

LIGHT GAUGE STEEL FRAMING SYSTEMS

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Анотація

У статті проаналізовано сучасні методи будівництва різних типів будівельних споруд з використанням ЛСТК, оцінено їх ефективність в будівництві, розглянуто їх види. Визначено основні переваги ЛСТК: легкість конструкції, висока міцність, стійкість до корозії, економічність, вогнестійкість, сейсмостійкість.

Ключові слова: легкі сталеві тонкостінні конструкції, легкість, міцність, вогнестійкість, сейсмостійкість.

Abstract

The article analyzes modern methods of building various types of buildings using LGSF, evaluates their effectiveness in construction, and considers their types. The main advantages of LGSF are determined: lightness of construction, high strength, corrosion resistance, cost-effectiveness, fire resistance, seismic resistance.

Keywords: light gauge steel framing, lightness, strength, fire resistance, seismic resistance.

Introduction

The current stage of development of the construction industry is characterized by the search for technologies that allow to reduce the construction time of objects as much as possible without losing their quality and energy efficiency. One of the most promising directions in this context is the use of technology of light steel thin-walled structures (LGSF).

LGSF technology is based on the use of steel profiles from thin rolled sheets, which are connected into a single frame. Originally developed as an alternative to traditional wooden frame construction, today it is used for the construction of a wide range of objects: from residential buildings and cottages to large industrial and commercial buildings.



Picture 1. The example of usage LGSF in civil construction

Research results

LGSF technology originated in the middle of the 20th century (1950s) in Canada. The main reason for its emergence was the need for rapid construction of high-quality housing in conditions of wood shortage and the need for industrialization of construction. Over time, the USA, Scandinavian countries and Japan borrowed Canada's experience. Today, LGSF is actively used in Ukraine in both the industrial and private sectors.

The basis of LGSF is 5 main galvanized steel profiles of certain shapes, namely:

C-profiles (C-shaped): The most common, used for walls, ceilings, beams, can be perforated or have stiffeners.

Z-profiles: Used for roofing and wall purlins, as well as distance purlins.

U-profiles: Used for walls, partitions, can also be perforated.

L-profiles (Angles): Used for cladding facades, support tables and other nodes.

Σ-profiles (Sigma): Specialized profiles for covering runs, transoms, beams, often perforated for installation.

The main requirement for these profiles is that they be made of high-strength structural steel with a thickness of 0.7 to 3 mm (there are individual cases when a profile with a smaller cross-section is used) and with an anti-corrosion zinc coating of at least 275 g/m² [1].

The main design solution of the LGSF system is that all profiles of the system are fastened together using self-tapping screws, bolts or self-tapping rivets - this results in an increased speed of installation of the structure.

The main characteristics of LGSF are:

1. Lightness of construction

LGSF profiles are made of thin-sheet steel with a thickness of 0.7 to 3 mm, which makes them extremely light compared to traditional building materials such as brick, concrete or wood. The lightness of the profiles reduces the load on the foundation, which allows the use of lighter and more economical foundation solutions. This is especially important in conditions of weak soils, where load reduction is critical.

2. High strength and heat resistance.

Despite their lightness, LGSF profiles have high strength and rigidity. This is achieved through the use of cold-rolled galvanized steel and a well-thought-out geometry of the profiles, which optimally distributes the load. The profiles can withstand significant compression, bending and tensile loads, which makes them ideal for creating load-bearing structures. This is especially important for multi-storey buildings and construction in seismically active areas.

3. Corrosion resistance.

LGSF profiles are made of galvanized steel, which is coated with a layer of zinc that protects the metal from corrosion. This is especially important in conditions of high humidity or under the influence of aggressive environments. Corrosion resistance significantly increases the service life of structures, making them durable and cost-effective.

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4. Speed and accuracy of installation.

LGSF profiles are manufactured with high accuracy, which allows for easy and quick installation of structures. All elements have standard dimensions and are easily adjusted on site, which significantly reduces construction time. This is especially important for projects that require quick construction, such as temporary buildings, industrial facilities or shopping complexes. The speed of installation also reduces labor costs and reduces overall construction costs.

5. Cost-effectiveness.

LGSF profiles allow to significantly reduce construction costs in several areas: Reduction of transportation costs: The lightness of the profiles means that their transportation is cheaper compared to heavier building materials. Reduction of foundation costs: The low mass of LGSF structures allows the use of lighter foundations, which reduces overall construction costs. Minimization of construction waste LGSF profiles are produced in standard sizes and shapes, which minimizes the amount of waste on the construction site and reduces disposal costs [2].

6. Design and architecture.

LGSF profiles provide wide opportunities for the design and implementation of various architectural solutions. They can be easily adapted to any project requirements, creating structures of various shapes and sizes. This allows architects and engineers to develop unique projects that include complex shapes and non-standard solutions. The possibility of easy redevelopment and modernization is also a significant advantage.

7. Environmental friendliness.

The steel from which LGSF profiles are made is an environmentally friendly material that is fully recyclable. In the process of manufacturing LGSF profiles, emissions of harmful substances are minimal, which meets modern environmental protection standards. In addition, steel structures have a long service life, which reduces the need for their frequent replacement and, accordingly, reduces the impact on the environment.

8. Fire resistance.

LGSF steel profiles have high fire resistance. Unlike wood, steel does not burn and does not support combustion, which makes LSTK a safer material in case of fire. With proper design and use of fire-retardant materials, such structures can withstand fire for a long time without losing their operational properties.

9. Seismic resistance.

LGSF structures have high seismic resistance. Their lightness and flexibility allow them to effectively absorb and distribute seismic loads, which makes LGSF an ideal material for construction in regions with high seismic activity. Such structures can withstand strong earthquakes with minimal damage, which significantly increases their safety and reliability.

10. Human resources. (HR)

The main, and probably the most important, advantage of LGSF is that working with them does not require highly qualified workers or engineers. It is enough to have a general idea of working with any metal profiles, undergo a twenty-minute briefing on the installation rules and a person can immediately begin to perform installation work on the LGSF profile. Also, for the installation of LGSF, large construction equipment is not required (except for high-rise buildings), which significantly affects the speed of erecting frames from LGSF. For example, for the installation of the frame of a one-story house measuring 9×12 meters, only two workers are required, who will complete this work in 48 working hours [3].

Conclusions

LGSF technology is one of the most promising areas of modern rapid construction. The analysis showed that the key advantages of such structures are high energy efficiency, environmental friendliness, durability, and a significant reduction in installation time compared to traditional brick or concrete. Due to the low weight of steel profiles, foundation and logistics costs are reduced.

LGSF are ideal for the residential and commercial sectors. In the context of modern requirements for sustainable development and cost-effectiveness, the introduction of thin-walled steel structures is a rational solution that allows you to combine the strength of the metal with high comfort of building operation.

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