Linear Heat Detectors for Floating Roof Storage Tanks

Application Guide

Kidde Fire Systems

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INTRODUCTION

Floating roof fuel tanks are universally used to store volatile petroleum-based liquids. By design, the floating roof remains in contact with the liquid surface of the fuel and covers almost its whole surface so as to limit the amount of evaporation and emission to the atmosphere. A rim seal around the edge of the tank prevents the always-present vapors from escaping.

Potentially devastating fires in floating roof fuel storage tanks can be caused by overheat, lightning strikes or from vapor ignition if the tank is filled or emptied too quickly. Due to the presence of highly volatile liquids and vapors in the vicinity and to prevent the spread of fire to other tanks in the tank farm, early detection and subsequent suppression of the overheat/fire condition are extremely critical.

A fast acting and reliable detection system can be achieved with the detector mounted in physical contact with or in close proximity of the rim seal. The ability to be placed, for all practical purposes, in physical contact with the seal makes Linear Heat Detection (LHD) the system of choice. Its inherent flexibility makes it possible for the Linear Heat Detection sensor to be attached to the rim seal /roof support structure.

Kidde provides two choices of Linear Heat Detectors: (a) Shorting type LHS™ and (b) Integrating type AlarmLine™.

LHS is a fixed temperature sensor whose special insulation melts at its specific alarm temperature and allows its two conductors to short together and create an alarm condition at the fire control panel.

AlarmLine is an integrating type system that consists of the AlarmLine sensor cable and an Interface module. The cable is constructed with a negative temperature coefficient material, where a change in temperature results in an exponential decrease in resistance of the sensor. The interface module interprets this resistance change and provides an output to a control panel once the field programmable alarm set point is exceeded. AlarmLine is typically used when features such as programmable alarm threshold, pre-alarm, short-circuit trouble discrimination and ability to reset after overheat condition are required.

LHD OPERATION

As the area around the rim seal overheats beyond the alarm temperature of the LHD sensor used, it generates an alarm condition at the Fire Alarm Control Panel. The Fire Alarm Control Panel then activates the appropriate Suppression System, typically a rim seal foam system and/or a cooling water spray on the tank shell exterior.

LOCATING LHD ON FLOATING FUEL STORAGE TANKS

The LHS or AlarmLine LHD is installed around the perimeter of the floating roof portion of a fuel storage tank, as shown in Figure 1. The sensor cable is installed close to the upper edge of the weather seal, using the roof's steel straps, where provided, as anchor points.

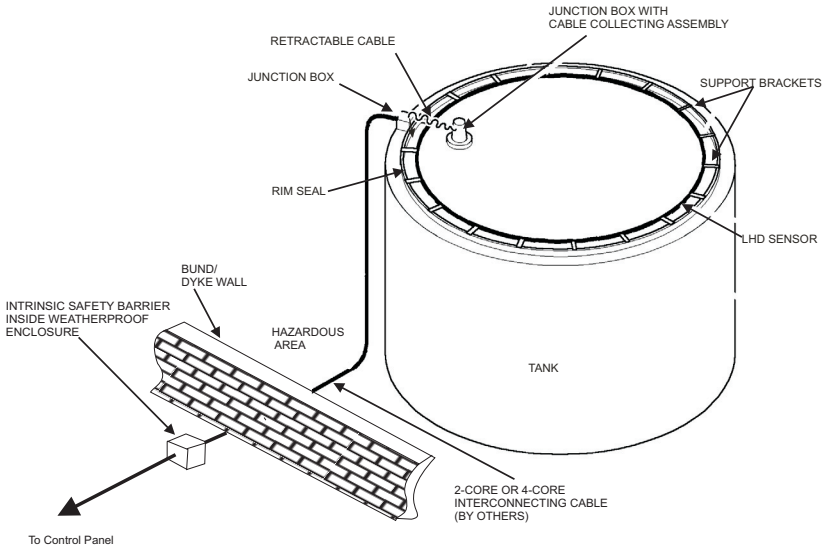

Figure 1. LHD Located Around Rim Seal

Alternatively as shown in Figure 2, the LHD can be attached to the metal barrier protecting the actual rim seal. When using this mounting method, the LHD sensor should be installed centrally between the wall of the tank and the seal protector plates supported at approximately 3.2 ft (1 m) intervals. An edge clip of suitable thickness is positioned with the location lug pointing to the outside of the tank and hammered into position using a wooden or suitable other non-metallic hammer to avoid sparking. When the clips are in position, a ¾ in. x 8 in. (20 mm x 200 mm) distance piece is secured to the clip by means of a stainless steel nut and bolt. The LHD sensor is then attached to the distance piece by means of a UV resistive cable tie and an insulating neoprene sleeve inserted between the between the clip and the sensor to prevent damage or hot spot heat transfer. This will position the LHD sensor cable above the center of the rim seal.

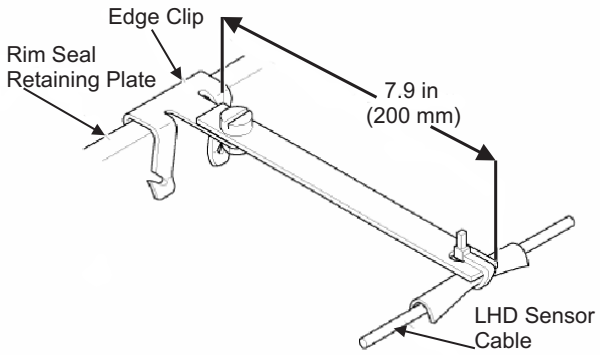

Figure 2. LHD Support Clips

Due consideration should be given to the following guidelines during installation:

- The sensor cable should not be in contact with any material which will act as a heat sink that may delay the transfer of heat from the area being monitored, or act as a hot spot to the sensor cable
- The sensor cable should be installed so that it is not compressed and is not adjacent to sharp objects that may damage the outer sheath
- The sensor cable bend radius should not be less than 2 in. (50 mm)
- The sensor cable should not be direct contact with cable ties. Neoprene sleeves shall be used.
- The sensor cable should not sag between sensor fixing clips nor should it be over-tensioned.

The LHD sensor cable typically terminates in a Junction Box (by others) located on the floating roof, as shown in Figure 4 and Figure 5. The connection of the LHD sensor cable (or its interconnection wire) to the tank shell top mounted Junction Box (by others) should be made using a Retractable Cable to allow for the rising and lowering of the floating roof.

The retractable cable may be made to collect in a stainless steel cable collector located on the tank roof. Since the construction of roof sections vary, the cable collector is manufactured 'blank' with only drainage holes in the base of the unit. As such, the locating and securing of the collector on the tank roof is dependent on the type of tank roof. In applications where high winds are likely to lift the cable from the collector, a guide cable should be used.

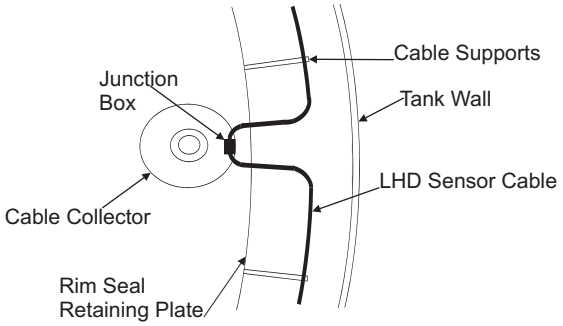

Figure 3. Cable Collector

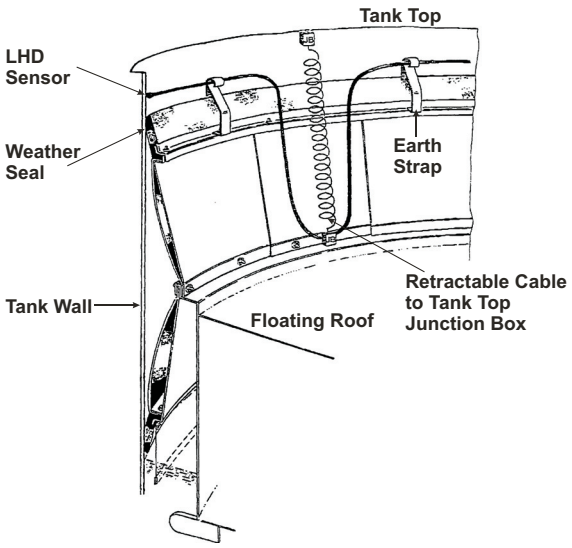

Figure 4. Retractable Cable

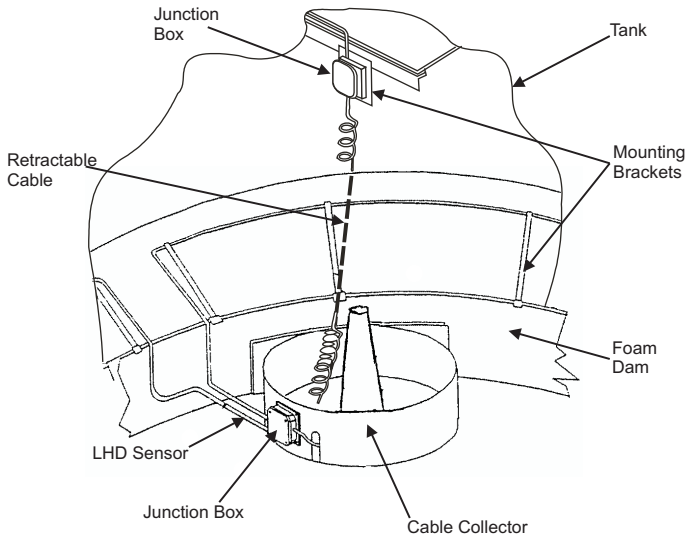

Figure 5. Tank Mounting Detail

Due consideration should be given to the following guidelines during installation:

- The cable collector unit when used must be installed on a level surface and securely fixed to prevent movement—preferably near the outside edge of the tank roof
- The retractable cable must have free and uninterrupted access into the cable collector, must drop vertically into it and should be terminated securely using suitable glands/strain relief and junction boxes.
- The shell-top junction box should be fixed on the permanent wall of the tank at the highest level possible whereas the roof-top junction box should be fixed to the outside rim of the cable collector
- All junction boxes and accessories used should be rated flame proof/explosion proof for hazardous service as required by the application and Authority Having Jurisdiction.

INTRINSIC SAFETY CONSIDERATIONS

Next, the shell top Junction Box connects to an Intrinsic Safety Barrier located outside the bund/dyke wall at the crossover from hazardous to safe area via an interconnecting cable. Interconnecting cables (by others) wherever used should be either 2-core or 4-core to correspond to the LHD sensor used, that is, LHS or AlarmLine respectively. The Intrinsic Safety barrier which must correspond to the LHD sensor used – as both LHS and AlarmLine require different barriers – is a 1-channel shunt diode device that limits the total energy entering the hazard via the sensor wiring conductors. LHS applications require one barrier per circuit whereas due to its being a 4-conductor sensor, AlarmLine applications require two barriers per circuit. Intrinsic Safety Barriers must be enclosed in a separate weather-tight enclosure.

CONVENTIONAL SYSTEM

A Conventional LHD system may be employed for applications protecting a small number of tanks. The Kidde AEGIS™ Panel is recommended for systems requiring notification, suppression control, annunciation and auxiliary functions such as breaker tripping, emergency power, etc. A Conventional Linear Heat Detection System using the AEGIS may consist of:

- AEGIS FACP:
  - Microprocessor based conventional Fire Alarm-Suppression control panel with 3 detection, 1 manual release, 1 abort and 2 supervisory inputs and 3 notification, 2 agent release and 4 relay outputs
- LHD zones:
  - Up to 3 detection circuits each with a number of 4-Wire AlarmLine Modules (limited only by wiring resistance and source of 24 VDC for the module), each 4-Wire module with a maximum of 3,280 feet (1,000 m) AlarmLine and two Intrinsic Safety Barriers
- Other Input Devices:
  - Conventional smoke detectors, water-flow switches, manual releases, etc as required.

INTELLIGENT LHD SYSTEM

An Intelligent LHD System is recommended for multi-zone applications where fire zone location requires zone output control for Notification, Suppression control, Annunciation and auxiliary functions such as breaker tripping, emergency power, etc. *It is the preferred design method over traditional multi-zone conventional, hard-wired linear heat detection and provides the added benefit of zone output control, text location indicator and installation cost savings.* An Intelligent Linear Heat Detection System using the ARIES-based FACP may consist of:

- ARIES™ or ARIES NET*Link*™ FACP:
  - Microprocessor based intelligent Fire Alarm-Suppression control panel with:
    - 1 Signaling Line Circuit (255 addresses) for ARIES
    - Up to 8 Signaling Line Circuits (2,040 addresses) for ARIES NET*Link*
- Addressable LHD zones:
  - SmartOne Addressable Input Modules (AI) each with a maximum of 860 feet (262 m) directly wired LHS Series cable and one Intrinsic Safety Barrier, OR
  - SmartOne Addressable AlarmLine Module (AAM) each with a maximum of 3,280 feet (1,000 m) directly wired AlarmLine cable and two Intrinsic Safety Barriers
- Other Input Devices:
  - SmartOne smoke detectors, water-flow switches, manual releases, etc as required.
- Other Output Devices:
  - SmartOne Addressable Output Modules (AO), Remote Release Modules (RRM), Addressable Signal Modules (ASM), etc as required.

Zoning is simple and easy with the Kidde Intelligent Linear Heat Detection System. Each LHD zone is created with an Addressable Input Module (AI) interfaced with up to 860 feet of directly wired LHS Sensor cable OR an Addressable AlarmLine Module (AAM) each with a maximum of 3,280 ft (1,000 m) AlarmLine. Up to 255 addressable devices (any mix including addressable LHD zones, Smoke Detectors, Manual Pull Stations, Waterflow switches, etc.) can be connected to each Signaling Line Circuit.

ADDITIONAL INFORMATION

Additional information on all the Linear Heat Detection System components mentioned in this guide can be found at www.kiddefiresystems.com

- LHS™ Sensor Cable (Data Sheet # K-73-201)
- AEGIS™ Conventional Fire Alarm-Suppression Control Panel (Data Sheet # K-84-100)
- ARIES™ Intelligent Fire Alarm-Suppression Control Panel (Data Sheet # K-77-157)
- ARIES NET*Link*™ Intelligent Fire Alarm-Suppression Control Panel (Data Sheet # K-76-800)

ORDERING INFORMATION

ALARMLINE™ LINEAR HEAT DETECTOR – SENSOR CABLES	
73-117068-X13	AlarmLine Sensor - Standard (X = 0 for 656 ft, 200 m roll & = 1 for 3280 ft, 1,000 m roll)
73-117068-X16	AlarmLine Sensor - Nylon Coated (X = 0 for 656 ft, 200 m roll & = 1 for 3280 ft, 1,000 m roll)
73-117068-X19	AlarmLine Sensor - Bronze Braided (X = 0 for 656 ft, 200 m roll & = 1 for 3280 ft, 1,000 m roll)
73-117068-041	AlarmLine Sensor Heat Pad
ALARMLINE™ LINEAR HEAT DETECTOR – INTERFACE MODULES	
73-100001-003	Addressable AlarmLine Module (AAM)
73-100003-001	NEMA 4 Enclosure for Addressable AlarmLine Module
73-117068-046	Conventional 4-Wire AlarmLine Interface Module with Relay and Enclosure
LHS™ LINEAR HEAT SENSOR CABLE	
73-515502-001	LHS-155^{o}F (68^{o}C) Alarm temperature. Indoor/Outdoor, PVC, 656 ft (200m) Roll
73-515510-001	LHS-155^{o}F (68^{o}C) Alarm temperature. Indoor/Outdoor, PVC, 3280 ft (1000m) Roll
73-519002-001	LHS-190^{o}F (88^{o}C) Alarm temperature. Indoor/Outdoor, PVC, 656 ft (200m) Roll
73-519010-001	LHS-190^{o}F (88^{o}C) Alarm temperature. Indoor/Outdoor, PVC, 3280 ft (1000m) Roll
73-522002-001	LHS-220^{o}F (105^{o}C) Alarm temperature. Indoor/Outdoor, PVC, 656 ft (200m) Roll
73-519010-001	LHS-220^{o}F (105^{o}C) Alarm temperature. Indoor/Outdoor, PVC, 3280 ft (1000m) Roll
73-535602-001	LHS-356^{o}F (180^{o}C) Alarm temperature. Indoor/Outdoor, PVC, 656 ft (200m) Roll
73-535610-001	LHS-356^{o}F (180^{o}C) Alarm temperature. Indoor/Outdoor, PVC, 3280 ft (1000m) Roll
INTRINSIC SAFETY EQUIPMENT	
73-117068-302	Intrinsic Safety Barrier for Intelligent LHS Systems (need one per zone) Compatible with Addressable Input (AI) Module
73-117068-131	Intrinsic Safety Barrier for AlarmLine LHD (need two per zone) Compatible with Conventional Interface and Addressable Module (AAM)
73-117068-132	Weather-Tight Enclosure for up to 5 Intrinsic Safety Barriers
73-117068-133	Weather-tight Enclosure for up to 13 Intrinsic Safety Barriers

MOUNTING ACCESSORIES	
73-117068-020	Nylon Cable Tie, Used with Nylon Cable Clamp. Supports sensor from pipe up to 8 in. diameter (100/pkg)
73-117068-022	Master Clamp, Used with Cable Clamp. Supports sensor from beam flanges up to 1/2 in. thick (100/pkg)
73-117068-023	Flange Clip, Used with Cable Clamp. Supports sensor from material up to 3/16 in. thick (100/pkg)
73-117068-024	Flange Clip, Used with Cable Clamp. Supports sensor from material from 3/16 in. to 1/4 in. thick (100/pkg)
73-117068-025	Nylon Cable Clamp, Used with Master Clamp, Flange Clips or Cable Tie (100/pkg)
73-117068-026	Weather-tight Connector, Used for sensor penetration of enclosure for Standard sensor
73-117068-027	Weather-tight Connector, Used for sensor penetration of enclosure for Metal braided or Nylon coated sensor
73-117068-028	AlarmLine In-line Sensor Splices (4 per splice, 10/pkg)
73-117068-029	AlarmLine In-line Sensor Splice Crimping Tool
73-117068-030	AlarmLine Sensor Termination Kit (1 kit terminates 10 zones, 10/pkg)
73-117068-051	Pipe Clip
73-117068-052	Neoprene Sleeving
73-117068-053	V-Clip (including rubber)
73-117068-054	Distance Piece 8 in. (200 mm) long
73-117068-055	Thermal Spacer Short 3 in. (75 mm)
73-117068-056	Thermal Spacer Long
73-117068-057	T-Clip
73-117068-060	Edge Clip, 1/16 in. (2-3 mm) Web
73-117068-061	Edge Clip, 2/16 in. (3-8 mm) Web
73-117068-062	Edge Clip, 5/16 in. (8-13 mm) Web
73-117068-063	Edge Clip, 9/16 in. (14-20 mm) Web
73-117068-070	Cable Collector
73-117068-071	Retractable cable 49 ft (15 m) long
73-117068-072	Retractable cable 33 ft (10 m) long
73-117068-073	Retractable cable 36 ft (11 m) long
73-117068-074	Retractable cable 39 ft (12 m) long
73-117068-075	Retractable cable 43 ft (13 m) long
73-117068-076	Retractable cable 46 ft (14 m) long
73-117068-077	Retractable cable 52 ft (16 m) long
73-117068-078	Retractable cable 56 ft (17 m) long
73-117068-079	Retractable cable 59 ft (18 m) long
73-117068-080	Retractable cable 62 ft (19 m) long
73-117068-081	Retractable cable 66 ft (20 m) long
73-117068-082	Retractable cable 69 ft (21 m) long
73-117068-083	Retractable cable 72 ft (22 m) long
73-117068-084	Retractable cable 75 ft (23 m) long
73-117068-085	Retractable cable 79 ft (24 m) long
73-117068-086	Retractable cable 82 ft (25 m) long

EXPORT INFORMATION (USA)
Jurisdiction: EAR
Classification: EAR99
This document contains technical data subject to the EAR.

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