Washing Technology Using Vacuum Boiling





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1. Overview

Currently in hospitals and sterilization agency facilities, reusable surgical and anesthetic instruments and other surgical implements used in clinical examinations or surgeries are first washed by hand or using various types of washer, and then put into a sterilizer to kill bacteria, so that they can be restored to a safe and infection-free condition before reuse.

Up until now, however, since there was no unit that could wash all types of instruments with different shapes, it was necessary to prepare several types of washer with different washing methods and choose the appropriate one from them. If the instrument/implement could not be washed by any type of washer, an operator had to wash it by hand.

2. Technical Features

We have developed the following two washing methods in which a hermetically sealed bath containing hot water is vacuumed in order to generate boiling. This enables effective washing of an object regardless of its shape. One of the methods is a liquid phase air supply pulse washing process, which eliminates contamination from the external surface, and the other is a vapor phase air supply pulse washing process, which washes the inside of tubular objects.

With the liquid phase air supply pulse washing method, in order to greatly improve washing performance, air is injected into the detergent while the inside of the bath is being vacuumed. This provokes explosive bumping, which eventually generates a fast wafer flow. This technology is best suited to washing the external surface of the object.

With the vapor phase air supply pulse washing method, on the other hand, in order to greatly improve washing performance, air is injected into the bath while it is being vacuumed. This creates a change in the pressure level, and the expansion/contraction of the detergent inside a tubular object or container with a complicated shape eventually generates a fast water flow. This technology is best suited to washing the internal surface of the object.

It is now possible, with these two new technologies, to wash any type of object easily regardless of its shape, simply by placing the object in the washer without any special settings. The following is a detailed description of the liquid phase air supply pulse washing and vapor phase air supply pulse washing.

2.1 Liquid phase air supply pulse washing

(1) The washer heats the detergent within the bath and vacuums the inside of the bath concurrently. (Fig. 1)

(2) When the inside of the bath is vacuumed up to the specified pressure level, the detergent starts boiling. For example, if the detergent is heated up to 50ºC, the detergent within the bath is boiled at approximately -89 kPa. The washing effect of the washer is achieved based on the agitation caused by boiling of the detergent within the bath. (Fig. 2)

(3) When a small amount of air is injected into the detergent while the detergent within the bath is boiling, the air becomes the center of the boiling, which results in explosive bumping within the bath.

Such explosive bumping of the detergent eventually generates a fast water flow inside the bath. This greatly agitates the detergent and increases the washing effect. (Fig. 3)

(4) The washer performs the above steps repeatedly for the specified time. By uniformly generating explosive bumping within the bath, the washer can wash the object uniformly with minimum unevenness.

2.1 Vapor phase air supply pulse washing

(1) The washer heats the detergent within the bath and vacuums the inside of the bath concurrently. After the washer has heated the detergent up to the specified temperature, it rapidly vacuums the inside of the bath. (Fig. 4)

(2) When the inside of the bath is vacuumed rapidly, the detergent is boiled. At this point, the detergent within the tubular object to be washed is also boiled, and the detergent is then pushed out of the object by the steam generated from the boiling. As a result, the inside of the object is filled with steam. The washer monitors the vacuum conditions so that the detergent within the object can be boiled completely. (Fig. 5)

(3) If the air is injected into the vapor phase inside the bath and the pressure is increased within a short period, the steam inside the object is condensed, and the detergent flashes into the object. This water flow washes the inside of the object. The water flow rate, at this point, is 2 to 3 m/s. (Fig. 6)

(4) The washer performs the above steps repeatedly for the specified number of times. With a conventional washer, since a nozzle was connected to supply the detergent to wash the object, the nozzle connection section could not be washed adequately.

In addition, since there was a difference in the pressure loss of the detergent flow depending on the size of the object to be washed, the flow was not the same for all objects. This caused a washing problem, as a result. With a washer using the new technology, however, such a problem does not occur.

Fig. 1 Pressurization and vacuuming at the same time

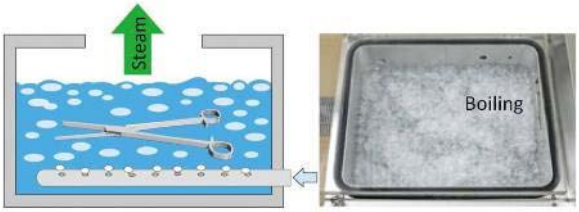

Fig. 2 Air is injected during boiling

Fig. 3 Explosive bumping

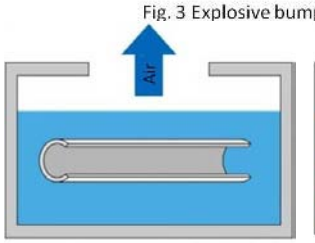

Fig. 4 Vacuuming inside the bath

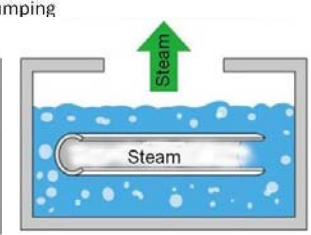

Fig. 5 Boiling conditions

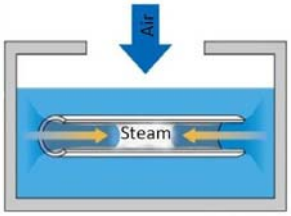

Fig. 6 Pressurization inside the bath


Fig. 7 Equipment appearance

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