

Status Quo and Countermeasures of Windproof Capability of Crane Working Condition

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Abstract. In recent years, the scale of coastal ports has continued to expand, and the wheel cranes produced by the port crane's own weight have generated wind resistance and corresponding mechanical development. This is characterized by advanced technology. The safety issues of large-scale machinery have always been the focus of our attention, especially based on their consideration of experimental public safety. For cranes, its large size is not strong enough for sudden gale-like disasters. This is something we need to consider. Therefore, improving the wind resistance of cranes and even their components, such as brakes, is a very necessary research topic. This article is devoted to this article and hopes to bring great help to engineering practice and put them into practice. We have simply calculated the windproof capacity and braking capacity required by the crane, simulated some important components, studied some differences between the actual and ideal, and obtained a certain requirement for the brake and crane to meet. Relationships, experiments show that this method does have its actual effect. At the same time, we have inevitably given some detailed countermeasures for some rough and sudden natural disasters. We believe that it will be of great help to engineering practice.

Key words: Crane; Wind Resistance; Improve; braking device.

1. Introduction

We know that nature's meteorological disasters are ruthless, which is especially true for some of the large-scale devices used in our daily lives [1]. This will inflict irreversible trauma on the physiology and heart of the operators and make them unable to calm down for a long time. For some large cranes, the damage is even worse [2]. For this, we must focus on strengthening the protection of large cranes. More specifically, this paper mainly evaluates and strengthens the windproof capacity of the crane [3], because if the windy wind causes the crane to roll over in the worst case, then this loss and some chain reactions are beyond our means. . It is necessary to study how to strengthen the windproof capability of cranes [4].

The current wind power capability of cranes used by us is different from each other [5]. Specifically, we can explain the following aspects:

Different cranes have different work locations and different working environments. Their work tasks are different. This has led to different tasks for different cranes. We need to carefully examine



their needs and handle reasonable arrangements as appropriate. And carefully plan the windproof measures of such cranes [6].

Different design vendors have different standards for windproof capability testing [7] of their own products. But some standards are not universal, for different venues.

For different cranes, there are different design staffs to test their windproof capacity, but artificial calculations inevitably have large errors. All of these require us to make certain additional measures on the day after tomorrow.

This article focuses on the improvement of the crane's windproof capacity, and also correspondingly studies the current status of modern cranes' windproof capability. This is very helpful for improving the living conditions of the crane, and I believe that it has a very good guiding significance for the implementation of the project.

2. Crane wind protection capability and assessment

For different cranes, in order to improve their windproof performance [9], we first need to assess their windproof capabilities. We use a crane of a certain type of unloading ship as an example to carry out a simple assessment to arrive at a general conclusion, hoping to find out some feasible improvement schemes [8]. The following table briefly gives some rough parameters of this type of unloading vessel [11]:

Table 1 Wind Proof Design for Ship-loaders

Project	Parameters	Project	Parameters
Weight	1500	35m/s Wind resistance	138
Number of wheels	40	Number of rail clamps	2
Brake wheel number	20	Track clamping device maximum holding force	50
Landside braking wheel number	8	Rail clamp and track friction factor	0.25
Sea side brake wheel	12	Track and wheel friction factor	0.12
Gauge	30	Original Design Wind Load Calculation Factor	1.1
Base distance	17		

For a brief analysis, here we use a finite element analysis method to simulate the wind load received by the hull, establish a corresponding model and analyze the stakes. According to some international standards and some examples [12], we take the direction of the load along the horizontal direction, and then the wind force is calculated as follows:

$$P = K \cdot C \cdot q \cdot A$$

We hereby express the wind force received by the crane with P. The approximate height coefficient is expressed by K. [10] the wind coefficient carried by the object is denoted by C, and the area of the crane under relevant conditions is used here by A. Indicated.

We calculate the pressure on each part of the crane, of course, using the method of finite element analysis to calculate, we can roughly get some value [13].

Analysis of the data shows that the pressure on each part is different. Different wind coefficients have different effects on the crane load. From this we can propose the following related improvement measures:

a). Use the frictional force of the crane's own weight to windbreak, taking into account the asymmetry of the structure while designing, and taking into account the pressure on different wheels.

b). Different windproof measures should be selected according to different working conditions. The relationship between the two should be considered at the beginning of the design.

c). For each crane, we should fully consider the measures that should be taken according to local standards and regulations.

3. Brake device improvements

We know that in order to deal with some natural disasters that may not be expected, most cranes are almost all equipped with certain wind protection devices [16]. This is what some devices do, such as devices in cart brakes, wheel brakes, wheel brakes, rail clips, and so on. Among them, we know that the cart brakes and the wheel brakes are the wheels of the brake carts. They can use the crane's own weight during the operation, and the friction is generated between the wheels and the rails [14] to break the cranes. Some of the above devices are configured on the outside for the crane, and the rail clipper is a device that directly acts on the crane. It uses the jaws to grip the rails and generate friction, thereby exerting a certain braking effect on the crane.

Below we discuss the calculation of the braking capacity of some devices.

If the crane's wheels are completely locked, the formula for friction generated by it is:

$$F = \mu G$$

Among them, G is the weight of each wheel.

The amount of friction that the brake can produce is:

$$F_3 = MR$$

By comparing the sizes of the two, we can determine whether the wheels are rolling [15].

In this paper, we have focused on strengthening the relevance of the crane's windproof capability, i.e., how to make it more viable in dealing with bad weather, without being subject to extreme weather conditions, making it the good working conditions cannot be carried out systematically as the operator imagines. We tested the crane's capabilities to varying degrees, and correspondingly performed some mathematical calculations on some of the improvement measures. Although some of them were carried out after taking into account the ideal conditions, they have more or less certain advantages. This is also very good compared to not taking action. For the brake device arrangement, we also made some tests accordingly. The results show that the results of these tests are generally very good, and have certain reference value for large-scale implementation. In order to deal with the increasingly severe weather conditions, we have proposed some measures to improve the crane. This is described in detail in the relevant sections of the article. We have conducted some tests on these measures. The experimental results show that these measures are very useful. In spite of this, there are still some tasks that need to be done to improve the wind brakes, such as the treatment of wheel oil. These are questions that need further look into. Although we have already done a lot of improvement measures, or have strengthened some structural stability in certain aspects, we think that this is far from enough for the windproof capacity of cranes, and a large number of more advanced and more mature ones. More simple and easy-to-use measures should be explored by all of us. These are all necessary because the weather in the future should be more extreme and it also requires us to rationally develop more stable and reliable devices to complete our daily lives.

Table 2 Carriage's Stopping Power for a Ship

Constraint point	Fx	Fy2	F2	F4	F5	F6
1	19	95	11.3	8.2	13.9	9.2
2	25	281	33.7	18.2	14.9	13.9
3	37	433	53.0	25.1	20.9	20.9
4	58	690	82.8	43.2	20.9	20.9
Sum	139	1499	180.8	94.7	70.6	64.9

Based on the data in the above table, we can come up with the following improvements:

a). Due to the persistence of the HAD's self-respect, use the HAG as much as possible to prevent wind damage.

b). Because the pressures of the four legs are different, a reasonable design of the pressure distribution of these components of the crane is required [16].

c). Because the braking ability of the rail clamp is related to the track contact area, the maintenance and maintenance of the clamping jaw must be strengthened.

d). Using effective technical means regularly check the braking device's capabilities and accurately grasp the brake status.

Conclusion

In this paper, we have focused on strengthening the relevance of the crane's windproof capability, i.e., how to make it more viable in dealing with bad weather, without being subject to extreme weather conditions, making it the good working conditions cannot be carried out systematically as the operator imagines. We tested the crane's capabilities to varying degrees, and correspondingly performed some mathematical calculations on some of the improvement measures. Although some of them were carried out after taking into account the ideal conditions, they have more or less certain advantages. This is also very good compared to not taking action. For the brake device arrangement, we also made some tests accordingly. The results show that the results of these tests are generally very good, and have certain reference value for large-scale implementation. In order to deal with the increasingly severe weather conditions, we have proposed some measures to improve the crane. This is described in detail in the relevant sections of the article. We have conducted some tests on these measures. The experimental results show that these measures are very useful. In spite of this, there are still some tasks that need to be done to improve the wind brakes, such as the treatment of wheel oil. These are questions that need further look into. Although we have already done a lot of improvement measures, or have strengthened some structural stability in certain aspects, we think that this is far from enough for the windproof capacity of cranes, and a large number of more advanced and more mature ones. More simple and easy-to-use measures should be explored by all of us. These are all necessary because the weather in the future should be more extreme and it also requires us to rationally develop more stable and reliable devices to complete our daily lives.

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