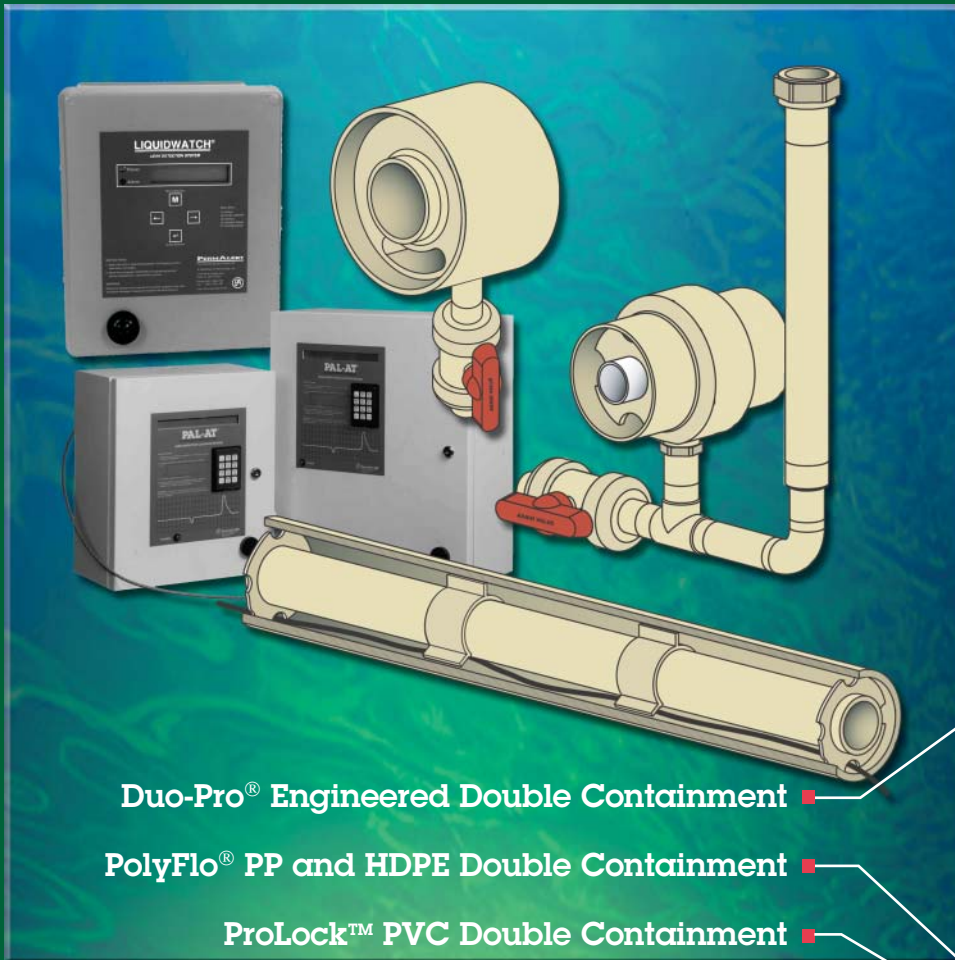


ASAHI/AMERICA

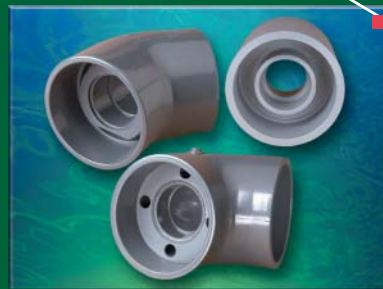
Leak Detection Basics



Duo-Pro® Engineered Double Containment

PolyFlo® PP and HDPE Double Containment

ProLock™ PVC Double Containment



Leak Detection Basics

The Environmental Protection Agency (EPA) has directed underground transport of hazardous materials be protected from release into the environment in its Standard 40 CFR, Part 280 & 281. Our Duo-Pro®, Poly-Flo®, and Pro-Lock™ systems have been specifically engineered to exceed the piping system requirements of the EPA. However, an important additional aspect of the EPA requirement is the specification for leak detection systems in all buried systems.

Pressurized systems must have automated leak detection, which are wired to shut-off valves in case a leak is detected, and drainage systems shall have at least a manual leak-detection system in place. Leak detection employment should also be considered in applications beyond those required by the EPA. In short, all double contained piping systems should have some form of leak detection. The issue then becomes how to properly select a means of leak detection.

A basic leak detection decision making-matrix should include:

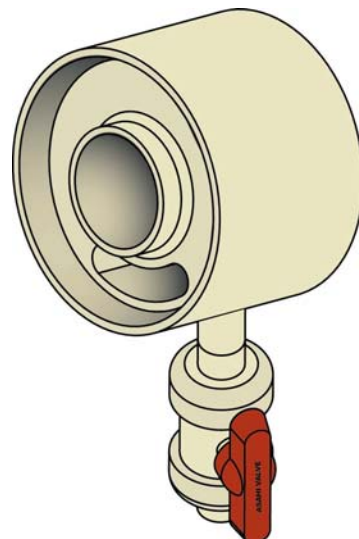
- What EPA requirements, if any, apply
- Is the system pressurized or drainage
- Will the system be buried
- If buried, is it under concrete or other difficult to access locations
- Is the media transported over work stations/areas (safety concerns)
- What are the potential safety hazards associated with media exposure
- How important is location of the leak in terms of costs of potential repair
- Is manual leak detection possible

The decision making process may be simplified by review of the three main types of available leak detection systems; manual, low-point and continuous cable. The features and benefits of these systems will often dictate the application in which they are employed.

Manual Leak Detection

Manual leak detection for drainage applications is the simplest of the three available methods. It is accomplished by accessing the annular space generally at low points in a system with a valve, plug, or pipe riser to grade. The EPA mandates a leak detection process that involves the periodic manual inspection of the ports at least every 30 days..

Asahi/America offers customized patented Dogbone® fittings that allow safe tapping into annular space without jeopardizing system integrity. Leak detection in the example shown, is accomplished by cycling the



valve to the on position. The system integrity is ensured when no media is present after opening. A solid Dogbone® can be utilized as a means of zoning a system. Systems with solid Dogbones® minimize and compartmentalize area where a leak may occur. This design helps minimize potential costs to find and repair a leak.

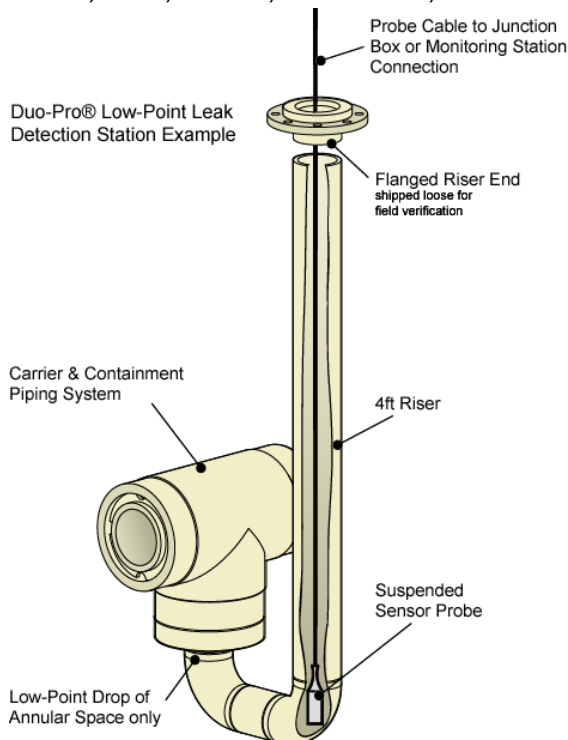
Manual Leak Detection Features, Benefits and Limitations

- Simplified system engineering
- Cost effective installation
- Relies on manual (human) operation
- Locates leaks within a zone or sector of a system
- Does not accurately pinpoint leaks
- Can be used with Duo-Pro®, Poly-Flo®, Fluid-Lok®, or Pro-Lock™ Systems

Electronic Low-Point Leak Detection

Low-point leak detection is similar to manual leak detection but utilizes electronic sensors in the place of manual valves or plugs. A wide variety of low-point sensors are available with varying functionality. Selection of sensor type is often dependent upon transported media. The two most common sensors are conductivity probes and float switch adapters.

Conductivity probes are triggered through the detection of all conductive liquids; water, acid, bases, chemicals, etc.



Float switches are designed to detect liquid as their name implies. As liquid enters the float switch, a trigger arm raises to a point in which a relay is activated.

Conductivity probes are generally best in piping systems in that they are triggered immediately upon contact with a liquid. Float Switches, on the other hand, are good for tank applications and activate after a certain level of liquid is reached.

In piping systems, low-point sensors can be installed in configurations shown as shown to the right. An access tee is used in which the annular space drains into accesses the branch of the tee. It

is then configured with a 90° elbows and a riser. A probe is generally suspended from the riser hanging directly over the low point of the fittings. Asahi/America offers a standard low point leak detection station by part number in its Dou-Pro®, Poly-Flo®, Fluid-Lok®, and Pro-Lock™ systems. Risers are supplied with a 4ft height and shipped loose for field verification and installation.

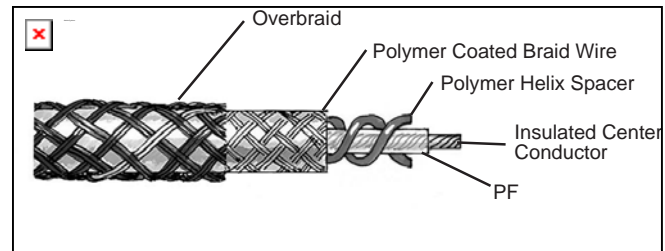
Electronic Low-Point Leak Detection Features, Benefits and Limitations

- Simplified system engineering
- Cost effective installation
- Automated detection process for buried applications
- Locates leaks within a zone or sector of a system
- Probes are generally tied-in at a central alarm location
- Can be used with Duo-Pro®, Poly-Flo®, Fluid-Lok®, or Pro-Lock™ Systems

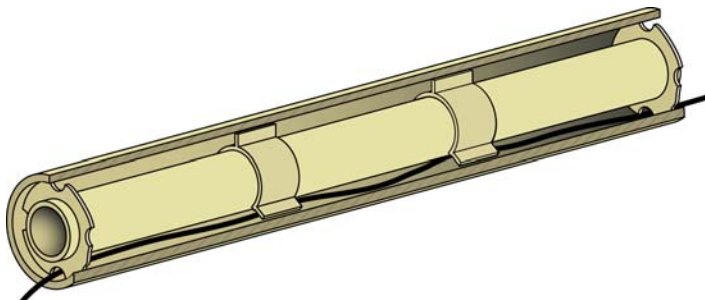
Continuous Leak Detection Cable

Continuous Leak Detection Sensing Cable offers the most accurate method of leak detection. Sensor Cable Systems are capable of locating multiple leaks without loss of accuracy and sensitivity. Leak locations can be determined to within

5 feet of source. Sensor cables utilize Time Domain Reflectometry technology as the basis of leak detection. The technology operates similar to radar. Thousands of times each minute, safe energy pulses are sent out on the sensor cables. As these energy pulses travel down the cable, reflections are returned to the monitoring unit and a “map” of the reflected energy from the cable is stored in memory. The presence of liquids on the sensor cable, in sufficient quantities to “wet” the cable, will alter its electrical properties. This alteration will cause a change of the reflection at that location. The alteration is then used to determine the location of a potential leak to within five feet.



In double contained piping systems, leak detection cable is installed by laying it on the bottom of the annular space between the carrier and containment piping. Pipe systems utilizing continuous cable **should always specify** pull rope requirements from system manufacturers. Pull ropes are used to facilitate pulling



of detection cable during installation of piping systems. Care should be taken to ensure sufficient annular space exists in selected double contained piping systems for use with leak detection cable.

Continuous Cable Leak Detection Features, Benefits and Limitations

- Requires engineered location of access ports.
- Requires sufficient annular space for pulling of cable; not compatible with Poly-Flo® systems
- Precise automated detection ideal for buried applications
- Locates leaks within five feet of source
- Most costly leak detection option
- Cables are generally tied-in at a central alarm location
- Can be used with Duo-Pro®, Fluid-Lok®, or Pro-Lock™ Systems

Leak Detection Component Supply Program

Asahi/America, with its strategic partner Perm-Alert, offers broad selection of leak detection components. The supply range of components is designed to facilitate specification, selection and installation of manual, low-point and continuous cable leak detection options. The following list pricing is offered as reference for the selection process. Asahi/America's Engineering Department is available to review your application process and assist with proper identification of required components.

MANUAL & PROBE LEAK DETECTION OPTIONS

Low-Point Leak Detection Stations

Low-point stations are utilized in manual or sensor probe leak detection installations. Stations are generally installed in the low points of double-contained systems. Solid Dogbones® are recommended to compartmentalize sectors of low-point systems. Successful installations usually utilize solid Dogbones® in the beginning and end of each specified sector as a means to isolate leaks and facilitate identifying location and repair. The Dogbone® spacing or zone sizes are determined by customer or system engineer.

The following table lists the standard, commonly installed low-point leak detection stations offered by Asahi/America. Low-points stations are provided with 4' riser, stub end, backing ring, EPDM gasket and blind flange. Stub End, backing ring, and blind flange are shipped loose for field elevation verification and installation.

Dou-Pro® Low-Point Stations

Size	Size Code	Pro150 x 150 (5252)	Pro150 x 45 (5337)	Pro45 x 45 (5368)	PVDF x Pro150 (6052)	PVDF x Pro45 (6152)	PVDF x PVDF (6252)
1x3	134	\$ 1,035.70	N.A.	N.A.	\$ 1,127.70	N.A.	\$ 3,306.00
2x4	420	\$ 1,044.50	\$ 885.80	N.A.	\$ 1,150.40	\$ 1,006.30	\$ 3,280.80
3x6	531	\$ 1,406.80	\$ 1,151.20	N.A.	\$ 1,514.10	\$ 1,249.10	\$ 3,897.40
4x8	583	\$ 1,760.60	\$ 1,356.80	\$ 1,326.40	\$ 1,792.60	\$ 1,362.70	\$ 4,737.60
6x10	627	\$ 2,183.40	\$ 1,844.40	\$ 1,771.40	\$ 2,301.40	\$ 1,865.60	\$ 6,754.00
8x12	660	\$ 2,881.80	\$ 2,208.20	\$ 2,097.10	\$ 3,099.40	\$ 2,416.50	\$ 9,276.80
10x14	702	\$ 3,248.50	\$ 2,680.20	\$ 2,500.10	\$ 3,709.00	\$ 2,730.40	N.A.
12x16	690	N.A.	N.A.	\$ 3,475.50	\$ 5,761.10	\$ 4,283.40	N.A.
14x18	710	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
16x20	726	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

Part Numbers are selected by combining the type code with the size code

Pro-Lock™ Low-Point Stations

Containment Size	Size Code	PVC Sch 80 (6490)	PVC Sch 40 (6773)	CPVC Sch80 (6490)
3"	(030)	\$ 636.40	\$ 559.20	\$ 973.80
4"	(040)	\$ 720.80	\$ 646.40	\$ 1,272.70
6"	(060)	\$ 868.40	\$ 806.40	\$ 1,676.20
8"	(080)	\$ 1,226.10	\$ 1,151.10	\$ 2,274.30

Part Numbers are selected by combining the type code with the size code

PVC & CPVC Low Point Stations are designed to have carrier pipe slip through fitting tee

Poly-Flo® Low-Point Stations

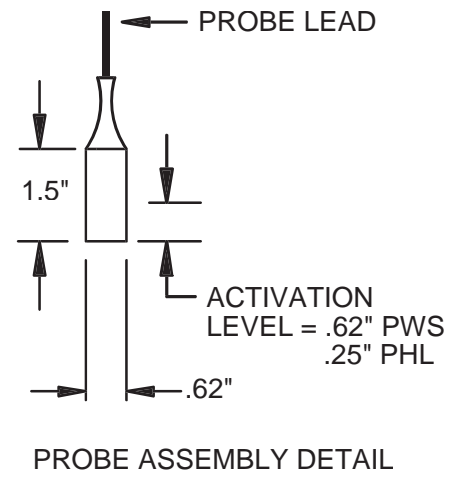
Size	Size Code	Black PP - FLG (4280)	Black HDPE - FLG (4480)	Black PP - PLUG (4281)	Black HDPE - PLUG (4481)
1x2	(249)	\$ 528.60	\$ 470.70	\$ 528.60	\$ 470.70
2x3	(338)	\$ 737.30	\$ 640.00	\$ 737.30	\$ 640.00
4x6	(532)	\$ 1,082.00	\$ 918.00	\$ 1,082.00	\$ 918.00

PROBES AND SWITCH OPTIONS

Series PWS Leak Detection Conductivity Probes

The PWS probe detects all conductive liquids - water, acid, bases, chemicals, etc. Its solid-state, stainless steel construction allows it to be used in corrosive environments and reset quickly after removal from a liquid. The unique design of the PWS probe eliminates the need for external power at the probe. A PWS probe is available for the PAL-AT® or LiquidWatch® systems:

- The PWS probe for the PAL-AT can easily be connected into a cable "sensing string" providing increased utilization of the PAL-AT capabilities
- Each probe assembly includes a probe integrator with 60 feet (18m) of jumper cable to connect to the sensing string, 20 feet (6m) of lead wire to attach the probe to the probe integrator and a NEMA 4X junction box.
- The PWS probe for LiquidWatch® includes the probe adapter that is installed in the 20 feet (6m) long probe lead wire. Additional lead wire is used if necessary.



PAL-AT NOTE:

- "-S" probes must be connected in the first 5,000 feet (1,500m) of the sensor string.
- "-L" probes must be connected more than 5,000 feet (1,500m) from the PAL-AT panel.

Series PWS Specification

- Probe Operating Temperature: 0°F to 180°F (-18°C to 80°C)
- Probe Length: 1.25" (32mm)
- Probe Diameter: .625" (16mm)
- Probe Lead Length: 20' (6m)
- Activation Level (min): .25" (6.4mm)
- Junction Box: (PAL-AT ONLY) NEMA 4X 10" x 8" x 4"
- Material: 304 Stainless Steel

Ordering Information*

For PAL-AT®

PWS-L Conductivity Probe	Part Number: 4564200
PWS-S Conductivity Probe	Part Number: 4564220

For LiquidWatch®

PWS-LW Conductivity Probe	Part Number: 4891000
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* = Please consult Asahi/America's Engineering Department for recommendations for additional required components (i.e. probe connectors, wires, cord grips...)

Monitoring Units

All electronic Leak Detection Systems require a monitoring unit to receive the input from probes or leak detection cable. Asahi/America offers the LiquidWatch® and Pal-AT® monitoring stations that are engineered to fulfill a wide range of application requirements:

LiquidWatch® Probe Systems

LiquidWatch® monitoring units have been engineered to meet a broad range of customer needs. The LiquidWatch® Panel is modular by design and can be configured with up to 64 probes and 16 alarm relays. The modular design allows for meeting current needs while allowing for future expansion of the system.

The standard panel is supplied with a monitoring capacity of up to 8 discreet probes. Additional probe monitoring requirements are met by the addition of single or multiple expansion cards capable of monitoring up to 8 additional probes each.



LiquidWatch® Features

- Sensing of organic liquid (hydrocarbons and solvents) or water within seconds of contact
- Vapor or gases are ignored
- Remote monitoring capability with a RS-232 interface and relays
- Nema 4X enclosure
- Up to 64 probes and 16 programmable alarm relays
- Optional UL Listed with Class 1, Division1, Group C & D sensor circuits

LiquidWatch® Ordering Information*

Asahi PN	Ref Num	Description
4890000	8027570	LiquidWatch® (Std Location)
4895000	8027571	LiquidWatch® (Int. Safe)
4892000	8027636	RPM-8 Probe Expansion Module Nema 4X
4892100	8027637	ORM-4 Relay Expansion Module w/ 1 RM-4
4892200	8027583	ORP-16 Relay Expansion Module w/ 1 RM-4

* = Please consult Asahi/America's Engineering Department for recommendations for additional required components (i.e. probe connectors, wires, cord grips...)

Pal-At® Leak Detection/Location Monitoring Units

Pal-At® Monitoring Systems are microprocessor based units capable of the continuous monitoring of a sensor string for leaks, breaks and shorts. The units have sensing ranges of 2,000; 5,000; 10,000; or 15,000 feet per cable with up to 8 cables per panel. The alarm unit operates on the principle of pulsed energy reflection and maps the entire length of the sensor cable. A digitalized system map is stored in nonvolatile memory. Alarm panels provide continuous indication that the sensor cable is being monitored.



Pal-At Features

- Can locate multiple leaks without loss of accuracy or sensitivity
- Can differentiate between breaks and shorts vs. a wetted cable
- Archives information with time and date
- RS-232 serial port communications
- Accepts both probes and cable sensors in one sensor string
- One cable for all liquids or multiple cables for differentiation
- AT40K and AT80K monitors up to eight separate cable strings when equipped with Cable Expansion Modules
- U.L. Listed and FM Approved to provide intrinsically safe sensor cable output circuits for Class 1, Division 1, Groups C & D Hazardous Locations

Pal At® Ordering Information*

Asahi PN	Ref Num	Description	Max Cables	Length Capacity
4552100	8027550	AT20C	1	2,000ft
4552200	8027555	AT50C	1	5,000ft
4552300	8027558	AT20K	2	5,000ft
4552400	8027563	AT40K	8	15,000ft**
4552500	8027610	AT80K	8	15,000ft**
4553100	8027610	XA50C Expansion Card AT40K		
4553200	8027613	XA100C Expansion Card AT20K/80K		

* = Please consult Asahi/America's Engineering Department for recommendations for additional required components (i.e. probe connectors, wires, cord grips...)

** = Max length for hydrocarbons is 10,000ft