

HIDDEN NBC FILTRATION SYSTEM

FIELD OF THE INVENTION

The present invention relates to a hidden safe room Nuclear Biological Chemical (NBC) filtration system, more particularly to a method and a device for
5 visually integrating a NBC filtration system in residential buildings.

BACKGROUND OF THE INVENTION

National civilian defense authorities such as US DEPARTMENT OF HOMELAND SECURITY (DHS) and Israel's HOME FRONT COMMAND instruct citizens to enter a sealed shelter in case of a nuclear, biological or chemical attack. In
10 Israel, every building has a sealed, blast protected safe room built to Israeli government standards. The standard requirements include minimal thickness and steel reinforcement of the concrete envelope, as well as instructions relating to the door and window. Windows are typically shielded with single or double swivel or sliding pocket wings made of steel. A recent regulation published by Israel's HOME FRONT
15 COMMAND enforces installation of a NBC filtration system in the blast protected safe room of every new building.

US. Pat. No. 6,328,775 to the present applicant describes a compact, portable system for protection against the penetration of contaminated air into a protected space. When the described unit is installed in a blast protected safe room, the system
20 includes an air intake fitted through an exterior wall of the building, carrying an integrated blast valve at the outer side of the wall and a quick connect flange at the inner side of the wall. An air exhaust unit is mounted through a preferably opposite interior wall of the safe room, provided with an over-pressure relief valve. The system further includes a portable NBC filter unit attachable to the air intake by means of the
25 quick connect flange and a portable electric blower unit operated by mains power and backed up by an internal battery. The blower unit is attachable to the outlet of the filter unit directly or with a flexible extension duct. A hand operated air pump is also included providing protection even in case of long term mains power failure. During normal conditions the filter and blower are stored in an easy to reach place and the safe room
30 is available for daily use. Upon declaration of an emergency state, the portable NBC filter is connected to the air intake and the portable electric blower is attached to the outlet of the filter.

However, portability of the unit is not always an advantage, in the case of blast protected safe room it is preferred that the entire unit is invisibly situated in a fixed position in the safe room such that no set up is required in event of emergency.

Additionally, since most of the time the safe room serves as an ordinary living
5 room it is desired that the entire NBC filtration system including the air intake and the air exhaust is hidden from the eye as far as possible.

Furthermore, the external appearance of the building is expected to be neat and free of exposing elements such as the blast valve or the air intake.

Accordingly, in relation to blast protected safe rooms, there is a need for a
10 hidden filtration unit that is fixed in position, ready to use with minimal set up and does not deteriorate the internal or external appearance of the building.

SUMMARY OF THE INVENTION

It is thus an object of the present invention to provide a NBC filtration system for blast protected safe rooms that is visually pleasant and properly integrated to both the
15 interior and exterior appearance of residential buildings. It is another object of the present invention to provide a fixed hidden storage compartment for the filtration unit components.

These objects are achieved according to one aspect of the present invention by providing a NBC filtration system for safe room applications comprising at least one of:

20 a. an air intake integrated into a window frame, by providing the window frame with an externally invisible air inlet passage connecting between the exterior space and the safe room space, wherein a filtration unit in air flow communication with the air inlet passage, draws air into the safe room through said air inlet passage; b. an air intake integrated into a tubular venting sleeve, by providing said venting sleeve with an
25 externally invisible air inlet passage connecting between the exterior space and the safe room space, wherein a filtration unit in air flow communication with said air inlet passage, draws air into the safe room through said air inlet passage; c. an air exhaust integrated into a door frame by providing the door frame with an air outlet passage made in at least one of the top and side profiles of the door frame, wherein an exhaust
30 duct fitted to the air outlet passage, discharges Oxygen lean air out of the safe room through said air outlet passage.

In accordance with another aspect of the present invention the filtration unit is invisibly secured in a cabinet, embedded in the concrete wall, being in air flow communication with the air intake of the above window frame or venting sleeve.

Additionally, the present invention seeks to provide a method for improving the aesthetic appearance of NBC filtration systems fitted in blast protected safe rooms, comprising the steps of: a. providing at least one of a window frame and venting sleeve with an integrated, externally invisible, air inlet passage connecting between the exterior space and the safe room space; b. providing a filtration unit that is in air flow communication with the exterior space, through said air inlet passage.

In accordance with another aspect of the present invention the above method further comprises the step of: c. providing a cabinet, embedded in the concrete wall, having an air inlet in flow communication with the inlet passage and placing said filtration unit in the cabinet.

In accordance with yet another aspect of the present invention the above method further comprises the steps of: d. providing a door frame with an integrated, air outlet passage made in at least one of the top and side profiles of the door frame, e. providing an exhaust duct fitted to said air outlet passage, for discharging Oxygen lean air out of the safe room through said air outlet passage.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to understand the invention and to see how it may be carried out in practice, embodiments will now be described, by way of non-limiting example only, with reference to the accompanying drawings, in which:

Fig. 1 is a perspective layout of a blast protected safe room made in accordance with an embodiment of the present invention, the concrete walls are illustrated by dashed lines;

Fig. 2 is a perspective view of a pocket sliding-shield window frame with passage for air intake from the pocket space;

Fig. 3 is a perspective view of the window frame of Fig. 2, provided with a cabinet for a filtration unit;

Fig. 4 is a perspective view of the window frame of Fig. 3, fitted with a removable cover shown in position in front of the cabinet space;

Fig. 5 is a perspective view of the window frame of Fig. 3, shown from the exterior side with the exterior pocket aesthetic cover removed for clarity;

Fig. 6 is a perspective view of a pocket sliding-shield window frame with inlet passage and duct leading air from the pocket space to a separate cabinet for filtration unit embedded in the concrete wall below the window frame;

Fig. 7 is a perspective view of a swivel dual wing type, shielded window frame with inlet passage and duct leading air from a side frame profile to a separate cabinet for filtration unit embedded in the concrete wall to one side of the window frame;

Fig. 8 is a perspective view of the upper part of a door frame as shown in Fig. 1,
5 equipped with an exhaust duct extending upwardly from the frame towards the outer side of the wall;

Fig. 9 is another perspective view of the upper part of a door frame as shown in Fig. 7;
and

Fig. 10 is a perspective view of a hidden filtration system based on venting sleeves.

10 DETAILED DESCRIPTION OF EMBODIMENTS

In the following description, identical elements that appear in more than one figure or that share similar functionality will be indicated by identical reference numerals.

With reference to Fig. 1, in relation to a first embodiment of the present
15 invention, there is shown a perspective schematic view of a blast protected safe room generally referenced 10, where the concrete envelope 12 is represented by dashed lines. The safe room 10 is provided with a NBC filtration system comprising at least one of: an air intake integrated into a window frame 14, which is positioned in an exterior wall of the building; and an air exhaust integrated into a door frame 16, which is
20 positioned in a preferably opposing interior wall of the building. Both window frame 14 and door frame 16 are made according to the specifications for blast protected safe room applications. Specifically shown in fig. 1, by way of example only, is a pocket sliding-shield type window frame 14 and outwardly opening swivel type door frame 16. Further shown in Fig. 1, is a cabinet 18, preferably embedded in the concrete wall, for
25 invisibly securing a filtration unit, being in air flow communication with the air intake as will be described below in more detail.

Referring to Figs. 2, 6 and 7, the air intake is integrated into the window frame 14 by providing the window frame with an externally invisible air inlet passage 24 (Fig. 2), 50 (Fig. 6) 80 (fig. 7), connecting between the exterior space and the room 10
30 space. The filtration unit which is in air flow communication with the air inlet passage 24, 50, 80, draws air into the room 10 through the externally invisible air inlet passage, therefore the air intake does not deteriorate the outer appearance of the building.

Referring to Figs. 8 and 9, the air exhaust is integrated into the door frame 16 by providing the door frame with an air outlet passage 90 (Fig. 9) made in at least one

of the top 96 and side profiles of the door frame 16. An exhaust duct 22 fitted to the air outlet passage 90, discharges Oxygen lean air out of the safe room through the air outlet passage 90, accordingly, the exhaust duct 22 is not visible from within the safe room 10.

5 In more detail, Figs. 2 to 5 depicts by way of example, a standard single pocket sliding-shield window frame 14 for blast protected safe room applications as known in the art. It will be understood that double pocket window frame may be used to the same extent. The frame 14 is modified with an externally invisible air inlet passage 24 made through the internal pocket panel 26. The inlet passage 24 is connecting
10 between the pocket space 27 (Fig. 5) which is open to the exterior space and the safe room 10 space. Typically, the volume adjacent the internal pocket panel 26 is filled with concrete, but according to an embodiment of the present invention, as shown in Fig. 3, a NBC cabinet 18 having an air inlet 30 cut through its backplate 32, is fitted to the internal pocket panel 26 such that the air inlet 30 of the NBC cabinet 18 is aligned with
15 the inlet passage 24 of the internal pocket panel 26. During construction of the building, concrete is filled around the NBC cabinet 18 which is finally embedded in the wall like the window frame 14.

A filtration unit (not shown) located in the NBC cabinet 18, draws air from within the pocket space 27 (Fig. 5) through the inlet passage 24 and air inlet 30, purifies and
20 delivers it into the safe room 10 space. The NBC cabinet 18 may be constructed as a frame 40 welded to the backplate 32 forming a protected space 42 of sufficient volume to store all components of the filtration unit. A removable or hinged cover 44, (Fig.4), with an air supply passage 46, is fitted in front of the cabinet 18, flush with the internal face of the concrete wall for minimal presence during normal daily use of the safe room
25 10.

The thickness of the backplate 32 of the NBC cabinet 18 is preferably calculated to provide amount of blast protection similar to that of the pocket sliding-shield 48.

The filtration unit components that are assembled into the NBC cabinet 18, may
30 include: NBC filter, electric blower, backup rechargeable battery and a second backup manual air pump. Preferably the entire system is assembled and ready to use simply by removal of a humidity seal fitted to the air supply passage 46.

With reference to Fig. 6, in relation to a second embodiment of the present invention, there is shown a similar standard single pocket sliding-shield window frame
35 14 for safe room applications, modified with an inlet passage 50, here made near the

bottom edge 52 of the internal pocket panel 26. A separate cabinet 60 is embedded in the concrete wall under the window frame 14 such that sufficient blast protection is provided to the cabinet 60 by the remaining concrete wall, eliminating the need for a blast protected backplate 32 as described above. An air inlet 62 is cut through the top wall 64 of the cabinet 60 and an air duct 66 is fitted between the air inlet passage 50 of the internal pocket panel 26 and the air inlet 62 of the cabinet 60. A removable or hinged cover 68 with an air supply passage 70, is fitted in front of the protected space 42, flush with the internal face of the concrete wall for minimal presence during normal daily use of the safe room 10.

10 It will be understood that similarly the inlet passage 50 can be made near the side edge 54 of the internal pocket panel 26 and the cabinet 60 can be embedded in the concrete wall to the side of the window frame 14 with the air inlet 62 provided to the cabinet 60 side wall 72.

With reference to Fig. 7, according to a third embodiment of the present invention, there is shown a standard dual swivel wing type, shielded window frame 74 for safe room applications. It will be understood that single swivel wing type, shielded window frame may be used to the same extent. The shield wings 76 (shown open) and 78 (shown closed), are not air tight sealed as known in the art, such that even when both shield wings 76, 78 are closed there is sufficient gap between the shield wings 76, 78 and the window frame 74 to allow free air draw into an air inlet passage 80, made in a side profile 82 of the window frame 74. A separate NBC cabinet 60 is embedded in the concrete wall to the side of the window frame 74. An air inlet 84 is opened in the side wall 86 of the cabinet 60 and an air duct 87 is fitted between the air inlet passage 80 of the window frame 74, and the air inlet 84 of the cabinet 60. A removable or hinged cover 68 with an air supply passage 70, is fitted in front of the cabinet 60, flush with the internal face of the concrete wall for minimal presence during normal daily use of the safe room.

It will be understood that similarly the inlet passage 80 can be made in the bottom profile 88 of the window frame 74 and the NBC cabinet 60 can be embedded in the concrete wall below the window frame 74 with the air inlet 84 provided to the NBC cabinet 60 top wall 89.

Furthermore, principally for achieving the goals of the present invention, the NBC cabinet 60 can be embedded in any acceptable location in the safe room wall as long as it remains in air flow communication with the inlet passage 24, 50, 80. of any of the above described embodiments.

Accordingly the present invention also seeks to provide a method for improving the aesthetic appearance of NBC filtration systems fitted in blast protected safe rooms. The method comprising the steps of:

a. providing at least one of a window frame 14 and venting sleeve 104 (as will be described below) with an integrated, externally invisible, air inlet passage 24, 50, 80, 106 connecting between the exterior space and the safe room 10 space;

b. providing a filtration unit that is in air flow communication with the exterior space, through the air inlet passage.

The method may further comprise the step of:

c. providing a cabinet 18, 60, that is embedded in the concrete wall, having an air inlet 30, 62, 84, 108 in flow communication with said inlet passage 24, 50, 80, 106 respectively and placing said filtration unit in the cabinet.

With reference to Figs. 8 and 9, there is shown an upper part of a blast protected safe room door frame 16, fitted with an integral exhaust duct 22, extending upwardly above the door frame. It will be understood that the exhaust duct 22 may equally extend to one or both sides of the door frame instead of extending upwardly. The exhaust duct 22 discharges Oxygen lean air out of the safe room through the outlet passage 90 (Fig. 9), made in the top profile 96 of the door frame 16, and duct 22 ending with an elbow 92 protruding to the exterior of the concrete wall. The exhaust duct 22 may be provided with an over pressure relief valve, preferably a gravitation over pressure relief valve, made of a single metal plate 94 resting on a horizontal seat right above the door frame 16 top profile 96. The metal plate weight determines the amount of overpressure build in the safe room, excessive overpressure will lift the metal plate and permit escape of air through the exhaust duct 22. The over pressure relief valve may serve also as a blast valve. The above described configuration of the exhaust duct eliminate the previous art of installing a direct through wall exhaust duct with a spring loaded relief valve that not only is complex but also compel a visible unpleasant appearance.

Accordingly the method for improving the aesthetic appearance of NBC filtration systems fitted in blast protected safe rooms, may further comprise the step of:

d. providing a door frame 16 with an integrated air outlet passage 90 made in at least one of the top 96 and side profiles of the door frame;

e. providing an exhaust duct 22 fitted to the air outlet passage 90, for discharging Oxygen lean air out of the safe room through said air outlet passage 90.

While the above embodiments of the present invention have been described in relation to windowed safe rooms as mostly implemented in Israel, there are safe room implementations for instance in Singapore, where the safe room is located in a central portion of a residential apartment with no access to an external wall and hence without a window. Yet, such safe rooms as well as shelters and windowed safe rooms are provided with at least one and typically two spaced apart tubular venting sleeves 104, 130 (Fig. 10) passing through the wall near the ceiling. These venting sleeves may equally serve for the purpose of the present invention instead of the window and door frames as described above.

With reference to Fig. 10, in relation to yet another embodiment of the present invention, there is shown an air intake integrated into a first tubular venting sleeve 104 for safe room applications passing through the wall, by providing the venting sleeve 104 with an externally invisible air inlet passage 106, connecting between the exterior space and the safe room space. A filtration unit in air flow communication with the air inlet passage 106, draws air into the safe room through the air inlet passage. The air intake passage 106 is shown directed downwards towards the floor by way of example.

The filtration unit may be placed in a separate cabinet 60 which is embedded in the concrete wall under the venting sleeve 104 such that sufficient blast protection is provided to the cabinet 60 by the remaining concrete wall. An air inlet 108 is cut through the top wall 110 of the cabinet 60 and an air duct 112 is fitted between the air inlet passage 106 of the venting sleeve and the air inlet 108 of the cabinet 60. Air filtration unit as described above is placed in the cabinet 60. A removable or hinged cover 68 with an air supply passage 70, is fitted in front of the protected space 42, flush with the internal face of the concrete wall for minimal presence during normal daily use of the safe room 10.

The cabinet 60, air duct 112 and venting sleeve 104 may be provided as a complete assembled unit that is embedded in the concrete wall during construction of the building. Optional blast valve 114 can be assembled on the external end 116 of the venting sleeve 104 and a stopper plate 118 on the internal end 120 to block free flow of air through the venting sleeve 104 while the NBC system is in operation.

An optional second tubular venting sleeve 130 discharges Oxygen lean air out of the safe room. The second venting sleeve 130 may be provided with a spring loaded relief valve 132 fitted to the external end 134 of the venting sleeve 130. The internal end 136 of the second venting sleeve 130 remains open.

In cases where only the first venting sleeve 104 is provided, the door frame may be fitted with an integral exhaust duct 22 as described above with reference to Figs. 8 and 9.

Accordingly the method as described above for improving the aesthetic
5 appearance of NBC filtration systems fitted in windowed blast protected safe rooms, may be applied to safe rooms without window, by providing a first venting sleeve 104 instead of window frame 14.

While the present invention has been described in conjunction with what is
10 deemed to be the most practical and preferred embodiments of the invention, it will be evident to those skilled in the art that the invention is not limited to the details of the above described and the foregoing illustrated embodiments. The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof. Accordingly, it is intended that the present invention embraces all
15 such alternatives, modifications and variations as fall within the scope and determined by the broadest interpretation of the appended claims.

CLAIMS:

1. A NBC filtration system for safe room applications comprising at least one of:
 - a) an air intake integrated into a shielded blast protected window frame, by providing said window frame with an externally invisible air inlet passage
5 connecting between a shielded exterior space and the safe room space, wherein a filtration unit in air flow communication with said air inlet passage, draws air into the safe room through said air inlet passage, redeeming a blast valve;
 - b) an air intake integrated into a shielded blast protected venting sleeve, by providing said venting sleeve with an externally invisible air inlet passage
10 connecting between a shielded exterior space and the safe room space, wherein a filtration unit in air flow communication with said air inlet passage, draws air into the safe room through said air inlet passage; and
 - c) an air exhaust integrated into a blast protected door frame by providing said door frame with an air outlet passage made in at least one of the top and side profiles
15 of the door frame, wherein an exhaust duct fitted to said air outlet passage, discharges Oxygen lean air out of the safe room through said air outlet passage.
2. A NBC filtration system as claimed in claim 1, wherein said filtration unit of said air intake integrated into either the shielded blast protected window frame or the shielded blast protected venting sleeve is invisibly secured in a cabinet, which is
20 embedded in a concrete wall and being in air flow communication with said air intake.
3. A NBC filtration system as claimed in claim 1 comprising a shielded blast protected window frame, wherein said shielded blast protected window frame is a pocket sliding-shield type window frame.
4. A NBC filtration system as claimed in claim 1 comprising a shielded blast
25 protected window frame, wherein said shielded blast protected window frame is swivel wing type, shielded window frame.
5. A NBC filtration system as claimed in claim 1 comprising a shielded blast protected door frame, wherein said blast protected door frame is an outwardly opening swivel type door frame.
- 30 6. A NBC filtration system as claimed in claim 3, wherein said air inlet passage is made through an internal pocket panel of said shielded blast protected window frame.

7. A NBC filtration system as claimed in claim 6, wherein an air inlet cut through a backplate of a cabinet housing the air filtration unit, is fitted to the internal pocket panel such that the air inlet of the cabinet is aligned with said air inlet passage of the internal pocket panel.

5 8. A NBC filtration system as claimed in claim 7, wherein the filtration unit located in said cabinet, draws air from within said pocket space through said inlet passage and said air inlet, purifies and delivers it into the safe room space.

9. A NBC filtration system as claimed in claim 8, wherein said cabinet is constructed as a frame welded to said backplate forming an embedded in concrete protected space of
10 sufficient volume to store all components of said filtration unit.

10. A NBC filtration system as claimed in claim 7, wherein a thickness of said backplate of the NBC cabinet is calculated to provide amount of blast protection similar to that of the pocket sliding-shield.

11. A NBC filtration system as claimed in claim 7, wherein the filtration unit
15 components that are assembled into said cabinet include at least one of: NBC filter, electric blower, backup rechargeable battery and a second backup manual air pump.

12. A NBC filtration system as claimed in claim 6, wherein said air inlet passage is made near a bottom edge of the internal pocket panel and a separate cabinet is embedded in a concrete wall disposed under the window frame, an air inlet is cut
20 through the top wall of the cabinet and an air duct is fitted between the air inlet passage of the internal pocket panel and the air inlet of the cabinet.

13. A NBC filtration system as claimed in claim 6, wherein said air inlet passage is made near a side edge of the internal pocket panel and a separate cabinet is embedded in a concrete wall disposed to one side of the window frame, an air inlet is cut through a
25 side wall of the cabinet and an air duct is fitted between the air inlet passage of the internal pocket panel and the air inlet of the cabinet.

14. A NBC filtration system as claimed in claim 4, wherein said air inlet passage is made in a side profile of the shielded blast protected window frame and a separate cabinet is embedded in a concrete wall disposed to the side of the shielded blast
30 protected window frame, an air inlet is cut through a side wall of the NBC cabinet and an air duct is fitted between the air inlet passage of the shielded blast protected window frame and the air inlet of the cabinet.

15 **15.** A NBC filtration system as claimed in claim 4, wherein said air inlet passage is made in a bottom profile of the shielded blast protected window frame and a separate cabinet is embedded in a concrete wall disposed below the shielded blast protected window frame, an air inlet is cut through a top wall of the cabinet and an air duct is fitted between the air inlet passage of the shielded blast protected window frame and the air inlet of the cabinet.

16. A NBC filtration system as claimed in any one of claims 2, 7 to 9 or 12 to 15, wherein a removable or hinged cover with an air supply passage, is fitted in front of the cabinet, flush with an internal face of a concrete wall for minimal presence during
10 normal use of the protected safe room.

17. A NBC filtration system as claimed in claim 1, wherein said exhaust duct fitted to the air exhaust integrated into the blast protected door frame air outlet passage ends with an elbow protruding to an exterior of a concrete wall surrounding the safe room.

18. A NBC filtration system as claimed in claim 1 comprising an air exhaust integrated
15 into a blast protected door frame, wherein said exhaust duct is provided with a gravitation over pressure relief valve.

19. A NBC filtration system as claimed in claim 18, wherein said gravitation over pressure relief valve is made of a single metal plate resting on a horizontal seat right above the door frame top profile.

20 **20.** A NBC filtration system as claimed in claim 18, wherein said gravitation over pressure relief valve serves also as a blast valve.

21. A NBC filtration system as claimed in claim 2 comprising a shielded blast protected venting sleeve, wherein said cabinet is embedded in the concrete wall under said venting sleeve, an air inlet is cut through a top wall of the cabinet and an air duct
25 is fitted between the air inlet passage of the venting sleeve and the air inlet of the cabinet.

22. A NBC filtration system as claimed in claim 21, wherein said cabinet, air duct and venting sleeve are provided as a complete assembled unit that is embedded in the concrete wall during construction of the building.

30 **23.** A NBC filtration system as claimed in claim 1 comprising a shielded blast protected venting sleeve, wherein a blast valve is assembled on an external end of the

venting sleeve and a stopper plate assembled on an internal end, while the NBC system is in operation.

24. A NBC filtration system as claimed in claim 1 comprising an air intake integrated into a shielded blast protected venting sleeve, further comprising a second tubular
5 venting sleeve for discharging Oxygen lean air out of the safe room.

25. A NBC filtration system as claimed in claim 24 wherein said second venting sleeve is provided with a spring loaded relief valve fitted to an external end of the second venting sleeve.

26. A method for concealing NBC filtration systems fitted in blast protected safe
10 rooms, comprising the steps of: a. providing at least one of a shielded blast protected window frame and venting sleeve with an integrated, externally invisible, air inlet passage connecting between an exterior space and the safe room space; and b. providing a filtration unit that is in air flow communication with the shielded exterior space, through said air inlet passage.

15 27. The method as claimed in claim 26, further comprising the step of: c. providing a cabinet, embedded in a concrete wall surrounding the safe room, having an air inlet in flow communication with said inlet passage and placing said filtration unit in the cabinet.

28. The method as claimed in claim 26, further comprising the steps of: d. providing a
20 door frame with an integrated, air outlet passage made in at least one of the top and side profiles of the door frame; and e. providing an exhaust duct fitted to said air outlet passage, discharging Oxygen lean air out of the safe room through said air outlet passage.