

# Key Points for Installation and Construction of Wind Electric Fan Foundation Ring

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**Abstract:** The installation and leveling of the foundation ring is the key process in the construction of the fan foundation. The installation orientation of the foundation ring strives to be accurate. At the same time, the accuracy of the flange level on the foundation ring is also very high. In this paper, the circular expansion fan is taken as an example to illustrate construction procedures, control points, and precautions for installation and leveling of the foundation ring. At the same time, several common quality problems that are easily generated during the construction process are listed. Corresponding solutions are proposed for each problem, which ultimately ensures the smooth installation of the fan and ensures safe operation of the fan.

## 1. Introduction

It is the trend of new energy development and utilization to innovate energy sources, optimize energy structure, develop clean energy and create green environment. Therefore, the wind power generation industry came into being and was widely promoted and applied in a short time. The number of wind farms has doubled. The installation and leveling of the foundation ring is a key process in the construction of the fan foundation. The circular expansion fan foundation is shown in "Figure 1: basic diagram of the fan".

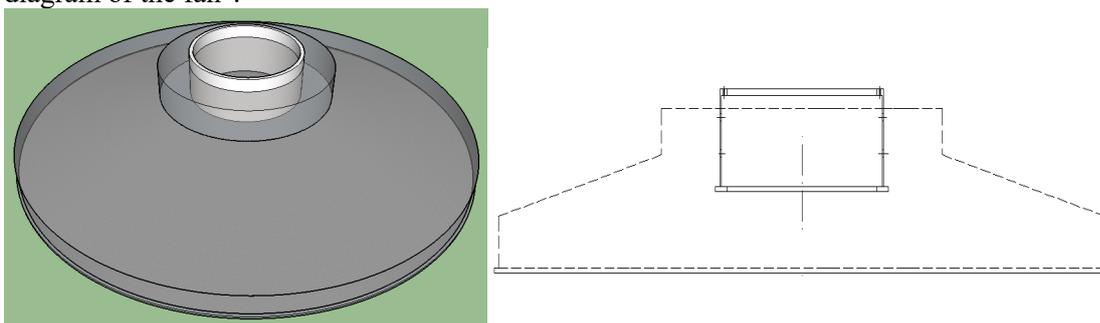


Figure 1. Schematic diagram of fan base

## 2. Construction process flow

GPS positioning base ring center→ The compass determines the main wind direction→ Theodolite determines the direction of tower doors and embedded parts→ Embedded parts positioning, installation, leveling→ Foundation ring bracket installation→ Foundation ring lifting →Rough leveling of the foundation ring→ Precision leveling of foundation ring→ Leveling and review before pouring concrete→ Leveling and review during concrete construction→ Final check of flatness after



completion of concrete placement.

### 3. The key points of the construction of the foundation ring installation

#### 3.1. Central positioning of the foundation ring

According to the drawings provided by the control piles and fan center coordinates. GPS is used to determine the center point of fan, and the center point of foundation ring is determined at the same time. According to the determined center point, the excavation of excavation pits is carried out according to the drawings and the line markings.

#### 3.2. The positioning and leveling of the preembedded parts

Check the drawings before construction and make embedded steel plate according to the drawing. Three embedded steel plates are numbered 1#, 2#, and 3# to calculate the positional relationship among the three embedded steel plates. Use a light metal rod that is not easily deformed to precisely make a positioning mold stand according to the calculated dimensions. After the foundation pit excavation is completed, determine the foundation center in the base of foundation ring. Place a high-precision compass or theodolite at the center of the substrate, and place the line according to the design requirements to determine the direction of the main wind and the tower door, and mark it in a timely manner (Save to the foundation ring installation.). When the foundation ring is hoisted, it shall ensure that the direction of the column door marked on the basic ring coincides with the mark.

In the process of concrete pouring, the embedding direction of 1# steel plate is determined according center point of foundation ring and the direction of tower cylinder door, then the positioning die holder is placed to determine the position of 2# and 3# steel plates. When positioning, the center point of the mold center coincides with the foundation center point, and the three end points correspond to the center points of three steel plates. The steel plate is embedded in concrete and the upper surface is flush with the top of the concrete. Measurement 1#, 2#, 3# steel flatness by level measurement, and the height difference is not greater than 1mm, and the leveling record of 1#, 2# and # 3 steel plates is filled in. After the concrete of cushion layer reaches the design strength of 75%, the line of steel plate is laid out to determine the center point of steel plate. After the center ring bracket center coincides with the center of steel plate, it is welded according to welding specification. The main wind direction, the direction of the column door and the relative position of the three steel plates are shown in figure 2: The main direction of the wind, embedded plate and tower door position schematic, locate the mold frame instance.

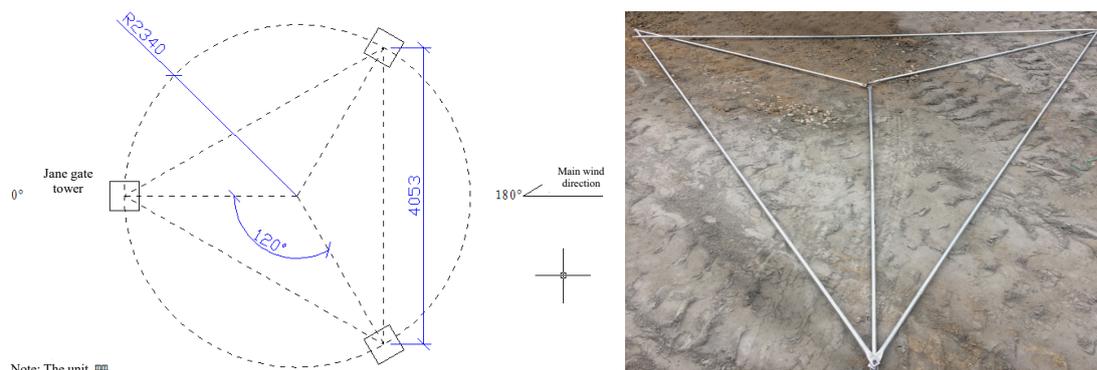


Figure 2. The main wind direction, the embedded steel plate and the tower door location map, the example of positioning dies carrier.

#### 3.3. Foundation ring entrance examination

After foundation ring enters the site, it is necessary to check the model, quantity, and quality of foundation rings and corresponding adjustment bolts, nuts, and other supporting materials. The surveyor checks the flatness of the upper flange surface of the basic ring and checks the technical data

of the underlying ring itself. The surveyors need to check the records of each foundation ring, and are not allowed to use the foundation ring with their own deviation.

### *3.4. Hoisting and leveling of the foundation ring*

After the foundation ring bracket is installed, the foundation ring can be hoisted. Before the crane is in place, the operator selects four hanging points evenly arranged on the basic ring, and suspends two steel wire ropes to carry out the test crane. When testing, slowly lift the foundation ring off the ground, make it level and ensure that the rope is not twisted. After the test hoisting is completed, the foundation ring is hoisted to the top of the support. Under the traction of the operator, the flange bolt hole of foundation ring is connected with the screw rod on the bracket, and the nut is tightened.

The foundation ring is roughly adjusted to the level. After the foundation ring hoisting, use a level gauge to measure the level of the three supports of the foundation ring is measured and recorded. The relative height difference is calculated according to the observation record, and use the jack to adjust the rise and fall according to the difference. When adjusting, install the jack first, then loosen the nut, and adjust the amount of thread at a constant speed.

After leveling, tighten the nut and check the flange level on the foundation ring.

The foundation ring is precisely leveled. The foundation ring flange surface by circumferential every 30 ° Angle split out 12 points in order number 1 # ~ # 12, using the marker identification point. On the observation record chart, the point diagram is drawn; and the observation results are recorded accurately; and the relative level of each point is obtained by calculation. If there is an error in a point or several points, it is adjusted according to the support height of foundation ring support screw. Adjust the thread width of screw thread for reference; adjust the half wire or a bit at a time to control the relative level error within 1mm. After the fan base reinforcement and embedded pipe installation are completed, the foundation ring is adjusted accurately for the first time. Complete measurement records should be retained and archived for each leveling survey or horizontal retest.

### *3.5. Review of Fan Foundation concrete during construction*

Before the construction of the foundation concrete, the level of the top surface foundation ring shall be measured again. The concrete can be poured after retesting. When the concrete surface rises, any abnormal events that affect the level of the foundation ring should be retested in time. When the concrete surface rises to a position 200 mm from the lower flange of the foundation ring, the level of foundation ring should be checked. Ensure that the flange level error on the foundation ring meets the design and specification requirements. After confirming it is correct, you can continue pouring concrete. After the completion of concrete pouring, it still needs to be premeasured once. All observation data in the process should be kept intact and archived.

## **4. Precautions during installation and construction of foundation rings**

4.1. A professional measuring engineer should be selected to adjust the foundation ring. The measuring instruments should be calibrated according to the frequency required by the specifications. The leveling instrument should be equipped with a micrometer. The data should be accurate to 0.1mm. If necessary, an electronic level can be used.

4.2. During the installation of reinforcing steel bars, any steel bars that pass through the foundation ring hole must not be in direct contact with the foundation ring. The weight of steel bars and formwork must not be applied to the foundation ring.

4.3. In the course of pouring concrete, concrete must not impact on the base ring, so as not to affect the level. At the same time, the vibrator must not directly contact the foundation ring. On-site personnel are prohibited from standing on the top surface of foundation ring. Other construction machinery should also avoid contact with the basic ring.

4.4. After the completion of the foundation concrete, the horizontal plane deviation of the flange surface shall be checked and check acceptance. The relative horizontality deviation of each point on the top surface of the foundation ring is controlled within 1mm (absolute value). The height of the inner concrete surface of the foundation ring should be accurately controlled according to the drawings.

4.5. When layered concrete is poured, the overall concrete surface is controlled to rise evenly to prevent the height difference of the concrete surface from generating a large lateral pressure on the foundation ring bracket. The flange on the foundation ring should be kept clean. Thin film mulching should be used before concrete placement. When the foundation ring level is measured again, the film should be uncovered, and the indium steel ruler will be placed on the flange on the foundation ring.

## 5. Quality problems and solutions in the construction of foundation ring installation

5.1. After the completion of the cushion concrete; if the 1#, 2#, 3# steel plate is not on a horizontal surface or single block of pre buried steel plate, if this kind of problem occurs, it will affect the installation of the foundation ring support. Therefore, during the installation of the foundation ring bracket, the welding gasket can be used to fill in and ensure that the foundation ring bracket is installed with an accurate level.

5.2. If the height of the concrete on the inner wall of foundation ring is too high, foundation ring and tower barrel connecting screw cannot be installed. In order to install the screw, the concrete should be cut down to allow sufficient height. Before concreting, a circular mark should be made at the inner wall of the foundation ring, or the foundation ring protection film should be covered to the position as the control line of the concrete surface.

5.3. The deviation of the foundation ring level is out of range, and the measured data should be rechecked. If there is a case of excessive horizontal deviation, the reason should be analyzed, and the gasket should be made up, or the position of the deviation should be carefully sanded until the horizontal degree error meets the requirements.

## 6. Conclusion

Fan foundation construction process, in foundation ring level did not meet the design requirements and cause rework or corrective situation happen late, delay the construction period, and large economic loss caused to the investor and contractor. Therefore, we should start to control the quality from the foundation ring manufacturing, transportation, approach, storage and so on. The construction should be controlled from low to high. (Including foundation stability control, Cushion embedded part self levelness control and relative height difference control, Installation precision of foundation ring bracket, foundation ring installation precision.)Accurately control the level of the basic ring, while avoiding the horizontal deviation due to the disturbance of the foundation ring in the construction process of steel bar installation, formwork installation and concrete pouring. If there is a real deviation in the foundation ring level before the concrete construction is completed, it is necessary to take scientific measures and take advantage of the mature experience to deal with it in a timely manner. Finally, it is necessary to ensure that foundation ring level meets the requirements, so as to create conditions for the smooth hoisting of fan equipment and the safe production of the fan.

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