

ADDENDUM E-18

Evaluation of Red Jacket Electronics Leak Detection Sensors

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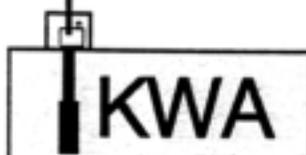
Evaluation of the Red Jacket Electronics Leak Detection Sensors

EPA Results Forms

PREPARED FOR:

Marley Pump Co.
a United Dominion Company

June 1, 1995



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PREPARED FOR:

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Preface

The data contained in this report was obtained from the Red Jacket Electronics Leak Detection Sensors. The test results are based on data collected using a modification of the EPA protocol "Liquid-Phase Out-of-Tank Product Detectors", EPA/530/UST-90/009. The work was conducted at the Leak Detection Test Center which is operated by Ken Wilcox Associates, Inc. Technical questions should be directed to Mr. Larry Seiter, Marley Pump Co., at (913) 541-2931.

KEN WILCOX ASSOCIATES, INC.

H. Kendall Wilcox

H. Kendall Wilcox, President

June 1, 1995

Modified Procedure
Results of U.S. EPA Standard Evaluation
Liquid-Phase Product Detectors

This form documents the performance of the liquid-phase product detector described below. The evaluation was conducted by the equipment manufacturer or a consultant to the manufacturer according to the U.S. EPA's "Standard Test Procedure for Evaluation Leak Detection Methods: Liquid-Phase Out-of-tank Liquid Product Detectors". The modifications to the procedure were made to accommodate the specialized requirements of interstitial monitors.

Tank owners using this leak detection system should keep this form on file to prove compliance with the federal regulations. Tank owners should check with State and local agencies to make sure this form satisfies their requirements.

Method Description

Name Red Jacket Electronics Dispenser Pan Monitor

Version number RE400-204-5

Vendor Marley Pump Co. (A United Dominion Company)

5800 Foxridge Drive

(street address)

Mission,

(city)

KS

(state)

66202

(zip)

(913) 831-5700

(phone)

Detector output type: () Quantitative (x) Qualitative

Detector operating principle: (X)Electrical Conductivity () Thermal Conductivity () Interface Probe
() Product Permeable () Product Soluble (X) Other Conductive polymer

Detector sampling frequency: () Intermittent (X) Continuous

Evaluation Results

The detectors listed above were tested for their ability to detect a layer of liquid (hydrocarbon or water) in a tank or a sump. The following parameters were determined:

Lower Detection Limit - The smallest product thickness that the detector can reliably detect.

Specificity - Whether or not the sensor responds to various products.

Precision - Agreement between multiple measurements of the same product level

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

Evaluation Results (continued)

> **Compiled Test Results** (for tests conducted at the lower detection limit)

<u>Test</u>	<u>Gasoline</u>	<u>Water</u>	<u>Diesel</u>
Probability of Detection	<u>100</u>	<u>100</u>	<u>100</u>
Probability of False Alarm	<u>0</u>	<u>0</u>	<u>0</u>
Accuracy (%)	<u>100</u>	<u>100</u>	<u>100</u>
Bias	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>
Precision (%)	<u>*</u>	<u>*</u>	<u>*</u>
Detection Time (hh:mm:ss)	<u>< 00:30:00</u>	<u>< 00:00:01</u>	<u>< 02:00:00</u>
Lower Detection Limit (in)	<u>*</u>	<u>*</u>	<u>*</u>

*See Attached Table.

Specificity Results (%)**

Commercial gasoline	<u>100</u>
Synthetic gasoline	<u>100</u>
Diesel fuel	<u>100</u>
Jet-A jet fuel	<u>100</u>
n-Hexane	<u>100</u>
Toluene	<u>100</u>
Xylene(s)	<u>100</u>
Water	<u>100</u>

**The sensor will respond to any liquid once the threshold has been exceeded.

> **Safety disclaimer: This test procedure only addresses the issue of the interstitial monitors ability to detect leaks. It does not test the equipment for safety hazards.**

Certification of Results

I certify that the interstitial monitor was installed and operated according to the vendor's instructions and that the results presented on this form are those obtained during the evaluation. I also certify that the evaluation was performed using the procedures described in the modified test protocol.

H. Kendall Wilcox, President
(printed name)

Ken Wilcox Associates, Inc.
(organization performing evaluation)

H. Kendall Wilcox
(Signature)

Independence, MO 64055
(city, state, zip)

June 1, 1995
(date)

(816) 795-7997
(phone number)

Test Results for the Red Jacket Electronics Dispenser Pan Monitor
Model Number: RE400-204-5

Run No.	Product Type											
	Water			Unleaded Gasoline			Diesel			Time to Recover**		
	Height to Alarm (in)*	Time to Alarm	Time to Recover	Height to Alarm (in)	Time to Alarm	Time to Recover	Height to Alarm (in)	Time to Alarm	Time to Recover	Height to Alarm (in)	Time to Alarm	Time to Recover**
1	0.413	<1 second	<1 second	0.175	9 min	< 1h-20min	0.175	1h-35min	1-2 days	0.175	1h-30min	1-2 days
2	0.413	<1 second	<1 second	0.175	9 min	< 1h-20min	0.175	1h-30min	1-2 days	0.175	1h-13min	1-2 days
3	0.406	<1 second	<1 second	0.175	9 min	< 1h-20min	0.175	1h-10min	1-2 days	0.175	1h-10min	1-2 days
4	0.406	<1 second	<1 second	0.175	11 min	< 1h-20min	0.175	1h-40min	1-2 days	0.175	1h-40min	1-2 days
5	0.413	<1 second	<1 second	0.175	15 min	< 1h-20min	0.175	1h-23min	1-2 days	0.175	1h-23min	1-2 days
6	0.413	<1 second	<1 second	0.175	11 min	< 1h-20min	0.175					
Mean (in)	0.411			0.175			0.175					
Accuracy	100			100			100					
Threshold (in)	0.427			0.175			0.175					
Precision (Std Dev)	0.003615			0.000000			0.000000					
Detection Time		<1 second			10.7 min						1h-25min	
Fall Time			<1 second			< 1h-20min						1-2 days

* Height of water alarm is user adjustable.

** Sensor reading may not return to pre-contaminated level. Operator may have to change threshold depending on the degree of contamination that the sensor has undergone.

Modified Procedure
Results of U.S. EPA Standard Evaluation
Liquid-Phase Product Detectors

This form documents the performance of the liquid-phase product detector described below. The evaluation was conducted by the equipment manufacturer or a consultant to the manufacturer according to the U.S. EPA's "Standard Test Procedure for Evaluation Leak Detection Methods: Liquid-Phase Out-of-tank Liquid Product Detectors". The modifications to the procedure were made to accommodate the specialized requirements of interstitial monitors.

Tank owners using this leak detection system should keep this form on file to prove compliance with the federal regulations. Tank owners should check with State and local agencies to make sure this form satisfies their requirements.

Method Description

Name Red Jacket Electronics Ground Water Monitor

Version number RE400-377-5, RE-378-5, RE400-381-5 (Numbered by length of sensor)

Vendor Marley Pump Co. (A United Dominion Company)

5800 Foxridge Drive

(street address)

Mission,

(city)

KS

(state)

66202

(zip)

(913) 831-5700

(phone)

Detector output type: () Quantitative (x) Qualitative

Detector operating principle: (X) Electrical Conductivity () Thermal Conductivity () Interface Probe
() Product Permeable () Product Soluble (X) Other Conductive polymer

Detector sampling frequency: () Intermittent (X) Continuous

Evaluation Results

The detectors listed above were tested for their ability to detect a layer of liquid (hydrocarbon or water) in a tank or a sump. The following parameters were determined:

Lower Detection Limit - The smallest product thickness that the detector can reliably detect.

Specificity - Whether or not the sensor responds to various products.

Precision - Agreement between multiple measurements of the same product level

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

Evaluation Results (continued)

> **Compiled Test Results** (for tests conducted at the lower detection limit)

<u>Test</u>	<u>Gasoline</u>	<u>Water</u>	<u>Diesel</u>
Probability of Detection	<u>100</u>	<u>*</u>	<u>100</u>
Probability of False Alarm	<u>0</u>	<u>*</u>	<u>0</u>
Accuracy (%)	<u>100</u>	<u>*</u>	<u>100</u>
Bias	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>
Precision (%)	<u>*</u>	<u>*</u>	<u>*</u>
Detection Time (hh:mm:ss)	<u>< 00:30:00</u>	<u>*</u>	<u>< 02:00:00</u>
Lower Detection Limit (in)	<u>*</u>	<u>*</u>	<u>*</u>

*See Attached Table.

Specificity Results (%)**

Commercial gasoline	<u>100</u>
Synthetic gasoline	<u>100</u>
Diesel fuel	<u>100</u>
Jet-A jet fuel	<u>100</u>
n-Hexane	<u>100</u>
Toluene	<u>100</u>
Xylene(s)	<u>100</u>
Water	<u>100</u>

**The sensor will respond to any liquid once the threshold has been exceeded.

> **Safety disclaimer: This test procedure only addresses the issue of the interstitial monitors ability to detect leaks. It does not test the equipment for safety hazards.**

Certification of Results

I certify that the interstitial monitor was installed and operated according to the vendor's instructions and that the results presented on this form are those obtained during the evaluation. I also certify that the evaluation was performed using the procedures described in the modified test protocol.

H. Kendall Wilcox, President
(printed name)

Ken Wilcox Associates, Inc.
(organization performing evaluation)

H. Kendall Wilcox
(Signature)

Independence, MO 64055
(city, state, zip)

June 1, 1995
(date)

(816) 795-7997
(phone number)

**Test Results for the Red Jacket Electronics Groundwater Monitor
Model Number: RE400-204-5**

Run No.	Product Type													
	Water						Unleaded Gasoline						Diesel	
	Height to Alarm Bottom (in)	Height to Alarm Top (in)	Time to Alarm	Time to Recover	Height to Alarm (in)	Time to Alarm	Time to Recover	Height to Alarm (in)	Time to Alarm	Time to Recover	Height to Alarm (in)	Time to Alarm	Time to Recover**	
1	*	*	<1 second	<1 second	0.175	9 min	< 1h-20min	0.175	9 min	< 1h-20min	0.175	1h-35min	1-2 days	
2	*	*	<1 second	<1 second	0.175	9 min	< 1h-20min	0.175	9 min	< 1h-20min	0.175	1h-30min	1-2 days	
3	*	*	<1 second	<1 second	0.175	9 min	< 1h-20min	0.175	9 min	< 1h-20min	0.175	1h-13min	1-2 days	
4	*	*	<1 second	<1 second	0.175	11 min	< 1h-20min	0.175	11 min	< 1h-20min	0.175	1h-10min	1-2 days	
5	*	*	<1 second	<1 second	0.175	15 min	< 1h-20min	0.175	15 min	< 1h-20min	0.175	1h-40min	1-2 days	
6	*	*	<1 second	<1 second	0.175	11 min	< 1h-20min	0.175	11 min	< 1h-20min	0.175	1h-23min	1-2 days	
Mean (in)					0.175			0.175			0.175			
Accuracy					100			100			100			
Threshold (in)					0.175			0.175			0.175			
Precision (Std Dev)					0.000000			0.000000			0.000000			
Detection Time			<1 second			10.7 min						1h-25min		
Fall Time				<1 second			< 1h-20min						1-2 days	

- * When the water level drops to within 1 inch of the bottom of the sensor, or rises to within 1 inch of the top of the sensor, the sensor will alarm.
- ** Sensor reading may not return to pre-contaminated level. Operator may have to change threshold depending on the degree of contamination that the sensor has undergone.

Modified Procedure
Results of U.S. EPA Standard Evaluation
Liquid-Phase Product Detectors

This form documents the performance of the liquid-phase product detector described below. The evaluation was conducted by the equipment manufacturer or a consultant to the manufacturer according to the U.S. EPA's "Standard Test Procedure for Evaluation Leak Detection Methods: Liquid-Phase Out-of-tank Liquid Product Detectors". The modifications to the procedure were made to accommodate the specialized requirements of interstitial monitors.

Tank owners using this leak detection system should keep this form on file to prove compliance with the federal regulations. Tank owners should check with State and local agencies to make sure this form satisfies their requirements.

Method Description

Name Red Jacket Electronics Liquid Refraction Sensor

Version number RE400-180-5

Vendor Marley Pump Co. (A United Dominion Company)

5800 Foxridge Drive

(street address)

Mission,

KS

66202

(913) 831-5700

(city)

(state)

(zip)

(phone)

Detector output type: () Quantitative (x) Qualitative

Detector operating principle: () Electrical Conductivity () Thermal Conductivity () Interface Probe
() Product Permeable () Product Soluble (X) Other Optical

Detector sampling frequency: () Intermittent (X) Continuous

Evaluation Results

The detectors listed above were tested for their ability to detect and distinguish between hydrocarbon and water in a tank or a sump. The following parameters were determined:

Lower Detection Limit - The smallest product height that the detector can reliably detect.

Specificity - Whether or not the sensor responds to various products.

Precision - Agreement between multiple measurements of the same product level

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

Evaluation Results (continued)

> **Compiled Test Results** (for tests conducted at the lower detection limit)

<u>Test</u>	<u>Gasoline</u>	<u>Water</u>	<u>Diesel</u>
Probability of Detection	<u>100</u>	<u>100</u>	<u>100</u>
Probability of False Alarm	<u>0</u>	<u>0</u>	<u>0</u>
Accuracy (%)	<u>100</u>	<u>100</u>	<u>100</u>
Bias	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>
Precision (%)	<u>*</u>	<u>*</u>	<u>*</u>
Detection Time (hh:mm:ss)	<u>< 00:00:01</u>	<u>< 00:00:01</u>	<u>< 00:00:01</u>
Lower Detection Limit (in)	<u>*</u>	<u>*</u>	<u>*</u>

*See Attached Table.

Specificity Results (%)**

Commercial gasoline	<u>100</u>
Synthetic gasoline	<u>100</u>
Diesel fuel	<u>100</u>
Jet-A jet fuel	<u>100</u>
n-Hexane	<u>100</u>
Toluene	<u>100</u>
Xylene(s)	<u>100</u>
Water	<u>100</u>

**The sensor will respond to any liquid once the threshold has been exceeded.

> **Safety disclaimer: This test procedure only addresses the issue of the interstitial monitors ability to detect leaks. It does not test the equipment for safety hazards.**

Certification of Results

I certify that the interstitial monitor was installed and operated according to the vendor's instructions and that the results presented on this form are those obtained during the evaluation. I also certify that the evaluation was performed using the procedures described in the modified test protocol.

H. Kendall Wilcox, President
(printed name)

Ken Wilcox Associates, Inc.
(organization performing evaluation)

H. Kendall Wilcox
(Signature)

Independence, MO 64055
(city, state, zip)

June 1, 1995
(date)

(816) 795-7997
(phone number)

Test Results for the Red Jacket Liquid Refraction Sensor
Model Number: RE400-180-5

Run No.	Product		
	Water	Unleaded Gasoline	Diesel
	Height to Alarm (in)	Height to Alarm (in)	Height to Alarm (in)
1	0.422	0.442	0.432
2	0.422	0.437	0.427
3	0.418	0.437	0.432
4	0.422	0.442	0.427
5	0.418	0.446	0.432
6	0.413	0.446	0.432

Mean (in)	0.419	0.442	0.430
Accuracy	100	100	100
Threshold (in)	0.435	0.459	0.442
Precision (Std Dev)	0.003601	0.004033	0.002582
Detection Time	< 1 second	< 1 second	< 1 second
Fall Time	< 1 second	< 1 second	< 1 second