LIQUID LEAK DETECTION SYSTEMS
OIL & GAS DIVISION

Liquid Hydrocarbon and Non-Conductive Solvent Leak Detection and Location System – Industrial & Commercial Building Applications– Specification

1.0 System Overview

A [liquid hydrocarbon] [non-conductive solvent] leak detection system shall be installed to continuously protect the critical areas of the Project Facilities *[Installation to be specified]* from the risk of [liquid hydrocarbon] [non-conductive solvent] leaks.

A complete detection system shall be installed.

2.0 Type

The detection system shall be composed of the following elements:

- FG-SYS or FG-NET digital monitoring unit, manufactured by TTK, or equivalent,
- FG-DOD intermediate digital boxes, manufactured by TTK, or equivalent,
- FG-OD addressable sense cables (sensors), manufactured by TTK, or equivalent,
- Jumper cables and all required ancillary equipment.

3.0 Overall System

The liquid leak detection system shall detect any abnormal presence of [liquid hydrocarbon] [non-conductive solvent] at any point of its connected sensors.

The liquid leak detection system shall be able to locate multiple [liquid hydrocarbon] [non-conductive solvent] leaks simultaneously as well as cable break faults (one per sensor).

The liquid leak detection system shall be able to monitor both [liquid hydrocarbon] [non-conductive solvent] leak detectors and [water] [acid solution] [basic solution] leak detectors on a single digital unit.

4.0 Sense Cable

4.1 Construction and Certification Requirements

Each sense cable (sensor) shall:

- have an embedded microchip circuit allowing the transmission of an addressable signal to the digital monitoring unit,
- have its own identity or unique address; this shall be programmed directly by the installer or the user, using the touch screen on the front face of the monitoring unit,
- be connected via male and female connectors,
- include a silicone sensing element, detection return wire, continuity wire, communication bus wire, power supply wires,
- have an external PE braid for mechanical protection,
- be made of an abrasive-resistant material,
- be made of light and flexible material in an easily identifiable colour,
- undergo to a mostly reversible [liquid hydrocarbon] [non-conductive solvent] absorption, allowing for absorbed liquid to be cleaned with appropriate solvent,
- be certified for safe use in ATEX Zone 0, protection mode "IA", Group IIB, Temperature Class T4.

Accessories shall be pre-connected. Jumper cable (Belden 8723 or equivalent) as well as end termination plug shall ensure the continuity of each circuit.

4.2 Performances

The [liquid hydrocarbon] [non-conductive solvent] sensor shall provide the following performances:

- Quick detection times, in particular :
  - Gasoline: 3-5 minutes max. (*)
  - Diesel fuel: 15-20 minutes max. (*)
  - Jet Fuels : shorter detection time than Diesel Oil

  (*) depending on temperature, leak conditions and composition
- Accuracy : sensor length = down to 3m,
- Reliable detection : insensitive to small pollutions, dirtiness, external loads (pressure),
- Insensitive to water,
- Cable reuse after leak detection, following cleaning with appropriate solvent,
- Possibility to perform leak detection tests under real conditions,

4.3 Standard Lengths

The following standard lengths of [liquid hydrocarbon] [non-conductive solvent] sensors shall be available:

- 3 m
- 7 m

- 12 m
- Long Line

5.0 System Capacity

The system shall be capable of monitoring up to 120 sensors overall.
It shall be possible to connect the monitoring unit with :

- o [liquid hydrocarbon] [non-conductive solvent] sensors - 1440 m overall max.(*)
- o [water] [acid solution] [basic solution] sensors - 1800 m overall max. (*)
- o a mix of the above.

(*) This length shall not include the jumper cable.
The [liquid hydrocarbon] [non-conductive solvent] sensors will be connected to the Monitoring Unit via FG-DOD intermediate digital boxes, manufactured by TTK, or equivalent.
It shall be possible to connect 10 [liquid hydrocarbon] [non-conductive solvent] sensors to one intermediate digital box.
A Zener Barrier device (if required) shall be installed between the intermediate digital box and the [liquid hydrocarbon] [non-conductive solvent] sensors to allow use of sensors in Hazardous Locations (ATEX Zone 0, e.g. for Group IIB).
The panel shall be able to show all the cables connected and group them by zone.
The panel shall be able to monitor three independent circuits of sensors.

6.0 Digital Monitoring Unit

The digital monitoring unit shall be a microprocessor based complete leak locating system. It shall receive data processed and transmitted by each sensor as well as raising the alarm. It shall be supplied from the same supplier as the sensors.

In the event of a leak, an audible alarm shall be triggered and a dry contact shall be activated.

[Digital Monitoring Unit: Interactive touch screen type – FG-NET or equivalent only:]

[The panel's touch screen display shall show the time and date of the alarm, the type of fault and the location of the leak to the nearest cable. Dynamic zone maps highlighting faults on the panel's screen shall be available as an optional feature. A power failure relay shall be activated when the power shuts down.]

6.1 Multiple leaks

Every sensor shall be able to detect and locate leaks independently. The system shall be able to show 120 simultaneous faults.

6.2 Cable break fault

Besides leaks, the system shall be capable to :

- detect any damaged sensors (cable break) - in the event of a cable break, an audible alarm is triggered and the dry contact is activated,
- locate multiple breaks to the nearest sensor,

- keep monitoring leaks upstream the break at all times and downstream the break if damage is partial only.

[Digital Monitoring Unit: Interactive touch screen type – FG-NET or equivalent only:]

[The dynamic zone maps showing a cable break and highlighting the exact location on the panel's screen are available as an optional feature.]

6.3 Sensor Isolation

The system shall be capable of isolating one specific sensor through "Ejection" feature.

6.4 Liquid types

The system shall be capable of monitoring different types of sensors for conductive liquids such as water, bases and acid, or liquids as hydrocarbon and non-conductive solvents. The system shall be able to manage all types of sensors mixed on the same circuit.

6.5 Access

For each function, the system shall provide three levels of access: unprotected, regular user, administrator.

6.6 Power

The digital monitoring unit shall be supplied by 100 VAC to 240 VAC, 50/60Hz, single phase. The total power consumption shall not exceed 25 VA.

6.7 Interface

There shall be 8 configurable dry contacts (relays) available in the system to enable remote monitoring and control. The dry contacts

shall indicate normal and alarm condition. The relay position shall be identified by a luminous indicator located on the motherboard of the digital unit. Any interruption in power shall be indicated by a specific dry contact.

RS-232, RS-422/485 serial ports with Modbus/Jbus communication protocol shall be available on the digital monitoring unit. The Modbus shall be able to show the status of each sensor individually.

[Digital Monitoring Unit: Interactive touch screen type – FG-NET or equivalent only:]

[An Ethernet port shall be available on the monitoring unit, for providing the following network functionalities:

- Modbus TCP
- SNMP traps for each sensor
- Alarm emails for each sensor
- Connection to optional additional relays in separate enclosure(s) - up to 384 relays.]

6.8 Enclosure

The digital monitoring unit shall be enclosed in a dust-tight enclosure.

[Digital Monitoring Unit: Interactive touch screen type – FG-NET or equivalent only:
Section start:

6.9 Touch screen display

A (7") touch screen display shall be assembled on the front of the digital monitoring unit. In the event of simultaneous leaks or multiple faults, the display shall show all alarms. English shall be the default language.

6.10 Menus format

As a minimum, the following menus shall be provided:

- "Setup": the user shall be able to set acknowledge mode, user access, relay status, time zone, language, sound alarm, serial links and network functionalities. An admin password shall be required to access this menu.
- "Event log": to view alarm history recorded.
- Up to five thousand (5000) events shall be stored in the event log on a FIFO basis.
- "Cables": the system shall be able to provide a general view of the installation on the screen. An interactive floor plan shall be available under this menu as an optional feature.
- "Help": a help section shall be available for troubleshooting.

Section end]

7.0 Jumper cable connection and ancillary equipment

7.1 Where leak detection is required, a four-core jumper cable shall be used to connect sensors in between zones, floors or rooms.

7.2 Warning labels shall be placed on the sensor approximately every five (5) metres. Hold-down clips shall be used to fix the sensors every one (1) metre.

8.0 Installation

The system shall be installed by well trained staff, with the procedure recommended by the manufacturer.

A Zener Barrier device (if required) shall be installed between the intermediate digital box and the [liquid hydrocarbon] [non-conductive solvent] sensors to allow use of sensors in Hazardous Locations (ATEX Zone 0, e.g. for Group IIC).

The [liquid hydrocarbon] [non-conductive solvent] sensors can be installed above ground or underground. For underground installations requiring direct burial, sensors will have to be run through dedicated plastic perforated pipes to allow sensor maintenance (cleaning after leak detection or replacement in case of damage).

[Direct burial only]

8.1 Direct Burial Applications

Sensor cable shall be installed in the specified perforated plastic pipe and as required by the manufacturer. Care shall be taken not to damage or contaminate the cable. Connectors shall be accessible in junction

boxes at grade or in manholes, valve pits or other locations. Plastic pipe risers to grade shall be installed to make the cable serviceable or replaceable in the field.

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