

PAL-AT[®]

Leak Detection/Location System

Guide Specification

Part 1 General

1.1 Furnish complete leak detection and location system consisting of a microprocessor based monitoring unit, sensor cables, probes, system layout map and auxiliary equipment required to provide continuous monitoring of the sensing string(s) for leaks (growing and multiple), shorts, breaks and probe activations. If any of these conditions should occur at any point along the cable, an alarm shall sound, type of condition and location shall be clearly identified. Systems that lose accuracy or alarm due to build-up of dust, dirt or other dry contaminants shall not be acceptable. (Optional :) [The system shall be designed to monitor piping and equipment in a computer room or clean room and shall detect all liquids, which may be present using a single sensor cable.] [The system shall monitor double contained piping, tanks, generator sets, single wall piping and/or trenches.] [The system shall monitor direct buried hydrocarbon sensing cable.]

1.2 Manufacturer

The system shall be the PAL-AT Leak Detection and Location System manufactured by PermAlert, Niles, Illinois, (847)-966-2190, permalertsales@permalert.com. The manufacturer shall have at least ten years' experience in supplying leak detection systems.

1.3 Approvals

The system shall be UL Listed (USA and Canada), CE certified.

When zener barriers are required for intrinsically safe sensor circuits for hazardous areas the components shall be UL Listed (USA and Canada), ATEX and IECEx approved for Class I, Division 1, Groups C & D or Zone 0, Group II B locations

FM Approval available including Class Number 7745 (Hydrocarbon Leak Detectors)

Part 2 Performances

2.1 The Leak Detection System shall locate the point of origin of the first liquid leak or fault (break/short/probe) within $\pm 0.25\%$ (0.6% for hydrocarbons) of the sensor string length, or ± 6 feet, whichever is greater. The system shall identify the type of alarm leak/break/short/probe as well as the location. The system shall be able to monitor (detect and locate) with up to 100' of cable wetted without significant inaccuracy in location.

For applications requiring U.S. EPA Third Party Approval the system shall be evaluated by an independent third party according to the Third Party Procedures developed according to the U.S. EPA's "Standard Test Procedure for Evaluating Leak Detection Methods: Liquid-Phase Out - of Tank Product Detectors." The evaluation results shall verify the system manufacturer's claim regarding sensitivity, range and other performance data.

2.2 Sensing String Length

The system shall be capable of monitoring up to [7,500] [3,000] feet of cable per sensor string from a single monitoring unit.

2.3 Multilevel Leak Alarms and Multiple Leaks

The system shall be capable of monitoring (detecting and locating) for initial leaks, growing leaks (multilevel alarm) and multiple leaks on the sensor cable.

2.4 Breaks and Shorts

The system shall be capable of identifying the location of breaks and shorts on the cable. When either of these faults occurs, an alarm shall sound and a display visible on the front of the monitoring unit shall clearly indicate the type of fault, i.e. BREAK or SHORT and display the location of the fault. Systems that cannot detect and identify shorts on the sensor cable are not acceptable.

2.5 Liquids Detected

The system shall be capable of detecting all liquids, including, but not limited to aqueous, hydrocarbon, conductive and nonconductive liquids. (Optional:) [Two cables are to be furnished to detect and differentiate between hydrocarbon/solvents and aqueous liquids.] [Only hydrocarbons are to be detected.]

2.6 Remote Annunciation

The system shall provide Modbus TCP and Modbus RTU output and dry contact relays for remote indication of an alarm condition. The relays shall provide indication that: (1) no alarm conditions exist; (2) a power failure has occurred; (3) an alarm condition exists but has not yet been silenced; (4) an alarm condition exists and has been silenced but not cleared; and (5) a second alarm has been detected after an alarm has been silenced but not cleared. An Ethernet RJ-45 port and two serial communications ports shall be available. Communications via TCP/IP, RS-232 and RS-485 with Modbus TCP, Modbus RTU, PALCOM[®] 10 and/or ASCII communication protocol to allow central point monitoring and control via a remote computer. (Optional:) [BACnet IP gateway shall be furnished]

2.7 Archives

The system shall record significant events in nonvolatile memory. A minimum of 900 events shall be stored. When the memory becomes full, the recorded events shall be deleted from memory on a FIFO basis. Each recorded event shall include the time and date that the event occurred. Archives shall be retrievable through the communication ports.

2.8 System Status

The system shall continuously provide positive indication that it is monitoring the sensing string and the status of the sensing string. The system clock shall provide the time and date on the LCD of the monitoring panel. The system clock shall be programmable by the user. A time and date indication shall be included for all events recorded in memory.

2.9 Security

The system shall have assignable password security to provide for varying levels of system access. A minimum of 20 passwords shall be available within the system. The system shall not permit unauthorized modifications to the sensing string to be made (i.e. shortening the cable length) without causing an alarm condition.

2.10 Sensor Types

The system shall be capable of monitoring sensor cables, probe sensors and switch sensors (such as float switches, pressure switches, etc.) from the same monitoring panel. Language displays (English, German, Spanish and others) shall indicate the status of the system.

2.11 Sensitivity

The system shall not detect incidental liquid contact that is not at least equivalent to a small puddle, 3 inches in diameter. The sensitivity of the system shall be field adjustable to increase or decrease the amount of wetted cable needed to cause an alarm from several inches to several feet.

Part 3 Products

3.1 Monitoring Unit

The monitoring unit shall be microprocessor based and capable of monitoring up to [7,500] [3,000] feet of sensing string per cable, including sensor cable, probes and jumper cable, depending on cable type. The monitoring unit shall indicate when any liquid or growing liquid contacts the sensor cable by sounding an alarm, actuating output relays, and displaying a message that states a leak has been detected and shows the location of that leak on the sensing string.

The monitoring unit shall have a green LED on the front panel to indicate the unit is powered. A 2-line by 40-character backlit LCD shall be visible from the front of the unit to provide system data. A red LED on the front panel shall indicate an alarm condition has occurred.

The monitoring unit power requirements shall be 120/240 VAC, 50 VA, 50/60 Hz, single-phase or 24 VDC, 24VA. Monitoring units shall be equipped with an RS-232 and an RS485/232 communication ports and a minimum of one power failure relay, one common and one per cable SPDT output relay, rated for 250 VAC, 10 A. The ability to locate a leak shall not depend on battery backed up functions. In the event of power failure, system conditions and parameters shall be stored in nonvolatile memory allowing the unit to automatically resume monitoring, without resetting, upon restoration of power. An on-off switch shall be provided in the panel for servicing.

The monitoring unit shall be enclosed in a Type 12 (IP52) enclosure. The Zener Barrier Panel (if required) shall provide connections for intrinsically safe sensor circuits for use in Class I, Division 1, Groups C and D and Zone 0, Group IIB Hazardous Locations. [Optional:] [A NEMA 4X outer enclosure shall be furnished with viewing window for mounting in wet locations.] [A NEMA 7 explosion proof outer enclosure shall be furnished.]

3.2 Sensor Cable

The sensor cables shall be suitable for use with the monitoring unit. The sensor cables shall be of coaxial construction consisting of an insulated copper center conductor, a suitable spacer material, and an insulated outer braid with a protective overbraid.

All coaxial sensor center conductors must not be less than 14 AWG for mechanical strength.

All cables must be capable of field installation of connectors by trained technicians. The cable shall be available in lengths up to 1,500 feet in bulk spools. All cables must be field repairable by trained technicians. Cable on flat surfaces shall have hold down clips every 8 feet and cable identification tags every 50 feet.

(Optional;) Cable shall be designed to detect hydrocarbons only and have a center core that allows hydrocarbon penetration.

For use with Perma-Pipe piping systems only [ATP Cable Only]

3.3 Sensor Cable In Polyurethane

The sensor cable installed in polyurethane foam insulation shall be a twisted-pair design consisting of 2 insulated 1.5 mm² insulated copper wires suitable for exposure to temperatures up to 135°C. The sensor cable shall detect water-based liquids. Maximum length of ATP cable sensor string shall be 5,000 feet.

Part 4 Installation

4.1 General

The system shall be installed per the manufacturer's recommended installation procedures. All local, state and federal codes and requirements shall be followed. The system shall be installed by properly trained personnel.

4.2 Graphic Locator Maps

A location map shall be provided with the system by the installing contractor; indicating the "As Installed" system configuration and sensing string layout. Footage along the cable shall be provided as references to locate leaks. Footage shall be based upon Calibration Points taken per Section 4.3.

4.3 Calibration Point

The installing contractor shall be responsible for taking and recording calibration points along the sensing string per the manufacturer's recommended procedures. All cable not in containment piping shall have cable tags every 50 feet.

4.4 Field Test of System

Tests shall be performed to demonstrate the ability of the system to detect and locate breaks, shorts and probes on the sensor string. The cable shall be shorted with the alarm and location verified. Leak testing shall be done per the following procedure to verify operation and ability to work with condensation pools of other static moisture.

- A. Wet the sensor cable near the start of the sensor string and silence/acknowledge the detection/location alarm.
- B. Increase the amount of cable wet and verify the second alarm and location. Clear the alarm queue.
- C. Wet the sensor cable near the end of the sensor string with the first location still wetted and silence/acknowledge the detection/location alarm and clear the alarm queue.
- D. Wet the sensor cable in three additional locations between the first and second leak location with each detection/location alarm being silenced/acknowledged and the alarm queue cleared with all prior leak locations still wetted.

Prepare and submit a report verifying leak location and detection accuracy for each event. Furnish a history print out of the test results from the panel. Submit TDR traces for each test run to allow verification of wet locations.

4.5 Field Technical Assistance

The contractor will provide manufacturer's technical assistance for contractor, training, installation inspection, start up and owner operating and maintenance training. Contractor is to follow the manufacturer's instructions for installation. A time-domain reflectometry graph of the cable installation shall be furnished at time of owner training.

[Direct buried hydrocarbon cable only]

4.6 Direct Buried Hydrocarbon Sensing Cable

Hydrocarbon sensor cable shall be installed in slotted PVC pipe as detailed on the drawing and as required by the manufacturer. Care shall be taken not to damage or contaminate the cable. The cable ends shall be sealed to prevent moisture ingress. Connectors shall be accessible in junction boxes at grade or in manholes, valve pits or other locations. PVC pipe risers to grade shall be installed to make the cable replaceable and serviceable in the field.

The contractor is to comply with the manufacturer's instructions in regards to installation of the system including design requirements.