SELF-CLEANING SECTIONAL PANEL TANK

The present application claims a priority date of patent application Nr. 18/433,463 (published as US2024/0174437A1 on 30 May 2024), which was filed with USPTO (United States Patent and Trademark Office) on 06 February 2024 (i.e., 02/06/2024), and has the title of Self-Cleaning Sectional Panel Tank. Relevant content and/or subject of the earlier priority patent application is hereby incorporated by the present reference wherever appropriate.

The field of this invention pertains to liquid storage systems, specifically to the design and operation of sectional panel tanks used for storing water and other liquids. It relates to the mechanisms and methods for maintaining the cleanliness and hygiene of such tanks through automated self-cleaning processes that employ integrated sprinkler systems for the distribution of cleaning and disinfectant solutions. This invention falls within the technical field of industrial cleaning systems, with a particular focus on improving maintenance efficiency and ensuring compliance with health and safety standards in water storage facilities.

Traditional cleaning methods typically require manual labour to scrub and rinse the tank's interior surfaces. This process is labour-intensive, time-consuming, and can lead to inconsistent cleaning results. Manual cleaning necessitates significant downtime for the tank, interrupting regular operations and leading to potential losses, especially in industrial or municipal settings where continuous water supply is critical. Some tanks have hard-to-reach areas, making thorough cleaning difficult. This can result in the accumulation of sediments, biofilms, and other contaminants that can compromise the quality of the stored liquid. Personnel performing manual cleaning may be exposed to hazardous conditions, especially when dealing with chemicals or confined spaces that pose health risks. The handling and dosing of cleaning chemicals require precision and can pose environmental and safety risks if not managed properly. Ensuring that tanks meet health and safety regulations through manual cleaning can be challenging, leading to potential violations and associated penalties.

Therefore, there is a need in the art for a self-cleaning sectional panel tank which can overcome these drawbacks. The present invention addresses these drawbacks by introducing an automated self-cleaning tank system.

The present application is described hereinafter by various embodiments. This application may, however, be embodied in many different forms and should not be construed as limited to the embodiment set forth herein.

The principle behind the invention of the self-cleaning sectional panel tank is to automate the cleaning process of tank interiors, ensuring effective and consistent hygiene maintenance with minimal manual intervention. The tank is designed to incorporate unit panels that join together to form the tank's structure, and include strategically placed directional sprinkler nozzles that dispense a cleaning and/or disinfectant solution throughout the interior surfaces. The primary problem statement addressed by this invention is the challenge of maintaining cleanliness and hygiene in sectional panel tanks, which are commonly used for storing water and other liquids.

Traditional cleaning methods are labour-intensive, time-consuming, and often insufficient, leading to contamination risks and difficulty in complying with health and safety regulations. This invention aims to solve these problems by providing a self-cleaning tank that can automatically mix and dispense cleaning solutions, effectively reach all interior surfaces with adjustable nozzles, and monitor and maintain water quality through integrated sensors and automation technologies. The system is designed to be self-contained, reducing the need for external cleaning services, and to ensure that the tank can be kept clean with minimal downtime and operational disruption.

As a first aspect, the present application discloses a sectional panel tank (i.e. panel tank, panel assembled tank or concealed container). The sectional panel tank comprises one or more side walls (i.e., sidewalls) that are joined together in forming the sectional panel tank. The side wall comprises a first unit panel having a first extension at a first edge of the first unit panel and a second unit panel having a second extension at a second edge of the second unit panel. The extensions (e.g., first extension, second extension) are also known as flanges, which may be folded or bent (e.g., at about 90^{o}) at the edges of the unit panels respectively. The second extension and the second extension are preferably joined together contiguously by fasteners (e.g., bolts and nuts) such that no gasket is required at their contacting areas. Accordingly, the second unit panel is then connected or attached to the first unit panel for providing a continuous surface of the side wall. As a whole, the first unit panel and the second unit panel provide structural support to the side wall or the sectional panel tank. The first unit panel or

the second unit panel may have various designs in terms of shape and dimensions. In some implementations, the first or the second unit panel size has a typical size of 1 meter (m) X 1 meter (m) and a typical thickness of 20 millimetres (mm). It is understood to the skilled person that the thickness of the unit panel is also dependent on its materials. For example, the unit pane made of fiberglass reinforced polymers (FRP) typically has the thickness of 5 to 10 millimetres (mm); while the unit panel made of stainless steel (SUS standard) has the thickness of 2 to 4 millimetres (mm), subject to the height of the sectional tank.

The first unit panel and the second unit panel are optionally made of impermeable, corrosion resistive or resistant and structurally robust materials. For example, the unit panels or the side wall of the sectional panel tank may comprise hot pressed metals or metal alloys sheets, such as stainless steel (SUS 304 or SUS 316), mild steel (such as hot dipped galvanized (HDG) or epoxy coated), copper, bronze, brass or galvanized steel; plastics, such as polyethylene or polypropylene; and composites, such as fiberglass reinforced polymers (FRP) (FRP/SUS or HDG/SUS), or glass reinforced plastics (GRP), including rubbers, EPDM, and mixture of rubber and plastics. The unit panels made of plastics or composites are particularly suitable for chemical equipment such as tanks or vessels. For example, the chemical equipment with a size ranging from less than 1 meter to 200 meters are fabricated by FRP unit panels. In addition, the first unit panel and/or the second unit panel may be treated with any coating for additional functions, e.g., an impermeable coating (such as fluoropolymer, epoxy, phenolic, phosphate, PTFE and FEP) for water sealing; a water repellent coating (such as silicone, polyurethane and zinc) for water resisting; and a corrosion-proof or chemical resistant coating (such as PE, PP, PVDF and ECTFE) for preventing corrosion. In particular, an ultraviolet (UV) laminate or gel coating is applied onto the FRP unit panel for preventing any damage caused by ultraviolet (UV) rays and meanwhile making a smooth surface.

The first unit panel and the second unit panel have substantially similar or identical shapes (e.g. square, rectangular, hexagonal), profiles, sizes, structures, materials and/or mechanical strength so that the first and second panels can be mass produced and standardized. In addition, surfaces or contours of the first unit panel, the second unit panel, the side wall or a combination of any of these (segments, panels, walls) can be curved (e.g. 3D geometric shape or 2D geometric shape) or straight. For example, the first unit panel and the second unit panel are aligned at an angle substantially larger than 90^{o}, 120^{o}, 150^{o} (e.g. around 180^{o} for being a flat side wall).

The first unit panel and the second unit panel are joined, affixed, or fastened together either detachably or permanently. In particular, they are contiguously, directly or immediately joined with direct surface contact at and/or by the first extension and the second extension without any intermediate materials, e.g. in the absence of any gasket, mechanical seal by the at least one fastener on the first extension and the second extension. In other words, the extensions or flanges of the first and second unit panels directly contact each other without any intermediate material so that the extensions or flanges can be tightened together strongly. Therefore, the first unit panel and the second unit panel have a line of division exposed, known as a seam joint.

The first extension and the second extension may adopt any form that provides structural support to the first unit panel and the second panel respectively. In particular, the first extension and the second extension are firmly and inflexibly jointed by touching each other directly without any foreign component between their contacting surfaces in order to form the side wall in a rigid form.

In some implementations, the first extension has one or more first flanges (or any other first external or internal ridge or rim for attachment) at the edges of the first unit panel. A flange is an example of the first extension or second extension, which is an external or internal ridge of the first unit panel, the second unit pane or another panel as an extra rim or lip, which provides structural support for strength, as a flange of an iron beam, an I-beam or a T-beam; or for attachment to another object, as the flange on the end of a pipe, steam cylinder, etc., or for a flange of a rail car or tram wheel. The first flange is folded from an inner side to an external side of the first unit panel or the sectional panel tank. The external side is a side exposed to air or ambient when the sectional panel tank is filled with content. Similarly, the second extension has one or more second flanges (or any other second external or internal ridge or rim for attachment) at the edges of the second unit panel. The second flange is also folded from an inner side to an external side of the second unit panel or the sectional panel tank. As discussed above, the first flange and the second flange are firmly and inflexibly jointed by touching each other directly without any foreign component (such as a gasket) between their contacting surfaces.

In some implementations, the first extension comprises a first margin (i.e. flange) of the first unit panel at its edges; while the second extension comprises a second margin (i.e. flange) of the second unit panel at its edges. The first margin or second margin preferably comprises an engagement hole (i.e. through hole, perforation) for receiving a securing means (e.g. fastener). The first margin and the second margin are directly fastened together (e.g. stacked) for making the first unit panel and the second unit panel as a unitary piece, thereby forming the side wall of the sectional panel tank. In particular, the first margin and the second margin have substantially similar or identical materials and/or thicknesses respectively, so that the first margin and the second margin can be produced along with the first unit panel and the second unit panel respectively. The first margin or the second margin may be also known as flange.

The sectional panel tank optionally comprises a jointer (also known as a plaster, a paste or any solidified plastic material), such as polymeric welding joint applied at the seam on inner sides of the first unit panel and the second unit panel of the sectional panel tank. The jointer thus bridges a gap between the neighbouring unit panels such that the inner sides or surfaces of the first unit panel and the second unit panel form a continuous surface, which is impermeable to solid, liquid or gas. Since inner sides of the sectional tank are covered by a continuous sheet or surface of impermeable material (e.g. polymer), the sectional panel obviates the gasket sealing between flanges or unit panels. For example, if inner sides of unit panels of the sectional panel tank are covered by polymer sheets, the jointer can be provided by polymer welding by adopting the polymer similar or identical to that of the inner sides. In particular, the jointer is made of a same material as the first unit panel and the second unit panel (i.e. stainless welding on SUS panel, PP welding on homogenous PP panels). The jointer is applied for preventing any leakage of the liquid or the gas in the sectional panel tank from the seam. The jointer may be formed by any suitable method according to a specific material of the jointer. For example, a thermoplastic welding is adopted when the jointer comprises one or more thermoplastic materials. Accordingly, the jointer is alternatively known as a welding joint, a welder, a sheet joint, a surface joint, a liner joint, a polymer joint or a polymer welding joint, butt weld joint, hot gas weld joint, electro fusion weld joint, extrusion weld joint, infrared weld joint, ultrasonic weld joint, laser weld joint, etc. depending on relevant materials or methods adopted.

In some implementations, the jointer has a conductive strip applied at the seam on the inner sides of the first unit panel and the second unit panel if the inner sides have thermoplastic materials. The conductive strip has electrical conducting materials (such as carbon particles, carbon nanotubes or graphene, metal particles) which are embedded inside a thermoplastic base material (such as HDPE) and form continuous electrical conducting paths. When the conductive strip is subjected to an induction heater having an electromagnet and an electronic oscillator, a high-frequency alternating current (AC) through the electromagnet would heat the electrical conducting materials (i.e., induction heating) and further melt the thermoplastic base material for sealing the seam between the first and second unit panels. Preferably, the thermoplastic base material would permeate thorough the seam and be visually inspected externally. If the thermoplastic base material forms a continuous path at the seam from outside the first and second unit panels, the first and second unit panels are reliably connected together.

The first unit panel optionally comprises a structural panel extending between the first extensions (such as the first flanges) at the first edges of the first unit panel for resisting pressure and weight of a load inside the sectional panel tank. The structural panel may comprise any component that has a high strength and good durability under pressure (e.g. water pressure) and various environmental conditions (such as temperature, ultraviolet (UV) radiation, corrosion, wind and rain). In addition, the structural panel may also have embossments (such as a cross embossment at a center of the structural panel) for further resisting the pressure. The structural panel may have various shapes and sizes, such as a square shape with an edge of around 1.2 meter (or around 4.0 feet) or 1.0 meter in length. For another example, the structural panel has a rectangular shape with a length of 2.0 meters and a width of 1.0 meter. For another example, the structural panel has a curved shape for assembling cylindrical sectional panel tank.

The structural panel may have various structure. For example, the structural panel has a single layer made of stainless steel or fiberglass reinforced polymers (FRP). For example, the structural panel has an inner layer made of stainless steel and an exterior layer made of fiberglass reinforced polymers (FRP). In the former case, the first unit panel and the second unit panel are joined via metal welding; and in the latter case, the first unit panel and the second unit panel are joined via solvent welding. Alternatively, the structural panel has an inner layer made of fiberglass reinforced polymers (FRP) and an exterior layer made of stainless steel. Similarly, the first unit panel and the second unit panel are joined via metal welding.

The sectional panel tank optionally comprises one or more linings joined, attached, affixed, adhered or fixed onto the inner side, exterior side or both of the side wall (such as the encapsulation of the unit panel; especially in the case of partition unit panels within the tank itself where both surfaces of the unit panels are exposed to the stored content), in order to prevent biological and chemical corrosion and resultant leakage of the fluid, solid, gas or sludge stored inside the sectional panel tank. The lining may have a dimension large enough for covering an inner area of the sectional panel tank. Moreover, the lining may comprise a plurality of lining sheets. The lining sheets may have a same or various dimensions for covering the first unit panel or the second unit panel. For example, one single lining sheet is used for covering the first unit panel. Alternatively, multiple lining sheets are joined together for covering the second unit panel. In addition, the lining is optionally connected to the jointer at the seam for further strengthening the jointer. In some implementations, the lining has a thickness in a range of 0.5 millimetre (mm) to 6 millimetre (mm), such as 2~4mm (i.e. from two to four millimetres) preferably, or 1 to 5 mm (i.e. from one to five millimetres) preferably. One or more of the lining or linings are extendable and/or flexible. Hence, the one or more linings are able to hold water inside the sectional panel tank even if the unit panels of the sectional panel tank are broken or breached. The unique ability of holding liquid content (e.g. water or hazardous chemical solutions) is beneficial, desired and/or critical for keeping integrity of the sectional panel tank, even when the sectional panel tank experience earthquake, collision and/vibration. Another point for consideration is a “double containment system” wherein two layers of linings are formed over a same side of the unit panel, in such design, even if there is a breach from the inside, no risk would occur of exposure of the content inside the sectional panel tank to the outside. In addition, a leakage sensor can be incorporated between the two linings to detect such breach to effect timely repair. The leakage detection is particular important for storage of hazardous chemicals or waste inside the sectional panel tank.

The lining may comprise a thermoplastic material, a thermoset material or both. The thermoplastic material includes thermoplastics and thermoplastic elastomers. Thermoplastics include but are not limited to PerFluoroAlkoxy (PFA), PolyFluoroEth, Polyethylene (PE) (such as low-density PE (LDPE), Cross Link PE (XLPE), High Density PE (HDPE), and Ultra High Molecular Weight Polyethylene (UHMWPE)), Polypropylene (PP) (such as PP Random

(PPR)), PolyTetraFluoroEthylene (PTFE), EthyleneChloroTrifFluoroEthylene (ECTFE), PolyVinyliDeneFluoride (PVDF), Fluorinated Ethylene Propylene (FEP) and Perfluoroalkoxy Alkanes (PFA). The thermoset material includes but is not limited to EthyleneVinylalcOHol (EVOH), PolyVinylChoride (PVC), PolyStyrene (PS), PolyCarbonate (PC), PolyMethylMethAcrylate (PMMA) and Acrylonitrile Butadiene Styrene (ABS). Therefore, the lining is bound or secured to the inner side of the side wall by a hybrid joining method if the first unit panel is made of metals or metal alloys (such as stainless-steel sheet) or a plastic joining if the first unit panel is made of plastic or composites. In particular, the hybrid joining comprises adhesive and solvent bonding (such as hot-metal adhesive bonding), as well as welding (such as thermal welding). The hybrid joining method is optionally conducted in combination of suitable mechanical bonding (such as gaskets) or joining methods (such as clinching or press joining). An adhesion strength of the lining to the first unit panel is optionally examined or tested by peel test and/or shear test with multiple force-extension courses.

The lining is optionally preformed (e.g. coated, moulded, adhered, attached or casted) onto the inner side, exterior side or both including the first extension (such as the flanges) of the first unit panel. The preforming process may be conducted by any suitable method accordingly to a nature of the sectional panel tank. For example, the sectional panel tank is made of metals (such as stainless steel), the preforming process is conducted by mechanical fastening, adhesive bonding, welding, moulding or a combination of any foregoing technologies.

The mechanical fastening method often uses clamping components or fasteners (such as, nuts, bolts, screws or rivets) or integrated design elements (such as snap-fit or press-fit). In addition, the mechanical fastening may also require mechanical operations such as drilling holes or making screw threads. The mechanical fastening method has several advantages such as simplicity, reliability and easy inspection and repair.

Alternatively, the adhesive bonding method optionally applies adhesives (such as heat sensitive adhesive or pressure sensitive adhesive) between the lining and the first unit panel. The adhesives bond the lining (such as polyester, fiberglass, felt, geotextile, and fabric backed liner (FBL)) and the first unit panel together by creating chemical and/or physical reactions for forming intermolecular forces at an interface of the lining and the first unit panel. The

adhesive bonding method has a major advantage of homogeneously distributing internal stresses throughout both the lining and the first unit panel, especially if incorporating an intermediate layer (e.g. fabric material) between the lining and the first unit panel.

Alternatively, the coating method applies the lining as a coat onto the structural panel. For example, the coating method adopts a thermal spray coating of lining materials to the structural panel whose inner surface is cleaned and roughened before the coating process. The thermal spray coating method is suitable for a variety of materials, including metal alloys, oxide and nonoxide ceramics, plastics, cermets, and composite structures comprised of metals, ceramics, and plastics. The thermal spray coating may generate the lining of various thickness, typically from 2.5 micrometres (μm) to 6.5 millimetres (mm). In addition, the thermal spray coating method has a rapid deposition rate and low processing costs. Furthermore, the thermal spray coating does not need a high temperature and thus would not create hazardous degradation to the structural panel during the processing.

The welding method comprises shielded metal arc welding (SMAW), gas tungsten arc welding (GTAW), gas metal arc welding (GMAW), submerged arc welding (SAW), ultrasonic welding, laser welding, friction stir welding, or friction spot welding when the lining and the unit panel are made of metal materials. For example, the lining material is titanium, whilst the panel material is stainless steel. The specific welding method is selected according to chemical and physical natures of the lining material and the panel material. The specific welding method is selected according to chemical and physical natures of the lining material and the panel material.

The moulding method is conducted by firstly pre-heating the thermoplastics lining, granules or pellets to a soften state and then directly applying the soften lining onto the panel. The moulding method further comprises compression moulding, injection moulding, blow moulding, rotational moulding, extrusion moulding, and thermoforming. In contrast, the preforming process is conducted by a polymeric joining method if the unit panel is made of polymers or polymeric composites (such as Fiberglass Reinforced Polymer (FRP)). The preforming process is thus conducted by mechanical fastening, adhesive bonding, welding, solvent bonding or a combination of any foregoing technologies. The mechanical fastening method and the adhesive bonding method are generally similar to those described above for the sectional panel tank made of metals. The preforming process is applicable to FRP or metal

(e.g. stainless steel), basically independent of the materials of which the unit (substrate) panel is made.

The welding method for polymers or polymeric materials comprises external heating methods including hot-gas welding, hot wedge welding, extrusion welding, hot plate welding, infrared (IR) welding and laser welding; as well as internal heating methods. The internal heating methods further comprises mechanical ways including spin welding, stir welding, vibration welding (i.e. friction welding) and ultrasonic welding; and electromagnetic ways including resistance welding (also known as implant welding or electrofusion welding), induction welding, dielectric welding and microwave welding. In addition, thermal spraying technologies are also suitable for welding of polymers or polymeric materials, including electrical means (such as plasma or arc) or chemical means (combustion flame). In particular, plasma spraying or plasma coating is adopted for welding a thin layer of polymers or polymeric materials.

The solvent bonding method is particularly suitable for preforming the lining onto the unit panel when the unit panel has a layer of thermosetting polymers. In particular, the polymers or polymeric materials are amorphous (such as PolyVinylChoride (PVC), acrylic (AK) and PolyStyrene (PS), PolyCarbonate (PC), PolyMethylMethAcrylate (PMMA) and Acrylonitrile Butadiene Styrene (ABS)). A solvent is applied at the interface of two unit panels for plasticizing the surfaces of the polymers or polymeric materials.

The lining optionally comprises a bonding layer on one surface or both surfaces of the lining. For example, the bonding layer comprises a fabric backed liner (FBL) having a thin layer of any fabric material (such as felt, polyester) to provide a rough or coarse surface for adhesives. For another example, the bonding layer comprises a thin homogenous layer of mechanical fixtures having a plurality of anchors, surface texture, extensions, legs, studs. In particular, various fillers may be embedded inside gaps between studs for specific purposes. When the fillers are porous materials (such as aerogel, rigid polyurethane (PUR), polyisocyanurate (PIR), mineral wool), the lining provides a thermal insulation function, fire resistance function, noise reduction function and a mechanical cushion function. The thermal insulation function ensures that the sectional panel tank is workable in special regions (such as high latitude countries in cold winter) or for special applications (such as spa). The mechanical cushion

function ensures that the lining is tightly pushed against the unit panel under a pressure of the water stored inside the sectional panel tank. In addition, the lining may work as a matrix for holding firmly various functional particular substances inside the lining without losing the functional particles when in contact with water. For example, the lining may hold a self-cleaning particular substance (such as titanium dioxide (TiO_2)) for removing any debris or sediments from the self-cleaning surface automatically. The self-cleaning particular substance is optionally superhydrophobic, superhydrophilic or photocatalytic. The lining may further hold an antimicrobial particular substance (such as silver nanoparticles) for killing any microbial-organism in the water.

The lining optionally comprises a fore layer (or first layer) and a base layer (or second layer). In particular, the fore layer and the base layer are co-extruded at manufacturing to form a homogenous boned liner. Typically, the fore layer and the base layer have a fore colour and a base colour respectively. The base colour is preferably distinctively different to human's eyes from the fore colour, so that any erosion, wear or destruction of an exposed fore layer of the two layers will uncover an underneath base layer of the two layers for an easy vision inspection. If the base colour is observed in the inner side of the sectional panel tank, repair or replacement is then warranted.

Both layers are joined by co-extrusion and/or the base and fore layers are optionally made of a same or similar material for a homogenous joint. In some implementations, the total thickness is in a range from 1.0 to 6.0 millimetres (mm). The base layer and the fore layer have a base thickness and a fore thickness respectively. Typically, the fore layer thickness account for no more than 50% (such as 10% or 30%) of the total thickness.

The sectional panel tank may further comprise a thermal insulation layer for reducing temperature fluctuation of the fluid inside the sectional panel tank. The thermal insulation layer is made of thermal insulation material that slows down heat transfer by conduction or convection, especially in a thickness direction of the first unit panel. The thermal insulation material comprises fiberglass, mineral wool, cellulose, polyurethane foam, polystyrene, aerogel, pyrogel, natural fibres (such as hemp, sheep's wool, cotton and straw) and polyisocyanurate (PIR) foam. The mineral wool further comprises glass wool, rock wool and slag wool. The polystyrene also further comprises expanded polystyrene (EPS) and extruded

polystyrene (XEPS). In particular, the thermal insulation material is preferred to be hydrophobic or non-absorbing to water, such as fiberglass.

The thermal insulation layer is optionally sandwiched between the unit panels and the lining. Due to its light weight, the thermal insulation layer can be held in place without further assistance. In particular, the thermal insulation layer is completely encapsulated by the unit panels and the lining such that the thermal insulation layer would be on one hand protected from external shocks and on the other hand not in touch with the liquid, solids, gas or sludge stored inside the sectional panel tank.

Alternatively, the thermal insulation layer, the external side of the first unit panel is treated or processed for being substantially reflective to light, heat, infrared wave or any other types of irradiation. In particular, since stainless steel (also known as inox steel or inox) is reflective to solar and thermal irradiations, the first unit panel made of stainless steel may achieve a same or similar reflective effect without the treatment. In addition, the reflective effect of stainless steel is further compounded by not converting wavelengths of incoming light. Therefore, solar energies carried by the incoming light are directly sent back into space substantially without atmospheric absorption, which effectively prevents re-radiation from the outside environment.

In addition to the thermal insulation layer, the sectional panel tank may also comprise a radiant barrier layer for further suppressing temperature fluctuation of the fluid inside the sectional panel tank. The radiant barrier layer is reflective to heat radiation (such as visible light or infrared waves) and thus reduces heat transfer. The radiant barrier layer optionally comprises a very thin and mirror-like aluminium foil. Alternatively, an external side first unit panel maybe treated with low heat transmission material such as chromium oxide and Iriotec pigments. It is understood to a skilled person that the thermal insulation is not to limit to heat reflection and heat dispersion layer only, a heat absorption coating on the exterior, interior or both exterior and interior can also be incorporated to keep the sectional panel tanks warm at night and/or during the winter months. In addition, a photovoltaic coating and/or laminate can also be harnessed for energy where needed.

The sectional panel tank optionally further comprises a shield layer for protecting the thermal insulation layer and the fireproofing layer. The shield layer is made of structural material

resisting to loads and impacts. The structural material comprises iron, concrete, aluminium (Al), composites, masonry, timber, adobe, alloy, bamboo, carbon fibres, fibre reinforced plastics and mudbrick. The iron further comprises wrought iron, cast iron, steel and stainless steel. The concrete further comprises reinforced concrete and pre-stressed concrete. The shield layer is optionally positioned externally to the thermal insulation layer and the fireproofing layer.

The sectional panel tank optionally further comprises a cover, an access hole (e.g. manhole), a ladder or a combination of the foregoing objects. The cover is used for partially or completely covering the sectional panel tank for preventing foreign contaminates. The cover optionally comprises a plurality of cover unit panels that are assembled and/or joined together into the single unitary piece of cover. Alternatively, the cover may be a pre-fabricated part and loaded as a whole onto the side wall of the sectional panel tank. The access hole is made as an opening to access the inner space of the sectional panel tank by a worker or technician for inspection, maintenance, or even modification (e.g. upgrading). The access hole is preferably located near a periphery edge of the sectional panel tank of the cover for easy access. The ladder comprises a bottom end at or near the ground; and a top end at or slightly higher than the cover. In particular, the top end is in vicinity of the access hole such that an operator can easily get to the access hole by climbing the ladder until the top end.

The sectional panel tank optionally further comprises a framework (e.g. structural bracing) that is either detachably or permanently connected to the first unit panel, the second unit panel or both for upholding structural integrity of the sectional panel tank. For example, the structural bracing may comprise an internal bracing and/or an external bracing. The internal bracing and the external bracing are often made of steel (such as steel rods) or even polymer which can withhold the designed pressure. The framework is optionally made of wood, engineered wood, concrete, structural steel or a combination of any of these. In addition, the framework comprises a side frame detachably connected to the side wall of the sectional panel tank. The side frame may further comprise a steel beam structure, a portal frame structure (also known as goal post structure), or box frame structure (also known as picture frame structure), or a cage frame structure. The box frame structure is particularly suitable since multiple horizontal bars and multiple vertical poles are combined together to create the box frame structure. Furthermore, the framework may also comprise a roof beam detachably connected

to the cover of the sectional panel tank for maintaining a shape of the cover. The framework comprises one or more rods that connects inner sides or outer sides of two opposite unit panels.

The sectional panel tank optionally further comprises an external foundation (also known as or structure) for supporting the framework. For example, the sectional panel tank comprises a concrete foundation (such as concrete flat foundation or plinth spaced at regular intervals) as the external foundation for supporting the sectional panel tank including the framework. The external foundation may also comprise a I-shaped (double-T) foundation, a slab-on-ground foundation or a frost protected foundation. One or more corner bracings (such as angle bar) are applied at the external foundation for structurally supporting the foundation. The corner bracing has a shape and a size adaptable to a specific foundation.

The framework optionally comprises at least one rod, shaft or other internal bracing that connects or fixes the inner sides of two opposite unit panels. In contrast to the side frame detachably connected to the external side of the sectional panel tank, the rods are secured inside the sectional panel tank by connecting the rods to the inner sides of two first unit panels at opposite sides of the sectional panel tank (i.e. opposite first unit panels). In addition, some internal bracings are tied diagonally to the unit panel.

The sectional panel tank optionally further comprises one or more sensors, communication modules (e.g. Internet-of-Things IoT device), or a combination of these for a monitoring operation status (such as water level) of the sectional panel tank. For example, water leak sensors are embedded behind the lining for detecting any leakage of the lining. If water stored inside the sectional panel tank is leaked though the lining, the water leak sensors would be triggered when the water gets in touch with the water leak sensors. In addition, the sectional panel tank may also have a warning device connected to the sensors and/or the communication modules for generating a warning signal (such as sound or light) to an operator of the sectional panel tank. Furthermore, the sectional panel tank may comprise solar panels for generating and providing electrical power to other components such as the sensors and the communication modules.

The sectional panel tank optionally further comprises a drainage panel having a drainage hole, orifice or valve for discharging the fluid away from the sectional panel tank. In some

implementation, the drainage hole is positioned at a bottom or sidewall of the sectional panel water tank for automatically discharging the fluid due to the gravity. In addition, the sectional panel tank may also comprise an inlet for filling the liquid into the sectional panel tank, an overflow pipe for diffusing the liquid out of the sectional panel tank, and an air vent for ventilation or pressure relief if the sectional panel tank is sealed when in operation.

The sectional panel tank optionally further comprises a cross connector (e.g. external bracket) configured to join four corners of neighbouring unit panels together. The cross connector provides an additional mechanical force for joining the unit panels and thus makes the sectional panel tank a unitary storage device.

The sectional panel tank optionally further comprises an inner partition or board completely encapsulated with the lining for providing an inner portion of the sectional panel tank. In this way, the sectional panel tank is divided into a plurality of smaller and independent cells for storing a same liquid or different liquids. Therefore, each cell may be constructed, maintained, inspected and repaired without any interference from any other cell. In addition, the lining may also be joined or attached to the inner partition for preventing communication of the liquids from individually cells.

The sectional panel tank optionally further comprises a base frame for holding the sectional panel tank at a building site (e.g. ground, rooftop). The base frame is either detachably or permanently attached to the bottom of the sectional panel tank. In addition, the base frame is optionally connected to the external foundation and or the framework of the sectional panel tank.

In addition to the side wall, the sectional panel tank may further comprise a bottom having a bottom extension. The bottom and the side wall are directly joined at the bottom extension and the side wall. For example, the first unit panel further comprises a side extension (such as a side flange) matching the bottom extension (such as a bottom flange) of the bottom. The bottom and the first unit panel are directly or contiguously joined by fixing the side extension and the bottom extension together.

If the sectional panel tank is elevated from the ground, the plastic welding (polymer welding) alone can join a bottom seam between the bottom extension and the side extension. In addition,

the sectional panel tank also comprises a bottom jointer or bottom protector applied at a bottom seam (also known as bottom gap or bottom joint) between the bottom extension and the side wall. The bottom jointer is applied to the bottom seam between the bottom extension and the side extension on the inner side of the first unit panel and an inner side of the bottom respectively. The bottom jointer is similar to the jointer at the seam between the first extension and the second extension. The bottom jointer is used for providing additional coverage that there is no leakage at the bottom seam. The bottom jointer is particularly important in a scenario when the plastic welding cannot reach a standard quality.

The bottom jointer is formed by any suitable method according to a specific material of the bottom jointer. For example, the bottom jointer is made by a thermoplastic welding method. The thermoplastic welding method is conducted by a mechanical welding means, a thermal welding means, an electromagnetic welding means, or a chemical welding means (also known as solvent welding). The mechanical means includes but not limited to ultrasonic welding (20-40 kHz), stir welding (1-100 Hz), vibration welding (100-250 Hz) and spin welding (1-100 Hz). The electromagnetic welding means includes but is not limited to induction welding (5-25 MHz), microwave welding (1-100 GHz), dielectric welding (1-100 MHz) and resistance, implant or electrofusion. The thermal welding means includes but is not limited to hot gas welding (such as tack welding and rod welding), extrusion welding, infrared welding, laser welding, hot wedge welding and hot plate or butt fusion welding. The thermoplastic welding is examined by using various methods for testing welding integrity. The methods include but are not limited to creep test (such as creep rupture test and tensile creep test), impact test, shear test, peel test (BS EN 12814-4), bend test (DVS), tensile test (DVS) and hydrostatic pressure test (ASTM). For example, the thermoplastic welding is examined by a non-destructive test (NDT) for ensuring a welding quality of the bottom. The non-destructive test includes but is not limited to holiday spark test, ultrasonic test, leak-tightness test, radiography and visual inspection (DVS). In particular, the non-destructive test comprises a holiday spark test for identifying unacceptable discontinuities such as pinholes, holidays, bare spots or thin points.

The sectional panel tank is also subjected to leakage test and vacuum test if gas would be stored inside the sectional panel tank. It is understood to a skilled person that the leakage test and vacuum test could refer to known standards, such as standards set by the DVS German Welding Society.

The bottom for the sectional panel tank may comprise a single component of any load bearing material (such as concrete, metal or compacted soil) and the lining is attached thereon for interfacing with the unit wall panel. The single component of the bottom may comprise one or more weight-bearing parts, such as a stainless-steel plate, sump and compacted soil plate for providing a flat bottom surface. The lining is then applied for completely covering the flat bottom surface; and then the sectional panel tank is directly built on the lining and the flat bottom surface. This technology is particularly used for oil storage tanks and chemical waste tanks. Alternatively, the bottom of the sectional panel tank may also comprise a third unit panel and a fourth unit panel similar to the first unit panel or the second unit panel. The third and the fourth unit panels are contiguously joined together for forming the bottom. For example, the bottom extension comprises a third extension (such as a third flange) and a fourth extension (such as a fourth flange) at peripheral edges of the third unit panel and the fourth unit panel respectively. The third extension and the fourth extension are joined together for forming the bottom. In some implementations, the bottom made of unit panels is supported above the ground by plinth or other heavy base. It is understood that the unit wall panels are not limited to a square shape, but might be of any other shapes, which are suitable for constructing a container (e.g. cylindrical container).

Similarly, the sectional panel tank may further comprise a roof. In particular, the roof is made of a chemically resistant material to chlorine gas or other corrosive chemicals (in gas state or liquid state) containing chlorine groups. Similar to the bottom of the sectional panel tank, the roof may be made of a single component (such as a monolithic covering) or assembled by a plurality of the unit panels (i.e. top unit panels) having top extensions. Similarly, the top extensions are joined together for forming the roof. The top extensions may be joined at top joints by nuts or bolts either inwardly (i.e. the top extension extending or pointing into the inner side of the sectional panel tank) or outwardly (i.e. the top extension extending or pointing out of the outer side of the sectional panel tank). In the former case, one or more supporting structures (such as steel bar) are provided below the roof for supporting the top joints since a human or an inspection machine often to walk on the roof. In the latter case, a flat and strong structure may be laid on the roof for covering the top unit panels and the top joints for the human or the inspection machine to walk on the roof. In addition, one or more supporting structures (such as steel bar) are provided at the top extension for supporting the roof.

Meanwhile, the roof and the side wall are directly joined at the top extension and the side wall. For example, the first unit panel further comprises a side extension (such as a side flange) matching the top extension (such as a top flange) of the roof. The roof and the first unit panel are directly joined by fixing the side extension and the top extension together. In some implementations, the side extension is folded in a horizontal direction and is thus parallel to the roof. In some implementations, the top extension is folded in a vertical direction and is thus parallel to the first unit panel. It is noted that all the above technologies joining the bottom and the side wall (such as plastic welding) are also suitable for joining the roof and the side wall.

The sectional panel tank optionally comprises a securing means for securing the first extension and the second extension of the side wall. For example, the first extension and the second extension have a first engaging hole and a second engaging hole respectively. The first engaging hole and the second engaging hole match each other in terms of size and position. The securing means comprises an engaging screw and an engaging nut. The engaging screw passes through the first and second engaging holes from the first extension and then rests on the first extension by a slotted head of the engaging screw. Then the engaging nut secures the engaging screw from the second extension on a thread of the engaging screw and thus fastens the first securing means. In addition, the securing means may further comprise a reinforcement plate arranged between the slotted head of the engaging screw and the first extension for avoiding damages to the first extension. Similarly, the sectional panel tank comprises another securing means for securing the third extension and the fourth extension of the bottom.

The first securing means and the second securing means (e.g. fasteners) may comprise a first coating and a second coating respectively for preventing any leakage from the first and second extensions. The first coating and the second coating are optionally compatible with the lining when covered by the lining, including material compatibility, including chemical compatibility. For example, the first coating and the second coating are made of the thermoplastic material such as PE, PP, PVDF and ECTFE. In particular, the first coating or the second coating is integrated with the first lining or the second lining for forming a unitary component by any method described above (such as co-extruding).

The sectional panel tank optionally comprises a fixture for joining, fastening or fixing the side extension and the bottom extension together. Similarly, the fixture may also comprise a fixing coating compatible with the lining such as thermoplastic material including PE, PP, PVDF and ECTFE. In particular, the fixing coating is also integrated with the lining as a unitary component by any method described (such as co-extruding).

The jointer including the bottom jointer is strongly combined with the lining at their joints by suitable methods according to the materials of the jointer and the lining, such as thermoplastic welding for thermoplastic materials. In some implementations, the combination is so strong that the jointer and the lining become a unitary structure. In other words, the unitary structure would not break first from the joints which has even stronger mechanical properties than the lining itself. In addition, if made of thermoplastic materials, the unitary structure would not be easily broken but expand substantially homogenously under pressure. The homogenous expansion guarantees that there is no weak position for the unitary structure such that the unitary structure can resist a rather large force. The degree of expansion is determined by the specific thermoplastic materials and thickness of the lining sheets under a certain force. For example, the unitary structure would expand for 3 to 9 times, or particularly 4 to 7 times. Therefore, if one of the unit panels of the sectional panel tank is broken or spoiled, water stored inside the sectional panel would be held by the unitary structure and not leaked outside the sectional panel tank. Under pressure of the stored water, the unitary structure would expand homogenously and not be breached easily. As a result, the unitary structure formed by the jointer and the lining provide an additional protection to the sectional panel tank in addition to the unit panels.

As a second aspect, the present application also discloses a prefabricated unit panel for the sectional panel tank of the first aspect. The prefabricated unit panel comprises a structural panel having an extension; and a lining sheet preformed on an inner side of the structural panel for substantially or completely covering the structural panel, including the extension. The lining sheet optionally comprises a thermoplastic material (such as PE, PP, PVDF and ECTFE); while the structural panel optionally comprises metals or metal alloys (such as stainless steel, copper, bronze, brass or galvanized steel), plastics (such as polyethylene or polypropylene), composites (such as fiberglass reinforced plastics (FRP) or glass reinforced plastics (GRP)).

Similar to the lining of the first aspect, the lining sheet comprises a base layer (also known as signal layer) of a first colour and a fore layer of a second colour, such that erosion of one of the layers (such as the fore layer) will expose another layer (such as the base layer) for vision inspection of premature wear or damage. The base layer (i.e. first layer) of the first colour and the fore layer (i.e. second layer) of a second colour are contiguously joined together.

The lining sheet is optionally preformed on an inner side of the structural panel for substantially or completely covering the structural panel, possibly including the extension.

Similar to the securing means of the first aspect, the extension optionally comprises an engaging hole for a securing means such as an engaging screw and an engaging nut. Accordingly, the lining sheet may comprise a through hole matching (e.g. size or diameter similar or identical) the engaging hole of the extension in terms of size and position for the securing means. Therefore, the extension and the lining sheets of one prefabricated unit panel are fixed together with those of another prefabricated unit panel by the securing means.

The lining sheet optionally comprises a bonding layer for bonding to the inner side of the structural panel tightly for forming a unitary structure. The structural panel preferably has a smooth surface facing towards the lining sheet for coupling the lining sheet to the structural panel more reliably via the vacuum forming process. For example, the bonding layer comprises a fabric backed liner (FBL) having a thin layer of any fabric material (such as felt, polyester) for increasing the contact areas. For another example, the bonding layer comprises a thin homogenous layer of mechanical fixtures having a plurality of anchors, surface texture, extensions, legs, studs for increasing the contact areas.

The inner side of the structural panel provides a rough surface for binding the lining sheet tightly for forming a unitary structure. In some implementations, the inner side has a plurality of protrusions for increasing the contact areas between the structural panel and the lining sheet. The protrusions may have any shapes and sizes as long as the protrusions do not create hindrance to the tight bonding of the lining sheet and the structural panel into the unitary component. The lining sheets substantially covers the structural panel completely including the extension for maximizing the contact areas between the structural panel and the lining

sheet. Excessive lining material extending out of the extension is completely trimmed away after the thermoforming process. Alternatively, a small portion of the excessive lining material is kept for the thermoplastic welding for joining two adjacent prefabricated unit panels. As a result, the inner sides of the structural unit panels are completely covered by the lining sheets and thus excluded from contact with water stored in the sectional panel tank. Since the thermoplastic materials are chemically stable and resistance to almost all hazardous wastes (such as biological or chemical solutions), the sectional panel tanked assembled by the prefabricated unit panels are also suitable for storing chemical solutions, in addition to water.

The prefabricated unit panel optionally further comprises a thermal insulation layer sandwiched between the structural unit panel and the lining sheet. The thermal insulation ensures that the sectional panel tank is workable in special regions (such as high latitude countries in cold winter) or for special applications (such as spa). The thermal insulation layer may be made up of any insulation materials which can effectively prevent heat conduction across the structural panel. The thermal insulation layer may have fibrous insulation materials (such as silica, glass fibers, rock wool, mineral wool, slag wool and alumina silica fibres), cellular insulation materials (such as closed-cell polystyrene, polyurethane, polyisocyanurate, polyolefin and elastomers), granular insulation materials (such as calcium silicate, expanded vermiculite, perlite, cellulose, diatomaceous earth and expanded polystyrene), and any combination of the foregoing objects.

In particular, the thermal insulation layer may be made of aerogel which on one hand has excellent thermal insulation with a typical R-value of around 20 due to its extremely low pore sizes for reducing gas conduction and on the other hand incredibly low density between 0.001 to 0.5 gram per cubic meter (g/cm3) for reducing weight of the prefabricated unit panel as a whole. The thermal insulation layer has a spacer for holding the aerogel for maintain a certain thickness of the thermal insulation layer. For example, the space has a porous material having a plurality of pores for the aerogel to fill. In other words, the space act as a backbone to the thermal insulation layer when aerogel is adopted.

In some implementations, the lining sheet, the structural panel and the second thermal insulation layer are formed into the unitary structure via a thermoforming process. The thermoforming process is also known as a plastic thermoforming process since the lining sheet predominantly comprises thermoplastic materials. Exemplary thermoplastic materials include

PerFluoroAlkoxy (PFA), PolyFluoroEth, Polyethylene (PE) (such as low-density PE (LDPE), Cross Link PE (XLPE), High Density PE (HDPE), and Ultra High Molecular Weight Polyethylene (UHMWPE)), Polypropylene (PP) (such as PP Random (PPR)), PolyTetraFluoroEthylene (PTFE), EthyleneChloroTrifFluoroEthylene (ECTFE), PolyVinyliDeneFluoride (PVDF), Fluorinated Ethylene Propylene (FEP) and Perfluoroalkoxy Alkanes (PFA). The thermoset material includes but is not limited to EthyleneVinylalcOHol (EVOH), PolyVinylChoride (PVC), PolyStyrene (PS), PolyCarbonate (PC), PolyMethylMethAcrylate (PMMA) and Acrylonitrile Butadiene Styrene (ABS).

The thermoforming process refers to any process in which the lining sheet is heated to soften, then conforms to the concave or female contours of the structural panel from the inner side under either negative pressure or positive pressure, and finally is cooled to environmental temperature for fixing the concave or female contours. In addition to the concave or female contours from the inner side, the thermoforming process can be also applied to convex or male contours from an external side of the structural panel for attaching another lining sheet or similar thermoplastic sheet to the external side tightly.

The thermoforming process may comprise a vacuum forming process in which the contours are formed under the negative pressure which pulls the lining sheet onto the inner side, the exterior side or both of the structural panel. The vacuum forming process is suitable for relatively large structural panel (such as 1-meter x 1-meter size); and also have lower running costs. Alternatively, the thermoforming process comprises a pressure forming process under the positive pressure. The pressure forming process is suitable for the structural panel which has complex shapes and subtle details on the contours since lining sheet is formed more uniformly with tight tolerances to the contours. It is appreciated that the thermoforming process optionally comprises a combination of the vacuum forming process and the pressure forming process for the relatively large structural panel having complex shapes and subtle details to the contours.

In some implementations, the lining sheet and the second thermal insulation layer are formed into a moulded structure via a moulding process. The moulded structure is then thermoformed with the structural panel into the unitary structure, via the vacuum forming process, the pressure forming process or a combination thereof. As a result, the first thermal insulation

layer and the second thermal insulation layer provide double thermal insulation abilities to the sectional panel tank assembled by the prefabricated unit panels; and the first lining sheet and the second lining sheet also provide double protection abilities for preventing leakage of the water or chemical solutions stored inside the sectional panel tank.

As a third aspect, the present application also discloses a method of making the side wall for the sectional panel tank of the first aspect. The method of making comprises a step of providing a first unit panel having a first extension at its peripheral edge; a step of providing a second unit panel having a second extension at its peripheral edge; a step of directly joining the first unit panel and the second unit panel together by securing a securing means at the first extension and the second extension; and a step of applying a jointer at a seam between the first extension and the second extension on inner sides of the first unit panel and the second unit panel. The jointer is applied by any suitable method discussed in the first aspect. If made of fiberglass reinforced plastics (FRP), the first unit panel and the second unit panel are provided by any suitable method, including sheet moulding compound (such as compression moulding), hand laid, bulk moulding compound (such as injection moulding, transfer moulding and compression moulding), and compression moulding. In particular, the applying step may comprise a thermoplastic welding process. The thermoplastic welding process is optionally conducted by a mechanical welding means, a thermal welding means, an electromagnetic welding means or a chemical welding means.

The method of making optionally comprises a step of joining or attaching a lining onto the inner sides of the first unit panel and the second unit panel separately or collectively. The lining has all the characteristics described in the first aspect. The lining is prepared by any suitable method, including but not limited to injection moulding, pultrusion, rotational moulding, compression moulding, extrusion, thermoforming or vacuum forming, calendaring and blow moulding. In particular, the joining step optionally comprises a thermoforming process. The method of making optionally further comprise a step of examining the jointer by a non-destructive test. The non-destructive test comprises a holiday spark test or vacuum test.

The method of making optionally comprises a step of selecting the lining for resisting corrosion of a predetermined host. For example, the lining is selected not to be made of step-growth polymers (such as polyesters, polyamides o polycarbonates) when the sectional panel

tank stored an acid solution or a base solution as the predetermined host. In addition, the method of making also optionally comprises a step of coating the securing means for avoiding a leakage of the predetermined host. Preferably, the coating is made of a same or similar material with the lining for easily and firmly joining the coating and the lining together. In some implementations, the coating and the lining are integrated together as a unitary component before they are joined onto the unit panel.

The joining step may further comprise a first step of providing a fore layer and a base layer; a second step of co-extruding the fore layer and the base layer for forming a homogenous bonded layer; and a third step of attaching the homogeneous bonded layer onto the inner side of the first unit panel. As described above, the fore layer has a fore colour; and the base layer has a base colour different from the fore colour for an easy visual inspection. In particular, the joining step comprises a step of joining the lining onto the first extension and the second extension for directly joining the first unit panel and the second unit panel. In this way, the method of making does not need any gasket inserted between the first extension and the second extension. Therefore, existing problems of the gasket such as leakage and corrosion are overcome; and the first unit panel and the second unit panel are joined more tightly and durably at the first and second extension.

As a fourth aspect, the present application also discloses in the case of thermoset lining such as PVC, ABS, PMMA (Acrylic), etc. a method of joining an individual lined sectional panel tank having two parts. The method of joining comprises a step of pressing the two parts; and a step of applying a jointer at a seam between the two parts. The two parts of the sectional panel tank is pressed together tightly such that the seam has a dimension less than 0.5 millimetres (mm) for creating a capillary effect. The jointer is in a liquid state and then goes into the seam due to the capillary effect. The jointer is finally fixed at the jointer and completely covers the seam for preventing any leakage. For example, a solution with a resin dissolved or suspended enters into the seam due to the capillary effect; and then the resin is fixed inside and near the seam by solvent welding.

As a fifth aspect, the present application also discloses a method of making the prefabricated unit panel for the sectional panel tank described in the second aspect. The method of making the prefabricated unit panel comprises a step of providing a structural panel having an

extension; a step of providing a lining sheet larger than the structural panel; and a step of attaching the lining sheet onto an inner side of the structural panel. In particular, the lining sheet completely covers the extension of the structural panel.

The lining optionally comprises a thermoplastic material. Accordingly, step of attaching may be conducted by a thermoforming method that is suitable for the thermoplastic material.

The lining optionally comprises a fore layer having a fore thickness and a base thickness having a base thickness. In some implementations, the fore thickness accounts for around 50% of the total thickness, such as ranging from 150 to 200 micrometres.

The structural panel is made of impermeable, corrosion resistive and structurally robust material, including metals or metal alloys (such as stainless steel, copper, bronze, brass, galvanized steel, aluminium, titanium, etc.), plastics (such as polyethylene or polypropylene), composites (such as fiberglass reinforced plastics (FRP) or glass reinforced plastics (GRP) carbon fiber).

The method of making the prefabricated unit panel optionally comprises a step of attaching a thermal insulation layer sandwiched between the structural panel and the lining for reducing temperature fluctuation.

The attaching step optionally comprises a thermoforming process for incorporating the lining sheet and the structural panel tightly into a unitary component if the lining sheet is made of thermoplastic materials. The unitary component can be directly used as the prefabricated unit panel without further processing or modification. The unitary component means the lining sheet would not be detached or removed completely from the structural panel during normal operation of the prefabricated unit panel.

The thermoforming process optionally comprises a vacuum forming process for bonding the lining sheet and the structural panel into the unitary component. The vacuum forming process comprises a step of aligning the lining sheet over the inner side of the structural panel; a step of heating the lining sheet to be pliable for deformation; and a step of forming the lining to the inner side through bonding the lining sheet and the structural panel by a negative pressure or

even substantially vacuum. In the heating step, the lining sheet is controlled to reach a temperature at or slightly above a glass transition temperature (Tg) but well below a rubbery state of the thermoplastic material of which the lining sheet is made. In addition, different locations of the lining sheet may be heated to different temperatures suitable for distinct features of the contours of the structural panel. To a specific location, the more concave or convex, the higher the temperature should be heated to for allowing more pliable deformation of the lining sheet at the specific location.

The forming step may comprise a procedure of moving the structural panel upwardly towards the lining sheet at a predetermined position; a procedure of vacuum forming the lining sheet to the structural panel for transferring contours of the inner side of the structural panel to the lining sheet via vacuum; and a procedure of cooling the lining sheet for crystalizing the contours to the lining sheet. In addition, the forming step optionally further comprises a step of pulling downwardly the lining sheet towards the structural panel for facilitating the step of moving the structural panel towards the lining sheet.

The thermoforming process optionally comprises a pressure forming process. In contrast to the vacuum forming process, the pressure forming process creates a positive pressure for bonding the lining sheet and the structural panel by pushing the lining sheet downwardly towards the lining sheet after the lining sheet is heated to become pliable for deformation. In addition, the thermoforming process may comprise a combination of the vacuum forming process and pressure forming process by creating a negative pressure under the lining sheet for pulling the lining sheet downwardly and a positive pressure above the lining sheet for pushing the lining sheet downwardly, respectively.

The method of making the prefabricated unit panel may further comprise a step of applying an adhesive layer between the lining sheet and the inner side of the structural panel. The adhesive layer provides additional force to bind the lining sheet and the structural panel.

The method of making the prefabricated unit panel may further comprise a step of applying a thermal insulation layer between the lining sheet and the inner side of the structural panel. As described above, the thermal insulation layer is made of low-density materials (such as

aerogel) for being sandwiched between the lining sheet and the structural panel into the unitary structure.

As a sixth aspect, there is provided a self-cleaning sectional panel tank. The tank comprises at least one side wall for joining other side walls in forming the sectional panel tank. The at least one side wall comprises a first unit panel having a first extension at its edge for supporting the first unit panel; and a second unit panel having a second extension at its edge. The first unit panel and the second unit panel are joined together contiguously at the first extension and the second extension by at least one fastener; and at least one directional sprinkler nozzle connected to the at least one side wall configured to discharge a cleaning and/or disinfectant solution onto interior surfaces of the self-cleaning sectional panel tank. Alternatively, instead of fixed directional sprinkler nozzles, the tank could utilize a network of retractable nozzles that extend during the cleaning cycle and retract when not in use to protect them from damage and reduce the risk of interference with the tank's contents. These nozzles could be embedded within the panel walls themselves and connected to an internal manifold that distributes the cleaning and/or disinfectant solution evenly throughout the tank.

In accordance with an embodiment of the present invention, the tank includes an external water pump connected to the sprinkler nozzle to maintain adequate pressure for the cleaning solution. Another embodiment may use an internal pump system that is built into the tank's structure to conserve space.

In accordance with an embodiment of the present invention, the cleaning solution is mixed on-site before the cleaning process. An embodiment could include a pre-mixed solution that is activated by a catalyst introduced just before the cleaning process.

In accordance with an embodiment of the present invention, the solution is drained from the tank after cleaning. An alternative embodiment could use a filtration and recycling system to reduce waste.

In accordance with an embodiment of the present invention, the tank's interior is rinsed with clean water or a neutralization chemical after dispensing the solution. Another embodiment could involve a drying phase using air circulation to remove excess moisture.

In accordance with an embodiment of the present invention, the nozzles can rotate to aerosolize the solution within the tank. An embodiment could feature stationary nozzles combined with a pressurized system to ensure coverage.

In accordance with an embodiment of the present invention, a mixing station automates the dispensing of the solution and clean water using dosing pumps and valves, controlled via Internet of Things Automation (IoTA). A manual version of the mixing station could be used in settings where digital automation is not feasible.

In accordance with an embodiment of the present invention, the tank is equipped with inline sensors for water quality monitoring post-cleaning. An embodiment could have periodic manual sampling for water quality assessment.

In accordance with an embodiment of the present invention, the IoTA-configured inline sensors inform authorities of compliance with water quality standards. Alternatively, a system could involve manual reporting to authorities based on scheduled tests.

In accordance with an embodiment of the present invention, the tank features both fixed and rotatable sprinkler heads for comprehensive interior coverage. Another embodiment could include modular nozzle heads that can be manually adjusted or replaced as needed for different coverage patterns.

In accordance with an embodiment of the present invention, the sprinkler nozzles are strategically placed for uniform distribution of the cleaning solution. In an alternative embodiment, the nozzles could be designed to move along tracks for adjustable positioning.

In accordance with an embodiment of the present invention, sensors integrated within the tank detect water levels to initiate cleaning automatically. Another embodiment might use a manual initiation system that begins the cleaning process based on user input.

In accordance with an embodiment of the present invention, the external water pump is equipped with variable speed control to adjust the cleaning solution's flow rate. An

embodiment could feature pumps with pre-set speeds for different tank sizes, eliminating the need for variable control.

In accordance with an embodiment of the present invention, a booster pump ensures effective reach and dispersion of the cleaning solution. Alternatively, the system could be designed for passive dispersion that relies on the natural flow of water.

In accordance with an embodiment of the present invention, check valves are integrated to prevent backflow and maintain directional flow of the solution. An embodiment could use mechanical barriers or siphon breaks instead of check valves to prevent backflow.

In accordance with an embodiment of the present invention, the mixing station is capable of preparing multiple types of cleaning solutions. A simpler embodiment might employ a single, universal cleaning solution to streamline the cleaning process.

In accordance with an embodiment of the present invention, multiple dosing pumps allow for precise metering of various chemicals into the solution. An embodiment could use gravity-fed dosing to simplify the chemical metering process.

In accordance with an embodiment of the present invention, motorized valves controlled by IoTA automate the regulation of water and cleaning chemicals into the mixing station. A manual valve system could be used for environments where automation is not practical.

In accordance with an embodiment of the present invention, the dosing pumps handle various types of cleaning chemicals, including alkaline, acidic, and neutral agents. An embodiment might feature a single pump system with a selector for different types of chemicals.

According to a second embodiment of the present invention, there is provided a method for a self-cleaning a sectional panel tank. The method comprises steps of providing at least one side wall, wherein the at least one side wall comprises a first unit panel with a first extension at its edge and a second unit panel with a second extension at its edge; joining the first unit panel and the second unit panel together contiguously at the first extension and the second extension using at least one fastener; mixing the cleaning and/or disinfectant solution on-site before each

cleaning; discharging a cleaning and disinfectant solution over interior surfaces of the tank using one or more directional sprinkler nozzles; maintaining adequate pressure during dispensing of the solution using an external water pump connected to the sprinkler nozzles; draining the solution after cleaning; and cleaning interior surfaces with clean water or a neutralization chemical after dispensing the solution. An alternative method for self-cleaning a sectional panel tank could involve a the side walls that would interlock, reducing the need for fasteners. The cleaning solution could be pre-formulated and activated by a trigger rather than being mixed on-site. Finally, the interior surfaces could be treated with an advanced hydrophobic coating that repels contaminants, reducing the frequency and intensity of cleaning required.

In accordance with an embodiment of the present invention, the method includes rotating the nozzles to aerosolize the solution throughout the tank. An embodiment could use a pulsating nozzle system to distribute the cleaning solution without rotation.

In accordance with an embodiment of the present invention, the dispensing of the solution and clean water is automated using IoTA-configured dosing pumps and valves. A semi-automated system requiring partial manual operation could be used in certain applications.

In accordance with an embodiment of the present invention, the method incorporates the integration of inline sensors for water quality monitoring and statutory compliance notification via IoTA. An alternative could include a manual checklist and records for compliance purposes.

In accordance with an embodiment of the present invention, the method activates both fixed and rotatable sprinkler heads for complete tank coverage. An embodiment might use a combination of fixed heads and manually rotated nozzles for selective coverage.

In accordance with an embodiment of the present invention, water pressure is increased using a booster pump to enhance the effectiveness of the cleaning process. The system could be configured to operate at a standard water pressure, using more effective nozzles to compensate.

In accordance with an embodiment of the present invention, the method includes preventing backflow using check valves. An embodiment might position the tank such that gravity assists in preventing backflow without the need for valves.

In accordance with an embodiment of the present invention, the method involves using multiple dosing pumps to introduce different cleaning chemicals. A single dosing system with a manually changeable input could be used for different chemicals.

In accordance with an embodiment of the present invention, the flow regulation of water and chemicals is automated via motorized valves and IoTA. An embodiment could involve manual adjustments to the flow based on observed cleaning efficacy.

In accordance with an embodiment of the present invention, the method allows for user control through an interface connected to the IoTA, providing manual adjustments to the cleaning cycles. A basic embodiment could feature pre-set cleaning cycles that do not require user input.

In accordance with an embodiment of the present invention, the method includes selecting and dosing different types of cleaning chemicals with the dosing pumps to address specific contaminants. An embodiment could use a set mixture of chemicals in a fixed ratio for a generalized cleaning process.

In accordance with an embodiment of the present invention, the method includes the on-site preparation of a fresh batch of cleaning and/or disinfectant solution. Once this new solution is mixed, it is used for a further cleaning process within the tank. The method implies a multi-stage cleaning method, where the tank may undergo multiple cleaning cycles with freshly prepared solutions for improved cleaning efficacy.

The accompanying Figures (i.e., Figs. or FIGS) illustrate embodiments and serve to explain principles of the disclosed embodiments. It is to be understood, however, that these Figures are presented for purposes of illustration only, and not for defining limits of relevant applications. It is to be noted, however, that the appended drawings illustrate only typical

embodiments of this application and are therefore not to be considered limiting of its scope, for the application may admit to other equally effective embodiments.

These and other features, benefits, and advantages of the present application will become apparent by reference to the following text Figure, with like reference numbers referring to like structures across the views, wherein:

Fig. 1 illustrates a partially exploded view of a first sectional panel tank with an external foundation;

Fig. 2 illustrates a partially exploded view of a variant of the first sectional panel tank in Fig. 1;

Fig. 3 illustrates a partially exploded view of the first sectional panel tank without an external foundation;

Fig. 4 illustrate a partially exploded view of a variant of the first sectional panel tank in Fig. 3;

Fig. 5 illustrates (a) an isometric view and (b) a cross-sectional view of a first unit panel from an internal point of view;

Fig. 6 illustrates (a) an isometric view and (b) a cross-sectional view of the first unit panel from an external point of view;

Fig. 7 illustrates a cross-sectional view of a variant of the first unit panel in Fig. 5(b);

Fig. 8 illustrates a cross-sectional view of another variant of the first unit panel in Fig. 5(b);

Fig. 9 illustrate a cross-sectional view of another variant of the first unit panel in Fig. 5(b);

Fig. 10 illustrate a cross-sectional view of another variant of the first unit panel in Fig. 5(b);

Fig. 11 illustrates a cross-sectional view of a modification to the first unit panel in Fig. 8 incorporated with studs;

Fig. 12 illustrate a cross-sectional view of a modification to the variant in Fig. 9 incorporated with studs;

Fig. 13 illustrate a cross-sectional view of another modification to the first unit panel in Fig. 5(b) incorporated with an adhesive layer;

Fig. 14 illustrates (a) a cross-sectional view of two identical unit panels in Fig. 5(b) vertically joined together at a joint, and (b) an enlarged cross-sectional view of the joint;

Fig. 15 illustrate (a) a cross-sectional view of two identical variants of the unit panels in Fig. 8 vertically joined together at a joint, and (b) an enlarged cross-sectional view of the joint;

Fig. 16 illustrates (a) an isometric view and (b) a cross-sectional view of a curved unit panel from an external point of view;

Fig. 17 illustrates a cross-sectional view of two identical curved unit panels joined together;

Fig. 18 illustrates a cross-sectional view of two identical variants of the curved unit panels joined together;

Fig. 19 illustrates a cross-sectional view of another two identical variants of the curved unit panels joined together;

Fig. 20 illustrates a cross-sectional view of another two identical variants of the curved unit panels joined together;

Fig. 21 illustrates a cross-sectional view of two identical modifications of the curved unit panels joined together;

Fig. 22 illustrates a top planar view of another two identical modifications of the curved unit panels joined together;

Fig. 23 illustrates a planar top view of three unit panels of Fig. 5(b) joined together;

Fig. 24 illustrates a planar top view of multiple unit panels of Fig. 5(b) joined together;

Fig. 25 illustrates a cross-sectional view of a unit panel of Fig. 5(b) and a planar unit panel orthogonally joined together;

Fig. 26 illustrates a cross-sectional view of another unit panel without a lining sheet;

Fig. 27 illustrates a cross-sectional view of two unit panels of Fig. 26 vertically joined together;

Fig. 28 illustrates an enlarged cross-sectional view of a lining sheet;

Fig. 29 illustrates a partially exploded view of a second sectional panel tank with an external foundation;

Fig. 30 illustrates a partially exploded view of a variant of the second sectional panel tank in Fig. 29;

Fig. 31 illustrates a partially exploded view of the second sectional panel tank without an external foundation;

Fig. 32 illustrates a partially exploded view of a variant of the second sectional panel tank in Fig. 31;

Fig. 33 illustrates a cross-sectional view of a third sectional panel tank;

Fig. 34 illustrates an enlarged cross-sectional view of a variant of the third sectional panel tank;

Fig. 35 illustrates a partially exploded view of a fourth sectional panel tank;

Fig. 36 illustrates a top view of the fourth sectional panel tank;

Fig. 37 illustrates a cross-sectional view of a curved unit panel;

Fig. 38 illustrates a cross-sectional view of two unit panels of Fig. 37 joining together.

Fig. 39 illustrates a cross-sectional view of a partition tank using the unit panels of Fig. 3;

Fig. 40 illustrates a cross-sectional view of another partition tank using the unit panels of Fig. 10;

Fig. 41 illustrates a cross-sectional view of a vacuum forming process;

Fig. 42 illustrates a self-cleaning sectional panel tank, in accordance with an embodiment of the present application; and

Fig. 43 illustrates a method of working of the self-cleaning sectional panel tank, in accordance with an embodiment of the present application.

The present application is described hereinafter by various embodiments with reference to the accompanying drawing, wherein reference numerals used in the accompanying drawing correspond to the like elements throughout the description. While the present application is described herein by way of example using embodiments and illustrative drawings, those skilled in the art will recognize that the application is not limited to the embodiments of drawing or drawings described and are not intended to represent the scale of the various components. Further, some components that may form a part of the application may not be illustrated in certain Figures, for ease of illustration, and such omissions do not limit the embodiments outlined in any way. It should be understood that the drawings and detailed description thereto are not intended to limit the application to the particular form disclosed, but on the contrary, the application is to cover all modifications, equivalents, and alternatives falling within the scope of the present application as defined by the appended claim. As used throughout this description, the word "may" is used in a permissive sense (i.e., meaning having the potential to), rather than the mandatory sense, (i.e., meaning must). Further, the words "a" or "an" mean "at least one" and the word "plurality" means "one or more" unless otherwise mentioned. Furthermore, the terminology and phraseology used herein is solely used for descriptive purposes and should not be construed as limiting in scope. Language such as "including," "comprising," "having," "containing," or "involving," and variations thereof, is intended to be broad and encompass the subject matter listed thereafter, equivalents, and additional subject matter not recited, and is not intended to exclude other additives,

components, integers or steps. Likewise, the term "comprising" is considered synonymous with the terms "including" or "containing" for applicable legal purposes.

Fig. 1 illustrates a partially exploded view of a first sectional panel tank 100 with an external foundation 130. The first sectional panel tank 100 has a cubic dimension with a bottom 102, a roof or cover 104 and four side walls, including a front wall 106, a rear wall 108 (not shown), a left wall 110 (not shown) and a right wall 112. Therefore, twelve (12) edges 138 of the sectional panel tank 100 are formed for the first sectional panel tank 100. The bottom 102, the cover 104 and the side walls 106, 108, 110, 112 are assembled by multiple unit panels 114 joined together. The first sectional panel tank 100 further comprises an access hole or manhole 116 at a corner of the cover 104, a ladder 118 fixed to the right wall 112, a drainage hole 120 connected to a drainage tube 122, an inlet 124 and an outlet 126 at an upper part and a lower part of the front wall 106 respectively. It is understood to a skilled person that the inlet 124 and the outlet 126 are typically furthest apart from each other for proper circulation of liquid to avoid stagnation. In particular, a top end 128 of the ladder 118 is located inn vicinity of the access hole 116. In addition, the external foundation 130 is laid on the ground for supporting the first sectional tank 100; and an external framework 132 connected to the multiple unit panels for upholding structural integrity of the first sectional panel tank 100. The first sectional panel tank 100 is used for storing a liquid 134 (not shown) inside a space defined by the bottom 102, the cover 104 and the four side walls 106, 108, 110, 112. The liquid 134 is filled into and discharged out of the space through the inlet 124 and the outlet 126. In addition, the liquid 134 is removed from the space through the drainage tube 122 and the drainage hole 120 in a quicker manner. It is understood to a skilled person that the outlet 126 is usually higher than the drainage hole 120 so that any sediments cannot enter into the supply line. Drainage hole 120 is usually the lowest point of the first sectional panel tank 100, where sedimentation can be discharged.

Fig. 2 illustrates a partially exploded view of a variant 150 of the first sectional panel tank 100 in Fig. 1. The variant 150 has a similar structure with the first sectional panel tank 100 and thus features of the variant 150 herein are made references to the first sectional panel tank 100 illustrated in Fig. 1. In addition to the ladder 118, the variant 150 has a second ladder 152 inside the variant 150 for easily getting access into the bottom 102 of the variant 150 via the access hole 116. Furthermore, the variant 150 has a partition 154 for partitioning the variant

150 into two small tanks, i.e. a first tank 156 enclosed by the front wall 106, the rear wall 108, the left wall 110 and the partition 154; and a second tank 158 enclosed by the front wall 106, the rear wall 108, the right wall 112 and the partition 154.

Fig. 3 illustrates a partially exploded view of the first sectional panel tank 100 without an external foundation 130. All features of the first sectional panel tank 100 are identical to those in Fig. 1, except that the bottom 102 is not needed. A compacted and flat soil plate (not shown) is prepared from the ground; and then a piece of lining 136 is spread on the compacted and flat soil plate. The first sectional panel tank 100 is directly built on the lining 136 by erecting the side walls 106, 108, 110, 112 and the joining the cover 104 with the side walls 106, 108, 110, 112. This first sectional panel tank 100 in Fig. 3 is particularly used for oil storage and chemical waste treatment. It is also understood that the first sectional panel tank 100 herein can also be suitable for potable water.

Fig. 4 illustrate a partially exploded view of the variant 170 of the first sectional panel tank in Fig. 3. The variant 170 has a similar structure with the first sectional panel tank 100 and thus features of the variant 150 herein are made references to the first sectional panel tank 100 illustrated in Fig. 3. In addition to the ladder 118, the variant 170 has a second ladder 172 inside the variant 170 for easily getting access into the lining 136 of the variant 170 via the access hole 116. Furthermore, the variant 170 has a partition 174 for partitioning the variant 170 into two small tanks, i.e. a first tank 176 enclosed by the front wall 106, the rear wall 108, the left wall 110 and the partition 174; and a second tank 178 enclosed by the front wall 106, the rear wall 108, the right wall 112 and the partition 174.

Fig. 5 illustrates an isometric view (Fig. 5(a)) and a cross-sectional view (Fig. 5(b)) of a first unit panel 200 from an internal point of view; and Fig. 6 illustrates an isometric view (Fig. 6(a)) and a cross-sectional view (Fig. 6(b)) of the first unit panel in Fig. 5 from an external point of view. The first unit panel 200 comprises a first structural panel 202, a first lining sheet 204 and a first extension 208. The first extension 208 further comprises four flanges folded at substantially 90 degrees at four peripheral edges of the first unit panel 200 respectively, i.e. a first front flange 210 folded at a first front edge 212, a first rear flange 214 folded at a first rear edge 216, a first left flange 218 folded at a first left edge 220, and a first right flange 222 folded at a first right edge 224. The first structural panel 202 thus extends between the four

flanges 210, 214, 218, 222. The first structural panel 202 is made of stainless steel that is impermeable, corrosion resistive, and mechanically robust for resisting pressure of the fluid 134. The four flanges 210, 214, 218, 222 are formed by folding the four edges 212, 216, 220, 224 respectively at substantially 90 degrees. In other words, the four flanges 210, 214, 218, 222 are substantially vertically positioned to the four edges 212, 216, 220, 224 respectively. In particular, the first structural panel 202 has a size less than four square meters and a thickness of around 2 millimetres (mm); while the first lining sheet 204 also has a thickness of around 2 millimetres (mm). Therefore, the first unit panel 200 has a total thickness of around 4 millimetres (mm).

As shown in Fig. 5(b), the first lining sheet 204 has two flat sides, i.e. a first side 242 and a second side 244. The first side 242 is joined to an inner surface 226 of the first structural panel 202 for forming the first unit panel 200 by a thermoforming method. In particular, the first lining sheet 204 completely covers the inner surface 226, including the first structural panel 202 and the first extension 208. The first lining sheet 204 is made of a thermoplastic material such as PE, PP, PVDF, ECTFE. Since in direct contact with the liquid 134, the first lining sheet 204 is required to be water-proof and corrosion resistant to water and almost all chemical solutions. Furthermore, the first unit panel 200 comprises a first embossment 230 on the first structural panel 202 for further strengthening mechanical properties of the first structural panel 202.

Fig. 7 illustrates a cross-sectional view of a variant 2000 of the first unit panel 200 in Fig. 5(b). The variant 2000 has a similar structure with the first unit panel 200 and thus features of the variant 2000 herein are made references to the first unit panel 200 illustrated in Fig. 5(b). In addition to covering the inner surface 226 and the first extension 208, the first lining sheet 204 also covers the external surface 228 of the first structural panel 202. In other words, the first lining sheet 204 encapsulates the first structural panel 202 and the first extension 208 completely. The variant 2000 is particularly suited for partition panels as seen in Fig 2 and Fig 4.

Fig. 8 illustrates a cross-sectional view of another variant 2100 of the first unit panel 200 in Fig. 5(b). The variant 2100 has a similar structure with the first unit panel 200 and thus features of the variant 2100 herein are made references to the first unit panel 200 illustrated in Fig.

5(b). in addition, the variant 2100 has a first thermal insulation layer 206 formed on an external surface 228 of the first structural unit panel 202 for reducing temperature fluctuation of the fluid 134. The first thermal insulation layer 206 is made of fiberglass that is light in weight and also hydrophobic to water. It is noted that the first thermal insulation layer 206 covers a central portion of the first unit panel 200, including the first embossment 230.

Fig. 9 illustrate a cross-sectional view of another variant 2200 of the first unit panel 200 in Fig. 5(b). The variant 2200 has a similar structure with the variant 2100 and thus features of the variant 2200 herein are made references to the variant 2100 illustrated in Fig. 8. In comparison, the first thermal insulation layer 206 is sandwiched between the first structural panel 202 and the first lining sheet 204. In other words, the first thermal insulation layer 206 is attached between the inner surface 226 of the first structural panel 202 and the first side 242 of the first lining sheet 204. Therefore, the first thermal insulation layer 206 for the variant 2200 is known as an inner insulation layer. The first thermal insulation layer 206 also covers the first structural panel 202 completely, but does not extend to cover the first extension 208.

Fig. 10 illustrate a cross-sectional view of another variant 2300 of the first unit panel 200 in Fig. 5(b). The variant 2300 has a similar structure with the variant 2200 and thus features of the variant 2300 herein are made references to the variant 2200 illustrated in Fig. 9. Similarly, the first thermal insulation layer 206 is sandwiched between the first structural panel 202 and the first lining sheet 204; but the first thermal insulation layer 206 is attached to the external surface 228 of the first structural panel 202 due to the complete encapsulation of the first structural panel 202 by the first lining sheet 204 similar to the variant 2000 in Fig. 7. Therefore, the first thermal insulation layer 206 for a variant 2300 is known as an external insulation layer. Meanwhile, the first lining sheet 204 is in direct contact with the inner surface 226 of the first structural panel 202.

Fig. 11 illustrate a cross-sectional view of a modification 2400 to the variant 2100 in Fig. 8 incorporated with studs 240. The studs 240 are either attached to the first side 242 of the first lining sheet 204 or attached to the inner surface 226 of the first structural panel 202. The first side 242 is assembled towards the first structural panel 202; and the second side 244 is in direct contact with water stored in the first unit panel tank 100. A continuous gap 246 is thus formed between the first structural panel 202 and the first side 242 of the first lining sheet 204. A porous filler 248 (such as aerogel) is filled inside the gap 246 as the first thermal insulation

layer 206 for providing thermal insulation. The thermal insulation ensures that the first sectional panel tank 100 is still workable in high latitude countries in a cold winter or for special applications (such as spa). In addition, the porous filler 248 may also provide cushion to external shocks. The cushion function ensures that the first lining sheet 204 is tightly pushed against the first structural panel 202 under a pressure of the water stored inside the first sectional panel tank 100. In particular, the studs 240 do not exist at the flanges 210, 214, 218, 222 for tightly and reliably joined the first side 242 and the first structural panel 202.

Fig. 12 illustrates a cross-sectional view of a modification 2500 to the variant 2200 in Fig. 9 with the studs 240. Similar to the modification 2400 in Fig. 11, the modification 2500 also has the filler 248 filled inside the gap 246 as the first thermal insulation layer 206. At the flanges 210, 214, 218, 222, the first lining sheet 204 is in direct with the first structural panel 202 without the studs 240.

Fig. 13 illustrates a cross-sectional view of another modification 2600 to the first unit panel 200 in Fig. 5(b) with an adhesive layer 2610 when the first lining sheet 204 has a fabric backed liner (FBL). The adhesive layer 2610 adheres the fabric backed liner (FBL) to the inner surface 226 of the first structural panel 202.

A second unit panel 250 is provided for being joined with the first unit panel 200 for forming the first sectional panel tank 100. The second unit panel 250 is identical to the first unit panel 200 as described in Fig. 5. In other words, the second unit panel 200 comprises a second structural panel 252, a second lining sheet 254 and a second extension 258, which resemble the first structural panel 202, the first lining sheet 204 and the first extension 208, respectively. The second extension 258 further comprises a second front flange 260 folded at a second front edge 262, a second rear flange 264 folded at a second rear edge 266, a second left flange 268 folded at a second left edge 270, and a second right flange 272 folded at a second right edge 274. The second lining sheet 254 is also formed on an inner surface 276 and an external surface 278 of the second unit panel 250. The second unit panel 250 also comprises a second embossment 280 for further strengthening mechanical properties of the second structural panel 252.

Fig. 14(a) illustrates a cross-sectional view of the first unit panel 200 at a top side and the second unit panel 250 at a bottom side vertically joined together at a joint 290. The unit panels 200, 250 are joined for forming the side walls 106, 108, 110, 112 of the first sectional panel tank 100 in Fig. 1 to Fig. 4. The first unit panel 200 and the second unit panel 250 are joined at the joint 290 between the first rear flange 214 and the second front flange 260 by a thermoplastic welding method. In addition, a fastener 235 (such as a screw (Nut and Bolt)) also binds the first rear flange 214 and the second front flange 260 at the joint 209.

Fig. 14(b) illustrates an enlarged cross-sectional view of the joint 290 in Fig. 14(a). It is clearly seen that the first rear flange 214 and the second front flange 260 are joined together at the joint 290. In detail, the first lining sheet 204 and the second lining sheet 254 are pressed in direct contact at the joint 290. The joint 290 comprises a seam 292 even if the first lining sheet 204 and the second lining sheet 254 are closely pressed against each other. The thermoplastic welding introduces a jointer 294 for joining the first lining sheet 204 and the second lining sheet 254. The jointer 294 is so strong and reliable that the joint 290 can seal the liquid 134 inside the first sectional panel tank 100 during its normal operation. In contrast to known techniques, no gasket is needed for preventing any leakage from the joint 290.

Fig. 15(a) illustrate a cross-sectional view of two identical variants 2100 in Fig. 8 vertically joined together at the joint 290, i.e. the variant 2100 at a top side and another variant 2150 at a bottom side, each of which has all the features of the variant 2100 in Fig. 8. The variants2100, 2150 are joined for forming the side walls 106, 108, 110, 112 of the first sectional panel tank 100 in Fig. 1 to Fig. 4. Similarly, the variants2100 and 2150 are joined at the joint 290 between the first rear flange 214 and the second front flange 260 by a thermoplastic welding method. In addition, the fastener 235 is also used to bind the first rear flange 214 and the second front flange 260 at the joint 290. In addition, the second variant 2150 has a second thermal insulation layer 256.

Fig. 15(b) illustrates an enlarged cross-sectional view of the joint 290. It is also clearly seen that the first rear flange 214 and the second front flange 260 are joined together at the joint 290 by thermoplastic welding which introduces the jointer 294 for sealing the seam 292. Similar to the Fig. 14(b), no gasket is needed for preventing any leakage from the joint 290.

In addition, the first thermal insulation layer 206, the first embossment 230, the second thermal insulation layer 256 and the second embossment 280 terminate outside the joint 290.

Fig. 16 illustrates (a) an isometric view and (b) a cross-sectional view of a curved unit panel 3000 from an external point of view. Similar to the unit panel 200 in Fig. 5(b), the curved unit panels 3000 has a curved structural panel 3002 which further has an extension 3020. The extension 3020 has a front flange 3022 folded at a front edge 3012, a rear flange 3024 folded at a rear edge 3014, a left flange 3026 folded at a left edge 3016 and a right flange 3028 folded at a right edge 3018. In addition, the curved unit panel 3000 has a curved lining sheet 3004 encapsulating an inner surface 3008 of the curved structural panel 3002, including the extension 3020 (i.e. the flanges 3022, 3024, 3026, 3028).

Fig. 17 illustrates a cross-sectional view of two identical curved unit panels joined together, i.e. a first curved unit panel 3040 and a second curved unit panel 3050, which have the same structures to the curved unit panel 3000 in Fig. 16. In other words, the second curved unit panel 3050 has a second structural panel 3052 which further has a second extension 3070. The second extension 3070 has a second front flange 3072 folded at a second front edge 3062, a second rear flange 3074 folded at a second rear edge 3064, a second left flange 3076 (not shown) folded at a second left edge 3066 (not shown) and a second right flange 3078 (not shown) folded at a second right edge 3068 (not shown). In addition, the second curved unit panel 3050 has a second lining sheet 3054. Similar to the joined unit panels 200, 250 in Fig. 14, the first and the second curved unit panels 3040, 3050 are joined together at a joint 3090. In detail, the curved lining sheet 3004 and the second lining sheet 3054 are pressed in direct contact at the joint 3090. The joint 3090 comprises a seam 3092 even if the curved lining sheet 3004 and the second lining sheet 3054 are closely pressed against each other. The thermoplastic welding introduces a jointer 3094 for joining the curved lining sheet 3004 and the second lining sheet 3054. A fastener 3096 (such as a screw) is also used to bind the rear flange 3024 and the second front edge 3062 at the joint 3009. In contrast to known techniques, no gasket is needed for preventing any leakage from the joint 3090.

Fig. 18 illustrates a cross-sectional view of two identical variants of the curved unit panels joined together; i.e. a first variant 3100 and a second variant 3150. The variants 3100, 3150 have a similar structure with the curved unit panels 3040, 3050 and thus features of the variants

3100, 3150 herein are made references to the curved unit panels 3040, 3050 illustrated in Fig. 17. Different from the curved unit panels 3040, 3050, the curved lining sheet 3004 encapsulates the curved structural panel 3002 entirely, including the inner surface 3008 and an external surface 3010 of the curved structural panel 3002. Similarly, the second lining sheet 3054 encapsulates the second structural panel 3052 entirely, including a second inner surface 3058 and a second external surface 3060 of the second structural panel 3052. The embodiment in Fig. 18 is suitable for the cases where a smaller cylindrical sectional panel tank sits within a bigger cylindrical sectional tank, which contain different substances (such as different liquids) respectively.

Fig. 19 illustrates a cross-sectional view of another two identical variants of the curved unit panels joined together, i.e. a first variant 3200 and a second variant 3250. The variants 3200, 3250 have a similar structure with the curved unit panels 3040, 3050 and thus features of the variants 3200, 3250 herein are made references to the curved unit panels 3040, 3050 illustrated in Fig. 17. Different from the curved unit panels 3000, 3050, the variants 3200, 3250 have a curved thermal insulation layer 3006 and a second thermal insulation layer 3056 respectively. The curved thermal insulation layer 3006 is sandwiched between the curved lining sheet 3004 and the inner surface 3008; while the second thermal insulation layer 3056 is also sandwiched between the second lining sheet 3054 and the second inner surface 3058.

Fig. 20 illustrates a cross-sectional view of another two identical variants of the curved unit panels joined together, i.e. the first variant 3200 and the second variant 3250. The variants 3200, 3250 have a similar structure with the variants 3100, 3150 and thus features of the variant 3200, 3250 herein are made references to the curved unit panels 3100, 3150 illustrated in Fig. 19. In comparison, the curved thermal insulation layer 3006 is sandwiched between the curved lining sheet 3004 and the external surface 3010; while the second thermal insulation layer 3056 is also sandwiched between the second lining sheet 3054 and the second externals surface 3060.

Fig. 21 illustrates a cross-sectional view of two identical modifications of the curved unit panels joined together, i.e., a first modification 3300 and a second modification 3350. The modifications 3300, 3350 have a similar structure with the curved unit panels 3040, 3050 and thus features of the modification 3300, 3350 herein are made references to the curved unit

panels 3040, 3050 illustrated in Fig. 17. In addition, the first modification 3300 has first studs 3310 sandwiched between the inner surface 3008 and the curved lining sheet 3004 for forming a first gap 3320; while the second modification 3350 has second studs 3360 sandwiched between the second inner surface 3508 and the second lining sheet 3504 for forming a second gap 3370. A first filler 3330 and a second filler 3380 are filled into the first gap 3320 and the second gap 3370, respectively. Similar to the filler 248 in Fig. 11 and Fig. 12, the fillers 3330, 3380 may act as the thermal insulation layers 3306, 3356 for providing thermal insulation. Alternatively, the fillers 3330, 3380 may provide cushion to external shocks. The first filler 3330 and the second filler 3380 may be the same or different.

Fig. 22 illustrates a cross-sectional view of another two identical modifications of the curved unit panels joined together, i.e. a first modification 3400 and a second modification 3450. The modifications 3300, 3350 have a similar structure with the curved unit panels 3040, 3050 and thus features of the modification 3300, 3350 herein are made references to the curved unit panels 3040, 3050 illustrated in Fig. 17. The modifications 3300, 3350 have a first adhesive layer 3340 and a second adhesive layer 3390, respectively when the lining sheets 3304, 3354 have fabric backed liner (FBL). The adhesive layers 3340, 3390 adhere the fabric backed liner (FBL) to the inner surfaces 3308, 3358 respectively.

Fig. 23 illustrates a cross-sectional view of three unit panels of Fig. 5(b) joined together, i.e. the first unit panel 200, the second unit panel 250 and a third unit panel 2700 vertically joined at the joint 290 and a joint 2710 in sequence for forming the right wall 112 and the front wall 106, respectively. Similar to the fastener 235, another fastener 2730 is used to further secure the joint 2710.

Fig. 24 illustrates a top planar view of multiple unit panels of Fig. 5(b) joined together for forming the variant 150 of the first sectional unit panel 100. In details, the first unit panels 200 and the second unit panels 250 are joined for forming the front wall 106, the rear wall 108, the left wall 110, the right wall 112 and partition 154, respectively.

Fig. 25 illustrates a cross-sectional view of the first unit panel 200 of Fig. 5(b) and a planar unit panel 2800 orthogonally joined together. The planar unit panel 2800 has a planar structural panel 2810 and a planar lining sheet 2820 formed together. The first unit panel 200 and the

planar unit panel 2800 are joined at a joint 2840 with the first rear flange 214 and a left end 2830 of the planar unit panel 2800. In addition, a fastener 2850 is used to further secure the joint 2840.

Fig. 26 illustrates a cross-sectional view of another unit panel, i.e. a third unit panel 300. Similar to the first unit panel 200 or the second unit panel 250, the third unit panel 300 comprises a third structural panel 302, a third thermal insulation layer 306, and a third extension 308. The third extension 308 further comprises a third front flange 310 folded at a third front edge 312, a third rear flange 314 folded at a third rear edge 316, a third left flange 318 (not shown) folded at a third left edge 320 (not shown), and a third right flange 322 (not shown) folded at a third right edge 324 (not shown). However, the third unit panel 300 does not have a lining sheet similar to the first lining sheet 204 or the second lining sheet 254.

In addition to the third unit panel 300, a fourth unit panel 350 is provided for being joined with the third unit panel 300. The fourth panel 350 is identical to the third unit panel 300 as described in Fig. 26. In other words, the fourth unit panel 300 comprises a fourth structural panel 352, a fourth thermal insulation layer 356, and a fourth extension 358. The fourth extension 358 further comprises a fourth front flange 360 folded at a fourth front edge 362, a fourth rear flange 364 folded at a fourth rear edge 366, a fourth left flange 368 folded at a fourth left edge 370, and a fourth right flange 372 folded at a fourth right edge 374.

Fig. 27(a) illustrates a cross-sectional view of two unit panels 300, 350 vertically joined for forming the side wall 106, 108, 110, 112 of the first sectional panel tank 100 in Fig.1 to Fig. 4. The third unit panel 300 and the fourth unit panel 350 are joined at a joint 390 between the third rear flange 314 and the fourth front flange 360 by a metal welding method. The joint 390 comprises a seam 392 even if the third rear flange 314 and the fourth front flange 360 are closely pressed against each other. The metal welding introduces a jointer 394 for joining the third rear flange 314 and the fourth front flange 360. In contrast to known techniques, no gasket is needed for preventing any leakage from the joint 390. To further prolong the life time of the first sectional panel tank 100, a single and continuous lining 340, instead of the two lining sheets 204, 254 joined together, is used to cover an inner surface 326 of the third unit panel 300, the inner surface 376 of the fourth unit panel 350 and the joint 390 for preventing any leakage. Similarly, the unit panels 300, 350 are also horizontally joined together for forming the bottom 102 and/or the cover 104 of the first sectional panel tank 100. In addition,

an adhesive 330 is applied to the third structural panel 302 and the fourth structural panel 352 before the lining 340 is applied for further fixing the lining in place.

Fig. 27(b) illustrates an enlarged cross-sectional view of a joint 390. The third rear flange 314 and the fourth front flange 360 are pressed against each other without a lining sheet or a known gasket in-between. The joint 390 comprises a seam 392 that is sealed by a jointer 394 by the solvent welding method. The lining 340 is then joined onto the joint 390 from the inner surfaces 326, 376 for further preventing any leakage from the joint 390.

Fig. 28 illustrates an enlarged cross-sectional view of the lining sheet 204, 254. The lining sheet 204, 254 comprises a first layer 296 attached on the inner surfaces 226, 276 of the unit panels 200, 250; and a second layer 298 attached on the first layer 296. In this way, the second layer 298 is in contact with the liquid 134 stored inside the first sectional panel tank 100. The first layer 296 and the second layer 298 has a first thickness 297 and a second thickness 299 of 200 micrometres and 1.8 millimetres respectively. The first layer 296 and the second layer 298 are both made of a same thermoplastic material such as PE, PP, PVDF, ECTFE for easy and reliable attachment. Therefore, the lining sheet 204, 254 has dual protections for liquid leakage since both the first layer 296 and the second layer 298 are water-proof. In particular, the first layer 296 has a blue colour; while the second layer 298 has a black colour. Any erosion or destruction of the second layer 298 will uncover the first layer 296 for an easy vision inspection. If the first colour is observed in the inner surfaces 226, 276 of the lining sheet204, 254, the second layer 298 needs to be replaced or repaired since it is already eroded or destructed. Similarly, the unit panels 200, 250 are also horizontally joined together for forming the bottom 102 and/or the cover 104 of the first sectional panel tank 100.

Fig. 29 illustrates a partially exploded view of a second sectional panel tank 500 with an external foundation 530. Similar to the first sectional panel tank 100, the second sectional panel comprises a bottom 502, a cover 504, a front wall 506, a rear wall 508 (not shown), a left wall 510 (not shown) and a right wall 512 that are built up by multiple unit panels 514. The second sectional panel 500 also comprises an access hole 516, a ladder 518, a drainage hole 520, a drainage tube 522, an inlet 524, an outlet 526 and the external foundation 530. A liquid 534 is stored inside the second sectional panel tank 500.

Instead of the external framework 132, the sectional panel tank 500 comprises an internal framework 532. The internal framework 532 comprises one or more rods 536 that connect the inner sides of two opposite unit panels 514. The rod 536 further comprises one or more beams 538 configured to connect inner sides of the opposite side walls 506, 508, 510, 512; and one or more poles 540 configured to connect inner sides of the bottom 502 and the cover 504. Similar to the structural panel 202, 252, 302, 352, the rod 536 optionally comprises metals or metal alloys (such as stainless steel, copper, bronze, brass or galvanized steel), plastics (such as polyethylene or polypropylene), composites (such as fiberglass reinforced plastics (FRP) or glass reinforced plastics (GRP)). In addition, the rod 536 is completely encapsulated by a lining 542 for resisting corrosion of the liquid 534. Accordingly, the lining 542 is either preformed or applied later on-site. The beam 538 and the pole 540 are arranged vertically to and thus support the side walls 506, 508, 510, 512 and the cover 504 respectively.

Fig. 30 illustrates a partially exploded view of a variant 550 of the second sectional panel tank 500 in Fig. 29. The variant 550 has a similar structure with the second sectional panel tank 500 and thus features of the variant 550 herein are made references to the second sectional panel tank 500 illustrated in Fig. 29. In addition to the ladder 518, the variant 550 has a second ladder 552 inside the variant 550 for easily getting access into the bottom 502 of the variant 550 via the access hole 516. Furthermore, the variant 550 has a partition 554 for partitioning the variant 550 into two small tanks, i.e. a first tank 556 enclosed by the front wall 506, the rear wall 508, the left wall 510 and the partition 554; and a second tank 558 enclosed by the front wall 506, the rear wall 508, the right wall 510 and the partition 554.

Fig. 31 illustrates a partially exploded view of the second sectional panel tank 500 without the external foundation 530. All features of the second sectional panel tank 500 are identical to those in Fig. 29, except that the bottom 502 is not needed. A compacted and flat soil plate 544 (not shown) is prepared from the ground; and then a piece of lining 542 is spread on the compacted and flat soil plate. The second sectional panel tank 500 is directly built on the lining 542 by erecting the side walls 506, 508, 510, 512 and the joining the cover 504 with the side walls 506, 508, 510, 512. This second sectional panel tank 500 in Fig. 31 is particularly used for oil storage and chemical waste treatment.

Fig. 32 illustrates a partially exploded view of a variant 570 of the second sectional panel tank 550 in Fig. 30. The variant 570 has a similar structure with the second sectional panel tank 500 and thus features of the variant 570 herein are made references to the second sectional panel tank 500 illustrated in Fig. 31. In addition to the ladder 518, the variant 570 has a second ladder 572 inside the variant 570 for easily getting access into the lining 536 of the variant 570 via the access hole 516. Furthermore, the variant 570 has a partition 574 for partitioning the variant 570 into two small tanks, i.e. a first tank 576 enclosed by the front wall 506, the rear wall 508, the left wall 510 and the partition 574; and a second tank 578 enclosed by the front wall 506, the rear wall 508, the right wall 510 and the partition 574.

Fig. 33 illustrates a cross-sectional view of a third sectional panel tank 600. The third sectional panel tank 600 shares some features of the first sectional panel tank 100, basically comprising a bottom 602, a cover 604 (not shown), a front wall 606 (not shown), a rear wall 608 (not shown), a left wall 610 and a right wall 612 that are built up by multiple unit panels 614. However, the sectional panel tank 600 is not an independent device that stands by itself, the bottom 602 and the four side walls 606, 608, 610, 612 are surrounded and supported by a facility 636. As shown in Fig. 33, the facility 636 comprises a hole 638 dug in a ground 640 of the earth. Since the ground 640 provides mechanical support to the bottom 602 and four side walls 606, 608, 610, 612, the unit panels 614 are loaded with less pressure from a liquid 634 (not shown) stored in the third sectional panel tank 600. Therefore, the third sectional panel tank 600 does not need additional features such as the external foundations 130, 530, the external framework 132 or the internal framework 532 and embossments 230, 280. Therefore, the third sectional panel 600 is less costly to build and maintain.

Fig. 34 illustrates an enlarged cross-sectional view of a variant 650 of the third sectional panel tank 600. The variant 650 is construed by the multiple first unit panels 200. In contrast to the third sectional panel tank 600, the first unit panel 200 is secured to the ground 640 through a bottom lining 652 via the fastener 654.

Fig. 35 illustrates a partially exploded view of a fourth sectional panel tank 700. In contrast to the sectional panel tanks 100, 500, 600 having a cubic dimension, the fourth sectional panel tank 700 has a cylindrical dimension. The fourth sectional panel tank 700 comprises a bottom 702 (not shown), a cover 704 and a side wall 706 that are assembled by multiple curved unit

panels 714 shown in Figs. 15 to 20. The fourth sectional panel 700 also comprises an access hole 716, a ladder 718, a drainage hole 720, a drainage tube 722 (not shown), an inlet 724, an outlet 726 and an external foundation 730. A liquid 734 (not shown) is stored inside the fourth sectional panel tank 700.

Fig. 36 illustrates a top view of the fourth sectional panel tank 700. It is clearly seen that the fourth sectional panel tank 700 is joined by multiple curved unit panels 714.

Fig. 37 illustrates a perspective view and a cross-sectional view of the curved unit panel 714. The curved unit panel 714 further comprises a structural panel 752 and a thermal insulation layer 756 and an extension 758. In contrast to the extensions 208, 258, 308, 358, the extension 758 comprises four margins at four peripheral edges of the curved unit panel 714 respectively, i.e. a front margin 760 (not shown) at a front edge 762, a rear margin 764 (not shown) at a rear edge 766, a left margin 768 at a left edge 770, and a right margin 772 at a right edge 774. In particular, the four margins 760, 764, 768, 772 are not folded at an angle (such as 90 degrees) to the edges 762, 768, 770, 774 respectively. The structural panel 752 thus extends between the four margins 760, 764, 768, 772.

Two curved unit panels 714 are joined together. Similarly, more curved unit panels 714 are joined together for forming the fourth sectional panel tank 700. Alternatively, a single curved unit panel 714 can also join itself for forming a cylindrical component; and multiple cylindrical components are joined vertically together for forming the fourth sectional panel tank 700. Fig. 38 illustrates a cross-sectional view of two curved unit panels 714 joining together, i.e. a fifth unit panel 750 and a sixth unit panel 751. The right margin 772 of the fifth unit panel 750 and the left margin 768 of the sixth unit panel 752 are overlapped and joined together. A single and continuous lining 754 is then joined onto inner surfaces of the fifth unit panel 750 and the sixth unit panel 751.

Fig. 39 illustrates a cross-sectional view of a partition tank 800 based on a sectional panel tank 801 described above, i.e. anyone of the sectional panel tanks 100, 500, 600, 700. The partition tank 800 is completely separated by a partition part 802 into a first sub-tank 804 and a second sub-tank 806. The first sub-tank 804 and the second sub-tank contain a first fluid 808 (not shown) and a second fluid 810 (not shown) respectively. In particular, the first fluid 808 and

the second fluid 810 do not communicate through the partition part 802. The partition part 802 comprises a first side 812 and a second side 814 in contact with the first fluid 808 and the second fluid 810 respectively.

The partition part 802 is firstly assembled from the second side 814 by joining the first unit panel 200 and the second unit panel 250 together at the joint 290 between the first lining sheet 204 and the second lining sheet 254. The first and second unit panels 200, 250 are then further joined at the joint 290 from the first side 812 of the partition part 800. The partition part 800 finally further comprises an additional lining sheet 816 covering the first side 812, particular the joint 290. Therefore, the joint 290 is protected from the first side 812 by the additional lining sheet 816 and from the second side 814 by the first and second lining sheets 204, 254. In other words, the partition part 802 is protected from the first fluid 808 by the pre-formed lining sheets 204, 254 at the first side 812; and from the second fluid 810 by the post-formed additional lining sheet 816 after the partition part 800 is assembled from the first side 812.

Fig. 40 illustrates a cross-sectional view of another partition tank 850 using the third unit panels 300 and the fourth unit panel 350 described in Fig. 27. Similar to the partition part 800, a partition part 852 is assembled for completely separating the partition tank 850 into a first sub-tank 854 and a second sub-tank 856 for containing a first fluid 858 and a second fluid 860 respectively. In contrast to the partition part 802, the partition part 852 is assembled by joining the third unit panel 300 and the fourth unit panel 350 at the joint 390 from both a first side 862 and a second side 864 of the partition part 852. The partition part 852 further comprises a first additional lining sheet 866 and a second additional lining sheet 868 for covering the first side 862 and the second side 864 respectively. In particular, the joint 390 is protected by the first and second lining sheets 866, 868 from the first side 862 and the second side 864 respectively. In other words, the partition part 852 is protected from the first fluid 858 and the second fluid 860 by the post-formed first and second additional lining sheets 866, 868 respectively after the partition part 850 is assembled.

Fig. 41 illustrates a cross-sectional view of a vacuum forming process S10 for producing a prefabricated unit panel 900, including but not limited to any unit panel describe above. An exemplary vacuum forming process S10 is shown process the prefabricated unit panel 900. A structural panel 910 is placed into a vacuum chamber 950 before the vacuum forming process

S10. The vacuum forming process S10 has a first step S100 (shown in Fig. 41(a)) of aligning a lining sheet 920 over the structural panel 910; a second step S200 (shown in Fig. 41(b)) of heating the lining sheet 920 to be pliable for deformation; and a third step S300 (shown in Fig. 41(c)) of forming the lining sheet 920 to an inner surface 912 of the structural panel 910 for bonding the lining sheet 920 and the structural panel 910 by a negative pressure. The negative pressure may be generated by any known apparatus or method, such as a vacuum pump which pumps air from the vacuum chamber 950 to an outside environment. A driving plate 960 is placed inside the vacuum chamber 950 for fixing and moving the structural panel 910 upwardly towards the lining sheet 920. In particular, the driving plate 960 has a plurality of orifices 970 for air to go through the driving plate 960. As shown by straight arrows 980 in Fig. 41(b), hot air goes upwardly through the orifices 970 to reach the lining sheet 920 for heating the lining sheet 920 to a predetermined temperature. The hot air is spread evenly through the orifices 970 for heating the lining sheet 920 more homogeneously. As shown by the curved arrows 990 in Fig. 41(c), the air inside the vacuuming chamber 950 is extracted outside for forming the negative pressure required for the vacuuming forming process.

In particular, the third step S300 further has a first procedure S310 of moving the structural panel 910 upwardly towards the lining sheet 920; a second procedure S320 of vacuum forming the lining sheet 920 to the structural panel 910 for transferring contours of the inner surface 912 of the structural panel 910 to the lining sheet 920; and a third procedure S330 of cooling the lining sheet 920 for crystalizing the contours to the lining sheet 920 and thus joining the structural panel 910 and the lining sheet 920 together.

Fig. 42 illustrates a self-cleaning sectional panel tank 1100, in accordance with an embodiment of the present application. As shown in Fig. 42, the self-cleaning sectional panel tank 1100 comprises side wall, first unit panel 1091, second unit panel 1092, one directional sprinkler nozzles 1102, 1104, an external water pump 1106, check valves 1110, 1114, 1118, motorized valves 1112, and dosing pumps 1116, 1120.

A first side wall 1081, a second side wall 1082, a third side wall 1083, a fourth side wall 1084, a fifth side wall 1085, and a sixth side wall 1086 (hereinafter, collectively called “the side walls 1081, 1082, 1083, 1084, 1085, 1086”) are constructed from multiple unit panels 1091, 1092 that join together to form the tank 1100. Each unit panel has extensions at its edges. The

side walls 1081, 1082, 1083, 1084, 1085, 1086 are fundamental structural components of the tank 1100. They are assembled to create the tank's 1100 periphery. Comprised of multiple unit panels 1091, 1092, these walls serve as the primary containment structure, keeping the stored water within and providing the surface against which cleaning solutions are sprayed.

There are first and second unit panels 1091, 1092, each with extensions at their edges for support and connectivity. The tank 1100 is modular in design, with each side wall 1081 constructed from a series of unit panels 1091, 1092. These unit panels 1091, 1092 are individual sections that fit together to form a complete wall. Each unit panel features or includes an extension at its edges, which are protrusions or flanges designed to overlap or fit snugly with adjacent panels. The first unit panel 1091 refers to one of the two primary types of panels used to construct a side wall, and the second unit panel 1092 is the complementary type that joins with the first to complete the wall structure.

Fasteners are used to contiguously join the unit panels 1091, 1092 at their respective extensions. Fasteners are mechanical securing devices, such as bolts, screws, or rivets, which are used to join the first- and second-unit panels 1091, 1092 at their extensions. They ensure a contiguous, secure fit between panels, maintaining the tank's 1100 structural integrity and preventing leaks. The fasteners are designed to withstand the stress of filled water and the chemical exposure during cleaning. In accordance with an embodiment of the present invention, gaskets may be disposed between the unit panels 1091, 1092 as sealant. The gaskets serve as a sealing layer between the panels, enhancing the leak-proof quality of the tank. They fill any small gaps or irregularities between the panel surfaces, preventing water from seeping through the joints. The material of the gasket is usually resilient and chemically resistant, ensuring it can withstand the environmental conditions inside the tank 1100, including exposure to water and cleaning chemicals. The gaskets also help to absorb any mechanical stress or minor movements between the panels 1091, 1092, thus reducing the risk of leaks over time.

Further, attached to the interior of the side walls 1081, 1082, 1083, 1084, 1085, 1086, the directional sprinkler nozzles 1102, 1104 are key to the self-cleaning functionality. At least one nozzle is connected to a side wall 1081 and configured to spray a cleaning/disinfectant solution onto the tank's 1100 first interior surface 1301, second interior surface 1302, third interior

surface 1303, fourth interior surface 1304, and fifth interior surface 1305 (hereinafter collectively called “interior surfaces 1301, 1302, 1303, 1304, 1305”). These nozzles 1102, 1104 can be aimed or adjusted to direct the flow of cleaning/disinfectant solution to specific areas within the tank 1100. They are capable of covering the interior surfaces 1301, 1302, 1303, 1304, 1305 of the tank 1100, ensuring that the cleaning solution reaches all areas for effective cleaning. The term "directional" implies that the spray pattern or direction can be controlled, either manually or automatically, to optimize the cleaning process.

In accordance win an embodiment of the present invention, the nozzles 1102, 1104 may rotate to cover the entire interior of the tank 1100. Rotatable nozzles 1104 are a type of directional sprinkler nozzle that can pivot or rotate to direct the cleaning solution to different parts of the tank 1100. These nozzles 1102, 1104 can be programmed or manually adjusted to ensure complete coverage, especially in corners or under surfaces that fixed nozzles 1102 might miss. The rotation allows for a dynamic cleaning process that can adapt to the tank’s 1100 geometry and any obstructions within.

In an embodiment of the present invention, the nozzle may include both fixed nozzles 1102 for steady streams and rotatable nozzles 1104 for comprehensive coverage. The tank 1100 employs two types of sprinkler nozzles 1102, 1104. The fixed nozzle 1102 deliver a consistent and steady stream of cleaning solution to designated areas. The rotatable nozzles 1104 can pivot or spin, providing dynamic coverage and the ability to reach variable angles and surfaces within the tank 1100 that may otherwise be missed by fixed nozzles 1102. The combination of fixed and rotatable nozzles 1104 ensures that the entire interior of the tank 1100 can be thoroughly cleaned, with the rotatable nozzles 1104 complementing the fixed nozzles 1102 by covering gaps in the spray pattern.

The nozzles 1102, 1104 may be located to uniformly distribute the solution over the tank’s 1100 interior. The placement of the nozzles 1102, 1104 is carefully considered to maximize the effectiveness of the cleaning process. Nozzles 1102, 1104 are positioned at locations that allow for even distribution of the cleaning solution across all interior surfaces 1301, 1302, 1303, 1304, 1305 of the tank 1100, including corners and edges. Strategic positioning helps avoid shadowed areas where the spray might not normally reach, ensuring a more uniform distribution and thorough cleaning process.

The self-cleaning sectional panel tank 1100 may comprise external water pump 1106 connected to the sprinkler nozzles 1102, 1104 to maintain pressure for dispensing the solution. As shown in Fig. 42, at least one conduit 1122 may inter connect series of the sprinkle nozzles 1102, 1104. As shown in Fig. 42, there may be multiple conduits disposed within the tank 1100 connecting the nozzles 1102, 1114. As shown in Fig. 42, there may be multiple conduits disposed within the tank 1100 connecting various nozzles 1102, 1114 inside the tank 1100. The pump 1106 may be installed outside of the tank 1100 and is part of the plumbing system that supplies the cleaning and/or disinfectant solution to the sprinkler nozzles 1102, 1104. Its primary function is to ensure that the solution is dispensed under adequate pressure, which is necessary for the nozzles 1102, 1104 to effectively distribute the cleaning agents over the tank's 1100 interior surfaces 1301, 1302, 1303, 1304, 1305. The pump 1106 may vary in capacity and power depending on the size of the tank 1100 and the required pressure to achieve optimal cleaning coverage.

In accordance with an embodiment of the present invention, the external pump 1106 may be a variable speed water pump 1106 that can adjust flow rate and pressure based on the tank's 1100 requirements. The external pump 1106 is designed with the capability to vary its speed, which in turn allows for control over the flow rate and pressure of the water and cleaning solution. By adjusting the speed, the pump 1106 can adapt to the cleaning requirements based on the tank 1100 size, the type of cleaning agents being used, and the desired intensity of the cleaning process. This feature adds flexibility and efficiency to the cleaning process, conserving energy when full power is not needed and providing extra pressure when heavy cleaning is required.

In accordance with an embodiment of the present invention, the external pump 1106 may be a booster pump 1106, a specific type of external pump used to increase water pressure. The booster pump 1106 is a dedicated device that increases the pressure of the water being delivered to the sprinkler nozzles 1102, 1104. It is typically used when the existing pressure is insufficient to achieve the desired flow rate for the sprinklers to effectively cover the tank's 1100 interior surfaces 1301, 1302, 1303, 1304, 1305. This pump 1106 can be particularly useful in larger tanks or in situations where the water supply has a naturally low pressure.

In additional, the self-cleaning sectional panel tank 1100 may include multiple dosing pumps 1116, 1120 for precise metering of different chemicals into the solution, each connected to a unique chemical line. The dosing pumps 1116, 1120 can accurately meter out various types of cleaning agents, such as alkaline solutions for greasy residues, acidic solutions for mineral deposits, and neutral chemicals for general cleaning purposes. The versatility also allows for the use of specific disinfectants to target certain types of bacteria or viruses, ensuring the tank 1100 can be adapted to meet different sanitation standards. The dosing pumps 1116, 1120 may be used to inject precise amounts of chemicals into the water to create the cleaning solution. Having multiple dosing pumps 1116, 1120 enables the tank 1100 to meter out multiple cleaning chemicals simultaneously or sequentially, depending on the desired cleaning solution composition. Each pump is typically connected to its own separate chemical supply line and can be individually controlled to achieve the correct dosage.

As shown in Fig. 42, a first supply line 1124 may be connected with a first dosing pump 1120. The first supply line 1124 may supply a chemical A meant for forming the solution for cleaning. Similarly, as shown in Fig. 42, a second supply sine 1126 may be connected with a second dosing pump 1116. The second supply line 1126 may supply a chemical B meant for forming the solution for cleaning.

In accordance with an additional or alternative embodiment, a mixing station may be equipped with dosing pumps 1116, 1120 and actuated valves, automated via Internet of Things (IoT) technology. The mixing station may be a dedicated component that automates the preparation of the cleaning solution. Equipped with dosing pumps 1116, 1120, it can precisely meter the required amounts of various chemicals into the mix. Actuated valves, controlled by IoT technology, can regulate the flow of chemicals and water, mixing them as needed. The automation provided by IoT allows for remote monitoring and control, as well as integration with other systems for a more intelligent cleaning process.

The solution is prepared within the tank 1100 before the cleaning process. Refers to the capability of the tank 1100 to prepare the cleaning and disinfectant solutions on the premises, just before the commencement of the cleaning cycle. This ensures that the chemical agents are fresh and at the correct concentration, which can be crucial for effective cleaning and to maintain the quality standards of the stored water. It also allows for the flexibility of adjusting

the cleaning solution composition based on specific cleaning requirements or water quality conditions.

In an embodiment of the present invention, the self-cleaning sectional panel tank 1100 may include a multi-solution mixing station capable of preparing various types of cleaning solutions. A mixing station designed to handle various types of cleaning solutions, which can be selected based on the specific cleaning needs of the tank 1100. It allows for the use of different cleaning agents—such as those targeting mineral deposits, biological growth, or other contaminants—by mixing them in the correct proportions. This station may include storage for multiple chemicals and the ability to switch between them as needed.

In accordance with an additional or alternative embodiment of the present invention, the mixing station and/or the external water pump 1106 are mobile and portable and are connected with the sprinkler nozzles 1102, 1104 when the need arises. The mixing station and/or the external water pump 1106 may include features such as wheels or a compact, lightweight construction that facilitates transportation. These units may also have handles, towing mechanisms, or be mountable on a vehicle or a cart for ease of movement. The portability is particularly useful for situations where the tank 1100 is located in a remote area, or where a permanent installation of cleaning equipment is impractical.

The mixing station can either be installed onsite, or as a mobile unit for those that don’t require any chemicals onsite or those that don’t have sufficient space to accommodate a mixing station permanently. A mobile unit may be connected to pre-installed sprinkler heads and pipe works to deploy for cleaning, disinfection, neutralization, etc.

Further, the inline sensors may be integrated within the supply lines to monitor water quality post-cleaning. These sensors such as, but not limited to, pH sensors, residual disinfectant sensors, turbidity sensors, microbial presence sensors, conductivity sensors, that are installed within the tank’s 1100 supply lines 1128, 1126, 1124, designed to activate and take readings as needed, particularly after the cleaning process. Their primary role is to assess the quality of the water by checking for parameters such as pH levels, residual disinfectant concentrations, turbidity, and possibly microbial presence. They ensure that the water quality remains within

acceptable limits and that the cleaning process has not adversely affected the water intended for storage.

The inline sensors may inform relevant authorities about water quality, ensuring statutory compliance. These are the inline sensors with connectivity features that enable them to communicate data via the Internet of Things Automation (IoTA) network. The present invention incorporates an advanced Internet of Things Automation (IoTA) designed to intelligently connect and manage a network of devices, sensors, and actuators through a centralized platform. This IoTA utilizes a combination of wireless communication protocols, real-time data processing, and adaptive control algorithms to facilitate autonomous operation of the connected devices. It is equipped with robust security features to safeguard data integrity and system operations.

The innovation detailed herein is particularly suited for applications requiring precision control, energy management, resource conservation, and overall system efficacy. It represents a significant improvement over traditional automated systems by offering a dynamic and self-improving operational framework. This IoTA is essential to the operation of [insert specific application or device, e.g., 'the self-cleaning sectional panel tank 1100'] as it enables the seamless coordination of [insert specific functions, e.g., 'cleaning cycles, solution mixing, and dispensing processes'] with minimal human intervention. The IoTA architecture supports a high degree of customization, allowing users to tailor the functionality to their specific requirements. The technical features and advantages of the IoTA as disclosed herein form the basis of its novelty and utility in the context of this patent document.

The data collected by the inline sensors can be automatically sent to relevant authorities or systems to report on the tank’s 1100 water quality, facilitating real-time monitoring and compliance with health and safety regulations. The inline sensors may monitor water quality after cleaning to detect any residual solution or deterioration in water quality. This technology ensures a proactive approach to water quality management, allowing for immediate action if the water quality deteriorates or if the cleaning process leaves behind residues that could affect potability.

In an additional or alternative embodiment of the present invention, the self-cleaning sectional panel tank 1100 may include one or more check valves 1110, 1114, 1118 configured to prevent backflow in the supply lines and ensure directional flow of the solution. The check valves 1110, 1114, 1118 are one-way valves that only allow the solution to flow in one direction. They are critical safety features that prevent the cleaning solution from flowing backwards into the clean water supply or other parts of the tank 1100 where it should not go. These valves are essential for maintaining the purity of the water supply and for the correct operation of the cleaning process. As shown in Fig. 42, the check valves 1110, 1114, 1118 are disposed corresponding to the supply lines 1128, 1126, 1124. As shown in Fig. 42, the first check valve 1118 is disposed corresponding to the first supply line 1124 and the first dosing pump 1120, where the first supply line 1124 may be providing chemical A. similarly, the second check valve 1114 is disposed corresponding to the second supply line 1126 and the second dosing pump 1116, where the second supply line 1126 may be providing chemical B. The third supply line 1128 is for potable water, connected with the third check valve 1110.

Further, the self-cleaning sectional panel tank 1100 may include motorized valve 1112 controlled by IoT technology for automated flow regulation. These are valves operated by motors rather than manually, and their operation can be controlled remotely through IoT technology. The motorized valve 1112 can be programmed to open or close to regulate the flow of water and/or chemicals into the mixing station, as part of the automated cleaning process. They allow for fine-tuned control over the mixing of cleaning solutions, as well as the ability to quickly shut off the flow in case of a problem. As shown in the Fig. 42, a third supply line 1128 adapted to supply potable water to the motorized valves 1112. The potable water is then mixed with the chemical A and B used for formation of the cleaning solution.

In an additional or alternative embodiment of the present invention, the self-cleaning sectional panel tank 1100 may include solution drainage configured to drain the solution from the tank 1100 after cleaning. After the cleaning cycle is completed, the used solution containing dirt, debris, and potentially hazardous chemicals needs to be removed from the tank 1100. This may be done via a drainage system designed to safely and efficiently evacuate the spent solution from the tank 1100 to prevent contamination of the stored water and to prepare the tank 1100 for its next use. The drainage system typically includes outlets, valves, and possibly a treatment or neutralization step before the solution is disposed of or recycled.

Further, in accordance with an embodiment of the present invention, the interior surfaces 1301, 1302, 1303, 1304, 1305 are cleaned with either clean water or a neutralization chemical after the disinfectant is dispensed. Following the application of the disinfectant solution, the tank's 1100 interior surfaces 1301, 1302, 1303, 1304, 1305 may require additional cleaning with clean water or a chemical that neutralizes the disinfectant. It is crucial to ensure that no harmful residues remain that could affect the water quality or safety. The process involves rinsing or applying another cleaning agent to neutralize and remove any remaining disinfectant.

Further, in an additional or alternative embodiment of the present invention, the self-cleaning sectional panel tank 1100 may include water level sensors such as, but not limited to, float-type level sensors, ultrasonic level sensors, capacitive level sensors, optical water level sensors, conductive level sensors, radar level sensors integrated to detect water levels and initiate cleaning as needed. This self-cleaning sectional panel tank 1100 includes sensors that detect the current water level inside the tank 1100. It can automatically trigger the initiation of the cleaning process when the water level falls below a certain threshold, ensuring that cleaning occurs when the tank 1100 is empty or low (nearly empty). This system prevents the unnecessary dilution of cleaning solutions and ensures that cleaning does not interfere with the tank's 1100 primary function of water storage.

Additionally, the self-cleaning sectional panel tank 1100 may include integrated channelling built into the side walls 1081, 1082, 1083, 1084, 1085, 1086 to house the supply lines. The integrated channelling may refer to channels or ductwork integrated into the tank's 1100 walls 1081 that house the supply lines for the cleaning solution. It is designed to keep the supply lines secure and out of the way, reducing the risk of damage and maintaining the tank's 1100 aesthetic and structural integrity. It also simplifies maintenance and inspection by providing an organized pathway for the lines.

Moreover, the self-cleaning sectional panel tank 1100 may include filter adapted to safely dispose of the cleaning solution while protecting the environment. Once the cleaning process is complete, the used solution needs to be removed from the tank 1100. The filtration may ensure that the solution is safely and efficiently directed out of the tank 1100. The filter can capture any particulate matter or residues from the cleaning process, preventing them from

entering the environment. The filter is essential for environmental protection and for complying with regulations regarding the discharge of cleaning chemicals.

In accordance with an additional or alternative embodiment of the present invention the self-cleaning sectional panel tank 1100 may include user Interface and IoTA for manual control and customization of cleaning cycles. The User Interface (UI) serves as the point of interaction between the user and the self-cleaning tank, often featuring a display and input controls. It allows operators to manually initiate cleaning cycles, customize settings such as the timing and intensity of the cycles, and adjust the composition of the cleaning solution according to specific needs. The IoTA enhances the UI by enabling remote access and control, data collection, and monitoring. It can also provide notifications and alerts about the tank's 1100 status, maintenance needs, or operation anomalies. The integration of IoTA allows for the scheduling of cleaning cycles, tracking of resource usage, and analysis of long-term performance data for optimization.

An embodiment of the invention optionally or preferably work in following manner.

Fig. 43 illustrates a method 1200 of working of the self-cleaning sectional panel tank, in accordance with an embodiment of the present application

Step 1210 (Provide at least one side wall): As shown in Fig. 43, at step 1210, at least one side wall 1081 is provided. The at least one side wall 1081 comprises a first unit panel 1091 with a first extension at its edge and a second unit panel 1092 with a second extension at its edge. The at least one side wall 1081 serves a dual purpose. Structurally, it contributes to the formation of the tank 1100, and functionally, it supports at least one directional sprinkler nozzle. This nozzle is a critical component of the tank’s 1100 self-cleaning mechanism, designed to discharge a cleaning and/or disinfectant solution onto the interior surfaces 1301, 1302, 1303, 1304, 1305 of the tank 1100. The side wall's 1081, 1082, 1083, 1084, 1085, 1086 design integrates the functionality of the self-cleaning sectional panel tank 1100 within the structural components, enhancing the efficacy of the self-cleaning process while maintaining the tank’s 1100 integrity.

The first unit panel 1091 possesses a first extension at its edge. This extension is not merely a protrusion but is specifically designed to facilitate the alignment and connection with the second unit panel 1092. The nature of the first extension may be such that it contributes to the structural strength, precision of assembly, or aesthetic of the side wall 1081. Similarly, the second unit panel 1092 includes a second extension at its edge. This extension aligns with the first extension of the first unit panel 1091. Together, they form a contiguous junction, ensuring a seamless interface between the two unit panels 1091, 1092.

Step 1220 (Join the first unit panel 1091 and the second unit panel 1092): as shown in Fig. 43, at step 1220, joining the first unit panel 1091 and the second unit panel 1092 together contiguously at the first extension and the second extension using at least one fastener. The assembly is achieved by joining a first unit panel 1091 and a second unit panel 1092 contiguously at their respective extensions using at least one fastener. The term 'contiguously' implies that the first unit panel 1091, with a first extension at its edge, and the second unit panel 1092, with a second extension at its edge, are joined without gaps or spaces. This precise joining is critical to the integrity of the tank 1100 and ensures that the interior is adequately sealed for the self-cleaning process. The panels are joined using at least one fastener. This could include a variety of fastening mechanisms, which could be screws, bolts, welding, or any other suitable fastening method that provides the required strength and stability for the side walls 1081, 1082, 1083, 1084, 1085, 1086 of the tank 1100. The joining of the panels 1091, 1092 not only forms the physical structure of the tank 1100 but also serves as the support for directional sprinkler nozzles 1102, 1104, which are integral to the self-cleaning feature of the tank 1100. The design and positioning of the panels take into account the placement and operation of these nozzles 1102, 1104. The panels 1091, 1092 are joined together using at least one fastener, a term that encompasses a broad range of possible securing devices, which could include but is not limited to, screws, bolts, clips, or adhesives. The fastener is chosen based on requirements for strength, durability, and ease of assembly or disassembly.

Step 1230 (Mix a cleaning and/or disinfectant solution on-site): as shown in Fig. 43, at step 1230, mixing the cleaning and/or disinfectant solution on-site before each cleaning. Fig. 43 sets the stage for step 1230, which details the preparation of the cleaning and disinfectant solution used in the self-cleaning sectional panel tank 1100. The method 1200 involves the on-site mixing of the solution immediately before each cleaning cycle, highlighting the ability

to produce a fresh and potent cleaning agent as required. The self-cleaning a sectional panel tank 1100 may select and dose different types of cleaning chemicals, such as alkaline, acidic, or neutral agents, with the dosing pumps 1116, 1120 to address specific contaminants.

The mixing station is utilized for the preparation of the cleaning solution. The mixing station may be designed to automate the dispensing of the solution and/or clean water using a series of dosing pumps 1116, 1120 and actuated valves, which may be managed by Internet of Things Automation (IoTA). This ensures precision and consistency in the solution's composition. The solution is composed of multiple chemical components, which are metered and introduced into the mixing station using a plurality of dosing pumps 1116, 1120. Each pump 1116, 1120 is connected to a separate chemical supply line, allowing for a customizable solution based on the tank’s 1100 specific cleaning requirements. The motorized valves 1112 in the supply lines, controlled by IoTA, regulate the flow of potable water and/or cleaning chemicals into the mixing station. The IoTA allows for adjustments to be made in real-time, adapting to the needs of each cleaning cycle.

In accordance with an embodiment of the present invention, the self-cleaning a sectional panel tank 1100 may provide user control through an interface connected to the IoTA, allowing manual adjustments to the cleaning cycles, including the composition and volume of the cleaning solution.

The self-cleaning sectional panel tank 1100 may be capable of preparing multiple types of cleaning solutions, which permits the selection of a specific solution tailored to the type of contaminants present within the tank 1100. This feature ensures that the cleaning process is both effective and efficient. The process includes measures for safe handling and environmental protection, such as ensuring that all chemicals are mixed in a controlled manner and any waste is properly managed.

By incorporating on-site mixing of the cleaning solution, the invention effectively addresses the concerns associated with long-term chemical storage and ensures that a fresh, potent solution is used for each cleaning cycle, improving the overall efficiency and safety of the tank 1100.

Step 1240 (Maintain adequate pressure during dispensing of the solution): as shown in Fig. 43, at step 1240, maintaining adequate pressure during dispensing of the solution using an external water pump 1106 connected to the sprinkler nozzles 1102, 1104. As delineated in Fig. 43, step 1240 focuses on the mechanism by which the self-cleaning sectional panel tank 1100 maintains the necessary pressure during the dispensing of the cleaning and disinfectant solution. This is achieved by utilizing an external water pump 1106 that is operatively connected to the directional sprinkler nozzles 1102, 1104. The external water pump 1106 is pivotal in ensuring that the cleaning and disinfectant solution is propelled through the sprinkler nozzles 1102, 1104 with adequate force to reach all interior surfaces 1301, 1302, 1303, 1304, 1305 of the tank 1100. This pump may be a standard or a booster pump 1106, chosen based on the required pressure and flow rate to achieve effective dispersion of the solution.

The water pump 1106 is directly connected to the sprinkler nozzles 1102, 1104. This direct connection is critical to maintain a steady and consistent pressure during the discharge of the cleaning solution, which is essential for the nozzles 1102, 1104 to operate as intended. The tank 1100 includes provisions for regulating the pressure of the solution. This may involve variable speed control on the water pump 1106 or other pressure-regulating mechanisms to adjust the pressure according to the size of the tank 1100 and the configuration of the sprinkler nozzles 1102, 1104. The self-cleaning a sectional panel tank 1100 may increase water pressure using the booster pump 1106 prior to discharging the cleaning solution to enhance the effectiveness of the sprinkler nozzles 1102, 1104. Maintaining adequate pressure is an integral part of the tank's 1100 self-cleaning cycle, ensuring that the cleaning and disinfectant solution is sprayed effectively over the tank's 1100 interior surfaces 1301, 1302, 1303, 1304, 1305. The tank 1100 includes safety features such as check valves 1110, 1114, 1118 to prevent backflow and automated shut-off mechanisms in case of a malfunction. These features ensure that the tank 1100 operates safely and efficiently, avoiding waste of the cleaning solution and potential safety hazards.

Step 1250 (Discharge the cleaning and disinfectant solution over interior surfaces): as shown in Fig. 43, at step 1250, discharging a cleaning and disinfectant solution over interior surfaces 1301, 1302, 1303, 1304, 1305 of the tank 1100 using one or more directional sprinkler nozzles 1102, 1104. The step 1250 encompasses the operational phase of the self-cleaning sectional panel tank 1100, where a cleaning and disinfectant solution is dispensed over the tank's 1100

interior surfaces 1301, 1302, 1303, 1304, 1305. This process involves the use of one or more directional sprinkler nozzles 1102, 1104, which are strategically connected to the tank's 1100 side walls 1081, 1082, 1083, 1084, 1085, 1086. The directional sprinkler nozzles 1102, 1104 are activated to discharge a specifically formulated cleaning and disinfectant solution using the conduits 1112. These nozzles 1102, 1104 are designed to ensure that the solution is evenly spread over the entire interior surface of the tank 1100, including the ceiling and top edges of the walls.

The discharged solution covers the interior surfaces 1301, 1302, 1303, 1304, 1305 and is left to act for a designated period, ensuring thorough cleaning and disinfection. The tank 1100 may include options for the nozzles 1102, 1104 to either emit a mist or rotate to fill the interior with an aerosolized solution, optimizing the distribution and effectiveness of the cleaning process. The cleaning and disinfectant solution is mixed on-site immediately before each cleaning cycle. This is to prevent the potential hazards of long-term chemical storage and to ensure the potency and efficacy of the solution. The process may be automated using the mixing station equipped with dosing pumps 1116, 1120 and actuated valves, all managed via Internet of Things (IoT) automation. This technology allows for precise control and monitoring of the cleaning process.

Step 1260 (Drain the solution after and cleaning clean interior surfaces 1301, 1302, 1303, 1304, 1305 with clean water or a neutralization chemical after dispensing the solution): as shown in Fig. 43, at step 1260, draining the solution after cleaning and cleaning interior surfaces 1301, 1302, 1303, 1304, 1305 with clean water or a neutralization chemical after dispensing the solution. As delineated in Fig. 43, step 1260 of the invention's process entails the evacuation of the cleaning and disinfectant solution post-cleaning, followed by a rinse of the interior surfaces 1301, 1302, 1303, 1304, 1305 with clean water or a neutralization chemical. This step is crucial for preparing the tank 100 for its intended use. After the cleaning solution has been allowed to act, the tank 1100 may initiate a drainage process. This involves opening drain valves or activating pumps designed to remove the cleaning solution from the tank 1100 efficiently. Subsequent to the drainage, the interior surfaces 1301, 1302, 1303, 1304, 1305 of the tank 1100 are thoroughly rinsed. This can be done with potable water to remove any residual cleaning agent or with a neutralization chemical if the cleaning solution requires neutralization to prevent any potential harm from leftover residues. The tank 1100 may include

an integrated system that facilitates both the drainage of the cleaning solution and the subsequent rinse, ensuring that the process is seamless and does not require manual intervention between steps.

The step 1260 may be automated, controlled via the Internet of Things automation, which would manage the timing, duration, and sequence of the drainage and rinsing cycles to optimize cleaning effectiveness and water usage. Post-rinse, the tank 1100 may typically be left to dry or is filled for use. The self-cleaning sectional panel tank 1100 ensures that no harmful levels of cleaning agents remain, maintaining the safety of the potable water. In accordance with an additional or alternative embodiment of the present invention, the self-cleaning a sectional panel tank 1100 may inspect the interior surfaces 1301, 1302, 1303, 1304, 1305 of the tank 1100 with a camera system after the cleaning process to ensure thorough cleaning and absence of residual contaminants. In accordance with an additional or alternative embodiment of the present invention, the self-cleaning a sectional panel tank 1100 may engage an emergency shutdown mechanism via the IoTA upon detection of any malfunction within the sprinkler nozzles 1102, 1104, dosing pumps 1116, 1120, or supply lines 1124, 1126, 1128.

Further, in accordance with an additional or alternative embodiment, as shown in Fig. 43, after the completion of the initial cleaning phase where the interior surfaces 1301, 1302, 1303, 1304, 1305 of the tank 1100 have been exposed to a cleaning and/or disinfectant solution and then presumably rinsed. A new batch of cleaning and/or disinfectant solution is prepared on-site. The implication is that this is not merely a reuse of the previously mixed solution but rather the preparation of a completely new mixture.

The significance of mixing the solution on-site suggests that the cleaning agents are created in proximity to the tank 1100, ensuring freshness and potency of the solution while also potentially allowing for customization based on the immediate cleaning needs observed after the first cycle. This could be especially important if the initial cleaning cycle indicated areas that require a stronger or differently formulated solution. For instance, if the first cycle was primarily disinfectant, the second might focus on removing mineral deposits or vice versa.

The present invention offers several technical advantages over the existing prior arts, significantly improving the process of maintaining sectional panel tanks:

The invention automates the cleaning process, removing the variability and inconsistency of manual cleaning. Automated systems can achieve a high degree of precision and consistency, ensuring that the entire interior surface of the tank is subjected to a thorough cleaning cycle. By eliminating the need for manual entry into the tanks for cleaning purposes, the invention significantly reduces labour costs and enhances worker safety. There is less risk of exposure to hazardous environments and substances, and the need for confined space entry permits is diminished. The self-cleaning process can be executed with the tank in-situ and possibly even in operation, which minimizes downtime. This is particularly beneficial in industrial applications where tank availability is critical to ongoing processes.

The invention's design allows for the directional sprinkler nozzles to reach all interior areas of the tank, including corners and other hard-to-clean areas, which might be overlooked or inaccessible during manual cleaning. Efficient Use of Cleaning Agents: The system is designed to precisely mix and meter the cleaning and disinfectant solutions, reducing waste and ensuring that the correct concentration of cleaning agents is used. This not only conserves chemicals but also minimizes the environmental impact of the cleaning process. With the capability of more frequent and reliable cleaning cycles, the invention helps maintain a high level of hygiene within the tank. This is crucial for tanks used in potable water systems, food and beverage industries, and any application where water quality is paramount. The automated and consistent cleaning process facilitates compliance with stringent health and safety regulations. With integrated sensors and IoT connectivity, the tank 1100 can provide real-time data and records of cleaning cycles, aiding in regulatory reporting and compliance.

The reduction in manual labour, improved cleaning efficiency, and minimized chemical usage result in a cost-effective solution over the long term. The tank's 1100 reliability and efficiency also reduce the potential costs associated with contamination or regulatory non-compliance. The inclusion of Internet of Things (IoT) technologies allows for advanced monitoring and control of the cleaning process. This can lead to predictive maintenance schedules, remote diagnostics, and immediate alerts if issues are detected, further enhancing the tank's 1100 reliability and performance. The design of the invention allows for integration into existing tank infrastructures with minimal modifications, making it a flexible solution that can be adapted to a wide range of tank sizes and configurations.

The technical advantages of the present invention create a more efficient, safe, and compliant environment for the storage and maintenance of liquids in sectional panel tanks, offering substantial improvements over the methods and systems found in prior art.

In the application, unless specified otherwise, the terms “comprising”, “comprise”, and grammatical variants thereof, intended to represent “open” or “inclusive” language such that they include recited elements but also permit inclusion of additional, non-explicitly recited elements.

Various modifications to these embodiments are apparent to those skilled in the art from the description and the accompanying drawings. The principles associated with the various embodiments described herein may be applied to other embodiments. Therefore, the description is not intended to be limited to the embodiments shown along with the accompanying drawings but is to be providing broadest scope consistent with the principles and the novel and inventive features disclosed or suggested herein. Accordingly, the application is anticipated to hold on to all other such alternatives, modifications, and variations that fall within the scope of the present application and the appended claims.

Reference Numerals

100 first sectional panel tank;
102 bottom;
104 cover;
106 front wall;
108 rear wall (not shown);
110 left wall (not shown);
112 right wall;
114 unit panel;
116 access hole;
118 ladder;
120 drainage hole;
122 drainage tube;
124 inlet;
126 outlet;
128 top end of the ladder;
130 external foundation;
132 external framework;
134 liquid (not shown);
136 lining;
138 edge of the sectional panel tank;
150 variant of the first sectional panel tank;
152 second ladder;
154 partition;
156 first tank;
158 second tank;
170 variant of the first sectional panel tank;
172 second ladder;
174 partition;
176 first tank;
178 second tank;
200 first unit panel;
202 first structural panel;

204 first lining sheet;
206 first thermal insulation layer;
208 first extension;
210 first front flange;
212 first front edge;
214 first rear flange;
216 first rear edge;
218 first left flange;
220 first left edge;
222 first right flange;
224 first right edge;
226 inner surface (of the first structural panel);
228 external surface (of the first structural panel);
230 first embossment;
235 fastener;
240 stud;
242 first side (of the first lining sheet);
244 second (side of the first lining sheet);
246 gap;
248 filler;
250 second unit panel;
252 second structural panel;
254 second lining sheet;
256 second thermal insulation layer;
258 second extension;
260 second front flange;
262 second front edge;
264 second rear flange;
266 second rear edge;
268 second left flange;
270 second left edge;
272 second right flange;
274 second right edge;
276 inner surface (of the second unit panel);

278 external surface (of the second unit panel);
280 second embossment;
290 joint;
292 seam;
294 jointer;
296 first layer (of the lining sheet);
297 first thickness;
298 second layer of the lining sheet;
299 second thickness;
2000 variant of the first unit panel;
2100 variant of the first unit panel;
2150 second variant of the first unit panel;
2200 variant of the first unit panel;
2300 variant of the first unit panel;
2400 modification to the variant 2100;
2500 modification to the variant 2200;
2600 modification to the first unit panel;
2610 adhesive layer;
2700 third unit panel;
2710 joint;
2730 fastener;
2800 planar unit panel;
2810 planar structural panel;
2820 planar lining sheet;
2830 left end;
2840 joint;
2850 fastener;
3000 curved unit panel;
3002 curved structural panel;
3004 curved lining sheet;
3006 curved thermal insulation layer;
3008 inner surface (of the curved structural panel);
3010 external surface (of the curved structural panel);
3012 front edge;

3014 rear edge;
3016 left edge;
3018 right edge;
3020 extension;
3022 front flange;
3024 rear flange;
3026 left flange;
3028 right flange;
3040 first curved unit panel;
3050 second curved unit panel;
3052 second structural panel;
3054 second lining sheet;
3056 second thermal insulation layer;
3058 second inner surface (of the second structural panel);
3060 second external surface (of the second structural panel);
3062 second front edge;
3064 second rear edge;
3066 second left edge (not shown);
3068 second right edge (not shown);
3070 second extension;
3072 second front flange;
3074 second rear flange;
3076 second left flange (not shown);
3078 second right flange (not shown);
3090 joint;
3092 seam;
3094 jointer;
3096 fastener;
3100 first variant of the curved structural panel;
3150 second variant of the curved structural panel;
3200 first variant of the curved structural panel;
3250 second variant of the curved structural panel;
3300 first modification of the curved structural panel;
3310 first studs;

3320 first gap;
3330 first filler;
3340 first adhesive layer;
3350 second modification of the curved structural panel;
3360 second studs;
3370 second gap;
3380 second filler;
3390 second adhesive layer;
3400 first modification of the curved structural panel;
3450 second modification of the curved structural panel;
300 third unit panel;
302 third structural panel;
306 third thermal insulation layer;
308 third extension;
310 third front flange;
312 third front edge;
314 third rear flange;
316 third rear edge;
318 third left flange;
320 third left edge;
322 third right flange;
324 third right edge;
326 inner surface of the third unit panel;
330 adhesive;
340 lining;
350 fourth unit panel;
352 fourth structural panel;
354 fourth lining sheet;
356 fourth thermal insulation layer;
358 fourth extension;
360 fourth front flange;
362 fourth front edge;
364 fourth rear flange;
366 fourth rear edge;

368 fourth left flange;
370 fourth left edge;
372 fourth right flange;
374 fourth right edge;
376 inner surface of the fourth unit panel;
390 joint;
392 seam;
394 welding solder;
396 first layer of the lining;
398 second layer of the lining;
400 bent unit panel;
402 bent portion;
404 first portion;
406 second portion;
500 second sectional panel tank;
502 bottom;
504 cover;
506 front wall;
508 rear wall (not shown);
510 left wall (not shown);
512 right wall;
514 unit panel;
516 access hole;
518 ladder;
520 drainage hole;
522 drainage tube;
524 inlet;
526 outlet;
528 top end of the ladder;
530 external foundation;
532 internal framework;
534 liquid (not shown);
536 rod;
538 beam;

540 pole;
542 lining;
544 soil plate;
550 variant of the second sectional panel tank;
552 second ladder;
554 partition;
556 first thank;
558 second tank;
570 variant of the first sectional panel tank;
572 second ladder;
574 partition;
576 first tank;
578 second tank;
600 third sectional panel tank;
602 bottom;
604 cover;
606 front wall;
608 rear wall;
610 left wall;
612 right wall;
614 unit panel;
634 liquid;
636 facility;
638 hole;
640 ground;
650 variant of the third sectional panel tank;
652 bottom lining;
654 fastener;
700 fourth sectional panel tank;
702 bottom;
704 cover;
706 side wall;
714 curved unit panel;
716 access hole;

718 ladder;
720 drainage hole;
722 drainage tube;
724 inlet;
726 outlet;
728 top end of the ladder;
730 external foundation;
734 liquid;
750 fifth unit panel;
751 sixth unit panel;
752 structural panel;
754 lining;
756 thermal insulation layer;
758 extension;
760 front margin;
762 front edge;
764 rear margin;
766 rear edge;
768 left margin;
772 right margin;
774 right edge;
800 partition tank;
801 sectional panel tank;
802 partition part;
804 first sub-tank;
806 second sub-tank;
808 first fluid;
810 second fluid;
812 first side of the partition part;
814 second side of the partition part;
816 additional lining sheet;
850 partition tank;
852 partition part;
854 first sub-tank;

856 second sub-tank;
858 first fluid;
860 second fluid;
862 first side;
864 second side;
866 first additional lining sheet;
868 second additional lining sheet;
900 prefabricated unit panel;
910 structural panel;
912 inner surface of the prefabricated unit panel;
920 lining sheet;
950 vacuum chamber;
960 driving plate;
970 orifices;
980 straight arrow;
990 curved arrow;
S10 vacuum forming process;
S100 first step;
S200 second step;
S300 third step;
S310 first procedure;
S320 second procedure;
S330 third procedure;
1100 A self-cleaning sectional panel tank/ The self-cleaning sectional panel tank/ This self-cleaning sectional panel tank/ the tank;
1102 Fixed nozzles/ sprinkler nozzles/ the nozzles/ these nozzles;
1104 Rotatable nozzles/ the nozzles/ sprinkler nozzles/ these nozzles;
1106 External water pump or booster pump/pump/ external pump/ water pump;
1081 First side wall/side wall/wall;
1082 Second side wall/side wall;
1083 Third side wall/side wall;
1084 Fourth side wall/side wall;
1085 Fifth side wall/side wall;
1086 Sixth side wall/side wall;

1091 First unit panel/ unit panel/ multiple unit panels/ the panels/ two-unit panels;

1092 Second unit panel/ unit panel/ multiple unit panels/ the panels /two-unit panels;

1110 Third check valve/ check valves;

1112 Motorized valve;

1114 Second check valve/ check valves;

1116 Second dosing pump/ dosing pumps/ pump;

1118 First check valve/ check valves;

1120 First dosing pump/ dosing pumps/ pump;

1122 Conduit/Multiple Conduits;

1124 First supply line/ supply lines;

1126 Second supply line/ supply lines;

1128 Third supply line/ supply lines;

1301 First interior surface/ interior surfaces;

1302 Second interior surface/ interior surfaces;

1303 Third interior surface/ interior surfaces;

1304 Forth interior surface/ interior surfaces;

1305 Fifth interior surface/ interior surfaces;

1200 A Method of Working of The Self-Cleaning Sectional Panel Tank;

1210 Provide At Least One Side Wall;

1220 Join the First Unit Panel and The Second Unit Panel;

1230 Mix A Cleaning and/or Disinfectant Solution On-Site;

1240 Maintain Adequate Pressure During Dispensing of The Solution;

1250 Discharge the Cleaning and Disinfectant Solution Over Interior Surfaces;

1260 Drain the Solution After and Cleaning Clean Interior Surfaces with Clean Water or A Neutralization Chemical After Dispensing the Solution

Claims

1. A self-cleaning sectional panel tank, comprising:

at least one side wall for joining other side walls in forming the sectional panel tank;

wherein the at least one side wall comprises:

a first unit panel having a first extension at its edge for supporting the first unit panel; and

a second unit panel having a second extension at its edge;

wherein the first unit panel and the second unit panel are joined together contiguously at the first extension and the second extension by at least one fastener; and

at least one directional sprinkler nozzle connected to the at least one side wall configured to discharge a cleaning and/or disinfectant solution onto interior surfaces of the self-cleaning sectional panel tank.

2. The self-cleaning sectional panel tank of claim 1, further comprising an external water pump connected to the at least one directional sprinkler nozzle using at least one conduit for maintaining adequate pressure in order to dispense of the cleaning and/or disinfectant solution.

3. The self-cleaning sectional panel tank of claim 1, wherein the cleaning and disinfectant solution is mixed on-site before cleaning process.

4. The self-cleaning sectional panel tank of claim 1, wherein the cleaning and/or disinfectant solution is drained from the tank after cleaning.

5. The self-cleaning sectional panel tank of claim 1, wherein the interior surfaces is cleaned with water or a neutralization chemical after dispensing the cleaning and/or disinfectant solution.

6. The self-cleaning sectional panel tank of claim 1, wherein the at least one or multiple directional sprinkler nozzles are configured to rotate to aerosolize the solution within the interior of the tank.

7. The self-cleaning sectional panel tank of claim 1, further comprising a mixing station configured to automate dispense the cleaning and/or disinfectant solution and/or uncontaminated water using a series of dosing pumps and actuated valves using Internet of Things Automation (IoTA).

8. The self-cleaning sectional panel tank of claim 2, further comprising:

inline sensors integrated within supply lines connected with the external water pump for monitoring water quality after cleaning to detect any residual solution or deterioration in water quality.

9. The self-cleaning sectional panel tank of claim 8, wherein:

the inline sensors, using IoTA, are configured to inform relevant authorities of fulfilment of statutory requirements for maintaining potable water tanks.

10. The self-cleaning sectional panel tank of claim 1, wherein the at least one directional sprinkler nozzle includes fixed and rotatable sprinkler heads, the fixed heads for a uniform stream and the rotatable heads for covering variable angles within the interior of the tank.

11. The self-cleaning sectional panel tank of claim 1, wherein multiple directional sprinkler nozzles are positioned at strategically determined locations on the side walls to ensure uniform distribution of the cleaning and/or disinfectant solution over the interior surfaces.

12. The self-cleaning sectional panel tank of claim 1, further comprising at least one sensor integrated within the side walls to detect a level of water and initiate cleaning process automatically when the tank is vacant or at a defined low water level.

13. The self-cleaning sectional panel tank of claim 2, wherein the external water pump is equipped with variable speed control to adjust a pressure and flow rate of the cleaning and/or disinfectant solution based on size and configuration of the tank.

14. The self-cleaning sectional panel tank of claim 2, wherein the external water pump is a booster pump configured to increase pressure of the water for the sprinkler nozzle to ensure effective reach and dispersion of the cleaning and/or disinfectant solution.

15. The self-cleaning sectional panel tank of claim 8, further comprising check valves integrated into the supply lines to prevent backflow and ensure the directional flow of the cleaning and/or disinfectant solution.

16. The self-cleaning sectional panel tank of claim 7, wherein the mixing station is configured to prepare multiple types of cleaning solutions, allowing for selection of a specific solution based on the nature of contaminants present in the tank.

17. The self-cleaning sectional panel tank of claim 2, wherein multiple dosing pumps are provided for precise metering of various chemicals into the solution, where individual pumps are connected to a separate chemical supply line.

18. The self-cleaning sectional panel tank of claim 8, further comprising motorized valves in the supply lines controlled by IoTA for automated regulation of a flow of potable water and cleaning chemicals into the mixing station.

19. The self-cleaning sectional panel tank of claim 17, wherein the dosing pumps are configured to handle different types of cleaning chemicals, selected from alkaline, acidic, and neutral agents, to match the cleaning requirements of various contaminants.

20. A method for a self-cleaning a sectional panel tank, comprising:

providing at least one side wall, wherein the at least one side wall comprises a first unit panel with a first extension at its edge and a second unit panel with a second extension at its edge;

joining the first unit panel and the second unit panel together contiguously at the first extension and the second extension using at least one fastener;

mixing a cleaning and/or disinfectant solution on-site before initiating any cleaning process;

discharging the cleaning and disinfectant solution over interior surfaces of the tank using one or more directional sprinkler nozzles;

maintaining adequate pressure during dispensing of the cleaning and/or disinfectant solution using an external water pump connected to the directional sprinkler nozzles;

draining the solution after cleaning; and

cleaning interior surfaces with uncontaminated water or a neutralization chemical after dispensing the solution.

21. The method of claim 20, comprising step of rotating the directional nozzles to aerosolize the solution, thereby covering a comprehensive area within the interior of the tank.

22. The method of claim 20, further comprising step of automating the dispensing of the cleaning and/or disinfectant solution and/or uncontaminated water using a mixing station configured with a series of dosing pumps and actuated valves utilizing Internet of Things Automation (IoTA).

23. The method of claim 20, further comprising step of:

integrating inline sensors within supply lines connected with the external pump to monitor water quality after cleaning to detect any residual solution or deterioration in water quality; and

utilizing IoTA to inform relevant authorities of fulfilment of statutory requirements for maintaining potable water tanks.

24. The method for self-cleaning a sectional panel tank as in claim 20, further comprising the steps of activating fixed and rotatable sprinkler heads, wherein the fixed heads

provide a continuous stream and the rotatable heads cover variable angles to ensure complete coverage of the tank interior.

25. The method for self-cleaning a sectional panel tank as in claim 20, further including the step of increasing water pressure using a booster pump prior to discharging the cleaning solution to enhance effectiveness of the sprinkler nozzles.

26. The method for self-cleaning a sectional panel tank as in claim 20, further comprising the step of preventing backflow of the cleaning and/or disinfectant solution using check valves integrated into supply lines connected with the external pump.

27. The method for self-cleaning a sectional panel tank as in claim 22, further including step of metering and introducing multiple cleaning chemicals into the mixing station using a plurality of dosing pumps, where individual pumps are connected to a separate supply line for different chemicals.

28. The method for self-cleaning a sectional panel tank as in claim 22, further comprising the step of automating flow regulation of potable water and chemicals into the mixing station via motorized valves controlled by Internet of Things Automation (IoTA).

29. The method for self-cleaning a sectional panel tank as in claim 22, further comprising the step of providing user control through an interface connected to the IoTA, allowing manual adjustments to cleaning cycles, including the composition and volume of the cleaning and/or disinfectant solution.

30. The method for self-cleaning a sectional panel tank as in claim 20, further including the step of selecting and dosing different types of cleaning chemicals, selected from a group comprising alkaline, acidic, or neutral agents, with the dosing pumps to address specific contaminants.

31. The method for self-cleaning a sectional panel tank as in claim 20, wherein after cleaning the interior surfaces, mixing another cleaning and/or disinfectant solution on-site for further cleaning process of the tank.