Evaluation of the Incon Automatic Tank Gauging System for Monthly Monitoring on Underground Storage Tanks up to 30,000 gallons

(Models: TS-1000; TS-1001; TS-2001)

EPA Forms

PREPARED FOR

Incon (Intelligent Controls, Inc.)

May 14, 1998

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Preface

This report describes testing conducted on the Incon Automatic Tank Gauging System. The results of this evaluation apply to the following models: TS-1000; TS-1001; and TS-2001. This evaluation meets the requirements of the U.S. Environmental Protection Agency for Automatic Tank Gauging Systems for Monthly Monitoring for 0.2 gal/h leaks of Underground Storage Tanks up to 30,000 gallons in volume. The forms contained in this report are based on data collected using the EPA protocol "Standard Test Procedures for Evaluating Leak Detection Methods: Automatic Tank Gauging Systems", EPA/530/UST-90/006, March 1990. Ken Wilcox Associates, Inc. prepared this report and conducted all of the leak simulations, data collection, and data analysis.

The system also meets the National Work Group on Leak Detection Evaluations (NWGLDE) [1] requirements for Automatic Tank Gauging Systems for testing below the 50% product level.[2]

Volume 1 of this evaluation contains the Final Report and Volume 2 contains the Test Data. This report was prepared by Mr. Jeffrey K. Wilcox, Ken Wilcox Associates, Inc. Technical Questions regarding this evaluation should be directed to Mr. Michael Johnson, Incon (Intelligent Controls, Inc.), at (207) 283-0156.

KEN WILCOX ASSOCIATES, INC.

Jeffrey K. Wilcox, M.E.S.
Project Engineer

Approved:

H. Kendall Wilcox, Ph.D.
President

May 14, 1998

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[1] The National Work Group for Leak Detection Evaluations consists of a group of State and Federal Regulators that review leak detection evaluations, new evaluation protocols, and other issues affecting the leak detection and underground storage tank industry.

[2] Letter from the Automatic Tank Gauge and Volumetric Tank Tightness Testing Committees of the NWGLDE to Gauge Vendors and other interested parties, April 28, 1997.

Results of U.S. EPA Standard Evaluation
Automatic Tank Gauging System (ATGS)

This form tells whether the automatic tank gauging system (ATGS) described below complies with the performance requirements of the federal underground storage tank regulation. 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 Evaluating Leak Detection Methods: Automatic Tank Gauging Systems." The full evaluation report also includes a form describing the method and a form summarizing the test data.

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

ATGS Description

Name Incon Automatic Tank Gauging System

Version number TS-1000; TS-1001; TS-2001

Vendor Incon, Inc. (Intelligent Controls)

74 Industrial Park Road
(street address)

Saco,	Maine	04072	(207) 283-0156
(city)	(state)	(zip)	(phone)

Evaluation Results

This ATGS which declares tank to be leaking when the measured leak rate exceeds the threshold of 0.10 gallon per hour, has a probability of false alarms [P_{FA}] of 4.3 %.

The corresponding probability of detection [P_D] of a 0.20 gallon per hour leak is 95.7 %.

The minimum water level (threshold) in the tank that the ATGS can detect is 0.208 inch.

The minimum change in water level that can be detected by the ATGS is 0.011 inches (provided that the water level is above the threshold).

Therefore, this ATGS (**X**) does ( ) does not meet the **federal** performance standards established by the U.S. Environmental Protection Agency (0.20 gallon per hour at P_D of 95% and P_{FA} of 5%), and this ATGS (**X**) does ( ) does not meet the **federal** performance standard of measuring water in the bottom of the tank to the nearest 1/8 inch.

Test Conditions During Evaluation

The evaluation testing was conducted in a 20,000 gallon ( ) steel (**X**) fiberglass tank that was 120 inches in diameter and 453 inches long.

The temperature difference between product added to fill the tank and product already in the tank ranged from -6.9 deg F to +5.6 deg F, with a standard deviation of 5.2 deg F.

The tests were conducted with the tank product levels 50 to 95 % full.

The product used in the evaluation was diesel fuel .

Name of ATGS Incon Automatic Tank Gauging System
Version TS-1000; TS-1001; TS-2001

Limitations on the Results

The performance estimates above are only valid when:

- The method has not been substantially changed.
- The vendor's instructions for installing ad operating the ATGS are followed.
- The tank contains a product identified on the method description form.
- The tank is no larger than 30,000 gallons.
- The tank is at least See Note Below [1] percent full.
- The waiting time after adding any substantial amount of product to the tank is 4 [2] hours.
- The temperature of the added product does not differ more than ±7.8 degrees Fahrenheit from that already in the tank.
- The total data collection time for the test is at least See note below [3] hours.
- Other limitations specified by the vendor of determined during testing:

  none

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

Certification of Results

I certify that the ATGS 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 according to one of the following:

(X) standard EPA test procedure for ATGS
( ) alternative EPA test procedure for ATGS

H. Kendall Wilcox, Ph.D., President	Ken Wilcox Associates, Inc.
(printed name)	(organization performing evaluation)
	Grain Valley, Missouri 64029
(signature)	(city, state. zip)
May 14, 1998	(816) 443-2494
(date)	(phone number)

[1] Ten percent is the minimum percent full for conducting a valid test on the tank used in the evaluation. The minimum product level at which a valid test can be conducted is dependent on the length of the probe. See the attached table for a list of probe lengths and their respective minimum test levels.

[2] Waiting times after deliveries ranged from 2 hrs 58 minutes to 6 hrs and averaged 4 hrs 9 minutes.

[3] The Incon ATGS automatically determines the length of the test based upon the quality of the test data. Test times for this evaluation ranged from 6 hrs 19 minutes to 8 hrs and averaged 6 hrs 51 minutes. Test times will generally be longer for larger tanks.

Reporting Form for Leak Rate Data
Automatic Tank Gauging System (ATGS)

ATGS Name and Version: Incon ATGS Models: TS-1000; TS-1001; TS-2001
Evaluation Period: from 19-Dec-96 to 15-Sept-97 (Dates)

Test No.	Date at Completion of Last Fill (d-m-y)	Time at Completion of Last Fill (military)	Date Test Began (d-m-y)	Time Test Began (military)	Time Test Ended (military)	Product Temperature Differential (deg F)	Nominal Leak Rate (gal/h)	Induced Leak Rate (gal/h)	Measured Leak Rate (gal/h)	Meas.-Ind. Leak Rate (gal/h)
1	19-Dec-96	1238	19-Dec-96	1638	2306	-0.4	0.2	-0.206	-0.21	-0.004
2	19-Dec-96	1238	20-Dec-96	0038	0659	-0.4	0	0.000	0.02	0.020
3	Test aborted due to test site operational problems - Replaced by Test 21.									
4	Test aborted due to test site operational problems - Replaced by Test 22.									
5	28-Dec-96	1630	28-Dec-96	2030	0430	5.6	0.1	-0.091	-0.07	0.021
6	28-Dec-96	1630	29-Dec-96	1107	1842	5.6	0.2	-0.168	-0.23	-0.062
7	29-Dec-96	2035	29-Dec-96	2330	0549	5.6	0	0.000	0.02	0.020
8	29-Dec-96	2035	30-Dec-96	1058	1718	5.6	0.3	-0.257	-0.33	-0.073
9	30-Dec-96	1835	30-Dec-96	2235	0454	-6.9	0.3	-0.295	-0.19	0.105
10	30-Dec-96	1835	31-Dec-96	0846	1506	-6.9	0.2	-0.180	-0.21	-0.030
11	31-Dec-96	1620	31-Dec-96	2020	0239	-6.9	0.1	-0.087	-0.05	0.037
12	31-Dec-96	1620	01-Jan-97	1105	1724	-6.9	0	0.000	-0.01	-0.010
13	02-Jan-97	1009	02-Jan-97	1307	1927	-0.4	0.3	-0.244	-0.21	0.034
14	02-Jan-97	1009	02-Jan-97	2200	0559	-0.4	0.1	-0.152	-0.18	-0.028
15	03-Jan-97	1054	03-Jan-97	1200	1800	-0.4	0	0.000	-0.03	-0.030
16	03-Jan-97	1054	03-Jan-97	2100	0459	-0.4	0.1	-0.137	-0.18	-0.043
17	12-Jan-97	1737	12-Jan-97	1950	0210	-0.4	0.2	-0.243	-0.13	0.113
18	12-Jan-97	1737	13-Jan-97	0757	1417	-0.4	0.3	-0.298	-0.32	-0.022
19	13-Jan-97	1930	14-Jan-97	0130	0749	5.1	0.3	-0.303	-0.38	-0.077
20	13-Jan-97	1930	14-Jan-97	0754	1413	5.1	0	0.000	-0.04	-0.040
21	14-Jan-97	1525	14-Jan-97	1737	2356	5.1	0.2	-0.183	-0.11	0.073
22	14-Jan-97	1525	15-Jan-97	0300	0919	5.1	0.1	-0.077	-0.09	-0.013
23	13-Sep-97	1500	13-Sep-97	1900	0259	-5.8	0	0.000	-0.04	-0.040
24	13-Sep-97	1500	14-Sep-97	0510	1309	-5.8	0.1	-0.110	-0.11	0.000
25	14-Sep-97	2025	15-Sep-97	0025	0824	-5.8	0.2	-0.189	-0.11	0.079
26	14-Sep-97	2025	15-Sep-97	1022	1822	-5.8	0.3	-0.277	-0.39	-0.113

Description
Automatic Tank Gauging System

This section describes briefly the important aspects of the automatic tank gauging system (ATGS). It is not intended to provide a thorough description of the principles behind the system or how the equipment works.

ATGS Name and Version

Incon Automatic Tank Gauging System Models: TS-1000; TS-1001; TS-2001

Product

> Product type

For what products can this ATGS be used? (check all applicable)

(X) gasoline

(X) diesel

(X) aviation fuel

(X) fuel oil #4

( ) fuel oil #6

(X) solvents

(X) waste oil

(X) other (list) Solvents compatible with sensors and with known coefficients of expansion and densities. Contact manufacturer for specific applications.

> Product level

What product level is required to conduct a test?

( ) greater than 90% full

( ) greater than 50% full

(X) other (specify) Dependent on probe length - see attached table

Does the ATGS measure inflow of water as well as loss of product (gallon per hour)?

(X) yes

( ) no

Does the ATGS detect the presence of water in the bottom of the tank?

(X) yes

( ) no

Level Measurement

What technique is used to measure changes in product volume?

( ) directly measure the volume of product change

( ) changes in head pressure

( ) changes in buoyancy of a probe

( ) mechanical level measure (e.g., ruler, dipstick)

( ) changes in capacitance

( ) ultrasonic

(X) change in level of float (specify principle, e.g., capacitance, magnetostrictive, load cell, etc.) Magnetostrictive

( ) other (describe briefly) _____

Temperature Measurement

If product temperature is measured during a test, how many temperature sensors are used?

( ) single sensor, without circulation

( ) single sensor, with circulation

( ) 2-4 sensors

(X) 5 or more sensors

( ) temperature-averaging probe

If product temperature is measured during a test, what type of temperature sensor is used?

(X) resistance temperature detector (RTD)

( ) bimetallic strip

( ) quartz crystal

( ) thermistor

( ) other (describe briefly) _____

If product temperature is not measured during a test, why not?

( ) the factor measured for change in level/volume is independent of temperature (e.g., mass)

( ) the factor measured for change in level/volume self-compensates for changes in temperature

( ) other (explain briefly) _____

Data Acquisition

How are the test data acquired and recorded?

( ) manually

( ) by strip chart

(X) by computer

Procedure information

> Waiting times

What is the minimum waiting period between adding a large volume of product (i.e., a delivery) and the beginning of a test (e.g., filling from 50% to 90-95% capacity)?

( ) no waiting period

( ) less than 3 hours

(X) 3-6 hours

( ) 7-12 hours

( ) more than 12 hours

( ) variable, depending on tank size, amount added, operator discretion, etc.

> Test duration

What is the minimum time for collecting data?

( ) less than 1 hour

( ) 1 hour

( ) 2 hours

( ) 3 hours

( ) 4 hours

(X) 5-10 hours

( ) more than 10 hours

( ) variable (explain) _____

> Total time

What is the total time needed to test with this ATGS after a delivery?
(waiting time plus testing time)

__10__ hours __0__ minutes (Assumes 4 hour waiting time and 6 hour testing time)

What is the sampling frequency for the level and temperature measurements?

(X) more than once per second

( ) at least once per minute

( ) every 1-15 minutes

( ) every 16-30 minutes

( ) every 31-60 minutes

( ) less than once per hour

( ) variable (explain) _____

> Identifying and correcting for interfering factors

How does the ATGS determine the presence and level of the ground water above the bottom of the tank?

(X) observation well near tank

( ) information from USGS, etc.

(X) information from personnel on-site

(X) presence of water in the tank

( ) other (describe briefly) _____

( ) level of ground water above bottom of the tank not determined

How does the ATGS correct for the interference due to the presence of ground water above the bottom of the tank?

(X) system tests for water incursion

( ) different product levels tested and leak rates compared

( ) other (describe briefly) _____

( ) no action

How does the ATGS determine when tank deformation has stopped following delivery of product?

(X) wait a specified period of time before beginning test

( ) watch the data trends and begin test when decrease in product level has stopped

( ) other (describe briefly) _____

( ) no procedure

Are the temperature and level sensors calibrated before each test?

( ) yes

(X) no

If not, how frequently are the sensors calibrated?

( ) weekly

( ) monthly

( ) yearly or less frequently

(X) never

> Interpreting test results

How are level changes converted to volume changes (i.e., how is height-to-volume conversion factor determined)?

( ) actual level changes observed when known volume is added or removed (e.g., liquid metal bar)

(X) theoretical ratio calculated from tank geometry

(X) interpolation from tank manufacturer's chart

( ) other (describe briefly)

( ) not applicable; volume measured directly

How is the coefficient of thermal expansion (Ce) of the product determined?

( ) actual sample taken for each test and Ce determined from specific gravity

(X) value supplied by vendor of product

(X) average value for type of product

( ) other (describe briefly) _____

How is the leak rate (gallon per hour) calculated?

( ) average of subsets of all data collected

( ) difference between first and last data collected

( ) from data from last _____ hours of test period

(X) from data determined to be valid by statistical analysis

( ) other (describe) _____

What threshold value for product volume change (gallon per hour) is used to declare that a tank is leaking?

( ) 0.05 gallon per hour

(X) 0.10 gallon per hour (for Monthly Monitoring)

( ) 0.20 gallon per hour

( ) other (list) _____

Under what conditions are test results considered inconclusive?

(X) too much variability in the data (standard deviation beyond a given value)

( ) unexplained product volume increase

( ) other (describe briefly) _____

Exceptions

Are there any conditions under which a test should not be conducted?

( ) water in the excavation zone

( ) large difference between ground temperature and delivered product temperature

( ) extremely high or low ambient temperature

( ) invalid for some products (specify) _____

(X) other (describe briefly) none _____

What are acceptable deviations from the standard testing protocol?

(X) none

( ) lengthen the duration of test

( ) other (describe briefly) _____

What elements of the test procedure are determined by personnel on-site?

(X) product level when test is conducted

(X) when to conduct test

( ) waiting period between filling tank and beginning test

( ) length of test

( ) determination that tank deformation has subsided

( ) determination of "outlier" data that may be discarded

( ) other (describe briefly) _____

( ) none

Attachment 1

Results of U.S. EPA Standard Evaluation
Automatic Tank Gauging System (ATGS)

Standard Lengths for Incon Probes (Low level testing information)

Standard Probe Length	Tank Diameter	Lowest Temperature Sensor from End of Shaft	Lowest Product Level for Valid Testing
29	24	2.68	8.68
41	36	4.15	10.15
53	48	5.62	11.62
57	52	6.1	12.1
69	64	7.57	13.57
77	72	8.55	14.55
81	76	9.04	15.04
89	84	10.01	16.01
101	96	11.48	17.48
113	108	12.95	18.95
125	120	14.41	20.41
131	126	15.15	21.15
137	132	15.88	21.88
149	144	17.35	23.35