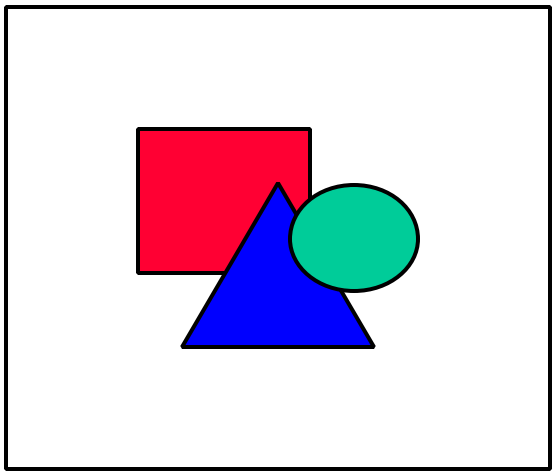

Approval # 970067-U (Replaces 960029-U)

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

Wisconsin Material Approval

Material: Red Jacket Tank and Line Leak Detection Systems

Manufacturer: The Marley Pump Company
5800 Foxridge Drive
Mission, Kansas 66202

SCOPE OF EVALUATION

The RLM 5000, RLM 5001, RLM 9000, ST 1400, ST 1401, ST 1401L, ST 1800, ST 1801 and ST 1801L were evaluated for use as volumetric tank tightness testing methods in accordance with **s. ILHR 10.61 (3)** and as automatic tank gauging systems in accordance with **s. ILHR 10.61 (4)**.

The PPM 4000, RLM 9000, ST 1401L, ST 1801L, XLP, DLD, XLD, FX1, FX2, FX1D, FX2D, FX1V, FX2V, FX1DV, FX2DV, CPT, Prolink and Big Flo systems were evaluated for use in hourly monitoring of rigid piping in accordance with **s. ILHR 10.615 (1)**. The PPM 4000, RLM 9000, ST 1401L, ST 1801L, XLP, FX1, FX2, FX1V, FX2V, CPT, Prolink and Big Flo systems were also evaluated for use in hourly monitoring of flexible piping in accordance with **s. ILHR 10.615 (1)**.

The PPM 4000, RLM 9000, ST 1401L, ST 1801L, CPT and Prolink were evaluated for use as line tightness testing methods for rigid and flexible piping in accordance with **s. ILHR 10.615 (2)**.
The PPM 4000 and RLM 9000 were evaluated for use in continuous monthly monitoring of rigid piping in accordance with **s. ILHR 10.615 (3)**.

The ST 1401L, ST 1801L, CPT and Prolink were evaluated for use in continuous monthly monitoring of rigid or flexible piping in accordance with **s. ILHR 10.615 (3)**.

The Dispenser Pan Monitor, version RE400-204-5; the Ground Water Monitor, versions RE400-377-5, RE400-378-5 and RE400-381-5 (numbered by length of sensor); the Liquid Refraction Sensor, version RE400-180-5; the Combination High Level/Low Level Sensor, versions RE400-179-5 to RE400-199-5 (numbered by length of sensor); the Hydrostatic Sensor, version RE400-042-5; the Overfill Sensor, versions RE400-05 (8,9)-5 and RE400-14 (7,8)-5 (numbered by float logic and well cap size); the Sump Sensor, version RE400-111-5; and the Optical Liquid Discrimination Sensor, version RE400-203-5 were evaluated for use as liquid-phase product detectors in accordance with **s. ILHR 10.61(5) to (8)**. These sensors were also evaluated for use in line leak detection in conjunction with the PPM 4000 and RLM 9000 models.

DESCRIPTION AND USE

RLM 5000, RLM 5001, and RLM 9000 Tank Tightness Testing Systems

The Red Jacket RLM 5000, RLM 5001 and RLM 9000 may be used as volumetric tank tightness testing methods for tanks containing gasoline, diesel fuel, aviation fuel, fuel oil #4, solvents, waste oil, ethanol and alcohol-gasoline blends.

The RLM 5000, RLM 5001 and RLM 9000 are capable of detecting the presence of water in the bottom of the tank. Changes in water level are measured by the systems.

The probe is permanently installed and the maximum test time is 8 hours. Data is collected until statistically significant data is obtained.

Tank deformation changes and stabilization effects are minimized by waiting the specified time period before beginning the test.

Leak rates are calculated using viable data determined by statistical analysis. Test results are considered to be inconclusive if there is too much variability in the data. Tests should not be conducted if there is a large difference between the ground temperature and the delivered product temperature.

There are no acceptable deviations in standard testing protocol. Extension of the waiting period between filling the tank and conducting the test beyond the minimum may be determined by the testing personnel on site.

RLM 5000, RLM 5001, and RLM 9000 Automatic Tank Gauging Systems

The Red Jacket RLM 5000, RLM 5001 and RLM 9000 may be used as automatic tank gauges for tanks containing gasoline, diesel fuel, aviation fuel, fuel oil #4, solvents and waste oil, ethanol and alcohol-gasoline blends.

The ATG systems detect the presence of water in the bottom of the tank and measure the inflow of water as well as the loss of product.

Leak rates are calculated using the data determined to be valid through statistical analysis. Test results are considered to be inconclusive if there is too much variability in the data. Tests should not be conducted if there is a large difference between ground temperature and delivered product temperature.

There are no acceptable deviations in the standard test protocol.

ST 1400, ST 1401, ST 1401L, ST 1800, ST 1801 and ST 1801L Tank Testing and Gauging Systems

The ST series monitors the tank continuously for leaks, in addition to running standard tightness testing and monthly monitoring tests.

The Red Jacket ST 1400 and ST 1800 systems may be used on tanks containing gasoline, diesel fuel, aviation fuel, solvents, fuel oil #4 and #6, ethanol, ethanol-gasoline mixtures and other liquids compatible with the probe and characterized for ultrasonics. The equipment is capable of detecting the presence of water in the bottom of the tank. Changes in water level are measured by a water sensor that must be attached to the probe.

Tank deformation changes and stabilization effects are minimized by waiting the specified 7- to 12-hour time period before beginning the test.

There are no acceptable deviations in standard testing protocol. Extension of the waiting period between filling the tank and conducting the test beyond the minimum may be determined by the testing personnel on site.

PPM 4000, RLM 9000, ST 1401L, ST 1801L, CPT and Prolink Line Leak Detection Systems

These systems may be used on lines containing gasoline, diesel, aviation fuel, alcohol and their blends with gasoline and some solvents. The ST 1401L, ST 1801L, CPT and Prolink systems may also be used on lines containing fuel oil #4. The control units are microprocessor controlled, automatic line leak detectors that differentiate between the types of signals produced by thermal contraction, line leaks and trapped air. The system monitors the product line between the tank and dispenser, including pump manifold and discharge line.
Tests are initiated after each operation of the submersible pump and may be conducted on demand. Annual line tightness testing may be manually initiated.

Time and pressure are both monitored by the console with the results displayed continuously on a liquid crystal display. The microprocessor stores information, determines if a leak exists and shuts down the system if a leak is detected. The control unit may be programmed to transmit leak alarm conditions or daily status reports to a remote location through a modem.

Three levels of tests are conducted automatically in the following sequence:

1. A Catastrophic Level Test is automatically conducted each time the pump is turned on. Large leaks of the order of 10 gallons per hour are detected in approximately eight seconds.

2. If the system passes the catastrophic level test, a Standard Level Test and a Precision Level Test are conducted sequentially after the pump is shut off. These tests will detect leaks small enough to meet the monthly monitoring and annual tightness test requirements specified in the EPA test protocol.

3. A Precision Level Test that will detect leaks as small as 0.1 gallons per hour in 1.5 to 2.5 hours is conducted if the system passes the standard level test and the pump remains off for the required time period.

The PPM 4000 and RLM 9000 rely on a precision functional element to hold the line pressure at 11 to 22 psi after the pump is shut off. The precision functional element is normally installed directly in the submersible pump for lines up to 4 inches in diameter. For systems that do not have functional elements in the pump, a remote functional element (called an ELD) may be installed in the line itself. The purpose of the ELD is identical to that of the precision functional element, which is to hold the line pressure at 11 to 22 psi when the pump is shut off. The location of the functional element is of no consequence to the test time since its only function is to reduce the line pressure to within a set range. The ST 1401L, ST 1801L, CPT and Prolink systems include a high pressure algorithm.

XLP, DLD, and XLD Line Leak Detection Systems

The Red Jacket XLP, DLD and XLD line leak detectors may be used on systems containing gasoline, diesel fuel, aviation fuel, fuel oil # 4 and solvents specified by the manufacturer. When used on flexible pipeline systems, the XLP may be used with systems containing gasoline, diesel fuel, aviation fuel and solvents specified by the manufacturer. The detectors use a preset threshold and single test to determine whether a pipeline is leaking. The systems declare a leak if the output of the measurement system exceeds a threshold of 3 gallons per hour.

The systems may be used when trapped vapor is present in the pipeline during the test.

Flow restrictors must be located at a depth such that pressure from lines will not adversely affect functioning of the system. The manufacturer recommends that the vertical elevation from the center line of the pump to the dispenser be no more than 5 feet for the XLP, and 11 feet for the DLD and XLD .

There is no waiting period between the last delivery of product to the tank or the last dispensing of product through the pipeline system and the start of data collection.

The total time for data collection for the automatic line detectors is approximately one to 15 minutes, depending on temperature.

FX1, FX2, FX1D, FX2D, FX1V, FX2V, FX1DV, FX2DV and Big Flo Line Leak Detector Systems

The FX series line leak detectors are mechanical devices that are permanently installed in pressurized line systems. The unit may be installed in a standard Red Jacket pump, downstream from the pump in a special adapter, or as a pilot valve for the Big Flo Leak Detector unit. When the pump is activated, product is metered into the line through a poppet valve. When the line pressure reaches a nominal value of 10-15 psi, the poppet valve opens and full flow into the line occurs. If the pressure does not reach 10-15 psi (i.e., a leak is present), the poppet does not open, and product flow in the line is restricted to approximately 3 gallons per minute. The FX models are designed to operate at lower flow rates than the Big Flo system.

The Big Flo leak detector is a diaphragm-operated valve which uses a pilot control valve to detect a leak. The pilot leak detector is mounted “piggy back” onto the Big Flo unit and controls the pressure on one side of the Big Flo’s control diaphragm. If the pilot detector detects a leak, it will close and put full pump pressure on the Big Flo’s control diaphragm. This will keep the control diaphragm closed and restrict the product flow. If the pilot valve is in the fully open position, which occurs when there is no leak greater than its threshold value, the pressure on the control diaphragm will be lower. This pump pressure will then lift the Big Flo’s poppet which allows the normal flow rate.

The FX1, FX2, FX1V and FX2V line leak detectors can be used with or without the Big Flo system, on rigid or flexible piping which has either single wall or double wall construction and which contains gasoline, diesel fuel, aviation fuel or some solvents. The FX1D, FX2D, FX1DV and FX2DV line leak detectors can be used with the Big Flo system, on single or double wall rigid piping which has a bulk modulus typically greater than 20,000 psi and which contains diesel fuel or some solvents. Rigid piping diameters can be from 1 to 6 inches, and flexible piping diameters can be up to 3 inches.

Liquid-Phase Product Detectors

The Red Jacket Liquid-Phase Product Detectors, used with an approved monitor, provide continuous sampling frequency and a qualitative output.

Sensors must be placed so that they will be able to detect a leak in any portion of the primary containment which routinely contains product. The geometry of the containment area in which the sensor is placed must be such that the system will be able to detect a 0.2 gph or 150-gallon release within 30 days.

TESTS AND RESULTS

The performance of the Red Jacket PPM 4000, RLM 9000, ST 1401L, ST 1801L, CPT and Prolink systems was determined using the EPA protocol for evaluation of pipeline leak detection systems. When used as an hourly line leak detector, these systems are 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 for monthly monitoring, these systems are capable of detecting a 0.2 gallon per hour leak at 20 psi with a P_{FA} of 0 percent and a P_D of 100 percent. When used as a line tightness test, the systems are capable of detecting a 0.1 gallon per hour leak at 45 psi with a P_{FA} of 0 percent and a P_D of 100 percent.

The performance of the DLD, XLD and XLP hourly pipeline monitoring systems was determined using the EPA protocol for evaluation of pipeline leak detection systems. When used as an automatic line leak detector, the systems are capable of detecting a 3 gallon per hour leak at 10 psi with a P_{FA} of 0 percent and P_D of 100 percent.

The performance of the RLM 5000, RLM 5001 and RLM 9000 leak detection systems was evaluated in accordance with the EPA protocol for volumetric tank testing methods. The systems were found to be capable of detecting a leak of 0.1 gallon per hour with a P_{FA} of 1 percent and a P_D of 99 percent when using a threshold of 0.05 gph.

The performance of the RLM 5000, RLM 5001 and RLM 9000 was also evaluated using the EPA protocol for automatic tank gauging methods. The systems were found to be capable of detecting a leak of 0.2 gallon per hour with a P_{FA} of less than 0.5 percent and a P_D of 99.9 percent when using a threshold of 0.058 gph.

The performance of the ST 1400 and ST 1800 leak detection systems was evaluated in accordance with the EPA protocol for volumetric tank tightness testing methods by ADA Technologies, Inc. The systems were found capable of detecting a leak of 0.1 gallon per hour with a P_D of 99.4 percent and a P_{FA} of 2.01 percent when using a threshold of 0.05 gph.

The performance of the ST 1400 and ST 1800 was also evaluated using the EPA protocol for automatic tank gauging methods by ADA Technologies. The systems were found capable of detecting a 0.2 gph leak with a P_D of 99.9 percent and a P_{FA} of 2.98 percent when using a threshold of 0.09 gph.

The FX1, FX2, FX1V and FX2V line leak detectors for hourly monitoring of both flexible and rigid lines were shown to have a probability of detecting a 3.0 gallon per hour leak at 10 psi of 100 percent.

The FX1D, FX2D, FX1DV and FX2DV line leak detectors for hourly monitoring of rigid lines was shown to have a probability of detecting a 3.0 gallon per hour leak at 10 psi of 100 percent.

The performance of the Liquid-Phase Product Detectors was determined using a test procedure developed following the EPA protocol for evaluation of liquid-phase, out-of-tank product detectors.

LIMITATIONS OF APPROVAL

Procedures specified by the Marley Pump Company shall be used for the installation and maintenance of equipment and to conduct all tests.

Records of sampling, testing or monitoring shall be maintained in accord with **s. ILHR 10.625 (2)**.

RLM 5000, RLM 5001 and RLM 9000 Tank Testing and Gauging Systems

The RLM 5000, RLM 5001 and RLM 9000 tank test systems are approved for use on tank sizes no larger than 15,000 gallons.

When used as a tank tightness test, the difference between the temperature of added product and in-tank product shall be no greater than + or - 8.0^{o}F, and the tank shall be filled to at least 95 percent capacity during the test.

When used as an automatic tank gauge, the difference between the temperature of added product and in-tank product shall be no greater than + or - 8.0^{o}F, and the tank shall be filled to at least 50 percent capacity during the test.

The waiting time between adding a substantial amount of product to the tank and the start of data collection shall be at least 6 hours.

ST 1400, ST 1401, ST 1401L, ST 1800, ST 1801 and ST 1801L Tank Testing and Gauging Systems

The ST 1400 and ST 1800 tank test systems are approved for use on tank up to 73,500 gallons.

When used as a tank tightness test, the difference between the temperature of added product and in-tank product shall be no greater than + or - 6.0°F, and the tank shall be filled to at least 95 percent capacity during the test.

When used as an automatic tank gauge, the difference between the temperature of added product and in-tank product shall be no greater than + or - 8.0°F, and the tank shall be filled to a height of at least 15 inches of product during the test.

The waiting time between adding a substantial amount of product to the tank and the start of data collection shall be at least 12 hours for the tank tightness test and at least 10 hours for operation as an automatic tank gauge.

PPM 4000, RLM 9000, ST 1401L, ST 1801L, CPT and Prolink Line Leak Detection Systems

The PPM 4000 and RLM 9000 models may be used on rigid lines no larger than 55 gallons in capacity.

The PPM 4000 and the RLM 9000 may also be used on flexible lines. The line capacity may not exceed 300 feet of 2-inch pipe.

The ST 1401L, ST 1801L, CPT and Prolink systems may be used for hourly testing on rigid or flexible lines up to 172 gallons capacity, or 400 feet in length by 3 1/4 inches in diameter. These systems can be used for monthly or annual testing on rigid or flexible lines up to 163 gallons capacity, or 350 feet in length by 3 3/8 inches in diameter.

There is no required waiting time between dispensing or product delivery and beginning the tests.

XLP, DLD and XLD Line Leak Detectors

The XLP, DLD and XLD leak detection systems are approved for use in underground storage tank facilities on pipeline systems which are constructed of fiberglass or steel and which have a maximum volume of 55 gallons.

The XLP leak detector is also approved for use with Enviroflex pipe manufactured by Total Containment, and with other flexible pipeline systems that have a bulk modulus below 15,000 psi. The maximum volume of the flexible pipeline shall be 48.6 gallons.

FX1, FX2, FX1V and FX2V, With or Without the Big Flo System

These systems do not require a specific waiting time after delivery or after dispensing, although a stabilization period of up to 45 minutes may be required when the temperature differences are very large.

The maximum line capacity for flexible piping is 50 gallons. This is equal to approximately 540 feet of 2-inch diameter Enviroflex line.

The maximum line capacity for rigid piping is 316 gallons. This is equal to approximately 700 feet of 3 3/8-inch diameter pipe.

FX1D, FX2D, FX1DV and FX2DV, With or Without the Big Flo System

These systems do not require a specific waiting time after delivery or after dispensing, although a stabilization period of up to 45 minutes may be required when the temperature differences are very large.

The maximum line capacity for rigid piping is 362 gallons. This is equal to approximately 784 feet of 3-inch line.

Liquid-Phase Product Detectors

Approval of the placement of the sensors shall be obtained in accordance with **s. ILHR 10.10**. Sensors shall be placed so they will detect a leak in any portion of the primary containment that routinely contains product. The configuration of the containment area in which the sensor is placed must be such that the system will be able to detect a 0.2-gph or 150-gallon release within 30 days.

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 these products. This approval addresses only the specified applications for the products and does not waive any code requirement unless specified herein.

Reviewed by: _____

Approval Date: _____ By: _____

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

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