

UNIT FOR CONNECTING MODULAR MOBILE ROOMS

TECHNICAL FIELD OF THE INVENTION

The present invention relates in general to the field of mobile structure assembly, and more particularly, to connecting a mobile cleanroom to another structure.

5 BACKGROUND OF THE INVENTION

Without limiting the scope of the invention, its background is described in connection with cleanroom construction and use.

U.S. Patent No. 6,634,149 B2, issued to Cates, et al teaches the configuration and assembly of components used to make up a wall system that is useful for cleanrooms. Specifically a
10 connector block for joining perpendicularly oriented studs, and a corner stud and deflection track for connecting the top track of a wall panel to a conventional ceiling grid.

U.S. Patent No. 5,713,791 A, issued to Long, et al., teaches a modular cleanroom conduit and the method for using it when transporting products between two cleanroom environments when traveling through a less clean environment between the cleanrooms. The conduit can
15 be adapted and modified for various distances between two cleanrooms. Each modular section has perforated floors and filters for filtering incoming gas being circulated, and exhausting out gas and contaminants.

U.S. Patent No. 4,667,579 A, issued to Daw, et al., teaches an industrial cleanroom structure having a plenum enclosure assembly on top of the cleanroom enclosure assembly. The
20 plenum assembly has a top, bottom, and side covers that are sealed to prevent contamination, and a filter system through which air enters the cleanroom enclosure. The cleanroom enclosure includes fabricated wall studs attached to the plenum support structure.

U.S. Patent No. 5,125,203 A, issued to Daw, et al., teaches a connector system to provide airtight sealing between a ceiling structure and a wall structure suitable for use in a
25 cleanroom enclosure. The connector system includes an elongate channel member which is attached to the ceiling structure such that it forms a continuous airtight seal. An elongate cap member which is received within the elongate channel member is attached to the wall structure to form the top edge of the wall structure. Elastomeric seal members are placed between the cap member and the channel member to create an airtight seal.

SUMMARY OF THE INVENTION

In one embodiment, the present invention is a connector unit for connecting two or more structures wherein at least one of the two or more structures being connected is a mobile structure validatable for pharmaceutical manufacturing or patient care. The connection is made by the movement of the mobile structure against the other structure and the connector unit includes an alignment system that guides the mobile structure to precisely dock the two or more structures together, a seal or seal system to create an air tight seal between two or more structures, or one or more structures and an environment, and a fixation system to affix the two or more structures to prevent unintentional movements of the two or more structures, or breakage of the seal or seal system. The connector unit can be used to connect one, two, or more previously validated pharmaceutical manufacturing or patient care units. The connection between the two or more structures can be disconnected, separated, and then reattached. In another embodiment, the connector unit connects two or more structures wherein at least one of the structures includes at least one of cleanrooms, isolation cubicles, containment cubicles, pods, modules, units, buildings, corridors, hallways, mobile structures, and access structures. In another aspect, a volume of a seal between the two or more structures is equal to or greater than a volume of a groove on an opposite surface. In another aspect, the seal surrounds an opening between the two or more structures to provide a hermetic seal.

In one aspect, the alignment system of the connector unit allows two or more structures to be pushed against each other and aligned in the same movement. The alignment system is important to allow a firm sealing between the two or more structures, and to avoid any damage to the sealing. The seal or seal system of the connector unit between the structures shall be reversible, not allow any air leaks, and must be able to stay intact for a prolonged period of time. The seal or seal system between the two or more structures, or one or more structures and the environment, can include at least one of induction sealing, cap sealing, adhesive sealant, bodok seal, Bridgman seal, compression seal fitting, diaphragm seal, ferrofluidic seal, a gasket, flange gasket, o-ring, o-ring boss seal, glass-ceramic-to-metal seals, piston ring, hose coupling, hermetic seal, hydrostatic seal, hydrodynamic seal, labyrinth seal, face seal, plug, radial shaft seal, siphon trap, split mechanical seal, wiper seal, dry gas seal, and exitex seal. In yet another aspect, the fixation system which keeps the structures together and avoid unintentional movements can include at least one of clamps,

spring loads, bolts, magnetic coupling, bayonet coupling, or locks. . In another aspect, a volume of a seal between the two or more structures is equal to or greater than a volume of a groove on an opposite surface. In another aspect, the seal surrounds an opening between the two or more structures to provide a hermetic seal.

- 5 The present invention also includes a method for connecting two or more structures with a connector unit wherein at least one of the two or more structures being connected is a mobile structure validatable for pharmaceutical manufacturing or patient care, the method comprising aligning the two or more structures to precisely dock the two or more structures together, sealing the two or more structures, or one or more structures and an environment air
10 tight with a seal or a sealing system, and affixing the two or more structures together solidly to prevent unintentional movements of the two or more structures, or breakage of the seal or seal system. In another aspect, a volume of a seal between the two or more structures is equal to or greater than a volume of a groove on an opposite surface. In another aspect, the seal surrounds an opening between the two or more structures to provide a hermetic seal.

15 BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the features and advantages of the present invention, reference is now made to the detailed description of the invention along with the accompanying figures and in which:

FIG. 1 is a top view of the connector unit connecting two structures.

- 20 FIG. 2 is a top view of the connector unit connecting a structure to a corridor.

FIG. 3 is a top view of an alignment system.

FIG. 4 is a top view of a sealing system.

FIG. 5 is a top view of a fixation system.

DETAILED DESCRIPTION OF THE INVENTION

- 25 While the making and using of various embodiments of the present invention are discussed in detail below, it should be appreciated that the present invention provides many applicable inventive concepts that can be embodied in a wide variety of specific contexts. The specific embodiments discussed herein are merely illustrative of specific ways to make and use the invention and do not limit the scope of the invention.

To facilitate the understanding of this invention, a number of terms are defined below. Terms defined herein have meanings as commonly understood by a person of ordinary skill in the areas relevant to the present invention. Terms such as “a”, “an” and “the” are not intended to refer to only a singular entity, but include the general class of which a specific example may be used for illustration. The terminology herein is used to describe specific embodiments of the invention, but their usage does not delimit the invention, except as outlined in the claims.

The present invention is a connector unit for connecting two or more structures wherein at least one of the two or more structures being connected is a mobile structure validatable for pharmaceutical manufacturing or patient care.

The present invention can be used with a modular pharmaceutical facility for the production of, e.g., vaccines and includes all the necessary quality control, quality assurance, and lot release functions. The end product can be made within the same or an adjacent module vaccine filled in bulk vials, suitable for distribution, and compliant with all FDA current Good Manufacturing Practices (cGMP) guidelines. The following terms are used interchangeably “modular unit”, “structure”, “unit” or “module” to describe a unitary structure that includes at least one portion that is a sealable, working area or cleanroom in which one or more functions or processes are conducted that require a controlled working environment and a mechanical service room or area (which may be closed or open) and that support the clean room and provides redundant services to the cleanroom, e.g., air-handling, electrical, water, waste water, waste disposal, chiller and/or heated water, gas, control units and sensors, security. These services will generally be connected to a source of the service that uses universal connectors, which are those commonly used as fittings in industry (e.g., 110 or 220 volt connections, ½-1 inch liquid or gas connections, wired or wireless connections to an intra, extra or internet and the like).

As used herein, the terms “validation” and “pre-validation” are intended to encompass all documented processes or acts undertaken to demonstrate that a procedure, a process or an activity will consistently yield an expected result or outcome. Validation often includes qualification of equipment and systems. Validation is a key required component of Good Manufacturing Practices (GMP) and other regulatory requirements. For example, in the pharmaceutical industry, validation of a facility and the process within it is done prior to obtaining regulatory approval for the commercial manufacture and sale of the pharmaceutical

product. Validation activities in the pharmaceutical industry may also include trial runs (pre-validation) before performing the actual validation to set validation limits, critical manufacturing controls, alert limits, etc. and to assess the potential outcome of the actual validation run. Validations routinely performed are cleaning validation, process validation, analytical method validation, computer system validation, qualifying systems and equipment including: design qualification (DQ), component qualification (CQ), installation qualification (IQ), operational qualification (OQ), and process qualification (PQ).

The skilled artisan will recognize that though the connector units, structures, facilities or units described in the instant invention are validatable, they may not be validated or required to be validated for certain uses and applications, particularly for non-human use or manufacture of products for non-human consumption (for e.g. veterinary applications, agriculture applications, pesticide manufacture, etc.).

The connector unit of the present invention can be used to form a suite or be part of multiple-modular unit facility, can include specific enclosed spaces for the manufacture, fermentation, growth (e.g., in a bioreactor) of the composition requiring an FDA approved, GMP or cGMP facility that includes, e.g., lights, controlled GMP areas consistent with USDA, CDC, FDA or regulations for foreign equivalents, including clean room conditions, purification, chromatography, bulk or individual vial filling, that can be arranged within, e.g., a standard factory or facility with a clearance sufficiently high to accommodate the units within. In one example, the modular units can be placed within a building shell that includes standard electrical connections, water, wastewater, air handling to which the units are connected. The present invention requires no pre-assembly or re-assembly of the multiple units as each can function independently and can be used for multiple purposes.

For example, a complete manufacturing facility can be built, within hours to days, from pre-assembled, pre-approved modular units that include all the equipment necessary for the desired function(s) for that unit within a manufacturing plant using the connector units of the present invention. These flexible-by-design GMP modular units allow for the design of production facilities for the rapid deployment and re-deployment of units based on the design needs. For example, one modular unit may include a self-contained bioreactor, the necessary liquid handling devices, refrigerators, tissue culture hoods and microbiology testing equipment, basic laboratory equipment (pipettors, sterile pipette tips, growth media, petri dishes, incubators and other general lab supplies), that has been tested and prevalidated to be

compliant with the cGMPs or other regulatory body compliance requirements or in compliance with applicable codes, statutes, ordinances, regulations or equivalents. A modular unit for protein isolation, adjacent to but completely independent from the bioreactor unit, can be positioned and in communication with the bioreactor unit such that the materials manufactured in the bioreactor are rapidly and easily transferred to the protein isolation unit that has, pre-approved and validated protein separation units, e.g., centrifuges, liquid chromatography columns, spectrophotometers, polyacrylamide gel electrophoresis (PAGE) units and bulk packaging units. Next, the bulk protein may be transferred to a packaging unit that includes all the equipment necessary to fill individual doses of the protein, small molecule or other agent that is being manufactured.

By connecting the individual modules, the present invention provides for the rapid exchange and continuous manufacture of product in case that one part of the manufacturing process must be changed or revalidated (e.g., in the case of the manufacture of a different biological or the detection of contamination) without the need to re-certify the entire facility. The addition of more modular units, connected by the connector unit(s) of the present invention, also allows for very rapid scale-up that can be customized for short periods of time. For example, a plant can receive the addition of modular units for scaling-up for a short period of time, the manufacture and isolation of a vaccine for a short period of time and the redeployment of those units elsewhere upon completion of the production run. In fact, the present invention can be used in existing manufacturing facilities for short-term expansion of manufacturing capacity without the need for revalidation of the new manufacturing capacity or the expensive, long-term installation of an additional production line that will only be used for a short period of time.

The connector units of the present invention can be used to connect modular units to stand-alone facilities and/or module units, which may be placed within and/or outside an existing structure. One example of such a structure is an empty facility or building. One such building could be of standard, pre-cast concrete construction, flat slab with smooth floors, concrete tilt wall, double T precast ceiling and having steel or other walls. In one non-limiting example, the walls can be epoxy coated for improved cleanability). Within the building, the modular units provide the dedicated wet laboratory, growth, bioprocess and purification units necessary for manufacture. These units are simply lifted into position (e.g.,

pushed on air bearings, casters, pallets), connected to a power source and, if necessary, a water and/or a wastewater supply.

The present invention allows the designer to have the ability to connect one functioning modular unit to one or more additional functioning modules without disrupting the function or compliance of the original modular unit(s). Furthermore, the designer also has the ability to disconnect one functioning module from one or more additional functioning modules without disrupting the function or compliance of the original modular unit(s).

The connector units taught herein can integrate into modular units to improve energy efficiency by connecting into an efficient energy recovery system that allows for energy recapture at a rate much higher than can be expected with existing methods throughout the connector unit(s) and the modular unit(s). The intake and exhaust of the redundant HVAC systems of the connector and modular unit(s) can be connected to the central HVAC of the building thereby enhancing the energy efficiency of both units. For example, the modular units of the present invention can be placed inside of a second environment (a building with ambient temperature or less humidity), which having the modular unit interact dynamically with that second environment. In this manner of operation, the modular unit can use ambient air that does not need to be treated by a large and expensive external air handling unit.

Another vast improvement over existing designs is the ability of the modular units to service multiple clients with a single cluster of modular units in a single contiguous manner through the connector units. For example, a biotechnology research park or similar entrepreneurial facility could host various different companies, each having their own production facility or modular unit. One distinct advantage of using the modular units is that each completely selfcontained modular unit can contain an individual hazardous waste, spills, etc., without affecting any other structures (within a process flow or affecting an adjacent production facility, e.g., when a facility has various manufacturing lines or different companies).

When the modular unit needs to be connected to a source of water, the incoming water could be purified in an adjacent modular unit that could service various different production lines or the module itself could include a water purification unit. The modular unit of the present invention has the advantage that the redundant air handling units, electrical panels and even the water filtration units can be in the portion of the modular unit that is adjacent the clean room and can be serviced without service personnel having to enter the clean room area.

When handling wastewater, the modular unit can include sump pumps to eliminate waste. Furthermore, the bag in/bag out filters connected to the air-handling units can also be changed without the need to enter the cleanroom area. These separate externally accessible portions of the modular units allow for maintenance and maintenance personnel to service the unit without the need to gown-up and enter the clean room area.

Duplicate processes and equipment for air handling, exhaust, etc., with automatic fault tolerance/failover allows the user, e.g., from an external panel or via the internet, to switch-over from a first system to a second system if sensors within the modular unit sense a problem with a component in the first system or as part of regular maintenance.

Another feature of the connector units of the present invention is the ability to use utility and other connection devices (e.g., plugs and fittings) that are well-known to maintenance personnel. For example, the modular units can use standard quick connectors for chilled water, electricity, etc. that allow the user to 'hot swap' the modular units externally. One advantage of the present invention is that it can take advantage of existing building infrastructure, e.g., mechanical equipment such as boilers, clean steam generator and compressors that can easily be connected to the units. The building's existing maintenance facilities and personnel can provide maintenance and service to the units and environmental service compliance from outside the clean room space via the mechanical are of the unit that is separate from the clean room space.

The connector units of the present invention can be made from, for example, a welded aluminum frame, with an all aluminum wall structure of materials and coatings that are cleanable in the drug production environment and are compliant with the cGMP's as described by the USDA, CDC, FDA or equivalent regulatory agency. Stainless steel fixtures and surfaces may also be used when necessary, but could add more weight to the unit if a weight limit exists.

The connection of the connector unit, e.g., within the clean room portion of the modular unit or even the maintenance portion of the modular unit, can be controlled and monitored externally using standard network information systems and remote systems monitoring.

Moreover, modular or connector units can be outfitted with air bearings, so that the modular units can be moved easily to other areas to be reconfigured in near real time to support necessary processes and surge capabilities without disturbing ongoing operations.

Each connector unit can be preassembled with a final documentation package that can include: the design, structural, mechanical, and electrical drawings, system dossiers, installation qualification and operational qualification plan and executed documents, maintenance logs, and pro-forma quality assurance documents including basic standard
5 operating procedures for connecting into modular units and/or fixed facilities. These may be provided in hard copy, or provided via a display panel within the modular unit or externally (including within the maintenance bay) that is electronic and can include the necessary passcode/password protection.

Space pressure can be monitored, e.g., the pressure in the connector units and/or modular
10 unit(s) to which they are connected. If the pressure drops to 0.0" water column (WC) or below, an alarm can be sent to the BAS. When an alarm is sent to the BAS, the system can call pre-programmed emergency telephone numbers and/or communication electronically via text or email.

Additional Points that can be monitored in the connector unit include, e.g., a static pressure
15 blowout sensor in communication with the air handling units (AHU's) For example, the BAS can determine if there is a belt failure in either of the AHU's or EF's by using, e.g., an amp sensor that monitors the change in amp draw on the motor. Another sensor can be a pitot tube in the supply air duct and exhaust air duct that monitors static pressure connected to the BAS. Also, gravity dampers, automatic dampers and damper end switches and the controls
20 can also be connected to and monitored by the BAS.

FIG. 1 depicts the connector unit connecting mobile modular structure 10a to a second mobile modular structure 10b. Mobile modular structure 10a includes two parts, a clean room 12 and a maintenance room 14a. Mobile modular structure 10b includes a clean room 16 and a maintenance room 14b. The maintenance room 14a and 14b are separated from the
25 clean room 12 and 16 by a wall 38 that isolates the clean room 12 and 16 from maintenance room 14a and 14b. Maintenance room 14a and 14b each have a single point of entry 36a and 36b, through which maintenance personnel can enter mobile modular structure 10a and 10b without needing to access the clean room 12 and 16. Clean room 12 provides a single entry/exit point 30 for mobile modular structure 10a. Clean room 16 in mobile modular
30 structure 10b includes a Material Airlock (MAL) room or area 22, which provides entry point 18, and a personnel airlock (PAL) room or area 24, which provides an exit point 28. The PAL can be a gown-in/gown-out room. Clean room 16 also has a docking bay 26,

which is where entry/exit point 30 from structure 10a connects to using the connector unit. The mobile modular structure 10a and 10b are shown with two air-handling units and a bag-in/bag-out filtration system, e.g., a high-efficiency particulate air (HEPA) filtration system.

FIG. 2 depicts the connector unit connecting mobile modular structure 10b to a corridor structure 20. Corridor structure 20 has a docking bay entry 34 which connects to entry point 18 in MAL room 22, and docking bay exit 32 which connects to exit point 28 in PAL room 24. However, the connector unit can be used to connect two or more structures wherein at least one of the structures being connected includes at least one of cleanrooms, isolation cubicles, containment cubicles, pods, modules, units, buildings, corridors, hallways, mobile structures, and access structures.

FIG. 3 depicts a closer and more detailed cross sectional top view of various embodiments of the alignment system of the connector unit, aligning mobile modular structure 10b to corridor structure 20. The alignment system is located between the outside wall 40 of cleanroom 16 and on the outside wall 42 of corridor structure 20, and can be positioned on any pair or any combinations of pairs of the surfaces between 40 and 42, 44 and 46, or 48 and 50 to help align and connect entry and exit 18 and 28 with docking bay entry and exit 34 and 32. The figure depicts a closer cross-sectional view of different embodiments of the alignment system between surfaces 40 and 42. One embodiment of the alignment system is a pair of protruding interlocking triangular wedges 80 and 82, with wedge 80 on outside cleanroom wall 40a and wedge 82 on outside corridor wall 42a. Another embodiment is a compressible protruding winged structure 86 on the outside corridor wall 42b, which compresses and fits into rectangular cutout 84 in the outside cleanroom wall 40b. The compression of the winged structure 86 inside the cutout 84 allows the accurate docking of the structures. Another embodiment is a protruding pointed house structure 90 on outside corridor wall 42c which aligns and fits into pointed house cutout 88 in outside cleanroom wall 40c. The pointed head on structure 90 allows for accurate and precise placement when sliding into the pointed cut out 88. Yet, another embodiment, this time with the protruding rounded half ellipse structure 92 being on the outside cleanroom wall 40d instead, which will align and fit into rounded half ellipse cutout 94 in outside corridor wall 42d. The rounded structure 92 allows for easy precise placement and docking of the modular mobile structure 10b. The alignment system however can be any type of cast and mold system, with a protruding cast of any shape on either outside wall 40 or 42, being used to align and fit into a complementary mold of the

cast on the opposite wall. Additional multiple designs that can be used for the alignment system including a tongue and groove design, interlocking structures, dovetail joints, and crenellated joints.

FIG. 4 depicts a closer and more detailed top view and various cross-sectional embodiments of the sealing system of the connector unit connecting mobile modular structure 10b to corridor structure 20. The sealing system borders cleanroom 16 entry and exit points 18 and 28, and corridor structure 20 docking bay entry and exit 34 and 32, between surfaces 40 and 42, 44 and 46, and 48 and 50. A cross-sectional top view of the sealing between surfaces 44 and 46 is shown with various embodiments of the sealing.

One embodiment is a single layer, rounded rectangular seal 60 that is placed between surfaces 44a and 46a. The seal can positioned opposite of the seal 60 shown by placing the seal on surface 46a instead of 44a (not depicted). Alternatively, the seal 60 can enter a groove 61 in surface 46a, with the volume of the seal 60 being equal to or greater than the volume of the groove 61 in surface 46a. The groove 61 and seals 60 can be positioned on either surface 44a or 46a, can be alternated, and can also surround the openings between cleanroom 16 and corridor 20.

Another embodiment is a double layer, thinner rounded seal 62 on surface 44b, which fits into grooves 63 on surface 46b or can contact surface 46b directly. Seal 62 and grooves 63 can be positioned vice versa with the seal on surface 46b instead, and the grooves 63 on surface 44b. The groove 63 and seals 62 can be positioned on either surface 44b or 46b, can be alternated, and can also surround the openings between cleanroom 16 and corridor 20.

Another embodiment is a trapezoidal shaped seal 64 between surfaces 44c and 46c wherein the seal would be thicker against one surface (or vice versa). The seal 64 can be positioned on surface 46c instead of 44c. Likewise, the seal 64 shown herein is not limited to a specific surface, but can be on surface 46c with the thicker lining against surface 44c. As with the embodiment described above, the seal 64 can enter the grooves 65 or directly contact the surface 46b (or vice versa). The groove 65 and seals 64 can be positioned on either surface 44c or 46c, can be alternated, and can also surround the openings between cleanroom 16 and corridor 20.

The fourth embodiment shows a single layer wider rounded seal 66 between surface 44d and 46d. Again, The seal 66 can be on surface 46d instead of 44d. As with the embodiment

described above, the seal 68 can enter the grooves 67 or directly contact the surface 46b (or vice versa). The groove 67 and seals 66 can be positioned on either surface 44d or 46d, can be alternated, and can also surround the openings between cleanroom 16 and corridor 20. The seal or seal system of the connector unit between the structures shall be reversible allowing the two structures to be undocked and separated when necessary. The seal system needs to not allow any air leaks, and must be able to stay intact for a prolonged period of time. There are multiple other designs available for the seal or seal system between the two or more structures, or one or more structures and the environment. The seal system designs for the connector unit can include at least one of induction sealing, cap sealing, adhesive sealant, bodok seal, Bridgman seal, compression seal fitting, diaphragm seal, ferrofluidic seal, a gasket, flange gasket, o-ring, o-ring boss seal, glass-ceramic-to-metal seals, piston ring, hose coupling, hermetic seal, hydrostatic seal, hydrodynamic seal, labyrinth seal, face seal, plug, radial shaft seal, siphon trap, split mechanical seal, wiper seal, dry gas seal, or exitex seal.

FIG. 5 depicts a closer and more detailed cross sectional, top view of various embodiments of the fixation system of the connector unit. Here, the fixation system would lock the mobile modular structure 10 and the corridor structure 20 together after the structures have been aligned and docked together. The fixation system keeps the structures together and avoids unintentional movements. The fixation system would be position on the outer edge of the mobile modular structure 10b between either surfaces 40 and 42, 44 and 46, 48 and 50, or any combinations of the pair of surfaces. Closer cross-sectional views of various embodiments of the fixation system are shown between surfaces 40 and 42. One embodiment of the fixation system shows a rigid swiveling hook 70 on surface 40a that swings onto a counter hook 72 on surface 42a. The hooks can be positioned vice versa with the swiveling component 72 on the outer corridor wall 42a, and the fixed counter hook on the outer cleanroom wall 40a. Another embodiment shows a rounded clip and capping system wherein a clip 74 interlocks with clip 76 and then held together by a swiveling cap 77. A third embodiment shown is the mobile modular structure 10b and the corridor structure 20 affixed together by magnetic couplings 78. These fixation systems do not only have to be between a single pair of surface 40 and 42, but can be between multiple pairs of surfaces including 44 and 46, or 48 and 50, or all. Multiple designs for the fixation system are available and can

include at least one of clamps, spring loads, bolts, magnetic coupling, bayonet coupling, or locks.

It is contemplated that any embodiment discussed in this specification can be implemented with respect to any method, kit, reagent, or composition of the invention, and vice versa.

5 Furthermore, compositions of the invention can be used to achieve methods of the invention.

It will be understood that particular embodiments described herein are shown by way of illustration and not as limitations of the invention. The principal features of this invention can be employed in various embodiments without departing from the scope of the invention. Those skilled in the art will recognize, or be able to ascertain using no more than routine
10 experimentation, numerous equivalents to the specific procedures described herein. Such equivalents are considered to be within the scope of this invention and are covered by the claims.

All publications and patent applications mentioned in the specification are indicative of the level of skill of those skilled in the art to which this invention pertains. All publications and
15 patent applications are herein incorporated by reference to the same extent as if each individual publication or patent application was specifically and individually indicated to be incorporated by reference.

The use of the word “a” or “an” when used in conjunction with the term “comprising” in the claims and/or the specification may mean “one,” but it is also consistent with the meaning of
20 “one or more,” “at least one,” and “one or more than one.” The use of the term “or” in the claims is used to mean “and/or” unless explicitly indicated to refer to alternatives only or the alternatives are mutually exclusive, although the disclosure supports a definition that refers to only alternatives and “and/or.” Throughout this application, the term “about” is used to indicate that a value includes the inherent variation of error for the device, the method being
25 employed to determine the value, or the variation that exists among the study subjects.

As used in this specification and claim(s), the words “comprising” (and any form of comprising, such as “comprise” and “comprises”), “having” (and any form of having, such as “have” and “has”), “including” (and any form of including, such as “includes” and “include”) or “containing” (and any form of containing, such as “contains” and “contain”)
30 are inclusive or open-ended and do not exclude additional, unrecited elements or method steps.

The term “or combinations thereof” as used herein refers to all permutations and combinations of the listed items preceding the term. For example, “A, B, C, or combinations thereof” is intended to include at least one of: A, B, C, AB, AC, BC, or ABC, and if order is important in a particular context, also BA, CA, CB, CBA, BCA, ACB, BAC, or CAB.

5 Continuing with this example, expressly included are combinations that contain repeats of one or more item or term, such as BB, AAA, AB, BBC, AAABCCCC, CBBAAA, CABABB, and so forth. The skilled artisan will understand that typically there is no limit on the number of items or terms in any combination, unless otherwise apparent from the context. In certain embodiments, the present invention may also include methods and
10 compositions in which the transition phrase “consisting essentially of” or “consisting of” may also be used.

As used herein, words of approximation such as, without limitation, “about”, “substantial” or “substantially” refers to a condition that when so modified is understood to not necessarily be absolute or perfect but would be considered close enough to those of ordinary skill in the art
15 to warrant designating the condition as being present. The extent to which the description may vary will depend on how great a change can be instituted and still have one of ordinary skilled in the art recognize the modified feature as still having the required characteristics and capabilities of the unmodified feature. In general, but subject to the preceding discussion, a numerical value herein that is modified by a word of approximation such as “about” may
20 vary from the stated value by at least ± 1 , 2, 3, 4, 5, 6, 7, 10, 12 or 15%.

All of the compositions and/or methods disclosed and claimed herein can be made and executed without undue experimentation in light of the present disclosure. While the compositions and methods of this invention have been described in terms of preferred
25 embodiments, it will be apparent to those of skill in the art that variations may be applied to the compositions and/or methods and in the steps or in the sequence of steps of the method described herein without departing from the concept, spirit and scope of the invention. All such similar substitutes and modifications apparent to those skilled in the art are deemed to be within the spirit, scope and concept of the invention as defined by the appended claims.

U.S. Patent No. 5,125,203

U.S. Patent No. 5,713,791

U.S. Patent No. 6,634,149

What is claimed is:

1. A connector unit for connecting two or more structures wherein at least one of the two or more structures being connected is a mobile structure validated for pharmaceutical manufacturing or patient care, the connector unit comprising:

5 an alignment system to precisely dock the two or more structures together;

a seal or seal system to create an air tight seal between two or more structures, or one or more structures and an environment; and

10 a fixation system to affix the two or more structures and prevent unintentional movements of the two or more structures, or breakage of the seal or seal system, wherein the unit can be used to connect one, two, or more previously validated pharmaceutical manufacturing or patient care units.

2. The connector unit of claim 1, wherein the two or more structures being connected further comprise at least one of cleanrooms, isolation cubicles, containment cubicles, pods, modules, units, buildings, corridors, hallways, mobile structures, and access structures.

15 3. The connector unit of claim 1, wherein the alignment system allows the two or more structures to be pushed against each other and aligned in the same movement.

4. The connector unit of claim 1, wherein the connection between the two or more structures can be disconnected, separated, and then reattached.

20 5. The connector unit of claim 1, wherein the seal or seal system between the two or more structure, or one or more structures and the environment is reversible.

6. The connector unit of claim 1, wherein the seal or seal system between the two or more structures or one or more structures and the environment further comprise at least one of induction sealing, cap sealing, adhesive sealant, bodok seal, Bridgman seal, compression seal fitting, diaphragm seal, ferrofluidic seal, a gasket, flange gasket, o-ring, o-ring boss seal, 25 glass-ceramic-to-metal seals, piston ring, hose coupling, hermetic seal, hydrostatic seal, hydrodynamic seal, labyrinth seal, face seal, plug, radial shaft seal, siphon trap, split mechanical seal, wiper seal, dry gas seal, and exitex seal.

7. The connector unit of claim 1, wherein the fixation system further comprise at least one of clamps, spring loads, bolts, magnetic coupling, bayonet coupling, or locks.

8. The connector unit of claim 1, wherein a volume of a seal between the two or more structures is equal to or greater than a volume of a groove on an opposite surface.

9. The connector unit of claim 1, wherein the seal surrounds an opening between the two or more structures to provide a hermetic seal.

5 10. A method for connecting two or more structures with a connector unit wherein at least one of the two or more structures being connected is a mobile structure validatable for pharmaceutical manufacturing or patient care, the method comprising:

aligning the two or more structures to precisely dock the two or more structures together;

10 sealing the two or more structures, or one or more structures and an environment air tight with a seal or a sealing system; and

affixing the two or more structures together solidly to prevent unintentional movements of the two or more structures, or breakage of the seal or seal system, wherein the unit can be used to connect one, two, or more previously validated pharmaceutical
15 manufacturing or patient care units.

11. The method of claim 10, wherein the two or more structures further comprise at least one of cleanrooms, isolation cubicles, containment cubicles, pods, modules, units, buildings, corridors, hallways, mobile structures, and access structures.

12. The method of claim 10, wherein the alignment system allows the two or more
20 structures to be pushed against each other and aligned in the same movement.

13. The method of claim 10, wherein the connection between the two or more structures can be disconnected, separated, and then reattached.

14. The method of claim 10, wherein the seal or seal system between the two or more structure, or one or more structures and the environment is reversible.

25 15. The method of claim 10, wherein the seal or seal system between the two or more structures or one or more structures and the environment further comprise at least one of induction sealing, cap sealing, adhesive sealant, bodok seal, Bridgman seal, compression seal fitting, diaphragm seal, ferrofluidic seal, a gasket, flange gasket, o-ring, o-ring boss seal, glass-ceramic-to-metal seals, piston ring, hose coupling, hermetic seal, hydrostatic seal,
30 hydrodynamic seal, labyrinth seal, face seal, plug, radial shaft seal, siphon trap, split mechanical seal, wiper seal, dry gas seal, and exitex seal.

16. The method of claim 10, wherein the fixation system further comprise at least one of clamps, spring loads, bolts, magnetic coupling, bayonet coupling, or locks.
17. The method of claim 10, wherein a volume of a seal between the two or more structures is equal to or greater than a volume of a groove on an opposite surface.
- 5 18. The method of claim 10, wherein the seal surrounds an opening between the two or more structures to provide a hermetic seal.
19. A method for connecting two or more structures with a connector unit wherein at least one of the two or more structures being connected is a mobile structure validatable for pharmaceutical manufacturing or patient care, the method comprising:
- 10 aligning the two or more structures to precisely dock the two or more structures together, sealing the two or more structures, or one or more structures and an environment air tight with a seal or a sealing system, and
- affixing the two or more structures together solidly to prevent unintentional movements of the two or more structures, or breakage of the seal or seal system.
- 15 20. The method of claim 19, wherein the two or more structures further comprise at least one of cleanrooms, isolation cubicles, containment cubicles, pods, modules, units, buildings, corridors, hallways, mobile structures, and access structures.