

ROOFTOP ELEVATOR ENGINE ROOM AND CONSTRUCTION METHOD THEREOF

Technical Field

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The present invention relates to a building structural component and a construction method thereof, in particular to an elevator engine room located on a rooftop and a method for constructing the elevator engine room.

Technical Background

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In the prior arts, the elevator engine room should be cast in-situ and built together with other structures arranged on the rooftop. This construction is difficult, because many workers have to carry out dangerous and complicated high-altitude operations for the construction above the rooftop, which would cause safety problem. Moreover, for the wall body and the top pate of the elevator engine room, a large number of templates and scaffolds should be established, thus requiring quite many woodworkers and steelworkers. After the concrete is poured, the templates and the scaffolds should provide support for 16 days before being removed. It is very difficult to take away the removed templates and scaffolds from the narrow passageway of the elevator engine room, and normally at least 10 days are necessary. In addition, due to the inconsistent surface quality of the cast-in-situ concrete, it takes another 4 days to repair the concrete surface.

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Therefore, the structure and construction of the conventional elevator engine room are not only unsafe, but also require much labor and material costs. In addition, the construction period required is also long.

Summary of the Invention

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The present invention aims to provide a rooftop elevator engine room and a method for constructing the elevator engine room, wherein the wall body and the top plate of the engine room are prefabricated, so that the workload for in-situ casting and the construction period can be both significantly saved.

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The present invention proposes a rooftop elevator engine room, comprising an engine room unit, and a cast-in-situ load-bearing structure supporting the engine room unit from below. The engine room unit is formed by connecting a plurality of prefabricated components together, each of which is formed as an integrally modular structure including a wall body and a top plate. A lower portion of the wall body of the prefabricated component is provided in advance with a later-pouring zone, into which exposed reinforcing bars of the wall body and of the cast-in-situ load-bearing structure all extend. The exposed reinforcing bars of the wall body and those of the cast-in-situ load-bearing structure are connected together, and said prefabricated component and the cast-in-situ load-bearing structure arranged therebelow are connected to each other through pouring concrete in the later-pouring zone. An outer surface of the wall body of the prefabricated component is provided with a first recess at a connecting side thereof, and an outer surface of the top plate of the prefabricated component is provided with a second recess at the connecting side. The wall body and the top plate are respectively provided with exposed reinforcing bars, which extend into the first and second recesses respectively. The exposed reinforcing bars in the first and second recesses of two adjacent prefabricated components are connected with each other, so that said adjacent prefabricated components are connected to each other through pouring concrete in the first and second recesses.

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The later-pouring zone is an inner concave zone formed on an outer side surface or an inner side surface of the wall body of the prefabricated component at the lower portion thereof. The wall body has a thickness of 90-120 mm at the later-pouring zone.

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The first recess and the second recess at the connecting side of the prefabricated component extend throughout the connecting sides of the wall body and the top plate of said prefabricated component respectively, each of the first recess and the second recess having a width of 300-500 mm.

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An outer edge of each of the first and second recesses is provided with a slope, which extends gradually downward and outward.

The cast-in-situ load-bearing structure includes a cast-in-situ load-bearing wall
10 higher than a floor of the rooftop.

The method for constructing the rooftop elevator engine room according to the present invention comprises the following steps:

A) completing the cast-in-situ load-bearing structure below the elevator engine
15 room at a construction site, the cast-in-situ load-bearing structure being provided at its top with exposed reinforcing bars;

B) hoisting the prefabricated components of the engine room unit to respectively designated positions above the cast-in-situ load-bearing structure, with mounting fittings being used for temporary support;

20 C) binding reinforcing bars in the later-pouring zone at the lower portion of the wall body of each prefabricated component, and connecting the exposed reinforcing bars at the lower portion of the wall body with the exposed reinforcing bars at the top of the cast-in-situ load-bearing structure arranged therebelow;

D) binding reinforcing bars in the first and second recesses at the connecting
25 sides of the wall body and the top plate of each prefabricated component, and connecting the exposed reinforcing bars at both sides of the connecting side together;

E) pouring, after outer templates are installed, concrete in the later-pouring zone and the first recess at the connecting side of the wall body, and in the second recess at the connecting side of the top plate of the prefabricated component; and

30 F) removing the outer templates and the mounting fittings after the concrete in

the later-pouring zone and in the first and second recesses reaches its designed age.

The method further comprises producing each prefabricated component as a whole by an iron mold before step B).

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When being produced, the prefabricated component is installed with ceiling beams, doors and windows.

In step A), a cast-in-situ load-bearing wall higher than the rooftop floor is poured under the engine room unit.

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Compared with the prior arts, the rooftop elevator engine room and the method for constructing the elevator engine room according to the present invention have the following technical advantages.

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First, the wall body and the top plate of the elevator engine room can be produced as a modular structural member in the factory in advance, and other structures above the rooftop can be constructed at the same time. Therefore, the on-site construction is easy, and the construction quality of the elevator engine room is improved.

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Second, the installation of the modular elevator engine room is convenient, and the high-altitude operations associated therewith are greatly reduced, so that the construction is of high safety.

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Third, the construction does not require templates and scaffolds. Therefore, only a few woodworkers and steelworkers are necessary at the construction site, thus significantly reducing the construction cost.

Fourth, the time for removing the templates and scaffolds after the concrete of

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the elevator engine room reaches sufficient strength can be saved. Therefore, the extra time for waiting and removing the templates can be saved, thus accelerating the construction.

5 Finally, the surface of concrete formed at the factory is of high quality, so that no extra treatment of surface repair performed by workers is required.

Brief Description of the Drawings

10 In order to more clearly illustrate the technical solutions of the embodiments of the present invention, the drawings used in the embodiments will be briefly described below. It is obvious that the following drawings only show some embodiments of the present invention. One ordinarily skilled in the art can also obtain other drawings based on these drawings without creative effort.

15 Fig. 1 schematically shows a perspective view of a rooftop elevator engine room according to the present invention, with reinforcing bars not being shown therein;

 Fig. 2 shows a plan view of the rooftop elevator engine room according to the
20 present invention, with reinforcing bars not being shown therein;

 Fig. 3 is a cross-sectional view showing a connection structure between a prefabricated component and a cast-in-situ load-bearing structure arranged therebelow;

25 Fig. 4 is a cross-sectional view showing a connection structure between two adjacent prefabricated components; and

 Fig. 5 is a perspective view showing the connection structure between the
30 prefabricated component and the cast-in-situ load-bearing structure arranged

therebelow.

Detailed Description of the Embodiments

5 The technical solutions in the embodiments of the present invention will be clearly and completely described in the following with reference to the accompanying drawings in the embodiments of the present invention, in order to enable one skilled in the art to better understand the technical solutions of the present invention. Obviously, the embodiments as described here are only some, but not all
10 embodiments of the present invention. All other embodiments obtained, on the basis of the embodiments of the present invention, by those skilled in the art without creative efforts shall fall within the scope of the present invention.

15 In the following, the present invention will be described in further detail with reference to the embodiments as shown.

20 As shown in Fig. 1, the rooftop elevator engine room according to the present invention comprises an engine room unit 1, and a cast-in-situ load-bearing structure 2 supporting the engine room unit 1 from below. According to the designed shape and size, and transportation requirements for excessively wide and high goods, the engine room unit 1 is designed as per modular principle, and divided into several prefabricated components of reinforcing concrete with suitable sizes. Each prefabricated component includes a wall body 16 and a top plate 17, and produced as a whole in a factory using an iron mold. Then, the prefabricated components are all
25 transported to the construction site, and connected together to form a main structure of the engine room unit 1. The cast-in-situ load-bearing structure 2 may be a load-bearing structure such as a load-bearing wall, a floor support or the like.

30 In the embodiment as shown in Figs. 1 and 2, the engine room unit 1 is formed by connecting prefabricated components 101, 102, 103, 104, 105, 106, 107 and 108

together. Of course, according to different designs and sizes, prefabricated components of different sizes and shapes can be also used for forming the engine room unit 1.

5 As shown in Figs. 3 and. 5, a lower portion of the wall body 16 of the prefabricated component is provided in advance with a later-pouring zone 11, which in this embodiment is an inner concave zone formed on an outer side surface of the wall body 16 at the lower portion thereof. The inner concave zone may extend throughout the lengthwise direction of the wall body 16, or extend partially along the
10 lengthwise direction of the wall body 16 only. The wall body 16 can have a thickness of 90-120 mm at the later-pouring zone 11. Of course, according to the environment at the construction site, the later-pouring zone 11 may be alternatively formed on an inner side surface of the wall body 16 at the lower portion thereof, if there is no floor surface or suspending member out of the building. The wall body 16 is provided in
15 advance with exposed reinforcing bars 51, which extend into the later-pouring zone 11. In addition, the cast-in-situ load-bearing structure 2 is provided at its top in advance with exposed reinforcing bars 53, which also extend into the later-pouring zone 11. The exposed reinforcing bars 51 of the wall body 16 and the exposed reinforcing bars 53 of the cast-in-situ load-bearing structure 2 can be connected together through
20 binding reinforcing bars 52 in the later-pouring zone 11, and the wall body 16 of the prefabricated component and the cast-in-situ load-bearing structure 2 arranged therebelow can be connected to each other through pouring concrete in the later-pouring zone 11.

25 As shown in Figs. 1 and 4, an outer surface of the wall body 16 of a prefabricated component is provided with a recess 13 at one side thereof to be connected with an adjacent prefabricated component, and an outer surface of the top plate 17 of said prefabricated component is provided with a recess 12 at one side thereof to be connected with said adjacent prefabricated component. The wall body 16 and the top
30 plate 17 are respectively provided with exposed reinforcing bars 54, which all extend

into the recesses 13 and 12 respectively. For the convenience of transportation and construction, these exposed reinforcing bars 54 are all arranged inside the recesses. In this embodiment, the recesses 13 and 12 respectively extend throughout the entire connecting sides of the wall body 16 and the top plate 17 of the prefabricated component. In addition, the bottom surfaces of the recesses are vertically connected with the outer surfaces of the inner wall 16 and the top plate 17 toward their inner sides. The widths of the recesses 12 and 13 are in a range of 300-500 mm, corresponding to the anchoring range of the exposed reinforcing bars 54. The exposed reinforcing bars 54 at one side of the connecting side can be connected with those at the other side thereof through binding reinforcing bars 55 in the recesses 12 and 13, and two adjacent prefabricated components can be joined together by pouring concrete in the recesses 12 and 13.

In order to compensate the installation error, a space 15 of about 15 mm is provided between two adjacent prefabricated components, and an outer edge of the recess 12 of the top plate 17 arranged at each side of the space 15 is provided with a slope 14, which extends gradually downward and outward. Therefore, when concrete is poured into the recess, the space 15 can be better filled with concrete, so that the prefabricated portion can be better combined with the cast-in-situ portion.

As shown in Fig. 3, when the designed height of the elevator engine room exceeds 3.5 meters, the cast-in-situ load-bearing structure 2 should be poured to a level above the surface of the rooftop floor 3 to form a cast-in-situ load-bearing wall 21, in consideration of transportation requirements for excessively high goods. The thickness of the load-bearing wall 21 can be the same as that of the wall body 16 of the prefabricated component arranged thereabove.

The method for constructing the rooftop elevator engine room according to the present invention comprises the following steps.

In step 1, according to the shape and size of the engine room unit 1 and transportation requirements for excessively wide and high goods, the engine room unit 1 is divided into multiple components of appropriate sizes through modular design. Each prefabricated component is produced as a whole by an iron mold. When
5 being produced, the prefabricated components can be installed with ceiling beams, doors and windows.

In step 2, the cast-in-situ load-bearing structure 2 below the elevator engine room is completed at the construction site. When the designed height of the elevator engine
10 room exceeds 3.5 meters, the cast-in-situ load-bearing wall 21 higher than the rooftop floor 3 should be further poured under the engine room unit 1. The cast-in-situ load-bearing structure 2 or the cast-in-situ load-bearing wall 21 is provided at its top with exposed reinforcing bars 53.

15 In step 3, temporary supporting members are arranged on the rooftop, and the prefabricated components are transported from the factory to the construction site.

In step 4, the prefabricated components of the engine room unit 1 are hoisted one by one, in sequence, to their designated positions above the cast-in-situ load-bearing
20 structure 2, with mounting fittings being disposed between each pre-fabricated component and the cast-in-situ load-bearing structure 2 for temporary support.

In step 5, the reinforcing bars 52 are bound in the later-pouring zone 11 at the lower portion of the wall body 16 of the prefabricated component, and the exposed
25 reinforcing bars 51 at the lower portion of the wall body 16 are connected with the exposed reinforcing bars 53 at the top of the cast-in-situ load-bearing structure 2 arranged therebelow.

In step 6, the reinforcing bars 55 are bound in the recesses 13 and 12 at the
30 connecting sides of the wall body 16 and the top plate 17 of the prefabricated

component, and the exposed reinforcing bars 54 at both connecting sides are connected together.

5 In step 7, after outer templates are installed, concrete is poured in the later-pouring zone 11, the recess 13 at the connecting side of the wall body 16, and the recess 12 at the connecting side of the top plate 17 of the prefabricated component.

10 In step 8, after the concrete in the later-pouring zone 11 and in the recesses 12 and 13 reaches its designed age, the outer templates and the mounting fittings are removed.

15 It can be seen that the construction of the rooftop elevator engine room according to the invention is very convenient and rapid, and greatly reduces the high-altitude operations, so that the construction is of high safety. In addition, the construction can save a large amount of on-site construction steps, and does not need to install and remove a large number of templates and scaffolds as in the cast-in-situ structure. Moreover, no treatment is required for the concrete surface, which can greatly shorten the construction period.

20 The foregoing description is merely illustrative of preferred embodiments of the present invention, and is not intended to limit the present invention. Various changes and modifications may be made by those skilled in the art. Any modifications, equivalent substitutions, improvements, and the like within the spirit and principles of the present invention are intended to be included within the scope of the present
25 invention.

CLAIMS

1. A rooftop elevator engine room, comprising an engine room unit (1), and a cast-in-situ load-bearing structure (2) supporting the engine room unit (1) from below,

5 characterizing in that the engine room unit (1) is formed by connecting a plurality of prefabricated components together, each of which is formed as an integrally modular structure including a wall body and a top plate;

a lower portion of the wall body of each prefabricated component is provided in advance with a later-pouring zone (11), into which exposed reinforcing bars of the wall body and of the cast-in-situ load-bearing structure (2) all extend, wherein the
10 exposed reinforcing bars of the wall body and those of the cast-in-situ load-bearing structure (2) are connected together, and said prefabricated component and the cast-in-situ load-bearing structure (2) arranged therebelow are connected to each other through pouring concrete in the later-pouring zone (11); and

15 an outer surface of the wall body of each prefabricated component is provided with a first recess at a connecting side thereof, and an outer surface of the top plate of the prefabricated component is provided with a second recess at the connecting side, wherein the wall body and the top plate are respectively provided with exposed reinforcing bars, which extend into the first and second recesses respectively, the
20 exposed reinforcing bars in the first and second recesses of two adjacent prefabricated components being connected with each other, so that said adjacent prefabricated components are connected to each other through pouring concrete in the first and second recesses.

25 2. The rooftop elevator engine room according to claim 1, characterizing in that the later-pouring zone (11) is an inner concave zone formed on an outer side surface or an inner side surface of the wall body of the prefabricated component at the lower portion thereof, and the wall body has a thickness of 90-120 mm at the later-pouring zone (11).

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3. The rooftop elevator engine room according to claim 1, characterizing in that the first recess and the second recess at the connecting side of the prefabricated component extend throughout the connecting sides of the wall body and the top plate of said prefabricated component respectively, each of the first recess and the second
5 recess having a width of 300-500 mm.

4. The rooftop elevator engine room according to claim 3, characterizing in that an outer edge of each of the first and second recesses is provided with a slope, which extends gradually downward and outward.

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5. The rooftop elevator engine room according to any one of claims 1 to 4, characterizing in that the cast-in-situ load-bearing structure (2) includes a cast-in-situ load-bearing wall (21) higher than a floor of the rooftop.

15 6. A method for constructing the rooftop elevator engine room of claim 1, comprising the following steps:

A) completing the cast-in-situ load-bearing structure (2) below the elevator engine room at a construction site, the cast-in-situ load-bearing structure (2) being provided at its top with exposed reinforcing bars;

20 B) hoisting the prefabricated components of the engine room unit (1) to respectively designated positions above the cast-in-situ load-bearing structure (2), with mounting fittings being used for temporary support;

C) binding reinforcing bars in the later-pouring zone (11) at the lower portion of the wall body of each prefabricated component, and connecting the exposed
25 reinforcing bars at the lower portion of the wall body with the exposed reinforcing bars at the top of the cast-in-situ load-bearing structure (2) arranged therebelow;

D) binding reinforcing bars in the first and second recesses at the connecting sides of the wall body and the top plate of each prefabricated component, and connecting the exposed reinforcing bars at both sides of the connecting side together;

30 E) pouring concrete, after outer templates are installed, in the later-pouring zone

(11), the first recess at the connecting side of the wall body, and the first recess at the connecting side of the top plate of each prefabricated component; and

F) removing the outer templates and the mounting fittings after the concrete in the later-pouring zone (11) and in the first and second recesses reaches its designed
5 age.

7. The method for constructing the rooftop elevator engine room according to claim 6, characterizing in that it further comprises producing each prefabricated component as a whole by an iron mold before step B).

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8. The method for constructing the rooftop elevator engine room according to claim 7, characterizing in that when being produced, the prefabricated component is installed with ceiling beams, doors and windows.

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9. The method for constructing the rooftop elevator engine room according to any one of claims 6 to 8, characterizing in that in step A), a cast-in-situ load-bearing wall (21) higher than the rooftop floor (3) is poured under the engine room unit (1).