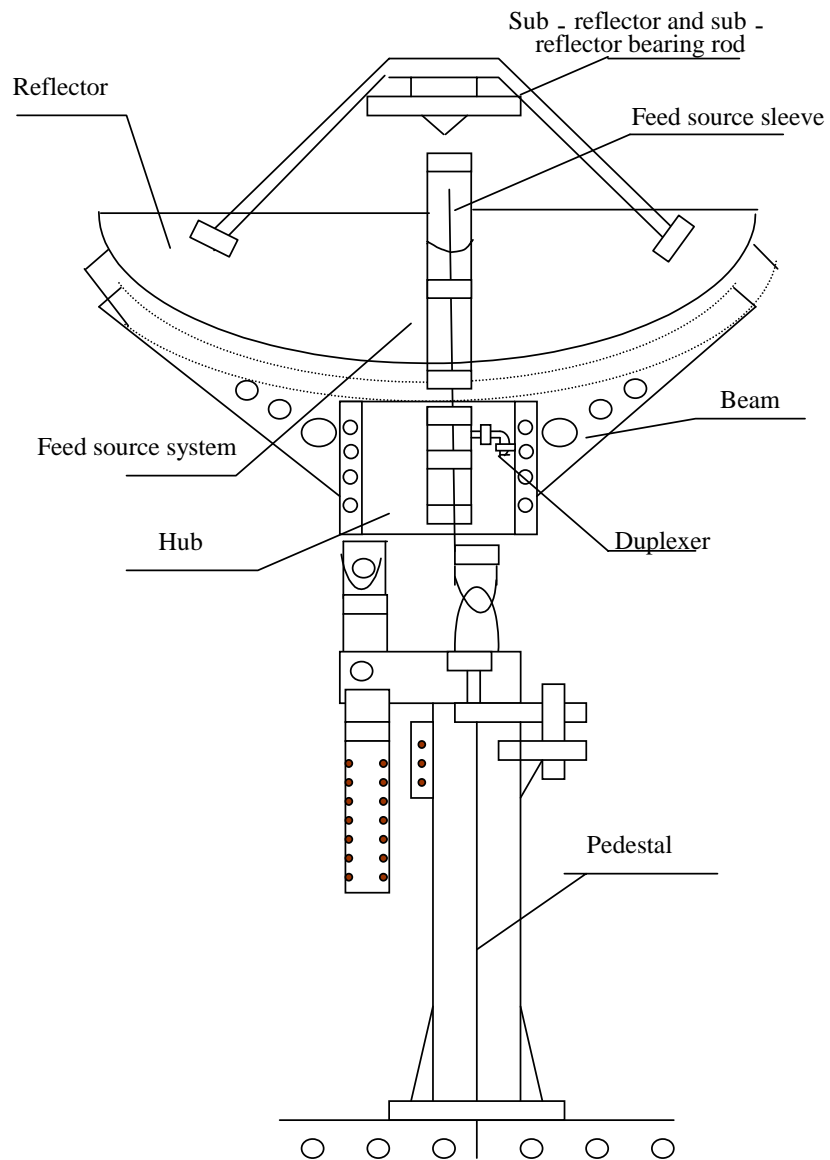


2.4M C-BAND RING-FOCUS ANTENNA

INSTALLATION AND SERVICE MANUAL



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1. INTRODUCTION

1.1. GENERAL

This manual is to setup and maintain the Level421 2.4m antenna system. The 2.4m ring-focus antenna is optimized and designed as a small-aperture antenna used in VSAT satellite communications. It serves as a SATCOM remote station antenna and VSAT system remote station antenna. It applies to C-band and can get configured to work as LINEAR or CIRCULAR polarized.

The ring-focus technology, the corrugated feed horn and other new technology is used to design this 2.4m antenna. The electrical specifications of it is quite advanced comparing to other offset C Band antennas known of brand manufacturers.

The main reflector is made of high precision aluminum alloy sectors shaped up via quenching and drawing. Moreover, the antenna has a subtle sub-reflector, a stable column structure pedestal, is reasonably designed with high accuracy, nice appearance, convenient to install, easy to operate, high mechanical strength, strong durability and high re-installation accuracy.

Despite other antennas in the market the level421 2.4 meter antenna system gets delivered INCLUDING an pedestal mounting which allows easily to mount the antenna to concrete surface.



Optional the antenna feed system can get fitted with a CIRCULAR polarizer which allows to use the unit on all C-Band satellites in orbit today.

The left picture shows the feed with the integrated C-Band Circular Polarizer. This can get configured to operate LHCP (Left Hand Circular Polarized) or RHCP (Right Hand Circular Polarized). The setting depends from the satellite used.

1.2. Main technical parameters

1.3. Electrical specifications:

	C-Reception	C-Transmission
Frequency	3.652-4.2	5.85-6.425
Gain	38.2	41.4
VSWR	1.25:1	1.25:1
Beam width -3dB	2.01°	1.36°
Beam width -15dB	4.04°	2.67°
Cross polarization isolation(on axis)	35db	35db
Within 1db beamwidth	>30db	>30db
Port to port isolation (Tx-Rx with filter)	85db	
Noise temperature	2-port	
10°E1	38°K	
20°E1	31°K	
40°E1	24°K	
Power capacity		5KW/port
Interface	CPR-229G	CPR-159G/137G
Feed insertion loss	0.15dB	0.18dB
Axial ratio	0.9dB	
Sidelobe envelope	CCIR-580	CCIR-580

Mechanical characteristics:

Main reflector diameter	D=2.4m
Sub-reflector diameter	D=0.336m
Azimuth angle	±60°
Elevation angle	5°~90°
Surface accuracy	0.5mm(r.m.s.)
Re-installation accuracy	0.6mm(r.m.s)
Net weight of the antenna	120kg
Painting	white

Environmental characteristics :

Operation wind speed	72Km/h-97Km/h
Survival wind speed	200Km/h
Humidity	0%~100%
Temperature	-30 degrees ~+60°C
Earthquake	Horizontal: 0.3G's; Vertical: 0.15G's

1.4. Unpacking test

After the antenna arrives, do the unpacking inspection as soon as possible to ensure all parts of the antenna have been received and are in good conditions.

1.5. Transportation damages

Any damages in the process of transportation should be reported and claim with the freight company immediately, before signing for the delivery.

1.6. Installation tools

The following tools are recommended.

Unpacking tools:

Cutting pliers	200mm	1
Crowbar		1
Hammer	3-pound	1

Installation tools

Adjustable spanner	300mm,	2
	150mm,	2
	450mm	1
Double-ender spanner	19/17	2
	14/2	2
	10/8	1
Screwdriver	'-' screwdriver	1
	cross screwdriver	1
Tape measure	3m	1
Rubber hammer	66mm	1
Iron hammer	1.36kg	1

Geological compass		1
Cutting pliers	200mm	1

2. Antenna installation

Note: The offered installation steps should be strictly abided by.

2.1. Foundation building (See Fig. 1)

Wind speed: 50m/s

Roll moment : 1188kg-m (actually according to 1400kg-m)

Max. headwind area: 4.52m²

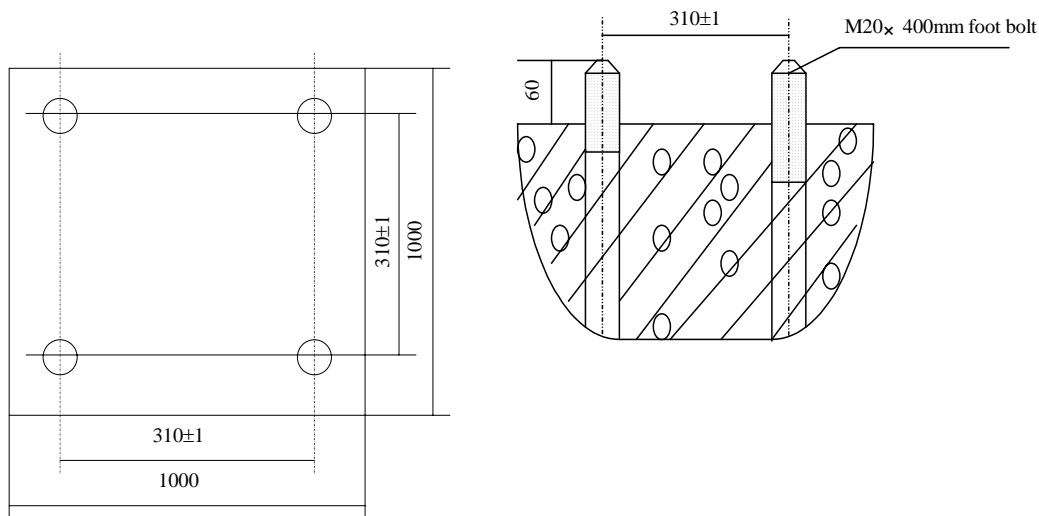


Fig.1 Foundation

Note:

1. The four foot bolts should form a square. The foundation should be even.
2. The foundation is of ferroconcrete structure. Its surface area is no less than 1m²; its depth is no less than 0.4m; and it is 100mm~200mm higher than the ground. The foot bolts (M20×400) are welded with the concrete bars. If the antenna is installed on the roof, the surface area of the foundation should be larger.

2.2. Completed antenna illustration (See Fig. 2)

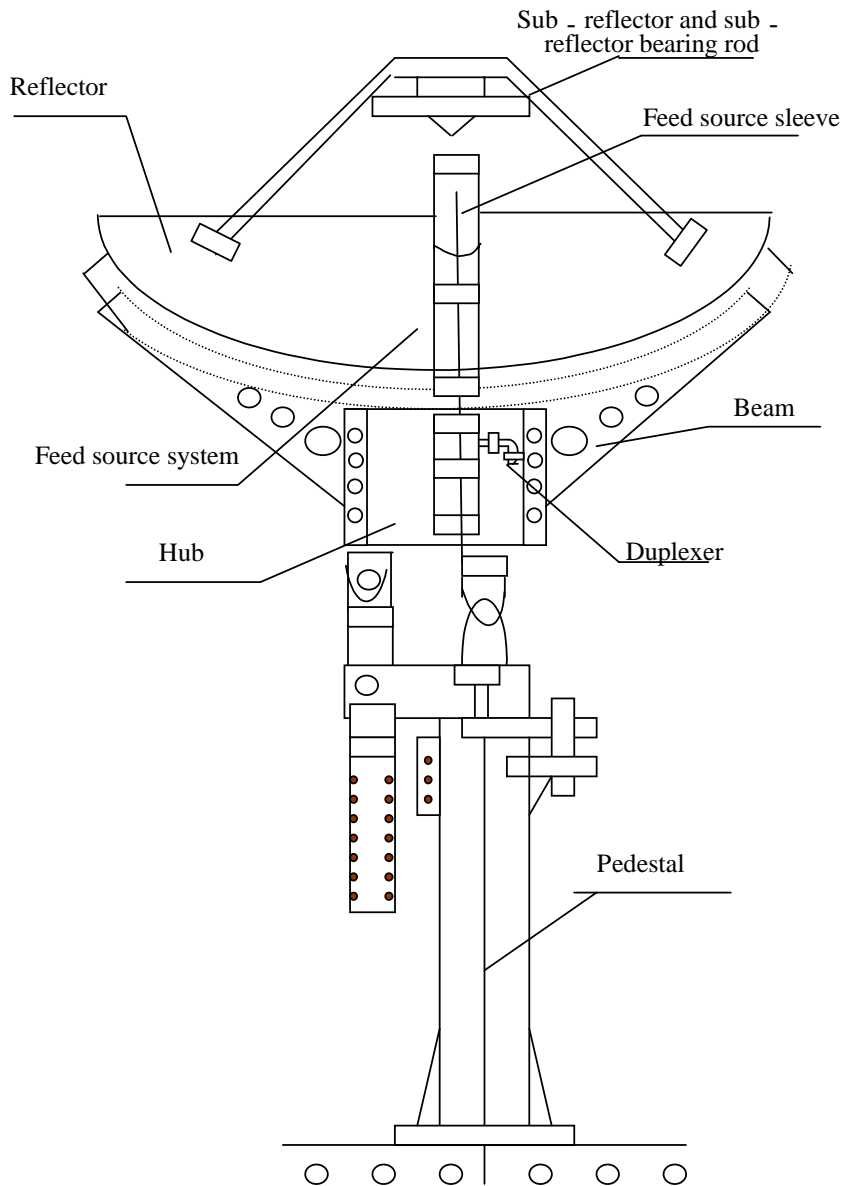


Fig. 2 Completed antenna

No.	Antenna System	Qty
1	reflector	8 pieces
2	reflector beam	8 pieces
3	hub	1 piece
4	sub-reflector	1 piece
5	sub-reflector bearing rod	4 pieces
6	feed system	1 piece
7	feed sleeve	1 piece
8	pedestal	1 piece

2.3. Antenna installation

2.3.1. Preparation of installation

1. Check the number of parts/components corresponding to the packing list.
2. These parts include beams, sectors, a sub-reflector bearing rod.
(See Fig. 3)
3. Fasteners: screws, bolts, nuts, washers.

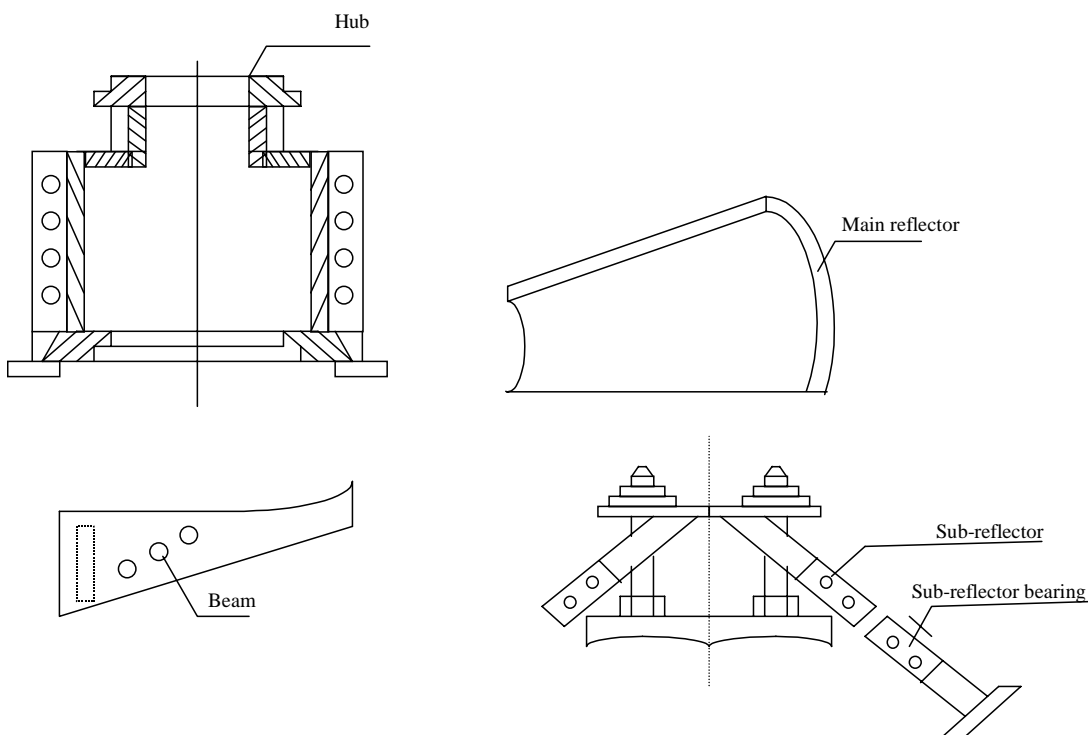


Fig. 3 Components

2.3.2. Pedestal installation (See Fig. 4)

Steps:

1. Ensure the azimuth direction.
2. Fix the mast on the foundation with foot bolts, and fasten the nuts.
3. Install the rotation on the mast, and fasten the bolts.

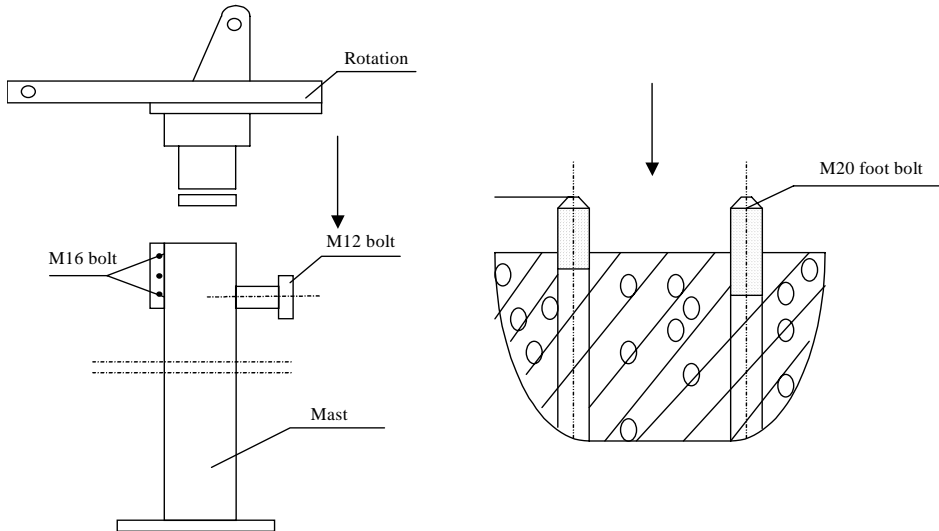


Fig. 4 Pedestal installation

List of Fasteners 1:

No.	Pedestal subsystem	Qty
1	M20 nut	4 pieces
2	Washer	4 pieces
3	spring washer	4 pieces
4	M16 bolt	2 pieces
5	washer	2 pieces
6	spring washer	2 pieces
7	M12 bolt	2 pieces



2.3.3. Azimuths and elevation device installation (See Fig. 5)

Steps:

1. Connect the three brackets respectively to the rotation and the elevation lead crew with pins.
2. Fix the supporting bar onto the rotation with M10×25 bolts. Connect the holder, the washers and M24 nuts to the supporting bar and the mast, and fasten the nuts.
3. Fix the elevation lead crew onto the rotation with pins.

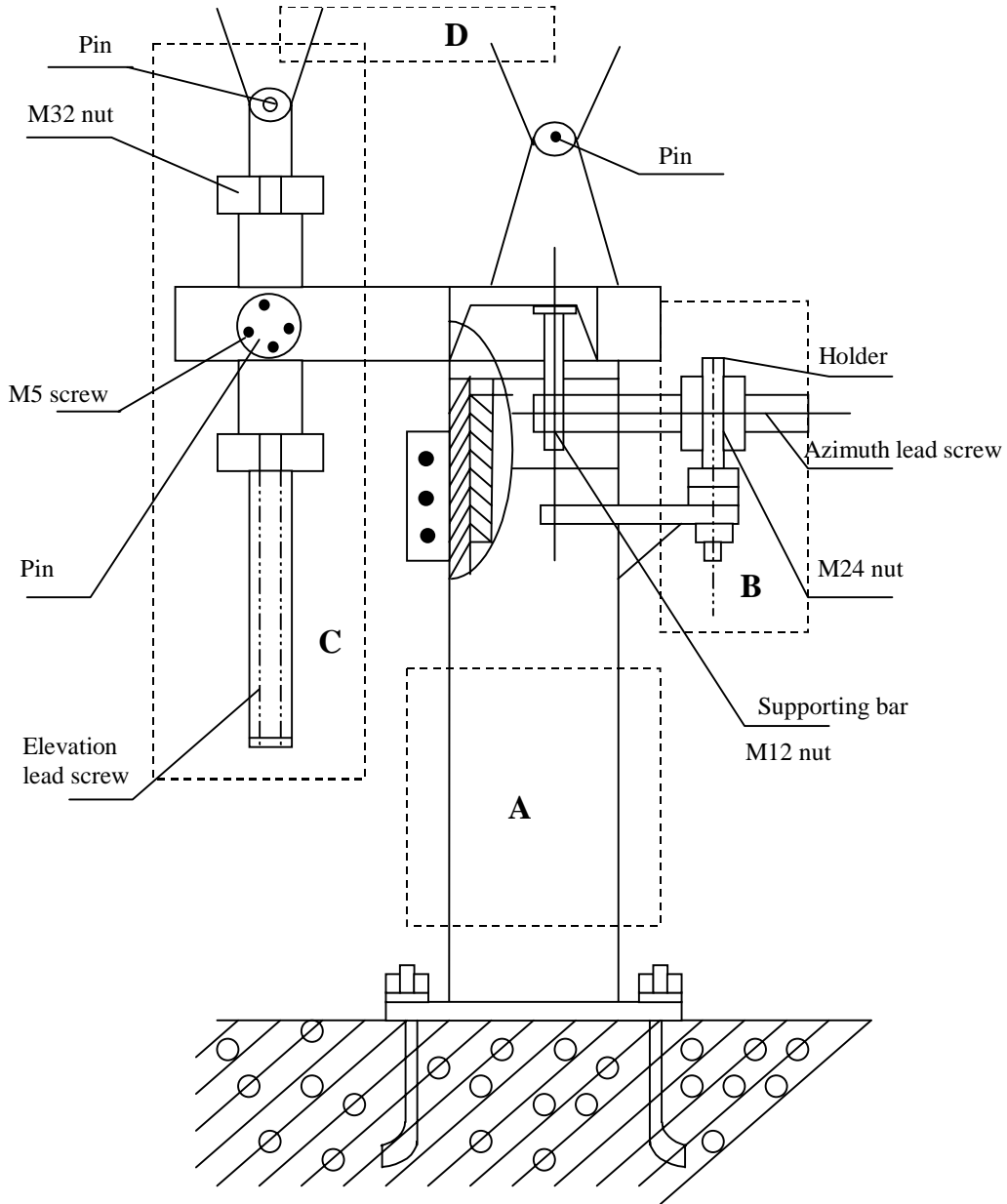


Fig. 5 Azimuth and elevation device installation

- A Mast installation B Azimuth lead screw installation
C Elevation lead screw installation D Hub bracket installation

Look angel from Botton upwards with installed CIRCULAR polarizer and 5 Watt BUC.



List of Fastener 2:

No.	Azimuth and elevation device subsystem	Qty
1	M10 bolt	4 pieces
2	M10washer	4 pieces
3	M10nut	4 pieces
4	M10spring washer	4 pieces
5	M5×10 screw	8 pieces
6	M12 nut	1 piece
7	M24 nut	2 pieces
8	M16 nut	1 piece
9	M32 nut	2 pieces
10	pin	5 pieces

2.3.4. Antenna reflector assembling



Above picture shows reflector panels

Steps:

1. Locate the beams on the hub with locating pins and set M8×30 bolts/nuts. Then fasten the nuts. (Fig. 6)
2. Locate the sectors on the beams with locating pins and set M6×30 bolts/nuts. After all sectors have been located, fasten the 30 M6 nuts.
3. Connect the sectors to the center of the hub with M4×15 bolts. (See Fig.7)

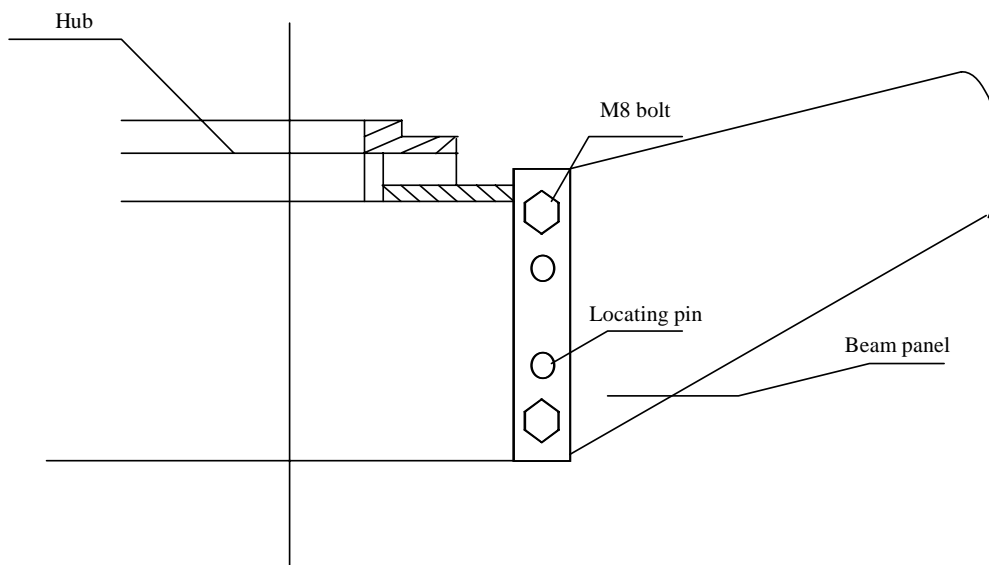


Fig. 6 Beams and hub connection

List of Fastener 3:

No.	Antenna head	Qty
1	M8×25 bolt	16 pieces
2	M8 nut	16 pieces
3	No. 8 washer	16 pieces
4	No.8 spring washer	16 pieces
5	locating pin	16 pieces
6	M6 nut	16 pieces
7	No. 6 washer	16 pieces
8	No. 6 spring washer	16 pieces

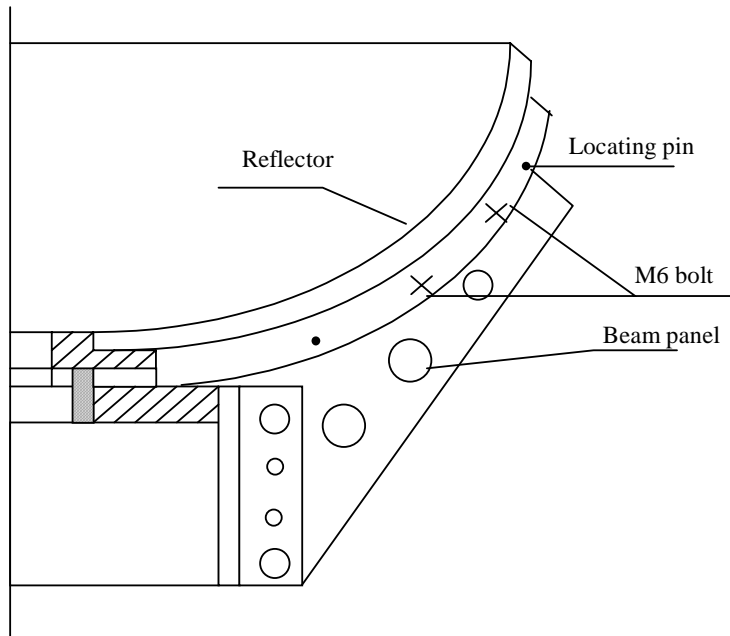


Fig. 7 Beams installation

List of Fastener 4:

No.	Antenna head	Qty
1	M6×30 bolt	16 pieces
2	M6 nut	16 pieces
3	No. 6 washer	16 pieces
4	No. 6 spring washer	16 pieces
5	M4×15 screw	16 pieces
6	locating pin	16 pieces
7	M6 nut	16 pieces
8	No. 6 washer	16 pieces
9	No. 6 spring washer	16 pieces

2.3.5. Feed source system installation (Fig. 8)

Steps:

1. Connect with the corrugated horn , a round wave-guide and phase shifter and fasten the M4 bolts. Seal rings shall be put into the seal groove. The seal groove is downward.
2. Above-mentioned parts shall be put into the feed source sleeve and fixed with M5×10 bolts and clips. Then fixed the sleeve on the hub with M5×15 screws. The seal film of corrugated horn shall carefully be protected. Replace it in case of damage.
3. Check if you will set up the feed system with or without CIRCULAR polarizer. The picture below shows the assembled feed system with CIRCULAR polarizer in place.



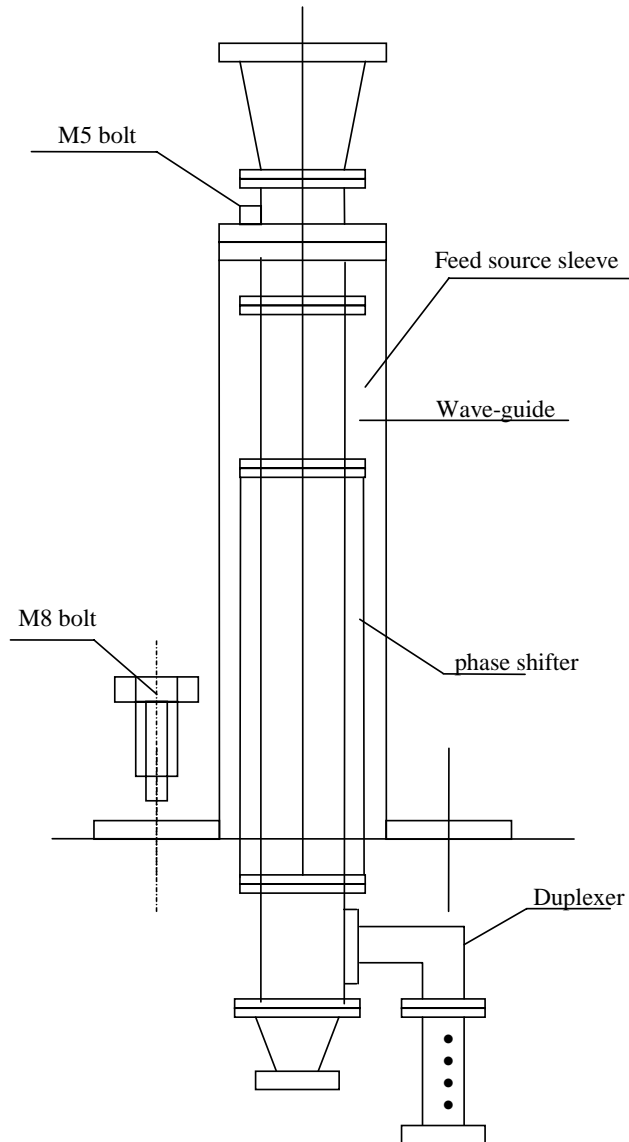


Fig. 8 Feed source system installation

List of Fastener 5:

No.	Feed source subsystem	Qty
1	M4×30 bolt	20 pieces
2	M4 nut	20 pieces
3	No.4 washer	20 pieces
4	M5×10 bolt	8 pieces
5	M8×15 bolt	4 pieces
6	No. 8 washer	4 pieces
7	No.5 washer	8 pieces

2.3.6. Sub-reflector installation (See fig. 9)

Steps:

1. According to the serial numbers, connect the bearing rod into sub-reflector with M6×25 bolts and fasten the bolts.
2. Connect the bear rod into the main reflectors with M6×25 bolts and fasten the bolts.

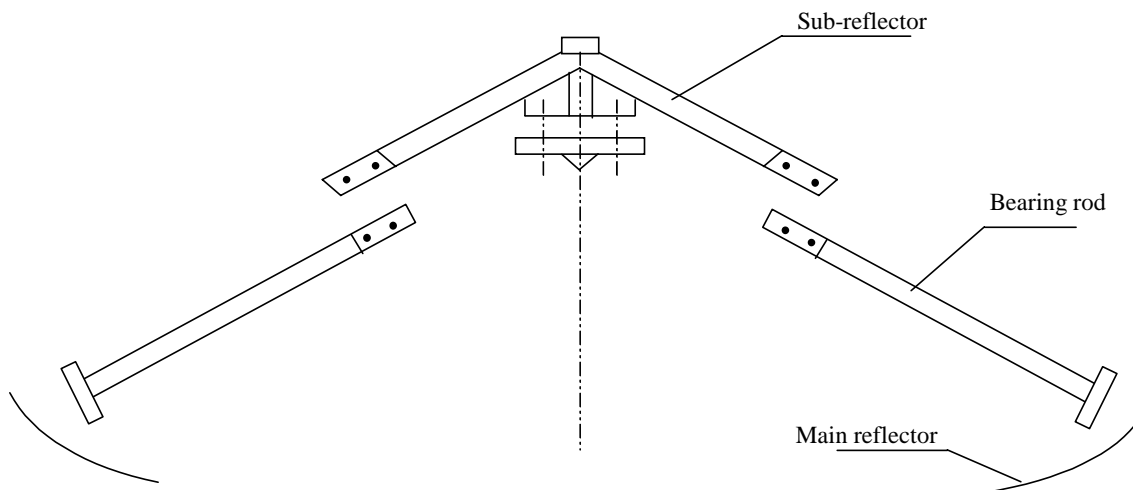


Fig. 9 Sub-reflector installation

List of Fastener 6:

No.	Sub-reflector subsystem	Qty
1	M6×30 bolt	24 pieces
2	M6 nut	24 pieces
3	No. 6 washer	24 pieces
4	No.6 spring washer	24 piece

2.3.7. Antenna integral hoisting (See Fig. 10)

The assembled antenna reflector, app. 120 kg, is lifted by 5~7 persons over the three brackets on the rotation, and fixed with 12 M10 bolts.

List of Fastener 7:

No.	Antenna integral hoisting	Qty
1	M10 bolt	12pieces
2	M10 nut	12 pieces
3	10 flat washer	12 pieces
4	10 spring washer	12 pieces

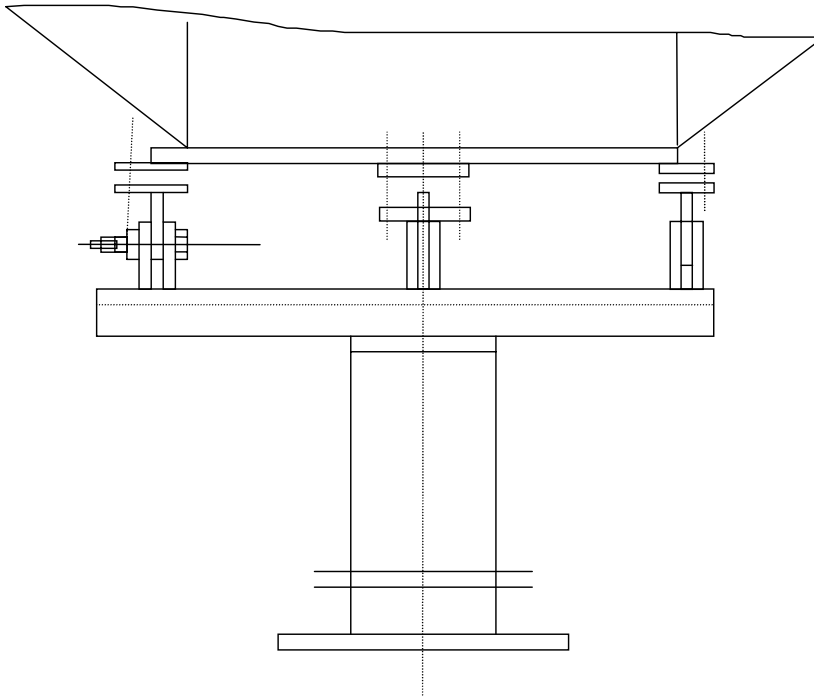


Fig. 10 Antenna integral hoisting

2.3.8. ODU supporting device installation (See Fig. 11)

Steps:

1. Connect the flange into the ODU with screws. Then the part is connected to the supporting device.
2. Connect the round wave-guide into the flange. Fixed the ODU supporting device on the hub with bolts.

List of Fastener 8:

No.	ODU subsystem	Qty
1	M8 bolt	2pieces
2	8 flat washer	2 pieces
3	8 spring washer	2 piece

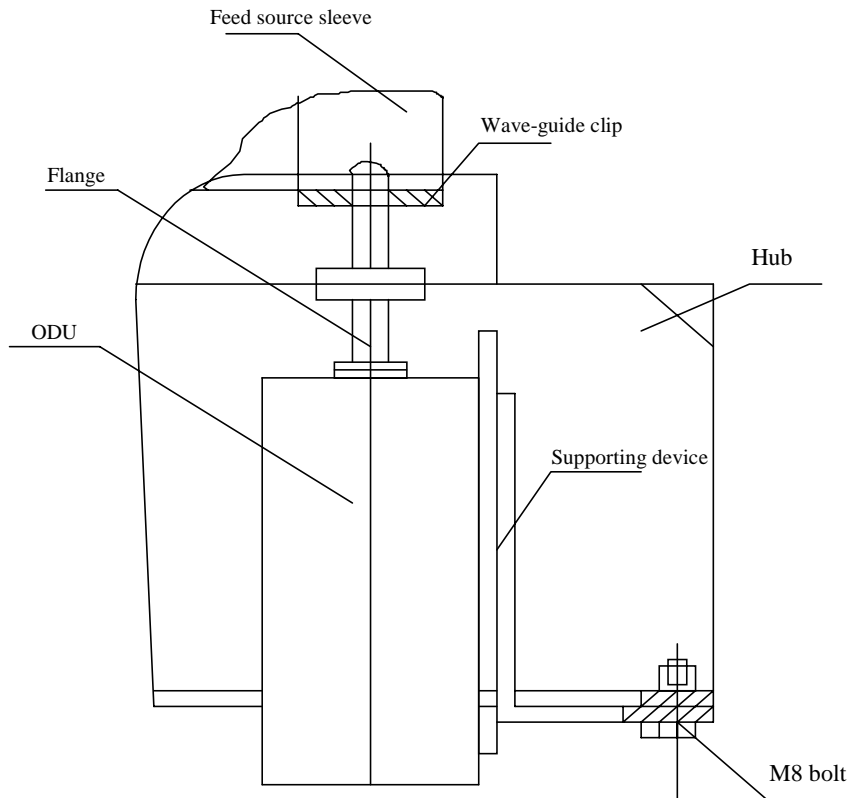


Fig. 11 ODU installation

3. Directing adjustment

Antenna directing means aiming the beam axis of the antenna at the satellite. According to the latitudes and longitudes of the satellite and the antenna site, adjust the azimuth and elevation angles in order to receive the satellite signal. Meanwhile adjust the polarization by the following steps. First loose the flange and rotate the duplexer. When it gets the best reception effect, fasten the flange. Then fasten the azimuth and elevation lead screws.

Antenna elevation angle:

$$E = \arctg\left(\frac{\cos\theta \times \cos(\Phi_s - \Phi_o) - R/(R + H)}{\sqrt{1 - (\cos\theta \times \cos(\Phi_s - \Phi_o))^2}}\right)$$

Antenna azimuth angle:

$$A = 180^\circ + \arctg\left(\frac{\tg(\Phi_s - \Phi_o)}{\sin\theta}\right)$$

Polarization angle:

$$P = \pm \left\{ 90^\circ - \arctg \left[\frac{\operatorname{tg} \theta}{\sin(\Phi_s - \Phi_o)} \right] \right\}$$

$$\Phi_s - \Phi_o < 0: \quad P = -$$

$$\Phi_s - \Phi_o > 0: \quad P = +$$

Letters in the formula:

R: earth semi-diameter (6370 km)

H: satellite height (35786 km)

Φ_s : east longitude of satellite earth station

θ : north latitude of satellite earth station

Φ_o : east longitude of sub-satellite point

4. Maintenance

1. Check the number of goods received.
2. Pay more attention to the important parts, such as the sectors, sub-reflector, microwave parts etc. Replace or repair the damaged parts in time.
3. Check whether the joint parts and fasteners is rusty. Clean the rust in time, grease lubricant on joint parts. The joint parts between lead screws, beams and mast should be greased before installing.
4. If it's necessary that operators need to stand on the main reflector, it should not be more than 2 persons. The operators should be in soft sole shoes and stand on the joint of sectors to avoid the distortion of the main reflector.
5. Pay attention to the seal film of the corrugated horn. Replace it in case of any damage.
6. The feed source system should not be watered. Sweating will influence the performance of the antenna, even break the communication.

7. Pay attention to the rust. Mend the painting in time. Clean and grease the joint parts timely. Check the fasteners in case of loosening.
8. Lighting precautions is necessary.

5. List of incasement

5.1. wrap

Wrap number : 1-1

Wrap material : wood/chipboard

No.	Size	Gross weight	Net weight	Qty	equipment
1	1.5×1.0×0.8	320kg	290kg	1	Antenna , foot bolt , fastener

5.2. Antenna system

No.	Antenna System	Qty
1	Reflector	8 pieces
2	Reflector beam	8 pieces
3	Hub	1 piece
4	Sub-reflector	1 piece
5	Sub-reflector bearing rod	4 pieces
6	Feed source system	1 piece
7	OMT	1piece
8	Feed source sleeve	1 piece
9	Phase shifter	1piece
9	Pedestal	1 piece
10	Azimuth drive	1 piece
11	Elevation drive	1 piece

12	Azimuth/elevation drive pole	1 piece
13	Fastener	1 set
14	Foot bolt	4 piece
15	User's manual	1
16	List of incasement	1

5.3. List of Fastener

List of Fasteners 1:

No.	Pedestal subsystem	Qty
1	M20 nut	4 pieces
2	Washer	4 pieces
3	spring washer	4 pieces
4	M16 bolt	2 pieces
5	washer	2 pieces
6	spring washer	2 pieces
7	M12 bolt	2 pieces

List of Fastener 2:

No.	Azimuth and elevation device subsystem	Qty
1	M10 bolt	4 pieces
2	M10washer	4 pieces
3	M10nut	4 pieces
4	M10spring washer	4 pieces
5	M5×10 screw	8 pieces
6	M12 nut	1 piece
7	M24 nut	2 pieces
8	M16 nut	1 piece
9	M32 nut	2 pieces
10	pin	5 pieces

List of Fastener 3:

No.	Antenna head	Qty
1	M8×25 bolt	16 pieces
2	M8 nut	16 pieces
3	No. 8 washer	16 pieces
4	No.8 spring washer	16 pieces

5	locating pin	16 pieces
6	M6 nut	16 pieces
7	No. 6 washer	16 pieces
8	No. 6 spring washer	16 pieces

List of Fastener 4:

No.	Antenna head	Qty
1	M6×30 bolt	16 pieces
2	M6 nut	16 pieces
3	No. 6 washer	16 pieces
4	No. 6 spring washer	16 pieces
5	M4×15 screw	16 pieces
6	locating pin	16 pieces
7	M6 nut	16 pieces
8	No. 6 washer	16 pieces
9	No. 6 spring washer	16 pieces

List of Fastener 5:

No.	Feed source subsystem	Qty
1	M4×30 bolt	20 pieces
2	M4 nut	20 pieces
3	No.4 washer	20 pieces
4	M5×10 bolt	8 pieces
5	M8×15 bolt	4 pieces
6	No. 8 washer	4 pieces
7	No.5 washer	8 pieces

List of Fastener 6:

No.	Sub-reflector subsystem	Qty
1	M6×30 bolt	24 pieces
2	M6 nut	24 pieces
3	No. 6 washer	24 pieces
4	No.6 spring washer	24 piece

List of Fastener 7:

No.	Antenna integral	Qty
-----	------------------	-----

	hoisting	
1	M10 bolt	12pieces
2	M10 nut	12 pieces
3	10 flat washer	12 pieces
4	10 spring washer	12 pieces

List of Fastener 8:

No.	ODU subsystem	Qty
1	M8 bolt	2pieces
2	8 flat washer	2 pieces
3	8 spring washer	2 piece

Thanks for using the level421 2.4 meter C- Band antenna system. If you do have questions, recommendations for product improvement or questions, please contact our support at: support@level421.com

Level421 GmbH

Küfergasse 11

D-89073 Ulm

GERMANY

Phone: +49 731 14064700

Fax: +49 731 14064711

<http://www.level421.com>