the seal handling, when an accuracy of a handling result is low, thereby leading to a problem in that a required sealing accuracy cannot be realized.

The present inventors have obtained the findings that in such seal handling, a surface-to-surface distance of flanges whose surfaces face each other is quantitatively perceived by measuring the surface-to-surface distance and a result of the measurement is confirmed, thereby allowing reliability of the seal handling to be enhanced.

Patent Literatures 1 to 3 neither disclose nor suggest any things as to the above-mentioned problem, and the above-mentioned problem cannot be solved by the configurations disclosed in these Patent Literatures 1 to 3.

[0005] Therefore, in view of the above-mentioned problem, an object of the present invention is to facilitation of determination of a state of seal handling and enhancement of reliability of the seal handling and handling skills based on findings required for the seal handling.

Solution to Problem

Summary

[0005a] In an aspect, the present disclosure refers to a seal handling determination system which determines a handling result by a surface-to-surface distance between flanges which are tightened by bolts and nuts, with a gasket being interposed between the flanges, the seal handling determination system comprising: a seal handling part which includes the flanges being tightened by the bolts and the nuts, with the gasket being interposed between the flanges; a surface-to-surface distance measurement part which measures ~~a~~ the surface-to-surface distance between the flanges; a processing

part which takes in first measured values of the surface-to-surface distance from the surface-to-surface distance measurement part in a plurality of stages from start of tightening of the bolts up to completion of the tightening, calculates a first difference between a maximum value and a minimum value of the first measured values of a temporary tightening stage or of a final tightening stage of the plurality of stages, and determines a first skill level by comparing the first difference and a first determination reference; and an information presentation part which presents any or all of calculation information and a calculation result, the calculation information and the calculation result being processed by the processing part.

[0005b] In another aspect, the present disclosure refers to a program which causes a computer to realize: a function to take in first measured values of a surface-to-surface distance between flanges being tightened by bolts and nuts with a gasket being interposed between the flanges, in a plurality of stages from start of tightening of the bolts of a seal handling part including the flanges up to completion of the tightening; a function to calculate a first difference between a maximum value and a minimum value of the first measured values of a temporary tightening stage or of a final tightening stage of the plurality of stages, and to determine a first skill level by comparing the first difference and a first determination reference; and a function to generate any or all of calculation information and a calculation result as a piece or pieces of presentation information, the calculation information and the calculation result being processed by a processing part.

[0005c] In another aspect, the present disclosure refers to a seal handling determination method for determining a handling result by a surface-to-surface distance between flanges being tightened by bolts and nuts with a gasket being

interposed between the flanges, the method comprising: a step of measuring the surface-to-surface distance between the flanges in a seal handling part, the seal handling part including the flanges being tightened by the bolts and the nuts with the gasket being interposed between the flanges; and a step of, in a plurality of stages from start of tightening of the bolts up to completion of the tightening, taking in first measured values of the surface-to-surface distance, calculating a first difference between a maximum value and a minimum value of the first measured values of a temporary tightening stage or of a final tightening stage of the plurality of stages, and determining a first skill level by comparing the first difference and a first determination reference.

[0005d] In an~~other aspect~~ example, the present disclosure refers to a seal handling learning system for learning seal handling by using a surface-to-surface distance between flanges being tightened by bolts and nuts with a gasket being interposed between the flanges, the system comprising: a seal handling part which includes the flanges being tightened by the bolts and the nuts, with the gasket being interposed between the flanges; a surface-to-surface distance measurement part which measures the surface-to-surface distance between the flanges; a processing part which takes in measured values of the surface-to-surface distance from the surface-to-surface distance measurement part in a plurality of stages from start of tightening of the bolts up to completion of the tightening, calculates a difference between a maximum value and a minimum value of the measured values, and determines a skill level by comparing the difference and a determination reference; and an information presentation part which presents any or all of calculation information and a calculation result, the calculation information and the calculation result being processed by the processing part.

[0006] In order to achieve the above-mentioned object, according to one example of a seal handling determination system of the present disclosure, the seal handling determination system determines a handling result by a surface-to-surface distance between flanges which are tightened by bolts and nuts, with a gasket being interposed between the flanges, and the seal handling determination system includes: a seal handling part which includes the flanges being tightened by the bolts and the nuts, with the gasket being interposed between the flanges; a surface-to-surface distance measurement part which measures a surface-to-surface distance between the flanges; a processing part which takes in measured values of the surface-to-surface distance from the surface-to-surface distance measurement part in a

CLAIMS

1. A seal handling determination system which determines a handling result by a surface-to-surface distance between flanges which are tightened by bolts and nuts, with a gasket being interposed between the flanges, the seal handling determination system comprising:

a seal handling part which includes the flanges being tightened by the bolts and the nuts, with the gasket being interposed between the flanges;

a surface-to-surface distance measurement part which measures thea surface-to-surface distance between the flanges;

a processing part which takes in first measured values of the surface-to-surface distance from the surface-to-surface distance measurement part in a plurality of stages from start of tightening of the bolts up to completion of the tightening, calculates a first difference between a maximum value and a minimum value of the first measured values of a temporary tightening stage or of a final tightening stage of the plurality of stages, and determines a first skill level by comparing the first difference and a first determination reference; and

an information presentation part which presents any or all of calculation information and a calculation result, the calculation information and the calculation result being processed by the processing part.

2. The seal handling determination system according to claim 1, further comprising an axial force measurement part which measures axial forces being exerted from the bolts on the flanges, wherein

the processing part takes in second measured values of the axial forces of the bolts in the plurality of stages from the start of the tightening of the bolts up to the completion of the tightening, calculates an average value

of the second measured values of the temporary tightening stage or of the final tightening stage, and determines a second skill level by comparing the average value and a second determination reference, and

the information presentation part presents any or all of calculation information and a calculation result, the calculation information and the calculation result being processed by the processing part.

3. The seal handling determination system according to claim 1, further comprising an axial force measurement part which measures axial forces being exerted from the bolts on the flanges, wherein

the processing part takes in second measured values of the axial forces of the bolts in the plurality of stages from the start of the tightening of the bolts up to the completion of the tightening, calculates a second difference between a maximum value and a minimum value of the second measured values of the temporary tightening stage or of the final tightening stage, and determines a third skill level by comparing the second difference and a third determination reference, and

the information presentation part presents any or all of calculation information and a calculation result, the calculation information and the calculation result being processed by the processing part.

4. The seal handling determination system according to claim 1~~ or 3~~, wherein the processing part calculates an amount of deviation of the first difference with respect to a reference value and determines a fourth skill level by comparing the amount of deviation and a fourth determination reference.

5. The seal handling determination system according to claim 3, wherein the processing part calculates an amount of deviation of the first or second difference with

respect to a reference value and determines a fourth skill level by comparing the amount of deviation and a fourth determination reference.

6.~~5.~~ The seal handling determination system according to claim 1, wherein the processing part employs any or two ~~or more~~ of a measurement portion on the flanges where the surface-to-surface distance is measured and a tightening time as a piece or pieces of identification information and performs information processing in a manner associated with the piece or the pieces of the identification information.

7.~~6.~~ A program which causes a computer to realize:

a function to take in first measured values of a surface-to-surface distance between flanges being tightened by bolts and nuts with a gasket being interposed between the flanges, in a plurality of stages from start of tightening of the bolts of a seal handling part including the flanges up to completion of the tightening;

a function to calculate a first difference between a maximum value and a minimum value of the first measured values of a temporary tightening stage or of a final tightening stage of the plurality of stages, and to determine a first skill level by comparing the first difference and a first determination reference; and

a function to generate any or all of calculation information and a calculation result as a piece or pieces of presentation information, the calculation information and the calculation result being processed by a processing part.

8.~~7.~~ The program according to claim 7~~6~~, the program further causing the computer to realize:

a function to take in second measured values of axial forces of the bolts in the plurality of stages from the start of the tightening of the bolts up to the completion

of the tightening;

a function to calculate an average value of the second measured values of the temporary tightening stage or of the final tightening stage, and to determine a second skill level by comparing the average value and a second determination reference; and

a function to generate any or all of calculation information and a calculation result as a piece or pieces of presentation information, the calculation information and the calculation result being processed by the processing part.

9.~~8.~~ The program according to claim 7~~6~~, the program further causing the computer to realize:

a function to take in second measured values of axial forces of the bolts in the plurality of stages from the start of the tightening of the bolts up to the completion of the tightening;

a function to calculate a second difference between a maximum value and a minimum value of the second measured values of the temporary tightening stage or of the final tightening stage, and to determine a third skill level by comparing the second difference and a third determination reference; and

a function to generate any or all of calculation information and a calculation result as a piece or pieces of presentation information, the calculation information and the calculation result being processed by the processing part.

10.~~9.~~ The program according to claim 7~~6 or 8~~, the program further causing the computer to realize:

a function to calculate an amount of deviation of the first difference with respect to a reference value and to determine a fourth skill level by comparing the amount of deviation and a fourth determination reference.

11. The program according to claim 9, the program further causing the computer to realize:

a function to calculate an amount of deviation of the first or second difference with respect to a reference value and to determine a fourth skill level by comparing the amount of deviation and a fourth determination reference.

12.~~10.~~ A seal handling determination method for determining a handling result by a surface-to-surface distance between flanges being tightened by bolts and nuts with a gasket being interposed between the flanges, the method comprising:

a step of measuring the surface-to-surface distance between the flanges in a seal handling part, the seal handling part including the flanges being tightened by the bolts and the nuts with the gasket being interposed between the flanges; and

a step of, in a plurality of stages from start of tightening of the bolts up to completion of the tightening, taking in first measured values of the surface-to-surface distance, calculating a first difference between a maximum value and a minimum value of the first measured values of a temporary tightening stage or of a final tightening stage of the plurality of stages, and determining a first skill level by comparing the first difference and a first determination reference.

13.~~11.~~ The seal handling determination method according to claim 12~~10~~, the method further comprising:

a step of measuring axial forces being exerted from the bolts on the flanges; and

a step of, in the plurality of stages from the start of the tightening of the bolts up to the completion of the tightening, taking in second measured values of the axial forces of~~from~~ the bolts, calculating an average value of

the second measured values of the temporary tightening stage or of the final tightening stage, and determining a second skill level by comparing the average value and a second determination reference.

14.~~12.~~ The seal handling determination method according to claim 12~~10~~, the method further comprising:

a step of measuring axial forces being exerted from the bolts on the flanges; and

a step of, in the plurality of stages from the start of the tightening of the bolts up to the completion of the tightening, taking in second measured values of the axial forces of~~from~~ the bolts, calculating a second difference between a maximum value and a minimum value of the second measured values of the temporary tightening stage or of the final tightening stage, and determining a third skill level by comparing the second difference and a third determination reference.

15.~~13.~~ The seal handling determination method according to claim 12~~10 or 12~~, the method further comprising: a step of calculating an amount of deviation of the first difference with respect to a reference value and determining a fourth skill level by comparing the amount of deviation and a fourth determination reference.

16. The seal handling determination method according to claim 14, the method further comprising: a step of calculating an amount of deviation of the first or second difference with respect to a reference value and determining a fourth skill level by comparing the amount of deviation and a fourth determination reference.

~~14. A seal handling learning system for learning seal handling by using a surface-to-surface distance between flanges being tightened by bolts and nuts with a gasket being interposed between the flanges, the system comprising:~~

~~a seal handling part which includes the flanges being tightened by the bolts and the nuts, with the gasket being interposed between the flanges;~~

~~a surface-to-surface distance measurement part which measures the surface-to-surface distance between the flanges;~~

~~a processing part which takes in measured values of the surface-to-surface distance from the surface-to-surface distance measurement part in a plurality of stages from start of tightening of the bolts up to completion of the tightening, calculates a difference between a maximum value and a minimum value of the measured values, and determines a skill level by comparing the difference and a determination reference; and~~

~~an information presentation part which presents any or all of calculation information and a calculation result, the calculation information and the calculation result being processed by the processing part.~~

~~15. The seal handling learning system according to claim 14, the system further comprising~~

~~an axial force measurement part which measures axial forces being exerted from the bolts on the flanges, wherein~~

~~the processing part takes in measured values from the axial force measurement part in the plurality of stages from the start of the tightening of the bolts up to the completion of the tightening, calculates an average value of the measured values, and determines a skill level by comparing the average value and a determination reference, and~~

~~the information presentation part presents any or all of calculation information and a calculation result, the calculation information and the calculation result being processed by the processing part.~~

~~16. The seal handling learning system according to claim 14, the system further comprising an axial force measurement part which measures axial forces being exerted from the bolts on the flanges, wherein~~

~~the processing part takes in measured values from the axial force measurement part in the plurality of stages from the start of the tightening of the bolts up to the completion of the tightening, calculates a difference between a maximum value and a minimum value of the measured values, and determines a skill level by comparing the difference and a determination reference, and~~

~~the information presentation part presents any or all of calculation information and a calculation result, the calculation information and the calculation result being processed by the processing part.~~