

PMP Liquid Level Sensors  
Solution Engineering Project No. 180543

**Background:**

Solution Engineering Group (SEG) was asked by PMP Corporation (PMP) to conduct testing on two Liquid Level Sensors with float switches to determine the lower level detection limit of the sensors. As part of this effort, SEG was asked to render its opinion as to if these sensors qualify as “a simple apparatus.”

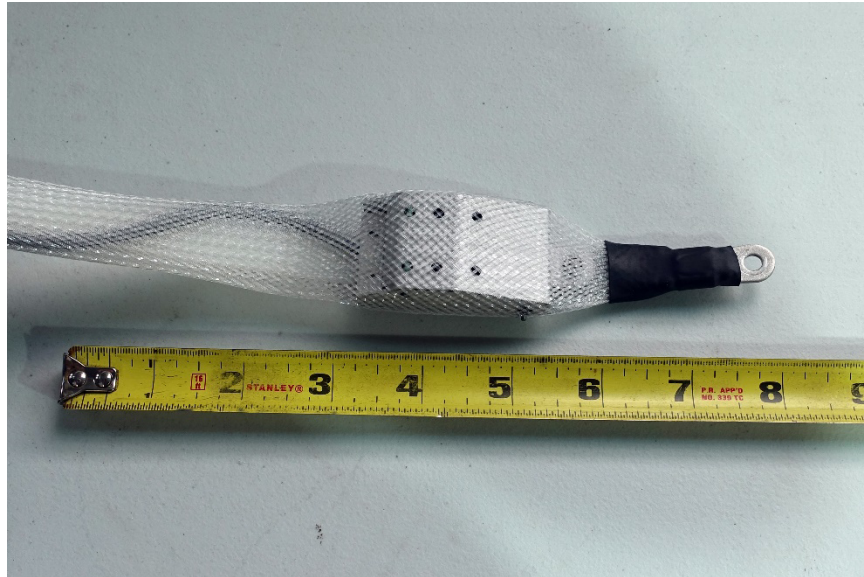


Photo #1: PMP # 63409



Photo #2: PMP # 63460

John Fildes, Ph.D. performed this evaluation for SEG. My CV is attached. Briefly summarized, my relevant experience serving as the Group Manager for the Sensors and Controls group at Northwestern University's Industrial Research Lab (BIRL), in which capacity I oversaw a group of 28 members, most with advanced degrees, performing numerous and extensive R&D projects involving a wide variety of sensors. I also maintained my own active research program, part of which involved over one million dollars of funding from the Gas Research Institute (GRI), First Alert, and the Electric Power Research Institute (EPRI) to develop innovative sensors. Part of my research involves applied electrochemistry, which involves the design and construction of measurement circuits and the modeling of electrochemical systems. I have also conducted studies to develop innovative model-based and sensor-based control systems under funding from the Navy (ONR), the Defense Advanced Research Projects Agency (DARPA), and the Great Lakes Composites Consortium. I also have used a variety of sensors and measurement systems in R&D projects funded by the aforementioned entities and the Army. My opinion is based on this experience.

PMP # 63409 Fiberglass tank Interstitial Sensor is a relatively thin sensor that contains a float switch with high resistance when open and very low resistance when closed. PMP # 63420 and 63460 are relatively squat cylindrical devices that contain float switches.

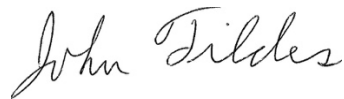
According to the National Electric Code (NEC) Section 504 Intrinsically Safe Systems, which is shown below, a switch is given as an example of a simple apparatus. The PMP sensors for which this opinion is rendered are switches, specifically contact switches that are normally open and that close when the level of a liquid exceeds a threshold height. These sensors do not have their own power source. They connect to a Veeder-Root tank monitor and connect the two terminals of the monitor's circuit when the contact switch closes. As such, these sensors do not generate their own voltage, current, or power, and as low impedance contact switches, they do not dissipate power, which meets the NEC specification of a simple apparatus. The contact switch is contained in a plastic housing. As a contact switch, the sensor is intended to be a passive component, and the Veeder-Root controller provides the active electrical systems and safety measures. For these reasons, the sensors for which this opinion is rendered, and ones that are electrically and physically equivalent meet the NEC specification of simple apparatus, especially considering these sensors are the type of device that is specifically cited by the NEC as an example of a simple apparatus.

**Simple Apparatus.** An electrical component or combination of components of simple construction with well defined electrical parameters that does not generate more than 1.5 volts, 100 milliamps, and 25 milliwatts, or a passive component that does not dissipate more than 1.3 watts and is compatible with the intrinsic safety of the circuit in which it is used.

Informational Note: The following apparatus are examples of simple apparatus:

- (a) Passive components, for example, switches, junction boxes, resistance temperature devices, and simple semiconductor devices such as LEDs
- (b) Sources of stored energy consisting of single components in simple circuits with well-defined parameters, for example, capacitors or inductors, whose values are considered when determining the overall safety of the system
- (c) Sources of generated energy, for example, thermocouples and photocells

**Prepared By:**

A handwritten signature in cursive script that reads "John Fildes".

John Fildes, Ph.D.