silica, etc., in the feed-water which has been brought into the boiler vessel onto the inside of the system but also discharging these components out the system by means of blowing-down.

The scale inhibition agent as referred to herein is one for preventing scaling of the hard component which has been brought into the water system, and for example, phosphates, such as trisodium phosphate, sodium tripolyphosphate, etc., or polymers, such as sodium polyacrylate, etc., are used.

[0004]

Meanwhile, even in the case of adopting such a scale inhibition method, in the case where unexpected hard components leakage or the like occurs, and a scale deposition, the operation of a boiler is stopped, the boiler water is discharged by means of full blowing-down, and thereafter, chemical cleaning with a scale dissolving and removing agent is carried out. For example, PTL 1 describes a scale removal method by chemical cleaning with a chelating agent, such as high-concentration ethylenediaminetetraacetic acid (EDTA), etc., or an organic acid, such as sulfamic acid, etc.

However, according to the scale removal method of PTL 1, the boiler is once stopped, and hence, there are involved such problems that the productivity is impaired; and that the cleaning costs are separately generated.

[0005]

In order to solve the foregoing problems, there is proposed a method for removing a scale without stopping the operation of the boiler. For example, PTL 2 describes a method in which a specified chelating agent, such as EDTA, nitrilotriacetic acid (NTA), diethylenetriamine, etc., and a specified dispersant, such a polymaleic acid, etc., are added into a boiler water, and a scale is removed while operating the boiler.

Citation List

Patent Literature

[0006]

PTL 1: JP H04-193971A

PTL 2: JP 2000-154996A

Technical Problem

[0007]

However, the chelating agent used in the scale removal method of PTL 2 encounters such a problem that the chelating agent also acts on iron that is a base material of the boiler, resulting as corrosion.

[0008]

Under such circumstances, the present invention has been made, and an object thereof is to provide a method for removing a scale in a steam generation facility, whereby it becomes possible to remove the scale deposited on the inside of a boiler vessel during the boiler operation without corrosion failure of the boiler.

Summary

In one aspect, the present invention refers to a method for removing a scale in a steam generation facility, wherein in the steam generation facility, a pH of boiler water is adjusted to 11.3 or more, and a polyacrylic acid having a weight average molecular weight that is 0.50 to 2.00 times a reference weight average molecular weight as calculated from the following calculation formula (1), or a salt thereof, is added in accordance with the pH value of the boiler water during the operation of a boiler, thereby removing a scale deposited on the inside of a boiler vessel: Reference weight average molecular weight = -8462 x {(pH value) - 11.3} + 61538 ••• (1). In another aspect, the present invention refers to a method for removing a scale in a steam generation facility, wherein in the steam generation facility, a pH of boiler water is adjusted to 11.3 or more, and a polyacrylic acid having a weight average molecular weight that is 0.50 to 2.00 times a reference weight average molecular weight as calculated by the following calculation method of reference weight average molecular weight, or a salt thereof, is added in accordance with the pH value of the boiler water during the operation of a boiler, thereby removing a scale deposited on the inside of a boiler vessel: the calculation method of reference weight average molecular weight including (1) in at least three pH values at a pH of 11.3 or more, a weight average molecular weight (Mw_{max}) of the polyacrylic acid at which a scale removal rate becomes maximum is measured; and (2) a relation formula between pH and Mw_{max} is determined by the least squares method while defining the pH as the x-axis and the Mw_{max} as the y-axis, respectively, and a weight average molecular weight at each pH obtained from the relation formula is defined as the reference weight average molecular weight.

Solution to Problem

[0009]

In order to solve the foregoing problem, the present inventors made extensive and intensive investigations. As a result, it has been found that a polyacrylic acid or its salt, which has hitherto been used for the purpose of preventing the deposition of a scale onto the inside of a boiler vessel, may remove the deposited scale. Then, as a result of further investigations, the present inventors have found an effective use condition of the polyacrylic acid or its salt, under which the removal efficiency of the scale may be tremendously improved, leading to accomplishment of the present invention.

[0010]

Specifically, the present invention provides the following [1] to [3].

[1] A method for removing a scale in a steam generation facility, wherein in the steam generation facility, a pH of boiler water is adjusted to 11.3 or more, and a polyacrylic acid having a weight average molecular weight that is 0.50 to 2.00 times a reference weight average molecular weight as calculated from the following calculation formula (1), or a salt thereof, is added in accordance with the pH value of the boiler water during the operation of a boiler, thereby removing a scale deposited on the inside of a boiler vessel:

Reference weight average molecular weight = -8462 × {(pH value) - 11.3} + 61538 • • • (1).

[2] A method for removing a scale in a steam generation facility, wherein in the steam generation facility, a pH of boiler water is adjusted to 11.3 or more, and a polyacrylic acid having a weight average molecular weight that is 0.50 to 2.00 times a reference weight average molecular weight as calculated by the following