



970048-U (Replaces 950051-U)

Approval #

Safety & Buildings Division

201 East Washington Avenue

P.O. Box 7969

Madison, WI 53707

Wisconsin Material Approval

Material

Encompass Leak Detection System and Soil Sentry
Liquid-Phase and Vapor-Phase
Product Detectors

Manufacturer

Arizona Instrument Corporation
4114 East Wood Street
Phoenix, Arizona 85040

SCOPE OF EVALUATION

The Encompass MTS IPAM system was evaluated for use as an automatic tank gauge in accordance with **section COMM 10.61 (4)**; the Encompass 17-901 system was evaluated for use as an automatic tank gauge in accordance with **s. COMM 10.61 (4)** and for use as a tank tightness testing system in accordance with **s. COMM 10.61 (3)**; the Encompass Continuous Statistical Tank Test (CSTT), Ultrasonic Probe Access Module system was evaluated for use as a monthly monitoring system for tanks in accordance with **s. COMM 10.61 (4)**; the Soil Sentry Twelve-X probes were evaluated for use as vapor product detectors to be used in accordance with **s. COMM 10.61 (5)**; the probes used with the Encompass APAM, Soil Sentry Liquid 330 and the Soil Sentry TLM 830, were evaluated for use as liquid product detectors to be used in accordance with **s. COMM 10.61 (7)**; and the Line Leak Detection system (AZI 17-905, 17-9502, and 17-9505) was evaluated as an annual line tightness test as specified in **section COMM 10.615 (2)** and as an hourly line leak detector as specified in **s. COMM 10.615 (1)**, of the current edition of the Wisconsin Flammable and Combustible Liquids Code.

DESCRIPTION AND USE

Encompass Automatic Tank Gauges

Encompass is a personal computer (PC) based software system for monitoring and reporting the output from leak detection probes. Probe access modules are used to provide the interface between the probes and PC.

The Encompass MTS IPAM consists of Encompass software, a magnetostrictive inventory probe access module (part 17-903), and a magnetostrictive inventory probe (part 17-9300). The Encompass 17-901 consists of Encompass software, an ultrasonic inventory probe access module (part 17-901), and an ultrasonic inventory probe (part 19-9100). The Encompass CSTT Ultrasonic Probe Access Module monitors fuel height and temperature automatically, tests for leaks on a continuous basis, and collects data during idle times in the tank to eliminate the need for scheduled tank tests. This data is merged with data from other periods to create a database that the CSTT uses to perform statistical analysis.

To use the Encompass systems, the user must provide an appropriate PC.

The Encompass MTS IPAM and 17-901 may be used to test tanks that contain gasoline, diesel, aviation fuel, fuel oil #4, fuel oil #6, solvents, waste oil and other products that are compatible with the probe if approved by the manufacturer. Fuel oil #6 that is tested with the MTS IPAM must be heated. The Encompass CSTT may be used to test tanks that contain gasoline, diesel, aviation fuel, fuel oil #4, and solvents.

The systems detect the presence of water in the bottom of the tank and measure water inflow as well as product loss. The MTS IPAM can detect changes in water level of 0.0034 inches above the minimum detectable level of 1.29 inches. The 17-901 can detect changes in water level of 0.012 inches above a minimum detectable level of 1.86 inches.

The average time for testing with the MTS IPAM, including waiting and testing time, is approximately 10 hours. The time for testing with the 17-901, including waiting and testing time, should be at least 7 hours. The time required for the CSTT to acquire enough data for a valid test is typically 11 days.

The MTS IPAM, the 17-901, and the CSTT all use a threshold of 0.10 gallon per hour to declare that a tank is leaking. For the MTS IPAM and the 17-901, results are considered to be inconclusive if there is too much variability in the data or there is excessive temperature change or tank wall deformation. The CSTT only reports tests that are conclusive.

For the MTS IPAM and the 17-901, the only acceptable deviation from the standard testing protocol is to extend the stabilization times or lengthen the duration of the test beyond the minimums. For the CSTT, the amount of required data is increased.

Volumetric Tank Tightness Testing

The Encompass 17-901, as described above, is also a volumetric tank tightness testing system. Since it uses an underfilled test method, topping off the tank and vapor pockets are not applicable, and ground water levels are not determined.

Leak rates are calculated from data that are determined valid by statistical analysis. The results are considered to be inconclusive if there is too much variability in the data or there are excessive temperature changes or tank all deformations. A threshold value of 0.05 gallon per hour is used to declare that a tank is leaking.

The total time required for a test with this method (including stabilization, equipment setup, data collection, and returning the tank to service) is 13 hours if performed after a delivery, and 7 hours for stable conditions.

Encompass Software With Other Probes

The Encompass software is designed to receive data from other out-of-tank liquid detecting probes via an accessory probe access module (APAM, Part 17-902) to provide interstitial and groundwater monitoring.

Use of any probe with the Encompass software shall be in accordance with the probe manufacturer's recommendations and the material approval for the probe.

Soil Sentry Twelve-X Vapor Monitor

The Soil Sentry Twelve-X console and sensor provide a quantitative output and a continuous sampling frequency.

The console and sensor are designed to be used within the Soil Sentry Twelve-X leak detection system manufactured by Arizona Instrument Corporation. The sensor, a metal oxide semi-conductor, is located within the remote system console. Vapor monitoring wells and a background reference well are connected to the console with tubing. A pump in the console automatically draws a separate sample for up to 20 minutes from each well three times a day to be analyzed by the sensor. If the system detects vapors above the alarm threshold, audible and visual alarms are activated. The operation and performance of the leak detection system as a whole were not evaluated under this approval, only the function of the sensor was evaluated.

The vapor monitoring system shall be designed and installed in accordance with **s. COMM 10.61 (3)**. Approval of the design and well placement must be obtained for each site in accordance with **s. COMM 10.10**.

An assessment shall be made of the installation site to determine the extent of existing soil contamination. The Soil Sentry Twelve-X sensor shall be used only if the level of background contamination will not interfere with detection of a release and the sensor will be able to detect an increase in concentration of product above background.

Monitoring wells shall be located in porous backfill in accordance with **s. COMM 10.61 (5)(a), (g), and (h)** and shall be clearly marked and secured.

A tightness test of the tanks and piping shall be conducted using an approved method in accordance with **s. COMM 10.61 (3)** prior to placing the tanks in service.

The evaluation of the Twelve-X vapor sensor was designed to identify the strengths and weaknesses of the sensor so that users could choose suitable detectors. The results of the sensor evaluation are given below.

The Twelve X vapor probe was tested for its ability to detect known concentrations of test gas. The following parameters were determined.

Accuracy - How closely test gas concentration, as measured by the detector, agrees with the actual gas concentration.

Bias - Whether the method consistently over-estimates or under-estimates gas concentration. Not applicable to qualitative detectors.

Detection Time - Amount of time the detector must be exposed to test gas before it responds.

Fall Time - Amount of time that passes before the detector returns to its baseline reading after test gas is removed.

Lower Detection Limit - The smallest gas concentration that the detector can reliably detect.

Specificity - Indicates the ability of the detector to detect several different test gases.

Accuracy, Response Time, and Lower Detection Limit Results

Commercial	Synthetic	Diesel	JP-4
------------	-----------	--------	------

	Gasoline	Gasoline	Fuel	Jet Fuel	JP-8
Accuracy* (%)	170	120	Not Determined	120	Not Determined
Bias	60	8.0	-20 @ 50 ppm	1.8	Not Determined
Precision*	6.3	7.7	12 ppm	18	Not Determined
Detection Time* (Min:sec)	12:20	12:27	15:00	12:33	15:00 min
Fall Time* (Min:sec)	11:53	11:53	15:00	11:55	15:00 min
Lower Detection Limit (ppm)	150	140	10	60	<0.01 gal/hr

* For tests conducted with 1000 ppm of test gas, except where otherwise indicated.

Specificity Results (%)**

Commercial Gasoline	<u>170</u>
Diesel	<u>Activated</u>
n-Hexane	<u>110</u>
JP-4 Jet Fuel	<u>90</u>
JP-8 Jet Fuel	<u>Activated</u>
Synthetic Gasoline	<u>110</u>
Toluene	<u>43</u>
Xylene(s)	<u>22</u>

**A limited number of tests were conducted to determine the response of the soil sentry 12X to diesel and JP-8 fuels.

The lower detection limit of JP-5 Jet Fuel was also determined to be 92 ppm.

Encompass APAM, Soil Sentry Liquid 330 and TLM-830 Interstitial Monitors

The probes used with the Encompass APAM Soil Sentry Liquid 330 and TLM-830 detect liquid in annular spaces using a measurement principle based on refractive indices. The probes will respond to any liquid that covers the probe tip.

The Soil Sentry consoles will remain in alarm for a specific alarm condition until it is cleared, even if the alarm condition later disappears or changes. The units must be manually reset.

The probes may also be used with the Encompass software and accessory probe access module.

A brief description of the probes is given below:

- 17-141A. This probe is programmed to alarm under wet conditions and is nondiscriminating. The operating principle is based on refraction of light. It was designed to be used in any orientation or position.
- 17-142A. This probe is smaller than the 141 series probe. It alarms under wet conditions and is designed to operate in any orientation or position.
- 17-143A. This probe is corrosion resistant. It triggers an alarm under wet conditions. It is designed to be used in any orientation or position.
- 17-144A. This probe will discriminate between water and hydrocarbon. Once the alarm is triggered it will remain in that alarm until reset, even if the liquid drops below the probe or is replaced by a different liquid. The control panel will indicate if the alarm was due to water or hydrocarbon.

The probes have detection and fall times of approximately three seconds and lower detection limits of 1.2 cm or less.

Only the 17-143A probe is compatible with toluene.

The probe must be placed in the lowest point of the interstice or be able to detect a leak in any portion of primary containment that routinely contains product.

Encompass Line Leak Detector

The basic Encompass Line Leak Detector system consists of a control panel that can be interfaced with up to four remote sensors installed in separate product lines. The remote sensor contains a flow sensor that measures volumetric fuel flow in the line. The Encompass software is used to program the system.

The Line Leak Detector system also has provisions for one or two Expansion Modules that can be used with the Line Leak Detector Control Panel. The Expansion Modules can be used to add up to eight remote sensors, for a maximum of twelve remote sensors.

For hourly monitoring, the Line Leak Detector system uses a preset threshold of 2 gallons per hour to declare a leak. For annual tightness testing, the preset threshold is 0.062 gallons per hour.

The system may be used when trapped vapor is present in the lines.

The Line Leak Detector system can be used to test lines that contain gasoline, diesel, aviation fuel, methanol, ethanol and gasoline-alcohol blends. The manufacturer should be contacted for other hydrocarbon applications.

The system can be used on pipelines pressurized to a maximum pressure of 50 PSI.

If a leak is declared, the system will print a message on the monitor, trigger an alarm and shut down the dispensing system.

There is no required waiting period between a product delivery and starting the test.

TESTS AND RESULTS

The performance of the probe used in the Soil Sentry Twelve X console and sensor was evaluated using the United States Environmental Protection Agency protocol for evaluation of vapor-phase out-of-tank product detectors and was found to be capable of detecting known concentrations of test gases.

The performance of the Soil Sentry Liquid 330 and TLM-830 consoles and probes, was determined using the EPA protocol for liquid-phase out-of-tank product detectors. The probes were found to be capable of detecting all liquids evaluated. The probes were found to have a lower detection limit of 1.2 cm or less which would be suitable for an interstitial monitor. In accordance with the manufacturer's recommendations, the probes may also be used with the Encompass APAM.

The performance of the Encompass MTS IPAM was determined using the EPA protocol for automatic tank gauging systems. The performance of the Encompass 17-901 was determined using a modified version of the EPA protocol for automatic tank gauging systems, and using the EPA protocol for volumetric tank tightness testing methods. The performance of the Encompass CSTT Ultrasonic Probe

Access Module was determined using a proposed Continuous Leak Detection System Evaluation Protocol that is deemed by the EPA to be equivalent in stringency to the EPA Evaluation Protocols. For the MTS IPAM, the probability of detecting a 0.2 gallon per hour leak was 97.8 percent, and the probability of false alarm was 2.20 percent. For monthly monitoring with the 17-901, the probability of detecting a 0.2 gallon per hour leak was determined to be 99.94 percent, and the probability of false alarm was determined to be 2.06 percent. For tank tightness testing with the 17-901, the probability of detection of a 0.10 gallon per hour leak was found to be 98 percent, and the system was found to be capable of detecting a leak of 0.05 gallon per hour with a probability of false alarm of 2 percent. For the CSTT, the probability of detecting a 0.2 gallon per hour leak was 99.52 percent, and the probability of false alarm was 0.48 percent

The performance of the Encompass Line Leak Detection system was determined using the EPA protocol for pipeline leak detection tests. The system was found to have a probability of detection for both a 3-gallon and 0.1-gallon per hour leak of 100 percent.

LIMITATIONS

The Soil Sentry Twelve-X console and sensor are approved for use as a vapor phase out-of-tank product detector to be installed in vapor monitoring system that complies with **s. COMM 10.61 (5)** to detect products specified in the description and use section.

The Encompass APAM, Soil Sentry Liquid 330 console or TLM-830 console used with probes 17-141A, 17-142A, 17-143A, or 17-144A, are approved for use as interstitial liquid phase product monitors for use with a double wall UST system, in accordance with **s. COMM 10.61 (7)(a)**.

The Encompass MTS IPAM and 17-901 may be used on tanks up to 15,000 gallons, and the tank shall be from 50 to 95 percent full. The waiting time after adding any substantial amount of product shall be at least three hours for the MTS IPAM and at least six hours for the 17-901. The temperature of the added product shall differ by no more than 7.1°F from that already in the tank, for the MTS IPAM, and by no more than 7.34°F for the 17-901. The total time for data collection shall be at least six hours for the MTS IPAM, and 7 hours for the 17-901. The Encompass CSTT may be used on tanks up to 15,000 gallons with a monthly throughput of 130,500 gallons or less, and the tank shall be from 18 to 100 percent full. The CSTT system may not be used for manifolded systems, the data records must cover 4 days or more, and the temperature of added product shall differ by no more than 12.8°F from that already in the tank.

The Encompass Line Leak Detection system is approved for use on underground storage tank pipeline systems that are typically constructed of fiberglass or steel and typically measure 2 or 3 inches in diameter. It may be used on pipelines of other materials provided the material has a section modulus of

at least 15,000 PSI to 35,000 PSI. The maximum bulk line volume to which this system can be applied is 341 gallons, which is equivalent to an 800-foot length (twice the tested length) of 3-inch line. The maximum flexible line volume is 50 gallons, which is equivalent to a 540-foot length of 2-inch line. For hourly monitoring, the test time is approximately 1 to 6 minutes. For annual tightness testing, the test time is approximately 1.5 to 6 hours. Mechanical line leak detectors shall be removed from the line.

All operating instructions and test procedures specified by Arizona Instrument Corporation shall be used to conduct all tests. All equipment shall be installed, maintained and operated in accordance with manufacturer's recommendations.

This approval will be valid through December 31, 2002, unless manufacturing modifications are made to the product or a re-examination is deemed necessary by the department. The Wisconsin Material Approval Number must be provided when plans that include this product are submitted for review.

DISCLAIMER

The Department is in no way endorsing or advertising this product. The EPA standards used to evaluate this equipment only addresses leak detection capabilities, not safety considerations. This approval addresses only the specified applications for the product and does not waive any code requirement not specified in this document.

Reviewed By: _____

Approval Date: _____ By: _____

Sam Rockweiler, P.E.
Code Development Section
Program Development Bureau