

CHASSIS WIRING METHOD AND STRUCTURE FOR URBAN RAIL VEHICLE

Field of the Invention

The present invention relates to the technical field of rail vehicles, in particular to a chassis wiring method and structure for an urban rail vehicle.

Background of the Invention

At present, there are mainly the following solutions for chassis wiring on rail vehicles: first, a high- and low-voltage switching fully sealed wiring structure under a rail vehicle, as disclosed in Chinese utility model CN207045332U, employs a high- and low-voltage switching wiring method, and seals each slot for cooperation; and second, a centralized wiring structure for a maglev train chassis, as disclosed in Chinese utility model CN208423671U, is formed by fixing a central slot on the chassis. Regardless of which solution is used, the wiring and wire connection are performed after slots are mounted on a vehicle body. This operation inevitably crosses with the installation of pipelines and devices. Especially, a vehicle end box generally employs a straight span solution, an electric hook box solution, a middle jumper box straight span solution, a middle jumper box plus electric hook box solution, or the like, so that on-line wiring affects each other. Under existing conditions, changes in device installation locations often lead to changes in wiring, such as adding or changing wires, which can also lead to repeated dismantling in the installation of pipelines and devices to waste a lot of time.

Summary of the Invention

In response to the shortcoming of inconvenient vehicle manufacturing caused by cross installation procedures of an existing chassis wiring structure for an urban rail vehicle and other systems of the vehicle, the technical problem to be solved by the present invention is to provide a chassis wiring method and structure for an urban rail vehicle, which can achieve independent assembly, wiring, and wire connection without cross installation procedures of all wiring structures and other systems.

In order to solve the above technical problem, the present invention provides a chassis wiring method for an urban rail vehicle, including:

1) simulation design of modular wiring harnesses

according to voltage grades of under-vehicle installation devices and on-vehicle installation devices of a chassis, designing models of a plurality of first branch wiring harnesses matching the voltage grades; meanwhile, designing corresponding lengths of the first branch wiring harnesses of the models according to positions of the under-vehicle installation devices and the on-vehicle installation devices of the chassis; arranging electronic products used in the rail vehicle at ends of the chassis, and arranging the first branch wiring harnesses in the middle of the chassis; designing positions of second branch wiring harnesses according to requirements for electrical connection of the electronic products arranged at the ends with the corresponding under-vehicle installation devices and on-vehicle installation devices, where the positions of the second branch wiring harnesses are designed at corresponding positions on the first branch wiring harnesses of the corresponding models; designing lengths of the second branch wiring harnesses according to distances between the positions of the second branch wiring harnesses and installation positions of the electronic products on the chassis;

2) off-line assembly

performing off-line assembly and wire connection on the first branch wiring harnesses, the electronic products, and the second branch wiring harnesses according to the design results in step 1) to form an integrated module A; and

3) on-line assembly

mounting the module A formed in step 2) as a whole below the chassis.

In the foregoing solution, the lengths and positions of cables are reasonably designed according to the positions of devices arranged on the chassis, and then the cables are assembled off line into wiring harnesses, so that the wiring and wire connection of the chassis wiring structure can be completed independently; and then the module is mounted as a whole on the vehicle chassis to avoid crossing of chassis wiring and wire connection procedures and other system installation procedures, and the chassis wiring

and wire connection can be carried out outside the vehicle (off line) and do not cross other procedures (such as assembly and installation of pipelines). Therefore, compared with conventional modes, the present parallel procedures distinguishing from the original serial cross procedures, which is facilitating, excellent manufacturability, and improves the production efficiency.

Preferably, the module A further includes individual modules formed by the electronic products in a box packaging manner.

Preferably, step 1) further includes: providing a structure of a central slot according to the models of the first branch wiring harnesses, and dividing the central slot into a high-voltage slot and a low-voltage slot that are spaced; a connecting structures on the central slot is mounted with chutes of the chassis;

step 2) further includes: mounting the branch wiring harnesses of the models in corresponding positions of the high-voltage slot and the low-voltage slot, so that the central slot and the module A form a module B; and

when step 3) is performed, the formed module B is mounted as a whole below the chassis.

Preferably, step 1) further includes: providing small slots according to the positions and lengths of the second branch wiring harnesses;

step 2) further includes: mounting the second branch wiring harnesses in the small slots, so that the small slots and the module B form a module C; and

when step 3) is performed, the formed module C is mounted as a whole below the chassis.

Preferably, step 1) further includes: providing small slots according to the positions and lengths of the second branch wiring harnesses;

step 2) further includes: mounting the second branch wiring harnesses in the small slots, so that the small slots and the module A form a module D; and

when step 3) is performed, the formed module D is mounted as a whole below the chassis.

Preferably, some of the first branch wiring harnesses of the models are mounted in an open manner, while the rest are mounted in a closed manner. The open mounting

indicates that, after the module is formed, the mounting structure of the first branch wiring harness is an open mounting structure formed on at least one side; and the closed mounting indicates that, after the module is formed, the mounting structure of the first branch wiring harness is a totally closed mounting structure.

The present invention further provides a chassis wiring structure for a rail vehicle, including a module A mounted as a whole on a chassis, where the module A includes electronic products, a plurality of first branch wiring harnesses, and a plurality of second branch wiring harnesses; each of the first branch wiring harnesses is provided with a plurality of interfaces connected to the second branch wiring harnesses, and each of the second branch wiring harnesses is connected to the corresponding interface and electronic product; and

after the module A is mounted on the chassis, the electronic products are disposed at vehicle ends of the chassis; and the first branch wiring harnesses are disposed in a device mounting region in the middle of the chassis.

Preferably, the chassis wiring structure for a rail vehicle further includes a central slot for mounting the first branch wiring harnesses, where the central slot is mounted below the chassis by means of a chute of the chassis, the central slot and the module A form a module B, and the module B is mounted as a whole on the chassis.

Preferably, the central slot includes a high-voltage slot and a low-voltage slot that are independently disposed and mounted in parallel, the high-voltage slot and the low-voltage slot are longitudinal disposed in a middle of the chassis and spaced apart, adjacent sides of the high-voltage slot and the low-voltage slot are connected by a first mounting bracket, and second mounting brackets are disposed on the sides of the high-voltage wire slot and the low-voltage wire slot, away from the first mounting bracket.

Preferably, the chassis wiring structure for a rail vehicle further includes small slots for mounting the second branch wiring harnesses, where portions, passing through regions of sleeper beams, of the small slots are mounted below the sleeper beams, the small slots and the module B form a module C, and the module C is mounted as a whole on the chassis.

Preferably, the chassis wiring structure for a rail vehicle further includes small slots for mounting the second branch wiring harnesses, where portions, passing through regions of sleeper beams, of the small slots are mounted below the sleeper beams, the small slots and the module A form a module D, and the module D is mounted as a whole on the chassis.

Compared with related technologies, beneficial effects of the present invention are as follows:

1. The chassis wiring method of the present invention facilitates maintenance and facilitates wire adding during or after vehicle manufacturing;
2. The chassis wiring method of the present invention facilitates manufacturing: all chassis wiring structures (central slot, small slot, vehicle end box, and bracket related accessories) do not cross other system installation procedures, and independent assembly, wiring, and wire connection can be achieved;
3. The chassis wiring method of the present invention has good platform performance and is compatible with existing or foreseeable vehicle wiring requirements; and
4. The chassis wiring method of the present invention has good electromagnetic compatibility.

Brief Description of the Drawings

FIG. 1 is a cross-sectional diagram of a wiring structure in a middle device mounting region of a vehicle chassis, which indicating a chassis wiring method for an urban rail vehicle in a longitudinal direction of the vehicle in the present invention;

FIG. 2 is a schematic diagram of a central slot in the present invention;

FIG. 3 is a schematic diagram of a wiring state of the central slot in the present invention; and

FIG. 4 is a schematic diagram of the wiring structure below the vehicle chassis, which indicating the chassis wiring method for an urban rail vehicle in the present invention.

Detailed Description of the Embodiments

The present invention will be described in detail below with reference to the

accompanying drawings and in combination with embodiments. It should be noted that the embodiments in the present invention and the features in the embodiments can be combined with each other without conflicts. For ease of narrative, the terms "upper", "lower", "left", and "right" described below are only consistent with the upper, lower, left and right directions of the drawings, and do not limit the structure.

Embodiment 1

This embodiment provides a chassis wiring method for an urban rail vehicle, including:

Step S1. Simulation design of modular wiring harnesses

Step S1.1. Design of first branch wiring harnesses

According to voltage grades of under-vehicle installation devices and on-vehicle installation devices of a chassis, designing models of a plurality of first branch wiring harnesses matching the voltage grades. Meanwhile, corresponding lengths of the first branch wiring harnesses of the models are designed according to positions of under-vehicle installation devices and on-vehicle installation devices of the chassis.

According to the voltage grades of the under-vehicle installation devices, a longitudinal end of the chassis is designed as a high-voltage end and the other end is designed as a low-voltage end. In this embodiment, the models of the first branch wiring harnesses include a pantograph cable or braking resistor cable, a motor cable, a 1500V circuit cable, a 380V circuit cable, a low-voltage bus, a 110V control cable, a 24V multi-core cable, and a signal and network cable.

The pantograph cable or braking resistor cable, the motor cable, the 1500V circuit cable, and the 380V circuit cable are high-voltage cables; and the rest are low-voltage cables. The high-voltage wiring harnesses are mounted in an open manner, and the low-voltage wiring harnesses are mounted in a closed manner.

Step S1.2. Design of second branch wiring harnesses

Electronic products used in the rail vehicle are arranged at ends of the chassis, and the first branch wiring harnesses are arranged in the middle of the chassis; and positions of second branch wiring harnesses are designed according to requirements for electrical connection of the electronic products arranged at the ends with the corresponding under-vehicle installation devices and on-vehicle installation devices, where the

positions of the second branch wiring harnesses are designed at corresponding positions on the first branch wiring harnesses of the corresponding models, and lengths of the second branch wiring harnesses are designed according to distances between the positions of the second branch wiring harnesses (positions for mounting the second branch wiring harnesses on the first branch wiring harnesses) and installation positions of the electronic products on the chassis (as shown in FIG. 4).

There are various electronic products that need to be connected to corresponding loops of a main circuit of the rail vehicle, respectively. The electronic products include a connector, a filter reactor, a terminal, and the like.

The electronic products are packed into individual modules with boxes. In this embodiment, each type or multiple types of electronic products are placed in a vehicle end box 2. Therefore, the vehicle end box 2 is mounted on the corresponding end of the chassis 1 according to the position requirements of the electronic products placed inside (as shown in FIG. 4).

Step S2. Off-line assembly

According to the design results in step S1, off-line assembly and wire connection are performed on the first branch wiring harnesses, the individual modules formed by the electronic products and the vehicle end boxes, and the second branch wiring harnesses to form an integrated module A.

Step S3. On-line assembly

The module A formed in step S3 is mounted as a whole below the chassis. The module A is mounted by means of chutes 6 of the chassis 1 (as shown in FIG. 1), which ensures that all cables and corresponding fixing structures do not pass through any holes on the chassis 1 and is conducive to wiring.

After assembly, the first branch wiring harnesses are located in a middle device mounting region of the chassis, and the electronic products are located at the ends of the chassis.

Embodiment 2

This embodiment repeats Embodiment 1, but has the following differences. In step S1.1, as shown in FIG. 2, a central slot 3 is designed according to the models of the first

branch wiring harnesses, and the central slot 3 is divided into a high-voltage slot 31 and a low-voltage slot 32 that are spaced. The high-voltage slot 31 and the low-voltage slot 32 are disposed in parallel, and the high-voltage slot 31 and the low-voltage slot 32 made of different profiles are spaced apart. The distance between the high-voltage slot 31 and the low-voltage slot 32 is not less than 100 mm. A first mounting bracket 11 is disposed between the high-voltage slot 31 and the low-voltage slot 32, and second mounting brackets 10 are disposed on the sides of the high-voltage wire slot 31 and the low-voltage wire slot 32, away from the first mounting bracket.

According to the models and types of the first branch wiring harnesses, the high-voltage slot 31 is divided into four voltage regions 311, and the low-voltage slot 32 is also divided into four voltage regions 321, that is, the central slot 3 has a total of eight voltage regions. Each voltage region is partitioned by a metal partition 9, and a cable of a different voltage grade is laid in each voltage region to ensure independent layout of each first branch wiring harness. Quantities of the voltage regions in the central slot 3 are enough to be compatible with cables of various voltage grades and functions of urban rail vehicles, and therefore, have good electromagnetic compatibility. Capacity of the central slot 3 is enough to be compatible with quantities of cables in existing and foreseeable manned and unmanned vehicles, and therefore, has good platform performance.

In step S2, as shown in FIG. 3, a pantograph cable or braking resistor cable a, a motor cable b, a 1500V circuit cable c, and a 380V circuit cable d are sequentially laid in the four voltage regions 311 of the high-voltage slot 31 from left to right, and a low-voltage bus e, a 110V control wire f, a 24V multi-core cable g, and a signal and network cable h are sequentially laid in the four voltage regions 321 of the low-voltage slot 32 from left to right. The pantograph cable or braking resistor cable a is laid in the leftmost voltage region 311 of the high-voltage slot 31 because the two types of cables have the same quantity and size and require almost the same space. During implementation, with the optimization of device layout, the two types of cables will not appear in the same segment of the high-voltage slot 31, so the two types of cables can be accommodated in one voltage region 311.

As shown in FIG. 2, the high-voltage slot 31 is an open slot with an opening facing upwards. The low-voltage slot 32 is a closed slot, a main opening of the low-voltage slot 32 faces downwards, and the opening is sealed with a detachable sealing plate 322. A wire binding bracket 323 that can be flipped downwards is mounted on the sealing plate 322. When wire adding or maintenance is performed in the later stage, only the sealing plate 322 is removed and the wire binding bracket 323 is flipped to facilitate maintenance and wire adding.

In this embodiment, the central slot is mounted on the basis of Embodiment 1, and the central slot and the module A form a module B.

When step 3) is performed, the formed module B is mounted as a whole below the chassis. As shown in FIG. 1, the mounted chassis wiring structure for the rail vehicle is shown in FIG. 4: the central slot 6 is located in the middle device mounting region of the chassis 1, namely, between bogies at two ends of the vehicle body. Brake pipelines 7 are arranged on two sides of the central slot 3, and an under-vehicle installation device 8 is suspended on a chassis edge beam or a vehicle bottom plate and located below the central slot 3.

As shown in FIG. 1 and FIG. 2, the first mounting bracket 11 and the second mounting brackets 10 are fixedly connected to corresponding chutes 6 on the chassis 1, respectively. All cable and corresponding fixing structures are fixed with the chutes 6 by hanging via fasteners, without passing through any holes on the chassis.

Embodiment 3

This embodiment repeats Embodiment 2, but has the following differences. Step S1.2 further includes: providing small slots 4 according to the positions and lengths of the second branch wiring harnesses. The small slots are continuously distributed (as shown in FIG. 4).

Step 2) further includes: mounting the second branch wiring harnesses in the small slots, so that the small slots and the module B form a module C;

When step 3) is performed, the formed module C is mounted as a whole below the chassis 1. Portions, passing through regions of sleeper beams 5, of the small slots 4 are mounted below the sleeper beams 5.

Embodiment 4

This embodiment repeats Embodiment 1, but has the following differences. Step 1) further includes: providing small slots 4 according to the positions and lengths of the second branch wiring harnesses.

Step 2) further includes: mounting the second branch wiring harnesses in the small slots 4, so that the small slots 4 and the module A form a module D.

When step 3) is performed, the formed module D is mounted as a whole below the chassis 1.

The structures and mounting methods of the small slots in this embodiment are the same as those in Embodiment 3.

The present invention further provides a chassis wiring structure for a rail vehicle, including a module A mounted as a whole on a chassis. The module A includes electronic products, a plurality of first branch wiring harnesses, and a plurality of second branch wiring harnesses. Each of the first branch wiring harnesses is provided with a plurality of interfaces connected to the second branch wiring harnesses, and each of the second branch wiring harnesses is connected to the corresponding interface and electronic product. Universal plugs are used at the interfaces for insertion. The wiring harnesses and electrical devices are also mounted by dedicated plug insertion. The electronic products are mounted in vehicle end boxes 2. The module A further includes the vehicle end boxes 2 for mounting the electronic products.

For the operability and aesthetics of overall installation of the first branch wiring harnesses on the chassis 1, the chassis wiring structure for a rail vehicle further includes a central slot 3 for mounting the first branch wiring harnesses, and the central slot 3 is mounted below the chassis 1 by means of a chute 6 of the chassis 1. The central slot 3 and the module A form a module B. The module B is mounted as a whole on the chassis.

In addition, in order to achieve continuity in the installation of the first branch wiring harnesses, the chassis wiring structure for a rail vehicle further includes small slots 4 for mounting the second branch wiring harnesses, and portions, passing through regions of sleeper beams, of the small slots 4 are mounted below the sleeper beams 5. The small

slots 4 and the module B form a module C. The module C is mounted as a whole on the chassis.

In another embodiment, the small slots 4 and the module A form a module D, and the module D is mounted as a whole on the chassis.

As shown in FIG. 4, after the module C is mounted on the chassis 1, the vehicle end boxes 2 are mounted at vehicle ends of the chassis 1 through bolts. The central slot 3 is disposed in a device mounting region in the middle of the chassis 1, and portions, passing through regions of sleeper beams, of the small slots 4 are mounted below the sleeper beams 5.

As shown in FIG. 4, no matter in which module manner the small slots 4 are mounted, a plurality of small slots 4 are mounted on a single second branch wiring harness, and the plurality of small slots 4 are continuously distributed from the central slot 3 to the vehicle end boxes 2.

The foregoing descriptions are merely embodiments of the present invention, and are not intended to limit the patent scope of the present disclosure. Any equivalent structures or equivalent process transformations made using the description and drawings of the present invention for direct or indirect use in other relevant technical fields shall also fall into the protection scope of the present invention.

Claims

1. A chassis wiring method for an urban rail vehicle, comprising:

1) simulation design of modular wiring harnesses

according to voltage grades of under-vehicle installation devices and on-vehicle installation devices of a chassis, designing models of a plurality of first branch wiring harnesses matching the voltage grades; meanwhile, designing corresponding lengths of the first branch wiring harnesses of the models according to positions of the under-vehicle installation devices and the on-vehicle installation devices of the chassis; arranging electronic products used in the rail vehicle at ends of the chassis, and arranging the first branch wiring harnesses in the middle of the chassis; designing positions of second branch wiring harnesses according to requirements for electrical connection of the electronic products arranged at the ends with the corresponding under-vehicle installation devices and on-vehicle installation devices, wherein the positions of the second branch wiring harnesses are designed at corresponding positions on the first branch wiring harnesses of the corresponding models; designing lengths of the second branch wiring harnesses according to distances between the positions of the second branch wiring harnesses and installation positions of the electronic products on the chassis;

2) off-line assembly

performing off-line assembly and wire connection on the first branch wiring harnesses, the electronic products, and the second branch wiring harnesses according to the design results in step 1) to form an integrated module A; and

3) on-line assembly

mounting the module A formed in step 2) as a whole below the chassis.

2. The chassis wiring method for an urban rail vehicle according to claim 1, wherein the module A further comprises individual modules formed by the electronic products in a box packaging manner.

3. The chassis wiring method for an urban rail vehicle according to claim 1, wherein step 1) further comprises: providing a structure of a central slot according to the models of the first branch wiring harnesses, and dividing the central slot into a high-voltage slot

and a low-voltage slot that are spaced; designing, a connecting structures on the central slot is mounted with chutes of the chassis;

step 2) further comprises: mounting the branch wiring harnesses of the models in corresponding positions of the high-voltage slot and the low-voltage slot, so that the central slot and the module A form a module B; and

when step 3) is performed, the formed module B is mounted as a whole below the chassis.

4. The chassis wiring method for an urban rail vehicle according to claim 3, wherein step 1) further comprises: providing small slots according to the positions and lengths of the second branch wiring harnesses;

step 2) further comprises: mounting the second branch wiring harnesses in the small slots, so that the small slots and the module B form a module C; and

when step 3) is performed, the formed module C is mounted as a whole below the chassis.

5. The chassis wiring method for an urban rail vehicle according to claim 1, wherein step 1) further comprises: providing small slots according to the positions and lengths of the second branch wiring harnesses;

step 2) further comprises: mounting the second branch wiring harnesses in the small slots, so that the small slots and the module A form a module D; and

when step 3) is performed, the formed module D is mounted as a whole below the chassis.

6. The chassis wiring method for an urban rail vehicle according to claim 1, wherein some of the first branch wiring harnesses of the models are mounted in an open manner, while the rest are mounted in a closed manner.

7. A chassis wiring structure for a rail vehicle, comprising a module A mounted as a whole on a chassis, wherein the module A comprises electronic products, a plurality of first branch wiring harnesses, and a plurality of second branch wiring harnesses; each of the first branch wiring harnesses is provided with a plurality of interfaces connected to the second branch wiring harnesses, and each of the second branch wiring harnesses is connected to the corresponding interface and electronic product; and

after the module A is mounted on the chassis, the electronic products are disposed at vehicle ends of the chassis; and the first branch wiring harnesses are disposed in a device mounting region in the middle of the chassis.

8. The chassis wiring structure for a rail vehicle according to claim 7, further comprising a central slot for mounting the first branch wiring harnesses, wherein the central slot is mounted below the chassis by means of a chute of the chassis, the central slot and the module A form a module B, and the module B is mounted as a whole on the chassis.

9. The chassis wiring structure for a rail vehicle according to claim 8, wherein the central slot comprises a high-voltage slot and a low-voltage slot that are independently disposed and mounted in parallel, the high-voltage slot and the low-voltage slot are longitudinal disposed in a middle of the chassis and spaced apart, adjacent sides of the high-voltage slot and the low-voltage slot are connected by a first mounting bracket, and second mounting brackets are disposed on the sides of the high-voltage wire slot and the low-voltage wire slot, away from the first mounting bracket outside the high-voltage wire slot and the low-voltage wire slot.

10. The chassis wiring structure for a rail vehicle according to claim 8, further comprising small slots for mounting the second branch wiring harnesses, wherein portions, passing through regions of sleeper beams, of the small slots are mounted below the sleeper beams, the small slots and the module B form a module C, and the module C is mounted as a whole on the chassis.

11. The chassis wiring structure for a rail vehicle according to claim 7, further comprising small slots for mounting the second branch wiring harnesses, wherein portions, passing through regions of sleeper beams, of the small slots are mounted below the sleeper beams, the small slots and the module A form a module D, and the module D is mounted as a whole on the chassis.