Wisconsin
Department of Commerce

970023-U (Revised)

Approval #

Safety & Buildings Division
201 East Washington Avenue
P.O. Box 7969
Madison, WI 53707

Wisconsin
Material Approval

Material: Automatic Tank Gauging, Volumetric Tank Tightness Testing, Line Leak Detection, and Liquid and Vapor Monitoring Systems

Manufacturer: Veeder-Root Company
125 Powder Forest Drive
P.O. Box 2003
Simsbury, CT 06070

SCOPE OF EVALUATION

The sensing probes used with the Veeder-Root TLS 250, TLS 250i, TLS 250i Plus, ILS 250, ILS 350, TLS 300, TLS 300C, TLS 300i, TLS 350, TLS 350R, TLSpc, TLS 350 with Continuous Statistical Leak Detection (CSLD), TLS 350 with Manifold Tanks CSLD, TLS Wireless Pressurized Line Leak Detector (WPLLD) and TLS Pressurized Line Leak Detector (PLLD) and dispenser pan sensor, manufactured by Veeder-Root have been evaluated for use as leak detection equipment conforming to specified portions of **ss. ILHR 10.61** and **ILHR 10.615** of the current edition of the Flammable and Combustible Liquids Code.

DESCRIPTION AND USE

Veeder-Root leak detection equipment consists of a group of probes and consoles, some of which are multi-purpose.

The following chart shows the appropriate consoles to be used with sensing probes covered by this approval.

		TLS 250	TLS 250i	TLS 250i Plus	ILS 250	TLS 300	TLS 300i TLS 300C	ILS 350	TLS 350, 350R, & pc	TLS PLLD
7842	ATG	X	X	X		X	(X)		X	
8472	TTT or ATG			X		X	(X)		X	
8473	TTT or ATG			X		X	(X)		X	
8473 with CSLD	Monthly Monitor					X			X	
8473 with Manifolded Tanks CSLD	Monthly Monitor					**X**			X	
8475	Line Leak Detector								X	
8484	Line Leak Detector									X
8494	Wireless PLLD								X	
794390-420	Liquid Sensor (Steel)		X	X	X		X	X	X	
794390-401	Liquid Sensor (FRP)		X	X	X		X	X	X	
794390-206	Liquid Sensor (Sump)		X	X	X		X	X	X	
794390-700	Vapor Sensor							X	X	
794390-621	Groundwater							X	X	
847900-001	Liquid Sensor (Pan)									
847900-002	Liquid Sensor (Pan)									
794380-208	Pipe Sump Sensor		X	X	X		X	X	X	
794380-209	Pipe Sump Sensor		X	X	X		X	X	X	
794380-301	Hydrostatic Sensor						X		X	
794380-302	Hydrostatic Sensor						X		X	
794380-320	Liquid Sensor (Pan)								X	
794380-321	Liquid Sensor (Pan)								X	
794380-322	Liquid Sensor (Pan)					X	X		X	
794380-340	Microsensor								X	
794380-341	Liquid Sensor (FRP)								X	
794380-350	Liquid Sensor (Sump)								X	
794380-351	Liquid Sensor (Sump)								X	
794380-352	Liquid Sensor (Sump)					X	X		X	
794380-621	Groundwater							X	X	
794380-622	Groundwater							X	X	
794380-624	Groundwater							X	X	

Notes: (X) indicates optional equipment for TLS 300i with in-tank leak detection.
The TLS 300C has a two tank limitation. The 847900-001 and 847900-002 pan liquid sensors do not require connection to a console.

The 8472, 8473, 8475, 8494, 7842, 794380 series, 794390 series and 847900 series probes may be used with gasoline, diesel fuel, aviation fuel and solvents. The 8473 probe may also be used with waste oil and alcohol or alcohol blends. The 8484 probe may be used with gasoline, diesel and aviation fuel only. The 794390-700 vapor phase monitor may be used with commercial gasoline and JP-4 jet fuel.

Discriminating sensors are typically used where water may also be present. The hydrostatic sensors measure high and low levels of calcium chloride or ethylene glycol antifreeze used in the interstice of double walled fiberglass tanks.

The 8473 probe measures changes in product volume be detecting changes in the level of the float using the magnetostrictive principle. The 8472 and 7842 probe versions measures changes in product volume by measuring changes in capacitance.

The 8472 and 8473 probes measure product temperature with five or more thermistors. The 7842 probe uses a temperature averaging probe.

The total time required for a test (including stabilization and data collection) is 10 hours for the 8473 and 8472 probes when used as a TTT or ATG. The total time is 13 hours for the 7842 probe ATG. When the CSLD option or Manifolded Tanks CSLD option is used, the tank will be monitored continuously.

The TLS 350 pipeline leak detection system, using the 8475 probe, uses a preset threshold and a single test to determine whether a pipeline is leaking. The system declares a leak if the output of the measurement system exceeds a threshold of 2.4 gph when used as an automatic line leak detector, 0.1 when used as a monthly monitor, and 0.04 gph when used as a line tightness test.

Since all three pipeline test modes of the TLS 350 pipeline line leak detection system operate at the normal operating pressure (26 to 27 psi), the actual target leak rates are not 3.0, 0.2 and 0.1 gph. Instead, using the square root law to convert flow rates from 10, 26 and 40 psi, respectively, to flow rates at a test pressure of 26 psi, target flow rates of 4.8, 0.2 and 0.8 gph, respectively, are obtained. The system sets alarm thresholds at half of these flow rates.

The TLS PLLD pipeline leak detection system using the 8484 probe automatically conducts a test in its "hourly" mode whenever the delivery pump is shut off. The pass/fail threshold is 1.88 gph. The line tightness test is initialized manually. The system isolates, pressurizes and monitors the lines in 18-minute cycles. When temperatures have stabilized so that a determination is possible, a threshold of 0.05 gph is applied to determine if the line is leaking. This system may be used on rigid or flexible piping with a bulk modulus between 500 and 56,000 psi.

The TLS WPLLD wireless pipeline leak detection system using the 8494 probe also conducts a test in the hourly mode whenever the pump is shut off. The line tightness mode is initiated manually after the hourly test is completed. Once initiated, the test is completely computer controlled and will conclude with a pass or fail decision unless the pump is activated prior to completing the test. This system may be used only on rigid fiberglass or steel pipes.

The interstitial and sump sensing probes 794390-420, 794390-401 and 794390-206 are float switches. When used with the appropriate console, the 794390-420 has a response time of less than

seven minutes and a minimum product activation height of less than 1.6 inches; the 794390-401 has a response time of less than four minutes and a minimum product activation height of less than 0.7 inch; the 794390-206 has a response time of less than nine minutes and a product activation height of less than 1.8 inches. All sensors have recovery times of less than one minute.

The dispenser pan sensor, 847900-001, is a product permeable probe which will respond to virtually any hydrocarbon or water that reaches the minimum detectable product level of approximately 1.7 inches. At the minimum level, the detection time is less than one second.

The differentiating dispenser pan sensor, 847900-002, is a combination of a float switch to detect the presence of any liquid above the minimum level and a product soluble probe to detect hydrocarbons.

The minimum detectable liquid level for the float switch is 6.39 inches with a detection time of less than one second. The minimum detectable levels of hydrocarbon was 1/16 of an inch, detection times were 20 minutes or less, depending on the product.

The groundwater monitoring sensor 794390-621 operates on the principal of electrical conductivity and provides a qualitative output and continuous monitoring. The lower detection limit was found to be 0.2 cm of product with detection times under nine minutes.

The Adsistor Vapor Sensor 794390-700 provides a qualitative output and continuous monitoring. The lower detection limit is 500 ppm with detection times of less than 17 minutes.

The piping sump sensors, 794380-208/209, use float switches to detect the presence of liquid in a dispenser pan or containment sump. The models are identical except 209 has a longer cable.

The dispenser pan/containment sump sensors, 794380-321/351 use ultrasonics to detect the presence of liquid in a dispenser pan or containment sump. The models are identical except the containment sump version has a longer housing.

The micro sensor, 794380-340, is an ultrasonic sensor used to detect the presence of liquid in an interstitial monitoring well or in a riser containment of a double walled steel underground tank.

The groundwater sensors, 794380-621/622/624 use electrical conductivity to detect the presence of hydrocarbons in groundwater.

The discriminating pan/sump sensors, 794380-322/352 use a combination of float switches and product-sensitive strips to detect the presence of liquid and to discriminate between conducting liquids, such as water and non-conducting liquids, such as hydrocarbons.

The discriminating interstitial sensor, 794380-341, is used in the interstitial space of double-walled underground fiberglass tanks. The discriminating pan sensor, 794380-320 and discriminating sump sensor, 794380-350 are used under dispensers and in containment sumps. They use ultrasonics to detect the presence of liquid and product-sensitive strips to discriminate between conducting liquids such as water and non-conducting liquids such as hydrocarbons.

The 794380-301/302 sensors are hydrostatic sensors with float switches to monitor the level of brine in the interstitial space of a double wall fiberglass tank. The 301 has a single float, the 302 a double float.

TESTS AND RESULTS

Volumetric Tank Test Systems

The performance of the 8472 and 8473 probes was determined in accordance with the EPA Protocol for volumetric tank testing methods. The 8472 probes were found to be capable of detecting a leak of 0.10 gallons per hour leak with a probability of false alarm of less than 0.10 percent and probability of detection of 99 percent.

The 8473 probe was found to be capable of detecting a leak of 0.10 gallons per hour with a probability of false alarm of less than 1.0 percent and probability of detection of 99 percent.

Automatic Tank Gauging Systems

The performance of the 8472, 8473 and 7842 probes was determined in accordance with the EPA Protocol for ATG systems.

The 8472 probe was found to be capable of detecting a leak of 0.20 gallons per hour leak with a probability of false alarm of less than 0.2 percent and a probability of detection of 99 percent. The minimum water level (threshold) that the ATG could detect was found to be 1.52 inches. The minimum change in water level that the ATG could detect was found to be 0.027 inches, provided the water level is above the threshold.

The 8473 probe was found to be capable of detecting a leak of 0.20 gallons per hour leak with a probability of false alarm of less than 0.1 percent and a probability of detection of 99 percent. The minimum water level (threshold) that the ATG could detect was found to be 1.32 inches. The minimum change in water level that the ATG could detect was found to be 0.024 inches, provided the water level is above the threshold.

The 7842 probe was found to be capable of detecting a leak of 0.20 gallons per hour with a probability of false alarm of 0.2 percent and a probability of detection of 95.1 percent. The minimum water level (threshold) that the ATG could detect was found to be 1.40 inches. The minimum change in water level

that the ATG could detect was found to be 0.040 inches, provided the water level is above the threshold.

Pipeline Leak Detector

The performance of the system using the 8475 sensing probe was determined using the EPA Protocol for evaluation of pipeline leak detection systems.

When used as an automatic line leak detector, the system is capable of detecting a 3-gallon per hour leak at 10 psi with a probability of false alarm (P_{FA}) of 0 percent and probability of detection of (P_D) of 100 percent.
When used as monthly monitoring, the system is capable of detecting a 0.2 gallons per hour leak at 27 psi with a P_{FA} of 0 percent and a P_D of 100 percent.

When used as a line tightness test, the system is capable of detecting a 0.1 gallons per hour leak at 40 psi with P_{FA} of 0 percent and a P_D of 100 percent. When the system is operated at 26 psi, it is capable of detecting an equivalent leak of 0.08 gph with a P_D of 95 percent and a P_{FA} of 5 percent.

The performance of the system using the 8484 and 8494 sensing probes was determined using the EPA Protocol for evaluation of pipeline leak detection systems.

When used as an automatic line leak detector, the system is capable of detecting a 3-gallon per hour leak at 10 psi with a probability of false alarm (P_{FA}) of 0 percent and probability of detection (P_D) of 100 percent.

When used as a line tightness test, the system is capable of detecting a 0.1 gallons per hour leak at 40 psi with P_{FA} of 0 percent and P_D of 100 percent.

Monthly Monitor

The Veeder-Root TLS 300 and TLS 350 with CSLD option and 8473 probe was evaluated using an alternative test procedure certified to be just as rigorous as the standard test procedure and was found to be capable of detecting a 0.2 gallons per hour leak with a probability of false alarm of less than 0.1 percent. The probability of detection using the 0.17 gph threshold was found to be 95 percent. The probability of detection using the 0.16 gph threshold was found to be 99 percent.

The Veeder Root TLS 300 and TLS 350 with manifolded tank CSLD and 8473 probe was evaluated in a similar manner. The probability of detection of a 0.20 gph leak was found to be 97 percent when a 0.16 gph threshold is used and 99 percent when a 0.15 gph threshold was used. For both thresholds, the probability of false alarm was found to be less than 0.01 percent.

Interstitial, Pan and Sump Liquid Sensors

The 794390-400, 794390-401, 794390-206, 847900-001, 847900-002 and 794380 series sensors were evaluated using test procedures that are equivalent to the EPA Protocol for evaluation of liquid-phase out-of-tank product detectors with respect to liquid contact product detectors. The sensors were activated by all appropriate liquids tested: Synthetic fuel, diesel fuel, home heating oil #2 and water for the 794390 series sensors and gasoline, diesel and water for the 847900 series sensors. The 794380 series sensors activated with all appropriate test liquids.

Groundwater Monitor

The 794390-621 sensor and 794380-621/622/624 groundwater sensors were evaluated in accordance with the standard EPA Protocol for liquid-phase out-of-tank product detectors. Of the tested products, the sensors activated for commercial gasoline and JP-4 jet fuel.

The EPA test procedures used only address the issue of the method's ability to detect leaks and not safety hazards.

LIMITATIONS OF APPROVAL

The appropriate procedures specified by Veeder-Root shall be used to install and operate the equipment and to conduct all tests. All equipment is designed to be permanently installed and shall not be used as portable testing equipment. There are no acceptable deviations in any of the standard test protocols.

The use of all versions of the automatic tank gauging or tank tightness testing systems is limited to tanks of 15,000 gallons capacity or less, except as specified for the TLS 300 and TLS 350 monitoring system with CSLD.

Sensing Probe 8472

Sensing Probe 8472, used with an appropriate console is approved for use as a tank tightness testing (TTT) method complying with **s. ILHR 10.61 (3)** and as an automatic tank gauge (ATG) complying with **s. ILHR 10.61 (4)**, able to measure water at the bottom of the tank to the nearest 1/8 inch.

When used as a tank tightness testing method, the tank shall be at least 95 percent full. The tank shall not be overfilled as this method does not compensate for vapor pockets. The waiting period between adding any substantial amount of product to the tank, and the start of data collection shall be at least 8.25 hours. The temperature of added product shall not differ more than 8.57 degrees F. The total time for data collection shall be at least 2 hours. The tightness test shall be used in conjunction with an ATG to continuously monitor the water level in the bottom of the tank. A tank is declared to be leaking

when the measured leak rate exceeds 0.071 gallons per hour. Test results are considered to be inconclusive if there is too much variability in the data or excessive temperature shifts.

When used as an automatic tank gauge, the tank shall contain at least enough liquid to activate the probe. This level will vary between 18 and 45 inches, depending on the length of the probe. The waiting period between adding any substantial product to the tank and the start of the data collection shall be at least 8.3 hours. The temperature of added product shall not differ more than 8.4 degrees F. The total time for data collection shall be at least 2 hours. A tank is declared to be leaking when the measured leak rate exceeds 0.126 gallons per hour.

Sensing Probe 8473

Sensing probe 8473, used with an appropriate console is approved for use as a tank tightness testing (TTT) method complying with **s. ILHR 10.61 (3)** and as an automatic tank gauge (ATG) complying with **s. ILHR 10.61 (4)**, able to measure water at the bottom of the tank to the nearest 1/8 inch.

When used as a volumetric tank tightness testing method, the tank shall be at least 95 percent full. The tank shall not be overfilled as this method does not compensate for vapor pockets. The waiting period between adding any substantial amount of product to the tank and the start of data collection shall be at least 8.25 hours. The temperature of added product shall not differ more than 8.57 degrees F. The total time for data collection shall be at least 3 hours. The tightness test shall be used in conjunction with an ATG to continuously monitor the water level in the bottom of the tank. A tank is declared to be leaking when the measured leak rate exceeds 0.069 gallons per hour. Test results are considered to be inconclusive if there is an unexplained volume increase or excessive volume decrease.

When used as an automatic tank gauge, the tank shall contain at least enough liquid to activate the probe. This level will vary between 18 and 45 inches, depending on the length of the probe. The waiting period between adding any substantial product to the tank and the start of data collection shall be at least 8.3 hours. The temperature of added product shall not differ more than 8.4 degrees F. The total time for data collection shall be at least 2 hours. A tank is declared to be leaking when the measured leak rate exceeds 0.093 gallons per hour. Test results are considered to be inconclusive if there is an unexplained volume increase or excessive volume decrease.

8473 Probe with CSLD Option

The CSLD option is approved for use with the 8473 probe and the TLS 300 and TLS 350 consoles as an equivalent method of monthly monitoring in compliance with **s. ILHR 10.61 (8)** for single, nonmanifolded tanks up to 45,000 gallons capacity.

The CSLD option evaluates product and temperature levels collected by the probes every few seconds. The system identifies periods during product dispensing, stabilization periods after product delivery and periods of temperature instability and ignores data from those periods.

The system prints a leak test report daily or on demand. The report indicates a pass, fail or inconclusive result using data from up to, but no more than, the preceding 28-day period.

A threshold of either 0.17 gph or 0.16 gph is used to declare a tank to be leaking, depending on the chosen mode of operation.

8473 Probe with Manifolded Tanks CSLD

The Manifolded Tanks CSLD is approved for use with the 8473 probe and the TLS 300 and TLS 350 console as an equivalent method of monthly monitoring in compliance with **s. ILHR 10.61 (8)** for single tank systems and systems of mainfolded tanks connected by a free-flowing siphon of up to 30,000 gallons total system capacity.

The Manifolded Tanks CSLD operates in the same manner as indicated for the other CSLD option. A probe is placed in each tank of the system. A threshold of either 0.16 gph or 0.15 gph is used to declare a system to be leaking, depending on the mode of operation chosen.

Sensing Probe 7842

Sensing probe 7842, used with the appropriate console, is approved for use as an automatic tank gauge (ATG) complying with **s. ILHR 10.61 (4)**, able to measure water at the bottom of the tank to the nearest 1/8 inch.

When used as an automatic tank gauge, the tank shall contain at least enough liquid to activate the probe. This level will vary between 18 and 45 inches, depending on the length of the probe. The waiting period between adding any substantial product to the tank and the start of data collection shall be at least 8.3 hours. The temperature of added product shall not differ more than 8.4 degrees F. The total time for data collection shall be at least 5 hours. A tank is declared to be leaking when the measured leak rate exceeds 0.13 gallons per hour. Test results are considered to be inconclusive if there is too much variability in the data.

Sensing Probe 8475

Sensing probe 8475 when used with the TLS 350 console, is approved for use as an automatic line leak detector (hourly monitoring test, 3 gph leak rate), line tightness test (0.1 gph leak rate), or monthly monitoring (0.2 gph leak rate) on steel or fiberglass lines as specified in **s. ILHR 10.615 (1), (2),** and **(3)** respectively.

Tightness tests shall be conducted at normal pipeline pressures of 26 to 50 psi. The waiting period between the last dispensing of product through the pipeline system and the start of data collection is determined by the system's computer and will depend on the volume of the pipeline and the difference in product and ground temperatures. The maximum time for data collection is 13.9 seconds for the hourly tests, 341 seconds for the monthly test, and 832 seconds for the line tightness test.
The maximum capacity of the pipeline that can be tested with this system is 41 gallons (236 feet of 2-inch diameter pipe).

Sensing Probe 8484

Sensing probe 8484, when used with the TLS PLLD console, is approved for use as an automatic line leak detector (hourly monitoring test, 3 gph leak rate) and as a line tightness test (0.1 gph leak rate), on rigid or flexible lines as specified in **s. ILHR 10.65 (1)** and **(3)**, respectively.

Tightness tests shall be conducted at 1.5 times the normal operating pressure of the pipeline. The waiting period between the last dispensing of product through the pipeline and the start of the data collection shall be 2.5 hours. The total data collection time for the test shall be at least 0.3 hours.

The maximum capacity of a rigid or flexible pipeline that can be tested with this system is 89.2 gallons (438 feet of 2-inch diameter pipe).

Interstitial and Sump Liquid Sensors

Sensors 0794390-420 and 794380-340, for double wall steel tanks; 0794390-401 and 794380-341 for double wall fiberglass tanks; 794380-208/209 hydrostatic sensors; 0794390-206 and 794380-350/351/352 for sumps; and 847900-001/002 and 794380-320/321/322 for dispenser pans, used with the appropriate consoles, are approved for use as interstitial liquid-phase product monitors for use within secondary containment of UST systems in accordance with **s. ILHR 10.61 (7)(a)**.

The sensors shall be placed to detect a release through any portion of primary containment that routinely contains product.

Groundwater Monitor

Sensors 794390-621 and 794380-621/622/624 used with an appropriate console, are approved for use as a continuous monitoring device for a groundwater well in compliance with **s. ILHR 10.61 (6)(e)**. All other portions of the groundwater monitoring system, including site/soil conditions, shall be in compliance with **s. ILHR 10.61 (6)** and shown on plans submitted for review in accordance with **s. ILHR 10.10**.

Vapor Sensor

Vapor sensor 794390-206 used with the appropriate console, is approved for use as a gasoline or JP-4 jet fuel vapor monitor in accordance with **s. ILHR 10.61 (5)(e)** where background levels are significantly below 500 ppm. All other portions of the vapor monitoring system including soil/backfill conditions shall be shown to be in compliance with **s. ILHR 10.61 (5)** in plans submitted for review in accordance with **s. ILHR 10.10**.

Piping Sump Sensors

In accordance with **s. ILHR 10.615 (3),** piping sump sensors 794380-208/209 can be approved as a method of monthly monitoring for piping on a case-by-case basis depending on the overall length and geometry of the system.

USE OF APPROVAL

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. 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: _____

Revision Date: _____ By: _____

Duane Hubeler
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