

# The Discussion of the Heat Preservation Technique of Small Log Home in Grigid Zone Area

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**Abstract:** The small log home architecture is being welcomed greatly by the market for their special architecture style and ecotypes healthiness. Confront with the energy crisis becoming more seriously, how to deal with the relationship between energy consuming in construction and in use of this kind of architecture is the key of having the continual development vitality. Through the mechanism analysis of the factors which influence the outside wall heat preservation question of log home.

**Key words:** log home, mechanism analysis, the heat preservation structure of outside wall

## 1. INTRODUCTION

Today when energy increasingly nervous, the people call the building type that imbecility consume and can reborn resources in residence construct; The people of the middle-class family society that will soon move forward also pay attention to the quality of the residence building more, pursue more healthy and ecosystem life style. Vast development space of this wood structure building meets these requests. The authority data shows that the United States of 1997 sets up 1,138,000 single body villa, among them 90% adoption wood structure; Japan constructed 1,215,000 sets of residences in 1999, among them 47% is a wood structure; The American single body villa set up 1,264,000 single body villa in 2000, the comparison of the wood structure was also or so in 90%. The build of small residence of the wood structure also rises quietly in the domestic. The consociation real estate development company of Beijing North America will invest 600,000,000 dollar RMB in north suburb in Peking, purchasing 100 sets of wood systems villa toward the company of vicerey, anticipating to be

construct completely in two years. More than 20 wood systems building was set up in Dalian lately in the alongside the sea road zoo, the gold stone a golf course, expanse of stars park, the wooden stick island guest house...etc. in these three years, all of these explained that the small residence of the wood structure has the extensive market need and foregrounds. As one type of wood building the log home architecture is subjected to the favor doubly for its good ecosystem, and the property of the reborn resources, but because of the timber consumes the dosage greatly, they were been apply in small residence buildings, such as deluxe villa and the holiday hotel...etc. Even have the traditional, nature, the log home architecture catered to the juice request of the idyllic life of the original flavor exactly that the deluxe villa pursuing, so it is a head choose within the small residence building type. According to the above-mentioned reason the golf holiday country villa that was set up in Harbin Erlong mountain was researched to manufacture and developed, are the first domestic the log home residence (Figure 1).



Figure 1 External appearance the golf holiday country villa

## 2.THE EXISTENT PROBLEM OF THE SMALL LOG HOME ARCHITECTURE

A log home architecture is be called in the United States" the Log Home", but be called in Russia"Дома ручной рубки", mean to use log as the material for the wall body construct, open a cave slot on the side of the log, The perpendicular wall takes to connect with horizontal wall mutually and bite to set up the wood architecture. We also can divide them into the whole wood building and not whole wood buildings again according to the cross section shape of a wood.

Not whole wood building mean that the whole wood

does not carry on the equal radius process, a wood cross section is placed in a wood shape, A log cross section that placed in a nature log shape, open a cave slot on the side of the log, The perpendicular wall takes to connect with horizontal wall mutually and bite to match each other to set up the wood architecture. (figure 2)

Because the natural shape of log constructed all the outside wall of architecture, the connection and biting to match each other become the focus and obstacle of research. The resolve of heat preservation structure technique of the outside wall in the Frigid Zone becomes the most important key problem.



Figure 2 Structure system of the log home architecture

## 3. THE MECHANISM ANALYSIS OF THE HEAT PRESERVATION FACTOR AFFECT OF OUTSIDE WALL

3.1 The assurance of the form of the cross section constructs

The difference of the whole wood building between the not whole wood building, the distinction is the difference of the shape of log the constructing wall, one shape is a regular, the unify sized, and have the compatibility parts, the another one is the shape that contain natural difference, different size, and have no compatibility parts. Then does the cross section structure form used for the log home wall be fit for the not whole wood building? Such as unwell should how to solve? This is the just key place of the research.

The whole log home body cross section structure contain three kinds of basic forms: Single slot type, double slot type, circle slot type. Among them, circle slot type can spread out a single circle slot type and double circle slot type. But all of these types request the nicety of the top and bottom pole piece, past all unwell used for not whole log home.

Be subjected to a structure of circle slot type inspire, processing the difficulty on the scene for the sake of the simplification, changing the shape of circle slot type cave slot of "V" matrix to simplify the difficulty of the spot process. (Figure 3) Its advantages are:

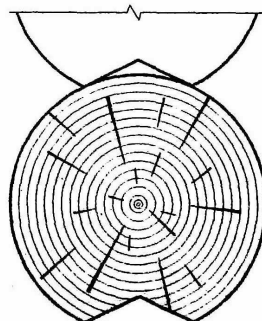


Figure 3 A type of "V" word structure form

3.1.1 Overcame disadvantageous factor that a circle slot type spot process are more difficulty, also simplified consumedly to the timber processes inconvenience that bring by not whole log home each cross section of wood does not equal radius, these very feat spot handicraft craft process, speeding the construction degree of progress, shortening to construct the work period.

3.1.2Inherited the advantage of a circle slot type constructs form completely, see from the structure

system, have the good wall body stability equally, and strong advantage of the anti-earthquake ability; See from the degree of process, the same need to be process to the lower part of a wood only, the simple construct, the small quantity of the timber exhausts, less work quantity than the construction of the single and double slot type.

### 3.2 The assurance of a size of "V" word

After solving not whole log home cross section form, the top and bottom of the wall body interrupted to face to bite each other to match to pour the ocular openings width of "V" word and the stability and timbers of the size direct influence wall body of the depth to consume the amount of material, so how the width and depths that make sure the openings is not whole wood constructs the technique processing of key.

**3.2.1 Sureness of the width of opening :** As Fig. 4 shows, for guarantee wall have enough stability, upper strata log want and have enough biting the width of equaling to at lower floor log, as everyone knows, equilateral triangle ideal steady form very, act as layers of log a certain section pour "V" word mouth width equal to lower floor log radius of section this at the  $r$ , can reach a kind of steady state between the log. But because the section of the natural timber can not be the ideal round, so integrated type log a certain section pour "V" word mouth width want and smaller than lower floor log this section average radius length of place, that is to say lower floor log this section average radius of place length whether upper strata log this section place pour "V" word mouth minimum critical value of width. For economize timber, pour "V" word mouth even difficult and heavy to open one's mouth width, following layers of log section place large radius heavy critical value most.

**3.2.2 Sureness of the depth of opening:** As Fig. 4 shows, base on the premise that the width is confirmed, for guarantee a certain section place pour "V" word reason keep in touch with the lower floor log under the

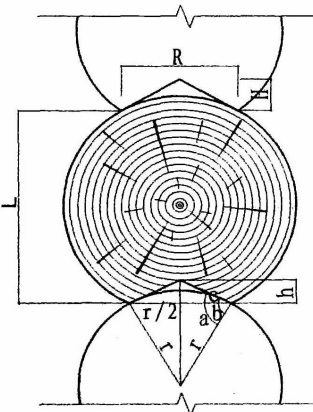


Figure 4 A structure form of type of "V" word

mouth,  $\alpha = 90^\circ$  is an ideal situation, that is to say, it is the ideal situation that it is tangent to pour two sides of the word mouth of "V" and lower floor log. Because not the section of the integrated type log is not the ideal round, to the every sections of every log and a stick of log, the two radiuses drawn are different at two o'clock when reason is contacted under the words mouth of "V" of it and upper strata log, but differ by about 4-6 mm, but carry on the adjustment of such error through constructing, so and design the effectiveness of practice for the theoretical research, suppose that the form of every section of the log is ideal round geometric figures, lower floor two radius (r or R) these of log and upper strata V word width of mouth of log made up triangle equilateral triangle certainly then, so interior angle b of its triangle is  $60^\circ$ . Angle a, b are all known parameters now, pursues to can know,  $c = a - b = 90^\circ - 60^\circ = 30^\circ$ , h of depth (or H) of the word mouth of "V" can be asked out. By type  $\text{tg}30^\circ = H/0.5r$  can be drawn,  $h \approx 0.3r$  or  $0.29r$ .

### 3.3 Mechanism that the outer wall conducts heat

Integrated type log little outer wall of residential housing toe out heat dissipation way have wall transmit heat and outer wall permeate and conduct heat two ways through air by heating conduct mainly.

**3.3.1** When the outer wall transmits heat by heating conduct, the wall is the greater in thickness, the greater thermal resistance is, it is the better to keep performance warm, then how to confirm the thickness of calculation of the outer wall? This is the key to solving fetching value of diameter of log of the integrated type.

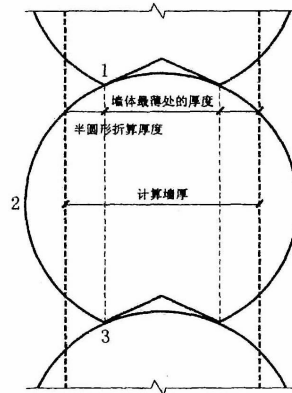


Figure 5 Calculate the thickness sketch map in the wall

Can be found out from Fig. 5, not the section of the log wall of the integrated type is to become sectional. Integrated type log wall of building in the section, lower floor log bite and hand over wall of office most thin jointly in two log, it is a weak link kept warm in wall; The thickest place of the wall is the diameter of the log, and the most favorable place kept warm in wall.

Through the above analysis, the thickness of

calculation of the wall should fetch the revision value of the average thickness of the wall. The average thickness of the wall means that the thickness of the thinnest place of the wall adds the semi-circular thickness of conversion of both sides. The thickness of most thin office of the wall is the width of opening one's mouth of the word mouth of "V", is radius  $r$  of the log. Semi-circular thickness of conversion fetch half of semi-circular thickness two and calculate on both sides, namely half of the radius of the log, namely  $r/2$  (the fetching value of this thickness is fully considered, integrated type log advise and cause and open one's mouth nonconformity of size exactly because of size, cause the part of the wall to keep performance warm to drop, so leave certain insurance coefficient). So the average thickness of the wall is  $r + r/2 = 1.5 R$ , namely integrated type log 1.5 times of radius. Because does not build each one of the same building the diameter of the integrated type log is not equal to, to facilitate and design and study, calculation thickness of wall fetch 1.5 integrated type log examine chides of radius multiply by sure insurance coefficient.

3.3.2 Integrated type logs building airtight in wall fine bad to concern outer wall keep to better than in broken performance warm directly. Integrated type log building want and solve wall and doors and windows hand over place airtight problem of chink, (Including layer join but level that produce sew, the same layers of butt joint and vertical seam, vertical-horizontal wall that produce interlock but cross that produce sew from head to foot) solve the problem that hand over chink produced each other between the log.

#### 4.SOLUTION

##### 4.1 The wall body structure

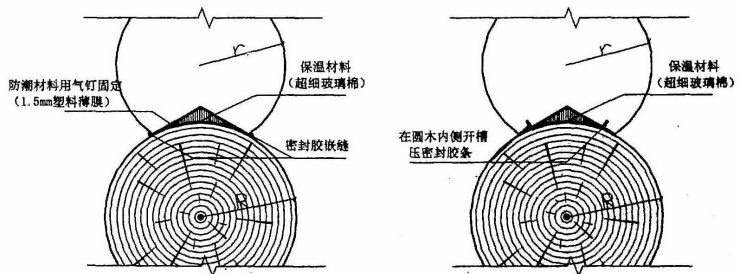


Figure 6 The level is sewn and constructed and designed

Not the structure of the log wall of the integrated type is joined, only three kinds of situations: First, the level between one layer of log from head to foot is sewn and constructed; Second, construct with the end of one layer of log in the face of the vertical seam that is connected; Third, horizontal vertical wall cross shut to bite sew and construct, because vertical to sew, structure and log unanimous basically in building integrated type that cross sew, so omitted.

The level of the log outer wall is sewn and constructed (the structure treatment method of the word mouth of namely "V"), see Fig 6. Different according to filleting means that is used, deal with the means dampproofly differently, it has two way of doing things:

The first way of doing things: Integrated type log coherent rectangular XiangKai "V" word mouth, look through on turning to putting "V" word mouth, it is then 1.5 mm. cut out as timber material feature plastic sheeting not thick and length, the width is the width of the word mouth of "V" of twice size specification measurement, pave the ultra thin glass wool felt fully on it, roll with ultra thin glass wool felt plastic sheeting fifty percent discount twice, wrap up in and live in at all with plastic sheeting ultra detailed glass wool felt, it is in the mouth to be wrapped up in the good plastic sheeting with ultra detailed glass wool felt and put "V" word, use and nail fixing angrily, there will be the one that keep warm with the dampproof material finally the log obversion of integrated type will come over, word mouth downward "V", put at the next layer of log fixing. The level between two log is sewn and use the filleting of the fluid sealant.

The second way of doing things: Integrated type log coherent rectangular XiangKai "V" word mouth, look through on turning to putting "V" word mouth, both sides of mouth coherent to turn on again two light trough, imbed trough soft rubber sealing strip while being rectangular in "V" word, then put the ultra detailed glass wool felt heat insulator in the word mouth of "V", use and nail fixing angrily, integrated type log come over by obversion finished finally, word mouth downward "V", put at the next layer of log fixing. The level between two logs was sewn and does not mix and use the filleting of the fluid sealant, because the soft

rubber has already played filleting function.

##### 4.2 The outside wall and doors and windows link the structure

Not certain error that the size of structure of the log building of the integrated type is caused by that measurement specification of timber is uncertain, using in integrated type dry dry law naturally in addition, the wall is sure to produce subsiding in

various degree after building up. For make to subside and can cause to pinch out of shape doors and windows wall, its method solved is: To go to reason and wall leave certain space doors and windows, while sinking in the wall can pinch in on doors and windows at the predestination. But how could the space of the wall and doors and windows leak out? This needs to adopt the means to construct to solve.

4.2.1 See Fig. 7 in structure connected with wall in window:

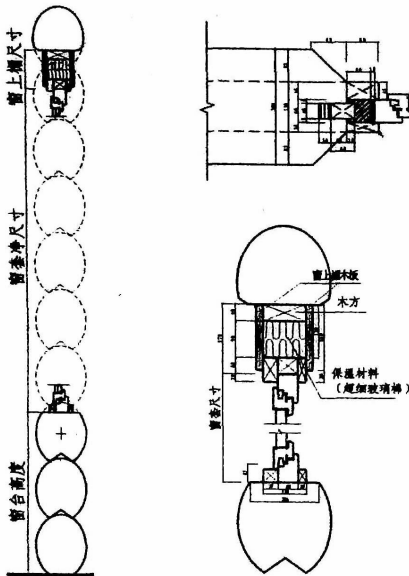


Figure 7 Structural map connected with window in wall

4.2.2 The structure practice that the door connects with outer wall is essentially identical with the window, does not narrate too much again.

#### 4.3 Gable, partition wall constructing

In order to lighten the dead weight of the wall, so "△" shape gable adopts the post panel wall of the frame, construct and design and see Fig.8.

### 5.CONCLUSION

Frigid zone integrated type log little residential housing outer wall keep warm research of issue only integrated type log first that building study, the study on it has regional certain one, this text has not only studied the performance of keeping warm of log architecture of integrated type, have not involved defending the research of the hot problem, has not furthered investigate it, sustainable development,

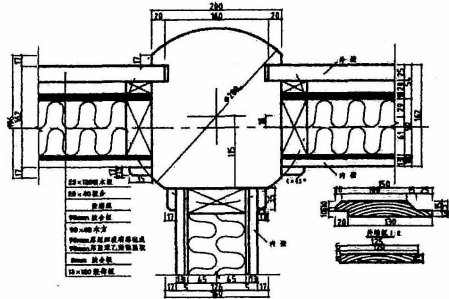


Figure 8 The post panel gable of the frame is constructed and designed

green relation in questions, such as building, etc. either, so frigid zone integrated type log building outer wall keep warm research of issue whole integrated type log building study original version of system, open iceberg corner only, integrated type log a kind of exploration form that building study. Study on it have much work want and do, we building scientific and technical personnel should to different region, different to require, propose that building the scheme and mode of a whole set of, to meet different markets' demands to the maximum extent, make a contribution to abundant wooden building system.

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