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Size Investigation and Engineering Application of Pull Screw Aluminum Alloy Template

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Abstract: As one of the aluminum alloy formwork systems, the pull screw aluminum alloy template is widely used in construction projects. However, in the template design, due to the inability to fully understand the structural measures of the template, the pull screw aluminum alloy template produced by various enterprises has different sizes, which makes it difficult for different enterprises to use the system template interchangeably, and the non-standard rate of the template is extremely high. In this paper, through the investigation of enterprises, the structure and size information of the system template are understood, and the application of the template in the design and construction of the template is summarized in combination with the engineering examples. The conclusions are as follows: The transverse and longitudinal stiffeners of rectangular and trapezoidal sections are arranged in the structure of the pull screw aluminum alloy template. The size of the template is: length 2600mm, 2700mm, width 500mm, 400mm, thickness 4mm. In the project, the pull screw aluminum alloy standard template is preferentially matched, and the wall surface is flat and smooth after use, which meets the requirements of facing and fair-faced concrete without plastering.

Keywords: Pull Screw Aluminum Alloy Template; Size Investigation; Engineering Applications; Cross Section of Stiffeners; Die Design

1. Introduction

Building template is an important building material, which is widely used in the process of building concrete pouring and forming. The formwork accounts for about 20 % ~ 30 % of the total cost of the project, 30 % ~ 40 % of the labor cost, and about 50 % of the total engineering quantity [1]. The formwork project is also an important way of green construction [2]. It is suitable for standardized high-rise residential buildings, in line with national energy conservation and environmental protection requirements, and has broad market prospects [3]. According to the different forms of force, aluminum alloy formwork can be divided into pull screw aluminum alloy template and pull-plate aluminum alloy template. Through comprehensive comparison, it is found that the pull screw aluminum alloy template has the advantages of simpler operation and higher flexibility. It is found that the pull screw system is more widely used in the market. Therefore, this paper studies the pull screw aluminum alloy template.

Because the specification only recommends that the template adopts a certain modulus in the design and production, but does not require the specific size and cross-section form of the template, the template manufacturers only rely on experience or reference to other manufacturers to produce the template design, so the template products are diverse, resulting in different enterprises. The template is difficult to interchange and use, and the problem of low versatility of the template is more significant. In this paper, the production process and standard template size information of the pull screw aluminum alloy template produced and used by the enterprise are investigated, and the application of the template in the design and construction of the template is summarized in combination with the engineering example.

2. Research on the Size of Pull Screw Aluminum Alloy Template

2.1 Domestic Specification Requirements

The size of the pull screw aluminum alloy template is based on the specification requirements and considers whether the mechanical properties of the template can meet the construction requirements [4]. However, due

to the current domestic research on the template is still less, the manufacturers can only refer to foreign template technology, the production of their own template, resulting in non-standard template rate is very high, the template reuse rate is low. The design of the formwork should consider the safety of the building structure, and follow the building modulus in the relevant specifications to select and determine. Building modulus is a kind of value-added unit used in architectural design [5]. The specification stipulates that the modulus of aluminum alloy template should conform to the relevant provisions in the" Standard for modular coordination of building" (GB/ T 50002-2013).

The template recommended by the specification should meet certain modulus requirements, and should have certain versatility and interchangeability. The standard template should be preferentially used in design and use. Therefore, the design of the standard template of the pull screw aluminum alloy should not only meet certain modulus, but also the design of each structural part of the template should be determined by a universal size series.

2.2 Standard Size of Pull Screw Aluminum Alloy Template

The pull screw aluminum alloy standard templates of four enterprises are investigated, focusing on the standard size of the template and the section form of the stiffener. The comparison results are shown in Table 1.

The material of the standard template of the pull screw type aluminum alloy is made of 6061-T6 aluminum alloy by extrusion and then welded with the stiffening rib. The standard template size is 2600 mm and 2700 mm in length, 400 mm and 500 mm in width, and 4 mm in thickness. The cross-section of the stiffening rib behind the template is mostly rectangular and trapezoidal. It is found that in the design of the mold, each enterprise has independent design criteria, but there is no big gap.

3. Engineering Application of Pull Screw Aluminum Alloy Template

3.1 Project Profile

The research object of this paper is the 3 # building structure located in a project under construction in Xianyang City. The building elevation is 57 m. The structure is a shear wall structure. The building is a 33-storey residential building. The building standard floor is 4-16 floors. The standard floor height is 3.15 m. The construction engineering template adopts the pull screw aluminum alloy template designed by Shaanxi Tian Li Cheng Construction Technology Co., Ltd.

Table 1. Size Table of Pull Screw Aluminum Alloy Standard Template Produced and Used by Enterprises

The name of firm	Panel thickness/mm	Size of the formwork/mm	Cross section of stiffeners
Shaanxi Tian Li Cheng Construction Technology Co., Ltd.	4	Width 400, Length 2600	Trapezoid section
Shaanxi Chang Yi Technology Co., Ltd.	3.7	1. Width 500, Length 2600 2. Width 500, Length 2700	Rectangular section
Xi'an Three Aluminum Aluminum Alloy Template Technology Co., Ltd.	4	Width 400, Length 2600	Rectangular, Trapezoid section
Xi'an Han Hua Construction Industry Co., Ltd.	4	1. Width 400, Length 2600 2. Width 500, Length 2600	Trapezoid, I-type, Allotype

3.2 Die Design of Pull Screw Type Aluminum Alloy Template

The templates used in this project are all pull screw aluminum alloy templates. When deepening the design of the building structure, only the standard layer building structure is deepened. The design of the pull screw aluminum alloy template should be divided into blocks according to the building structure. This paper only explains the design of the wall, and the design process of the pull screw aluminum alloy template is as follows:

(1) Communication needs. Before the mold design, according to the needs of the building structure, the template system is communicated in advance.

(2) Examining pictures. Compare the building wall column diagram to ensure that there is no contradiction in the size of any structural

member in the diagram.

(3) Drawing confirmation. When there are contradictions or errors in the drawings, the confirmation request is made to Party A through official documents. For the more complex structure or the structure that is not suitable for the pull screw aluminum alloy formwork, the deepening understanding is carried out and the communication with Party A is carried out. After the deepening, the final deepening design scheme is confirmed, and the formal letter of Party A is sent to confirm the feasibility of the deepening design scheme.

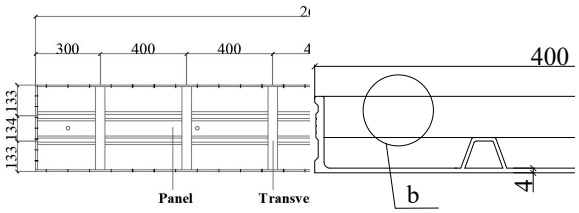
(4) Establishment of wall template library. First, invest a certain amount of time to understand the standard layer wall size changes. Then calculate the length of all templates, create modules corresponding to the specifications, store them in CAD, and add them to the drawing file in the form of a table. After completing the creation and addition of the block, let the other members re-check.

(5) Molding steps. When the outer wall of the wall on the floor is equipped with a mold, the corner plate of the outer wall is first configured, and then the mold is matched from the corner to the other side of the wall. The mold is preferentially adapted using a standard plate and is adapted to the inner wall template. The bolt holes between the two sides of the template are aligned with each other, so that the two sides of the template are pulled together on the back ridge through the screw.

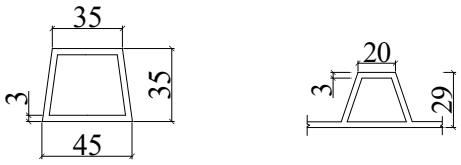
(6) In order to ensure the accuracy of the installation position of the wall template, all the positioning axes in the original diagram are re-copied to the plane diagram after the die matching of all the wall-to-screw aluminum alloy templates. Finally, the designed die matching diagram is organized into a special frame of the company.

(7) After the design of the drawings with MSTEEL tool, the number of templates in the drawings after the design of the mold is counted, and then made into the engineering template processing production order.

According to the principle of mold matching, the standard layer wall of 3 # building of a project under construction in Xianyang City is designed, and the standard is selected to match the pull screw aluminum alloy template. The size information of the standard template and the form of plate rib structure are shown in Figure 1.



(a) Template Plane Diagram **(b) Template cross Section**



(c) Longitudinal Rib Section Diagram **(d) Transverse Rib Section Diagram**

Figure 1. The Schematic Diagram of the Pull Screw Aluminum Alloy Template Structure/mm

3.3 Construction Technology of Pull Screw Type Aluminum Alloy Template

The characteristics of the quick dismantling system of the pull screw type aluminum alloy template is that when the concrete in the formwork reaches half of the design strength, the pull screw type aluminum alloy template can be removed in advance, leaving only the steel support supporting the floor, thus shortening the construction period. The specific construction process is shown in Figure 2:

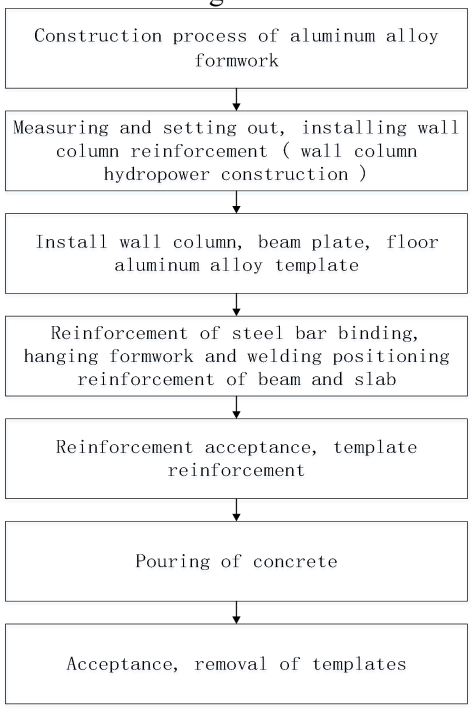


Figure 2. Construction Technology of Aluminum Alloy Formwork

The construction plan is formulated, and the template is assembled by the trained personnel. According to the location of the structural wall, the measurement and setting out positioning and the introduction of the elevation are carried out. Then, the wall reinforcement is bound and the hydropower project is embedded within the scope of the measurement and setting out. After the construction of this process, the supervision and the acceptance of the Party A personnel are waiting. After the acceptance is qualified, the installation of the pull screw aluminum alloy template is carried out. Firstly, according to the control line, the wall formwork on one side is installed by the pin pin piece. After the formwork is placed in advance according to the control line, the formwork on both sides is connected to the back ridge with a screw, and the formwork is fixed with a diagonal brace [6].

After the installation of the pull screw aluminum alloy wall template, the beam slab and floor slab are installed, and the floor slab and beam slab reinforcement and hydropower are pre-embedded [7]. After the installation is completed, the supervision and Party A are notified to accept the reinforcement and formwork. If the acceptance is unqualified, the reinforcement and debugging will continue until the acceptance is qualified. The concrete is poured, and the concrete is poured in sequence, as shown in Figure 3.

Figure 3. On-site Concrete Pouring Drawing

3.4 Template Effect

When the strength value of concrete is allowed to be dismantled early in the specification, the formwork is dismantled after the consent of Party A and the supervisor. The inclined support, back ridge and screw are dismantled first, and then the wall formwork, beam slab and floor aluminum alloy formwork are dismantled successively. The top support is dismantled after the upper layer curing is completed. Remove the template, remove the template should be stacked in the correct order, and make a distinct logo [8].

The good construction quality of aluminum template can ensure the stability and surface quality of components [9]. Each template is connected to the hole through the pin to ensure the stable connection and verticality of the template, and the seam is tight, so as to eliminate the leakage of the expansion mold [10].

In the whole concrete pouring process of the project, there is no slurry leakage or burst mode phenomenon in the pull screw aluminum alloy formwork used, and only a small amount of water seepage occurs at the joint of the formwork, which indicates that the formwork is in good working condition.

After demoulding, the wall surface is smooth and clean, basically meeting the requirements of facing and fair-faced concrete, without plastering, saving costs, as shown in Figure 4 below.

Figure 4. Application Effect Diagram of Pull Screw Type Aluminum Alloy Template

4. Conclusion

In order to fully understand the structural measures of the pull screw type aluminum alloy template and the size information of the standard plate, the enterprise investigation was carried out, and the application of the system formwork in the design and construction of the formwork was summarized in combination with the engineering example:

(1) It is found that the standard plate of pull screw aluminum alloy is mainly made of 6061-T6 aluminum alloy profile by extrusion and welding with stiffeners. The size of the standard plate is: 2600mm, 2700mm long, 500mm, 400mm wide, 4mm thick. The transverse and longitudinal stiffeners are arranged behind the template, and the cross section of the stiffeners is mostly rectangular and trapezoidal.

(2) In the engineering mold design of the pull screw type aluminum alloy template, the standard of the pull screw type aluminum alloy template is used first, and the use of the standard plate also reduces the complexity of the mold design. After the formwork is used, the wall

surface is smooth and smooth, which meets the requirements of the finishing and fair-faced concrete, without plastering and saving costs.

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