

**FUEL ACCOUNTABILITY IN COLLAPSIBLE FABRIC
TANKS, ACCURACY AND PRECISION MEASUREMENTS
AND IMPROVED REPORTING PROCEDURES**

**FINAL TECHNICAL REPORT
No. 502**

**By
Joel A. Schmitgal, U.S. Army Ground Vehicle Systems Center
and
Kevin L. Shannon, Southwest Research Institute**

**GVSC Fuels and Lubricants Research Facility
Southwest Research Institute® (SwRI®)
San Antonio, TX**

**For
Eric R. Sattler**

**Force Projection Technology
Warren, Michigan**

Contract No. W56HZV-15-C-0030 (WD 032)

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EXECUTIVE SUMMARY

The Army desires to calculate the accuracy and precision of the volumetric measurement of fuel contained within collapsible fabric tanks (CFTs) using both procedures currently employed in the field and also alternative measurement techniques that could improve fuel accountability and help to resolve reporting challenges for both capitalized and non-capitalized (Army owned) bulk fuel storage and distribution sites worldwide. SwRI tested different design concept flow meters during fuel transfers between CFTs over a three month period at its dedicated revetment facility in San Antonio, TX from mid-August to early December 2021.

A fuel transfer event at SwRI's CFT Facility would involve the movement of a nominal 20,000 gallon volume of Jet A fuel from one 20,000 gallon capacity CFT to another using an electric pump at a moderated flow rate of approximately 125 gallons/minute. This process would take three to four hours from beginning to end. The entire 20,000 gallon fuel volume would flow through a series of meters from the origin CFT (filled with fuel to capacity) to the empty destination CFT, which allows for comparison of measured fuel volumes between meters. From the discharge side of the electric pump, fuel first passed through a manufacturer calibrated reference positive displacement flow meter and then through a series of candidate flow meters before arriving at the destination tank. The design characteristic of the candidate flow meters was either turbine, vortex, or Coriolis in nature. Some of the turbine flow meters had received a post-production modification to improve fuel measurement by taking fuel temperature and density into account. Additionally, SwRI staff manually assessed the height of CFTs using the conventional "stick and string" technique at regular fuel volume intervals. When referenced against a strapping chart developed from the initial fuel fill of the CFT, a fuel volume estimate could be derived. Indirect fuel volume measurement was converted from liquid pressure changes for two CFTs equipped with tactical tank gauging transducer probes installed within the tank. On average, at least one fuel transfer per week took place over the time period of August through December 2021. Information on the flow meters can be found in APPENDIX A.

In August of 2021 a team comprised of SwRI staff and approximately a dozen military personnel from both the U.S. Army and U.S. Marine Corps convened at the SwRI CFT Facility for a few days to collect manual "stick and string" CFT heights during scheduled fuel transfer events that was monitored by the flow meters. This data, along with all associated flow meter data, was processed to calculate CFT volume error, meter error, and gain/loss values. These calculations were also applied to all fuel transfer events taking place during the study period of mid-August to early December 2021.

The results of this study showed that Coriolis and modified turbine flow meters perform similarly and have the lowest fuel measurement error compared to positive displacement reference flow meters. Unmodified turbine flow meters were clearly not in the same class, but this may be due to the low number of units used in the study and their state of repair after undergoing prior field use. The in-tank gauging system has its merits in inventorying static fuel supplies, but is not well-suited to changes in fuel volume through CFT issues/receipts or assessing fuel volume at extremes of CFT full fuel capacity or emptiness.

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The authors would like to acknowledge the contribution of the GFLRF technical and administrative support staff.

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ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
CFT	Collapsible Fabric Tank
DoD	Department of Defense
GFE	Government Furnished Equipment
GFLRF	GVSC Fuels and Lubricants Research Facility
max	maximum
min	minimum
N/A	Not Applicable
SwRI	Southwest Research Institute
USMC	United States Marine Corps

1.0 BACKGROUND & INTRODUCTION

1.1 FUEL INVENTORY DETERMINATION

Historically, the task of inventorying fuel stored in collapsible fabric tanks (CFT)s at military depots or forward areas has fallen to personnel who manually collect CFT heights in order to ascertain the volume of fuel present. These CFT heights are taken using the “stick and string” technique, whereby a string affixed to the CFT’s center vent pipe is pulled taut and level, then held against a vertical plumb measuring stick of sufficient length with 1/8 inch gradations. The recorded height is then checked against a reference “strapping chart” that converts the tank height to a corresponding fuel volume. These strapping charts are either created in the field during the CFT’s first fuel fill (in conjunction with the use of a trusted fuel metering device) or come from the CFT manufacturer. The variations inherent to this method can lead to confusing or contradictory fuel inventory data. Tank heights collected on back-to-back days, possibly by different personnel, may differ by up to 3 inches—equivalent to hundreds and even thousands of gallons of fuel—even if no fuel was removed from or added to the CFT during that time. This tedious and time-consuming manual process becomes onerous to logistics personnel responsible for tracking the total volume of fuel stored in active tank farms made up of scores of CFTs which are constantly being filled and discharged to supply vehicles and equipment. Inconsistencies in CFT height measurements can be attributable to human error, atmospheric changes, fuel temperature changes caused by incident solar radiation and the corresponding thermal expansion of the fuel, and the CFT’s age and natural tendency to flex in different directions depending on the volume of fuel contained, among others that may not be readily identifiable within the scope of this report.

The objective of this effort was to calculate the accuracy and precision of the volumetric measurement of fuel contained within collapsible fabric tanks using (i) procedures currently employed in the field; and (ii) alternative measurement techniques that could improve fuel accountability and help to resolve current reporting challenges for both capitalized and non-capitalized (Army owned) bulk fuel storage and distribution sites worldwide.

2.0 METHODS

2.1 CFT FACILITY AT SWRI

The CFT Facility at SwRI in San Antonio, Texas is well suited to simultaneously evaluate several fuel flow measuring devices connected to 20,000 gallon capacity CFTs. The site is an open, outdoor, 22,000 square-foot concrete-lined revetment replete with stainless steel fuel distribution lines, valves, electric-motorized pumps, calibrated flow meters, and hoses to service fuel bladder tanks up to 50,000 gallons in capacity. 100,000 gallons of Jet A fuel was kept on hand at the site for periodic transfer to the CFTs according to a weekly schedule over the course of the project. All CFTs and flow meters were unprotected from the elements of sun, rain, and even occasional ice and snow.



Figure 1. SwRI CFT Facility (Viewed from Northwest)

SwRI developed a testing matrix that involved six 20,000 gallon capacity CFTs of varying age, fabric composition (urethane and nitrile), make, and model. Included in the test matrix were two

positive displacement reference flow meters and the following candidate flow meters: eight turbine flow meters manufactured by FloCat, two Coriolis flow meters from FuelTrax, one prototype vortex flow meter, and two in-tank pressure transducer probes from Varec. The flow meters are described in detail in APPENDIX A. Of the eight turbine flow meters manufactured by FloCat, five were modified by the Penn State Applied Research Laboratory to replace the stock turbine with an enhanced version and install a thermocouple in the unit. Fuel flow displayed by the Penn State modified meters is calculated based on assumed API gravity of the fuel, measured flow, and fuel temperature.

The automated tank metering and gauging test matrix called for weekly fuel transfer events in which the entire fuel contents of one CFT (nominally 20,000 gallons) would flow to another through one of the positive displacement reference meters and then all of the candidate flow meters connected in series. Fuel flow was accomplished using an electric pump controlled with variable frequency drive at a moderated flow rate of approximately 125 gallons per minute. From the discharge side of the electric pump, fuel first passed through a calibrated positive displacement reference flow meter and then through a series of candidate flow meters before arriving at the destination tank. For the two CFTs equipped with a Varec tactical tank gauging pressure transducer probe installed within the tank, indirect fuel flow and volume measurement was calculated from the observed hydrostatic pressure changes detected by the probe as the level of fuel in the CFT changed during filling or draining. This pressure data was automatically and instantly converted to fuel volume in gallons using the Varec system software.

In August of 2021, a manual tank gauging effort was organized at SwRI to collect data under a testing matrix of 20,000 gallon fuel transfers from one CFT to another, divided into 4,000 gallon increments. Fuel movement was stopped (pump shut off and valves closed) to allow both the fuel origin tank and destination tank to be gauged with stick and string methodology by 12 different personnel at each 4,000 gallon increment. In order to establish a baseline competency level, a brief training session on the correct application of the manual gauging technique was provided on-site to all participants before data collection began. Fuel movement between the tanks was controlled at the typical 125 gallons per minute flow rate. The tank heights measured by the 12 personnel were then converted to gallons using custom strapping charts developed by GVSC based on the initial CFT fill data collected by SwRI, which is shown in APPENDIX B. Calculations for CFT volume error, human error, and CFT volume gain/loss are shown in APPENDIX C.

Weekly fuel transfer flow meter data accumulated from September through December 2021 was processed to generate CFT volume error, meter error, and CFT volume gain/loss calculations for both same meter and alternate meter scenarios. For the same meter calculations, both CFT fuel receipts and issues over the 3 month evaluation period were determined from flow measurement values (in gallons) collected from an individual meter. Data from selectively paired alternate meters with a common principle of operation (i.e. Coriolis, stock FloCat turbine, Penn State modified turbine) was given similar treatment for comparison of fuel receipts and issues. This data appears in APPENDIX D.

A separate manual tank gauging effort took place at USMC Camp Lejeune, NC in October 2020 under the direction of GVSC, prior to the one held at SwRI in August 2021. The data generated from the manual tank gauging measurements submitted by the 9 participants is summarized in APPENDIX E. The manually measured tank heights were then converted to gallons via a reference strapping chart from the CFT manufacturer; it is shown in APPENDIX F. The Camp Lejeune data was included in this report for comparative study with data obtained at SwRI.

3.0 DATA ANALYSIS

3.1.1 MANUAL GAUGING ACCURACY

Manual tank gauging data was collected by 12 volunteers comprised of SwRI staff and U.S. Army and U.S. Marine Corps personnel at SwRI in August 2021 in order to calculate the precision and accuracy associated with this approach. Representatives from the Army Petroleum Center led a training session for all participants prior to collection of manual gauging CFT measurements to ensure that all personnel were utilizing standard and accepted techniques. These manual gauging results were compared to data collected from calibrated positive displacement reference flow meters to determine the accuracy of the “stick and string” methodology. The average CFT volume gauging error for the sample set of all 12 personnel compared to the positive displacement meter ranged from a high of 6.3% when the CFT was roughly 25% full of fuel down to a low of 1.6% when the CFT was completely filled with fuel (nominally 20,000 gallons). The individual maximum CFT volume errors are also worth noting here. These maximum human errors ranged as high as 14.3% when the CFT was roughly 25% full of fuel but decreased considerably to 4.8% for measurements taken of a completely filled CFT. This indicates that manual height measurement

error tracks with CFT fill level, connecting increased human error to lower fuel volumes in the CFT. This is not surprising due to the uneven vertical and lateral expansion of the CFT as it fills with fuel. As the folds in the CFT fabric are pushed out until the surface skin becomes taut, the subjectivity of the human height measurement is compounded. The operator may record a manual tank height for the CFT based on the contact of the string level with the CFT surface, which may not be consistent in all directions and therefore not reflective of the actual fuel quantity contained in the CFT. Conversely, this same notion applies to CFT vertical and lateral contraction as fuel is drained. Human error is also a function of temperament, previous experience, training level, and personal investment in the process, among others. See APPENDIX G for the complete set of calculations derived from this data.

In the field, tank gauging accuracy is calculated utilizing a gain/loss formula per Army Regulation 710-2¹, Supply Policy Below the National Level² for non-capitalized fuel, and Instruction Number: DLA Energy I-11 for capitalized fuel sites. The gain/loss is calculated utilizing Equation 1. CFT gain/loss calculations from a singular measurement recorded by a particular individual ranged from 14.2% down to 0.0%, with the average gain/loss ranging from 3.7% down to 2.5%. These accuracy calculations also show a dependency on the CFT fill level with the numbers improving as the CFT reaches capacity. See Table C-1 for a complete listing of gain/loss calculations. The average gain/loss calculation for the manual gauging measurements was 3.1%.

Equation 1. Calculated Gain/Loss (all units are in gallons):

$$\frac{[\text{Physical Closing Inventory (candidate meter or manual gauge)} - \text{Closing Book Balance True Inventory (reference meter)}]}{[\text{Opening Inventory} + \text{True Inventory Receipts (reference meter)}]} \times 100 = \% \text{ gain/loss}$$

¹ **Army, Headquarters Department of the, [ed.].** Supply Policy Below the National Level. *Army Regulation 710–2*. Washington, DC : s.n., March 28, 2008.

² **Defense Logistics Agency Energy.** STANDARD OPERATING PROCEDURES FOR DEFENSE WORKING CAPITAL FUND (DWCF) OWNED FUEL AT DEFENSE FUEL SUPPORT POINTS SUPPORTING OPERATION ENDURING FREEDOM. Fort Belvoir, VA : s.n., June 26, 2012. Instruction Number: DLA Energy I-11.

3.1.2 MANUAL GAUGING PRECISION

The data collected in the manual gauging exercise described above was analyzed per the methodology spelled out in ASTM D6300 as provided in APPENDIX H. The data analysis indicates that the reproducibility ("R") of the measurement, or the difference in results obtained from two trained individuals in optimal conditions for a 20K CFT would exceed $R = 0.3089 * (X ^ 0.4986)$ inches only 5% of the time (one case in 20 in the long run), where X is the measured CFT height, equaling approximately 2.4 inches at a 60 inch CFT height measurement. This is a reasonable number in comparison to the limited Camp Lejeune data analysis, which resulted in a calculated reproducibility of 2.1 inches (rounded to the nearest tenth of an inch) for all CFT heights as seen in APPENDIX I.

The CFT manual height data was converted to gallons and also subjected to ASTM D6300 analysis. The data processing output indicates that the difference in results obtained from two trained individuals gauging a CFT in optimal conditions, in the same environment, both having equivalent training and similar experience, for a 20K CFT would exceed 597.4 gallons (rounded to the nearest tenth of a gallon) only 5% of the time (one case in 20 in the long run) as shown in APPENDIX J. The calculated reproducibility is reasonable compared to the limited Camp Lejeune data analysis, which yielded a calculated reproducibility of 803.8 gallons as seen in APPENDIX K. The Camp Lejeune data was collected by untrained personnel in a high stress field environment, as opposed to the controlled setting of the SwRI CFT Facility.

3.1.3 AUTOMATED METERING ACCURACY

Meter error was determined by comparison of the flow data (in gallons) reported by the candidate flow meters to the reference flow meters. This is shown in APPENDIX D. The two FuelTrax meters that employ Coriolis technology had the lowest average incident of meter error, ranging between 0.7% and 1.3%. The five Penn State modified FloCat meters returned an average error ranging between 0.8% and 1.9%, and the three stock FloCat meters had an error average ranging from 3.9% to 5.2%. The meter error for the two Varec tactical tank gauging systems ranged from 3.0% to 10.3%. It must be noted here that Varec tactical tank gauging systems were only installed in two of the six CFTs used in the study, therefore flow data was not available for all tank-to-tank fuel transactions.

3.1.4 AUTOMATED METERING PRECISION

Meter precision was calculated per the methodology spelled out in ASTM D6300 for the stock FloCat, Penn State modified FloCat, and the FuelTrax Coriolis meters and is provided in APPENDIX L, and is also further explained in Equation 2 thru Equation 4. The limited amount of data obtained for the stock FloCat meters and FuelTrax meters did not allow for outliers to be calculated and removed from the precision calculations, but the data presented in Table 1 provides a working interim reproducibility range for automated methods. The precision of the turbine meters modified by the Penn State Applied Research Laboratory is favorably comparable to more expensive Coriolis meters, reflected in the lower reproducibility outputs at each of the four volume increments examined. The higher precision values derived from the limited FloCat data set is due to the elevated flow data variability observed from the small sample set comprised of just three meters. The number of candidate meters of each style affects the precision calculation, and if one meter generated inconsistent results compared to the others, which may have performed well, the overall precision calculation would still be negatively impacted for the meter group as a whole. The turbine FloCat meters modified by Penn State Applied Research Laboratory and the FuelTrax Coriolis meters demonstrated superior precision compared to manual gauging precision of 597.4 gallons by a factor of roughly 4.5X at the lower CFT fuel volumes. However, as the CFT volume increased, the precision in this volume calculation from the data generated by these meters decreased, until the precision difference between manual gauging and these flow meters was virtually indistinguishable at the 20,000 gallon full CFT mark.

Equation 2. Stock FloCat Meter Reproducibility

$$\text{Reproducibility} = 9.8668 * X ^ {0.6216} \text{ Gallons}$$

Equation 3. Penn State modified FloCat Meter Reproducibility

$$\text{Reproducibility} = 1.688\text{E-}02 * X ^ {1.0514} \text{ Gallons}$$

Equation 4. FuelTrax Coriolis Meter Reproducibility

$$\text{Reproducibility} = 9.016\text{E-}03 * X ^ {1.1696} \text{ Gallons}$$

Table 1. Calculated Reproducibility for Automated Meters in Gallons

Reproducibility at Specific Fuel Volume Increments			
Gallons	Stock FloCat	Penn State FloCat	Fueltrax
5000	1965	131	191
10000	3024	271	430
15000	3891	415	691
20000	4653	562	967

3.1.5 AUTOMATED GAUGING ACCURACY

The automated meter-in-meter-out gauging technique was performed using the same meter types (stock FloCat, Penn State modified FloCat, or Coriolis) to calculate CFT volume. Different style meters were not paired together for this data analysis. These results were compared to those obtained from a calibrated reference positive displacement flow meter to determine the accuracy of this methodology. This was accomplished by recording the fuel volume that passed through a candidate flow meter during receipt of fuel into a CFT and while issuing out of a CFT. The data was evaluated from two perspectives on meter receipt/issue pairs: from the same meter as fuel was transferred into and out of the CFT (designated in this report as meter pairs MP11, MP22, etc.) or through the receipt of fuel through one meter and issue of fuel through a second meter (designated meter pair MP12, MP45, etc.)

As seen in APPENDIX D, all meter types were grouped by average CFT volume error against the data obtained from the positive displacement meters. The FuelTrax meters that employ Coriolis technology and the Penn State modified FloCat meters displayed the lowest CFT volume error, with the FuelTrax averaging between 0.5% and 2.4% and the Penn State modified FloCat meters ranging between 0.6% and 1.5%. The CFT volume error for the stock FloCat meters was noticeably higher, averaging between 2.9% up to 8.5%. The Varec tactical tank gauging system, which was only installed in two of the CFTs, had an average error ranging from 1.2% to 1.7%. Lower errors can be attributed to the advanced technology of the Coriolis and Penn State modified turbine flow meters which compensate for fuel density and temperature in their reported flow values.

One might expect accuracy calculations to be more favorable for data collected from the same meter as opposed to different meters, but this was not always the case. Variations in the data

depend on the consistency of the flow meter from one fuel measurement event to another. Some of these turbine meter units had seen prior field use which may have adversely affected their condition and day-to-day performance. The accuracy of the Varec Tactical Gauging System, which uses in-tank pressure transducers, had the narrowest range of error but ranked slightly behind that of the better performing in-line flow meters when best case scenarios are considered for each meter type.

Using Equation 1 to calculate the CFT volume gain/loss (also seen in APPENDIX D), the average gain/loss calculation for the FuelTrax meters that employ Coriolis technology had the lowest incident of error averaging between 0.3% and 0.6%, the Penn State modified FloCat meters had a gain/loss averaging between 0.3% and 0.9%, while the stock flow meters had an average gain/loss ranging from 1.8% to 3.4%, and the Varec tactical tank had an average gain loss ranging from 0.9% to 1.0%. For all of these calculations, obvious outliers were removed in order to preserve the integrity of the data set. Any statistical adjustments were applied evenly across the individual flow meter units in order to reduce bias.

3.1.6 AUTOMATED GAUGING PRECISION

The tank gauging precision calculations for the automated meter-in-meter-out gauging technique was performed using like meter types to calculate CFT volume for same meter and alternate meter combinations for the stock FloCat, Penn State modified FloCat, and the FuelTrax Coriolis meters via ASTM D6300 methodology. This is shown in APPENDIX M. The limited amount of data obtained for the stock FloCat meters and FuelTrax meters did not allow for outliers to be calculated and removed from the precision calculations, but the data presented in Table 2 and 3 respectively provides a working interim reproducibility range for automated methods.

Equation 5. Same Meter CFT Volume Stock FloCat Reproducibility

$$\text{Reproducibility} = 54.827 * X ^ {0.4795} \text{ gallons}$$

Equation 6. Same Meter CFT Volume Penn State Modified Reproducibility

$$\text{Reproducibility} = 2079.5 \text{ gallons}$$

Equation 7. Same Meter FuelTrax CFT Volume Reproducibility

$$\text{Reproducibility} = 645.19 \text{ gallons}$$

Table 2. Same Meter CFT Volume Reproducibility in gallons

Gallons	Stock FloCat
5000	3256
10000	4539
15000	5514
20000	6329

Equation 8. Alternate Meter CFT Volume Stock FloCat Reproducibility

$$\text{Reproducibility} = 8982.3 \text{ gallons}$$

Equation 9. Alternate Meter CFT Volume Penn State Modified Reproducibility

$$\text{Reproducibility} = 487.22 * X ^ {0.1729} \text{ gallons}$$

Equation 10. Alternate Meter FuelTrax CFT Volume Reproducibility

$$\text{Reproducibility} = 2625.5 \text{ gallons}$$

Table 3. Alternate Meters CFT Volume reproducibility in gallons

Gallons	Penn State FloCat
5000	2125
10000	2395
15000	2569
20000	2700

No Varec tactical tank precision calculations could be calculated as the two systems would need to be installed on the same CFT to provide replicative results. This prevented the generation of similar data sets.

4.0 OBSERVATIONS

The arrangement of the fuel distribution plumbing at the CFT Facility created an opportunity to directly compare different flow meter styles, since the same volume of fuel would pass through all meters in series during a fuel transfer event between CFTs. In every fuel transfer event, the SwRI positive displacement style flow meters were used as the reference to which all candidate meters were compared. Fuel flow was suspended by deactivating the electric pumps and closing the tank valves at nominal 5,000 gallon increments so that SwRI staff could inspect each meter and record the volume of fuel measured on the meter's display screen.

At times, entrained air in the fuel was observed via transparent sight glasses placed at critical junctions in the fuel distribution lines. Air bubbles in the fuel are suspected to cause flow reading errors among some flow meter types. When the fuel cycling program was initially begun, entrained air was present to some degree during a fuel transfer event, but as the system was operated and refined, leaks in the CFT hoses and distribution lines were identified and remedied. Once entrained air was virtually eliminated from the system, flow meter readings tended to agree more consistently. Turbine flow meters are considered susceptible to the effects of entrained air in the fuel and significant meter errors were observed in some of these meters when high levels of entrained air were present. However, other turbine flow meters in the same flow path returned reasonable fuel volume values during the same fuel transfer event. The design principle of the FUELTRAX Coriolis meters is reputed to be unaffected by pressure, temperature and viscosity, and to minimize the effect of entrained air as well. The large blue commercial FUELTRAX flow meter was outfitted with an air eliminator tank that the green military version of the FUELTRAX meter did not have. The fuel flow data yielded by the two units was very similar regardless of the entrained air observed in the system. Since the Varec tactical tank gauging probe was installed inside a CFT and therefore immersed in a stationary volume of fuel, entrained air effects were not applicable to it. The FloCat meters delivered to SwRI for the test program were in varying states of repair and operability, since several of them had undergone prior usage in the field. SwRI worked with GVSC to diagnose and return as many of these meters to service as possible, but their sensitivity to humidity rendered only a few units operational at a time for study purposes. For these meters, limited data sets were collected depending on if the meter was functioning.

The vortex flow meter consistently measured much lower than all the other meters, by 25% or more. This was reported to the manufacturer in the interest of obtaining troubleshooting guidance to bring the meter's reported values more in line with the other meters. A manufacturer technical service representative recommended to SwRI that a Hart communicator device be connected to the meter itself in order to diagnose and re-program the appropriate settings for the fuel type. The SwRI Instrumentation Shop routinely employs this device for electronics hardware setup, but the communications format used at SwRI was not compatible with the vortex flow meter. The manufacturer then sent a configured USB Hart modem to SwRI which was designed to easily program the meter. Once received at SwRI, the Hart modem was connected to the meter and the recommended parameters were programmed into it. This did not resolve the errant flow meter volumes. The vortex flow meter continued to produce data consistently out of line with the other meters and rather similar to that which was generated prior to the troubleshooting efforts undertaken by SwRI with the flow meter manufacturer. Data from this meter was clearly an outlier and was not included in the statistical data analysis found in APPENDIX D or APPENDIX L.

The Varec Tactical Gauging System was only installed in two of the CFTs (the SEI Jungle King and Desert King), so data was not generated from this meter for the other four tanks. The Varec system seemed to perform well in the middle volumes of the tank capacity, but became unpredictable and erratic at the extremes of CFT emptiness or maximum fill. This is most likely due to a limitation inherent in the principle of operation, which created a virtual strapping chart when the tank was filled. During initial fuel fill, the system software connects the incremental hydraulic pressure measured in the CFT by the inserted transducer probe to the detected 'pings' associated with known fuel volumes emitted by the magnetic pickup of an inline positive displacement flow meter. The positive displacement meter is only needed for initial system setup and is then removed for routine use of the tactical gauging system thereafter. For all subsequent fuel transfers, the changes in pressure detected by the transducer probe in the tank are converted to fuel volume measurements by the Varec system software. As long as the pressure changes are consistent and differentiable, the software reports reliable and reasonable tank volumes and fuel flow rates, although at a slight time lag. As the tank reaches its maximum or minimum capacity, the pressure changes exerted by the fuel in the CFT become gradually smaller and eventually almost imperceptible. The software outputs react accordingly, displaying wild swings anywhere between twice the actual fuel flow to zero.

SwRI staff observed that the Varec system was susceptible to data lags and also environmental and natural interferences. As long as the electric pump demand was kept constant and the fuel flow rate was stable, the Varec software registered accurate flow values. Whenever the pump was throttled down or increased, the expected effect did not manifest in the Varec for 15 to 30 seconds or more. This made on-the-fly measurements difficult to impossible to obtain. A reference “breather” port in the Varec hardware stem externally attached to the CFT vent port could become plugged from environmental factors. This occurred in one instance where the tank volume at startup showed zero gallons in an obviously full 20K gallon CFT. A call was placed to Varec for technical support and SwRI staff were directed to inspect the breather port as a diagnostic step. It was then discovered that a spider or worm had built a dense silk nest inside the breather port, effectively cutting off access from the internal sensor to the atmospheric pressure reference outside. The spider web-like material was carefully extracted using a narrow pointed tool and the system immediately returned to normal operation once the breather opening was fully cleared. It would be reasonable to assume that other environmental or natural factors could plug this breather port, such as ice, snow, or freezing rain, disabling the entire Varec system.

Varec recommends leaving a minimum 1,000 gallon residual fuel volume in a CFT that has their tactical gauging system installed. The reason for this is that the pressure transducer probe inserted in the CFT is very fragile and sensitive. At fuel volumes below 1,000 gallons, the vacuum force exerted by the pump suctioning fuel from the CFT can damage the electronic sensors in the Varec probe. SwRI standard practice for transferring fuel from one CFT to another at the revetment typically called for withdrawing fuel until the tank was flat and presumed empty. This was not done for the SEI Jungle King and Desert King tanks that had Varec probes installed.

As a group, the candidate stock FloCat turbine style flow meters did not compare well statistically with the reference positive displacement meters, candidate Penn State modified FloCat meters, or the candidate Coriolis meters. Some of the individual turbine flow meters performed exceptionally well and were consistent week in/week out, yielding flow volume data quality that rivaled that of the Coriolis meters. The eight turbine flow meters were received as GFE in varying stages of repair and some showed noticeable wear and tear from prior field service. The differences in accuracy and precision performance of these meters could be attributed to the handling and exposure received previously, which may have adversely affected the electronics in some of the units.

The Varec tactical tank gauging probe was connected to a positive displacement meter (also supplied by Varec) for initial strapping of the CFTs that it was gauging. Since it is more realistic that a turbine meter would be utilized for this purpose in the field, the use of the positive displacement meter in this experiment may give this system an higher accuracy than would be realized in a field environment that relies on a less accurate meter.

5.0 RECOMMENDATIONS

Manual tank gauging accuracy and precision data should be repeated on a 50K and 210K gallon CFTs to determine if the calculated values can be used across the family of CFT sizes or if they are dependent on CFT volume.

In order to perform future data collection activities such that precision values for the Varec tactical tank gauging probe can be calculated, two or more systems in the same CFT should be considered.

Future work should include a minimum of 4 meters of each type, preferably six or more, to provide sufficient degrees of freedom to calculate meter and CFT volume precision calculations.

The gain/loss values in Army Regulation 710-2 (1) and the Supply Policy Below the National Level (2) for should be updated for non-capitalized fuel and DLA-I-11 in the 2.1 to 3.1% range.

Future work on manual tank gauging should include an analysis of error related to the use of manufacturer strapping charts, since the development of strapping charts in the field can create a significant burden on operators.

Future work should span a greater scope of CFT volumes and meter data collection to further mature the accuracy and precision data presented in this interim report. Testing on 50K and 210K CFTs should investigate the reproducibility of manual tank gauging to analyze precision calculations on 20K, 50K and 210KCFTs, or see if these values can be extrapolated out to 210K CFTs as well.

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APPENDIX A

Flow Meters

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Table A-1. SwRI Flow Meter #1 Details

S/N:	E00661
Model/Part No.:	H242LS11NA/P11N/0
NSN:	N/A
Manufacturer:	Max Machinery, Inc.
Style:	Positive Displacement

Figure A-1. SwRI Reference Flow Meter #1 (3 inch)
Upper Left—Location of Meter Relative to Discharge Side of Pump #1 (Yellow Arrow)

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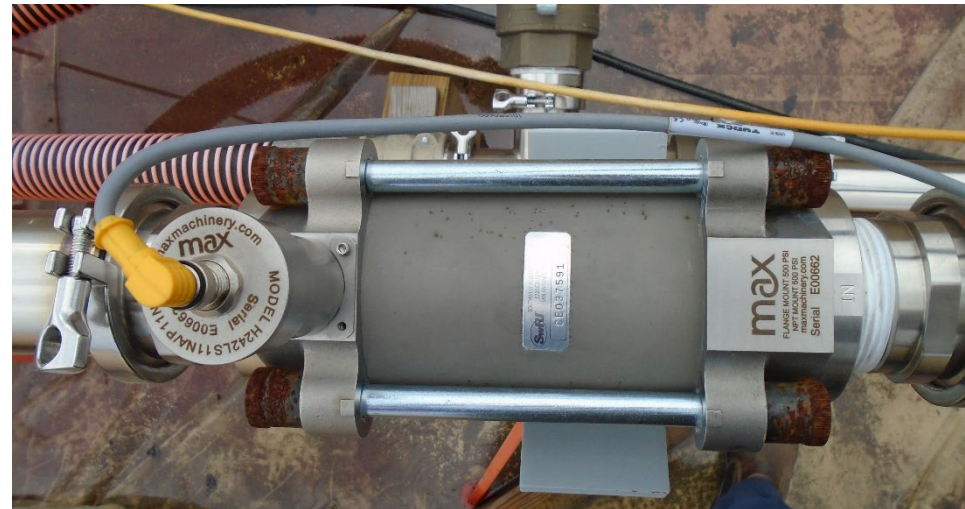
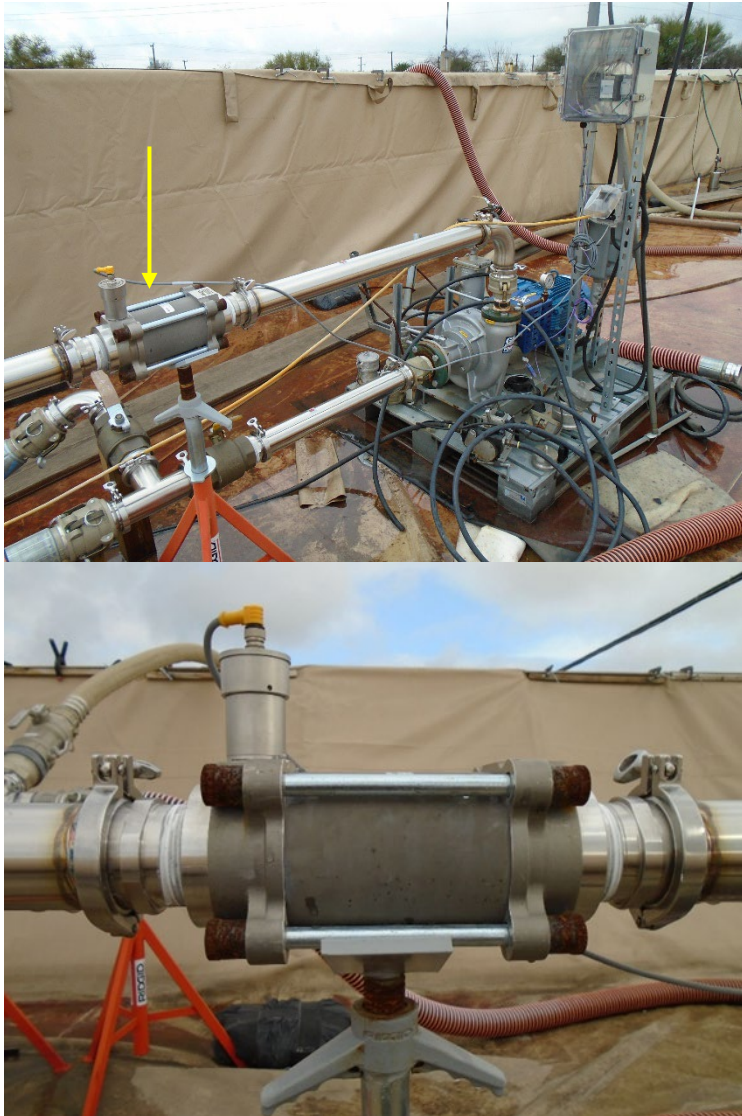


Table A-2. SwRI Flow Meter #2 Details

S/N:	E00662
Model/Part No.:	H242LS11NA/P11N/0
NSN:	N/A
Manufacturer:	Max Machinery, Inc.
Style:	Positive Displacement

Figure A-2. SwRI Reference Flow Meter #2 (3 inch)
Upper Left—Location of Meter Relative to Discharge Side of Pump #2 (Yellow Arrow)

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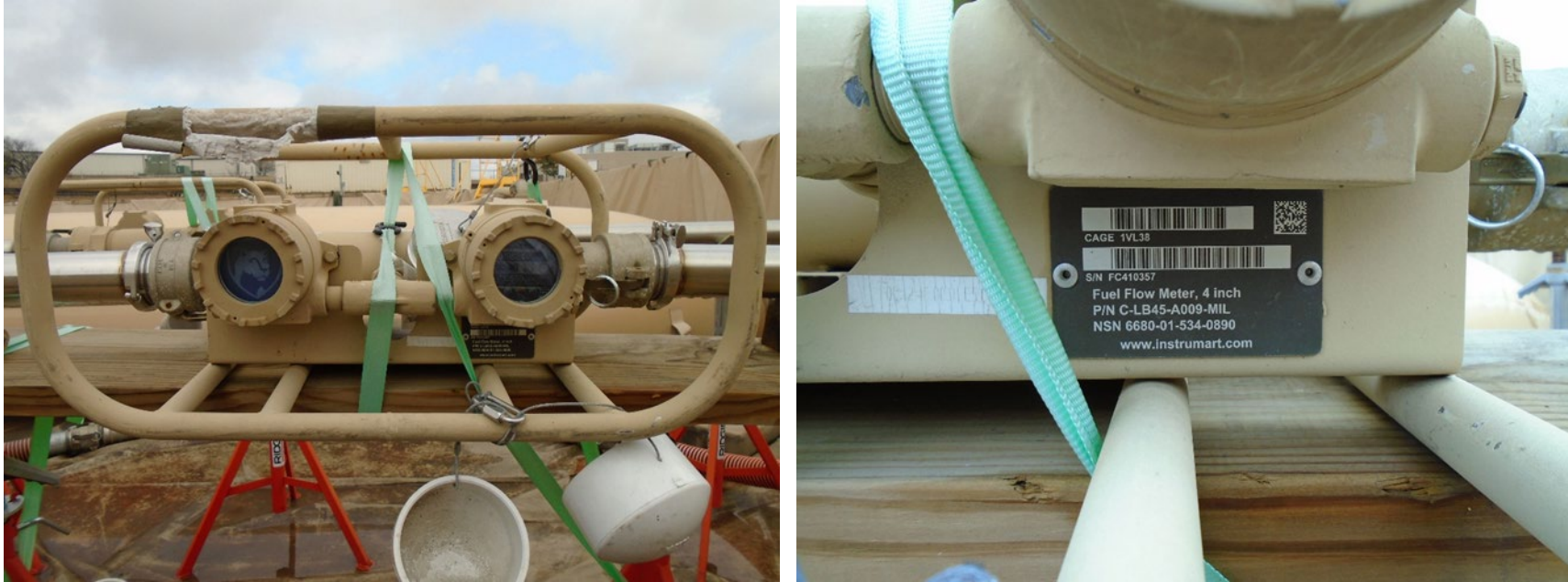


Figure A-3. Candidate Flow Meter #1 (4 inch)

Table A-3. Candidate Flow Meter #1 Details

S/N:	FC410357
Model/Part No.:	C-LB45-A009-MIL
NSN:	6680-01-534-0890
Manufacturer:	FloCat (modified by Penn State)
Style:	Turbine

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Figure A-4. Candidate Flow Meter #2 (4 inch)

Table A-4. Candidate Flow Meter #2 Details

S/N:	FC400310
Model/Part No.:	C-LB45-A009-MIL
NSN:	6680-01-534-0890
Manufacturer:	FloCat (modified by Penn State)
Style:	Turbine

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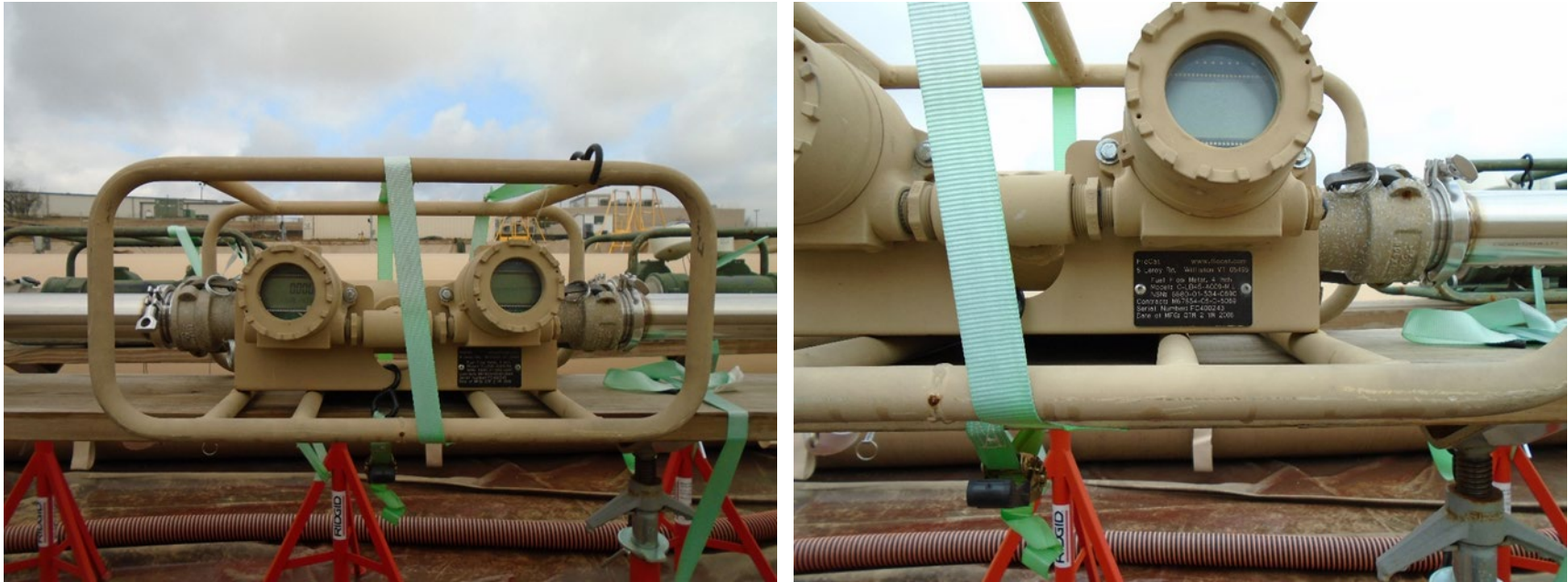


Figure A-5. Candidate Flow Meter #3 (4 inch)

Table A-5. Candidate Flow Meter #3 Details

S/N:	FC400243
Model/Part No.:	C-LB45-A009-MIL
NSN:	6680-01-534-0890
Manufacturer:	FloCat
Style:	Turbine

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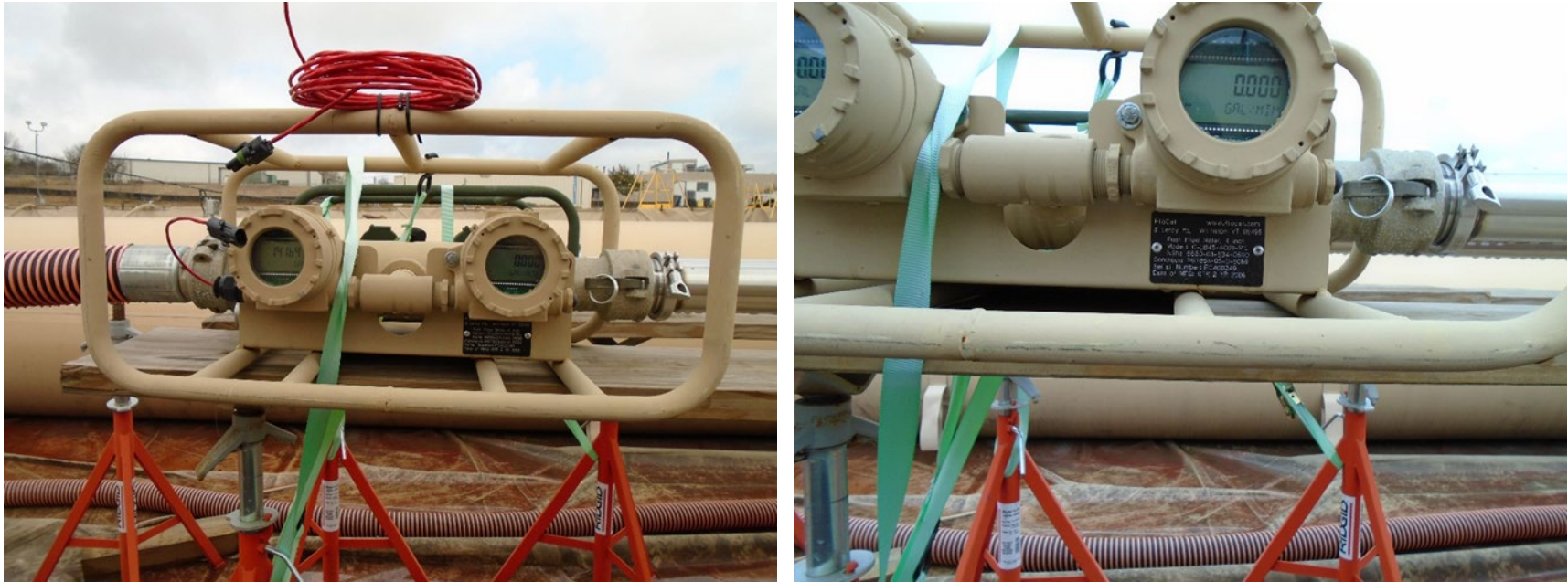


Figure A-6. Candidate Flow Meter #4 (4 inch)

Table A-6. Candidate Flow Meter #4 Details

S/N:	FC400249
Model/Part No.:	C-LB45-A009-MIL
NSN:	6680-01-534-0890
Manufacturer:	FloCat
Style:	Turbine

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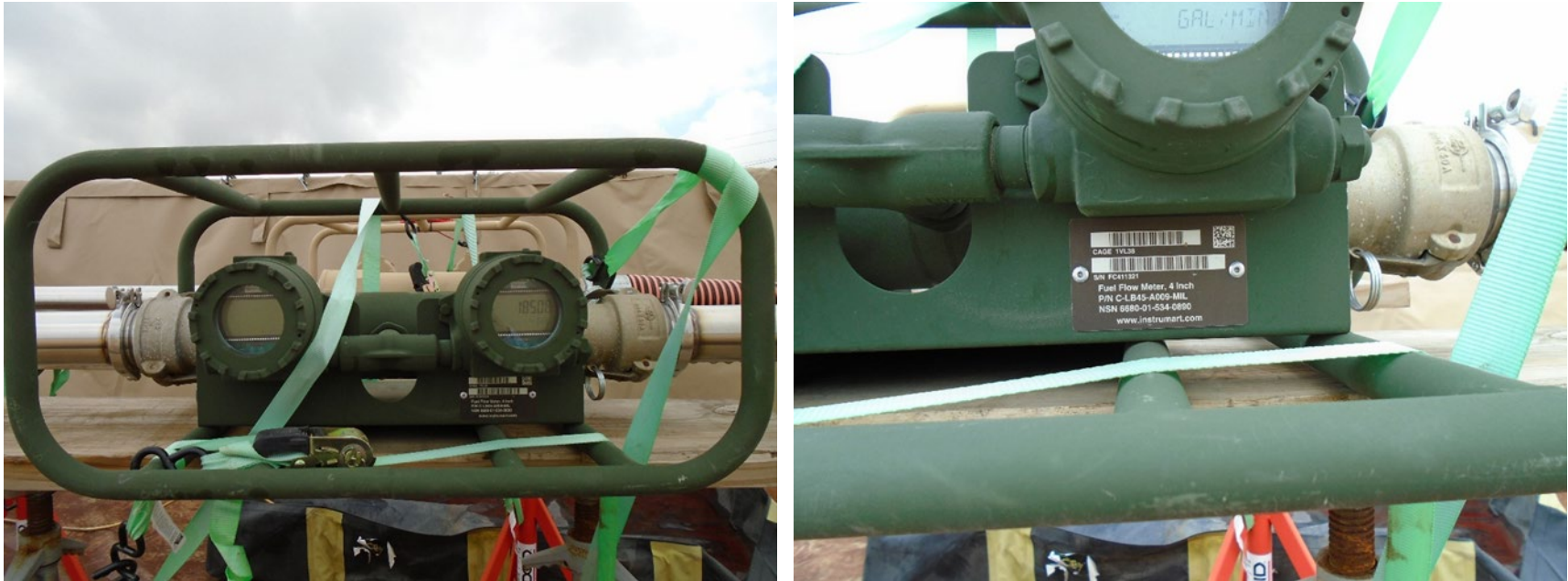


Figure A-7. Candidate Flow Meter #5 (4 inch)

Table A-7. Candidate Flow Meter #5 Details

S/N:	FC411321
Model/Part No.:	C-LB45-A009-MIL
NSN:	6680-01-534-0890
Manufacturer:	FloCat
Style:	Turbine

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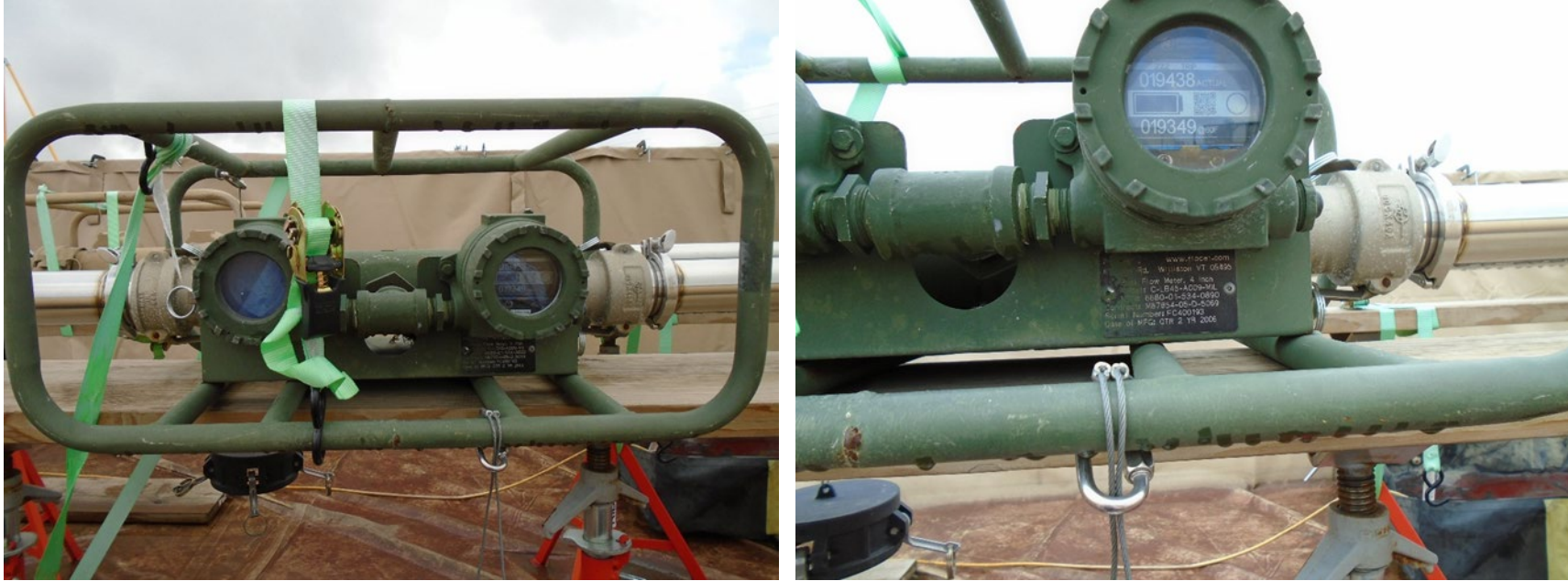


Figure A-8. Candidate Flow Meter #6 (4 inch)

Table A-8. Candidate Flow Meter #6 Details

S/N:	FC400193
Model/Part No.:	C-LB45-A009-MIL
NSN:	6680-01-534-0890
Manufacturer:	FloCat (modified by Penn State)
Style:	Turbine

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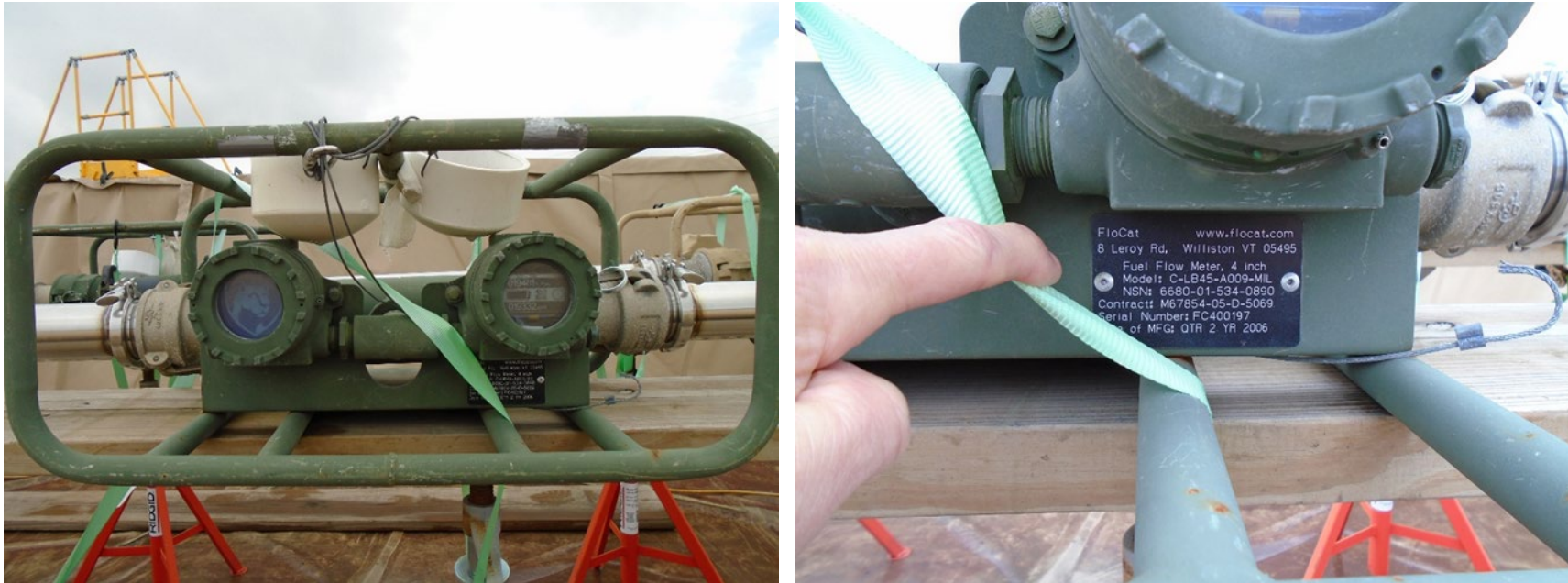


Figure A-9. Candidate Flow Meter #7 (4 inch)

Table A-9. Candidate Flow Meter #7 Details

S/N:	FC400197
Model/Part No.:	C-LB45-A009-MIL
NSN:	6680-01-534-0890
Manufacturer:	FloCat (modified by Penn State)
Style:	Turbine

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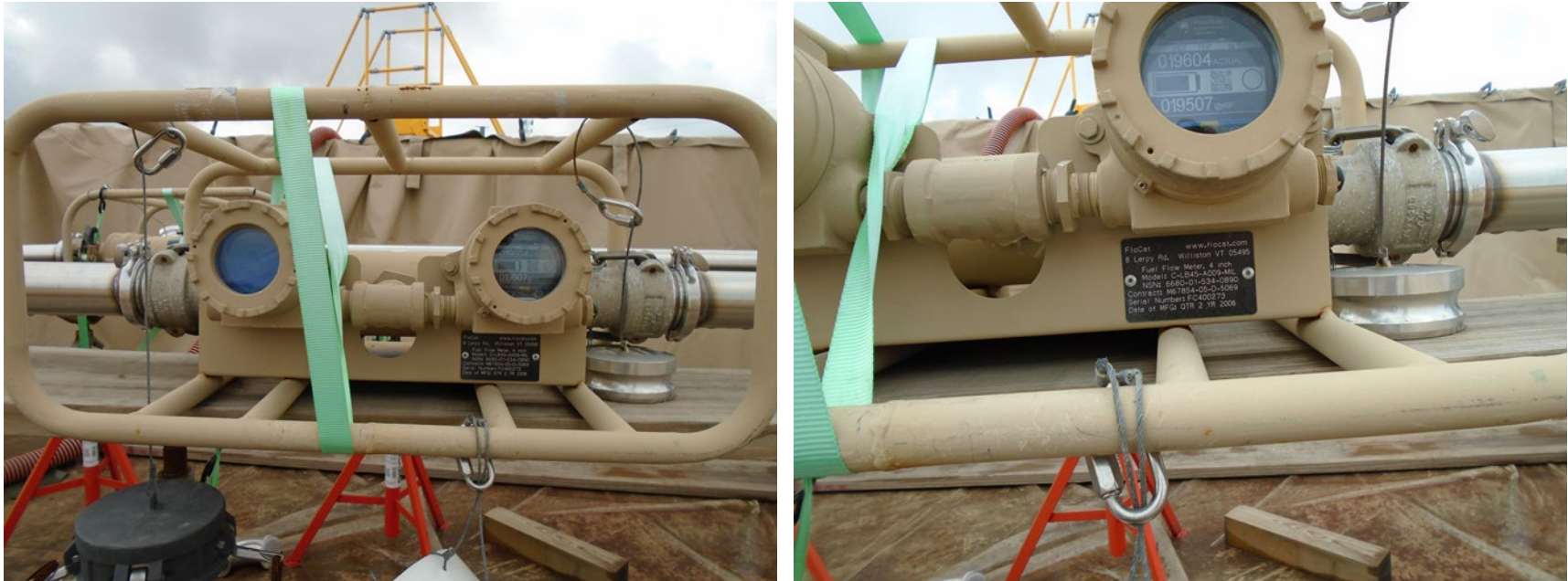


Figure A-10. Candidate Flow Meter #8 (4 inch)

Table A-10. Candidate Flow Meter #8 Details

S/N:	FC400273
Model/Part No.:	C-LB45-A009-MIL
NSN:	6680-01-534-0890
Manufacturer:	FloCat (modified by Penn State)
Style:	Turbine

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Figure A-11. Candidate Flow Meter #9 (2 inch)

Table A-11. Candidate Flow Meter #9 Details

S/N:	N/A (no exterior badging present)
Model/Part No.:	EMMU
NSN:	N/A
Manufacturer:	FUELTRAX
Style:	Coriolis

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Figure A-12. Candidate Flow Meter #10 (3 inch)

Table A-12. Candidate Flow Meter #10 Details

S/N:	N/A
Model/Part No.:	FTX-MMU-1010
NSN:	N/A
Manufacturer:	FUELTRAX
Style:	Coriolis

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Figure A-13. Candidate Flow Meter #11 (4 inch)

Table A-13. Candidate Flow Meter #11 Details

S/N:	N/A
Model/Part No.:	CSA12021
NSN:	N/A
Manufacturer:	Not provided
Style:	Vortex

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Table A-14. Tactical Fuel Gauge System Details

S/N:	
Model/Part No.:	N7660AT2B1A
NSN:	N/A
Manufacturer:	Varec
Style:	Pressure Transducer (in tank)

**Figure A-14. Top Row (Left to Right)—Varec Cables and Control Boxes, Positive Displacement Flow Meter Used for Varec Virtual Strapping Chart Setup, Single Varec Cable/Probe Assembly
Bottom Left—Varec Cables to Probes Installation Through CFT Vent Pipes (Yellow Arrows)**

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APPENDIX B

Custom Strapping Charts

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MPC 3S7A6

Tactical Fuel Bladder Gauge Calibration Chart (Page 1 of 2)													
Use this spreadsheet to locally develop a bladder gauge chart for each tactical bladder IAW the ARCENT Petroleum Accountability and Reporting Procedures MOI and Collapsible Tank Strapping and Gauging Procedures Instructions.													
Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity
0		6"		1' 0"	3,840	1' 6"	5,760	2' 0"	7,680	2' 6"	9,600	3' 0"	11,455
1/8"		1/8"		1/8"	3,880	1/8"	5,800	1/8"	7,720	1/8"	9,640	1/8"	11,477
1/4"		1/4"		1/4"	3,920	1/4"	5,840	1/4"	7,760	1/4"	9,680	1/4"	11,500
3/8"		3/8"		3/8"	3,960	3/8"	5,880	3/8"	7,800	3/8"	9,720	3/8"	11,523
1/2"		1/2"		1/2"	4,000	1/2"	5,920	1/2"	7,840	1/2"	9,760	1/2"	11,545
5/8"		5/8"		5/8"	4,040	5/8"	5,960	5/8"	7,880	5/8"	9,800	5/8"	11,568
3/4"		3/4"		3/4"	4,080	3/4"	6,000	3/4"	7,920	3/4"	9,840	3/4"	11,591
7/8"		7/8"		7/8"	4,120	7/8"	6,040	7/8"	7,960	7/8"	9,880	7/8"	11,614
1"		7"		1' 1"	4,160	1' 7"	6,080	2' 1"	8,000	2' 7"	9,920	3' 1"	11,636
1/8"		1/8"		1/8"	4,200	1/8"	6,120	1/8"	8,040	1/8"	9,960	1/8"	11,659
1/4"		1/4"		1/4"	4,240	1/4"	6,160	1/4"	8,080	1/4"	10,000	1/4"	11,682
3/8"		3/8"		3/8"	4,280	3/8"	6,200	3/8"	8,120	3/8"	10,056	3/8"	11,705
1/2"		1/2"		1/2"	4,320	1/2"	6,240	1/2"	8,160	1/2"	10,111	1/2"	11,727
5/8"		5/8"		5/8"	4,360	5/8"	6,280	5/8"	8,200	5/8"	10,167	5/8"	11,750
3/4"		3/4"		3/4"	4,400	3/4"	6,320	3/4"	8,240	3/4"	10,222	3/4"	11,773
7/8"		7/8"		7/8"	4,440	7/8"	6,360	7/8"	8,280	7/8"	10,278	7/8"	11,795
2"		8"		1' 2"	4,480	1' 8"	6,400	2' 2"	8,320	2' 8"	10,333	3' 2"	11,818
1/8"		1/8"		1/8"	4,520	1/8"	6,440	1/8"	8,360	1/8"	10,389	1/8"	11,841
1/4"		1/4"		1/4"	4,560	1/4"	6,480	1/4"	8,400	1/4"	10,444	1/4"	11,864
3/8"		3/8"		3/8"	4,600	3/8"	6,520	3/8"	8,440	3/8"	10,500	3/8"	11,886
1/2"		1/2"		1/2"	4,640	1/2"	6,560	1/2"	8,480	1/2"	10,556	1/2"	11,909
5/8"		5/8"		5/8"	4,680	5/8"	6,600	5/8"	8,520	5/8"	10,611	5/8"	11,932
3/4"		3/4"		3/4"	4,720	3/4"	6,640	3/4"	8,560	3/4"	10,667	3/4"	11,955
7/8"		7/8"		7/8"	4,760	7/8"	6,680	7/8"	8,600	7/8"	10,722	7/8"	11,977
3"		9"		1' 3"	4,800	1' 9"	6,720	2' 3"	8,640	2' 9"	10,778	3' 3"	12,000
1/8"		1/8"		1/8"	4,840	1/8"	6,760	1/8"	8,680	1/8"	10,833	1/8"	12,050
1/4"		1/4"		1/4"	4,880	1/4"	6,800	1/4"	8,720	1/4"	10,889	1/4"	12,100
3/8"		3/8"		3/8"	4,920	3/8"	6,840	3/8"	8,760	3/8"	10,944	3/8"	12,150
1/2"		1/2"		1/2"	4,960	1/2"	6,880	1/2"	8,800	1/2"	11,000	1/2"	12,200
5/8"		5/8"		5/8"	5,000	5/8"	6,920	5/8"	8,840	5/8"	11,023	5/8"	12,250
3/4"		3/4"		3/4"	5,040	3/4"	6,960	3/4"	8,880	3/4"	11,045	3/4"	12,300
7/8"		7/8"		7/8"	5,080	7/8"	7,000	7/8"	8,920	7/8"	11,068	7/8"	12,350
4"		10"		1' 4"	5,120	1' 10"	7,040	2' 4"	8,960	2' 10"	11,091	3' 4"	12,400
1/8"		1/8"		1/8"	5,160	1/8"	7,080	1/8"	9,000	1/8"	11,114	1/8"	12,450
1/4"		1/4"		1/4"	5,200	1/4"	7,120	1/4"	9,040	1/4"	11,136	1/4"	12,500
3/8"		3/8"		3/8"	5,240	3/8"	7,160	3/8"	9,080	3/8"	11,159	3/8"	12,550
1/2"		1/2"		1/2"	5,280	1/2"	7,200	1/2"	9,120	1/2"	11,182	1/2"	12,600
5/8"		5/8"		5/8"	5,320	5/8"	7,240	5/8"	9,160	5/8"	11,205	5/8"	12,650
3/4"		3/4"		3/4"	5,360	3/4"	7,280	3/4"	9,200	3/4"	11,227	3/4"	12,700
7/8"		7/8"		7/8"	5,400	7/8"	7,320	7/8"	9,240	7/8"	11,250	7/8"	12,750
5"		11"		1' 5"	5,440	1' 11"	7,360	2' 5"	9,280	2' 11"	11,273	3' 5"	12,800
1/8"		1/8"		1/8"	5,480	1/8"	7,400	1/8"	9,320	1/8"	11,295	1/8"	12,850
1/4"		1/4"		1/4"	5,520	1/4"	7,440	1/4"	9,360	1/4"	11,318	1/4"	12,900
3/8"		3/8"		3/8"	5,560	3/8"	7,480	3/8"	9,400	3/8"	11,341	3/8"	12,950
1/2"		1/2"		1/2"	5,600	1/2"	7,520	1/2"	9,440	1/2"	11,364	1/2"	13,000
5/8"		5/8"		5/8"	5,640	5/8"	7,560	5/8"	9,480	5/8"	11,386	5/8"	13,036
3/4"		3/4"		3/4"	5,680	3/4"	7,600	3/4"	9,520	3/4"	11,409	3/4"	13,071
7/8"		7/8"		7/8"	5,720	7/8"	7,640	7/8"	9,560	7/8"	11,432	7/8"	13,107

Figure B-1. Strapping Chart for MPC 3S7A6 Developed from Initial Fill Data

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Tactical Fuel Bladder Gauge Calibration Chart (Page 2 of 2)											
Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity
3' 6"	13,139	4' 0"	14,667	4' 6"	16,238	5' 0"	17,500	5' 6"	19,601	6' 0"	
1/8"	13,179	1/8"	14,694	1/8"	16,262	1/8"	17,531	1/8"	19,651	1/8"	
1/4"	13,214	1/4"	14,722	1/4"	16,286	1/4"	17,563	1/4"	19,701	1/4"	
3/8"	13,250	3/8"	14,750	3/8"	16,310	3/8"	17,594	3/8"	19,751	3/8"	
1/2"	13,286	1/2"	14,778	1/2"	16,333	1/2"	17,625	1/2"	19,801	1/2"	
5/8"	13,321	5/8"	14,806	5/8"	16,357	5/8"	17,656	5/8"	19,851	5/8"	
3/4"	13,357	3/4"	14,833	3/4"	16,381	3/4"	17,688	3/4"	19,901	3/4"	
7/8"	13,393	7/8"	14,861	7/8"	16,405	7/8"	17,719	7/8"	19,951	7/8"	
3' 7"	13,429	4' 1"	14,889	4' 7"	16,429	5' 1"	17,750	5' 7"	20,001	6' 1"	
1/8"	13,464	1/8"	14,917	1/8"	16,452	1/8"	17,781	1/8"	20,051		
1/4"	13,500	1/4"	14,944	1/4"	16,476	1/4"	17,813	1/4"	20,101		
3/8"	13,536	3/8"	14,972	3/8"	16,500	3/8"	17,844	3/8"	20,151		
1/2"	13,571	1/2"	15,000	1/2"	16,524	1/2"	17,875	1/2"	20,201		
5/8"	13,607	5/8"	15,038	5/8"	16,548	5/8"	17,906	5/8"	20,251		
3/4"	13,643	3/4"	15,077	3/4"	16,571	3/4"	17,938	3/4"	20,301		
7/8"	13,679	7/8"	15,115	7/8"	16,595	7/8"	17,969	7/8"	20,351		
3' 8"	13,714	4' 2"	15,154	4' 8"	16,619	5' 2"	18,000	5' 8"	20,401		
1/8"	13,750	1/8"	15,192	1/8"	16,643	1/8"	18,050	1/8"	20,451		
1/4"	13,786	1/4"	15,231	1/4"	16,667	1/4"	18,100	1/4"	20,502		
3/8"	13,821	3/8"	15,269	3/8"	16,690	3/8"	18,150	3/8"	20,552		
1/2"	13,857	1/2"	15,308	1/2"	16,714	1/2"	18,200	1/2"	20,602		
5/8"	13,893	5/8"	15,346	5/8"	16,738	5/8"	18,250	5/8"	20,652		
3/4"	13,929	3/4"	15,385	3/4"	16,762	3/4"	18,300	3/4"	20,702		
7/8"	13,964	7/8"	15,423	7/8"	16,786	7/8"	18,350	7/8"	20,752		
3' 9"	14,000	4' 3"	15,462	4' 9"	16,810	5' 3"	18,400	5' 9"	20,802		
1/8"	14,028	1/8"	15,500	1/8"	16,833	1/8"	18,450	1/8"	20,852		
1/4"	14,056	1/4"	15,538	1/4"	16,857	1/4"	18,500	1/4"	20,902		
3/8"	14,083	3/8"	15,577	3/8"	16,881	3/8"	18,550	3/8"	20,952		
1/2"	14,111	1/2"	15,615	1/2"	16,905	1/2"	18,600	1/2"	21,002		
5/8"	14,139	5/8"	15,654	5/8"	16,929	5/8"	18,650	5/8"	21,052		
3/4"	14,167	3/4"	15,692	3/4"	16,952	3/4"	18,700	3/4"	21,102		
7/8"	14,194	7/8"	15,731	7/8"	16,976	7/8"	18,750	7/8"	21,152		
3' 10"	14,222	4' 4"	15,769	4' 10"	17,000	5' 4"	18,800	5' 10"	21,202		
1/8"	14,250	1/8"	15,808	1/8"	17,031	1/8"	18,850	1/8"			
1/4"	14,278	1/4"	15,846	1/4"	17,063	1/4"	18,900	1/4"			
3/8"	14,306	3/8"	15,885	3/8"	17,094	3/8"	18,950	3/8"			
1/2"	14,333	1/2"	15,923	1/2"	17,125	1/2"	19,000	1/2"			
5/8"	14,361	5/8"	15,962	5/8"	17,156	5/8"	19,050	5/8"			
3/4"	14,389	3/4"	16,000	3/4"	17,188	3/4"	19,100	3/4"			
7/8"	14,417	7/8"	16,024	7/8"	17,219	7/8"	19,150	7/8"			
3' 11"	14,444	4' 5"	16,048	4' 11"	17,250	5' 5"	19,200	5' 11"			
1/8"	14,472	1/8"	16,071	1/8"	17,281	1/8"	19,250	1/8"			
1/4"	14,500	1/4"	16,095	1/4"	17,313	1/4"	19,300	1/4"			
3/8"	14,528	3/8"	16,119	3/8"	17,344	3/8"	19,350	3/8"			
1/2"	14,556	1/2"	16,143	1/2"	17,375	1/2"	19,400	1/2"			
5/8"	14,583	5/8"	16,167	5/8"	17,406	5/8"	19,450	5/8"			
3/4"	14,611	3/4"	16,190	3/4"	17,438	3/4"	19,501	3/4"			
7/8"	14,639	7/8"	16,214	7/8"	17,469	7/8"	19,551	7/8"			

Figure B-2. Strapping Chart for MPC 3S7A6 Developed from Initial Fill Data (Continued)

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JGB Nitrile #2

Tactical Fuel Bladder Gauge Calibration Chart (Page 1 of 2)													
Use this spreadsheet to locally develop a bladder gauge chart for each tactical bladder IAW the ARCENT Petroleum Accountability and Reporting Procedures MOI and Collapsible Tank Strapping and Gauging Procedures Instructions.													
Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity
0		6"	2,049	1' 0	4,098	1' 6"	6,146	2" 0"	8,200	2' 6"	10,429	3' 0"	12,176
1/8"		1/8"	2,091	1/8"	4,140	1/8"	6,189	1/8"	8,300	1/8"	10,464	1/8"	12,206
1/4"		1/4"	2,134	1/4"	4,183	1/4"	6,232	1/4"	8,400	1/4"	10,500	1/4"	12,235
3/8"		3/8"	2,177	3/8"	4,226	3/8"	6,274	3/8"	8,500	3/8"	10,536	3/8"	12,265
1/2"		1/2"	2,220	1/2"	4,268	1/2"	6,317	1/2"	8,600	1/2"	10,571	1/2"	12,294
5/8"		5/8"	2,262	5/8"	4,311	5/8"	6,360	5/8"	8,700	5/8"	10,607	5/8"	12,324
3/4"		3/4"	2,305	3/4"	4,354	3/4"	6,402	3/4"	8,800	3/4"	10,643	3/4"	12,353
7/8"		7/8"	2,348	7/8"	4,396	7/8"	6,445	7/8"	8,900	7/8"	10,679	7/8"	12,382
1"		7"	2,390	1' 1"	4,439	1' 7"	6,488	2' 1"	9,000	2' 7"	10,714	3' 1"	12,412
1/8"		1/8"	2,433	1/8"	4,482	1/8"	6,530	1/8"	9,036	1/8"	10,750	1/8"	12,441
1/4"		1/4"	2,476	1/4"	4,524	1/4"	6,573	1/4"	9,071	1/4"	10,786	1/4"	12,471
3/8"		3/8"	2,518	3/8"	4,567	3/8"	6,616	3/8"	9,107	3/8"	10,821	3/8"	12,500
1/2"		1/2"	2,561	1/2"	4,610	1/2"	6,659	1/2"	9,143	1/2"	10,857	1/2"	12,529
5/8"		5/8"	2,604	5/8"	4,652	5/8"	6,701	5/8"	9,179	5/8"	10,893	5/8"	12,559
3/4"		3/4"	2,646	3/4"	4,695	3/4"	6,744	3/4"	9,214	3/4"	10,929	3/4"	12,588
7/8"		7/8"	2,689	7/8"	4,738	7/8"	6,787	7/8"	9,250	7/8"	10,964	7/8"	12,618
2"		8"	2,732	1' 2"	4,780	1' 8"	6,829	2' 2"	9,286	2' 8"	11,000	3' 2"	12,647
1/8"		1/8"	2,774	1/8"	4,823	1/8"	6,872	1/8"	9,321	1/8"	11,038	1/8"	12,676
1/4"		1/4"	2,817	1/4"	4,866	1/4"	6,915	1/4"	9,357	1/4"	11,077	1/4"	12,706
3/8"		3/8"	2,860	3/8"	4,909	3/8"	6,957	3/8"	9,393	3/8"	11,115	3/8"	12,735
1/2"		1/2"	2,902	1/2"	4,951	1/2"	7,000	1/2"	9,429	1/2"	11,154	1/2"	12,765
5/8"		5/8"	2,945	5/8"	4,994	5/8"	7,038	5/8"	9,464	5/8"	11,192	5/8"	12,794
3/4"		3/4"	2,988	3/4"	5,037	3/4"	7,077	3/4"	9,500	3/4"	11,231	3/4"	12,824
7/8"		7/8"	3,030	7/8"	5,079	7/8"	7,115	7/8"	9,536	7/8"	11,269	7/8"	12,853
3"		9"	3,073	1' 3"	5,122	1' 9"	7,154	2' 3"	9,571	2' 9"	11,308	3' 3"	12,882
1/8"		1/8"	3,116	1/8"	5,165	1/8"	7,192	1/8"	9,607	1/8"	11,346	1/8"	12,912
1/4"		1/4"	3,159	1/4"	5,207	1/4"	7,231	1/4"	9,643	1/4"	11,385	1/4"	12,941
3/8"		3/8"	3,201	3/8"	5,250	3/8"	7,269	3/8"	9,679	3/8"	11,423	3/8"	12,971
1/2"		1/2"	3,244	1/2"	5,293	1/2"	7,308	1/2"	9,714	1/2"	11,462	1/2"	13,000
5/8"		5/8"	3,287	5/8"	5,335	5/8"	7,346	5/8"	9,750	5/8"	11,500	5/8"	13,036
3/4"		3/4"	3,329	3/4"	5,378	3/4"	7,385	3/4"	9,786	3/4"	11,538	3/4"	13,071
7/8"		7/8"	3,372	7/8"	5,421	7/8"	7,423	7/8"	9,821	7/8"	11,577	7/8"	13,107
4"		10"	3,415	1' 4"	5,463	1' 10"	7,462	2' 4"	9,857	2' 10"	11,615	3' 4"	13,143
1/8"		1/8"	3,457	1/8"	5,506	1/8"	7,500	1/8"	9,893	1/8"	11,654	1/8"	13,179
1/4"		1/4"	3,500	1/4"	5,549	1/4"	7,538	1/4"	9,929	1/4"	11,692	1/4"	13,214
3/8"		3/8"	3,543	3/8"	5,591	3/8"	7,577	3/8"	9,964	3/8"	11,731	3/8"	13,250
1/2"		1/2"	3,585	1/2"	5,634	1/2"	7,615	1/2"	10,000	1/2"	11,769	1/2"	13,286
5/8"		5/8"	3,628	5/8"	5,677	5/8"	7,654	5/8"	10,036	5/8"	11,808	5/8"	13,321
3/4"		3/4"	3,671	3/4"	5,720	3/4"	7,692	3/4"	10,071	3/4"	11,846	3/4"	13,357
7/8"		7/8"	3,713	7/8"	5,762	7/8"	7,731	7/8"	10,107	7/8"	11,885	7/8"	13,393
5"		11"	3,756	1' 5"	5,805	1' 11"	7,769	2' 5"	10,143	2' 11"	11,923	3' 5"	13,429
1/8"		1/8"	3,799	1/8"	5,848	1/8"	7,808	1/8"	10,179	1/8"	11,962	1/8"	13,464
1/4"		1/4"	3,841	1/4"	5,890	1/4"	7,846	1/4"	10,214	1/4"	12,000	1/4"	13,500
3/8"		3/8"	3,884	3/8"	5,933	3/8"	7,885	3/8"	10,250	3/8"	12,029	3/8"	13,536
1/2"		1/2"	3,927	1/2"	5,976	1/2"	7,923	1/2"	10,286	1/2"	12,059	1/2"	13,571
5/8"		5/8"	3,970	5/8"	6,018	5/8"	7,962	5/8"	10,321	5/8"	12,088	5/8"	13,607
3/4"		3/4"	4,012	3/4"	6,061	3/4"	8,000	3/4"	10,357	3/4"	12,118	3/4"	13,643
7/8"		7/8"	4,055	7/8"	6,104	7/8"	8,100	7/8"	10,393	7/8"	12,147	7/8"	13,679

Figure B-3. Strapping Chart for JGB Nitrile #2 Developed from Initial Fill Data

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Tactical Fuel Bladder Gauge Calibration Chart (Page 2 of 2)											
Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity
3' 6"	13,714	4' 0"	15,444	4' 6"	16,933	5' 0"	18,500	5' 6"		6' 0"	
1/8"	13,750	1/8"	15,472	1/8"	16,967	1/8"	18,536	1/8"		1/8"	
1/4"	13,786	1/4"	15,500	1/4"	17,000	1/4"	18,571	1/4"		1/4"	
3/8"	13,821	3/8"	15,528	3/8"	17,031	3/8"	18,607	3/8"		3/8"	
1/2"	13,857	1/2"	15,556	1/2"	17,063	1/2"	18,643	1/2"		1/2"	
5/8"	13,893	5/8"	15,583	5/8"	17,094	5/8"	18,679	5/8"		5/8"	
3/4"	13,929	3/4"	15,611	3/4"	17,125	3/4"	18,714	3/4"		3/4"	
7/8"	13,964	7/8"	15,639	7/8"	17,156	7/8"	18,750	7/8"		7/8"	
3' 7"	14,000	4' 1"	15,667	4' 7"	17,188	5' 1"	18,786	5' 7"		6' 1"	
1/8"	14,042	1/8"	15,694	1/8"	17,219	1/8"	18,821	1/8"			
1/4"	14,083	1/4"	15,722	1/4"	17,250	1/4"	18,857	1/4"			
3/8"	14,125	3/8"	15,750	3/8"	17,281	3/8"	18,893	3/8"			
1/2"	14,167	1/2"	15,778	1/2"	17,313	1/2"	18,929	1/2"			
5/8"	14,208	5/8"	15,806	5/8"	17,344	5/8"	18,964	5/8"			
3/4"	14,250	3/4"	15,833	3/4"	17,375	3/4"	19,000	3/4"			
7/8"	14,292	7/8"	15,861	7/8"	17,406	7/8"	19,035	7/8"			
3' 8"	14,333	4' 2"	15,889	4' 8"	17,438	5' 2"	19,070	5' 8"			
1/8"	14,375	1/8"	15,917	1/8"	17,469	1/8"	19,106	1/8"			
1/4"	14,417	1/4"	15,944	1/4"	17,500	1/4"	19,141	1/4"			
3/8"	14,458	3/8"	15,972	3/8"	17,531	3/8"	19,176	3/8"			
1/2"	14,500	1/2"	16,000	1/2"	17,563	1/2"	19,211	1/2"			
5/8"	14,542	5/8"	16,033	5/8"	17,594	5/8"	19,246	5/8"			
3/4"	14,583	3/4"	16,067	3/4"	17,625	3/4"	19,282	3/4"			
7/8"	14,625	7/8"	16,100	7/8"	17,656	7/8"	19,317	7/8"			
3' 9"	14,667	4' 3"	16,133	4' 9"	17,688	5' 3"	19,352	5' 9"			
1/8"	14,708	1/8"	16,167	1/8"	17,719	1/8"	19,387	1/8"			
1/4"	14,750	1/4"	16,200	1/4"	17,750	1/4"	19,422	1/4"			
3/8"	14,792	3/8"	16,233	3/8"	17,781	3/8"	19,458	3/8"			
1/2"	14,833	1/2"	16,267	1/2"	17,813	1/2"	19,493	1/2"			
5/8"	14,875	5/8"	16,300	5/8"	17,844	5/8"	19,528	5/8"			
3/4"	14,917	3/4"	16,333	3/4"	17,875	3/4"	19,563	3/4"			
7/8"	14,958	7/8"	16,367	7/8"	17,906	7/8"	19,598	7/8"			
3' 10"	15,000	4' 4"	16,400	4' 10"	17,938	5' 4"	19,634	5' 10"			
1/8"	15,028	1/8"	16,433	1/8"	17,969	1/8"	19,669	1/8"			
1/4"	15,056	1/4"	16,467	1/4"	18,000	1/4"	19,704	1/4"			
3/8"	15,083	3/8"	16,500	3/8"	18,036	3/8"		3/8"			
1/2"	15,111	1/2"	16,533	1/2"	18,071	1/2"		1/2"			
5/8"	15,139	5/8"	16,567	5/8"	18,107	5/8"		5/8"			
3/4"	15,167	3/4"	16,600	3/4"	18,143	3/4"		3/4"			
7/8"	15,194	7/8"	16,633	7/8"	18,179	7/8"		7/8"			
3' 11"	15,222	4' 5"	16,667	4' 11"	18,214	5' 5"		5' 11"			
1/8"	15,250	1/8"	16,700	1/8"	18,250	1/8"		1/8"			
1/4"	15,278	1/4"	16,733	1/4"	18,286	1/4"		1/4"			
3/8"	15,306	3/8"	16,767	3/8"	18,321	3/8"		3/8"			
1/2"	15,333	1/2"	16,800	1/2"	18,357	1/2"		1/2"			
5/8"	15,361	5/8"	16,833	5/8"	18,393	5/8"		5/8"			
3/4"	15,389	3/4"	16,867	3/4"	18,429	3/4"		3/4"			
7/8"	15,417	7/8"	16,900	7/8"	18,964	7/8"		7/8"			

Figure B-4. Strapping Chart for JGB Nitrile #2 Developed from Initial Fill Data (Continued)

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Jungle King

Tactical Fuel Bladder Gauge Calibration Chart (Page 1 of 2)													
Use this spreadsheet to locally develop a bladder gauge chart for each tactical bladder IAW the ARCENT Petroleum Accountability and Reporting Procedures MOI and Collapsible Tank Strapping and Gauging Procedures Instructions.													
Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity
0		6"	2,063	1' 0	4,556	1' 6"	7,222	2' 0"	9,889	2' 6"	12,200	3' 0"	14,077
1/8"		1/8"	2,094	1/8"	4,611	1/8"	7,278	1/8"	9,944	1/8"	12,250	1/8"	14,115
1/4"		1/4"	2,125	1/4"	4,667	1/4"	7,333	1/4"	10,000	1/4"	12,300	1/4"	14,154
3/8"		3/8"	2,156	3/8"	4,722	3/8"	7,389	3/8"	10,042	3/8"	12,350	3/8"	14,192
1/2"		1/2"	2,188	1/2"	4,778	1/2"	7,444	1/2"	10,083	1/2"	12,400	1/2"	14,231
5/8"		5/8"	2,219	5/8"	4,833	5/8"	7,500	5/8"	10,125	5/8"	12,450	5/8"	14,269
3/4"		3/4"	2,250	3/4"	4,889	3/4"	7,556	3/4"	10,167	3/4"	12,500	3/4"	14,308
7/8"		7/8"	2,281	7/8"	4,944	7/8"	7,611	7/8"	10,208	7/8"	12,550	7/8"	14,346
1"		7"	2,313	1' 1"	5,000	1' 7"	7,667	2' 1"	10,250	2' 7"	12,600	3' 1"	14,385
1/8"		1/8"	2,344	1/8"	5,050	1/8"	7,722	1/8"	10,292	1/8"	12,650	1/8"	14,423
1/4"		1/4"	2,375	1/4"	5,100	1/4"	7,778	1/4"	10,333	1/4"	12,700	1/4"	14,462
3/8"		3/8"	2,406	3/8"	5,150	3/8"	7,833	3/8"	10,375	3/8"	12,750	3/8"	14,500
1/2"		1/2"	2,438	1/2"	5,200	1/2"	7,889	1/2"	10,417	1/2"	12,800	1/2"	14,538
5/8"		5/8"	2,469	5/8"	5,250	5/8"	7,944	5/8"	10,458	5/8"	12,850	5/8"	14,577
3/4"		3/4"	2,500	3/4"	5,300	3/4"	8,000	3/4"	10,500	3/4"	12,900	3/4"	14,615
7/8"		7/8"	2,531	7/8"	5,350	7/8"	8,056	7/8"	10,542	7/8"	12,950	7/8"	14,654
2"		8"	2,563	1' 2"	5,400	1' 8"	8,111	2' 2"	10,583	2' 8"	13,000	3' 2"	14,692
1/8"		1/8"	2,594	1/8"	5,450	1/8"	8,167	1/8"	10,625	1/8"	13,033	1/8"	14,731
1/4"		1/4"	2,625	1/4"	5,500	1/4"	8,222	1/4"	10,667	1/4"	13,067	1/4"	14,769
3/8"		3/8"	2,656	3/8"	5,550	3/8"	8,278	3/8"	10,708	3/8"	13,100	3/8"	14,808
1/2"		1/2"	2,688	1/2"	5,600	1/2"	8,333	1/2"	10,750	1/2"	13,133	1/2"	14,846
5/8"		5/8"	2,719	5/8"	5,650	5/8"	8,389	5/8"	10,792	5/8"	13,167	5/8"	14,885
3/4"		3/4"	2,750	3/4"	5,700	3/4"	8,444	3/4"	10,833	3/4"	13,200	3/4"	14,923
7/8"		7/8"	2,781	7/8"	5,750	7/8"	8,500	7/8"	10,875	7/8"	13,233	7/8"	14,962
3"		9"	2,813	1' 3"	5,800	1' 9"	8,556	2' 3"	10,917	2' 9"	13,267	3' 3"	15,000
1/8"		1/8"	2,844	1/8"	5,850	1/8"	8,611	1/8"	10,958	1/8"	13,300	1/8"	15,036
1/4"		1/4"	2,875	1/4"	5,900	1/4"	8,667	1/4"	11,000	1/4"	13,333	1/4"	15,071
3/8"		3/8"	2,906	3/8"	5,950	3/8"	8,722	3/8"	11,056	3/8"	13,367	3/8"	15,107
1/2"	1,000	1/2"	2,938	1/2"	6,000	1/2"	8,778	1/2"	11,111	1/2"	13,400	1/2"	15,143
5/8"	1,056	5/8"	2,969	5/8"	6,063	5/8"	8,833	5/8"	11,167	5/8"	13,433	5/8"	15,179
3/4"	1,111	3/4"	3,000	3/4"	6,125	3/4"	8,889	3/4"	11,222	3/4"	13,467	3/4"	15,214
7/8"	1,167	7/8"	3,125	7/8"	6,188	7/8"	8,944	7/8"	11,278	7/8"	13,500	7/8"	15,250
4"	1,222	10"	3,250	1' 4"	6,250	1' 10"	9,000	2' 4"	11,333	2' 10"	13,533	3' 4"	15,286
1/8"	1,278	1/8"	3,375	1/8"	6,313	1/8"	9,056	1/8"	11,389	1/8"	13,567	1/8"	15,321
1/4"	1,333	1/4"	3,500	1/4"	6,375	1/4"	9,111	1/4"	11,444	1/4"	13,600	1/4"	15,357
3/8"	1,389	3/8"	3,625	3/8"	6,438	3/8"	9,167	3/8"	11,500	3/8"	13,633	3/8"	15,393
1/2"	1,444	1/2"	3,750	1/2"	6,500	1/2"	9,222	1/2"	11,556	1/2"	13,667	1/2"	15,429
5/8"	1,500	5/8"	3,875	5/8"	6,563	5/8"	9,278	5/8"	11,611	5/8"	13,700	5/8"	15,464
3/4"	1,556	3/4"	4,000	3/4"	6,625	3/4"	9,333	3/4"	11,667	3/4"	13,733	3/4"	15,500
7/8"	1,611	7/8"	4,056	7/8"	6,688	7/8"	9,389	7/8"	11,722	7/8"	13,767	7/8"	15,536
5"	1,667	11"	4,111	1' 5"	6,750	1' 11"	9,444	2' 5"	11,778	2' 11"	13,800	3' 5"	15,571
1/8"	1,722	1/8"	4,167	1/8"	6,813	1/8"	9,500	1/8"	11,833	1/8"	13,833	1/8"	15,607
1/4"	1,778	1/4"	4,222	1/4"	6,875	1/4"	9,556	1/4"	11,889	1/4"	13,867	1/4"	15,643
3/8"	1,833	3/8"	4,278	3/8"	6,938	3/8"	9,611	3/8"	11,944	3/8"	13,900	3/8"	15,679
1/2"	1,889	1/2"	4,333	1/2"	7,000	1/2"	9,667	1/2"	12,000	1/2"	13,933	1/2"	15,714
5/8"	1,944	5/8"	4,389	5/8"	7,056	5/8"	9,722	5/8"	12,050	5/8"	13,967	5/8"	15,750
3/4"	2,000	3/4"	4,444	3/4"	7,111	3/4"	9,778	3/4"	12,100	3/4"	14,000	3/4"	15,786
7/8"	2,031	7/8"	4,500	7/8"	7,167	7/8"	9,833	7/8"	12,150	7/8"	14,038	7/8"	15,821

Figure B-5. Strapping Chart for Jungle King Developed from Initial Fill Data

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Tactical Fuel Bladder Gauge Calibration Chart (Page 2 of 2)											
Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity
3' 6"	13,714	4' 0"	15,444	4' 6"	16,933	5' 0"	18,500	5' 6"		6' 0"	
1/8"	13,750	1/8"	15,472	1/8"	16,967	1/8"	18,536	1/8"		1/8"	
1/4"	13,786	1/4"	15,500	1/4"	17,000	1/4"	18,571	1/4"		1/4"	
3/8"	13,821	3/8"	15,528	3/8"	17,031	3/8"	18,607	3/8"		3/8"	
1/2"	13,857	1/2"	15,556	1/2"	17,063	1/2"	18,643	1/2"		1/2"	
5/8"	13,893	5/8"	15,583	5/8"	17,094	5/8"	18,679	5/8"		5/8"	
3/4"	13,929	3/4"	15,611	3/4"	17,125	3/4"	18,714	3/4"		3/4"	
7/8"	13,964	7/8"	15,639	7/8"	17,156	7/8"	18,750	7/8"		7/8"	
3' 7"	14,000	4' 1"	15,667	4' 7"	17,188	5' 1"	18,786	5' 7"		6' 1"	
1/8"	14,042	1/8"	15,694	1/8"	17,219	1/8"	18,821	1/8"			
1/4"	14,083	1/4"	15,722	1/4"	17,250	1/4"	18,857	1/4"			
3/8"	14,125	3/8"	15,750	3/8"	17,281	3/8"	18,893	3/8"			
1/2"	14,167	1/2"	15,778	1/2"	17,313	1/2"	18,929	1/2"			
5/8"	14,208	5/8"	15,806	5/8"	17,344	5/8"	18,964	5/8"			
3/4"	14,250	3/4"	15,833	3/4"	17,375	3/4"	19,000	3/4"			
7/8"	14,292	7/8"	15,861	7/8"	17,406	7/8"	19,035	7/8"			
3' 8"	14,333	4' 2"	15,889	4' 8"	17,438	5' 2"	19,070	5' 8"			
1/8"	14,375	1/8"	15,917	1/8"	17,469	1/8"	19,106	1/8"			
1/4"	14,417	1/4"	15,944	1/4"	17,500	1/4"	19,141	1/4"			
3/8"	14,458	3/8"	15,972	3/8"	17,531	3/8"	19,176	3/8"			
1/2"	14,500	1/2"	16,000	1/2"	17,563	1/2"	19,211	1/2"			
5/8"	14,542	5/8"	16,033	5/8"	17,594	5/8"	19,246	5/8"			
3/4"	14,583	3/4"	16,067	3/4"	17,625	3/4"	19,282	3/4"			
7/8"	14,625	7/8"	16,100	7/8"	17,656	7/8"	19,317	7/8"			
3' 9"	14,667	4' 3"	16,133	4' 9"	17,688	5' 3"	19,352	5' 9"			
1/8"	14,708	1/8"	16,167	1/8"	17,719	1/8"	19,387	1/8"			
1/4"	14,750	1/4"	16,200	1/4"	17,750	1/4"	19,422	1/4"			
3/8"	14,792	3/8"	16,233	3/8"	17,781	3/8"	19,458	3/8"			
1/2"	14,833	1/2"	16,267	1/2"	17,813	1/2"	19,493	1/2"			
5/8"	14,875	5/8"	16,300	5/8"	17,844	5/8"	19,528	5/8"			
3/4"	14,917	3/4"	16,333	3/4"	17,875	3/4"	19,563	3/4"			
7/8"	14,958	7/8"	16,367	7/8"	17,906	7/8"	19,598	7/8"			
3' 10"	15,000	4' 4"	16,400	4' 10"	17,938	5' 4"	19,634	5' 10"			
1/8"	15,028	1/8"	16,433	1/8"	17,969	1/8"	19,669	1/8"			
1/4"	15,056	1/4"	16,467	1/4"	18,000	1/4"	19,704	1/4"			
3/8"	15,083	3/8"	16,500	3/8"	18,036	3/8"		3/8"			
1/2"	15,111	1/2"	16,533	1/2"	18,071	1/2"		1/2"			
5/8"	15,139	5/8"	16,567	5/8"	18,107	5/8"		5/8"			
3/4"	15,167	3/4"	16,600	3/4"	18,143	3/4"		3/4"			
7/8"	15,194	7/8"	16,633	7/8"	18,179	7/8"		7/8"			
3' 11"	15,222	4' 5"	16,667	4' 11"	18,214	5' 5"		5' 11"			
1/8"	15,250	1/8"	16,700	1/8"	18,250	1/8"		1/8"			
1/4"	15,278	1/4"	16,733	1/4"	18,286	1/4"		1/4"			
3/8"	15,306	3/8"	16,767	3/8"	18,321	3/8"		3/8"			
1/2"	15,333	1/2"	16,800	1/2"	18,357	1/2"		1/2"			
5/8"	15,361	5/8"	16,833	5/8"	18,393	5/8"		5/8"			
3/4"	15,389	3/4"	16,867	3/4"	18,429	3/4"		3/4"			
7/8"	15,417	7/8"	16,900	7/8"	18,464	7/8"		7/8"			

Figure B-6. Strapping Chart for Jungle King Developed from Initial Fill Data (Continued)

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GTA Spiral

Tactical Fuel Bladder Gauge Calibration Chart (Page 1 of 2)													
Use this spreadsheet to locally develop a bladder gauge chart for each tactical bladder IAW the ARCENT Petroleum Accountability and Reporting Procedures MOI and Collapsible Tank Strapping and Gauging Procedures Instructions.													
Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity
0		6"	2,600	1' 0	5,400	1' 6"	7,833	2' 0"	9,923	2' 6"	12,133	3' 0"	13,786
1/8"		1/8"	2,650	1/8"	5,450	1/8"	7,875	1/8"	9,962	1/8"	12,167	1/8"	13,821
1/4"		1/4"	2,700	1/4"	5,500	1/4"	7,917	1/4"	10,000	1/4"	12,200	1/4"	13,857
3/8"		3/8"	2,750	3/8"	5,550	3/8"	7,958	3/8"	10,045	3/8"	12,233	3/8"	13,893
1/2"		1/2"	2,800	1/2"	5,600	1/2"	8,000	1/2"	10,091	1/2"	12,267	1/2"	13,929
5/8"		5/8"	2,850	5/8"	5,650	5/8"	8,050	5/8"	10,136	5/8"	12,300	5/8"	13,964
3/4"		3/4"	2,900	3/4"	5,700	3/4"	8,100	3/4"	10,182	3/4"	12,333	3/4"	14,000
7/8"		7/8"	2,950	7/8"	5,750	7/8"	8,150	7/8"	10,227	7/8"	12,367	7/8"	14,045
1"		7"	3,000	1' 1"	5,800	1' 7"	8,200	2' 1"	10,273	2' 7"	12,400	3' 1"	14,091
1/8"		1/8"	3,071	1/8"	5,850	1/8"	8,250	1/8"	10,318	1/8"	12,433	1/8"	14,136
1/4"		1/4"	3,143	1/4"	5,900	1/4"	8,300	1/4"	10,364	1/4"	12,467	1/4"	14,182
3/8"		3/8"	3,214	3/8"	5,950	3/8"	8,350	3/8"	10,409	3/8"	12,500	3/8"	14,227
1/2"		1/2"	3,286	1/2"	6,000	1/2"	8,400	1/2"	10,455	1/2"	12,533	1/2"	14,273
5/8"		5/8"	3,357	5/8"	6,063	5/8"	8,450	5/8"	10,500	5/8"	12,567	5/8"	14,318
3/4"		3/4"	3,429	3/4"	6,125	3/4"	8,500	3/4"	10,545	3/4"	12,600	3/4"	14,364
7/8"		7/8"	3,500	7/8"	6,188	7/8"	8,550	7/8"	10,591	7/8"	12,633	7/8"	14,409
2"	1,000	8"	3,571	1' 2"	6,250	1' 8"	8,600	2' 2"	10,636	2' 8"	12,667	3' 2"	14,455
1/8"	1,050	1/8"	3,643	1/8"	6,313	1/8"	8,650	1/8"	10,682	1/8"	12,700	1/8"	14,500
1/4"	1,100	1/4"	3,714	1/4"	6,375	1/4"	8,700	1/4"	10,727	1/4"	12,733	1/4"	14,545
3/8"	1,150	3/8"	3,786	3/8"	6,438	3/8"	8,750	3/8"	10,773	3/8"	12,767	3/8"	14,591
1/2"	1,200	1/2"	3,857	1/2"	6,500	1/2"	8,800	1/2"	10,818	1/2"	12,800	1/2"	14,636
5/8"	1,250	5/8"	3,929	5/8"	6,563	5/8"	8,850	5/8"	10,864	5/8"	12,833	5/8"	14,682
3/4"	1,300	3/4"	4,000	3/4"	6,625	3/4"	8,900	3/4"	10,909	3/4"	12,867	3/4"	14,727
7/8"	1,350	7/8"	4,056	7/8"	6,688	7/8"	8,950	7/8"	10,955	7/8"	12,900	7/8"	14,773
3"	1,400	9"	4,111	1' 3"	6,750	1' 9"	9,000	2' 3"	11,000	2' 9"	12,933	3' 3"	14,818
1/8"	1,450	1/8"	4,167	1/8"	6,813	1/8"	9,038	1/8"	11,050	1/8"	12,967	1/8"	14,864
1/4"	1,500	1/4"	4,222	1/4"	6,875	1/4"	9,077	1/4"	11,100	1/4"	13,000	1/4"	14,909
3/8"	1,550	3/8"	4,278	3/8"	6,938	3/8"	9,115	3/8"	11,150	3/8"	13,036	3/8"	14,955
1/2"	1,600	1/2"	4,333	1/2"	7,000	1/2"	9,154	1/2"	11,200	1/2"	13,071	1/2"	15,000
5/8"	1,650	5/8"	4,389	5/8"	7,042	5/8"	9,192	5/8"	11,250	5/8"	13,107	5/8"	15,033
3/4"	1,700	3/4"	4,444	3/4"	7,083	3/4"	9,231	3/4"	11,300	3/4"	13,143	3/4"	15,067
7/8"	1,750	7/8"	4,500	7/8"	7,125	7/8"	9,269	7/8"	11,350	7/8"	13,179	7/8"	15,100
4"	1,800	10"	4,556	1' 4"	7,167	1' 10"	9,308	2' 4"	11,400	2' 10"	13,214	3' 4"	15,133
1/8"	1,850	1/8"	4,611	1/8"	7,208	1/8"	9,346	1/8"	11,450	1/8"	13,250	1/8"	15,167
1/4"	1,900	1/4"	4,667	1/4"	7,250	1/4"	9,385	1/4"	11,500	1/4"	13,286	1/4"	15,200
3/8"	1,950	3/8"	4,722	3/8"	7,292	3/8"	9,423	3/8"	11,550	3/8"	13,321	3/8"	15,233
1/2"	2,000	1/2"	4,778	1/2"	7,333	1/2"	9,462	1/2"	11,600	1/2"	13,357	1/2"	15,267
5/8"	2,050	5/8"	4,833	5/8"	7,375	5/8"	9,500	5/8"	11,650	5/8"	13,393	5/8"	15,300
3/4"	2,100	3/4"	4,889	3/4"	7,417	3/4"	9,538	3/4"	11,700	3/4"	13,429	3/4"	15,333
7/8"	2,150	7/8"	4,944	7/8"	7,458	7/8"	9,577	7/8"	11,750	7/8"	13,464	7/8"	15,367
5"	2,200	11"	5,000	1' 5"	7,500	1' 11"	9,615	2' 5"	11,800	2' 11"	13,500	3' 5"	15,400
1/8"	2,250	1/8"	5,050	1/8"	7,542	1/8"	9,654	1/8"	11,850	1/8"	13,536	1/8"	15,433
1/4"	2,300	1/4"	5,100	1/4"	7,583	1/4"	9,692	1/4"	11,900	1/4"	13,571	1/4"	15,467
3/8"	2,350	3/8"	5,150	3/8"	7,625	3/8"	9,731	3/8"	11,950	3/8"	13,607	3/8"	15,500
1/2"	2,400	1/2"	5,200	1/2"	7,667	1/2"	9,769	1/2"	12,000	1/2"	13,643	1/2"	15,533
5/8"	2,450	5/8"	5,250	5/8"	7,708	5/8"	9,808	5/8"	12,033	5/8"	13,679	5/8"	15,567
3/4"	2,500	3/4"	5,300	3/4"	7,750	3/4"	9,846	3/4"	12,067	3/4"	13,714	3/4"	15,600
7/8"	2,550	7/8"	5,350	7/8"	7,792	7/8"	9,885	7/8"	12,100	7/8"	13,750	7/8"	15,633

Figure B-7. Strapping Chart for GTA Spiral Developed from Initial Fill Data

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Tactical Fuel Bladder Gauge Calibration Chart (Page 2 of 2)											
Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity
3' 6"	15,667	4' 0"	17,500	4' 6"	18,895	5' 0"		5' 6"		6' 0"	
1/8"	15,700	1/8"	17,536	1/8"	18,921	1/8"		1/8"		1/8"	
1/4"	15,733	1/4"	17,571	1/4"	18,947	1/4"		1/4"		1/4"	
3/8"	15,767	3/8"	17,607	3/8"	18,974	3/8"		3/8"		3/8"	
1/2"	15,800	1/2"	17,643	1/2"	19,000	1/2"		1/2"		1/2"	
5/8"	15,833	5/8"	17,679	5/8"	19,031	5/8"		5/8"		5/8"	
3/4"	15,867	3/4"	17,714	3/4"	19,063	3/4"		3/4"		3/4"	
7/8"	15,900	7/8"	17,750	7/8"	19,094	7/8"		7/8"		7/8"	
3' 7"	15,933	4' 1"	17,786	4' 7"	19,125	5' 1"		5' 7"		6' 1"	
1/8"	15,967	1/8"	17,821	1/8"	19,156	1/8"		1/8"			
1/4"	16,000	1/4"	17,857	1/4"	19,188	1/4"		1/4"			
3/8"	16,042	3/8"	17,893	3/8"	19,219	3/8"		3/8"			
1/2"	16,083	1/2"	17,929	1/2"	19,250	1/2"		1/2"			
5/8"	16,125	5/8"	17,964	5/8"	19,282	5/8"		5/8"			
3/4"	16,167	3/4"	18,000	3/4"	19,313	3/4"		3/4"			
7/8"	16,208	7/8"	18,026	7/8"	19,344	7/8"		7/8"			
3' 8"	16,250	4' 2"	18,053	4' 8"	19,375	5' 2"		5' 8"			
1/8"	16,292	1/8"	18,079	1/8"	19,407	1/8"		1/8"			
1/4"	16,333	1/4"	18,105	1/4"	19,438	1/4"		1/4"			
3/8"	16,375	3/8"	18,132	3/8"	19,469	3/8"		3/8"			
1/2"	16,417	1/2"	18,158	1/2"	19,501	1/2"		1/2"			
5/8"	16,458	5/8"	18,184	5/8"	19,532	5/8"		5/8"			
3/4"	16,500	3/4"	18,211	3/4"	19,563	3/4"		3/4"			
7/8"	16,542	7/8"	18,237	7/8"	19,594	7/8"		7/8"			
3' 9"	16,583	4' 3"	18,263	4' 9"	19,626	5' 3"		5' 9"			
1/8"	16,625	1/8"	18,289	1/8"	19,657	1/8"		1/8"			
1/4"	16,667	1/4"	18,316	1/4"	19,688	1/4"		1/4"			
3/8"	16,708	3/8"	18,342	3/8"	19,719	3/8"		3/8"			
1/2"	16,750	1/2"	18,368	1/2"	19,751	1/2"		1/2"			
5/8"	16,792	5/8"	18,395	5/8"	19,782	5/8"		5/8"			
3/4"	16,833	3/4"	18,421	3/4"	19,813	3/4"		3/4"			
7/8"	16,875	7/8"	18,447	7/8"	19,845	7/8"		7/8"			
3' 10"	16,917	4' 4"	18,474	4' 10"	19,876	5' 4"		5' 10"			
1/8"	16,958	1/8"	18,500	1/8"	19,907	1/8"		1/8"			
1/4"	17,000	1/4"	18,526	1/4"	19,938	1/4"		1/4"			
3/8"	17,036	3/8"	18,553	3/8"	19,970	3/8"		3/8"			
1/2"	17,071	1/2"	18,579	1/2"	20,001	1/2"		1/2"			
5/8"	17,107	5/8"	18,605	5/8"		5/8"		5/8"			
3/4"	17,143	3/4"	18,632	3/4"		3/4"		3/4"			
7/8"	17,179	7/8"	18,658	7/8"		7/8"		7/8"			
3' 11"	17,214	4' 5"	18,684	4' 11"		5' 5"		5' 11"			
1/8"	17,250	1/8"	18,711	1/8"		1/8"		1/8"			
1/4"	17,286	1/4"	18,737	1/4"		1/4"		1/4"			
3/8"	17,321	3/8"	18,763	3/8"		3/8"		3/8"			
1/2"	17,357	1/2"	18,789	1/2"		1/2"		1/2"			
5/8"	17,393	5/8"	18,816	5/8"		5/8"		5/8"			
3/4"	17,429	3/4"	18,842	3/4"		3/4"		3/4"			
7/8"	17,464	7/8"	18,868	7/8"		7/8"		7/8"			

Figure B-8. Strapping Chart for GTA Spiral Developed from Initial Fill Data (Continued)

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Desert King

Tactical Fuel Bladder Gauge Calibration Chart (Page 1 of 2)													
Use this spreadsheet to locally develop a bladder gauge chart for each tactical bladder IAW the ARCENT Petroleum Accountability and Reporting Procedures MOI and Collapsible Tank Strapping and Gauging Procedures Instructions.													
Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity
0		6"	1,444	1' 0	4,000	1' 6"	6,727	2' 0"	9,400	2' 6"	11,600	3' 0"	13,538
1/8"		1/8"	1,500	1/8"	4,050	1/8"	6,773	1/8"	9,450	1/8"	11,650	1/8"	13,577
1/4"		1/4"	1,556	1/4"	4,100	1/4"	6,818	1/4"	9,500	1/4"	11,700	1/4"	13,615
3/8"		3/8"	1,611	3/8"	4,150	3/8"	6,864	3/8"	9,550	3/8"	11,750	3/8"	13,654
1/2"		1/2"	1,667	1/2"	4,200	1/2"	6,909	1/2"	9,600	1/2"	11,800	1/2"	13,692
5/8"		5/8"	1,722	5/8"	4,250	5/8"	6,955	5/8"	9,650	5/8"	11,850	5/8"	13,731
3/4"		3/4"	1,778	3/4"	4,300	3/4"	7,000	3/4"	9,700	3/4"	11,900	3/4"	13,769
7/8"		7/8"	1,833	7/8"	4,350	7/8"	7,050	7/8"	9,750	7/8"	11,950	7/8"	13,808
1"		7"	1,889	1' 1"	4,400	1' 7"	7,100	2' 1"	9,800	2' 7"	12,000	3' 1"	13,846
1/8"		1/8"	1,944	1/8"	4,450	1/8"	7,150	1/8"	9,850	1/8"	12,038	1/8"	13,885
1/4"		1/4"	2,000	1/4"	4,500	1/4"	7,200	1/4"	9,900	1/4"	12,077	1/4"	13,923
3/8"		3/8"	2,038	3/8"	4,550	3/8"	7,250	3/8"	9,950	3/8"	12,115	3/8"	13,962
1/2"		1/2"	2,077	1/2"	4,600	1/2"	7,300	1/2"	10,000	1/2"	12,154	1/2"	14,000
5/8"		5/8"	2,115	5/8"	4,650	5/8"	7,350	5/8"	10,042	5/8"	12,192	5/8"	14,042
3/4"		3/4"	2,154	3/4"	4,700	3/4"	7,400	3/4"	10,083	3/4"	12,231	3/4"	14,083
7/8"		7/8"	2,192	7/8"	4,750	7/8"	7,450	7/8"	10,125	7/8"	12,269	7/8"	14,125
2"		8"	2,231	1' 2"	4,800	1' 8"	7,500	2' 2"	10,167	2' 8"	12,308	3' 2"	14,167
1/8"		1/8"	2,269	1/8"	4,850	1/8"	7,550	1/8"	10,208	1/8"	12,346	1/8"	14,208
1/4"		1/4"	2,308	1/4"	4,900	1/4"	7,600	1/4"	10,250	1/4"	12,385	1/4"	14,250
3/8"		3/8"	2,346	3/8"	4,950	3/8"	7,650	3/8"	10,292	3/8"	12,423	3/8"	14,292
1/2"		1/2"	2,385	1/2"	5,000	1/2"	7,700	1/2"	10,333	1/2"	12,462	1/2"	14,333
5/8"		5/8"	2,423	5/8"	5,083	5/8"	7,750	5/8"	10,375	5/8"	12,500	5/8"	14,375
3/4"		3/4"	2,462	3/4"	5,167	3/4"	7,800	3/4"	10,417	3/4"	12,538	3/4"	14,417
7/8"		7/8"	2,500	7/8"	5,250	7/8"	7,850	7/8"	10,458	7/8"	12,577	7/8"	14,458
3"		9"	2,538	1' 3"	5,333	1' 9"	7,900	2' 3"	10,500	2' 9"	12,615	3' 3"	14,500
1/8"		1/8"	2,577	1/8"	5,417	1/8"	7,950	1/8"	10,542	1/8"	12,654	1/8"	14,542
1/4"		1/4"	2,615	1/4"	5,500	1/4"	8,000	1/4"	10,583	1/4"	12,692	1/4"	14,583
3/8"		3/8"	2,654	3/8"	5,583	3/8"	8,071	3/8"	10,625	3/8"	12,731	3/8"	14,625
1/2"		1/2"	2,692	1/2"	5,667	1/2"	8,143	1/2"	10,667	1/2"	12,769	1/2"	14,667
5/8"		5/8"	2,731	5/8"	5,750	5/8"	8,214	5/8"	10,708	5/8"	12,808	5/8"	14,708
3/4"		3/4"	2,769	3/4"	5,833	3/4"	8,286	3/4"	10,750	3/4"	12,846	3/4"	14,750
7/8"		7/8"	2,808	7/8"	5,917	7/8"	8,357	7/8"	10,792	7/8"	12,885	7/8"	14,792
4"		10"	2,846	1' 4"	6,000	1' 10"	8,429	2' 4"	10,833	2' 10"	12,923	3' 4"	14,833
1/8"		1/8"	2,885	1/8"	6,045	1/8"	8,500	1/8"	10,875	1/8"	12,962	1/8"	14,875
1/4"		1/4"	2,923	1/4"	6,091	1/4"	8,571	1/4"	10,917	1/4"	13,000	1/4"	14,917
3/8"		3/8"	2,962	3/8"	6,136	3/8"	8,643	3/8"	10,958	3/8"	13,038	3/8"	14,958
1/2"		1/2"	3,000	1/2"	6,182	1/2"	8,714	1/2"	11,000	1/2"	13,077	1/2"	15,000
5/8"		5/8"	3,083	5/8"	6,227	5/8"	8,786	5/8"	11,050	5/8"	13,115	5/8"	15,050
3/4"		3/4"	3,174	3/4"	6,273	3/4"	8,857	3/4"	11,100	3/4"	13,154	3/4"	15,100
7/8"		7/8"	3,265	7/8"	6,318	7/8"	8,929	7/8"	11,150	7/8"	13,192	7/8"	15,150
5"	1,000	11"	3,356	1' 5"	6,364	1' 11"	9,000	2' 5"	11,200	2' 11"	13,231	3' 5"	15,200
1/8"	1,056	1/8"	3,447	1/8"	6,409	1/8"	9,050	1/8"	11,250	1/8"	13,269	1/8"	15,250
1/4"	1,111	1/4"	3,538	1/4"	6,455	1/4"	9,100	1/4"	11,300	1/4"	13,308	1/4"	15,300
3/8"	1,167	3/8"	3,629	3/8"	6,500	3/8"	9,150	3/8"	11,350	3/8"	13,346	3/8"	15,350
1/2"	1,222	1/2"	3,720	1/2"	6,545	1/2"	9,200	1/2"	11,400	1/2"	13,385	1/2"	15,400
5/8"	1,278	5/8"	3,811	5/8"	6,591	5/8"	9,250	5/8"	11,450	5/8"	13,423	5/8"	15,450
3/4"	1,333	3/4"	3,902	3/4"	6,636	3/4"	9,300	3/4"	11,500	3/4"	13,462	3/4"	15,500
7/8"	1,389	7/8"	3,992	7/8"	6,682	7/8"	9,350	7/8"	11,550	7/8"	13,500	7/8"	15,550

Figure B-9. Strapping Chart for Desert King Developed from Initial Fill Data

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Tactical Fuel Bladder Gauge Calibration Chart (Page 2 of 2)											
Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity
3' 6"	15,600	4' 0"	17,692	4' 6"	19,462	5' 0"		5' 6"		6' 0"	
1/8"	15,650	1/8"	17,731	1/8"	19,500	1/8"		1/8"		1/8"	
1/4"	15,700	1/4"	17,769	1/4"	19,538	1/4"		1/4"		1/4"	
3/8"	15,750	3/8"	17,808	3/8"	19,577	3/8"		3/8"		3/8"	
1/2"	15,800	1/2"	17,846	1/2"	19,615	1/2"		1/2"		1/2"	
5/8"	15,850	5/8"	17,885	5/8"	19,654	5/8"		5/8"		5/8"	
3/4"	15,900	3/4"	17,923	3/4"	19,692	3/4"		3/4"		3/4"	
7/8"	15,950	7/8"	17,962	7/8"	19,731	7/8"		7/8"		7/8"	
3' 7"	16,000	4' 1"	18,000	4' 7"	19,769	5' 1"		5' 7"		6' 1"	
1/8"	16,045	1/8"	18,036	1/8"	19,808	1/8"		1/8"			
1/4"	16,091	1/4"	18,071	1/4"	19,846	1/4"		1/4"			
3/8"	16,136	3/8"	18,107	3/8"	19,885	3/8"		3/8"			
1/2"	16,182	1/2"	18,143	1/2"	19,923	1/2"		1/2"			
5/8"	16,227	5/8"	18,179	5/8"	19,962	5/8"		5/8"			
3/4"	16,273	3/4"	18,214	3/4"	20,000	3/4"		3/4"			
7/8"	16,318	7/8"	18,250	7/8"		7/8"		7/8"			
3' 8"	16,364	4' 2"	18,286	4' 8"		5' 2"		5' 8"			
1/8"	16,409	1/8"	18,321	1/8"		1/8"		1/8"			
1/4"	16,455	1/4"	18,357	1/4"		1/4"		1/4"			
3/8"	16,500	3/8"	18,393	3/8"		3/8"		3/8"			
1/2"	16,545	1/2"	18,429	1/2"		1/2"		1/2"			
5/8"	16,591	5/8"	18,464	5/8"		5/8"		5/8"			
3/4"	16,636	3/4"	18,500	3/4"		3/4"		3/4"			
7/8"	16,682	7/8"	18,536	7/8"		7/8"		7/8"			
3' 9"	16,727	4' 3"	18,571	4' 9"		5' 3"		5' 9"			
1/8"	16,773	1/8"	18,607	1/8"		1/8"		1/8"			
1/4"	16,818	1/4"	18,643	1/4"		1/4"		1/4"			
3/8"	16,864	3/8"	18,679	3/8"		3/8"		3/8"			
1/2"	16,909	1/2"	18,714	1/2"		1/2"		1/2"			
5/8"	16,955	5/8"	18,750	5/8"		5/8"		5/8"			
3/4"	17,000	3/4"	18,786	3/4"		3/4"		3/4"			
7/8"	17,038	7/8"	18,821	7/8"		7/8"		7/8"			
3' 10"	17,077	4' 4"	18,857	4' 10"		5' 4"		5' 10"			
1/8"	17,115	1/8"	18,893	1/8"		1/8"		1/8"			
1/4"	17,154	1/4"	18,929	1/4"		1/4"		1/4"			
3/8"	17,192	3/8"	18,964	3/8"		3/8"		3/8"			
1/2"	17,231	1/2"	19,000	1/2"		1/2"		1/2"			
5/8"	17,269	5/8"	19,038	5/8"		5/8"		5/8"			
3/4"	17,308	3/4"	19,077	3/4"		3/4"		3/4"			
7/8"	17,346	7/8"	19,115	7/8"		7/8"		7/8"			
3' 11"	17,385	4' 5"	19,154	4' 11"		5' 5"		5' 11"			
1/8"	17,423	1/8"	19,192	1/8"		1/8"		1/8"			
1/4"	17,462	1/4"	19,231	1/4"		1/4"		1/4"			
3/8"	17,500	3/8"	19,269	3/8"		3/8"		3/8"			
1/2"	17,538	1/2"	19,308	1/2"		1/2"		1/2"			
5/8"	17,577	5/8"	19,346	5/8"		5/8"		5/8"			
3/4"	17,615	3/4"	19,385	3/4"		3/4"		3/4"			
7/8"	17,654	7/8"	19,423	7/8"		7/8"		7/8"			

Figure B-10. Strapping Chart for Desert King Developed from Initial Fill Data (Continued)

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AEF MILPAWS #4

Tactical Fuel Bladder Gauge Calibration Chart (Page 1 of 2)													
Use this spreadsheet to locally develop a bladder gauge chart for each tactical bladder IAW the ARCENT Petroleum Accountability and Reporting Procedures MOI and Collapsible Tank Strapping and Gauging Procedures Instructions.													
Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity
0		6"	1,750	1' 0"	3,833	1' 6"	6,000	2" 0"	8,125	2' 6"	9,625	3' 0"	11,400
1/8"		1/8"	1,771	1/8"	3,875	1/8"	6,056	1/8"	8,156	1/8"	9,656	1/8"	11,433
1/4"		1/4"	1,792	1/4"	3,917	1/4"	6,111	1/4"	8,188	1/4"	9,688	1/4"	11,467
3/8"		3/8"	1,812	3/8"	3,958	3/8"	6,167	3/8"	8,219	3/8"	9,719	3/8"	11,500
1/2"		1/2"	1,833	1/2"	4,000	1/2"	6,222	1/2"	8,250	1/2"	9,750	1/2"	11,533
5/8"		5/8"	1,854	5/8"	4,042	5/8"	6,278	5/8"	8,281	5/8"	9,781	5/8"	11,567
3/4"		3/4"	1,875	3/4"	4,083	3/4"	6,333	3/4"	8,313	3/4"	9,813	3/4"	11,600
7/8"		7/8"	1,896	7/8"	4,125	7/8"	6,389	7/8"	8,344	7/8"	9,844	7/8"	11,633
1"		7"	1,917	1' 1"	4,167	1' 7"	6,444	2' 1"	8,375	2' 7"	9,875	3' 1"	11,667
1/8"		1/8"	1,937	1/8"	4,208	1/8"	6,500	1/8"	8,406	1/8"	9,906	1/8"	11,700
1/4"		1/4"	1,958	1/4"	4,250	1/4"	6,556	1/4"	8,438	1/4"	9,938	1/4"	11,733
3/8"		3/8"	1,979	3/8"	4,292	3/8"	6,611	3/8"	8,469	3/8"	9,969	3/8"	11,767
1/2"	1,000	1/2"	2,000	1/2"	4,333	1/2"	6,667	1/2"	8,500	1/2"	10,000	1/2"	11,800
5/8"	1,021	5/8"	2,063	5/8"	4,375	5/8"	6,722	5/8"	8,531	5/8"	10,042	5/8"	11,833
3/4"	1,042	3/4"	2,125	3/4"	4,417	3/4"	6,778	3/4"	8,563	3/4"	10,083	3/4"	11,867
7/8"	1,062	7/8"	2,188	7/8"	4,458	7/8"	6,833	7/8"	8,594	7/8"	10,125	7/8"	11,900
2"	1,083	8"	2,250	1' 2"	4,500	1' 8"	6,889	2' 2"	8,625	2' 8"	10,167	3' 2"	11,933
1/8"	1,104	1/8"	2,313	1/8"	4,542	1/8"	6,944	1/8"	8,656	1/8"	10,208	1/8"	11,967
1/4"	1,125	1/4"	2,375	1/4"	4,583	1/4"	7,000	1/4"	8,688	1/4"	10,250	1/4"	12,000
3/8"	1,146	3/8"	2,438	3/8"	4,625	3/8"	7,038	3/8"	8,719	3/8"	10,292	3/8"	12,033
1/2"	1,167	1/2"	2,500	1/2"	4,667	1/2"	7,077	1/2"	8,750	1/2"	10,333	1/2"	12,067
5/8"	1,187	5/8"	2,563	5/8"	4,708	5/8"	7,115	5/8"	8,781	5/8"	10,375	5/8"	12,100
3/4"	1,208	3/4"	2,625	3/4"	4,750	3/4"	7,154	3/4"	8,813	3/4"	10,417	3/4"	12,133
7/8"	1,229	7/8"	2,688	7/8"	4,792	7/8"	7,192	7/8"	8,844	7/8"	10,458	7/8"	12,167
3"	1,250	9"	2,750	1' 3"	4,833	1' 9"	7,231	2' 3"	8,875	2' 9"	10,500	3' 3"	12,200
1/8"	1,271	1/8"	2,813	1/8"	4,875	1/8"	7,269	1/8"	8,906	1/8"	10,542	1/8"	12,233
1/4"	1,292	1/4"	2,875	1/4"	4,917	1/4"	7,308	1/4"	8,938	1/4"	10,583	1/4"	12,267
3/8"	1,312	3/8"	2,938	3/8"	4,958	3/8"	7,346	3/8"	8,969	3/8"	10,625	3/8"	12,300
1/2"	1,333	1/2"	3,000	1/2"	5,000	1/2"	7,385	1/2"	9,000	1/2"	10,667	1/2"	12,333
5/8"	1,354	5/8"	3,042	5/8"	5,050	5/8"	7,423	5/8"	9,031	5/8"	10,708	5/8"	12,367
3/4"	1,375	3/4"	3,083	3/4"	5,100	3/4"	7,462	3/4"	9,063	3/4"	10,750	3/4"	12,400
7/8"	1,396	7/8"	3,125	7/8"	5,150	7/8"	7,500	7/8"	9,094	7/8"	10,792	7/8"	12,433
4"	1,417	10"	3,167	1' 4"	5,200	1' 10"	7,538	2' 4"	9,125	2' 10"	10,833	3' 4"	12,467
1/8"	1,437	1/8"	3,208	1/8"	5,250	1/8"	7,577	1/8"	9,156	1/8"	10,875	1/8"	12,500
1/4"	1,458	1/4"	3,250	1/4"	5,300	1/4"	7,615	1/4"	9,188	1/4"	10,917	1/4"	12,533
3/8"	1,479	3/8"	3,292	3/8"	5,350	3/8"	7,654	3/8"	9,219	3/8"	10,958	3/8"	12,567
1/2"	1,500	1/2"	3,333	1/2"	5,400	1/2"	7,692	1/2"	9,250	1/2"	11,000	1/2"	12,600
5/8"	1,521	5/8"	3,375	5/8"	5,450	5/8"	7,731	5/8"	9,281	5/8"	11,033	5/8"	12,633
3/4"	1,542	3/4"	3,417	3/4"	5,500	3/4"	7,769	3/4"	9,313	3/4"	11,067	3/4"	12,667
7/8"	1,562	7/8"	3,458	7/8"	5,550	7/8"	7,808	7/8"	9,344	7/8"	11,100	7/8"	12,700
5"	1,583	11"	3,500	1' 5"	5,600	1' 11"	7,846	2' 5"	9,375	2' 11"	11,133	3' 5"	12,733
1/8"	1,604	1/8"	3,542	1/8"	5,650	1/8"	7,885	1/8"	9,406	1/8"	11,167	1/8"	12,767
1/4"	1,625	1/4"	3,583	1/4"	5,700	1/4"	7,923	1/4"	9,438	1/4"	11,200	1/4"	12,800
3/8"	1,646	3/8"	3,625	3/8"	5,750	3/8"	7,962	3/8"	9,469	3/8"	11,233	3/8"	12,833
1/2"	1,667	1/2"	3,667	1/2"	5,800	1/2"	8,000	1/2"	9,500	1/2"	11,267	1/2"	12,867
5/8"	1,687	5/8"	3,708	5/8"	5,850	5/8"	8,031	5/8"	9,531	5/8"	11,300	5/8"	12,900
3/4"	1,708	3/4"	3,750	3/4"	5,900	3/4"	8,063	3/4"	9,563	3/4"	11,333	3/4"	12,933
7/8"	1,729	7/8"	3,792	7/8"	5,950	7/8"	8,094	7/8"	9,594	7/8"	11,367	7/8"	12,967

Figure B-11. Strapping Chart for AEF MILPAWS #4 Developed from Initial Fill Data

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Tactical Fuel Bladder Gauge Calibration Chart (Page 2 of 2)											
Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity	Gauge	Quantity
3' 6"	13,000	4' 0"	14,333	4' 6"	15,750	5' 0"	17,071	5' 6"	18,441	6' 0"	
1/8"	13,028	1/8"	14,361	1/8"	15,781	1/8"	17,107	1/8"	18,461	1/8"	
1/4"	13,056	1/4"	14,389	1/4"	15,813	1/4"	17,143	1/4"	18,481	1/4"	
3/8"	13,083	3/8"	14,417	3/8"	15,844	3/8"	17,179	3/8"	18,501	3/8"	
1/2"	13,111	1/2"	14,444	1/2"	15,875	1/2"	17,214	1/2"	18,521	1/2"	
5/8"	13,139	5/8"	14,472	5/8"	15,906	5/8"	17,250	5/8"	18,541	5/8"	
3/4"	13,167	3/4"	14,500	3/4"	15,938	3/4"	17,286	3/4"	18,562	3/4"	
7/8"	13,194	7/8"	14,528	7/8"	15,969	7/8"	17,321	7/8"	18,582	7/8"	
3' 7"	13,222	4' 1"	14,556	4' 7"	16,000	5' 1"	17,357	5' 7"	18,602	6' 1"	
1/8"	13,250	1/8"	14,583	1/8"	16,026	1/8"	17,393	1/8"	18,622		
1/4"	13,278	1/4"	14,611	1/4"	16,053	1/4"	17,429	1/4"	18,642		
3/8"	13,306	3/8"	14,639	3/8"	16,079	3/8"	17,464	3/8"	18,662		
1/2"	13,333	1/2"	14,667	1/2"	16,105	1/2"	17,500	1/2"	18,682		
5/8"	13,361	5/8"	14,694	5/8"	16,132	5/8"	17,536	5/8"	18,702		
3/4"	13,389	3/4"	14,722	3/4"	16,158	3/4"	17,571	3/4"	18,722		
7/8"	13,417	7/8"	14,750	7/8"	16,184	7/8"	17,607	7/8"	18,742		
3' 8"	13,444	4' 2"	14,778	4' 8"	16,211	5' 2"	17,643	5' 8"	18,762		
1/8"	13,472	1/8"	14,806	1/8"	16,237	1/8"	17,679	1/8"	18,782		
1/4"	13,500	1/4"	14,833	1/4"	16,263	1/4"	17,714	1/4"	18,802		
3/8"	13,528	3/8"	14,861	3/8"	16,289	3/8"	17,750	3/8"	18,822		
1/2"	13,556	1/2"	14,889	1/2"	16,316	1/2"	17,786	1/2"	18,842		
5/8"	13,583	5/8"	14,917	5/8"	16,342	5/8"	17,821	5/8"	18,862		
3/4"	13,611	3/4"	14,944	3/4"	16,368	3/4"	17,857	3/4"	18,882		
7/8"	13,639	7/8"	14,972	7/8"	16,395	7/8"	17,893	7/8"	18,902		
3' 9"	13,667	4' 3"	15,000	4' 9"	16,421	5' 3"	17,929	5' 9"	18,922		
1/8"	13,694	1/8"	15,031	1/8"	16,447	1/8"	17,964	1/8"	18,943		
1/4"	13,722	1/4"	15,063	1/4"	16,474	1/4"	18,000	1/4"	18,963		
3/8"	13,750	3/8"	15,094	3/8"	16,500	3/8"	18,020	3/8"	18,983		
1/2"	13,778	1/2"	15,125	1/2"	16,526	1/2"	18,040	1/2"	19,003		
5/8"	13,806	5/8"	15,156	5/8"	16,553	5/8"	18,060	5/8"	19,023		
3/4"	13,833	3/4"	15,188	3/4"	16,579	3/4"	18,080	3/4"	19,043		
7/8"	13,861	7/8"	15,219	7/8"	16,605	7/8"	18,100	7/8"	19,063		
3' 10"	13,889	4' 4"	15,250	4' 10"	16,632	5' 4"	18,120	5' 10"	19,083		
1/8"	13,917	1/8"	15,281	1/8"	16,658	1/8"	18,140	1/8"	19,103		
1/4"	13,944	1/4"	15,313	1/4"	16,684	1/4"	18,160	1/4"	19,123		
3/8"	13,972	3/8"	15,344	3/8"	16,711	3/8"	18,180	3/8"			
1/2"	14,000	1/2"	15,375	1/2"	16,737	1/2"	18,201	1/2"			
5/8"	14,028	5/8"	15,406	5/8"	16,763	5/8"	18,221	5/8"			
3/4"	14,056	3/4"	15,438	3/4"	16,789	3/4"	18,241	3/4"			
7/8"	14,083	7/8"	15,469	7/8"	16,816	7/8"	18,261	7/8"			
3' 11"	14,111	4' 5"	15,500	4' 11"	16,842	5' 5"	18,281	5' 11"			
1/8"	14,139	1/8"	15,531	1/8"	16,868	1/8"	18,301	1/8"			
1/4"	14,167	1/4"	15,563	1/4"	16,895	1/4"	18,321	1/4"			
3/8"	14,194	3/8"	15,594	3/8"	16,921	3/8"	18,341	3/8"			
1/2"	14,222	1/2"	15,625	1/2"	16,947	1/2"	18,361	1/2"			
5/8"	14,250	5/8"	15,656	5/8"	16,974	5/8"	18,381	5/8"			
3/4"	14,278	3/4"	15,688	3/4"	17,000	3/4"	18,401	3/4"			
7/8"	14,306	7/8"	15,719	7/8"	17,036	7/8"	18,421	7/8"			

Figure B-12. Strapping Chart for AEF MILPAWS #4 Developed from Initial Fill Data (Continued)

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APPENDIX C
Manual Tank Gauging Data Calculations

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Table C-1. Fuel Transfer Events with Manual Gauging August 2021
Compiled from Nominal 20,000 Gallon Fuel Transfers Between CFTs
MPC #6 to SEI Desert King #9, AEF MILPAWS #4 to JGB #2 Nitrile, GTA Spiral #7 to SEI Jungle King #8

<u>Participant</u>	<u>Avg. CFT Volume Error</u>	<u>Median CFT Volume Error</u>	<u>CFT Volume Error Max/Min</u>		<u>Avg. Human Error</u>	<u>Median Human Error</u>	<u>Human Error Max/Min</u>		<u>Avg. CFT Volume Gain/Loss</u>	<u>Median CFT Volume Gain/Loss</u>	<u>CFT Volume Gain/Loss Max/Min</u>	
Person 1	3.0%	1.9%	11.8%	0.2%	3.5%	2.9%	11.8%	0.1%	2.8%	1.4%	11.8%	0.2%
Person 2	2.9%	1.9%	11.3%	0.2%	3.5%	2.4%	8.5%	0.2%	2.5%	1.5%	8.2%	0.2%
Person 3	4.1%	3.4%	14.2%	0.1%	4.3%	3.7%	14.2%	0.1%	3.6%	2.9%	14.2%	0.1%
Person 4	3.7%	2.4%	13.4%	0.1%	4.0%	3.3%	13.4%	0.1%	3.4%	2.0%	13.4%	0.1%
Person 5	4.3%	2.9%	14.3%	0.0%	4.3%	4.1%	14.2%	0.0%	3.7%	2.4%	14.2%	0.0%
Person 6	3.6%	2.4%	13.8%	0.0%	4.1%	3.9%	12.5%	0.1%	3.1%	2.2%	12.5%	0.0%
Person 7	3.2%	2.0%	12.6%	0.2%	3.5%	2.7%	12.6%	0.5%	2.8%	1.9%	12.6%	0.1%
Person 8	3.1%	3.0%	13.4%	0.1%	3.2%	2.8%	13.4%	0.1%	2.7%	2.7%	13.4%	0.1%
Person 9	3.8%	3.0%	12.5%	0.3%	3.9%	3.0%	12.5%	0.3%	3.3%	2.3%	12.5%	0.3%
Person 10	3.1%	2.4%	10.2%	0.2%	3.2%	2.6%	10.2%	0.0%	2.7%	2.0%	10.2%	0.2%
Person 11	3.1%	1.5%	11.0%	0.1%	3.4%	3.0%	11.0%	0.1%	2.7%	1.5%	11.0%	0.1%
Person 12	3.7%	2.7%	11.8%	1.0%	4.3%	4.0%	11.8%	0.9%	3.5%	2.2%	11.8%	1.0%

	<u>Avg. CFT Volume Error</u>	<u>Median CFT Volume Error</u>	<u>CFT Volume Error Max/Min</u>		<u>Avg. Human Error</u>	<u>Median Human Error</u>	<u>Human Error Max/Min</u>		<u>Avg. CFT Volume Gain/Loss</u>	<u>Median CFT Volume Gain/Loss</u>	<u>CFT Volume Gain/Loss Max/Min</u>	
Persons	3.5%	2.4%	14.3%	0.0%	3.8%	3.0%	14.2%	0.0%	3.1%	2.1%	14.2%	0.0%

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Table C-2. Manual Gauging Data for CFT MPC 3S7A6
CFT Height Measured and Corresponding Calculated Fuel Volume

	Tank Height (Inches)	Fuel Volume (Gallons)	Tank Height (Inches)	Fuel Volume (Gallons)	Tank Height (Inches)	Fuel Volume (Gallons)	Tank Height (Inches)	Fuel Volume (Gallons)
Person 1	66.5	19,801	48.625	14,806	33.625	11,023	21.625	6,920
Person 2	64.75	19,100	46.625	14,361	32.5	10,556	21.625	6,920
Person 3	67.125	20,051	48.5	14,778	33.125	10,833	22.25	7,120
Person 4	65.875	19,551	48.5	14,778	33.75	11,045	22.25	7,120
Person 5	66.875	19,951	48.5	14,778	33.875	11,068	21.5	6,880
Person 6	64.75	19,100	47.5	14,556	32.75	10,667	21.25	6,800
Person 7	66.625	19,851	47.375	14,528	33.875	11,068	22.125	7,080
Person 8	66.375	19,751	48	14,667	33.125	10,833	22.25	7,120
Person 9	65.125	19,300	47	14,444	33.125	10,833	21.875	7,000
Person 10	66.375	19,751	47.625	14,583	33.25	10,889	22	7,040
Person 11	66.25	19,701	47.875	14,639	33.625	11,023	21.75	6,960
Person 12	--	--	47.5	14,556	33	10,778	21.75	6,960
SwRI Reference Meter	--	19,533	--	15,533	--	11,533	--	7,533

**Table C-3. Manual Gauging Data for CFT SEI Desert King
CFT Height Measured and Corresponding Calculated Fuel Volume**

	Tank Height (Inches)	Fuel Volume (Gallons)	Tank Height (Inches)	Fuel Volume (Gallons)	Tank Height (Inches)	Fuel Volume (Gallons)	Tank Height (Inches)	Fuel Volume (Gallons)
Person 1	16.75	6,273	26.25	10,250	36.125	13,577	54.75	19,692
Person 2	15.875	5,917	25.25	9,900	35.25	13,308	53	19,154
Person 3	17.5	6,409	26.875	10,458	36	13,538	54.875	19,731
Person 4	17	6,364	26	10,167	36.5	13,692	54.875	19,731
Person 5	17.125	6,409	26.125	10,208	36	13,538	54.875	19,731
Person 6	16.25	6,091	24.875	9,750	35.5	13,385	53.75	19,385
Person 7	16.875	6,318	25.375	9,950	36.5	13,692	55.125	19,808
Person 8	17	6,364	25.375	9,950	36	13,538	54.75	19,692
Person 9	16.125	6,045	25.5	10,000	35.625	13,423	53.5	19,308
Person 10	16.5	6,182	25.75	10,083	35.875	13,500	54.75	19,692
Person 11	16.625	6,227	25.375	9,950	36.625	13,731	54.375	19,577
Person 12	16.75	6,273	25.75	10,083	35.75	13,462	54	19,462
SwRI Reference Meter	--	5,611	--	9,611	--	13,611	--	19,189

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Table C-4. Manual Gauging Data for CFT AEF MILPAWS #4
CFT Height Measured and Corresponding Calculated Fuel Volume

	Tank Height (Inches)	Fuel Volume (Gallons)	Tank Height (Inches)	Fuel Volume (Gallons)	Tank Height (Inches)	Fuel Volume (Gallons)	Tank Height (Inches)	Fuel Volume (Gallons)
Person 1	67.000	18,602	48.250	14,361	33.125	10,542	20.125	6,889
Person 2	65.625	18,381	47.000	14,111	31.250	9,938	19.375	6,611
Person 3	67.875	18,742	47.000	14,111	33.500	10,667	20.875	7,192
Person 4	64.875	18,261	47.500	14,222	32.750	10,417	20.250	7,000
Person 5	67.250	18,642	48.500	14,444	31.875	10,125	20.250	7,000
Person 6	67.000	18,602	47.250	14,167	31.125	9,906	19.625	6,722
Person 7	66.375	18,501	47.625	14,250	32.875	10,458	20.875	7,192
Person 8	67.125	18,622	48.500	14,444	32.875	10,458	19.875	6,833
Person 9	66.250	18,481	45.875	14,528	31.000	9,875	19.000	6,444
Person 10	67.750	18,722	48.000	14,333	32.375	10,292	19.750	6,778
Person 11	67.125	18,622	47.375	14,194	31.875	10,125	19.625	6,722
Person 12	--	--	--	--	--	--	--	--
SwRI Reference Meter	--	18,642	--	14,642	--	10,642	--	6,642

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Table C-5. Manual Gauging Data for JGB Nitrile #2
CFT Height Measured and Corresponding Calculated Fuel Volume

	Tank Height (Inches)	Fuel Volume (Gallons)	Tank Height (Inches)	Fuel Volume (Gallons)	Tank Height (Inches)	Fuel Volume (Gallons)	Tank Height (Inches)	Fuel Volume (Gallons)
Person 1	11.250	3,841	23.000	7,769	36.000	12,176	62.375	19,176
Person 2	10.750	3,671	21.875	7,423	34.500	11,769	60.125	18,536
Person 3	10.250	3,500	23.000	7,769	37.000	12,412	62.500	19,211
Person 4	11.250	3,841	23.125	7,808	36.250	12,235	61.875	19,035
Person 5	10.500	3,585	22.875	7,731	39.500	13,000	62.250	19,141
Person 6	10.250	3,500	22.125	7,500	34.875	11,885	61.000	18,786
Person 7	11.000	3,756	23.500	7,923	36.375	12,265	62.250	19,141
Person 8	11.625	3,970	22.875	7,731	35.500	12,059	61.250	18,857
Person 9	10.250	3,500	20.875	7,115	35.125	11,962	60.750	18,714
Person 10	11.000	3,756	22.500	7,615	35.375	12,029	60.500	18,643
Person 11	10.875	3,713	22.500	7,615	35.625	12,088	61.500	18,929
Person 12	--	--	--	--	--	--	--	--
SwRI Reference Meter	--	4,000	--	8,000	--	12,000	--	18,642

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**Table C-6. Manual Gauging Data for GTA Spiral
CFT Height Measured and Corresponding Calculated Fuel Volume**

	Tank Height (Inches)	Fuel Volume (Gallons)	Tank Height (Inches)	Fuel Volume (Gallons)	Tank Height (Inches)	Fuel Volume (Gallons)	Tank Height (Inches)	Fuel Volume (Gallons)
Person 1	55.875	19,344	41.5	15,533	28.88	11,750	17.38	7,625
Person 2	54	18,895	40	15,133	27.63	11,250	16.75	7,417
Person 3	56.5	19,501	40.5	15,267	28	11,400	18.13	7,875
Person 4	56	19,375	41.75	15,600	29.38	11,950	17.63	7,708
Person 5	56	19,375	41.5	15,533	29.5	12,000	17.5	7,667
Person 6	56.5	19,501	39	14,818	26.88	10,955	17.5	7,667
Person 7	56	19,375	41.13	15,433	28.5	11,600	17.5	7,667
Person 8	55.25	19,188	42.13	15,700	28.38	11,550	18.13	7,875
Person 9	53.875	18,868	40.63	15,300	26.88	10,955	16.88	7,458
Person 10	55.375	19,219	41.38	15,500	27.63	11,250	17.63	7,708
Person 11	55.875	19,344	41.25	15,467	27.88	11,350	17.63	7,708
Person 12	52.5	18,579	39.75	15,067	28.75	11,700	17.25	7,583
SwRI Reference Meter	--	19,514	--	15,514	--	11,514	--	7,514

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**Table C-7. Manual Gauging Data for SEI Jungle King
CFT Height Measured and Corresponding Calculated Fuel Volume**

	Tank Height (Inches)	Fuel Volume (Gallons)	Tank Height (Inches)	Fuel Volume (Gallons)	Tank Height (Inches)	Fuel Volume (Gallons)	Tank Height (Inches)	Fuel Volume (Gallons)
Person 1	12.375	4,722	23.13	9,500	34.13	13,567	55.38	20,623
Person 2	13.25	5,100	22.5	9,222	33.13	13,300	53.75	19,779
Person 3	13.5	5,200	22.75	9,333	34	13,533	54.75	20,299
Person 4	11.625	4,389	23.13	9,500	34.38	13,633	55.75	20,818
Person 5	13.125	5,050	23	9,444	34.13	13,567	55.5	20,688
Person 6	13.25	5,100	23	9,444	34.38	13,633	55.13	20,494
Person 7	13.25	5,100	23	9,444	34.25	13,600	55.38	20,623
Person 8	13.375	5,150	23.13	9,500	33.5	13,400	55.63	20,753
Person 9	13.25	5,100	22.63	9,278	33.38	13,367	54.5	20,169
Person 10	13.25	5,100	22.75	9,333	33.63	13,433	55.25	20,559
Person 11	13.5	5,200	23.25	9,556	33.5	13,400	54.38	20,104
Person 12	13.25	5,050	23.25	9,556	33.5	13,400	54.75	20,299
SwRI Reference Meter	--	5,000	--	9,000	--	13,000	--	19,514

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APPENDIX D
Flow Meter Accuracy Data

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**Table D-1. Fuel Transfer Events September – December 2021
GTA Spiral #7 and SEI Jungle King #8
Fuel Flow Compared to Same Meter**

MPXY = Meter Pair

X = Receipt Y = Issue

**G = Green FuelTrax
PS = Penn State Lab**

B = Blue FuelTrax

<u>Flow meter</u>	<u>Avg. CFT Volume Error</u>	<u>Median CFT Volume Error</u>	<u>CFT Volume Error Max/Min</u>		<u>Avg. Meter Error</u>	<u>Median Meter Error</u>	<u>Meter Error Max/Min</u>		<u>Avg. CFT Volume Gain/Loss</u>	<u>Median CFT Volume Gain/Loss</u>	<u>CFT Volume Gain/Loss Max/Min</u>	
PS/FloCat Turbine flow meter MP11	0.8%	0.2%	8.6%	0.0%	0.7%	0.5%	2.8%	0.0%	0.3%	0.2%	2.1%	0.0%
PS/FloCat Turbine flow meter MP22	1.1%	0.3%	9.0%	0.1%	1.0%	0.7%	4.0%	0.1%	0.5%	0.3%	2.8%	0.0%
FloCat Turbine flow meter MP44	13.5%	1.1%	8.2%	0.0%	3.2%	2.8%	7.0%	0.0%	1.8%	0.8%	6.5%	0.0%
FloCat Turbine flow meter MP55	3.6%	2.7%	11.2%	1.3%	6.2%	6.1%	8.5%	5.2%	2.4%	2.1%	4.3%	1.3%
PS/FloCat Turbine flow meter MP66	0.7%	0.5%	2.1%	0.3%	1.0%	0.9%	1.6%	0.7%	0.4%	0.4%	0.7%	0.2%
PS/FloCat Turbine flow meter MP77	0.6%	0.4%	2.6%	0.2%	1.0%	0.9%	2.8%	0.3%	0.4%	0.4%	1.1%	0.2%
PS/FloCat Turbine flow meter MP88	0.1%	0.1%	0.4%	0.0%	0.3%	0.2%	0.7%	0.0%	0.1%	0.1%	0.4%	0.0%
Coriolis meter MPGG	0.6%	0.4%	2.6%	0.0%	0.8%	0.5%	2.7%	0.1%	0.3%	0.3%	1.0%	0.0%
Coriolis meter MPBB	0.5%	0.3%	2.1%	0.0%	0.6%	0.6%	0.8%	0.1%	0.3%	0.2%	0.5%	0.0%
Pressure Transducer Varec Tactical Fuel Gauge (calculated)	1.7%	0.7%	16.4%	0.0%	3.0%	1.2%	26.8%	0.1%	1.0%	0.5%	6.0%	0.0%

	<u>Avg. CFT Volume Error</u>	<u>Median CFT Volume Error</u>	<u>CFT Volume Error Max/Min</u>		<u>Avg. Meter Error</u>	<u>Median Meter Error</u>	<u>Meter Error Max/Min</u>		<u>Avg. CFT Volume Gain/Loss</u>	<u>Median CFT Volume Gain/Loss</u>	<u>CFT Volume Gain/Loss Max/Min</u>	
FloCat meters only	8.5%	1.9%	11.2%	0.0%	4.7%	4.4%	8.5%	0.0%	2.1%	1.5%	6.5%	0.0%
FloCat meters modified by Penn State only	0.7%	0.3%	9.0%	0.0%	0.8%	0.7%	4.0%	0.0%	0.4%	0.3%	2.8%	0.0%
Coriolis meters only	0.5%	0.3%	2.6%	0.0%	0.7%	0.6%	2.7%	0.1%	0.3%	0.3%	1.0%	0.0%

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**Table D-2. Fuel Transfer Events September – December 2021
GTA Spiral #7 and SEI Jungle King #8
Fuel Flow Compared to Alternate Meters**

MPXY =	Meter Pair
G =	Green FuelTrax
PS =	Penn State Lab

X = Receipt	Y = Issue
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B =	Blue FuelTrax
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<u>Flow meter</u>	<u>Avg. CFT Volume Error</u>	<u>Median CFT Volume Error</u>	<u>CFT Volume Error Max/Min</u>		<u>Avg. Meter Error</u>	<u>Median Meter Error</u>	<u>Meter Error Max/Min</u>		<u>Avg. CFT Volume Gain/Loss</u>	<u>Median CFT Volume Gain/Loss</u>	<u>CFT Volume Gain/Loss Max/Min</u>	
PS/FloCat Turbine flow meter MP12	0.8%	0.2%	7.0%	0.0%	0.7%	0.4%	4.0%	0.0%	0.4%	0.1%	2.5%	0.0%
PS/FloCat Turbine flow meter MP27	0.6%	0.4%	2.4%	0.2%	0.9%	0.7%	2.4%	0.3%	0.3%	0.3%	0.7%	0.2%
FloCat Turbine flow meter MP45	2.8%	1.3%	10.3%	0.0%	3.2%	3.1%	6.6%	0.0%	1.4%	1.0%	3.9%	0.0%
FloCat Turbine flow meter MP54	4.1%	2.7%	16.2%	1.4%	6.2%	6.0%	8.5%	5.2%	2.6%	2.1%	4.9%	1.3%
PS/FloCat Turbine flow meter MP67	0.8%	0.5%	2.3%	0.3%	1.0%	0.9%	1.5%	0.8%	0.4%	0.4%	0.7%	0.3%
PS/FloCat Turbine flow meter MP78	0.3%	0.3%	1.1%	0.1%	0.7%	0.6%	2.8%	0.1%	0.3%	0.2%	1.1%	0.0%
PS/FloCat Turbine flow meter MP81	0.8%	0.2%	8.4%	0.0%	0.6%	0.4%	2.8%	0.0%	0.3%	0.2%	2.1%	0.0%
Coriolis meter MPGB	0.5%	0.3%	2.1%	0.0%	0.6%	0.6%	1.7%	0.1%	0.3%	0.2%	0.8%	0.0%
Coriolis meter MPBG	0.6%	0.3%	2.6%	0.0%	0.7%	0.6%	2.7%	0.1%	0.3%	0.3%	1.0%	0.0%

	<u>Avg. CFT Volume Error</u>	<u>Median CFT Volume Error</u>	<u>CFT Volume Error Max/Min</u>		<u>Avg. Meter Error</u>	<u>Median Meter Error</u>	<u>Meter Error Max/Min</u>		<u>Avg. CFT Volume Gain/Loss</u>	<u>Median CFT Volume Gain/Loss</u>	<u>CFT Volume Gain/Loss Max/Min</u>	
FloCat meters only	3.4%	2.0%	16.2%	0.0%	4.7%	4.5%	8.5%	0.0%	2.0%	1.5%	4.9%	0.0%
FloCat meters modified by Penn State only	0.7%	0.3%	8.4%	0.0%	0.8%	0.6%	4.0%	0.0%	0.4%	0.2%	2.5%	0.0%
Coriolis meters only	0.5%	0.3%	2.6%	0.0%	0.7%	0.6%	2.7%	0.1%	0.3%	0.3%	1.0%	0.0%

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Table D-3. Fuel Transfer Events September – December 2021
GTA Spiral #7 and SEI Jungle King #8
Raw Data

<u>Flow meter description</u>	GTA Spiral #7 Volume - RECEIPTS Date: 09/08/2021 Fuel transferred from SEI Jungle King #8 to GTA Spiral #7				SEI Jungle King #8 Volume - ISSUES Date: 09/16/2021 Fuel transferred from GTA Spiral #7 to SEI Jungle King #8			
	<u>Fuel volume transferred (gallons)</u>				<u>Fuel volume transferred (gallons)</u>			
SwRI PD (Max Machinery)	5,006	10,000	15,000	19,455	5,000	9,999	15,000	18,323
FloCat/Penn State (S/N FC410357) 1	5,013	10,031	15,049	19,485	5,027	10,057	15,094	18,509
FloCat/Penn State (S/N FC400310) 2	4,972	9,950	14,927	19,323	4,973	9,951	14,942	18,351
FloCat/Penn State (S/N FC400289) 3	--	--	--	--	--	--	--	--
FloCat (S/N FC400249) 4	--	--	--	--	--	--	--	--
FloCat (S/N FC411321) 5	--	--	--	--	4,691	9,380	14,051	17,140
FloCat/Penn State (S/N FC400338) 6	--	--	--	--	--	--	--	--
FloCat/Penn State (S/N FC400197) 7	4,951	9,928	14,905	19,295	4,954	9,916	14,880	18,183
FloCat/Penn State (S/N FC400273) 8	5,024	10,051	15,076	19,518	5,008	10,019	15,027	18,352
FuelTrax green (EMMU)	--	--	--	--	5,035	10,074	15,112	18,408
FuelTrax blue (S/N FTX-MMU-1010)	--	--	--	--	5,030	10,062	15,095	18,436
Vortex flow meter (S/N 0188771)	--	--	--	--	3,706	7,439	11,221	13,733
Varec Tactical Fuel Gauge (calculated)	5,051	9,979	14,932	18,449	5,082	10,108	15,100	18,445
Tank height (inches)	10.50	23.25	39.00	55.00	14.50	27.25	41.50	53.00
Tank volume (gallons)	4,707	9,693	14,909	19,142	5,757	10,955	15,920	19,278

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GTA Spiral #7 Volume - RECEIPTS Date: 10/8/2021 Fuel transferred from SEI Jungle King #8 to GTA Spiral #7				
<u>Flow meter description</u>	<u>Fuel volume transferred (gallons)</u>			
SwRI PD (Max Machinery)	5,002	9,999	14,998	18,408
FloCat/Penn State (S/N FC410357) 1	5,025	10,049	15,072	18,472
FloCat/Penn State (S/N FC400310) 2	4,973	9,944	14,911	18,239
FloCat/Penn State (S/N FC400289) 3	--	--	--	--
FloCat (S/N FC400249) 4	--	--	--	--
FloCat (S/N FC411321) 5	4,734	9,471	14,196	17,316
FloCat/Penn State (S/N FC400338) 6	--	--	--	--
FloCat/Penn State (S/N FC400197) 7	4,951	9,908	14,867	18,180
FloCat/Penn State (S/N FC400273) 8	5,015	10,031	15,043	18,439
FuelTrax green (EMMU)	4,983	10,067	15,101	18,516
FuelTrax blue (S/N FTX-MMU-1010)	5,030	10,059	15,091	18,513
Vortex flow meter (S/N 0188771)	--	--	--	--
Varec Tactical Fuel Gauge (calculated)	5,069	10,008	14,977	18,444
Tank height (inches)	13.50	26.50	42.50	55.00
Tank volume (gallons)	5,942	10,855	15,927	19,142

SEI Jungle King #8 Volume - ISSUES Date: 10/26/2021 Fuel transferred from GTA Spiral #7 to SEI Jungle King #8			
<u>Fuel volume transferred (gallons)</u>			
5,005	9,999	14,999	18,368
5,023	10,048	15,077	18,470
4,982	9,968	14,964	18,365
--	--	--	--
--	--	--	--
4,599	9,318	14,020	17,186
--	--	--	--
4,945	9,909	14,877	18,219
5,017	10,035	15,048	18,414
5,024	10,065	15,091	18,478
5,039	10,071	15,108	18,499
3,614	7,324	11,033	13,540
5,105	10,131	15,118	18,480
15.00	27.00	42.00	53.25
5,975	10,860	16,078	19,344

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GTA Spiral #7 Volume – RECEIPTS Date: 11/4/2021 Fuel transferred from SEI Jungle King #8 to GTA Spiral #7				
<u>Flow meter description</u>	<u>Fuel volume transferred (gallons)</u>			
SwRI PD (Max Machinery)	5,001	10,000	15,000	19,558
FloCat/Penn State (S/N FC410357) 1	5,027	10,054	15,075	19,638
FloCat/Penn State (S/N FC400310) 2	4,970	9,939	14,899	19,406
FloCat/Penn State (S/N FC400289) 3	--	--	--	--
FloCat (S/N FC400249) 4	--	--	--	--
FloCat (S/N FC411321) 5	4,701	9,405	14,092	18,338
FloCat/Penn State (S/N FC400338) 6	--	--	--	--
FloCat/Penn State (S/N FC400197) 7	4,950	9,906	14,842	19,345
FloCat/Penn State (S/N FC400273) 8	5,010	10,021	15,022	19,567
FuelTrax green (EMMU)	5,022	10,045	15,067	19,618
FuelTrax blue (S/N FTX-MMU-1010)	5,032	10,064	15,097	19,661
Vortex flow meter (S/N 0188771)	--	--	--	--
Varec Tactical Fuel Gauge (calculated)	5,098	10,080	15,084	18,422
Tank height (inches)	11.50	25.00	39.50	55.25
Tank volume (gallons)	5,123	10,324	15,058	19,199

SEI Jungle King #8 Volume – ISSUES Date: 11/18/2021 Fuel transferred from GTA Spiral #7 to SEI Jungle King #8				
<u>Fuel volume transferred (gallons)</u>				
5,000	10,000	15,000	18,425	
5,012	10,080	15,183	18,704	
5,013	10,129	15,305	18,867	
--	--	--	--	
5,263	10,548	15,878	19,543	
4,670	9,381	14,063	17,274	
4,919	9,883	14,841	18,239	
4,925	9,886	14,821	18,216	
4,971	9,982	14,985	18,413	
4,866	9,861	14,973	18,354	
4,984	10,018	15,053	18,487	
3,564	7,290	10,978	13,539	
5,110	10,209	15,344	18,872	
15.25	28.00	41.50	53.00	
6,083	11,239	15,920	19,278	

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	GTA Spiral #7 Volume – RECEIPTS Date: 12/1/2021 Fuel transferred from SEI Jungle King #8 to GTA Spiral #7			
<u>Flow meter description</u>	<u>Fuel volume transferred (gallons)</u>			
SwRI PD (Max Machinery)	5,003	9,998	15,001	19,630
FloCat/Penn State (S/N FC410357) 1	5,008	10,007	15,011	19,624
FloCat/Penn State (S/N FC400310) 2	4,966	9,925	14,886	19,458
FloCat (S/N FC400243) 3	--	--	--	--
FloCat (S/N FC400249) 4	5,020	10,028	15,042	19,671
FloCat (S/N FC411321) 5	4,728	9,444	14,161	18,508
FloCat/Penn State (S/N FC400193) 6	4,958	9,912	14,869	19,438
FloCat/Penn State (S/N FC400197) 7	4,972	9,922	14,848	19,401
FloCat/Penn State (S/N FC400273) 8	5,005	10,000	14,997	19,604
FuelTrax green (EMMU)	5,030	10,001	15,078	19,696
FuelTrax blue (S/N FTX-MMU-1010)	5,030	10,053	15,084	19,706
Vortex flow meter (S/N 0188771)	3,710	7,393	11,085	14,476
Varec Tactical Fuel Gauge (calculated)	5,093	10,075	15,101	18,521
Tank height (inches)	11.50	23.50	37.75	55.25
Tank volume (gallons)	5,123	9,784	14,533	19,199

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Table D-4. Fuel Transfer Events September – December 2021
JGB #2 Nitrile and AEF MILPAWS #4
Fuel Flow Compared to Same Meter

MPXY =	Meter Pair
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X = Receipt	Y = Issue
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G =	Green FuelTrax
PS =	Penn State Lab

B =	Blue FuelTrax
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<u>Flow meter</u>	<u>Avg. CFT Volume Error</u>	<u>Median CFT Volume Error</u>	<u>CFT Volume Error Max/Min</u>		<u>Avg. Meter Error</u>	<u>Median Meter Error</u>	<u>Meter Error Max/Min</u>		<u>Avg. CFT Volume Gain/Loss</u>	<u>Median CFT Volume Gain/Loss</u>	<u>CFT Volume Gain/Loss Max/Min</u>	
PS/FloCat Turbine flow meter MP11	1.6%	0.5%	12.3%	0.0%	2.1%	1.0%	8.7%	0.1%	0.9%	0.3%	4.9%	0.0%
PS/FloCat Turbine flow meter MP22	2.1%	0.7%	14.8%	0.0%	2.8%	1.4%	10.5%	0.0%	1.2%	0.6%	6.3%	0.0%
FloCat Turbine flow meter MP44	2.3%	0.2%	10.1%	0.0%	3.4%	2.9%	7.4%	0.1%	2.1%	0.8%	8.4%	0.0%
FloCat Turbine flow meter MP55	4.4%	3.7%	11.7%	1.4%	6.9%	6.7%	11.2%	5.2%	3.7%	3.0%	7.9%	1.4%
PS/FloCat Turbine flow meter MP66	1.5%	0.4%	8.5%	0.3%	0.9%	0.8%	1.3%	0.7%	0.5%	0.3%	1.2%	0.2%
MP77	1.7%	0.5%	16.8%	0.1%	1.0%	0.9%	3.7%	0.2%	0.5%	0.3%	1.7%	0.1%
MP88	0.8%	0.2%	8.5%	0.0%	0.4%	0.3%	2.1%	0.0%	0.2%	0.1%	0.9%	0.0%
MPGG	1.2%	0.8%	5.6%	0.0%	1.8%	0.7%	7.0%	0.0%	0.8%	0.3%	3.6%	0.0%
MPBB	3.4%	0.3%	1.5%	0.1%	0.8%	0.6%	4.1%	0.4%	0.4%	0.3%	1.3%	0.1%

	<u>Avg. CFT Volume Error</u>	<u>Median CFT Volume Error</u>	<u>CFT Volume Error Max/Min</u>		<u>Avg. Meter Error</u>	<u>Median Meter Error</u>	<u>Meter Error Max/Min</u>		<u>Avg. CFT Volume Gain/Loss</u>	<u>Median CFT Volume Gain/Loss</u>	<u>CFT Volume Gain/Loss Max/Min</u>	
FloCat meters only	3.3%	1.9%	11.7%	0.0%	5.2%	4.8%	11.2%	0.1%	2.9%	1.9%	8.4%	0.0%
FloCat meters modified by Penn State only	1.5%	0.5%	16.8%	0.0%	1.4%	0.9%	10.5%	0.0%	0.7%	0.3%	6.3%	0.0%
Coriolis meters only	2.3%	0.6%	5.6%	0.0%	1.3%	0.7%	7.0%	0.0%	0.6%	0.3%	3.6%	0.0%

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Table D-5. Fuel Transfer Events September – December 2021
JGB #2 Nitrile and AEF MILPAWS #4
Fuel Flow Compared to Alternate Meters

MPXY =	Meter Pair
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X = Receipt	Y = Issue
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G =	Green FuelTrax
PS =	Penn State Lab

B =	Blue FuelTrax
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Flow meter	<u>Avg. CFT</u> <u>Volume</u> <u>Error</u>	<u>Median CFT</u> <u>Volume</u> <u>Error</u>	<u>CFT Volume</u> <u>Error Max/Min</u>		<u>Avg. Meter</u> <u>Error</u>	<u>Median Meter</u> <u>Error</u>	<u>Meter Error</u> <u>Max/Min</u>		<u>Avg. CFT</u> <u>Volume</u> <u>Gain/Loss</u>	<u>Median CFT</u> <u>Volume</u> <u>Gain/Loss</u>	<u>CFT Volume</u> <u>Gain/Loss</u> <u>Max/Min</u>	
PS/FloCat Turbine flow meter MP12	2.2%	0.4%	6.2%	0.0%	2.2%	1.1%	8.7%	0.0%	1.0%	0.3%	5.4%	0.0%
PS/FloCat Turbine flow meter MP27	1.3%	0.6%	7.0%	0.1%	2.4%	1.0%	10.5%	0.3%	1.1%	0.4%	7.0%	0.1%
FloCat Turbine flow meter MP45	5.2%	1.3%	7.9%	0.0%	3.4%	3.3%	7.0%	0.1%	1.7%	0.9%	5.5%	0.0%
FloCat Turbine flow meter MP54	6.5%	3.8%	19.6%	1.4%	6.5%	6.5%	7.4%	5.3%	5.1%	2.9%	18.4%	1.4%
PS/FloCat Turbine flow meter MP67	0.7%	0.4%	1.3%	0.3%	1.0%	1.0%	1.3%	0.4%	0.5%	0.3%	1.3%	0.3%
PS/FloCat Turbine flow meter MP78	0.4%	0.1%	1.8%	0.0%	0.6%	0.4%	2.1%	0.0%	0.4%	0.1%	1.8%	0.0%
PS/FloCat Turbine flow meter MP81	0.7%	0.3%	5.0%	0.0%	0.9%	0.7%	3.8%	0.1%	0.6%	0.3%	4.9%	0.0%
Coriolis meter MPGB	3.6%	0.4%	4.5%	0.0%	1.4%	0.7%	6.2%	0.0%	0.7%	0.4%	4.5%	0.0%
Coriolis meter MPBG	1.2%	0.4%	6.0%	0.1%	1.3%	0.6%	7.0%	0.0%	0.6%	0.3%	2.7%	0.0%

	<u>Avg. CFT</u> <u>Volume</u> <u>Error</u>	<u>Median CFT</u> <u>Volume</u> <u>Error</u>	<u>CFT Volume</u> <u>Error Max/Min</u>		<u>Avg. Meter</u> <u>Error</u>	<u>Median Meter</u> <u>Error</u>	<u>Meter Error</u> <u>Max/Min</u>		<u>Avg. CFT</u> <u>Volume</u> <u>Gain/Loss</u>	<u>Median CFT</u> <u>Volume</u> <u>Gain/Loss</u>	<u>CFT Volume</u> <u>Gain/Loss</u> <u>Max/Min</u>	
FloCat meters only	5.8%	2.5%	19.6%	0.0%	5.0%	4.9%	7.4%	0.1%	3.4%	1.9%	18.4%	0.0%
FloCat meters modified by Penn State only	0.6%	0.4%	7.0%	0.0%	1.4%	1.0%	10.5%	0.0%	0.7%	0.3%	7.0%	0.0%
Coriolis meters only	2.4%	0.4%	6.0%	0.0%	1.3%	0.6%	7.0%	0.0%	0.6%	0.3%	4.5%	0.0%

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Table D-6. Fuel Transfer Events September – December 2021
JGB #2 Nitrile and AEF MILPAWS #4
Raw Data

JGB #2 Nitrile Volume – RECEIPTS					MP #4 Volume – ISSUES			
Date: 09/14/2021 Fuel transferred from AEF MILPAWS #4 to JGB #2 Nitrile					Date: 10/1/2021 Fuel transferred from JGB #2 Nitrile to AEF MILPAWS #4			
Flow meter description	Fuel volume transferred (gallons)				Fuel volume transferred (gallons)			
SwRI PD (Max Machinery)	5,003	10,003	15,001	18,094	5,001	9,998	14,997	18,380
FloCat/Penn State (S/N FC410357) 1	5,274	10,658	16,090	19,433	4,901	9,934	14,966	18,383
FloCat/Penn State (S/N FC400310) 2	5,352	10,833	16,354	19,744	4,847	9,853	14,877	18,320
FloCat/Penn State (S/N FC400289) 3	--	--	--	--	--	--	--	--
FloCat (S/N FC400249) 4	--	--	--	--	--	--	--	--
FloCat (S/N FC411321) 5	4,567	9,159	13,728	16,533	4,441	9,133	13,794	16,937
FloCat/Penn State (S/N FC400338) 6	--	--	--	--	--	--	--	--
FloCat/Penn State (S/N FC400197) 7	4,912	9,886	14,863	17,929	4,814	9,766	14,678	17,999
FloCat/Penn State (S/N FC400273) 8	4,953	9,950	14,944	18,023	4,897	9,908	14,904	18,271
FuelTrax green (EMMU)	4,951	9,988	15,014	18,106	4,653	9,684	14,712	18,094
FuelTrax blue (S/N FTX-MMU-1010)	5,077	10,106	15,131	18,210	5,206	10,229	15,255	18,620
Vortex flow meter(S/N 0188771)	3,667	7,453	11,234	13,542	2,700	6,395	10,120	12,625
Tank height (inches)	13.50	28.75	47.00	60.00	15.25	31.00	51.50	66.00
Tank volume (gallons)	4,831	9,873	15,205	18,536	5,131	9,942	15,254	18,361

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JGB #2 Nitrile Volume - RECEIPTS				
Date: 10/15/2021 Fuel transferred from AEF MILPAWS #4 to JGB #2 Nitrile				
<u>Flow meter description</u>	<u>Fuel volume transferred (gallons)</u>			
SwRI PD (Max Machinery)	5,003	10,003	14,998	18,724
FloCat/Penn State (S/N FC410357) 1	5,006	10,029	15,051	18,735
FloCat/Penn State (S/N FC400310) 2	4,945	9,916	14,881	18,525
FloCat/Penn State (S/N FC400289) 3	--	--	--	--
FloCat (S/N FC400249) 4	--	--	--	--
FloCat (S/N FC411321) 5	4,695	9,427	14,164	17,635
FloCat/Penn State (S/N FC400338) 6	--	--	--	--
FloCat/Penn State (S/N FC400197) 7	4,929	9,904	14,878	18,530
FloCat/Penn State (S/N FC400273) 8	4,980	9,991	14,999	18,672
FuelTrax green (EMMU)	4,803	9,962	14,988	18,699
FuelTrax blue (S/N FTX-MMU-1010)	5,022	10,049	15,074	18,746
Vortex flow meter (S/N 0188771)	3,619	7,342	11,081	13,814
Tank height (inches)	13.00	27.50	45.50	60.00
Tank volume (gallons)	4,657	9,480	14,796	18,536

MP #4 Volume – ISSUES			
Date: 10/27/2021 Fuel transferred from JGB #2 Nitrile to AEF MILPAWS #4			
<u>Fuel volume transferred (gallons)</u>			
5,001	10,000	15,000	18,584
5,036	10,072	15,122	18,746
4,993	9,991	15,047	18,707
--	--	--	--
--	--	--	--
4,719	9,435	14,124	17,448
--	--	--	--
4,984	9,968	14,940	18,488
5,022	10,041	15,047	18,606
5,022	9,908	15,089	18,677
5,035	10,070	15,106	18,659
3,672	7,386	11,115	13,798
14.25	29.50	49.50	66.00
4,804	9,512	14,783	18,361

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JGB #2 Nitrile Volume – RECEIPTS				
Date: 11/11/2021 Fuel transferred from AEF MILPAWS #4 to JGB #2 Nitrile				
<u>Flow meter description</u>	<u>Fuel volume transferred (gallons)</u>			
SwRI PD (Max Machinery)	5,001	9,999	15,000	18,622
FloCat/Penn State (S/N FC410357) 1	4,988	9,990	14,986	18,592
FloCat/Penn State (S/N FC400310) 2	4,957	9,927	14,889	18,465
FloCat/Penn State (S/N FC400289) 3	--	--	--	--
FloCat (S/N FC400249) 4	5,006	10,029	15,049	18,668
FloCat (S/N FC411321) 5	4,672	9,367	14,054	17,429
FloCat/Penn State (S/N FC400338) 6	4,937	9,901	14,860	18,434
FloCat/Penn State (S/N FC400197) 7	4,958	9,946	14,930	18,527
FloCat/Penn State (S/N FC400273) 8	4,987	10,001	15,008	18,620
FuelTrax green (EMMU)	4,943	9,953	14,779	18,627
FuelTrax blue (S/N FTX-MMU-1010)	5,028	10,058	15,091	18,700
Vortex flow meter (S/N 0188771)	3,665	7,352	11,075	13,737
Tank height (inches)	12.50	26.50	44.50	60.50
Tank volume (gallons)	4,482	9,163	14,520	18,656

MP #4 Volume – ISSUES			
Date: 11/22/2021 Fuel transferred from JGB #2 Nitrile to AEF MILPAWS #4			
<u>Fuel volume transferred (gallons)</u>			
5,001	10,000	15,000	18,693
5,051	10,148	15,301	19,134
5,075	10,244	15,447	19,298
--	--	--	--
5,265	10,588	15,948	19,913
4,693	9,371	14,031	17,467
4,959	9,920	14,876	18,538
4,946	9,894	14,841	18,518
5,007	10,014	15,012	18,704
4,992	9,852	15,092	18,788
5,036	10,071	15,104	18,817
3,701	7,427	11,171	13,948
15.75	30.50	49.00	66.00
5,293	9,799	14,664	18,361

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Table D-7. Fuel Transfer Events September – December 2021
MPC #6 and SEI Desert King #9
Fuel Flow Compared to Same Meter

MPXY =	Meter Pair
G =	Green FuelTrax
PS =	Penn State Lab

X = Receipt	Y = Issue
B =	Blue FuelTrax

<u>Flow meter</u>	<u>Avg. CFT Volume Error</u>	<u>Median CFT Volume Error</u>	<u>CFT Volume Error Max/Min</u>		<u>Avg. Meter Error</u>	<u>Median Meter Error</u>	<u>Meter Error Max/Min</u>		<u>Avg. CFT Volume Gain/Loss</u>	<u>Median CFT Volume Gain/Loss</u>	<u>CFT Volume Gain/Loss Max/Min</u>	
PS/FloCat Turbine flow meter MP11	1.7%	0.2%	9.5%	0.0%	2.7%	0.5%	10.9%	0.0%	1.3%	0.2%	9.5%	0.0%
PS/FloCat Turbine flow meter MP22	2.7%	1.3%	11.4%	0.2%	4.4%	3.6%	12.4%	0.6%	2.0%	1.0%	11.4%	0.2%
FloCat Turbine flow meter MP44	0.1%	0.1%	0.3%	0.0%	0.2%	0.1%	0.4%	0.0%	0.1%	0.0%	0.2%	0.0%
FloCat Turbine flow meter MP55	5.8%	3.5%	13.8%	1.1%	7.6%	7.2%	16.0%	5.2%	3.5%	2.6%	10.3%	1.1%
PS/FloCat Turbine flow meter MP66	0.5%	0.4%	0.9%	0.2%	1.0%	1.0%	1.3%	0.8%	0.4%	0.3%	0.6%	0.2%
MP77	0.8%	0.5%	3.2%	0.2%	1.3%	1.3%	3.6%	0.3%	0.6%	0.4%	2.4%	0.1%
MP88	0.2%	0.1%	1.1%	0.0%	0.3%	0.2%	2.2%	0.0%	0.1%	0.1%	1.1%	0.0%
MPGG	1.3%	0.4%	11.0%	0.0%	1.5%	0.6%	7.0%	0.1%	0.7%	0.3%	4.3%	0.0%
MPBB	0.3%	0.2%	0.7%	0.0%	0.5%	0.6%	0.7%	0.1%	0.2%	0.2%	0.5%	0.0%
Varec Tactical Fuel Gauge (calculated)	1.2%	0.7%	9.1%	0.1%	10.3%	0.9%	100.0%	0.0%	0.9%	0.4%	5.7%	0.0%
	<u>Avg. CFT Volume Error</u>	<u>Median CFT Volume Error</u>	<u>CFT Volume Error Max/Min</u>		<u>Avg. Meter Error</u>	<u>Median Meter Error</u>	<u>Meter Error Max/Min</u>		<u>Avg. CFT Volume Gain/Loss</u>	<u>Median CFT Volume Gain/Loss</u>	<u>CFT Volume Gain/Loss Max/Min</u>	
FloCat meters only	2.9%	1.8%	13.8%	0.0%	3.9%	3.7%	16.0%	0.0%	1.8%	1.3%	10.3%	0.0%
FloCat meters modified by Penn State only	1.2%	0.4%	11.4%	0.0%	1.9%	1.0%	12.4%	0.0%	0.9%	0.3%	11.4%	0.0%
Coriolis meters only	0.8%	0.3%	11.0%	0.0%	1.0%	0.6%	7.0%	0.1%	0.4%	0.2%	4.3%	0.0%

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Table D-8. Fuel Transfer Events September – December 2021
CFTs involved: MPC #6 and SEI Desert King #9
Fuel Flow Compared to Alternate Meters

MPXY =	Meter Pair
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X = Receipt	Y = Issue
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G =	Green FuelTrax
PS =	Penn State Lab

B =	Blue FuelTrax
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<u>Flow meter</u>	<u>Avg. CFT Volume Error</u>	<u>Median CFT Volume Error</u>	<u>CFT Volume Error Max/Min</u>		<u>Avg. Meter Error</u>	<u>Median Meter Error</u>	<u>Meter Error Max/Min</u>		<u>Avg. CFT Volume Gain/Loss</u>	<u>Median CFT Volume Gain/Loss</u>	<u>CFT Volume Gain/Loss Max/Min</u>	
PS/FloCat Turbine flow meter MP12	1.8%	0.2%	9.5%	0.0%	2.8%	0.5%	10.9%	0.0%	1.3%	0.2%	9.5%	0.0%
PS/FloCat Turbine flow meter MP27	1.4%	0.3%	11.4%	0.1%	2.8%	1.0%	12.4%	0.3%	1.3%	0.3%	11.4%	0.1%
FloCat Turbine flow meter MP45	2.0%	1.2%	5.7%	0.0%	3.7%	3.6%	7.6%	0.1%	1.3%	1.0%	3.2%	0.0%
FloCat Turbine flow meter MP54	5.5%	3.2%	16.8%	0.0%	6.6%	6.7%	16.0%	0.0%	3.4%	2.4%	16.8%	0.0%
PS/FloCat Turbine flow meter MP67	0.3%	0.3%	0.6%	0.1%	0.7%	0.8%	1.1%	0.3%	0.3%	0.2%	0.6%	0.1%
PS/FloCat Turbine flow meter MP78	0.6%	0.4%	2.4%	0.0%	1.0%	1.1%	3.6%	0.0%	0.5%	0.4%	2.4%	0.0%
PS/FloCat Turbine flow meter MP81	3.2%	0.2%	8.6%	0.0%	1.5%	0.3%	6.5%	0.0%	0.8%	0.1%	5.7%	0.0%
Coriolis meter MPGB	0.4%	0.3%	1.0%	0.0%	0.6%	0.5%	1.8%	0.1%	0.2%	0.2%	0.6%	0.0%
Coriolis meter MPBG	1.3%	0.3%	11.0%	0.0%	1.4%	0.6%	7.0%	0.0%	0.6%	0.2%	4.3%	0.0%
Varec Tactical Fuel Gauge (calculated)	1.2%	0.7%	9.1%	0.1%	10.3%	0.9%	100.0%	0.0%	0.9%	0.4%	5.7%	0.0%

	<u>Avg. CFT Volume Error</u>	<u>Median CFT Volume Error</u>	<u>CFT Volume Error Max/Min</u>		<u>Avg. Meter Error</u>	<u>Median Meter Error</u>	<u>Meter Error Max/Min</u>		<u>Avg. CFT Volume Gain/Loss</u>	<u>Median CFT Volume Gain/Loss</u>	<u>CFT Volume Gain/Loss Max/Min</u>	
FloCat meters only	3.7%	2.2%	16.8%	0.0%	5.2%	5.1%	16.0%	0.0%	2.3%	1.7%	16.8%	0.0%
FloCat meters modified by Penn State only	1.5%	0.3%	11.4%	0.0%	1.8%	0.8%	12.4%	0.0%	0.8%	0.2%	11.4%	0.0%
Coriolis meters only	0.8%	0.3%	11.0%	0.0%	1.0%	0.6%	7.0%	0.0%	0.4%	0.2%	4.3%	0.0%

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Table D- 9. Fuel Transfer Events September – December 2021
CFTs involved: MPC #6 and SEI Desert King #9
Raw Data

<u>Flow meter description</u>	MPC #6 Volume – RECEIPTS Date: 09/07/2021 Fuel transferred from SEI Desert King #9 to MPC #6				DK #9 Volume – ISSUES Date: 09/15/2021 Fuel transferred from MPC #6 to SEI Desert King #9			
	NOTE: entrained air observed in sight glass (heavy)				NOTE: entrained air NOT observed in sight glass			
	<u>Fuel volume transferred (gallons)</u>				<u>Fuel volume transferred (gallons)</u>			
SwRI PD (Max Machinery)	5,002	9,999	15,000	19,438	5,000	10,000	14,999	18,054
FloCat/Penn State (S/N FC410357) 1	5,475	10,919	16,464	21,242	5,102	10,229	15,470	18,681
FloCat/Penn State (S/N FC400310) 2	5,570	11,066	16,687	21,523	5,137	10,285	15,527	18,755
FloCat/Penn State (S/N FC400289) 3	--	--	--	--	--	--	--	--
FloCat (S/N FC400249) 4	--	--	--	--	--	--	--	--
FloCat (S/N FC411321) 5	4,549	8,995	13,526	17,572	4,591	9,192	13,780	16,580
FloCat/Penn State (S/N FC400338) 6	--	--	--	--	--	--	--	--
FloCat/Penn State (S/N FC400197) 7	4,884	9,702	14,610	18,974	4,965	9,948	14,924	17,965
FloCat/Penn State (S/N FC400273) 8	4,969	9,856	14,844	19,270	4,986	9,987	14,981	18,028
FuelTrax green (EMMU)	--	--	--	--	5,006	10,041	15,074	18,070
FuelTrax blue (S/N FTX-MMU-1010)	--	--	--	--	5,027	10,058	15,089	18,151
Vortex flow meter (S/N 0188771)	--	--	--	--	3,972	8,799	13,308	16,880
Varec Tactical Fuel Gauge (calculated)	4,968	9,924	14,890	--	5,165	10,173	15,128	18,184
Tank height (inches)	--	30.25	48.00	66.00	16.25	28.75	42.75	53.25
Tank volume (gallons)	--	9,943	14,588	19,418	5,940	11,018	15,986	19,212

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MPC #6 Volume – RECEIPTS Date: 10/7/2021 Fuel transferred from SEI Desert King #9 to MPC #6 NOTE: entrained air NOT observed in sight glass				
<u>Flow meter description</u>	<u>Fuel volume transferred (gallons)</u>			
SwRI PD (Max Machinery)	5,000	9,999	15,000	18,290
FloCat/Penn State (S/N FC410357) 1	5,018	10,044	15,054	18,351
FloCat/Penn State (S/N FC400310) 2	4,961	9,931	14,880	18,137
FloCat/Penn State (S/N FC400289) 3	--	--	--	--
FloCat (S/N FC400249) 4	--	--	--	--
FloCat (S/N FC411321) 5	4,725	9,465	14,193	17,285
FloCat/Penn State (S/N FC400338) 6	--	--	--	--
FloCat/Penn State (S/N FC400197) 7	4,924	9,868	14,797	18,024
FloCat/Penn State (S/N FC400273) 8	5,001	10,017	15,008	18,295
FuelTrax green (EMMU)	5,021	10,029	15,001	18,308
FuelTrax blue (S/N FTX-MMU-1010)	5,028	10,060	15,088	18,396
Vortex flow meter (S/N 0188771)	3,719	7,435	11,186	13,621
Varec Tactical Fuel Gauge (calculated)	5,052	10,008	14,984	18,293
Tank height (inches)	20.00	33.50	51.50	66.00
Tank volume (gallons)	7,313	10,785	15,518	19,418

DK #9 Volume – ISSUES Date: 10/20/2021 Fuel transferred from MPC #6 to SEI Desert King #9			
<u>Fuel volume transferred (gallons)</u>			
5,000	10,015	15,000	17,786
5,156	10,404	15,689	18,657
5,212	10,483	15,773	18,746
--	--	--	--
--	--	--	--
4,668	9,348	13,972	16,548
--	--	--	--
4,949	9,900	14,812	17,552
5,005	10,024	15,002	17,775
5,333	10,254	15,108	18,090
5,033	10,074	15,089	17,871
3,722	7,487	11,226	13,327
5,165	10,164	15,181	17,960
17.50	30.25	45.00	53.50
6,475	11,587	16,713	19,284

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	MPC #6 Volume – RECEIPTS			
	Date: 11/2/2021 Fuel transferred from SEI Desert King #9 to MPC #6			
<u>Flow meter description</u>	<u>Fuel volume transferred (gallons)</u>			
SwRI PD (Max Machinery)	5,000	10,000	14,999	18,549
FloCat/Penn State (S/N FC410357) 1	5,024	10,052	15,076	18,624
FloCat/Penn State (S/N FC400310) 2	4,969	9,939	14,899	18,402
FloCat/Penn State (S/N FC400289) 3	--	--	--	--
FloCat (S/N FC400249) 4	--	--	--	--
FloCat (S/N FC411321) 5	4,696	9,380	14,055	17,355
FloCat/Penn State (S/N FC400338) 6	--	--	--	--
FloCat/Penn State (S/N FC400197) 7	4,946	9,879	14,807	18,283
FloCat/Penn State (S/N FC400273) 8	5,009	10,016	15,014	18,544
FuelTrax green (EMMU)	5,031	10,005	15,092	18,640
FuelTrax blue (S/N FTX-MMU-1010)	5,032	10,064	15,095	18,655
Vortex flow meter (S/N 0188771)	3,682	7,411	11,779	14,383
Varec Tactical Fuel Gauge (calculated)	5,062	10,037	15,016	18,914
Tank height (inches)	18.00	31.75	51.25	66.00
Tank volume (gallons)	6,805	10,331	15,451	19,418

	DK #9 Volume – ISSUES			
	Date: 11/16/2021 Fuel transferred from MPC #6 to SEI Desert King #9			
	<u>Fuel volume transferred (gallons)</u>			
	5,000	10,000	15,000	17,623
	4,975	9,977	14,971	17,588
	--	--	--	--
	--	--	--	--
	4,992	9,992	14,985	17,597
	4,619	9,265	13,897	16,327
	4,934	9,894	14,843	17,437
	4,961	9,946	14,921	17,529
	4,977	9,977	14,964	17,577
	4,974	9,943	15,058	17,598
	5,026	10,053	15,081	17,699
	--	--	--	--
	5,175	9,675	15,207	17,852
	17.50	29.50	43.00	53.00
	6,475	11,303	16,067	19,140

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	MPC #6 Volume – RECEIPTS Date: 11/29/2021 Fuel transferred from SEI Desert King #9 to MPC #6			
<u>Flow meter description</u>	<u>Fuel volume transferred (gallons)</u>			
SwRI PD (Max Machinery)	5,001	10,008	15,000	19,889
FloCat/Penn State (S/N FC410357) 1	5,002	10,022	15,025	19,914
FloCat/Penn State (S/N FC400310) 2	--	--	--	--
FloCat (S/N FC400243) 3	--	--	--	--
FloCat (S/N FC400249) 4	5,008	10,023	15,018	19,900
FloCat (S/N FC411321) 5	5,799	10,480	15,142	19,702
FloCat/Penn State (S/N FC400193) 6	4,948	9,915	14,865	19,700
FloCat/Penn State (S/N FC400197) 7	4,936	9,877	14,803	19,635
FloCat/Penn State (S/N FC400273) 8	4,989	9,995	14,984	19,858
FuelTrax green (EMMU)	5,007	9,981	15,065	19,940
FuelTrax blue (S/N FTX-MMU-1010)	5,023	10,058	15,078	19,981
Vortex flow meter (S/N 0188771)	3,677	7,409	11,134	14,774
Varec Tactical Fuel Gauge (calculated)	5,069	10,065	15,076	18,687
Tank height (inches)	14.00	28.75	46.50	66.25
Tank volume (gallons)	5,792	9,556	14,191	19,486

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APPENDIX E
USMC Camp Lejeune Manual Tank Gauging Data

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**Table E-1. Camp Lejeune Tank Gauging Data
Showing CFT Height Measured and Corresponding Calculated Fuel Volume**

	Tank Height (Inches)	Fuel Volume (Gallons)	Tank Height (Inches)	Fuel Volume (Gallons)	Tank Height (Inches)	Fuel Volume (Gallons)	Tank Height (Inches)	Fuel Volume (Gallons)	Tank Height (Inches)	Fuel Volume (Gallons)	Tank Height (Inches)	Fuel Volume (Gallons)
Person 1	11.38	6,132	32.25	14,560	27.88	12,849	16.50	8,021	14.50	7,115	37.00	16,330
Person 2	14.25	7,000	34.75	15,503	27.50	12,698	17.00	8,245	15.25	7,457	36.75	16,239
Person 3	13.75	6,770	31.75	14,369	27.50	12,698	17.00	8,245	14.50	7,115	37.13	16,376
Person 4	12.38	6,132	34.19	15,317	27.75	12,799	17.25	8,357	14.50	7,115	36.88	16,285
Person 5	12.25	6,073	35.00	15,596	27.25	12,598	17.50	8,468	14.38	7,057	36.75	16,239
Person 6	12.75	6,307	32.50	14,656	27.75	12,799	18.50	8,910	14.50	7,115	36.50	16,148
Person 7	12.75	6,307	32.25	14,560	28.00	12,899	17.00	8,245	14.50	7,115	35.88	15,919
Person 8	13.00	6,423	33.75	15,129	27.13	12,547	18.50	8,910	14.63	7,172	37.25	16,421
Person 9	13.50	6,655	--	--	27.25	12,598	--	--	--	--	36.75	16,239

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APPENDIX F

North American Fuel Tank 20K Nitrile Tank Strapping Chart

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20K NITRILE TANK STRAPPING CHART

Inches	Gallons	Inches	Gallons	Inches	Gallons	Inches	Gallons	Inches	Gallons	Inches	Gallons	Inches	Gallons	Inches	Gallons
0.13	65.50	8.13	4105.22	16.13	7852.66	24.13	11318.27	32.13	14512.48	40.13	17445.74	48.13	20128.50	56.13	22571.20
0.25	130.92	8.25	4165.99	16.25	7908.95	24.25	11370.24	32.25	14560.29	40.25	17489.56	48.25	20168.49	56.25	22607.52
0.38	196.26	8.38	4226.70	16.38	7965.17	24.38	11422.14	32.38	14608.04	40.38	17533.32	48.38	20208.41	56.38	22643.78
0.50	261.54	8.50	4287.33	16.50	8021.33	24.50	11473.98	32.50	14655.72	40.50	17577.01	48.50	20248.28	56.50	22679.99
0.63	326.74	8.63	4347.89	16.63	8077.41	24.63	11525.75	32.63	14703.34	40.63	17620.64	48.63	20288.09	56.63	22716.14
0.75	391.87	8.75	4408.38	16.75	8133.43	24.75	11577.45	32.75	14750.90	40.75	17664.22	48.75	20327.85	56.75	22752.23
0.88	456.92	8.88	4468.80	16.88	8189.37	24.88	11629.09	32.88	14798.40	40.88	17707.73	48.88	20367.54	56.88	22788.27
1.00	521.90	9.00	4529.14	17.00	8245.25	25.00	11680.66	33.00	14845.83	41.00	17751.18	49.00	20407.18	57.00	22824.25
1.13	586.80	9.13	4589.42	17.13	8301.06	25.13	11732.17	33.13	14893.19	41.13	17794.57	49.13	20446.75	57.13	22860.18
1.25	651.63	9.25	4649.62	17.25	8356.80	25.25	11783.61	33.25	14940.50	41.25	17837.90	49.25	20486.27	57.25	22896.05
1.38	716.39	9.38	4709.76	17.38	8412.48	25.38	11834.99	33.38	14987.74	41.38	17881.77	49.38	20525.73	57.38	22931.87
1.50	781.08	9.50	4769.82	17.50	8468.08	25.50	11886.30	33.50	15034.91	41.50	17924.38	49.50	20565.13	57.50	22967.63
1.63	845.69	9.63	4829.81	17.63	8523.62	25.63	11937.54	33.63	15082.03	41.63	17967.53	49.63	20604.48	57.63	23003.33
1.75	910.23	9.75	4889.73	17.75	8579.08	25.75	11988.72	33.75	15129.08	41.75	18010.61	49.75	20643.76	57.75	23038.98
1.88	974.69	9.88	4949.59	17.88	8634.48	25.88	12039.83	33.88	15176.07	41.88	18053.64	49.88	20682.99	57.88	23074.57
2.00	1039.08	10.00	5009.36	18.00	8689.81	26.00	12090.87	34.00	15222.99	42.00	18096.60	50.00	20722.16	58.00	23110.11
2.13	1103.40	10.13	5069.07	18.13	8745.08	26.13	12141.85	34.13	15269.85	42.13	18139.51	50.13	20761.27	58.13	23145.59
2.25	1167.64	10.25	5128.71	18.25	8800.27	26.25	12192.77	34.25	15316.65	42.25	18182.35	50.25	20800.33	58.25	23181.02
2.38	1231.81	10.38	5188.28	18.38	8855.40	26.38	12243.62	34.38	15363.38	42.38	18225.14	50.38	20839.32	58.38	23216.39
2.50	1295.91	10.50	5247.78	18.50	8910.46	26.50	12294.40	34.50	15410.05	42.50	18267.86	50.50	20878.26	58.50	23251.70
2.63	1359.94	10.63	5307.20	18.63	8965.45	26.63	12345.12	34.63	15456.66	42.63	18310.52	50.63	20917.14	58.63	23286.96
2.75	1423.89	10.75	5366.56	18.75	9020.37	26.75	12395.77	34.75	15503.21	42.75	18353.13	50.75	20955.96	58.75	23322.17
2.88	1487.77	10.88	5425.84	18.88	9075.23	26.88	12446.36	34.88	15549.69	42.88	18395.67	50.88	20994.73	58.88	23357.32
3.00	1551.57	11.00	5485.06	19.00	9130.01	27.00	12496.88	35.00	15596.11	43.00	18438.15	51.00	21033.44	59.00	23392.41
3.13	1615.31	11.13	5544.20	19.13	9184.73	27.13	12547.34	35.13	15642.47	43.13	18480.57	51.13	21072.08	59.13	23427.45
3.25	1678.97	11.25	5603.27	19.25	9239.38	27.25	12597.73	35.25	15688.77	43.25	18522.93	51.25	21110.68	59.25	23462.44
3.38	1742.55	11.38	5662.28	19.38	9293.96	27.38	12648.06	35.38	15735.00	43.38	18565.23	51.38	21149.21	59.38	23497.37
3.50	1806.07	11.50	5721.21	19.50	9348.48	27.50	12698.32	35.50	15781.17	43.50	18607.48	51.50	21187.69	59.50	23532.24
3.63	1869.51	11.63	5780.07	19.63	9402.93	27.63	12748.51	35.63	15827.27	43.63	18649.66	51.63	21226.10	59.63	23567.06
3.75	1932.88	11.75	5838.87	19.75	9457.31	27.75	12798.64	35.75	15873.32	43.75	18691.78	51.75	21264.47	59.75	23601.83
3.88	1996.17	11.88	5897.59	19.88	9511.62	27.88	12848.71	35.88	15919.30	43.88	18733.84	51.88	21302.77	59.88	23636.54
4.00	2059.40	12.00	5956.24	20.00	9565.86	28.00	12898.71	36.00	15965.22	44.00	18775.84	52.00	21341.02	60.00	23671.19
4.13	2122.55	12.13	6014.82	20.13	9620.04	28.13	12948.64	36.13	16011.08	44.13	18817.78	52.13	21379.21	60.13	23705.79
4.25	2185.62	12.25	6073.34	20.25	9674.15	28.25	12998.51	36.25	16056.87	44.25	18859.66	52.25	21417.34	60.25	23740.34
4.38	2248.63	12.38	6131.78	20.38	9728.19	28.38	13048.32	36.38	16102.60	44.38	18901.48	52.38	21455.41	60.38	23774.83
4.50	2311.56	12.50	6190.15	20.50	9782.17	28.50	13098.06	36.50	16148.27	44.50	18943.25	52.50	21493.43	60.50	23809.26
4.63	2374.42	12.63	6248.45	20.63	9836.07	28.63	13147.74	36.63	16193.88	44.63	18984.95	52.63	21531.39	60.63	23843.65
4.75	2437.21	12.75	6306.68	20.75	9889.91	28.75	13197.35	36.75	16239.42	44.75	19026.59	52.75	21569.29	60.75	23877.97
4.88	2499.92	12.88	6364.85	20.88	9943.69	28.88	13246.89	36.88	16284.91	44.88	19068.17	52.88	21607.14	60.88	23912.24
5.00	2562.57	13.00	6422.94	21.00	9997.39	29.00	13296.37	37.00	16330.33	45.00	19109.70	53.00	21644.93	61.00	23946.46
5.13	2625.14	13.13	6480.96	21.13	10051.03	29.13	13345.79	37.13	16375.68	45.13	19151.16	53.13	21682.66	61.13	23980.62
5.25	2687.63	13.25	6538.91	21.25	10104.60	29.25	13395.14	37.25	16420.98	45.25	19192.56	53.25	21720.33	61.25	24014.73
5.38	2750.06	13.38	6596.80	21.38	10158.10	29.38	13444.43	37.38	16466.22	45.38	19233.91	53.38	21757.95	61.38	24048.79
5.50	2812.41	13.50	6654.61	21.50	10211.54	29.50	13493.65	37.50	16511.39	45.50	19275.19	53.50	21795.51	61.50	24082.79
5.63	2874.69	13.63	6712.35	21.63	10264.91	29.63	13542.81	37.63	16556.50	45.63	19316.42	53.63	21833.01	61.63	24116.73
5.75	2936.90	13.75	6770.03	21.75	10318.21	29.75	13591.90	37.75	16601.55	45.75	19357.58	53.75	21870.46	61.75	24150.62
5.88	2999.04	13.88	6827.63	21.88	10371.45	29.88	13640.93	37.88	16646.53	45.88	19398.69	53.88	21907.85	61.88	24184.46
6.00	3061.11	14.00	6885.17	22.00	10424.62	30.00	13689.90	38.00	16691.46	46.00	19439.74	54.00	21945.18	62.00	24218.24
6.13	3123.10	14.13	6942.63	22.13	10477.72	30.13	13738.80	38.13	16736.32	46.13	19480.72	54.13	21982.46	62.13	24251.97
6.25	3185.02	14.25	7000.03	22.25	10530.75	30.25	13787.63	38.25	16781.12	46.25	19521.65	54.25	22019.68	62.25	24285.64
6.38	3246.87	14.38	7057.35	22.38	10583.72	30.38	13836.41	38.38	16825.86	46.38	19562.52	54.38	22056.84	62.38	24320.61
6.50	3308.64	14.50	7114.61	22.50	10636.62	30.50	13885.11	38.50	16870.54	46.50	19603.33	54.50	22093.95	62.50	24352.83
6.63	3370.35	14.63	7171.80	22.63	10689.45	30.63	13933.76	38.63	16915.15	46.63	19644.08	54.63	22131.00	62.63	24387.68
6.75	3431.98	14.75	7228.92	22.75	10742.22	30.75	13982.33	38.75	16959.71	46.75	19684.78	54.75	22167.99	62.75	24419.80
6.88	3493.54	14.88	7285.97	22.88	10794.92	30.88	14030.85	38.88	17004.20	46.88	19725.41	54.88	22204.93	62.88	24454.54
7.00	3555.03	15.00	7342.95	23.00	10847.55	31.00	14079.30	39.00	17048.63	47.00	19765.98	55.00	22241.81	63.00	24486.55
7.13	3616.45	15.13	7399.86	23.13	10900.12	31.13	14127.69	39.13	17093.00	47.13	19806.50	55.13	22278.63	63.13	24521.18
7.25	3677.80	15.25	7456.70	23.25	10952.62	31.25	14176.01	39.25	17137.31	47.25	19846.95	55.25	22315.40	63.25	24553.09
7.38	3739.07	15.38	7513.47	23.38	11005.06	31.38	14224.27	39.38	17181.55	47.38	19887.35	55.38	22352.11	63.38	24587.61
7.50	3800.28	15.50	7570.18	23.50	11057.42	31.50	14272.46	39.50	17225.74	47.50	19927.69	55.50	22388.77	63.50	24619.42
7.63	3861.41	15.63	7626.81	23.63	11109.73	31.63	14320.59	39.63	17269.86	47.63	19967.97	55.63	22425.37	63.63	24653.82
7.75	3922.47	15.75	7683.38	23.75	11161.96	31.75	14368.66	39.75	17313.92	47.75	20008.19	55.75	22461.91	63.75	24685.52
7.88	3983.46	15.88	7739.87	23.88	11214.13	31.88	14416.66	39.88	17357.92	47.88	20048.35	55.88	22498.40	63.88	24719.82
															

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APPENDIX G
Manual CFT Gauging Accuracy Calculations

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Participant	Avg. CFT Volume Error	Median CFT Volume Error	CFT Volume Error Max/Min		Avg. Human Error	Median Human Error	Human Error Max/Min		Avg. CFT Volume Gain/Loss	Median CFT Volume Gain/Loss	CFT Volume Gain/Loss Max/Min	
Person 1	3.0%	1.9%	11.8%	0.2%	3.5%	2.9%	11.8%	0.1%	2.8%	1.4%	11.8%	0.2%
Person 1 25% full	4.9%	4.6%	11.8%	1.5%	5.8%	4.8%	11.8%	1.5%	4.4%	3.6%	11.8%	0.9%
Person 1 50% full	2.6%	1.8%	8.9%	0.2%	3.8%	3.7%	6.6%	0.9%	2.4%	1.3%	8.9%	0.2%
Person 1 75% full	3.0%	2.6%	6.3%	0.5%	2.1%	1.7%	4.7%	0.1%	2.7%	2.4%	5.0%	0.5%
Person 1 100% full	1.6%	1.6%	2.8%	0.2%	2.3%	2.0%	5.7%	0.2%	1.6%	1.6%	2.8%	0.2%
Person 2	2.9%	1.9%	11.3%	0.2%	3.5%	2.4%	8.5%	0.2%	2.5%	1.5%	8.2%	0.2%
Person 2 25% full	5.8%	5.5%	11.3%	2.0%	4.3%	3.7%	8.2%	0.5%	4.6%	4.5%	8.2%	1.5%
Person 2 50% full	1.6%	1.5%	3.2%	0.2%	5.0%	4.8%	8.5%	2.3%	1.3%	1.3%	3.2%	0.2%
Person 2 75% full	2.7%	2.5%	4.9%	0.6%	3.3%	2.4%	7.5%	1.9%	2.4%	2.2%	4.3%	0.6%
Person 2 100% full	1.5%	1.4%	3.2%	0.2%	1.5%	1.4%	3.2%	0.2%	1.5%	1.4%	3.2%	0.2%
Person 3	4.1%	3.4%	14.2%	0.1%	4.3%	3.7%	14.2%	0.1%	3.6%	2.9%	14.2%	0.1%
Person 3 25% full	8.2%	7.2%	14.2%	4.0%	8.2%	6.9%	14.2%	4.0%	7.1%	4.5%	14.2%	2.6%
Person 3 50% full	2.1%	1.3%	5.5%	0.5%	3.8%	3.3%	8.8%	0.2%	1.8%	1.2%	3.9%	0.4%
Person 3 75% full	4.5%	4.9%	7.9%	1.5%	3.0%	3.5%	4.9%	0.5%	4.0%	4.4%	6.4%	1.2%
Person 3 100% full	1.4%	1.0%	3.2%	0.1%	2.2%	2.7%	4.0%	0.1%	1.4%	1.0%	3.2%	0.1%
Person 4	3.7%	2.4%	13.4%	0.1%	4.0%	3.3%	13.4%	0.1%	3.4%	2.0%	13.4%	0.1%
Person 4 25% full	7.1%	6.5%	13.4%	1.1%	7.2%	5.4%	13.4%	2.6%	6.3%	4.8%	13.4%	0.7%
Person 4 50% full	3.8%	2.2%	13.2%	0.4%	4.0%	4.0%	5.8%	2.1%	3.5%	1.9%	13.2%	0.4%
Person 4 75% full	2.4%	2.4%	5.0%	0.3%	2.6%	2.4%	4.9%	0.6%	2.2%	2.3%	4.0%	0.2%
Person 4 100% full	1.6%	1.4%	3.3%	0.1%	2.4%	2.1%	6.7%	0.1%	1.6%	1.4%	3.3%	0.1%
Person 5	4.3%	2.9%	14.3%	0.0%	4.3%	4.1%	14.2%	0.0%	3.7%	2.4%	14.2%	0.0%
Person 5 25% full	7.8%	7.3%	14.3%	1.0%	6.9%	7.0%	14.2%	1.0%	6.5%	5.7%	14.2%	1.0%
Person 5 50% full	3.0%	2.9%	4.4%	1.9%	4.6%	4.5%	6.2%	3.4%	2.6%	2.1%	4.4%	1.9%
Person 5 75% full	4.4%	3.0%	10.8%	0.9%	3.3%	2.9%	8.3%	0.1%	4.0%	2.9%	10.8%	0.8%
Person 5 100% full	1.9%	2.3%	3.2%	0.0%	2.4%	2.4%	6.0%	0.0%	1.9%	2.3%	3.2%	0.0%
Person 6	3.6%	2.4%	13.8%	0.0%	4.1%	3.9%	12.5%	0.1%	3.1%	2.2%	12.5%	0.0%
Person 6 25% full	8.2%	9.4%	13.8%	2.0%	6.0%	5.3%	12.5%	1.2%	6.5%	7.4%	12.5%	1.3%
Person 6 50% full	2.0%	1.9%	3.8%	0.0%	5.3%	5.6%	7.5%	1.4%	1.8%	1.4%	3.8%	0.0%
Person 6 75% full	3.1%	3.2%	4.4%	1.4%	3.6%	3.9%	6.3%	1.0%	2.7%	2.8%	3.5%	1.4%
Person 6 100% full	1.3%	1.6%	2.2%	0.1%	1.6%	0.9%	5.0%	0.1%	1.3%	1.6%	2.2%	0.1%
Person 7	3.2%	2.0%	12.6%	0.2%	3.5%	2.7%	12.6%	0.5%	2.8%	1.9%	12.6%	0.1%
Person 7 25% full	5.5%	4.0%	12.6%	0.2%	6.2%	6.1%	12.6%	2.0%	4.7%	4.0%	12.6%	0.1%
Person 7 50% full	3.0%	2.9%	5.1%	1.5%	2.7%	2.6%	4.9%	0.7%	2.6%	2.9%	3.8%	1.1%
Person 7 75% full	2.7%	1.8%	8.3%	0.4%	2.8%	2.4%	6.5%	0.5%	2.4%	1.6%	6.7%	0.3%
Person 7 100% full	1.6%	1.4%	2.8%	0.7%	2.4%	2.2%	5.7%	0.7%	1.6%	1.4%	2.8%	0.7%
Person 8	3.1%	3.0%	13.4%	0.1%	3.2%	2.8%	13.4%	0.1%	2.7%	2.7%	13.4%	0.1%
Person 8 25% full	5.2%	4.2%	13.4%	0.8%	5.1%	3.9%	13.4%	0.8%	4.4%	2.9%	13.4%	0.8%
Person 8 50% full	2.3%	2.3%	4.0%	0.1%	3.4%	3.4%	6.1%	0.3%	2.2%	2.1%	4.0%	0.1%
Person 8 75% full	3.0%	2.9%	6.9%	0.7%	2.0%	1.3%	5.6%	0.5%	2.6%	2.7%	5.5%	0.7%
Person 8 100% full	1.8%	1.4%	4.2%	0.1%	2.2%	1.4%	6.4%	0.1%	1.8%	1.4%	4.2%	0.1%
Person 9	3.8%	3.0%	12.5%	0.3%	3.9%	3.0%	12.5%	0.3%	3.3%	2.3%	12.5%	0.3%
Person 9 25% full	6.9%	7.5%	12.5%	2.0%	5.5%	5.0%	12.5%	0.7%	5.7%	5.2%	12.5%	1.5%
Person 9 50% full	3.4%	3.4%	6.2%	0.5%	6.1%	5.5%	11.1%	3.1%	2.8%	2.5%	5.1%	0.5%
Person 9 75% full	3.5%	3.5%	7.6%	0.3%	2.3%	1.4%	7.0%	0.3%	3.2%	3.2%	7.6%	0.3%
Person 9 100% full	1.5%	1.3%	3.3%	0.6%	1.6%	1.0%	3.4%	0.4%	1.5%	1.3%	3.3%	0.6%

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Participant	Avg. CFT Volume Error	Median CFT Volume Error	CFT Volume Error Max/Min		Avg. Human Error	Median Human Error	Human Error Max/Min		Avg. CFT Volume Gain/Loss	Median CFT Volume Gain/Loss	CFT Volume Gain/Loss Max/Min	
Person 10	3.1%	2.4%	10.2%	0.2%	3.2%	2.6%	10.2%	0.0%	2.7%	2.0%	10.2%	0.2%
Person 10 25% full	5.8%	6.2%	10.2%	2.0%	4.9%	4.3%	10.2%	2.0%	4.7%	4.4%	10.2%	1.4%
Person 10 50% full	1.8%	2.0%	2.9%	0.4%	4.1%	4.3%	5.6%	2.3%	1.6%	1.7%	2.6%	0.3%
Person 10 75% full	3.4%	3.1%	7.4%	0.8%	2.1%	1.5%	6.1%	0.1%	3.0%	2.8%	5.9%	0.8%
Person 10 100% full	1.6%	1.3%	3.2%	0.2%	1.8%	1.3%	5.4%	0.0%	1.6%	1.3%	3.2%	0.2%
Person 11	3.1%	1.5%	11.0%	0.1%	3.4%	3.0%	11.0%	0.1%	2.7%	1.5%	11.0%	0.1%
Person 11 25% full	6.3%	6.0%	11.0%	0.9%	5.6%	5.6%	11.0%	1.2%	5.3%	4.9%	11.0%	0.6%
Person 11 50% full	2.2%	2.0%	3.9%	0.7%	4.2%	4.6%	6.2%	1.4%	2.0%	1.9%	3.9%	0.5%
Person 11 75% full	2.9%	2.2%	6.8%	0.8%	2.3%	2.0%	5.8%	0.3%	2.5%	1.9%	5.4%	0.6%
Person 11 100% full	0.9%	0.9%	1.4%	0.1%	1.4%	1.2%	3.0%	0.1%	0.9%	0.9%	1.4%	0.1%
Person 12	3.7%	2.7%	11.8%	1.0%	4.3%	4.0%	11.8%	0.9%	3.5%	2.2%	11.8%	1.0%
Person 12 25% full	4.2%	2.1%	11.8%	1.0%	5.3%	4.3%	11.8%	0.9%	3.9%	1.3%	11.8%	1.0%
Person 12 50% full	3.8%	3.8%	5.7%	1.8%	4.8%	5.5%	6.5%	1.6%	3.3%	3.0%	5.6%	1.5%
Person 12 75% full	3.7%	3.6%	6.3%	1.1%	3.3%	3.0%	6.3%	1.1%	3.7%	3.6%	6.3%	1.1%
Person 12 100% full	3.0%	2.2%	4.8%	1.9%	3.4%	4.0%	4.8%	1.4%	3.0%	2.2%	4.8%	1.9%

	<u>Avg. CFT Volume Error</u>	Median CFT Volume Error	CFT Volume Error Max/Min		Avg. Human Error	Median Human Error	Human Error Max/Min		Avg. CFT Volume Gain/Loss	Median CFT Volume Gain/Loss	CFT Volume Gain/Loss Max/Min	
Persons	3.5%	2.4%	14.3%	0.0%	3.8%	3.0%	14.2%	0.0%	3.1%	2.1%	14.2%	0.0%
Persons 25% full	6.3%	6.1%	14.3%	0.2%	5.9%	5.2%	14.2%	0.5%	5.3%	4.5%	14.2%	0.1%
Persons 50% full	2.6%	2.1%	13.2%	0.0%	4.3%	4.4%	11.1%	0.2%	2.3%	1.9%	13.2%	0.0%
Persons 75% full	3.3%	3.0%	10.8%	0.3%	2.7%	2.4%	8.3%	0.1%	3.0%	2.7%	10.8%	0.2%
Persons 100% full	1.6%	1.4%	4.8%	0.0%	2.1%	1.7%	6.7%	0.0%	1.6%	1.4%	4.8%	0.0%

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APPENDIX H
Manual Gauging Precision Calculations in Inches

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ASTM Committee D02 Precision Evaluation

12:30, 16 May 2022

Manual tank gauging 20K tank reproducibility inches

$$\text{Reproducibility} = 0.3089 * X ^ 0.4986 \text{ inches}$$

	Initial	Final
Number of laboratories	12	12
Number of samples	24	24
Number of repeats	1	

REGRESSIONS (AFTER OUTLIER TESTS)

TRANSFORMATION TYPE: NONE

Regression	Fitted Variable	Coefficient B	t- Test	Ratio	% Sig.
Unweighted D v. (m+B0)	m + 3.5167E+01	8.5707E-03	B=0	4.45	0.0
Weighted	Intercept	-4.22427E+00			
ln(d,D) v. ln(m+B0)	ln(m + 23.445)	9.04319E-01	B=1	0.66	51.1
(for Log Transform)	Dummy	0.00000E+00			
	Dummy * Ln(m+B0)	0.00000E+00	B=0	0.00	0.0
Weighted	Intercept	-2.29363E+00			
ln(d,D) v. ln(m+B0)	ln(m)	4.98642E-01	B=0	6.11	0.0
(for Power Transform)	Dummy	0.00000E+00			
	Dummy * Ln(m+B0)	0.00000E+00	B=0	0.00	0.0
	Critical t (5%, 44) =			2.02	5.0

* Coefficient used = 0.4986

Transformation used: X^0.5014

COMMENTS:

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This report was prepared using D2PP, Version 5.3.35
from data file manual gauging data ASTM D6300 inches.xls, Sheet1, .

DATA MISSING OR REJECTED (Data rejection limit 20%):

LABORATORY	SAMPLE	DUP	TEST
(L4	,S21	,)	Hawkins-cells
(L5	,S7	,)	Hawkins-cells
(L9	,S6	,)	Hawkins-cells
(L12	,S1	,)	Missing, <, or 0.0
(L12	,S2	,)	Missing, <, or 0.0
(L12	,S3	,)	Missing, <, or 0.0
(L12	,S4	,)	Missing, <, or 0.0
(L12	,S5	,)	Missing, <, or 0.0
(L12	,S6	,)	Missing, <, or 0.0
(L12	,S7	,)	Missing, <, or 0.0
(L12	,S8	,)	Missing, <, or 0.0
(L12	,S9	,)	Missing, <, or 0.0
(L12	,S17	,)	Hawkins-cells

SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: NONE

Sample	No. of Results	Mean	Between Labs		
			S.D.	DF	R
S5	11	10.818	.4656	10	1.5
S21	11	13.216	.3015	10	.95
S13	12	16.698	.4568	11	1.4
S20	12	17.490	.4110	11	1.3
S4	11	19.966	.5839	10	1.8
S12	12	21.854	.3278	11	1.0
S6	10	22.738	.4875	9	1.6
S22	12	22.958	.2462	11	.77
S14	12	25.708	.5392	11	1.7
S19	12	28.188	.8668	11	2.7
S3	11	32.239	.8650	10	2.7
S11	12	33.302	.4474	11	1.4
S23	12	33.823	.4312	11	1.3
S7	10	35.663	.7547	9	2.4
S15	12	35.979	.4191	11	1.3
S18	12	40.875	.9201	11	2.9

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CONTINUE

SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: NONE

Sample	No. of Results	Mean	Between Labs		
			S.D.	DF	R
S2	11	47.534	.7768	10	2.4
S10	12	47.802	.6472	11	2.0
S16	12	54.385	.6688	11	2.1
S24	12	55.010	.5946	11	1.9
S17	11	55.568	.8916	10	2.8
S8	11	61.489	.8243	10	2.6
S9	11	66.057	.8298	10	2.6
S1	11	66.750	.8997	10	2.8

SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: Power

Sample	No. of Results	Mean	Between Labs		
			S.D.	DF	R
S5	11	3.2994	.7115E-01	10	.22
S21	11	3.6483	.4223E-01	10	.13
S13	12	4.1021	.5636E-01	11	.18
S20	12	4.1986	.4953E-01	11	.15
S4	11	4.4867	.6572E-01	10	.21
S12	12	4.6950	.3535E-01	11	.11
S6	10	4.7890	.5159E-01	9	.17
S22	12	4.8125	.2591E-01	11	.81E-01
S14	12	5.0932	.5340E-01	11	.17
S19	12	5.3335	.8231E-01	11	.26
S3	11	5.7051	.7685E-01	10	.24
S11	12	5.7991	.3909E-01	11	.12
S23	12	5.8444	.3737E-01	11	.12
S7	10	6.0015	.6363E-01	9	.20
S15	12	6.0283	.3521E-01	11	.11
S18	12	6.4263	.7281E-01	11	.23

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CONTINUE

SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: Power

Sample	No. of Results	Mean	Between Labs		
			S.D.	DF	R
S2	11	6.9317	.5693E-01	10	.18
S10	12	6.9513	.4723E-01	11	.15
S16	12	7.4159	.4585E-01	11	.14
S24	12	7.4585	.4050E-01	11	.13
S17	11	7.4962	.6054E-01	10	.19
S8	11	7.8867	.5306E-01	10	.17
S9	11	8.1752	.5159E-01	10	.16
S1	11	8.2181	.5568E-01	10	.18

VARIANCE ANALYSIS

Transform Type: Power

	Sum of squares		DF	Mean square	F
	Estimated	Exact			
Sample Means	5.887049E+02	5.542868E+02			
Lab Means	3.532976E-01	3.460840E-01	11	3.14622E-02	18.942
Interaction	3.986319E-01		240	1.66097E-03	
Pairs	5.894568E+02	5.550315E+02			
Total	5.894568E+02				
Critical F (5%, 11, 240) =					1.829

	Expectation of Mean Squares
Lab means	1.0000 V(r) + 1 V(I) + 22.8182 V(L)
Interaction	1.0000 V(r) + 1 V(I)
Repeats	1.0000 V(r)

	DF	Variance	Precision
Transformed data			
Reproducibility	48	5.933992E-03	1.549E-01

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INPUT DATA FOR:

Manual tank gauging 20K tank reproducibility inches

		S1	S2	S3	S4	S5	S6	S7
L1	1	67.000	48.250	33.125	20.125	11.250	23.000	36.000
L2	1	65.625	47.000	31.250	19.375	10.750	21.875	34.500
L3	1	67.875	47.000	33.500	20.875	10.250	23.000	37.000
L4	1	64.875	47.500	32.750	20.250	11.250	23.125	36.250
L5	1	67.250	48.500	31.875	20.250	10.500	22.875	39.500
L6	1	67.000	47.250	31.125	19.625	10.250	22.125	34.875
L7	1	66.375	47.625	32.875	20.875	11.000	23.500	36.375
L8	1	67.125	48.500	32.875	19.875	11.625	22.875	35.500
L9	1	66.250	45.875	31.000	19.000	10.250	20.875	35.125
L10	1	67.750	48.000	32.375	19.750	11.000	22.500	35.375
L11	1	67.125	47.375	31.875	19.625	10.875	22.500	35.625
L12	1	-999.900	-999.900	-999.900	-999.900	-999.900	-999.900	-999.900

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CONTINUE

INPUT DATA FOR:

Manual tank gauging 20K tank reproducibility inches

		S8	S9	S10	S11	S12	S13	S14
L1	1	62.375	66.500	48.625	33.625	21.625	16.750	26.250
L2	1	60.125	64.750	46.625	32.500	21.625	15.875	25.250
L3	1	62.500	67.125	48.500	33.125	22.250	17.500	26.875
L4	1	61.875	65.875	48.500	33.750	22.250	17.000	26.000
L5	1	62.250	66.875	48.500	33.875	21.500	17.125	26.125
L6	1	61.000	64.750	47.500	32.750	21.250	16.250	24.875
L7	1	62.250	66.625	47.375	33.875	22.125	16.875	25.375
L8	1	61.250	66.375	48.000	33.125	22.250	17.000	25.375
L9	1	60.750	65.125	47.000	33.125	21.875	16.125	25.500
L10	1	60.500	66.375	47.625	33.250	22.000	16.500	25.750
L11	1	61.500	66.250	47.875	33.625	21.750	16.625	25.375
L12	1	-999.900	-999.900	47.500	33.000	21.750	16.750	25.750

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INPUT DATA FOR:

Manual tank gauging 20K tank reproducibility inches

		S15	S16	S17	S18	S19	S20	S21
L1	1	36.125	54.750	55.875	41.500	28.875	17.375	12.375
L2	1	35.250	53.000	54.000	40.000	27.625	16.750	13.250
L3	1	36.000	54.875	56.500	40.500	28.000	18.125	13.500
L4	1	36.500	54.875	56.000	41.750	29.375	17.625	11.625
L5	1	36.000	54.875	56.000	41.500	29.500	17.500	13.125
L6	1	35.500	53.750	56.500	39.000	26.875	17.500	13.250
L7	1	36.500	55.125	56.000	41.125	28.500	17.500	13.250
L8	1	36.000	54.750	55.250	42.125	28.375	18.125	13.375
L9	1	35.625	53.500	53.875	40.625	26.875	16.875	13.250
L10	1	35.875	54.750	55.375	41.375	27.625	17.625	13.250
L11	1	36.625	54.375	55.875	41.250	27.875	17.625	13.500
L12	1	35.750	54.000	52.500	39.750	28.750	17.250	13.250

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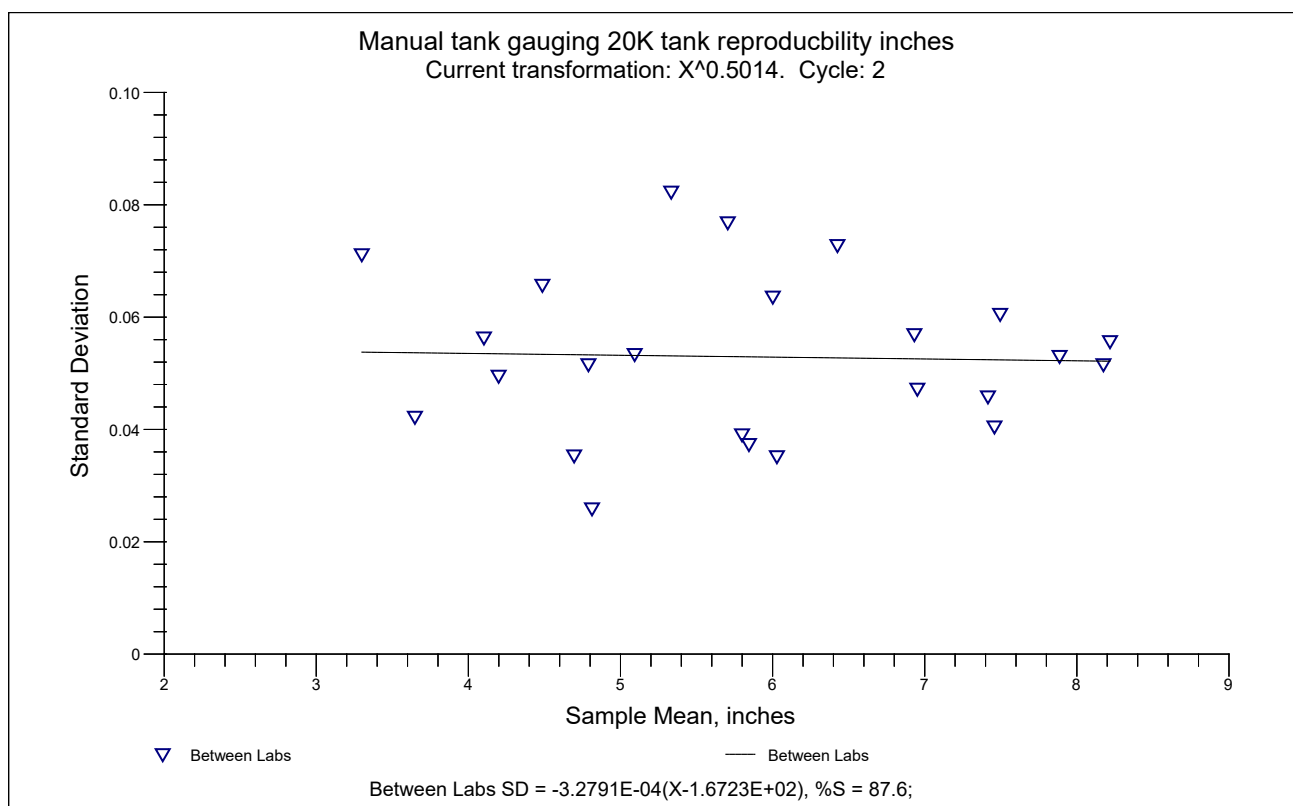
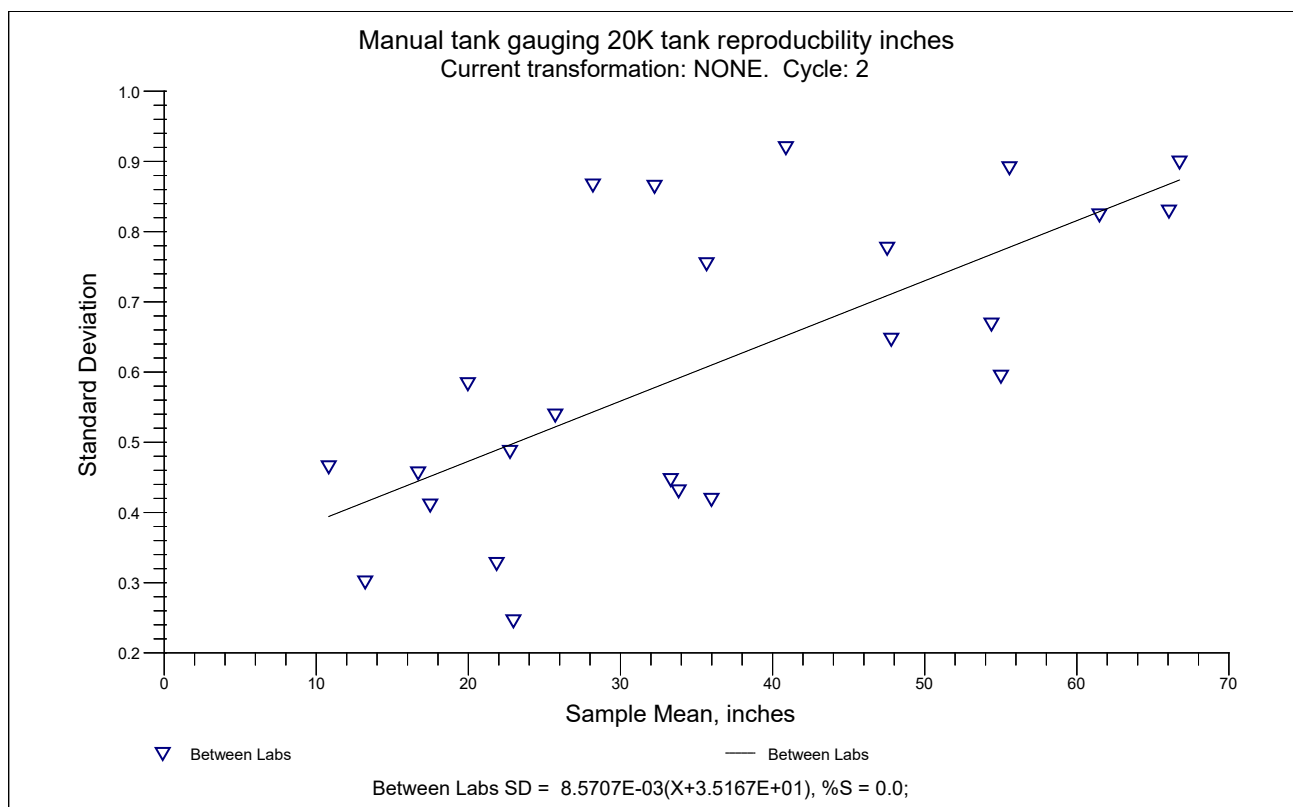
INPUT DATA FOR:

Manual tank gauging 20K tank reproducibility inches

		S22	S23	S24
L1	1	23.125	34.125	55.375
L2	1	22.500	33.125	53.750
L3	1	22.750	34.000	54.750
L4	1	23.125	34.375	55.750
L5	1	23.000	34.125	55.500
L6	1	23.000	34.375	55.125
L7	1	23.000	34.250	55.375
L8	1	23.125	33.500	55.625
L9	1	22.625	33.375	54.500
L10	1	22.750	33.625	55.250
L11	1	23.250	33.500	54.375
L12	1	23.250	33.500	54.750

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APPENDIX I

Camp Lejeune Precision Calculations for Manual Gauging in Inches

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ASTM Committee D02 Precision Evaluation

10:21, 17 May 2022

Manual tank gauging 20K tank reproducibility inches

Reproducibility = 2.0595 inches

	Initial	Final
Number of laboratories	9	9
Number of samples	6	6
Number of repeats	1	

REGRESSIONS (AFTER OUTLIER TESTS)

TRANSFORMATION TYPE: NONE

Regression	Fitted Variable	Coefficient B	t- Test	% Sig.
Unweighted D v. (m+B0)	m + 1.4507E+02	3.7962E-03	B=0	0.20 85.1
Weighted	Intercept	-2.48028E-01		
ln(d,D) v. ln(m+B0)	ln(m)	-7.58526E-02	B=1	0.47 64.8
(for Log Transform)	Dummy	0.00000E+00		
	Dummy * Ln(m+B0)	0.00000E+00	B=0	0.00 0.0
Weighted	Intercept	-4.85458E-01		
ln(d,D) v. ln(m+B0)	ln(m)	-4.07125E-02	B=0	0.09 92.6
(for Power Transform)	Dummy	0.00000E+00		
	Dummy * Ln(m+B0)	0.00000E+00	B=0	0.00 0.0
	Critical t (5%, 8) =			2.31 5.0

Transformation used: NONE

COMMENTS:

This report was prepared using D2PP, Version 5.3.35
from data file manual gauging data ASTM D6300 inches Lejeune.xls, Sheet1, .

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DATA MISSING OR REJECTED (Data rejection limit 20%):

LABORATORY	SAMPLE	DUP	TEST
(L9	,S2	,)	Missing, <, or 0.0
(L9	,S4	,)	Missing, <, or 0.0
(L9	,S5	,)	Missing, <, or 0.0

SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: NONE

Sample	No. of Results	Mean	Between Labs		
			S.D.	DF	R
S1	9	12.889	.8648	8	2.8
S5	8	14.594	.2735	7	.91
S4	8	17.406	.7312	7	2.4
S3	9	27.556	.3069	8	1.0
S2	8	33.305	1.267	7	4.2
S6	9	36.764	.4024	8	1.3

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VARIANCE ANALYSIS

Transform Type: NONE

		Sum of squares		DF	Mean square	F
		Estimated	Exact			
Sample Means		4.653315E+03	4.438522E+03			
Lab Means		4.550658E+00	4.518799E+00	8	5.64850E-01	1.100
Interaction		1.900806E+01		37	5.13731E-01	
Pairs		4.676874E+03	4.462049E+03			
Total		4.676874E+03				
Critical F (5%, 8, 37) =						2.201

		Expectation of Mean Squares	
Lab means		1.0000 V(r) + 1 V(I) +	5.6250 V(L)
Interaction		1.0000 V(r) + 1 V(I)	
Repeats		1.0000 V(r)	

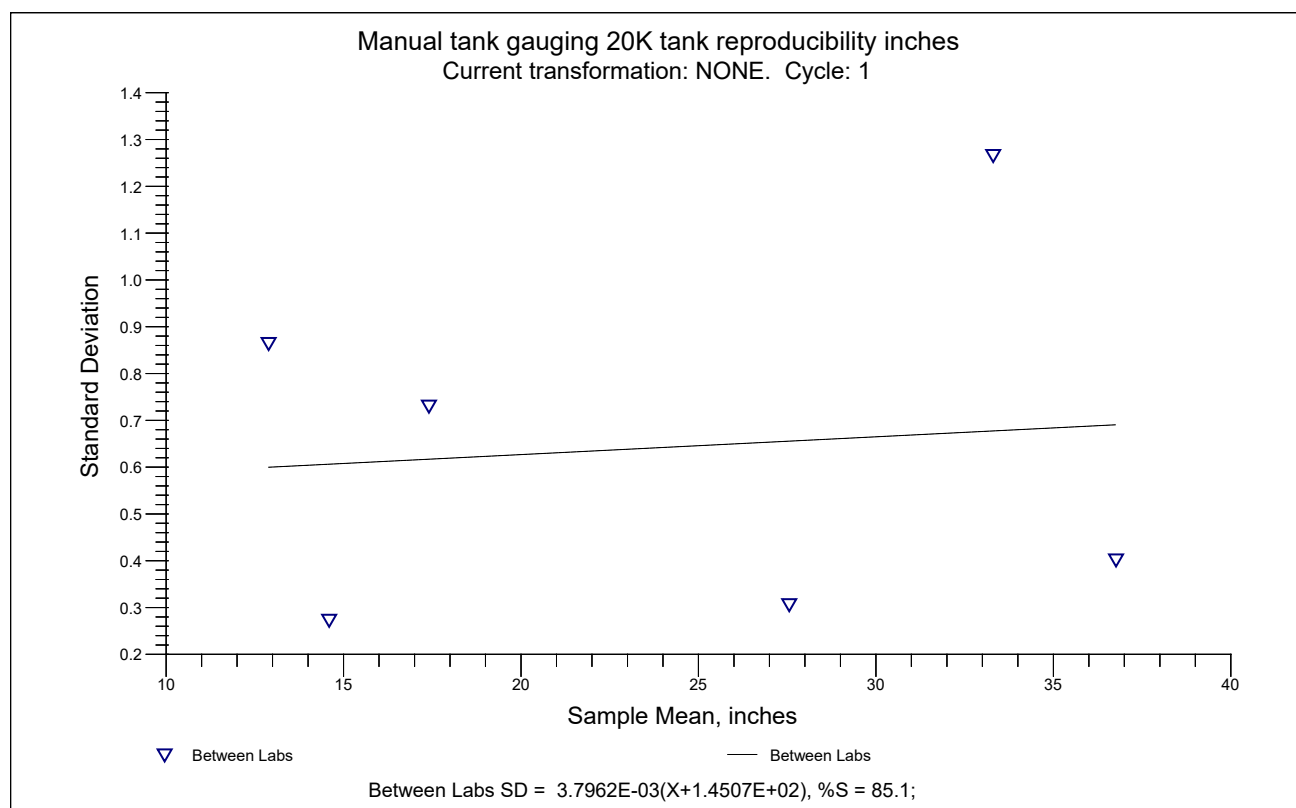
	DF	Variance	Precision
Repeatability	0	0.000000E+00	0.000E+00
Reproducibility	45	1.045638E+00	2.060E+00

INPUT DATA FOR:

Manual tank gauging 20K tank reproducibility inches

		S1	S2	S3	S4	S5	S6
L1	1	11.3750	32.2500	27.8750	16.5000	14.5000	37.0000
L2	1	14.2500	34.7500	27.5000	17.0000	15.2500	36.7500
L3	1	13.7500	31.7500	27.5000	17.0000	14.5000	37.1250
L4	1	12.3750	34.1875	27.7500	17.2500	14.5000	36.8750
L5	1	12.2500	35.0000	27.2500	17.5000	14.3750	36.7500
L6	1	12.7500	32.5000	27.7500	18.5000	14.5000	36.5000
L7	1	12.7500	32.2500	28.0000	17.0000	14.5000	35.8750
L8	1	13.0000	33.7500	27.1250	18.5000	14.6250	37.2500
L9	1	13.5000	-999.9000	27.2500	-999.9000	-999.9000	36.7500

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APPENDIX J
Precision Calculations for Manual Gauging in Gallons

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ASTM Committee D02 Precision Evaluation

12:35, 16 May 2022

Manual tank gauging 20K tank reproducibility gallons

Reproducibility = 597.41 gallons

	Initial	Final
Number of laboratories	12	12
Number of samples	21	21
Number of repeats	1	

REGRESSIONS (AFTER OUTLIER TESTS)

TRANSFORMATION TYPE: NONE

Regression	Fitted Variable	Coefficient B	t- Test	% Sig.
Unweighted D v. (m+B0)	m + 6.4666E+04	2.6053E-03	B=0	0.80 43.2
Weighted ln(d,D) v. ln(m+B0) (for Log Transform)	Intercept ln(m + 43111.) Dummy Dummy * Ln(m+B0)	-1.33271E+00 6.02191E-01 0.00000E+00 0.00000E+00	B=1 B=0	0.63 53.1 0.00 0.0
Weighted ln(d,D) v. ln(m+B0) (for Power Transform)	Intercept ln(m +3.6E+22) Dummy Dummy * Ln(m+B0)	5.23340E+00 7.03994E-04 0.00000E+00 0.00000E+00	B=0 B=0	0.00 99.8 0.00 0.0
Critical t (5%, 38) =			2.02	5.0

Transformation used: NONE

COMMENTS:

This report was prepared using D2PP, Version 5.3.35
from data file manual gauging data ASTM D6300 gallons.xls, Sheet1, .

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DATA MISSING OR REJECTED (Data rejection limit 20%):

LABORATORY	SAMPLE	DUP	TEST
(L3	,S8	,)	Missing, <, or 0.0
(L5	,S6	,)	Hawkins-cells
(L12	,S1	,)	Missing, <, or 0.0
(L12	,S2	,)	Missing, <, or 0.0
(L12	,S3	,)	Missing, <, or 0.0
(L12	,S4	,)	Missing, <, or 0.0
(L12	,S5	,)	Missing, <, or 0.0
(L12	,S6	,)	Missing, <, or 0.0
(L12	,S7	,)	Missing, <, or 0.0
(L12	,S8	,)	Missing, <, or 0.0

SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: NONE

Sample	No. of Results	Mean	Between Labs		
			S.D.	DF	R
S19	12	5021.8	234.0	11	.73E+03
S11	12	6239.3	155.0	11	.48E+03
S4	11	6853.1	232.5	10	.73E+03
S5	11	7636.4	223.8	10	.71E+03
S18	12	7663.2	137.0	11	.43E+03
S20	12	9425.9	109.4	11	.34E+03
S12	12	10063.	188.5	11	.59E+03
S3	11	10255.	276.1	10	.87E+03
S10	12	10885.	166.9	11	.52E+03
S17	12	11476.	345.5	11	.11E+04
S6	10	12088.	191.1	9	.61E+03
S21	12	13486.	115.0	11	.36E+03
S13	12	13532.	129.0	11	.40E+03
S2	11	14288.	143.4	10	.45E+03
S9	12	14623.	143.8	11	.45E+03
S16	12	15363.	254.6	11	.79E+03

CONTINUE

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SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: NONE

Sample	No. of Results	Mean	Between Labs		
			S.D.	DF	R
S1	11	18562.	144.3	10	.45E+03
S7	11	18924.	234.5	10	.74E+03
S15	12	19214.	286.3	11	.89E+03
S14	12	19580.	205.8	11	.64E+03
S8	10	19586.	311.3	9	.10E+04

VARIANCE ANALYSIS

Transform Type: NONE

	Sum of squares		DF	Mean square	F
	Estimated	Exact			
Sample Means	5.273992E+09	5.032923E+09			
Lab Means	4.282471E+06	4.189769E+06	11	3.80888E+05	14.207
Interaction	5.629946E+06		210	2.68093E+04	
Pairs	5.283904E+09	5.042743E+09			
Total	5.283904E+09				
Critical F (5%, 11, 210) =					1.834

	Expectation of Mean Squares
Lab means	1.0000 V(r) + 1 V(I) + 20.0909 V(L)
Interaction	1.0000 V(r) + 1 V(I)
Repeats	1.0000 V(r)

	DF	Variance	Precision
Repeatability	0	0.000000E+00	0.000E+00
Reproducibility	55	8.886620E+04	5.974E+02

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INPUT DATA FOR:

Manual tank gauging 20K tank reproducibility gallons

		S1	S2	S3	S4	S5	S6
L1	1	18601.607	14361.111	10541.667	6888.889	7769.231	12176.471
L2	1	18381.018	14111.111	9937.500	6611.111	7423.077	11769.231
L3	1	18741.982	14111.111	10666.667	7192.308	7769.231	12411.765
L4	1	18260.696	14222.222	10416.667	7000.000	7807.692	12235.294
L5	1	18641.714	14444.444	10125.000	7000.000	7730.769	13000.000
L6	1	18601.607	14166.667	9906.250	6722.222	7500.000	11884.615
L7	1	18501.339	14250.000	10458.333	7192.308	7923.077	12264.706
L8	1	18621.661	14444.444	10458.333	6833.333	7730.769	12058.824
L9	1	18481.286	14527.778	9875.000	6444.444	7115.385	11961.538
L10	1	18721.929	14333.333	10291.667	6777.778	7615.385	12029.412
L11	1	18621.661	14194.444	10125.000	6722.222	7615.385	12088.235
L12	1	-999.900	-999.900	-999.900	-999.900	-999.900	-999.900

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CONTINUE

INPUT DATA FOR:

Manual tank gauging 20K tank reproducibility gallons

		S7	S8	S9	S10	S11	S12
L1	1	19176.000	19800.800	14805.556	11022.727	6272.727	10250.000
L2	1	18535.714	19100.100	14361.111	10555.556	5916.667	9900.000
L3	1	19211.200	-999.900	14777.778	10833.333	6409.091	10458.333
L4	1	19035.200	19550.550	14777.778	11045.455	6363.636	10166.667
L5	1	19140.800	19950.950	14777.778	11068.182	6409.091	10208.333
L6	1	18785.714	19100.100	14555.556	10666.667	6090.909	9750.000
L7	1	19140.800	19850.850	14527.778	11068.182	6318.182	9950.000
L8	1	18857.143	19750.750	14666.667	10833.333	6363.636	9950.000
L9	1	18714.286	19300.300	14444.444	10833.333	6045.455	10000.000
L10	1	18642.857	19750.750	14583.333	10888.889	6181.818	10083.333
L11	1	18928.571	19700.700	14638.889	11022.727	6227.273	9950.000
L12	1	-999.900	-999.900	14555.556	10777.778	6272.727	10083.333

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CONTINUE

INPUT DATA FOR:

Manual tank gauging 20K tank reproducibility gallons

		S13	S14	S15	S16	S17	S18
L1	1	13576.923	19692.308	19344.094	15533.333	11750.000	7625.000
L2	1	13307.692	19153.846	18894.737	15133.333	11250.000	7416.667
L3	1	13538.462	19730.769	19500.500	15266.667	11400.000	7875.000
L4	1	13692.308	19730.769	19375.375	15600.000	11950.000	7708.333
L5	1	13538.462	19730.769	19375.375	15533.333	12000.000	7666.667
L6	1	13384.615	19384.615	19500.500	14818.182	10954.545	7666.667
L7	1	13692.308	19807.692	19375.375	15433.333	11600.000	7666.667
L8	1	13538.462	19692.308	19187.688	15700.000	11550.000	7875.000
L9	1	13423.077	19307.692	18868.421	15300.000	10954.545	7458.333
L10	1	13500.000	19692.308	19218.969	15500.000	11250.000	7708.333
L11	1	13730.769	19576.923	19344.094	15466.667	11350.000	7708.333
L12	1	13461.538	19461.538	18578.947	15066.667	11700.000	7583.333

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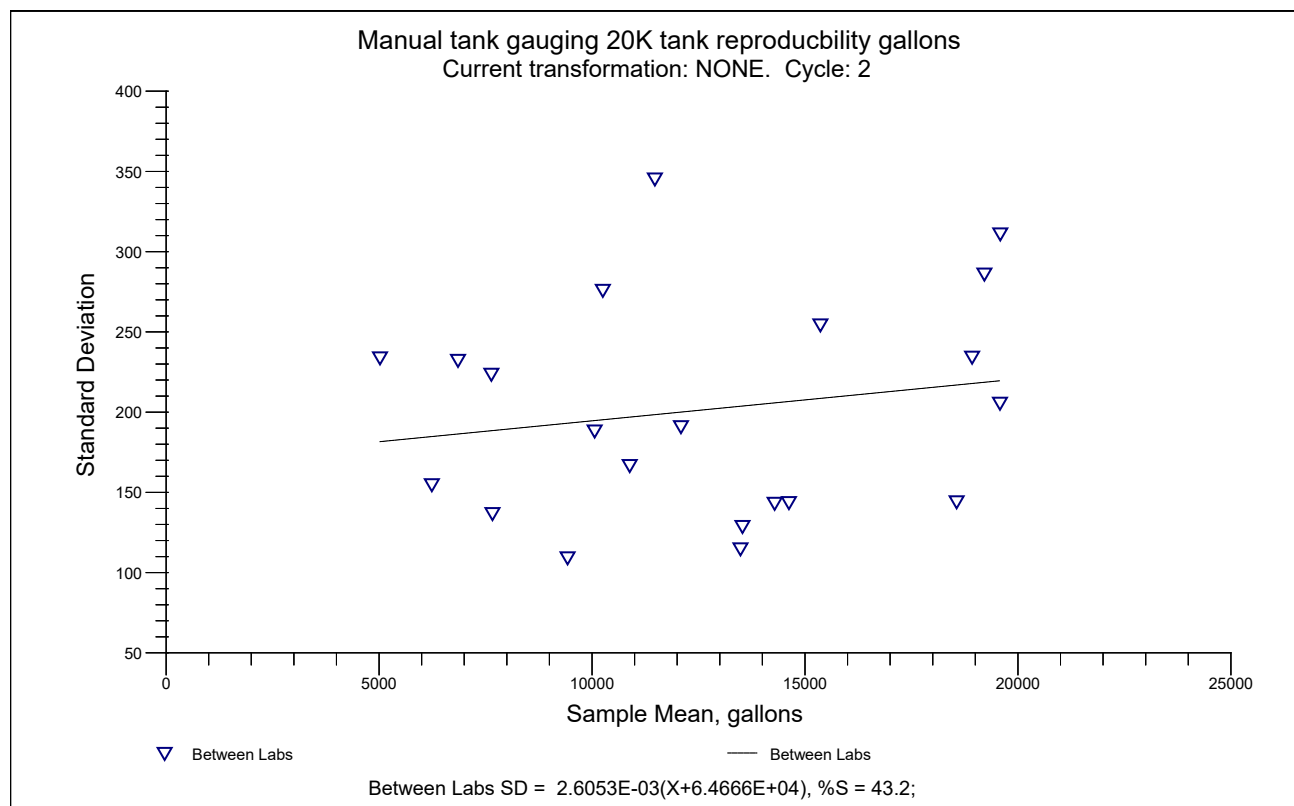
CONTINUE

INPUT DATA FOR:

Manual tank gauging 20K tank reproducibility gallons

		S19	S20	S21
L1	1	4722.222	9500.000	13566.667
L2	1	5100.000	9222.222	13300.000
L3	1	5200.000	9333.333	13533.333
L4	1	4388.889	9500.000	13633.333
L5	1	5050.000	9444.444	13566.667
L6	1	5100.000	9444.444	13633.333
L7	1	5100.000	9444.444	13600.000
L8	1	5150.000	9500.000	13400.000
L9	1	5100.000	9277.778	13366.667
L10	1	5100.000	9333.333	13433.333
L11	1	5200.000	9555.556	13400.000
L12	1	5050.000	9555.556	13400.000

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APPENDIX K

Camp Lejeune Precision Calculations for Manual Gauging in Gallons

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ASTM Committee D02 Precision Evaluation

10:21, 17 May 2022

Manual tank gauging 20K tank reproducibility gallons

Reproducibility = 803.84 gallons

	Initial	Final
Number of laboratories	9	9
Number of samples	6	6
Number of repeats	1	

REGRESSIONS (AFTER OUTLIER TESTS)

TRANSFORMATION TYPE: NONE

Regression	Fitted Variable	Coefficient B	t- Test	% Sig.
Unweighted D v. (m+B0)	m + 1.8018E+05	1.3265E-03	B=0	0.08 94.3
Weighted ln(d,D) v. ln(m+B0) (for Log Transform)	Intercept ln(m +1.2E+05) Dummy Dummy * Ln(m+B0)	2.60167E+01 -1.75130E+00 0.00000E+00 0.00000E+00	B=1 B=0 B=0	0.48 63.9 0.00 0.0
Weighted ln(d,D) v. ln(m+B0) (for Power Transform)	Intercept ln(m) Dummy Dummy * Ln(m+B0)	6.83231E+00 -1.57107E-01 0.00000E+00 0.00000E+00	B=0 B=0 B=0	0.31 76.7 0.00 0.0
	Critical t (5%, 8) =			2.31 5.0

Transformation used: NONE

COMMENTS:

This report was prepared using D2PP, Version 5.3.35
from data file manual gauging data ASTM D6300 gallons lejeune.xls, Sheet1, .

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DATA MISSING OR REJECTED (Data rejection limit 20%):

LABORATORY	SAMPLE	DUP	TEST
(L9	,S2	,)	Missing, <, or 0.0
(L9	,S4	,)	Missing, <, or 0.0
(L9	,S5	,)	Missing, <, or 0.0

SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: NONE

	No. of Sample Results	Mean	Between Labs		
			S.D.	DF	R
S1	9	6422.0	321.3	8	.10E+04
S5	8	7157.4	124.8	7	.42E+03
S4	8	8425.4	324.6	7	.11E+04
S3	9	12720.	123.2	8	.40E+03
S2	8	14961.	480.7	7	.16E+04
S6	9	16244.	146.8	8	.48E+03

VARIANCE ANALYSIS

Transform Type: NONE

	Sum of squares		DF	Mean square	F
	Estimated	Exact			
Sample Means	7.963553E+08	7.594011E+08			
Lab Means	6.251601E+05	6.210215E+05	8	7.76277E+04	0.969
Interaction	2.962888E+06		37	8.00781E+04	
Pairs	7.999434E+08	7.629851E+08			
Total	7.999434E+08				
Critical F (5%, 8, 37) =					2.201

	Expectation of Mean Squares
Lab means	1.0000 V(r) + 1 V(I) + 5.6250 V(L)
Interaction	1.0000 V(r) + 1 V(I)
Repeats	1.0000 V(r)

	DF	Variance	Precision
Repeatability	0	0.000000E+00	0.000E+00
Reproducibility	45	1.592849E+05	8.038E+02

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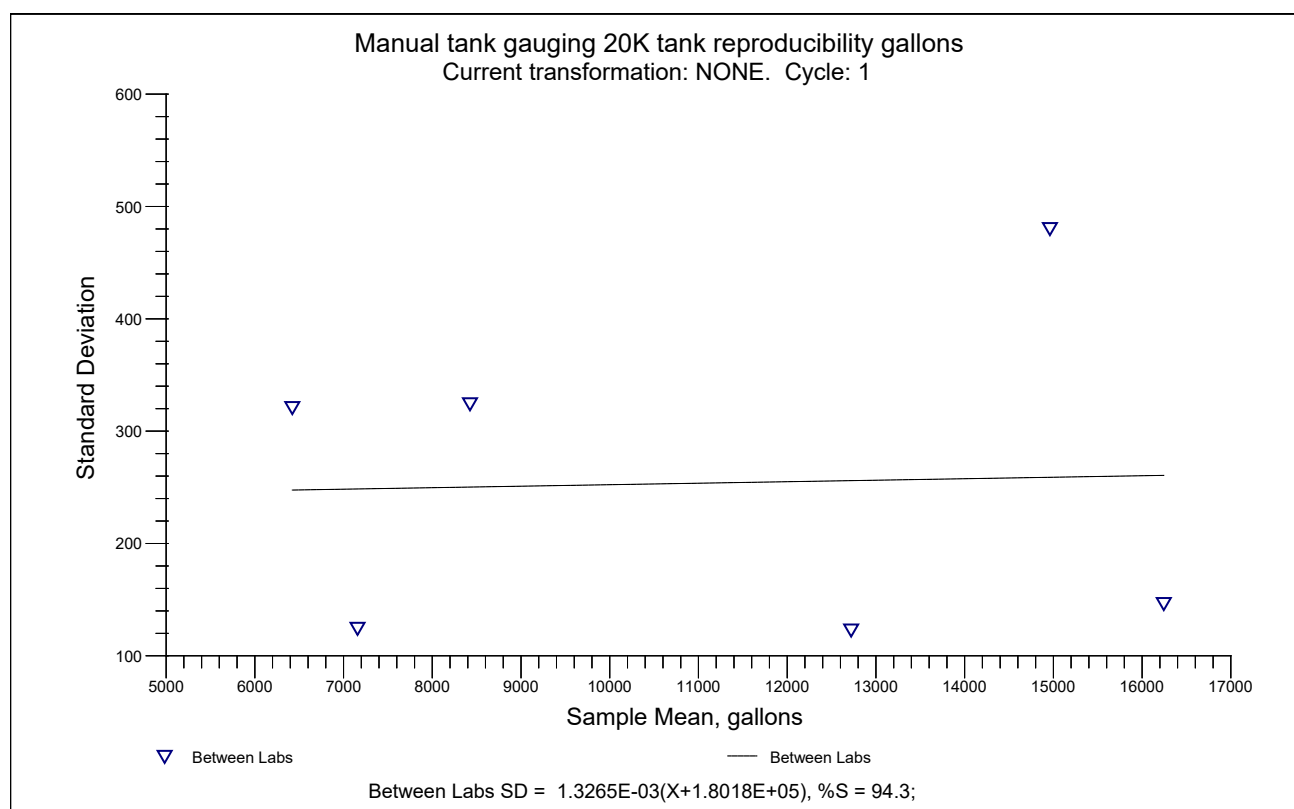
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INPUT DATA FOR:

Manual tank gauging 20K tank reproducibility gallons

		S1	S2	S3	S4	S5	S6
L1	1	6131.78	14560.29	12848.71	8021.33	7114.61	16330.33
L2	1	7000.03	15503.21	12698.32	8245.25	7456.70	16239.42
L3	1	6770.03	14368.66	12698.32	8245.25	7114.61	16375.68
L4	1	6131.78	15316.65	12798.64	8356.80	7114.61	16284.91
L5	1	6073.34	15596.11	12597.73	8468.08	7057.35	16239.42
L6	1	6306.68	14655.72	12798.64	8910.46	7114.61	16148.27
L7	1	6306.68	14560.29	12898.71	8245.25	7114.61	15919.30
L8	1	6422.94	15129.08	12547.34	8910.46	7171.80	16420.98
L9	1	6654.61	-999.90	12597.73	-999.90	-999.90	16239.42

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APPENDIX L
Precision Calculations for Flow Meters in Gallons

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ASTM Committee D02 Precision Evaluation

12:22, 17 May 2022

Stock FloCat

Reproducibility = $9.8668 * X^{0.6216}$ Gallons

	Initial	Final
Number of laboratories	2	2
Number of samples	24	24
Number of repeats	1	

REGRESSIONS (AFTER OUTLIER TESTS)

TRANSFORMATION TYPE: NONE

Regression	Fitted Variable	Coefficient B	t- Test	t- Ratio	% Sig.
Unweighted D v. (m+B0)	m + 2.4127E+03	4.7269E-02	B=0	3.10	0.5
Weighted	Intercept	-5.85894E-01			
ln(d,D) v. ln(m+B0)	ln(m + 1608.5)	7.28469E-01	B=1	1.16	25.2
(for Log Transform)	Dummy	0.00000E+00			
	Dummy * Ln(m+B0)	0.00000E+00	B=0	0.00	0.0
Weighted	Intercept	5.18387E-01			
ln(d,D) v. ln(m+B0)	ln(m)	6.21647E-01	*B=0	3.13	0.3
(for Power Transform)	Dummy	0.00000E+00			
	Dummy * Ln(m+B0)	0.00000E+00	B=0	0.00	0.0
	Critical t (5%, 44) =			2.02	5.0

* Coefficient used = 0.6216

Transformation used: $X^{0.3784}$

COMMENTS:

This report was prepared using D2PP, Version 5.3.35
 from data file FloCat meter data ASTM D6300.xls, Sheet1, .

DATA MISSING OR REJECTED (Data rejection limit 20%):

LABORATORY SAMPLE DUP TEST

CAUTION!!

<5 laboratories

<30 Lab x Sample DF

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SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: NONE

Sample	No. of Results	Mean	Between Labs		
			S.D.	DF	R
S17	2	4805.5	263.8	1	.47E+04
S9	2	4839.0	236.2	1	.42E+04
S5	2	4874.0	206.5	1	.37E+04
S1	2	4966.5	419.3	1	.75E+04
S13	2	4979.0	404.5	1	.73E+04
S21	2	5403.5	559.3	1	.10E+05
S18	2	9628.5	514.1	1	.92E+04
S10	2	9698.0	468.1	1	.84E+04
S6	2	9736.0	413.0	1	.74E+04
S2	2	9964.5	825.2	1	.15E+05
S14	2	9979.5	860.5	1	.15E+05
S22	2	10252.	323.1	1	.58E+04
S19	2	14441.	769.3	1	.14E+05
S11	2	14552.	703.6	1	.13E+05
S7	2	14602.	623.0	1	.11E+05
S3	2	14971.	1283.	1	.23E+05

CONTINUE

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SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: NONE

Sample	No. of Results	Mean	Between Labs		
			S.D.	DF	R
S15	2	14990.	1356.	1	.24E+05
S23	2	15080.	87.68	1	.16E+04
S20	2	16962.	898.0	1	.16E+05
S12	2	18049.	876.1	1	.16E+05
S4	2	18409.	1604.	1	.29E+05
S16	2	18690.	1730.	1	.31E+05
S8	2	19090.	822.4	1	.15E+05
S24	2	19801.	140.0	1	.25E+04

SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: Power

Sample	No. of Results	Mean	Between Labs		
			S.D.	DF	R
S17	2	24.723	.5137	1	9.2
S9	2	24.789	.4580	1	8.2
S5	2	24.857	.3986	1	7.2
S1	2	25.027	.8004	1	14.
S13	2	25.051	.7708	1	14.
S21	2	25.833	1.013	1	18.
S18	2	32.159	.6500	1	12.
S10	2	32.248	.5892	1	11.
S6	2	32.297	.5185	1	9.3
S2	2	32.572	1.022	1	18.
S14	2	32.589	1.065	1	19.
S22	2	32.935	.3929	1	7.1
S19	2	37.490	.7561	1	14.
S11	2	37.600	.6881	1	12.
S7	2	37.650	.6080	1	11.
S3	2	37.995	1.234	1	22.

CONTINUE

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SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: Power

Sample	Results	No. of Mean	Between Labs		
			S.D.	DF	R
S15	2	38.011	1.302	1	23.
S23	2	38.116	.8386E-01	1	1.5
S20	2	39.844	.7985	1	14.
S12	2	40.792	.7495	1	13.
S4	2	41.086	1.356	1	24.
S16	2	41.320	1.449	1	26.
S8	2	41.668	.6794	1	12.
S24	2	42.254	.1131	1	2.0

VARIANCE ANALYSIS

Transform Type: Power

	Sum of squares		DF	Mean square	F
	Estimated	Exact			
Sample Means	1.788871E+03	1.788871E+03			
Lab Means	9.411297E+00	9.411297E+00	1	9.41130E+00	30.465
Interaction	7.105189E+00		23	3.08921E-01	
Pairs	1.805387E+03	1.805387E+03			
Total	1.805387E+03				
Critical F (5%, 1, 23) =					4.279

	Expectation of Mean Squares
Lab means	1.0000 V(r) + 1 V(I) + 24.0000 V(L)
Interaction	1.0000 V(r) + 1 V(I)
Repeats	1.0000 V(r)

	DF	Variance	Precision
Transformed data			
Reproducibility	3	1.376374E+00	3.734E+00

INPUT DATA FOR:
Stock FloCat

		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
L4	1	5263	10548	15878	19543	5020	10028	15042	19671	5006	10029
L5	1	4670	9381	14063	17274	4728	9444	14161	18508	4672	9367

CONTINUE

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INPUT DATA FOR:
Stock FloCat

		S11	S12	S13	S14	S15	S16	S17	S18	S19	S20
L4	1	15049	18668	5265	10588	15948	19913	4992	9992	14985	17597
L5	1	14054	17429	4693	9371	14031	17467	4619	9265	13897	16327

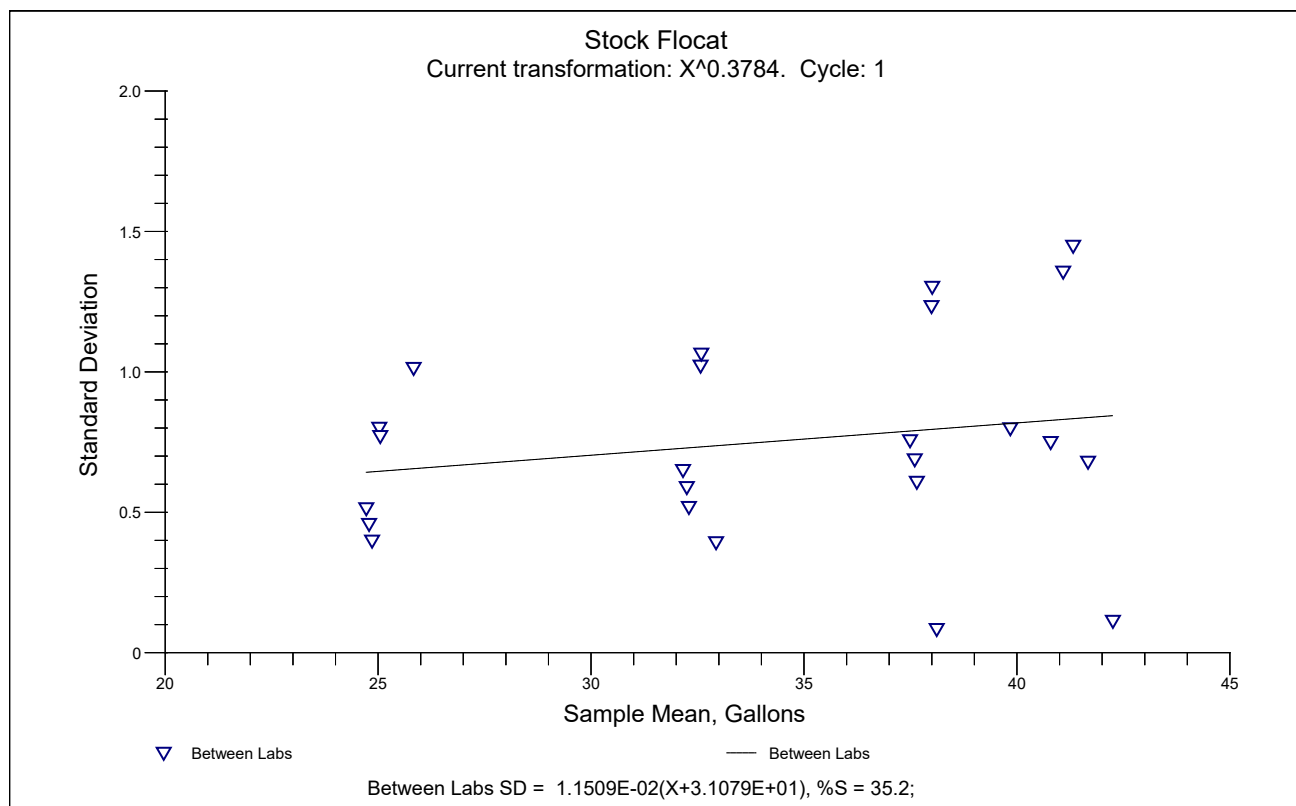
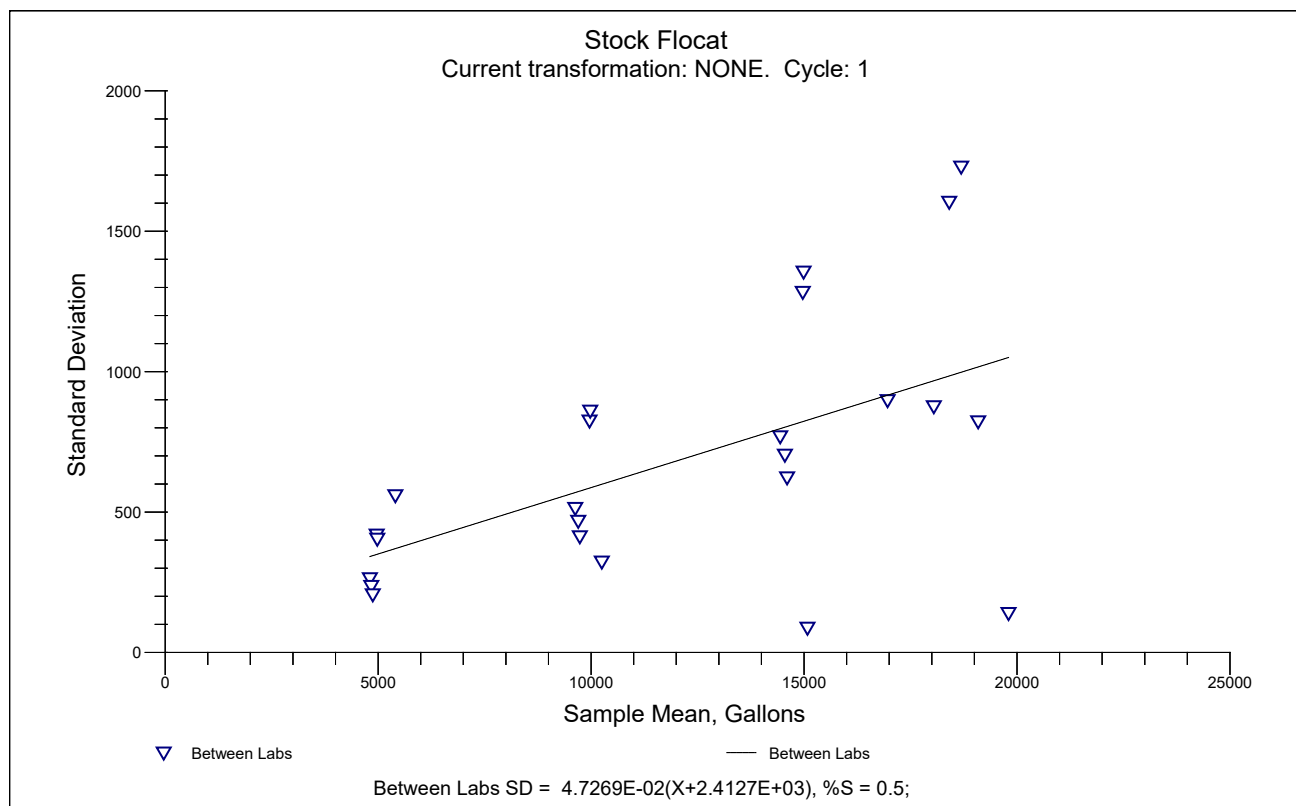
CONTINUE

INPUT DATA FOR:
Stock FloCat

		S21	S22	S23	S24
L4	1	5008	10023	15018	19900
L5	1	5799	10480	15142	19702

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ASTM Committee D02 Precision Evaluation

12:26, 17 May 2022

Penn State FloCat

Reproducibility = $1.688\text{E-}02 * X^{1.0514}$ Gallons

	Initial	Final
Number of laboratories	5	5
Number of samples	80	80
Number of repeats	1	

REGRESSIONS (AFTER OUTLIER TESTS)

TRANSFORMATION TYPE: NONE

Regression	Fitted Variable	Coefficient B	Test	t- Ratio	% Sig.
Unweighted D v. (m+B0)	m - 8.7102E+02	8.5131E-03	B=0	6.50	0.0
Weighted	Intercept	-5.40763E+00			
ln(d,D) v. ln(m+B0)	ln(m)	1.05136E+00	B=1	0.75	45.6
(for Log Transform)	Dummy	0.00000E+00			
	Dummy * Ln(m+B0)	0.00000E+00	B=0	0.00	0.0
Weighted	Intercept	-5.40763E+00			
ln(d,D) v. ln(m+B0)	ln(m)	1.05136E+00	*B=0	15.30	0.0
(for Power Transform)	Dummy	0.00000E+00			
	Dummy * Ln(m+B0)	0.00000E+00	B=0	0.00	0.0
	Critical t (5%,156) =			1.98	5.0

* Coefficient used = 1.0514

Transformation used: $X^{-0.0514}$

COMMENTS:

This report was prepared using D2PP, Version 5.3.35
 from data file penn state FloCat meter data ASTM D6300.xls, Sheet1, .

DATA MISSING OR REJECTED (Data rejection limit 20%):

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LABORATORY	SAMPLE	DUP	TEST
(L1	,S29	,)	Hawkins-cells
(L1	,S30	,)	Hawkins-cells
(L1	,S31	,)	Hawkins-cells
(L1	,S32	,)	Hawkins-cells
(L2	,S29	,)	Hawkins-cells
(L2	,S30	,)	Hawkins-cells
(L2	,S31	,)	Hawkins-cells
(L2	,S32	,)	Hawkins-cells
(L2	,S73	,)	Missing, <, or 0.0
(L2	,S74	,)	Missing, <, or 0.0
(L2	,S75	,)	Missing, <, or 0.0
(L2	,S76	,)	Missing, <, or 0.0
(L2	,S77	,)	Missing, <, or 0.0
(L2	,S78	,)	Missing, <, or 0.0
(L2	,S79	,)	Missing, <, or 0.0
(L2	,S80	,)	Missing, <, or 0.0
(L6	,S1	,)	Missing, <, or 0.0
(L6	,S2	,)	Missing, <, or 0.0
(L6	,S3	,)	Missing, <, or 0.0
(L6	,S4	,)	Missing, <, or 0.0
(L6	,S5	,)	Missing, <, or 0.0
(L6	,S6	,)	Missing, <, or 0.0
(L6	,S7	,)	Missing, <, or 0.0
(L6	,S8	,)	Missing, <, or 0.0
(L6	,S9	,)	Missing, <, or 0.0
(L6	,S10	,)	Missing, <, or 0.0
(L6	,S11	,)	Missing, <, or 0.0
(L6	,S12	,)	Missing, <, or 0.0
(L6	,S13	,)	Missing, <, or 0.0
(L6	,S14	,)	Missing, <, or 0.0
(L6	,S15	,)	Missing, <, or 0.0
(L6	,S16	,)	Missing, <, or 0.0
(L6	,S17	,)	Missing, <, or 0.0
(L6	,S18	,)	Missing, <, or 0.0
(L6	,S19	,)	Missing, <, or 0.0
(L6	,S20	,)	Missing, <, or 0.0
(L6	,S29	,)	Missing, <, or 0.0
(L6	,S30	,)	Missing, <, or 0.0
(L6	,S31	,)	Missing, <, or 0.0
(L6	,S32	,)	Missing, <, or 0.0
(L6	,S33	,)	Missing, <, or 0.0
(L6	,S34	,)	Missing, <, or 0.0
(L6	,S35	,)	Missing, <, or 0.0
(L6	,S36	,)	Missing, <, or 0.0

CONTINUED

UNCLASSIFIED

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DATA MISSING OR REJECTED (Data rejection limit 20%):

LABORATORY	SAMPLE	DUP	TEST
(L6	,S37	,)	Missing, <, or 0.0
(L6	,S38	,)	Missing, <, or 0.0
(L6	,S39	,)	Missing, <, or 0.0
(L6	,S40	,)	Missing, <, or 0.0
(L6	,S41	,)	Missing, <, or 0.0
(L6	,S42	,)	Missing, <, or 0.0
(L6	,S43	,)	Missing, <, or 0.0
(L6	,S44	,)	Missing, <, or 0.0
(L6	,S53	,)	Missing, <, or 0.0
(L6	,S54	,)	Missing, <, or 0.0
(L6	,S55	,)	Missing, <, or 0.0
(L6	,S56	,)	Missing, <, or 0.0
(L6	,S57	,)	Missing, <, or 0.0
(L6	,S58	,)	Missing, <, or 0.0
(L6	,S59	,)	Missing, <, or 0.0
(L6	,S60	,)	Missing, <, or 0.0
(L6	,S61	,)	Missing, <, or 0.0
(L6	,S62	,)	Missing, <, or 0.0
(L6	,S63	,)	Missing, <, or 0.0
(L6	,S64	,)	Missing, <, or 0.0
(L6	,S65	,)	Missing, <, or 0.0
(L6	,S66	,)	Missing, <, or 0.0
(L6	,S67	,)	Missing, <, or 0.0
(L6	,S68	,)	Missing, <, or 0.0
(L6	,S69	,)	Missing, <, or 0.0
(L6	,S70	,)	Missing, <, or 0.0
(L6	,S71	,)	Missing, <, or 0.0
(L6	,S72	,)	Missing, <, or 0.0
(L7	,S53	,)	Hawkins-cells
(L7	,S54	,)	Hawkins-cells
(L7	,S55	,)	Hawkins-cells
(L7	,S56	,)	Hawkins-cells
(L7	,S65	,)	Hawkins-cells
(L7	,S66	,)	Hawkins-cells
(L7	,S67	,)	Hawkins-cells
(L7	,S68	,)	Hawkins-cells
(L8	,S53	,)	Hawkins-cells
(L8	,S54	,)	Hawkins-cells
(L8	,S55	,)	Hawkins-cells
(L8	,S56	,)	Hawkins-cells
(L8	,S65	,)	Hawkins-cells
(L8	,S66	,)	Hawkins-cells
(L8	,S67	,)	Hawkins-cells
(L8	,S68	,)	Hawkins-cells

CONTINUED

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DATA MISSING OR REJECTED (Data rejection limit 20%):

LABORATORY SAMPLE DUP TEST

SAMPLE MEANS AND STANDARD DEVIATIONS
 After any outlier rejections

Transform Type: NONE

Sample	No. of		Between Labs		
	Results	Mean	S.D.	DF	R
S33	4	4864.8	41.81	3	.19E+03
S29	2	4932.5	28.99	1	.52E+03
S73	4	4961.8	19.82	3	89.
S37	4	4965.0	34.65	3	.16E+03
S45	5	4965.4	21.85	4	86.
S21	5	4968.0	45.33	4	.18E+03
S77	4	4968.8	31.72	3	.14E+03
S61	4	4976.0	42.10	3	.19E+03
S25	5	4981.8	23.11	4	91.
S69	4	4987.0	35.86	3	.16E+03
S17	4	4989.3	35.43	3	.16E+03
S1	4	4990.0	34.30	3	.15E+03
S5	4	4990.5	33.05	3	.15E+03
S9	4	4991.0	34.91	3	.16E+03
S13	4	4991.8	36.03	3	.16E+03
S49	5	5007.6	56.09	4	.22E+03
S41	4	5008.8	24.35	3	.11E+03
S57	4	5047.5	84.79	3	.38E+03
S65	2	5184.0	39.60	1	.71E+03
S53	2	5522.5	67.18	1	.12E+04
S34	4	9865.3	74.28	3	.33E+03
S30	2	9918.0	45.25	1	.81E+03
S74	4	9948.5	39.16	3	.18E+03
S78	4	9952.3	67.68	3	.30E+03
S46	5	9953.0	42.14	4	.17E+03
S26	5	9953.2	46.24	4	.18E+03
S38	4	9960.0	59.98	3	.27E+03
S62	4	9965.0	80.64	3	.36E+03
S70	4	9971.5	77.62	3	.35E+03
S18	4	9980.0	69.07	3	.31E+03
S10	4	9983.0	67.84	3	.31E+03
S6	4	9985.8	63.91	3	.29E+03
S2	4	9990.0	60.13	3	.27E+03
S14	4	9990.0	64.38	3	.29E+03
S22	5	9992.0	111.5	4	.44E+03
S42	4	10018.	47.17	3	.21E+03
S50	5	10044.	149.7	4	.59E+03
S58	4	10112.	169.4	3	.76E+03
S66	2	10444.	55.86	1	.10E+04
S54	2	10993.	103.9	1	.19E+04
S35	4	14856.	124.5	3	.56E+03

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CONTINUE

SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: NONE

Sample	No. of		S.D.	Between Labs	
	Results	Mean		DF	R
S31	2	14904.	57.28	1	.10E+04
S79	4	14919.	103.0	3	.46E+03
S27	5	14922.	76.04	4	.30E+03
S75	4	14925.	58.81	3	.26E+03
S47	5	14935.	62.64	4	.25E+03
S63	4	14935.	117.7	3	.53E+03
S71	4	14949.	119.7	3	.54E+03
S39	4	14952.	86.65	3	.39E+03
S19	4	14960.	107.6	3	.48E+03
S11	4	14973.	99.63	3	.45E+03
S7	4	14986.	94.02	3	.42E+03
S3	4	14989.	85.77	3	.39E+03
S15	4	14992.	90.13	3	.41E+03
S23	5	15027.	212.4	4	.83E+03
S43	4	15039.	74.87	3	.34E+03
S51	5	15095.	267.3	4	.10E+04
S59	4	15226.	316.9	3	.14E+04
S67	2	15731.	59.40	1	.11E+04
S55	2	16576.	157.7	1	.28E+04
S76	4	17533.	68.78	3	.31E+03
S32	2	17976.	66.47	1	.12E+04
S64	4	18202.	149.2	3	.67E+03
S36	4	18243.	169.2	3	.76E+03
S12	4	18333.	144.7	3	.65E+03
S8	4	18349.	133.1	3	.60E+03
S60	4	18357.	418.4	3	.19E+04
S16	4	18367.	107.6	3	.48E+03
S72	4	18463.	151.2	3	.68E+03
S24	5	18488.	288.1	4	.11E+04
S48	5	18528.	79.63	4	.31E+03
S40	4	18616.	104.8	3	.47E+03
S44	4	18637.	115.4	3	.52E+03
S68	2	18702.	62.93	1	.11E+04
S52	5	18838.	356.9	4	.14E+04
S4	4	19405.	112.5	3	.51E+03
S20	4	19489.	136.5	3	.61E+03
S28	5	19505.	101.8	4	.40E+03
S80	4	19777.	130.9	3	.59E+03
S56	2	21383.	198.7	1	.36E+04

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SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: Power

Sample	No. of		Between Labs		
	Results	Mean	S.D.	DF	R
S56	2	.59901	.2861E-03	1	.51E-02
S80	4	.60142	.2047E-03	3	.92E-03
S28	5	.60185	.1614E-03	4	.63E-03
S20	4	.60187	.2167E-03	3	.98E-03
S4	4	.60201	.1794E-03	3	.81E-03
S52	5	.60293	.5853E-03	4	.23E-02
S68	2	.60315	.1043E-03	1	.19E-02
S44	4	.60326	.1922E-03	3	.87E-03
S40	4	.60329	.1746E-03	3	.79E-03
S48	5	.60344	.1333E-03	4	.52E-03
S24	5	.60351	.4822E-03	4	.19E-02
S72	4	.60355	.2542E-03	3	.11E-02
S16	4	.60371	.1821E-03	3	.82E-03
S60	4	.60373	.7074E-03	3	.32E-02
S8	4	.60374	.2252E-03	3	.10E-02
S12	4	.60377	.2450E-03	3	.11E-02
S36	4	.60392	.2890E-03	3	.13E-02
S64	4	.60399	.2546E-03	3	.11E-02
S32	2	.60438	.1149E-03	1	.21E-02
S76	4	.60515	.1222E-03	3	.55E-03
S55	2	.60690	.2968E-03	1	.53E-02
S67	2	.60854	.1181E-03	1	.21E-02
S59	4	.60956	.6523E-03	3	.29E-02
S51	5	.60983	.5534E-03	4	.22E-02
S43	4	.60995	.1562E-03	3	.70E-03
S23	5	.60997	.4423E-03	4	.17E-02
S15	4	.61005	.1887E-03	3	.85E-03
S3	4	.61005	.1794E-03	3	.81E-03
S7	4	.61006	.1967E-03	3	.89E-03
S11	4	.61008	.2087E-03	3	.94E-03
S19	4	.61011	.2255E-03	3	.10E-02
S39	4	.61013	.1817E-03	3	.82E-03
S71	4	.61013	.2514E-03	3	.11E-02
S47	5	.61016	.1315E-03	4	.52E-03
S63	4	.61016	.2473E-03	3	.11E-02
S75	4	.61018	.1238E-03	3	.56E-03
S27	5	.61019	.1597E-03	4	.63E-03
S79	4	.61020	.2166E-03	3	.97E-03
S31	2	.61023	.1205E-03	1	.22E-02
S35	4	.61033	.2638E-03	3	.12E-02
S54	2	.61985	.3013E-03	1	.54E-02

CONTINUE

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SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: Power

Sample	No. of		Between Labs		
	Results	Mean	S.D.	DF	R
S66	2	.62149	.1709E-03	1	.31E-02
S58	4	.62252	.5361E-03	3	.24E-02
S50	5	.62274	.4759E-03	4	.19E-02
S42	4	.62282	.1507E-03	3	.68E-03
S22	5	.62290	.3570E-03	4	.14E-02
S2	4	.62291	.1927E-03	3	.87E-03
S14	4	.62291	.2066E-03	3	.93E-03
S6	4	.62292	.2049E-03	3	.92E-03
S10	4	.62293	.2176E-03	3	.98E-03
S18	4	.62294	.2216E-03	3	.10E-02
S70	4	.62297	.2494E-03	3	.11E-02
S62	4	.62299	.2594E-03	3	.12E-02
S38	4	.62300	.1928E-03	3	.87E-03
S26	5	.62302	.1486E-03	4	.58E-03
S46	5	.62302	.1356E-03	4	.53E-03
S78	4	.62303	.2178E-03	3	.98E-03
S74	4	.62304	.1262E-03	3	.57E-03
S30	2	.62314	.1461E-03	1	.26E-02
S34	4	.62331	.2417E-03	3	.11E-02
S53	2	.64218	.4015E-03	1	.72E-02
S65	2	.64427	.2530E-03	1	.45E-02
S57	4	.64516	.5569E-03	3	.25E-02
S41	4	.64541	.1612E-03	3	.73E-03
S49	5	.64542	.3715E-03	4	.15E-02
S13	4	.64552	.2399E-03	3	.11E-02
S9	4	.64553	.2322E-03	3	.10E-02
S5	4	.64553	.2197E-03	3	.99E-03
S1	4	.64553	.2282E-03	3	.10E-02
S17	4	.64554	.2357E-03	3	.11E-02
S69	4	.64555	.2387E-03	3	.11E-02
S25	5	.64559	.1539E-03	4	.60E-03
S61	4	.64563	.2811E-03	3	.13E-02
S77	4	.64567	.2119E-03	3	.95E-03
S21	5	.64568	.3029E-03	4	.12E-02
S45	5	.64570	.1460E-03	4	.57E-03
S37	4	.64570	.2315E-03	3	.10E-02
S73	4	.64572	.1328E-03	3	.60E-03
S29	2	.64592	.1951E-03	1	.35E-02
S33	4	.64638	.2859E-03	3	.13E-02

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VARIANCE ANALYSIS

Transform Type: Power

	Sum of squares		DF	Mean square	F
	Estimated	Exact			
Sample Means	1.043867E-01	8.146720E-02			
Lab Means	1.470807E-05	9.696119E-06	4	2.42403E-06	58.016
Interaction	9.526379E-06		228	4.17824E-08	
Pairs	1.044109E-01	8.148642E-02			
Total	1.044109E-01				
Critical F (5%, 4, 228) =					2.411

Expectation of Mean Squares

Lab means	1.0000 V(r) + 1 V(I) + 58.0000 V(L)
Interaction	1.0000 V(r) + 1 V(I)
Repeats	1.0000 V(r)

	DF	Variance	Precision
Transformed data			
Reproducibility	15	1.657112E-07	8.677E-04

INPUT DATA FOR:

Penn State FloCat

		S1	S2	S3	S4	S5	S6	S7	S8
L1	1	5013.0	10031.0	15049.0	19485.0	5027.0	10057.0	15094.0	18509.0
L2	1	4972.0	9950.0	14927.0	19323.0	4973.0	9951.0	14942.0	18351.0
L6	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
L7	1	4951.0	9928.0	14905.0	19295.0	4954.0	9916.0	14880.0	18183.0
L8	1	5024.0	10051.0	15076.0	19518.0	5008.0	10019.0	15027.0	18352.0

CONTINUE

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INPUT DATA FOR:
Penn State FloCat

		S9	S10	S11	S12	S13	S14	S15	S16
L1	1	5025.0	10049.0	15072.0	18472.0	5023.0	10048.0	15077.0	18470.0
L2	1	4973.0	9944.0	14911.0	18239.0	4982.0	9968.0	14964.0	18365.0
L6	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
L7	1	4951.0	9908.0	14867.0	18180.0	4945.0	9909.0	14877.0	18219.0
L8	1	5015.0	10031.0	15043.0	18439.0	5017.0	10035.0	15048.0	18414.0

CONTINUE

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INPUT DATA FOR:
Penn State FloCat

		S17	S18	S19	S20	S21	S22	S23	S24
L1	1	5027.0	10054.0	15075.0	19638.0	5012.0	10080.0	15183.0	18704.0
L2	1	4970.0	9939.0	14899.0	19406.0	5013.0	10129.0	15305.0	18867.0
L6	1	-999.9	-999.9	-999.9	-999.9	4919.0	9883.0	14841.0	18239.0
L7	1	4950.0	9906.0	14842.0	19345.0	4925.0	9886.0	14821.0	18216.0
L8	1	5010.0	10021.0	15022.0	19567.0	4971.0	9982.0	14985.0	18413.0

CONTINUE

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INPUT DATA FOR:
Penn State FloCat

		S25	S26	S27	S28	S29	S30	S31	S32
L1	1	5008.0	10007.0	15011.0	19624.0	5274.0	10658.0	16090.0	19433.0
L2	1	4966.0	9925.0	14886.0	19458.0	5352.0	10833.0	16354.0	19744.0
L6	1	4958.0	9912.0	14869.0	19438.0	-999.9	-999.9	-999.9	-999.9
L7	1	4972.0	9922.0	14848.0	19401.0	4912.0	9886.0	14863.0	17929.0
L8	1	5005.0	10000.0	14997.0	19604.0	4953.0	9950.0	14944.0	18023.0

CONTINUE

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INPUT DATA FOR:
Penn State FloCat

		S33	S34	S35	S36	S37	S38	S39	S40
L1	1	4901.0	9934.0	14966.0	18383.0	5006.0	10029.0	15051.0	18735.0
L2	1	4847.0	9853.0	14877.0	18320.0	4945.0	9916.0	14881.0	18525.0
L6	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
L7	1	4814.0	9766.0	14678.0	17999.0	4929.0	9904.0	14878.0	18530.0
L8	1	4897.0	9908.0	14904.0	18271.0	4980.0	9991.0	14999.0	18672.0

CONTINUE

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INPUT DATA FOR:
Penn State FloCat

		S41	S42	S43	S44	S45	S46	S47	S48
L1	1	5036.0	10072.0	15122.0	18746.0	4988.0	9990.0	14986.0	18592.0
L2	1	4993.0	9991.0	15047.0	18707.0	4957.0	9927.0	14889.0	18465.0
L6	1	-999.9	-999.9	-999.9	-999.9	4937.0	9901.0	14860.0	18434.0
L7	1	4984.0	9968.0	14940.0	18488.0	4958.0	9946.0	14930.0	18527.0
L8	1	5022.0	10041.0	15047.0	18606.0	4987.0	10001.0	15008.0	18620.0

CONTINUE

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INPUT DATA FOR:
Penn State FloCat

		S49	S50	S51	S52	S53	S54	S55	S56
L1	1	5051.0	10148.0	15301.0	19134.0	5475.0	10919.0	16464.0	21242.0
L2	1	5075.0	10244.0	15447.0	19298.0	5570.0	11066.0	16687.0	21523.0
L6	1	4959.0	9920.0	14876.0	18538.0	-999.9	-999.9	-999.9	-999.9
L7	1	4946.0	9894.0	14841.0	18518.0	4884.0	9702.0	14610.0	18974.0
L8	1	5007.0	10014.0	15012.0	18704.0	4969.0	9856.0	14844.0	19270.0

CONTINUE

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INPUT DATA FOR:
Penn State FloCat

		S57	S58	S59	S60	S61	S62	S63	S64
L1	1	5102.0	10229.0	15470.0	18681.0	5018.0	10044.0	15054.0	18351.0
L2	1	5137.0	10285.0	15527.0	18755.0	4961.0	9931.0	14880.0	18137.0
L6	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
L7	1	4965.0	9948.0	14924.0	17965.0	4924.0	9868.0	14797.0	18024.0
L8	1	4986.0	9987.0	14981.0	18028.0	5001.0	10017.0	15008.0	18295.0

CONTINUE

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INPUT DATA FOR:
Penn State FloCat

		S65	S66	S67	S68	S69	S70	S71	S72
L1	1	5156.0	10404.0	15689.0	18657.0	5024.0	10052.0	15076.0	18624.0
L2	1	5212.0	10483.0	15773.0	18746.0	4969.0	9939.0	14899.0	18402.0
L6	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
L7	1	4949.0	9900.0	14812.0	17552.0	4946.0	9879.0	14807.0	18283.0
L8	1	5005.0	10024.0	15002.0	17775.0	5009.0	10016.0	15014.0	18544.0

CONTINUE

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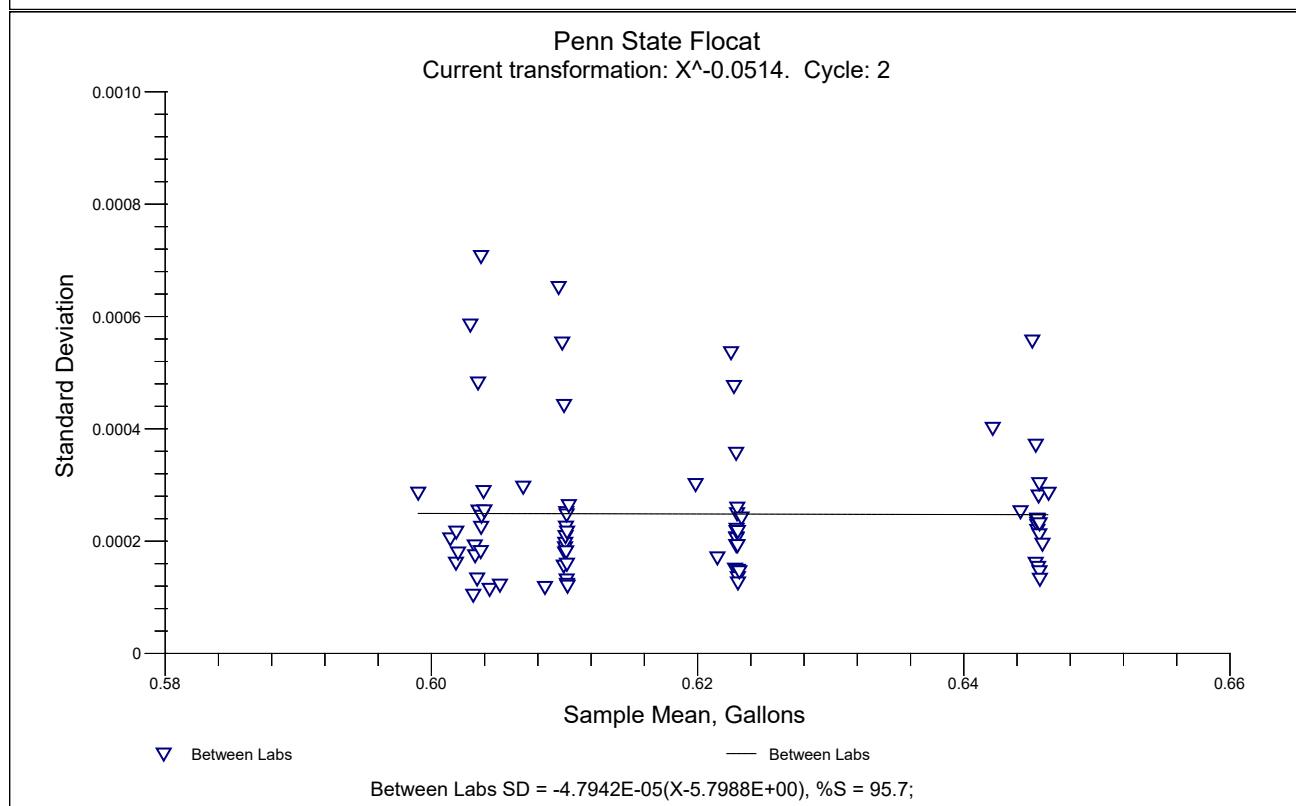
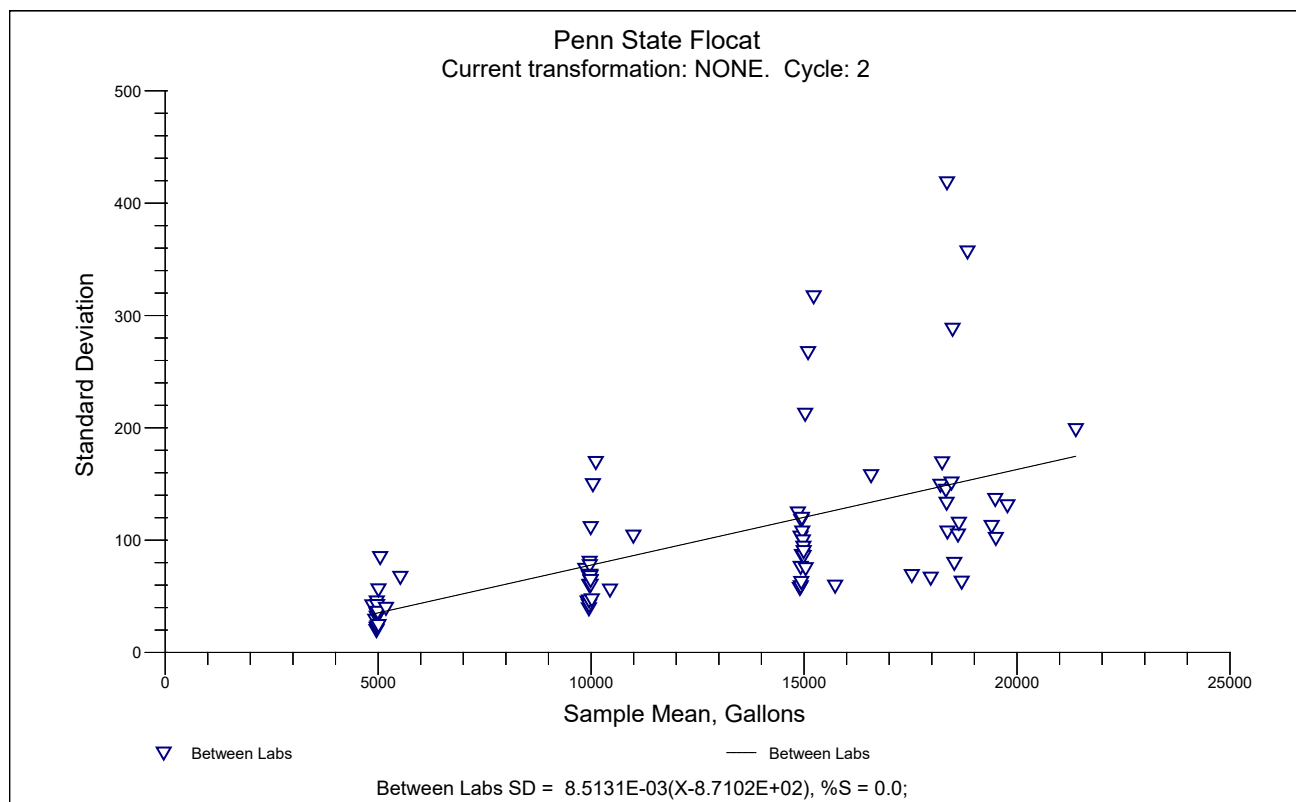
UNCLASSIFIED

INPUT DATA FOR:
Penn State FloCat

		S73	S74	S75	S76	S77	S78	S79	S80
L1	1	4975.0	9977.0	14971.0	17588.0	5002.0	10022.0	15025.0	19914.0
L2	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
L6	1	4934.0	9894.0	14843.0	17437.0	4948.0	9915.0	14865.0	19700.0
L7	1	4961.0	9946.0	14921.0	17529.0	4936.0	9877.0	14803.0	19635.0
L8	1	4977.0	9977.0	14964.0	17577.0	4989.0	9995.0	14984.0	19858.0

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ASTM Committee D02 Precision Evaluation

12:37, 17 May 2022

Fueltrax meter reproducibility gallons

Reproducibility = $9.016\text{E-}03 * X^{1.1696}$ Gallons

	Initial	Final
Number of laboratories	2	2
Number of samples	72	72
Number of repeats	1	

REGRESSIONS (AFTER OUTLIER TESTS)

TRANSFORMATION TYPE: NONE

Regression	Fitted Variable	Coefficient B	Test	t- Ratio	% Sig.
Unweighted D v. (m+B0)	m - 8.9071E+04	-8.4084E-04	B=0	0.40	69.2
Weighted	Intercept	-7.87241E+00			
ln(d,D) v. ln(m+B0)	ln(m)	1.16955E+00	B=1	0.30	76.1
(for Log Transform)	Dummy	0.00000E+00			
	Dummy * Ln(m+B0)	0.00000E+00	B=0	0.00	0.0
Weighted	Intercept	-7.87241E+00			
ln(d,D) v. ln(m+B0)	ln(m)	1.16955E+00	*B=0	2.10	3.7
(for Power Transform)	Dummy	0.00000E+00			
	Dummy * Ln(m+B0)	0.00000E+00	B=0	0.00	0.0
	Critical t (5%,140) =			1.98	5.0

* Coefficient used = 1.1696

Transformation used: $X^{-0.1696}$

COMMENTS:

This report was prepared using D2PP, Version 5.3.35
 from data file fueltrax meter data ASTM D6300.xls, Sheet1, .

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DATA MISSING OR REJECTED (Data rejection limit 20%):

LABORATORY SAMPLE DUP TEST

CAUTION!!

<5 laboratories

Cell drops terminated

SAMPLE MEANS AND STANDARD DEVIATIONS

Transform Type: NONE

After any outlier rejections

Sample	No. of Results	Mean	Between Labs		
			S.D.	DF	R
S33	2	4912.5	154.9	1	.28E+04
S17	2	4925.0	83.44	1	.15E+04
S29	2	4929.5	391.0	1	.70E+04
S41	2	4985.5	60.10	1	.11E+04
S65	2	5000.0	36.77	1	.66E+03
S5	2	5006.5	33.23	1	.60E+03
S25	2	5014.0	89.10	1	.16E+04
S45	2	5014.0	31.11	1	.56E+03
S69	2	5015.0	11.31	1	.20E+03
S49	2	5016.5	14.85	1	.27E+03
S53	2	5024.5	4.950	1	89.
S13	2	5027.0	7.071	1	.13E+03
S37	2	5028.5	9.192	1	.17E+03
S21	2	5030.0	.0000	1	.00
S9	2	5031.5	10.61	1	.19E+03
S61	2	5031.5	.7071	1	13.

CONTINUE

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SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: NONE

Sample	No. of		Between Labs		
	Results	Mean	S.D.	DF	R
S1	2	5032.5	3.536	1	64.
S57	2	5183.0	212.1	1	.38E+04
S18	2	9939.5	111.0	1	.20E+04
S30	2	9956.5	385.4	1	.69E+04
S46	2	9961.5	154.9	1	.28E+04
S38	2	9989.0	114.6	1	.21E+04
S66	2	9998.0	77.78	1	.14E+04
S42	2	10006.	74.25	1	.13E+04
S34	2	10006.	61.52	1	.11E+04
S70	2	10020.	54.45	1	.98E+03
S22	2	10027.	36.77	1	.66E+03
S62	2	10035.	41.72	1	.75E+03
S54	2	10045.	21.92	1	.39E+03
S26	2	10047.	83.44	1	.15E+04
S50	2	10050.	12.02	1	.22E+03
S14	2	10055.	13.44	1	.24E+03
S6	2	10063.	5.657	1	.10E+03
S2	2	10068.	8.485	1	.15E+03
S10	2	10068.	4.243	1	76.
S58	2	10164.	127.3	1	.23E+04
S43	2	14935.	220.6	1	.40E+04
S31	2	14984.	384.0	1	.69E+04
S19	2	15013.	56.57	1	.10E+04
S35	2	15031.	60.81	1	.11E+04
S55	2	15045.	61.52	1	.11E+04
S67	2	15070.	16.26	1	.29E+03
S71	2	15072.	9.192	1	.17E+03
S27	2	15073.	82.73	1	.15E+04
S23	2	15081.	4.243	1	76.
S51	2	15082.	10.61	1	.19E+03
S15	2	15082.	21.21	1	.38E+03
S63	2	15094.	2.121	1	38.
S7	2	15096.	7.071	1	.13E+03
S39	2	15098.	12.02	1	.22E+03
S47	2	15098.	8.485	1	.15E+03
S59	2	15099.	13.44	1	.24E+03
S11	2	15100.	12.02	1	.22E+03
S3	2	15104.	12.02	1	.22E+03
S68	2	17649.	71.42	1	.13E+04
S60	2	17981.	154.9	1	.28E+04
S52	2	18111.	57.28	1	.10E+04

CONTINUE

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SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: NONE

Sample	Results	No. of Mean	Between Labs		
			S.D.	DF	R
S28	2	18158.	73.54	1	.13E+04
S56	2	18352.	62.23	1	.11E+04
S32	2	18357.	371.9	1	.67E+04
S20	2	18421.	94.05	1	.17E+04
S4	2	18422.	19.80	1	.36E+03
S12	2	18489.	14.85	1	.27E+03
S8	2	18515.	2.121	1	38.
S64	2	18648.	10.61	1	.19E+03
S44	2	18664.	51.62	1	.93E+03
S40	2	18668.	12.73	1	.23E+03
S36	2	18723.	33.23	1	.60E+03
S48	2	18803.	20.51	1	.37E+03
S16	2	19640.	30.41	1	.55E+03
S24	2	19701.	7.071	1	.13E+03
S72	2	19961.	28.99	1	.52E+03

SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: Power

Sample	Results	No. of Mean	Between Labs		
			S.D.	DF	R
S72	2	.18651	.4594E-04	1	.83E-03
S24	2	.18692	.1138E-04	1	.20E-03
S16	2	.18702	.4911E-04	1	.88E-03
S48	2	.18841	.3485E-04	1	.63E-03
S36	2	.18854	.5676E-04	1	.10E-02
S40	2	.18863	.2181E-04	1	.39E-03
S44	2	.18864	.8849E-04	1	.16E-02
S64	2	.18867	.1820E-04	1	.33E-03
S8	2	.18890	.3671E-05	1	.66E-04
S12	2	.18894	.2574E-04	1	.46E-03
S4	2	.18906	.3446E-04	1	.62E-03
S20	2	.18906	.1637E-03	1	.29E-02
S32	2	.18918	.6501E-03	1	.12E-01
S56	2	.18918	.1088E-03	1	.20E-02
S28	2	.18952	.1302E-03	1	.23E-02
S52	2	.18961	.1017E-03	1	.18E-02

CONTINUE

UNCLASSIFIED

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SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: Power

Sample	No. of		Between Labs		
	Results	Mean	S.D.	DF	R
S60	2	.18984	.2773E-03	1	.50E-02
S68	2	.19044	.1307E-03	1	.23E-02
S3	2	.19554	.2639E-04	1	.47E-03
S11	2	.19555	.2640E-04	1	.47E-03
S59	2	.19555	.2951E-04	1	.53E-03
S47	2	.19555	.1864E-04	1	.33E-03
S39	2	.19555	.2641E-04	1	.47E-03
S7	2	.19555	.1554E-04	1	.28E-03
S63	2	.19556	.4661E-05	1	.84E-04
S15	2	.19558	.4666E-04	1	.84E-03
S51	2	.19559	.2333E-04	1	.42E-03
S23	2	.19559	.9332E-05	1	.17E-03
S27	2	.19561	.1821E-03	1	.33E-02
S71	2	.19561	.2023E-04	1	.36E-03
S67	2	.19561	.3580E-04	1	.64E-03
S55	2	.19567	.1357E-03	1	.24E-02
S35	2	.19570	.1343E-03	1	.24E-02
S19	2	.19574	.1251E-03	1	.22E-02
S31	2	.19581	.8511E-03	1	.15E-01
S43	2	.19591	.4908E-03	1	.88E-02
S58	2	.20912	.4442E-03	1	.80E-02
S10	2	.20946	.1497E-04	1	.27E-03
S2	2	.20946	.2994E-04	1	.54E-03
S6	2	.20948	.1997E-04	1	.36E-03
S14	2	.20951	.4748E-04	1	.85E-03
S50	2	.20953	.4251E-04	1	.76E-03
S26	2	.20953	.2951E-03	1	.53E-02
S54	2	.20954	.7756E-04	1	.14E-02
S62	2	.20958	.1478E-03	1	.27E-02
S22	2	.20961	.1304E-03	1	.23E-02
S70	2	.20963	.1932E-03	1	.35E-02
S34	2	.20968	.2187E-03	1	.39E-02
S42	2	.20968	.2639E-03	1	.47E-02
S66	2	.20971	.2767E-03	1	.50E-02
S38	2	.20974	.4079E-03	1	.73E-02
S46	2	.20984	.5533E-03	1	.99E-02
S30	2	.20987	.1378E-02	1	.25E-01
S18	2	.20992	.3977E-03	1	.71E-02
S57	2	.23445	.1628E-02	1	.29E-01
S1	2	.23560	.2807E-04	1	.50E-03
S61	2	.23561	.5616E-05	1	.10E-03

CONTINUE

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SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: Power

Sample	Results	No. of Mean	Between Labs		
			S.D.	DF	R
S9	2	.23561	.8424E-04	1	.15E-02
S21	2	.23562	.0000	1	.00
S37	2	.23563	.7306E-04	1	.13E-02
S13	2	.23564	.5622E-04	1	.10E-02
S53	2	.23566	.3937E-04	1	.71E-03
S49	2	.23573	.1183E-03	1	.21E-02
S69	2	.23574	.9020E-04	1	.16E-02
S45	2	.23575	.2481E-03	1	.45E-02
S25	2	.23575	.7105E-03	1	.13E-01
S5	2	.23581	.2655E-03	1	.48E-02
S65	2	.23586	.2942E-03	1	.53E-02
S41	2	.23598	.4825E-03	1	.87E-02
S17	2	.23647	.6795E-03	1	.12E-01
S29	2	.23650	.3185E-02	1	.57E-01
S33	2	.23658	.1265E-02	1	.23E-01

VARIANCE ANALYSIS

Transform Type: Power

	Sum of squares		DF	Mean square	F
	Estimated	Exact			
Sample Means	4.675478E-02	4.675478E-02			
Lab Means	2.456414E-06	2.456415E-06	1	2.45641E-06	9.608
Interaction	1.815263E-05		71	2.55671E-07	
Pairs	4.677539E-02	4.677539E-02			
Total	4.677539E-02				
Critical F (5%, 1, 71) =					3.976

	Expectation of Mean Squares
Lab means	1.0000 V(r) + 1 V(I) + 72.0000 V(L)
Interaction	1.0000 V(r) + 1 V(I)
Repeats	1.0000 V(r)

	DF	Variance	Precision
Transformed data			
Reproducibility	40	5.724734E-07	1.529E-03

INPUT DATA FOR:

Fueltrax meter reproducibility gallons

		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
L1	1	5035	10074	15112	18408	4983	10067	15101	18516	5024	10065
L2	1	5030	10062	15095	18436	5030	10059	15091	18513	5039	10071

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CONTINUE

INPUT DATA FOR:

Fueltrax meter reproducibility gallons

		S11	S12	S13	S14	S15	S16	S17	S18	S19	S20
L1	1	15091	18478	5022	10045	15067	19618	4866	9861	14973	18354
L2	1	15108	18499	5032	10064	15097	19661	4984	10018	15053	18487

CONTINUE

INPUT DATA FOR:

Fueltrax meter reproducibility gallons

		S21	S22	S23	S24	S25	S26	S27	S28	S29	S30
L1	1	5030	10001	15078	19696	4951	9988	15014	18106	4653	9684
L2	1	5030	10053	15084	19706	5077	10106	15131	18210	5206	10229

CONTINUE

INPUT DATA FOR:

Fueltrax meter reproducibility gallons

		S31	S32	S33	S34	S35	S36	S37	S38	S39	S40
L1	1	14712	18094	4803	9962	14988	18699	5022	9908	15089	18677
L2	1	15255	18620	5022	10049	15074	18746	5035	10070	15106	18659

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CONTINUE

INPUT DATA FOR:

Fueltrax meter reproducibility gallons

		S41	S42	S43	S44	S45	S46	S47	S48	S49	S50
L1	1	4943	9953	14779	18627	4992	9852	15092	18788	5006	10041
L2	1	5028	10058	15091	18700	5036	10071	15104	18817	5027	10058

CONTINUE

INPUT DATA FOR:

Fueltrax meter reproducibility gallons

		S51	S52	S53	S54	S55	S56	S57	S58	S59	S60
L1	1	15074	18070	5021	10029	15001	18308	5333	10254	15108	18090
L2	1	15089	18151	5028	10060	15088	18396	5033	10074	15089	17871

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CONTINUE

INPUT DATA FOR:

Fueltrax meter reproducibility gallons

		S61	S62	S63	S64	S65	S66	S67	S68	S69	S70
L1	1	5031	10005	15092	18640	4974	9943	15058	17598	5007	9981
L2	1	5032	10064	15095	18655	5026	10053	15081	17699	5023	10058

CONTINUE

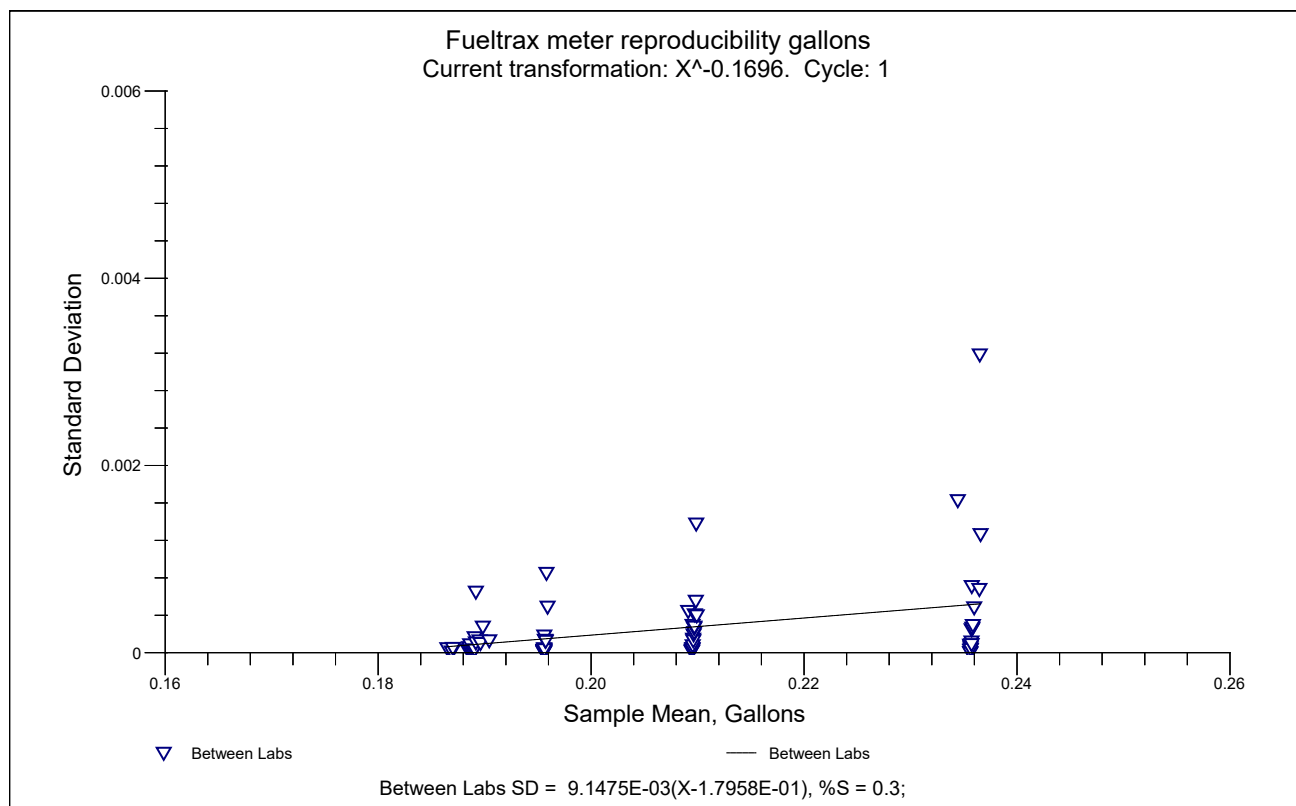
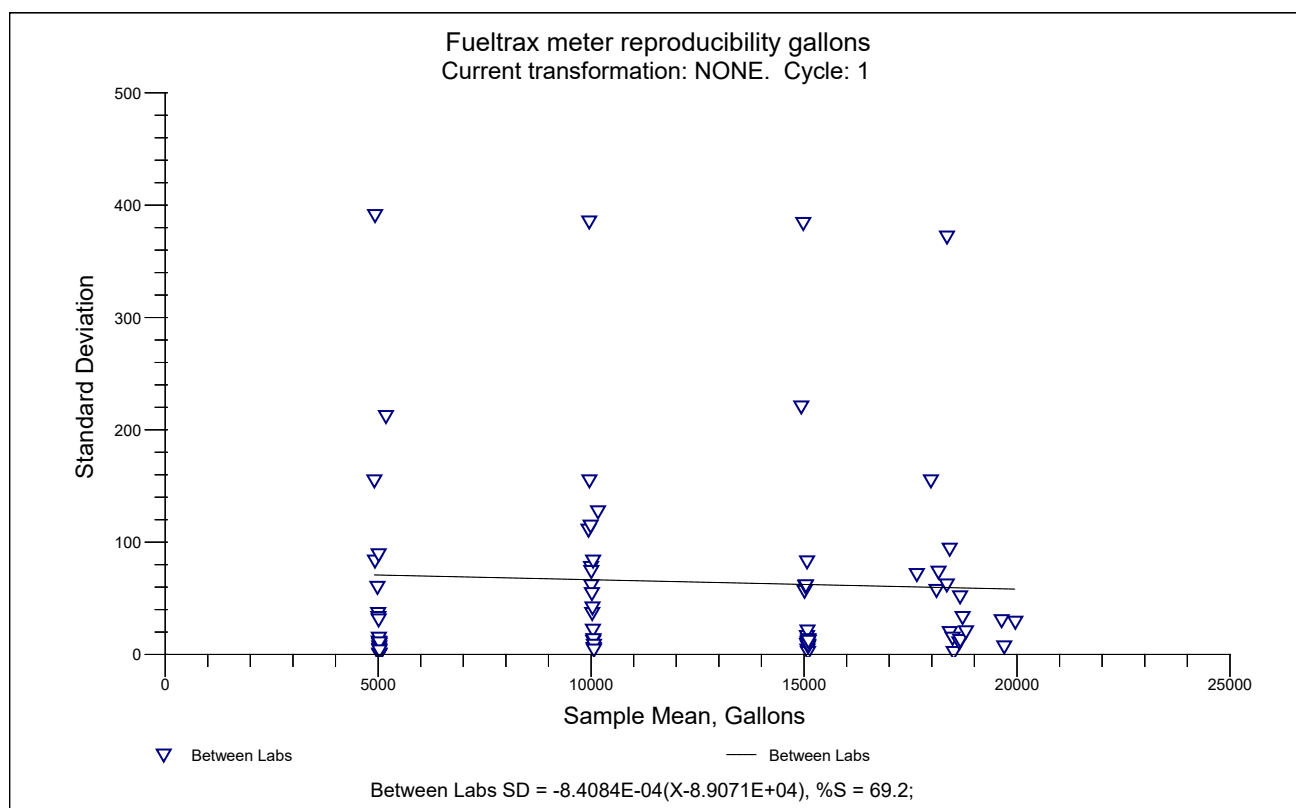
INPUT DATA FOR:

Fueltrax meter reproducibility gallons

		S71	S72
L1	1	15065	19940
L2	1	15078	19981

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APPENDIX M

Precision Calculations for Automated CFT volumes in Gallons

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Same Meter CFT Volume Stock FloCat Reproducibility

ASTM Committee D02 Precision Evaluation

8:16, 16 Jun 2022

Same Meters Stock FloCat CFT Volume reproducibility gallons

Reproducibility = $54.827 * X^{0.4795}$ gallons

	Initial	Final
Number of laboratories	2	2
Number of samples	38	38
Number of repeats	1	

REGRESSIONS (AFTER OUTLIER TESTS)

TRANSFORMATION TYPE: NONE

Regression	Fitted Variable	Coefficient B	t- Test	% Sig.
Unweighted D v. (m+B0)	m + 3.7582E+04	1.9352E-02	B=0	0.82 41.8
Weighted ln(d,D) v. ln(m+B0) (for Log Transform)	Intercept ln(m + 25055.) Dummy Dummy * Ln(m+B0)	-9.16784E+00 1.47863E+00 0.00000E+00 0.00000E+00	B=1 B=0	0.56 57.9 0.00 0.0
Weighted ln(d,D) v. ln(m+B0) (for Power Transform)	Intercept ln(m) Dummy Dummy * Ln(m+B0)	1.95958E+00 4.79453E-01 0.00000E+00 0.00000E+00	*B=0 B=0	2.57 1.2 0.00 0.0
Critical t (5%, 72) =				1.99 5.0

* Coefficient used = 0.4795

Transformation used: $X^{0.5205}$

COMMENTS:

This report was prepared using D2PP, Version 5.3.35
 from data file samemeters stock flocat CFT volume data ASTM D6300.xls,
 Sheet1, .

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DATA MISSING OR REJECTED (Data rejection limit 20%):

LABORATORY SAMPLE DUP TEST

CAUTION!!

<5 laboratories

Cell drops terminated

SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: NONE

Sample	No. of		Between Labs		
	Results	Mean	S.D.	DF	R
S23	2	731.50	19.09	1	.34E+03
S15	2	2335.5	2351.	1	.42E+05
S34	2	2791.0	1015.	1	.18E+05
S26	2	3615.5	113.8	1	.20E+04
S4	2	4019.5	371.2	1	.67E+04
S22	2	4432.0	355.0	1	.64E+04
S35	2	4716.5	529.6	1	.95E+04
S16	2	5230.5	317.5	1	.57E+04
S9	2	5259.0	1629.	1	.29E+05
S27	2	5519.0	714.2	1	.13E+05
S33	2	6229.0	694.4	1	.12E+05
S3	2	6540.5	499.9	1	.90E+04
S14	2	7164.0	2587.	1	.46E+05
S25	2	8469.0	121.6	1	.22E+04
S5	2	9423.0	188.1	1	.34E+04
S21	2	9442.0	849.9	1	.15E+05

CONTINUE

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SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: NONE

Sample	No. of		Between Labs		
	Results	Mean	S.D.	DF	R
S36	2	9714.5	935.5	1	.17E+05
S10	2	10082.	1879.	1	.34E+05
S17	2	10090.	85.56	1	.15E+04
S28	2	10520.	1170.	1	.21E+05
S32	2	11235.	236.2	1	.42E+04
S2	2	11353.	755.2	1	.14E+05
S13	2	12012.	2823.	1	.51E+05
S24	2	13328.	353.6	1	.64E+04
S6	2	14271.	48.08	1	.86E+03
S20	2	14443.	1306.	1	.23E+05
S37	2	14721.	1394.	1	.25E+05
S11	2	14895.	2135.	1	.38E+05
S18	2	14943.	149.9	1	.27E+04
S29	2	15530.	1665.	1	.30E+05
S1	2	16176.	1006.	1	.18E+05
S31	2	16233.	169.7	1	.30E+04
S12	2	17416.	2263.	1	.41E+05
S38	2	18159.	1715.	1	.31E+05
S19	2	18440.	322.4	1	.58E+04
S7	2	19100.	283.5	1	.51E+04
S30	2	19230.	2039.	1	.37E+05
S8	2	23821.	511.2	1	.92E+04

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SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: Power

Sample	Results	No. of Mean	Between Labs		
			S.D.	DF	R
S23	2	30.960	.4206	1	7.6
S15	2	52.297	32.03	1	.58E+03
S34	2	61.637	11.87	1	.21E+03
S26	2	71.121	1.166	1	21.
S4	2	75.117	3.615	1	65.
S22	2	79.046	3.298	1	59.
S35	2	81.616	4.778	1	86.
S9	2	85.918	14.02	1	.25E+03
S16	2	86.179	2.724	1	49.
S27	2	88.549	5.976	1	.11E+03
S33	2	94.332	5.482	1	99.
S3	2	96.798	3.854	1	69.
S14	2	100.69	19.23	1	.35E+03
S25	2	110.77	.8280	1	15.
S5	2	117.10	1.217	1	22.
S21	2	117.17	5.495	1	99.
S36	2	118.91	5.967	1	.11E+03
S10	2	121.03	11.79	1	.21E+03
S17	2	121.34	.5356	1	9.6
S28	2	123.91	7.186	1	.13E+03
S32	2	128.33	1.404	1	25.
S2	2	128.99	4.469	1	80.
S13	2	132.41	16.31	1	.29E+03
S24	2	140.26	1.937	1	35.
S6	2	145.34	.2549	1	4.6
S20	2	146.17	6.887	1	.12E+03
S37	2	147.63	7.283	1	.13E+03
S11	2	148.42	11.10	1	.20E+03
S18	2	148.86	.7773	1	14.
S29	2	151.77	8.483	1	.15E+03
S1	2	155.10	5.021	1	90.
S31	2	155.42	.8457	1	15.
S12	2	161.05	10.92	1	.20E+03
S38	2	164.67	8.102	1	.15E+03
S19	2	166.08	1.512	1	27.
S7	2	169.15	1.307	1	23.
S30	2	169.63	9.376	1	.17E+03
S8	2	189.75	2.120	1	38.

VARIANCE ANALYSIS

Transform Type: Power

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		Sum of squares		DF	Mean square	F
		Estimated	Exact			
Sample Means		1.038660E+05	1.038660E+05			
Lab Means		9.495653E+02	9.495653E+02	1	9.49565E+02	16.939
Interaction		2.074109E+03		37	5.60570E+01	
Pairs		1.068897E+05	1.068897E+05			
Total		1.068897E+05				
Critical F (5%, 1, 37) =						4.105

		Expectation of Mean Squares	
Lab means		1.0000 V(r) + 1 V(I) + 38.0000 V(L)	
Interaction		1.0000 V(r) + 1 V(I)	
Repeats		1.0000 V(r)	

	DF	Variance	Precision
Transformed data			
Reproducibility	9	1.591407E+02	2.854E+01

INPUT DATA FOR:

Stock FloCat CFT Volume reproducibility gallons

		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
MP44	1	16887	11887	6894	4282	9290	14305	19300	24182	6411	11411
MP55	1	15465	10819	6187	3757	9556	14237	18899	23459	4107	8753

CONTINUE

INPUT DATA FOR:

Stock FloCat CFT Volume reproducibility gallons

		S11	S12	S13	S14	S15	S16	S17	S18	S19	S20
MP44	1	16404	19016	14008	8993	3998	5006	10029	15049	18668	15366
MP55	1	13385	15815	10016	5335	673	5455	10150	14837	18212	13519

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CONTINUE

INPUT DATA FOR:

Stock FloCat CFT Volume reproducibility gallons

		S21	S22	S23	S24	S25	S26	S27	S28	S29	S30
MP44	1	10043	4683	718	13578	8555	3535	6024	11347	16707	20672
MP55	1	8841	4181	745	13078	8383	3696	5014	9692	14352	17788

CONTINUE

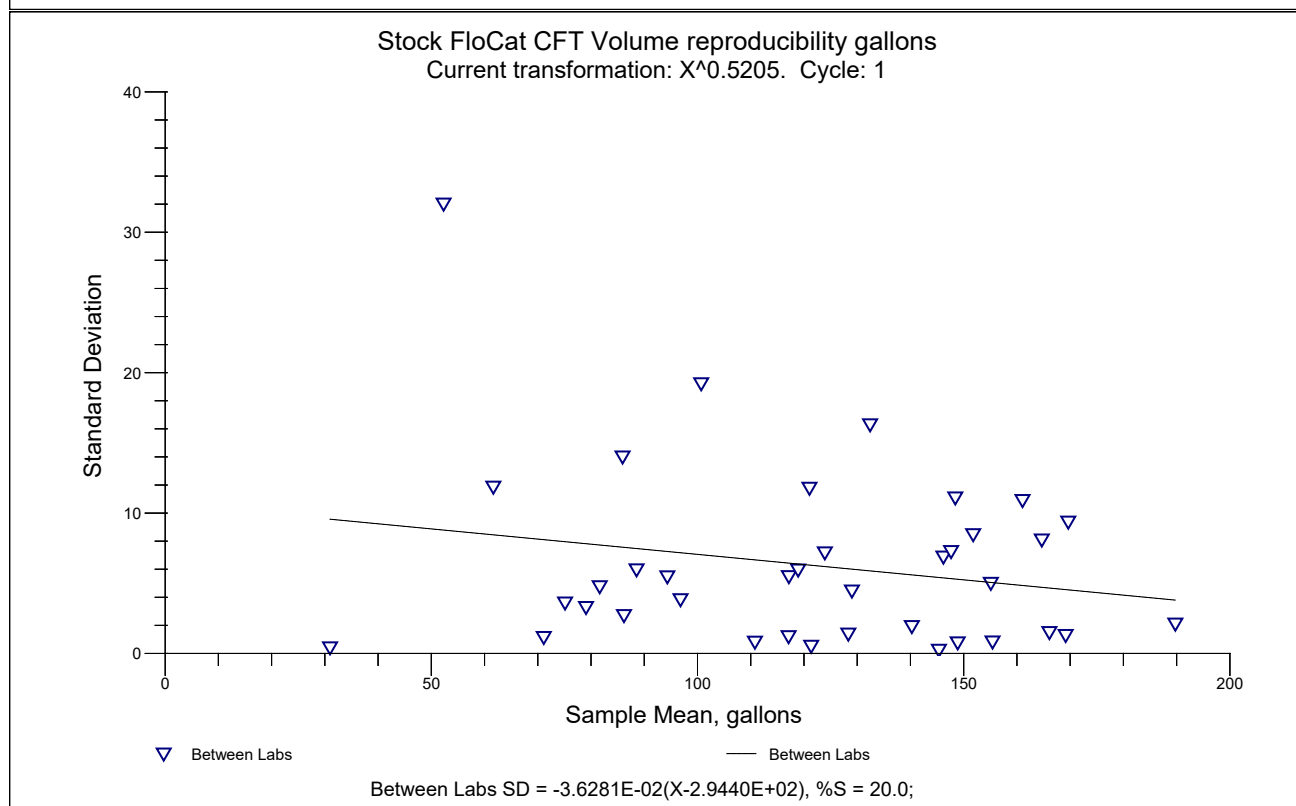
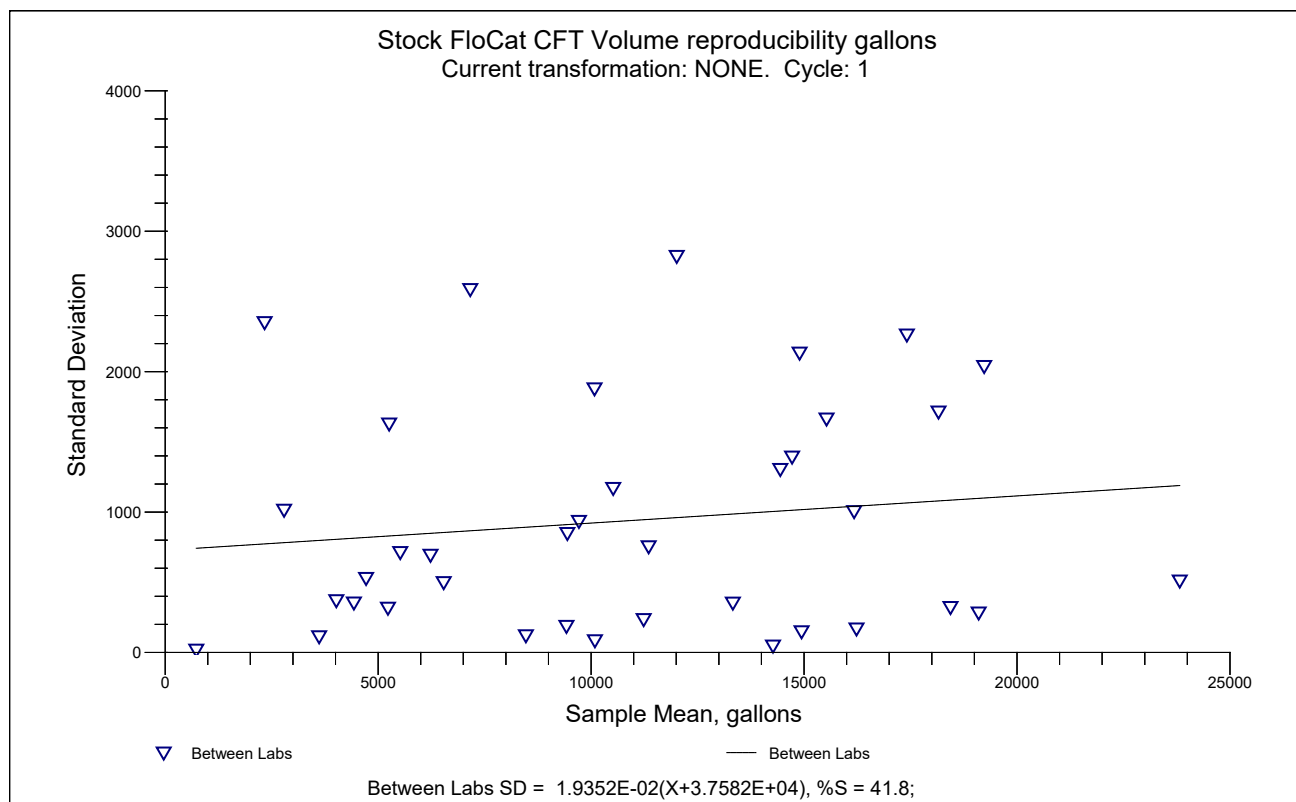
INPUT DATA FOR:

Stock FloCat CFT Volume reproducibility gallons

		S31	S32	S33	S34	S35	S36	S37	S38
MP44	1	16353	11068	5738	2073	5091	10376	15706	19371
MP55	1	16113	11402	6720	3509	4342	9053	13735	16946

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Same Meter CFT Volume Penn State Modified Reproducibility

ASTM Committee D02 Precision Evaluation

8:52, 16 Jun 2022

Same Meter PS Modified CFT volume reproducibility

Reproducibility = 2079.5 gallons

	Initial	Final
Number of laboratories	6	5
Number of samples	100	100
Number of repeats	1	

REGRESSIONS (AFTER OUTLIER TESTS)

TRANSFORMATION TYPE: NONE

Regression	Fitted Variable	Coefficient B	t- Test	% Sig.
Unweighted D v. (m+B0)	m + 5.2965E+04	8.7395E-03	B=0	1.67 9.8
Weighted ln(d,D) v. ln(m+B0) (for Log Transform)	Intercept ln(m + 35310.) Dummy Dummy * Ln(m+B0)	-2.77179E+00 8.25235E-01 0.00000E+00 0.00000E+00	B=1 B=0	0.40 69.1 0.00 0.0
Weighted ln(d,D) v. ln(m+B0) (for Power Transform)	Intercept ln(m +1.5E+16) Dummy Dummy * Ln(m+B0)	4.59260E+00 4.27735E-02 0.00000E+00 0.00000E+00	B=0 B=0	0.02 98.3 0.00 0.0
Critical t (5%,196) =				1.97 5.0

Transformation used: NONE

COMMENTS:

This report was prepared using D2PP, Version 5.3.35

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from data file samemeters PS modified flocat CFT volume data ASTM D6300.xls,
Sheet1, .

DATA MISSING OR REJECTED (Data rejection limit 20%):

LABORATORY	SAMPLE	DUP	TEST
(MP22	,S21	,)	Missing, <, or 0.0
(MP22	,S22	,)	Missing, <, or 0.0
(MP22	,S23	,)	Missing, <, or 0.0
(MP22	,S24	,)	Missing, <, or 0.0
(MP22	,S25	,)	Missing, <, or 0.0
(MP22	,S26	,)	Missing, <, or 0.0
(MP22	,S27	,)	Missing, <, or 0.0
(MP22	,S28	,)	Missing, <, or 0.0
(MP22	,S45	,)	Missing, <, or 0.0
(MP22	,S46	,)	Missing, <, or 0.0
(MP22	,S47	,)	Missing, <, or 0.0
(MP22	,S48	,)	Missing, <, or 0.0
(MP22	,S49	,)	Missing, <, or 0.0
(MP22	,S50	,)	Missing, <, or 0.0
(MP22	,S51	,)	Missing, <, or 0.0
(MP33	,	,)	Locked out - data missing or 0
(MP66	,S1	,)	Missing, <, or 0.0
(MP66	,S2	,)	Missing, <, or 0.0
(MP66	,S3	,)	Missing, <, or 0.0
(MP66	,S4	,)	Missing, <, or 0.0
(MP66	,S5	,)	Missing, <, or 0.0
(MP66	,S6	,)	Missing, <, or 0.0
(MP66	,S7	,)	Missing, <, or 0.0
(MP66	,S8	,)	Missing, <, or 0.0
(MP66	,S9	,)	Missing, <, or 0.0
(MP66	,S10	,)	Missing, <, or 0.0
(MP66	,S11	,)	Missing, <, or 0.0
(MP66	,S12	,)	Missing, <, or 0.0
(MP66	,S13	,)	Missing, <, or 0.0
(MP66	,S14	,)	Missing, <, or 0.0
(MP66	,S15	,)	Missing, <, or 0.0
(MP66	,S16	,)	Missing, <, or 0.0
(MP66	,S17	,)	Missing, <, or 0.0
(MP66	,S18	,)	Missing, <, or 0.0
(MP66	,S19	,)	Missing, <, or 0.0
(MP66	,S20	,)	Missing, <, or 0.0
(MP66	,S29	,)	Missing, <, or 0.0
(MP66	,S30	,)	Missing, <, or 0.0
(MP66	,S31	,)	Missing, <, or 0.0
(MP66	,S32	,)	Missing, <, or 0.0
(MP66	,S33	,)	Missing, <, or 0.0
(MP66	,S34	,)	Missing, <, or 0.0
(MP66	,S35	,)	Missing, <, or 0.0

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(MP66 ,S36 ,) Missing, <, or 0.0
CONTINUED

DATA MISSING OR REJECTED (Data rejection limit 20%):

LABORATORY	SAMPLE	DUP	TEST
(MP66	,S37	,)	Missing, <, or 0.0
(MP66	,S38	,)	Missing, <, or 0.0
(MP66	,S39	,)	Missing, <, or 0.0
(MP66	,S40	,)	Missing, <, or 0.0
(MP66	,S41	,)	Missing, <, or 0.0
(MP66	,S42	,)	Missing, <, or 0.0
(MP66	,S43	,)	Missing, <, or 0.0
(MP66	,S44	,)	Missing, <, or 0.0
(MP66	,S52	,)	Missing, <, or 0.0
(MP66	,S53	,)	Missing, <, or 0.0
(MP66	,S54	,)	Missing, <, or 0.0
(MP66	,S55	,)	Missing, <, or 0.0
(MP66	,S56	,)	Missing, <, or 0.0
(MP66	,S57	,)	Missing, <, or 0.0
(MP66	,S58	,)	Missing, <, or 0.0
(MP66	,S59	,)	Missing, <, or 0.0
(MP66	,S60	,)	Missing, <, or 0.0
(MP66	,S61	,)	Missing, <, or 0.0
(MP66	,S62	,)	Missing, <, or 0.0
(MP66	,S63	,)	Missing, <, or 0.0
(MP66	,S64	,)	Missing, <, or 0.0
(MP66	,S65	,)	Missing, <, or 0.0
(MP66	,S66	,)	Missing, <, or 0.0
(MP66	,S67	,)	Missing, <, or 0.0
(MP66	,S68	,)	Hawkins-cells
(MP66	,S69	,)	Hawkins-cells
(MP66	,S70	,)	Hawkins-cells
(MP66	,S71	,)	Hawkins-cells
(MP66	,S76	,)	Missing, <, or 0.0
(MP66	,S77	,)	Missing, <, or 0.0
(MP66	,S78	,)	Missing, <, or 0.0
(MP66	,S79	,)	Missing, <, or 0.0
(MP66	,S80	,)	Missing, <, or 0.0
(MP66	,S81	,)	Missing, <, or 0.0
(MP66	,S82	,)	Missing, <, or 0.0
(MP66	,S83	,)	Missing, <, or 0.0
(MP66	,S84	,)	Missing, <, or 0.0
(MP66	,S85	,)	Missing, <, or 0.0
(MP66	,S86	,)	Missing, <, or 0.0
(MP66	,S87	,)	Missing, <, or 0.0
(MP66	,S88	,)	Missing, <, or 0.0
(MP66	,S89	,)	Missing, <, or 0.0
(MP66	,S90	,)	Missing, <, or 0.0
(MP66	,S91	,)	Missing, <, or 0.0

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CONTINUED

DATA MISSING OR REJECTED (Data rejection limit 20%):

LABORATORY	SAMPLE	DUP	TEST
(MP66	,S96	,)	Missing, <, or 0.0
(MP66	,S97	,)	Missing, <, or 0.0
(MP66	,S98	,)	Missing, <, or 0.0
(MP66	,S99	,)	Missing, <, or 0.0
(MP66	,S100	,)	Missing, <, or 0.0

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SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: NONE

Sample	No. of Results	Mean	Between Labs		
			S.D.	DF	R
S83	4	627.75	134.7	3	.61E+03
S91	4	718.75	252.4	3	.11E+04
S44	4	938.25	896.7	3	.40E+04
S36	4	1155.5	395.3	3	.18E+04
S75	5	1358.8	500.1	4	.20E+04
S67	4	1537.8	701.6	3	.32E+04
S59	4	1539.0	823.5	3	.37E+04
S8	4	2895.0	897.6	3	.40E+04
S16	4	2956.0	344.9	3	.16E+04
S51	4	3453.8	709.2	3	.32E+04
S24	4	3966.0	539.0	3	.24E+04
S82	4	4291.0	132.7	3	.60E+03
S90	4	4312.8	244.3	3	.11E+04
S35	4	4422.5	397.2	3	.18E+04
S43	4	4439.0	920.2	3	.41E+04
S58	4	4926.0	872.7	3	.39E+04
S74	5	5101.8	513.7	4	.20E+04
S66	4	5132.8	757.2	3	.34E+04
S84	4	5625.8	137.1	3	.62E+03
S92	5	5734.4	266.1	4	.10E+04
S45	4	5764.3	703.8	3	.32E+04
S15	4	5811.3	462.3	3	.21E+04
S76	4	5864.8	41.81	3	.19E+03
S96	4	5990.0	34.30	3	.15E+03
S7	4	6026.8	998.9	3	.45E+04
S29	4	6047.5	84.79	3	.38E+03
S52	4	6122.8	222.6	3	.10E+04
S1	4	6224.5	348.0	3	.16E+04
S37	4	6250.0	520.7	3	.23E+04
S60	4	6504.0	829.6	3	.37E+04
S68	4	6510.3	699.8	3	.31E+04
S23	4	6574.0	536.5	3	.24E+04
S9	4	7871.0	915.0	3	.41E+04
S17	4	7943.0	371.2	3	.17E+04
S50	4	8420.8	716.3	3	.32E+04
S25	4	8934.8	554.2	3	.25E+04
S81	4	9283.3	135.4	3	.61E+03
S89	4	9294.3	236.4	3	.11E+04
S34	4	9392.3	399.5	3	.18E+04
S42	4	9399.0	951.0	3	.43E+04
S57	4	9917.0	912.7	3	.41E+04

CONTINUE

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SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: NONE

Sample	No. of Results	Mean	Between Labs		
			S.D.	DF	R
S65	4	10145.	803.9	3	.36E+04
S73	5	10153.	556.3	4	.22E+04
S85	4	10635.	145.8	3	.66E+03
S46	4	10751.	697.7	3	.31E+04
S93	5	10771.	353.0	4	.14E+04
S77	4	10865.	74.28	3	.33E+03
S14	4	10911.	666.3	3	.30E+04
S97	4	10990.	60.13	3	.27E+03
S30	4	11112.	169.4	3	.76E+03
S6	4	11140.	1146.	3	.52E+04
S53	4	11332.	483.8	3	.22E+04
S38	4	11372.	674.9	3	.30E+04
S2	4	11386.	706.0	3	.32E+04
S61	4	11499.	828.1	3	.37E+04
S69	4	11504.	689.8	3	.31E+04
S22	4	11550.	532.9	3	.24E+04
S10	4	12860.	928.5	3	.42E+04
S18	4	12928.	406.4	3	.18E+04
S49	4	13404.	725.5	3	.33E+04
S26	4	13918.	577.1	3	.26E+04
S80	4	14278.	144.5	3	.65E+03
S88	4	14281.	230.9	3	.10E+04
S41	4	14365.	984.5	3	.44E+04
S33	4	14381.	404.6	3	.18E+04
S56	4	14918.	932.3	3	.42E+04
S64	4	15146.	821.0	3	.37E+04
S72	5	15190.	601.4	4	.24E+04
S100	4	15415.	82.81	3	.37E+03
S86	4	15656.	183.3	3	.82E+03
S47	4	15727.	693.4	3	.31E+04
S94	5	15822.	463.5	4	.18E+04
S78	4	15856.	124.5	3	.56E+03
S98	4	15989.	85.77	3	.39E+03
S13	4	16016.	838.4	3	.38E+04
S5	4	16205.	1231.	3	.55E+04
S31	4	16226.	316.9	3	.14E+04
S39	4	16489.	869.3	3	.39E+04
S70	4	16491.	679.2	3	.31E+04
S62	4	16491.	826.4	3	.37E+04
S21	4	16537.	529.7	3	.24E+04
S54	4	16563.	769.5	3	.35E+04

CONTINUE

SAMPLE MEANS AND STANDARD DEVIATIONS

Transform Type: NONE

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After any outlier rejections

Sample	No. of Results	Mean	Between Labs		
			S.D.	DF	R
S3	4	16651.	1075.	3	.48E+04
S11	4	17830.	943.5	3	.42E+04
S19	4	17905.	442.3	3	.20E+04
S48	4	18335.	691.2	3	.31E+04
S27	4	18885.	600.4	3	.27E+04
S79	4	19243.	169.2	3	.76E+03
S87	4	19254.	232.0	3	.10E+04
S40	4	19352.	991.9	3	.45E+04
S32	4	19357.	418.4	3	.19E+04
S95	5	19565.	547.3	4	.21E+04
S55	4	19782.	940.4	3	.42E+04
S71	4	20089.	670.8	3	.30E+04
S63	4	20155.	825.6	3	.37E+04
S99	4	20405.	112.5	3	.51E+03
S12	4	21097.	959.7	3	.43E+04
S4	4	21252.	1316.	3	.59E+04
S20	4	21419.	470.4	3	.21E+04
S28	4	23743.	615.1	3	.28E+04

VARIANCE ANALYSIS

Sum of squares

Transform Type: NONE

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	Estimated	Exact	DF	Mean square	F
Sample Means	1.732258E+10	1.412488E+10			
Lab Means	1.024174E+08	8.734912E+07	4	2.18373E+07	175.258
Interaction	3.787867E+07		304	1.24601E+05	
Pairs	1.746288E+10	1.425011E+10			
Total	1.746288E+10				
Critical F (5%, 4, 304) =					2.401

	Expectation of Mean Squares
Lab means	1.0000 V(r) + 1 V(I) + 77.0000 V(L)
Interaction	1.0000 V(r) + 1 V(I)
Repeats	1.0000 V(r)

	DF	Variance	Precision
Repeatability	0	0.000000E+00	0.000E+00
Reproducibility	8	8.131675E+05	2.079E+03

INPUT DATA FOR:

PS Modified CFT volume reproducibility

		S1	S2	S3	S4	S5	S6	S7
MP11	1	6475.0	11919.0	17464.0	22242.0	17140.0	12013.0	6772.0
MP22	1	6570.0	12066.0	17687.0	22523.0	17386.0	12238.0	6996.0
MP33	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP66	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP77	1	5884.0	10702.0	15610.0	19974.0	15009.0	10026.0	5050.0
MP88	1	5969.0	10856.0	15844.0	20270.0	15284.0	10283.0	5289.0

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CONTINUE

INPUT DATA FOR:

PS Modified CFT volume reproducibility

		S8	S9	S10	S11	S12	S13	S14
MP11	1	3561.0	8579.0	13605.0	18615.0	21912.0	16756.0	11508.0
MP22	1	3768.0	8729.0	13699.0	18648.0	21905.0	16693.0	11422.0
MP33	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP66	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP77	1	2009.0	6933.0	11877.0	16806.0	20033.0	15084.0	10133.0
MP88	1	2242.0	7243.0	12259.0	17250.0	20537.0	15532.0	10581.0

CONTINUE

INPUT DATA FOR:

PS Modified CFT volume reproducibility

		S15	S16	S17	S18	S19	S20	S21
MP11	1	6223.0	3255.0	8279.0	13307.0	18331.0	21879.0	16904.0
MP22	1	6132.0	3159.0	8128.0	13098.0	18058.0	21561.0	-999.9
MP33	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP66	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	16945.0
MP77	1	5221.0	2481.0	7427.0	12360.0	17288.0	20764.0	15803.0
MP88	1	5669.0	2929.0	7938.0	12945.0	17943.0	21473.0	16496.0

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CONTINUE

INPUT DATA FOR:

PS Modified CFT volume reproducibility

		S22	S23	S24	S25	S26	S27	S28
MP11	1	11902.0	6908.0	4291.0	9293.0	14313.0	19316.0	24205.0
MP22	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP33	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP66	1	11985.0	7036.0	4442.0	9390.0	14357.0	19307.0	24142.0
MP77	1	10818.0	5843.0	3235.0	8171.0	13112.0	18038.0	22870.0
MP88	1	11496.0	6509.0	3896.0	8885.0	13891.0	18880.0	23754.0

CONTINUE

INPUT DATA FOR:

PS Modified CFT volume reproducibility

		S29	S30	S31	S32	S33	S34	S35
MP11	1	6102.0	11229.0	16470.0	19681.0	14663.0	9637.0	4627.0
MP22	1	6137.0	11285.0	16527.0	19755.0	14794.0	9824.0	4875.0
MP33	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP66	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP77	1	5965.0	10948.0	15924.0	18965.0	14041.0	9097.0	4168.0
MP88	1	5986.0	10987.0	15981.0	19028.0	14027.0	9011.0	4020.0

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CONTINUE

INPUT DATA FOR:

PS Modified CFT volume reproducibility

		S36	S37	S38	S39	S40	S41	S42
MP11	1	1330.0	6542.0	11790.0	17075.0	20043.0	15019.0	9991.0
MP22	1	1618.0	6830.0	12101.0	17391.0	20364.0	15395.0	10425.0
MP33	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP66	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP77	1	941.0	5890.0	10841.0	15753.0	18493.0	13547.0	8614.0
MP88	1	733.0	5738.0	10757.0	15735.0	18508.0	13499.0	8566.0

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CONTINUE

INPUT DATA FOR:

PS Modified CFT volume reproducibility

		S43	S44	S45	S46	S47	S48	S49
MP11	1	4967.0	1419.0	6394.0	11396.0	16390.0	19007.0	14005.0
MP22	1	5465.0	1962.0	-999.9	-999.9	-999.9	-999.9	-999.9
MP33	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP66	1	-999.9	-999.9	6353.0	11313.0	16262.0	18856.0	14059.0
MP77	1	3686.0	210.0	5171.0	10156.0	15131.0	17739.0	12803.0
MP88	1	3638.0	162.0	5139.0	10139.0	15126.0	17739.0	12750.0

CONTINUE

INPUT DATA FOR:

PS Modified CFT volume reproducibility

		S50	S51	S52	S53	S54	S55	S56
MP11	1	8985.0	3982.0	6274.0	11658.0	17090.0	20433.0	15532.0
MP22	1	-999.9	-999.9	6352.0	11833.0	17354.0	20744.0	15897.0
MP33	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP66	1	9092.0	4142.0	-999.9	-999.9	-999.9	-999.9	-999.9
MP77	1	7862.0	2936.0	5912.0	10886.0	15863.0	18929.0	14115.0
MP88	1	7744.0	2755.0	5953.0	10950.0	15944.0	19023.0	14126.0

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CONTINUE

INPUT DATA FOR:

PS Modified CFT volume reproducibility

		S57	S58	S59	S60	S61	S62	S63
MP11	1	10499.0	5467.0	2050.0	7056.0	12079.0	17101.0	20785.0
MP22	1	10891.0	5867.0	2424.0	7369.0	12340.0	17305.0	20949.0
MP33	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP66	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP77	1	9163.0	4251.0	930.0	5859.0	10834.0	15808.0	19460.0
MP88	1	9115.0	4119.0	752.0	5732.0	10743.0	15751.0	19424.0

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CONTINUE

INPUT DATA FOR:

PS Modified CFT volume reproducibility

		S64	S65	S66	S67	S68	S69	S70
MP11	1	15749.0	10713.0	5663.0	2039.0	7027.0	12029.0	17025.0
MP22	1	15956.0	10958.0	5902.0	2242.0	7199.0	12169.0	17131.0
MP33	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP66	1	-999.9	-999.9	-999.9	-999.9	13647.0	8683.0	3724.0
MP77	1	14476.0	9492.0	4520.0	972.0	5930.0	10918.0	15902.0
MP88	1	14402.0	9418.0	4446.0	898.0	5885.0	10899.0	15906.0

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CONTINUE

INPUT DATA FOR:

PS Modified CFT volume reproducibility

		S71	S72	S73	S74	S75	S76	S77
MP11	1	20631.0	15580.0	10483.0	5330.0	1497.0	5901.0	10934.0
MP22	1	20707.0	15632.0	10463.0	5260.0	1409.0	5847.0	10853.0
MP33	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP66	1	150.0	15672.0	10711.0	5755.0	2093.0	-999.9	-999.9
MP77	1	19499.0	14553.0	9605.0	4658.0	981.0	5814.0	10766.0
MP88	1	19518.0	14511.0	9504.0	4506.0	814.0	5897.0	10908.0

CONTINUE

INPUT DATA FOR:

PS Modified CFT volume reproducibility

		S78	S79	S80	S81	S82	S83	S84
MP11	1	15966.0	19383.0	14377.0	9354.0	4332.0	648.0	5641.0
MP22	1	15877.0	19320.0	14375.0	9404.0	4439.0	795.0	5788.0
MP33	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP66	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP77	1	15678.0	18999.0	14070.0	9095.0	4121.0	469.0	5453.0
MP88	1	15904.0	19271.0	14291.0	9280.0	4272.0	599.0	5621.0

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CONTINUE

INPUT DATA FOR:

PS Modified CFT volume reproducibility

		S85	S86	S87	S88	S89	S90	S91
MP11	1	10677.0	15727.0	19351.0	14363.0	9361.0	4365.0	759.0
MP22	1	10786.0	15842.0	19502.0	14545.0	9575.0	4613.0	1037.0
MP33	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP66	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP77	1	10437.0	15409.0	18957.0	13999.0	9011.0	4027.0	430.0
MP88	1	10640.0	15646.0	19205.0	14218.0	9230.0	4246.0	649.0

CONTINUE

INPUT DATA FOR:

PS Modified CFT volume reproducibility

		S92	S93	S94	S95	S96	S97	S98
MP11	1	5810.0	10907.0	16060.0	19893.0	6013.0	11031.0	16049.0
MP22	1	6112.0	11281.0	16484.0	20335.0	5972.0	10950.0	15927.0
MP33	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP66	1	5718.0	10679.0	15635.0	19297.0	-999.9	-999.9	-999.9
MP77	1	5376.0	10324.0	15271.0	18948.0	5951.0	10928.0	15905.0
MP88	1	5656.0	10663.0	15661.0	19353.0	6024.0	11051.0	16076.0

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CONTINUE

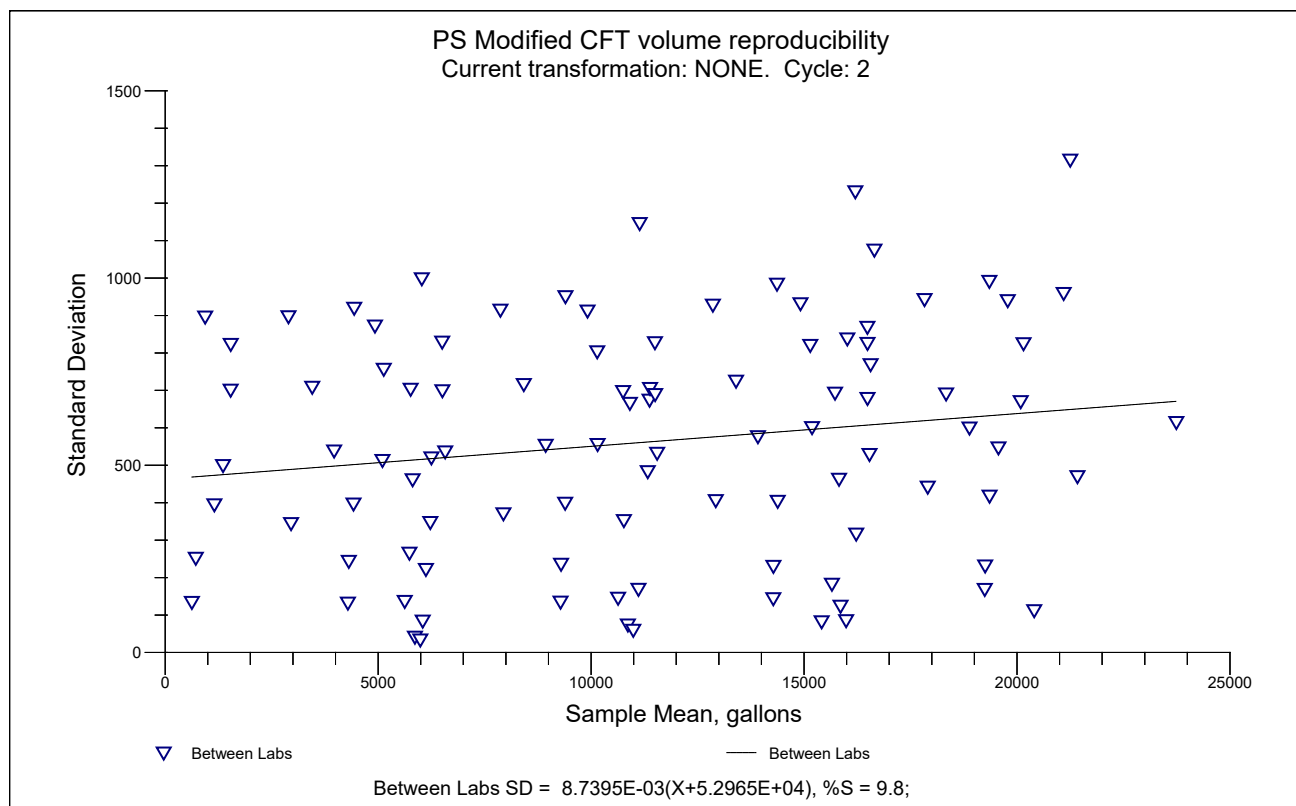
INPUT DATA FOR:

PS Modified CFT volume reproducibility

		S99	S100
MP11	1	20485.0	15458.0
MP22	1	20323.0	15350.0
MP33	1	-999.9	-999.9
MP66	1	-999.9	-999.9
MP77	1	20295.0	15341.0
MP88	1	20518.0	15510.0

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Same Meter FuelTrax CFT Volume Reproducibility

ASTM Committee D02 Precision Evaluation

8:19, 16 Jun 2022

Same Meters Fueltrax CFT Volume reproducibility

Reproducibility = 645.19 gallons

	Initial	Final
Number of laboratories	2	2
Number of samples	100	100
Number of repeats	1	

REGRESSIONS (AFTER OUTLIER TESTS)

TRANSFORMATION TYPE: CODED

Regression	Fitted Variable	Coefficient B	t- Test	Ratio	% Sig.
Unweighted D v. (m+B0)	m + 1.5992E+05	8.9982E-04	B=0	0.29	77.2
Weighted	Intercept	1.51584E+01			
ln(d,D) v. ln(m+B0)	ln(m +1.3E+05)	-9.30241E-01	B=1	0.69	49.3
(for Log Transform)	Dummy	0.00000E+00			
	Dummy * Ln(m+B0)	0.00000E+00	B=0	0.00	0.0
Weighted	Intercept	3.83647E+00			
ln(d,D) v. ln(m+B0)	ln(m +6.6E+49)	2.60410E-03	B=0	0.00	99.9
(for Power Transform)	Dummy	0.00000E+00			
	Dummy * Ln(m+B0)	0.00000E+00	B=0	0.00	0.0
	Critical t (5%,196) =			1.97	5.0

Transformation used: 22003.0001 - X

COMMENTS:

This report was prepared using D2PP, Version 5.3.35
 from data file samemeters fueltrax CFT volume data ASTM D6300.xls, Sheet1, .

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DATA MISSING OR REJECTED (Data rejection limit 20%):

LABORATORY SAMPLE DUP TEST

CAUTION!!

<5 laboratories

Cell drops terminated

SAMPLE MEANS AND STANDARD DEVIATIONS

Transform Type: CODED

After any outlier rejections

Sample	No. of Results	Mean	Between Labs		
			S.D.	DF	R
S24	2	19.000	26.87	1	.48E+03
S8	2	2323.5	4.950	1	89.
S16	2	2332.0	16.97	1	.30E+03
S95	2	2455.5	21.92	1	.39E+03
S87	2	2563.5	297.7	1	.53E+04
S71	2	2646.0	371.9	1	.67E+04
S79	2	2700.5	326.0	1	.59E+04
S50	2	2845.0	73.54	1	.13E+04
S28	2	2892.5	57.28	1	.10E+04
S36	2	3264.0	159.8	1	.29E+04
S57	2	3543.5	338.7	1	.61E+04
S64	2	3561.0	314.0	1	.56E+04
S43	2	4361.0	39.60	1	.71E+03
S23	2	4908.0	46.67	1	.84E+03
S7	2	5631.0	4.243	1	76.
S94	2	5874.0	26.87	1	.48E+03

CONTINUE

SAMPLE MEANS AND STANDARD DEVIATIONS

Transform Type: CODED

After any outlier rejections

Sample	No. of Results	Mean	Between Labs		
			S.D.	DF	R
S15	2	5886.0	8.485	1	.15E+03
S27	2	5921.5	10.61	1	.19E+03
S49	2	5930.5	82.73	1	.15E+04

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S70	2	6019.5	384.0	1	.69E+04
S35	2	6146.0	18.38	1	.33E+03
S86	2	6268.0	285.7	1	.51E+04
S78	2	6271.0	350.7	1	.63E+04
S42	2	6940.0	15.56	1	.28E+03
S56	2	7235.0	311.1	1	.56E+04
S63	2	7289.5	145.0	1	.26E+04
S17	2	7331.0	21.21	1	.38E+03
S9	2	7363.5	16.26	1	.29E+03
S96	2	7488.5	30.41	1	.55E+03
S72	2	7558.5	217.1	1	.39E+04
S88	2	7580.5	3.536	1	64.
S1	2	7581.5	14.85	1	.27E+03
S80	2	7688.0	268.7	1	.48E+04
S29	2	7917.0	52.33	1	.94E+03
S37	2	8393.5	21.92	1	.39E+03
S58	2	8561.0	353.6	1	.64E+04
S65	2	8688.0	185.3	1	.33E+04
S51	2	8838.5	391.0	1	.70E+04
S44	2	9334.5	30.41	1	.55E+03
S22	2	9960.0	1.414	1	25.
S6	2	10631.	35.36	1	.64E+03
S93	2	10907.	25.46	1	.46E+03
S14	2	10945.	48.08	1	.86E+03
S26	2	10954.	12.02	1	.22E+03
S48	2	10956.	83.44	1	.15E+04
S69	2	11047.	385.4	1	.69E+04
S34	2	11081.	132.2	1	.24E+04
S77	2	11380.	453.3	1	.81E+04
S85	2	11405.	432.0	1	.78E+04
S100	2	11462.	786.3	1	.14E+05
S41	2	12012.	45.96	1	.83E+03
S62	2	12219.	291.3	1	.52E+04
S55	2	12261.	310.4	1	.56E+04
S18	2	12329.	62.23	1	.11E+04
S10	2	12367.	24.75	1	.44E+03
S97	2	12516.	36.77	1	.66E+03
S2	2	12615.	12.02	1	.22E+03

CONTINUE

SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: CODED

Sample	No. of Results	Mean	Between Labs		
			S.D.	DF	R
S89	2	12616.	8.485	1	.15E+03
S73	2	12652.	310.4	1	.56E+04
S81	2	12708.	254.6	1	.46E+04
S30	2	12937.	35.36	1	.64E+03
S38	2	13397.	62.93	1	.11E+04

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S59	2	13519.	455.4	1	.82E+04
S66	2	13636.	309.0	1	.56E+04
S52	2	13866.	385.4	1	.69E+04
S45	2	14339.	73.54	1	.13E+04
S21	2	14965.	44.55	1	.80E+03
S5	2	15651.	52.33	1	.94E+03
S13	2	15948.	7.071	1	.13E+03
S92	2	15964.	13.44	1	.24E+03
S25	2	15987.	14.85	1	.27E+03
S47	2	15989.	89.10	1	.16E+04
S33	2	16062.	217.1	1	.39E+04
S68	2	16074.	391.0	1	.70E+04
S76	2	16340.	347.9	1	.63E+04
S84	2	16352.	308.3	1	.55E+04
S99	2	16490.	779.9	1	.14E+05
S40	2	17010.	4.950	1	89.
S61	2	17239.	305.5	1	.55E+04
S54	2	17354.	217.1	1	.39E+04
S19	2	17401.	.7071	1	13.
S11	2	17426.	14.85	1	.27E+03
S98	2	17546.	47.38	1	.85E+03
S82	2	17638.	108.2	1	.19E+04
S3	2	17647.	10.61	1	.19E+03
S90	2	17652.	12.02	1	.22E+03
S74	2	17677.	311.1	1	.56E+04
S31	2	17937.	4.243	1	76.
S39	2	18456.	23.33	1	.42E+03
S60	2	18626.	350.7	1	.63E+04
S67	2	18772.	162.6	1	.29E+04
S53	2	18893.	384.0	1	.69E+04
S46	2	19391.	28.28	1	.51E+03
S20	2	19980.	55.86	1	.10E+04
S4	2	20676.	57.28	1	.10E+04
S91	2	20970.	19.80	1	.36E+03
S12	2	20980.	6.364	1	.11E+03
S32	2	21245.	4.950	1	89.

CONTINUE

SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: CODED

Sample	No. of Results	Mean	Between Labs		
			S.D.	DF	R
S83	2	21366.	277.2	1	.50E+04
S75	2	21369.	338.7	1	.61E+04

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VARIANCE ANALYSIS			Transform Type: CODED		
		Sum of squares			
	Estimated	Exact	DF	Mean square	F
Sample Means	6.205362E+09	6.205362E+09			
Lab Means	4.304178E+04	4.304178E+04	1	4.30418E+04	0.812
Interaction	5.244820E+06		99	5.29780E+04	
Pairs	6.210650E+09	6.210650E+09			
Total	6.210650E+09				
Critical F (5%, 1, 99) =					3.937

		Expectation of Mean Squares	
Lab means	1.0000	V(r) + 1	V(I) +100.0000 V(L)
Interaction	1.0000	V(r) + 1	V(I)
Repeats	1.0000	V(r)	

	DF	Variance	Precision
Transformed data			
Reproducibility	100	1.057572E+05	6.452E+02

INPUT DATA FOR:
Fueltrax CFT Volume reproducibility, (CODED)

		S1	S2	S3	S4	S5	S6
EMMU	1	7571.00	12606.00	17639.00	20635.00	15614.00	10606.00
MMU	1	7592.00	12623.00	17654.00	20716.00	15688.00	10656.00

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CONTINUE

INPUT DATA FOR:

Fueltrax CFT Volume reproducibility, (CODED)

		S7	S8	S9	S10	S11	S12
EMMU	1	5634.00	2327.00	7375.00	12349.00	17436.00	20984.00
MMU	1	5628.00	2320.00	7352.00	12384.00	17415.00	20975.00

CONTINUE

INPUT DATA FOR:

Fueltrax CFT Volume reproducibility, (CODED)

		S13	S14	S15	S16	S17	S18
EMMU	1	15953.00	10979.00	5892.00	2344.00	7316.00	12285.00
MMU	1	15943.00	10911.00	5880.00	2320.00	7346.00	12373.00

CONTINUE

INPUT DATA FOR:

Fueltrax CFT Volume reproducibility, (CODED)

		S19	S20	S21	S22	S23	S24
EMMU	1	17400.00	19940.00	14933.00	9959.00	4875.00	0.00
MMU	1	17401.00	20019.00	14996.00	9961.00	4941.00	38.00

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CONTINUE

INPUT DATA FOR:

Fueltrax CFT Volume reproducibility, (CODED)

		S25	S26	S27	S28	S29	S30
EMMU	1	15997.00	10962.00	5929.00	2933.00	7954.00	12962.00
MMU	1	15976.00	10945.00	5914.00	2852.00	7880.00	12912.00

CONTINUE

INPUT DATA FOR:

Fueltrax CFT Volume reproducibility, (CODED)

		S31	S32	S33	S34	S35	S36
EMMU	1	17934.00	21241.00	15908.00	10987.00	6133.00	3151.00
MMU	1	17940.00	21248.00	16215.00	11174.00	6159.00	3377.00

CONTINUE

INPUT DATA FOR:

Fueltrax CFT Volume reproducibility, (CODED)

		S37	S38	S39	S40	S41	S42
EMMU	1	8378.00	13352.00	18439.00	17013.00	12044.00	6929.00
MMU	1	8409.00	13441.00	18472.00	17006.00	11979.00	6951.00

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CONTINUE

INPUT DATA FOR:

Fueltrax CFT Volume reproducibility, (CODED)

		S43	S44	S45	S46	S47	S48
EMMU	1	4389.00	9313.00	14287.00	19371.00	16052.00	11015.00
MMU	1	4333.00	9356.00	14391.00	19411.00	15926.00	10897.00

CONTINUE

INPUT DATA FOR:

Fueltrax CFT Volume reproducibility, (CODED)

		S49	S50	S51	S52	S53	S54
EMMU	1	5989.00	2897.00	8562.00	13593.00	18621.00	17200.00
MMU	1	5872.00	2793.00	9115.00	14138.00	19164.00	17507.00

CONTINUE

INPUT DATA FOR:

Fueltrax CFT Volume reproducibility, (CODED)

		S55	S56	S57	S58	S59	S60
EMMU	1	12041.00	7015.00	3304.00	8311.00	13197.00	18378.00
MMU	1	12480.00	7455.00	3783.00	8811.00	13841.00	18874.00

CONTINUE

INPUT DATA FOR:

Fueltrax CFT Volume reproducibility, (CODED)

		S61	S62	S63	S64	S65	S66
EMMU	1	17023.00	12013.00	7187.00	3339.00	8557.00	13417.00
MMU	1	17455.00	12425.00	7392.00	3783.00	8819.00	13854.00

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CONTINUE

INPUT DATA FOR:

Fueltrax CFT Volume reproducibility, (CODED)

		S67	S68	S69	S70	S71	S72
EMMU	1	18657.00	16350.00	11319.00	6291.00	2909.00	7712.00
MMU	1	18887.00	15797.00	10774.00	5748.00	2383.00	7405.00

CONTINUE

INPUT DATA FOR:

Fueltrax CFT Volume reproducibility, (CODED)

		S73	S74	S75	S76	S77	S78
EMMU	1	12871.00	17897.00	21608.00	16586.00	11700.00	6519.00
MMU	1	12432.00	17457.00	21129.00	16094.00	11059.00	6023.00

CONTINUE

INPUT DATA FOR:

Fueltrax CFT Volume reproducibility, (CODED)

		S79	S80	S81	S82	S83	S84
EMMU	1	2931.00	7878.00	12888.00	17714.00	21562.00	16570.00
MMU	1	2470.00	7498.00	12528.00	17561.00	21170.00	16134.00

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CONTINUE

INPUT DATA FOR:

Fueltrax CFT Volume reproducibility, (CODED)

		S85	S86	S87	S88	S89	S90
EMMU	1	11710.00	6470.00	2774.00	7583.00	12622.00	17660.00
MMU	1	11099.00	6066.00	2353.00	7578.00	12610.00	17643.00

CONTINUE

INPUT DATA FOR:

Fueltrax CFT Volume reproducibility, (CODED)

		S91	S92	S93	S94	S95	S96
EMMU	1	20956.00	15973.00	10889.00	5855.00	2440.00	7467.00
MMU	1	20984.00	15954.00	10925.00	5893.00	2471.00	7510.00

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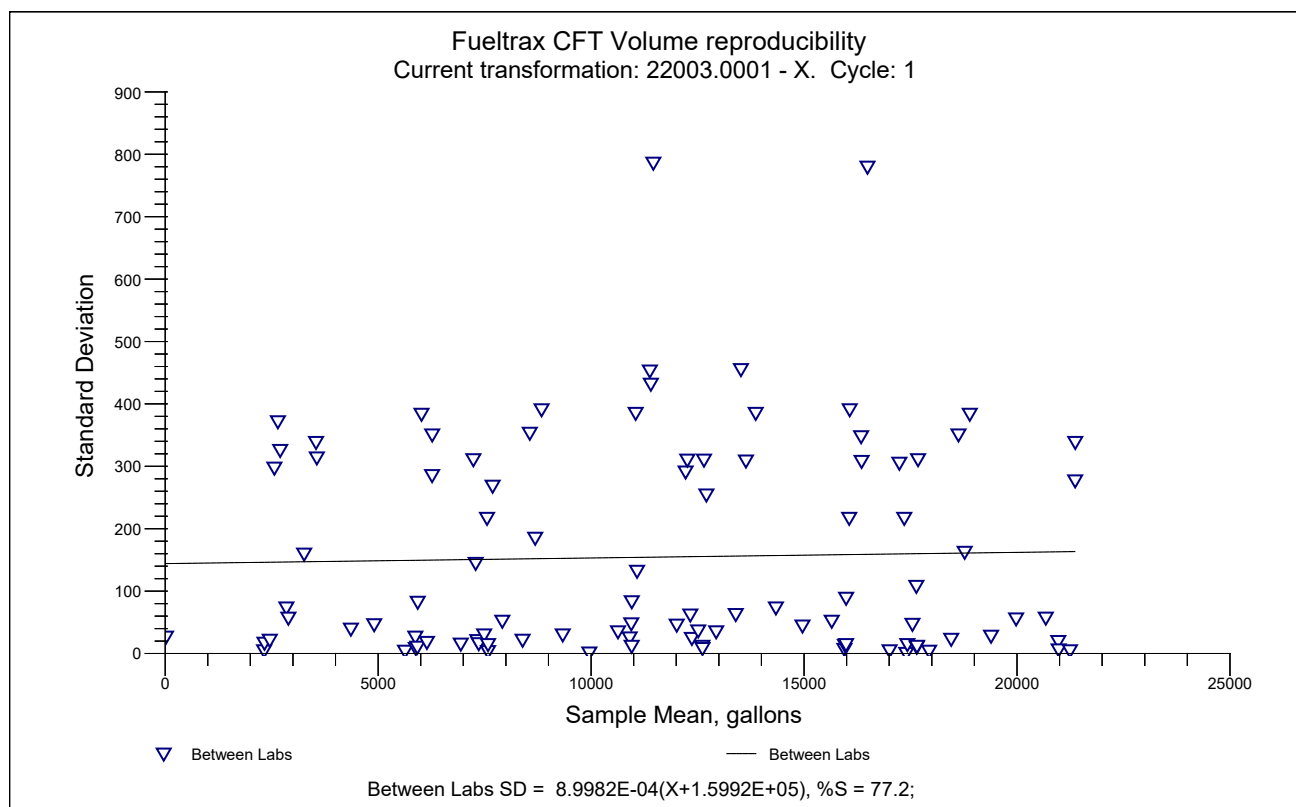
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CONTINUE

INPUT DATA FOR:

Fueltrax CFT Volume reproducibility, (CODED)

		S97	S98	S99	S100
EMMU	1	12490.00	17512.00	17041.00	12018.00
MMU	1	12542.00	17579.00	15938.00	10906.00



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Alternate Meter CFT Volume Stock FloCat Reproducibility

ASTM Committee D02 Precision Evaluation

11:27, 16 Jun 2022

Alt meters Stock FloCat CFT Volume reproducibility gallons

Reproducibility = 8982.3 gallons

	Initial	Final
Number of laboratories	2	2
Number of samples	31	31
Number of repeats	1	

REGRESSIONS (AFTER OUTLIER TESTS)

TRANSFORMATION TYPE: CODED

Regression	Fitted Variable	Coefficient B	Test	t- Ratio	% Sig.
Unweighted D v. (m+B0)	m + 2.7873E+04	5.8159E-02	B=0	0.91	37.3
Weighted ln(d,D) v. ln(m+B0) (for Log Transform)	Intercept ln(m + 43871.) Dummy Dummy * Ln(m+B0)	-1.45078E+01 2.01136E+00 0.00000E+00 0.00000E+00	B=1 B=0 B=0	0.94 0.00	34.9 0.0
Weighted ln(d,D) v. ln(m+B0) (for Power Transform)	Intercept ln(m +1.0E+08) Dummy Dummy * Ln(m+B0)	3.57479E+00 2.13218E-01 0.00000E+00 0.00000E+00	B=0 B=0 B=0	0.05 0.00	96.0 0.0
Critical t (5%, 58) =				2.00	5.0

Transformation used: 25289.0001 - X

COMMENTS:

This report was prepared using D2PP, Version 5.3.35

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from data file altimeters stock flocat CFT volume data ASTM D6300.xls, Sheet1,
.

DATA MISSING OR REJECTED (Data rejection limit 20%):

LABORATORY SAMPLE DUP TEST

CAUTION!!

<5 laboratories

Cell drops terminated

SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: CODED

Sample	No. of Results	Mean	Between Labs		
			S.D.	DF	R
S7	2	2914.5	4122.	1	.74E+05
S24	2	4051.0	323.9	1	.58E+04
S11	2	5399.5	618.7	1	.11E+05
S31	2	6734.0	1812.	1	.33E+05
S6	2	7635.5	3894.	1	.70E+05
S23	2	7751.5	697.9	1	.13E+05
S10	2	7920.5	747.4	1	.13E+05
S25	2	9537.0	2061.	1	.37E+05
S30	2	10172.	1491.	1	.27E+05
S1	2	10559.	3347.	1	.60E+05
S12	2	10803.	1178.	1	.21E+05
S18	2	11187.	2741.	1	.49E+05
S5	2	12464.	3659.	1	.66E+05
S9	2	12733.	1003.	1	.18E+05
S22	2	12762.	1193.	1	.21E+05
S26	2	14535.	2466.	1	.44E+05

CONTINUE

SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: CODED

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Sample	No. of Results	Mean	Between Labs		
			S.D.	DF	R
S15	2	15094.	4784.	1	.86E+05
S29	2	15178.	1032.	1	.19E+05
S16	2	15258.	2088.	1	.38E+05
S2	2	15382.	3598.	1	.65E+05
S17	2	15424.	8952.	1	.16E+06
S13	2	15651.	941.9	1	.17E+05
S19	2	16188.	3197.	1	.57E+05
S4	2	17312.	3422.	1	.61E+05
S8	2	17556.	1253.	1	.23E+05
S21	2	17762.	1649.	1	.30E+05
S27	2	19541.	2925.	1	.53E+05
S28	2	20176.	626.5	1	.11E+05
S3	2	20195.	3853.	1	.69E+05
S14	2	20480.	706.4	1	.13E+05
S20	2	21198.	3692.	1	.66E+05

VARIANCE ANALYSIS

Transform Type: CODED

	Sum of squares		DF	Mean square	F
	Estimated	Exact			
Sample Means	1.541156E+09	1.541156E+09			
Lab Means	6.211605E+07	6.211605E+07	1	6.21161E+07	8.885
Interaction	2.097392E+08		30	6.99131E+06	
Pairs	1.813011E+09	1.813011E+09			

Total 1.813011E+09

Critical F (5%, 1, 30) = 4.171

	Expectation of Mean Squares
Lab means	1.0000 V(r) + 1 V(I) + 31.0000 V(L)
Interaction	1.0000 V(r) + 1 V(I)
Repeats	1.0000 V(r)

	DF	Variance	Precision
Transformed data			
Reproducibility	14	1.753905E+07	8.982E+03

INPUT DATA FOR:

Alt meters Stock FloCat CFT Volume reproducibility gallons, (CODED)

		S1	S2	S3	S4	S5	S6	S7	S8
MP45	1	8192	12838	17470	14892	9877	4882	0	18442
MP54	1	12926	17926	22919	19732	15051	10389	5829	16670

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CONTINUE

INPUT DATA FOR:

Alt meters Stock FloCat CFT Volume reproducibility gallons, (CODED)

		S9	S10	S11	S12	S13	S14	S15	S16
MP45	1	13442	8449	5837	11636	16317	20979	18476	13781
MP54	1	12024	7392	4962	9970	14985	19980	11711	16734

CONTINUE

INPUT DATA FOR:

Alt meters Stock FloCat CFT Volume reproducibility gallons, (CODED)

		S17	S18	S19	S20	S21	S22	S23	S24
MP45	1	9094	9249	13927	18587	18928	13605	8245	4280
MP54	1	21754	13125	18448	23808	16596	11918	7258	3822

CONTINUE

INPUT DATA FOR:

Alt meters Stock FloCat CFT Volume reproducibility gallons, (CODED)

		S25	S26	S27	S28	S29	S30	S31
MP45	1	8080	12791	17473	19733	14448	9118	5453
MP54	1	10994	16279	21609	20619	15908	11226	8015

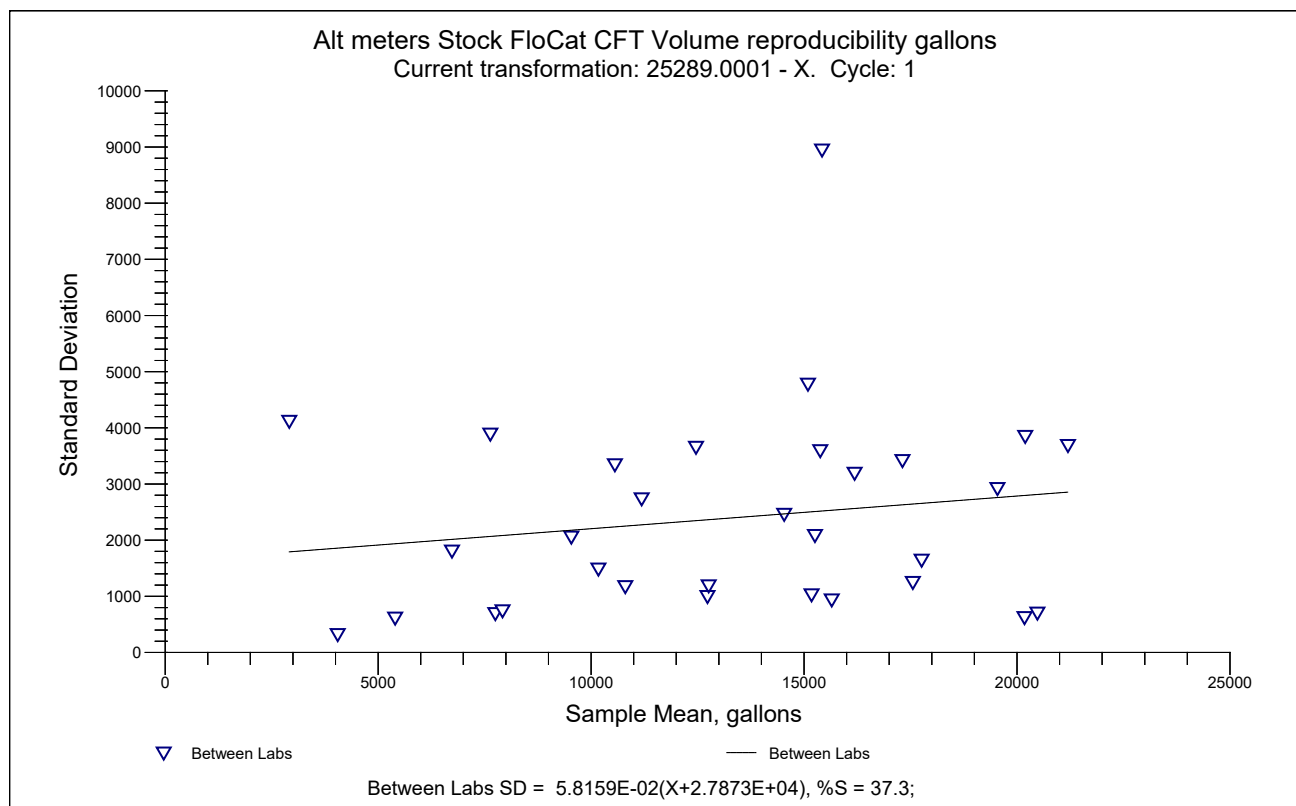
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Alternate Meter CFT Volume Penn State Modified Reproducibility

ASTM Committee D02 Precision Evaluation

11:24, 16 Jun 2022

Alt Meters PS Modified CFT volume reproducibility

Reproducibility = $487.22 * X^{0.1729}$ gallons

	Initial	Final
Number of laboratories	5	4
Number of samples	100	100
Number of repeats	1	

REGRESSIONS (AFTER OUTLIER TESTS)

TRANSFORMATION TYPE: NONE

Regression	Fitted Variable	Coefficient B	t- Test	Ratio	% Sig.
Unweighted D v. (m+B0)	m + 3.1290E+04	1.3667E-02	B=0	2.61	1.1
Weighted ln(d,D) v. ln(m+B0) (for Log Transform)	Intercept ln(m + 20860.) Dummy Dummy * Ln(m+B0)	-1.87790E+00 7.73567E-01 0.00000E+00 0.00000E+00	B=1 B=0	0.77 0.00	44.2 0.0
Weighted ln(d,D) v. ln(m+B0) (for Power Transform)	Intercept ln(m) Dummy Dummy * Ln(m+B0)	4.56007E+00 1.72899E-01 0.00000E+00 0.00000E+00	*B=0 B=0	2.34 0.00	2.0 0.0
Critical t (5%,196) =				1.97	5.0

* Coefficient used = 0.1729

Transformation used: $X^{0.8271}$

COMMENTS:

This report was prepared using D2PP, Version 5.3.35

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from data file altimeters PS modified flocat CFT volume data ASTM D6300.xls,
Sheet1, .

DATA MISSING OR REJECTED (Data rejection limit 20%):

LABORATORY	SAMPLE	DUP	TEST
(MP27	,S21	,)	Missing, <, or 0.0
(MP27	,S22	,)	Missing, <, or 0.0
(MP27	,S23	,)	Missing, <, or 0.0
(MP27	,S24	,)	Missing, <, or 0.0
(MP27	,S25	,)	Missing, <, or 0.0
(MP27	,S26	,)	Missing, <, or 0.0
(MP27	,S27	,)	Missing, <, or 0.0
(MP27	,S28	,)	Missing, <, or 0.0
(MP27	,S45	,)	Missing, <, or 0.0
(MP27	,S46	,)	Missing, <, or 0.0
(MP27	,S47	,)	Missing, <, or 0.0
(MP27	,S48	,)	Missing, <, or 0.0
(MP27	,S49	,)	Missing, <, or 0.0
(MP27	,S50	,)	Missing, <, or 0.0
(MP27	,S51	,)	Missing, <, or 0.0
(MP67	,	,)	Locked out - data missing or 0
(MP78	,S1	,)	Missing, <, or 0.0
(MP78	,S2	,)	Missing, <, or 0.0
(MP78	,S3	,)	Missing, <, or 0.0
(MP78	,S4	,)	Missing, <, or 0.0
(MP78	,S5	,)	Missing, <, or 0.0
(MP78	,S6	,)	Missing, <, or 0.0
(MP78	,S7	,)	Missing, <, or 0.0
(MP78	,S8	,)	Missing, <, or 0.0
(MP78	,S9	,)	Missing, <, or 0.0
(MP78	,S10	,)	Missing, <, or 0.0
(MP78	,S11	,)	Missing, <, or 0.0
(MP78	,S12	,)	Missing, <, or 0.0
(MP78	,S13	,)	Missing, <, or 0.0
(MP78	,S14	,)	Missing, <, or 0.0
(MP78	,S15	,)	Missing, <, or 0.0
(MP78	,S16	,)	Missing, <, or 0.0
(MP78	,S17	,)	Missing, <, or 0.0
(MP78	,S18	,)	Missing, <, or 0.0
(MP78	,S19	,)	Missing, <, or 0.0
(MP78	,S20	,)	Missing, <, or 0.0
(MP78	,S29	,)	Missing, <, or 0.0
(MP78	,S30	,)	Missing, <, or 0.0
(MP78	,S31	,)	Missing, <, or 0.0
(MP78	,S32	,)	Missing, <, or 0.0
(MP78	,S33	,)	Missing, <, or 0.0
(MP78	,S34	,)	Missing, <, or 0.0
(MP78	,S35	,)	Missing, <, or 0.0

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(MP78 ,S36 ,) Missing, <, or 0.0
CONTINUED

DATA MISSING OR REJECTED (Data rejection limit 20%):

LABORATORY	SAMPLE	DUP	TEST
(MP78	,S37	,)	Missing, <, or 0.0
(MP78	,S38	,)	Missing, <, or 0.0
(MP78	,S39	,)	Missing, <, or 0.0
(MP78	,S40	,)	Missing, <, or 0.0
(MP78	,S41	,)	Missing, <, or 0.0
(MP78	,S42	,)	Missing, <, or 0.0
(MP78	,S43	,)	Missing, <, or 0.0
(MP78	,S44	,)	Missing, <, or 0.0
(MP78	,S52	,)	Missing, <, or 0.0
(MP78	,S53	,)	Missing, <, or 0.0
(MP78	,S54	,)	Missing, <, or 0.0
(MP78	,S55	,)	Missing, <, or 0.0
(MP78	,S56	,)	Missing, <, or 0.0
(MP78	,S57	,)	Missing, <, or 0.0
(MP78	,S58	,)	Missing, <, or 0.0
(MP78	,S59	,)	Missing, <, or 0.0
(MP78	,S60	,)	Missing, <, or 0.0
(MP78	,S61	,)	Missing, <, or 0.0
(MP78	,S62	,)	Missing, <, or 0.0
(MP78	,S63	,)	Missing, <, or 0.0
(MP78	,S64	,)	Missing, <, or 0.0
(MP78	,S65	,)	Missing, <, or 0.0
(MP78	,S66	,)	Missing, <, or 0.0
(MP78	,S67	,)	Missing, <, or 0.0
(MP78	,S68	,)	Hawkins-cells
(MP78	,S69	,)	Hawkins-cells
(MP78	,S70	,)	Hawkins-cells
(MP78	,S71	,)	Hawkins-cells
(MP78	,S76	,)	Missing, <, or 0.0
(MP78	,S77	,)	Missing, <, or 0.0
(MP78	,S78	,)	Missing, <, or 0.0
(MP78	,S79	,)	Missing, <, or 0.0
(MP78	,S80	,)	Missing, <, or 0.0
(MP78	,S81	,)	Missing, <, or 0.0
(MP78	,S82	,)	Missing, <, or 0.0
(MP78	,S83	,)	Missing, <, or 0.0
(MP78	,S84	,)	Missing, <, or 0.0
(MP78	,S85	,)	Missing, <, or 0.0
(MP78	,S86	,)	Missing, <, or 0.0
(MP78	,S87	,)	Missing, <, or 0.0
(MP78	,S88	,)	Missing, <, or 0.0
(MP78	,S89	,)	Missing, <, or 0.0
(MP78	,S90	,)	Missing, <, or 0.0
(MP78	,S91	,)	Missing, <, or 0.0

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CONTINUED

DATA MISSING OR REJECTED (Data rejection limit 20%):

LABORATORY	SAMPLE	DUP	TEST
(MP78	,S96	,)	Missing, <, or 0.0
(MP78	,S97	,)	Missing, <, or 0.0
(MP78	,S98	,)	Missing, <, or 0.0
(MP78	,S99	,)	Missing, <, or 0.0
(MP78	,S100	,)	Missing, <, or 0.0
(MP81	,S44	,)	Hawkins-cells

CAUTION!!

<5 laboratories

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SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: NONE

Sample	No. of Results	Mean	Between Labs		
			S.D.	DF	R
S83	3	637.33	163.3	2	.99E+03
S91	3	742.00	303.9	2	.18E+04
S36	3	1296.3	339.8	2	.21E+04
S75	4	1495.0	458.0	3	.21E+04
S44	2	1690.5	384.0	1	.69E+04
S67	3	1751.0	682.2	2	.42E+04
S59	3	1801.3	777.4	2	.47E+04
S16	3	2965.0	421.9	2	.26E+04
S8	3	3112.7	961.4	2	.58E+04
S51	3	3686.7	655.0	2	.40E+04
S24	3	3989.3	657.6	2	.40E+04
S82	3	4297.3	161.8	2	.98E+03
S90	3	4335.0	294.1	2	.18E+04
S35	3	4556.7	358.7	2	.22E+04
S43	3	4706.0	917.8	2	.56E+04
S58	3	5195.0	841.6	2	.51E+04
S74	4	5250.8	451.7	3	.20E+04
S66	3	5361.7	738.6	2	.45E+04
S84	3	5627.3	167.9	2	.10E+04
S92	4	5754.0	303.0	3	.14E+04
S76	3	5854.0	43.92	2	.27E+03
S15	3	5858.7	554.1	2	.34E+04
S45	3	5972.7	694.6	2	.42E+04
S96	3	5978.7	31.53	2	.19E+03
S29	3	6068.0	90.90	2	.55E+03
S52	3	6179.3	234.8	2	.14E+04
S7	3	6272.7	1065.	2	.65E+04
S1	3	6309.7	371.7	2	.23E+04
S37	3	6420.7	481.6	2	.29E+04
S23	3	6595.7	655.0	2	.40E+04
S68	3	6718.7	688.4	2	.42E+04
S60	3	6761.3	797.0	2	.48E+04
S17	3	7944.7	454.6	2	.28E+04
S9	3	8080.3	996.4	2	.61E+04
S50	3	8646.3	681.4	2	.41E+04
S25	3	8951.3	677.5	2	.41E+04
S81	3	9284.3	165.9	2	.10E+04
S89	3	9315.7	284.7	2	.17E+04
S34	3	9519.3	377.5	2	.23E+04
S42	3	9676.7	945.5	2	.58E+04
S57	3	10184.	906.0	2	.55E+04

CONTINUE

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SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: NONE

Sample	No. of Results	Mean	Between Labs		
			S.D.	DF	R
S73	4	10316.	486.8	3	.22E+04
S65	3	10388.	785.3	2	.48E+04
S85	3	10633.	178.6	2	.11E+04
S93	4	10798.	401.7	3	.18E+04
S77	3	10851.	84.02	2	.51E+03
S46	3	10955.	693.2	2	.42E+04
S97	3	10970.	54.24	2	.33E+03
S14	3	11021.	770.2	2	.47E+04
S30	3	11154.	180.6	2	.11E+04
S6	3	11426.	1217.	2	.74E+04
S53	3	11459.	503.9	2	.31E+04
S2	3	11562.	748.7	2	.46E+04
S22	3	11568.	651.1	2	.40E+04
S38	3	11577.	656.4	2	.40E+04
S69	3	11705.	685.4	2	.42E+04
S61	3	11751.	804.8	2	.49E+04
S18	3	12922.	497.5	2	.30E+04
S10	3	13060.	1026.	2	.62E+04
S49	3	13622.	710.1	2	.43E+04
S26	3	13927.	706.4	2	.43E+04
S80	3	14274.	176.7	2	.11E+04
S88	3	14302.	278.0	2	.17E+04
S33	3	14499.	402.3	2	.24E+04
S41	3	14654.	976.7	2	.59E+04
S56	3	15181.	941.3	2	.57E+04
S72	4	15359.	538.8	3	.24E+04
S100	3	15383.	65.11	2	.40E+03
S64	3	15394.	801.4	2	.49E+04
S86	3	15659.	224.3	2	.14E+04
S78	3	15840.	147.5	2	.90E+03
S94	4	15863.	525.0	3	.24E+04
S47	3	15928.	692.9	2	.42E+04
S98	3	15960.	77.57	2	.47E+03
S13	3	16178.	947.7	2	.58E+04
S31	3	16307.	332.9	2	.20E+04
S5	3	16512.	1307.	2	.80E+04
S21	3	16551.	647.8	2	.39E+04
S70	3	16686.	681.0	2	.41E+04
S62	3	16738.	811.8	2	.49E+04
S39	3	16740.	869.0	2	.53E+04
S54	3	16769.	795.6	2	.48E+04

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CONTINUE

SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: NONE

Sample	No. of Results	Mean	Between Labs		
			S.D.	DF	R
S3	3	16920.	1140.	2	.69E+04
S19	3	17892.	540.9	2	.33E+04
S11	3	18023.	1054.	2	.64E+04
S48	3	18534.	692.6	2	.42E+04
S27	3	18887.	735.3	2	.45E+04
S79	3	19234.	205.9	2	.13E+04
S87	3	19270.	281.4	2	.17E+04
S32	3	19467.	436.3	2	.27E+04
S95	4	19618.	616.9	3	.28E+04
S40	3	19633.	1001.	2	.61E+04
S55	3	20035.	970.6	2	.59E+04
S71	3	20279.	676.6	2	.41E+04
S99	3	20368.	102.6	2	.62E+03
S63	3	20398.	816.5	2	.50E+04
S12	3	21283.	1083.	2	.66E+04
S20	3	21401.	574.4	2	.35E+04
S4	3	21580.	1398.	2	.85E+04
S28	3	23739.	753.2	2	.46E+04

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SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: Power

Sample	No. of		Between Labs		
	Results	Mean	S.D.	DF	R
S83	3	208.02	44.42	2	.27E+03
S91	3	234.66	80.91	2	.49E+03
S36	3	374.16	81.86	2	.50E+03
S75	4	420.30	106.8	3	.48E+03
S44	2	466.75	87.92	1	.16E+04
S67	3	477.51	158.9	2	.97E+03
S59	3	487.91	180.2	2	.11E+04
S16	3	743.49	88.24	2	.54E+03
S8	3	770.92	201.6	2	.12E+04
S51	3	889.77	132.2	2	.80E+03
S24	3	949.99	130.8	2	.80E+03
S82	3	1011.6	31.54	2	.19E+03
S90	3	1018.7	57.25	2	.35E+03
S35	3	1061.5	69.29	2	.42E+03
S43	3	1088.5	177.3	2	.11E+04
S58	3	1181.9	159.7	2	.97E+03
S74	4	1193.5	85.16	3	.38E+03
S66	3	1213.7	139.4	2	.85E+03
S84	3	1264.3	31.22	2	.19E+03
S92	4	1287.7	56.13	3	.25E+03
S76	3	1306.3	8.105	2	49.
S15	3	1306.6	102.8	2	.63E+03
S45	3	1327.3	128.6	2	.78E+03
S96	3	1329.3	5.798	2	35.
S29	3	1345.7	16.68	2	.10E+03
S52	3	1366.0	43.00	2	.26E+03
S7	3	1381.2	196.0	2	.12E+04
S1	3	1389.7	67.91	2	.41E+03
S37	3	1409.7	87.70	2	.53E+03
S23	3	1441.1	119.0	2	.72E+03
S68	3	1463.3	124.7	2	.76E+03
S60	3	1470.7	144.2	2	.88E+03
S17	3	1681.5	79.80	2	.49E+03
S9	3	1704.2	175.1	2	.11E+04
S50	3	1803.1	118.0	2	.72E+03
S25	3	1855.6	116.7	2	.71E+03
S81	3	1913.0	28.29	2	.17E+03
S89	3	1918.3	48.53	2	.30E+03
S34	3	1952.9	64.16	2	.39E+03
S42	3	1978.8	160.6	2	.98E+03
S57	3	2064.4	152.5	2	.93E+03

CONTINUE

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SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: Power

Sample	No. of		Between Labs		
	Results	Mean	S.D.	DF	R
S73	4	2086.9	81.76	3	.37E+03
S65	3	2098.7	131.7	2	.80E+03
S85	3	2140.2	29.74	2	.18E+03
S93	4	2167.4	66.69	3	.30E+03
S77	3	2176.4	13.94	2	85.
S46	3	2193.2	115.2	2	.70E+03
S97	3	2196.1	8.980	2	55.
S14	3	2204.0	127.9	2	.78E+03
S30	3	2226.5	29.84	2	.18E+03
S6	3	2270.0	201.3	2	.12E+04
S53	3	2276.6	82.97	2	.50E+03
S2	3	2293.3	123.2	2	.75E+03
S22	3	2294.4	107.1	2	.65E+03
S38	3	2295.8	107.9	2	.66E+03
S69	3	2316.8	112.6	2	.68E+03
S61	3	2324.1	132.1	2	.80E+03
S18	3	2514.4	80.21	2	.49E+03
S10	3	2536.2	165.5	2	.10E+04
S49	3	2626.5	113.6	2	.69E+03
S26	3	2675.1	112.5	2	.68E+03
S80	3	2730.4	27.97	2	.17E+03
S88	3	2734.8	43.99	2	.27E+03
S33	3	2765.9	63.55	2	.39E+03
S41	3	2789.7	154.3	2	.94E+03
S56	3	2872.6	147.8	2	.90E+03
S72	4	2900.8	84.43	3	.38E+03
S100	3	2904.7	10.17	2	62.
S64	3	2906.0	125.5	2	.76E+03
S86	3	2947.8	34.94	2	.21E+03
S78	3	2975.9	22.92	2	.14E+03
S94	4	2979.2	81.55	3	.37E+03
S47	3	2989.2	107.8	2	.66E+03
S98	3	2994.6	12.04	2	73.
S13	3	3027.8	147.2	2	.90E+03
S31	3	3048.2	51.52	2	.31E+03
S5	3	3079.0	202.5	2	.12E+04
S21	3	3085.7	100.1	2	.61E+03
S70	3	3106.5	105.1	2	.64E+03
S62	3	3114.4	125.2	2	.76E+03
S39	3	3114.6	134.1	2	.82E+03
S54	3	3119.2	122.7	2	.75E+03

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CONTINUE

SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: Power

Sample	No. of		Between Labs		
	Results	Mean	S.D.	DF	R
S3	3	3142.1	175.8	2	.11E+04
S19	3	3291.3	82.39	2	.50E+03
S11	3	3310.7	160.7	2	.98E+03
S48	3	3388.5	104.9	2	.64E+03
S27	3	3441.8	111.1	2	.68E+03
S79	3	3494.2	30.96	2	.19E+03
S87	3	3499.6	42.29	2	.26E+03
S32	3	3529.1	65.50	2	.40E+03
S95	4	3551.7	92.36	3	.42E+03
S40	3	3553.7	150.2	2	.91E+03
S55	3	3613.8	145.1	2	.88E+03
S71	3	3650.4	100.9	2	.61E+03
S99	3	3663.7	15.26	2	93.
S63	3	3668.0	121.7	2	.74E+03
S12	3	3799.0	160.3	2	.98E+03
S20	3	3816.7	84.81	2	.52E+03
S4	3	3842.4	206.5	2	.13E+04
S28	3	4158.4	109.3	2	.67E+03

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VARIANCE ANALYSIS

Transform Type: Power

	Sum of squares		DF	Mean square	F
	Estimated	Exact			
Sample Means	3.941613E+08	2.997954E+08			
Lab Means	2.180906E+06	1.908915E+06	3	6.36305E+05	204.522
Interaction	6.346800E+05		204	3.11118E+03	
Pairs	3.969769E+08	3.023390E+08			
Total	3.969769E+08				
Critical F (5%, 3, 204) =					2.649

Expectation of Mean Squares

Lab means	1.0000 V(r) + 1 V(I) + 69.0000 V(L)
Interaction	1.0000 V(r) + 1 V(I)
Repeats	1.0000 V(r)

	DF	Variance	Precision
Transformed data			
Reproducibility	5	2.457580E+04	4.030E+02

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INPUT DATA FOR:

Alt Meters PS Modified CFT volume reproducibility

		S1	S2	S3	S4	S5	S6	S7
MP12	1	6475.0	11919.0	17464.0	22242.0	17140.0	12013.0	6772.0
MP27	1	6570.0	12066.0	17687.0	22523.0	17386.0	12238.0	6996.0
MP67	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP78	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP81	1	5884.0	10702.0	15610.0	19974.0	15009.0	10026.0	5050.0

CONTINUE

INPUT DATA FOR:

Alt Meters PS Modified CFT volume reproducibility

		S8	S9	S10	S11	S12	S13	S14
MP12	1	3561.0	8579.0	13605.0	18615.0	21912.0	16756.0	11508.0
MP27	1	3768.0	8729.0	13699.0	18648.0	21905.0	16693.0	11422.0
MP67	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP78	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP81	1	2009.0	6933.0	11877.0	16806.0	20033.0	15084.0	10133.0

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CONTINUE

INPUT DATA FOR:

Alt Meters PS Modified CFT volume reproducibility

		S15	S16	S17	S18	S19	S20	S21
MP12	1	6223.0	3255.0	8279.0	13307.0	18331.0	21879.0	16904.0
MP27	1	6132.0	3159.0	8128.0	13098.0	18058.0	21561.0	-999.9
MP67	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP78	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	16945.0
MP81	1	5221.0	2481.0	7427.0	12360.0	17288.0	20764.0	15803.0

CONTINUE

INPUT DATA FOR:

Alt Meters PS Modified CFT volume reproducibility

		S22	S23	S24	S25	S26	S27	S28
MP12	1	11902.0	6908.0	4291.0	9293.0	14313.0	19316.0	24205.0
MP27	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP67	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP78	1	11985.0	7036.0	4442.0	9390.0	14357.0	19307.0	24142.0
MP81	1	10818.0	5843.0	3235.0	8171.0	13112.0	18038.0	22870.0

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CONTINUE

INPUT DATA FOR:

Alt Meters PS Modified CFT volume reproducibility

		S29	S30	S31	S32	S33	S34	S35
MP12	1	6102.0	11229.0	16470.0	19681.0	14663.0	9637.0	4627.0
MP27	1	6137.0	11285.0	16527.0	19755.0	14794.0	9824.0	4875.0
MP67	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP78	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP81	1	5965.0	10948.0	15924.0	18965.0	14041.0	9097.0	4168.0

CONTINUE

INPUT DATA FOR:

Alt Meters PS Modified CFT volume reproducibility

		S36	S37	S38	S39	S40	S41	S42
MP12	1	1330.0	6542.0	11790.0	17075.0	20043.0	15019.0	9991.0
MP27	1	1618.0	6830.0	12101.0	17391.0	20364.0	15395.0	10425.0
MP67	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP78	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP81	1	941.0	5890.0	10841.0	15753.0	18493.0	13547.0	8614.0

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CONTINUE

INPUT DATA FOR:

Alt Meters PS Modified CFT volume reproducibility

		S43	S44	S45	S46	S47	S48	S49
MP12	1	4967.0	1419.0	6394.0	11396.0	16390.0	19007.0	14005.0
MP27	1	5465.0	1962.0	-999.9	-999.9	-999.9	-999.9	-999.9
MP67	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP78	1	-999.9	-999.9	6353.0	11313.0	16262.0	18856.0	14059.0
MP81	1	3686.0	210.0	5171.0	10156.0	15131.0	17739.0	12803.0

CONTINUE

INPUT DATA FOR:

Alt Meters PS Modified CFT volume reproducibility

		S50	S51	S52	S53	S54	S55	S56
MP12	1	8985.0	3982.0	6274.0	11658.0	17090.0	20433.0	15532.0
MP27	1	-999.9	-999.9	6352.0	11833.0	17354.0	20744.0	15897.0
MP67	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP78	1	9092.0	4142.0	-999.9	-999.9	-999.9	-999.9	-999.9
MP81	1	7862.0	2936.0	5912.0	10886.0	15863.0	18929.0	14115.0

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CONTINUE

INPUT DATA FOR:

Alt Meters PS Modified CFT volume reproducibility

		S57	S58	S59	S60	S61	S62	S63
MP12	1	10499.0	5467.0	2050.0	7056.0	12079.0	17101.0	20785.0
MP27	1	10891.0	5867.0	2424.0	7369.0	12340.0	17305.0	20949.0
MP67	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP78	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP81	1	9163.0	4251.0	930.0	5859.0	10834.0	15808.0	19460.0

CONTINUE

INPUT DATA FOR:

Alt Meters PS Modified CFT volume reproducibility

		S64	S65	S66	S67	S68	S69	S70
MP12	1	15749.0	10713.0	5663.0	2039.0	7027.0	12029.0	17025.0
MP27	1	15956.0	10958.0	5902.0	2242.0	7199.0	12169.0	17131.0
MP67	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP78	1	-999.9	-999.9	-999.9	-999.9	13647.0	8683.0	3724.0
MP81	1	14476.0	9492.0	4520.0	972.0	5930.0	10918.0	15902.0

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CONTINUE

INPUT DATA FOR:

Alt Meters PS Modified CFT volume reproducibility

		S71	S72	S73	S74	S75	S76	S77
MP12	1	20631.0	15580.0	10483.0	5330.0	1497.0	5901.0	10934.0
MP27	1	20707.0	15632.0	10463.0	5260.0	1409.0	5847.0	10853.0
MP67	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP78	1	150.0	15672.0	10711.0	5755.0	2093.0	-999.9	-999.9
MP81	1	19499.0	14553.0	9605.0	4658.0	981.0	5814.0	10766.0

CONTINUE

INPUT DATA FOR:

Alt Meters PS Modified CFT volume reproducibility

		S78	S79	S80	S81	S82	S83	S84
MP12	1	15966.0	19383.0	14377.0	9354.0	4332.0	648.0	5641.0
MP27	1	15877.0	19320.0	14375.0	9404.0	4439.0	795.0	5788.0
MP67	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP78	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP81	1	15678.0	18999.0	14070.0	9095.0	4121.0	469.0	5453.0

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CONTINUE

INPUT DATA FOR:

Alt Meters PS Modified CFT volume reproducibility

		S85	S86	S87	S88	S89	S90	S91
MP12	1	10677.0	15727.0	19351.0	14363.0	9361.0	4365.0	759.0
MP27	1	10786.0	15842.0	19502.0	14545.0	9575.0	4613.0	1037.0
MP67	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP78	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP81	1	10437.0	15409.0	18957.0	13999.0	9011.0	4027.0	430.0

CONTINUE

INPUT DATA FOR:

Alt Meters PS Modified CFT volume reproducibility

		S92	S93	S94	S95	S96	S97	S98
MP12	1	5810.0	10907.0	16060.0	19893.0	6013.0	11031.0	16049.0
MP27	1	6112.0	11281.0	16484.0	20335.0	5972.0	10950.0	15927.0
MP67	1	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9	-999.9
MP78	1	5718.0	10679.0	15635.0	19297.0	-999.9	-999.9	-999.9
MP81	1	5376.0	10324.0	15271.0	18948.0	5951.0	10928.0	15905.0

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CONTINUE

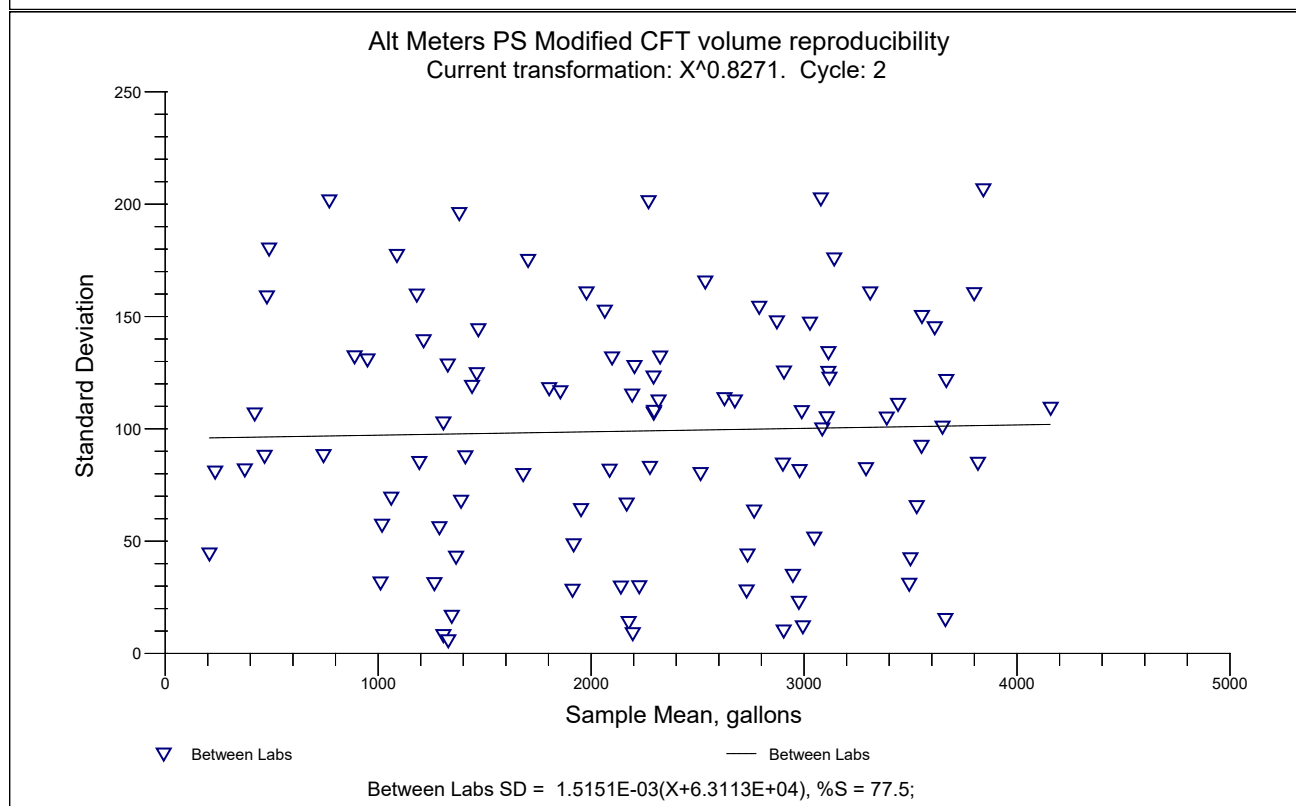
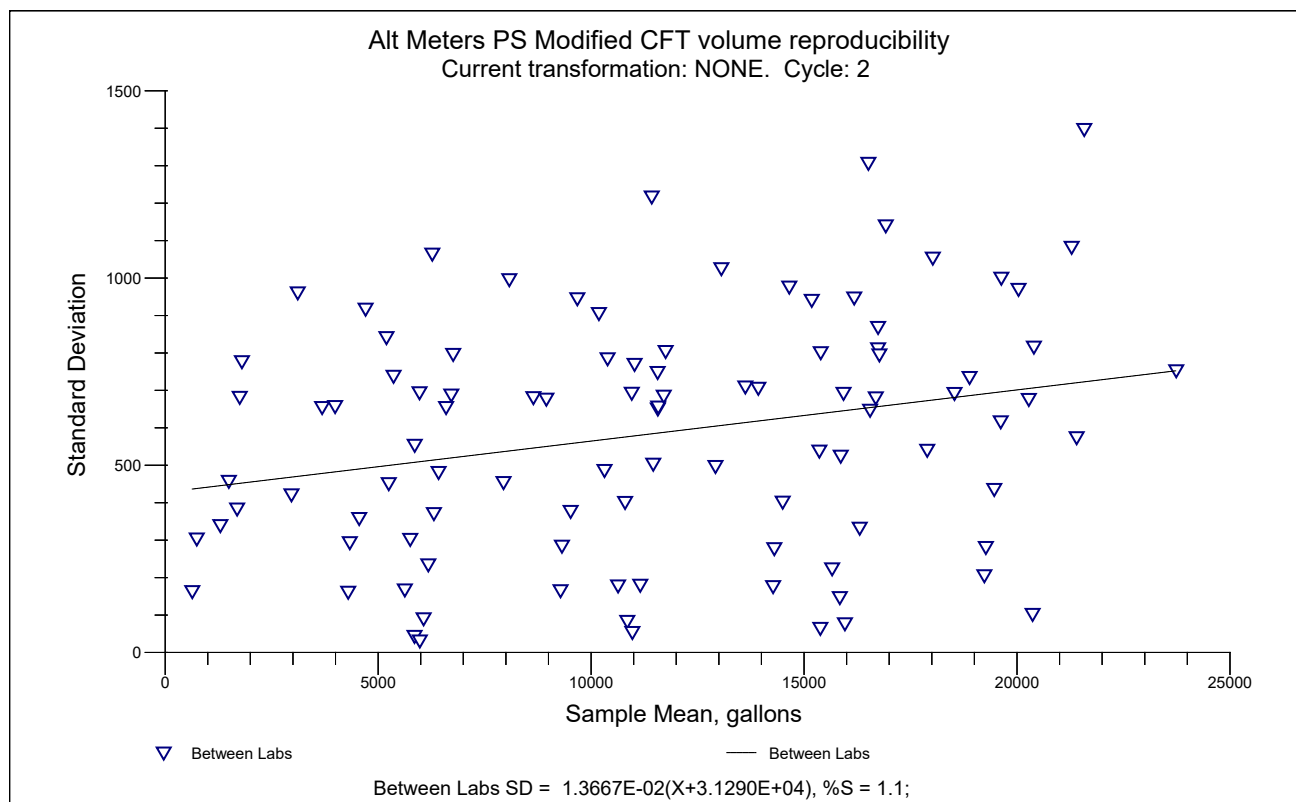
INPUT DATA FOR:

Alt Meters PS Modified CFT volume reproducibility

		S99	S100
MP12	1	20485.0	15458.0
MP27	1	20323.0	15350.0
MP67	1	-999.9	-999.9
MP78	1	-999.9	-999.9
MP81	1	20295.0	15341.0

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Alternate Meter FuelTrax CFT Volume Reproducibility

ASTM Committee D02 Precision Evaluation

11:22, 16 Jun 2022

Alt Meters Fueltrax CFT Volume reproducibility

Reproducibility = 2625.5 gallons

	Initial	Final
Number of laboratories	2	2
Number of samples	100	100
Number of repeats	1	

REGRESSIONS (AFTER OUTLIER TESTS)

TRANSFORMATION TYPE: CODED

Regression	Fitted Variable	Coefficient B	t- Test	Ratio	% Sig.
Unweighted D v. (m+B0)	m + 1.5640E+05	2.8691E-03	B=0	0.35	72.8
Weighted ln(d,D) v. ln(m+B0)	Intercept	-2.76413E+01			
(for Log Transform)	ln(m +1.3E+05)	2.78430E+00	B=1	0.63	53.2
	Dummy	0.00000E+00			
	Dummy * Ln(m+B0)	0.00000E+00	B=0	0.00	0.0
Weighted ln(d,D) v. ln(m+B0)	Intercept	3.91274E+00			
(for Power Transform)	ln(m +1.3E+19)	3.20912E-02	B=0	0.08	93.4
	Dummy	0.00000E+00			
	Dummy * Ln(m+B0)	0.00000E+00	B=0	0.00	0.0
Critical t (5%,196) =				1.97	5.0

Transformation used: 22631.0001 - X

COMMENTS:

This report was prepared using D2PP, Version 5.3.35
 from data file Alt meters fueltrax CFT volume data ASTM D6300.xls, Sheet1, .

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DATA MISSING OR REJECTED (Data rejection limit 20%):

LABORATORY SAMPLE DUP TEST

CAUTION!!

<5 laboratories

SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: CODED

Sample	No. of Results	Mean	Between Labs		
			S.D.	DF	R
S20	2	664.50	939.7	1	.17E+05
S95	2	1949.0	46.67	1	.84E+03
S12	2	2977.5	840.7	1	.15E+05
S4	2	2992.0	62.23	1	.11E+04
S87	2	3097.5	2.121	1	38.
S83	2	3189.5	464.6	1	.83E+04
S67	2	3274.0	371.9	1	.67E+04
S75	2	3328.5	392.4	1	.71E+04
S46	2	3473.0	73.54	1	.13E+04
S24	2	3520.5	57.28	1	.10E+04
S60	2	3610.5	1223.	1	.22E+05
S53	2	3613.5	1194.	1	.21E+05
S32	2	3892.0	35.36	1	.64E+03
S39	2	4989.0	185.3	1	.33E+04
S19	2	5553.5	919.9	1	.17E+05
S3	2	6299.5	61.52	1	.11E+04

CONTINUE

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SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: CODED

Sample	No. of		Between Labs		
	Results	Mean	S.D.	DF	R
S94	2	6506.5	37.48	1	.67E+03
S86	2	6516.0	7.071	1	.13E+03
S11	2	6531.5	832.3	1	.15E+05
S23	2	6549.5	10.61	1	.19E+03
S45	2	6558.5	82.73	1	.15E+04
S66	2	6647.5	384.0	1	.69E+04
S31	2	6774.0	106.1	1	.19E+04
S96	2	6870.5	125.2	1	.22E+04
S82	2	6894.0	452.5	1	.81E+04
S74	2	6899.0	417.2	1	.75E+04
S52	2	7305.0	1222.	1	.22E+05
S59	2	7339.0	1392.	1	.25E+05
S38	2	7568.0	130.1	1	.23E+04
S13	2	7976.5	876.1	1	.16E+05
S88	2	8131.5	12.02	1	.22E+03
S68	2	8186.5	526.8	1	.95E+04
S76	2	8314.0	452.5	1	.81E+04
S25	2	8545.0	62.23	1	.11E+04
S54	2	8634.5	1193.	1	.21E+05
S61	2	8737.5	1414.	1	.25E+05
S5	2	8827.5	772.9	1	.14E+05
S47	2	8908.5	1180.	1	.21E+05
S33	2	9021.5	103.9	1	.19E+04
S40	2	9962.5	137.9	1	.25E+04
S18	2	10606.	965.2	1	.17E+05
S2	2	11300.	21.92	1	.39E+03
S93	2	11534.	29.70	1	.53E+03
S85	2	11549.	5.657	1	.10E+03
S22	2	11582.	12.02	1	.22E+03
S44	2	11584.	83.44	1	.15E+04
S10	2	11591.	871.9	1	.16E+05
S65	2	11675.	385.4	1	.69E+04
S30	2	11709.	7.778	1	.14E+03
S97	2	11885.	152.7	1	.27E+04
S73	2	12008.	519.7	1	.93E+04
S81	2	12031.	598.9	1	.11E+05
S58	2	12269.	1245.	1	.22E+05
S51	2	12331.	1223.	1	.22E+05
S37	2	12640.	191.6	1	.34E+04
S14	2	12975.	917.1	1	.16E+05
S89	2	13168.	5.657	1	.10E+03

CONTINUE

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SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: CODED

Sample	No. of Results	Mean	Between Labs		
			S.D.	DF	R
S69	2	13280.	433.5	1	.78E+04
S77	2	13334.	466.7	1	.84E+04
S26	2	13565.	79.20	1	.14E+04
S55	2	13595.	1298.	1	.23E+05
S62	2	13685.	1537.	1	.28E+05
S6	2	13809.	857.7	1	.15E+05
S48	2	13936.	1175.	1	.21E+05
S34	2	14025.	145.0	1	.26E+04
S41	2	14967.	181.0	1	.33E+04
S17	2	15610.	922.1	1	.17E+05
S1	2	16320.	4.950	1	89.
S92	2	16562.	23.33	1	.42E+03
S9	2	16594.	830.9	1	.15E+05
S84	2	16606.	33.23	1	.60E+03
S21	2	16615.	14.85	1	.27E+03
S43	2	16617.	89.10	1	.16E+04
S29	2	16690.	92.63	1	.17E+04
S64	2	16702.	391.0	1	.70E+04
S98	2	16959.	98.29	1	.18E+04
S72	2	16968.	414.4	1	.74E+04
S80	2	16978.	475.2	1	.85E+04
S57	2	17289.	1231.	1	.22E+05
S50	2	17424.	1316.	1	.24E+05
S36	2	17638.	150.6	1	.27E+04
S15	2	18046.	855.6	1	.15E+05
S90	2	18200.	13.44	1	.24E+03
S78	2	18264.	613.1	1	.11E+05
S70	2	18305.	432.7	1	.78E+04
S27	2	18565.	118.8	1	.21E+04
S56	2	18704.	1196.	1	.21E+05
S7	2	18743.	971.6	1	.17E+05
S63	2	18822.	1391.	1	.25E+05
S49	2	18963.	1173.	1	.21E+05
S35	2	19084.	105.4	1	.19E+04
S42	2	20019.	135.8	1	.24E+04
S100	2	20366.	135.8	1	.24E+04
S99	2	20366.	135.8	1	.24E+04
S16	2	20625.	910.8	1	.16E+05
S91	2	21589.	16.26	1	.29E+03
S8	2	21625.	830.1	1	.15E+05
S28	2	21873.	119.5	1	.21E+04

CONTINUE

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SAMPLE MEANS AND STANDARD DEVIATIONS
After any outlier rejections

Transform Type: CODED

Sample	Results	No. of Mean	Between Labs		
			S.D.	DF	R
S79	2	21992.	444.1	1	.80E+04
S71	2	21997.	405.2	1	.73E+04

VARIANCE ANALYSIS

Transform Type: CODED

	Sum of squares		DF	Mean square	F
	Estimated	Exact			
Sample Means	6.445836E+09	6.445836E+09			
Lab Means	2.303915E+07	2.303915E+07	1	2.30392E+07	105.240
Interaction	2.167317E+07		99	2.18921E+05	
Pairs	6.490549E+09	6.490549E+09			
Total	6.490549E+09				
Critical F (5%, 1, 99) =					3.937

	Expectation of Mean Squares
Lab means	1.0000 V(r) + 1 V(I) +100.0000 V(L)
Interaction	1.0000 V(r) + 1 V(I)
Repeats	1.0000 V(r)

	DF	Variance	Precision
Transformed data			
Reproducibility	4	8.942463E+05	2.626E+03

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INPUT DATA FOR:

Alt Meters Fueltrax CFT Volume reproducibility, (CODED)

			S1	S2	S3	S4	S5	S6	S7	S8
EMMU to MM	1	16323	11315	6343	3036	9374	14415	19430	22212	
MMU to EMM	1	16316	11284	6256	2948	8281	13202	18056	21038	

CONTINUE

INPUT DATA FOR:

Alt Meters Fueltrax CFT Volume reproducibility, (CODED)

			S9	S10	S11	S12	S13	S14	S15	S16
EMMU to MM	1	17181	12207	7120	3572	8596	13623	18651	21269	
MMU to EMM	1	16006	10974	5943	2383	7357	12326	17441	19981	

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CONTINUE

INPUT DATA FOR:

Alt Meters Fueltrax CFT Volume reproducibility, (CODED)

		S17	S18	S19	S20	S21	S22	S23	S24
EMMU to MM	1	16262	11288	6204	1329	16625	11590	6557	3561
MMU to EMM	1	14958	9923	4903	0	16604	11573	6542	3480

CONTINUE

INPUT DATA FOR:

Alt Meters Fueltrax CFT Volume reproducibility, (CODED)

		S25	S26	S27	S28	S29	S30	S31	S32
EMMU to MM	1	8589	13621	18649	21957	16624	11703	6849	3867
MMU to EMM	1	8501	13509	18481	21788	16755	11714	6699	3917

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CONTINUE

INPUT DATA FOR:

Alt Meters Fueltrax CFT Volume reproducibility, (CODED)

		S33	S34	S35	S36	S37	S38	S39	S40
EMMU to MM	1	9095	14127	19158	17744	12775	7660	5120	10060
MMU to EMM	1	8948	13922	19009	17531	12504	7476	4858	9865

CONTINUE

INPUT DATA FOR:

Alt Meters Fueltrax CFT Volume reproducibility, (CODED)

		S41	S42	S43	S44	S45	S46	S47	S48
EMMU to MM	1	15095	20115	16680	11643	6617	3525	9743	14766
MMU to EMM	1	14839	19923	16554	11525	6500	3421	8074	13105

CONTINUE

INPUT DATA FOR:

Alt Meters Fueltrax CFT Volume reproducibility, (CODED)

		S49	S50	S51	S52	S53	S54	S55	S56
EMMU to MM	1	19792	18354	13195	8169	4458	9478	14513	19549
MMU to EMM	1	18133	16493	11466	6441	2769	7791	12677	17858

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CONTINUE

INPUT DATA FOR:

Alt Meters Fueltrax CFT Volume reproducibility, (CODED)

			S57	S58	S59	S60	S61	S62	S63	S64
EMMU to MM	1	18159	13149	8323	4475	9737	14772	19805	16978	
MMU to EMM	1	16418	11388	6355	2746	7738	12598	17838	16425	

CONTINUE

INPUT DATA FOR:

Alt Meters Fueltrax CFT Volume reproducibility, (CODED)

			S65	S66	S67	S68	S69	S70	S71	S72
EMMU to MM	1	11947	6919	3537	8559	13586	18611	22283	17261	
MMU to EMM	1	11402	6376	3011	7814	12973	17999	21710	16675	

CONTINUE

INPUT DATA FOR:

Alt Meters Fueltrax CFT Volume reproducibility, (CODED)

			S73	S74	S75	S76	S77	S78	S79	S80
EMMU to MM	1	12375	7194	3606	8634	13664	18697	22306	17314	
MMU to EMM	1	11640	6604	3051	7994	13004	17830	21678	16642	

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CONTINUE

INPUT DATA FOR:

Alt Meters Fueltrax CFT Volume reproducibility, (CODED)

		S81	S82	S83	S84	S85	S86	S87	S88
EMMU to MM	1	12454	7214	3518	16629	11545	6511	3096	8140
MMU to EMM	1	11607	6574	2861	16582	11553	6521	3099	8123

CONTINUE

INPUT DATA FOR:

Alt Meters Fueltrax CFT Volume reproducibility, (CODED)

		S89	S90	S91	S92	S93	S94	S95	S96
EMMU to MM	1	13172	18209	21600	16578	11555	6533	1982	6959
MMU to EMM	1	13164	18190	21577	16545	11513	6480	1916	6782

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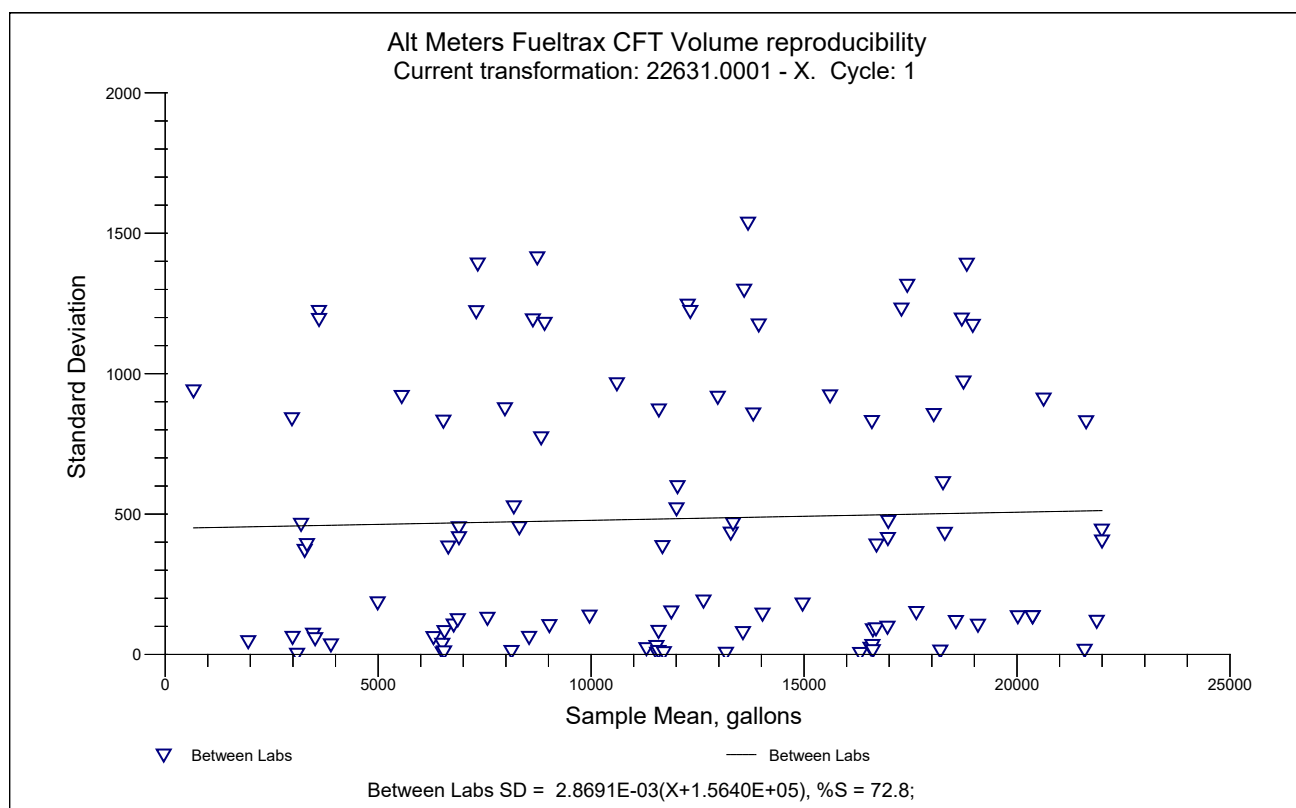
INPUT DATA FOR:

Alt Meters Fueltrax CFT Volume reproducibility, (CODED)

			S97	S98	S99	S100
EMMU to MM	1	11993	17028	20462	20462	
MMU to EMM	1	11777	16889	20270	20270	

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