RESEARCH ARTICLE

Study on key points of steel structure construction technology on high-rise building

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Abstract: Study of steel structure construction technology on high-rise building was needed to strengthen, in order to improve the construction quality and safety of our building, ensure the normal operation of production and living of people. Therefore, the article will analyze the common technology in steel structure construction of highrise building, and expect able to play a certain reference function.
Keywords: steel structure, high-rise building, construction technology

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1 Introduction

High-rise building is not only an important symbol of urbanization, but also an important measure to solve the urban land tensions. Steel structure, the mainstream structure of high-rise building, was widely used in highrise building engineering. Steel structure possess many advantages for high-rise building, but the steel structure construction system was large and complex, had high demands for the steel materials and construction technology. Especially the modern construction industry puts forward higher requirements on steel structure to meet the diverse needs of people. Ways to select the appropriate construction method in the structure with variable performance and type in order to ensure the quality of building has become a required course of modern architecture engineers[1].

2 Performance Requirements of Steel

2.1 Steel Mechanical Index

The mechanical indexes of structural steel include yield point, tensile strength, elongation, impact toughness at low temperature. These indexes should meet the requirements of the specification of steel structure design, but the low temperature impact toughness was tested only when working in low temperature environment. Determination of steel mechanical index should conform to the provisions of sampling of steel mechanics and process performance test (GB2975-82).

2.2 Chemical Composition of Steel

It is related to the machinability, toughness and durability, etc. Among them, the content of carbon, alloying elements and the limit content of impurities such as sulfur, phosphorus and other elements should conform to the requirements of specification (GB222-84).

2.3 Process Performance

Process performance mainly includes weldability and processing performance. Weldability is related to the content of carbon or carbon equivalent (low alloy steel), can be evaluated by solderability test. The processing performance was determined by cold bending test. The (gb232-88) is considered as the standard.

2.4 Deviation of Geometry Size

The deviation of overall dimensions and theory dimensions of steel products (steel plates, shape steel, round steel, steel tube) must be within the allowable range. The allowable deviation may refer to the national standard such as GB709-88, GB706-88, GB787-88, GB978-88, GB707-88, GB816-88, etc.

2.5 Shape Defects of Steel

Steel surface must not have bubbles, scab, pull cracks, crack, drape, inclusion and pressured iron oxide. These defects must be removed, and the concave depth should not be greater than the negative deviation of thickness. In addition, when the steel surface has defects such as corrosion, pitting or scratches, the depth should not be greater than the 1/2 of negative deviation of steel thickness[2].

3 Main point for steel structure design

3.1 Clear the related specifications and procedures of steel structure design

The specification and procedures involved in steel structure design may be divided into three types: national standards, industry rules, association rules.

3.2 Understanding the concept of service life and design reference period of steel structure design

There are some differences in service life, design reference period and life of construction of steel structure design. The so-called service life of design usually refers to that within the specified time at the beginning of design, the products will not encounter the big problem for large servicing, and they only need routine maintenance to meet the design concept at the beginning of design. For the design reference period, it refers to determining the time parameters selected by live load values in the process of design, statistic of different years are made according to a specific area and relationship, in order to determine its failure rate, finally fixing the reference period.

3.3 Key points of steel structure drawing

The same as many design drawing, the design drawing of steel structure was divided into two parts, the design drawings at the beginning of design and construction drawing. Strictly in accordance with the relevant provisions of design review, the designer of drawing was mainly to study the design drawing in depth, the relevant construction units of steel structure were to design according to the direction of practical engineering. In the process of design, the two parts of designers must have a good coordination, make a mutual penetration of their own thought, in order to achieve a common goal, ensure the smooth implementation of projects, finally achieved the goal of project[3].

3.4 Key points of steel processing

3.4.1 Hot forming processing

The steel was processed after heated to a certain temperature. This method was suitable for forming, bending, and correcting the workpiece which cannot be processed at room temperature. The end temperature of hot working should not be lower than 700°C. The steel will produce blue brittleness when heating to 200~300°C, so hammering and bending were strictly prohibited. The steel with content of carbon beyond the low carbon steel generally cannot perform hot working.

3.4.2 Cold forming

It was conducted at room temperature. The required permanent deformation of material was achieved since the external forces was beyond the yield strength of material, or some parts of material is disconnected from the material as required since external force was beyond the ultimate strength of material. All the cold processing have a tendency to make the material become hard and brittle, therefore, the steel may be back to normal status through heat treatment, or serious hardening edge part may be peeled off. Carbon steel must not be processed when the ambient temperature is below -16 °C. Low alloy steel must not be processed when below -12 °C.

3.4.3 Bending

A process method used to curve the sheet or shape steel into a certain shape by processing equipment and certain tooling according to the design requirements. Cold bending was suitable for sheet, small steel. Hot bending was suitable for thick plate, complex component and shape steel, the hot bending temperature was within 950~1100°C[4].

3.4.4 Rolled plate processing

The method used to elongate the outer fiber and shorten the inner fiber of flat steel plate under the action of external force to produce bending deformation. Rolled plate was made by roller machine. It was divided into cold rolling and hot rolling according to the different temperature of material. Rolled plate is mainly used for welding round pipe string, pipe, air bags, etc.

3.5 Key points of fire protection of steel structure

The steel was a kind of thermal conductivity material, the whole steel structure in high-rise building had strong heat conductivity. The flexibility, tensile resistance and strength of steel will fell sharply with the rise of temperature. The yield point and ultimate strength will dropped significantly when the temperature is between 430°C and 540°C, if excess 540°C, the steel structure will gradually lose their strength and bearing capacity. If building fire occurs, thus structure will bring the whole building catastrophic consequences. So fire prevention measures must be made in the process of design and construction of steel structure. The common steel structure fireproofing measures include setting fire barrier, the use of closed steel members of building materials, outsourcing refractory plate, setting the spray water supply pipe network, etc.

3.5.1 Setting fire barrier

Set fire barrier on the counter-fire surface of steel members, in order to separate the steel members and fire. For example,

install fireproof ceiling under the steel beam, set fire prevention board with a certain width on the outside of the steel column, etc.

3.5.2 Masonry firebrick or poured concrete

The masonry firebrick or poured concrete were used to completely close steel members. This method has the advantage of high strength and impact resistance. While the disadvantage is needing larger space. For example, when using c20 concrete protection column, 5~10 cm of thickness is needed to reach the fire resistance of 1.5~3 h. In addition, the construction of this method is also troublesome, especially on the steel beam and brace, the construction is very difficult[5,6].

3.5.3 Outsourcing refractory lightweight plate

The refractory lightweight plate was used as fireproof outsourcing layer. The main material of refractory lightweight plate was the non-toxic refractory material such as cement, gypsum, calcium silicate, vermiculite, ceramic fiber, rock wool, gravel, etc. They were processed into protective layer through different construction method after processing into sheets. The method of sheet protection includes direct parceling or attaching, connection with reinforcement iron, flexible material winding, etc. For example, flexible ceramic fiber blanket was wrapped on steel members, calcium silicon plate use with the inorganic fiber, autoclaved lightweight concrete slab, inorganic fiber reinforced gypsum board, precast concrete plate applied directly, etc. The refractory lightweight plate, as fire protection outsourcing layer, has advantages of smooth surface, good decorative, convenient construction, less space, low comprehensive cost, etc. At present, this method was gradually widely used[7].

3.5.4 Setting spray water supply pipe

The spray water supply network is set at the top of steel structure, spray water will open automatically (or manually) when fire occurs, and continuous flow of water film will form on the surface of steel members, which have the effect of protection.

4 Conclusion

Steel structure has huge construction quantities, complicated structure, and high quality requirements, hence, we shall develop reasonable construction technology and construction process in the construction to select suitable mechanical equipment. A different steel and welding methods are selected according to the different types of steel structure and requirements of building, therefore blindly follow measures will not conform to the actual situation. At the same time, we shall strictly control the construction quality and complete the safety protection to reduce accidents.

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