

DESCRIPTION

DEVICE CONNECTION METHOD FOR PLANT

Technical Field

[0001]

The present invention relates to a device connection method for a plant in connecting various devices by using cables, for example, in construction of a plant that mines, produces, or refines oil, natural gas, or the like, and more specifically, a device connection method for a plant that is capable of shortening a construction period of the various devices.

Background Art

[0002]

One example of a task in plant construction work is a task of connecting a local electrical room (LER) to various devices by using electrical cables (hereinafter also simply referred to as "cables").

[0003]

In a conventional device connection method for connecting an LER to various devices, cables are laid after the LER and the various devices have been installed, and then, the LER and the various devices are connected by the cables. In such a device connection method, a cable laying task is not started until a task of installing the LER and

the various devices is completed, and the cable laying task is performed after the task of installing the LER and the various devices.

[0004]

Such a device connection task is similarly performed in construction work of not only an onshore plant, such as an oil refining plant, a petrochemical plant, or an onshore natural gas liquefaction plant (an LNG plant), but also an offshore plant that mines or produces oil, natural gas, or the like on the sea.

[0005]

A known example of a system to be used as an offshore plant is a floating system, such as a floating production, storage, and offloading system (FPSO) that produces, stores, and offloads oil, natural gas, or the like, a floating storage and offloading system (FSO) that does not include a production system and only performs storage and offloading, a floating storage unit (FSU) that only performs storage, or a floating liquefied natural gas production system (FLNG) that is specialized in production, storage, and offloading of liquefied natural gas.

[0006]

Here, in construction of the floating system, similarly to vessels such as tankers, first, a hull is built or assembled, and then, the hull is launched, is

moored to a quay wall, and is fit out.

In fitting-out work of the floating system, not only interior finishing of a living section or the like but also an electrical room that stores power distribution equipment, a measuring instrument room that stores measuring instruments and the like, and various devices, such as a gas turbine for power generation, are installed.

[0007]

The various devices are assembled and modularized in advance together with peripheral devices or the like on land, as described, for example, in Patent Literature 1, and the fitting-out work of the floating system is performed by installing, in the hull, a module that has been assembled in advance.

Citation List

Patent Literature

[0008]

Patent Literature 1: JP 2015-518943 A

Summary of Invention

Technical Problem

[0009]

Meanwhile, many cables to be used in plants have a large size, have a large diameter, and are heavy, and

therefore it takes time to handle the cables. Therefore, it takes a long time to lay cables after a task of installing an LER and various devices has been completed, and connect the LER to the various devices by using the cables.

[0010]

In addition, after the LER and the various cables have been connected by the cables, commissioning before the start of the operation (for example, confirmation as to whether the LER and the various devices have been connected normally via the cables, and the like) is performed. However, in a conventional device connection method, as described above, a cable laying task and a cable connection task need to be performed after a task of installing the LER and the various devices has been completed. This causes a problem in which it takes time to start commissioning and a construction period as a whole becomes longer.

[0011]

Note that, in a case where a large-sized cable is laid, a cable laid part such as a pipe rack is designed in consideration of a laying space. On the other hand, an end of an extended cable is placed in a wound state until the cable and a device are connected. The large diameter of the cable requires a wide space as a place for the end of

the cable. However, in construction of a floating system for which a space is limited in comparison with a plant constructed on land, it is not realistic to perform a task while securing such a space.

[0012]

It is an object of the present invention to provide a device connection method for a plant that is capable of shortening a plant construction period by enabling commissioning to be started immediately after installation of various devices in construction of the plant.

Solution to Problem

[0013]

The present invention includes the following items.

[0014]

[1] A device connection method for a plant for connecting a plurality of devices by using a cable in construction of the plant, the device connection method including:

a first installation process for installing a first device;

a second installation process for installing a second device;

a laying process for laying the cable; and

a connection process for connecting the cable to the

second device, in which

the second installation process is completed when or after the first installation process is completed,

the laying process is completed before or when the second installation process is completed, and

the connection process is performed when or after the second installation process is completed.

[0015]

[2] The device connection method for a plant described in [1], in which

the second installation process includes a disposition process for disposing a sub-cable, one end of the sub-cable being connected to the second device, in a state where another end of the sub-cable is located at a laying height of the cable, and

in the connection process,

the second device and the cable are connected via the sub-cable.

[0016]

[3] The device connection method for a plant described in [2], in which

the cable and the sub-cable are connected via a connector.

[0017]

[4] The device connection method for a plant described

in any one of [1] to [3], in which

at least one of the first device and the second device is disposed in a position that is spaced apart from a construction reference plane of the plant in a height direction.

[0018]

[5] The device connection method for a plant described in any one of [1] to [4], in which

the cable is laid below a construction reference plane of the plant.

[0019]

[6] The device connection method for a plant described in any one of [1] to [5], in which

the first device includes a local electrical room, and

the second device is installed to be incorporated into a module for the construction of the plant.

[0020]

[7] The device connection method for a plant described in [6], in which

in the laying process, the cable is laid below the second device,

the second installation process includes a suspension process for suspending a sub-cable, one end of the sub-cable being connected to the second device, from

the module in a state where another end of the sub-cable is located at a laying height of the cable, and

in the connection process, the cable and the sub-cable are connected via a connector.

[0021]

[8] The device connection method for a plant described in any one of [1] to [7], in which

the plant includes a floating system, and the laying process, the second installation process, and the connection process are performed on an ocean.

Advantageous Effects of Invention

[0022]

According to the present invention, a connection process can be performed upon completion of a first installation process and a second installation process, and then commissioning can be started immediately. Therefore, the time required to start commissioning after installation of various devices can be shortened, and this enables a plant construction period to be shortened.

Brief Description of Drawings

[0023]

Fig. 1 is a schematic diagram for explaining a configuration of a floating system according to an

embodiment.

Fig. 2 is a Gantt chart for explaining a device connection method in the floating system of Fig. 1.

Fig. 3 is a Gantt chart for explaining another device connection method in the floating system of Fig. 1.

Fig. 4 is a Gantt chart for explaining another device connection method in the floating system of Fig. 1.

Fig. 5 is a Gantt chart for explaining another device connection method in the floating system of Fig. 1.

Fig. 6 is a Gantt chart for explaining another device connection method in the floating system of Fig. 1.

Fig. 7 is a Gantt chart for explaining another device connection method in the floating system of Fig. 1.

Fig. 8 is a Gantt chart for explaining another device connection method in the floating system of Fig. 1.

Fig. 9 is a Gantt chart for explaining another device connection method in the floating system of Fig. 1.

Fig. 10 is a schematic diagram for explaining a configuration of a floating system according to another embodiment.

Fig. 11 is a schematic diagram for explaining a configuration of a floating system according to another embodiment.

Fig. 12 is a schematic diagram for explaining a configuration of a floating system according to another

embodiment.

Description of Embodiments

[0024]

Device connection methods for a plant according to embodiments of the present invention are described below with reference to the drawings, by using, as an example, connection of a local electrical room (LER) to various devices in a floating system. Fig. 1 is a schematic diagram for explaining a configuration of a floating system according to an embodiment, and Fig. 2 is a Gantt chart for explaining a device connection method in the floating system of Fig. 1.

[0025]

As illustrated in Fig. 1, a floating system 10 according to the present embodiment includes a hull 12, a local electrical room (LER) 16 (a first device in the present invention) and a device 20 (a second device in the present invention) that have been installed on an upper deck 14 of the hull 12, and a cable 22 that electrically connects the LER 16 to the device 20.

[0026]

Note that, a "hull" herein means a body part excluding the LER 16, the device 20, the cable 22, and other equipment from the floating system 10. In addition,

the floating system 10 includes a floating production, storage, and offloading system (FPSO), a floating storage and offloading system (FSO), a floating storage unit (FSU), a floating liquefied natural gas production system (FLNG), and the like.

[0027]

Note that, in such a floating system 10, it is preferable that the upper deck 14 be set to be a construction reference plane. In addition, herein, an upper side of the construction reference plane is referred to as "on a vessel", and a lower side of the construction reference plane is referred to as "in a vessel".

[0028]

The LER 16 is equipment that stores various types of electrical equipment, such as a distribution board that supplies power to various devices or the like that have been installed in the floating system 10, a watthour meter that displays an amount of supplied power, or a transformer that adjusts voltage.

[0029]

The device 20 includes, for example, a power generation device, such as a gas turbine, that generates power, and an electric device such as a pump (a motor). In a case where the device 20 is a power generation device, power is transmitted from the device 20 to the LER 16 via

the cable 22. On the other hand, in a case where the device 20 is an electric device, power is transmitted from the LER 16 to the device 20 via the cable.

[0030]

The cable 22 electrically connects the LER 16 to the device 20, and is not particularly limited if the cable 22 can transmit power. In a case where the cable 22 is used in a plant, it is preferable that the diameter of the cable 22 be 3 mm to 120 mm, and it is more preferable that the diameter of the cable 22 be 10 mm to 80 mm.

[0031]

In the present embodiment, the LER 16 is directly connected to the cable 22, and the device 20 is directly connected to the cable 22. However, connection may be performed, for example, via a sub-cable (not illustrated). In addition, in this case, the cable 22 and the sub-cable may be connected via a connector (not illustrated).

[0032]

In the present embodiment, the LER 16, the device 20, and the cable 22 are installed or laid, and are connected to each other on the upper deck 14 of the hull 12 in a procedure as illustrated in Fig. 2.

[0033]

As illustrated in Fig. 2, first, a first installation process for installing the LER 16 on the upper

deck 14 is performed. Next, after completion of the first installation process, a laying process for laying the cable 22 is performed. Then, after completion of the laying process, a second installation process for installing the device 20 on the upper deck 14 is performed.

[0034]

After completion of the second installation process, a connection process for connecting another end of the cable 22 to the device 20 is performed.

Note that, in the present embodiment, one end of the cable 22 may be connected to the LER 16 in parallel to the laying process or at any timing after the laying process. However, it is preferable that the one end of the cable 22 be connected to the LER 16 before or when the connection process is completed.

[0035]

In addition, the present invention includes device connection methods as described below.

Fig. 3 is a Gantt chart for explaining another device connection method in the floating system of Fig. 1.

[0036]

As illustrated in Fig. 3, first, a first installation process for installing the LER 16 on the upper deck 14 is performed, and a laying process for laying the cable 22 is performed while the first installation process

is being performed. Then, after completion of the first installation process, a second installation process for installing the device 20 on the upper deck 14 is performed.

[0037]

After completion of the second installation process, a connection process for connecting another end of the cable 22 to the device 20 is performed.

Note that, in the present embodiment, if the first installation process has been completed, one end of the cable 22 may be connected to the LER 16 in parallel to the laying process or at any timing after the laying process. However, it is preferable that the one end of the cable 22 be connected to the LER 16 before or when the connection process is completed.

[0038]

Fig. 4 is a Gantt chart for explaining another device connection method in the floating system of Fig. 1.

[0039]

As illustrated in Fig. 4, first, a first installation process for installing the LER 16 on the upper deck 14 is performed, and a laying process for laying the cable 22 is performed in such a way that the laying process is completed before or when the first installation process is completed. Then, after completion of the first installation process, a second installation process for

installing the device 20 on the upper deck 14 is performed.

[0040]

After completion of the second installation process, a connection process for connecting another end of the cable 22 to the device 20 is performed.

Note that, in the present embodiment, if the first installation process has been completed, one end of the cable 22 may be connected to the LER 16 at any timing. However, it is preferable that the one end of the cable 22 be connected to the LER 16 before or when the connection process is completed.

[0041]

Fig. 5 is a Gantt chart for explaining another device connection method in the floating system of Fig. 1.

[0042]

As illustrated in Fig. 5, first, a first installation process for installing the LER 16 on the upper deck 14 is performed. Next, after completion of the first installation process, a second installation process for installing the device 20 on the upper deck 14 is performed, and a laying process for laying the cable 22 is performed in such a way that the laying process is completed before or when the second installation process is completed.

[0043]

After completion of the second installation process,

a connection process for connecting another end of the cable 22 to the device 20 is performed.

Note that, in the present embodiment, one end of the cable 22 may be connected to the LER 16 in parallel to the laying process or at any timing after the laying process. However, it is preferable that the one end of the cable 22 be connected to the LER 16 before or when the connection process is completed.

[0044]

Fig. 6 is a Gantt chart for explaining another device connection method in the floating system of Fig. 1.

[0045]

As illustrated in Fig. 6, first, a first installation process for installing the LER 16 on the upper deck 14 is performed, and a laying process for laying the cable 22 is performed in such a way that the laying process is completed before or when the first installation process is completed. In addition, a second installation process for installing the device 20 on the upper deck 14 is started in parallel to the first installation process and the laying process.

[0046]

After completion of the second installation process, a connection process for connecting another end of the cable 22 to the device 20 is performed.

Note that, in the present embodiment, if the first installation process has been completed, one end of the cable 22 may be connected to the LER 16 at any timing. However, it is preferable that the one end of the cable 22 be connected to the LER 16 before or when the connection process is completed.

[0047]

Fig. 7 is a Gantt chart for explaining another device connection method in the floating system of Fig. 1.

[0048]

As illustrated in Fig. 7, first, a first installation process for installing the LER 16 on the upper deck 14 is performed, and a second installation process for installing the device 20 on the upper deck 14 is performed. In addition, a laying process for laying the cable 22 is performed in such a way that the laying process is completed after the first installation process is completed and before or when the second installation process is completed.

[0049]

After completion of the second installation process, a connection process for connecting another end of the cable 22 to the device 20 is performed.

Note that, in the present embodiment, if the first installation process has been completed, one end of the

cable 22 may be connected to the LER 16 in parallel to the laying process or at any timing after the laying process. However, it is preferable that the one end of the cable 22 be connected to the LER 16 before or when the connection process is completed.

[0050]

Fig. 8 is a Gantt chart for explaining another device connection method in the floating system of Fig. 1.

[0051]

As illustrated in Fig. 8, first, a first installation process for installing the LER 16 on the upper deck 14 is performed, and a second installation process for installing the device 20 on the upper deck 14 is performed. In addition, a laying process for laying the cable 22 is performed in such a way that the laying process is completed before or when the first installation process and the second installation process are completed.

[0052]

After completion of the second installation process, a connection process for connecting another end of the cable 22 to the device 20 is performed.

Note that, in the present embodiment, if the first installation process has been completed, one end of the cable 22 may be connected to the LER 16 at any timing. However, it is preferable that the one end of the cable 22

be connected to the LER 16 before or when the connection process is completed.

[0053]

Fig. 9 is a Gantt chart for explaining another device connection method in the floating system of Fig. 1.

[0054]

As illustrated in Fig. 9, first, a first installation process for installing the LER 16 on the upper deck 14 is performed, and a second installation process for installing the device 20 on the upper deck 14 is performed. In addition, a laying process for laying the cable 22 is performed in such a way that the laying process is completed simultaneously with completion of the first installation process. In this case, the first installation process, the second installation process, and the laying process may be completed simultaneously.

[0055]

After completion of the second installation process, a connection process for connecting another end of the cable 22 to the device 20 is performed.

Note that, in the present embodiment, if the first installation process has been completed, one end of the cable 22 may be connected to the LER 16 at any timing. However, it is preferable that the one end of the cable 22 be connected to the LER 16 before or when the connection

process is completed.

[0056]

As described above, in a device connection method for a plant according to the present invention, respective processes are performed in such a way that a second installation process is completed when or after a first installation process is completed, a laying process is completed before or when the second installation process is completed, and a connection process is performed when or after the second installation process is completed.

[0057]

Stated another way, if the respective processes are performed as described above, the order of the respective processes is not limited to the orders described above of the respective processes, as illustrated in Figs. 2 to 9.

[0058]

Fig. 10 is a schematic diagram for explaining a configuration of a floating system according to another embodiment.

A floating system 10 according to the present embodiment basically has a configuration that is similar to a configuration of the floating system 10 illustrated in Fig. 1, similar components are denoted by the same reference signs, and the detailed description of the similar components is omitted.

[0059]

In the present embodiment, the device 20 is placed on a rack 24, and is disposed in a position that is spaced apart from the upper deck 14. Stated another way, in the laying process, the cable 22 is laid below the device 20.

[0060]

In addition, the second installation process includes a disposition process for disposing a sub-cable 26 in which one end is connected to the device 20, in such a way that another end of the sub-cable 26 is located at a laying height of the cable 22, that is, on the upper deck 14.

[0061]

Specifically, in the second installation process, the device 20 is disposed on the rack 24, and then, one end of the sub-cable 26 is connected to the device 20. Next, another end of the sub-cable 26 is disposed to be located on the upper deck 14.

[0062]

Then, in the connection process, the cable 22 is connected to the other end of the sub-cable 26, and therefore the device 20 is connected to the cable 22.

In a case where the cable 22 is connected to the sub-cable 26, as described above, the cable 22 can also be connected to the sub-cable 26 via a connector 28. By

employing such a configuration, a task of connecting the cable 22 to the sub-cable 26 is simplified, and misconnection or the like can be avoided.

[0063]

Fig. 11 is a schematic diagram for explaining a configuration of a floating system according to another embodiment.

A floating system 10 according to the present embodiment basically has a configuration that is similar to a configuration of the floating system 10 illustrated in Fig. 1, similar components are denoted by the same reference signs, and the detailed description of the similar components is omitted.

[0064]

In the present embodiment, the device 20 has been modularized in advance as a module 18 together with a peripheral device or the like. In addition, the second installation process includes a suspension process for suspending, from the module 18, the sub-cable 26 in which one end is connected to the device 20, in such a way that another end of the sub-cable 26 is located at a laying height of the cable 22, that is, on the upper deck 14.

[0065]

Specifically, in the second installation process, the module 18 incorporated with the device 20 is disposed

on the upper deck 14, and then, one end of the sub-cable 26 is connected to the device 20. Next, another end of the sub-cable 26 is disposed to be located on the upper deck 14.

[0066]

Then, in the connection process, the cable 22 is connected to the other end of the sub-cable 26, and therefore the device 20 is connected to the cable 22.

In a case where the cable 22 is connected to the sub-cable 26, as described above, the cable 22 can also be connected to the sub-cable 26 via the connector 28. By employing such a configuration, a task of connecting the cable 22 to the sub-cable 26 is simplified, and misconnection or the like can be avoided.

[0067]

Fig. 12 is a schematic diagram for explaining a configuration of a floating system according to another embodiment.

A floating system 10 according to the present embodiment basically has a configuration that is similar to a configuration of the floating system 10 illustrated in Fig. 1, similar components are denoted by the same reference signs, and the detailed description of the similar components is omitted.

[0068]

In the present embodiment, the LER 16 and the cable 22 are disposed in a vessel. In addition, the device 20 has been modularized in advance as the module 18 together with a peripheral device or the like.

[0069]

Similarly in a case where such a configuration is employed, the suspension process may be performed in the second installation process, and the device 20 and the cable 22 may be connected via the sub-cable 26.

[0070]

Stated another way, in a case where the device 20 and the cable 22 are located to be spaced apart from each other in a height direction, the disposition process or the suspension process may be performed in the second installation process, and the device 20 and the cable 22 may be connected via the sub-cable 26.

[0071]

Note that, in the present embodiment, the LER 16 and the cable 22 are disposed in a vessel. However, only the LER 16 can also be disposed in the vessel. In contrast, the device 20 can also be disposed in the vessel. Alternatively, only the cable 22 can also be disposed in the vessel. Moreover, the LER 16, the cable 22, and the device 20 can also be disposed in the vessel.

[0072]

Preferred embodiments of the present invention have been described above, but the present invention is not limited to these preferred embodiments. For example, in the embodiments described above, a case where the cable 22 is laid below the device 20 (on the upper deck 14) has been described, but the present invention is not limited to this. In a case where the LER 16 is located at substantially the same height as a height of the pipe rack or is located higher than the pipe rack, in the laying process, the cable 22 may be laid to extend on a top of the pipe rack or in the pipe rack, and on a top of the module 18 or in the module 18. In this case, in the disposition process, an end of the cable 22 is located on the pipe rack, and therefore another end of the sub-cable connected to the device 20 is located on the pipe rack in order to be connected to the end of the cable 22.

[0073]

In addition, in the embodiments described above, it has been described that the LER 16 is a first device and the device 20 is a second device. However, the LER 16 may be the second device, and the device 20 may be the first device. Further, both the first device and the second device may be a device installed in a module, and the LER 16 may be omitted.

[0074]

Furthermore, the embodiments described above have been described by using, as an example, a case where a floating system is constructed as a plant. However, the present invention can also be applied to an onshore plant, such as an onshore natural gas liquefaction plant (an LNG plant), that serves as a plant. In a case where the present invention is applied to an onshore plant, as described above, it is preferable that the ground be set to be a construction reference plane.

[0075]

In addition, in the case of a floating system, in general, an LER or various devices are installed in fitting-out work conducted on the ocean. However, various variations can be made without departing from an object of the present invention such that, for example, the LER or the various devices may be installed before the fitting-out work in a case where the LER is installed in a vessel.

Reference Signs List

[0076]

- 10 Floating system
- 12 Hull
- 14 Upper deck
- 18 Module
- 20 Device

22	Cable
24	Rack
26	Sub-cable
28	Connector

CLAIMS

1. A device connection method for a plant for connecting a plurality of devices by using a cable in construction of the plant, the device connection method comprising:

a first installation process for installing a first device;

a second installation process for installing a second device;

a laying process for laying the cable;

a first connection process for connecting one end of the cable to the first device; and

a second connection process for connecting another end of the cable to the second device, wherein

the second installation process is completed when or after the first installation process is completed,

the laying process is completed before or when the

second installation process is completed,

the second connection process is performed when or after the second installation process is completed, and

the first connection process is performed before or when the second connection process is completed,

the second device is installed to be incorporated into a module for the construction of the plant,

in the laying process, the cable is laid below the second device,

the second installation process includes a suspension process for suspending a sub-cable, one end of the sub-cable being connected to the second device, from the module in a state where another end of the sub-cable is located at a laying height of the cable, and

in the second connection process, the cable and the sub-cable are connected.

2. The device connection method for a plant according to claim 1, wherein

the whole or a part of the laying process is performed in parallel with the first installation process.

3. The device connection method for a plant according to claim 1 or claim 2, wherein

the whole or a part of the laying process is performed in parallel with the second installation process.

4. The device connection method for a plant according to any one of claims 1 to 3, wherein

a diameter of the cable is 3 mm to 120 mm.

5. The device connection method for a plant according to claim 4, wherein

the diameter of the cable is 10 mm to 80 mm.

6. The device connection method for a plant according to any one of claims 1 to 5, wherein

the second installation process includes a disposition process for disposing a sub-cable, one end of the sub-cable being connected to the second device, in a state where another end of the sub-cable is located at a laying height of the cable, and

in the second connection process,

the second device and the cable are connected via the sub-cable.

7. The device connection method for a plant according to claim 6, wherein

the cable and the sub-cable are connected via a connector.

8. The device connection method for a plant according to any one of claims 1 to 7, wherein

at least one of the first device and the second device is disposed in a position that is spaced apart from a

construction reference plane of the plant in a height direction.

9. The device connection method for a plant according to any one of claims 1 to 8, wherein

the cable is laid below a construction reference plane of the plant.

10. The device connection method for a plant according to any one of claims 1 to 9, wherein

the first device includes a local electrical room.

11. The device connection method for a plant according to any one of claims 1 to 10, wherein

the plant includes a floating system, and the laying process, the second installation process, the first connection process and the second connection process are performed on an ocean.