acquiring flange information containing gasket information fitting with the flanges from a flange tag, acquiring gasket information from a gasket tag, collating the gasket information contained in the flange information with the gasket information acquired from the gasket tag, selecting a tightening condition from the tightening condition information provided that the gasket fits with the flanges, acquiring on-tightening or post-tightening tightening information from a sensor attached to the bolt to evaluate whether tightening conforms to the tightening condition, and presenting tightening result information containing at least the tightening condition and the evaluation result, in association with the flanges.

[0008]

The flange tightening management method may further comprise the step of, at the time of collation of the gasket information, outputting presentation information indicative of whether the gasket fits with the flanges.

[0009]

The flange tightening management method may further comprise the steps of determining whether the tightening condition is satisfied during tightening of the flanges, and presenting a result of the determination.

[0010]

The flange tightening management method may further comprise the steps of acquiring worker information from a worker tag, and presenting the flange, the tightening condition, and the evaluation result, in association with the worker information.

[0011]

In the flange tightening management method, the flange information may contain at least gasket information fitting with the flanges and information indicative of a tightening procedure.

[0012]

In the flange tightening management method, the tightening condition information may contain the flange information and the gasket information.

[0013]

The flange tightening management method may further comprise the steps of forming a gasket from a gasket material, and attaching the gasket tag containing the gasket information, to the gasket.

[0014]

In order to accomplish the above object, according to an aspect of a flange tightening management system of the present invention, the flange tightening management system is used for management of tightening that tightens flanges sandwiching a gasket therebetween by a plurality of bolts and nuts and comprises a sensor detecting tightening information and a server connected wiredly or wirelessly to the sensor, wherein the server acquires tightening condition information associated with the flanges, acquires flange information from a first information tag on the flange side, acquires gasket information from a second information tag on the gasket side, collates gasket information contained in the flange information with the gasket information acquired from the second information tag, selects a tightening condition from the tightening condition information on condition that the gasket fits with the flanges, and acquires on-tightening or post-tightening tightening information from the sensor, to evaluate whether tightening of the flanges conforms to the tightening condition.

In order to accomplish the above object, according to an aspect of a flange tightening management system of the present invention, the flange tightening management system is used for management of tightening that tightens flanges sandwiching a gasket therebetween by a plurality of bolts and nuts and comprises a sensor attached to the bolt for detecting tightening information and a server connected wiredly or wirelessly to the sensor, wherein the server acquires tightening condition information associated with the flanges, acquires flange information containing gasket information fitting with the flanges from a flange tag, acquires gasket information from a gasket tag, collates the gasket information

contained in the flange information with the gasket information acquired from the gasket tag, selects a tightening condition from the tightening condition information provided that the gasket fits with the flanges, acquires on-tightening or post-tightening tightening information from the sensor to evaluate whether tightening of the flanges conforms to the tightening condition, and presents tightening result information containing at least the tightening condition and the evaluation result in association with the flanges.

[0015]

In order to achieve the above object, according to an aspect of a flange tightening management program of the present invention, the flange tightening management program is run by a computer used for management of tightening that tightens flanges sandwiching a gasket therebetween by a plurality of bolts and nuts and drives the computer to execute the functions of acquiring tightening condition information associated with the flanges, acquiring flange information from a first information tag on the flange side, acquiring gasket information from a second information tag on the gasket side, collating gasket information contained in the flange information with the gasket information acquired from the second information tag, selecting a tightening condition from the tightening condition information on condition that the gasket fits with the flanges, and acquiring on-tightening or post-tightening tightening information to evaluate whether tightening conforms to the tightening condition.

In order to achieve the above object, according to an aspect of a flange tightening management program of the present invention, the flange tightening management program is run by a computer used for management of tightening that tightens flanges sandwiching a gasket therebetween by a plurality of bolts and nuts and drives the computer to execute the functions of acquiring tightening condition information associated with the flanges, acquiring flange information containing gasket information fitting with the flanges from a flange tag, acquiring gasket information from a gasket tag,

collating the gasket information contained in the flange information with the gasket information acquired from the gasket tag, selecting a tightening condition from the tightening condition information, provided that the gasket fits with the flanges, acquiring on-tightening or post-tightening tightening information from a sensor attached to the bolt to evaluate whether tightening conforms to the tightening condition, and presenting the tightening result information containing at least the tightening condition and the evaluation result in association with the flanges.

[0016]

In order to attain the above object, according to an aspect of a flange tightening management device of the present invention, the flange tightening management device is used for management of tightening that tightens flanges sandwiching a gasket therebetween by a plurality of bolts and nuts and comprises an information acquiring unit that acquires tightening condition information associated with the flanges, acquires flange information from a first information tag on the flange side, acquires gasket information from a second information tag on the gasket side, and acquires on-tightening or post-tightening tightening information; and a processing unit that collates gasket information contained in the flange information with the gasket information acquired from the second information tag and selects a tightening condition from the tightening condition information on condition that the gasket fits with the flanges, to evaluate whether tightening of the flange conforms to the tightening condition.

In order to attain the above object, according to an aspect of a flange tightening management device of the present invention, the flange tightening management device is used for management of tightening that tightens flanges sandwiching a gasket therebetween by a plurality of bolts and nuts and comprises an information acquiring unit that acquires tightening condition information associated with the flanges, acquires flange information containing gasket information fitting with the flanges from a flange

tag, acquires gasket information from a gasket tag, and acquires on-tightening or post-tightening tightening information from a sensor attached to the bolt; a processing unit that collates the gasket information contained in the flange information with the gasket information acquired from the gasket tag and selects a tightening condition from the tightening condition information provided that the gasket fits with the flanges, to evaluate whether tightening of the flanges conforms to the tightening condition; and an information presenting unit that presents tightening result information containing at least the tightening condition and the evaluation result in association with the flanges.

ADVANTAGEOUS EFFECTS OF INVENTION

[0017]

According to the present invention, the following effects can be obtained.

[0018]

(1) By use of a computer having a flange tightening monitoring function, there can be implemented consistent management of multi-function processing including flange and gasket selection, tightening condition setting, tightening status evaluation, tightening result recording, and its information presentation, thus achieving flange tightening management not relying on the worker's experience and intuition.

[0019]

(2) As a result of acquiring tightening information from a sensor disposed on the bolt to thereby evaluate the conformation to the tightening condition, the status of the flange or gasket to be tightened can be grasped so that highly reliable flange tightening management can be implemented.

[0020]

(3) Since it is evaluated based on the tightening result whether the tightening status conforms to the tightening condition, the degree of dependence on the worker is reduced so that tightening with a smaller error can be implemented.

44-2. The temporary storage area 44-1 temporarily stores flange information 60 acquired from the flange 10, gasket information 62 acquired from the gasket 12, and worker information 64 acquired from a worker tag 84 (Fig. 5B) and tightening result information 66 for example.

[0064]

A database for a tightening condition table 68, log information tables 70-1 and 70-2, etc. is built in the storage are 44-2. The tightening condition table 68 records tightening condition information associated with the flange 10. The log information tables 70-1 and 70-2 record information such as the tightening result and the tightening determination result.

[0065]

<Sensors 4-1, 4-2, ..., and 4-N>

[0066]

Fig. 4 shows an example of the bolt 14 having the sensor 4. This bolt 14 comprises a bolt body 72 that has a strain gauge 74 disposed in the interior thereof. The strain gauge 74 is an example of the sensors 4-1, 4-2, ..., and 4-N of this disclosure and detects a strain occurring in the bolt body 72 by the torque T applied to the bolts 14-1, 14-2, ..., and 14-N by the tightening tool 18. This strain represents the axial force F applied to the bolt 14 by tightening. A cable 76 for example is connected to the strain gauge 74 so that the detection axial force F may be taken out as a sensor output through the cable 76.

[0067]

<Worker Information 64>

[0068]

Fig. 5A shows a worker information table. The worker information table 80 is memorized in the server 6 for example and stores worker information acquired from a worker in charge of tightening. This worker information table 80 contains as an example of the worker information a worker identification (ID), a user, a worker name, etc. The worker ID is identification

tightening result recording, and information presentation thereof, thus enabling the flange tightening management not relying on the worker's experience and intuition to be advantageously achieved.

REFERENCE SIGNS LIST

[0175]

2, 130 flange tightening management system
4, 4-1, 4-2, …, 4-N sensor
6 server
8 flange tightening portion
10, 10-1, 10-2 flange
12 gasket
14, 14-1, 14-2, …, 14-N bolt
16 nut
18 tightening tool
20 data accumulating unit
22 processing unit
24 monitor
26 input operating unit
30 flange tag
32 gasket tag
34 management function unit
36 storage/display function unit
40 processing unit
42, 142 processor
44, 144 storing unit
46, 146 input/output unit (I/O)
48, 150 communicating unit
50, 156 external memory
52, 148 input operating unit
54, 152 displaying unit
56 touch panel
60 flange information
62 gasket information
64 worker information

CLAIMS

1. A flange tightening management method using a computer for management of tightening that tightens flanges sandwiching a gasket therebetween by a plurality of bolts and nuts, comprising the steps of:

acquiring tightening condition information associated with the flanges;

acquiring flange information from a first information tag on the flange side;

acquiring gasket information from a second information tag on the gasket side;

collating gasket information contained in the flange information with the gasket information acquired from the second information tag;

selecting a tightening condition from the tightening condition information, on condition that the gasket fits with the flanges; and

acquiring on-tightening or post-tightening tightening information, to evaluate whether this tightening information conforms to the tightening condition.

2. A flange tightening management method using a computer for management of tightening that tightens flanges sandwiching a gasket therebetween by a plurality of bolts and nuts, comprising the steps of:

acquiring tightening condition information associated with the flanges;

acquiring flange information containing gasket information fitting with the flanges, from a flange tag;

acquiring gasket information from a gasket tag;

collating the gasket information contained in the flange information with the gasket information acquired from the gasket tag;

selecting a tightening condition from the tightening condition information, provided that the gasket fits with the

by a plurality of bolts and nuts, comprising:

a sensor attached to the bolt, for detecting tightening information; and

a server connected wiredly or wirelessly to the sensor, wherein

the server

acquires tightening condition information associated with the flanges;

acquires flange information containing gasket information fitting with the flanges, from a flange tag;

acquires gasket information from a gasket tag;

collates the gasket information contained in the flange information with the gasket information acquired from the gasket tag;

selects a tightening condition from the tightening condition information, provided that the gasket fits with the flanges;

acquires on-tightening or post-tightening tightening information from the sensor, to evaluate whether tightening of the flanges conforms to the tightening condition; and

presents tightening result information containing at least the tightening condition and the evaluation result, in association with the flanges.

11. A flange tightening management program run by a computer used for management of tightening that tightens flanges sandwiching a gasket therebetween by a plurality of bolts and nuts, the program driving the computer to execute the functions of:

acquiring tightening condition information associated with the flanges;

acquiring flange information from a first information tag on the flange side;

acquiring gasket information from a second information tag on the gasket side;

collating gasket information contained in the flange information with the gasket information acquired from the second

information tag;

selecting a tightening condition from the tightening condition information, on condition that the gasket fits with the flanges; and

acquiring on-tightening or post-tightening tightening information, to evaluate whether tightening conforms to the tightening condition.

12. A flange tightening management program run by a computer used for management of tightening that tightens flanges sandwiching a gasket therebetween by a plurality of bolts and nuts, the program driving the computer to execute the functions of:

acquiring tightening condition information associated with the flanges;

acquiring flange information containing gasket information fitting with the flanges, from a flange tag;

acquiring gasket information from a gasket tag;

collating the gasket information contained in the flange information with the gasket information acquired from the gasket tag;

selecting a tightening condition from the tightening condition information, provided that the gasket fits with the flanges;

acquiring on-tightening or post-tightening tightening information from a sensor attached to the bolt, to evaluate whether tightening conforms to the tightening condition; and

presenting the tightening result information containing at least the tightening condition and the evaluation result, in association with the flanges.

13. A flange tightening management device used for management of tightening that tightens flanges sandwiching a gasket therebetween by a plurality of bolts and nuts, comprising:

an information acquiring unit that acquires tightening condition information associated with the flanges, acquires flange

information from a first information tag on the flange side, acquires gasket information from a second information tag on the gasket side, and acquires on-tightening or post-tightening tightening information; and

a processing unit that collates gasket information contained in the flange information with the gasket information acquired from the second information tag and selects a tightening condition from the tightening condition information, on condition that the gasket fits with the flanges, to evaluate whether tightening of the flange conforms to the tightening condition.

14. A flange tightening management device used for management of tightening that tightens flanges sandwiching a gasket therebetween by a plurality of bolts and nuts, comprising:

an information acquiring unit that

acquires tightening condition information associated with the flanges,

acquires flange information containing gasket information fitting with the flanges, from a flange tag,

acquires gasket information from a gasket tag, and

acquires on-tightening or post-tightening tightening information from a sensor attached to the bolt;

a processing unit that

collates the gasket information contained in the flange information with the gasket information acquired from the gasket tag, and

selects a tightening condition from the tightening condition information, provided that the gasket fits with the flanges, to evaluate whether tightening of the flanges conforms to the tightening condition; and

an information presenting unit that presents tightening result information containing at least the tightening condition and the evaluation result, in association with the flanges.