An electrical enclosure that includes a sidewall, a back and a top, defining an interior. The top of the enclosure is adapted to open and provide access to the interior. The enclosure includes a backplane mounted to the interior of the enclosure. The backplane has at least one cutout where the cutout is positioned on the backplane to align with an obstacle positioned on the enclosure sidewall and extending into the enclosure interior. In another embodiment, the backplane consists of a plurality of backplane modules or segments attached to the enclosure, each separately removable without field disassembly of an installed enclosure.
An Electrical Enclosure Removable Backplate

Field of Invention

The invention relates to electrical enclosures, and more particularly, electrical enclosures with removable backplanes and modular backplanes, allowing modular replacement of components, and multiple operational modes.

Background of the invention

Electrical enclosures are cases used to protect the electrical components stored inside the enclosure. The electrical components are mounted on a backplane or backplate or panel that is secured or mounted to the interior of the enclosure case. The backplane may be predrilled with a series of openings to accommodate mounting electrical components to the backplate. Typical enclosures are rectangular boxes constructed of metals (such as steel, aluminum) or fiberglass or plastic. The enclosure generally has a top cover or door that can be opened to provide access to the electrical components mounted in the panel. The cover, when closed, provides a degree of protection for the electrical components against moisture and other adverse environmental conditions. When closed, the enclosure is resistant to weather, insects, etc. Electrical wiring penetrates the enclosure typically through conduits or similar devices that are joined or secured to the enclosure using specialized fittings. The enclosure is generally fixedly mounted in place, such as to a wall, post, or other fixed structure.

Some enclosures include an inner swing panel or interior cover plate that is exposed when the enclosure cover is opened. The interior cover plate generally is mounted on the enclosure behind the door or enclosure cover. The interior cover plate or inner-swing panel is used to mount switches, circuit breakers, gauges, lamps or other components that the operator may need to periodically access for various reasons, but still protect the electrical components mounted on the backplate. The interior cover plate or swing panel can be moved to provide access to the interior of the enclosure. Generally, the inner swing panel is hingedly connected to the enclosure, but can
be screw mounted, toggle mounted or otherwise removably mounted. An example of such an enclosure is shown in figure 1. Shown are enclosure 1, cover 2, and interior swing panel 3. The interior swing panel 3 shown in figure 1 is hingedly mounted to the enclosure, as is the cover plate 2. To accommodate a hingedly mounted interior swing panel, many enclosures include an interior projection support bracket or lip attached to the interior of the enclosure opposite the hinged side of the interior swing panel (not shown). This bracket or lip is used to support the interior swing panel in a closed position.

In assembling an enclosure, the electrical components will be installed and wired as needed to the backplane. The backplane is then inserted into the interior of the enclosure and secured to the enclosure (usually, by corner screw mounts installed at suitable locations in the interior of the enclosure). The door electrical components are added (either to the interior cover plate (inner swing panel) or enclosure cover or both) as well as components mounted in the exterior of the enclosure (such as warning lamps, alarms or lightning arresters), and operationally wired to the backplane as needed. The assembled enclosure is then transported to the field, where suitable enclosure cutouts are installed through the enclosure sidewalls to accommodate the required incoming conduits or other devices. In some instances, the enclosure cutouts can be placed in the device in the assembly plant, if a high degree of tolerance is allowable in the field installation.

The assembled enclosure is then fixedly mounted at its desired location, and conduits are attached. Wire is pulled through the conduits for connection to the backplane mounted components, providing power and communication/control channels to allow the components to communicate/control with external devices, such as pumps or process equipment. The wires in the conduit are operationally connected to the electrical equipment on the backplane, such as using standard fixed terminal connectors or pull apart terminal connectors. Once the enclosure is assembled, mounted and the conduits attached and wired, removal of the operational enclosure
and its internal components are difficult. To remove the backplane (for instance to remove the backplane due to flood damage), the installed unit is usually field disassembled - the conduit is detached from the enclosure and external wiring uncoupled to the enclosure, allowing the entire enclosure to be removed from its installed location. Then, the equipment mounted on the enclosure that extends into the interior of the enclosure must be removed, as the interior extend of this equipment presents a physical obstacle to lifting the backplane off the mounts and out of the interior of the enclosure. Once these obstructions are removed, the backplane can be disconnected from the mounts, allowing removal of the backplane from the enclosure. Removal of the backplane from a fully installed enclosure is very difficult or impossible. Further, field disassembly may result in costly and lengthy shutdown of critical control systems. To avoid this, servicing of components on the backplane generally entails field service of the components on the backplane while the backplane is installed in the enclosure. This can be a difficult task as troubleshooting must take place in an environment of the enclosure.

In instances where extensive re-hab of the electrical components are required (for instance, due to flooding, lighting strikes, other adverse conditions) or where new designs require extensive replacement of components, it is necessary to remove the backplane. In this instance, a complete new enclosure and backplane will usually be provided, that is, a new enclosure is provided in the field to "swap" out with the existing installed enclosure. Such a procedure is expensive and time consuming as it requires field disassembly of the mounted enclosure (removal of conduits from the enclosure and associated wiring, and dismount of the mounted enclosure) and adds the costs of an additional enclosure. It would be beneficial to be able to easily and quickly remove mass components to reduce downtime.

Many enclosures house control equipment for critical infrastructure, such as a sewage lift or pump stations, or manufacturing infrastructures, such as assembly line control equipment, or other process equipment, where downtime is costly. In periods of downtime, for instance for repair,
scheduled maintenance or shutdowns in anticipation of emergencies (e.g. hurricanes, evacuations), critical infrastructure or process control can be unnecessarily lost. It would be beneficial to be able to easily and quickly remove specific components, such as costly non-critical electrical components, allowing the remaining components to continue to operate in a back-up mode.

The ability to remove the backplane or a portion of the backplane with attached electrical components, without disturbing the enclosure field mount is desirable.

**Summary of the invention**

The invention is a backplane system that provides for an easily removable backplane or portions of a backplane. One embodiment includes a backplane with cutouts aligned with the location of elements that protrude into the interior of the enclosure. Another embodiment provides backplane modules, each separately removable from the enclosure. Another embodiment provides for vertical stacking of the backplane modules, or alternatively, vertical stacking of swing panel doors. This invention combines all interior components into one or multiple "bucket" style modules which can be easily removed, allowing for complete replacement of the any module or the entire bucket of modules without the need to disassemble or de-install the installed enclosure.

The invention will be described in the context of an enclosure for a sewage lift station, but should not be limited to this particular application.

**Brief Descriptions of the Drawings**

Figure 1 is a perspective view of a prior art enclosure.

Figure 2 is a schematic of a pump station showing the electrical enclosure used in the station.

Figure 3 is a front view of an enclosure showing the backplane installed.

Figure 4 is a front view of the enclosure of figure 3 with components mounted on the backplane.

Figure 5 is a prospective view of the backplane/inner swing panel assembly.

Figure 6 is an exploded view showing the removable backplane/inner swing panel assembly and
enclosure.

Figure 7 is a top view of a backplane and the corresponding inner-swing panel showing allocation of components.

Figure 8 is a prospective view of an enclosure with a segmented two module backplane system.

Figure 9A is a top view of the interior of an enclosure equipped with a strip mounting system.

Figure 9B is a top view of the interior of an enclosure equipped with a lattice mounting system.

Figure 10 is a top view of the interior of an enclosure equipped with three backplane modules system.

Figure 11 is a perspective view of a portion of the enclosure depicting two swing panels or two vertical backplane.

Figure 12 is a front view depicting a stacked two layer backplane system, including a segmented top layer.

Preferred Embodiment of the Invention

Single Module Embodiment - Removable unit

An exemplary system will be described for a sewage lift station. The first embodiment is a single backplane embodiment. A typical sewage lift station consists of pit, pump, floats for pump activation and a control panel. The lift stations can be located in populous areas such as subdivisions and are susceptible to tampering or vandalism. This requires that the controls be tamper resistant, and hence all the controls, switches, lights and the like are mounted and sealed in an outer enclosure. The outer enclosure 1 of the control panel may be made of many materials, including steel, aluminum, plastic or fiberglass, and may be optionally be watertight when closed.

The controls needed to operate the lift station are usually located inside the enclosure mounted on a backplane 5, typically a plate (not necessarily flat) which may also be made of various materials. The backplane 5 may be pre-perforated for mounting typical electrical components.

Typically, a specific pump control panel is designed for the application, and the design
implemented by assembling the needed electrical components onto the backplane, wired appropriately, and the assembled backplane is then tested in a facility specializing in control panel manufacturing prior to field installation. For instance, figure 4 represents a typical control panel and backplane arrangement suitable for dual pump operation.

The sewage lift station control panel consists of an enclosure 1 (shell), an inner backplane 5 and electrical components, which are mounted thereon, as well as electrical components that may be positioned on an interior cover plate or inner swing panel (not to be mistaken with the outer enclosure door). The enclosure 1 has a sidewall, a back and a top (the top can also be referred to interchangeably as the front), where the top 2 can be opened to provide access to the enclosure interior. As shown, the top 2 is a cover that is hinged to the sidewall (see fig 6). The interior cover plate 3 or inner swing panel door usually contains lights, switches and meters, counters or timers, and may be used to mount fairly expensive equipment, such as radios, PLCs, microprocessors, inter-active screens, etc. The outer enclosure 1 has mounted on it various components 10 that penetrate the enclosure 1, such as alarm lights, lightning arrestors, and conduit penetrations all of which protrude into the enclosure, as shown in figure 3. These interior protrusions restrict the removal of an installed backplane 5. Periodic repair and upgrade of controls is commonly performed on sewage lift stations. To accomplish this task without field disassembly of the installed enclosure, the backplate 5 includes cutouts or notches 20 located on its outer edge that are substantially aligned with components 10 mounted on the enclosure that penetrate the interior of the enclosure. The cutouts are sufficiently deep to provide the needed clearance for removal of the backplate past these obstructions. The cutouts or notches 20 thus allow the backplane 5 to be lifted out of the enclosure 1, after disconnecting the control/power wiring from the conduits to the backplane and from the equipment mounted on the enclosure and/or swing panel. See figure 3 and 4.

As can be seen in figure 3 and 4, the number of cutouts 20 can be less than the number of
obstructions 10, as a single cutout 20 can accommodate a number of obstructions 10. For instance, the bottom backplane cutout of figure 3 and 4 accommodates four conduit attachments. Alternatively, the backplane 5 may have a hinged portion or a detachable portion that can be removed or rotated up and out of the way, thereby creating a cutout or notch portion, providing the needed clearance over obstructions in the enclosure's interior (not shown). Since enclosures can be quite large, such a 4 feet tall by 3 feet wide by 1 foot deep, the backplane can also include grab handles 60 positioned on the backplane 5 in the interior of the enclosure 1 to assist in removal of the backplane (figure 8). As used, a grab handle 60 is a device meant to be grasped by an operator, allowing the operator to pull the handle and remove the backplane 5 (after detaching it from the back of the interior enclosure). Preferably, a grab handle 60 should not be a mounted electrical component. Alternatively, the backplane may have notches on the edge as a grab handle 60 to allow an operator's hand or pickup device to latch onto the backplane 5 for removal. The backplane 5 or plate is mounted to the interior of the enclosure 1, generally by bolts, screws or a quick type release connectors, through openings 30 on backplane aligned with a screw/bolt type mount positioned on the enclosure interior back wall. To remove the backplane 5 with mounted components, the wiring on those devices mounted external to the backplane 5 that connect to the backplane 5 must be disconnected - quick release terminal blocks or strips or quick disconnect connectors can be used to allow for ease of disassembly, such as PCVK4-7.62 available from Phoenix Contact. After wiring disconnection, the attachment members holding the backplane 5 to the enclosure 1 are removed, and the entire backplane 5 with attached components can be easily removed without disassembly of the field installation of the enclosure itself.

As mentioned, the enclosure 1 may include two covers, an exterior cover 2 and an interior cover 3. The interior cover 3 may have electrical devices mounted to the interior cover 3. In this instance, it may be desirable to remove the backplane 5 and interior cover 3 at the same time. In this instance, the interior cover 3 should be attached to the backplane 5 to allow the assembly to
be extracted as a unit. Such an assembly is shown in figure 5. Shown is backplane 5, with cover supports 12. Cover supports may be upstanding legs (with or without lip area 12C), upstanding posts 12A, or some other support means. As shown, the interior cover 3 is hingedly attached to one pair of legs 12. Alternatively, interior cover 3 may be attached to a single leg (shown as leg 12C). Grab handles 60 can be included either on the front of the interior cover 3, the back side of the interior cover 3, the backplane 5, or a combination of both.

As shown in figure 5, the interior cover plate 3 is an inner swing panel 3 that is hingedly attached to the cover support 12. Instead of being hingedly attached, the interior cover plate 3 could be attached to the legs by screws, bolts, latches or other attachment means. One method of hingedly attaching the inner swing panel is to use quick disconnectable spring hinges 61 such as shown in Figure 8. The quick disconnectable hinges 61 allow for ease of removal of the swing panel door 3. As shown in figure 5, one pair of legs is used to attach the inner swing panel 3 to the cover support 12, and the opposing pair of upstanding legs 12 is used to support the swing panel 3 when closed. In this embodiment, inner swing panel 3 has latches 4 that interface with a horizontal tab 12b positioned on the cover support to allow the interior cover 3 to latch or lock in place. In some installations, the opposing support legs may not be required, as the interior cover 3, if suitably sized, could rest on a lip or ledge formed by an inner projecting partial wall on the enclosure (not shown). Instead of upstanding legs 12, upstanding posts 12a could be used, as shown by the dashed posts in Figure 5. These posts could be screwed to or bolted to the backplane 5.

Figure 6 shows how the backplane 5 is removably inserted into the enclosure. Also shown in figure 6 is a raised platform 40 mounted on the backplane. Such a raised platform is used to mount switches and lights and other devices when there is no inner swing panel 3 for mounting. The single backplane 5, as described, provides a one piece backplane module that allows for ease of replacement of the backplane 5. A supplier can build a new module with components installed
and ship it to a lift station in need of repair or upgrade. The old module would then be disconnected and removed from the existing enclosure and the new module installed quickly and easily, all without field disassembly of the installed enclosure. Removal is made possible by the cutouts or notched portions 30 allowing the backplane 5 to clear any obstructions that extend into the interior of the enclosure 1. This insures the lift station is non operational for only a short period of time.

**Backup or Emergency Mode**

When electrical components are mounted on the inner cover 3 (hereafter referred to as a swing panel), it is possible, with careful component selection, to have the backplane 5 provide functionality when the swing panel's 3 electronics is absent or removed. For instance, if high-level non-critical functionality is provided only by swing panel 3 mounted electrical components, the swing panel 3 can be removed from the enclosure 1, with its mounted components, leaving the remaining components on the backplane 5 to function in an operational backup mode. For instance, if remote control and communications electronics are mounted on the swing panel 3, removing the swing panel 3 will remove the ability to remotely monitor and remotely control, but the electronics on the backplane 5 can be designed to operate in a local automatic mode.

For instance, shown in figure 7 is a swing panel 3 having pilot lights, a radio for external communications of status and external control of settable features, and other components. On the backplane 5 are located the hardware needed for actual control of the lift station, such as pump starters, relays, circuit breakers, etc, shown for duplex operation (two pump operations). In this configuration, the swing panel 3 contains equipment that provides desirable but not necessary features for operation of the lift station. When all features are operating, the operating mode is considered the normal operating mode. With the swing panel 3 removed (or certain backplate modules removed, as described later) the operating mode is referred to as a backup mode or emergency operating mode. By back-up operational mode (or emergency mode) is meant that the
lift station remains operational, but high level features, such as remote control or remote communications, test features, or control of optional non-necessary equipment, may be lacking or non-operational. In backup mode, the functionality provided by the components mounted on the swing panel is lacking, but the base function or critical features of the lift station continues to operate (e.g. pumps turn on and off in response to signals received from floats in the lift station). Critical features or components are those components in the enclosure that are necessary for the control of the remote device operated, that is, a critical component is one without which the external device fails. For instance, in a pump station environment- control of the pump requires that the communication lines with the remote float switches remain, and the associated relays that the switches control for turning on/off the pumps are also critical.

To ease transition between the emergency and normal mode, a switch (hardware or software) can be included to indicate that the swing panel equipment is non-functional or missing (the switch can be a hardware switch or a software option). Alternatively, simply disconnecting the plug connection (such as in a pull apart terminal) between the backplate and the swing panel can be used as an indicator or switch, or the switch can be located on the swing panel, and operation of the switch informs the backplane electronics to ignore the swing panel electronics.

The backup mode is useful for emergency situations. For instance, in hurricane zones where the threat of flooding is high, expensive and hard to replace non-critical equipment may be located on the swing panel, thereby allowing a user to remove the swing panel and components in an emergency but allowing core functions to remain operational with the electrical system located on the backplane (or the remaining backplate modules). In the event of flooding, the remaining backplane components would be sacrificed, but the sacrificed backplane can be readily replaced without field disassembly of the installed enclosure and the saved extracted swing panel replaced. If the panel is not flooded, the lift station will continue to operate during the emergency until/unless power is lost, and should automatically reboot or restart when power is restored. The
high level functionality removed with the swing panel 3 mounted components can later be restored by reinstalling the removed swing panel. Also shown in figure 10, mounted on the enclosure 1 are check valves 100 and 200, and air release vent valve 300. Check valve 100 allows water to enter the enclosure during a flood, while valve 200 allows water to drain from the enclosure interior when flood waters recede. As the enclosure 1 is generally watertight, in a flood situation, the buoyant force on the enclosure 1 can exert sufficient force to damage the conduit connectors /fittings and even tear the enclosure loose, thereby requiring replacement of the enclosure and conduit sections. The air release valve 300 allows air to exit and enter to provide for fluid flow into/out of a sealed enclosure 1. The check valves can be about A pound release valves to keep insects out of the enclosure.

When considering the swing panel and backplate as a unit assembly, (possibly removable from each other but can be extracted from the enclosure as a unit) the combination describes an enclosure system having two modules, the backplane module and the swing panel module.

**Modular Backplate**

The backplate itself can be a combination of modular backplane modules or segments 70, such as shown in Figure 8. Shown is a side-by-side first backplane module or segment 70A and second backplane module or segment 70B. Each backplane module 70 is mounted to the interior of the enclosure 1. Because most enclosures only provide four mounting locations at the corners of the enclosure interior, a mounting system 40 can be included, such as mounting strips 50 (see figure 9A), or a substantially two dimensional mounting lattice 51. See Figure 9B. The mounting system 40 can be attached to the four mounts 30 located in the enclosure and provide additional locations on which to attach a backplane module 70. The mounting system 40 can be almost any configuration.

When backplane modules 70 are used, it is preferred that each module 70 be removable without field disassembly of the enclosure 1. However, by using modules 70, notches may not be
necessary in a particular module, or in any module. For instance, in a two module system (module 7OA and 70B) comprising a split backplane (see figure 8) where module 7OA is mounted with no obstructions blocking removal, module 7OA can be removed by detaching it from the mount system 40, and lifting up on the grab handles 60 - no cutouts are required on module 7OA.

If module 70B has obstructions blocking removal (such as the conduit 90 shown in figure 8, module 7OA could be removed first, leaving sufficient space in the enclosure so that module 70B could be detached from the mounting system, and slid to the area previously occupied by module 7OA until the obstructions are cleared, allowing removal of module 70B. Note, when a swing panel 3 is installed, the swing panel would usually have to be removed in order to extract the backplane modules. Alternatively, even if module 70B is blocked, because of the split backplane design, it may be possible to detach module 70B from the mounting system 40 and tilt or rotate the module 70B so that the non-obstructed edge (reference 73 in figure 8) is raised, thereby providing sufficient room to slip the module 70B out past the obstructions. To assist in this feature, the mount strip may be a hinged mount strip, or the mounting system may include two vertically oriented legs 78 (one embodiment is shown in figure 9) having openings to accommodate hinges positioned on the backplane module, such as removable hinges 61 shown in figure 8. If two side-by-side backplate modules 7OA and 70B are used, with each to be rotatable, four vertical legs 78 or two hinged mounting strips may be needed, allowing each module to separately rotate. In certain instances, cutouts on at least one of the modules may be preferred.

The modular system provides flexibility to designers of the electrical/electronic components that need to be installed on the modular backplane system. For instance, there may be a series of components that are not robust and are high failure components (e.g. time between failures for these components is low). These non-robust components could be positioned on one backplate module, with the remaining robust components positioned on another module. This allows for operational spare modules (modules with installed components) to be kept for non-
robust components, and when a non-robust component fails, an operational spare module can be
brought to the field and installed without the need to disassemble the field mount of the enclosure,
and without the need for replacement of the entire backplane, allowing for a reduction in spare
costs. The non-working and replaced backplane module can then be trouble-shot at the
convenience of the operator remotely from the enclosure. Alternatively, the modules may
accommodate individual functional features. For instance, in an enclosure housing equipment to
operate two pumps, pump A and pump B in a lift station, three modules, 7OA, 7OB and 7OC may
be used: one module 7OA for the equipment only associated with pump A, one module 7OB for
the equipment only associated with pump B, and a third module 7OC for the equipment common
to pump A and pump B See Figure 10. The modular backplane system provides for quick
turnaround and reduces the cost of maintaining spare component-equipped modules. The system
also allows for standardized modules, for instance, in figure 10, the backplane module for pump A
is identical to that for pump B. Only the connector wiring is different, and by using quick
disconnect terminals, such as pull apart terminals, the wiring connections can be made relatively
inexpensively. As indicated, several modules can be used to increase the flexibility of the system.

Vertically Stacked Modules

Another flexible design alternative is to use vertically stacked backplate modules, creating
vertical layers of modules. Generally, given the limited space in an electrical enclosure box, two
backplane layers will be sufficient, as more than two can be cumbersome. A layered modular
backplate system provides an enclosure having a more compact footprint, and with each layer
accessible, provides ease of maintenance. In a layered system, backplate modules are vertically
stacked, one above the other. Mounting one module above another requires a mount system to
accommodate vertical stacking and removal of stacked modules for repair purposes. Modules may
be mounted to one another using mounting posts with quick disconnect couplings or clips, with
the mounting posts positioned the upper side of the lowermost module or the lower side of the
uppermost module. Alternatively, the vertically leg 78 system shown in Figure 9A can be used, with each module 70 having disconnectable hinges (such 61 shown in figure 8) that interface to the vertical leg 78. As shown, the vertical legs 78 are positioned on one mounting strip 50. In this configuration, the vertical legs 78 can be of sufficient height to additionally accommodate the swing panel 3. Alternatively, if the upper module is a small module, (say a 1/3 panel configuration) then the vertical leg hinge mounts 78 can be located along the top edge, side edge, or in the center of a lower backplane, as needed. As shown in figure 9A, the vertical legs 78 have a triangular type shape taper to allow each module in the stacked layers to rotate about 90 degrees, without interference from the rotated upper layer module.

Alternatively, the lowermost module (the one furthest from the enclosure opening) can be attached to the rear of the enclosure, and the uppermost module installed using a hinged-type connector strip. The vertical stacked modules may be employed only over a portion of the entire backplane area, such as module 400 in figure 12. When the modules are rotatable or hinged, the free end may be supported by legs or a post on the adjacent lower backplate, and latchable to such to lock the module in place, or latchable to adjacent modules to create a unit structure.

Another stacked embodiment would include vertically stacked swing panels or inner doors modules 3. For instance, shown in figure 11 is a enclosure 1 having two swing panel doors 3A and 3B modules, each mounted on the same hinge system. The two swing panel modules 3A and 3B may be latched together at one of the edges to provide for the panels to move in unison, but separable at the users discretion. Alternatively, each swing panel module may be latchable to vertical support (shown as 80 and 81 in figure 9A); the lower swing panel module 3B would have cutouts aligned with the lips associated with legs 81 to allow the lower swing panel 3B to clear these legs when lowered to rest on legs 81. Alternatively the lower swing panel modules may be slightly smaller than the swing panel module above it, allowing each to be separately latched to a bracket or step bracket positioned on the backplane.
As described, the system is flexible and designed for removing various components without the need to disassemble the filed installed enclosure. Wiring from the cable conduit can carry power and signaling to each backplane (directly or through connectors) or to a single backplane or swing panel, and from thence, to the remaining modules. In each case, each module is operatively connected as required to the power/communication wires. The system is capable of being removed a module at a time, or totally removed as a unit, for instance, by removing the attachment for the lattice mount, the entire system (backplane modules and any swing panel doors connected to the system, plus the lattice mount) can be removed. The modules are generally substantially flat or planar plates, and may have upstanding legs or pegs attached thereto or molded as a unitary structure.
Claims

I claim:

1. An electrical enclosure system comprising an enclosure having a sidewall, a back and a top, defining an interior and exterior, said top adapted to open and provide access to said interior, said enclosure having a cable conduit joined to said sidewall, said cable conduit having wires disposed therein and a backplane system, said backplane system including a plurality of backplane modules for mounting electrical components thereon, each module mounted to a mounting system located in the interior of said enclosure, where each said module is adapted to be removable from the interior of the enclosure without detaching said cable conduit from said sidewall, each said backplane module operatively connected to said wires in disposed in said conduit.

2. The electrical enclosure system of claim 1 wherein said backplane modules are mounted in a substantially single plane.

3. The electrical enclosure system of claim 1 wherein said plurality of backplane modules comprises a first backplane module and a second backplane module, said first and second backplane modules mounted substantially parallel but vertically offset from one another.

4. An electrical enclosure system comprising an enclosure having a sidewall, a back and a top, defining an interior, said top adapted to open and provide access to said interior, and a substantially planar backplane having edges, said backplane mounted to the interior of said enclosure, said backplane having at least one upstanding leg, and an interior cover plate supported by one of said at least one upstanding leg, said backplane having at least one cutout positioned on said backplane edges, said cutout positioned to align with an obstacle positioned on said enclosure sidewall and extending into said enclosure interior and of sufficient extent to allow said backplane to be removed from said interior without removing the obstacle.
5. The electrical enclosure of claim 4 wherein said interior cover plate is hingedly mounted on one of said at least one upstanding leg.

6. The electrical enclosure of claim 4 wherein further including a second upstanding leg, and said interior cover plate includes a latch, said latch latchable to said second upstanding leg.

7. In combination with an installed electrical enclosure comprising an enclosure having a sidewall, a back and a top, defining an interior, said top adapted to open and provide access to said interior, a plurality of components positioned on said enclosure and projecting into said interior of said enclosure; a removable backplane comprising a backplane mounted to the interior of said enclosure, said backplane having at least one upstanding leg, said backplane having at least one cutout, said cutout being aligned with at least one of said interior projections of said components and sized to allow said backplane to be removed from said interior of said enclosure without removing said components positioned on said enclosure, said backplane further having a grab handle to assist removal.

8. A method of removing a backplane from an installed electrical enclosure, where said electrical enclosure comprises a sidewall, a back and a top, defining an interior, said top adapted to open and provide access to said interior, a plurality of components positioned on said enclosure and projecting into said interior of said enclosure; said plurality of components including at least one conduit mount coupled to a conduit, wiring passing though said conduit into said interior of said enclosure; backplane mounted to the interior of said enclosure and having a series of electrical devices mounted on said backplane, said backplane having at least one cutout, said cutout being aligned with at least one of said interior projections, said wiring coupled to a subset of said electrical devices; the method comprising the steps of opening said top of said enclosure, decoupling said wiring from said electrical devices; dismounting said backplane from said enclosure; and lifting said
backplane from said enclosure interior without removing said components positioned on said enclosure.

9. An electrical system comprising an electrical device and an electrical enclosure, said device located remotely from said electrical enclosure, said electrical enclosure having a sidewall, a back and a top, defining an interior and exterior, said top adapted to open and provide access to said interior, said enclosure interior housing electrical components operatively communicating in a normal mode with said electrical device, said electrical enclosure having a conduit attached thereto and receiving power through wires disposed in said conduit, said electrical components positioned on a peripheral component module and a necessary component module, each module being a substantially planar surface mounted in said interior of said enclosure, each module operatively powered by said wires, said peripheral equipment module being removed, and said device operatively communicating in an emergency mode with said components positioned only on said necessary component module.

10. The electrical enclosure system of claim 1 further comprising a first swing panel module, said first swing panel module being substantially planar and removably connected to at least one vertical upstanding leg positioned on one of said backplane modules.

11. The electrical enclosure of claim 10 wherein said first swing panel module is hingedly removably connected to said upstanding leg.

12. The electrical system of claim 9 wherein said electrical device comprises a pump.

13. The electrical system of claim 12 wherein said pump is an air blower.
TYPICAL SEWAGE LIFT STATION

FIGURE 2
**INTERNATIONAL SEARCH REPORT**

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
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<tbody>
<tr>
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<td>1-13</td>
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Further documents are listed in the continuation of Box C.

Date of the actual completion of the international search: 26 June 2008 (26.06.2008)

Date of mailing of the international search report: 07 JUL 2ddS

Authorized officer: Lee W. Young