EPA-AA-EOD-FSB-88/3

Technical Report

The Emco Fuel Tank Monitoring System

Systems Analysis

By

B. Scott Ruble
Mechanical Engineering Technician

December 28, 1988

NOTICE

Facility Support Branch
Engineering Operations Division
Office of Mobile Sources
U. S. Environmental Protection Agency
2565 Plymouth Road
Ann Arbor, MI 48105

Table of Contents

Objective

A system verification was performed on the Emco Fuel Tank Monitoring System (EFTMS). Three aspects of the Emco system were investigated. The purpose of this report is to present the findings of the investigation which dealt with the following:

Segment 1) Compare the fuel level and volume measurement data of the new Emco system to related data of the old dipstick measurement method.

Segment 2) Check the volume measuring accuracy of the Emco system and compare it to that specified by the manufacturer.

Segment 3) Document the existing information that is stored in the Tank Level Monitor.

Summary

Segment 1
EFTMS and Dipstick Data Comparison

The fuel level measurements collected electronically by the Emco Fuel Tank Monitoring System (EFTMS) were very similar to those collected manually by the dipstick method. Correspondingly, the conversion table graphs for both methods were almost identical. As can be seen by the difference and percent difference plots of the conversion tables in appendices D and E, there is minimal scatter. On the average, however, the dipstick measurements of fuel level were slightly higher than the EFTMS's. For fuel storage tanks one through eight, the average difference between EFTMS and dipstick fuel level measurements was 1.56 inches. In terms of volume (gallons), the largest percent difference between the two measurement methods, expressed as a percent of full scale capacity, was 3.6% and the lowest was .87%. For a given tank, however, the offset was quite consistent. Hence the data is acceptable for our use in monitoring tank fuel levels.

Segment 2
Check of EFTMS Accuracy and Comparison to Manufacturer's Specifications

The actual volume measuring accuracy was checked and compared to the manufacturer's claimed volumetric accuracy. For purposes of comparison, the accuracy claimed by the manufacturer, which is expressed in inches, was converted into units of gallons. The manufacturer's specifications claim accuracies of approximately ± 0.53 to ± 1.700 gallons of fuel depending on the level of fuel in the tank. These volumetric accuracies represent $\pm .01$ inches of fuel at specific ranges of the storage tank. The EFTMS displayed a perfect accuracy for storage tanks 1, 2, 4 and 7 and an accuracy of ± 1 gallon in tanks 3, 5, 6 and 8. Overall, the volume measuring accuracy of the EPA's EFTMS meets or exceeds that guaranteed by the manufacturer.

Segment 3
Information Stored in the Tank Level Monitor

Via the front panel of the Tank Level Monitor most of the information programmed into the EFTMS was obtained. A complete listing of this information is included in appendix L. Further information such as the conversion table can be obtained by interfacing a computer with the Tank Level Monitor. However, due to the complexity of this operation and lack of equipment, an interface was not attempted. If more information is desired or an alteration to the factory programmed information is needed, the company which services the EFTMS should be contacted for assistance.

Background

This study involves fuel storage tanks one through eight which contain various fuels used in vehicle testing. These storage tanks have a capacity of 10,000 gallons and have a diameter of 92 inches. With their cylindrical body and spherical ends, the storage tanks resemble the shape of a cigar. The tanks are located underground at the rear of the EPA.

The old method of determining storage tank fuel volume involved using a dipstick. Resembling a long wooden pole marked off in increments of 1/4", the dipstick was used to measure the fuel depth of the storage tanks. The measured inches of fuel could then be converted into gallons via a conversion table supplied by the tank manufacturer, Owens/Corning. A copy of this conversion table for the Fiberglas* fuel storage tanks is supplied in appendix A.

Due to the technique involved in dipstick fuel measurements, some inherent problems existed. These problems consisted of the following:

1. When taking measurements, the fuel level line left on the dipstick was difficult to detect.

2. The dipstick could not be used during wet weather.

3. The dipstick had a low sensitivity to small volume changes.

4. In cold weather, the fuel level line would not evaporate off of the stick which made future stick readings difficult.

To improve upon the old method of fuel measurement, the EPA installed an EFTMS. The new measurement system, manufactured by Emco Wheaton, utilizes tank probes to sense both fuel and water levels. These probes generate electrical signals which are picked up by the Tank Level Monitor mounted inside the EPA. For purposes of converting inches of fuel into gallons, the EFTMS also has its own conversion table which is programmed into the Tank Level Monitor. A copy of the downloaded EFTMS conversion table is included in appendix B. The EFTMS currently monitors storage tanks one through eight. As depicted in the following picture (figure 1), the EFTMS consists of the Emco tank probes, float sensing mechanisms, Tank Level Monitor, and assorted wiring.

*Registered TM - Owens Corning Fiberglas Corporation

Fuel Tank Farm
(cross section of two fuel tanks)

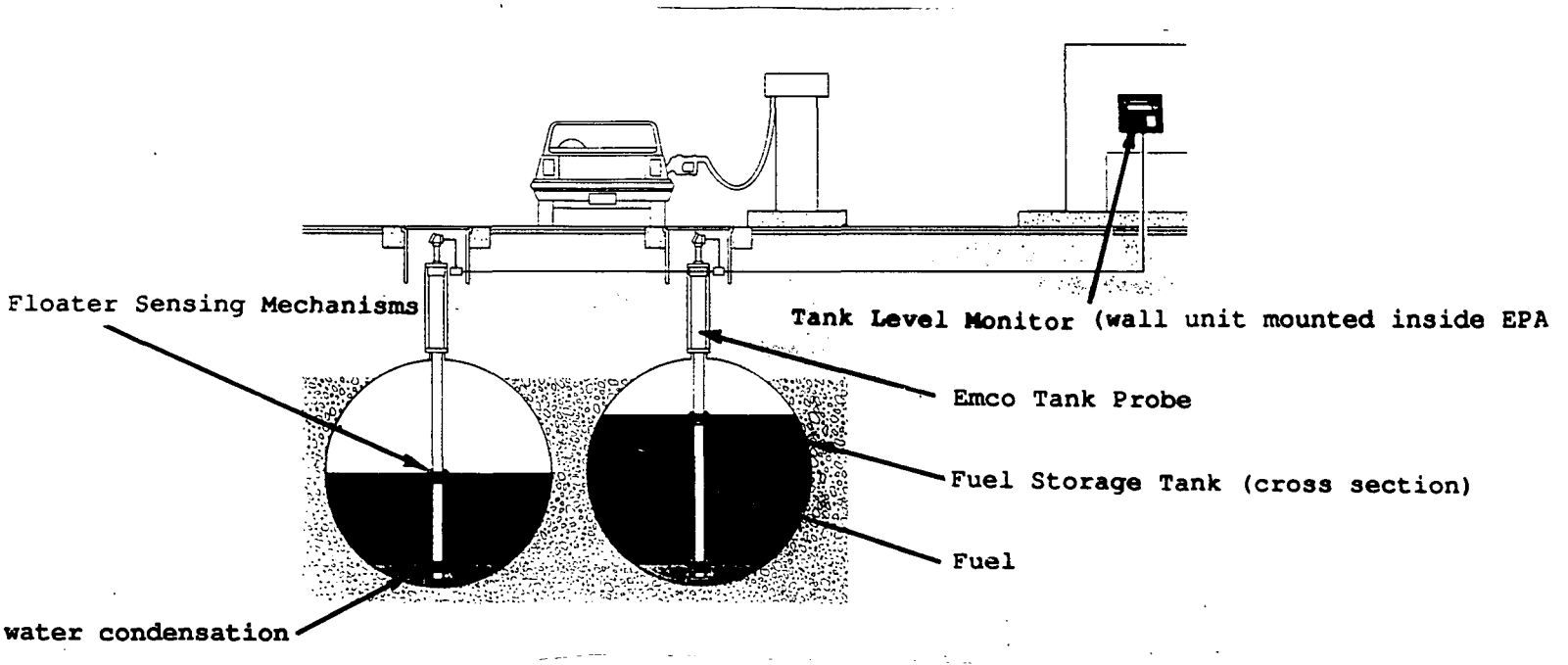


Figure 1.
See the operating and installation manuals for additional details.

Segment 1
EFTMS and Dipstick Data Comparison

Conversion Table Comparison

Initially the conversion tables of the EFTMS and the dipstick method were compared. These conversion tables facilitate the changing of fuel depth (inches) into fuel volume (gallons). For the dipstick method, the Fiberglas* conversion table (model C-3) included in appendix A was utilized. As for the EFTMS, the downloaded conversion table from the Tank Level Monitor was used. The EFTMS conversion table, presented in appendix B was supplied by Warren Braun, a manufacturer's representative. For both of the conversion tables volume vs. depth was plotted to establish a visual correlation. As can be seen from these graphs (appendix C), the curves for the conversion tables are nearly identical. The difference and percent difference graphs of these conversion tables further support their similarity. Both graphs displayed minimal scatter and are included in appendices D and E respectively.

Comparison of EFTMS and Dipstick Readings

To check for any discrepancies in EFTMS or dipstick measurements, their readings of fuel level were plotted over a three month period. These fuel level measurements were collected by the chemistry lab prior to this study. However, please note that these measurements obtained by the EFTMS and the dipstick method were not performed at the exact same time. A time span of approximately 30 minutes separated the measurements taken by the EFTMS and dipstick method. Therefore any fuel removed from the tanks after the dipstick reading was taken and prior to the EFTMS reading would bias the data. Based on this, large discrepancies between specific dipstick readings and EFTMS measurements could be explained. However large discrepancies between the two methods over a long period of time may indicate a significant difference between the two measurements systems.

Both the EFTMS and the dipstick method use the inch as its base unit. Therefore, disregarding potential bias effects due to unexpected fuel removal, any volume discrepancies between the two methods is directly related to measuring fuel levels differently. Hence to save time, the large fuel level data set which was collected in inches was not converted into units of gallons.

As can be seen by the comparison graphs included in appendix F, the dipstick fuel level measurements are generally higher for most storage tanks than those of the EFTMS. The pitch of the storage tanks may be the primary reason for this discrepancy. Due to the physical parameters of the storage tanks, all dipstick readings can only be taken from the South end of the tanks, but the EFTMS sensing probes were installed at the North end of the tanks. Any pitch in the tanks could cause a variation in the fuel levels determined by either method. The EFTMS does have the capability to correct for tank pitch. However because the EPA does not precisely know the tank pitches, all pitch correction factors for the EFTMS have been set to zero. Though the EFTMS seems more advanced than its counterpart, it is important to note that this report does not compare the accuracy of the two methods.

*Registered TM - Owens Corning Fiberglas Corporation

To obtain a numerical assessment of the difference between the two methods, the percent difference and percent difference full scale were plotted for the entire fuel level data set. These graphs are included in appendices G and H respectively. In addition, the average difference between the EFTMS and dipstick fuel level readings were calculated for all tanks.

The following is a summary of the results. All values are in units of inches.

Tank 1	Tank 2	Tank 3	Tank 4	Tank 5	Tank 6	Tank 7	Tank 8
-1.29	-.01	-1.91	-1.80	-.91	-2.80	-1.60	-2.21

Average of all Differences for all Tanks: -1.56

To establish a volumetric comparison, the difference in gallons between the two methods was calculated. These results are displayed in appendix I. Only the most extreme volume differences were considered for these calculations. Overall, the lowest full scale percent difference was .87% for tank 5 and the highest was 3.60% for tank 6.

Study Limitations

Only a portion of each storage tank's total volume could be examined at this time. Because the graph of Tank Volume vs. Inches represents a third order polynomial, discrepancies between the two measurement systems may be more pronounced at different portions of a tank. Also the only data available to study the difference between the dipstick method and the EFTMS could be biased due to different measurement times.

Recommendations

Only 3 months of data was available for this study. A larger data set collected over a longer period of time is needed to compare the measurement methods over the full range of tank volumes. Also action should be taken to ensure that the two measurements from each of the two methods are taken at the exact same time.

Conclusions

The conversion tables for the two methods were nearly identical. Data collected by the EFTMS and the dipstick method were very similar. However, the dipstick data readings were on the average higher than those of the EFTMS.

Segment 2
Comparison of EFTMS Accuracy to Manufacturer's Specifications

Discussion of Manufacturer's Accuracy Specifications

For the purposes of the EPA, the manufacturer of the EFTMS did not report the accuracy of the EFTMS in terms that were convenient for a volume accuracy assessment. The manufacturer, Emco Wheaton, specified that the float sensing mechanisms, shown in figure 1, were accurate to ±.01" of fuel. However for comparison purposes, a manufacturer's volume measuring accuracy in units of gallons was needed. Based on the manufacturer's reported float accuracy, the EFTMS's corresponding accuracy for volume measurement was derived.

In the process of deriving the EFTMS volume measuring accuracy, a number of different factors were assessed. As a result of the cylindrical shape of the storage tanks, the volume measuring accuracy should vary with respect to the fuel level. This variable volume accuracy is a result of the EFTMS using fuel inches as its base measurement which the machine then converts into gallons via a conversion table. The conversion table, which is included in appendix B, produced a third order polynomial when gallons vs. inches was plotted. Hence, volume inaccuracies should be more enhanced at the midpoint of this curve (appendix C) than at the beginning or end of the curve. In other words, the volume measuring accuracy of the EFTMS should be least accurate when a storage tank is half full. To support this statement, the EFTMS volume measuring accuracy for nine different tank volumes was calculated with respect to the floater's accuracy of ±.01". The results of all the calculations are included in appendix J. The greatest volume measuring accuracy was ±.53 gallons for the range 0-10.5 inches of fuel and the lowest accuracy was ±1.70 gallons for the range 50.5-60.5 inches of fuel is approximately the middle of a typical 10,000 gallon storage tank.

Discussion of Actual EFTMS Measuring Accuracy

To obtain data on the actual volume measuring accuracy of the EFTMS, a fuel measurement study was conducted on all eight storage tanks. With a five gallon container certified by the National Bureau of Standards, 20 gallons of fuel was removed in five gallon increments from seven of the eight storage tanks. After each five gallon extraction, the volume change registered by the EFTMS was recorded. Tank number 6 is a dump tank and doesn't have any readily accessible extraction points. Therefore, on tank number 6, 20 gallons of fuel was dumped into it in five gallon increments. As with the other tanks, the same data collection procedure was followed on tank 6. All of the data and statistics which were collected are presented in appendix K. Overall for a 20 gallon fuel sample, the EFTMS displayed a perfect accuracy for storage 1, 2, 4, and 7. For storage tanks 3, 5, 6, and 8 the EFTMS displayed an accuracy of ±1 gallon. However, it should be noted that the Tank Level Monitor only has a resolution of 1 gallon.

Comparison of Accuracies: Actual vs. Manufacturer

The manufacturer indicated that the EFTMS is accurate to ±.01" of fuel which translates into a volume accuracy ranging from ±.531 gallons to ±1.70 gallons. This study suggests that the EPA's particular Emco equipment generally meets the sensitivity specified by the manufacturer.

The following data are the EFTMS derived manufacturer volume measuring accuracies for each tank with respect to individual tank fuel volumes (appendix J). All units are in gallons, also these stated values represent ±0.01" of fuel at the tank fuel level when the measurements were taken.

Tank 1	Tank 2	Tank 3	Tank 4	Tank 5	Tank 6	Tank 7	Tank 8
±1.37	±1.19	±.949	±.949	±.949	±1.22	±1.37	±1.37

The following are the EFTMS deviations from true volumes for each tank (appendix K). All units are in gallons.

Tank 1	Tank 2	Tank 3	Tank 4	Tank 5	Tank 6	Tank 7	Tank 8
±0.00	±0.00	-1.00	±0.00	-1.00	+1.00	±0.00	+1.00

Overall, most of the deviations are lower than the derived manufacturer accuracies for each individual tank. Only tanks 3 and 5 have EFTMS deviations which exceed their respective derived manufacturer accuracies.

Both tanks 3 and 5 showed a deviation of -1 gallon which is above the manufacturer's accuracy specification of ±.949 gallons. However, this only represents a difference of .051 gallons. A -1 gallon error for a 20 gallon sample only represents a 5% error. Relative to the entire storage tank volume of 10,00 gallons, a -1 gallon error signifies a .01% error. Also, it is important to note that the Tank Level Monitor is only capable of displaying or printing gallon values which are whole numbers. All fractions of gallons are either rounded up or down to the nearest whole number integer. Hence, the volume measurements of tanks 3 and 5 may have been below the ±.949 gallon specification, but upon displaying their measurements the Tank Level Monitor rounded them up. In addition, the specification of ±.949 gallons is only a derived approximation of the EFTMS volume measuring accuracy for a certain region of the storage tank. In essence, because the deviations in tanks 3 and 5 are not significant, a serious compliance problem with manufacturer specifications does not exist.

Study Limitations

The limitations of this study are as follows:

1. The entire range of each fuel tank volume could not be tested because of fuel usage limitations. Only readings of the most current volume for each tank could be assessed.

2. This study does not address the issue of absolute fuel volume measurement. It only evaluates the accuracy with which the EFTMS can detect volume change. No conclusion from this study can be made about the absolute volume accuracy of the EFTMS.

Recommendations

In response to study limitation number 1, it is recommend that a future project be instituted to assess a greater range of volume changes. Such a study could be performed at the next refilling of the storage tanks. As for study limitation number 2, no feasible ideas have been developed to address that issue.

Conclusions

Except for a few very minor irregularities, the Emco Fuel Tank Monitoring System does meet the manufacturer's specifications. In fact, the EFTMS exceeds many of the volume measuring accuracies which were calculated from data reported by the manufacturer.

Segment 3
Information Stored in the Tank Level Monitor

Information Attainable from the Tank Level Monitor

All pertinent information about the fuel tank farm can be obtained from the front panel of the Tank Level Monitor which is mounted inside the EPA. The print mode and the display mode enable an operator to access different sets of data on the storage tanks. The following is a listing of the information which can be obtained from the different modes.

Print Mode:

- Date and Time
- Shift Report
- Station Header
- Inventory Report
- Alarm Pending
- Alarm History
- Tank Parameters

Display Mode:

- Fuel Level and Temperature
- Fuel in Temperature Compensated Gallons
- Fuel and Water Level in Inches
- Ullage
- Date and Time
- Automatic Report Print Times
- Maximum Tank Volume
- Calibration Value
- Fuel Type

For information on how to actually access this information from the front panel of the Tank Level Monitor please refer to the manual, "Tank Level Monitor Operating Instructions".

Data Stored in the Tank Level Monitor

For purposes of documentation, most of the data which is currently programmed into the Tank Level Monitor was recorded. All collected data can be accessed via the front panel of the Tank Level Monitor. This information is listed in appendix L. Further information such as the conversion table can be obtained if a computer is interfaced with the Tank Level Monitor. However, due to the complexity of this operation and lack of equipment, an interface was not attempted. If more information is desired or an alteration to the existing factory programmed information is needed, the company which services the EFTMS should be contacted for assistance.

Study Limitations

More information is stored in the Tank Level Monitor than presented in this report. However, this information can only be obtained by interfacing the Tank Level Monitor with another computer.

Recommendations

To insure the integrity of the EFTMS, the factory preset access code should be changed. Via the Tank Level Monitor, the access code allows individuals to set various important tank parameters such as the pitch correction factor, calibration value, and the product code. If an individual accidentally or intentionally used the access code which is mentioned in the "Tank Level Monitor Operating Instructions", he could change very important tank parameters and consequently cause future invalid tank measurements.

Conclusions

All data accessible from the front panel of the Tank Level Monitor is included in appendix L.

OVERALL REPORT

Recommendations

1. To allow a greater range of tank volumes to be compared, EFTMS and dipstick measurements should be collected over a period of time longer than three months. Also measurements by the EFTMS and dipstick should be taken at the same time.

2. To determine the measurement accuracy of greater volume changes, tank volume measurements should be taken with the EFTMS at the next tank refilling.

3. To safeguard against accidents or potential foul play, the EFTMS factory preset access code should be changed.

4. The EFTMS performance is adequate for the EPA's needs and it should be approved as our primary underground fuel level sensing device.

Conclusions

Segment 1
EFTMS and Dipstick Data Comparison

The volume measurements collected electronically by the EFTMS were very similar to those collected manually by the dipstick method. On the average, however, the dipstick measurements of fuel level were slightly higher than the EFTMS's. The conversion tables for both methods were almost identical. In terms of volume(gallons), the largest percent difference between the two measurement methods relative to the entire tank volume was 3.6% and the lowest was .87%. These offsets are quite consistent for any given tank.

Segment 2
Comparison of EFTMS Accuracy to Manufacturer's Specifications

Overall, the volume measuring accuracy of the EPA's EFTMS is better than that guaranteed by the manufacturer. Relative to manufacturer specifications, the greatest accuracy was $\pm$.53 gallons of fuel and the lowest was $\pm$1.70 gallons. These accuracies are based on the EFTMS's sensitivity to different fuel levels. With respect to the system's actual accuracy, the EFTMS displayed a perfect accuracy for storage tanks 1, 2, 4, and 7 and an accuracy of $\pm$1 gallon in tanks 3, 5, 6, and 8. However, it should be noted that the Tank Level Monitor only has a resolution of 1 gallon.

Segment 3
Information Stored in the Tank Level Monitor

Via the front panel of the Tank Level Sensor, which is mounted inside the EPA, most of the information programmed into the EFTMS was obtained. A complete listing of this information is included in appendix L.

OWENS CORNING FIBERGLAS

Fiberglas* Tanks for Fuel Storage

Calibration Chart

Model C-3 10,000 Gallon Tanks

Model C-3 10,000 Gallon Tanks/Tank Size and Capacity in Gallons

Calibrations for Level Tanks — Actual Capacity 9520 Gallons

Dipstick	Gallons	Dipstick	Gallons	Dipstick	Gallons	Dipstick	Gallons	Dipstick	Gallons	Dipstick	Gallons	Dipstick	Gallons
1/8"	1	6 1/2"	245	12 7/8"	727	19 1/4"	1351	25 5/8"	2077	32"	2874	38 3/8"	3719
1/4"	1	6 5/8"	253	13"	738	19 3/8"	1364	25 3/4"	2092	32 1/8"	2890	38 1/2"	3736
3/8"	2	6 3/4"	260	13 1/8"	749	19 1/2"	1378	25 7/8"	2107	32 1/4"	2906	38 5/8"	3752
1/2"	3	6 7/8"	268	13 1/4"	760	19 5/8"	1391	26"	2122	32 3/8"	2923	38 3/4"	3769
5/8"	4	7"	276	13 3/8"	771	19 3/4"	1405	26 1/8"	2137	32 1/2"	2939	38 7/8"	3786
3/4"	5	7 1/8"	284	13 1/2"	783	19 7/8"	1418	26 1/4"	2152	32 5/8"	2955	39"	3803
7/8"	6	7 1/4"	292	13 5/8"	794	20"	1432	26 3/8"	2167	32 3/4"	2971	39 1/8"	3820
1"	8	7 3/8"	300	13 3/4"	805	20 1/8"	1446	26 1/2"	2182	32 7/8"	2988	39 1/4"	3837
1 1/8"	10	7 1/2"	308	13 7/8"	817	20 1/4"	1459	26 5/8"	2197	33"	3004	39 3/8"	3854
1 1/4"	12	7 5/8"	317	14"	828	20 3/8"	1473	26 3/4"	2213	33 1/8"	3020	39 1/2"	3870
1 3/8"	15	7 3/4"	325	14 1/8"	839	20 1/2"	1486	26 7/8"	2228	33 1/4"	3037	39 5/8"	3887
1 1/2"	18	7 7/8"	333	14 1/4"	851	20 5/8"	1500	27"	2243	33 3/8"	3053	39 3/4"	3904
1 5/8"	21	8"	342	14 3/8"	862	20 3/4"	1514	27 1/8"	2258	33 1/2"	3069	39 7/8"	3921
1 3/4"	25	8 1/8"	351	14 1/2"	874	20 7/8"	1527	27 1/4"	2274	33 5/8"	3086	40"	3938
1 7/8"	28	8 1/4"	359	14 5/8"	886	21"	1541	27 3/8"	2289	33 3/4"	3102	40 1/8"	3955
2"	32	8 3/8"	368	14 3/4"	897	21 1/8"	1555	27 1/2"	2304	33 7/8"	3119	40 1/4"	3972
2 1/8"	36	8 1/2"	377	14 7/8"	909	21 1/4"	1569	27 5/8"	2320	34"	3135	40 3/8"	3989
2 1/4"	40	8 5/8"	386	15"	921	21 3/8"	1583	27 3/4"	2335	34 1/8"	3151	40 1/2"	4006
2 3/8"	44	8 3/4"	395	15 1/8"	933	21 1/2"	1597	27 7/8"	2350	34 1/4"	3168	40 5/8"	4023
2 1/2"	48	8 7/8"	404	15 1/4"	945	21 5/8"	1611	28"	2366	34 3/8"	3184	40 3/4"	4040
2 5/8"	53	9"	413	15 3/8"	957	21 3/4"	1625	28 1/8"	2382	34 1/2"	3201	40 7/8"	4057
2 3/4"	57	9 1/8"	422	15 1/2"	969	21 7/8"	1639	28 1/4"	2397	34 5/8"	3217	41"	4074
2 7/8"	62	9 1/4"	431	15 5/8"	981	22"	1653	28 3/8"	2413	34 3/4"	3234	41 1/8"	4091
3"	67	9 3/8"	441	15 3/4"	994	22 1/8"	1667	28 1/2"	2428	34 7/8"	3251	41 1/4"	4108
3 1/8"	72	9 1/2"	450	15 7/8"	1006	22 1/4"	1681	28 5/8"	2444	35"	3267	41 3/8"	4125
3 1/4"	77	9 5/8"	459	16"	1018	22 3/8"	1695	28 3/4"	2460	35 1/8"	3283	41 1/2"	4142
3 3/8"	82	9 3/4"	469	16 1/8"	1030	22 1/2"	1710	28 7/8"	2475	35 1/4"	3300	41 5/8"	4160
3 1/2"	88	9 7/8"	478	16 1/4"	1042	22 5/8"	1724	29"	2491	35 3/8"	3316	41 3/4"	4177
3 5/8"	93	10"	488	16 3/8"	1055	22 3/4"	1738	29 1/8"	2507	35 1/2"	3333	41 7/8"	4194
3 3/4"	99	10 1/8"	498	16 1/2"	1067	22 7/8"	1753	29 1/4"	2522	35 5/8"	3349	42"	4211
3 7/8"	104	10 1/4"	508	16 5/8"	1079	23"	1767	29 3/8"	2538	35 3/4"	3366	42 1/8"	4228
4"	110	10 3/8"	518	16 3/4"	1092	23 1/8"	1781	29 1/2"	2554	35 7/8"	3382	42 1/4"	4245
4 1/8"	116	10 1/2"	527	16 7/8"	1104	23 1/4"	1796	29 5/8"	2570	36"	3399	42 3/8"	4262
4 1/4"	122	10 5/8"	538	17"	1117	23 3/8"	1811	29 3/4"	2585	36 1/8"	3416	42 1/2"	4280
4 3/8"	128	10 3/4"	548	17 1/8"	1130	23 1/2"	1826	29 7/8"	2601	36 1/4"	3432	42 5/8"	4297
4 1/2"	134	10 7/8"	558	17 1/4"	1142	23 5/8"	1840	30"	2617	36 3/8"	3449	42 3/4"	4314
4 5/8"	140	11"	568	17 3/8"	1155	23 3/4"	1855	30 1/8"	2633	36 1/2"	3466	42 7/8"	4331
4 3/4"	146	11 1/8"	578	17 1/2"	1168	23 7/8"	1869	30 1/4"	2649	36 5/8"	3483	43"	4348
4 7/8"	152	11 1/4"	588	17 5/8"	1181	24"	1884	30 3/8"	2665	36 3/4"	3499	43 1/8"	4365
5"	159	11 3/8"	599	17 3/4"	1194	24 1/8"	1899	30 1/2"	2681	36 7/8"	3516	43 1/4"	4382
5 1/8"	166	11 1/2"	609	17 7/8"	1207	24 1/4"	1913	30 5/8"	2697	37"	3533	43 3/8"	4399
5 1/4"	172	11 5/8"	619	18"	1220	24 3/8"	1928	30 3/4"	2713	37 1/8"	3550	43 1/2"	4417
5 3/8"	179	11 3/4"	630	18 1/8"	1233	24 1/2"	1943	30 7/8"	2729	37 1/4"	3567	43 5/8"	4434
5 1/2"	186	11 7/8"	640	18 1/4"	1246	24 5/8"	1958	31"	2746	37 3/8"	3584	43 3/4"	4451
5 5/8"	193	12"	651	18 3/8"	1259	24 3/4"	1972	31 1/8"	2761	37 1/2"	3600	43 7/8"	4468
5 3/4"	200	12 1/8"	662	18 1/2"	1272	24 7/8"	1987	31 1/4"	2777	37 5/8"	3617	44"	4485
5 7/8"	208	12 1/4"	672	18 5/8"	1285	25"	2002	31 3/8"	2793	37 3/4"	3634	44 1/8"	4502
6"	215	12 3/8"	683	18 3/4"	1298	25 1/8"	2017	31 1/2"	2809	37 7/8"	3651	44 1/4"	4519
6 1/8"	222	12 1/2"	694	18 7/8"	1311	25 1/4"	2032	31 5/8"	2826	38"	3668	44 3/8"	4536
6 1/4"	230	12 5/8"	705	19"	1324	25 3/8"	2047	31 3/4"	2842	38 1/8"	3685	44 1/2"	4553
6 3/8"	237	12 3/4"	716	19 1/8"	1337	25 1/2"	2062	31 7/8"	2858	38 1/4"	3702	44 5/8"	4571

Model C-3 10,000 Gallon Tanks/Tank Size and Capacity in Gallons

Calibrations for Level Tanks — Actual Capacity 9520 Gallons

Dipstick	Gallons	Dipstick	Gallons	Dipstick	Gallons	Dipstick	Gallons	Dipstick	Gallons	Dipstick	Gallons	Dipstick	Gallons
44 3/4"	4588	51 5/8"	5530	58 1/2"	6451	65 3/8"	7322	72 1/4"	8115	79 1/8"	8793	86"	9305
44 7/8"	4605	51 3/4"	5547	58 5/8"	6467	65 1/2"	7337	72 3/8"	8128	79 1/4"	8804	86 1/8"	9312
45"	4622	51 7/8"	5564	58 3/4"	6483	65 5/8"	7352	72 1/2"	8142	79 3/8"	8815	86 1/4"	9319
45 1/8"	4639	52"	5581	58 7/8"	6500	65 3/4"	7368	72 5/8"	8155	79 1/2"	8826	86 3/8"	9326
45 1/4"	4656	52 1/8"	5598	59"	6516	65 7/8"	7383	72 3/4"	8168	79 5/8"	8837	86 1/2"	9333
45 3/8"	4674	52 1/4"	5615	59 1/8"	6532	66"	7398	72 7/8"	8182	79 3/4"	8848	86 5/8"	9340
45 1/2"	4691	52 3/8"	5632	59 1/4"	6549	66 1/8"	7413	73"	8195	79 7/8"	8858	86 3/4"	9347
45 5/8"	4708	52 1/2"	5649	59 3/8"	6565	66 1/4"	7428	73 1/8"	8208	80"	8869	86 7/8"	9353
45 3/4"	4725	52 5/8"	5666	59 1/2"	6581	66 3/8"	7443	73 1/4"	8221	80 1/8"	8880	87"	9360
45 7/8"	4743	52 3/4"	5683	59 5/8"	6597	66 1/2"	7458	73 3/8"	8235	80 1/4"	8890	87 1/8"	9367
46"	4760	52 7/8"	5700	59 3/4"	6614	66 5/8"	7473	73 1/2"	8248	80 3/8"	8901	87 1/4"	9373
46 1/8"	4777	53"	5717	59 7/8"	6630	66 3/4"	7488	73 5/8"	8261	80 1/2"	8911	87 3/8"	9379
46 1/4"	4795	53 1/8"	5734	60"	6646	66 7/8"	7503	73 3/4"	8274	80 5/8"	8921	87 1/2"	9386
46 3/8"	4812	53 1/4"	5751	60 1/8"	6662	67"	7518	73 7/8"	8287	80 3/4"	8932	87 5/8"	9392
46 1/2"	4829	53 3/8"	5768	60 1/4"	6678	67 1/8"	7533	74"	8300	80 7/8"	8942	87 3/4"	9398
46 5/8"	4846	53 1/2"	5785	60 3/8"	6695	67 1/4"	7548	74 1/8"	8313	81"	8952	87 7/8"	9404
46 3/4"	4864	53 5/8"	5801	60 1/2"	6711	67 3/8"	7562	74 1/4"	8326	81 1/8"	8962	88"	9410
46 7/8"	4881	53 3/4"	5818	60 5/8"	6727	67 1/2"	7577	74 3/8"	8339	81 1/4"	8972	88 1/8"	9416
47"	4898	53 7/8"	5835	60 3/4"	6743	67 5/8"	7592	74 1/2"	8351	81 3/8"	8982	88 1/4"	9422
47 1/8"	4915	54"	5852	60 7/8"	6759	67 3/4"	7607	74 5/8"	8364	81 1/2"	8992	88 3/8"	9427
47 1/4"	4932	54 1/8"	5869	61"	6775	67 7/8"	7621	74 3/4"	8377	81 5/8"	9002	88 1/2"	9433
47 3/8"	4949	54 1/4"	5886	61 1/8"	6791	68"	7636	74 7/8"	8389	81 3/4"	9012	88 5/8"	9438
47 1/2"	4967	54 3/8"	5903	61 1/4"	6807	68 1/8"	7651	75"	8402	81 7/8"	9021	88 3/4"	9443
47 5/8"	4984	54 1/2"	5920	61 3/8"	6823	68 1/4"	7665	75 1/8"	8415	82"	9031	88 7/8"	9448
47 3/4"	5001	54 5/8"	5937	61 1/2"	6839	68 3/8"	7680	75 1/4"	8427	82 1/8"	9041	89"	9453
47 7/8"	5018	54 3/4"	5953	61 5/8"	6855	68 1/2"	7694	75 3/8"	8440	82 1/4"	9050	89 1/8"	9458
48"	5035	54 7/8"	5970	61 3/4"	6870	68 5/8"	7709	75 1/2"	8452	82 3/8"	9060	89 1/4"	9462
48 1/8"	5052	55"	5987	61 7/8"	6886	68 3/4"	7723	75 5/8"	8465	82 1/2"	9069	89 3/8"	9467
48 1/4"	5069	55 1/8"	6004	62"	6902	68 7/8"	7738	75 3/4"	8477	82 5/8"	9078	89 1/2"	9471
48 3/8"	5086	55 1/4"	6020	62 1/8"	6918	69"	7752	75 7/8"	8490	82 3/4"	9088	89 5/8"	9475
48 1/2"	5103	55 3/8"	6037	62 1/4"	6934	69 1/8"	7766	76"	8502	82 7/8"	9097	89 3/4"	9479
48 5/8"	5121	55 1/2"	6054	62 3/8"	6949	69 1/4"	7781	76 1/8"	8514	83"	9106	89 7/8"	9483
48 3/4"	5138	55 5/8"	6070	62 1/2"	6965	69 3/8"	7795	76 1/4"	8526	83 1/8"	9115	90"	9487
48 7/8"	5155	55 3/4"	6087	62 5/8"	6981	69 1/2"	7809	76 3/8"	8538	83 1/4"	9124	90 1/8"	9491
49"	5172	55 7/8"	6103	62 3/4"	6997	69 5/8"	7823	76 1/2"	8550	83 3/8"	9133	90 1/4"	9494
49 1/8"	5189	56"	6120	62 7/8"	7012	69 3/4"	7838	76 5/8"	8562	83 1/2"	9142	90 3/8"	949[illegible]
49 1/4"	5206	56 1/8"	6137	63"	7028	69 7/8"	7852	76 3/4"	8574	83 5/8"	9151	90 1/2"	9501
49 3/8"	5223	56 1/4"	6153	63 1/8"	7044	70"	7866	76 7/8"	8586	83 3/4"	9160	90 5/8"	9504
49 1/2"	5241	56 3/8"	6170	63 1/4"	7059	70 1/8"	7880	77"	8598	83 7/8"	9168	90 3/4"	9507
49 5/8"	5258	56 1/2"	6187	63 3/8"	7075	70 1/4"	7894	77 1/8"	8610	84"	9177	90 7/8"	9510
49 3/4"	5275	56 5/8"	6203	63 1/2"	7091	70 3/8"	7908	77 1/4"	8622	84 1/8"	9186	91"	9512
49 7/8"	5292	56 3/4"	6220	63 5/8"	7106	70 1/2"	7922	77 3/8"	8634	84 1/4"	9194	91 1/8"	9514
50"	5309	56 7/8"	6236	63 3/4"	7122	70 5/8"	7936	77 1/2"	8645	84 3/8"	9203	91 1/4"	9515
50 1/8"	5326	57"	6253	63 7/8"	7137	70 3/4"	7950	77 5/8"	8657	84 1/2"	9211	91 3/8"	9517
50 1/4"	5343	57 1/8"	6270	64"	7153	70 7/8"	7964	77 3/4"	8669	84 5/8"	9219	91 1/2"	9518
50 3/8"	5360	57 1/4"	6286	64 1/8"	7168	71"	7978	77 7/8"	8680	84 3/4"	9228	91 5/8"	9518
50 1/2"	5377	57 3/8"	6303	64 1/4"	7184	71 1/8"	7992	78"	8692	84 7/8"	9236	91 3/4"	9519
50 5/8"	5394	57 1/2"	6319	64 3/8"	7199	71 1/4"	8006	78 1/8"	8703	85"	9244	91 7/8"	9519
50 3/4"	5411	57 5/8"	6336	64 1/2"	7215	71 3/8"	8020	78 1/4"	8715	85 1/8"	9252	92"	9520
50 7/8"	5428	57 3/4"	6352	64 5/8"	7230	71 1/2"	8033	78 3/8"	8726	85 1/4"	9260		
51"	5445	57 7/8"	6369	64 3/4"	7245	71 5/8"	8047	78 1/2"	8737	85 3/8"	9268		
51 1/8"	5462	58"	6385	64 7/8"	7261	71 3/4"	8061	78 5/8"	8749	85 1/2"	9275		
51 1/4"	5479	58 1/8"	6401	65"	7276	71 7/8"	8074	78 3/4"	8760	85 5/8"	9283		
51 3/8"	5496	58 1/4"	6418	65 1/8"	7291	72"	8088	78 7/8"	8771	85 3/4"	9290		
51 1/2"	5513	58 3/8"	6434	65 1/4"	7307	72 1/8"	8102	79"	8782	85 7/8"	9298		

EFTMS Conversion Table

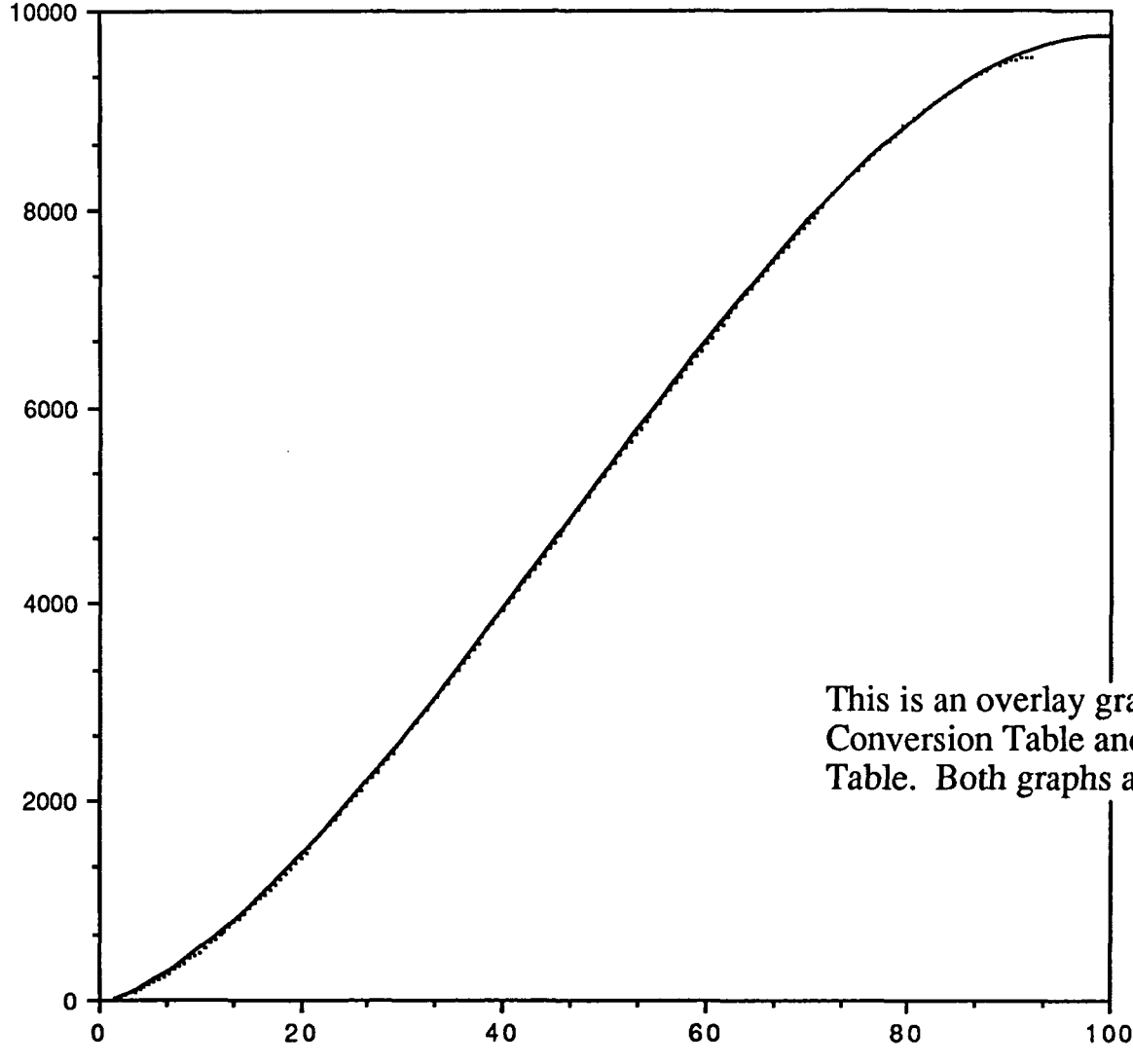
STICK (IN)	VOLUME (GALLONS)	STICK (IN)	VOLUME (GALLONS)	STICK (IN)	VOLUME (GALLONS)	STICK (IN)	VOLUME (GALLONS)
0.50	2.20	27.00	2243.02	53.50	5784.54	80.00	8868.6
1.00	8.16	27.50	2304.45	54.00	5851.98	80.50	8910.7
1.50	18.32	28.00	2366.28	54.50	5919.27	81.00	8951.8
2.00	31.88	28.50	2428.50	55.00	5986.38	81.50	8991.9
2.50	48.22	29.00	2491.09	55.50	6053.31	82.00	9031.0
3.00	66.86	29.50	2554.05	56.00	6120.04	82.50	9069.2
3.50	87.49	30.00	2617.35	56.50	6186.58	83.00	9106.2
4.00	109.88	30.50	2680.99	57.00	6252.90	83.50	9142.3
4.50	133.89	31.00	2744.95	57.50	6319.00	84.00	9177.1
5.00	159.43	31.50	2809.22	58.00	6384.87	84.50	9210.9
5.50	186.43	32.00	2873.78	58.50	6450.48	85.00	9243.4
6.00	214.86	32.50	2938.63	59.00	6515.85	85.50	9274.7
6.50	244.67	33.00	3003.75	59.50	6580.94	86.00	9304.7
7.00	275.82	33.50	3069.13	60.00	6645.76	86.50	9333.4
7.50	308.27	34.00	3134.75	60.50	6710.28	87.00	9360.5
8.00	341.97	34.50	3200.62	61.00	6774.51	87.50	9386.2
8.50	376.88	35.00	3266.71	61.50	6838.42	88.00	9410.2
9.00	412.95	35.50	3333.01	62.00	6902.01	88.50	9432.5
9.50	450.12	36.00	3399.53	62.50	6965.26	89.00	9453.0
10.00	488.35	36.50	3466.24	63.00	7028.17	89.50	9471.4
10.50	527.59	37.00	3533.15	63.50	7090.72	90.00	9487.7
11.00	567.82	37.50	3600.24	64.00	7152.90	90.50	9501.5
11.50	608.98	38.00	3667.50	64.50	7214.70	91.00	9512.0
12.00	651.05	38.50	3734.93	65.00	7276.11	91.50	9518.6
12.50	694.01	39.00	3802.52	65.50	7337.12	92.00	9519.6
13.00	737.83	39.50	3870.26	66.00	7397.71		
13.50	782.48	40.00	3938.13	66.50	7457.87		
14.00	827.96	40.50	4006.14	67.00	7517.59		
14.50	874.25	41.00	4074.27	67.50	7576.86		
15.00	921.32	41.50	4142.51	68.00	7635.66		
15.50	969.17	42.00	4210.85	68.50	7693.98		
16.00	1017.77	42.50	4279.29	69.00	7751.80		
16.50	1067.11	43.00	4347.80	69.50	7809.12		
17.00	1117.17	43.50	4416.38	70.00	7865.92		
17.50	1167.94	44.00	4485.01	70.50	7922.19		
18.00	1219.39	44.50	4553.69	71.00	7977.90		
18.50	1271.50	45.00	4622.39	71.50	8033.05		
19.00	1324.25	45.50	4691.12	72.00	8087.62		
19.50	1377.64	46.00	4759.86	72.50	8141.61		
20.00	1431.63	46.50	4828.59	73.00	8194.98		
20.50	1486.21	47.00	4897.31	73.50	8247.73		
21.00	1541.37	47.50	4966.00	74.00	8299.85		
21.50	1597.08	48.00	5034.66	74.50	8351.31		
22.00	1653.34	48.50	5103.26	75.00	8402.10		
22.50	1710.13	49.00	5171.81	75.50	8452.20		
23.00	1767.43	49.50	5240.29	76.00	8501.59		
23.50	1825.23	50.00	5308.69	76.50	8550.25		
24.00	1883.53	50.50	5377.01	77.00	8598.17		
24.50	1942.31	51.00	5445.23	77.50	8645.31		
25.00	2001.56	51.50	5513.34	78.00	8691.66		
25.50	2061.26	52.00	5581.33	78.50	8737.20		
26.00	2121.42	52.50	5649.21	79.00	8781.91		
26.50	2182.01	53.00	5716.94	79.50	8825.73		

Fiberglas* (Dipstick) Conversion Table

y = - 72.282 + 37.483x + 2.2042x^2 - 1.5983e-2x^3 R^2 = 1.000

Emco Conversion Table

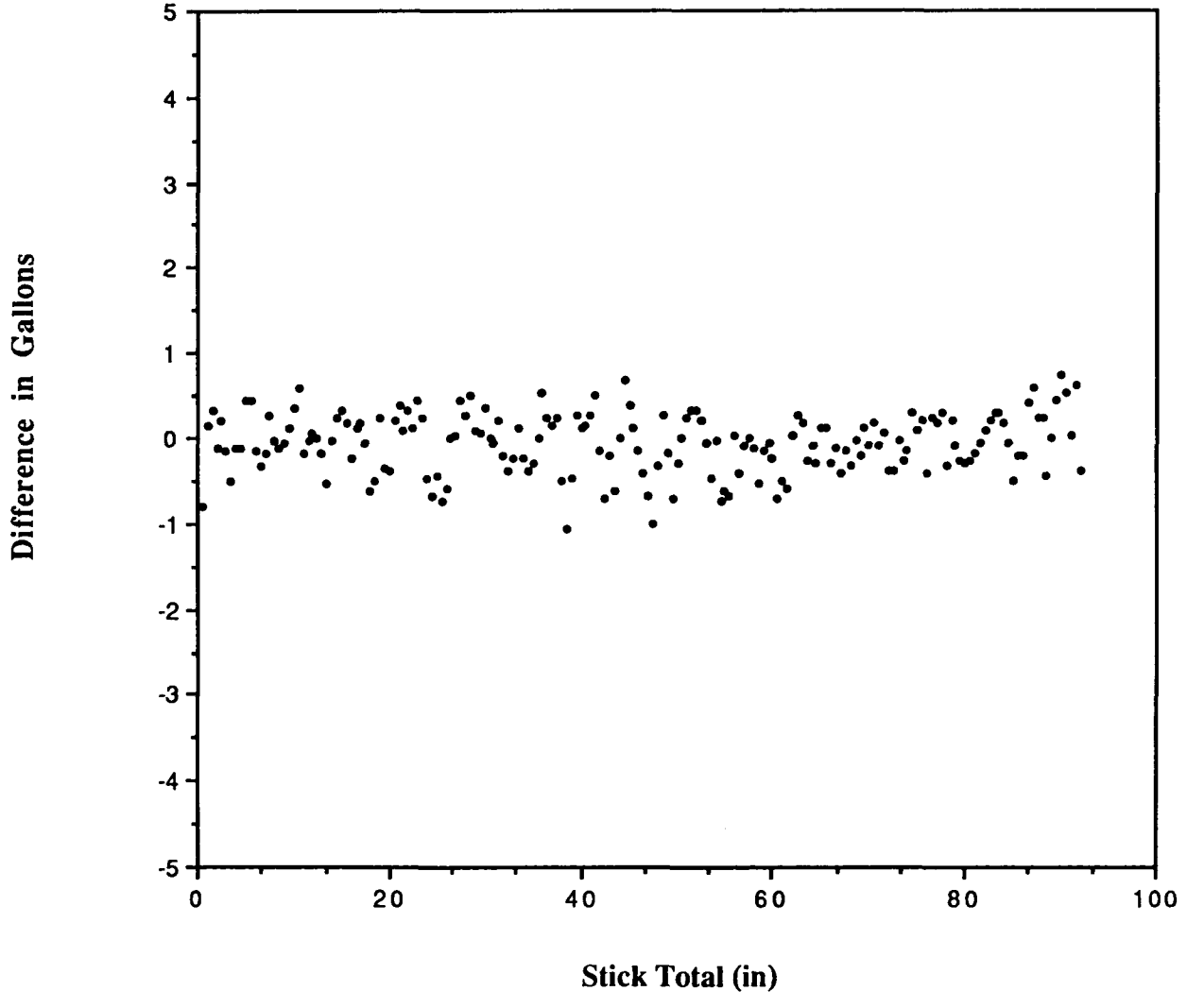
y = -72.356 + 37.494x + 2.2038x^2 - 1.5979e-2x^3 R^2 = 1.000



This is an overlay graph of the Fiberglas* Conversion Table and the Emco Conversion Table. Both graphs are almost identical.

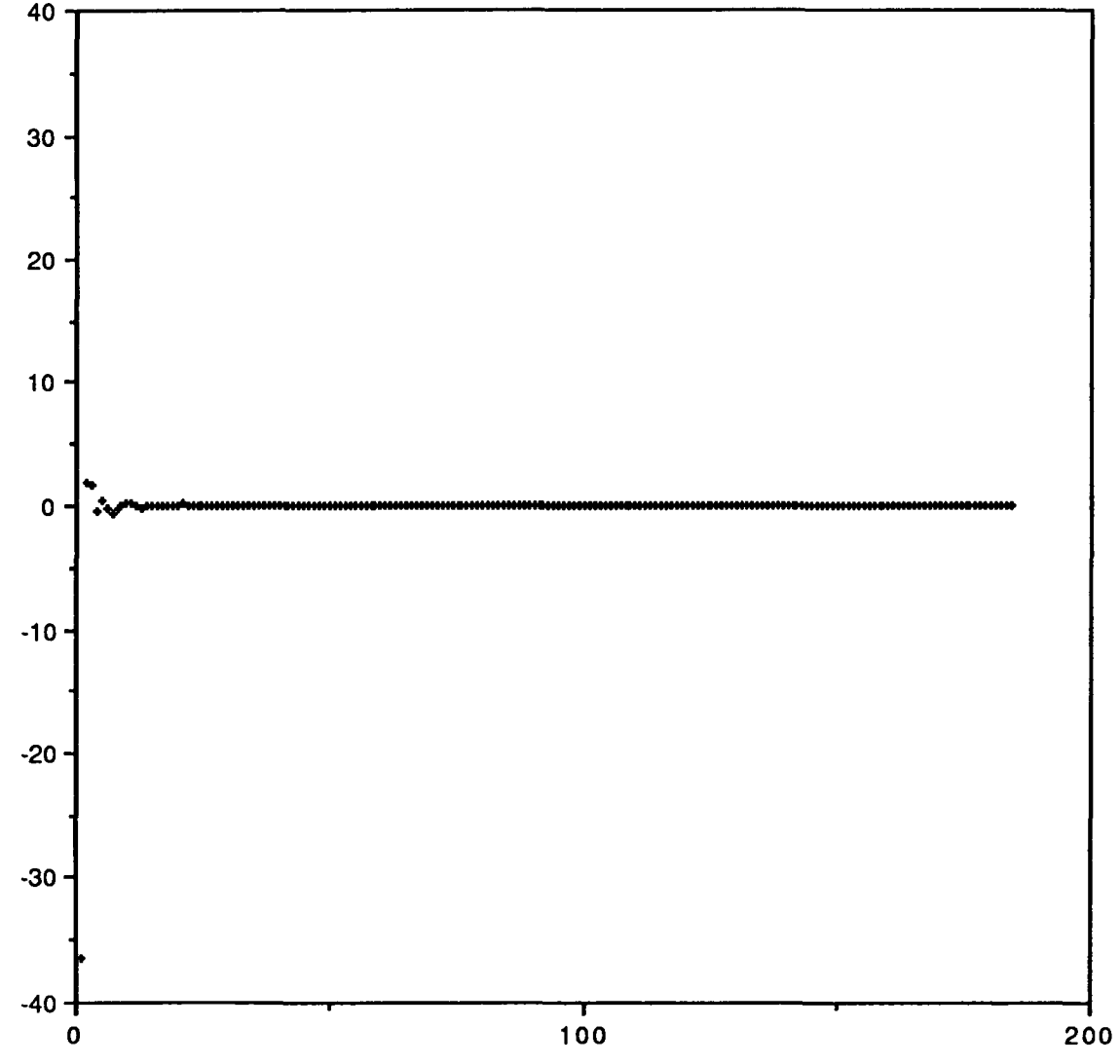
Difference in Gallons Between the Emco Conversion Table and the Fiberglas* Conversion Table

(Emco Gallons - Fiberglas* Gallons)



Percent Difference Between Emco Conversion Table Gallons and Fiberglas* Conversion Table Gallons

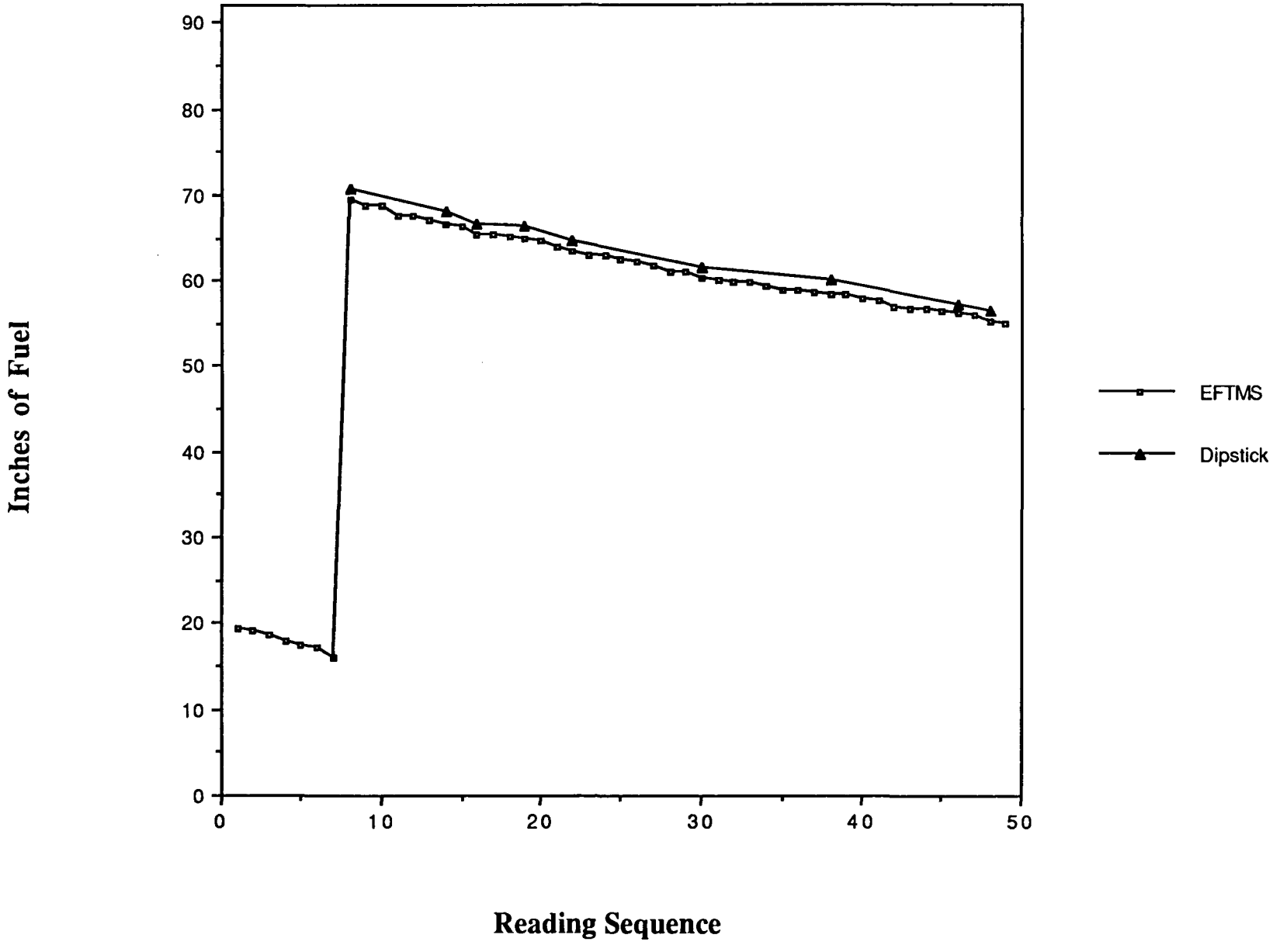
((Emco Gallons - Fiberglas* Gallons)/ Emco Gallons) x 100



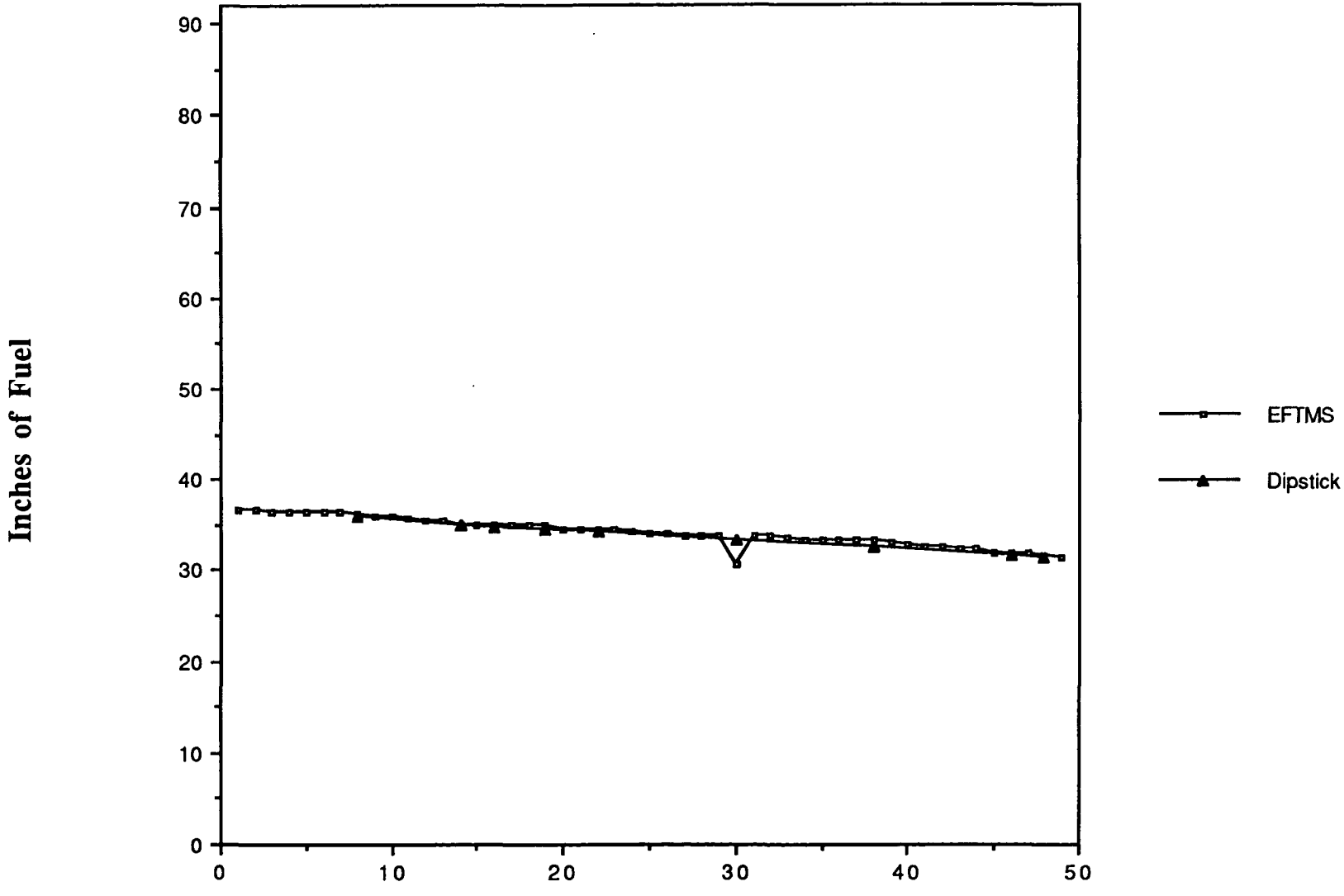
Appendix F

Comparison of Emco and Dipstick Readings

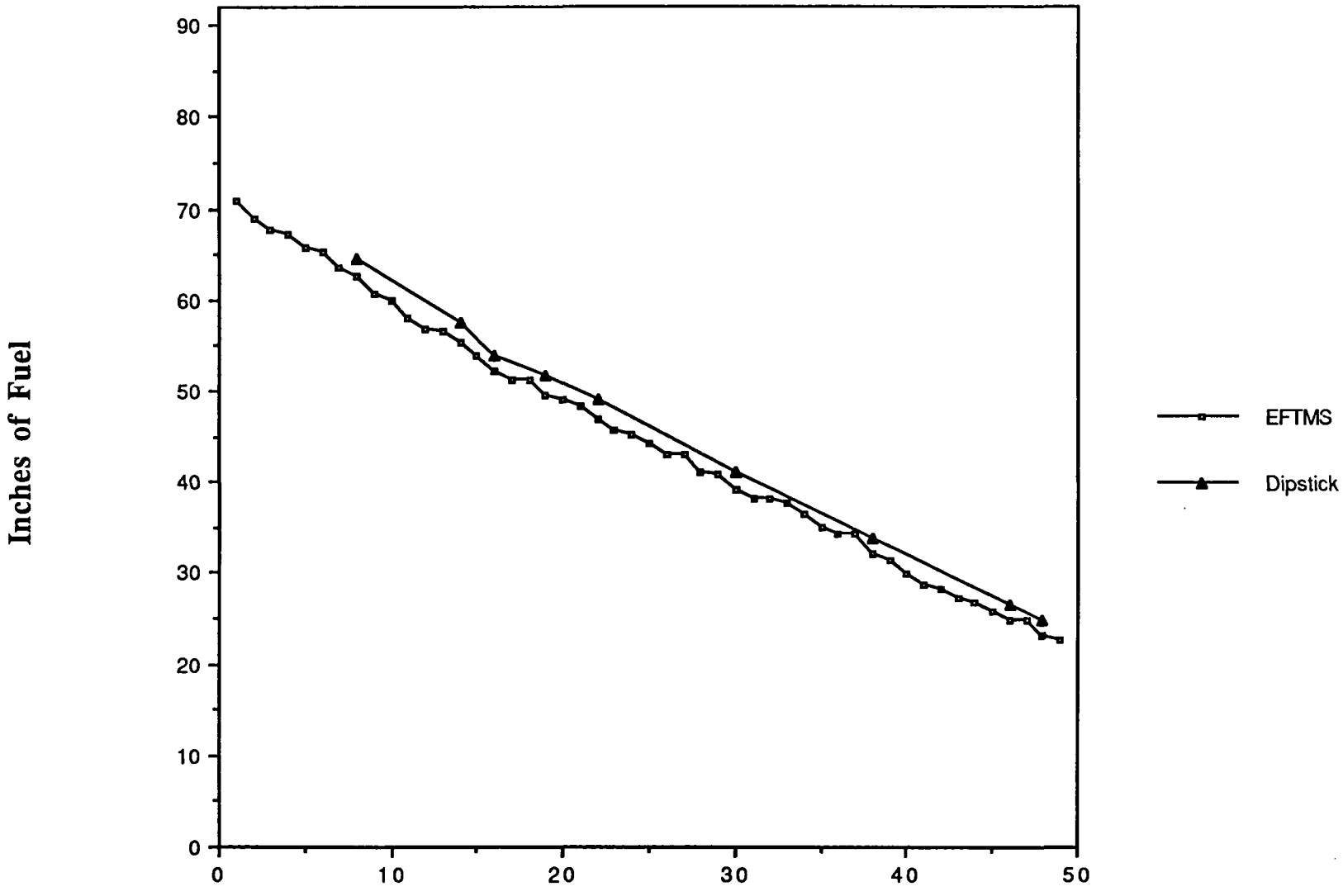
Tank 1 Comparison of EFTMS and Dipstick Readings



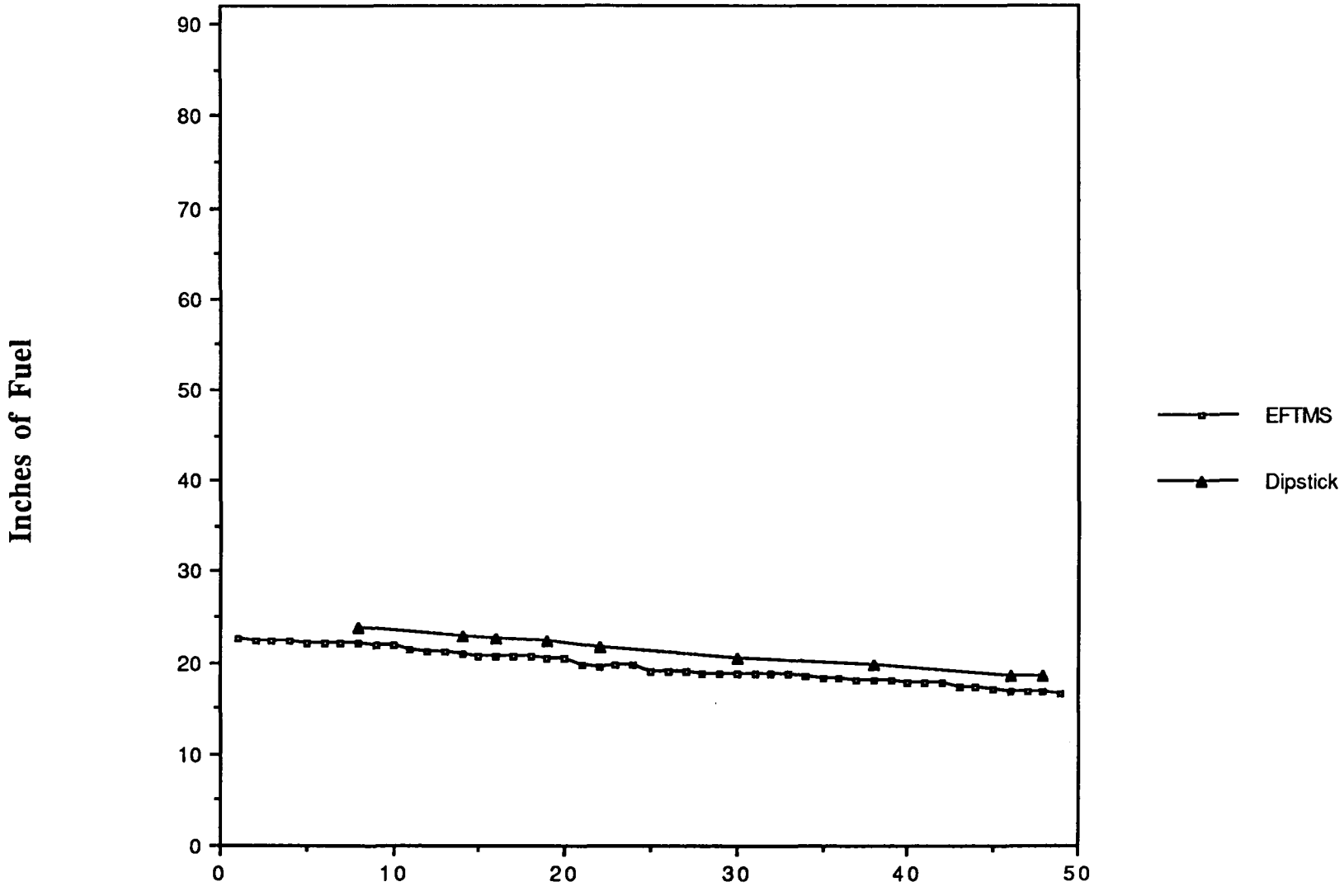
Tank 2 Comparison of EFTMS and Dipstick Readings



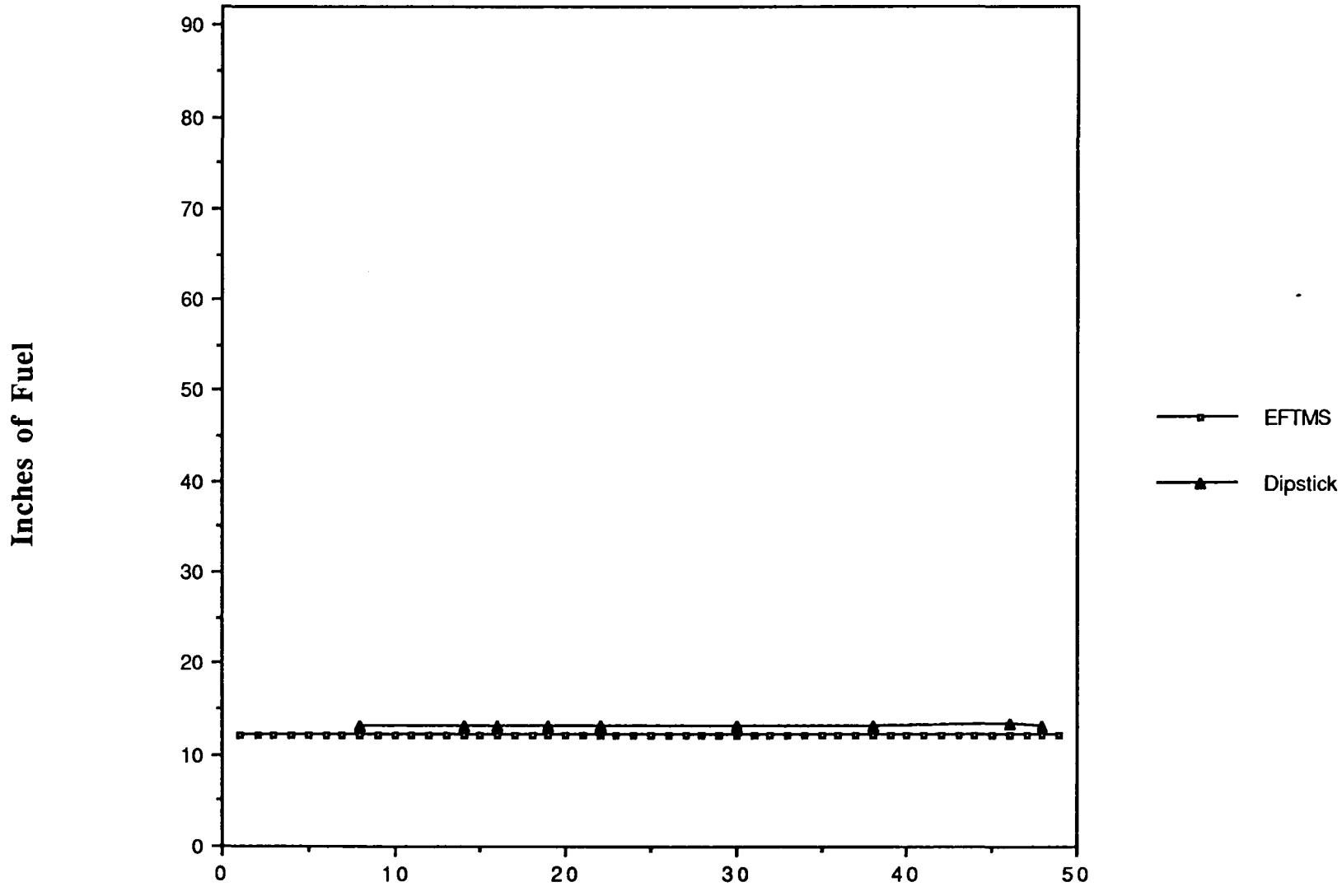
Tank 3 Comparison of EFTMS and Dipstick Readings



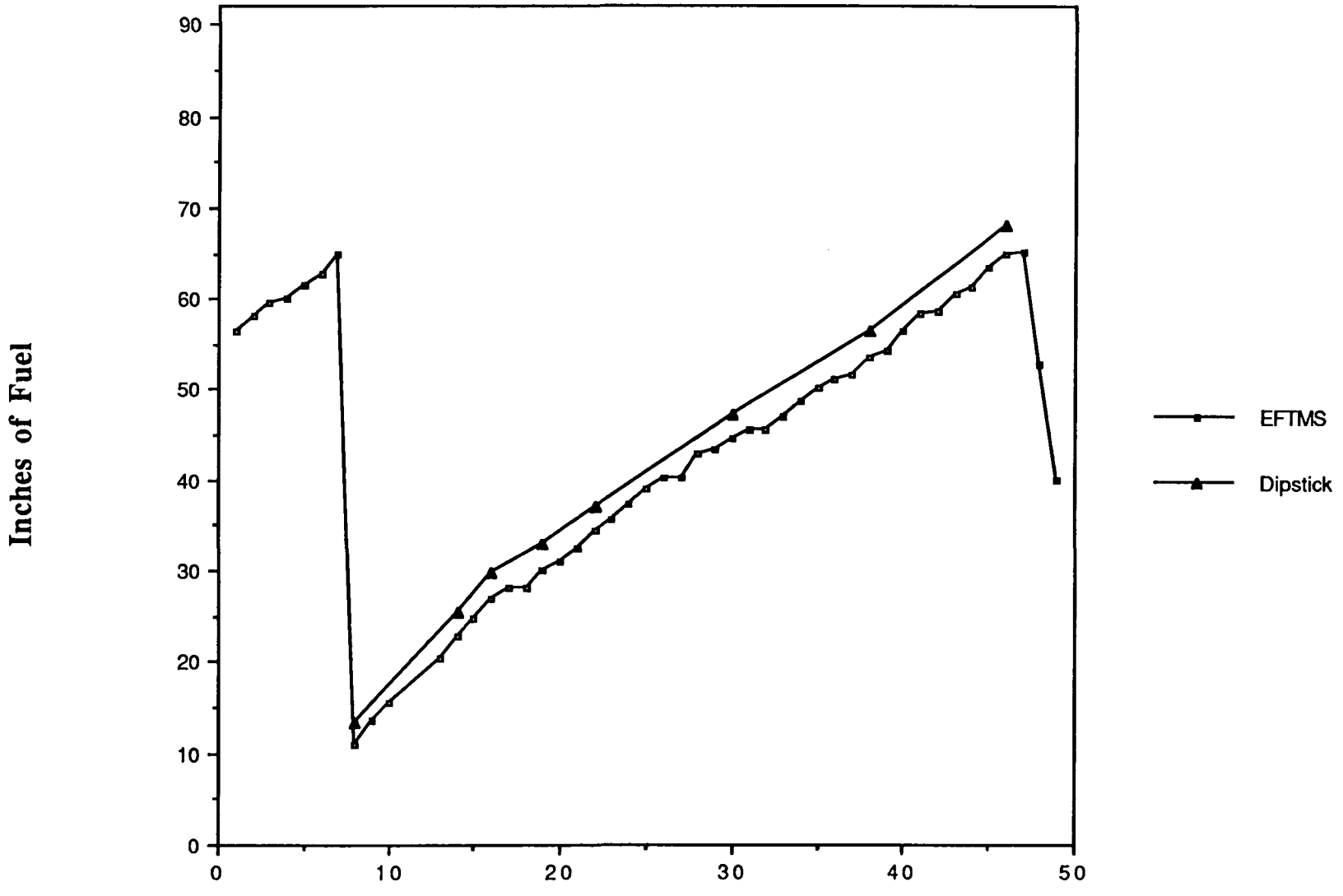
Tank 4 Comparison of EFTMS and Dipstick Readings



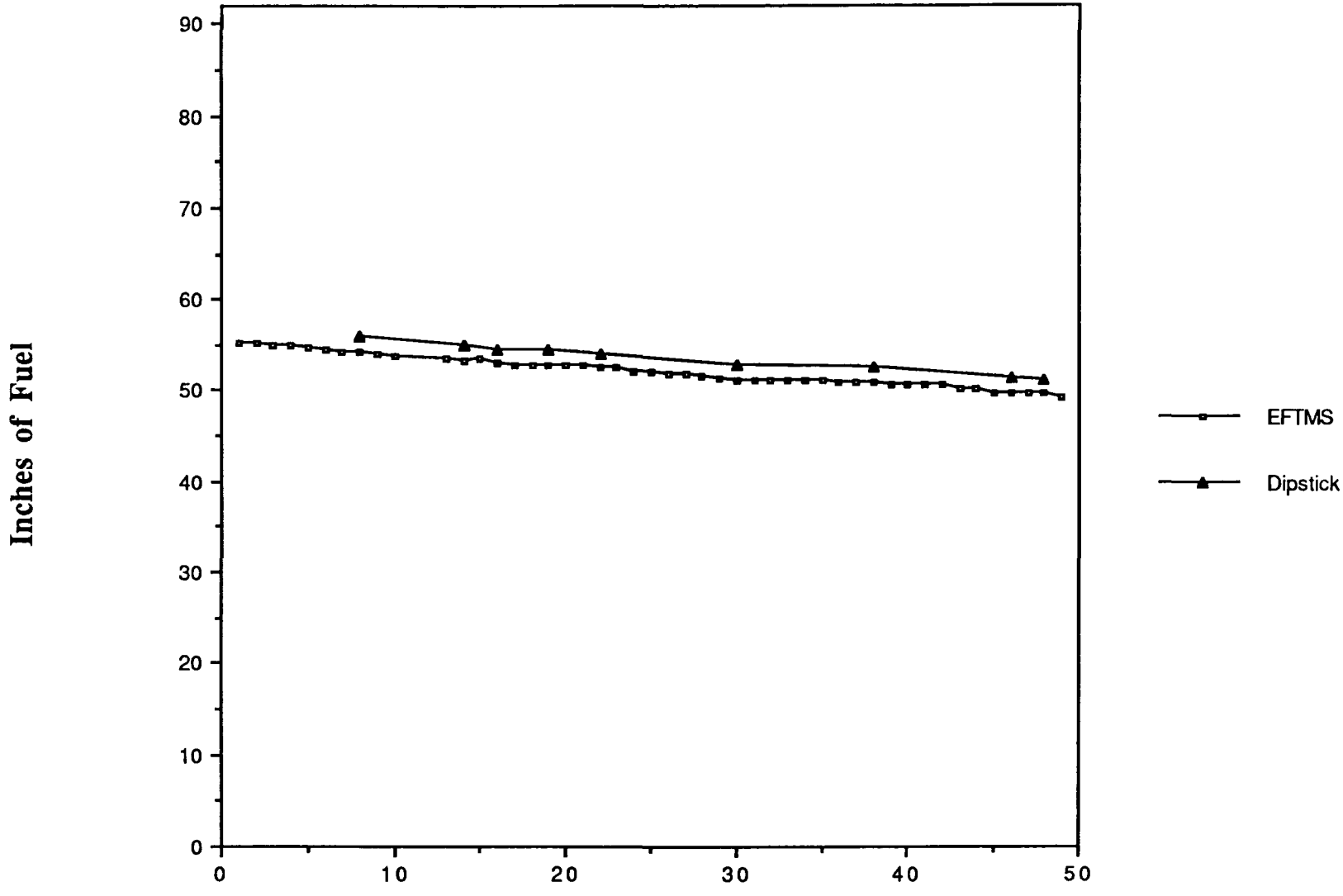
Tank 5 Comparison of EFTMS and Dipstick Readings



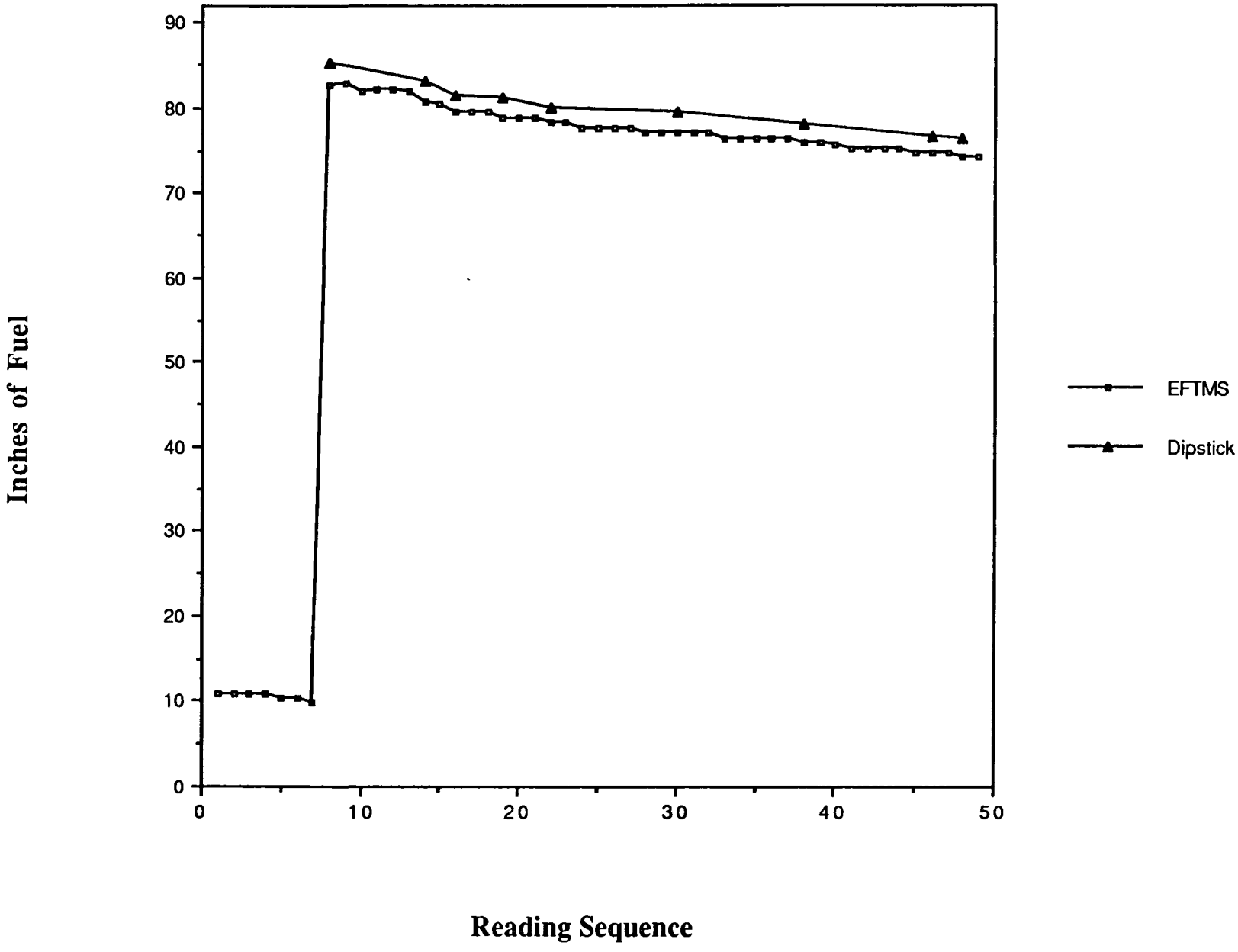
Tank 6 Comparison of EFTMS and Dipstick Readings



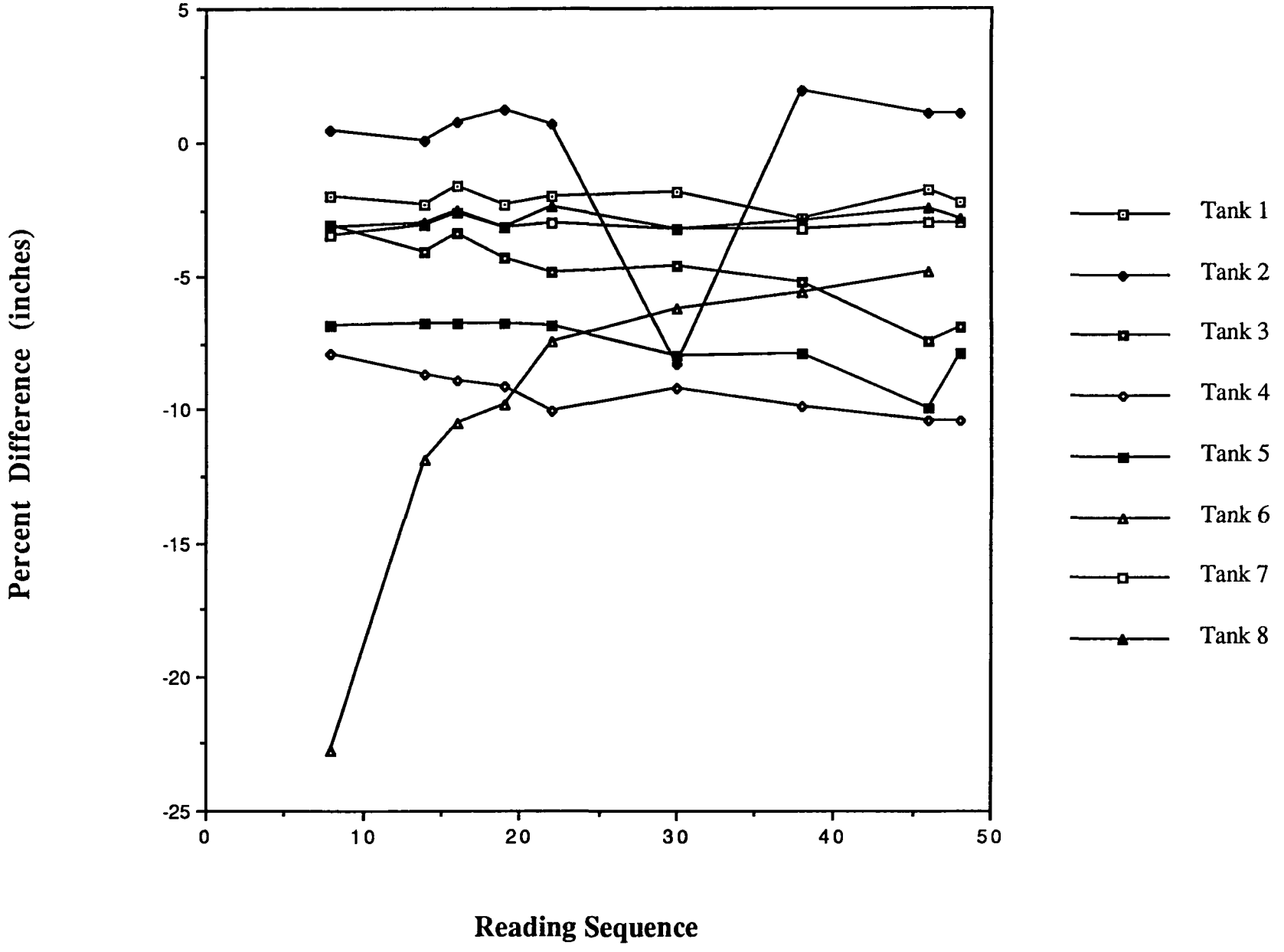
Tank 7 Comparison of EFTMS and Dipstick Readings



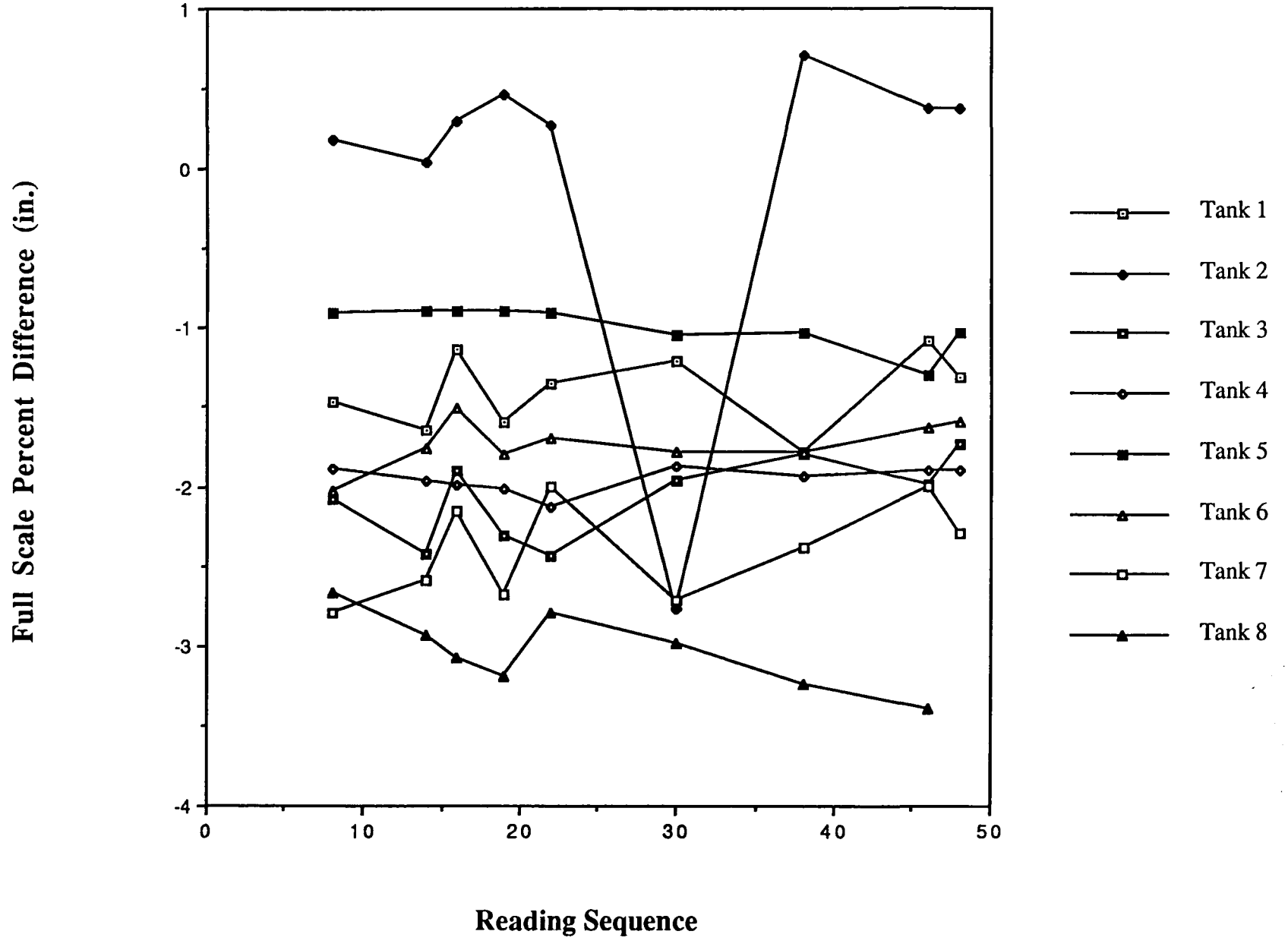
Tank 8 Comparison of EFTMS and Dipstick Readings



Tanks 1-8 Readings, Emco and Dipstick Percent Differences (inches)



Tanks 1-8 Readings, Emco and Dipstick
Full Scale Percent Difference (inches)



Appendix I

This appendix lists the volume measurement differences between the EFTMS and the dipstick method. Please note that the volume of one tank is 10,000 gallons and the following equation was used to calculate the full scale percent difference:

((Emco gallons - Dipstick gallons)/10,000) x 100

Tank 1

Largest Measurement Difference:	**1.51 in.**
Corresponding Measurement Difference in Gallons:	**177.79 gal.**
Full Scale Percent Difference in Gallons:	**1.80%**

Tank 2

Largest Measurement Difference:	**2.55 in.**
Corresponding Measurement Difference in Gallons:	**322.76 gal.**
Full Scale Percent Difference in Gallons:	**3.23%**

Tank 3

Largest Measurement Difference:	**2.23 in.**
Corresponding Measurement Difference in Gallons:	**270 gal.**
Full Scale Percent Difference in Gallons:	**2.70%**

Tank 4

Largest Measurement Difference:	**1.96 in.**
Corresponding Measurement Difference in Gallons:	**219.44 gal.**
Full Scale Percent Difference in Gallons:	**2.19%**

Tank 5

Largest Measurement Difference:	**1.20 in.**
Corresponding Measurement Difference in Gallons:	**86.78 gal.**
Full Scale Percent Difference in Gallons:	**0.87%**

Tank 6

Largest Measurement Difference:	**3.13 in.**
Corresponding Measurement Difference in Gallons:	**359.55 gal.**
Full Scale Percent Difference in Gallons:	**3.60%**

Tank 7

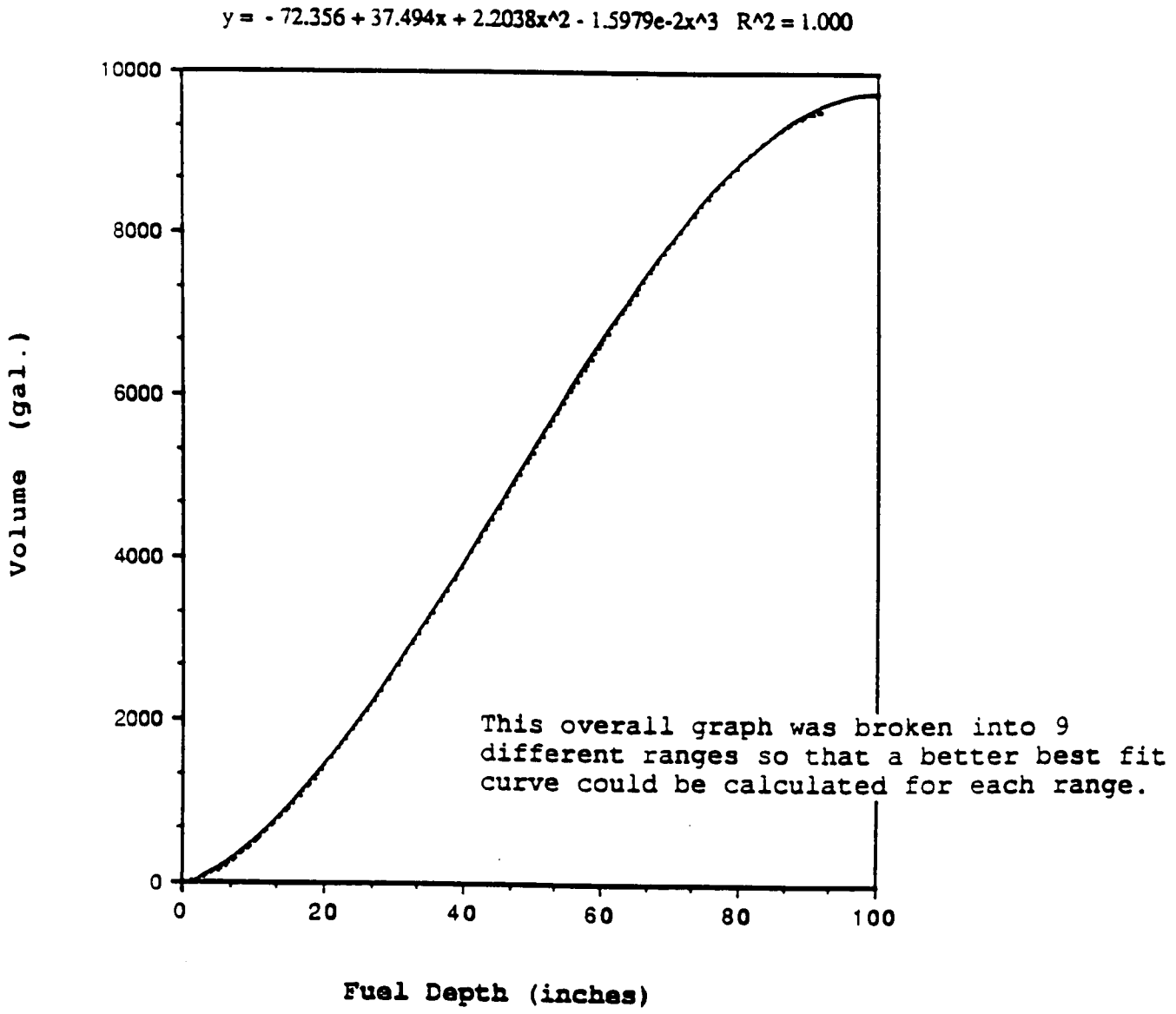
Largest Measurement Difference:	**1.87 in.**
Corresponding Measurement Difference in Gallons:	**268.06 gal.**
Full Scale Percent Difference in Gallons:	**2.68%**

Tank 8

Largest Measurement Difference:	**2.58 in.**
Corresponding Measurement Difference in Gallons:	**174.28 gal.**
Full Scale Percent Difference in Gallons:	**1.74%**

Appendix J

Graph of EFTMS Conversion Table



Calculated Manufacturer's Volume Measuring Accuracies

y= Fuel Volume (gallons)
x=Fuel Level (inches)

Range #1: (0-10.5 inches of fuel)

Governing Equation: $y = -6.0139 + 9.4618x + 5.3897x^2 - .14028x^3$

Accuracy: ±.531 gallons

Range #2: (10.5-20.5 inches of fuel)

Governing Equation: $y = -74.428 + 32.453x + 2.6205x^2 - .0239x^3$

Accuracy: ±.949 gallons

Range #3: (20.5-30.5 inches of fuel)

Governing Equation: $y = -157.67 + 44.107x + 2.0773x^2 - .01547x^3$

Accuracy: ±1.19 gallons

Range #4: (30.5-40.5 inches of fuel)

Governing Equation: $y = -283.72 + 54.935x + 1.7729x^2 - .01269x^3$

Accuracy: ±1.32 gallons

Range #5: (40.5-50.5 inches of fuel)

Governing Equation: $y = -86.454 + 40.872x + 2.1053x^2 - .0153x^3$

Accuracy: ±1.37 gallons

Range #6: (50.5-60.5 inches of fuel)

Governing Equation: $y = -228.59 + 50.806x + 1.879x^2 - .0136x^3$

Accuracy: ±1.70 gallons

Range #7: (60.5-70.5 inches of fuel)

Governing Equation: $y = 350.71 + 22.113x + 2.3537x^2 - .016223x^3$

Accuracy: ±1.22 gallons

Range #8: (70.5-80.5 inches of fuel)

Governing Equation: $y = 3671.6 - 116.81x + 4.2926x^2 - .02526x^3$

Accuracy: ±1.01 gallons

Range #9: (80.5-92 inches of fuel)

Governing Equation: $y = 69112 + 2462x + 32.309x^2 - .13683x^3$

Accuracy: ±.65 gallons

Summary of Results

Greatest Accuracy: **±.531 gallons** (0-10.5 inches of fuel)
Lowest Accuracy: **±1.70 gallons** (50.5-60.5 inches of fuel)

As can be seen from these results, the volume measuring accuracy is least accurate when the storage tank is approximately half full. However, the worst accuracy of ±1.70 gallons only represents .017% error for the entire tank volume.

Appendix K

Actual EFTMS Volume Measuring DATA

Tank #1 (Fleet Gasoline)

Original Gallons of Fuel: 4931
Original Inches of Fuel: 47.25

Total Gallons Removed	EFTMS Measured Volume (gal.)	EFTMS Measured Fuel Inches
5	4927	47.22
10	4922	47.18
15	4917	47.15
20	4911	47.11

5 Gallon Increments: (0-5 gal interval) 4 gal. removal indicated
(15-20 gal interval) 6 gal. removal indicated

Final Difference from Original Volume: **20 gallons**

Tank #2 (Oxygenated Test Gasoline)

Original Gallons of Fuel: 2392
Original Inches of Fuel: 28.21

Total Gallons Removed	EFTMS Measured Volume (gal.)	EFTMS Measured Fuel Inches
5	2387	28.17
10	2382	28.13
15	2377	28.10
20	2372	28.06

5 Gallon Increments: No Discrepancies

Final Difference from Original Volume: **20 gallon**

Tank #3 (Unleaded Test Gasoline (96 Ron))

Original Gallons of Fuel: 564
Original Inches of Fuel: 10.96

Total Gallons Removed	EFTMS Measured Volume (gal.)	EFTMS Measured Fuel Inches
5	559	10.90
10	555	10.85
15	550	10.79
20	545	10.72

5 Gallon Increments: (5-10 gal interval) 4 gal. removal indicated

Final Difference from Original Volume: **19 gallons**

Tank #4 (Gasohol Test Fuel)

Original Gallons of Fuel: 566
Original Inches of Fuel: 10.97

Total Gallons Removed	EFTMS Measured Volume (gal.)	EFTMS Measured Fuel Inches
5	560	10.91
10	556	10.85
15	550	10.80
20	546	10.74

5 Gallon Increments: (0-5 gal interval) 6 gal. removal indicated
(5-10 gal interval) 4 gal. removal indicated
(10-15 gal interval) 6 gal. removal indicated
(15-20 gal interval) 4 gal. removal indicated

Final Difference from Original Volume: **20 gallons**

Tank #5 (Diesel Test Fuel)

Original Gallons of Fuel: 628
Original Inches of Fuel: 11.74

Total Gallons Removed	EFTMS Measured Volume (gal.)	EFTMS Measured Fuel Inches
5	623	11.68
10	619	11.63
15	614	11.57
20	609	11.51

5 Gallon Increments: (5-10 gal interval) 4 gal. removal indicated

Final Difference from Original Volume: **19 gallons**

Tank #6 (Excess Test Fuel)

Original Gallons of Fuel: 5045
Original Inches of Fuel: 63.31

Total Gallons Added	EFTMS Measured Volume (gal.)	EFTMS Measured Fuel Inches
5	5049	63.35
10	5056	62.78
15	5060	62.55
20	5066	62.21

5 Gallon Increments: (0-5 gal interval) 4 gal. removal indicated
(5-10 gal interval) 7 gal. removal indicated
(10-15 gal interval) 4 gal. removal indicated
(15-20 gal interval) 6 gal. removal indicated

Final Difference from Original Volume: **21 gallons**

Tank #7 (Unleaded Commercial Test Gasoline)

Original Gallons of Fuel: 4332
Original Inches of Fuel: 42.89

Total Gallons Removed	EFTMS Measured Volume (gal.)	EFTMS Measured Fuel Inches
5	4327	42.86
10	4322	42.82
15	4318	42.78
20	4312	42.74

5 Gallon Increments: (10-15 gal interval) 4 gal. removal indicated
(15-20 gal interval) 6 gal. removal indicated

Final Difference from Original Volume: **20 gallons**

Tank #8 (Unleaded Test Gasoline (96 Ron))

Original Gallons of Fuel: 4838
Original Inches of Fuel: 46.57

Total Gallons Removed	EFTMS Measured Volume (gal.)	EFTMS Measured Fuel Inches
5	4833	46.53
10	4828	46.50
15	4822	46.46
20	4827	46.42

5 Gallon Increments: (10-15 gal interval) 6 gal. removal indicated

Final Difference from Original Volume: **21 gallons**

Summary of Actual EFTMS Data

Overall 20 gallons samples

	Tanks
EFTMS indicated **19 gallons** removed :	3,5
EFTMS indicated **20 gallons** removed:	1,2,4,7
EFTMS indicated **21 gallons** removed:	6,8

Number of incidences of deviation from the 5 gallon sample:

Tank	Number of Deviations
1.....	2
2.....	0
3.....	1
4.....	4
5.....	1
6.....	4
7.....	2
8.....	1

Worst Display of Accuracy : **Tank #6**

The EFTMS indicated a 21 gal. removal of fuel for the overall 20 gal. sample. Also a 7 gal. removal was indicated for the 5-10 gal. interval.

The following items can be set from the front panel of the Tank Level Monitor:

1. Date and Time
2. Shift Report Times
3. Manager Code
4. Station Header
5. Alarm Levels
6. Calibration Value
7. Pitch Correction
8. Tank Number
9. Sensor Number
10. Tank Type
11. Fuel Type

The current settings as of 7/28/88 are the following:

•Shift Report Times: 99:99 (disabled)

•Factory Set Access Code: 11111

•Manager Access Code: 97248

•Station Header:
U.S. EPA Tank Farm
2565 Plymouth Rd.
Ann Arbor, Mi 48105

•Alarm Levels:	Tanks 1,2,4,5,6,7	Tanks 3,8
Low Product Level:	500 gal.	1000 gal.
High Product Level:	9518 gal.	9518 gal.
High Water Level:	2 in.	2 in.

•Calibration Value: 2500 (all tanks)

•Probe Length: 38850 steps (all tanks)

•Pitch Correction: +0 (all tanks)

•Start Leak Test(printout): 11:02:47 P.M.
•Leak Test Report(printout): 5:02:59 A.M.

•Individual Tank Information:

Tank Number:	1	2	3	4	5	6	7	8
Probe Address:	1	2	3	4	5	6	7	0
Tank Table:	1	1	1	1	1	1	1	1
Product Code:	9	9	9	9	5	9	9	9
Label:	FLTGAS	OXYTF	ULTG1	GASHOL	*	EXCTF	ULTGCM	ULTG2
TC Value:	.00068	.000675	.00068	.000675	*	.00068	.00068	.00068

*Tank 5 uses standard #2D label and TC value of DSL-#2 and .000450 respectively.