

SPECIFICATION
SAFETY CABINET

TECHNICAL FIELD

5 [0001]

The present invention relates to a safety cabinet that handles pathogen or the like in a device.

BACKGROUND ART

10 [0002]

A biohazard countermeasure class II cabinet (hereinafter referred to as "safety cabinet") is used for research of infectious disease, pharmaceutical research or manufacturing, aseptic preparation and adjustment of anticancer drugs. The safety cabinet supplies clean air in which dust, pathogen, and the like are filtered by a HEPA filter or UPLA filter for blow-off from an upper blow-off part of a workspace formed in a device, sucks air of a laboratory in which the safety cabinet is disposed and air of the workspace together, from a work opening section formed at a front of the workspace and a work table front suction port formed in front of the work table which is a bottom of the workspace, and generates an inflow air flow in the work opening section. Further, when the sucked air is exhausted out of the safety cabinet, air containing pathogen or the like is filtered with an exhaust

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HEPA filter or an UPLA filter. The HEPA filter is an abbreviation of High Efficiency Particulate Air Filter, and the UPLA filter is an abbreviation of Ultra Low Penetration Air Filter. The inflow air flow generated at the work opening
5 section prevents pathogen or the like handled in the workspace from leaking out of the safety cabinet and causing infection to researchers and spreading to the environment. In the case of a class II cabinet, it is used in a wide range of fields because a so-called "aseptic operation" in which clean air is
10 supplied to the workspace is available.

[0003]

The performance for preventing pathogen or the like handled by the safety cabinet from leaking out of the workspace is the air speed of the clean air blown out to the
15 workspace, the magnitude of the air speed of the inflow air flow generated at the work opening section and a balance of both. Further, if there is a leakage in the HEPA filter/UPLA filter, the leakage causes a problem that pathogen or the like may leak out of the safety cabinet through the HEPA
20 filter/UPLA filter or the clean air cannot be supplied to the workspace. Furthermore, if there is a hole on an outer wall of the safety cabinet, since there is a possibility that pathogen or the like may leak, the tightness of the structure is required. When the safety cabinet is used, the HEPA
25 filter/UPLA filter is clogged, which reduces the blow-off air

speed and the air speed of the inflow air flow, and there is a possibility that pathogen or the like may leak from the workspace, or by opening the holes in the HEPA filter/UPLA filter, there is a possibility that pathogen or the like may
5 leak. The same is also applied to a case where the hole is formed on the outer wall of the safety cabinet. Therefore, periodic inspection is required to maintain the performance of the safety cabinet.

[0004]

10 As a background art in the present technical field, there are JIS K 3800:2009 (Non-Patent Document 1) and JP 2004-181434 A (Patent Document 1). Non-Patent Document 1 discloses required performances of the safety cabinet, a delivery inspection at the time of shipment by the manufacturer, an
15 inspection after installation at the site, and inspection items at the time of maintenance and management at the site. Further, Patent Document 1 discloses a method of leading air in a negative pressure space surrounding a workspace for handling the pathogen or the like to an exhaust HEPA filter
20 and a blowing unit, and purifying the air with the exhaust HEPA filter.

CITATION LIST

PATENT DOCUMENT

25 [0005]

Patent Document 1: JP 2004-181434 A

NON-PATENT DOCUMENT

[0006]

Non-Patent Document 1: JIS K3800:2009

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SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0007]

In the safety cabinet of Patent Document 1, a method is
10 described in which the air sucked into the space of a back
surface and both sides of the workspace is purified by the
exhaust HEPA filter and discharged out of the device. There is
a possibility that the air on the back surface and both sides
of the workspace contains pathogen or the like that leaks from
15 a gap of the workspace wall surface. The pathogen or the like
is recovered by the HEPA filter before being discharged out of
the safety cabinet.

[0008]

Non-Patent Document 1 discloses the required performance
20 of a safety cabinet and a test method. The penetration ratio
of the HEPA filter is described as the required performance
for managing the prevention of the leakage of pathogen or the
like from the HEPA filter. The method is that a suction port
of a detector for penetration ratio measurement is kept within
25 25 mm from the filter surface and the entire surface of the

filter blow-off surface is scan-tested for the entire filter medium of the downstream side of the HEPA filter, and the dust concentration measured on the downstream side of the HEPA filter is divided by the dust concentration on the upstream side of the HEPA filter to obtain the penetration ratio. The penetration ratio in the scanning test is managed not to exceed 0.01% in aerosol particles of 0.3 μm at all points of the filter.

[0009]

10 Due to the structure of the safety cabinet, the penetration ratio when the scanning test is not possible is 0.005% or less at a position before the air filtered by the HEPA filter mixes with other air flow. According to the US safety cabinet standard, NSF/ANSI 49-2014 Biosafety Cabinetry, 15 even if the UPLA filter is used, it is assumed that there is no site in which the penetration ratio exceeds 0.01% in the aerosol particles of 0.3 μm , and the penetration ratio test method and determination criteria are the same even when the HEPA filter or the UPLA filter is used.

20 [0010]

 In addition, Non-Patent Document 1 discloses airtightness as a required performance in which pathogen or the like does not leak from the outer wall of the safety cabinet. The test method is to seal a front opening section (a work opening 25 section) and the exhaust port of the safety cabinet, if

necessary, the suction port, pressurize the inside of the safety cabinet to 500 Pa, using the compressed air, and check for the presence or absence of leakage from the outer wall. The penetration ratio test of the HEPA filter and the airtightness test of the safety cabinet are periodic inspection items required to maintain the performance of the safety cabinet that prevents the leakage of pathogen or the like in combination with the air speed test.

[0011]

10 The outer wall of the safety cabinet is a part in which the periphery of the safety cabinet contacts with air of the laboratory when the safety cabinet is disposed in the laboratory. Because covers for design attached to the safety cabinet without the airtightness performance of Non-Patent Document 1 do not have the airtightness performance, there is
15 a possibility that pathogen or the like may leak. Thus, such covers are excluded from the definition of the outer wall. Further, the outer wall of the safety cabinet is connected to the wall surface in the workspace of the safety cabinet at the work opening section on the front of the safety cabinet, but
20 the definition of the outer wall is separated from the wall surface in the workspace at the work opening section. A front panel for the experimenter to look into the workspace is formed at the upper part of the work opening section. One side
25 of the front panel forms one side in the workspace, and the

other side thereof is connected to the outer wall of the safety cabinet, but the front panel is not defined as a part of the outer wall of the safety cabinet but is defined as the front panel. The method of sealing the work opening section in the airtightness test of Non-Patent Document 1 includes a method of using the front panel and a method of sealing the work opening section with a test cover including the front panel and the work opening section. When different materials are configured to be stacked on the outer side of the safety cabinet and the inner wall of the workspace, a space may be created between the two materials. In this case, the airtightness performance of Non-Patent Document 1 may be maintained outside or on the inner wall of the workspace.

[0012]

There is a plurality of types and kinds of structures in the safety cabinet as described in Non-Patent Document 1. Fig. 9 is a cross-sectional view illustrating the kinds of the safety cabinet of related art.

[0013]

When handling pathogen or the like in the workspace, it is necessary to filter the pathogen or the like by the HEPA filter from the air leaked from the wall surface of the workspace before discharging out of the safety cabinet. Whether pathogen or the like is filtered by the HEPA filter can be checked by the penetration ratio test of the HEPA

filter. If the non-workspace side of the workspace inner wall surface is a safety cabinet outer wall, it is possible to check by the airtightness test that there is no leakage in the outer wall.

5 [0014]

In the case of the safety cabinets of symbols A, B, D and F in Fig. 9, since a back flow path 108 of the workspace back surface is supplied with air blown out of the blower, the pressure becomes higher than the workspace. If a leakage
10 occurs on the back surface of the workspace, in the symbols A and B, pathogen or the like handled in the workspace and dust generated from the blower enter the workspace, and in the symbols D and F, dust generated by the blower enters the workspace. Since Non-Patent Document 1 does not stipulate that
15 dust generated by the blower enters the workspace, the symbol D exists in the standard. However, in recent years, since a clean space for aseptic operation is used in various fields, in some cases, dust generated by the blower may not be required to enter the workspace.

20 [0015]

When performing the penetration ratio test of the HEPA filter, the downstream side of the HEPA filter of symbol D and an exhaust HEPA filter 101a of symbol F is a negative pressure space surrounded by the safety cabinet outer wall. Since an
25 ambient air dust enters from the insertion port of the arm, it

is difficult to insert an arm with a detector for penetration ratio test into a negative pressure space and conduct a scanning test. In this case, as a case where the scanning test is not possible, the penetration ratio of 0.005% or less is managed at the representative point. Although it is considered as a representative point, because the sensitivity of the penetration ratio differs depending on the distance from the HEPA filter blow-off surface and the mixed state of the air flow, it is necessary to perform measurement at a representative point recommended by the manufacturer.

[0016]

In the drawing of the symbol F, an exhaust blower 112 is disposed in the safety cabinet, but the cabinet of type B2 of the symbol F is required to exhaust the air outdoors. Thus, there is a case where the exhaust blower 112 is prepared and exhausted on the building side and is not placed in the safety cabinet. In this case, the back flow path 108 of the workspace back surface is under negative pressure by the suction of the building exhaust blower. If a leakage occurs on the workspace back surface in this structure, pathogen or the like handled in the workspace leaks into the back flow path 108. The leaked pathogen or the like is exhausted without being collected by the HEPA filter. In the airtightness test of this structure, a front opening section (a work opening section), the suction port including a blow-off blower 111, and an exhaust port 114

are sealed, and the inside of the safety cabinet is pressurized to 500 Pa using compressed air to check the presence or absence of leakage from the outer wall. However, as a leakage of the workspace back surface is inside the sealed safety cabinet, the leakage is overlooked.

[0017]

An object of the present invention is to provide a safety cabinet which prevents the leakage from oversight in the airtightness test and the HEPA filter penetration ratio test, even if pathogen or the like leaks from the workspace wall surface inside the safety cabinet.

SOLUTIONS TO PROBLEMS

[0018]

In an example of the safety cabinet of the present invention for solving the above problems, there is provided a safety cabinet which has a work surface on a bottom of a workspace, a front panel at a front of the workspace, and a work opening section below the front panel, and has a first air purification means configured to filter exhaust air for exhausting air in the workspace, wherein non-workspace sides of a side wall surface and a back wall surface of the workspace are formed by an outer wall of a device with prescribed airtightness performance.

EFFECTS OF THE INVENTION

[0019]

According to the present invention, the possibility that pathogen or the like leaks from the workspace wall surface or the HEPA filter can be accurately determined by the test method of the safety cabinet.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020]

Fig. 1A is an example of an external front view illustrating a safety cabinet of Example 1.

Fig. 1B is an example of a side cross-sectional view illustrating the safety cabinet of Example 1.

Fig. 1C is an example of a cross-sectional view of an outer wall of the safety cabinet.

Fig. 2A is an example of a front cross-sectional view illustrating the safety cabinet of Example 1.

Fig. 2B is an example of a side cross-sectional view illustrating the safety cabinet of Example 1.

Fig. 3A is an example of an external front view at the time of an airtightness test illustrating the safety cabinet of Example 1.

Fig. 3B is an example of a side cross-sectional view at the time of the airtightness test, illustrating the safety cabinet of Example 1.

Fig. 4A is an example of a front cross-sectional view illustrating a safety cabinet of Example 2.

Fig. 4B is an example of a side cross-sectional view illustrating the safety cabinet of Example 2.

5 Fig. 5A is an example of a front cross-sectional view illustrating a safety cabinet of Example 3.

Fig. 5B is an example of a side cross-sectional view illustrating the safety cabinet of Example 3.

10 Fig. 6A is an example of a front cross-sectional view illustrating a safety cabinet of Example 4.

Fig. 6B is an example of a side cross-sectional view illustrating the safety cabinet of Example 4.

Fig. 7 is an example of a structural view of electrical components in a workspace.

15 Fig. 8A is an example of a side cross-sectional view illustrating a safety cabinet of Example 5.

Fig. 8B is an example of a side cross-sectional view at the time of a penetration ratio test illustrating a safety cabinet of Example 5.

20 Fig. 9 is a side cross-sectional view illustrating types of safety cabinets of related art.

MODE FOR CARRYING OUT THE INVENTION

[0021]

25 Hereinafter, examples of the present invention will be

described using the drawings. In the drawings illustrating the examples, the same components are denoted by the same names and symbols as much as possible, and the repetitive description thereof will not be provided.

5 Example 1

[0022]

Fig. 1A is an example of an external front view illustrating the safety cabinet of Example 1, and Fig. 1B is an example of a side cross-sectional view. Moreover, Fig. 2A
10 is an example of front sectional view which illustrates the safety cabinet of Example 1 at the time of work, and Fig. 2B is an example of side cross-sectional view.

[0023]

A blow-off blower 111 sucks the air in a laboratory in
15 which a safety cabinet 100 is disposed, and pressurizes a pressure chamber 113. Since the pressure chamber 113 is connected to a blow-off HEPA filter 101b, the air in the laboratory is purified by the blow-off HEPA filter 101b and blown out to a workspace 105 as clean air 102. The blow-off
20 air speed of the clean air 102 blown into the workspace 105 is rectified by a flow straightening plate 110.

[0024]

The front of the workspace 105 is surrounded by a front panel 104, the side surface thereof is surrounded by a
25 workspace side wall surface 105a, the back surface thereof is

surrounded by a workspace back wall surface 105b, and the bottom surface thereof is surrounded by a work surface 106a of a work table 106. A work opening section 103 is formed below the front panel 104. The front panel 104 may be of a sliding type or a flip-up type. A researcher inserts his/her arm from the work opening section 103 into the workspace 105 to handle the pathogen or the like 115. A work table front suction port 107 is formed in front of the work table 106 and below the front panel 104 to suck air in the laboratory and air containing the pathogen or the like 115 of the workspace 105. During the experiment, there is a possibility that air in the laboratory may contain the pathogen or the like 115. This inflowing air is an inflow air flow 116.

[0025]

A rear suction port 109 is formed at the rear of the workspace 105. The clean air 102 blown out to the workspace 105 and the pathogen or the like 115 handled in the workspace 105 are divided into the work table front suction port 107 and the rear suction port 109 and sucked. Since the sucked air contains the pathogen or the like 115 and dust in the laboratory, it is filtered and exhausted by the exhaust HEPA filter 101a formed below the work table 106. The air filtered by the exhaust HEPA filter 101a enters an exhaust flow path 119 from an exhaust flow path inlet 120, is sucked from the exhaust port 114 by the exhaust blower 112, and is discharged

out of the safety cabinet 100.

[0026]

In this air flow configuration, since both the clean air 102 to be blown out and the inflow air flow 116 entering the safety cabinet 100 from the work opening section 103 are filtered by the exhaust HEPA filter 101a and exhausted from the exhaust port 114, there is no air flow circulating in the safety cabinet 100. This structure is set as a class II type B2 in the safety cabinet standard. When the air flow circulates in the safety cabinet, gaseous substances and radioactive substances which are not collected by the HEPA filter pass through the blow-off HEPA filter 101b and blow out again to the workspace 105. Depending on the experimental contents, in some cases, there is a need to eliminate the re-circulating gaseous substances and radioactive substances. In that case, a safety cabinet 100 of class II type B2 is used. Since a gaseous substance not collected by the HEPA filter is used, a duct is always connected to the exhaust port 114 to exhaust the air outdoors. The gaseous substances are exhausted outdoors, but pathogen or the like 115 is collected by the exhaust HEPA filter 101a.

[0027]

In addition, the workspace side wall surface 105a, the workspace back wall surface 105b, and the opposite sides of the air flowing surface of the wall surfaces forming the space

on the suction sides of the exhaust HEPA filter 101a are formed by the safety cabinet outer wall 100a. Further, the safety cabinet outer wall 100a has prescribed airtightness performance.

5 [0028]

Fig. 1C illustrates a partial cross-sectional structural view of the outer wall of the safety cabinet. The workspace back wall surface 105b may be made of a material (such as stainless steel SUS304) resistant to a disinfectant, and a
10 painted steel plate may be used for the safety cabinet outer wall 100a. When different members are connected, they are connected by screws, welding or the like on the opposite side of the workspace 105 of the flow straightening plate 110 or on the opposite side of the workspace 105 of the work surface
15 106a (not illustrated). An air layer may be formed between the workspace back wall surface 105b and the safety cabinet outer wall 100a, when they are formed of different members. An air layer may be present or in close contact between the workspace back wall surface 105b and the safety cabinet outer wall 100a,
20 but air should not leak from the outer wall 100a. The same also applies to the case of the workspace side wall surface 105a.

[0029]

Moreover, as a design of the safety cabinet 100, there is
25 a case where a detachable cover is provided. In the definition

of the safety cabinet outer wall 100a, a pressure of 500 Pa is applied to the inside of the safety cabinet 100 to perform the airtightness test, and the surface for evaluating the presence or absence of a leakage is set as the safety cabinet outer wall 100a. Therefore, when a leakage is evaluated by foaming of soap water or the like, it is a surface to which soap water is applied or sprayed.

[0030]

Periodic maintenance is necessary to maintain the ability which confines pathogen or the likes handled by the safety cabinet in the safety cabinet. In order to confine pathogen or the like by air flow, it is important the inflow air flow 116 generated at the work opening section 103, the magnitude of the air speed of the clean air 102 blown out of the flow straightening plate 110 and maintenance of a balance of both. The air speed of the clean air 102 to be blown out may be evaluated near the height of the lower end of the front panel 104 rather than near the flow straightening plate 110. In addition, it is also necessary to check that the exhaust HEPA filter 101a and the blow-off HEPA filter 101b maintain the performance capable of collecting the pathogen or the like. This performance of the HEPA filter is called a penetration ratio. Furthermore, since the air flow containing the pathogen or the like 115 is flowing in the safety cabinet 100, it is necessary to check that a hole is not perforated in the safety

cabinet outer wall 100a. This performance is called airtightness.

[0031]

When checking the penetration ratio of the blow-off HEPA
5 filter 101b, in the operation state of the safety cabinet 100,
a ratio of the concentration on the upstream side in which an
appropriate simulated dust load is imparted to the upstream
side of the blow-off HEPA filter 101b from the suction side of
the blow-off blower 111 and the concentration of the simulated
10 dust, on the downstream side, leaking and penetrating to the
downstream side of the blow-off HEPA filter 101b is measured
as the penetration ratio. According to JIS K3800 standard for
safety cabinets, aerosol particles of 0.3 μm are given as a
suitable simulated dust load, and the entire surface of the
15 blow-off surface of the blow-off HEPA filter 101b is subjected
to a scanning test, and it is checked that there is no region
in which the penetration ratio exceeds 0.01%. When performing
the scanning test, the flow straightening plate 110 on the
downstream of the blow-off HEPA filter 101b is detached, and
20 there is a need to maintain a distance between the blow-off
surface of the blow-off HEPA filter 101b and a suction port of
a penetration ratio detector (not illustrated) for penetration
ratio measurement within 25 mm.

[0032]

25 When checking the penetration ratio of the exhaust HEPA

filter 101a, an appropriate simulated dust load is applied from the work table front suction port 107 on the upstream side of the exhaust HEPA filter 101a in the operating state of the safety cabinet 100. At this time, if the concentration of the load on the upstream side of the exhaust HEPA filter 101b does not rise to a concentration sufficient for measurement, the load for the penetration ratio test may be supplied from the work table front suction port 107, using a blower of the test (not illustrated). On the downstream side of the exhaust HEPA filter 101a, as in the case of the blow-off HEPA filter 101b, when the distance between the blow-off surface and the suction port of the penetration ratio detector is kept within 25 mm and the scanning test is performed, since the downstream side of the exhaust HEPA filter 101a has a negative pressure compared to the pressure of the laboratory in which the safety cabinet 100 is disposed, an opening section is provided in the safety cabinet outer wall 100a on the downstream side of the exhaust HEPA filter 101a, and when an arm with a penetration ratio detector is inserted, the dust in the laboratory is sucked from the opening section to the downstream side of the exhaust HEPA filter 101a. In this case, since an appropriate scanning test cannot be performed, a penetration ratio of 0.005% or less is checked at a representative point on the basis of the safety cabinet standard of Non-Patent Document 1. When evaluating at a representative point, it is necessary to

perform the measurement at a place where the air coming out of the entire blow-off surface of the exhaust HEPA filter 101a mixes sufficiently. In Example 1, the air is sufficiently mixed by flowing through the exhaust flow path 119 located downstream of the exhaust HEPA filter 101a, and the penetration ratio of 0.005% or less can be managed at the representative point of the exhaust port 114.

[0033]

As a measurement position at a representative point of the exhaust port 114, a penetration ratio measurement hole 118 (not illustrated) may be provided in the exhaust flow path 119.

[0034]

The example of the external appearance front view at the time of the airtightness test which illustrates the safety cabinet of Example 1 is illustrated in Fig. 3A, and an example of side cross-sectional view is illustrated in Fig. 3B.

[0035]

As a test method of proving that the pathogen or the like handled inside the safety cabinet 100 does not leak from the safety cabinet outer wall 100a, the airtightness test is defined in the standard of safety cabinet, JIS K3800 and US NSF/ANSI 49. In the airtightness test, when using the safety cabinet 100, the opened part is closed with a test cover, and the inside is pressurized with a predetermined pressure to check that there is no leakage from the outer wall, thereby

proving that the pathogen or the like 115 does not leak from the safety cabinet outer wall 100a in the usage condition in which the blow-off blower 111 and the exhaust blower 112 of the safety cabinet are operated.

5 [0036]

The suction side of the blow-off blower 111, the front panel 104, and the exhaust port 114 of the safety cabinet 100 are sealed using a cover 121 for airtightness test. When the blow-off blower 111 is covered with a cover for design of the
10 safety cabinet 100 and having a suction port, if the cover for design has airtightness, the suction port of the cover for design may be sealed with a test cover. After sealing is completed, as specified in the safety cabinet standard, a positive pressure maintenance method of pressurizing the
15 inside to 500 Pa by compressed air and checking that the pressure drop after 30 minutes is within 10% is used, alternatively, by a soap method of checking that there is no foaming by applying or spraying soap water or a foam leakage detection agent to the area in which there is a risk of
20 leakage, such as a junction of the outer wall, in the state in which the inside is pressurized to 500 Pa, thereby checking that there is no leakage on the outer wall.

[0037]

In the safety cabinet of related art, the non-workspace
25 side of the workspace side wall surface 105a is the outer wall

of the safety cabinet, and the non-workspace side of the workspace back wall surface 105b is the back flow path 108. Furthermore, in the safety cabinet of class II type B2 (conventional example, Fig. 9 symbol F), even if air not
5 passing through the exhaust HEPA filter 101a leaks to the back flow path 108, it cannot be found in the airtightness test. In this example, since the workspace side wall surface 105b on both sides of the workspace 105 and the non-workspace 105 side of the workspace back wall surface 105b are formed by the
10 safety cabinet outer wall 100a, the possibility that the pathogen or the like 115 leaks from the outer wall of the workspace 105 can be checked or eliminated by the airtightness test.

[0038]

15 In addition, the method of evaluating that there is no possibility that the pathogen or the like may leak when using a safety cabinet from around the front panel 104 covered with the cover 121 for airtightness test at the time of airtightness test is defined in the standard of the safety
20 cabinet as an air flow direction test.

Example 2

[0039]

Fig. 4A is an example of a front cross-sectional view illustrating the safety cabinet of Example 2, and Fig. 4B is
25 an example of a side cross-sectional view.

[0040]

In Example 2, the exhaust blower 112 is provided in the exhaust flow path 119 on the downstream of the exhaust HEPA filter 101a in Example 1. The safety cabinet of Class II Type B2 of the example is always used for outdoor exhaust. The clean air 102 blown out to the workspace 105 is blown out by the blow-off blower 111, and the inflow air flow 116 is generated by the suction air flow of the exhaust blower 112. The blow-off air speed of the clean air 102 depends on the capacity of the blow-off blower 111 in the safety cabinet 100. In Example 1, the inflow air flow 116 depends on the capacity of the exhaust blower 114 installed outside the safety cabinet 100, and in Example 2, the inflow air flow 116 depends on the exhaust blower 112 disposed in the exhaust flow path 119 of the safety cabinet 100. Therefore, in Example 2, the blow-off air speed of the clean air 102 and the air speed of the inflow air flow 116 are evaluated by the safety cabinet 100 alone, and the external static pressure at the exhaust port 114 can be handed over to the exhaust system of the installation place in the state of 0 Pa. This enables the separation of responsibility in maintaining the performance of the safety cabinet 100.

[0041]

In Fig. 4B, a penetration ratio measurement tube 122 having a penetration ratio measurement hole 118 is provided on

the suction side of the exhaust blower 112 in which the air blown out of the exhaust HEPA filter 101a is well mixed in the exhaust flow path 119, and a penetration ratio measurement tube cap 123 is provided on the opposite side of the
5 penetration ratio measurement hole 118. At the time of the penetration ratio test, by removing the penetration ratio measurement tube cap 123, and by taking the air into the penetration ratio detector (not illustrated), the penetration ratio test can be performed at a representative point at which
10 the air specified by the manufacturer is well mixed.

Example 3

[0042]

Fig. 5A is an example of a front cross-sectional view illustrating the safety cabinet of Example 3, and Fig. 5B is
15 an example of a side cross-sectional view.

[0043]

In Example 3, as in Example 1, an exhaust HEPA filter 101a is disposed below a work table 106. On the downstream side of the exhaust HEPA filter 101a, an exhaust blower 112 is
20 disposed below the work table 106, and an exhaust flow path 119 is provided on the blow-off side of the exhaust blower 112. When the penetration ratio of the exhaust HEPA filter 101a is measured in Example 3, it is difficult to carry out a scanning test on the blow-off surface of the exhaust HEPA filter 101a
25 as in other examples. In this case, it is necessary to

evaluate the penetration ratio of 0.005% or less, by taking a place in which the air blown out from the exhaust HEPA filter 101a is well mixed together as a representative point. However, an exhaust blower suction port 124 which is a suction port of
5 air of the exhaust blower 112 is a place in which the air from all the positions on the surface of the exhaust HEPA filter 101a gathers, and is the most suitable place as a representative point. In Example 3, a penetration ratio measurement hole 118 of a penetration ratio detection tube 122
10 is disposed near an inlet such as the facing surface of the inlet or on an inlet circumference of the exhaust blower suction port 124, and a detachable penetration ratio measurement tube cap 123 is disposed on the opposite side of the penetration ratio measurement hole 118 of the penetration
15 ratio measurement tube 122.

[0044]

When measuring the penetration ratio of the exhaust HEPA filter 101a, by applying a load to the upstream side of the exhaust HEPA filter 101a, and by removing the penetration
20 ratio measurement tube cap 123 and connecting it to a penetration ratio detector (not illustrated), it is possible to reliably take in the air from the exhaust HEPA filter 101a in a mixed state into the penetration ratio detector.

[0045]

25 According to this example, since the exhaust blower 112

is disposed in the safety cabinet 100, it is possible to deliver the air to an exhaust system on a building side with an external static pressure of 0 Pa as in Example 2.

[0046]

5 Further, in Fig. 5B, in order to use the air that mixes well on the suction side of the exhaust blower 112, the exhaust flow path 119 on the blow-off side of the exhaust blower 112 may or may not be provided in the safety cabinet 100.

10 Example 4

[0047]

Fig. 6A is an example of a front cross-sectional view illustrating the safety cabinet of Example 4, and Fig. 6B is an example of a side cross-sectional view.

15 [0048]

In this example, as in other examples, the non-workspace side of the workspace back wall surface 105b is formed by the safety cabinet outer wall 100a. In Example 4, the exhaust HEPA filter 101a is disposed above the workspace 105. Air that may
20 contain the pathogen or the like 115 sucked from the work table front suction port 107 and the rear suction port 109 of the work table 106 passes through the exhaust flow path inlet 120 and the exhaust flow path 119, and is guided to the exhaust HEPA filter 101a. An exhaust blower 112 is disposed on
25 the downstream side of the exhaust HEPA filter 101a, and the

air from which the pathogen or the like 115 has been removed is exhausted from the exhaust port 114.

[0049]

The penetration ratio measurement hole 118 of the
5 penetration ratio detection tube 122 is disposed in the vicinity of the inlet such as a surface facing the inlet or on the inlet circumference of the exhaust blower suction port 124 of the exhaust blower 112, and the detachable penetration ratio measurement tube cap 123 is disposed on the opposite
10 side of the penetration ratio measurement hole 118 of the penetration ratio measurement tube 122. At the time of the penetration ratio test, the penetration ratio of the penetration ratio measurement hole 118 is measured as a representative point in which the air from the exhaust HEPA
15 filter 101a is well mixed.

[0050]

According to the present example, since the blower, the HEPA filter, and the like are not disposed below the work table 106, by maintaining the airtightness on the bottom of
20 the work table 106, it is possible to obtain a structure in which components below the work table 106 can be easily disassembled. This structure is advantageous when the loading height at the time of loading the device is made versatile.

[0051]

25 Fig. 7 is an example of a structural view of the

electrical components in the workspace. In common with the Examples 1 to 4, there are cases where components are attached by connecting electrical wiring from the workspace 105 such as a germicidal lamp socket and a socket to the workspace back wall surface 105b. In that case, it is necessary to provide an opening section connected to the outside of the safety cabinet 100 in the workspace back wall surface 105b for the convenience of component attachment and wiring.

[0052]

10 When the socket 128 inside the workspace 105 is wired from the outside of the safety cabinet, the opening section for the socket 128 is covered with the outer wall cover 131. The outer wall cover 131 is provided with a wiring connector 130. As the wiring connector 130, one having airtightness is
15 commercially available. The outside of the safety cabinet 100 and the socket 128 are wired, using the wiring connector 130. The place in which the outer wall cover 131 and the safety cabinet outer wall 100a are in contact with each other is secured its airtightness by a caulking material 129, such that
20 it is possible to maintain the airtightness required for the safety cabinet. This method is also applied to the case of the workspace side wall surface 105a.

Example 5

[0053]

25 Fig. 8A is an example of a side cross-sectional view

illustrating the safety cabinet of Example 5, and Fig. 8B is an example of a side cross-sectional view at the time of penetration ratio test.

[0054]

5 When measuring the penetration ratio of the HEPA filter 101, it is necessary to measure the concentration of simulated dust of both the upstream and downstream sides of the HEPA filter, and to divide the downstream side concentration by the upstream side concentration. In order to calculate the
10 penetration ratio of 0.01% or less and 0.005% or less, it is necessary to sufficiently increase the simulated dust concentration of the upstream side. In that case, it is necessary to increase the supply amount of simulated dust to the upstream side. In the case of measuring the penetration
15 ratio of the blow-off HEPA filter 101b, it is possible to input the simulated dust using the pressure of the blow-off blower 111 and fill the inside of the pressure chamber 113. However, when there is no blower or pressure chamber on the upstream side of the exhaust HEPA filter 101a, it is necessary
20 to input the simulated dust into the workspace 105 from the work opening section 103 with the test blower 125 and to increase the simulated dust concentration on the upstream side of the exhaust HEPA filter 101a. However, in this case, since the simulated dust is filled inside workspace 105 used for the
25 experiment, and the simulated dust adheres to the inner wall

surface of the workspace 105, the inside of the workspace 105 needs to be cleaned after the penetration ratio test.

[0055]

In general, the safety cabinet has a structure in which
5 the work table 106 below the work surface 106a can store liquid for the convenience of putting a disinfecting solution or the like to perform disinfection. Therefore, the workspace side around the opening section of the work table lower opening section 126 has a protrusion for blocking water. In
10 addition, the work surface 106a is detachable in order to make the lower part of the work surface 106a cleanable.

[0056]

In Example 5, the work surface 106a is lifted as illustrated in Fig. 8B, and the protrusion around the work
15 table lower opening section 126 is covered with a penetration ratio test cover 127 to seal the space in which the exhaust HEPA filter 101a is disposed. The penetration ratio test cover 127 is provided with an opening section to which the blow-off port of the test blower 125 can be connected. By suctioning
20 the simulated dust for penetration ratio test from the test blower 125, the upstream side of the exhaust HEPA filter 101a can be pressurized with air containing the simulated dust, and can be raised to an upstream concentration sufficient for measurement. In the present example, since only the space
25 around the exhaust HEPA filter 101a below the work table 106

is contaminated by the simulated dust, it is possible to prevent the inside of the work section 105 from being contaminated by the simulated dust. The concentration measurement method on the downstream side of the exhaust HEPA filter 101a is the same as in other examples.

[0057]

According to Example 1 to 5, in the safety cabinet in which it is difficult to perform the penetration ratio test by the scanning test of the exhaust HEPA filter, it is possible to provide a safety cabinet which facilitates checking of penetration ratio and eliminates the possibility of pathogen or the like leaking from the outer wall of the workspace. In addition, since the test method and the air flow condition at the time of the test are in the state of the same air flow at the time of shipment by the safety cabinet manufacturer and at the site inspection performed regularly, evaluation can be made by the same measurement sensitivity at the time of shipment by the safety cabinet manufacturer and at the site inspection.

[0058]

Although the safety cabinet standard of Non-Patent Document 1 describes the penetration ratio test method using a relative densitometer (photometer), in the examples, the same also applies to a case in which the dust concentration on the upstream side of the HEPA filter and the dust concentration on

the downstream side of the HEPA filter are measured and compared, using a light scattering type automatic particle counter (a particle counter).

5 REFERENCE SIGNS LIST

[0059]

100 Safety cabinet

100a Safety cabinet outer wall

101a Exhaust HEPA filter

10 101b Blow-off HEPA filter

102 Clean air

103 Work opening section

104 Front panel

105 Workspace

15 105a Workspace side wall surface

105b Workspace back wall surface

106 Work table

106a Work surface

107 Work table front suction port

20 108 Back flow path

109 Rear suction port

110 Flow straightening plate

111 Blow-off blower

112 Exhaust blower

25 113 Pressure chamber

- 114 Exhaust port
- 115 Pathogen or the like
- 116 Inflow air flow
- 118 Penetration ratio measurement hole
- 5 119 Exhaust flow path
- 120 Exhaust flow path inlet
- 121 Airtightness test cover
- 122 Penetration ratio measurement tube
- 123 Penetration ratio measurement tube cap
- 10 124 Exhaust blower suction port
- 125 Test blower
- 126 Work table lower opening section
- 127 Penetration ratio test cover
- 128 Socket
- 15 129 Caulking material
- 130 Wiring connector
- 131 Outer wall cover

CLAIMS

1. A safety cabinet which has a work surface on a bottom of a workspace, a front panel at a front of the workspace, and a work opening section below the front panel, and has a first
5 air purification means configured to filter exhaust air for exhausting air in the workspace,

wherein non-workspace sides of a side wall surface and a back wall surface of the workspace are formed by an outer wall of a device with prescribed airtightness performance.

10

2. The safety cabinet according to claim 1, wherein the air purified by a second air purification means is supplied from an upper surface of the workspace.

15 3. The safety cabinet according to claim 1 or 2, wherein the first air purification means is disposed below the workspace, and

the safety cabinet includes an exhaust flow path having an air inlet on a downstream side of the first air
20 purification means and an outlet outside the device.

4. The safety cabinet according to claim 3, wherein a blowing unit is connectable to the outlet side of the exhaust flow path.

25

5. The safety cabinet according to claim 1 or 2, wherein the first air purification means is disposed below the workspace, and

the safety cabinet includes:

5 an exhaust flow path having an air inlet on the downstream side of the first air purification means; and

a blowing unit disposed on the outlet side of the exhaust flow path.

10 6. The safety cabinet according to claim 5, wherein a measurement hole of a penetration ratio measurement tube is disposed on a suction side of the blowing unit.

7. The safety cabinet according to claim 1 or 2, wherein the first air purification means is disposed below the workspace, and

the safety cabinet includes a blowing unit disposed on a lower side of the first air purification means.

20 8. The safety cabinet according to claim 1 or 2, further comprising:

an exhaust flow path having an air inlet on the lower side of the workspace and having an outlet above the workspace;

25 the first air purification means disposed at the outlet

of the exhaust flow path; and

a blowing unit disposed on a downstream side of the first air purification means.

5 9. The safety cabinet according to claim 7 or 8, wherein a measurement hole of a penetration ratio measurement tube is disposed at the suction port of the blowing unit.

10 10. The safety cabinet according to any one of claims 1 to 9, further comprising:

an opening section below the work surface at the bottom of the workspace;

15 a penetration ratio test cover which covers the opening section and seals a space in which the first air purification means is disposed; and

a test blowing unit connected to the penetration ratio test cover.

20 11. A safety cabinet which has a workspace inside, to which a clean air is supplied from an upper surface of the workspace, and from which air is discharged from a work surface side of a bottom of the workspace,

25 wherein a front panel is provided at a front of the workspace, and a work opening section is provided below the front panel, and

a side wall side and a back wall side of the workspace are configured by superimposing a workspace wall surface and an outer wall of a device with prescribed airtightness performance.

5

12. The safety cabinet according to claim 11, wherein the workspace wall surface and the outer wall of the device with prescribed airtightness performance are connected on the side wall side and the back wall side of the workspace.

10