

Results of Third Party Standard Evaluation Cable Sensor Liquid Contact Product Detectors

This form documents the performance of the cable sensor liquid contact leak detection system described below. The evaluation was conducted by the equipment manufacturer or a consultant to the manufacturer according to the Third Party Procedures developed according to the U.S. EPA's "Standard Test Procedure for Evaluating Leak Detection Methods: Liquid-Phase Out-of-Tank Product Detectors."¹

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 verify that this form satisfies their requirements.

Method Description

Name TraceTek TTDM Alarm and Location Module

Version with TT3000 Water Sensing Cable

Vendor Raychem Corporation, TraceTek Products Group

300 Constitution Drive

(street address)

Menlo Park

CA

94025 - 1164

(415) 361 - 3333

(city)

(state)

(zip)

(phone)

Detector output type: Quantitative

Detector operating principle: Electrical Conductivity Capacitance Change

Interface Probe Product Permeable Product Soluble Thermal Conductivity

Other _____

Detector sampling frequency: Intermittent Continuous

Evaluation Results

The detector described above was tested for its ability to detect test liquids in contact with the cable sensor. The following parameters were determined:

- **Detection Accuracy** - The measure of sensor response to the presence of liquids.
- **Bias** - Whether the method consistently over-estimates or under-estimates leak location. Not applicable to qualitative detectors.
- **Detection Length** - The length of cable in contact with liquid, when the sensor is activated.
- **Response Time** - Amount of time the detector must be exposed to liquid before it responds.
- **Recovery Time** - Amount of time that passes before the detector returns to its baseline reading after the test liquid is removed.
- **Lower Detection Limit** - The smallest liquid concentration that the detector can reliably detect.
- **Maximum Effective Range (MER)** - The longest length of sensor cables that can be connected to form a leak detection network.
- **Precision** - Agreement between multiple measurements of the leak location. Not applicable to qualitative detectors.
- **Product Activation Height** - The height of liquid to cause sensor activation.
- **Relative Accuracy** - A statistical term defining the percent difference between the measured values and the reference values.
- **Specificity** - Indicates the level of response, of the detector, to several different liquids.

¹ Carnegie Mellon Research Institute. Test Procedures for Third Party Evaluation of Leak Detection Methods: Cable Sensor Liquid Contact Leak Detection Systems: Final Report - November 11, 1991.

Evaluation Results (continued)

> Compiled Test Results for Quantitative Detector

Sensor Cable Maximum Effective Range (MER): 5000 ft (1524 m)

Test Product Flow Rate: 0.093 ± .004 gal/hr.

	Detection Accuracy %	Product Activation Height cm (in)	Detection Length ft (cm)	Response Time at a Flow Rate of 0.093 gal/hr	Recovery Time
<u>Accuracy and Response Time</u> 3 wt% Salt Water (6 tests at each length) 1/3 MER Cable Test Length <u>1667 ft</u>	100%	Product Flow was stopped after the system alarmed, and well before <u>1.0 ft (30.5 cm)</u> of sensor cable was covered. < 0.3 cm (< 0.12 in)	< 15.2 cm (< 6.0 in)	< 1 min.	< 1 min.
2/3 MER Cable Test Length <u>3334 ft</u>	100%	< 0.3 cm (< 0.12 in)	< 15.2 cm (< 6.0 in)	< 1 min.	< 1 min.
MER Cable Test Length <u>5000 ft</u>	100%	< 0.3 cm (< 0.12 in)	< 15.2 cm (< 6.0 in)	< 1 min.	< 1 min.
<u>Lower Detection Limit @ MER</u> 3 wt% Salt Water (6 tests)	100%	< 0.3 cm ** (< 0.12 in)	< 5.08 cm (< 2.0 in)	< 1 min.	< 1 min.
<u>Specificity @ MER</u> (3 tests for each liquid)					
Synthetic Fuel	0%	not applicable	not applicable	not applicable	not applicable
Diesel Fuel	0%	not applicable	not applicable	not applicable	not applicable.
Unleaded Gasoline	0%	not applicable	not applicable	not applicable	not applicable.
Water	100%	< 0.3 cm (< 0.12 in)	[100.0%]* < 15.2 cm (< 6.0 in)	< 1 min.	< 1 min.

*Specificity Reference: 3 wt% Salt Water

** Product Flow was stopped after the system alarmed, and well before 4.0 in (10 cm) of sensor cable was covered.

Marc Perloff
(signature)

February 20, 1998
(date)

Evaluation Results (continued)**> Compiled Test Results for Product Location Measurements.**

	Cable Test Length (1/3 MER) 1666 ± 0 ft	Cable Test Length (2/3 MER) 3333 ± 0 ft	Cable Test Length (MER) 4999 ± 0 ft
Product Location Accuracy 3 wt% Salt Water (6 tests at each length)			
Average Observed Value	1665 ft	3331 ft	4997 ft
Standard Deviation	± 1 ft	± 2 ft	± 1 ft
Relative Accuracy (%)	0.11	0.12	0.03
Coefficient of Variation (%)	0.03	0.05	0.03
Bias (%)	- 0.08	- 0.08	- 0.01
Specificity (%) @ MER (3 tests for each liquid)			
Synthetic Fuel			No Response
Diesel Fuel			No Response
Unleaded Gasoline			No Response
Water (Average Observed Value)			[100.0]* 4998 ± 1 ft

* Specificity Reference: 3 wt% Salt Water

> Safety disclaimer: This test procedure only addresses the issue of the method's ability to detect the presence of liquid product. It does not test the equipment for safety hazards.

Certification of Results

I certify that the cable sensor liquid contact product detector was operated according to the vendor's instructions and that the evaluation was performed according to the Third Party Procedures developed according to the U.S. EPA's "Standard Test Procedure for Evaluating Leak Detection Methods: Liquid-Phase Out-of-Tank Product Detectors."¹ I also certify that the results presented above are those obtained during the evaluation.

Marc Portnoff
(printed name)

Marc Portnoff
(signature)

February 20, 1998
(date)

Carnegie Mellon Research Institute **
(organization performing evaluation)

Pittsburgh, PA 15230
(city, state, zip)

(412) 268-3495
(phone number)

** Consultant to the Manufacturer

At the request of TraceTek additional specificity tests were performed. The results are tabulated below.

Evaluation Results (added tests)

Sensor Cable Maximum Effective Range (MER): 5000 ft (1524 m)

Test Product Flow Rate: 0.093 ± .004 gal/hr.

	Detection Accuracy %	Product Activation Height cm (in)	Detection Length ft (cm)	Response Time at a Flow Rate of 0.93 gal/hr	Recovery Time
Specificity @ MER (3 tests for each liquid)					
5 vol% Oil in 3 wt% Salt Water	100%	< 0.3 cm (< 0.12 in)	[100.0%]* < 15.2 cm (< 6.0 in)	<1 min.	<1 min.
10 vol% Oil in 3 wt% Salt Water	100%	< 0.3 cm (< 0.12 in)	[100.0%]* < 15.2 cm (< 6.0 in)	<1 min.	<1 min.
0.1 Molar Hydrochloric Acid	100%	< 0.3 cm (< 0.12 in)	[100.0%]* < 15.2 cm (< 6.0 in)	<1 min.	<1 min.
0.1 Molar Sodium Hydroxide	100%	< 0.3 cm (< 0.12 in)	[100.0%]* < 15.2 cm (< 6.0 in)	<1 min.	<1 min.
JP-8 Jet Fuel	0%	not applicable	not applicable	not applicable	not applicable

* Specificity Reference: 3 wt% Salt Water

Man Petroff
(signature)

February 20, 1998
(date)

Liquid Contact Product Detector TraceTek TTDM Alarm and Location Module
 Version _____ with TT3000 Water Sensing Cable

At the request of TraceTek additional specificity tests were performed. The results are tabulated below.

Evaluation Results (added tests)

Sensor Cable Maximum Effective Range (MER): 5000 ft (1524 m)

Test Product Flow Rate: 0.093 ± .004 gal/hr.

<u>Product Location</u>	<u>Cable Test Length (MER)</u> <u>4999 ± 0 ft</u>
<u>Specificity (%) @ MER</u> <u>(3 tests for each liquid)</u>	
5 vol% oil in 3 wt% Salt Water (Average Observed Value)	[100.0]* 4998 ± 1 ft
10 vol% oil in 3 wt% Salt Water (Average Observed Value)	[100.0]* 4998 ± 1 ft
0.1 Molar Hydrochloric Acid (Average Observed Value)	[100.0]* 4999 ± 1 ft
0.1 Molar Sodium Hydroxide (Average Observed Value)	[100.0]* 4998 ± 1 ft
JP-8 Jet Fuel (Average Observed Value)	No Response

* Specificity Reference: 3 wt% Salt Water

Marc Portnuff
(signature)

February 20, 1998
(date)

Test Procedures for Third Party Evaluation of Leak Detection Methods: Cable Sensor Liquid Contact Leak Detection Systems

**Subject: TraceTek TTDM Alarm and Location Module with
TT3000 Water Sensing Cable**

Date: February 20, 1998

Carnegie Mellon Research Institute evaluated the above TraceTek system according to the following test protocol:

CMRI TEST PROCEDURES: Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems, Carnegie Mellon Research Institute, Final Report, November 11, 1991.

The procedure was modified as listed below to evaluate the TT3000 water sensing cable:

- 3 wt% salt water, was substituted for unleaded gasoline as the test liquid used for conducting the accuracy and response time tests and the lower detection level tests.
- The following test liquids were added or substituted to the list of specificity tests:
 - * 5 vol% oil in 3 wt% salt water (mixed, not emulsified)
 - * 10 vol% oil in 3 wt% salt water (mixed, not emulsified)
 - * 0.1 molar hydrochloric acid
 - * 0.1 molar sodium hydroxide
 - * JP-8 jet fuel
 - * Unleaded gasoline was substituted for home heating oil
- The test liquids were delivered at an average rate of 0.93 gal/hr. yielding a test liquid rate of rise of 1.4 mm/min.

Carnegie Mellon Research Institute (CMRI) was selected by Raychem Corporation, TraceTek Products Group, to evaluate its Underground Storage Tank Leak Detection Monitoring System. Their system, listed below, was evaluated using an EPA approved equivalent test protocol modified to test the TT3000 water sensing cable.

The TraceTek equipment was properly set up, calibrated, and maintained, according to written instructions provided by TraceTek and as required by the test protocols.

TraceTek TTDM Alarm and Location Module with:

TT3000 Water Sensing Cable

Liquid-Contact Protocol

LIQUID-CONTACT TESTING: November 1991, Equivalent test procedure for evaluating leak detection methods for Cable Sensor Liquid Contact product detectors [Carnegie Mellon Research Institute. Test Procedures for Third Party Evaluation of Leak Detection Methods: Cable Sensor Liquid Contact Leak Detection Systems: Final Report - November 11, 1991.].

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