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# GENERAL TMS-147 TOWER SPECIFICATION & OPERATION MANUAL

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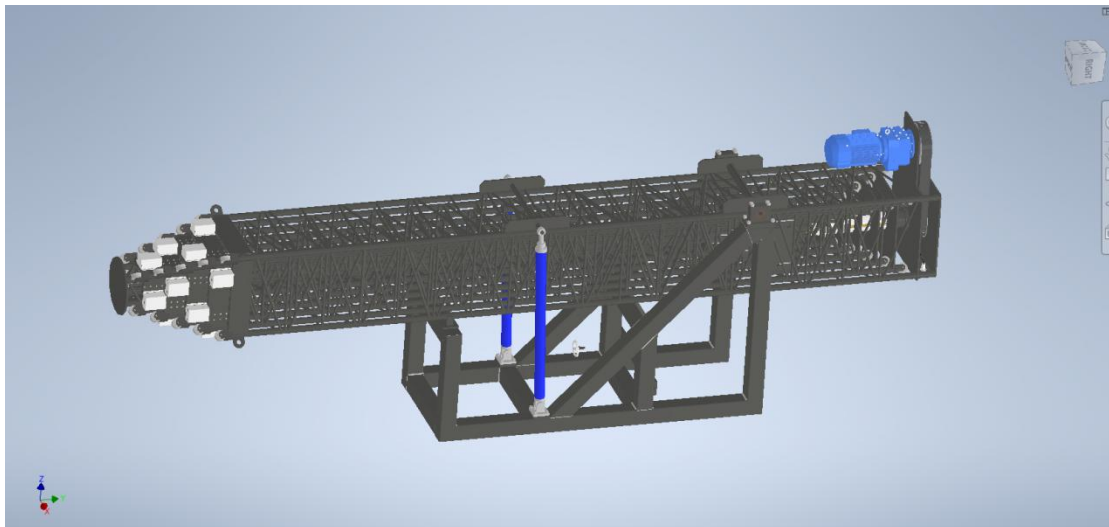


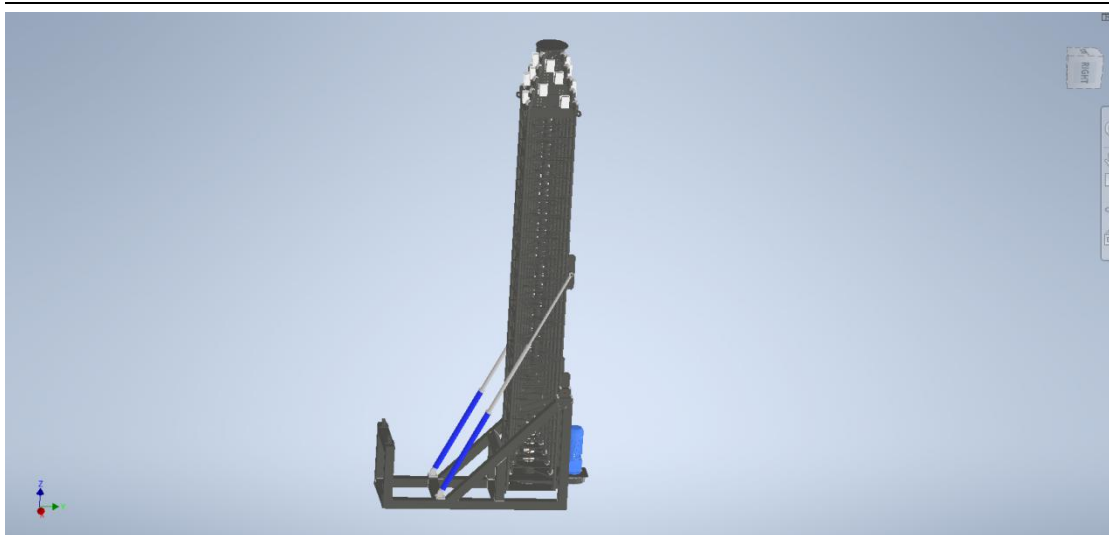
## Description of Tower

The tianhemast tower Model TMS-147 is a self-supporting (subject to strict load & environmental conditions) and guy capable telescopic structure with an extended height of approximately 45m (147ft) above ground level (AGL). The tower is composed of six 9m each heavy-duty, hot dipped galvanized steel telescoping lattice sections mounted to a 90degree tilting mechanism structural base. The tower is tilted to the vertical position by tandem heavy duty hydraulic cylinders and automatically elevated by spindle drive with a 12kw motorized belt gear system. While extending section one by one, the tower locked automatically by itself from four-way latch pins, each latch pin suffers max **6T capacity**, so four pins can have **the capacity 12T max for total system**.

To ensure the safety of the tower operation, several limited switches has been applied to the tower system, while the mast extended to its full position, an upper limited switch will automatically disconnect the motor electric circuit. Secondly, if the limited switch is broken, the spindle itself will loop freely without coupling with the screw nut which is mounted on bottom of each tower section.

Our tower advantage is that our team designed spindle screw system that eliminate stainless steel rope for tower operation which is safer and easier for operation without stainless steel rope and its redundancy rope system that is very complicated for operation and its time-consuming maintenance.



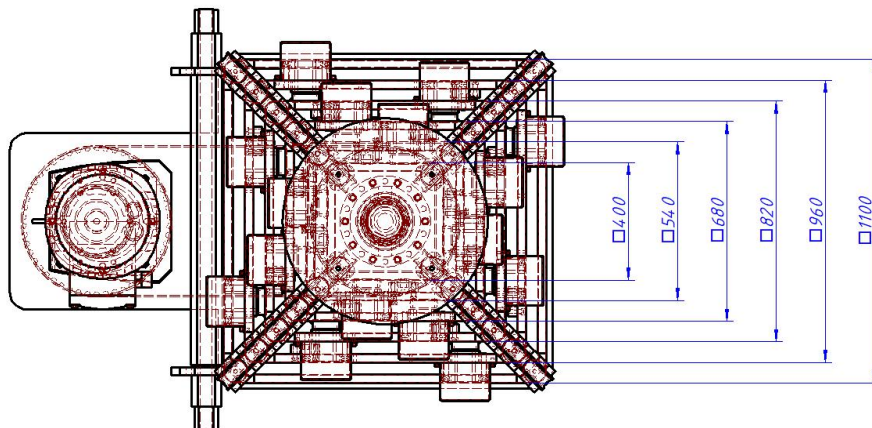


**GENERAL SUPPLY EQUIPMENT LIST**

Equipment list
45m tower
Hydraulic power station & multi section oil cylinder
PLC
Touch screen
Lightening protection kit
Aviation obstruction LED light solar powered
Kevlar guy rope kit (optional)

## Tower Technical and Material Standards

TMS-147 Standard Material Specification: (from top section down)					
Tower section	Face width	Length	Tube OD / Wall thickness	Diagonal brace/rod	Approx. weight
6	0.4m	9m	80mm/3mm	30mm/3mm	411KGS
5	0.54m	9m	80mm/3mm	30mm/3mm	535KGS
4	0.68m	9m	80mm/3mm	30mm/3mm	615KGS
3	0.82m	9m	80mm/3mm	30mm/3mm	732KGS
2	0.96m	9m	80mm/4mm	30mm/3mm	1000KGS
1	1.1m	9m	80mm/4mm	30mm/3mm	1614KGS



## TIANHEMAST Tower Technical and Material Standards (continue)

Tower Height Extend	45m
Tower Height Nest	10m
Max Wind Speed at Erection	32km/h
Payload at Top of Tower	2.5T
Erection/ Retraction Speed	3.3m/min
Hydraulic Tilt Speed	Within 60s
Power Requirement	30kw
Scope/Motor & Gear Box Ratio	1:6.84
Motor RPM	213r/min

*\* Estimated wind speed ratings are solely based on prior structural studies; actual ratings may vary significantly pursuant to client-specific load scenarios*

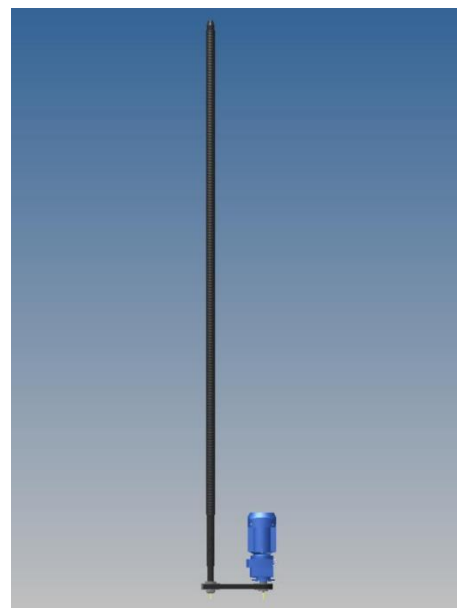
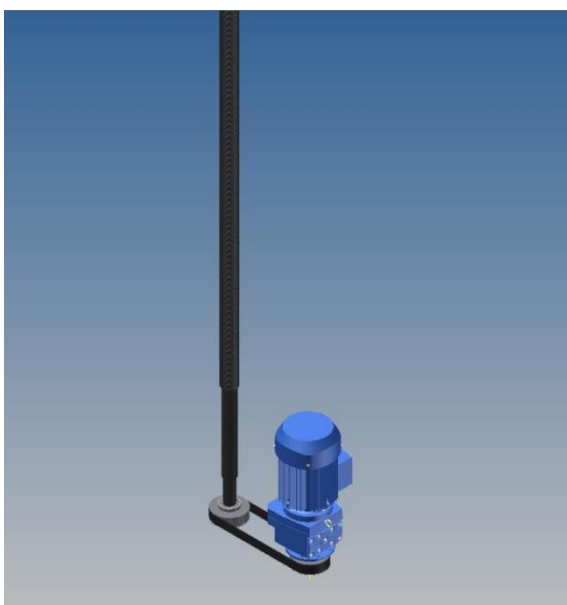
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Standard Material Specifications	
Legs mechanical tubing welded	HSS ASTM DOM 1026 Alloy
Structural shapes solid rod bars angle etc	ASTM A-36~36 Ksi Yield Strength
Structural steel tube	ASTM A-500~50 Ksi Yield Strength
Welded E70 electrode	AWS D1.1 Latest Rev.
Hot Dipped Galvanize	ASTM A-123
Bolts hardware	ASTM F1941 SAE Grade 8
Horizontals flat bar	ASTM A-36~36 Ksi Yield Strength

- All work shall be in conformance with the requirements of the Uniform Building Code (UBC), and structural requirements of the Telecommunications Industries Association (TIA) - Electronic Industries Assoc. -TIA-EIA 222-G
- Steel fabrication shall conform to the requirements of AISC Manual of Steel Construction/Electronic Industries

## **TIANHEMAST MOTOR & GEAR DESIGN for Tower**

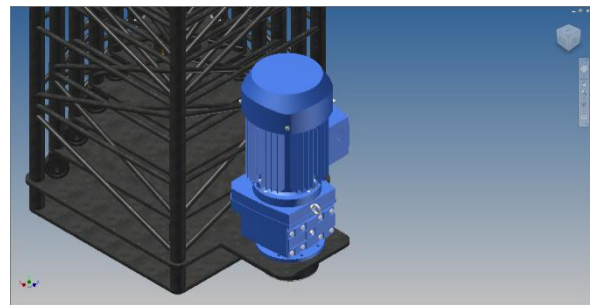
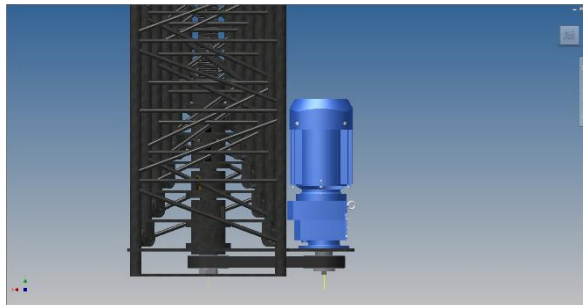
The way of TMS-147 Tower operation is differently from what current towers on the market which are mostly operated by stainless steel rope with pulley and redundant rope kits. It has special coupling on each section bottom base to embrace the spindle screw for elevation. The spindle is linked to a gear with belt around the bottom base and on the other side of the belt, it connects the 3phase asynchronous motor which has 22kw power consumption very powerful one.



Power Requirement	30kw
Motor Type	3phase asynchronous motor
Connection	Belt
Scope/Motor & Gear Box Ratio	1:6.84
Motor RPM	213r/min

Advantages:

- Easy assembly and maintenance
- Lock the tower in any heights with spindle plus motor brake (double lock to ensure tower from retraction)
- No stainless steel rope evolved for a safer way of operation
- Smooth elevation without shak



## **Tower Structural & Engineering Analysis Report**

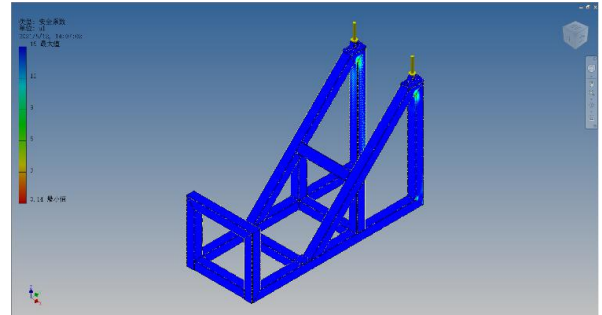
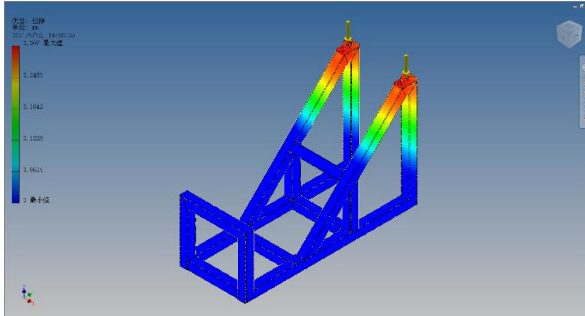
A rigorous Finite Element Analysis program, STAADPro FEM, may be utilized to perform stress analysis review to determine tower member design in conformance to the ANSI/TIA/EIA 222-G Standard requirements for a client's specific load configuration.

The latticed towers members are modeled using beam elements for the leg members, truss elements for the bracing and cable elements for the raising, lowering and support spindle. The structural parameters and geometry of the members are included in the tower modeling. The wind loading are calculated for the different wind directions and then applied as external loads on the structure with the self-weight loading internally determined. In order to obtain the maximum stress occurring in all tower members and guy wires (if deployed in the guyed configuration), four different wind directions relative to the tower and guys (Face Wind, Apex Wind, Parallel Wind) are considered.

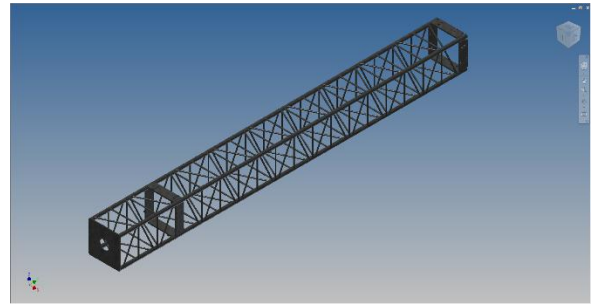
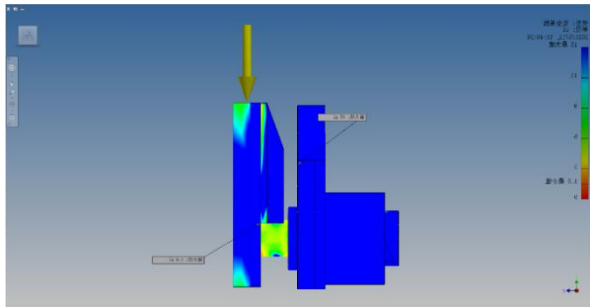
### ANALYSIS RESULT

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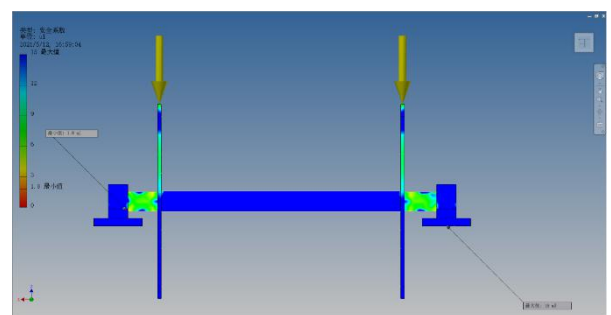
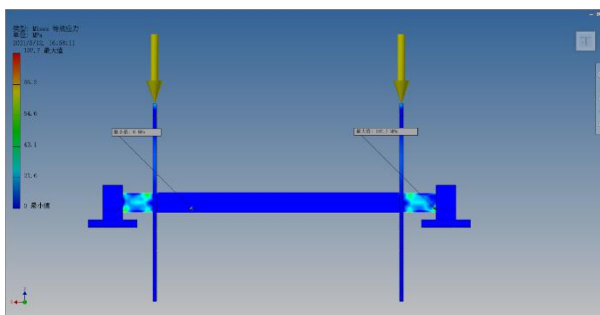
- Displacement of tilt structure while fully loaded max 0.3mm , Max force loaded within the broke stress of steel



- LOCK PIN analysis within the broke stress of steel



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- Axle analysis of tilt mechanism



## Tower Environmental Guideline

Given the environmental characteristics in which the equipment may be deployed, *TIANHEMAST* proposes to manufacture the ***tower and trailer*** for survival/storage without

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excessive degradation (renders the equipment inoperable) utilizing the following environmental parameters as guides:

- Temperature/ Humidity:
  - Operational: to **-23°C/-9°F** (ambient); to **-35°C/-31°F** temperature may be achieved (*requires alternate hydraulic/gear fluids, thermostat controlled electric or similar heat sources, thermal enclosures/wraps for specific components*) to **+60°C (140°F)** / 98% Humidity@ 25°C (intermittent); to **+40°C/104°F** (continuous duty)
  - Storage: to **-35°C/-31°F** to **+60°C/140°F** ~ Humidity @ 20% to 100%
  - Solar radiation of 1100 watts/meter<sup>2</sup>
- Altitude:
  - Operational mode to 4,000 meters; non-operational and storage to 12,000 meters
- Sand/Dust:
  - Operational in desert environment ~ meet 0.95g/m<sup>3</sup> with wind speeds up to 40 km/hr at a height of 3m. Particle size from 74 micrometers to 1000 micrometers, with the average size ranging from 74 to 350.
- Salt Spray/Fog:
  - Storage, exposure and operation during or after exposure to salt atmosphere ~ (*requires regular preventative maintenance and stainless steel cable upgrade for longer-term corrosion resistance against salt air exposure*)
- Fungus/Insects:
  - Storage and exposure to insect and fungus conditions ~ utilization of non-nutrient materials where practical
- Rain:
  - Precluded from leakage to sensitive parts, exposure to rain rates of 5cm/hr with wind levels of 80 km/hr
- Sun:
  - Exposed surfaces and materials resistant to long-term exposure to sunshine ~ surface finishes, gaskets and cables ~ solar radiation of 1100 watts/meter<sup>2</sup>
- Corrosion:
  - All components and materials protected against excessive corrosion. All surfaces to be painted and/or
  - chemically treated for corrosion resistance. Avoidance of galvanic corrosion due to contact of dissimilar metals. All galvanized steel members hot dipped per ASTM-A-123 at time of fabrication ~ (*requires regular preventative maintenance and stainless steel cable upgrade for longer-term corrosion resistance to salt air exposure*)



## Other equipment except tower main body

### 1> Aviation warning light

Aviation obstruction light

Type	Aviation Obstruction lights
Input Voltage	18v
Lamp Luminous	160lm/w
Material	Aluminum +PC+ABS
Battery type	Lead acid 12V 7AH
Charging time	6-8hours
Color temperature	Cool white



### 2> Lightning protection kit

Lightening arrester

Pre-discharge time (μs)	60
Lightning impact Discharge current I <sub>imp</sub> (kA, 10/350μs)	400
Wind resistance	40m/s
Material	304 SS
Height	600mm
No of arrester	9



Benefits of the designated lightning arrester

- New stainless material, corrosion resistance and strong wind resistance.
- Maintenance-free and passive.
- Long service life and simple installation.
- The exciter obtains energy from the clouds, forms an upward pilot, and actively guides mines into the ground.
- Compared with traditional lightning rods, the protection range is larger at the same height.
- Lightning is more effective, reducing the probability of lightning strikes falling on the protected object.

16mm<sup>2</sup> copper cable 46m  
Copper Galvanized Ground rod

### 3> Touch screen control panel with PLC control

#### PLC specification:

1. XD3 series standard PLC, including 16, 24, 32, 48, 60 point specifications.
2. It has complete functions and can meet the needs of the absolute majority of users.
3. Speed and capacity are greatly improved compared to XC series
4. Input type: NPN
5. Output type: transistor (T), relay (R)
6. Power specification: AC220V
7. Support X-NET fieldbus function
8. Support high-speed counting (up to 80KHz), pulse output (up to 100KHz), frequency measurement and other special functions
9. Standard USB port for programming download
10. Support 1~10 expansion modules, 1 expansion ED, 1~2 expansion BD (16 points are not supported)



Item	Specification
Insulation voltage	Above DC 500V 2MΩ
Anti-noise	Noise voltage 1000Vp-p 1us pulse for 1 minute
Air	No corrosive and flammable gas

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Environmental temperature	0C°~60C°
Environmental humidity	5%~95%
USB	USB Quick download port, connect to PC to download/upload/monitor
PORT1	RS232, Connect to host computer, man-machine interface programming or debugging
PORT2	RS485, Connect smart meters, inverters, etc.
PORT3	Extended ED communication port
GND (FG)	The third type of grounding (not common grounding with strong current system)*3

**Touch screen specification :**



- a) Brand new ultra-thin design, with multiple download methods (Ethernet, USB port, U disk import)
- b) With penetrating function, Xinje XD/XL/XG series PLC program can be uploaded/downloaded through the touch screen
- c) 16.77 million colors, the picture quality is exquisite and traceless, and the display effect is comparable to LCD monitors
- d) Download, start, run, three in one ultra-high-speed response
- e) Support C language script function, calculation, free protocol writing, drawing, improve programming freedom
  - i. Support BMP, JPEG format picture display
  - ii. Rich three-dimensional 3D library, the picture is more vivid
  - iii. Flexible parts selection space, custom animation trajectory design
  - iv. Data collection and storage function, support time trend graph, XY trend

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graph and other forms of data management

- v. Recipe data storage and two-way transmission to improve work efficiency

Features

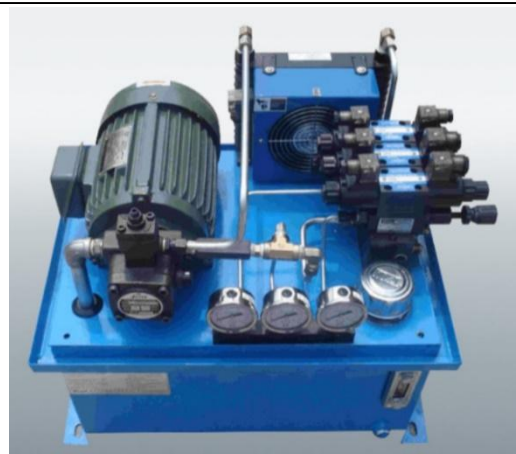
1. ARM9 CPU, 400MHz main frequency, 128MB storage capacity
2. 4.3~15.6 inches, 16.77 million colors, TFT liquid crystal display, LED backlight
3. 2 COM ports (not supported by some models), independent communication, support RS232/RS422/RS485 communication mode, can realize multiple screens and one machine
4. Standard clock
5. USB-B interface for data transmission

Item	Specification
Size	7"
Resolution	800*480
LCD Screen	TFT LCD display, LED backlight
Display color	16.77 million colors
Brightness (cd/m2)	200
Touch panel	Four-wire resistive touch screen
LCD lifespan	more than 50,000 hours, ambient temperature is 25C°, 24 hours operation
Memory	128MB
Anti-interference ability	Interference voltage: 1500Vp-p Pulse period: 1us Duration: 1 minute
Power supply	24vDC

#### 4> Electric hydraulic pump station

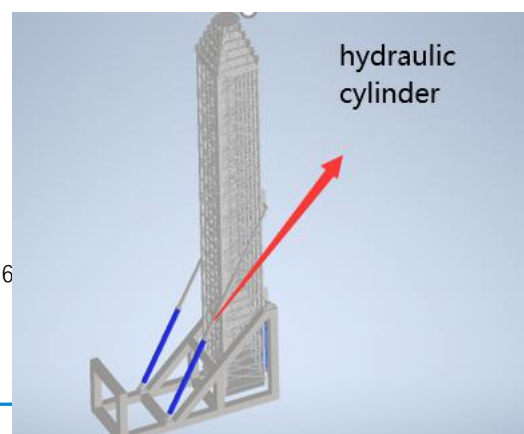
High quality hydraulic oil pump brief specs:

Power consumption	2KW
Pressure range	2~10MPA
Oil tank capacity	35L
Oil flow	2.5~6L/min
Power supply	220v/380v



Purpose of the station is to supply oil to *hydraulic*

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*cylinder* the tilting structure to stand the tower up vertically and while restoration the tower to support the tower from horizontal tilting down to vertical position for transportation.

**5> Optional Kevlar rope guy wire kit**



**6> Super capacity motor**

Power consumption	22KW
Voltage	380V
Rated RPM	1400
Type	Three phase



**TOWER Operation Safety Precaution**



DANGER indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury.



WARNING indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.



CAUTION indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury. It is also used to alert against unsafe practices.

#### GENERAL SAFETY PRECAUTIONS

The following are general safety precautions that are not related to any specific procedures and therefore do not appear else-where in this publication. These are recommended precautions that personnel must understand and apply during many phases of operation and maintenance.



**Electrocution Hazard!** Contact with high voltage will result in death or serious injury. Observe general safety precautions for handling equipment using high voltage. Do not locate or operate mast near electrical lines, cables or other unwanted sources of electricity. Do not operate mast in lightning. Be certain electrical cables are undamaged and properly terminated. Always disconnect power before performing service, repair or test operations.



**Safety Instruction - Read Manual!** Failure to follow operating instructions could result in death or serious injury. Read and understand the operator's manual before using the mast.



**Tip Over Hazard!** Mast tip over could result in death or serious injury. Do not operate in high winds. Operate on level ground only. Stand clear of mast and mast payload during operation. Be certain mast is level and secure before and during installation, operation and maintenance.



**Safety Instruction - Trained Personnel Only!** Death or serious injury could result if proper inspection, installation, operation and maintenance procedures are not observed. Installation, operation and maintenance to be performed by trained and authorized personnel only. Proper eye protection should be worn when servicing the mast.



**Health and Safety Hazard!** Solvent used to clean parts is potentially dangerous. Avoid inhalation of fumes and also pro-longed contact to skin.

**▲ WARNING**

**Safety Instruction – Resuscitation Alert!** Personnel working with or near high voltages should be familiar with modern methods of resuscitation. Such information may be obtained from the Bureau of Medicine and Surgery.

**SPECIFIC SAFETY PRECAUTIONS**

The following are safety precautions that are related to specific procedures and therefore appear elsewhere in this publication for emphasis. These are recommended precautions that personnel must understand and apply during specific phases of installation, operation and maintenance.

**▲ WARNING**

**Pinch Point Hazard!** Moving parts can crush and cut resulting in death or serious injury. Keep clear of moving parts while operating mast.

**▲ WARNING**

**Crush Hazard!** Death or serious injury could result if mast fails suddenly. Do not stand directly beneath the mast or its payload. Be certain payload is properly installed and secured.

**▲ WARNING**

**Relocation Hazard!** Relocating the mast during operation or after extension could result in death or serious injury. Do not relocate the mast during operation or while extended. This applies especially to masts mounted to trailer. Operate the mast only if the trailer is stationary and the vehicle engine is off.

**▲ WARNING**

**Fire Hazard!** Do not smoke. Keep cleaning solvent away from ignition sources. Always store cleaning solvent in the proper marked container.

**▲ WARNING**

**Mast Extension Hazard!** Extending mast into obstructions could result in death or serious injury and could render the mast inoperable and partially extended. Before applying power and operating the mast, be certain there is sufficient clearance above and to all sides of the expected location of the fully extended mast and payload. Keep all persons clear of mast and mast extension. Do not lean directly over the mast.

**▲ WARNING**

**Safety Instruction – Operation!** At all times prior to mast operation, insure that:

- 1.) The mast area is free of personnel and mechanical obstruction;
- 2.) All electrical cables are undamaged and properly terminated;
- 3.) The operator must have full view of the mast during use;
- 4.) Any transit tie-downs on the payload have been removed;
- 5.) The vehicle is not moving;

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6.) The area above the mast is free of mechanical obstructions.

**▲ CAUTION**

**Safety Instruction – Roof Access!** If mast will be mounted to a trailer, user must provide safe means to access the roof of the trailer during installation and maintenance.

**▲ CAUTION**

**Entanglement Hazard!** Tangled cables can cause equipment damage. Ensure control cables are not tangled and are free to pay out as mast is extended.

## Tower Operational Guideline

### Part elevation

Step1> Park the trailer on the appropriate place.

Step2> Use the **spirit leveler ruller** to adjust the angle of trailer platform to zero degree both x and y axle. (please refer to the photos Figure#1 Figure#2)

Step3> Press Tower 90 degree tilt button from the touch screen panel, then the hydraulic oil pump station starts supply oil to the cylinder to make the tower to vertical position.

Step4> Put the safety **Wheel thread bolt** onto the right place ( **where as Figure#3 showed** ) and it will touch the **switch sensor** in Figure #4 and then press Tower elevation, otherwise if you press tower elevation then PLC will not allow you to elevate the tower.

**PS Figure#4 are read arrow place of Figure#3**

The tower will going up section by section , each section has locking pin on four side of the tower to lock in place section by section until the tower going to the full height or client designated heights.

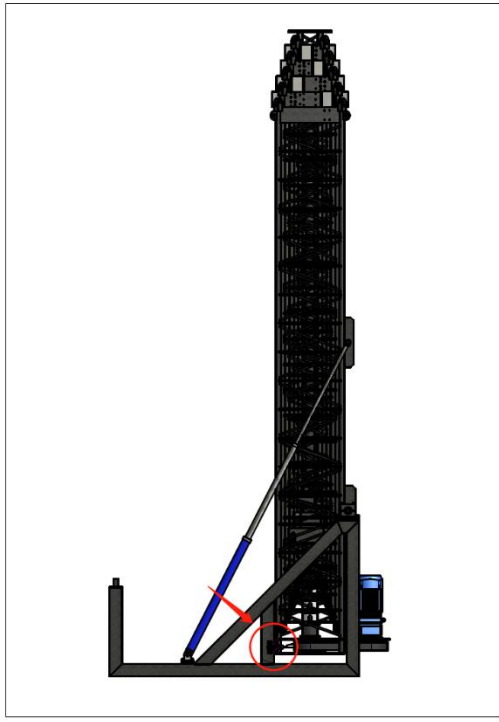




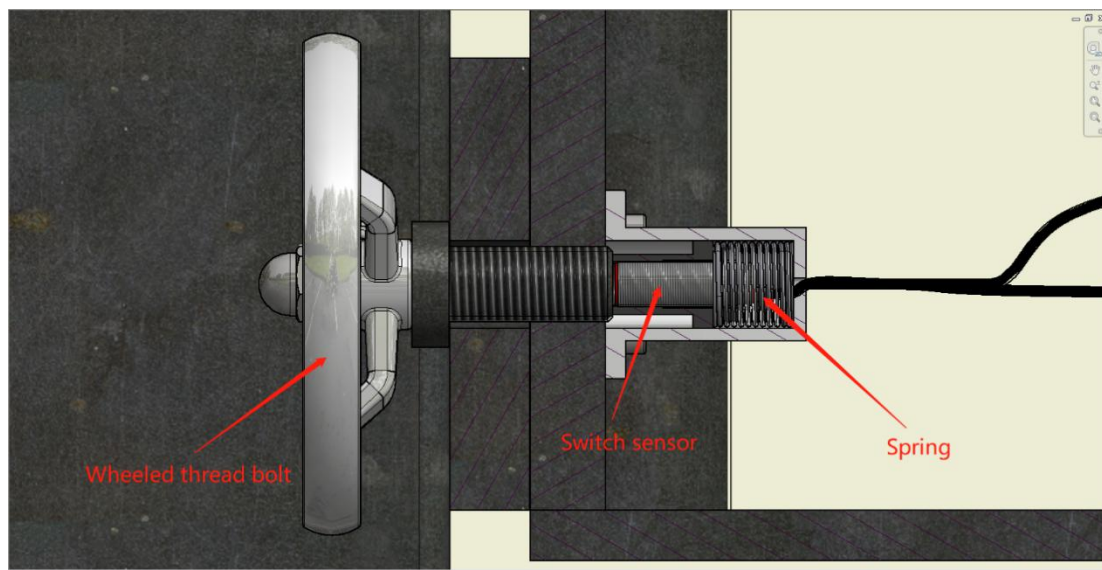
**Figure #1**



**Figure #2**



**Figure #3**



**Figure #4**

### Part restoration

Step1> Keep clear from the ground except the operation guy, press retract button on the touch screen panel. Then the tower will retract one section by one section until the last section fully retracted.

Step2> Make sure the last section is fully retracted, remove safety **Wheel thread bolt** hole and then press tower tilt down button on the touch panel, the tower gradually tilt

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down to the horizontal position.

