lifting gear, lift the bearing onto the carriage. Position the carriage under the tower base.

c. Assemble the traction lift and the rope loops as shown in Figure 5.5-1. Connect the lower rope loop to the eye bolts and the upper rope loop to the cross-member of the rotary column and lift the bearing into position using the traction lift.

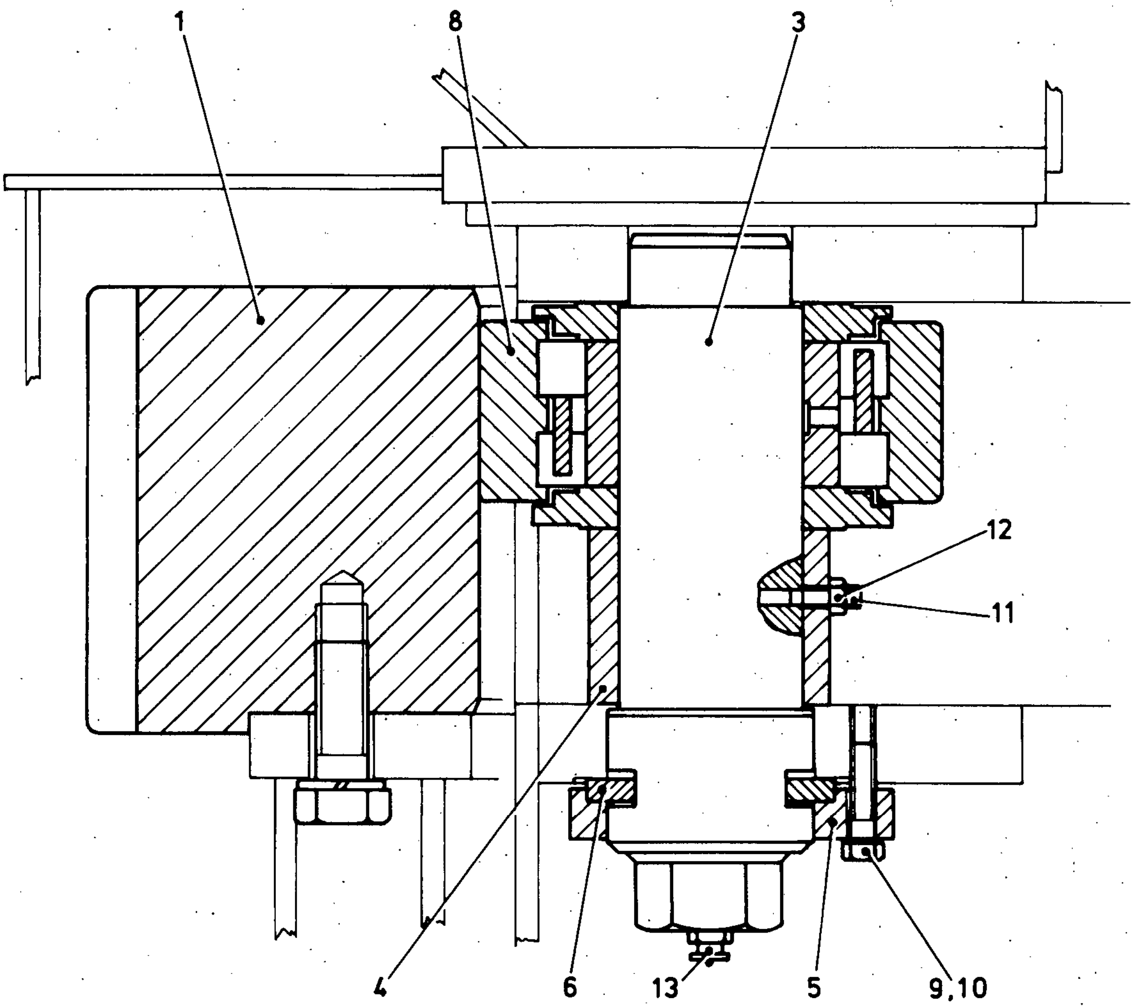
d. Secure the bearing to the tower flange, using the nuts, washers and bolts as shown in Figure 5.5-1. Disconnect the rope loops and the traction lift.

e. Slacken the vertical setting bolts to lower the rotary column onto the bearing. Adjust the horizontal setting bolts to align the holes in the base of the rotary column with the corresponding holes in the top of the bearing. Insert the long bolts which secure the bearing to the rotary column flange and fully tighten.

f. Slacken the vertical and horizontal setting bolts and remove the lifting gear.

7. ADJUSTMENT OF UPPER AZIMUTH BEARING ROLLERS (Figure 5.7-1)

The bearing rollers of the upper azimuth bearing are pre-assembled in the rotary column and must be adjusted as necessary to ensure that all rollers are making good contact with the inner face of the azimuth toothed ring and to obtain true verticallity of the rotary column. Checking and adjustment is made as follows:



Installation Of Upper Azimuth Bearing

a. Assemble a dial gauge and position it on the azimuth toothed ring (1) so that the operating arm of the gauge is touching the face of the rotary column and the dial pointer is indicating zero.

b. Slowly rotate the rotary column manually and observe the dial gauge. If the dial pointer deflects from zero, the rotary column is not central about the vertical axis and the upper azimuth bearing rollers (8) must be adjusted, as necessary, as detailed in step c.

c. Slacken the bolts (9) and rotate the shaft (3) in the required direction. Tighten bolts (9) after adjustment.

d. Repeat steps b. and c. until the dial pointer remains at zero during one full revolution of the rotary column and all bearing rollers are in contact with the inner face of the azimuth toothed ring.

8. <u>FITTING TOWER TO BASE RING</u> (Figure 5.3-1)

a. Prepare a support on the concrete support column, using two lengths of timber approximately 100 mm (4 in) square.

b. Fit four lifting eyebolts to the azimuth toothed ring and lift the assembled tower into position over the base ring so that the opening in the tower floor, for the supply cables, is adjacent to the North point of the base ring.

c. Remove the nuts (8) from the anchor bolts (2) and insert the bolts into their respective holes in the tower base. Fit the upper bevelled washers (7) over the anchor bolts, so that the bevelled face is uppermost. Fit and hand tighten the nuts (8) and locknuts (9).

<u>NOTE:</u> When fitting the nuts (8) to the anchor bolts (2), ensure that the bevelled face of the nut is downwards.

d. Fit the jacking screws (3) to the tower base and screw the lock nuts (4) onto the jacking screws.

e. Use the jacking screws (3) to lift the tower sufficiently to facilitate the removal of the two lengths of timber.

f. Rotate the rotary column so that the operating strikers for the azimuth range and limit switches are positioned adjacent to the South point of the base ring.

g. Remove the transportation supports from the cable wrap and secure the inner end of the wrap to the support rings on the rotary column.

h. Level the tower, using a spirit level and the jacking screws. When the tower is level, tighten the nuts and lock nuts (8 and 9) on the anchor bolts (2) and the lock nuts (4) on the jacking screws (3). Tighten the setting screws (5), to prevent the tower rotating, and lock with nuts (6).

j. Remove the eyebolts from the azimuth toothed ring.

k. Remove all foreign matter from, and clean, the mating faces of the azimuth yoke and rotary column.

9. INSTALLING THE AZIMUTH YOKE

a. Examine the azimuth stow-pin and the stow-pin hole, in the toothed ring, for damage.

b. Position the azimuth yoke over the rotary column so that the open end of the yoke is facing the North point of the base ring, and the holes for the azimuth stow-pin are aligned.

c. Connect the azimuth yoke to the rotary column using socket headed screws and spring washers. The screws are inserted into the azimuth yoke from underneath the top flange of the rotary column. Tighten the screws with a torque wrench, set to slip at 31 kg.m (224.3 lb ft).

d. Insert the azimuth stow-pin to lock the azimuth yoke in position relative to the azimuth toothed ring. The eccentric bush, in which the stow pin housing is mounted, permits adjustment of the stow pin to facilitate its mating (refer to Section Four, Sub-section 18).

10. INSTALLING THE AZIMUTH YOKE ANNEXE

a. Lift the azimuth yoke annexe into position over the open end of the azimuth yoke, insert the seal between the yoke and the yoke annexe. Secure the yoke annexe in place with bolts and washers.

b. Assemble the ladder and bolt it to the rear of the azimuth yoke annexe. Secure the bracing frame between the ladder and the azimuth yoke.

c. Secure the platforms to the sides of the azimuth yoke. Fit the roofing over the azimuth yoke and yoke annexe and secure in place with counter-sunk head screws.

d. Fit and secure the safety rails around the platform and assemble the davit on its mounting plate.

e. Bolt the buffer and support block in position (refer to Figure 4.8-1).

f. Connect the cables and hoses of the cable wrap at connector plate P1 (in rotary column) and at connector plate P2 (inside concrete support column), refer to Part One, Section Two, Sub-section 11.

11. INSTALLING THE DRIVE ASSEMBLIES

The drive assemblies must be installed in a preset sequence. Before installing the drive assemblies check that the special lifting tools are available and serviceable. The drive motors must be removed from the elevation gearboxes before installation, the azimuth drive assemblies can be installed fully assembled.

NOTE: The gearboxes are filled with oil.

Ensure that the main circuit breaker, 00a1, in Rack K1 is off before any electrical connections are made to the drive assemblies.

Before installing the drive assemblies, carry out an insulation resistance test on the d.c. drive motors using a 250 V megger. The resistance must be greater than 2 MΩ.

11.1 ELEVATION DRIVE ASSEMBLIES (Figures 4.24-2, 5.11-1 and 5.11-2)

a. Fit the lower guide rails in position for installation of the first elevation drive assembly. Insert the locking pins and check the rails for security.

b. Position the installation device on the platform, adjacent to the hatch.

c. Using a davit, or other suitable lifting tackle, lower one of the elevation drive assemblies onto the cradle of the installation device, so that the drain tap is at the bottom.

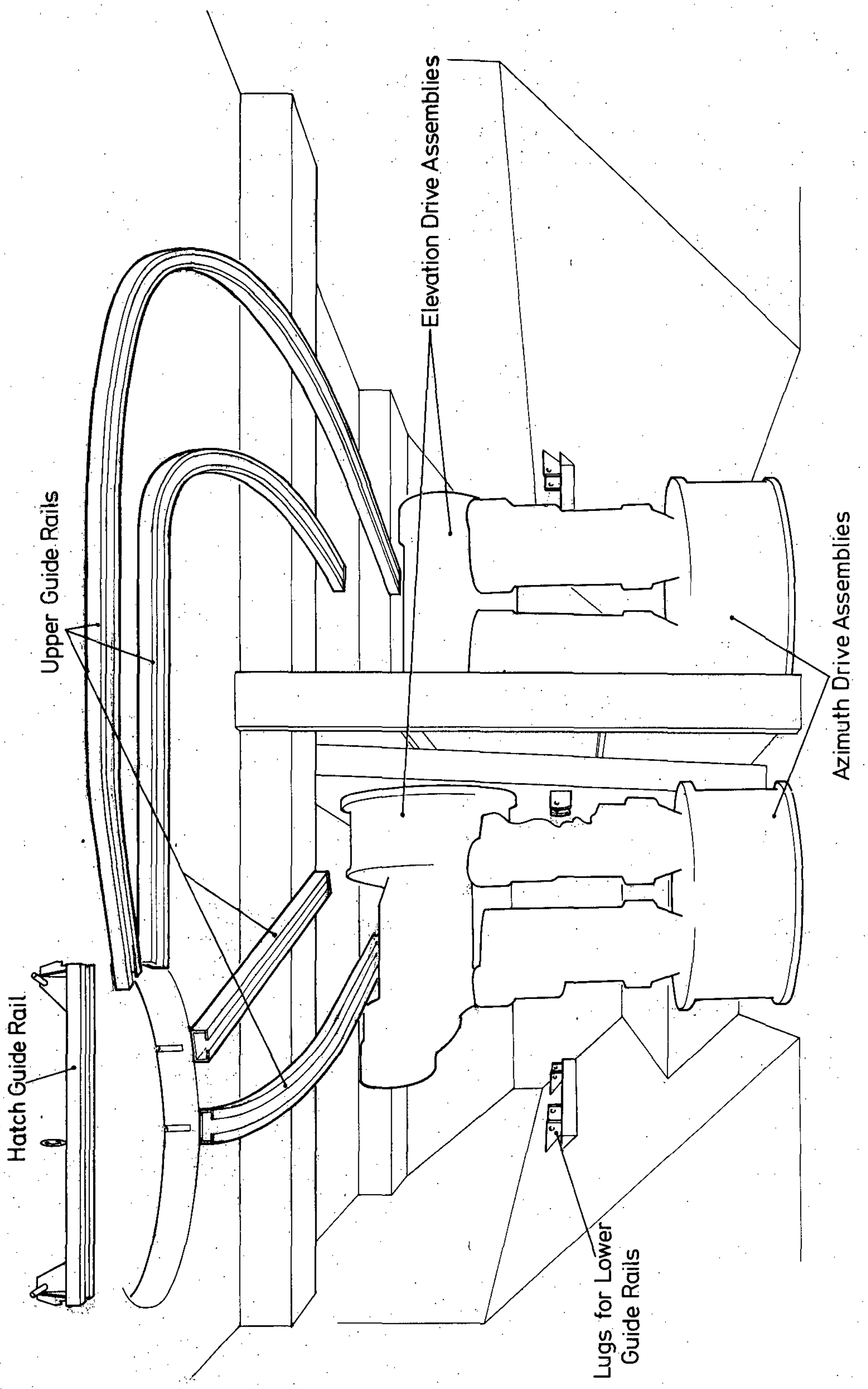
d. Secure the drive assembly to the cradle with the chains. Locate the trolley carrier plate under the chains and engage the rollers of the trolley in the loose hatch guide rail.

e. Secure the trolley to the hatch guide rail with rope or wire, to prevent the trolley rolling along the rail.

f. Lift the hatch guide rail complete with the drive assembly and lower into the hatch until the hatch guide rail engages in the correct slots in the sides of the hatch.

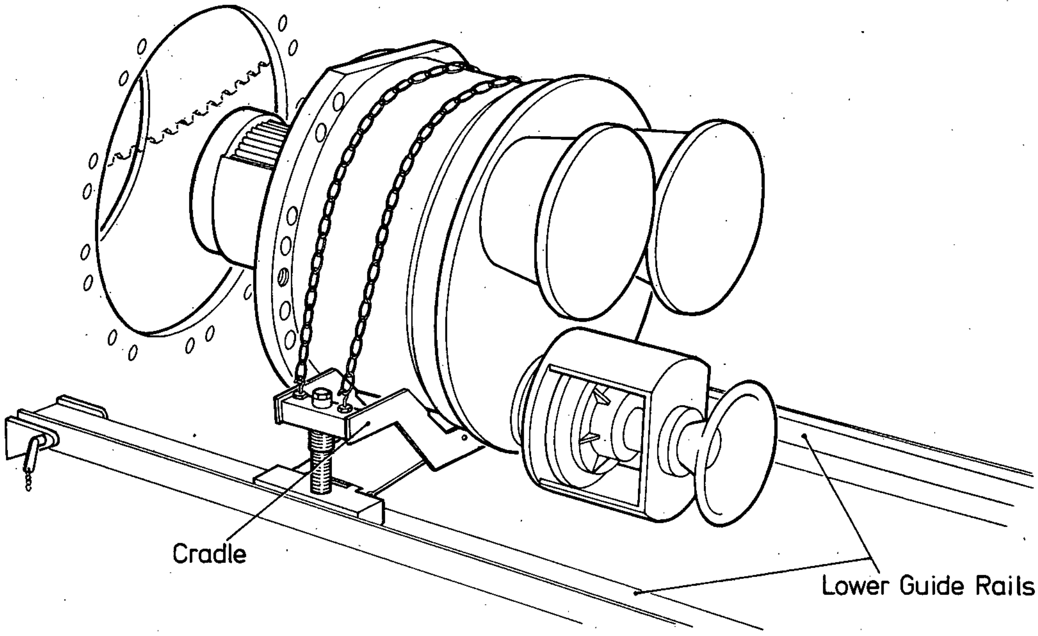
g. Check that the upper guide rails are secure, release the trolley and roll the drive assembly along the upper guide rail into position above the lower guide rails.

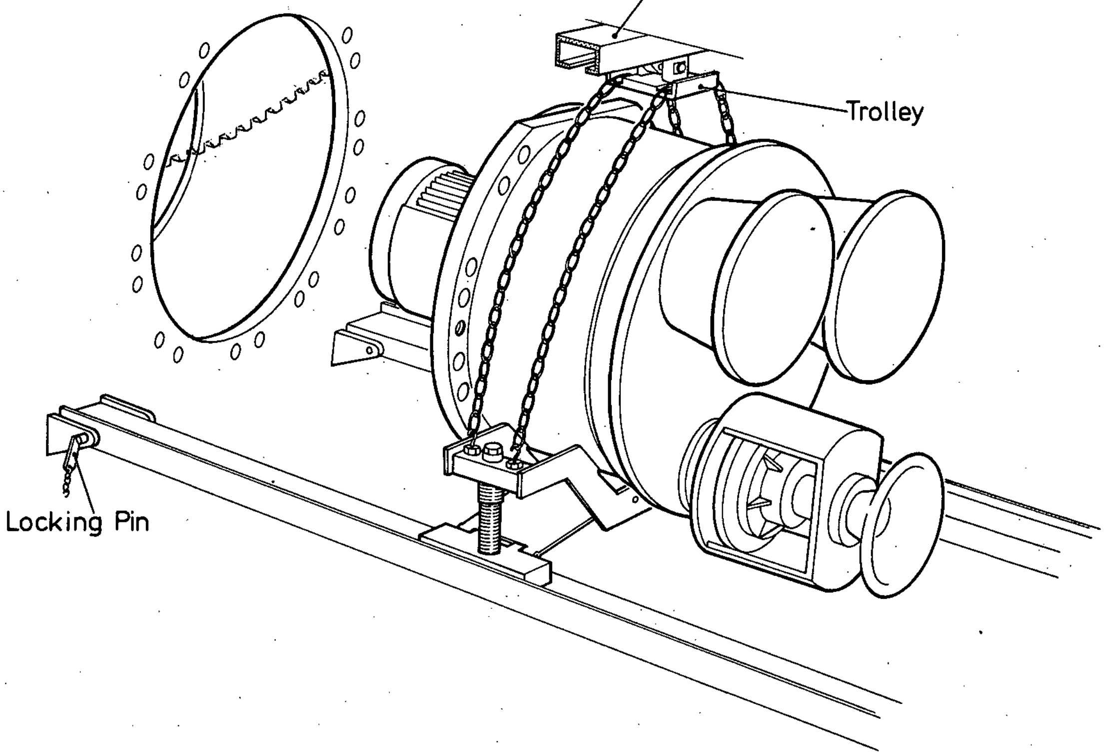
h. Adjust on the threaded sleeves of the cradle until the ball rollers make contact with the lower guide rails.



Guide Rails and Securing Lugs

Fig. 5.11-1





Elevation Drive Assemblies-Installation

Fig. 5.11-2

j. Release the chains to free the trolley, then re-secure the chains around the drive assembly.

k. Move the drive assembly, on the cradle, towards the mounting flange on the elevation toothed segment casing.

m. Adjust on the threaded sleeves of the cradle until the securing holes on the gearbox flange are aligned below their respective holes on the mounting flange. Move the drive assembly towards the mounting flange until the pinion gear bearing housing locates in the hole on the opposite side of the toothed segment casing. Raise the drive assembly on the cradle until the securing holes on the gearbox flange are aligned with their respective holes on the mounting flange.

n. Fit and secure the elevation pinion bearing flange ring (refer to Figure 4.8-1). Insert the securing screws in the mounting flange and tighten evenly.

p. Release the chains from the cradle and drive assembly. Lower the cradle sufficiently to permit its removal from the lower guide rails.

q. Remove the lower guide rails.

r. Fit the two d.c. drive motors using the trolley and suitable lifting strops.

<u>CAUTION:</u> THE THREADED PART OF THE MOTOR LIFTING EYEBOLTS MUST NOT BE LONGER THAN 16 mm OTHERWISE THE FIELD WINDINGS MAY BE DAMAGED.

<u>NOTE:</u> Access to the holes for the mounting bolts is obtained by removing the driving end band cover.

s. Connect the brake release Bowden cable between the brake pedal and the brake attachment linkage on the brake and handwheel assembly.

t. Locate the heater mat around the gearbox and secure in position.

u. Make all electrical connections between the drive assembly and its associated distribution box Q1 or Q2. Refer to the Antenna Servo, Drive and Control Sub-system Handbook No. 601.

v. Repeat steps a. to u. for the second elevation drive assembly.

w. Check the oil level in each gearbox and top up as necessary (refer to Part Two, Section One, Sub-section 4.1).

11.2 <u>AZIMUTH DRIVE ASSEMBLIES</u> (Figures 4.24-1 and 5.11-1)

a. Check that the upper guide rails for the azimuth drive assemblies are secure.

b. Using the davit, or other suitable lifting tackle, lift one of the azimuth drive assemblies onto the platform adjacent to the hatch.

c. Screw the lower end of the installation device into the tapped hole in the bearing support on top of the gearbox. Tighten the lock nut.

d. Engage the rollers of the installation device in the loose hatch guide rail. Secure the installation device to the hatch guide rail with rope or wire, to prevent the installation device rolling along the rail.

e. Lift the hatch guide rail complete with the drive assembly and lower into the hatch until the hatch guide rail engages in the correct slots in the sides of the hatch.

f. Release the installation device so that it is free to roll along the upper guide rail.

g. Move the drive assembly along the upper guide rail until it is in position above its mounting flange and approximately 40 mm (1.6 in) from the centring point.

h. Lower the drive assembly by rotating the turn-buckle on the installation device, until the output pinion of the drive assembly loosely engages the azimuth toothed ring. If necessary, manually lift the magnetic brake and use the handwheel to align the gear teeth.

j. Move the drive assembly towards the centring point to obtain a tighter engagement of the gear teeth, then lower the drive assembly completely until the pinion gear bearing housing locates in the hole in the bottom of the azimuth yoke.

k. Fit and secure the azimuth pinion bearing flange ring (refer to Figure 4.8-1). Insert the drive assembly securing bolts in the mounting flange. Remove the installation device. Tighten all securing bolts evenly.

m. Locate the heater mat around the gearbox and secure in position.

n. Make all electrical connections between the drive assembly and its associated distribution box Q3 or Q4. (Refer to the Antenna Servo, Drive and Control Sub-system Handbook No. 601.)

p. Repeat steps a. to n. for the second azimuth drive assembly.

q. Check the oil level in each gearbox and top up as necessary (refer to Part Two, Section One, Sub-section 4.1).

12. MOUNTING THE AZIMUTH CABIN (Figure 4.9-1)

a. Using the lifting bars provided on the top of the azimuth cabin, lift the cabin into position on the platform. During the mounting procedure insert rubber sealings at the cable and water hose openings.

b. Secure the cabin to the platform by screws inserted into the cabin mounting feet.

c. Fit protective edging around the cable and hose openings.

13. ASSEMBLING THE ELEVATION YOKE (Figures 4.10-1 and 5.13-1)

a. Prepare a level foundation for the elevation bearing trestles, so that the upper inner edges of the trestles are approximately 3444 mm (11 ft 3 in) apart.

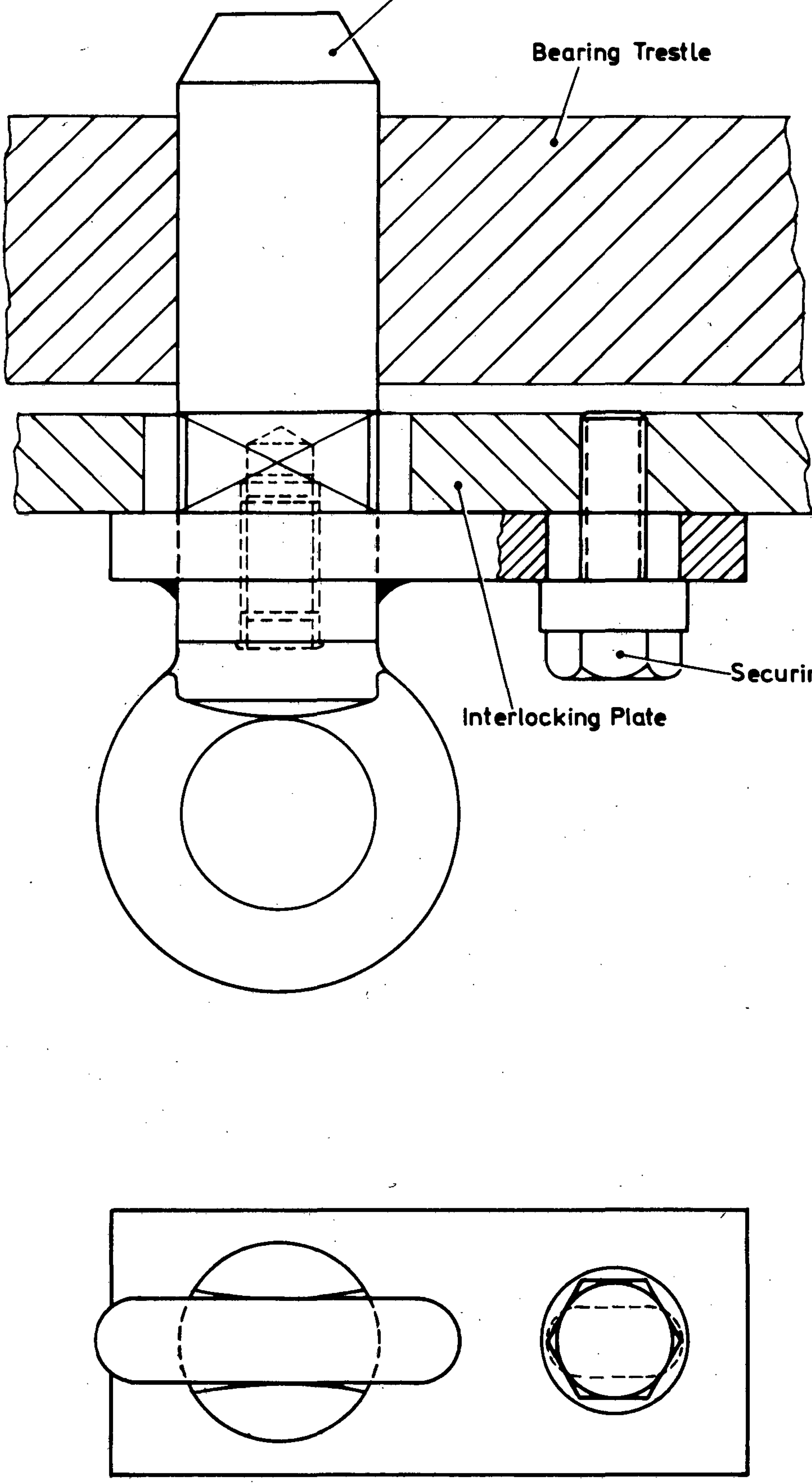
b. Set the two halves of the elevation yoke in position with their reflector interface surfaces uppermost. Apply sealing liquid to all jointing faces. Connect the two yoke halves together by first bolting the two butt straps in position using the fitted bolts and then by bolting the side flanges together with the fitted bolts. Complete assembly of the elevation yoke by inserting and tightening remaining bolts and nuts.

c. Lift the assembled elevation yoke into position over the bearing trestles so that the bearing axes in both the yoke and the trestles are approximately aligned. Insert and secure the four interlocking bolts to interlock the elevation yoke with the bearing trestles.

14. INSTALLING THE ELEVATION BEARINGS (Figures 2.4-3 and 5.14-1)

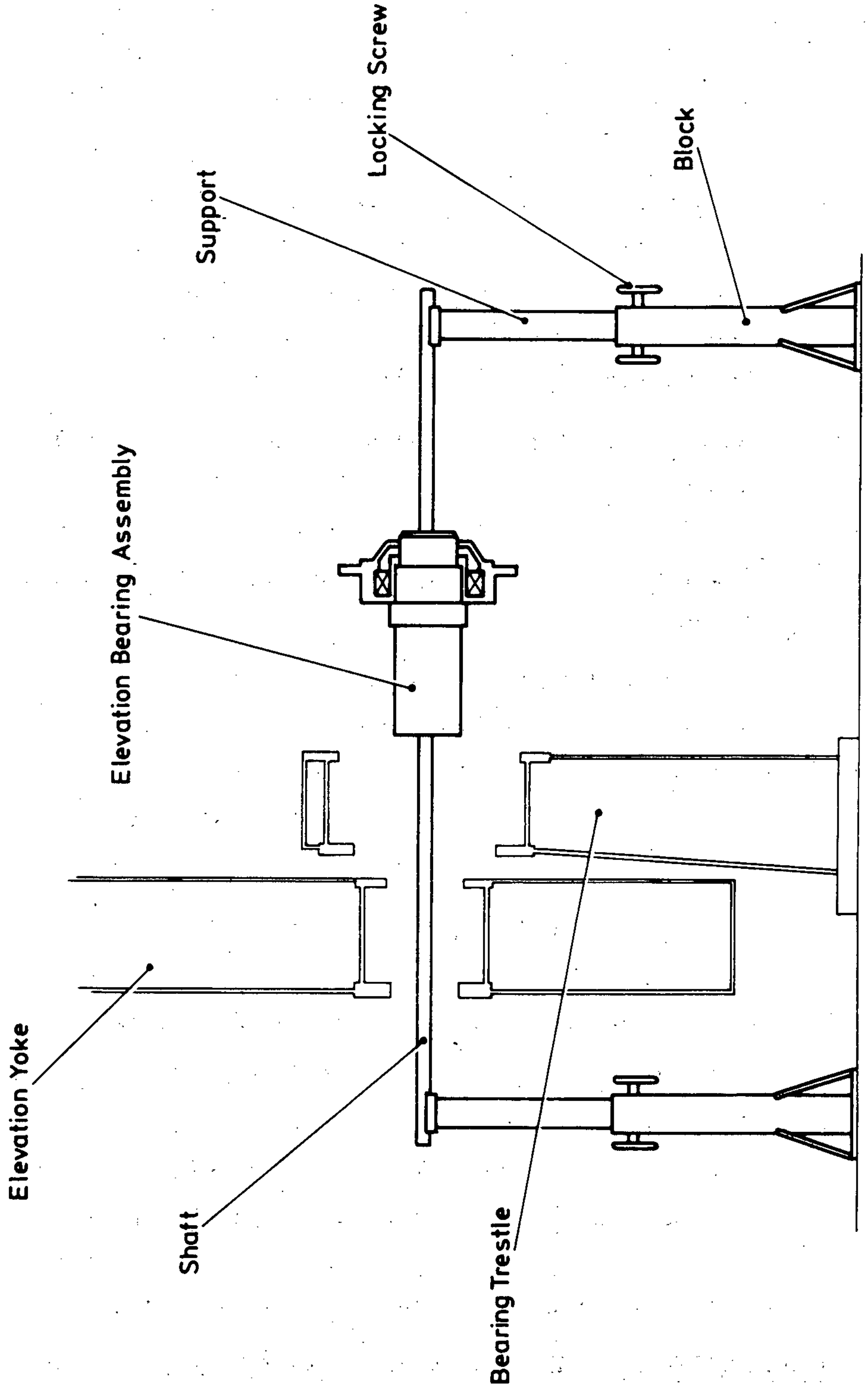
The elevation bearings are installed as complete assemblies as follows:

a. Place the support blocks of the installation device, one on either side of the bearing location position at the elevation cabin side of the yoke.



Yoke Interlocking Bolt

Fig. 5.13-1



Installation of Elevation Bearings

Fig. 5.14-1

b. Using suitable lifting gear, lift the bearing assembly (assembly with the longer pivot shaft) until it is in line with the bearing location position on the inner face of the bearing trestle.

c. Push the shaft of the installation device through the bearing location holes in the elevation yoke and trestle, and through the axial hole in the pivot shaft of the bearing assembly. Lower the shaft until it is supported by the two support blocks.

d. Adjust the height of the shaft as necessary and insert the pivot shaft of the bearing assembly into the trestle opening until the bearing housing locates in the bearing trestle. Remove the lifting gear from the bearing assembly.

e. Fit the end plate to the pivot shaft using the two special long installation bolts (size M16 x 100) provided for the purpose. After fitting, remove the two special installation bolts and secure the end plate to the pivot shaft and elevation yoke with the correct securing screws.

f. Secure the bearing housing to the trestle with the appropriate securing screws.

g. Remove the shaft of the installation device and fit the cover plate to the bearing assembly end plate.

h. Repeat steps a. to g. for the bearing assembly on the azimuth cabin side of the yoke. It will be necessary to remove the two cover plates from the inner end of the bearing assembly before installation and to replace them after installation of the bearing assembly.

15. <u>ASSEMBLING ELEVATION CABIN AND TOOTHED SEGMENT</u> (Figures 4.9-1 and 4.10-1)

a. Locate the semi-circular, rear part of the elevation cabin, complete with toothed segment, under the elevation yoke.

b. Insert rubber sealing and secure the centre and rear parts of the elevation cabin together.

c. Bolt the arrestor plate support block to the flange.

16. MOUNTING THE ELEVATION YOKE (Figures 4.8-1, 4.12-1 and 4.13-1)

a. Clean the mating surfaces of the trestles and their mounting positions on the azimuth yoke.

b. Lift the elevation yoke into position on the azimuth yoke taking care not to damage the gearing when engaging the toothed segment with the output pinions of the elevation drive assemblies.

c. Insert the fitted bolts in the mounting flanges of the bearing trestles.

d. Fit the trestle securing screws and tighten with a torque wrench, set to slip at 8.5 kp.m (61.5 lb ft).

e. Fasten the braided copper strips (lightning protection jumpers) to the bearing trestles and arms of the elevation yoke to bridge the elevation bearings.

f. Remove the interlocking bolts from the two yokes.

g. Turn the elevation yoke to the 90° position and insert the elevation stow pin. The eccentric bush, in which the stow pin housing is mounted, permits adjustment of the stow pin to facilitate its mating (refer to Section Four, Sub-section 18).

h. Loosen the screws holding the azimuth cabin in position. Align the opening in the azimuth cabin with that in the elevation cabin and secure the azimuth cabin in place.

j. Install the cabling and hoses from the connector plate in the rotary column to the elevation cabin.

k. Position the roller-mounted platform in the elevation cabin and secure it to the azimuth cabin (refer to Figure 4.13-1).

m. Fit and secure the rubber sealing strip between the interface of the elevation and azimuth cabins (refer to Figure 4.12-1).

17. INSTALLING THE CABIN AIR CONDITIONING PLANT (Figures 4.23-1 to 4.23-5 and 5.17-1)

a. Position and secure the 'Barrymount' base-frame to the antenna platform.

b. Fit the SPARE air conditioning unit in the base-frame position which is nearest the azimuth cabin.

c. Fit the MAIN air conditioning unit in the remaining base-frame position.

d. Secure both units to the base-frame.

e. Fit the cabin inlet air duct MA 1184-10, and ventilator shutter assembly to the flanges which are on the top surface of each unit.

f. Fit ducting section MA 1184-30 to the azimuth cabin inlet grille.

g. Position ducting section MA 1184-20, applying rubber sealant where required, and fasten the ducting catches.

h. Fit the azimuth cabin outlet air duct MA 1184-40, and ventilator shutter assembly to the flanges at the rear of each air conditioning unit.

j. Secure right-angled section MA 1184-50 to the ducting fitted in the previous operation, using rubber sealant as required.

k. Fit the ducting section MA 1184-70 to the azimuth cabin outlet grille.

m. Fit the remaining right-angled ducting section MA 1184-60 which will complete the assembly. Use rubber sealant as required.

n. Fit the control box pillars and support frame to the platform.

p. Secure the control box to its frame.

q. Refer to Figure 5.17-1 and connect the wiring cables as detailed in As-Built Documentation, Volume 1.

18. SETTING THE BUFFERS

With the elevation yoke locked in the 90° position, adjust the buffer on the platform as follows:

a. Slacken the lock nut and rotate the buffer until it just makes contact with the arrestor plate on the elevation toothed segment.

b. Tighten the lock nut to retain the buffer in its set position.

CAUTION: DURING THE FOLLOWING CHECK, TWO MEN SHOULD KEEP CLOSE OBSERVATION ON THE ELEVATION YOKE TO ENSURE THAT IT DOES NOT FOUL ANY PART OF THE PEDESTAL OR CABIN AIR CONDITIONING STRUCTURE. IF SUCH FOULING SHOULD OCCUR, HANDCRANKING MUST BE STOPPED IMMEDIATELY.

c. Check the correct operation of the buffer by releasing the elevation stow pin and handcranking the elevation yoke against the buffer, so that the buffer retracts approximately 60 mm (2.4 in),i.e.equivalent to 2° of rotation.

d. Handcrank the elevation yoke to 0° position and insert the stow pin.

e. Repeat operations a. to c. for the buffer on the front of the azimuth yoke but observing the following note.

NOTE: When carrying out operation a., adjust the buffer to leave an air gap of 4 mm to 5 mm (0.16 in to 0.2 in) between the buffer and the arrestor plate.
When carrying out operation c., the buffer should retract 62 mm (2.45 in), i.e. equivalent to 2° of rotation.

f. Return the elevation yoke to the 90° position and insert the stow pin.

19. LEVELLING THE PEDESTAL

19.1 GENERAL

The checks and adjustments necessary for levelling the pedestal can only be made if the following conditions are observed:

a. The influence of solar radiation must be avoided and the temperatures in the pedestal must be kept balanced (the test is best carried out at early morning or under the radome).

b. There must be no load shifting on the pedestal and personnel assisting in the test must remain in their places during the test.

c. The work must be carried out in the set sequence.

19.2 LEVELLING PROCEDURE (Figure 5.19-1)

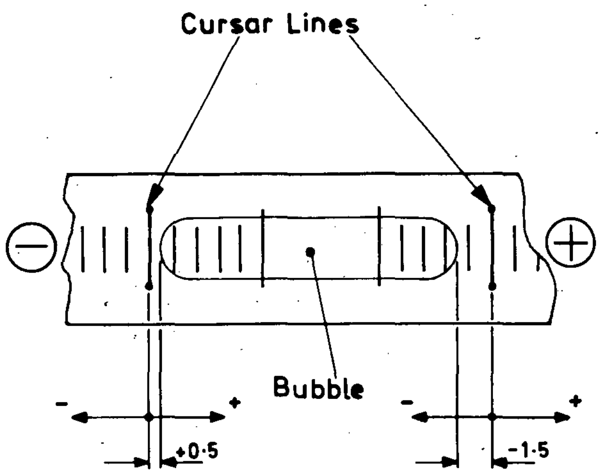
a. Ensure that the elevation stow pin is engaged with the elevation yoke in the 90° position, and that the azimuth stow pin is disengaged.

b. Install the spirit levels on the triangular datum plate located on the floor of the azimuth yoke. Before installing, ensure that the mating faces of the mounting feet and the datum plate are perfectly clean.

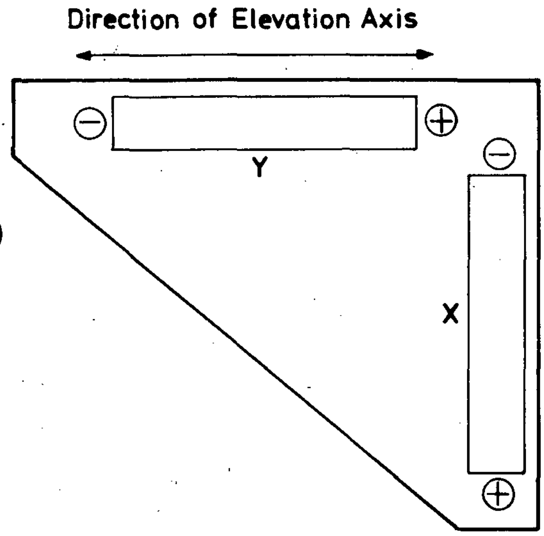
c. Mark the spirit levels as shown in Figure 5.19-1.

d. Ensure that the threads of all jacking screws and anchor bolts are clean and well greased (Calypsol G205) and that the jacking screws operate freely. Be sure that all jacking screws are tightened back into contact with their bearing plates.

e. Loosen the nuts on the anchor bolts around the base ring and slacken jacking screws 2, 4 and 6 (refer to Figure 5.3-1) so that the tower is supported on jacking screws 1, 3 and 5 only.



Enter readings and resultant average as shown below.



Position AZ Axis	X Spirit Level (p)			Y Spirit Level (p)		
	Left	Right	Average	Left	Right	Average
0° 180°				+0·5	-1·5	-0·5
		Average:			Average:	
180° 0°						
		Balance:			Balance:	

Date: Time: Weather:

In Charge Of Reading:

In Charge Of Reporting:

Example Measuring Report for Adjustment of the Azimuth Axis

Fig. 5.19-1

f. Rotate the azimuth yoke slowly, one full turn in each direction of rotation in azimuth, to allow the platform to settle. Observe the movement of the bubbles in the levels in relation to the azimuth position during the last turn.

g. Adjust the spirit levels by means of the adjusting screws so that the expected range of movement of the bubbles will be approximately centred. Lock the adjusting screws.

NOTE: It is most important that the spirit level adjusting screws are not altered during the rest of the procedure.

h. Take readings of the spirit levels x and y with the azimuth yoke at 0° and then at 180°. Refer to Sub-section 19.3 for method of reading the levels.

NOTE: Wait at least two minutes, in each test position of the azimuth yoke, to allow the bubbles to settle before noting the readings.

j. Calculate for each spirit level the average value of the readings noted at the 0° and 180° positions of the azimuth yoke. These values are the bubble positions to achieve in the subsequent adjustment steps.

k. Using a torque wrench, adjust jacking screw 1, until the bubble of Y spirit level moves to the position calculated in j. Note the torque required to tighten the jacking screw against its bearing plate.

NOTE: One division on the spirit level is approximately equal to 6° rotation of the jacking screw.

m. Adjust jacking screws 3 and 5 equal and opposite amounts, until the bubble of X spirit level moves to the position calculated in j.

n. Tighten jacking screws 2, 4 and 6 by applying to each a torque of half the value required to tighten jacking screw 1 (refer to k).

p. Tighten the nuts and lock nuts on the anchor bolts using a torque wrench set first to slip at 60 kg.m (435 lb ft) and then slip at 72 kg.m (522 lb ft). Tighten diagonally opposite pairs of anchor bolts in sequence.

q. Take new readings of spirit levels X and Y at 180° and 0° positions of the azimuth yoke.

r. If the magnitude of error, as calculated from the last set of readings, is less than 10 divisions (equivalent to approximately 20 seconds of arc axis tilting), then the levelling is satisfactory.

Magnitude of error is calculated as in the following example:

Azimuth Test Position		Average of Readings X	Average of Readings Y
0°		−6	−2
180°		+1	+2
	Error	−7	−4

$$\text{Magnitude of error} = \sqrt{7^2 + 4^2}$$

$$= \sqrt{49 + 16}$$

$$= 8 \text{ approx.}$$

If the magnitude of error is greater than 10 divisions then the levelling process must be repeated.

On completion of levelling, liberally coat the anchor bolts and jacking screws with silicon grease Calypsol G205.

19.3 METHOD OF READING SPIRIT LEVEL (Figure 5.19-1)

The reading of the bubble position illustrated is calculated by noting the reading of the left-hand edge of the bubble in relation to the left-hand cursur line and similarly the reading of the right-hand edge of the bubble in relation to the right-hand cursur line. The amount the bubble centre is offset from the central position between the cursur lines is the reading required, e.g.

Left side of bubble	+0.5
Right side of bubble	-1.5
Algebraic sum	-1.0
Divide algebraic sum by 2	-0.5
Therefore reading	-0.5

NOTE: All readings are to be accurate to within one half of a division and are to be noted in the measuring report. An example of this report is shown in Figure 5.19-1.

20. MOUNTING THE REFLECTOR (Figure 4.10-1)

Refer to the Reflector, Feed and System Waveguide Interconnection Handbook No. 603 for assembly of the reflector.

a. Remove the cover plates from the installation openings in the elevation cabin and elevation yoke.

b. Fit the seals around the reflector hub.

c. Clean the interface pads on the outer face of the elevation cabin and coat with Molykote.

d. Mount the reflector onto the elevation yoke, carefully aligning the yoke guide bolts with their respective holes in the reflector hub.

e. Secure the reflector to the yoke. Tighten the securing bolts using a torque wrench set to slip at 17 kg.m (123 lb ft).

21. COMPLETION OF PEDESTAL INSTALLATION (Figure 4.3-1)

a. Fit the tower catwalk segments and sealings and secure in place with screws.

b. Bolt the zinc plate sealings to the lower angle of the catwalk.

c. Drill through the sealings and earthing ring and secure the sealings to the earthing ring with screws. Fasten the zinc plate sealings to the concrete support column using the tension tape.

d. Fit the three lightining protection brush holders, complete with brushes, to the bottom of the azimuth yoke.

e. Check that all plug connections are correct and connect in accordance with the Cabling Schedules.

f. Check the mains voltage supplies.

g. Connect the lighting and air conditioning system supply.

h. Check that water hoses are securely clamped.

j. Install the electronic equipment in the cabins (refer to Part One, Section Two, Sub-section 3.4) as detailed in the equipment handbooks.

22. INSTALLATION OF THE DATA PICK-UP UNITS (Figures 2.3-6 and 2.9-1)

Installation of the data pick-up units should not take place until all other work on the pedestal is completed. Before commencing installation of the units set the antenna to +90^{o} in elevation and to +180^{o} in azimuth and insert the elevation and azimuth stow pins.

The installation procedure for both pick-up units is similar and is as follows:

a. Screw the intermediate flange to the bearing pivot shaft.

b. Screw and cotter-pin the mounting shaft to the intermediate flange, aligning the location marks.

NOTE: The mounting shaft and intermediate flange are manufactured as a matched set and must therefore be used together.

c. Clean the mounting shaft with a lint free cloth and coat the shaft with a thin layer of Belzona anti-seize grease.

d. Carefully slide the hollow data pick-up shaft over the mounting shaft.

e. Rotate the data pick-up unit, applying slight axial pressure to locate the pin at the bottom of the hollow shaft in the slot in the mounting shaft.

f. Clamp the hollow shaft of the data pick-up unit to the mounting shaft, using the clamping ring.

NOTE: The azimuth unit is provided with a catch to hold the unit in position until the clamping ring is secured.

g. Slacken, but do NOT remove, the three stop screws in the casing to permit the hollow shaft to turn freely in the casing.

h. Secure the reference lever to the casing and reference point.

j. Remove the transportation clamp and align the data pick-up unit (refer to the commissioning procedure in the Antenna Servo, Drive and Control Sub-system Handbook No. 601).

23. COMMISSIONING THE CABIN AIR CONDITIONING PLANT

23.1 COOLING AND HEATING CONTROL TESTS (Figures 4.23-6 and 4.23-7)

Carry out the following procedure to check the cooling and heating control circuits:

WARNING: DURING THIS PROCEDURE, CARE MUST BE TAKEN NOT TO CONTACT LIVE TERMINALS IN THE CONTROL BOX.

a. Set the DISTRIBUTION switch to 0 and open the control box door.

b. Set the SPARE unit selector switch 1b1 to 0.

c. Set the MAIN unit selector switch 2b1 to COOLING.

d. Set the DISTRIBUTION switch to 1 and check that:

   i VENTILATOR ON - MAIN UNIT lamp 2h2 lights.

   ii COMPRESSOR ON - MAIN UNIT lamp 2h3 lights.

e. Set the selector switch 2b1 to HEATING and check that:

   i VENTILATOR ON - MAIN UNIT lamp 2h2 lights.

   ii After a 3 minute delay (set by delay relay 2d1), the HEATING ON - MAIN UNIT lamp 2h1 lights.

f. Set the MAIN unit selector switch 2b1 to 0.

g. Set the SPARE unit selector switch 1b1 to COOLING and check that:

   i VENTILATOR ON - SPARE UNIT lamp 1h2 lights.

   ii COMPRESSOR ON - SPARE UNIT lamp 1h1 lights.

h. Set the SPARE unit selector switch to HEATING and check that:

   i VENTILATOR - SPARE UNIT lamp 1h2 lights.

   ii HEATING ON - SPARE UNIT lamp 1h3 lights after a 3 minute delay.

j. Set the DISTRIBUTION switch to 0.

k. Set both selector switches 1b1 and 2b1 to AUTOMATIC.

m. Set the DISTRIBUTION switch to 1.

23.2 AUTOMATIC TESTS

Carry out the following procedure to check operation of the automatic control and changeover circuits:

NOTE: This test can only be performed when the outside air temperature is above +10°C. Before the tests, set the cabin thermostat to a setting which causes the cooling equipment to operate, and check that the MAIN unit is operating.

a. Remove the plastic cover from the 7-day time switch Od5 and turn the knurled black knob clockwise until a changeover occurs, i.e. from the MAIN unit operating to the SPARE unit operating. Check that:

i The MAIN UNIT BREAKING DOWN lamp 2h4 does not light.

ii The SPARE UNIT WORKING lamp Oh2 lights.

b. Turn the time switch knob clockwise again until a second changeover occurs; check that:

i The SPARE UNIT BREAKING DOWN lamp 1h4 does not light.

ii The MAIN UNIT WORKING lamp Oh3 lights.

23.3 FAILURE TESTS

Carry out the following procedure to simulate a failure in the control circuits:

a. With the MAIN unit in COOLING operation, switch off the MAIN unit compressor motor isolating fuse-switch 2a1, check that:

i The MAIN unit compressor motor and ventilation fan motor are stopped.

ii The MAIN UNIT BREAKING lamp 2h4 lights.

iii After 3 minutes, the compressor motor and ventilation fan of the SPARE unit start, and the SPARE UNIT WORKING, VENTILATOR ON - SPARE UNIT and COMPRESSOR ON - SPARE UNIT lamps light.

b. To cancel the failure and to reset the control circuits, switch on the isolating fuse switch 2a1 and press the BREAKDOWN OUT pushbutton Ob2. Check that:

i MAIN UNIT BREAKING DOWN lamp 2h4 goes out.

ii VENTILATOR ON - SPARE UNIT and COMPRESSOR ON - SPARE UNIT lamps go out.

iii Complete automatic changeover to the MAIN unit is established again after 3 minutes.

c. Repeat 23.3 for the SPARE unit.

23.4 COOLING AND HEATING TEMPERATURE TESTS

NOTE: The following tests must be carried out when the outside air temperature is less than +20°C and decreasing (i.e. in the evening).

23.4.1 Test Equipment

5 Remote-reading thermometers (0°C to +40°C ±0.5°C)

1 Thermometer -50°C to +10°C ±0.5°C

1 Thermometer 0°C to +100°C ±0.5°C

6 Forced-air space heaters (cooling test only) 1 kW to 2 kW each.

1 External mains supply cable for the space heaters.

23.4.2 Setting-up the Test Equipment (Figure 5.23-1)

a. Position the sensing devices of the five remote-reading thermometers as follows:

i TH1 approximately 10 cm out from the centre of the cabin outlet grille.

ii TH2 approximately 10 cm out from the centre of the cabin inlet grille.

iii TH3 in the middle of the azimuth cabin.

iv TH4 in the middle of the elevation cabin.

v TH5 outside the cabins, approximately 30 cm from the elevation cabin and on the elevation axis.

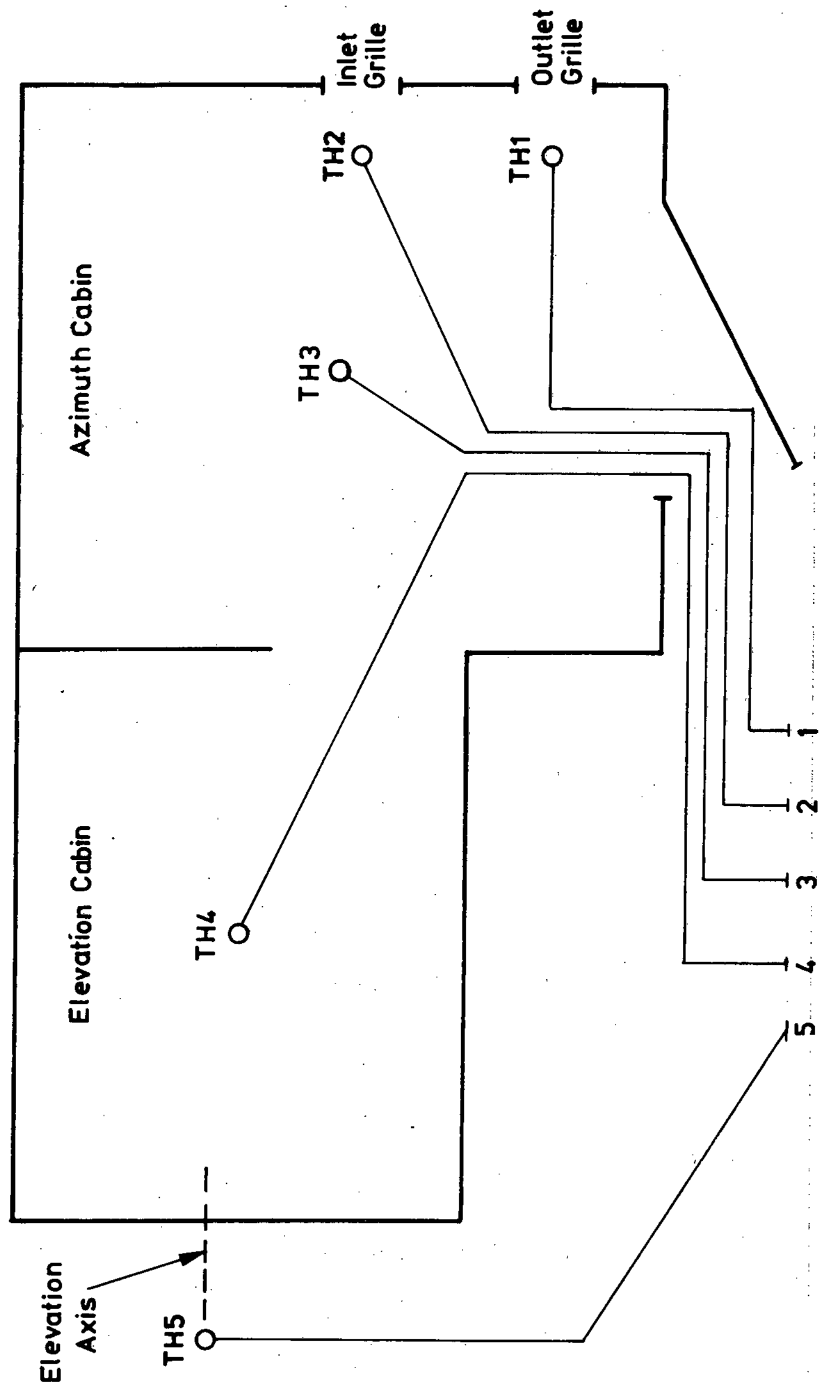
b. Position the ventilation grille louvres as follows:

i Cabin inlet grille (furthest from door). Set the horizontal (inner) louvres in the horizontal plane; set the vertical (outer) louvres so that they are directed away from the cabin entrance door, angled approximately 20° from the 'straight ahead' position.

ii Cabin outlet grille (nearest to door). Set the horizontal (inner) louvres so that they are directed towards the cabin roof and at an angle of approximately 20° to the horizontal plane; set the vertical (outer) louvres so that they are directed towards the entrance door, angled approximately 20° from the 'straight ahead' position.

23.4.3 Heating Test (Cabin Equipment not Operating).

NOTE: It is important that during the test the cabin temperature does not exceed +40°C, otherwise damage to the cabin equipment could occur.



Location of Remote Reading Thermometers

Fig. 5.23-1

Carry out the following procedure:

a. Set the cabin thermostat to 35°C.

b. Switch off all cabin equipment. Set the main switch on distribution box R02 to 1.

c. Place strips of foam rubber at the inner edge of the door where the remote reading thermometer capillaries are routed, in order to protect them from damage.

d. Also place foam rubber strips on the door frame edge. Carefully close the cabin entrance door so that the remote-reading thermometer capillaries are sandwiched between the foam rubber strips; do not attempt to push the door completely home, otherwise damage may result to the capillaries.

e. Using plastic masking tape (at least 5 cm wide), seal the remaining space between the door and its frame.

f. With the air conditioning plant set to AUTOMATIC and with the MAIN unit operating, set the DISTRIBUTION switch to 1 and run the plant for four hours, then check that the remote reading thermometers read as follows:

TH1 should be at least 8°C higher than TH5

TH2 should be at least 14°C higher than TH5

TH3 should be at least 11°C higher than TH5

TH4 should be at least 8°C higher than TH5

g. Unseal and open the cabin door. Set the cabin thermostat to +22°C or proceed to the cooling test which follows.

23.4.4 Cooling Test (Cabin Equipment Operating)

a. Refer to Table 5.23-1 and install forced-air space heaters in the azimuth and elevation cabins as required, depending on the ambient temperature, positioned so that they are not directed at the thermometer sensors or at the cabin equipment.

b. Set the cabin thermostat to +15°C.

c. Close and seal the cabin door, as previously described for the heating test (refer to Sub-section 23.4.3).

d. With the air conditioning plant set to AUTOMATIC and with the MAIN unit operating, set the DISTRIBUTION switch to 1 and run the plant for four hours, recording the thermometer readings every quarter of an hour. During this period, if the cabin temperature rises to +35°C, the space heaters should be switched off to keep the cabin temperature below +35°C.

At the end of the four hours, thermometers TH1 to TH4 should indicate the readings shown in Table 5.23-1 for the ambient temperature recorded by thermometer TH5.

After completing the tests for the MAIN unit, the same tests should be carried out for the SPARE unit, but a period of at least four hours should pass, with the cabin door open, between the MAIN unit tests and the SPARE unit tests.

After completing the tests, set the cabin thermostat to +22°C.

Table 5.23-1

Cooling Test Requirements

Ambient Temperature TH5	Additional Forced Air Heaters		Temperature Difference Corresponding to Ambient Readings (Thermometer TH5)				Reference to Notes
	EL-Cabin	AZ-Cabin	TH1	TH2	TH3	TH4	
Above +30°C	-	-	-8°C	-14°C	-10°C	-8°C	See note 1
+25° to +30°C	-	1 kW	-2°C	-10°C	-2°C	-2°C	See note 1
+20° to +25°C	1 kW	2 kW	+8°C	-4°C	+8°C	+8°C	See note 2
+15° to +20°C	2 kW	2 kW	+10°C	-2°C	+10°C	+10°C	See note 2
+10° to +15°C	3 kW	3 kW	+14°C	-	+14°C	+14°C	See note 3
+5° to +10°C	4 kW	3 kW	+16°C	-	+16°C	+16°C	See note 3
0° to 5°C	4 kW	4 kW	-	-	-	-	See note 4
Below 0°C	-	-	-	-	-	-	See note 5

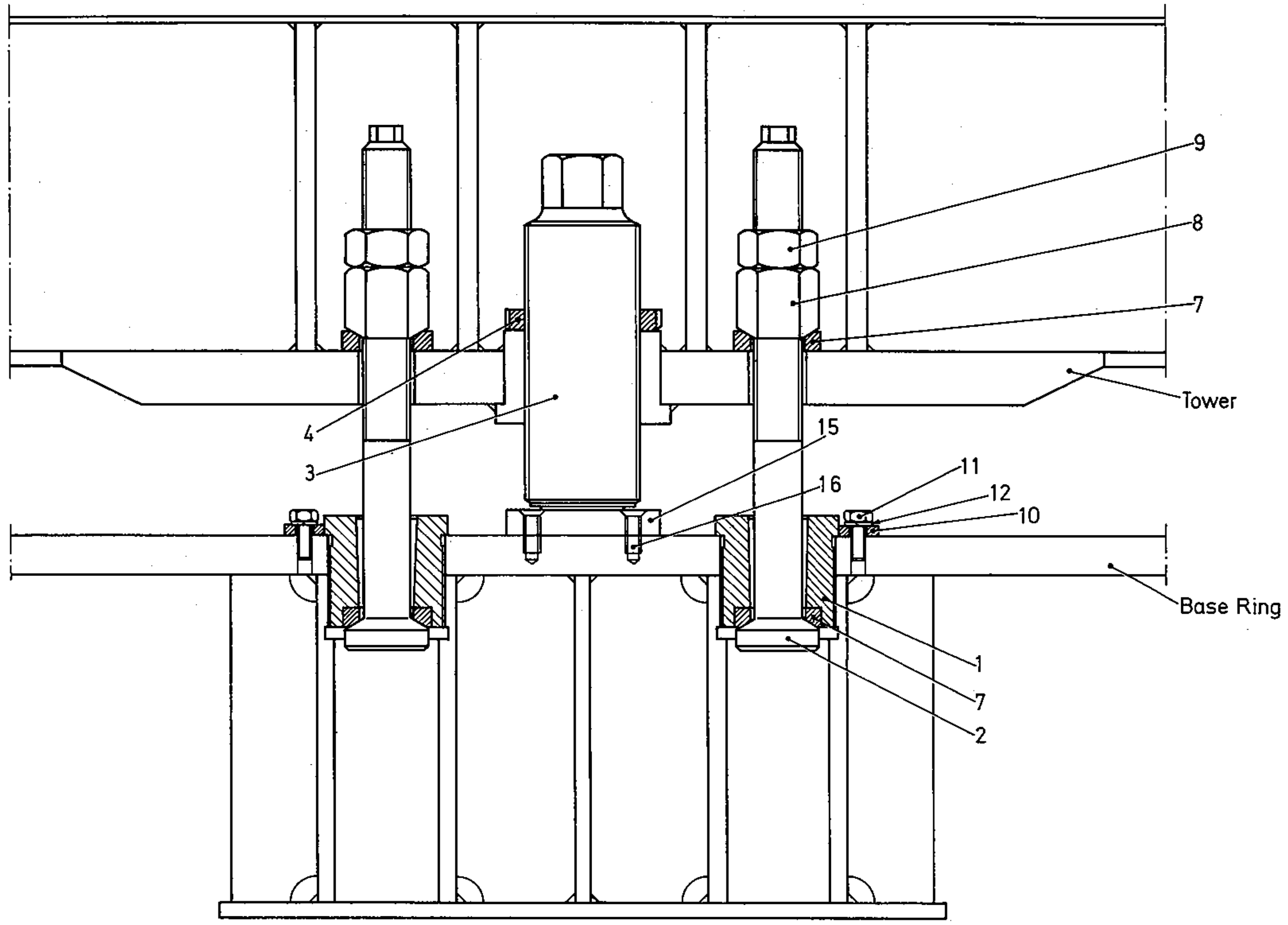
NOTE 1: The temperatures of TH1 to TH4 should be below ambient by at least the difference in the Table. (Example: Ambient is +36°C; in this case the reading of TH1 should be +28°C or less). At ambient temperatures of +30°C it may be possible that the temperature difference at TH1 reaches +15°C or more and the air conditioner will be switched off by the thermostat. In this case record the time.

NOTE 2: For this region of ambient temperature only the difference between TH1 and TH2 is of interest and must be at least 12°C. The temperatures indicated for TH1, TH3 and TH4 are maximum values above ambient and may be lower.

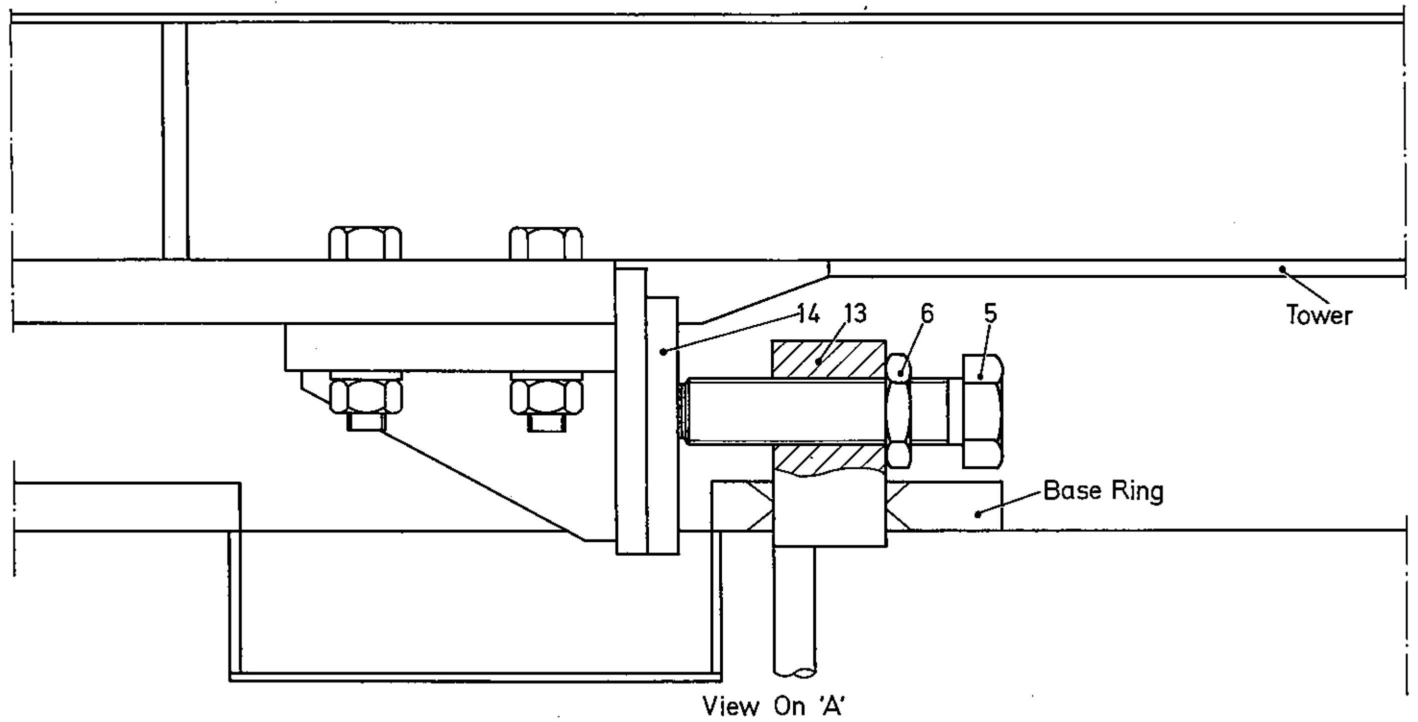
NOTE 3: Correct values for TH2 cannot be given. The temperature difference between TH1 and TH2 should be at least 10°C. In order to prevent the external thermostat switching off when the ambient temperature is lower than +10°C, it will be necessary to warm up the air surrounding the outside thermostat, using a forced air heater.

NOTE 4: In this region of ambient temperature, an additional forced air heater should be directed at the evaporator, to prevent it freezing.

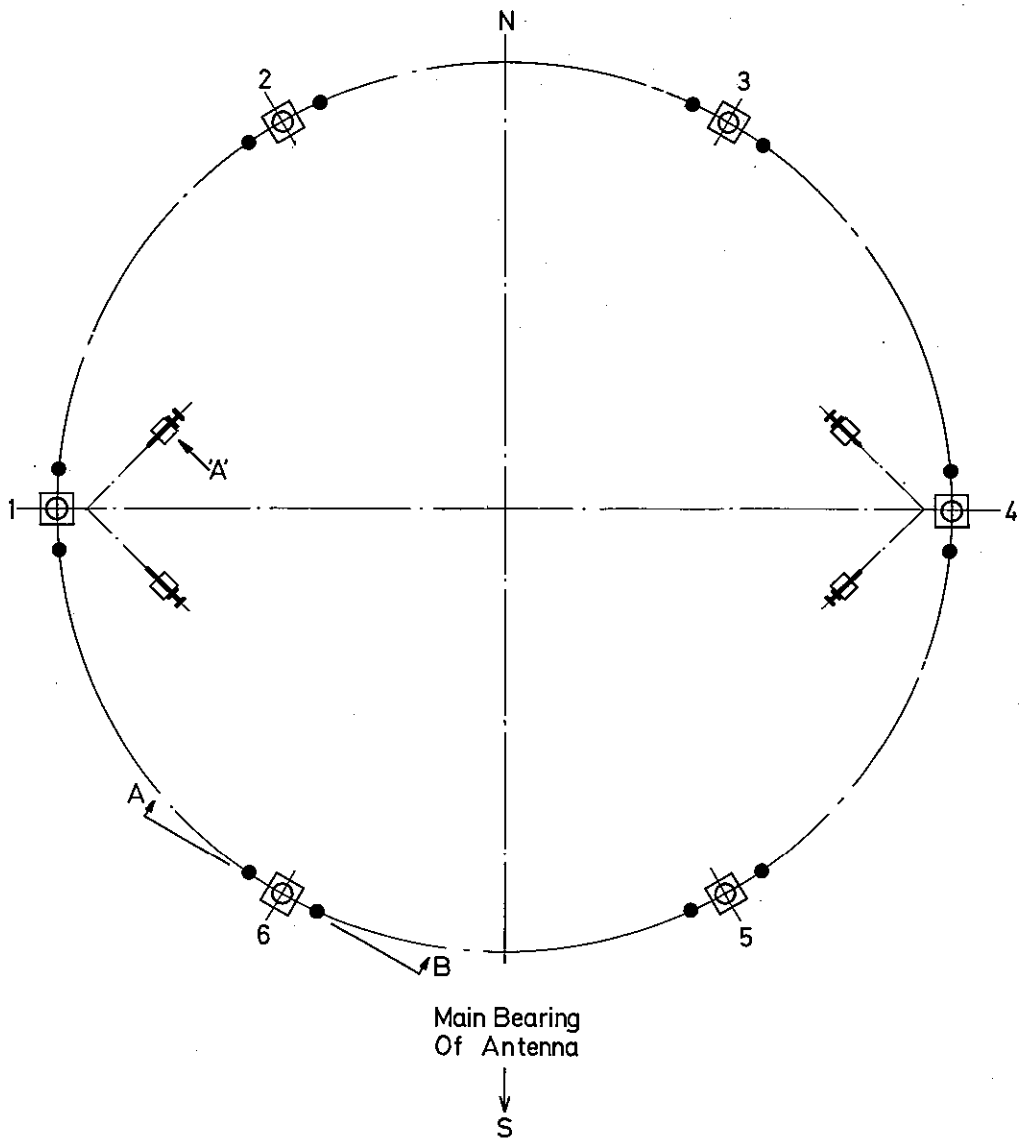
NOTE 5: At temperatures below 0°C, the cooling test should not be attempted.



Section A-B



View On 'A'



Location Of Anchor Bolts, Jacking Screws And Setting Screws

Anchor Bolts, Jacking And Setting Screws
(Installation And Adjustment)
Figure 5.3-1

Part 1

Air Conditioning Plant - Wiring Diagram
Figure 5.17-1
Part 1

PART ONE

SECTION SIX

OPERATING INSTRUCTIONS

CAUTION: THE AREA WITHIN THE RANGE OF MOVEMENT OF THE ANTENNA MUST BE KEPT CLEAR OF OBSTACLES AT ALL TIMES.

1. GENERAL

Operating instructions are confined to the air conditioning equipment only. The pedestal drive assemblies operate in conjunction with the servo and drive system and reference should therefore be made to the Antenna Servo, Drive and Control Sub-system Handbook No. 601 for relevant operating instructions. Operating instructions for the equipment fitted in or on the pedestal are contained in the appropriate equipment handbooks. It is, however, considered necessary to repeat the handcranking warning and the emergency switching-off procedure for the pedestal drive.

2. HANDCRANKING

WARNING: IT IS ESSENTIAL, FOR SAFETY REASONS, THAT AN OPERATOR IS POSITIONED AT EACH HANDWHEEL OF THE AXIS ABOUT WHICH HANDCRANKING IS TO TAKE PLACE. EACH HANDWHEEL MUST BE ENGAGED AND GRIPPED FIRMLY IN BOTH HANDS BEFORE RELEASING THE BRAKES. THIS IS PARTICULARLY IMPORTANT ON THE ELEVATION AXIS, WHERE THE ANTENNA MAY RUN AWAY UNDER ITS OWN WEIGHT. AT SITES NOT FITTED WITH A RADOME, HIGH WINDS MAY ALSO CAUSE DRIVE TORQUES ABOUT BOTH AXES.

3. EMERGENCY SWITCHING-OFF (PEDESTAL DRIVE)

Movement of the pedestal, in both azimuth and elevation, can be stopped immediately by the operation of any one of the following emergency off switches.

a. One located on the wall of the left-hand chamber of the gearbox room.

NOTE: This switch has a locking mechanism that must be manually reset before drive power can be restored.

b. One on the Cabin Control Panel.

c. One in Bay 4 of the Station Control Console.

d. One in Bay 5 of the Station Control Console.

e. One on Rack K1 (rear door below voltmeter).

4. CABIN AIR CONDITIONING PLANT

4.1 GENERAL

Under normal operational conditions, the cabin air conditioning plant is automatically controlled by two thermostats, one in the azimuth cabin near the air conditioning outlet grille, which is set to the required cabin temperature, and one outside the cabins, mounted on the right-hand side of the air conditioning control box. This second thermostat, which is controlled by the temperature of the outside air, must always be set to +10°C. This setting prevents the cooling system from operating, and therefore freezing, if the outside air temperature is lower than +10°C. Fresh air dampers on each of the two air conditioning units can be adjusted by hand to suit the various operating conditions described in Sub-section 4.3.

In the event of a failure in the operating air conditioning unit, the second unit is automatically brought into service, an alarm signal is relayed to the station control console and the failure is indicated by lamps on the air conditioning plant control box door.

A time switch automatically controls the periods of duty of the two air conditioning units. The time switch is pre-set during commissioning so that the MAIN unit operates for six days each week, and the SPARE unit operates for one day each week. Each air conditioning unit also has a delay time switch which is pre-set during commissioning to three minutes. These delay operations of the breakdown circuit and alarm indications to allow time for the automatic changeover from one air conditioning unit to the other.

4.2 CONTROL BOX

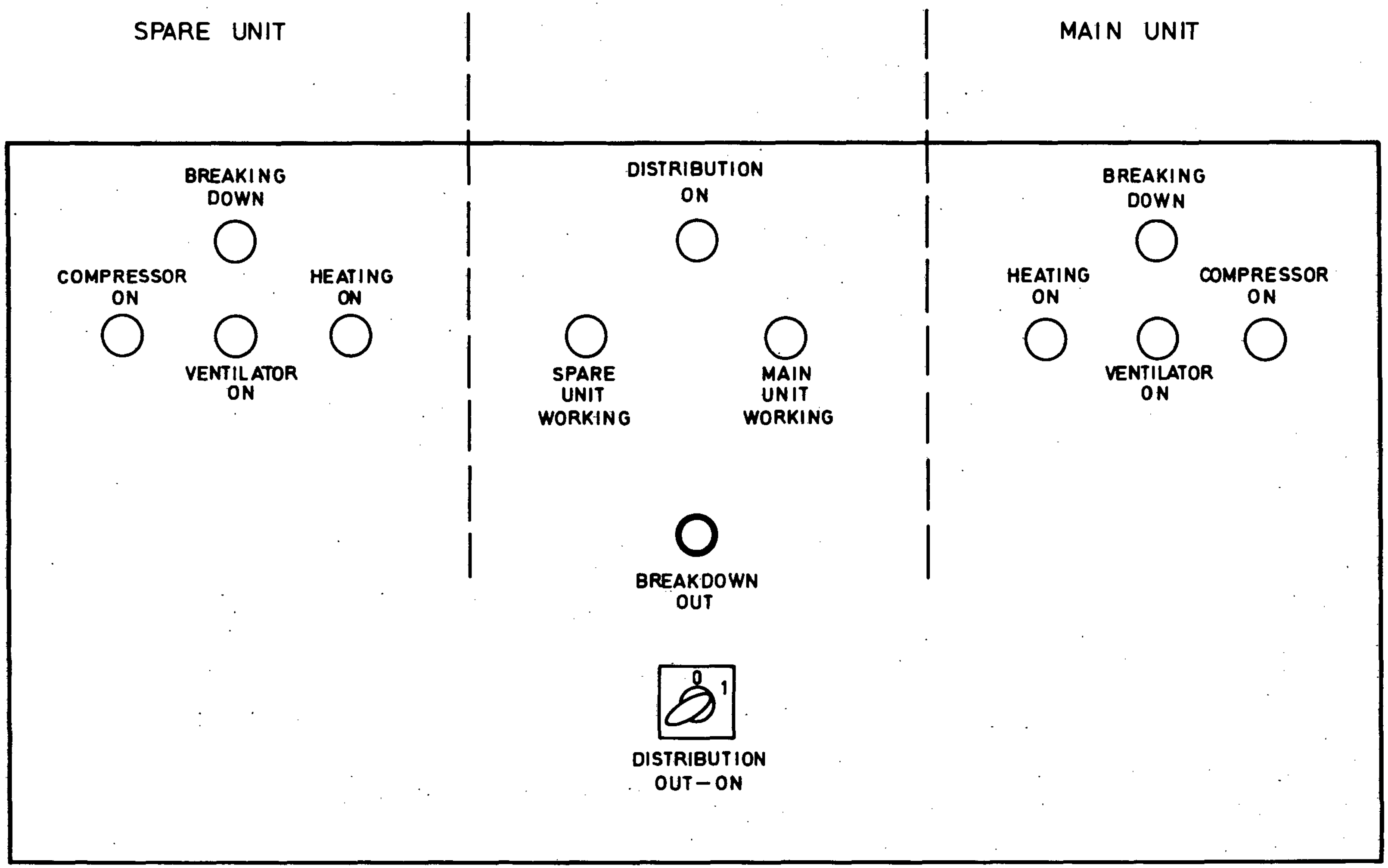
4.2.1 Control Box Door (Figure 6.4-1)

Indicating lamps and switches on the door of the control box are listed in Table 6.4-1.

Table 6.4-1

Control Box Lamps and Switches

Legend	Component	Circuit Reference	Function
DISTRIBUTION ON	lamp (white)	0h1	Lights if power is present when DISTRIBUTION switch is set to 1.
SPARE UNIT WORKING	lamp (orange)	0h2	Lights when SPARE unit is operational, after the 3 minute delay.
MAIN UNIT WORKING	lamp (orange)	0h3	Lights when the MAIN unit is operational, after the 3 minute delay.
COMPRESSOR ON - SPARE UNIT	lamp (red)	1h1	Lights when power is supplied to the SPARE unit compressor motor.
VENTILATOR ON - SPARE UNIT	lamp (red)	1h2	Lights when power is supplied to the SPARE unit ventilation fan.
HEATING ON - SPARE UNIT	lamp (red)	1h3	Lights when power is supplied to the SPARE unit heater.
SPARE UNIT BREAKING DOWN	lamp (white)	1h4	Lights if there is a fault condition in the SPARE unit.



Control Box Lamps and Switches

Fig. 6.4-1

Table 6.4-1 (Cont'd.)

Legend	Component	Circuit Reference	Function
HEATING ON - MAIN UNIT	lamp (red)	2h1	Lights when power is supplied to the MAIN unit heater.
VENTILATOR ON - MAIN UNIT	lamp (red)	2h2	Lights when power is supplied to the MAIN unit ventilation fan.
COMPRESSOR ON - MAIN UNIT	lamp (red)	2h3	Lights when power is supplied to the MAIN unit compressor motor.
MAIN UNIT BREAKING DOWN	lamp (white)	2h4	Lights if there is a fault condition in the MAIN unit.
DISTRIBUTION OUT-ON	switch	Ob1	Connects power to the control circuits and rotary actuators.
BREAKDOWN OUT	push-button switch	Ob2	After a fault condition has been corrected, this push-button is pressed to reset the control circuits and cancel the alarm indications.

4.2.2 Switchgear Inside the Control Box (Figure 4.23-7)

The following switchgear is fitted inside the control box:

1a1 and 2a1 Compressor motor isolating fuse-switches which automatically trip in the event of a current overload; they may also be hand-operated.

1a2 and 2a2 Ventilation fan motor isolating fuse-switches which trip in the event of a current overload; they may also be hand-operated.

1a3 and 2a3 3 kW heater isolating fuse-switches which trip in the event of a current overload; they may also be hand-operated.

1b1 and 2b1	AUTOMATIC-O-COOLING-HEATING selector switches. Normally, both are set to AUTOMATIC, but for maintenance and breakdown procedures either may be used to select COOLING or HEATING if the other switch is set to O.
Oe3	Transformer Om3 isolating fuse-switch which automatically trips in the event of a current overload; it may also be hand-operated to isolate transformer Om3, the control circuits and the crankcase heaters from the three-phase supplies.
Od5	Seven-day time switch which determines the changeover times and periods of operation of the MAIN and SPARE units. Normally, Od5 is set so that the MAIN unit operates for six days and the SPARE unit for one day each week.
1d1 and 2d1	Delay time switches which delay operation of the breakdown circuit to allow time for the automatic shutter changeover to take place. A delay time of up to ten minutes is possible; normally, the relays are set to a delay of three minutes.

4.3 OPERATING CONDITIONS

4.3.1 General

The performance of the cabin air conditioning plant is determined by the settings of the cabin thermostat and the outside thermostat and by the position of the fresh air dampers. Unless the outside air temperature is extreme, the recommended setting for the cabin thermostat, for comfortable personnel working conditions is +22°C. The outside thermostat, on the control box, must always be set to +10°C. The fresh air dampers should be adjusted as described in Sub-sections 4.3.2 and 4.3.3.

4.3.2 All Cabin Equipment Operating

a. Outside temperature -40°C to -20°C. The cabin thermostat keeps the 3 kW heater continuously switched on and maintains the cabin temperature between +2°C and +22°C. In this range of temperatures, the outside air dampers should be set fully closed so that cabin air is completely recirculated.

b. Outside temperature -20°C to +2°C. The cabin thermostat controls the 3 kW heater so that the cabin temperature is maintained at about the thermostat setting. The outside air dampers should be adjusted to give the desired air change.

c. Outside temperature +2°C to +10°C. The cabin thermostat keeps the 3 kW heater switched off but the outside thermostat inhibits starting of the cooling equipment to prevent it from freezing. In this range, the heat generated by the cabin equipment in operation raises the cabin temperature up to a maximum of +30°C. The outside air dampers should be set fully open so that the maximum amount of outside air is drawn in.

d. Outside temperature +10°C to +40°C. The cabin thermostat controls the cooling equipment so that the cabin temperature is maintained at about the thermostat setting. The outside air dampers may be adjusted to give the desired air change.

e. Outside temperature +40°C to +70°C. The cabin thermostat keeps the cooling equipment switched on, but it is not capable of keeping the cabin temperature constant. In this condition the heat transferred through the cabin walls raises the cabin temperature to a maximum of about +38°C at an outside temperature of $+70^{\circ}C$. In this range the outside air dampers should be set fully closed so that cabin air is completely recirculated.

NOTE: When the outside temperature is approximately $+10^{\circ}C$, personnel working in the cabin may detect the rise of cabin temperature which follows the shutdown of the cooling equipment when the outside temperature falls below $+10^{\circ}C$. They should be aware that this increase of cabin temperature does not result from any failure in the air conditioning plant.

4.3.3 Cabin Equipment not Operating

a. Outside temperature $-40^{\circ}C$ to $-22^{\circ}C$. The cabin thermostat keeps the 3 kW heater continuously switched on, but the heater is unable to raise the cabin temperature above $0^{\circ}C$. In this range, a supplementary fan heater of about 3 kW rating, switchable in 1 kW steps, may be used to raise the cabin temperature above $0^{\circ}C$. The outside air dampers should be set fully closed so that cabin air is completely recirculated. The extra 3 kW heater should not be supplied from a pedestal-mounted outlet because the current would exceed the rating of the isolation transformer.

b. Outside temperature $-22^{\circ}C$ to $-2^{\circ}C$. The cabin thermostat keeps the 3 kW heater continuously switched on and maintains the cabin temperature between $0^{\circ}C$ and $+22^{\circ}C$. In this condition the outside air dampers should be set fully closed so that cabin air is completely recirculated.

c. Outside temperature $-2^{\circ}C$ to $+60^{\circ}C$. The cabin thermostat controls the heating and cooling equipment so that the cabin temperature is maintained at about the thermostat setting. Automatic changeover from heating to cooling will occur in the region of $+22^{\circ}C$. The outside air dampers should be adjusted to give the desired air change.

d. Outside temperature $+40^{\circ}C$ to $+70^{\circ}C$. The cabin thermostat keeps the cooling equipment switched on but is not capable of keeping the cabin temperature constant. In this condition, the heat transferred through the cabin walls raises the cabin temperature to a maximum of about $+27^{\circ}C$ at an outside temperature of $+70^{\circ}C$. In this range of temperature the outside air dampers should be set fully closed so that cabin air is completely recirculated.

4.4 SWITCHING ON THE CABIN AIR CONDITIONING PLANT

To switch on the cabin air conditioning plant, proceed as follows:

a. Set the MAIN SWITCH on distribution box RO2 (azimuth cabin) to 1.

b. Open the control box door and, after ensuring that all the isolating fuse-switches are switched on, set both AUTOMATIC-O-COOLING-HEATING switches to AUTOMATIC.

c. Close the control box door and set the DISTRIBUTION switch to 1.

4.5 SWITCHING OFF THE CABIN AIR CONDITIONING PLANT

The air conditioning plant may be switched off by setting the DISTRIBUTION switch to 0. This action removes power from both the MAIN and the SPARE units of the plant, but maintains the supply to the compressor crankcase heaters.

4.6 EMERGENCY SWITCH-OFF (CABIN AIR CONDITIONING PLANT)

In an emergency, the air conditioning plant can be shut down by setting the MAIN SWITCH on distribution box RO2 (azimuth cabin) to 0. If the emergency condition has made both air conditioning units inoperative, the DISTRIBUTION switch on the control box must be set to its 0 position. However, if only one of the units is out of service, the remaining unit can be switched into service as follows:

a. Set the AUTOMATIC-0-COOLING-HEATING switch of the out of service unit to 0.

b. Set the AUTOMATIC-0-COOLING-HEATING switch of the serviceable unit to either COOLING or to HEATING, as required.

c. Close the MAIN SWITCH on distribution box RO2.

4.7 MAINS SUPPLIES (Figure 2.10-4)

The three-phase mains supply for the air conditioning plant is connected via the MAIN SWITCH on distribution box RO2 (azimuth cabin). The single-phase mains supply for the rotary actuators and air conditioning control switchgear is connected via the DISTRIBUTION switch on the control box.

NOTE: To maintain the supply to the compressor crankcase heaters, the MAIN SWITCH on distribution box RO2 should always remain in the 1 (on) position, even when the air conditioning plant is out of service. Only during a procedure involving the risk of electric shock should the three-phase supplies be disconnected by the MAIN SWITCH.

PART TWO

MAINTENANCE

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PART TWO

SECTION ONE

FIRST LEVEL MAINTENANCE

CAUTION: GREAT CARE MUST BE EXERCISED WHEN CARRYING OUT THE MAINTENANCE PROCEDURES. CARELESS MAINTENANCE MAY CAUSE OUTAGE.

1. GENERAL

This section contains maintenance information relating to the structural components of the pedestal, drive assemblies, air conditioning units and davit. Maintenance instructions for the equipment housed in the azimuth and elevation cabins are contained in the relevant handbooks.

Maintenance should be carried out, as far as possible, during normal operation of the pedestal and especially during those periods when minimum position changes occur. If there is planned off-duty time or station outage due to other faults, full advantage should be taken of these times for maintenance, particularly for those maintenance actions requiring movement of the antenna.

The maintenance procedures detailed for the air conditioning equipment apply primarily to the MAIN air conditioning unit. The same procedures should be applied to the SPARE unit at periodicities approximately four times longer than those stated for the MAIN unit. The cleaning period for the filters depends on local conditions and can only be determined by experience.

Attention should be given to the following WARNINGS before commencing any maintenance work.

<u>WARNINGS:</u> (1) PERSONNEL REQUIRED TO WORK WITHIN AN AREA OF HIGH RADIATION RISK MUST ENSURE THAT THE 'SAFE TO TRANSMIT' KEY HAS BEEN REMOVED AND IS IN THEIR POSSESSION BEFORE COMMENCING WORK.

(2) PERSONNEL REQUIRED TO WORK IN AN AREA WHERE THERE IS DANGER DUE TO SUDDEN MOVEMENT OF THE ANTENNA (E.G. CABLE WRAP COMPARTMENT), MUST ENSURE THAT THE 'SAFE TO ROTATE' KEY HAS BEEN REMOVED AND IS IN THEIR POSSESSION BEFORE COMMENCING WORK.

(3) WHEN WORKING ON THE PEDESTAL, AT TEMPERATURES SIGNIFICANTLY BELOW FREEZING POINT, PERSONNEL SHOULD WEAR PROTECTIVE CLOTHING (GLOVES ETC.), TO PREVENT THE POSSIBILITY OF INJURY DUE TO THEIR SKIN FREEZING TO METAL PARTS.

(4) SAFETY INTERLOCKS MUST NOT BE BYPASSED OR RENDERED INOPERATIVE UNDER ANY CIRCUMSTANCES.

(5) WHEN WORKING ON THE AIR CONDITIONING PLANT, PERSONNEL SHOULD BE AWARE OF THE RISK DUE TO THE POSSIBILITY OF THE EQUIPMENT STARTING AUTOMATICALLY.

2. DAILY

2.1 CABIN AIR CONDITIONING PLANT

2.1.1 Condensate Container

Check the level of water in the condensate container below the control box. The container must never be allowed to remain full.

3. MONTHLY

3.1 CABINS

a. Check the condition of the cabin sealings.

b. Check the cabins and the surface of the reflector hub cavity for moisture. Remove any moisture which has collected.

If moisture is observed inside the cabins it is probable that the cabin air conditioning is faulty. Moisture on the external surfaces of the cabins can be evaporated by running the radome exhaust fan.

3.2 DRIVE ASSEMBLIES

a. Check for oil leakage. If excessive leakage is observed check oil levels as detailed in Sub-section 4.1.

b. Check that the blowers are firmly secured in the correct position on the drive motors.

NOTE: Blowers are correctly aligned during installation and it is recommended that alignment marks be made on the drive motor and end cover to ensure correct alignment after any subsequent removal of the blowers for maintenance or repair.

c. Lightly grease the brake lifting lever studs on the azimuth drive assemblies using silicon grease Calypsol G205.

d. Lightly grease the pivots of the handwheel unlocking lever and the interlocking drum of the handcranking mechanism using silicon grease Calypsol G205.

e. At a time compatible with operation, engage and disengage the handwheels. Check that the HANDCRANK indicators on the control console and control panel function correctly. Ensure that the servo system is switched 'ON' immediately after resetting the handwheel unlocking lever, by pressing the MASTER ON pushbutton at the control console, Bay 5, for at least 2 seconds.

<u>NOTE:</u> The handcrank microswitch is mounted on a bracket secured by two screws located in slots in the bracket. If it is necessary to adjust the position of the microswitch, slacken the two screws, move the bracket together with the microswitch in the required direction, apply Loctite to the threads of the screws and retighten the screws.

<u>CAUTION:</u> DO <u>NOT</u> LIFT BOTH BRAKES AT THE SAME TIME WHEN MAKING THE FOLLOWING CHECK.

f. At a time compatible with operation, manually operate each brake, one at a time, and check that the BRAKES ON indicators function correctly, i.e. with both brakes of one axis applied, BRAKES ON indicator lamp should light; with only one brake applied, BRAKES ON indicator lamp should not light.

g. Check the drive assemblies for abnormal noise.

h. At a time compatible with operation, check each stow pin by carefully operating it until it touches the toothed ring (or segment). Check that the INTERLOCK indicators on the control console and cabin panel function correctly. Simulate engaged position by operating the stow pin switch by hand. Check that the ENGAGED indicators on the control console and cabin panel function correctly.

Restore each stow pin to its fully disengaged position and ensure that the servo system is immediately switched 'ON' by pressing the MASTER ON pushbutton at the control console, Bay 5, for at least 2 seconds.

j. Grease the drive assembly installation equipment and ensure that all moving parts work freely. Use silicon grease Calypsol G205.

3.3 CABLE WRAP COMPARTMENT

WARNING: ENSURE THAT THE 'SAFE TO ROTATE' KEY IS REMOVED FROM THE CONTROL CONSOLE BEFORE WORKING IN THE CABLE WRAP COMPARTMENT.

When the satellite drift rate requires no antenna correction for a sufficiently long period, carry out the following maintenance:

a. Visually check that the cables and hoses are in good condition and uniformly positioned, and that all connectors are secure.

b. Check, by hand, that the spiral turns of the cable wrap move easily over the compartment floor.

c. Visually inspect the azimuth limit and range switches and ensure that they are secure.

3.4 ELEVATION LIMIT SWITCHES

Visually inspect the elevation limit switches and ensure that they are secure.

3.5 CABIN AIR CONDITIONING PLANT

3.5.1 Compressor Oil Level

Check crankcase oil level in each of the two compressors.

To ensure that coolant is not mixed with oil, thus giving a false indication, the compressor should be run for at least three minutes prior to the reading being taken; this period of operation causes the majority of any coolant present in the oil to be evaporated.

NOTE: The compressor must not be running when the level is read.

Proceed as follows:

a. Set the DISTRIBUTION switch on the control box to '0'.

b. Release and pivot the control box on its mounting.

c. Remove the safety grille from the front of the air conditioning unit.

d. Using a long-handled mirror, examine the oil level sight-glass which is situated on the right-hand side at the rear of the compressor, near the base of the unit.

e. For a newly installed compressor which has been filled with oil, but not yet been run, the correct oil level is almost at the top of the sight-glass.

f. When the compressor has been run, the oil is distributed around the lubricating circuit and the oil level falls to about half-way up the sight-glass. Therefore, for operational compressors, the correct oil level is half-way up the sight-glass, with the compressor not running.

NOTE: An oil level in excess of half-way up the sight-glass is not desirable as the excess oil might penetrate the cooling system circuit and reduce its efficiency.

If the oil level is less than half-way up the sight-glass, the oil should be topped up, as described in Part Two, Section Three, Sub-section 19.1.

3.5.2 Coolant Levels

Check coolant level in each of the two air conditioning units. The coolant level sight-glass is located at the rear of each air conditioning unit, near the base. The following coolant levels are applicable:

a. If the unit is not running, and has not recently been running, the correct coolant level is half-way up the sight-glass.

b. If the unit is running, and has been running for at least three minutes, the correct coolant level is approximately a quarter-way up the sight-glass.

If the coolant level is less than specified in a. or b., the unit should be checked for coolant leaks and the coolant topped up, as described in Part Two, Section Three, Sub-section 19.5.

WARNING: UNDER NO CIRCUMSTANCES SHOULD AN AIR CONDITIONING UNIT WITH A KNOWN COOLANT LEAK BE ALLOWED TO RUN IN THE COOLING MODE.

4. EVERY THREE MONTHS

4.1 DRIVE ASSEMBLIES

a. Check the oil level in the elevation gearboxes. The level should be within approximately 5 mm (0.2 in) of the level plug hole in the end plate. Top up as necessary with Shell Tellus T27 oil.

NOTE: Do NOT use Shell Tellus 27.

b. Check the oil level in the azimuth gearboxes. The level should be between 10 mm and 15 mm (0.4 in and 0.6 in) of the underside of the gearbox end plate. Make check at filler/breather plug hole in end plate. Top up as necessary with Shell Tellus T27 oil. Observe note given in a.

NOTE: For stations which might experience long periods of extremely cold weather, Shell Tellus T17 oil is recommended (refer to Part One, Section Three, Sub-section 4.10).

4.2 DATA PICK-UP UNITS

a. Check that the reference lever linkage is secure and undamaged.

b. Lightly grease around the press-fit at the reference point using Belzona Anti-seize.

4.3 LIMIT AND RANGE SWITCHES

At a time compatible with operation, manually operate the azimuth emergency limit and range switches and the elevation emergency limit switches. Check that the appropriate CCW, CW, UPPER LIMIT or LOWER LIMIT indicators function correctly on the control console and cabin panel, and that the relative drive motors are interlocked (refer to Antenna Servo, Drive and Control Handbook No. 601).

The azimuth switches can be reached from the larger access hole in the tower, without entering the tower. The azimuth range switches must be operated in conjunction with the appropriate azimuth emergency limit switch. After the check ensure that all switches are immediately restored to their previous positions and press the MASTER ON pushbutton at the control console, Bay 5, for at least 2 seconds.

5. EVERY SIX MONTHS

5.1 CABIN AIR CONDITIONING PLANT

5.1.1 General

Every six months, a thorough inspection of the entire air conditioning plant should be carried out. After switching off the mains power switch, the electrical circuits in the control box should be examined for signs of over-heating or loose connections.

The evaporator should be checked for the ingress of dirt or foreign particles and, if necessary should be reverse-flushed (from the ventilating fan side) with a water jet, after removing the filter mats (see Sub-section 5.1.3); take care to keep the water jet away from the electrical equipment.

The condenser should be cleaned of accummulated dirt by using a compressed air line.

5.1.2 V-belts

a. Set the DISTRIBUTION switch on the control box to 'O'.

b. Swing the control box away from the air conditioning units.

c. Remove the front grilles.

d. Inspect the compressor V-belts for signs of wear or oil contamination. If a V-belt is found to be defective, all three should be renewed, as described in Section Three, Sub-section 19.14.

e. Check for correct tension. Firm application of thumb pressure half-way between the pulley wheels should result in 2.5 cm (1 in) total deflection.

f. If necessary, adjust the tension by means of the adjusting bolts on the motor attachment brackets.

g. Check that the compressor motor fan blades do not touch the condenser baffle; if necessary, loosen the fixing screws and re-position the baffle.

h. Replace the grilles and control box and set the DISTRIBUTION switch to '1'.

5.1.3 Filters

The required frequency of filter cleaning will depend on local conditions and should be determined from experience; however, it is recommended that initially the filters should be checked and, if necessary, cleaned every six months.

The activated carbon filter may be removed and the carbon graules discarded at the first inspection; it is not required at SATCOM sites.

Filter cleaning should be carried out as follows:

a. Open the cover flap, at the top rear of the air conditioning unit, and withdraw the filter unit frame.

b. Remove the retaining spring and pull out the top filter mat and (first inspection only) the carbon filter container.

c. First inspection only; remove the screws securing the fine wire mesh of the carbon filter and discard the carbon. Do not refill; re-assemble the carbon filter.

d. Clean both filter mats and the filter framework with a vacuum cleaner.

e. Re-assemble the filter mats.

f. Replace the filter frame, fit the retaining spring and close the cover flap.

5.2 DRIVE ASSEMBLIES

5.2.1 Brakes (Refer to Part One, Figures 4.17-3 and 4.17-4)

a. Check that the azimuth brake lifting levers have 10° to 15° of free movement before they contact the brake plate.

b. To adjust the free movement, slacken the lock nut holding the brake lifting lever stud and turn the stud until the required amount of free movement is obtained. Tighten the lock nut and re-check the amount of free movement of the brake lifting lever.

If the stud is difficult to turn, remove the brake lifting lever and screw on a pair of lock nuts by which the stud can be turned with the aid of a spanner. Replace the lever on completion.

NOTE: One stud per brake has left-hand thread.

c. Check that each elevation brake attachement linkage has a small amount of free movement when the brake is fully on. Adjust as necessary on the Bowden cable.

d. Ensure that the brake is fully on (brake lifting levers must be engaged in clips).

e. Check the gap between the solenoid housing and the brake plate. Measure at several points on the circumference using feeler gauges and calculate the average value. This average value should be between 0.4 mm and 0.6 mm (0.016 in and 0.024 in).

f. To adjust the gap, remove the two Allen screws from the knurled adjusting nut, rotate the nut the required amount and replace the Allen screws. Rotation of the adjusting nut until the next pair of holes in the nut are aligned with the threaded holes in the brake lining plate will adjust the air gap by 0.15 mm (0.006 in).

CAUTION: THE SECOND BRAKE, FOR THE AXIS OF THE BRAKE UNDER TEST, MUST REMAIN APPLIED DURING THE FOLLOWING TEST.

g. Check, by slow manual operation, that the BRAKES ON/BRAKES OFF microswitch operates before the brake plate makes contact with the solenoid housing.

Ensure that the BRAKES ON indicators function correctly on the control console and on the cabin panel, i.e. the BRAKES ON indicators should go off.

NOTE: The BRAKES OFF indicators should remain unlit during test since it requires both brakes of one axis to be lifted before the BRAKES OFF indicators, for that axis, light.

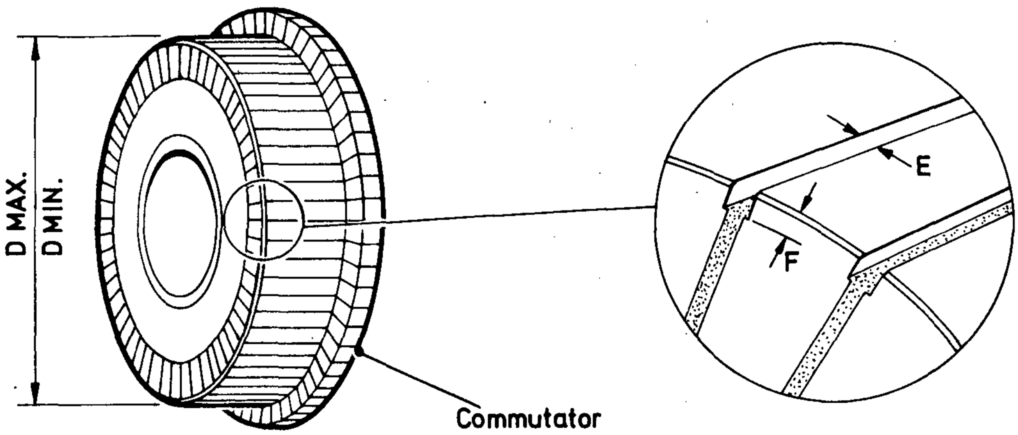
h. To adjust the operating position of the micro-switch, slacken the lock nut on the adjusting screw and move adjusting screw as required. Make allowance for microswitch hysteresis. Tighten the lock nut on completion.

5.2.2 D.C. Drive Motors and Blowers (Figure 1.5-1)

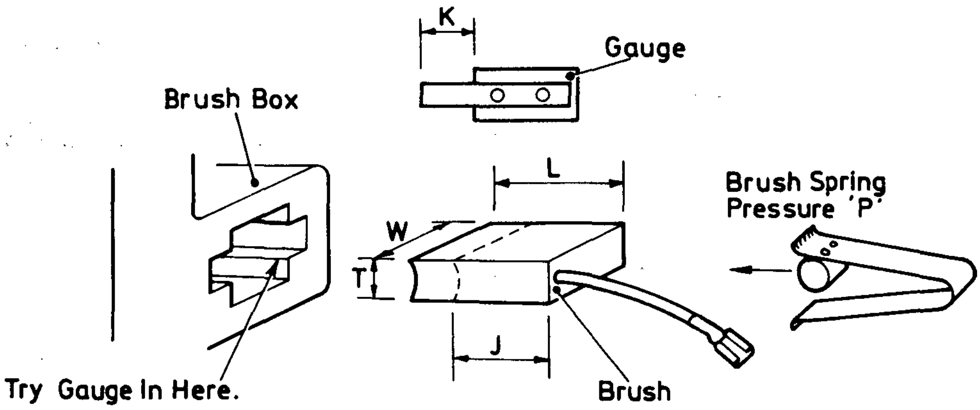
a. Remove the complete blower assembly to gain access to the brushgear. Ensure that the position for replacing the blower assembly is clearly marked before loosening the clamping screws.

b. Check the amount of wear on each brush by inserting the small end of the brushwear gauge (specially provided for the purpose) into the slot in the brush box, until the end of the gauge touches the top of the brush. If the shoulder of the gauge touches the top of the brush box, then the brush is worn beyond the minimum brush length and must be renewed.

NOTE: If the brush wear gauge is not available, the brushes should be removed from their brush boxes and the length of each brush measured (Figure 1.5-1, J). If this length is less than 22 mm (0.866 in) the brush must be renewed.



D MAX.		D MIN.		Undercut Width 'E'		Undercut Depth 'F'	
mm	inch	mm	inch	mm	inch	mm	inch
79	3·11	75	2·95	0·889	0·035	0·762	0·03



Brush Dimensions			Minimum Brush Length				Spring Pressure 'P'	
			mm		inch			
Tmm	Wmm	Lmm	J	K	J	K	Grammes	ozs.
10	20	32	22	8	0·866	0·315	401	14·2

D.C. Drive Motors - Commutator Maintenance

Fig. 1.5-1

If it is necessary to fit new brushes, ensure that after bedding them in, the carbon dust is blown out of the motor. Also ensure that the brush moves freely in the brush box and that the brush lead will move down without fouling the box as the brush wears.

c. Inspect the commutator surface for wear and other irregularities. Measure the depth of undercutting on the worn part of the commutator. When this is less than 0.25 mm (0.01 in), the armature should be removed for skimming and undercutting at the first opportunity and a spare armature or a spare motor should be installed (refer to Part Two, Section Three, Sub-section 10).

d. Clean any carbon dust from the motors.

e. Check that the brushes are free in the brush boxes.

f. Replace the motor end cover, complete with blower, making sure that the positioning marks are aligned.

g. Check the blowers for abnormal noises and ensure that the rotation is in correct direction by checking that there is air coming out of the drive end of the d.c. drive motors.

5.2.3 Tacho-generators

CAUTION: BEFORE MAKING THE FOLLOWING CHECKS ON THE TACHO-GENERATOR, ENSURE THAT THE SAFE TO ROTATE KEY IS SET TO OFF AND REMOVED.

a. Release the spring-catch and remove the gear cover of each tacho-generator.

b. Check that the carbon brushes move freely and that they have not worn beyond their limit. If a brush is worn to less than 15 mm (0.6 in) in length it must be renewed (length when new 20 mm (0.8 in)).

c. Inspect the collector for wear or damage.

d. Replace the gear cover on completion.

5.3 LIGHTING SYSTEM

a. Electrically isolate the lighting system.

b. Check that the emergency light operates correctly (refer to Part One, Section Two, Sub-section 11.4).

c. Clean the distribution box.

d. Check all terminals and tighten as necessary.

e. Examine the plug and socket connections for serviceability.

f. Restore the lighting system supply and ensure that all lights and switches operate correctly.

5.4 PEDESTAL, GENERAL

a. Spray the outside of the azimuth toothed ring and the elevation toothed segment with Mobil Spray TAC D.

b. Spray the inside of the azimuth toothed ring with Rocket Spray WD40.

c. Check the elevation and lower azimuth bearing covers for evidence of leakage of grease. Add BP Aero grease 31B1, via the grease nipples, as necessary to replace losses. Indication that a bearing is full is when old grease extrudes from the labyrinth rings of the bearing.

d. Grease hinges of doors using silicon grease Calypsol G205.

e. Lubricate the accessible parts of the stow pin bolts using Mobil Spray TAC D.

f. Grease the upper azimuth bearing rollers via the grease nipples provided. Use BP Aero grease 31B1 (approximately 10 g per roller).

5.5 CABLE WRAP COMPARTMENT

When the satellite drift rate requires no antenna correction for a sufficiently long period, carry out the following maintenance, having first observed the WARNING given in Sub-section 3.3.

a. Clean the cable wrap.

b. Check the rollers and ball rollers on the cable wrap for damage and for correct operation.

c. Clean the floor of the compartment and coat it with Rocket Spray WD40.

6. ANNUAL

6.1 DRIVE ASSEMBLIES

Drain all the oil from the gearboxes and refill each gearbox with 23 litres (40.5 pints) of Shell Tellus T27 oil. (Do not use Shell Tellus 27 oil).

NOTE: For stations which might experience long periods of extremely cold weather, Shell Tellus T17 oil is recommended (refer to Part One, Section Three, Sub-section 4.10).

Holes are provided in the floor underneath the azimuth gearboxes through which the draining hoses are passed so that the oil can be collected in suitable containers below. A hand pump is provided on site for refilling the gearboxes.

NOTE: Changing the oil of the gearboxes must be carried out after the first 12 months service and subsequently after every 24 months.

6.2 PEDESTAL, GENERAL

a. Grease the lower azimuth bearing and the elevation bearings via the grease nipples. Pump in grease (BP Aero grease 31B1) until the old grease extrudes from the labyrinth rings of the bearings.

b. Lubricate all black bolts (e.g. jacking and adjustment screws) with silicon grease Calypsol G205.

c. Check all bare surfaces for rust. Grease as necessary with silicon grease Calypsol G205.

6.3 DAVIT

a. Visually inspect the wire for damage or fraying.

b. Visually inspect the gearing for damage.

c. Grease the wire using silicon grease Calypsol G205.

d. Grease the davit at the seven greasing points provided, using grease Type 120, DIN 51825.

NOTE: Safety tests should be carried out in accordance with any existing national regulations.

6.4 DATA PICK-UP UNITS

a. Remove the cover of each data pick-up unit and check the colour of the Silicagel bags; if the bags are pink they must be replaced by new bags.

b. Check that the resolver and limit switch securing screws are tight.

7. EVERY TWO YEARS

a. Check the tightness of all bolts; verify the tightness of the following bolts at the stated torques:

Item	Torque loading	
	kg. m	lb ft
Azimuth yoke/rotary column screws	31.0	224.3
Bearing assembly securing screws	8.5	61.5
Anchor bolt nuts	72.0	522.0
Reflector securing bolts	17.0	123.0

b. Inspect all coated surfaces for deterioration in the protective epoxy coating. For areas with slight damage to the epoxy coating, clean the affected area and apply a top coat of Elgol 737.

c. For large areas, clean the surface with emery cloth or a steel brush to remove all loose particles.

d. Use activator Elgol-EG and a clean cloth to remove all existing epoxy coating over the defective area.

e. Renew priming coat, as required, using Elgol 734 yellow.

f. To recover the damaged areas, proceed as follows:

NOTE: For quantities in excess of 1 kg (2.21 lb) Elgol dilution 937 is to be used.

i Mix seven parts by weight of 734 with one part of 738 hardener. Apply and allow to dry.

NOTE: The drying time is 3 to 4 hours.

ii First coat (Elgol 735 grey): Mix five parts by weight of 735 with one part of 738 hardener. Apply and allow to dry.

iii Apply second coat (Elgol 737 - RAL 7035): Mix two parts of 737 with one part of 738 hardener.

NOTE: If the period between the applications of the coats exceeds 24 hours, the surface is to be treated with activator Elgol-EL.

8. OPPORTUNITY MAINTENANCE

On those occasions of station outage or off-duty time when movement of the antenna is permissible, the following maintenance checks should be done.

<u>WARNING:</u> IT IS ESSENTIAL, FOR SAFETY REASONS, THAT AN OPERATOR IS POSITIONED AT EACH HANDWHEEL OF THE AXIS ABOUT WHICH HANDCRANKING IS TO TAKE PLACE. EACH HANDWHEEL MUST BE ENGAGED AND GRIPPED FIRMLY IN BOTH HANDS BEFORE RELEASING THE BRAKES. THIS IS PARTICULARLY IMPORTANT ON THE ELEVATION AXIS, WHERE THE ANTENNA MAY RUN AWAY UNDER ITS OWN WEIGHT.

a. Operate the handwheels of all drive assemblies to check movement over the full range of antenna travel.

b. At the extremities of movement on the azimuth axis check that the CCW and CW LIMIT indicators light on the control console and control panel.

c. At the extremities of movement on the elevation axis check that the UPPER and LOWER LIMIT indicators light on the control console and control panel.

d. At each stow pin position, stop the antenna and insert the appropriate stow pin. Check that the STOW PIN INTERLOCK and ENGAGED indicators function correctly on the control console and control panel.

e. Check axis verticallity as described under Part One, Section Five, Sub-section 19, 'Levelling the Pedestal'. Do not disturb the jacking screw settings or anchor bolts. Only take readings of the spirit levels at the various positions as described and ensure that the magnitude of error is within the tolerance permitted. Re-adjust only if the magnitude of error is greater than the permitted tolerance.

<u>NOTE:</u> This check to be carried out approximately every 2 years.

PART TWO

SECTION TWO

SECOND LEVEL MAINTENANCE

This section is not applicable to the equipment covered in this Handbook.

PART TWO

SECTION THREE

THIRD LEVEL MAINTENANCE

1. GENERAL

This section contains instructions for the removal, replacement and, where necessary, dismantling and re-assembling of the major sub-assemblies of the pedestal and air conditioning units.

The instructions are intended for use during repair or replacement procedures and are essentially for maintenance which is not carried out on a periodicity basis.

The principal special tools required to perform each maintenance task are listed at the beginning of the relevant sub-section.

Maintenance instructions for the servo and drive equipment associated with the drive assemblies and for the equipment housed in the azimuth and elevation cabins, are contained in the relevant equipment handbooks.

1.1 REMOVING AND REPLACING DRIVE ASSEMBLIES

Two drive assemblies are provided for each axis of the pedestal, but it is possible to drive the pedestal with one drive assembly of an axis running idle (refer to the Antenna Servo, Drive and Control Handbook, No. 601). Removal or replacing of one drive assembly will therefore restrict operation of the pedestal only for the time required to disengage or engage the output pinion. With some care, occasional small tracking corrections, by handcranking, may be possible during this work.

With proper planning, taking into account the varying drift rate of the satellite, station outage can be reduced to a minimum or even completely avoided.

2. REMOVAL OF AZIMUTH DRIVE ASSEMBLY (Part One, Figures 4.24-1 and 5.11-1)

2.1 SPECIAL TOOLS

A special tool kit is provided for use during the removal and replacement of the drive assemblies. The kit comprises the following items:

Installation device - azimuth drive assembly	: Type GMH7064471	: (1)
Installation device - elevation drive assembly (includes socket wrench insert SW32 and two chains, 1.5 m long)	: Type GMH7064470	: (1)
Lower guide rail 1338 mm long (includes four locking pins with chains and spring pins)	: Type GMH7064479	: (2)
Hatch guide rail 1120 mm long	: Type GMH7262348	: (1)

2.2 PROCEDURE

a. Check that the respective upper guide rail is fitted and secure.

b. Ensure all power supplies are switched off at their respective circuit breakers (refer to the Antenna Servo, Drive and Control Handbook No. 601). Unplug all electrical connections at the associated distribution box Q3 or Q4. Unclip the cables and coil them neatly.

c. Remove the heater mat complete with terminal boxes.

d. Position the installation device on the upper guide rail above the drive assembly.

e. Screw the lower end of the installation device into the tapped hole in the bearing support on top of the gearbox and secure with the lock nut.

f. Remove the drive assembly securing bolts.

g. Remove the azimuth pinion bearing flange ring (refer to Part One, Figure 4.8-1).

h. Using the jacking screw holes provided in the mounting flange, jack the drive assembly until the spigot of the gearbox flange is clear of its locating hole; at the same time, taking the weight of the drive assembly on the installation device.

j. Move the drive assembly away from the centring point sufficiently to unmesh the drive assembly output pinion from the azimuth toothed ring.

k. Raise the drive assembly on the installation device until it is clear of the gearbox room floor.

NOTE: The antenna can now be moved again.

m. Position the hatch guide rail in the slots in the hatch.

n. Move the drive assembly along the upper guide rail and on to the hatch guide rail.

p. Secure the installation device to the hatch guide rail, with rope or wire, to prevent the installation device rolling along the rail.

q. Using the davit or other suitable lifting tackle, lift the drive assembly, complete with the hatch guide rail, clear of the gearbox compartment.

3. REPLACING AZIMUTH DRIVE ASSEMBLY (Part One, Figures 4.24-1 and 5.11-1)

3.1 SPECIAL TOOLS

Refer to Sub-section 2.1.

3.2 PROCEDURE

a. Check that the respective upper guide rail is fitted and secure.

b. Using the davit, or other suitable lifting tackle, lift the drive assembly onto the platform adjacent to the gearbox room access hatch.

c. Screw the lower end of the installation device into the tapped hole in the bearing support on top of the gearbox. Tighten the lock nut.

d. Engage the rollers of the installation device in the loose hatch guide rail. Secure the installation device to the hatch guide rail, with rope or wire, to prevent the installation device rolling along the rail.

e. Lift the hatch guide rail, complete with the drive assembly, and lower into the hatch until the hatch guide rail engages in the correct slots in the sides of the hatch.

f. Release the installation device so that it is free to roll along the upper guide rail.

g. Move the drive assembly along the upper guide rail until it is in position above its mounting flange and approximately 40 mm (1.6 in) from the centring point.

h. Lower the drive assembly, by rotating the turnbuckle on the installation device, until the output pinion of the drive assembly loosely engages the azimuth toothed ring. If necessary, manually lift the brake and use the handwheel to align the gear teeth.

j. Move the drive assembly towards the centring point, to obtain a tighter engagement of the gear teeth, then lower the drive assembly completely until the output pinion bearing housing locates in the hole in the bottom of the azimuth yoke.

k. Fit and secure the azimuth pinion bearing flange ring (refer to Part One, Figure 4.8-1). Insert the drive assembly securing bolts. Remove the installation device. Tighten all securing bolts evenly.

m. Ensure that the blowers are correctly aligned.

n. Locate the heater mat around the gearbox and secure in position.

p. Make all electrical connections between the drive assembly and its associated distribution box Q3 or Q4 (refer to the Antenna Servo, Drive and Control Handbook No. 601).

q. Make functional checks in the respective Emergency Drive Mode to ensure correct direction of drive, correct field current and correct direction of rotation of blowers. (Refer to the Antenna Servo, Drive and Control Handbook No. 601.)

4. REMOVAL OF ELEVATION DRIVE ASSEMBLY (Part One, Figures 4.24-2, 5.11-1 and 5.11-2)

4.1 SPECIAL TOOLS

Refer to Sub-section 2.1.

4.2 PROCEDURE

a. Check that the respective upper guide rail is fitted and secure.

b. Ensure that all power supplies are switched off at their respective circuit breakers (refer to the Antenna Servo, Drive and Control Handbook No. 601). Unplug all electrical connections at the associated distribution box Q1 or Q2. Unclip the cables and coil them neatly.

c. Remove the heater mat complete with terminal boxes.

d. Ensure that the alignment positions for the two blower units are clearly marked, then unclamp the units and remove.

e. Remove the band covers from the drive ends of the two d.c. drive motors to obtain access to their securing bolts.

f. Using the trolley of the installation device and suitable lifting strops, remove both d.c. drive motors. Ensure that the positions of the motors, relative to the gearbox, are clearly marked before removal.

g. Disconnect the Bowden cable from the brake attachment linkage, remove the bracket and tie the end of the cable clear of the working area.

h. Fit the lower guide rails. Insert the locking pins and check that the rails are secure.

j. Position the trolley of the installation device on the lower guide rails beneath the gearbox.

k. Raise the cradle by adjusting on the threaded sleeves until the cradle makes contact with the gearbox. Secure the gearbox to the cradle with the chains provided.

m. Remove the drive assembly securing bolts and the elevation pinion bearing flange ring (refer to Part One, Figure 4.8-1).

n. Using the jacking screw holes provided in the mounting flange, jack the drive assembly until the spigot of the flange is clear of its locating hole approximately 25 mm (1 in).

p. Lower the drive assembly sufficiently to unmesh the drive assembly output pinion from the elevation toothed segment.

q. Move the drive assembly, on the cradle, away from the elevation toothed segment casing until it is located beneath the upper guide rail.

r. Engage the rollers of the trolley on the upper guide rail. Raise the cradle by means of the threaded sleeves, release the chains from around the gearbox and re-secure them so that they pass over the carrier plate of the trolley.

s. Adjust on the threaded sleeves of the cradle until the cradle is clear of the lower guide rails.

t. Position the hatch guide rail in the slots in the hatch.

u. Move the drive assembly along the upper guide rail and on to the hatch guide rail.

v. Secure the trolley to the hatch guide rail with rope or wire to prevent the trolley rolling along the rail.

w. Using the davit or other suitable lifting tackle, lift the drive assembly, complete with the hatch guide rail, clear of the gearbox compartment.

5. REPLACING ELEVATION DRIVE ASSEMBLY (Part One, Figures 4.24-2, 5.11-1 and 5.11-2)

NOTE: Ensure that the d.c. drive motors are removed from the drive assembly before commencing replacement.

5.1 SPECIAL TOOLS

Refer to Sub-section 2.1.

5.2 PROCEDURE

a. Check that the respective upper guide rail is fitted and secure.

b. Fit the lower guide rails. Insert the locking pins and check that the rails are secure.

c. Position the cradle of the installation device on the platform, adjacent to the hatch.

d. Using the davit, or other suitable lifting tackle, lower the drive assembly onto the cradle, so that the drain tap is at the bottom.

e. Secure the drive assembly to the cradle with the chains. Locate the trolley carrier plate under the chains and engage the rollers of the trolley in the loose hatch guide rail.

f. Secure the trolley to the hatch guide rail, with rope or wire, to prevent the trolley rolling along the rail.

g. Lift the hatch guide rail complete with the drive assembly and lower into the hatch until the hatch guide rail engages in the correct slots in the sides of the hatch.

h. Release the trolley and roll the drive assembly along the upper guide rail into position above the lower guide rails.

j. Adjust on the threaded sleeves of the cradle until the ball rollers make contact with the lower guide rails.

k. Release the chains to free the trolley then re-secure the chains around the drive assembly.

m. Move the drive assembly close to the elevation toothed segment casing. Adjust the height of the cradle until the drive assembly is approximately 25 mm (1 in) below its final height.

n. Carefully align the teeth of the output pinion of the drive assembly with the teeth of the elevation toothed segment. Use the handwheel to position the output pinion for engagement.

p. Raise the drive assembly to fully engage the output pinion with the elevation toothed segment.

q. Move the drive assembly forward until the output pinion bearing housing locates in the hole on the opposite side of the toothed segment casing. Fit and secure the elevation pinion bearing flange ring (refer to Part One, Figure 4.8-1). Insert the securing bolts into the mounting flange and tighten evenly and carefully to pull the drive assembly into its final position. Fully tighten all securing bolts.

r. Release the chains from the cradle and drive assembly. Lower the cradle sufficiently to permit its removal from the lower guide rails.

s. Remove the lower guide rails.

t. Secure the Bowden cable bracket to the brake and handwheel assembly and connect the Bowden cable to the brake attachment linkage. Check that there is a small amount of free movement on the brake attachment linkage when the brake is fully on. Adjust if necessary on the Bowden cable.

u. Using the trolley of the installation device and suitable lifting strops, replace both d.c. drive motors. Ensure that the motor to gearbox positioning marks are aligned before securing the motors. Replace the band covers on the motors.

v. Clamp the blower units on to the d.c. drive motors taking care to ensure that the positioning marks are correctly aligned.

w. Fit the heater mat around the gearbox.

x. Make all electrical connections between the drive assembly and its associated distribution box Q1 or Q2 (refer to the Antenna Servo, Drive and Control Handbook No. 601).

y. Make functional checks in the respective Emergency Drive Mode to ensure correct direction of drive, correct field current and correct direction of rotation of blowers (Refer to the Antenna Servo, Drive and Control Handbook No. 601.)

6. DISMANTLING THE GEARBOX (Figure 3.6-1)

6.1 SPECIAL TOOLS

Hydraulic press, 20 tons.

'Skefco' oil injection pump, Type SKF226400A.

Support frame (can be improvised).

6.2 PROCEDURE

a. Position the gearbox on a suitable frame with the output pinion downwards.

b. Drain the oil from the gearbox into a suitable container.

c. Before removing the d.c. drive motors, ensure that the positions of the motors, relative to the gearbox, are clearly marked. Remove the d.c. drive motors, securing bolts are located under the band cover at the drive end.

d. Remove the securing screws from each motor mounting assembly (59) (see also Figure 3.6-2). Insert these screws into the tapped holes in the base of each mounting assembly and use them to jack the mounting assemblies from the gearbox end plate (57). Remove the screws when the spigots of the mounting assemblies are just clear of the end plate.

e. Move the motor mounting assembly radially outwards from the centre of the end plate, then lift away from the gearbox.

f. Remove the securing screws from the base of the tacho-generator mounting flange (116) and use them to jack the tacho-generator drive assembly (115), complete with the tacho-generator (122), from the gearbox end plate (57).

g. Remove the cover of the brake terminal box, disconnect the solenoid and microswitch cables at the terminal block and unscrew the lock nuts securing the flexible conduit.

h. Remove the securing screws (80) and lift the brake and handwheel assembly (81) from the gearbox end plate (57) (see also Figure 3.6-3).

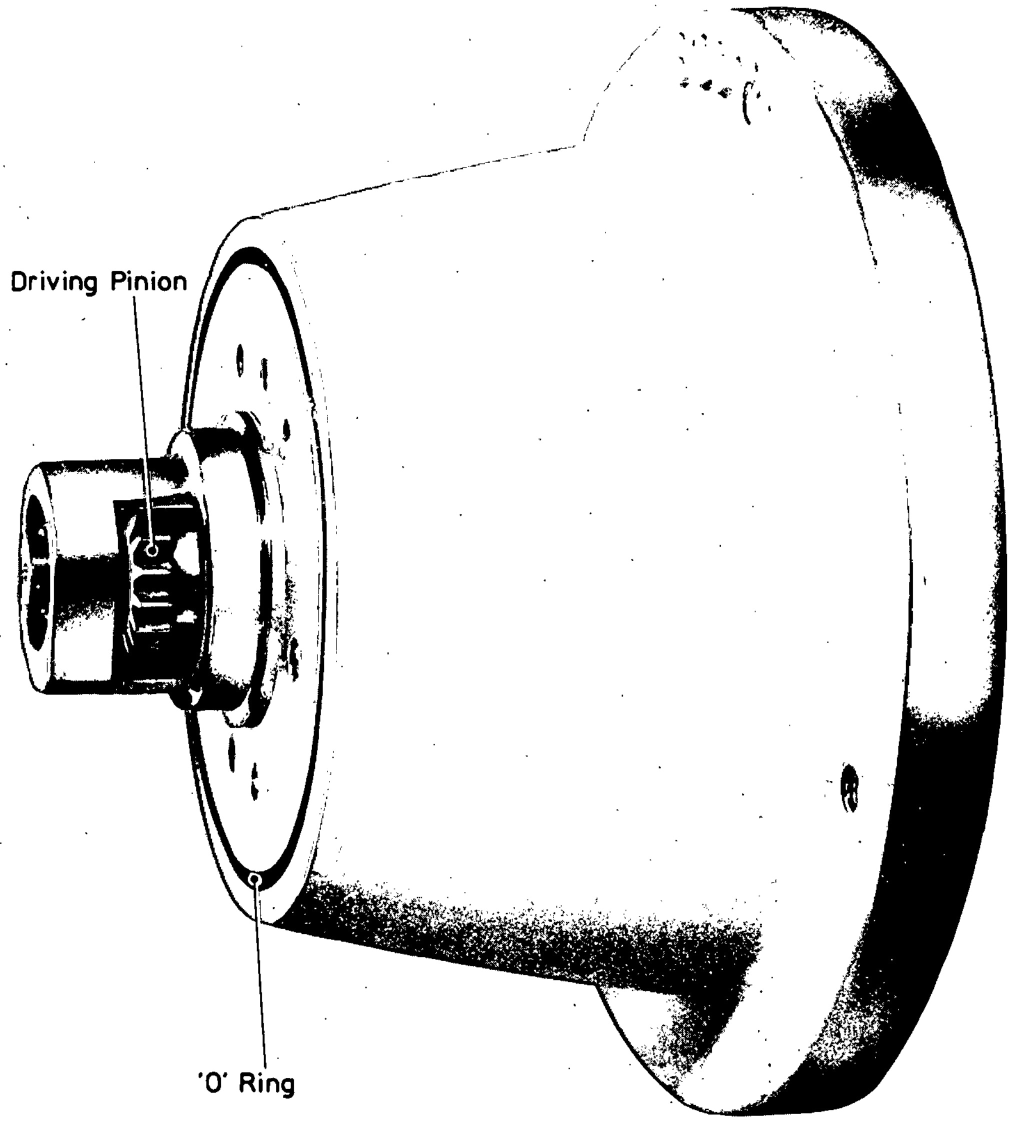
j. Remove securing screws (74) and use them to jack off the bearing support (78) complete with bearing (73).

k. Remove end plate securing screws (58). Using a hide-faced mallet strike the lower face of the protruding edge of end plate (57) to break the seal. Lift the end plate clear of the gearbox. Remove gasket (79).

m. Remove the first reduction wheel (56) complete with bearing housing (see also Figure 3.6-4).

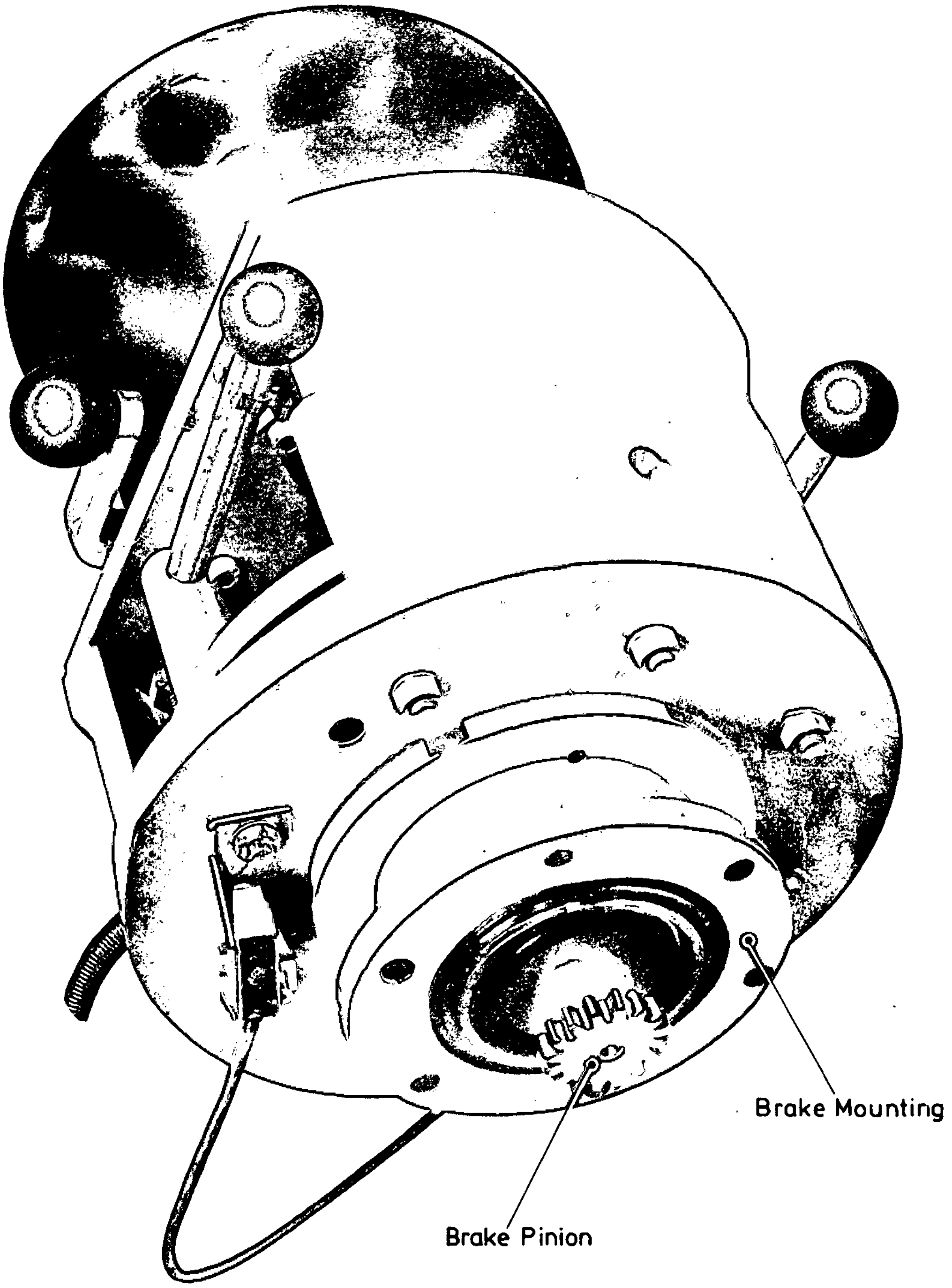
n. Remove the first stage planet carrier assembly (33) (see also Figure 3.6-5).

p. Remove securing screws (31) to release the output assembly (1) from gear case (32). Insert the screws in the tapped holes in the flange of the end housing (item 10, Figure 3.6-6), and use them to jack the output assembly from the gear case. Extract dowels (77) and remove the gear case.



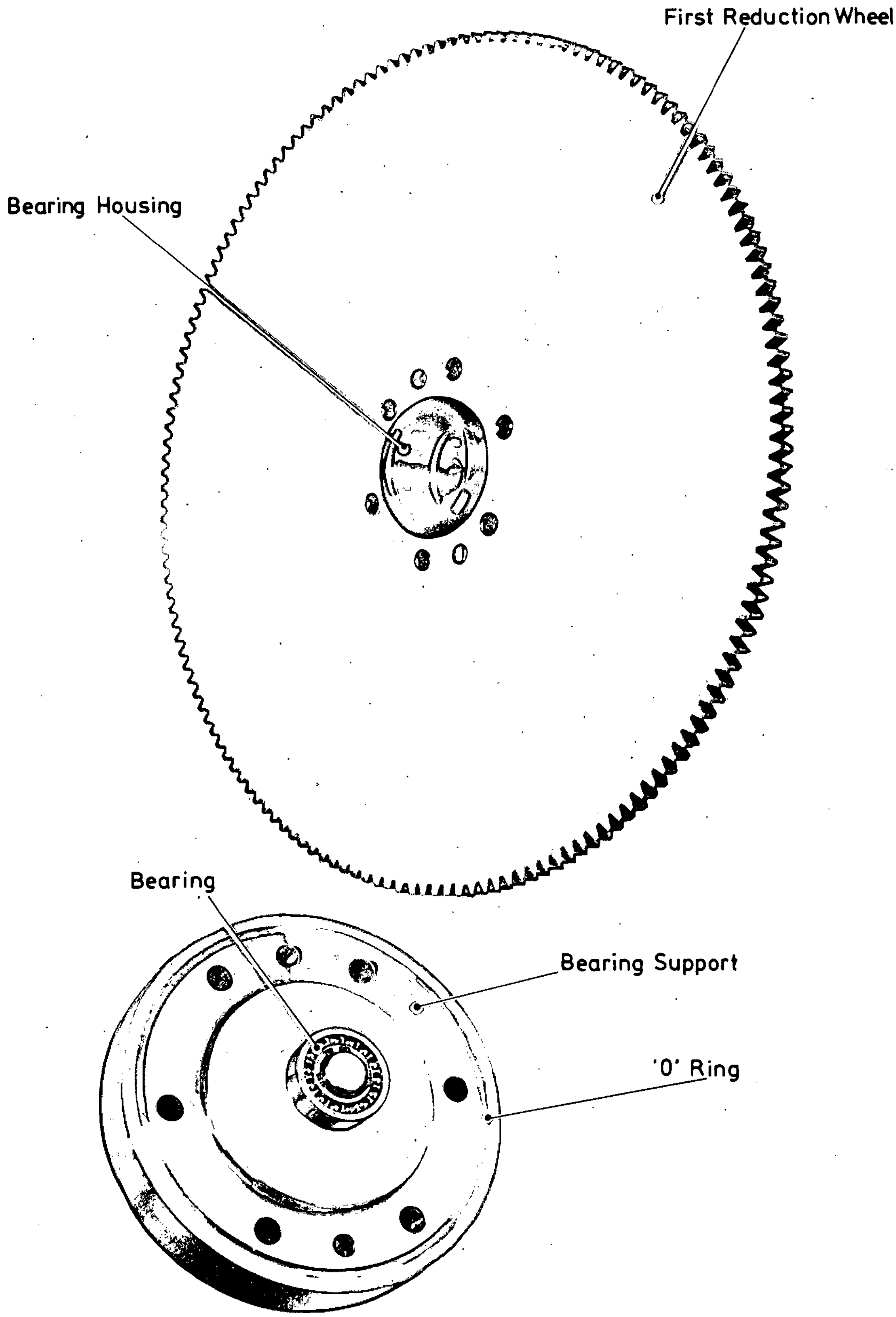
Motor Mounting Assembly

Fig. 3.6-2



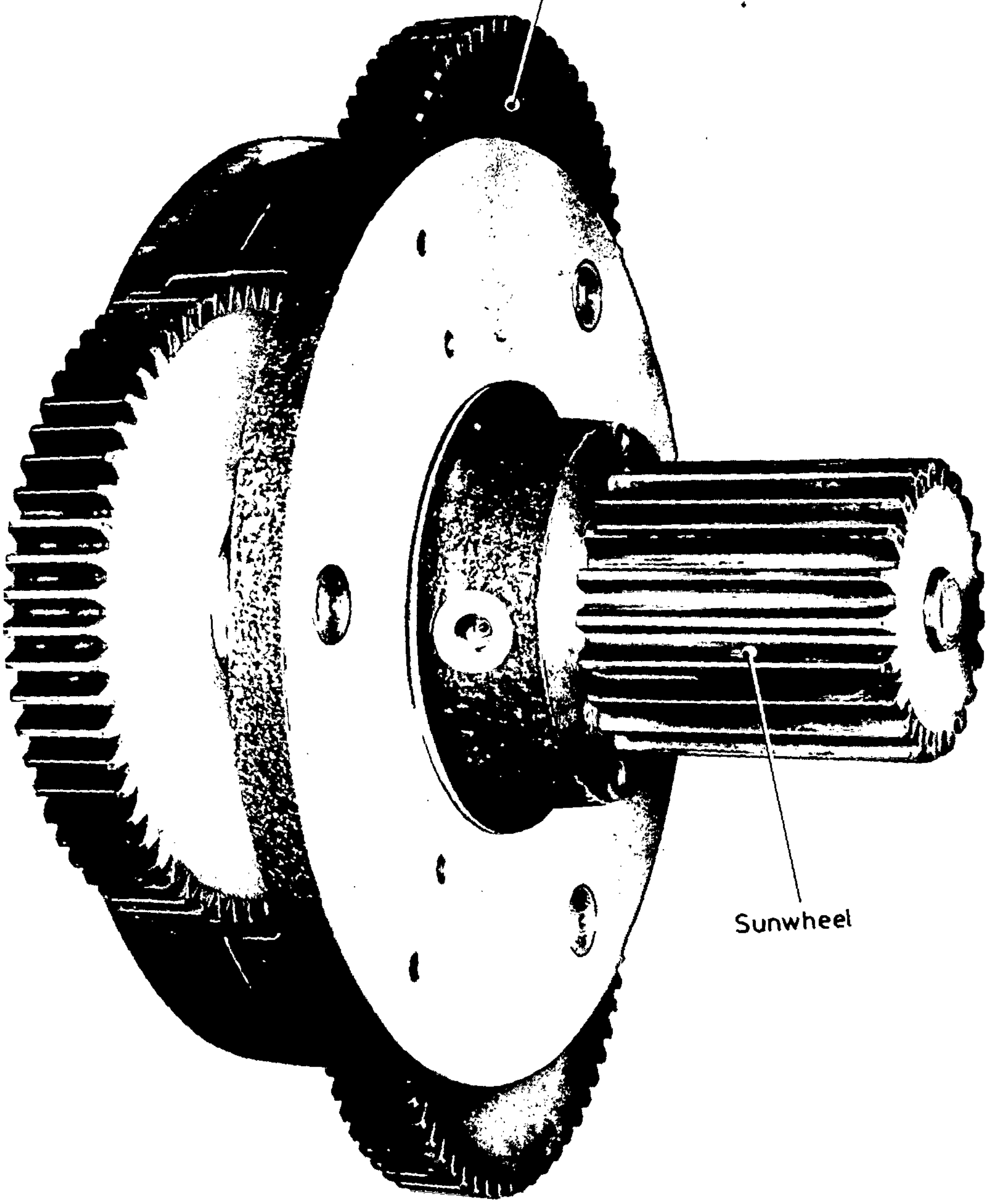
Brake and Handwheel Assembly

Fig. 3.6-3



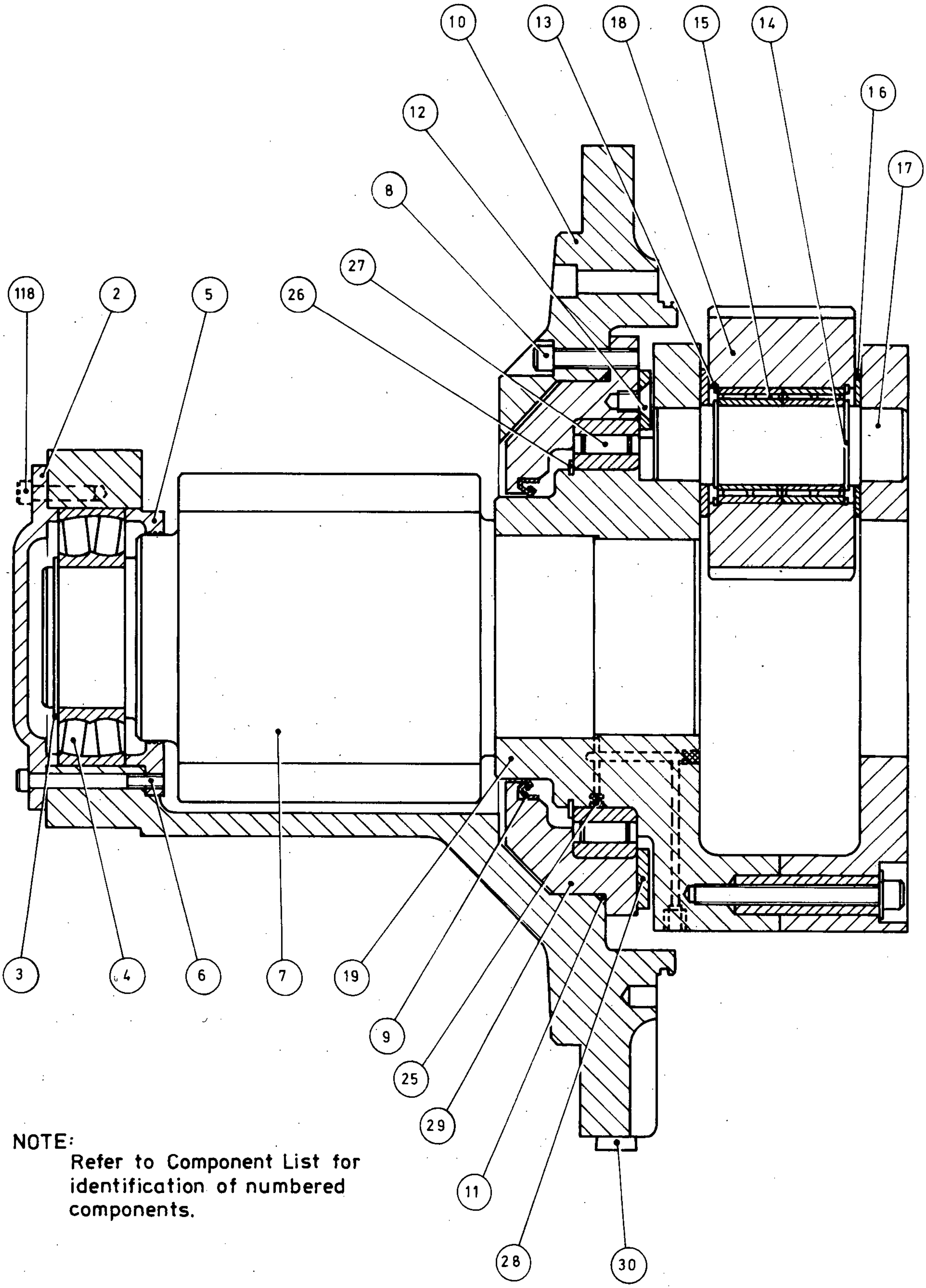
First Reduction Wheel and Bearing

Fig. 3.6-4



First Stage Planet Carrier Assembly

Fig. 3.6-5



NOTE:
Refer to Component List for identification of numbered components.

Output Assembly

Fig. 3.6-6

q. Refer to Figure 3.6-6. Invert the output assembly so that output pinion (7) is uppermost. Remove screws (6) and (118) and remove bearing retainer (2). Remove screws securing bearing housing (29) to the end housing (10). Use the screws to jack the end housing from the bearing housing.

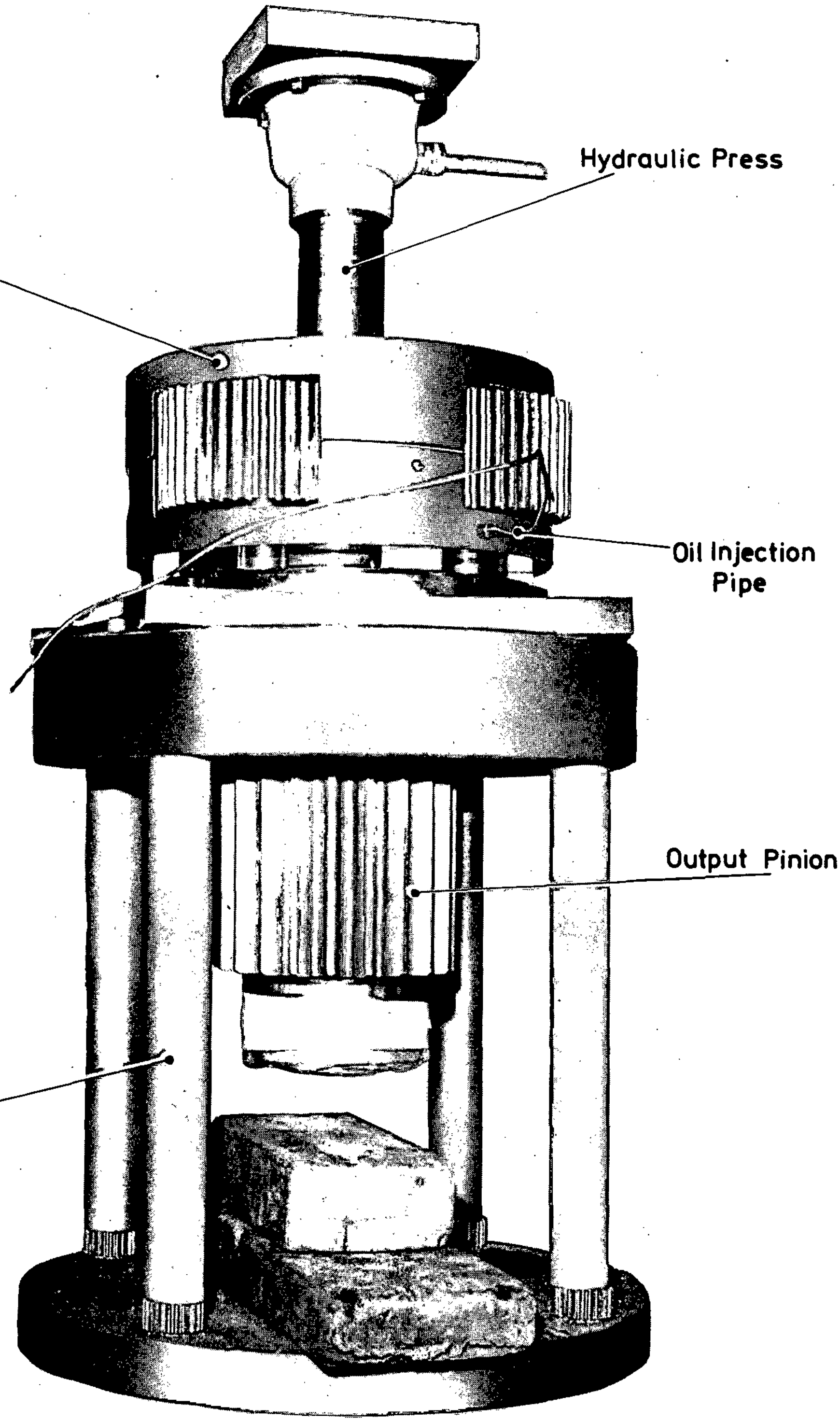
r. Position the second stage planet carrier assembly under the hydraulic press with the output pinion downwards (Figure 3.6-7). Connect the 'Skefco' oil injecting pump to the planet carrier assembly.

s. Operate the oil injecting pump until there is firm resistance to further pumping. Apply pressure to the shaft of the output pinion using the hydraulic press. A pressure of approximately 20,663 kg (20 tons) is required to break the seal between the pinion shaft and the carrier.

t. As the pinion is released from the carrier, maintain a firm pressure with the 'Skefco' pump. Ensure that the pinion is well supported as it is ejected from the carrier. Disconnect the 'Skefco' pump from the carrier on completion.

u. Refer to Figure 3.6-6. Remove bearing housing (29) from the planet carrier assembly (19). Remove screws (12) and remove retaining ring (28). Lift the outer ring of bearing (27) out of the bearing housing. If necessary, remove the oil seal (9).

NOTE: If the oil seal is removed it must be discarded and a new seal fitted on reassembly of the gearbox.



Removal of Output Pinion

Fig. 3.6-7

7. REASSEMBLING THE GEARBOX (Figure 3.6-1)

7.1 SPECIAL TOOLS

Hydraulic press, 20 tons.

'Skefco' oil injection pump, Type SKF226400A.

7.2 PROCEDURE

NOTE: Examine all oil seals, 'O' rings and gaskets and renew, if defective, during reassembly. Check the grease in the bearing (item 4, Figure 3.6-6). If it has deteriorated, renew grease. Use Shell Alvania RA. (approximately 250 g).

a. Refer to Figure 3.6-6. If oil seal (9) has been removed, insert a new oil seal into the bearing housing (29) and press into place using a wooden disc approximately 178 mm (7 in) in diameter.

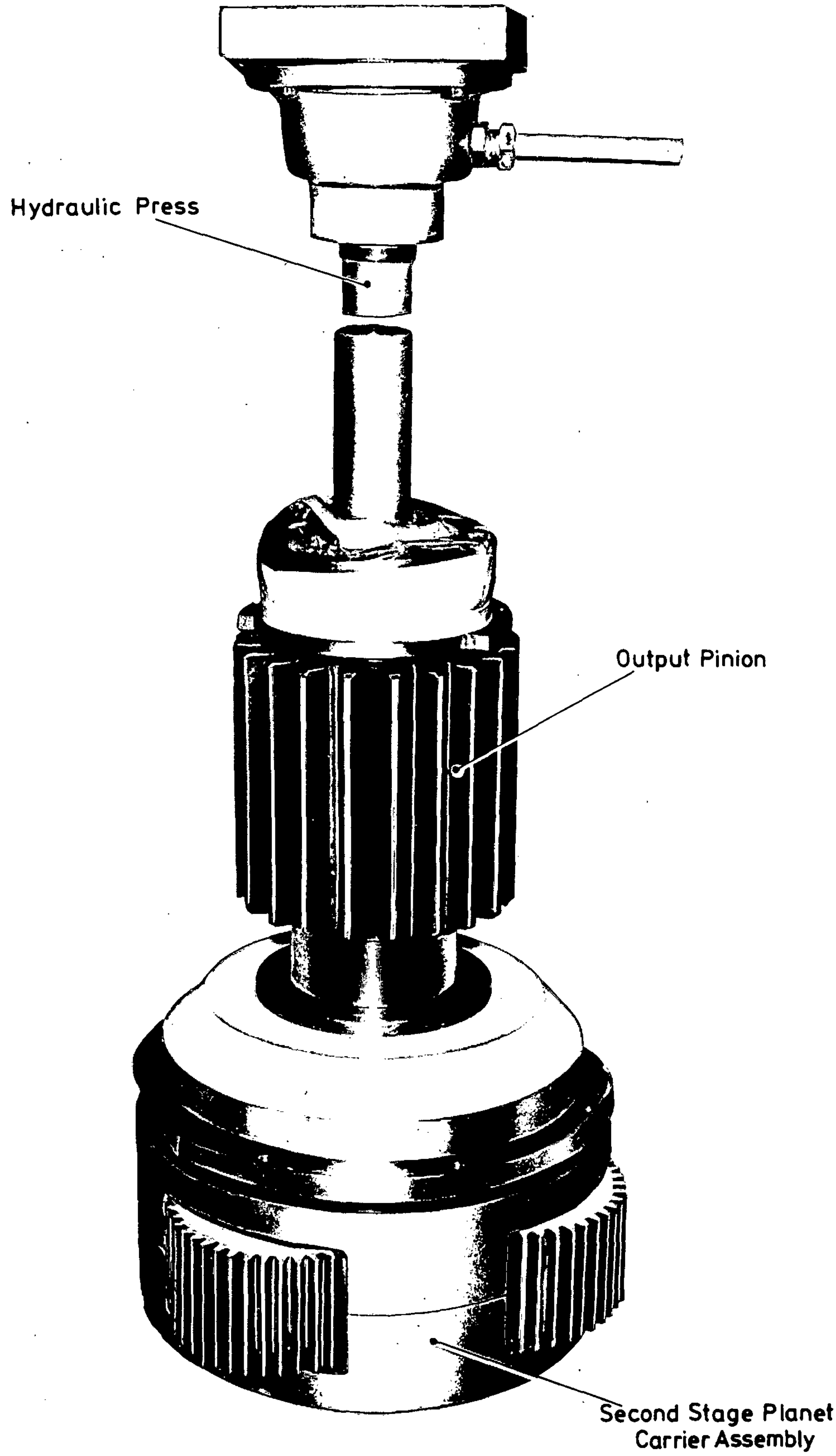
b. Refer to Figure 3.6-6. Replace the outer ring of bearing (27) in bearing housing (29). Replace retaining ring (28) and secure with screws (12). Carefully fit the bearing housing over the planet carrier assembly (19).

   NOTE: Care must be taken during this operation to prevent the oil seal being damaged. Use a thin plastic rule or similar device to lift the lip of the oil seal over the edge of the carrier.

c. Refer to Figure 3.7-1. Position the second stage planet carrier assembly under the hydraulic press and connect the 'Skefco' pump to the planet carrier.

d. Position the output pinion on the planet carrier assembly (pinion shaft downwards) and check that the pinion is vertical.

e. Keeping the output pinion vertical, bring the ram of the hydraulic press into contact with the top of the pinion.



Inserting Output Pinion into Planet Carrier

Fig. 3.7-1

f. Operate the 'Skefco' pump until there is a firm resistance to further pumping. Apply pressure to the output pinion using the hydraulic press.

g. Maintain the pressure with the 'Skefco' pump as the pinion shaft is pressed into the planet carrier. When the shaft is fully located in the carrier, release the pump pressure while maintaining the pressure with the hydraulic press.

h. Disconnect the 'Skefco' pump and release the pressure in the hydraulic press.

j. Refer to Figure 3.6-6. Ensure that 'O' ring (11) is fitted to bearing housing (29) and secure the end housing (10) to the bearing housing using screws (8).

k. Refer to Figure 3.6-6. Fit bearing retainer (2) and secure to end housing (10) with screws (6) and (118).

m. Fit dowels (77) to gear case (32). Ensure that 'O' ring (11) is fitted to the end housing and secure output assembly (1) to the gear case using screws (31). Ensure that the output assembly is correctly positioned depending on whether it is for Azimuth or Elevation drive (refer to Part One, Section Four, Sub-section 17.1).

n. Replace the first stage planet carrier assembly (33) in gear case (32).

p. Replace the first reduction wheel (56) complete with bearing housing.

q. Apply a coat of sealant to the mating faces of end plate (57) and gear case (32). Fit gasket (79) and secure the end plate to the gear case using screws (58). Recommended sealant is Hylomar, manufactured by Marston Lubricants Ltd. Apply Loctite to the screws before inserting them.

NOTE: Apply a coat of sealant to the mating faces of end plate (57) and bearing support (78), motor mounting assemblies (59), tacho-generator mounting flange (116) and brake and handwheel assembly (81) before securing those items. (Steps r. to u.). Apply Loctite to all securing screws before inserting them.

r. Ensure that 'O' ring (11) is fitted to the bearing support and secure the bearing support, complete with bearing (73) to end plate (57).

s. Ensure that 'O' ring (11) is fitted to the mounting flange of the brake and handwheel assembly (81). Mount the assembly on the gearbox end plate (57) and secure with screws (80).

t. Ensure that 'O' ring (11) is fitted to the tacho-generator mounting flange (116). Secure the mounting flange, complete with the tacho-generator assembly, to end plate (57).

u. Ensure that 'O' rings (11) are fitted to the motor mounting assemblies (59). Secure the assemblies to gearbox end plate (57).

v. Connect the brake solenoid and microswitch cables to the terminals of the brake terminal box. Secure the flexible conduit with the lock nuts. Replace the terminal box cover.

w. Ensure that the nylon rings of the Nylicon couplings are in position and then replace the d.c. motors making sure that the motor to gearbox positioning marks are aligned. Replace the band covers after securing the motors.

NOTE: The d.c. motors for the elevation drive assemblies are fitted after the drive assembly is replaced in the pedestal.

x. Refill the gearbox with oil and check for leaks (refer to Part Two, Section One, Sub-section 6.1).

8. DISMANTLING BRAKE AND HANDWHEEL ASSEMBLY (Figure 3.8-1)

NOTE: Brake and handwheel assembly removed from the drive assembly as detailed in Sub-section 6, Steps g. and h.

Elevation brake assemblies must first have the brake attachment linkage removed by releasing the clamping screws securing the two halves of the clamp to the brake mounting (refer to Part One, Figure 4.17-4).

8.1 PROCEDURE

a. Release screws (105) securing back plate (107) to the brake mounting (96).

b. Remove back plate (107) complete with flanged bearing housing (106), bush (109), interlocking drum (111) and handwheel (112). Take care not to damage bearing (104).

c. Release screws (105) securing bearing housing (106) to the back plate (107) and remove the bearing housing, bush (109) and interlocking drum (111) complete with handwheel assembly.

d. Use external circlip pliers to remove circlip (108). Carefully remove bearing (104), using a bearing extractor.

e. Release the two Allen screws in the knurled nut and remove the nut.

f. Remove the brake lining plate and extract Woodruffe key (101) from the pinion shaft.

g. Remove brake lifting levers (147 and 154). (Azimuth assemblies only). Remove brake plate (100).

h. Remove the coil springs from the spigots.

NOTE: The springs have been selected for the correct brake torque and may have been adjusted by washers fitted to the spigots. The springs and washers must be replaced in exactly the same arrangement when re-assembling.

j. Remove the lock nuts from the spigots and unscrew the spigots from brake mounting (96).

k. Use internal circlip pliers to remove circlip (93).

m. Carefully remove pinion shaft (92) complete with bearing (94).

n. Use external circlip pliers to remove circlip (95) and remove bearing (94) using the bearing extractor.

p. Extract seal (97) from the brake mounting (96).

9. REASSEMBLING BRAKE AND HANDWHEEL ASSEMBLY (Figure 3.8-1)

9.1 SPECIAL TOOLS

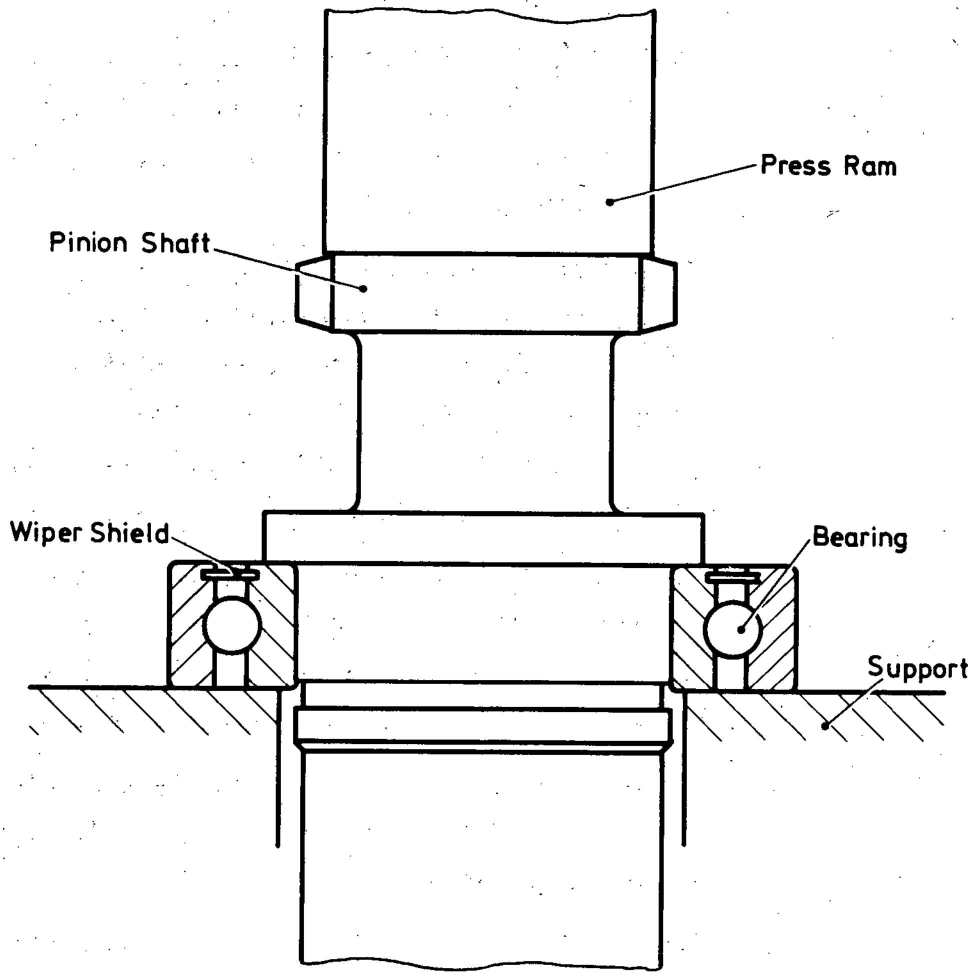
Hydraulic press (20 tons).

9.2 PROCEDURE

a. Ensure that the solenoid housing and coil are firmly secured in place and free from iron particles.

b. Insert a new seal (97) into brake mounting (96) and press into position using a metal tube of slightly smaller diameter than the outer diameter of the seal. Take care not to damage the seal.

c. Fit bearing (94) to pinion shaft (92), so that the wiper shield is facing the pinion. Mount the bearing and shaft in the press, align the shaft squarely with the bearing, and press the bearing fully into position on the shaft as shown in Figure 3.9-1.



Fitting Bearing to Pinion Shaft

Fig. 3.9-1

d. Using external circlip pliers, fit circlip (95) to the pinion shaft.

e. Fill the seal housing bore of the brake mounting (96), from the seal to the flange face, with grease (Shell Alvania RA).

<u>NOTE:</u> In the following operation, care must be taken to ensure that the shaft seal is not damaged when pressing the bearing into the housing.

f. Insert pinion shaft (92) into the brake mounting (96), and mount the assembled items in the press. Align the shaft (92) and bearing (94) carefully with the bore of the brake mounting. Press the bearing into the bore and fit circlip (93), using internal circlip pliers.

g. Fit washers (145) to the spigots and secure the spigots to the brake mounting (96) with the lock nuts. Fit the coil springs over the spigots. Observe the NOTE in Sub-section 8.1, step h.

h. If removed during dismantling, replace adjustment screw (127) and secure with lock nut (128) to brake plate (100).

j. Mount brake plate (100) on the pinion shaft (92).

k. Insert the Woodruffe key (101) into the keyway in the pinion shaft (92) and assemble the brake lining plate to the pinion shaft.

m. Screw the knurled nut onto the threaded part of pinion shaft (92). Align the holes in the brake lining plate with a pair of holes in the knurled nut. Insert the two Allen screws.

n. Invert the assembly and position in a press so that the face of the pinion is supported on the press bed. Fit bearing (104) over the end of pinion shaft (92), so that the wiper is facing the pinion. Align the bearing squarely with the pinion shaft and press the bearing onto the shaft.

p. Use external circlip pliers to fit circlip (108).

q. Assemble flanged bearing housing (106) to the back plate (107) and secure in position using screws (105).

r. Assemble bush (109) on bearing housing (106) and mount the interlocking drum (111), complete with the handwheel assembly, on the bush.

s. Carefully insert handwheel spindle (103) into the bore of pinion shaft (92) so that the end of the spindle locates in the Oilite bearing (102). Secure back plate (107) to the brake mounting (96) with screws (105).

t. Assemble brake lifting levers (147 and 154) to their respective spigots (azimuth assemblies only).

u. Secure the two halves of the brake attachment linkage to the brake mounting. (Elevation assemblies only, refer to Part One, Figure 4.17-4).

v. Check brake as detailed in Part Two, Section One, Sub-section 5.2.1, steps a. to f.

w. Check that when the brake is manually lifted, the BRAKES ON/BRAKES OFF microswitch (123) operates just before brake plate (100) makes contact with the solenoid housing, and switches back just before the brake is fully applied.

10. RENEWING D.C. DRIVE MOTOR ARMATURE

10.1 PROCEDURE

With the d.c. drive motor removed from the drive assembly and transported to a suitable working area, proceed as follows:

a. Ensure that the alignment position for the blower unit is clearly marked, then unclamp the unit and remove.

b. Mark precisely the position of the brush box/ terminal bar assembly relative to the body and end cover of the motor to ensure correct alignment if it should be disturbed during dismantling.

c. Remove the brush springs and brushes by lightly pressing together the U-shaped brass spring.

d. Remove the screws securing the bearing inner cap at the non-driving end. Do not disturb the screws clamping the brush box/terminal bar assembly.

e. Remove the driving end band cover.

f. Stand the motor on its commutator end cover and remove the screws securing the driving end cover.

g. Withdraw the armature complete with bearings.

h. Remove the bearings, using a bearing extractor, and remove the bearing inner cap from the non-driving end of the shaft.

j. Clean the bearing inner cap and place it on the non-driving end of the shaft of the replacement armature.

k. Fit the bearings to the replacement armature.

NOTE: If the serviceability of the bearings is in doubt, fit new bearings. Bearings are pre-packed with grease.

m. Insert the replacement armature into the yoke of the motor, carefully locating the non-driving bearing in its housing in the end cover.

n. Secure the driving end cover to the body of the motor with the four securing screws.

p. Secure the bearing inner cap to the commutator end cover.

q. Check that the brush box/terminal bar assembly has not been disturbed and that the RFI suppression capacitor is securely connected.

r. Replace the brushes and brush springs. Check that the brushes move freely in their boxes without the brush leads fouling the boxes.

s. Check that all bolts are tight and that the armature rotates freely.

t. Replace the driving end band cover.

u. Replace the blower unit, ensure that it is correctly positioned on the d.c. drive motor and tighten the clamping screw.

11. REMOVAL OF ELEVATION SPHERICAL ROLLER BEARING (Figure 3.11-1)

11.1 SPECIAL TOOLS

A special tool kit, designed for the removal and replacement of the elevation and azimuth bearings, is available for work on these bearings. Each kit comprises the following items:

Pulling device	: Type GMH7063530	: (1)
Installation device - lower azimuth bearing	: Type GMH7063517	: (1)
Traction lift, 1.5 tons	: Type BBC3046	: (1)
Rope loop, 11 mm diameter, 1.5 mm length	: Type BBC3301	: (2)
Lucas press, HP20/50	: Type BBC3040	: (2)

High pressure hose, 450 kp/cm^2,NW6/3 m length	: Type BBC3040	: (2)
Handpump ZKP10/25	: Type BBC3043	: (1)
Oil pump	: Type SKF226400A	: (1)
Pump support	: Type SKF227982	: (1)
High pressure hose	: Type SKF227957	: (1)
Hammering spanner	: Type SKF718910	: (1)
Hammering spanner	: Type SKF718911	: (1)
Withdrawing nut	: Type SKF HML43T	: (1)
Toolkit for above listed items		: (1)
Withdrawal clamp	: Type GMH7064498	: (1)
Withdrawal bolt	: Type GMH7064499	: (2)
Installation device - elevation bearings	: Type GMH7063518	: (1)
Compression ring	: Type GMH7762265	: (1)
Interlocking bolt	: Type GMH7064430	: (4)

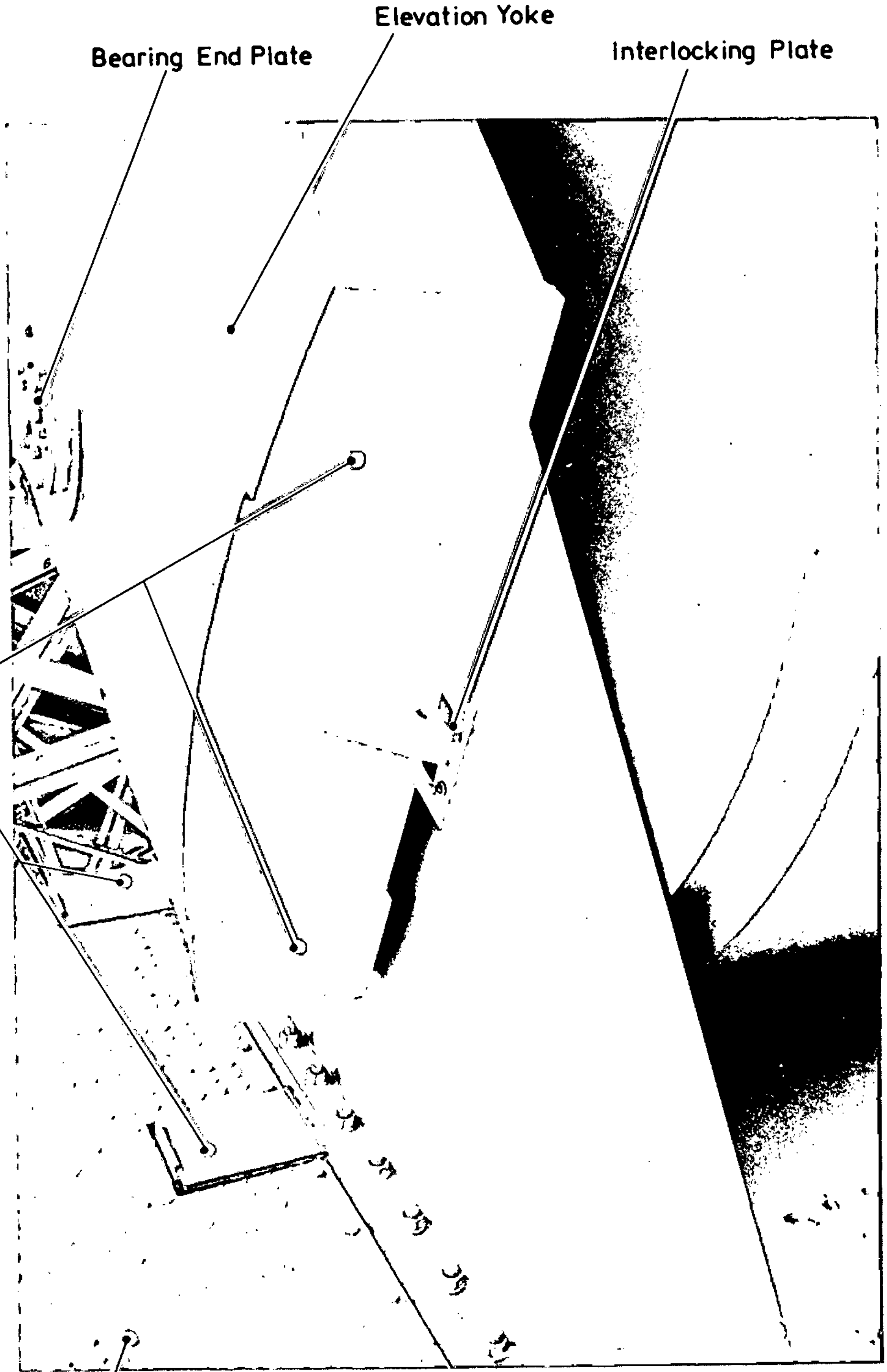
NOTE: If the bearing to be removed is the left-hand bearing (elevation cabin side) then the elevation data pick-up unit must be removed (refer to Sub-section 17).

If the bearing to be removed is the right-hand bearing then the bearing access cover plate, in the azimuth cabin, must first be removed.

11.2 PROCEDURE (Part One, Figure 2.4-3)

a. Interlock the azimuth and elevation yokes using the four interlocking bolts.

b. Position the two hydraulic presses on the platform jacking pads under the elevation yoke on the side from which the bearing is to be removed. Support the weight of the yoke on the presses.



Elevation Yoke Jacking Pads

Fig. 3.11-1

c. Remove the end cover. Using feeler gauges measure the gap between the hydraulic sleeve and the bearing as indicated. Note the measurement.

d. Remove the locking nut and locking plate (left-hand bearing only).

e. Remove the compression ring (right-hand bearing only).

f. Connect the oil pump to the hydraulic connector on the hydraulic sleeve.

g. Using the oil pump remove the tapered hydraulic sleeve from the pivot shaft.

h. Remove the bearing housing securing screws.

j. Using the bearing housing securing screws, jack the bearing housing, complete with the spherical roller bearing, from the trestle.

k. Remove the bearing housing, complete with spherical roller bearing, from the pivot shaft.

NOTE: The bearing housing assembly can be lifted from the pivot shaft by two men, without the aid of lifting gear.

12. REPLACING THE ELEVATION SPHERICAL ROLLER BEARING (Part One, Figure 2.4-3)

12.1 SPECIAL TOOLS

Refer to Sub-section 11.1.

12.2 PROCEDURE

With the azimuth and elevation yokes interlocked and the elevation yoke supported on the two presses, proceed as follows:

a. Lift the bearing housing, complete with spherical roller bearing, on to the pivot shaft and secure to the trestle with the securing screws.

NOTE: The bearing housing assembly can be lifted into position by two men, without the aid of lifting gear.

b. Fit the hydraulic sleeve to the pivot shaft.

c. Left-hand bearing only. Fit the locking plate and locking nut. Tighten the locking nut to press the hydraulic sleeve into position. Check with feeler gauges, as indicated, and ensure that the gap between the hydraulic sleeve and the bearing is the same as that noted in Sub-section 11.2, step c. Secure the locking nut with the locking plate.

d. Right-hand bearing only. Fit the compression ring and tighten its securing screws to press the hydraulic sleeve into position. Check with feeler gauges, as indicated, and ensure that the gap between the hydraulic sleeve and the bearing is the same as that noted in Sub-section 11.2, step c.

e. Ensure that the bearing is adequately greased with BP Aero Grease 31B1 and that the end cover is approximately half-filled with the same grease.

f. Fit the end cover and secure with the securing screws.

g. Remove the hydraulic presses and interlocking bolts.

h. Left-hand bearing only. Replace the elevation data pick-up unit as detailed in Sub-section 18.

j. Right-hand bearing only. Replace the bearing access cover plate in the azimuth cabin.

13. REMOVAL OF LOWER AZIMUTH BEARING (Part One, Figures 4.24-3 and 5.5-1)

13.1 SPECIAL TOOLS

Refer to Sub-section 11.1.

13.2 PROCEDURE

a. Remove the azimuth data pick-up unit as detailed in Sub-section 17.

b. Install the pulling device and the hydraulic presses as shown in Part One, Figure 5.5-1, and connect the handpump and hoses to the presses.

c. Fit two eyebolts to the top face of the bearing and attach the rope loops and traction lift. Secure the upper rope loop around the cross-member near the top of the rotary column and ensure that the ropes are tight and ready to take the weight of the bearing.

d. Tighten the vertical and horizontal setting bolts to support the weight of the rotary column.

e. Release the screws securing the bearing pivot shaft to the rotary column and remove the nuts and bolts securing the flange of the bearing housing to the tower.

f. Operate the hydraulic presses and slowly release the traction lift until the bearing and its housing are clear of the tower base.

g. Release the pressure in the hydraulic presses and remove the presses and pulling device.

h. Assemble the block and connection bridge of the installation device and locate the carriage under the bearing.

j. Lower the bearing on to the carriage. Remove the traction lift and rope loops.

14. REPLACING LOWER AZIMUTH BEARING (Part One, Figures 4.24-3 and 5.5-1)

14.1 SPECIAL TOOLS

Refer to Sub-section 11.1.

14.2 PROCEDURE

a. Assemble the block and connection bridge of the installation device and mount the carriage on the connection bridge.

b. Fit two eyebolts to the top face of the bearing and, using suitable lifting gear, lift the bearing on to the carriage. Position the carriage under the tower base.

c. Assemble the traction lift and rope loops as shown. Secure the upper rope loop around the cross-member near the top of the rotary column.

d. Lift the bearing into position using the traction lift.

e. Secure the bearing housing flange to the tower and the bearing pivot shaft to the rotary column. Tighten all securing screws and nuts.

f. Disconnect and remove the traction lift and rope loops.

g. Slacken the vertical and horizontal setting bolts to release the rotary column.

h. Remove the lifting gear.

15. REMOVAL OF UPPER AZIMUTH BEARING ROLLER (Part One, Figure 5.7-1)

15.1 SPECIAL TOOLS

Refer to Sub-section 11.1.

15.2 PROCEDURE

a. Remove the four bolts (9) and locking washers (10) and remove retaining plate (5).

b. Extract the two half-round (Woodruffe) keys (6) from the end of shaft (3).

c. Turn shaft (3) until bearing roller (8) is clear of the inner face of the azimuth toothed ring (1).

d. Remove stud (11) and nut (12) from spacer (4).

e. Attach the withdrawal clamp and bolts to the end of shaft (3).

f. Tighten the withdrawal bolts evenly and extract shaft (3). Remove bearing roller (8) and spacer (4) as the shaft is extracted.

16. REPLACING UPPER AZIMUTH BEARING ROLLER (Part One, Figure 5.7-1)

16.1 PROCEDURE

a. Insert shaft (3) into the lower of the two flanges at the top of the rotary column.

b. Fit spacer (4) and bearing roller (8) to the shaft.

c. Locate the end of shaft (3) in the recess in the upper flange of the rotary column. Using a lead or copper faced hammer, carefully drive the shaft fully into the recess.

d. Turn shaft (3) until bearing roller (8) makes contact with the inner face of the azimuth toothed ring (1).

e. Fit the two half-round (Woodruffe) keys (6) and retaining plate (5) to the lower end of shaft (3). Secure the retaining plate with the four bolts (9) and locking washers (10).

f. Align the hole in spacer (4) with the corresponding hole in shaft (3) and secure the spacer in position using stud (11) and nut (12).

17. REMOVAL OF DATA PICK-UP UNIT (Part One, Figures 2.3-6 and 2.9-1)

CAUTION: THE DATA PICK-UP UNIT IS A DELICATE PIECE OF EQUIPMENT AND MUST, THEREFORE, BE HANDLED WITH GREAT CARE DURING REMOVAL AND REPLACEMENT.

NOTE: Before commencing removal of the unit, set the antenna to $+90^{\circ}$ in elevation and to $+180^{\circ}$ in azimuth and insert the elevation and azimuth stow pins.

17.1 PROCEDURE

a. Unplug the electrical cables at the unit terminal box.

b. Secure the casing and shaft with the transportation clamp provided.

c. Disconnect the reference lever from the casing and reference point.

d. Tighten the three stop screws in the casing to lock the hollow shaft.

e. Slacken the clamping ring which secures the hollow shaft of the data pick-up unit to the mounting shaft and remove the data pick-up unit.

NOTE: The azimuth unit is provided with a catch to hold the unit in position while the clamping ring is slackened.

The following steps f. and g. should only be carried out if absolutely necessary for the purpose of the work being undertaken at the time, as disturbance of the mounting shaft and intermediate flange may affect alignment.

f. Remove the screws and cotter-pin securing the mounting shaft to the intermediate flange and remove the mounting shaft.

g. Remove the screws securing the intermediate flange to the bearing pivot shaft and remove the intermediate flange.

18. REPLACEMENT OF DATA PICK-UP UNIT (Part One, Figures 2.3-6 and 2.9-1)

NOTE: Ensure that the antenna is set to $+90^{\circ}$ in elevation and $+180^{\circ}$ in azimuth with both stow pins engaged before commencing replacement.

Observe the CAUTION at the beginning of Sub-section 17.

18.1 PROCEDURE

NOTE: Steps a. and b. are only necessary if the mounting shaft and intermediate flange have been removed.

a. Screw the intermediate flange to the bearing pivot shaft.

b. Screw and cotter-pin the mounting shaft to the intermediate flange, aligning the location marks.

NOTE: The mounting shaft and intermediate flange are manufactured as a matched set and must therefore be used together. Axial misalignment will degrade the accuracy of position measurement.

c. Clean the mounting shaft with a lint free cloth and inspect the surface for damage or unevenness. Coat the shaft with a thin layer of Belzona anti-seize grease.

d. Carefully slide the hollow data pick-up shaft over the mounting shaft.

e. Rotate the data pick-up unit, applying slight axial pressure to locate the pin at the bottom of the hollow shaft in the slot in the mounting shaft.

f. Clamp the hollow shaft of the data pick-up unit to the mounting shaft, using the clamping ring.

NOTE: The azimuth unit is provided with a catch to hold the unit in position until the clamping ring is secured.

g. Secure the reference lever to the casing and reference point.

h. Slacken, but do NOT remove, the three stop screws in the casing to permit the hollow shaft to turn freely in the casing.

j. Remove the transportation clamp.

k. Plug the electrical cables to the unit terminal box.

m. Align the data pick-up unit. Refer to the commissioning procedure in the Antenna Servo, Drive and Control Sub-system Handbook No. 601.

19. CABIN AIR CONDITIONING PLANT

WARNING: A REFRIGERATION SPECIALIST MUST BE CALLED IN TO PERFORM ANY MAINTENANCE TASKS WHICH INVOLVE COMPRESSOR OIL OR COOLANT REPLENISHMENT.

19.1 CHANGING THE COMPRESSOR OIL

The compressor oil should be changed after an initial running period of 200 hours, subsequently after 800 hours and 3,000 hours and thereafter it need only be changed every 6,000 hours.

19.1.1 Special Tools and Materials

Manometer (16 atmospheres)

Adapter for manometer - 1/4 in to 7/16 in UNF

Tray for oil (approximately 5 litres capacity)

Funnel (to fit oil filler hole)

Oil - dried Shell Clavus 933 (3 litres)

Suction pipe - (Order No. 13-601)

Bottle of coolant, Type R114 (Type F114 in N. America).

19.1.2 Procedure

a. Remove the screw plug from the compressor suction valve and fit the manometer.

b. Turn the spindle of the suction valve approximately two turns clockwise.

c. Run the compressor until the manometer indicates zero. Stop the compressor.

d. Turn the spindle of the compressor pressure valve fully clockwise. Remove the screw plug.

e. Place the tray in position under the compressor drain screw at the rear of the compressor. Remove the screw and allow the oil to drain into the tray.

f. Replace the drain screw and remove the tray.

g. Remove the oil filler plug at the top, front of the compressor.

h. Using the funnel, pour the 3 litres of oil into the filler hole. Check that the level is approximately half-way up the oil sight-glass.

j. Replace the filler plug.

k. Turn the spindle of the compressor suction valve fully counter-clockwise and remove the manometer.

m. Fit the adapter to the compressor suction valve.

n. Connect the suction pipe between the adapter and the coolant bottle.

p. Hold the bottle with the valve uppermost, open the bottle valve and allow the gas to pass through the compressor and out of the hole on the pressure valve for at least 10 seconds. While the gas is still passing, turn the spindle of the pressure valve fully counter-clockwise.

q. Close the bottle valve and disconnect the bottle from the compressor suction valve. Remove the adapter and replace the screw plug.

r. Replace the pressure valve screw plug but do not fully tighten.

s. Turn the spindle of the pressure valve slowly clockwise and allow the gas to escape from around the screw plug for about two seconds.

t. Turn the spindle of the pressure valve fully counter-clockwise then tighten the screw.

CAUTION: BEFORE PUTTING THE AIR CONDITIONING PLANT INTO OPERATION ENSURE THAT THE SPINDLES OF THE COMPRESSOR SUCTION AND PRESSURE VALVES AND THE COLLECTOR VALVE ARE ALL TURNED FULLY COUNTER-CLOCKWISE.

19.2 CHECKING THE COOLING SYSTEM FOR LEAKS

19.2.1 Special Tools and Materials

Multi-purpose spanner - Belzer R6950M, Type Lilliput II

Spanner adapter, 10 mm square - No. 10-010

Nitrogen bottle

Pressure reducing valve

Manometer (16 atmospheres)

Adapter for manometer - 1/4 in to 7/16 in UNF

Nekal solution

19.2.2 Procedure

a. Set the compressor motor isolating fuse-switch (1a1 or 2a1) to OFF.

CAUTION: SET THE DISTRIBUTION SWITCH TO 0 BEFORE MAKING THE FOLLOWING CONNECTION.

b. To open the solenoid valve without running the compressor, make a temporary connection on the terminal blocks inside the control box. Connect L11/8 to L13/1 for the MAIN unit or L12/8 to L13/1 for the SPARE UNIT. Set the DISTRIBUTION switch to 1.

c. Turn the spindle of the collector valve fully counter-clockwise.

d. Fit the pressure reducing valve to the nitrogen bottle.

e. Remove the cap from the collector valve and connect the nitrogen bottle to the collector valve.

f. Turn the spindle of the collector valve three turns clockwise.

g. Remove the screw plug from the compressor suction valve and fit the manometer with the aid of the adapter.

h. Turn the spindle of the suction valve fully counter-clockwise, then approximately two turns clockwise.

j. Open the valve of the nitrogen bottle and check that the manometer indicates a pressure of between 4 and 6 atmospheres.

k. Apply Nekal solution to all the joints of the cooling system. Check for bubbles which will indicate the leak.

m. Repair any leaks as necessary then repeat the check using a nitrogen pressure of 10 atmospheres.

n. Turn the spindle of the compressor pressure valve fully counter-clockwise and loosen the screw plug of the pressure valve. If the valve is fully closed there will be no leak from around the plug. Tighten the plug.

p. Close the valve of the nitrogen bottle and disconnect from the collector valve.

q. Set the spindles of all three valves (i.e. collector, suction and pressure) to their half-way positions to allow the nitrogen to escape from the system.

r. Vacuum test the system as detailed in the following Sub-section.

19.3 COOLING SYSTEM VACUUM TEST

19.3.1 Special Tools

Vacuum pump - Type LK (Order No. 13-600)

Suction pipe (Order No. 13-601)

Tee-piece adapter (Order No. 36-360)

3 x Adapters - Type EN (Order No. 36-173)

Hose, length 1 m, to fit adapters

Manometer (16 atmospheres)

Adapter for manometer - 1/4 in to 7/16 in UNF

Multi-purpose spanner - Belzer R6950M, Type Lilliput II

Spanner adapter, 10 mm square - No. 10-010

19.3.2 Procedure

a. Fit the manometer to the collector valve.

b. Remove the screw plug from the compressor suction valve and fit the tee-piece adapter.

c. Remove the screw plug from the compressor valve and fit one adapter Type EN.

d. Connect the hose between the adapters on the two compressor valves.

e. Connect one end of the suction pipe to the vacuum pump and the other end to the tee-piece adapter.

f. Run the vacuum pump until the manometer indicates a vacuum of -1 atmosphere.

g. Turn the spindles of both compressor valves (suction and pressure) fully counter-clockwise.

h. Stop the vacuum pump.

j. Check the manometer over a period of three hours to ensure that the indicated vacuum remains at -1 atmosphere.

k. Turn the spindle of the collector valve fully counter-clockwise. Disconnect the vacuum pump and remove the adapters and hoses from the compressor. Remove the manometer.

m. Fill the system with coolant as detailed in the following Sub-section.

19.4 FILLING THE COOLING SYSTEM WITH COOLANT

19.4.1 Special Tools and Materials

Multi-purpose spanner - Belzer R6950M, Type Lilliput II

Spanner adapter, 10 mm square - No. 10-010

13 kg bottle of coolant, Type R114. (Type F114 in N. America).

Suction pipe - (Order No. 13-601)

Manometer (16 atmospheres)

Adapter for manometer - 1/4 in to 7/16 in UNF

Container of hot water.

19.4.2 Procedure

a. Replace the screw plug on the compressor pressure valve and fit the manometer to the compressor suction valve.

b. Connect one end of the suction pipe to the bottle of coolant and the other end, loosely, to the collector valve.

c. Open the valve on the bottle, allow the coolant to disperse all the air from the suction pipe then tighten the suction pipe connection at the collector valve.

d. Invert the bottle of coolant so that its valve is downwards.

e. Turn the spindle of the collector valve three to four turns clockwise. The vacuum locked in the system will suck approximately half the coolant from the bottle.

f. Close the valve on the bottle.

g. Stand the bottle in the container of hot water for a few minutes.

h. Invert the bottle and open the bottle valve.

j. Repeat steps f. to h. until the bottle is empty. The bottle is empty when no noise of escaping coolant is heard when step h. is carried out.

k. Check that the level of coolant observed in the sight-glass is between the 1/2 and 2/3 full levels.

m. Set the spindles of all three valves (i.e. collector, suction and pressure) to their fully counter-clockwise positions.

n. Close the bottle valve and disconnect the suction hose from the collector valve. Fit the cap to the collector valve and tighten fully (ensure that a good copper washer is fitted to the cap).

p. Turn the spindle of the suction valve approximately two turns clockwise. Run the compressor and check that the pressure, indicated on the manometer, rises.

q. Stop the compressor. Turn the spindle of the suction valve fully counter-clockwise.

r. Remove the manometer and replace the screw plug on the suction valve.

Read the CAUTION at the end of Sub-section 19.1.2.

19.5 REPLENISHING THE COOLING SYSTEM WITH COOLANT

If the level of coolant observed in the sight-glass is below approximately 1 cm, the system must be replenished with coolant as follows:

19.5.1 Special Tools and Materials

Multi-purpose spanner - Belzer R6950M, Type Lilliput II

Spanner adapter, 10 mm square - No. 10-010

Manometer (16 atmospheres)

Adapter for manometer - 1/4 in to 7/16 in UNF

Suction pipe - (Order No. 13-601)

Bottle of coolant, Type R114 (Type F114 in N. America).

19.5.2 Procedure

a. Remove the cap from the collector valve. Connect one end of the suction pipe to the bottle of coolant and the other end, loosely, to the collector valve.

b. Remove the screw plug from the compressor suction valve and fit the manometer.

c. Open the valve on the bottle, allow the coolant to disperse all the air from the suction pipe, then tighten the suction pipe connection at the collector valve. Invert the bottle so that the valve is downwards.

d. Run the compressor. Turn the spindle of the collector valve fully clockwise.

e. Check the level of the coolant at the sight-glass. When the level observed is between 1/2 and 2/3 full, stop the compressor and turn the spindle of the collector valve fully counter-clockwise.

f. Close the bottle valve and disconnect the suction pipe from the collector valve. Fit the cap to the collector valve and tighten fully (ensure that a good copper washer is fitted to the cap).

g. Turn the spindle of the compressor suction valve approximately two turns clockwise. Run the compressor and check that the pressure, indicated on the manometer, rises.

h. Stop the compressor. Turn the spindle of the suction valve fully counter-clockwise.

j. Remove the manometer and replace the screw plug on the suction valve.

19.6 REMOVING AIR FROM THE COOLING SYSTEM

19.6.1 Special Tools

Manometer (16 atmospheres)

Adapter for manometer - 1/4 in to 7/16 in UNF

Multi-purpose spanner - Belzer R6950M,
Type Lilliput II

Spanner adapter, 10 mm square - No. 10-010

Thermometer (ambient temperature range)

19.6.2 Procedure

a. Switch off the air conditioning unit and leave for 24 hours.

b. Remove the screw plug from the compressor pressure valve and fit the manometer.

c. Turn the spindle of the pressure valve fully clockwise.

d. Note the outside air temperature shown on the thermometer and the pressure as indicated on the manometer. Refer to Table 3.19-1 to obtain the correct value of pressure for the noted temperature.

Table 3.19-1

Coolant Pressure-Temperature Table

Temperature (^{o}C)	Pressure ata
-15	0.476
-10	0.595
-5	0.735
0	0.900
+5	1.092
10	1.318
15	1.574
20	1.867
25	2.201
30	2.579
35	3.005
40	3.478
45	4.01
50	4.59

Temperature (^{o}C)	Pressure ata
55	5.25
60	5.97
65	6.5
70	7.5
75	8.2
80	9.5
85	10.3
90	11.7
95	12.7
100	14.1
105	15.5
110	17.1
115	18.8
120	20.7

If the pressure indicated on the manometer is high, loosen the manometer to vent the air from the system. Tighten the manometer and note the new reading. If the new reading is still high, loosen the manometer to vent the air and retighten the manometer. Repeat until the pressure indicated is in accordance with that given in the table.

e. Turn the spindle of the pressure valve fully counter-clockwise, remove the manometer and replace the screw plug.

f. Remove the screw plug from the compressor suction valve and fit the manometer.

g. Turn the spindle of the collector valve fully clockwise.

h. Run the compressor.

j. Turn the spindle of the suction valve approximately two turns clockwise and check the manometer reading. Reading should be zero and should remain on zero.

k. If the manometer reading rises, stop the compressor, turn the spindles of the suction valve and collector valve to their fully counter-clockwise positions and repeat steps b. to j. until the manometer reading remains on zero.

19.7 REMOVING THE COMPRESSOR DRIVE MOTOR

The compressor motor weighs approximately 50 kg (110 lb) and the removal procedure is likely to require three men. A wooden plank 150 cm x 30 cm x 5 cm (60 in x 12 in x 2 in) can be used to support the weight of the motor during withdrawal. In the case of a SPARE unit replacement, it will be necessary to remove the left-hand control box support pillar as well as a cover plate on the grille surround frame.

19.7.1 Procedure

a. Swing the control box clear of the air conditioning units and remove the air grille. Close the collector valve by turning fully clockwise, to allow the compressor to pump the coolant into the collector.

b. When the under-pressure switch operates, close the compressor suction valve and open the screw on the side of the compressor to release any remaining pressure.

c. Switch the MAIN SWITCH on distribution box RO2 (azimuth cabin) to its O (OFF) position.

d. Note the cable connections to the motor, and disconnect the motor terminals.

e. Isolate the condenser by closing the isolation valves between the compressor and the condenser, and between the collector and the heat exchanger.

f. Disconnect the pipes and remove the condenser from the unit.

g. Use a 13 mm open-ended spanner to release the screw in the centre of the fan.

h. Loosen the fan by turning the wheel puller nut with a 24 mm open-ended spanner. Remove the fan from the motor shaft.

j. Insert the wooden plank between the motor and the compressor.

k. Support the weight of the motor and remove the motor securing bolts. Lower the motor onto the plank and remove the V-belts.

m. Remove the motor from the front of the unit (i.e. towards the cabin).

19.8 INSTALLING THE COMPRESSOR DRIVE MOTOR

19.8.1 Procedure

a. Position the motor in the unit, with the aid of the plank.

b. Fit the V-belts on the motor pulley and secure the motor in position with its securing bolts. Remove the plank.

c. Adjust the tension of the V-belts by means of the adjusting bolts on the motor attachment brackets. There should be 2.5 cm (1 in) total deflection with firm thumb pressure at a point half-way between the pulley wheels.

d. Re-connect the cabling to the motor terminals.

e. Fit the spacer and fan on the shaft at the rear end of the motor. Fit the washer and insert the screw to retain the fan in position.

f. Temporarily switch on the electrical supply and check that the motor runs in the direction indicated by the arrow on the motor casing. Switch off the supply.

g. If the motor does not rotate in the correct direction, check the cable connections at the motor terminals.

h. When the motor rotates in the correct direction, switch off the supply, replace the condenser and reconnect the pipes. Open the isolating valves.

j. Fit all panels to the unit and secure in place. Switch on the power to the unit and carry out a functional check of the cooling system.

k. Replace the support column and return the control box to its correct position.

19.9 RENEWING THE COMPRESSOR

19.9.1 Procedure

a. Swing the control box clear of the air conditioning units and remove the left-hand support pillar. Remove the air grille.

b. Close the suction valve by turning it fully clockwise, to allow the compressor to pump the coolant into the collector.

c. When the under-pressure switch operates, close the pressure valve and open the screw on the side of the compressor to release any remaining pressure.

d. Set the MAIN SWITCH on distribution box RO2 (azimuth cabin) to its OFF position. Disconnect the wiring from the compressor crankcase heaters.

e. Disconnect the flanged connections between the pressure valve and compressor, and between the suction valve and the compressor.

f. Release the bolts in the base of the compressor and remove the V-belts from the compressor pulley. Remove the compressor from the air conditioning unit.

g. Install the new compressor, fit the V-belts over the pulley wheel and insert the securing bolts into the compressor base. Adjust the tension on the V-belts, as described in Sub-section 19.8.1.

h. Connect the pressure valve and suction valve to the compressor, and connect the wiring to the crankcase heater terminals.

j. Check all accessible bolts for tightness.

k. Open the compressor isolating valves by turning them in a counter-clockwise direction. Replace the air grille and support pillar. Reposition the control box in front of the air conditioning units.

m. Switch on the electrical supply to the unit at distribution box R02. Switch on the under-pressure switch, and turn the DISTRIBUTION switch on the control box to 1.

n. Carry out a functional check on the cooling system.

19.10 RENEWING THE FILTER-DRIER

19.10.1 Procedure

a. Switch off the electrical supply to the air conditioning plant by setting the DISTRIBUTION switch on the control box to 0, this action causes the solenoid valve to close.

b. Close the collector valve.

c. Melt the solder joints and remove the filter-drier from the circuit.

d. Fit a new filter-drier (Alco Type GLZ 1462004P1) in position and seal the joints with solder.

e. Release the screws at the flange of the collector valve, to allow any air in the circuit to escape.

f. Tighten the screws and open the collector valve. Check the tightness of the flange screws.

g. Switch on the supply to the air conditioning plant.

Carry out a functional check of the cooling system.

19.11 RENEWING THE SOLENOID VALVE

19.11.1 Procedure

a. Swing the control box clear of the air conditioning units and remove the air grille. Close the suction valve, by turning it fully clockwise, to allow the compressor to pump the coolant into the collector.

b. When the under-pressure switch operates, close the pressure valve and open the screw on the side of the compressor to release any remaining pressure.

c. Set the MAIN SWITCH on distribution box RO2 (azimuth cabin) to OFF. Remove the front plate from the ventilating fan unit and remove the terminal box from inside the unit. Disconnect the electrical connections to the fan.

d. Unsolder the joints and remove the valve from the circuit.

e. Fit the new solenoid valve (BBC Type GLZ 1451002R1). Seal the joints with solder.

f. Connect the solenoid valve electrical connections. Replace the terminal box, fan connections and front plate.

g. Set the MAIN SWITCH on distribution box RO2 to ON. Switch on the under-pressure switch.

h. Carry out a functional check of the cooling system.

19.12 RENEWING THE EXPANSION VALVE

19.12.1 Procedure

a. Swing the control box clear of the air conditioning units and remove the air grille. Close the suction valve by turning it fully clockwise, to allow the compressor to pump the coolant into the collector.

b. When the under-pressure switch operates, close the pressure valve and open the screw on the side of the compressor to release any remaining pressure. Set the MAIN SWITCH on distribution box RO2 (azimuth cabin) to its OFF position.

c. Remove the front plate from the ventilating fan unit, and remove the terminal box from inside the unit, after disconnecting the fan.

d. Unsolder the joints and remove the expansion valve from the circuit.

e. Fit the new expansion valve (Type Flica TMX5 R114) into the cooling circuit. Seal the joints with solder.

f. Replace the terminal box, reconnect the fan and replace the front plate.

g. Set the MAIN SWITCH on distribution box RO2 to ON and switch on the under-pressure switch.

h. Replace the air grille and control box.

j. Carry out a functional check of the cooling system.

19.13 RENEWING THE VENTILATION FAN

19.13.1 Procedure

a. Set the MAIN SWITCH on distribution box RO2 (azimuth cabin) to OFF.

b. Remove the front plate from the fan unit and remove the terminal box from inside the unit.

c. Disconnect the electrical supply leads to the fan.

d. Release the fan securing bolts and remove the fan.

e. Fit the new fan and secure in position.

f. Replace the terminal box, make the electrical connections to the fan and refit the front plate. Switch on the electrical supply to the air conditioning unit and check that the fan runs in the correct direction.

19.14 RENEWING THE V-BELTS

19.14.1 Procedure

a. Swing the control box clear of the air conditioning units and remove the air grille.

b. Switch the MAIN SWITCH on distribution box RO2 (azimuth cabin) to OFF.

c. Slacken the clamp bolts which adjust the V-belt tension, to the fully-slack position.

d. Remove the three V-belts.

e. Fit three new V-belts (Type Conti 12.5 x 1850 to DIN 7753).

f. Adjust the clamp bolts to tension the V-belts, as described in Sub-section 19.8.1.

g. Check that the compressor motor fan blades do not touch the condenser baffle. If necessary, re-position the baffle, after loosening the fixing screws.

h. Replace the front grille and the control box.

j. Switch on the power at distribution box RO2 and carry out a functional check of the cooling system.

19.15 SETTING THE PRESSURE SWITCHES

NOTE: The cooling system pressure switches are calibrated and set by the manufacturer and normally do not require adjustment.

If it is found necessary to check the settings of the pressure switches, carry out the following.

19.15.1 Special Tools

Manometer (20 atmospheres)
Manometer (2 atmospheres)

19.15.2 Procedure

a. Fit Manometers as follows:

i Switch off the air conditioning unit and remove the air intake grille.

ii Remove the screw plug from the compressor suction valve (left-hand side of the compressor) and fit a 20-atmosphere manometer.

iii Remove the screw plug from the compressor pressure valve (right-hand side from the front of the unit) and fit a 2-atmosphere manometer.

iv Run the compressor briefly, then switch off.

v Turn both compressor valve spindles about two turns clockwise and check that the manometers indicate the idle pressure shown in Table 3.19-1 for the ambient temperature.

b. Over-pressure Switch

i Partially obstruct the condenser airflow outlet at the rear of the unit with a piece of cardboard.

ii Start the compressor and observe the rising reading on the 20-atmosphere manometer. At 17.1 ata the over-pressure switch should operate, stopping the compressor motor.

iii If necessary, adjust the pressure setting of the over-pressure switch so that the motor stops when the pressure reaches 17.1 ata, on the manometer.

iv Remove the cardboard and observe the falling manometer reading.

v Check that the compressor motor re-starts when the pressure falls to 14.1 ata.

vi If necessary, adjust the differential setting of the over-pressure switch to achieve step v.

c. Under-pressure Switch

i Blank off the evaporator airflow by blocking the cabin outlet grille with cardboard.

ii Run the compressor.

iii When the inlet manometer reading falls to 0.47 ata, the under-pressure switch should operate, stopping the compressor motor.

iv If necessary, adjust the pressure setting of the under-pressure switch so that the motor stops when the manometer reading falls to 0.47 ata.

v Remove the cardboard from the grille and observe the rising manometer reading. At 0.73 ata, the under-pressure switch should operate again.

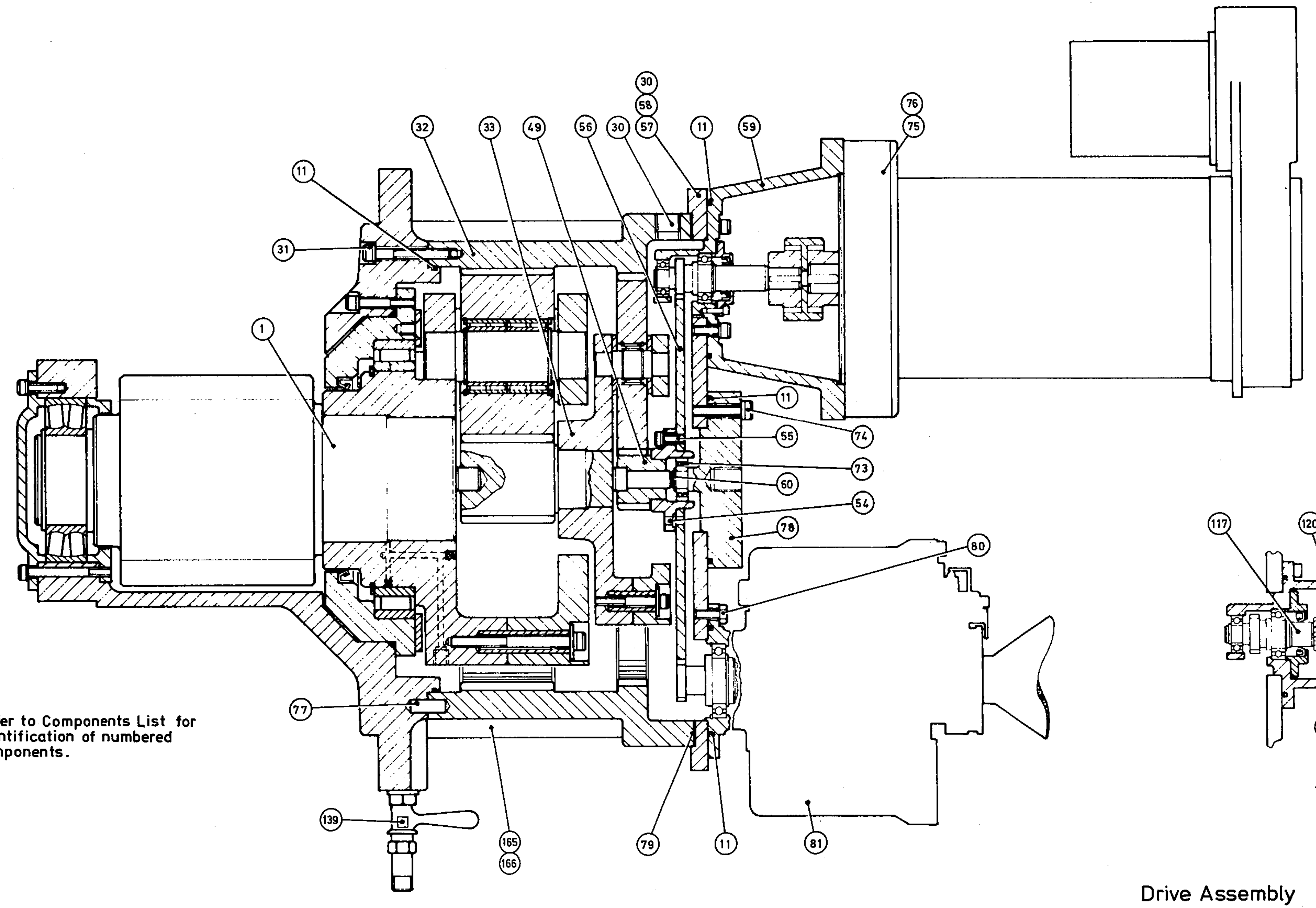
vi If necessary, adjust the differential setting of the under-pressure switch to achieve step v.

vii Switch off the air conditioning unit.

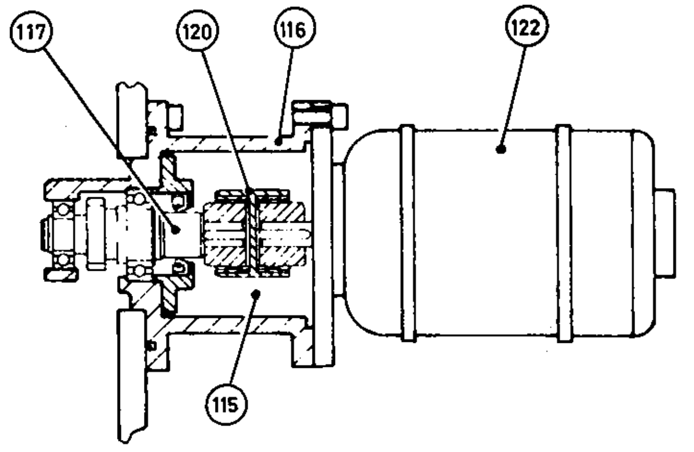
viii Turn the spindles of both compressor valves FULLY COUNTER-CLOCKWISE.

ix Disconnect the two manometers and replace the two screw plugs.

x Replace the air intake grille and switch on the air conditioning unit.



NOTE:
Refer to Components List for identification of numbered components.



Tacho - Generator Mounting Detail

Drive Assembly
Figure 3.6-1
Part 2

NOTE:
Refer to Component List for identification of numbered components.

Brake and Handwheel Assembly (Azimuth)
Figure 3.8-1
Part 2

PART THREE

FAULT LOCATION

LIST OF CONTENTS

SECTION ONE

FIRST LEVEL FAULT LOCATION

SECTION TWO

SECOND LEVEL FAULT LOCATION

PART THREE

SECTION ONE

FIRST LEVEL FAULT LOCATION

1. GENERAL

Fault location on the pedestal is confined to the lighting and ancillary power system and the cabin air conditioning plant. Fault location on the servo and drive equipment and on the other equipment mounted on the pedestal is given in the relevant handbooks.

2. LIGHTING AND ANCILLARY POWER SYSTEM

Faults on the lighting and ancillary power system will be confined to the failure of a filament or a fuse. If a filament fails, renew the lamp. If a fuse fails proceed as follows:

a. Electrically isolate the circuit.

b. Remove the fuse, check that it is of the correct rating and determine the cause of the failure.

c. Rectify the fault.

d. Fit a serviceable fuse of the correct rating and restore the power supply to the circuit.

3. CABIN AIR CONDITIONING PLANT

FIRST LEVEL FAULT LOCATION

Fault	Cause	Action
Electrical supply failure (no indicator lamps light).	a. Loss of 3-phase supply. b. Loss of single phase supply.	a. Check MAIN SWITCH on distribution box R02 is ON. b. Having established that the 3-phase supplies are present, check the 220 V transformer and its associated switches and connections.
Compressor does not run smoothly.	a. Vee-belt faulty. b. Air in coolant pipes.	a. Fit new set of Vee-belts. b. Bleed air from coolant pipes.
MAIN or SPARE UNIT WORKING lamp fails to light.	a. Faulty lamp. b. Faulty time switch.	a. Fit new lamp. b. Establish fault by examination of relay Od3 (Od4). Attempt changeover by adjusting time switch setting.
VENTILATOR ON lamp fails to light.	a. Lamp faulty. b. Fan motor fault.	a. Fit new lamp. b. Check whether protection switch has tripped out. Locate cause of overload.
HEATING ON lamp lights but blown air is not heated.	Heater supply fault.	Check 3-phase connections to heater element.

N A T O U N C L A S S I F I E D

PART THREE

SECTION TWO

SECOND LEVEL FAULT LOCATION

1. CABIN AIR CONDITIONING PLANT   SECOND LEVEL FAULT LOCATION

(Refer to Part One, Figures 2.10-5 to 2.10-8)

Fault	Cause	Action
Blown air is not cooled during warm cabin condition	a. Compressor fails to start.	a. Check drive motor protection switch and contactor. Check pressure switch.
	b. Compressor fails to start except when selector switch is set to COOLING (other selector switch OFF).	b. Locate fault associated with: i Od3 (Od4) ii Od1 iii 1c2 (2c2)
	c. Fault in thermostat.	c. Readjust or renew component.
Pressure switch open	a. Overpressure in cooling system due to an air lock or contaminated condenser.	a. Bleed air from coolant pipes; top up with coolant. Clean condenser.
	b. Underpressure in cooling system due to lack of coolant or contaminated filter-drier.	b. Top up coolant or renew filter drier.
Blown air not warmed when cabin temperature is below cabin thermostat setting.	a. Heater isolation switch set to OFF.	a. Switch on.
	b. Heater supply fault.	b. Check 3-phase supply leads to heater.
	c. Relay Od2 not energized due to faulty thermostat or its associated connections.	c. Locate faulty component.

Fault	Cause	Action
Ventilator fan operates only when selector switch is set to HEATING or COOLING.	'Unit ready' relay 0d3 (0d4) fails to operate.	Check time switch and its assocaited circuits to 0d3 and 0d4.
Compressor motor fails to operate when selector switch is at COOLING (Remaining selector switch OFF).	a. Protection switch tripped out. b. Under-pressure switch open. c. V-belts slipping. d. Fault in contactor 1c1 (2c1). e. Faulty drive motor/connections.	a. Establish cause of overload. b. Investigate as previously stated. c. Adjust V-belts. d. Replace faulty contactor. e. Replace motor or repair connection.
Under-pressure switch switches on and off at frequent intervals. Nominal cabin temperature not reached.	a. Air filter dirty. b. Lack of coolant.	a. Clean or renew air filter. b. Determine reason and rectify.
Rise in temperature of cooling air, caused by condenser temperature near to ambient temperature.	Leakage of coolant from cooling circuit.	Determine cause and rectify; replenish coolant.
Frost forming on the pipe-line near the compressor.	a. Thermostatic expansion valve open, does not control, may be frozen. Expansion valve sensor loose. b. Drier or drier-filter blocked.	a. Examine valve, thaw if necessary, renew valve. b. Renew filter-drier.

PART FOUR

COMPONENTS LIST

LIST OF CONTENTS

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N A T O   U N C L A S S I F I E D

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COMPONENTS LIST

EQUIPMENT: PEDESTAL

ASSEMBLY: GENERAL ASSEMBLY

Item No.	Description	No. Off	Manufacturer	Manufact.Type or Drawing Nos.	NATO Stock No.
	Base ring with adjusting device, complete (4 segment parts)	1	BBC, Mannheim	GMH 6967/613a	
	Tower, complete, with catwalk	1	MAN,Gustavsburg	GMH 6967/614	
	Rotary column	1	MAN,Gustavsburg	GMH 6967/615	
	Azimuth yoke	1	MAN,Gustavsburg	GMH 6967/616	
	Elevation bearing trestle (a) for data pick-up installation	1	MAN,Gustavsburg	GMH 6967/616	
	(b) normal	1			
	Azimuth yoke annexe, complete with side platforms, hand railings, opening covers	1	MAN,Gustavsburg	GMH 6967/617	
	Elevation yoke, complete, with elevation cabin (three parts)	1	MAN,Gustavsburg	GMH 6967/618 GMH 6967/620	
	Azimuth cabin	1	MAN,Gustavsburg	GMH 6967/620	
	Roller-mounted platform (with support for cabin control panel)	1	BBC, Mannheim	GMH 6967/542	
	Sealings for azimuth yoke and azimuth yoke annexe	1 Set	BBC, Mannheim	GMH 7064/493	

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Iss. 1

N A T O   U N C L A S S I F I E D

COMPONENTS LIST

EQUIPMENT: PEDESTAL

ASSEMBLY: GENERAL ASSEMBLY (Cont'd.)

Item No.	Description	No. Off	Manufacturer	Manufact.Type or Drawing Nos.	NATO Stock No.
	Ladder	1	BBC, Mannheim	GMH 7064/647	
	Tower anchor bolts	12	MAN,Gustavsburg	GMH 7064/412	
	Tower setting screws	4	MAN,Gustavsburg	GMH 7064/424	
	Tower jacking screws	6	MAN,Gustavsburg	GMH 7064/427	
	Interlocking bolt for azimuth/elevation yoke	4	MAN,Gustavsburg	GMH 7064/430	
	Pivot shaft for elevation bearing (data pick-up side)	1	MAN,Gustavsburg	GMH 7064/432	
	Pivot shaft for elevation bearing	1	MAN,Gustavsburg	GMH 7064/433	
	Bolt for stow-pin	2	MAN,Gustavsburg	GMH 7064/436	
	Azimuth toothed ring	1	MAN,Gustavsburg	GMH 7064/464	
	Elevation toothed segment	1	MAN,Gustavsburg	GMH 7064/467	
	Lightning protection brush contact	3	BBC, Mannheim	GMH 7064/541	
	Elevation bearing	2	MAN,Gustavsburg	GMH 6167/622	
	Lower azimuth bearing	1	MAN,Gustavsburg	GMH 6967/623	
	Stow-pin, elevation and azimuth	2	MAN,Gustavsburg	GMH 6967/624a	

COMPONENTS LIST

EQUIPMENT: PEDESTAL   ASSEMBLY: GENERAL ASSEMBLY (Cont'd.)

Item No.	Description	No. Off	Manufacturer	Manufact.Type or Drawing Nos.	NATO Stock No.
	Upper azimuth bearing (comprising 12 bearing rollers)	1	MAN,Gustavsburg	GMH 6967/642	
	Buffer, elevation and azimuth	2	MAN,Gustavsburg	GMH 6967/673	
	Cable wrap (without cables)	1	BBC,Mannheim	GMH 6967/595	
	Azimuth yoke sealing with plates and cabin bushing	1 Set	BBC,Mannheim	GMH 7067/538 GMH 7067/520 GMH 7067/519 GMH 7067/518	
	Protection plate for limit switch	2 2	BBC,Mannheim	GMH 7067/513 GMH 7067/514	
	Support for lighting system (side platform, azimuth yoke)	2	BBC,Mannheim	GMH 7067/511	
	Datum plate for spirit levels	1	BBC,Mannheim	GMH 7067/501	
	Spirit levels (complete assembly) with accessories	1	BBC,Mannheim	GMH 6967/578	
	Plate metal sheeting with tension band	1 Set	BBC,Mannheim	GMH 6967/528	
	Connector plate P1 (two parts)	1	BBC,Mannheim	GMH 6967/645 GMH 6967/646	
	Connector plate P2	1	BBC,Mannheim	GMH 6967/644	

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COMPONENTS LIST

EQUIPMENT: PEDESTAL

ASSEMBLY: GENERAL ASSEMBLY (Cont'd.)

Item No.	Description	No. Off	Manufacturer	Manufact.Type or Drawing Nos.	NATO Stock No.
	Emergency limit switch	4	Schmersal	TD441-11Yt	
	Range limit switch	2	Schmersal	M2C441-11Yt	
	Bracket for azimuth range and limit switches	4	BBC,Mannheim	GMH 6967/684	
	Bracket for elevation limit switch	2	BBC,Mannheim	GMH 6967/687	
	Striker (cam type) for AZ limit switch	1	BBC,Mannheim	GMH 6967/686	
	Striker (cam type) for EL limit switch	1	BBC,Mannheim	GMH 6967/688	
	Striker (pin type) for AZ range switch	1	BBC,Mannheim	GMH 6967/685	
	Lightning protection cable (for elevation bearings)	2	BBC,Mannheim		
	Profile rubber	7 m (70 mm x 8 mm)	BBC,Mannheim		
	Profile rubber	7 m (15 mm x 8 mm)	BBC,Mannheim		
	Rubber plate with drillings	(168 mm x 68 mm x 8 mm)	BBC,Mannheim		
	Sponge rubber, round profile	3.5 m (50 mm dia)	BBC,Mannheim		

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COMPONENTS LIST

EQUIPMENT: PEDESTAL ASSEMBLY: GENERAL ASSEMBLY (Cont'd.)

Item No.	Description	No. Off	Manufacturer	Manufact.Type or Drawing Nos.	NATO Stock No.
	Sponge rubber, round profile	2 m (50 mm dia)	BBC, Mannheim		
	Sponge rubber, round profile	11 m (30 mm dia)	BBC, Mannheim		
	Sponge rubber profile	3 m (30 mm x 20 mm)	BBC, Mannheim		
	Cabin Air Conditioning Plant				
	Pedestal Lighting and Ancillary Power				
	Drive Assembly				

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COMPONENTS LIST

EQUIPMENT: PEDESTAL

ASSEMBLY: CABIN AIR CONDITIONING PLANT

Item No.	Description	No. Off	Manufacturer	Manufact.Type or Drawing Nos.	NATO Stock No.
	Control Box			APV 712/1538	
	Cabin Outlet Air Ducting			MA 1184-1	
	Cabin Inlet Air Ducting			MA 1184-2	
	Main and Spare Units				

COMPONENTS LIST

EQUIPMENT: CABIN AIR CONDITIONING PLANT

ASSEMBLY: CONTROL BOX (APV 712/1538)
(Part One, Figures 4.23-6 and 4.23-7)

Cct.Ref.	Value	Description	Rating	Tol.	Manufacturer	Manufact.Type or Drawing Nos.	NATO Stock No.
1a1 and 2a1		Isolating fuse-switch (3-phase) 50 Hz			BBC	M631,1s,16-25A	
1a1 and 2a1		Isolating fuse-switch (3-phase) 60 Hz			BBC	GRH63,1s,38-63A	
1a2 and 2a2		Isolating fuse-switch (3-phase) 50 Hz			BBC	M611,1s,0,6-1A	
1a2 and 2a2		Isolating fuse-switch (3-phase) 60 Hz			BBC	M611,1s,1,6-2.5A	
1a3 and 2a3		Isolating fuse-switch (3-phase) 50 Hz			BBC	S203L,1s 10A	
1a3 and 2a3		Isolating fuse-switch 60 Hz			BBC	S203L,1s 10A	
1c1 and 2c1		Contactor, (50 Hz)			BBC	SLA 32,24+20 22 OV 50 Hz	
1c1 and 2c1		Contactor, (60 Hz)			BBC	SLA 60,25+20 22 OV 60 Hz	
1c2, 2c2, 1c3, and 2c3		Contactor, (50 Hz)			BBC	SLA 7,25+20 22 OV 50 Hz	
1c2, 2c2, 1c3, and 2c3		Contactor, (60 Hz)			BBC	SLA 7,25+20 22 OV 60 Hz	
0e3		Isolating fuse-switch			BBC	S202L,6A	
0d5		7-day time switch			Grässlin	WU TU 220V 50Hz	
0d5		7-day time switch			Grässlin	WU TU 220V 60Hz	
0d1, 0d2, 0d3 and 0d4		Relay			BBC	HSA 62 22 OV 50 Hz	
0d1, 0d2, 0d3 and 0d4		Relay			BBC	HSA 62 22 OV 60 Hz	

N A T O   U N C L A S S I F I E D

COMPONENTS LIST

EQUIPMENT: CABIN AIR CONDITIONING PLANT

ASSEMBLY: CONTROL BOX (APV 712/1538) (Cont'd.)
(Part One, Figures 4.23-6 and 4.23-7)

Cct.Ref.	Value	Description	Rating	Tol.	Manufacturer	Manufact.Type or Drawing Nos.	NATO Stock No.
1d2 and 2d2		Relay			BBC	HSA 44 22 OV 50 Hz	
1d2 and 2d2		Relay			BBC	HSA 44 22 OV 60 Hz	
1d1 and 2d1		Delay time switch			Dold	ZR1u704	
Ob1		Switch			Solenoid	2Ef Front Table P54	
1b1 and 2b1		Selector switch, 4-way six-pole			Solenoid		
Om3		Transformer 250 VA, 380/220 V 50 Hz			BBC	GLZ 1267655	
Om3		Transformer 250 VA, 208/220 V			BBC	GLZ 1267656	
Ob2		Pushbutton switch			Siemens	P54	
Oh1 to Oh3 1h1 to 1h4 2h1 to 2h4		Indicator lampholder			Siemens	P54	
		Lamp bulb 220 V			Siemens	DIN49-810	
Oe2		Outside thermostat			Danfoss	RT 34	

COMPONENTS LIST

EQUIPMENT: CABIN AIR CONDITIONING PLANT

ASSEMBLY: CABIN OUTLET AIR DUCTING (MA 1184-1)
(Part One, Figure 4.23-4)

Item No.	Description	No. Off	Manufacturer	Manufact.Type or Drawing Nos.	NATO Stock No.
-	Ducting section	1	Grünzweig & Hartmann AG	MA 1184-40	
-	Ducting section	1	Grünzweig & Hartmann AG	MA 1184-50	
-	Ducting section	1	Grünzweig & Hartmann AG	MA 1184-60	
-	Ducting section	1	Grünzweig & Hartmann AG	MA 1184-70	
Om2	Rotary actuator (50 Hz)	1	Sauter	AR 31 WA-A 1-25/3-36 220 V 50 Hz	
Om2	Rotary actuator (60 Hz)	1	Sauter	AR 31 WA-A 1-26/3-36 220 V 60 Hz	

COMPONENTS LIST

EQUIPMENT: CABIN AIR CONDITIONING PLANT

ASSEMBLY: CABIN INLET AIR DUCTING (MA 1184-2)
(Part One, Figure 4.23-3)

Item No.	Description	No. Off	Manufacturer	Manufact.Type or Drawing Nos.	NATO Stock No.
-	Ducting section	1	Grünzweig & Hartmann AG	MA 1184-10	
-	Ducting section	1	Grünzweig & Hartmann AG	MA 1184-20	
-	Ducting section	1	Grünzweig & Hartmann AG	MA 1184-30	
Om1	Rotary actuator (50 Hz)	1	Sauter	AR31 WA-A 1-25/3-36 220 V 50 Hz	
Om1	Rotary actuator (60 Hz)	1	Sauter	AR31 WA-A 1-26/3-36 220 V 60 Hz	

COMPONENTS LIST

EQUIPMENT: CABIN AIR CONDITIONING PLANT

ASSEMBLY: MAIN AND SPARE UNITS
(Part One, Figure 4.23-2)

Item No.	Description	No. Off	Manufacturer	Manufact.Type or Drawing Nos.	NATO Stock No.
1	Main framework assembly	1	BBC	GLZ6557040R1	
2	Compressor ES.25	1	BBC	MY1100063R1	
3	Motor, compressor drive 120-208 V, 60 Hz (1m1 and 2m1)	1	BBC	GLZ1211055R1	
4	Motor, compressor drive 220-380 V, 50 Hz (1m1 and 2m1)	1	BBC	GLZ1211055R2	
5	Pulley wheel, compressor motor	1	Wesmag	-	
6	V-belt 12.5 x 1850 to DIN7753	3	Conti	-	
7	Condenser	1	BBC	GLZ1321041R1	
8	Fan wheel, compressor motor	1	BBC	GLZ1611014R1	
9	Air duct, compressor motor	1	BBC	GLZ1631005R1	
10	Heat-exchanger	1	BBC	MY1335013R1	
11	Filter-drier	1	Alco	GLZ1462004P1	
12	Cover plate	2	BBC	GLZ6557038R1	
13	Front grille	1	BBC	GLZ1632001R1	
14	Under-pressure switch (60 Hz)	1	Danfoss	RT 1	
15	Over-pressure switch (60 Hz)	1	Danfoss	RT 5	

COMPONENTS LIST

EQUIPMENT: CABIN AIR CONDITIONING PLANT

ASSEMBLY: MAIN AND SPARE UNITS (Cont'd.)
(Part One, Figure 4.23-2)

Item No.	Description	No. Off	Manufacturer	Manufact.Type or Drawing Nos.	NATO Stock No.
16	Washer, compressor drive motor (DIN1542, QST34-2)	1	-	-	
17	Pressure pipe (DIN2391 RST35)	1	-	-	
18	Pair of flanges	1	BBC	MYM448515	
19	Pair of flanges	1	BBC	MYM448515	
20	Washer, compressor motor	1	-	-	
21	Bracket, heat exchanger (DIN1541 St)	2	-	-	
22	Pipe bracket (DIN1597)	1	Rasmussen	-	
23	Pipe bracket (DIN1597)	1	Rasmussen	-	
24	Nameplate	1	BBC	MY1110023R1	
25	Lubricating oil (3 litres Shell Clavus 933)	1	Shell	-	
26	Coolant (10 kg)	-	-	R114 (F114, N. America)	
27	Crankcase heater (1r1 and 2r1)	1	BBC	MY1143925R2	
28	Housing	1	BBC	GLZ6557042R1	
29	Cover	1	BBC	GLZ6557044R1	

COMPONENTS LIST

EQUIPMENT: CABIN AIR CONDITIONING PLANT

ASSEMBLY: MAIN AND SPARE UNITS (Cont'd.)
(Part One, Figure 4.23-2)

Item No.	Description	No. Off	Manufacturer	Manufact.Type or Drawing Nos.	NATO Stock No.
30	Evaporator	1	BBC	GLZ1335046R1	
31	Drip-tray	1	BBC	GLZ6557041R1	
32	Air filter	1	BBC	GLZ1635002	
33	Switch box (not used)	1	BBC	-	
34	Heater element assembly (1r2 and 2r2)	1	BBC	GLZ1247070R2	
35	Ventilation fan (60 Hz) (1m2 and 2m2)	1	Gebhard	DS160-4	
36	Ventilation fan (50 Hz) (1m2 and 2m2)	1	Gebhard	DS160-4	
37	Solenoid valve (60 Hz) (1s1 and 2s1)	1	BBC	GLZ1451002R1	
38	Solenoid valve (50 Hz) (1s1 and 2s1)	1	BBC	GLZ1451002R1	
39	Thermostatic expansion valve	1	Flica	TMX5 R114	
40	Distributor	1	Flica	VV4	
41	Filter cover	1	BBC	GLZ6557045R1	
42	Under-pressure switch (50 Hz)	1	Danfoss	RT 1	
43	Over-pressure switch (50 Hz)	1	Danfoss	RT 5	
44	Sleeve	1	BBC	GMN453447	

COMPONENTS LIST

EQUIPMENT: CABIN AIR CONDITIONING PLANT

ASSEMBLY: MAIN AND SPARE UNITS (Cont'd.)
(Part One, Figure 4.23-2)

Item No.	Description	No. Off	Manufacturer	Manufact.Type or Drawing Nos.	NATO Stock No.
45	Suction pipe (DIN1754)	1	BBC	SF-CUF25	
46	Bend, 180 deg.	2	BBC	GMM453451P.7	
47	Bend, 90 deg.	11	BBC	GMM453450P.9	
48	Bend,(DIN2605)	2	-	-	
49	Pipe (DIN1754)	3	-	SF-CUF25	
50	Screw, hex. head	1	-	M16x30 DIN933m V2A	
51	Screw, hex. head	8	-	M12x40 DIN931m V2A	
52	Nut, hex.	8	-	M12 DIN934m V2A	
53	Spring	8	-	B12 DIN127 SnBz8	
54	Washer	8	-	A13DIN9021 Ms	
55	Screw, hex. head	18	-	M10x20 DIN933m V2A	
56	Screw, hex. head	12	-	M8x35 DIN 931 V2A	
57	Nut hex.	36	-	M8 DIN934 V2A	

COMPONENTS LIST

EQUIPMENT: CABIN AIR CONDITIONING PLANT

ASSEMBLY: MAIN AND SPARE UNITS (Cont'd.)
(Part One, Figure 4.23-2)

Item No.	Description	No. Off	Manufacturer	Manufact.Type or Drawing Nos.	NATO Stock No.
58	Spring	8	-	B8 DIN127 SnBz8	
59	Grommet 28 x 32 x 42 x 1.5	1	-	MYN489200 (Blk)	
60	Grommet 16 x 20 x 29.5 x 4		BBC	MYN489200 (Blk)	
61	Injection pipe (DIN1754)	7	-	SF-CUF20	
62	Pipe, fluid (DIN1754)	1	-	SF-CUF20	
63	Pipe (DIN1754)	1	-	SF-CUF20	
64	Pipe (DIN1754)	1	-	SF-CUF20	
65	Reducing piece (DIN2857)	1	BBC	GMN453448P.9	
66	Insulation	2	-	Tble.4DIN40605 HP2061.3	
67	Grommet 21 x 32 x 38 x 1.5	1	BBC	MYN489200 (Blk).	
68	Screw, hex. head	34	-	M8x20 DIN933m V2A	
69	Washer, split	64	BBC	8MYN337214	
70	Screw hex. head	20	-	M6x30 DIN933 V2A	

COMPONENTS LIST

EQUIPMENT: CABIN AIR CONDITIONING PLANT

ASSEMBLY: MAIN AND SPARE UNITS (Cont'd.)
(Part One, Figure 4.23-2)

Item No.	Description	No. Off	Manufacturer	Manufact.Type or Drawing Nos.	NATO Stock No.
71	Washer, split	29	BBC	6MYN337214	
72	Screw, hex. head	9	-	M6x15 DIN933 V2A	
73	Screw, hex. head	8	-	M8x25 DIN931m V2A	
74	Screw countersunk	6	-	M5x10 DIN63 Ms	
75	Locking washer	6	-	V5.3DIN6798 SnBz6	
76	Screw, hex. head	1	-	M8x25 DIN933m V2A	
77	Nut M8	18	BBC	GME9933077P.55	
78	Nut M10	16	BBC	GME9933077P.56	
79	Spring	18	-	B10DIN127 SnBz8	
80	Washer	2	-	A10.5DIN9021 MS	
81	Washer	4	-	A8.4DIN9021 MS	
82	Plate	2	BBC	GLZ6557047R1	
83	Nut, hex. head	4	-	M5DIN934 V2A	

COMPONENTS LIST

EQUIPMENT: CABIN AIR CONDITIONING PLANT

ASSEMBLY: MAIN AND SPARE UNITS (Cont'd.)
(Part One, Figure 4.23-2)

Item No.	Description	No. Off	Manufacturer	Manufact.Type or Drawing Nos.	NATO Stock No.
84	Spring	4	-	B5DIN127 SnBz8	
85	Screw, hex. head	4	-	M5x15 DIN933 V2A	
86	Nipple, connection	2	-	Lbg20215.4 R2 (mat. MS)	
87	Nut, domed	2	-	A6DIN8912 MS	
88	Sealing ring	2	-	13.2 x 18 x 1.5 sonst (or n DIN7603 cn)	
89	Insulation, 2.7 m^2	-	Armaflex	-	
90	Adhesive (for Armaflex)	-	Fischer	22-441	
91	Insulation hose	-	Armaflex	-	
92	Installation material	-	BBC	GLZ6557050R6	
93	Control pipe DIN1754	1	-	SF-CUF20	
94	Screw, cheese head	4	-	AM4x35DIN84	
95	Nut, hex.	4	-	M4DIN934m MS	
96	Washer, split	4	BBC	4MYM337214	

COMPONENTS LIST

EQUIPMENT: CABIN AIR CONDITIONING PLANT

ASSEMBLY: MAIN AND SPARE UNITS (Cont'd.)
(Part One, Figure 4.23-2)

Item No.	Description	No. Off	Manufacturer	Manufact.Type or Drawing Nos.	NATO Stock No.
97	Heater 208 V	1	BBC	GLZ1247070R1	
98	Reducing piece	1	BBC	GMN453455P.27	
99	Installation material	1	BBC	GLZ6557050R5	
100	Ring, spacing	1	BBC	GLZ1228008R1	
101	Hand-lever, damper	1	BBC	28MYN453439T7	
102	Bend 90 deg.	1	BBC	GMN453450P29	

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COMPONENTS LIST

EQUIPMENT: PEDESTAL ASSEMBLY: LIGHTING AND ANCILLARY POWER

Item No.	Description	No. Off	Manufacturer	Manufact.Type or Drawing Nos.	NATO Stock No.
	Cables, azimuth cabin		BBC, Mannheim	Cable No. 4303, 4304, 4305, 4307, 4308	
	Cables, elevation cabin		BBC, Mannheim	Cable No. 4309, 4310, 4311, 4312	
	Cables, gearbox room		BBC, Mannheim	Cable No. 4321 to 4326, 4328 4329, 4331 to 4333	
	Cables, cable wrap		BBC, Mannheim	Cable No. 4338 to 4346	
	Cables, rotary column			Cable No. 4330, 4334 to 4337	
	Cables, external lighting system		BBC, Mannheim	Cable No. 4313a with plug MS-3100 G-18-11S-F80. 4313b with plug MS-3100 G-18-11P-F80. 4314 to 4320.	
	Distribution box R02		BBC, Mannheim	J2 16 rs	
	Power circuit breaker		BBC, Mannheim	GHR 100	

COMPONENTS LIST

EQUIPMENT: PEDESTAL

ASSEMBLY: LIGHTING AND ANCILLARY POWER (Cont'd.)

Item No.	Description	No. Off	Manufacturer	Manufact.Type or Drawing Nos.	NATO Stock No.
	Circuit breaker		BBC, Mannheim	S203TK10S	
	Circuit breaker (medium)		BBC, Mannheim	S201TL6S	
	Lamps		BBC, Mannheim	7064N (Cast with PG16)	
	Power outlet socket (single-phase) with earthing contact		BBC, Mannheim	ABL 1949-020	
	Cast metal distribution boxes		BBC, Mannheim	655	
	Emergency off switch		BBC, Mannheim	1133E	
	Adhesive magnet (with eyebolt)		BBC, Mannheim	92.209	
	Isolating transformer P6, (single-phase) 220/220 V, 4 kVA, 50 Hz, 18.2 A (European Stations only)		Siemens	S/N 704/16781	
	Isolating transformer P6, (single-phase) 120/120 V, 4 kVA, 60 Hz, 33 A (N. American Stations only)		Siemens	S/N 704/16782	

EQUIPMENT: PEDESTAL

COMPONENTS LIST

ASSEMBLY: DRIVE ASSEMBLY
(Part Two, Figures 3.6-1, 3.6-6
and 3.8-1)

Item No.	Description	No. Off	Manufacturer	Manufact.Type or Drawing Nos.	NATO Stock No.
1	Output Assembly	1	V.C.O.G.	B211508	
2	Bearing Retainer	1	V.C.O.G.	C211534	
3	Circlip	1	Ellison	External 100 m	
4	Spherical Roller Bearing	1	Hoffman	22220	
5	Labyrinth	1	V.C.O.G.	C211529	
6	Cap Screw M10 x 90 mm long	3	Unbrako		
7	Output Pinion	1	V.C.O.G.	C211514	
8	Cap Screw M12 x 60 mm long	7	Unbrako		
9	Oil Seal	1	Weston	W87577547	
10	End Housing	1	V.C.O.G.	B211523	
11	Extruded Rubber 1/8 section	As req'd.	Gaco		
12	Countersunk Screw M12 x 20 mm long	6	Unbrako		
13	Circlip	8	Ellison	BR80	
14	Circlip	8	Ina	WR55	
15	Needle Bearing	8	Ina	NA6911	

N A T O U N C L A S S I F I E D

EQUIPMENT: PEDESTAL

COMPONENTS LIST

ASSEMBLY: DRIVE ASSEMBLY (Cont'd.)
(Part Two, Figures 3.6-1, 3.6-6
and 3.8-1)

Item No.	Description	No. Off	Manufacturer	Manufact.Type or Drawing Nos.	NATO Stock No.
16	Thrust Washer	8	V.C.O.G.	D211542	
17	Planet Spindle	4	V.C.O.G.	C211531	
18	Planet Wheel	4	V.C.O.G.	C211516	
19	Planet Carrier Assembly	1	V.C.O.G.	B211511	
20	Planet Carrier	1	V.C.O.G.	B211510	
21	Dowel	4	V.C.O.G.	D211546	
22	Cap Screw M12 x 130 mm long	4	Unbrako		
23	Washer	4	V.C.O.G.	D211519	
24	Planet Carrier	1	V.C.O.G.	B211525	
25	5/16 in UNF Plug	As requ'd.	V.C.O.G.		
26	Circlip	1	Ellison	External $9^1/_4$	
27	Roller Bearing	1	Blackwell	ND 403	
28	Retaining Ring	1	V.C.O.G.	C211547	
29	Bearing Housing	1	V.C.O.G.	B211518	
30	$^3/_4$ in BSP Tapered Plug	3	Unbrako		

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COMPONENTS LIST

EQUIPMENT: PEDESTAL

ASSEMBLY: DRIVE ASSEMBLY (Cont'd.)
(Part Two, Figures 3.6-1, 3.6-6
and 3.8-1)

Item No.	Description	No. Off	Manufacturer	Manufact.Type or Drawing Nos.	NATO Stock No.
31	Cap Screw M12 x 80 mm long	12	Unbrako		
32	Gearcase	1	V.C.O.G.	B211505	
33	Gear Assembly	1	V.C.O.G.	C211509	
34	Planet Carrier Assembly	1	V.C.O.G.	B211513	
35	Planet Carrier	1	V.C.O.G.	B211524	
36	Dowel	3	V.C.O.G.	D211545	
37	Cap Screw M10 x 65 mm long	3	Unbrako		
38	Planet Carrier	1	V.C.O.G.	B211526	
39	Washer	3	V.C.O.G.	D211520	
40	Sunwheel Assembly	1	V.C.O.G.	C211512	
41	Thrust Bearing	1	V.C.O.G.	D211544	
42	Sunwheel	1	V.C.O.G.	C211532	
43	Thrust Washer	6	V.C.O.G.	D211541	
44	Circlip	6	Ina	BR45	
45	Needle Bearing	3	Ina	NKI 30/20	

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COMPONENTS LIST

EQUIPMENT: PEDESTAL

ASSEMBLY: DRIVE ASSEMBLY (Cont'd.)
(Part Two, Figures 3.6-1, 3.6-6 and 3.8-1)

Item No.	Description	No. Off	Manufacturer	Manufact.Type or Drawing Nos.	NATO Stock No.
46	Circlip	6	Ina	WR30	
47	Planet Spindle	3	V.C.O.G.	C211539	
48	Planet Wheel	3	V.C.O.G.	C211515	
49	Sunwheel Assembly	1	V.C.O.G.	C211540	
50	Sunwheel	1	V.C.O.G.	C211538	
51	Flange	1	V.C.O.G.	C211537	
52	Thrust Bearing	1	V.C.O.G.	D211543	
53	CAF Gasket $3^3/_8$ in o/d, $2^1/_8$in i/d x $^1/_{32}$ in	3	R. Klinger		
54	Stepped Dowel	2	V.C.O.G.	SB127	
55	Cap Screw M10 x 22 mm long	6	Unbrako		
56	Wheel (1st Reduction)	1	V.C.O.G.	C211536	
57	End Plate	1	V.C.O.G.	B211522	
58	Cap Screw M12 x 40 mm long	11	Unbrako		
59	Motor Mounting Assembly	2	V.C.O.G.	B211506	

COMPONENTS LIST

EQUIPMENT: PEDESTAL

ASSEMBLY: DRIVE ASSEMBLY (Cont'd.)
(Part Two, Figures 3.6-1, 3.6-6 and 3.8-1)

Item No.	Description	No. Off	Manufacturer	Manufact.Type or Drawing Nos.	NATO Stock No.
60	Circlip	4	Ellison	External 20 mm	
61	Circlip	3	Ellison	External 30 mm	
62	Motor Mounting Flange	2	V.C.O.G.	B211517	
63	Cap Screw M12 x 50 mm long	2	Unbrako		
64	Cap Screw M6 x 20 mm long	10	Unbrako		
65	Seal Housing	3	V.C.O.G.	C211530	
66	Ball Bearing	3	Any Manufacturer	British Standard No. BRE 030	
67	Input Shaft	2	V.C.O.G.	B211528	
68	Key	2	V.C.O.G.	SB101	
69	Oil Seal	3	Gaco	M1S12	
70	Nylicon Coupling	2	David Brown	C211567	
71	Ball Bearing	3	Any Manufacturer	British Standard BRE 020	
72	Cap Screw M12 x 30 mm long	10	Unbrako		

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COMPONENTS LIST

EQUIPMENT: PEDESTAL

ASSEMBLY: DRIVE ASSEMBLY (Cont'd.)
(Part Two, Figures 3.6-1, 3.6-6 and 3.8-1)

Item No.	Description	No. Off	Manufacturer	Manufact.Type or Drawing Nos.	NATO Stock No.
73	Double Row Ball Bearing	1	Any Manufacturer	British Standard No. BAL 020	
74	Cap Screw M12 x 55 mm long	6	Unbrako		
75	Electric Motor (Drive Motor)	2	Scott	Special K112	
	Bearing (Commutator end)	2	R & M	LJ25, open type with special sealed plate (I.S.O.Type 6205)	
	Bearing (Drive end)	2	R & M	LJ40D, half-sealed to motor side (I.S.O. Type 6206)	
	Blower Motor	2	Parvalux Ltd.	SD 18B/76460/9G	
	Bearings for Blower Motor	2	Skefco	RLS4	
76	Hex. Hd. Screw M14 x 40 mm long	8	Bridges		
77	Dowel	12	Boneham & Turner	D211548	
78	Bearing Support	1	V.C.O.G.	C211533	
79	CAF Gasket $22^7/_8$ in o/d, $20^5/_8$ in i/d x 1/32 in	1	R. Klinger		

N A T O   U N C L A S S I F I E D

COMPONENTS LIST

EQUIPMENT: PEDESTAL

ASSEMBLY: DRIVE ASSEMBLY (Cont'd.)
(Part Two, Figures 3.6-1, 3.6-6
and 3.8-1)

Item No.	Description	No. Off	Manufacturer	Manufact.Type or Drawing Nos.	NATO Stock No.
80	Hex. Hd. Bolt M10 x 25 mm long	6	Bridges		
81	Brake and Handwheel Assembly	1	V.C.O.G.	B211554	
82	Cap Screw M6 x 25 mm long	2	Unbrako		
83	Retaining Plate	1	V.C.O.G.	D211555	
84	Handwheel Unlocking Lever	1	V.C.O.G.	C211556	
85	Spherical Knob $^5/_8$ in	1	Bluemel	D105	
86	Retaining Pin	1	A. D. Wood	D211598	
87	Bush $^7/_8$ in long	1	Glacier Metal Co. Ltd.	CT539	
88	Pivot Pin	1	V.C.O.G.	D211557	
90	Plate	1	V.C.O.G.	D211558	
91	Chain	1	A. D. Wood	510-02	
92	Brake Pinion	1	V.C.O.G.	B211549	
93	Circlip	1	Ellison	Internal 80 mm	
94	Ball Bearing	1	Any Manufacturer	British Standard No.BRE 050 RS	

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COMPONENTS LIST

EQUIPMENT: PEDESTAL

ASSEMBLY: DRIVE ASSEMBLY (Cont'd.) (Part Two, Figures 3.6-1, 3.6-6 and 3.8-1)

Item No.	Description	No. Off	Manufacturer	Manufact.Type or Drawing Nos.	NATO Stock No.
95	Circlip	1	Ellison	External 50 mm	
96	Brake Mounting	1	V.C.O.G.	A211527	
97	Oil Seal	1	Gaco	MIS 114	
99	Wed'k Csk Screw $^5/_{16}$ in BSW x $^3/_4$ in long	3	Unbrako		
100	Brake	1	Simmons	C211587	
101	Key	1	V.C.O.G.	D211559	
102	Bearing $^3/_4$ in long	1	V.C.O.G.	D211565	
103	Handwheel Spindle	1	V.C.O.G.	C211550	
104	Ball Bearing	1	Any Manufacturer	British Standard No.BRE 040 RS	
105	Cap Screw M8 x 20 mm long	11	Unbrako		
106	Flanged Bearing Housing	1	V.C.O.G.	C211552	
107	Back Plate	1	V.C.O.G.	B211553	
108	Circlip	1	Ellison	External 40 mm	
109	Bush	1	V.C.O.G.	D211562	

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EQUIPMENT: PEDESTAL

COMPONENTS LIST

ASSEMBLY: DRIVE ASSEMBLY (Cont'd.)
(Part Two, Figures 3.6-1, 3.6-6
and 3.8-1)

Item No.	Description	No. Off	Manufacturer	Manufact.Type or Drawing Nos.	NATO Stock No.
110	Cap Screw M8 x 55 mm long	2	Unbrako		
111	Interlocking Drum	1	V.C.O.G.	C211551	
112	Handwheel	1	Ray Engineer-ing Co. Ltd.	Patt. No. 59	
113	Washer	1	V.C.O.G.	D211560	
114	Key	1	V.C.O.G.	SB101	
115	Tacho-generator Drive Assembly	1	V.C.O.G.	B211507	
116	Tacho-generator Mounting Flange	1	V.C.O.G.	C211521	
117	Tacho-generator Drive Shaft	1	V.C.O.G.	C211535	
118	Cap Screw M10 x 30 mm long	7	Unbrako		
119	Key 5 mm x 5 mm x 1 in long	1	V.C.O.G.		
120	Tacho-generator Coupling	1	Brown Boveri	G/MJ4770854	
121	Cap Screw M10 x 25 mm long	4	Unbrako		
122	Tacho-generator	1	Georgi-Kobold	KPX506	
	Brushes for item 122	6		AG35	
123	Microswitch	2	Burgess	V9/715	

COMPONENTS LIST

EQUIPMENT: PEDESTAL

ASSEMBLY: DRIVE ASSEMBLY (Cont'd.)
(Part Two, Figures 3.6-1, 3.6-6
and 3.8-1)

Item No.	Description	No. Off	Manufacturer	Manufact.Type or Drawing Nos.	NATO Stock No.
124	Cap Screw M6 x 12 mm long	6	Unbrako		
125	Dowel 0.187 in Nom dia x $^1/_2$ in long	2	V.C.O.G.		
126	Block	1	V.C.O.G.	C211566	
127	Special Adjustment Screw	1	V.C.O.G.	D211585	
128	Nut M12	1			
129	Bracket	1	V.C.O.G.	D211586	
132	Cap Screw M10 x 30 mm long	3	Unbrako		
133	Handwheel Unlocking Lever Extension	1	V.C.O.G.	C211591	
136	Cap Screw M8 x 25 mm long	3	Unbrako		
137	Screw $^5/_8$ in BSF Hex Hd. x 1 in long	1			
138	Bush	1	'Grip'	H7S	
139	Drain Cock ($^3/_4$ in BSP)	1	BSS	Fig. 193S	
141	Key	2	V.C.O.G.	D211595	
142	Grub Screw $^1/_4$ in BSW x $^1/_2$ in long	2	V.C.O.G.		
143	Electrical Connection Diagram	-	-	C211596	

COMPONENTS LIST

EQUIPMENT: PEDESTAL

ASSEMBLY: DRIVE ASSEMBLY (Cont'd.)
(Part Two, Figures 3.6-1, 3.6-6
and 3.8-1)

Item No.	Description	No. Off	Manufacturer	Manufact.Type or Drawing Nos.	NATO Stock No.
144	Wed'k Cap Screw M4 x 12 mm long	1	Unbrako		
145	Washer $^3/_4$ in	1	-		
146	Key $^3/_{16}$ in x $^3/_{16}$ in x $1^5/_8$	1	V.C.O.G.	SB101	
147	Ball End Handles	2	Purefoy Unit Tooling Ltd.	373-60	
148	'O' Ring		Dowty	2000084475	
149	Stud	1	V.C.O.G.	D211451	
150	Clamping Nut	1	V.C.O.G.	D211452	
152	Lever Extension	1	V.C.O.G.	D211456	
153	6BA Screw $^3/_4$ in long	2			
154	Clamping Nut (Left-Hand Thread)	1	V.C.O.G.	D211460	
155	Stud (Left-Hand Thread)	2	V.C.O.G.	D211459	
157	6BA Hex Nut	2			
158	6BA Screw 1 in long	2			
159	Bracket	1	V.C.O.G.	C211455	
160	Switch Mounting	1	V.C.O.G.	D211457	

EQUIPMENT: PEDESTAL

COMPONENTS LIST

ASSEMBLY: DRIVE ASSEMBLY (Cont'd.)
(Part Two, Figures 3.6-1, 3.6-6 and 3.8-1)

Item No.	Description	No. Off	Manufacturer	Manufact.Type or Drawing Nos.	NATO Stock No.
161	Screw M4 x 10 mm long	2	Bridges		
162	Clips	2	Terry's	80/0	
163	$^{1}/_{2}$ in BS Whit Locknut (Left-Hand Thread)	2	V.C.O.G.	D211462	
164	$^{1}/_{2}$ in BS Whit Locknut (Right-Hand Thread)	2	V.C.O.G.	D211463	
165	Heater (220 V, 50 Hz, single-phase, 580 W) (European Stations only)	1	Isopad	MJMW $1^{1}/_{2}/8^{1}/_{4}$ x $20^{1}/_{2}$, 220 V	
166	Heater (120 V, 60 Hz, single-phase, 680 W((N. American Stations only)	1	Isopad	MJMW $1^{1}/_{2}/8^{1}/_{4}$ x $20^{1}/_{2}$, 120 V	

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MANUFACTURERS - LIST OF ABBREVIATIONS

BBC	-	Brown Boverie Corporation
Gaco	-	George Angus & Co. Ltd.
R & M	-	Ransome and Marles Ltd.
V.C.O.G.	-	Vickers Compact Orbital Gearworks