

## Detailed Wind Prood Joints Design in Aluminium Standing Seam Metal Roofing System

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**Abstract.** Detailed wind prood joints design in aluminium standing seam metal roofing system is discussed in this paper. The aluminum standing seam metal roofing systems are more widely used in large public buildings; different actual project shows that it meets the complex shape of the building and the natural environment. Its point support system performance and long smooth roofing sheets meet the natural shape. As a lightweight roofing system, the problem of weak wind resistance is increasingly exposed, especially in typhoon and other inclement weather roof is easy to be overturned; Hangzhou project etc. are introduced in standing seam aluminium magnesium manganese metal roofing system of reinforcement measures. The discussion can provide the similar reference for other related project.

### Introduction

In the architectural design of the 21st century the aesthetic attractiveness of glass and metal is more and more expressively characterizing the world of building. Aluminium is the material to visualize our future. Aluminium alloy roofing system combines the excellent characteristics of aluminium such as low weight and high stability with the advantages of an intelligent and carefully thought out standing seam system.

Standing seam metal roofing system in large-scale public buildings is widely used, such as the capital airport T3 terminal building (2008), China National Stadium (2008), Fuzhou Strait Olympic Sports Center Stadium (2015), As shown in figure 1. According to the present design, construction, the use in practice proved that, this system is set of outstanding roofing systems, its characteristic is: 1) the roofing system constructing is flexible, can meet the many kinds of constructions requirements, from the simple slope roof to the complex arched roof; 2) the aluminum alloy sheet can be laid from the eaves to the eaves or from the ridge to the avers without joint 3) aluminum alloy roofing sheet has high ratio of strength-weight 4) aluminum alloy roofing sheet has easy workability, it can be processed in the order or in the construction site 5) good ability of against corrosion of this system. Therefore, the aluminum alloy roofing system has the good durability, lowly maintains cost even not need to maintain. This system's high ratio of strength-weight, the easy workability and simplified the installation procedure can promote the light steel structure's development, although at present the cost of this system is still high, after synthesis service cost consideration, this roofing system's ratio of performance-price is still very reasonable.

In the standing seam metal roof design, wind loads are usually control design case; because of the light weight of the roof structure, and are often designed for ultra wide roof, roof system with larger windage area, the actual wind pressure usually cannot be accurately calculated, according to existing load code<sup>[1]</sup> for design of design value is relatively small. Standing seam metal roof wind resistant performance mainly depends on the lock seam of roof sheet and metal clip, metal clip fixed with roof purlin.



(a) Capital Airport T3 Terminal Building (2008)



(b) China National Stadium (2008)



(c) Fuzhou Strait Olympic Sports Center Stadium (2015)

Fig.1 Standing Seam Metal Roofing System in Large-scale Public Buildings

### Characteristics of Standing Seam Metal Roof System

The detailed wind prood joints design in aluminium standing seam metal roofing system is given from Fig.1-Fig.4<sup>[2-5]</sup>. Case 1 and case 2 of detailed wind prood joints design is given in Fig.1 and Fig.2. The typical sheet shape of aluminum alloy roofing is given in Fig.4.

Standing seam metal roof is composed of cold-formed thin-walled standing seam metal roofing and insulation, thermal insulation, moisture resistance, sound absorption, sound insulation and structural assemblage, tectonic layer set according to the monitoring requirements of function and the characteristics of the building and design to determine, standing seam metal roof can be widely used, its main features are as follows: 1) Standing seam metal roof system using light material combined, the weight is light, the general single standing seam metal roof system weight about  $0.1\text{KN/m}^2$ , complex structure of Built-Up Roofing System is generally not more than  $0.5\text{KN/m}^2$ ; 2) Based on the durability of the metal plate and surface coating, standing seam metal roof panel has good resistance corrosion and the mechanical connection manner, ageing resistance, good corrosion resistance, with less maintenance can maintain good performance and functionality; 3) High strength, stable structure,

safe and reliable structure; 4) Good waterproof performance and stable and durable; 5) Have good machinability, can meet the requirements of different buildings; 6) Standing seam metal roof system component in the prefabrication live on-site assembly, for different regions and different functions require the use of appropriate combination, has good applicability; 7) good fire proofing performance; 8) Standing seam metal roofing materials can be recycled, is the ideal green building materials.

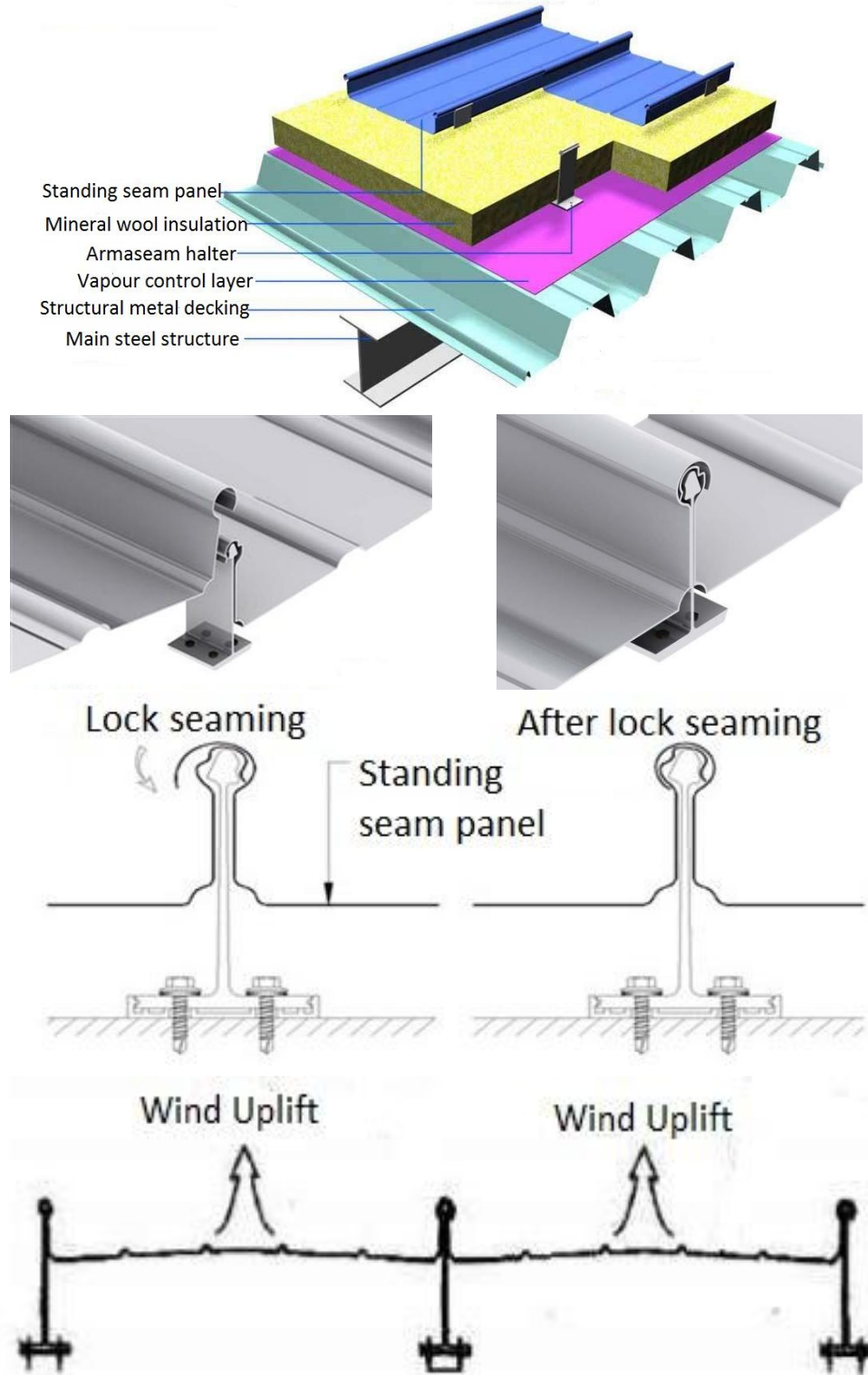


Fig.2 Case 1 of Detailed Wind Plood Joints Design

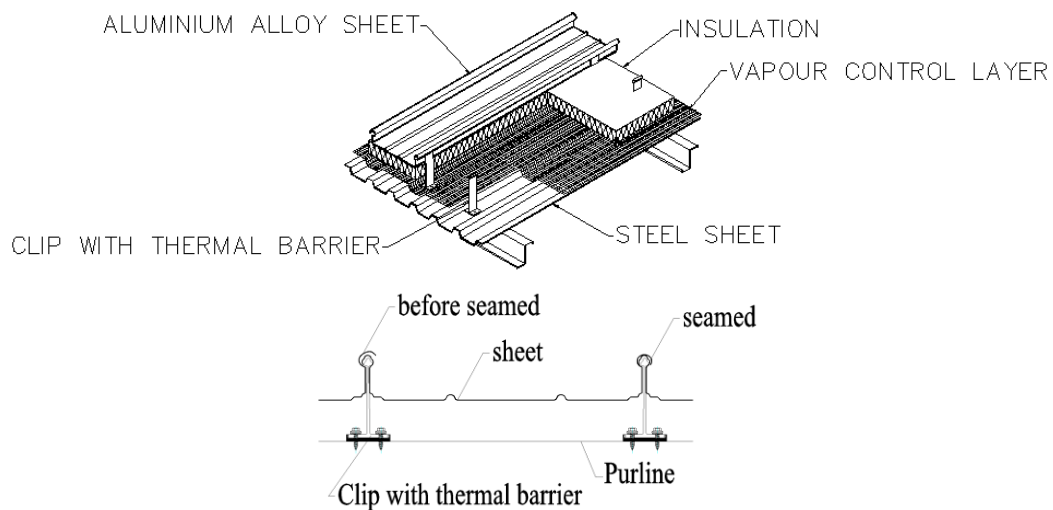


Fig.3 Case 2 of Typical Constructing of Roofing System

According to the engineering experience, the weak parts of the wind resistant performance of standing seam roof is cornice, gutter edge, roof skylight edge etc., these sites need to consider the detail not to catch the wind and covered or plugging parts to strengthen the connection. Structure of wind resistance measures include: 1) Reduce the purlin spacing, through increased support connections to strengthen roof sheet of wind resistance effect; 2) bearing screws strengthen measures, adopt high strength and durable stainless steel self tapping screws; 3) roof sheet seam bearing reinforcement measures, in the weak parts of the wind resistance and wind pressure larger areas, additional fixture aluminum alloy square tube connection is adopt to effectively improve the wind resistance performance of the whole roof system; 4) in the process of construction control measures.

Standing seam metal roof system of wind capacity is mainly affected by the late stage of capacity control and reducing sheet width can effectively improve the bearing capacity of the wind. The wind capacity mainly depends on the bearing capacity of the construction machinery sewing bite close degree.

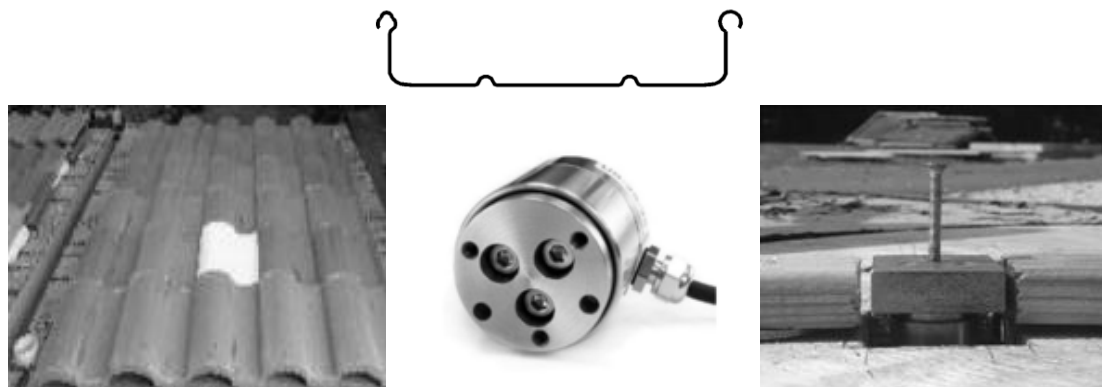


Fig.4 Joints Sheet Shape of Typical Aluminum Alloy Roofing

## Summary

Due to the use of standing seam metal roof flexibility brought many innovative architectural designs, such as the roof and walls of various buildings, large slope roof, variable slope roof, arched roof and a variety of irregular curved roof. With standing seam metal roof system of the building, can obtain good practical effect.

The metal roof sheet is connected by mechanical bite, which has the characteristics of integrity, and the whole system depends on the weakest connection node in the structure. As a lightweight roofing

system, the problem of weak wind resistance is increasingly exposed, especially in typhoon and other inclement weather roof is easy to be overturned. Economic and reasonable reinforcement measures were taken to improve the load bearing capacity of the roof system.

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