CORIOLIS FORCE FLOWMETER DATA EVALUATION PROJECT
FINAL REPORT

SCOPE OF WORK

The primary emphasis of this project is the re-evaluation of the existing data and the development of any new conclusions. As part of this analysis the existing database will be reviewed for anomalies in proving report sequences that would indicate that data had been selectively chosen. On July 2,1998 HMC, Inc was requested by the task group chair to modify the scope of work to address the items in attachment I of E. Carlson's June 15, 1998 letter. These issues include linearity, repeatability/reproducibility; swirl and asymmetrical flow effects; proving methods; physical property effects such as pressure, temperature, viscosity and density variation (short time).

BACKGROUND

The API initiated work to develop a Coriolis Measurement Standard in 1989, the draft standard was submitted for ballot in December 1992 and again in the fall of 1993. As a result of the negative ballots both times, the document was issued in May 1995 as a Draft Committee Report and a Coriolis Task Group was formed to develop a recommendation for future efforts relating to a standard on Coriolis Force Flowmeter. The recommendation was to continue the development of a draft standard divided into two parts, mass and volume measurement. This recommendation was based on the initial analysis of more than 900 field-proving reports. This project added 70 additional data sets representing three meter manufacturers and sixteen sites to the original collection of data sets. Additionally, data continued to arrive after the deadlines.

A report summarizing the data collection and analysis efforts of the task group was prepared and presented in February 1997. Data was obtained for meters configured for both volume and mass measurement; additionally meters were proved on both a mass and volume basis. The criteria used to evaluate the data was that the range of repeatability of a proving had to be ≤0.05%; and the meter factor over time could deviate by no more than ±0.25% from the average meter factor for all of the proving's (reproducibility).

The results of the proving result analysis showed that for meters configured for volume; 83% met the reproducibility criteria and 91% met the repeatability criteria. Those meters configured for mass met the reproducibility criteria 90% of the time and the repeatability 81%. That report is considered to be a part of this report and the effort will be focused on addressing the issues in attachment I.

DISCUSSION OF ANALYSIS RESULTS

The focus of this discussion will be to address the issues from attachment I in the agreed to format, therefore:

PERFORMANCE ATTRIBUTES

LINEARITY

1a. What is the linearity accuracy of the meter?

1b. The linearity accuracy is the specification of a meter's ability to maintain a near constant calibration factor throughout a specified flow range. The percent deviation from the median calibration factor for a constant set of defined operating conditions is the statement of linearity. A review of the data submitted indicates that this is normal operating proving data and as such is taken over an extended time at varying operating conditions. The data available ranged from 3-5% to 30% (i.e., 40-70%) of full-scale flow. However the predominant result was the concentration of results over a narrow operating flow range.

1c. Therefore there is insufficient data to fully determine the linearity of the Coriolis Meter under hydrocarbon operating conditions. This is an area needing further data development and analysis. To determine a meter's linearity one must prove the meter throughout a specified flow range at a constant set of operating conditions. Therefore, this is normally done by developing consecutive meter factors, in a given time period, for a range of flow rates (high to low or low too high). Thus ensuring an almost constant set of operating conditions.

REPEATABILITY

2a. What is the Coriolis meter's repeatability?

2b. Repeatability defines how close the measurement indications are to each other or in other word's, the meter's ability to reproduce its calibration curve, adjusted for the hydrocarbon, under the same operating conditions. The Coriolis task group has defined that the range of repeatability of a proving had to meet criteria of ≤0.05%. A review of meters configured for both volume and mass measurement of the three specified hydrocarbon type classifications indicates that there is sufficient data to determine repeatability for Crude Oil (Volume and Mass), Fractionated/Unfractionated hydrocarbons (Volume and Mass) and marginally for Products (Mass).

2c/d. the following tables summarize the Coriolis meter's repeatability and reproducibility results based on the data submitted. The results are summarized by hydrocarbon type and measurement/proving configuration. The data sets include both outliners and data that meet criteria. As installation effects are understood and clarified these values will improve. These installation/operating effects include temperature.

REPRODUCIBILITY

3a. What is the Coriolis meter's capability to meet reproducibility criteria?

3b.Reproducibility defines how close the measurement indications are to each other over time. The Coriolis task group has defined that the meter factor over time could deviate by no more than ±0.25% from the average meter factor for all of the proving's.

There is sufficient data to allow the calculation of reproducibility and verify that the meter factor meets criteria. Between 83 and 90 % of the data sets met the acceptability criteria. The following tables summarize the repeatability and reproducibility values of the various data sets.

The poorer repeatability and reproducibility exhibited by the Fractionated/Unfractionated product seems to stem from a number of causes. Small data base, especially when separated into the different product types. Close coupling to pumps and the resulting pulsation and compressibility effects. Use of SVP's with no pre-run, the differential pressure allows the product to expand and compress rapidly, insufficient backpressure. Additionally those SVP's that use nitrogen to actuate the piston may exhibit freewheeling of the piston contributing to the expansion/compression of the product in a rapid and non-repeatable manner. These are just some of the potential causes, more data is needed for a more in-depth analysis.

Appendix A contains the graphical and tabular details supporting the repeatability and reproducibility results for the data submitted.

Table 1a. METER REPEATABILITY and REPRODUCIBILITY SUMMARY

Crude Oil and Condensate
Volume Proving

Meter	Provings	Ave. Meter Factor	Range	STD. DEV.	Pulse Rep'ty	Range	STD. DEV.
Co1MAV1	18	1.0000	0.0106	0.0030	0.03%	0.04%	0.01%
Co1MBV2	14	0.9971	0.0034	0.0009	0.04	0.04	0.01
Co2MBV1	18	1.0025	0.0019	0.0005	0.04	0.07	0.02
Co8MBV1	5	1.0006	0.0022	0.0009	0.02	0.04	0.02
Co8MBV2	5	1.0012	0.0062	0.0023	0.08	0.32	0.14
Co8MBV3	5	1.0022	0.0023	0.0011	0.05	0.18	0.08
Co9MBV1	26	1.0020	0.0028	0.0006	0.03	0.04	0.01
Co9MBV2	25	1.0052	0.0037	0.0010	0.03	0.05	0.01
Co11MBV1	9	1.0056	0.0025	0.0010	0.09	0.15	0.06
Co11MBV1	3	1.0055	0.0007	0.0004	0.23	0.28	0.16
Co11MBV1	5	1.0056	0.0027	0.0011	0.08	0.13	0.07
Co11MCV2	5	1.0053	0.0024	0.0009	0.03	0.03	0.01
Co11MCV3	11	1.0048	0.0026	0.0007	0.05	0.05	0.01
Co11MCV4	2	1.0107	0.0006	0.0004	0.05	0.01	0.01
Co13MBV1	17	1.0126	0.0064	0.0020	0.03	0.06	0.01
Co13MBV2	14	1.0220	0.0080	0.0021	0.03	0.05	0.01
Co13MBV3	14	1.0249	0.0143	0.0037	0.03	0.06	0.01
Co13MBV4	17	0.9942	0.0094	0.0022	0.03	0.02	0.01
Co13MBV5	18	1.0132	0.0240	0.0059	0.03	0.07	0.02
Co13MBV6	19	1.0136	0.0234	0.0059	0.03	0.04	0.01
Co13MBV7	17	0.9946	0.0041	0.0013	0.03	0.06	0.01
Co13MBV8	18	1.0153	0.0200	0.0044	0.03	0.06	0.02
Co13MBV9	17	1.0147	0.0255	0.0051	0.03	0.06	0.01
Co39MCV4	12	1.0034	0.0226	0.0058	0.06	0.77	0.01
Co39MCV5	13	1.0063	0.0026	0.0007	0.06	0.77	0.01
Co39MCV7	13	1.0018	0.0042	0.0012	0.06	0.77	0.01
Co39MCV8	13	1.0013	0.0034	0.0011	0.06	0.77	0.01
AVERAGE:		1.0062			0.05		
RANGE:		0.0307			0.23		
STD. DEV.		0.0075			0.04		

Table 1b. METER REPEATABILITY and REPRODUCIBILITY SUMMARY

Crude Oil and Condensate
Mass
Proving

Meter	Provings	Ave. Meter Factor	Range	STD. DEV.	Pulse Rep'ty	Range	STD. DEV.
Co2MBM1	4	1.0019	0.0011	0.0005	0.04	0.02	0.01
Co14MBM1	36	1.0037	0.0047	0.0011	0.03	0.09	0.02
Co14MBM2	32	1.0046	0.0037	0.0009	0.02	0.06	0.02
Co14MBM3	31	1.0047	0.0039	0.0010	0.06	0.39	0.08
Co14MBM4	32	1.0045	0.0038	0.0008	0.03	0.14	0.03
Co14MBM5	31	1.0031	0.0042	0.0012	0.02	0.05	0.01
Co14MBM6	32	1.0036	0.0044	0.0009	0.02	0.06	0.02
Co14MBM7	66	1.0086	0.0031	0.0006	0.02	0.05	0.01
AVERAGE:		1.0043			0.03		
RANGE:		0.0067			0.04		
STD. DEV.		0.0020			0.01		

Table 2a. METER REPEATABILITY and REPRODUCIBILITY SUMMARY

Products
Volume
Proving

Meter	Provings	Ave. Meter Factor	Range	STD. DEV.	Pulse Rep'ty	Range	STD. DEV.
Co4MBV1	30	1.0020	0.0032	0.0008	0.03	0.04	0.01
Co10MBV1	33	1.0009	0.0108	0.0023	0.06	0.43	0.09
AVERAGE:		1.0015			0.05		
RANGE:		0.0011			0.03		
STD. DEV.		0.0008			0.02		

Table 2b. METER REPEATABILITY and REPRODUCIBILITY SUMMARY

Products
Mass Proving

Meter	Provings	Ave. Meter Factor	Range	STD. DEV.	Pulse Rep'ty	Range	STD. DEV.
Co5MBM1	**36**	**1.007**	**0.0049**	**0.001**	**0.20**	**0.51**	**0.11**
Co5MBM2	**3**	**1.0008**	**0.0041**	**0.0021**	**0.05**	**0.07**	**0.04**

AVERAGE:	**1.0039**	**0.13**
RANGE:	**0.0062**	**0.15**
STD. DEV.	**0.0044**	**0.11**

Table 3a. METER REPEATABILITY and REPRODUCIBILITY SUMMARY

Fractionated/Unfractionated Product
Volume
Proving

Meter	Provings	Ave. Meter Factor	Range	STD. DEV.	Pulse Rep'ty	Range	STD. DEV.
Co1MBV3	**7**	**1.0092**	**0.0080**	**0.0032**	**0.05**	**0.09**	**0.03**
Co6MBV1	**9**	**1.0371**	**0.0604**	**0.0289**	**0.14**	**0.79**	**0.27**
Co6MBV2	**9**	**1.0121**	**0.0278**	**0.0084**	**0.06**	**0.17**	**0.05**
Co6MBV3	**5**	**1.0623**	**0.0095**	**0.0043**	**0.04**	**0.04**	**0.02**
Co6MBV4	**6**	**1.0257**	**0.0047**	**0.0016**	**0.06**	**0.10**	**0.04**
Co7MBV3	**7**	**0.9979**	**0.0037**	**0.0012**	**0.04**	**0.16**	**0.06**
Co12MBV1	**46**	**0.9991**	**0.0021**	**0.0005**	**0.03**	**0.06**	**0.02**
Co30MBV1	**3**	**1.0003**	**0.0007**	**0.0004**	**0.03**	**0.05**	**0.01**
Co30MBV2	**3**	**0.9998**	**0.0004**	**0.0002**	**0.03**	**0.05**	**0.01**
Co30MBV3	**3**	**1.0001**	**0.0002**	**0.0001**	**0.03**	**0.05**	**0.01**
Co30MBV4	**3**	**0.9997**	**0.0002**	**0.0001**	**0.03**	**0.05**	**0.01**
Co30MBV5	**3**	**1.0003**	**0.0005**	**0.0003**	**0.03**	**0.05**	**0.01**
Co30MBV6	**3**	**1.0004**	**0.0010**	**0.0005**	**0.03**	**0.05**	**0.01**

AVERAGE:	**1.0111**	**0.05**
RANGE:	**0.0644**	**0.11**
STD. DEV.	**0.0195**	**0.03**

Table 3b. METER REPEATABILITY and REPRODUCIBILITY SUMMARY

Fractionated/Unfractionated Product
Mass Proving

Meter	Provings	Ave. Meter Factor	Range	STD. DEV.	Pulse Rep'ty	Range	STD. DEV.
Co7MBM1	**7**	**1.0012**	**0.0494**	**0.0153**	**0.04**	**0.05**	**0.02**
Co7MBM2	**7**	**1.0041**	**0.0630**	**0.0186**	**0.04**	**0.05**	**0.02**
C038MDM1	**7**	**0.9993**	**0.0093**	**0.0029**	**0.05**	**0.17**	**0.01**
AVERAGE:		**1.0015**			**0.04**		
RANGE:		**0.0048**			**0.01**		
STD. DEV.		**0.0024**			**0.01**		

SWIRL AND ASYMMETRICAL FLOW

4a. What is the effect of swirl and asymmetrical flow on the Coriolis meter's performance?
4b. There is sufficient information available from research and regression analyses of the meter factor versus flow rate to address these issues.
4c. In comparison to velocity or inference meters which require fully developed flow at the point of measurement, Coriolis meters measure the amount of deflection caused by the Coriolis force on the tubes, which are being resonated at their natural frequency. The dampening of the deflection is caused by the density change in the product not the velocity. In fact the typical meter through its design induces swirl, which results in a more homogeneous product.
4d. Tests by the NEL Coriolis Consortium, which tested meters from eight different Coriolis meter manufacturers showed that only one of the eight meters tested exhibited what appeared to be a swirl effect, and it appeared to manifest itself as a zero shift. Additional testing by SIREP further supported the minimal effect. Most of the effect was at the very low flow rates, less than 30%.

Appendix B contains plots of the swirl and asymmetric effects tests conducted by SIREP.

Additionally regression analyses were performed on meter factor versus flow rate for regularly proven meters. The intent of these regressions was to identify flow rate effects, and to try and correlate the variation in meter factors to swirl influences by studying the meter installation sketches. However, no strong correlation between meter factor and flow rate was identified which would warrant trying to identify swirl influences.

A paper, The Effect of Swirl on Coriolis Mass Flowmeters, presented by T. Patten further supports this minimal effect and shows the results quantitatively of the testing for swirl on various inlet configurations. The largest average mass flow rate error is 0.027% for a double elbow, elbow closest to sensor perpendicular to sensor tube plane. The range of average mass flow rate error was 0.002% to 0.027%.

VIBRATION

5a. What is the vibration effects on the Coriolis meter's performance?
5b. While vibration influences can not be identified from the field proving data, there does exist research data, which does identify the effects of vibration on the Coriolis meter.
5c. Vibration is one of the issues that must be addressed in the design of the metering station and by the manufacturers in their meter design. It is something that can not be totally eliminated and therefore must be managed.
5d. Vibration, like temperature, affects all mechanical structures. The random noise that Coriolis meters are subjected to in operating environments is sporadic, unrepeatable and consequently difficult to identify. Manufacturers have established testing criteria to quantify the additional measurement uncertainty that vibration induces. Additionally manufacturers have added automatic routines in their electronics that samples system noise multiple successive times and calculates an average zero offset. This allows the reference channel to be adjusted by this amount to make the phase shift with respect to the measurement channel equal to zero at no flow. The NEL tests show only one out of the eight meters tested with a noticeable vibration influence. The effects of vibration can be minimized with normal pipe supports and damping.

VELOCITY OF SOUND EFFECTS

6a. What is the velocity of sound influence on the Coriolis meter's performance?
6b. There is research on the velocity of sound's effects on Coriolis meters, this influence can not be determined in the field. The primary effect of this influence is density measurement errors.
6c. While the velocity of sound influence could and probably does play some part in meter factor shift when proving different hydrocarbons, its effect is not very strong.
6d. The velocity of sound influence is related to the localized compression and decompression of fluid at the surface of the flow tube, as it vibrates back and forth. This effect depends on the interaction of the vibrating flow tube and the velocity at which sound travels through the fluid. If the flow tube wall's velocity approaches the velocity of sound in the fluid, there will be localized compression of the fluid at the tube wall, causing a localized density increase. The net result will be density errors. The low frequencies at which Coriolis meters operate have the effect of causing relatively insignificant effects.

PRESSURE AND TEMPERATURE EFFECTS

7a. What are the effects of pressure and temperature effects on Coriolis meters performance?
7b. There is sufficient technical data available through research to quantify these effects.
7c. These effects can be quantified and compensated for in the majority.
7d. All mechanical equipment is affected by pressure and temperature changes. In Coriolis meters, pressure can have a minimal effect on flow measurement. As the operating pressure

increase from the calibration pressure, slight stiffening of the sensor tube structure creates a negative bias error or offset. Conversely, as pressure decreases from the calibration pressure, the structure relaxes and a positive bias error occurs. Smaller sensors have little or no pressure effect because of the high tube wall thickness to outside diameter ratio. As the ratio decreases in larger sensors the pressure effect is more apparent. Pressure effects all Coriolis meters some more than others. One must understand this effect and balance the trade off between pressure effect tube geometry and flow sensitivity.

In Coriolis meters, changes in temperature (liquid) affect both tube stiffness and zero stability. The sensor tubes change stiffness with temperature. Young's Modulus of Elasticity characterizes elasticity changes in metal as a function of temperature. The change is repeatable and can be corrected. Zero stability effects cannot be corrected because they are caused by geometric and structural asymmetries in the sensor that are not repeatable.
The process temperature effect has been defined as a zero stability drift per degree of temperature change and is expressed as a percent of nominal flow rate per °C. Consequently, changes in zero stability are an additive uncertainty for a Coriolis meter. Zeroing the meter at the operating temperature can minimize the effects of process temperature changes.

DENSITY AND VISCOSITY

8a. What are the effects on Coriolis meter due to changes in density and viscosity?
8b. Coriolis meters are affected by changes in density and viscosity. Coriolis meters are not directly sensitive to changes in viscosity. However, there is an inherent tradeoff between accuracy, viscosity and pressure drop. Accuracy can be indirectly and adversely affected as viscosity rises and increases the pressure loss through the meter. To obtain large phase shifts with low stresses relatively long tubes are needed. For a 1-inch sensor the tube is typically 30 inches. A 200-cP product would generate approximately a 32-psi pressure drop at about 225 lb/min.
When designing new systems this pressure loss can be accommodated. However, when retrofitting an existing meter system few options exist. The meter can be either oversized and the flow rate is restricted. Either way the Coriolis meter is operated at a higher turn down from its full scale rated flow. Additionally zero offsets are more pronounced at these conditions These changes can be compensated for by correction factors or equipment selection.
8c/d. a change in fluid density shifts the Coriolis meter's calibration resulting in a measurement error. Although the meter theoretically should perform independently of fluid density, all meters are affected to varying degrees. While Coriolis tubes maintain their mass symmetry and balance across all operating conditions, the mass distribution of the tubes does change the fluid becomes more or less dense. Perfect symmetry and balance under varying operating conditions is not achievable, therefore all Coriolis meters exhibit calibration shifts with density changes. To recalibrate the Coriolis meter for the new fluid characteristics, a proving under actual field operating conditions should be accomplished.

CONTROL ATTRIBUTES

DATA QUALITY AND INTEGRITY

COMPLETE PROVING REPORTS VS. DATA SUMMARY

Of the forty-seven data sets reviewed, eight contained only a summary of the proving result and the date. The majority of these eight were from one submitter of data. The remainder (39) submitted copies of the actual proving reports, which were predominately, generated by third party contract provers.
No evidence was found that the data submitted was selectively compiled.

Table 4. Data Analysis by Hydrocarbon Type

HYDROCARBON TYPE	No. of Data Points	% of TOTAL
Crude Oil (Table A)	636	67.0
Products (Table B)	43	5.0
Fractionated Liquids	197	21.0
Other (Aromatics, etc)	69	7.0

PROVING REPORT ANOMALIES

The majority, over 95%, of the data submitted for an analysis is high quality. Of the forty-seven data sets evaluated only thirteen contained no anomalies, the rest contained anomalies of one type or another. The predominant anomaly was missing sequential proving reports, which was identified predominately using information contained within the submitted reports, such as previous Meter Factor and not finding the indicated report. The majority of these missing reports were probably not sent due to administrative reasons, such as lost files, etc. In a number of cases a company submitted multiple months of data on multiple meter sites and the proving reports for the same month were missing from all data sets submitted. Additional anomalies included changing pulses per unit volume and changing provers.

One company submitted both good and bad proving data. They submitted over 40 reports performed with the meter improperly zeroed and another forty plus reports after the meter was properly calibrated.

Appendix C contains a detailed list of anomalies by meter.

Table 5. Data Analysis by Meter Manufacturer

Meter Manufacturer	No. of Meters	% of Total
A	18	2.0
B	820	87.0
C	94	10.0
D	13	1.0

PROVER TYPES AND PROVING METHODS

The bi-directional pipe prover was the predominate prover used to prove these meters, using five or six consecutive round trips to develop the meter factor. However on two of the data sets, which represent one company, ten (10) round trips were made and then five round trips were selected (not consecutive) from which the meter factor was calculated.

Table 6. Data Analysis by Prover Type

Prover Type	No. of Provers	% of Total
Bi-directional	562	59.0
SVP	383	41.0

Those facilities using SVP's to perform the proving utilized two or three runs of ten (10) to twelve (12) passes each to develop the meter factor. Therefore they are developing the meter factor on the average of averages.

Ten of the data sets were proving and solving for the k-factor and not meter factor, therefore they were excluded from further evaluation. This does not include those that changed the pulse per unit volume and then used the new pulses for all subsequent proving's.

The preliminary average pulse repeatability on the other thirty-seven data set's was 0.0475%, however if three data sets, which contained some large excursions, were excluded the pulse repeatability would be 0.0382%.

RECOMMENDATIONS TO ADDRESS IDENTIFIED INFLUENCES

Meter Zeroing. The zero set point was adjusted @ startup and not adjusted subsequently on all except three data sets. However the need for proper meter zeroing was identified from other references, two areas in particular that meter zeroing were effective in achieving resolution included significant temperature changes and operating the meter in its lower flow range.

Entrained Gas/Vapor. The zero shift due to entrained vapor while operating or shutdown needs to be part of the metering system design criteria. Various references indicated that when vapor became trapped in a meter, it would indicate flow even when shut down. This occurs because the meter now has two fluids of different densities, the vibration velocities transmitted through the two fluids are now dampened at different time intervals, signaling flow.

Proving Issues

Pulses per Unit Volume—pulses utilized ranged as high as 100,000 pulses per barrel and as low as 5,000 pulses per barrel. I would strongly recommend that the task group consider guidelines for the number of pulses per unit volume on either a fixed basis or a sliding basis (based on meter size). The TG may wish to consider 8000 to 10,000 pulses per barrel as standard.

Small Volume Provers—the use of averages of averages when generating the meter factor has a tendency to smooth out the results and therefore indicate better performance than merited. Therefore SVP's should utilized three or more consecutive runs of one pass each to generate the meter factor. I believe this requirement was recently incorporated into the MPMS.

Density —a procedure needs to be incorporated into the volume proving procedure to compare the indicated density from the Coriolis meter with the flowing density. Additionally the source of the proving density must be clearly indicated.

Meter Factor vs. k-factor—the task group may wish to give some direction on keeping the k-factor (pulse per unit volume) constant and developing a meter factor, instead of trying to solve for k-factor, which gives a unity meter factor.

FUTURE WORK ITEMS

Meter Linearity. Meter linearity at operating conditions, with a balance between hydrocarbon, meter size/manufacturer and proving method needs to be conducted to provide both insight into zero shift and rangeability

Meter Comparison. One company submitted data on both a displacement and Coriolis meter, which were in series and proved simultaneously. Another two or three installations had similar arrangements. The limited information seems to indicate a bias between the meters with the Coriolis meter having a larger range 0.09% versus 0.06% for the displacement meter. The repeatability was greater for the Coriolis 0.04-0.05% versus 0.02-0.04% for the displacement. This is a very limited set of information and no conclusions can be drawn.

Product Proving Data. More proving data for Products is needed on both a volume and mass basis. Only two data sets are available for each type of proving.

Light Hydrocarbons (Mass) Only three data sets are available for Light Hydrocarbons-Mass proving's.

Mass Proving's in general more data is really needed for all three-hydrocarbon types for the mass proving type.

Peter W Kosewicz
Hydrocarbon Measurement Consultants, Inc.

APPENDIX A

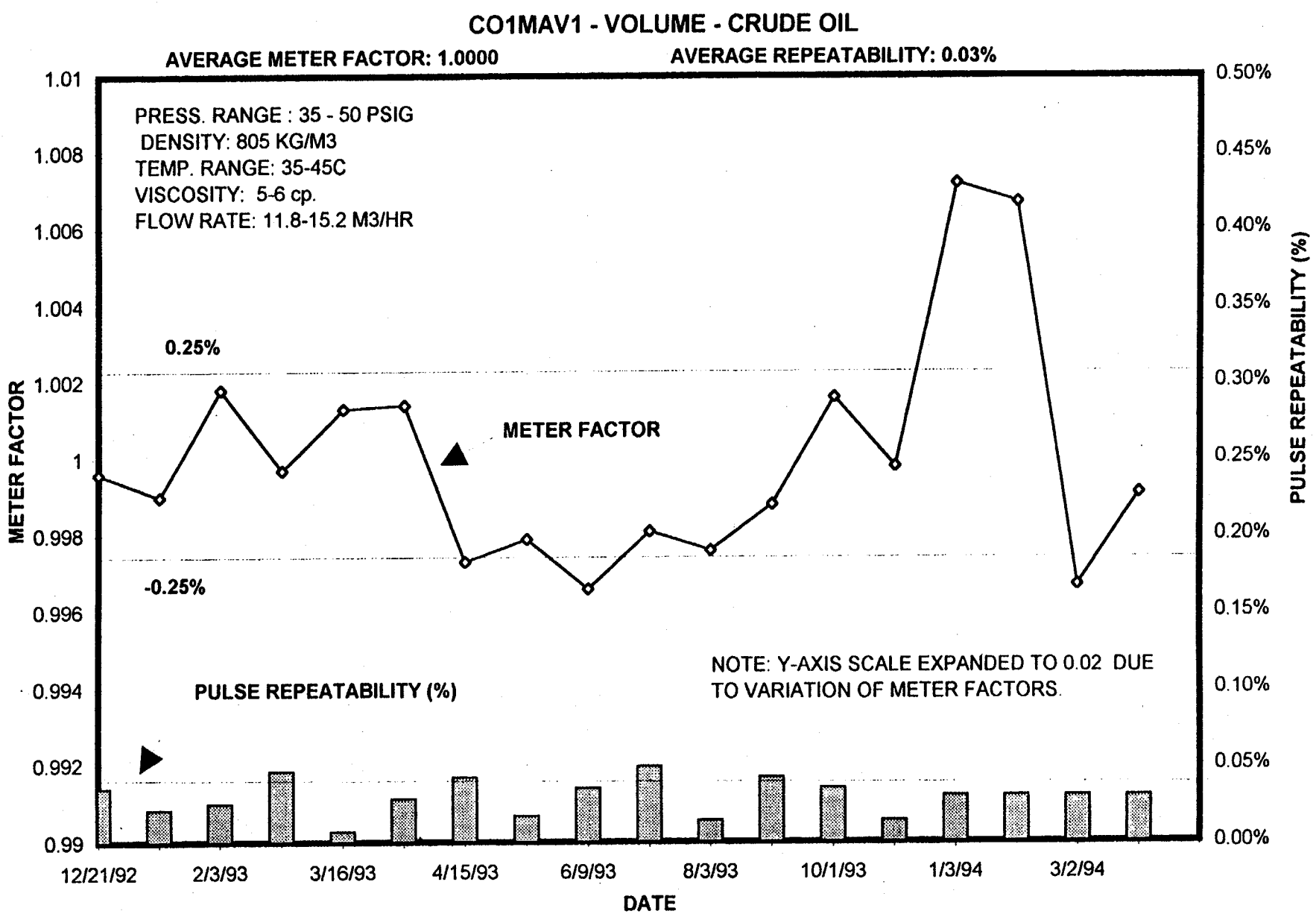
REPEATABILITY AND REPRODUCIBILITY

Volume Meter Factor Control Chart

Company No. 1 / Meter Type A / V1
Fluid: Crude oil / Density: 805 kg/m3
Viscosity: 5 - 6 cp.
Conventional Pipe Prover

Proving Date	Meter Factor	Pulse Rep'ty	Temp.(C)	Press.	m3/hr
12/21/92	0.9996	0.04%	40	50	11.8
1/25/93	0.9990	0.02%	33	50	15.2
2/3/93	1.0018	0.03%	40	50	15.2
3/8/93	0.9997	0.05%	40	45	15.2
3/16/93	1.0013	0.01%	38	45	15.2
4/1/93	1.0014	0.03%	39	45	15.2
4/15/93	0.9973	0.04%	43	45	15.2
5/3/93	0.9979	0.02%	42	45	15.2
6/9/93	0.9966	0.04%	42	55	14.2
7/9/93	0.9981	0.05%	37	40	15.6
8/3/93	0.9976	0.01%	45	45	15.2
9/20/93	0.9988	0.04%	43	45	15.5
10/1/93	1.0016	0.04%	39	45	15.3
12/2/93	0.9998	0.01%	39	40	15.3
1/3/94	1.0072	0.03%	35	40	15.0
2/26/94	1.0067	0.03%	39	40	14.8
3/2/94	0.9967	0.03%	41	35	13.1
4/6/94	0.9991	0.03%	38	35	13.7

AVERAGE:	1.0000	0.03%
RANGE:	0.0106	0.04%
STD. DEV.:	0.0030	0.01%

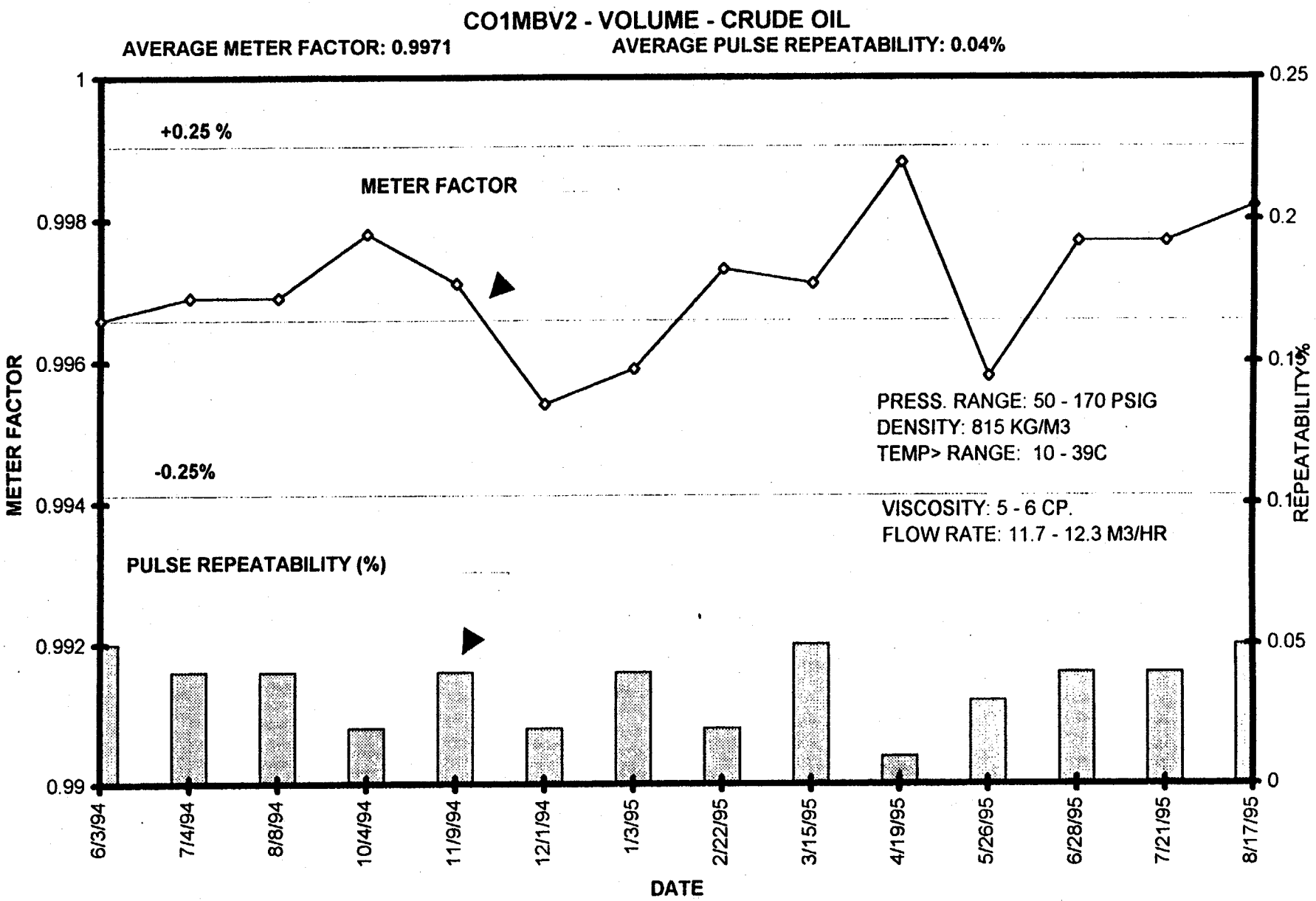

CO1MAV1 - VOLUME - CRUDE OIL
AVERAGE METER FACTOR: 1.0000
AVERAGE REPEATABILITY: 0.03%
PRESS. RANGE : 35 - 50 PSIG
DENSITY: 805 KG/M3
TEMP. RANGE: 35-45C
VISCOSITY: 5-6 cp.
FLOW RATE: 11.8-15.2 M3/HR
0.25%
-0.25%
METER FACTOR
PULSE REPEATABILITY (%)
NOTE: Y-AXIS SCALE EXPANDED TO 0.02 DUE TO VARIATION OF METER FACTORS.
METER FACTOR
1.01
1.008
1.006
1.004
1.002
1
0.998
0.996
0.994
0.992
0.99
PULSE REPEATABILITY (%)
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
12/21/92
2/3/93
3/16/93
4/15/93
6/9/93
8/3/93
10/1/93
1/3/94
3/2/94
DATE

Volume Meter Factor Control Chart

Company No. 1 / Meter Type B / V2
Fluid: Crude oil / Density: 815 Kg/m3
Viscosity: 5 - 6 cp.
Conventional Pipe Prover

Proving Date	Meter Factor	Pulse Rep'ty	Temp.	Press.	m3/hr
6/3/94	0.9966	0.05	35.9	150	12
7/4/94	0.9969	0.04	31.8	170	11.7
8/8/94	0.9969	0.04	40.4	165	11.1
10/4/94	0.9978	0.02	35.5	150	12.2
11/9/94	0.9971	0.04	39.3	155	12.2
12/1/94	0.9954	0.02	34.4	140	12.1
1/3/95	0.9959	0.04	27.1	95	12.3
2/22/95	0.9973	0.02	12.4	80	12.2
3/15/95	0.9971	0.05	29.9	85	12.2
4/19/95	0.9988	0.01	1.8	50	11.9
5/26/95	0.9958	0.03	42.7	80	12.2
6/28/95	0.9977	0.04	14.2	70	12.2
7/21/95	0.9977	0.04	13.5	75	12.2
8/17/95	0.9982	0.05	10.6	75	12.2

AVERAGE:	0.9971	0.04
SPREAD:	0.0034	0.04
STD. DEV.:	0.0009	0.01

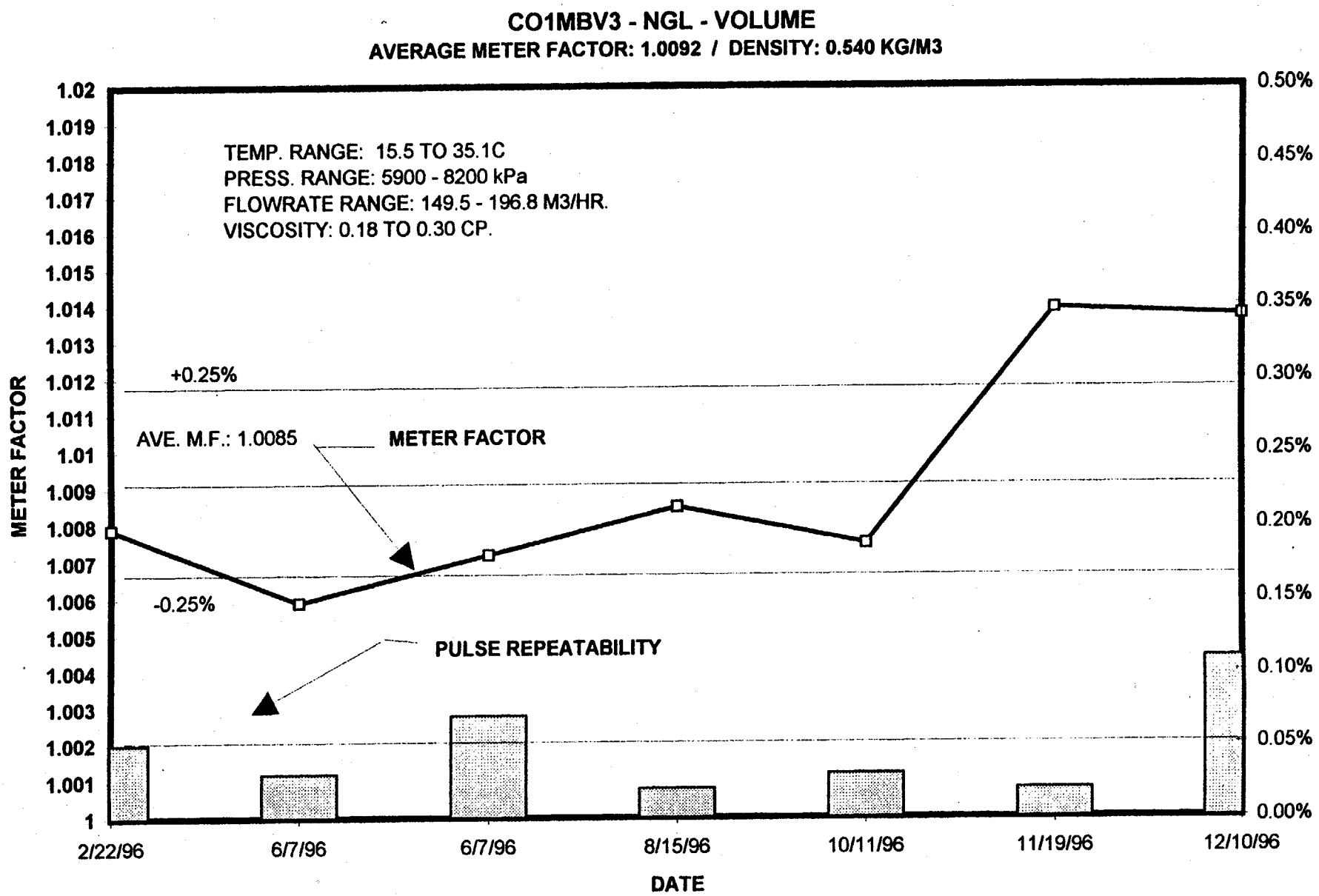

CO1MBV2 - VOLUME - CRUDE OIL
AVERAGE METER FACTOR: 0.9971
AVERAGE PULSE REPEATABILITY: 0.04%
+0.25 %
METER FACTOR
-0.25%
PULSE REPEATABILITY (%)
PRESS. RANGE: 50 - 170 PSIG
DENSITY: 815 KG/M3
TEMP> RANGE: 10 - 39C
VISCOSITY: 5 - 6 CP.
FLOW RATE: 11.7 - 12.3 M3/HR
METER FACTOR
REPEATABILITY%
1
0.998
0.996
0.994
0.992
0.99
0.25
0.2
0.15
0.1
0.05
0
6/3/94
7/4/94
8/8/94
10/4/94
11/9/94
12/1/94
1/3/95
2/22/95
3/15/95
4/19/95
5/26/95
6/28/95
7/21/95
8/17/95
DATE

Volume Meter Factor Control Chart

Company No. 1 / Meter Type B / V3
Meter Size: 3 inch
Fluid: NGL / Density: 540 Kg/m3
Viscosity: 0.18 - 0.30 cp.
Conventional Pipe Prover

Proving Date	Meter Factor	Pulse Rep'ty	Temp.(C)	Press.(kPa)	m3/hr	% Max. F.R.
2/22/96	1.0079	0.05%	30.5	5900	185.8	36.9
6/7/96	1.0059	0.03%	32.8	6750	159.0	31.6
6/7/96	1.0072	0.07%	33.3	8000	191.2	37.9
8/15/96	1.0085	0.02%	35.1	8000	196.8	39.1
10/11/96	1.0075	0.03%	27.0	6520	149.5	29.7
11/19/96	1.0139	0.02%	15.5	7650	160.3	31.8
12/10/96	1.0137	0.11%	20.0	8200	196.8	39.1

AVERAGE:	1.0092	0.05%
RANGE:	0.0080	0.09%
STD. DEV.:	0.0032	0.03%

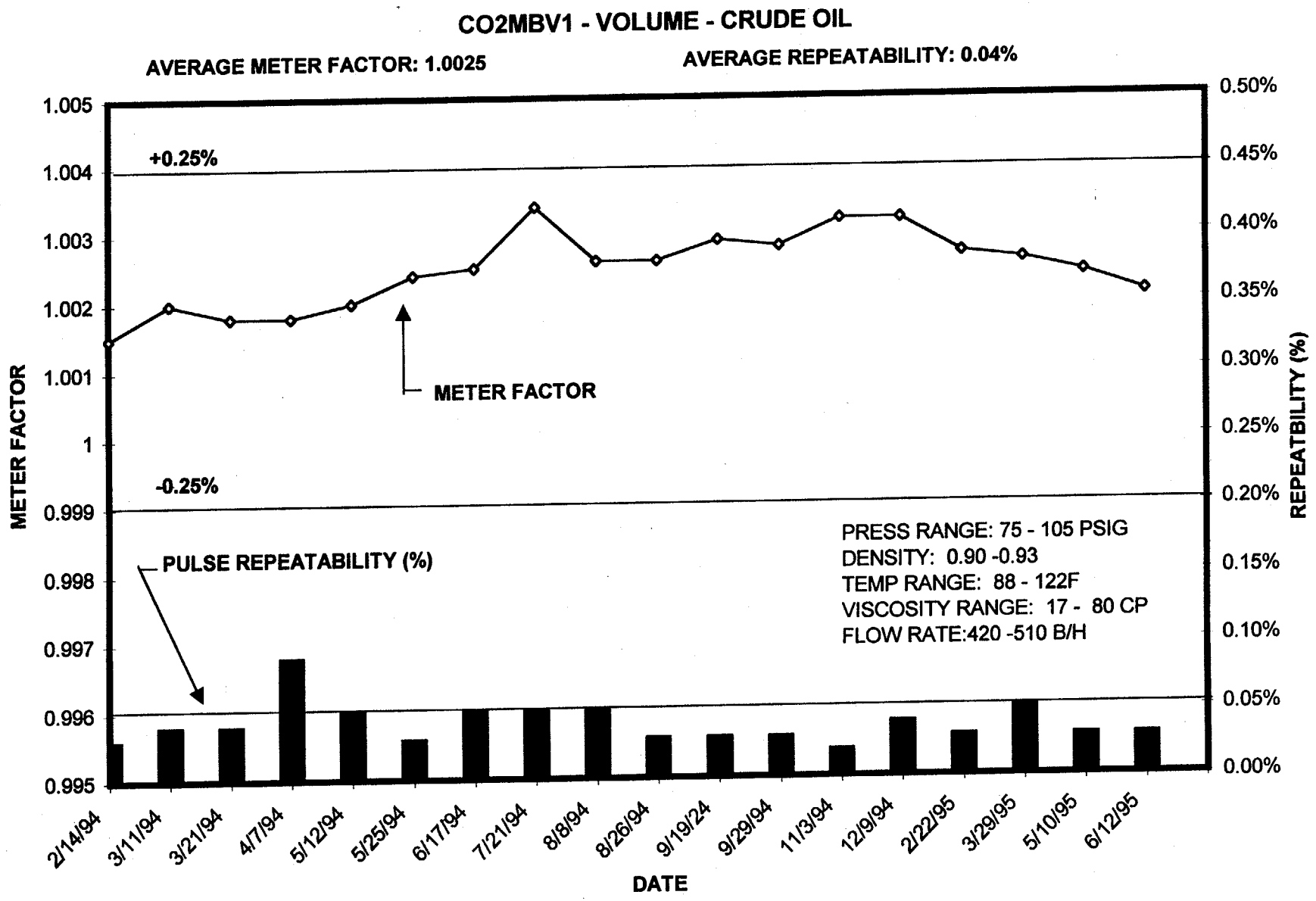

CO1MBV3 - NGL - VOLUME
AVERAGE METER FACTOR: 1.0092 / DENSITY: 0.540 KG/M3
TEMP. RANGE: 15.5 TO 35.1C
PRESS. RANGE: 5900 - 8200 kPa
FLOWRATE RANGE: 149.5 - 196.8 M3/HR.
VISCOSITY: 0.18 TO 0.30 CP.
+0.25%
AVE. M.F.: 1.0085
METER FACTOR
-0.25%
PULSE REPEATABILITY
METER FACTOR
1.02
1.019
1.018
1.017
1.016
1.015
1.014
1.013
1.012
1.011
1.01
1.009
1.008
1.007
1.006
1.005
1.004
1.003
1.002
1.001
1
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
2/22/96
6/7/96
6/7/96
8/15/96
10/11/96
11/19/96
12/10/96
DATE

Volume Meter Factor Control Chart

Company No.2 / Meter Type B / V1
Meter Size: 3 inch
Fluid:Crude Oil / Density 0.900 to 0.930
Viscosity: 17 to 80 cp (88F to 122F)
Conventional Pipe Prover

Proving Date	Mtr. factor	Rep'ty	Temp.(F)	PSIG	BPR	% Max F.R.	S.G.U.
2/14/94	1.0015	0.03%	87	100	422	22.3	0.9033
3/11/94	1.0020	0.04%	91	100	505	26.5	0.8998
3/21/94	1.0018	0.04%	93	112	422	22.2	0.9010
4/7/94	1.0018	0.09%	103	104	507	26.7	0.9010
5/12/94	1.0020	0.05%	105	80	504	27.0	0.9181
5/25/94	1.0024	0.03%	112	85	505	27.2	0.9214
6/17/94	1.0025	0.05%	115	82	506	27.1	0.9155
7/21/94	1.0034	0.05%	122	85	422	22.9	0.9292
8/8/94	1.0026	0.05%	121	105	420	22.5	0.9155
8/26/94	1.0026	0.03%	118	80	502	27.1	0.9253
9/19/24	1.0029	0.03%	114	92	423	22.8	0.9233
9/29/94	1.0028	0.03%	112	90	423	22.8	0.9233
11/3/94	1.0032	0.02%	96	80	482	25.7	0.9120
12/9/94	1.0032	0.04%	88	89	422	22.7	0.9209
2/22/95	1.0027	0.03%	91	90	422	22.8	0.9233
3/29/95	1.0026	0.05%	88	85	477	25.4	0.9120
5/10/95	1.0024	0.03%	98	85	473	25.4	0.9179
6/12/95	1.0021	0.03%	109	75	478	25.8	0.9227

AVERAGE:	1.0025	0.04%
RANGE:	0.0019	0.07%
STD. DEV.:	0.0005	0.02%


CO2MBV1 - VOLUME - CRUDE OIL
AVERAGE METER FACTOR: 1.0025
AVERAGE REPEATABILITY: 0.04%
METER FACTOR
REPEATBILITY (%)
+0.25%
-0.25%
METER FACTOR
PULSE REPEATABILITY (%)
PRESS RANGE: 75 - 105 PSIG
DENSITY: 0.90 -0.93
TEMP RANGE: 88 - 122F
VISCOSITY RANGE: 17 - 80 CP
FLOW RATE:420 -510 B/H
1.005
1.004
1.003
1.002
1.001
1
0.999
0.998
0.997
0.996
0.995
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
2/14/94
3/11/94
3/21/94
4/7/94
5/12/94
5/25/94
6/17/94
7/21/94
8/8/94
8/26/94
9/19/24
9/29/94
11/3/94
12/9/94
2/22/95
3/29/95
5/10/95
6/12/95
DATE

Mass Meter Factor Control Chart

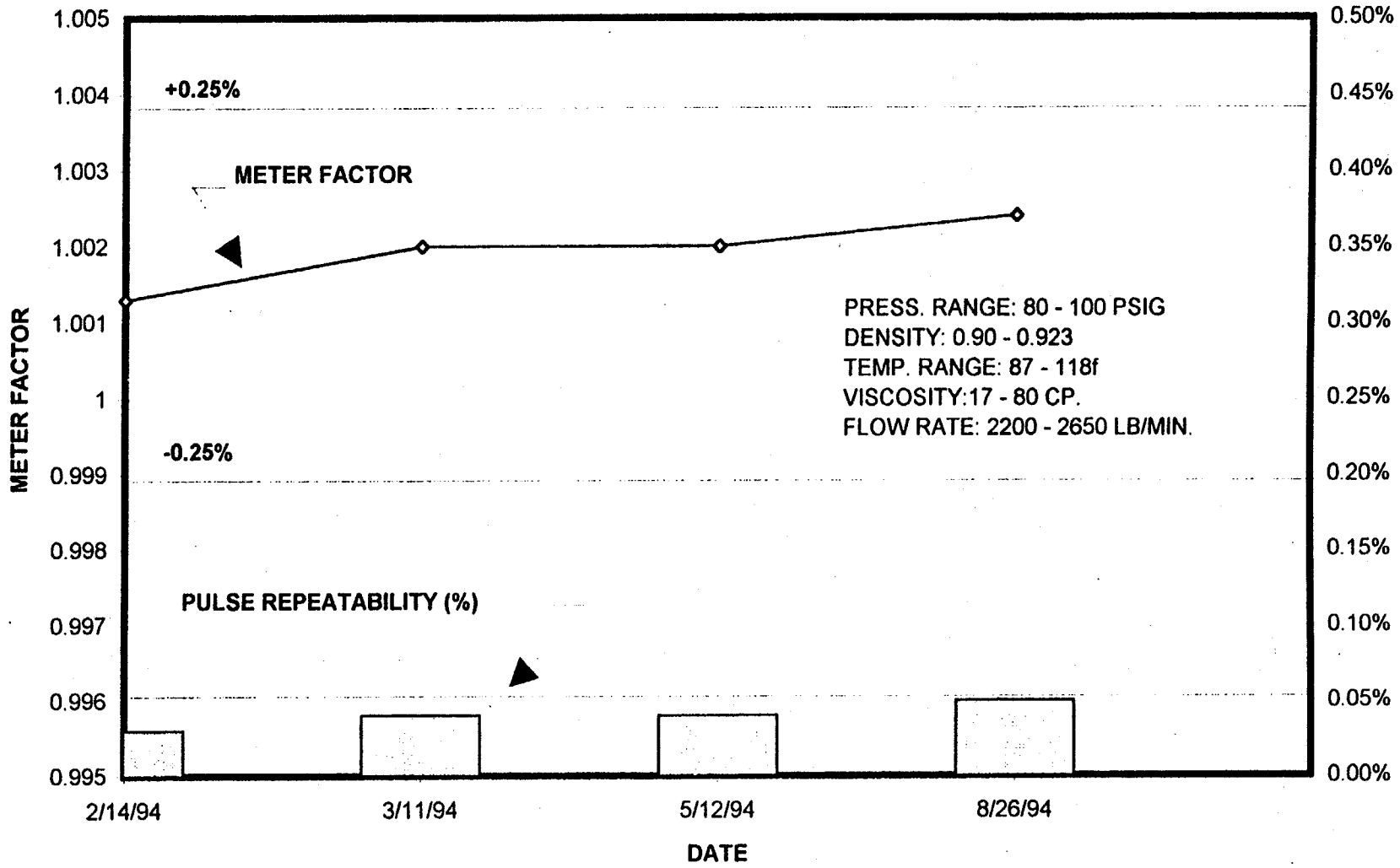
Company No. 2 / Meter Type B / M1
Fluid: Crude Oil / Density: 0.90 to 0.923
Viscosity: 17 to 80 cp.
Conventional Pipe Prover

Proving Date	Meter Factor	Pulse Rep'ty	Temp.	PSIG	LB/M	Density
2/14/94	1.0013	0.03%	87	100	2200	0.9033
3/11/94	1.0020	0.04%	91	100	2617	0.8998
5/12/94	1.0020	0.04%	104	80	2647	0.9181
8/26/94	1.0024	0.05%	118	80	2647	0.9239

AVERAGE:	1.0019	0.04%
RANGE:	0.0011	0.02%
STD. DEV:	0.0005	0.01%

CO2MB1 - MASS - CRUDE OIL

AVERAGE METER FACTOR: 1.0019 **AVERAGE REPEATABILITY: 0.04%**



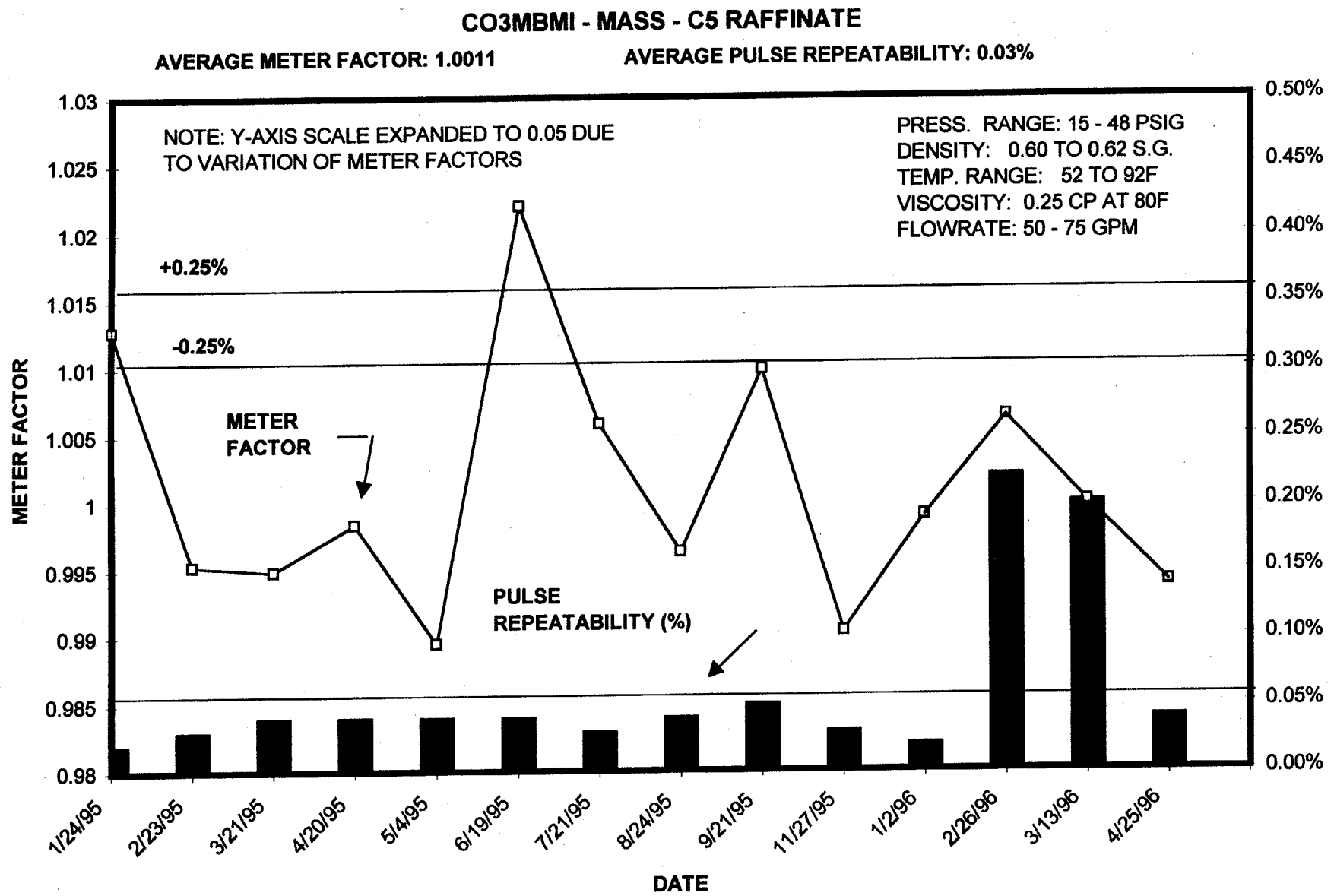
Mass Meter Factor Control Chart

Company No. 3 / Meter Type [illegible]
Meter Size: 1.5 Inch
Fluid: C5 / Density: [illegible]
Viscosity: [illegible] cp
Conventional Pipe Prover

Proving Date	K Factor	Deviation	Pulse Repty	Temp	Min	GPM	% Max FR	MMF
1/24/95	62.6252	1.28%	0.02%	52	40	63	11.5	1.0128
2/23/95	62.3337	0.47%	0.03%	63	43	52	9.5	0.9953
3/21/95	62.0168	0.51%	0.04%	71	48	61	11.1	0.9949
4/20/95	61.9192	0.16%	0.04%	79	40	50	9.1	0.9984
5/4/95	61.2693	1.06%	0.04%	92	18	63	11.5	0.9895
6/19/95	62.6167	2.15%	0.04%	82	25	72	13.1	1.0220
7/21/95	62.9874	0.59%	0.03%	88	25	55	10.0	1.0059
8/24/95	62.7547	0.37%	0.04%	83	20	68	12.4	0.9963
9/21/95	63.3768	0.98%	0.05%	85	25	76	13.8	1.0099
11/27/95	62.7659	0.97%	0.03%	71	20	70	12.7	0.9904
1/2/96	62.7026	0.10%	0.02%	61	15	65	11.8	0.9990
2/26/96	63.1059	0.64%	0.22%	79	15	58	10.5	1.0064
3/13/96	63.1051	0.01%	0.20%	70	20	80	14.5	1.0000
4/25/96	62.7260	0.64%	0.04%	75	10	70	12.7	0.9940

AVERAGE:	62.5932	0.71%	0.06%	1.0011
RANGE:	2.1075	2.1%	0.20%	0.0325
STD. DEV.:	0.55	0.56%	0.06%	0.0092

Note:(1) K Factor is in Pulses per pound
(2) Deviation is calculated from previous month factor

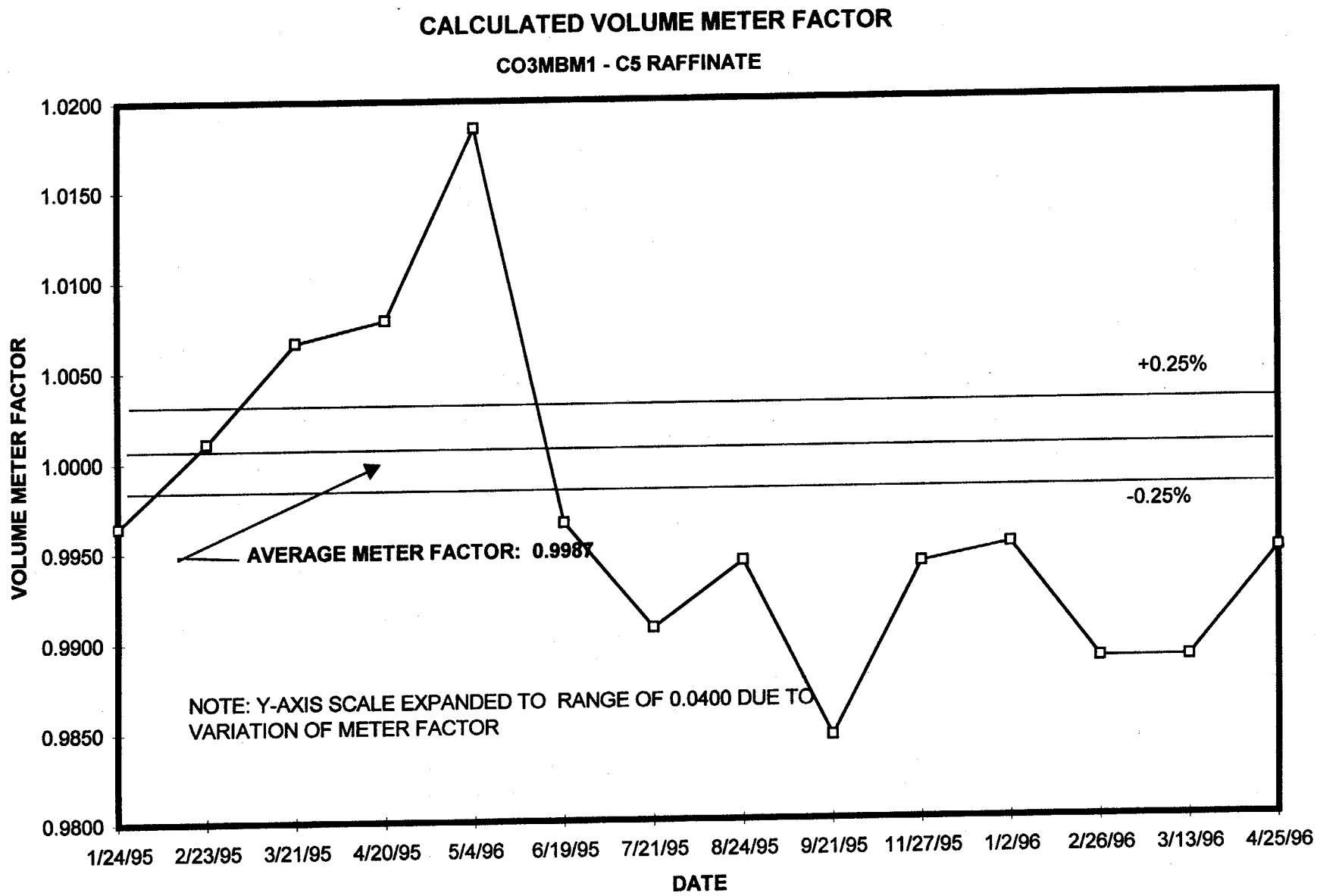

CO3MBMI - MASS - C5 RAFFINATE
AVERAGE METER FACTOR: 1.0011
AVERAGE PULSE REPEATABILITY: 0.03%
NOTE: Y-AXIS SCALE EXPANDED TO 0.05 DUE TO VARIATION OF METER FACTORS
PRESS. RANGE: 15 - 48 PSIG
DENSITY: 0.60 TO 0.62 S.G.
TEMP. RANGE: 52 TO 92F
VISCOSITY: 0.25 CP AT 80F
FLOWRATE: 50 - 75 GPM
+0.25%
-0.25%
METER FACTOR
PULSE REPEATABILITY (%)
METER FACTOR
1.03
1.025
1.02
1.015
1.01
1.005
1
0.995
0.99
0.985
0.98
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
1/24/95
2/23/95
3/21/95
4/20/95
5/4/95
6/19/95
7/21/95
8/24/95
9/21/95
11/27/95
1/2/96
2/26/96
3/13/96
4/25/96
DATE

CALCULATED VOLUME METER FACTOR

Company No. 37 / Meter Type E / M1
Meter Size 2-6 inch
Fluid: Co Condnsate
Viscosity = 0.25 cp
Conventional Pipe Prover
VMF calculated from proving streams

Proving Date	VMF 1	VMF 2	VMF 3	VMF 4	VMF 5	AVE VMF	AVE. DENS
1/24/95	0.9964	0.9966	0.9964	0.9963	0.9964	0.9964	0.6224
2/23/95	1.0009	1.0010	1.0012	1.0012	1.0010	1.0011	0.6219
3/21/95	1.0067	1.0067	1.0067	1.0064	1.0064	1.0066	0.6202
4/20/95	1.0077	1.0077	1.0075	1.0080	1.0080	1.0078	0.6182
5/4/96	1.0188	1.0185	1.0185	1.0184	1.0181	1.0185	0.6176
6/19/95	0.9968	0.9967	0.9964	0.9965	0.9963	0.9965	0.6206
7/21/95	0.9907	0.9904	0.9910	0.9907	0.9905	0.9907	0.6060
8/24/95	0.9942	0.9943	0.9944	0.9942	0.9947	0.9944	0.6119
9/21/95	0.9848	0.9846	0.9842	0.9848	0.9847	0.9846	0.6066
11/27/95	0.9939	0.9943	0.9943	0.9942	0.9942	0.9942	0.6136
1/2/96	0.9950	0.9952	0.9952	0.9952	0.9953	0.9952	0.6198
2/26/96						0.9888	0.5977
3/13/96	0.9891	0.9885	0.9882	0.9898	0.9901	0.9888	0.6945
4/25/96	0.9946	0.9950	0.9949	0.9946	0.9949	0.9948	0.6102

AVERAGE:	0.9970	0.6201
MAX:	1.0185	0.6945
MIN:	0.9846	0.5977
RANGE:	0.0338	0.0968
STD DEV:	0.0089	0.0226


CALCULATED VOLUME METER FACTOR
CO3MBM1 - C5 RAFFINATE
VOLUME METER FACTOR
1.0200
1.0150
1.0100
1.0050
1.0000
0.9950
0.9900
0.9850
0.9800
+0.25%
-0.25%
AVERAGE METER FACTOR: 0.9987
NOTE: Y-AXIS SCALE EXPANDED TO RANGE OF 0.0400 DUE TO VARIATION OF METER FACTOR
1/24/95
2/23/95
3/21/95
4/20/95
5/4/96
6/19/95
7/21/95
8/24/95
9/21/95
11/27/95
1/2/96
2/26/96
3/13/96
4/25/96
DATE

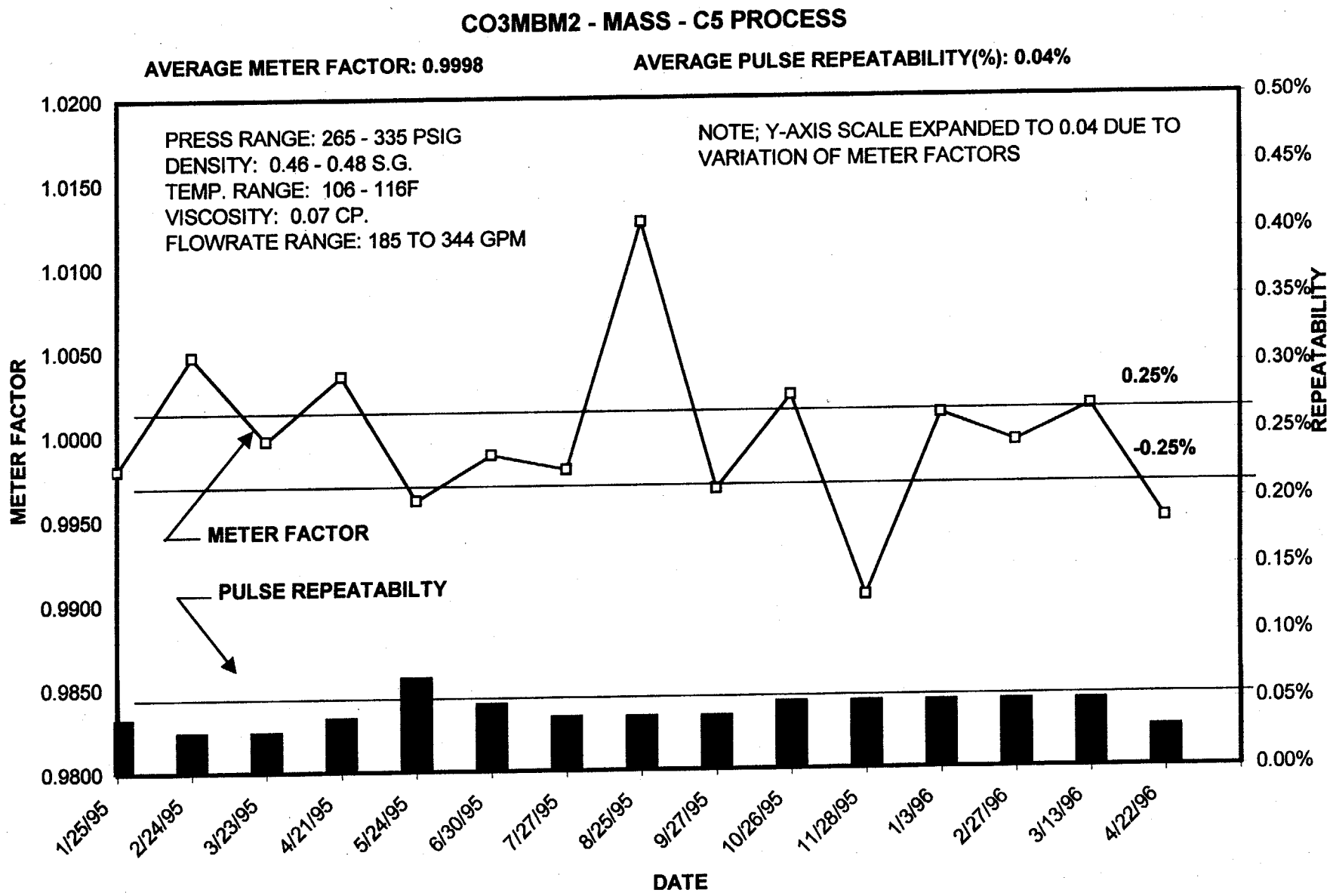
Mass Meter Factor Control Chart

Company No. 3 / Meter Type [illegible]
Meter Size: 3 Inch
Fluid: C5 Process / Density [illegible]
Viscosity: 0.07 cp
Mass Proving using [illegible]
Density from meter [illegible]

Proving Date	K Factor	Deviation	Pulse Reply	Temp.	Press.	GPM	% Max FR	MMF
1/25/95	28.4810	0.20%	0.04%	113	335	344	19.3	0.9980
2/24/95	28.6142	0.47%	0.03%	115	315	330	18.5	1.0047
3/23/95	28.6068	0.03%	0.03%	115	295	270	15.1	0.9997
4/21/95	28.7078	0.35%	0.04%	115	280	220	12.3	1.0035
5/24/95	28.5956	0.39%	0.07%	116	295	265	14.8	0.9961
6/30/95	28.5613	0.12%	0.05%	116	295	271	15.2	0.9988
7/27/95	28.5021	0.21%	0.04%	115	355	342	19.2	0.9979
8/25/95	28.8613	1.24%	0.04%	116	310	296	16.6	1.0126
9/27/95	28.7660	0.33%	0.04%	109	275	220	12.3	0.9967
10/26/95	28.8295	0.22%	0.05%	110	265	185	10.4	1.0022
11/28/95	28.5503	0.98%	0.05%	114	290	270	15.1	0.9903
1/3/96	28.5826	0.11%	0.05%	106	275	275	15.4	1.0011
2/27/96	28.5664	0.06%	0.05%	112	320	305	17.1	0.9994
3/13/96	28.6094	0.15%	0.05%	114	305	300	16.8	1.0015
4/22/96	28.4612	0.52%	0.03%	114	310	310	17.4	0.9948

AVERAGE:	28.6197	0.36%	0.04%	0.9998
RANGE:	0.4001	1.21%	0.04%	0.0223
STD.DEV.:	0.1204	0.34%	0.01%	0.0051

Note:(1) K Factor is in Pulses per pound
(2) Deviation is calculated from previous month factor


CO3MBM2 - MASS - C5 PROCESS
AVERAGE METER FACTOR: 0.9998
AVERAGE PULSE REPEATABILITY(%): 0.04%
PRESS RANGE: 265 - 335 PSIG
DENSITY: 0.46 - 0.48 S.G.
TEMP. RANGE: 106 - 116F
VISCOSITY: 0.07 CP.
FLOWRATE RANGE: 185 TO 344 GPM
NOTE; Y-AXIS SCALE EXPANDED TO 0.04 DUE TO VARIATION OF METER FACTORS
METER FACTOR
PULSE REPEATABILTY
0.25%
-0.25%
METER FACTOR
REPEATABILITY
1.0200
1.0150
1.0100
1.0050
1.0000
0.9950
0.9900
0.9850
0.9800
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
1/25/95
2/24/95
3/23/95
4/21/95
5/24/95
6/30/95
7/27/95
8/25/95
9/27/95
10/26/95
11/28/95
1/3/96
2/27/96
3/13/96
4/22/96
DATE

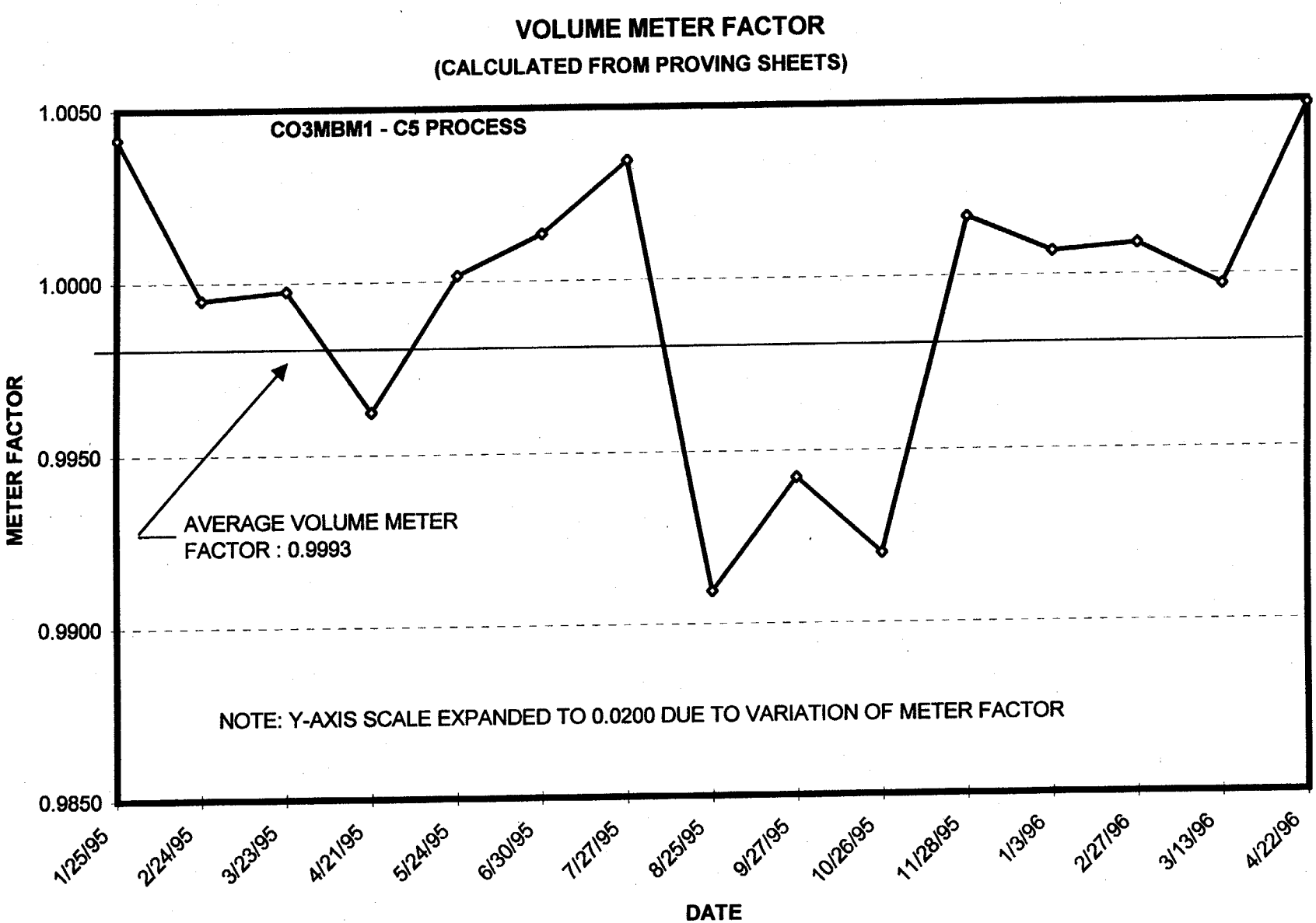
Calculated Volume Meter Factor

Company No. 3 / Meter Type [illegible]
Meter Size: 3 inch
Fluid: [illegible]
Viscosity: [illegible] cp
Conventional Pipe Pro[illegible]

Proving Date	VMF-1	VMF-2	VMF-3	VMF-4	VMF-5	AVE. VMF	AVE. DENS.
1/25/95	1.0040	1.0041	1.0041	1.0044	1.0042	1.0042	0.4709
2/24/95	0.9994	0.9998	0.9993	0.9992	0.9998	0.9995	0.4679
3/23/95	0.9997	0.9997	0.9997	0.9999	0.9998	0.9998	0.4673
4/21/95	0.9962	0.9962	0.9963	0.9961	0.9964	0.9962	0.4676
5/24/95	1.0000	1.0005	1.0003	1.0000	1.0001	1.0002	0.4670
6/30/95	1.0016	1.0012	1.0011	1.0011	1.0018	1.0014	0.4664
7/27/95	1.0029	1.0035	1.0036	1.0034	1.0039	1.0035	0.4684
8/25/95	0.9912	0.9909	0.9913	0.9907	0.9907	0.9910	0.4671
9/27/95	0.9940	0.9937	0.9943	0.9946	0.9946	0.9942	0.4737
10/26/95	0.9917	0.9917	0.9924	0.9922	0.9922	0.9920	0.4713
11/28/95	1.0015	1.0019	1.0021	1.0015	1.0016	1.0017	0.4676
1/3/96	1.0005	1.0001	1.0007	1.0010	1.0008	1.0007	0.4774
2/27/96	1.0009	1.0011	1.0011	1.0014	1.0016	1.0009	0.4709
3/13/96	1.0002	0.9998	0.9997	0.9996	0.9991	0.9997	0.4698
4/22/96	1.0051	1.0050	1.0047	1.0048	1.0047	1.0049	0.4693

AVERAGE :	0.9993	0.4695
MAX	1.0049	0.4774
MIN	0.9910	0.4664
RANGE	0.0139	0.0110
STDDEV	0.0042	0.0030

NOTE: The above meter factors were calculated assuming a K Factor of 28.6 pulses per Lb.

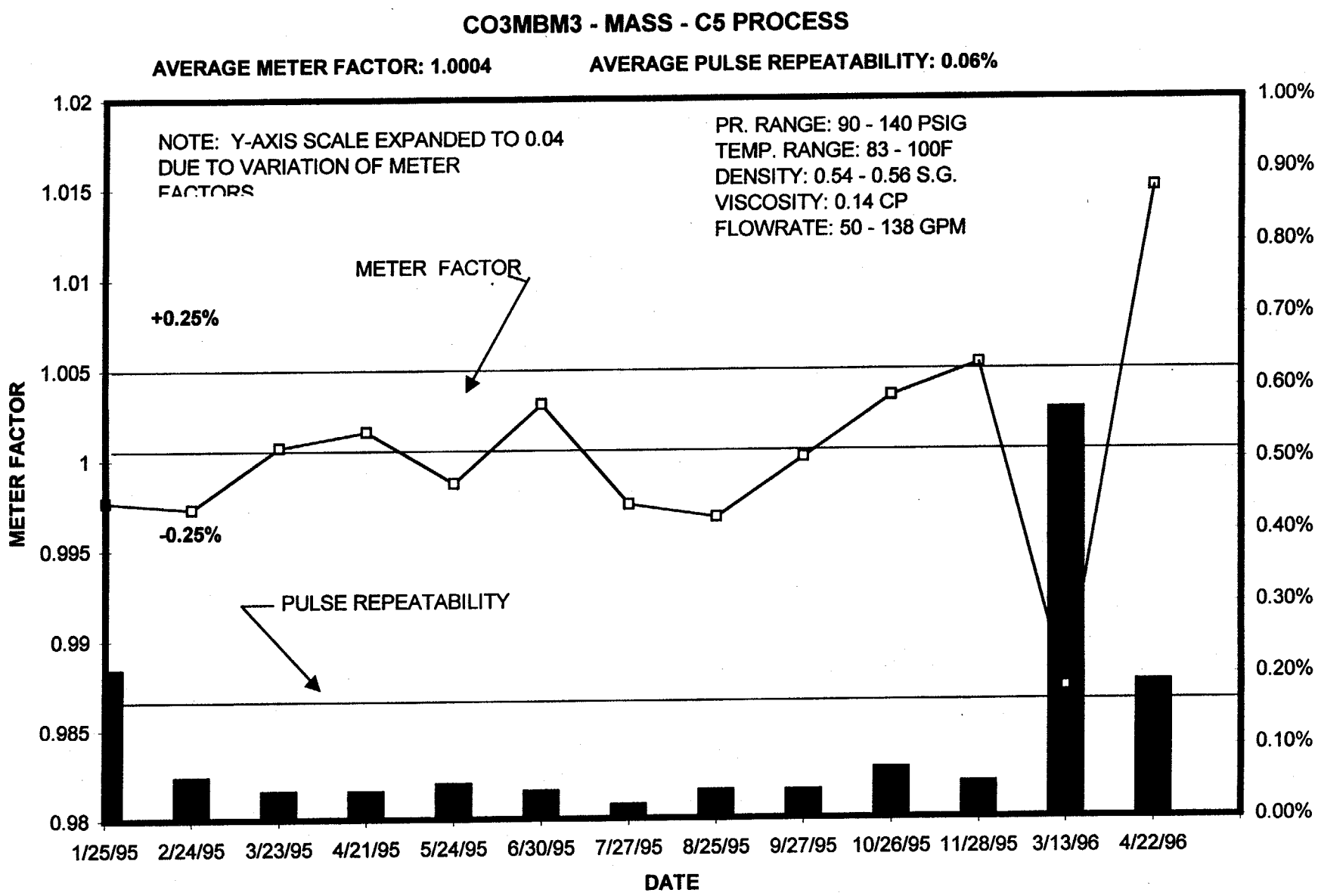

VOLUME METER FACTOR
(CALCULATED FROM PROVING SHEETS)
CO3MBM1 - C5 PROCESS
1.0050
1.0000
0.9950
0.9900
0.9850
METER FACTOR
AVERAGE VOLUME METER
FACTOR : 0.9993
NOTE: Y-AXIS SCALE EXPANDED TO 0.0200 DUE TO VARIATION OF METER FACTOR
1/25/95
2/24/95
3/23/95
4/21/95
5/24/95
6/30/95
7/27/95
8/25/95
9/27/95
10/26/95
11/28/95
1/3/96
2/27/96
3/13/96
4/22/96
DATE

Mass Meter Factor Control Chart

Company No. 3 / Meter Type B / M3
Meter Size: 3 Inch
Fluid: C5 Process / [illegible]
Viscosity: 0.14 cp
Mass Proving using [illegible]
Density from meter

Proving Date	K Factor	Deviation	Pulse Rep'ty	Temp.	Press.	GPM	% Max FR	MMF
1/25/95	59.1124		0.21%	85	135	138	9.048364	0.9977
2/24/95	58.9557	0.27%	0.06%	83	130	65		0.9973
3/23/95	58.9985	0.07%	0.04%	93	135	82		1.0007
4/21/95	59.0934	0.16%	0.04%	93	128	86		1.0016
5/24/95	59.0164	0.13%	0.05%	92	125	50		0.9987
6/30/95	59.1993	0.31%	0.04%	94	130	70		1.0031
7/27/95	59.0537	0.25%	0.02%	100	90	70		0.9975
8/25/95	58.8673	0.32%	0.04%	96	140	55		0.9968
9/27/95	58.8741	0.01%	0.04%	89	135	60		1.0001
10/26/95	59.0803	0.35%	0.07%	88	125	43		1.0035
11/28/95	59.3935	0.52%	0.05%	86	120	65		1.0053
3/13/96	58.6381	1.28%	0.57%	95	120	65		0.9873
4/22/96	59.5180	1.48%	0.19%	92	125	55		1.0150
AVERAGE:	59.0616	0.43%	0.11%					1.00035
RANGE:	0.8799	1.47%	0.55%					0.0277
STD. DEV.:	0.2256	0.47%	0.15%					0.00625

Note:(1) K Factor is in Pulses per pound
(2) Deviation is calculated from previous month factor


CO3MBM3 - MASS - C5 PROCESS
AVERAGE METER FACTOR: 1.0004
AVERAGE PULSE REPEATABILITY: 0.06%
NOTE: Y-AXIS SCALE EXPANDED TO 0.04 DUE TO VARIATION OF METER FACTORS
PR. RANGE: 90 - 140 PSIG
TEMP. RANGE: 83 - 100F
DENSITY: 0.54 - 0.56 S.G.
VISCOSITY: 0.14 CP
FLOWRATE: 50 - 138 GPM
METER FACTOR
+0.25%
-0.25%
PULSE REPEATABILITY
METER FACTOR
1.02
1.015
1.01
1.005
1
0.995
0.99
0.985
0.98
1.00%
0.90%
0.80%
0.70%
0.60%
0.50%
0.40%
0.30%
0.20%
0.10%
0.00%
1/25/95
2/24/95
3/23/95
4/21/95
5/24/95
6/30/95
7/27/95
8/25/95
9/27/95
10/26/95
11/28/95
3/13/96
4/22/96
DATE

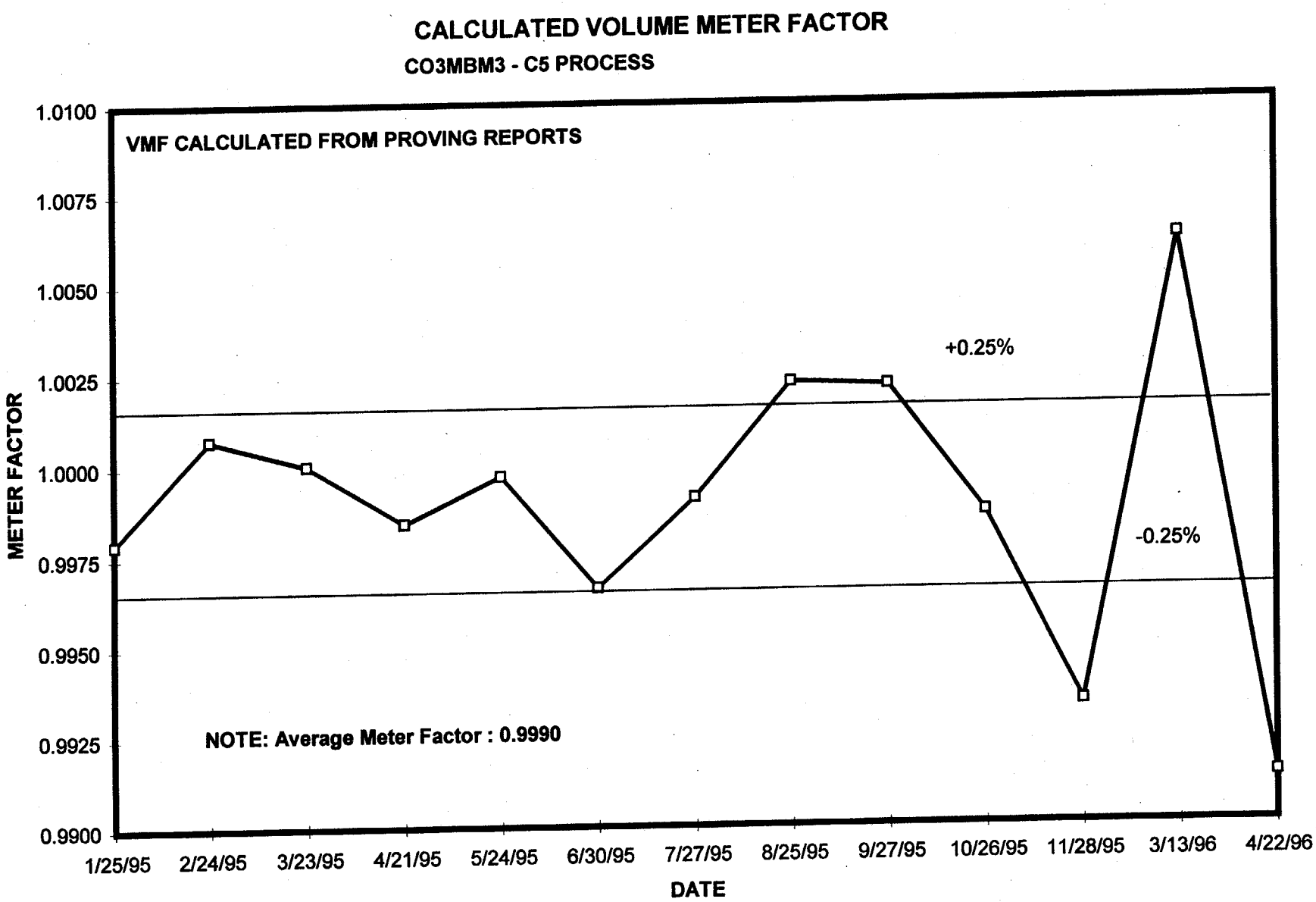
Calculated Volume Meter Factor

Company No. 3 / Meter Type B / M3
Meter Size: 3 inch
Fluid: Oil Process / Density: 0.8410 - 0.8750
Viscosity: 1.14 cp
Mass Proving using Conventional Prover
Density from Meter

Proving Date	VMF-1	VMF-2	VMF-3	VMF-4	VMF-5	AVE. VMF	AVE. DENS.
1/25/95	0.9955	0.9977	0.9984	0.9994	0.9986	0.9979	0.5596
2/24/95	1.0001	1.0005	1.0008	1.0010	1.0014	1.0008	0.5564
3/23/95	1.0000	1.0002	1.0002	1.0001	0.9997	1.0000	0.5585
4/21/95	0.9980	0.9985	0.9986	0.9986	0.9985	0.9984	0.5550
5/24/95	1.0004	1.0006	0.9992	0.9992	0.9992	0.9997	0.5547
6/30/95	0.9960	0.9963	0.9969	0.9972	0.9967	0.9966	0.5563
7/27/95	0.9997	0.9993	0.9988	0.9989	0.9988	0.9991	0.5504
8/25/95	1.0021	1.0023	1.0021	1.0024	1.0023	1.0022	0.5551
9/27/95	1.0019	1.0022	1.0024	1.0020	1.0022	1.0021	0.5446
10/26/95	0.9986	0.9984	0.9984	0.9988	0.9990	0.9986	0.5516
11/28/95	0.9933	0.9936	0.9930	0.9933	0.9936	0.9934	0.5532
3/13/96	1.0076	1.0073	1.0034	1.0043	1.0083	1.0062	0.5512
4/22/96	0.9920	0.9905	0.9922	0.9914	0.9904	0.9913	0.5483

AVERAGE:	0.9990	0.5535
MAX:	1.0062	0.5596
MIN:	0.9913	0.5446
RANGE:	0.0149	0.0150
STD.DEV:	0.0038	0.0042

NOTE: The above meter factors were calculated assuming a K Factor of 59 Pulses per pound.

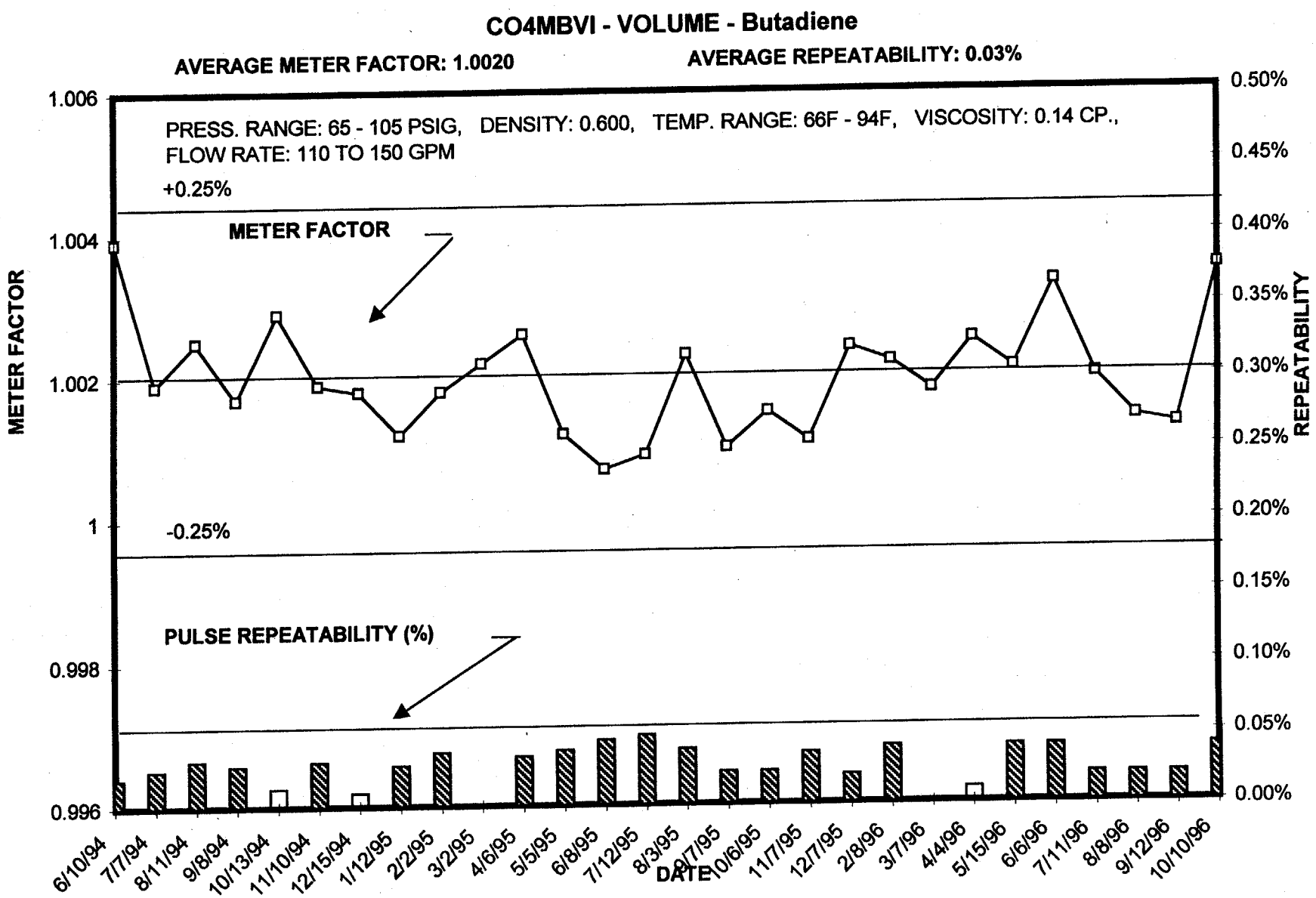

CALCULATED VOLUME METER FACTOR
CO3MBM3 - C5 PROCESS
VMF CALCULATED FROM PROVING REPORTS
+0.25%
-0.25%
NOTE: Average Meter Factor : 0.9990
METER FACTOR
1.0100
1.0075
1.0050
1.0025
1.0000
0.9975
0.9950
0.9925
0.9900
1/25/95
2/24/95
3/23/95
4/21/95
5/24/95
6/30/95
7/27/95
8/25/95
9/27/95
10/26/95
11/28/95
3/13/96
4/22/96
DATE

Volume Meter Factor Control Chart

Company No. 4 / Meter Type B / V1
Meter Size: 3 inch
Fluid: Butadiene / Density: [illegible]
Viscosity: 0.14 cp
Conventional Pipe Proven

Proving Date	Meter Factor	Pulse Rep'ty	Temp (F)	psig	GPM	% Max. F.R.
6/10/94	1.0039	0.02%	91F	85	123	6.2
7/7/94	1.0019	0.03%	90F	95	137	6.9
8/11/94	1.0025	0.03%	86F	105	143	7.2
9/8/94	1.0017	0.03%	85F	105	122	6.1
10/13/94	1.0029	0.01%	79F	85	122	6.1
11/10/94	1.0019	0.03%	74F	80	132	6.6
12/15/94	1.0018	0.01%	70F	70	121	6.1
1/12/95	1.0012	0.03%	78F	90	156	7.8
2/2/95	1.0018	0.04%	67F	90	148	7.4
3/2/95	1.0022					
4/6/95	1.0026	0.04%	67F	60	113	5.7
5/5/95	1.0012	0.04%	85F	95	103	5.2
6/8/95	1.0007	0.05%	91F	80	150	7.5
7/12/95	1.0009	0.05%	92F	100	139	7.0
8/3/95	1.0023	0.04%	91F	95	135	6.8
9/7/95	1.0010	0.02%	94F	80	137	6.9
10/6/95	1.0015	0.02%	81F	75	134	6.7
11/7/95	1.0011	0.04%	84F	80	142	7.1
12/7/95	1.0024	0.02%	73F	65	110	5.5
2/8/96	1.0022	0.04%	66F	75	138	6.9
3/7/96	1.0018					
4/4/96	1.0025	0.01%	78F	75	138	6.9
5/15/96	1.0021	0.04%	87F	75	125	6.3
6/6/96	1.0033	0.04%	88F	75	116	5.8
7/11/96	1.0020	0.02%	91F	100	161	8.1
8/8/96	1.0014	0.02%	95F	110	161	8.1
9/12/96	1.0013	0.02%	92F	110	159	8.0
10/10/96	1.0035	0.04%	85F	80	159	8.0

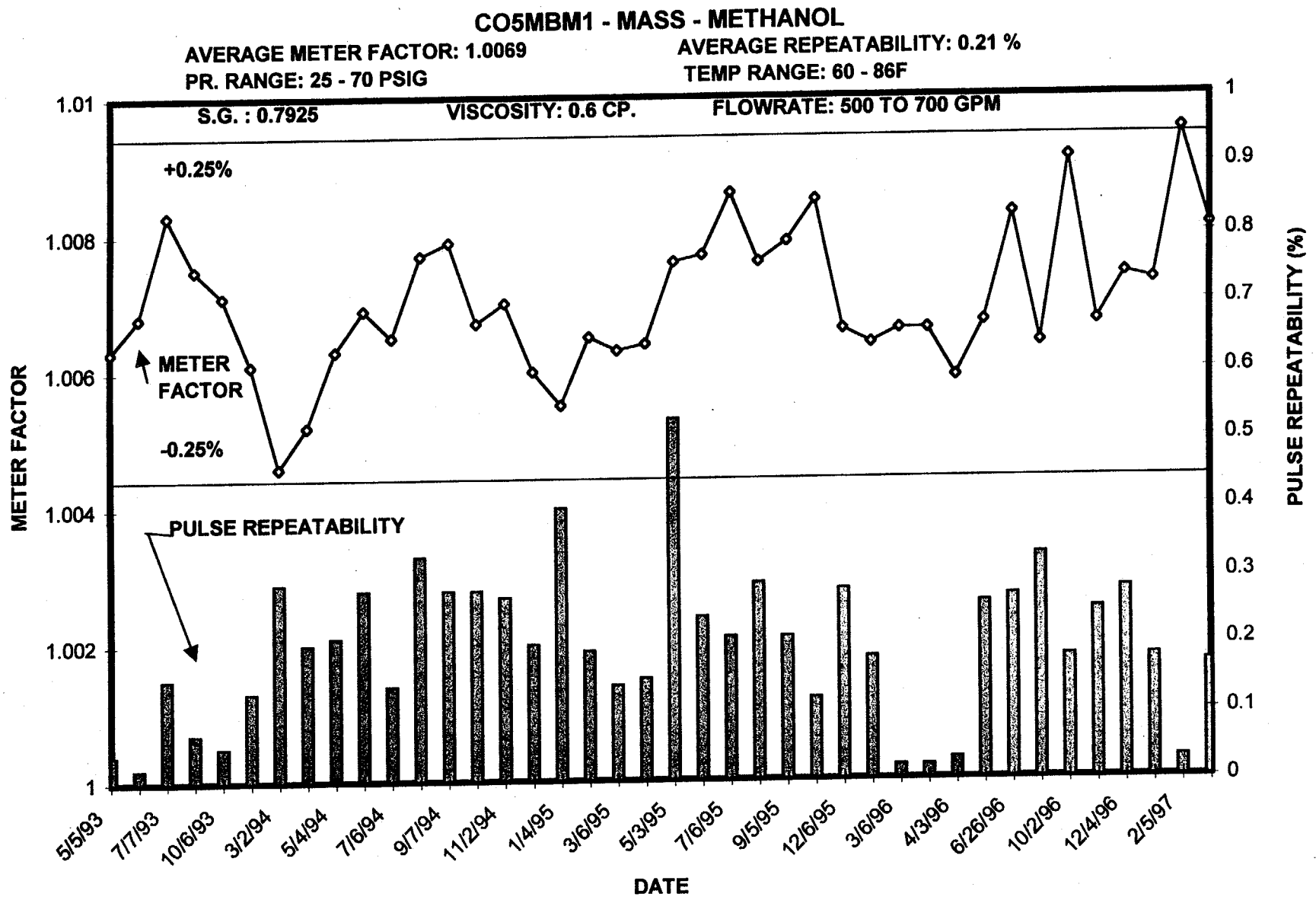
AVERAGE:	1.0020	0.03%
RANGE:	0.0032	0.04%
STD. DEV:	0.0008	0.01%


CO4MBVI - VOLUME - Butadiene
AVERAGE METER FACTOR: 1.0020
AVERAGE REPEATABILITY: 0.03%
PRESS. RANGE: 65 - 105 PSIG, DENSITY: 0.600, TEMP. RANGE: 66F - 94F, VISCOSITY: 0.14 CP.,
FLOW RATE: 110 TO 150 GPM
+0.25%
METER FACTOR
-0.25%
PULSE REPEATABILITY (%)
METER FACTOR
REPEATABILITY
1.006
1.004
1.002
1
0.998
0.996
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
6/10/94
7/7/94
8/11/94
9/8/94
10/13/94
11/10/94
12/15/94
1/12/95
2/2/95
3/2/95
4/6/95
5/5/95
6/8/95
7/12/95
8/3/95
9/7/95
10/6/95
11/7/95
12/7/95
2/8/96
3/7/96
4/4/96
5/15/96
6/6/96
7/11/96
8/8/96
9/12/96
10/10/96
DATE

Mass Meter Factor Control Chart

Company No: 57 Meter Type: B / M1
Meter Size: 3 Inch
Fluid: Methanol / Density: 0.7925
Viscosity: 0.6 cp @ 60F
Conversion: 2.5 Square

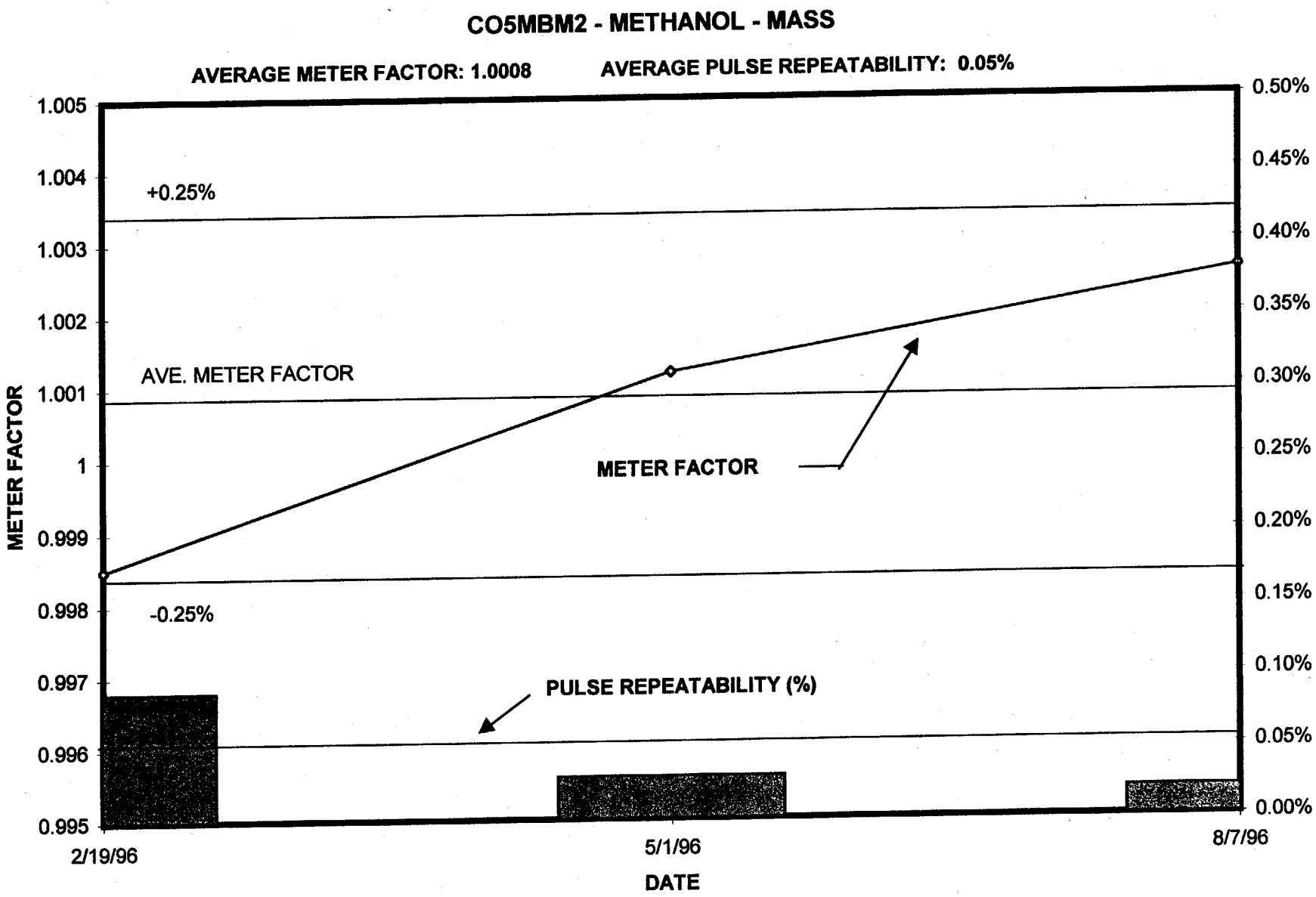
Proving Date	Meter Factors	Pulses Rec'vd	Temp (F)	psig	GPM	% Max R.R.
5/5/93	1.0063	0.04	74	65	608	57.4
6/2/93	1.0068	0.02	77	72	672	63.5
7/7/93	1.0083	0.15	82	68	640	60.5
8/27/93	1.0075	0.07	84	70	600	56.7
10/6/93	1.0071	0.05	82	40	707	66.8
12/1/93	1.0061	0.13	67	30	701	66.2
3/2/94	1.0046	0.29	61	25	701	66.2
4/14/94	1.0052	0.20	72	28	706	66.7
5/4/94	1.0063	0.21	73	35	704	66.5
6/1/94	1.0069	0.28	80	45	692	65.4
7/6/94	1.0065	0.14	85	40	698	65.9
8/3/94	1.0077	0.33	85	40	693	65.5
9/7/94	1.0079	0.28	85	45	686	64.8
10/5/94	1.0067	0.28	82	45	701	66.2
11/2/94	1.0070	0.27	77	45	683	64.5
12/7/94	1.0060	0.20	75	47	686	64.8
1/4/95	1.0055	0.40	60	45	675	63.8
2/1/95	1.0065	0.19	61	25	683	64.5
3/6/95	1.0063	0.14	65	30	671	63.4
4/5/95	1.0064	0.15	69	37	490	46.3
5/3/95	1.0076	0.53	75	45	681	64.3
6/7/95	1.0077	0.24	83	40	672	63.5
7/6/95	1.0086	0.21	86	40	652	61.6
8/2/95	1.0076	0.29	86	30	670	63.3
9/5/95	1.0079	0.21	84	35	674	63.7
11/1/95	1.0085	0.12	77	45	690	65.2
12/6/95	1.0066	0.28	74	35	685	64.7
1/24/96	1.0064	0.18	67	45	671	63.4
3/6/96	1.0066	0.02	69	50	680	64.2
4/3/96	1.0059	0.03	67	40	686	64.8
5/1/96	1.0067	0.26	72	35	670	63.3
6/26/96	1.0083	0.27	84	54	637	60.2
8/7/96	1.0064	0.33	87	30	678	64.1
10/2/96	1.0091	0.18	80	62	660	62.4
11/6/96	1.0067	0.25	78	30	655	61.9
12/4/96	1.0074	0.28	70	56	675	63.8
1/8/97	1.0073	0.18	62	30	682	64.4
2/5/97	1.0095	0.03	61	30	692	65.4
3/5/97	1.0081	0.17	67	30	670	63.3
AVERAGE	1.0070	0.20				
RANGE	0.0049	0.51				
STD. DEV.	0.0010	0.11				


CO5MBM1 - MASS - METHANOL
AVERAGE METER FACTOR: 1.0069
AVERAGE REPEATABILITY: 0.21 %
PR. RANGE: 25 - 70 PSIG
TEMP RANGE: 60 - 86F
S.G. : 0.7925
VISCOSITY: 0.6 CP.
FLOWRATE: 500 TO 700 GPM
+0.25%
METER FACTOR
-0.25%
PULSE REPEATABILITY
METER FACTOR
PULSE REPEATABILITY (%)
DATE
1.01
1.008
1.006
1.004
1.002
1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
5/5/93
7/7/93
10/6/93
3/2/94
5/4/94
7/6/94
9/7/94
11/2/94
1/4/95
3/6/95
5/3/95
7/6/95
9/5/95
12/6/95
3/6/96
4/3/96
6/26/96
10/2/96
12/4/96
2/5/97

Mass Meter Factor Control Chart

Company No. [illegible]
Meter Size [illegible]
Fluid [illegible]
Viscosity [illegible]
Corrosion [illegible]

Proving Date	Meter Factor	Pulse Rep'ty	[illegible]	[illegible]	[illegible]	% Max. E.R.
2/19/96	0.9985	0.09%	91	580	138	13.0
5/1/96	1.0012	0.03%	88	620	N.A.	N.A.
8/7/96	1.0026	0.02%	101	600	145	13.7
AVERAGE:	1.0008	0.05%				
RANGE:	0.0041	0.07%				
STD. DEV.:	0.0021	0.04%				

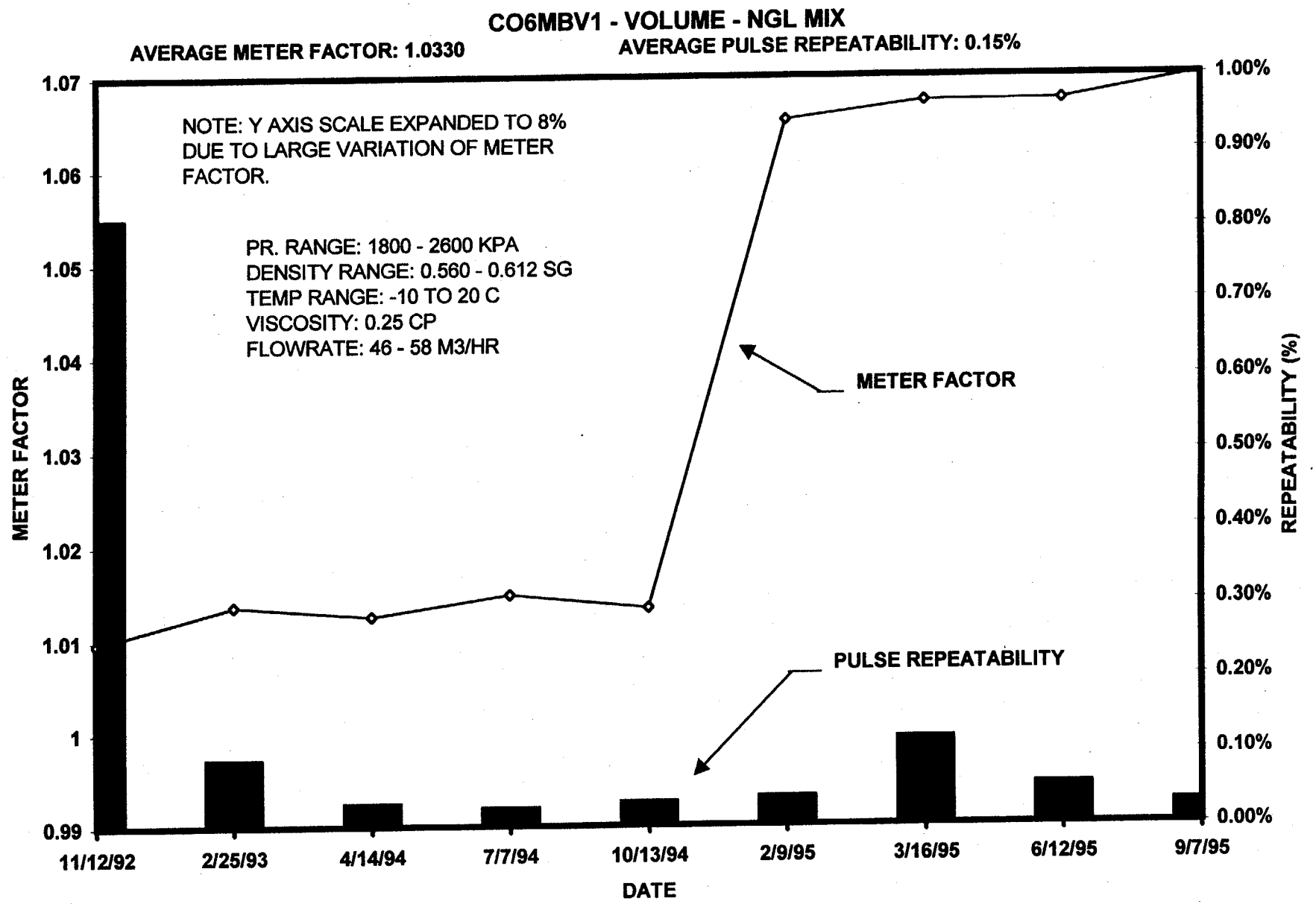

CO5MBM2 - METHANOL - MASS
AVERAGE METER FACTOR: 1.0008
AVERAGE PULSE REPEATABILITY: 0.05%
1.005
1.004
1.003
1.002
1.001
1
0.999
0.998
0.997
0.996
0.995
METER FACTOR
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
+0.25%
AVE. METER FACTOR
-0.25%
METER FACTOR
PULSE REPEATABILITY (%)
2/19/96
5/1/96
8/7/96
DATE

Volume Meter Factor Control Chart

Company No. 6 / Meter Type [illegible]
Meter Size: 3 inch
Fluid: NGL Mix [illegible]
Viscosity: 0.2 [illegible]
Conventional [illegible]

Proving Date	Meter Factor	Pulse Repty.	Temp. (C)	Pr. (kPa)	m3/hr	% Max FR
11/12/92	1.0097	0.81%	2.0	1793	N.A.	N.A.
2/25/93	1.0137	0.09%	-9.5	2475	49.5	14.4
4/14/94	1.0126	0.03%	3.0	2600	46.2	13.5
7/7/94	1.0148	0.02%	18.9	2500	58.0	16.9
10/13/94	1.0134	0.03%	9.4	2500	46.2	13.5
2/9/95	1.0653	0.04%	7.6	2400	54.5	15.9
3/16/95	1.0673	0.12%	7.0	2400	42.7	12.5
6/12/95	1.0674	0.05%	19.3	2320	51.3	15.0
9/7/95	1.0701	0.03%	16.4	2805	52.4	15.3

AVERAGE:	1.0371	0.14%
RANGE:	0.0604	0.79%
STD. DEV.:	0.0289	0.27%

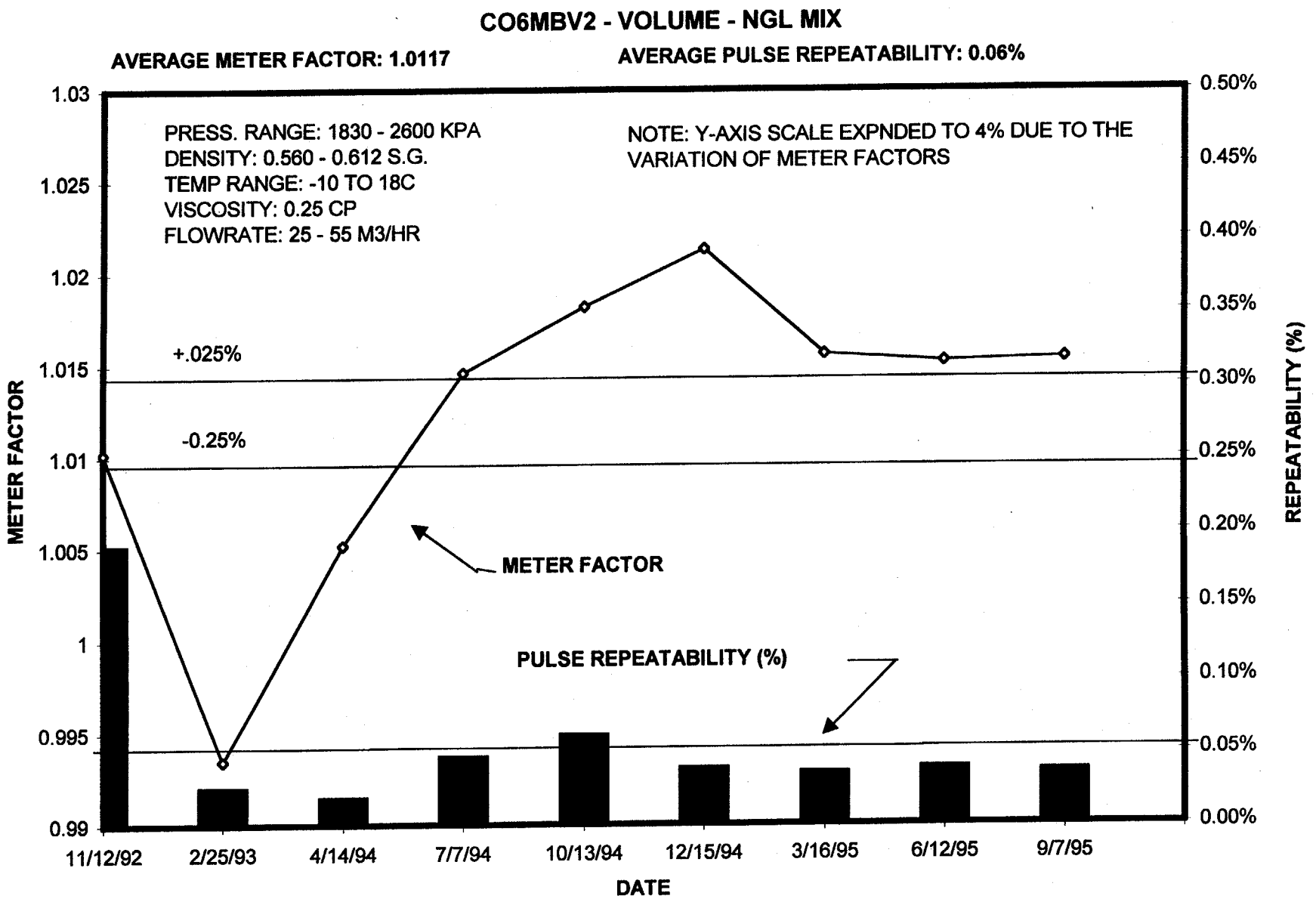

CO6MBV1 - VOLUME - NGL MIX
AVERAGE METER FACTOR: 1.0330
AVERAGE PULSE REPEATABILITY: 0.15%
NOTE: Y AXIS SCALE EXPANDED TO 8% DUE TO LARGE VARIATION OF METER FACTOR.
PR. RANGE: 1800 - 2600 KPA
DENSITY RANGE: 0.560 - 0.612 SG
TEMP RANGE: -10 TO 20 C
VISCOSITY: 0.25 CP
FLOWRATE: 46 - 58 M3/HR
METER FACTOR
PULSE REPEATABILITY
METER FACTOR
REPEATABILITY (%)
1.07
1.06
1.05
1.04
1.03
1.02
1.01
1
0.99
1.00%
0.90%
0.80%
0.70%
0.60%
0.50%
0.40%
0.30%
0.20%
0.10%
0.00%
11/12/92
2/25/93
4/14/94
7/7/94
10/13/94
2/9/95
3/16/95
6/12/95
9/7/95
DATE

Volume Meter Factor Control Chart

Company No. 6 / Meter Type B / V2
Meter Size: [illegible]
Fluid: [illegible]
Viscosity: [illegible]
Conventional Pipe [illegible]

Proving Date	Meter Factor	Pulse Rep'ty	Temp. C	Pr. (kPa)	m3/hr	% Max FR
11/12/92	1.0102	0.19%	2.6	1827	46.6	27.8
2/25/93	0.9935	0.03%	-4.6	2425	53.7	32.1
4/14/94	1.0052	0.02%	2.3	2600	25.2	15.0
7/7/94	1.0146	0.05%	18.2	2500	52.0	31.1
10/13/94	1.0182	0.06%	9.3	2500	46.9	28.0
12/15/94	1.0213	0.04%	-10.0	2500	54.5	32.5
3/16/95	1.0156	0.04%	6.7	2400	52.3	31.2
6/12/95	1.0152	0.04%	18.3	2510	44.8	26.8
9/7/95	1.0154	0.04%	15	2730	42.5	25.4

AVERAGE:	1.0121	0.06%
RANGE:	0.0278	0.17%
STD. DEV.:	0.0084	0.05%

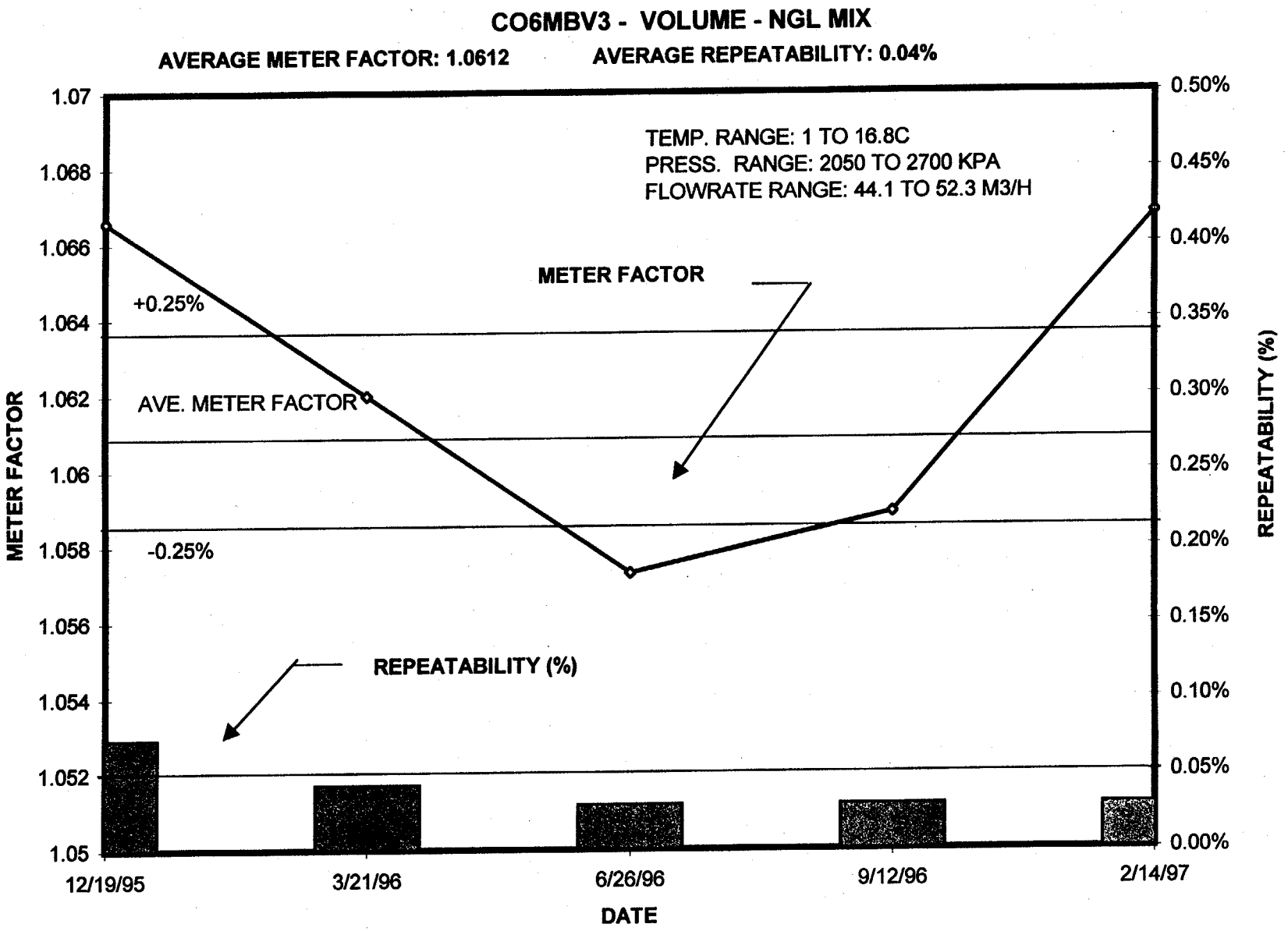

CO6MBV2 - VOLUME - NGL MIX
AVERAGE METER FACTOR: 1.0117
AVERAGE PULSE REPEATABILITY: 0.06%
PRESS. RANGE: 1830 - 2600 KPA
DENSITY: 0.560 - 0.612 S.G.
TEMP RANGE: -10 TO 18C
VISCOSITY: 0.25 CP
FLOWRATE: 25 - 55 M3/HR
NOTE: Y-AXIS SCALE EXPNDED TO 4% DUE TO THE VARIATION OF METER FACTORS
+.025%
-0.25%
METER FACTOR
PULSE REPEATABILITY (%)
METER FACTOR
REPEATABILITY (%)
DATE
1.03
1.025
1.02
1.015
1.01
1.005
1
0.995
0.99
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
11/12/92
2/25/93
4/14/94
7/7/94
10/13/94
12/15/94
3/16/95
6/12/95
9/7/95

Volume Meter Factor Control Chart

Company No. 6 / Meter Type [illegible]
Meter Size: [illegible]
Fluid: NGL [illegible]
Viscosity: [illegible]
Conventional [illegible]

Proving Date	Meter Factor	Pulse Repay	Temp. (C)	Pr. (kPa)	m3/hr	% Max FR
12/19/95	1.0666	0.07%	1	2400	44.1	12.9
3/21/96	1.0620	0.04%	-2.4	2700	51.2	14.9
6/26/96	1.0573	0.03%	16.1	2050	49.7	14.5
9/12/96	1.0589	0.03%	16.8	2450	52.3	15.3
2/14/97	1.0668	0.03%	1.5	2755	51.1	14.9

AVERAGE:	1.0623	0.04%
RANGE:	0.0095	0.04%
STD. DEV.:	0.0043	0.02%

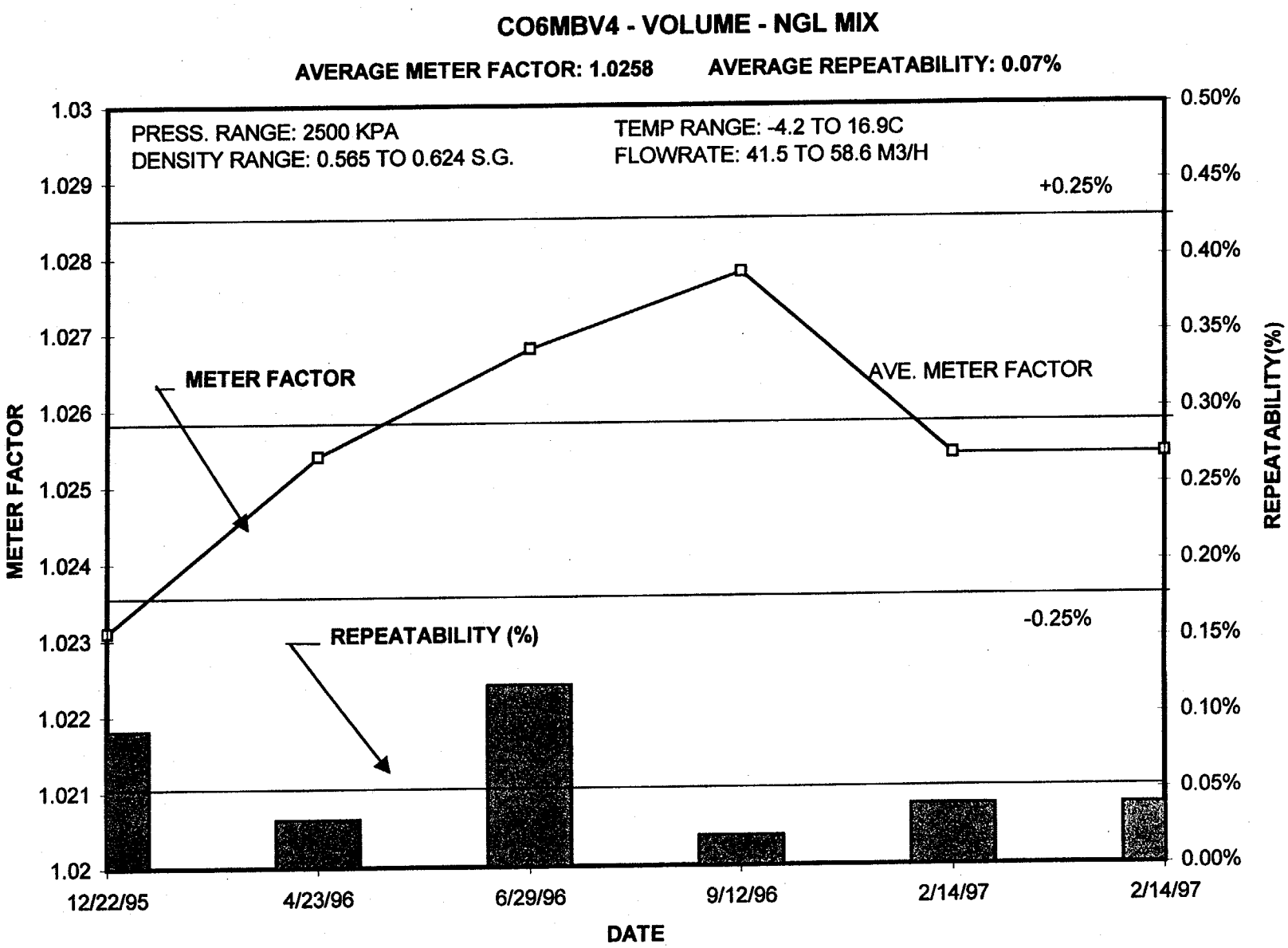

CO6MBV3 - VOLUME - NGL MIX
AVERAGE METER FACTOR: 1.0612
AVERAGE REPEATABILITY: 0.04%
TEMP. RANGE: 1 TO 16.8C
PRESS. RANGE: 2050 TO 2700 KPA
FLOWRATE RANGE: 44.1 TO 52.3 M3/H
METER FACTOR
+0.25%
AVE. METER FACTOR
-0.25%
REPEATABILITY (%)
METER FACTOR
REPEATABILITY (%)
1.07
1.068
1.066
1.064
1.062
1.06
1.058
1.056
1.054
1.052
1.05
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
12/19/95
3/21/96
6/26/96
9/12/96
2/14/97
DATE

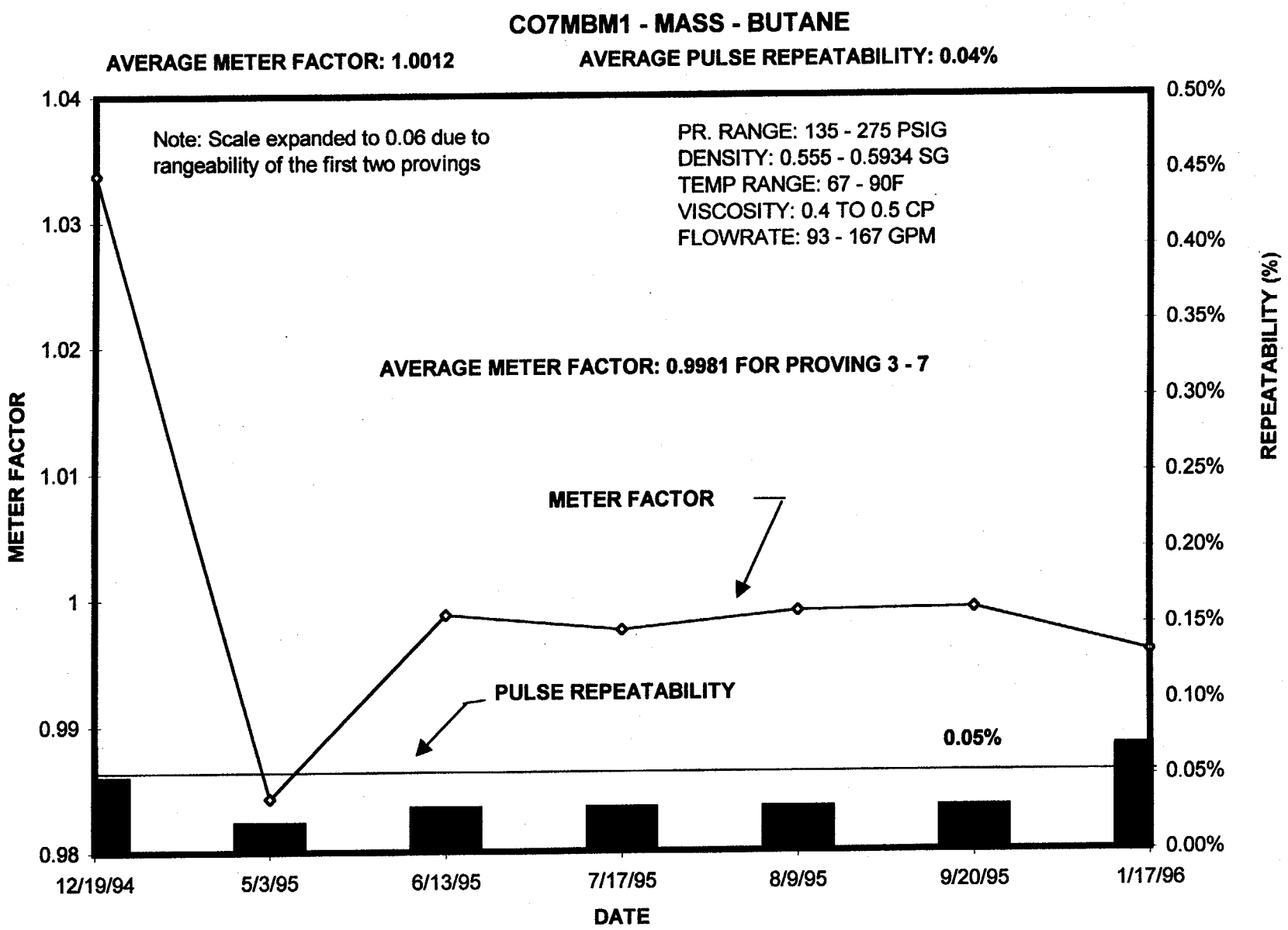
Volume Meter Factor Control Chart

Company No. 6 / Meter Type B / V4
Meter Size: 3 inch
Fluid: NGL Mix / Density [illegible]
Viscosity: [illegible] cp
Conventional Pipe Prov[illegible]

Proving Date	Meter Factor	Pulse Rep'ty	Temp. C	Pr. (kPa)	m3/hr	% Max FR
12/22/95	1.0231	0.09%	-4.2	2500	45.9	14.1
4/23/96	1.0254	0.03%	11.5	2500	41.5	12.7
6/29/96	1.0268	0.12%	14.1	2500	49.7	15.3
9/12/96	1.0278	0.02%	16.9	2500	58.6	18.0
2/14/97	1.0254	0.04%	0.8	2650	50.5	15.5
2/14/97	1.0254	0.04%	3.4	2650	44.3	13.6

AVERAGE:	1.0257	0.06%
RANGE:	0.0047	0.10%
STD. DEV.	0.0016	0.04%


CO6MBV4 - VOLUME - NGL MIX
AVERAGE METER FACTOR: 1.0258
AVERAGE REPEATABILITY: 0.07%
PRESS. RANGE: 2500 KPA
DENSITY RANGE: 0.565 TO 0.624 S.G.
TEMP RANGE: -4.2 TO 16.9C
FLOWRATE: 41.5 TO 58.6 M3/H
+0.25%
-0.25%
METER FACTOR
AVE. METER FACTOR
REPEATABILITY (%)
METER FACTOR
REPEATABILITY(%)
1.03
1.029
1.028
1.027
1.026
1.025
1.024
1.023
1.022
1.021
1.02
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
12/22/95
4/23/96
6/29/96
9/12/96
2/14/97
2/14/97
DATE

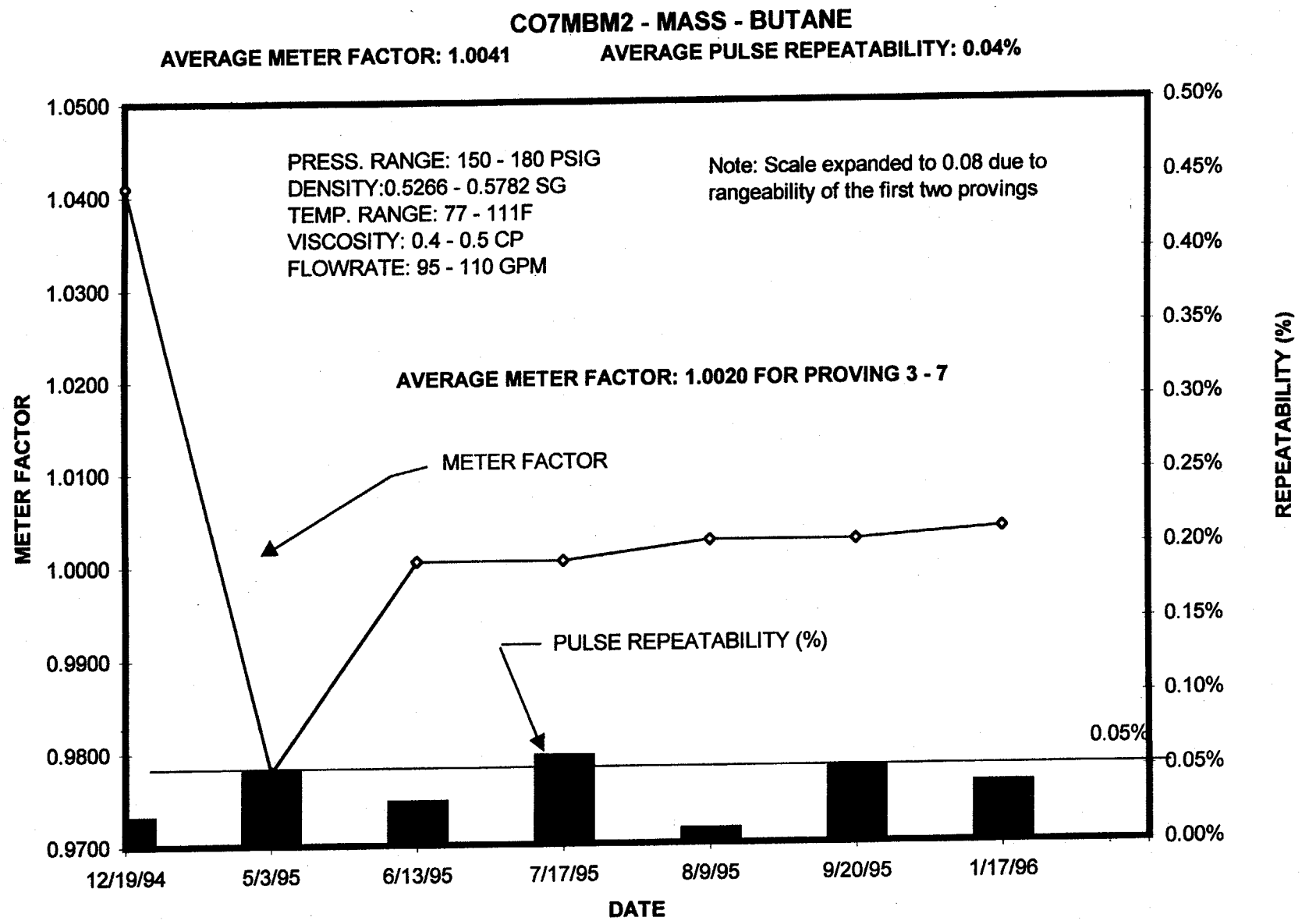

CO7MBM1 - MASS - BUTANE
AVERAGE METER FACTOR: 1.0012
AVERAGE PULSE REPEATABILITY: 0.04%
Note: Scale expanded to 0.06 due to rangeability of the first two provings
PR. RANGE: 135 - 275 PSIG
DENSITY: 0.555 - 0.5934 SG
TEMP RANGE: 67 - 90F
VISCOSITY: 0.4 TO 0.5 CP
FLOWRATE: 93 - 167 GPM
AVERAGE METER FACTOR: 0.9981 FOR PROVING 3 - 7
METER FACTOR
PULSE REPEATABILITY
0.05%
METER FACTOR
REPEATABILITY (%)
1.04
1.03
1.02
1.01
1
0.99
0.98
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
12/19/94
5/3/95
6/13/95
7/17/95
8/9/95
9/20/95
1/17/96
DATE

Mass Meter Factor Control Chart

Company No. 77 Meter [illegible]
Meter size: 1.5 inch [illegible]
Viscosity: [illegible]
Conventional Pipe [illegible]

Proving Date	Meter Factor	Pulse Rcpty	Temp	PSIG	CPM	[illegible]	[illegible]
12/19/94	1.0410	0.02%	77F	165	97	0.5782	16.7
5/3/95	0.9780	0.05%	99F	150	N.A.	0.5297	N.A.
6/13/95	1.0005	0.03%	95F	180	105	0.5336	16.7
7/17/95	1.0005	0.06%	100F	170	101	0.5295	15.9
8/9/95	1.0026	0.01%	103F	150	109	0.5504	17.9
9/20/95	1.0026	0.05%	111F	150	101	0.5266	15.9
1/17/96	1.0038	0.04%	81F	155	95	0.5497	15.6

AVERAGE:	1.0041	0.04%
SPREAD:	0.063	0.05%
STD. DEV.:	0.0186	0.02%

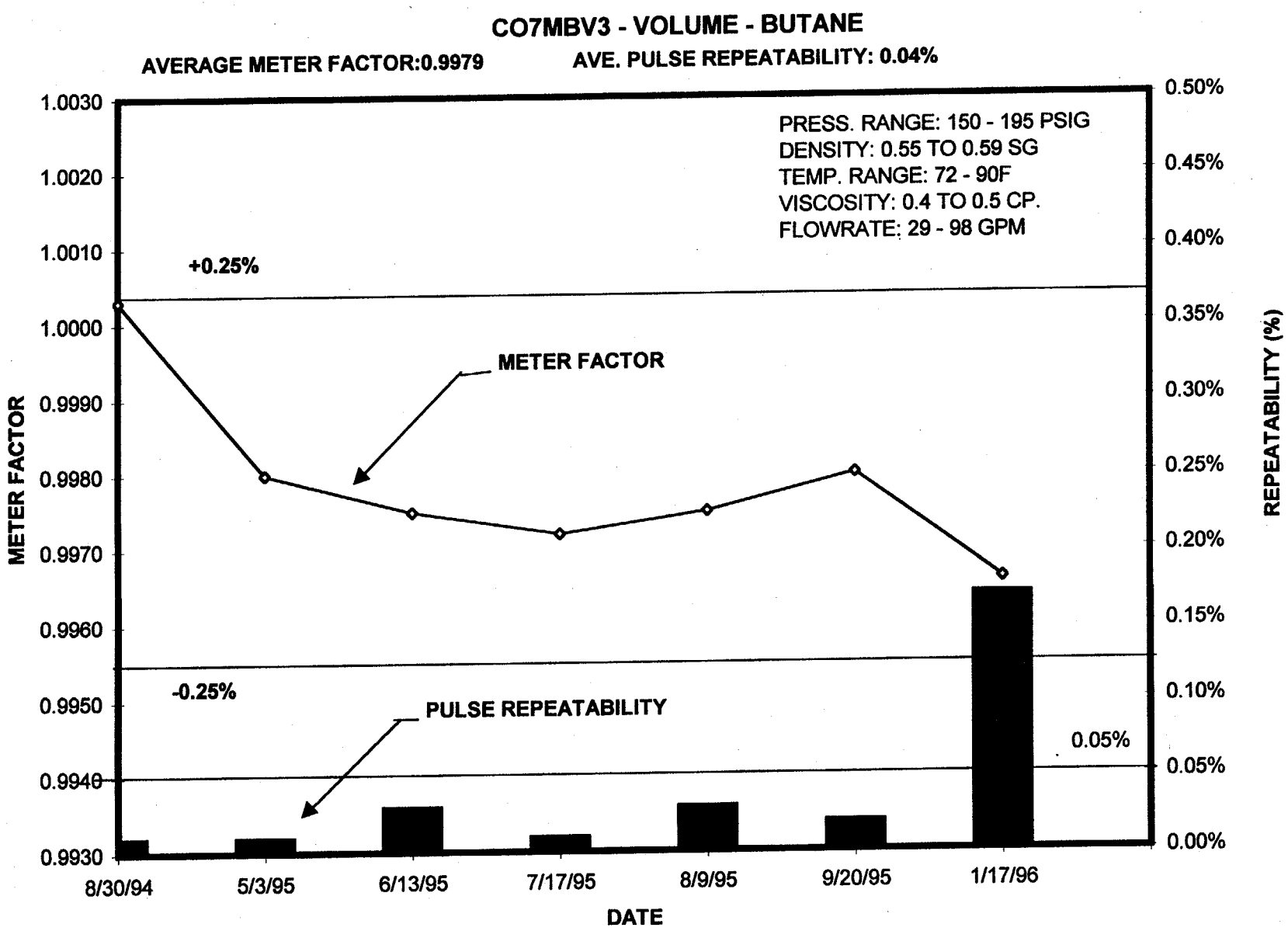

CO7MBM2 - MASS - BUTANE
AVERAGE METER FACTOR: 1.0041
AVERAGE PULSE REPEATABILITY: 0.04%
PRESS. RANGE: 150 - 180 PSIG
DENSITY:0.5266 - 0.5782 SG
TEMP. RANGE: 77 - 111F
VISCOSITY: 0.4 - 0.5 CP
FLOWRATE: 95 - 110 GPM
Note: Scale expanded to 0.08 due to rangeability of the first two provings
AVERAGE METER FACTOR: 1.0020 FOR PROVING 3 - 7
METER FACTOR
PULSE REPEATABILITY (%)
0.05%
METER FACTOR
1.0500
1.0400
1.0300
1.0200
1.0100
1.0000
0.9900
0.9800
0.9700
REPEATABILITY (%)
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
12/19/94
5/3/95
6/13/95
7/17/95
8/9/95
9/20/95
1/17/96
DATE

Volume Meter Factor Control Chart

Company No. 7 / Meter Type: [illegible]
Meter size: 2 Inch
Fluid: Butane / Density: [illegible]
Viscosity: [illegible]
Conventional Pipe Pro[illegible]

Proving Date	Meter Factor	Pulse Repeat.	Temp.	PSIG	GPM	% Max FR
8/30/94	1.0003	0.01%	87F	150	98	14.6
5/3/95	0.9980	0.01%	77F	195	29	4.3
6/13/95	0.9975	0.03%	83F	195	41	6.1
7/17/95	0.9972	0.01%	87F	190	49	7.3
8/9/95	0.9975	0.03%	88F	195	47	7.0
9/20/95	0.9980	0.02%	90F	175	47	7.0
1/17/96	0.9966	0.17%	72F	170	41	6.1

AVERAGE:	0.9979	0.04%
RANGE:	0.0037	0.16%
STD. DEV.:	0.0012	0.06%


CO7MBV3 - VOLUME - BUTANE
AVERAGE METER FACTOR:0.9979
AVE. PULSE REPEATABILITY: 0.04%
PRESS. RANGE: 150 - 195 PSIG
DENSITY: 0.55 TO 0.59 SG
TEMP. RANGE: 72 - 90F
VISCOSITY: 0.4 TO 0.5 CP.
FLOWRATE: 29 - 98 GPM
+0.25%
-0.25%
METER FACTOR
PULSE REPEATABILITY
0.05%
METER FACTOR
REPEATABILITY (%)
1.0030
1.0020
1.0010
1.0000
0.9990
0.9980
0.9970
0.9960
0.9950
0.9940
0.9930
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
8/30/94
5/3/95
6/13/95
7/17/95
8/9/95
9/20/95
1/17/96
DATE

Volume Meter Factor Control Chart

Company No. 8 / Meter B / [illegible]
Meter size: 3 inch
Fluid: Crude Oil / 895 - 900 Kg/m3
Viscosity: 220 cp
Conventional Pipe Prov[illegible]

Proving Date	Meter Factor	Pulse Rep'ty	Temp	Press	m³/h	% Max F.R.
4/10/95	1.0022	0.02%	8.7C	240	91.3	41.3
5/11/95	1.0002	0.01%	13.6C	100	82	37.1
7/10/95	1.0000	0.01%	18.6C	100	90.5	41.0
10/16/95	1.0006	0.05%	15.9C	122	87.7	39.7
6/13/96	1.0000	0.03%	18.3C	180	60.0	27.2

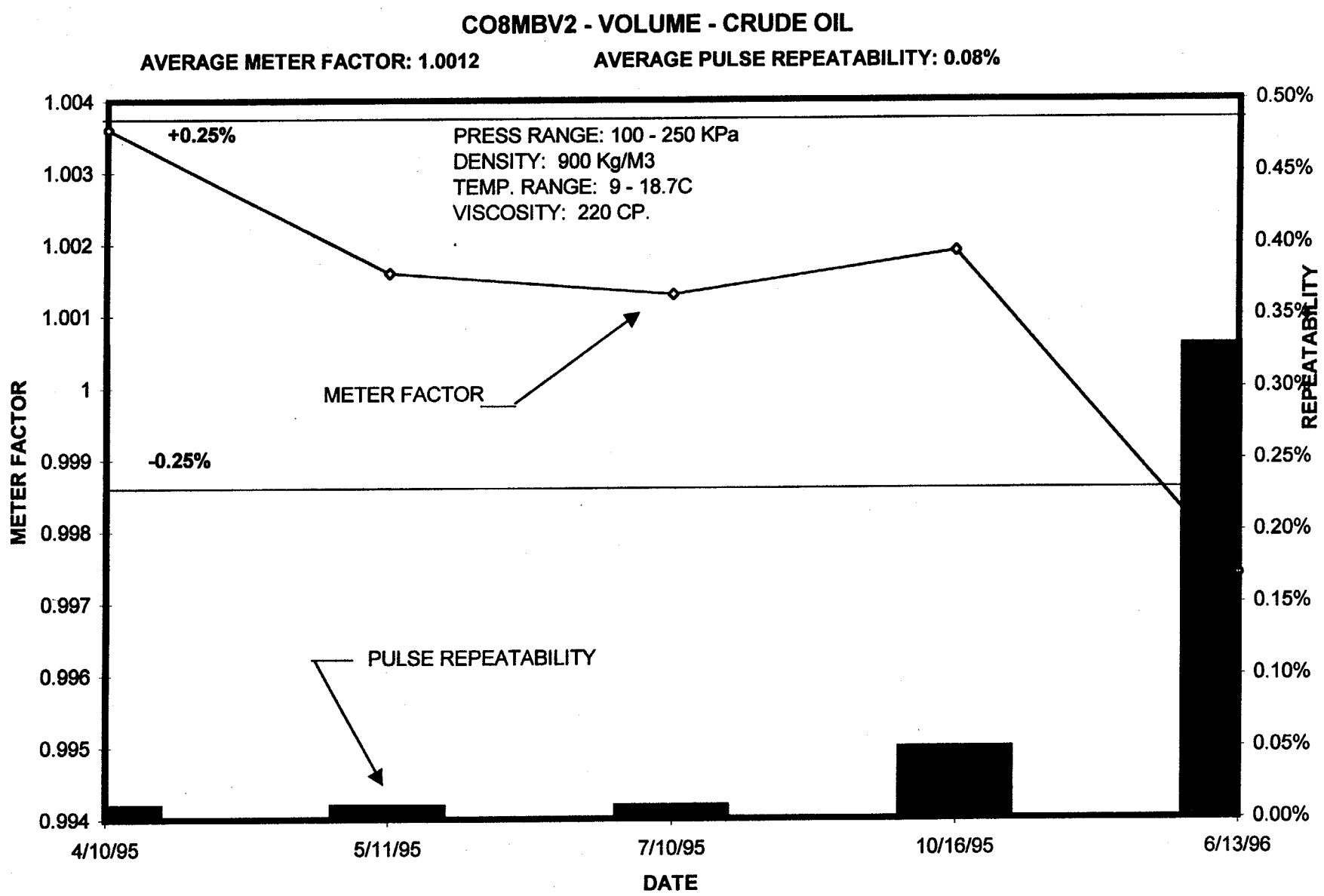
AVERAGE:	1.0006	0.02%
RANGE:	0.0022	0.04%
STD. DEV.:	0.0009	0.02%

Volume Meter Factor Control Chart

Company No. 5 / Meter [illegible] / V2
Meter size: 3 inch [illegible]
Fluid: Crude Oil / [illegible]
Viscosity: 220 [illegible]
Conventional Pipe [illegible]

Proving Date	Meter Factor	Pulse Repty	Temp	psig	m3/hr	% Max. F.R.
4/10/95	1.0036	0.01%	8.6C	250	99.5	45.0
5/11/95	1.0016	0.01%	13.6C	100	78.3	35.4
7/10/95	1.0013	0.01%	18.5C	140	95.3	43.1
10/16/95	1.0019	0.05%	16.5C	126	89.1	40.3
6/13/96	0.9974	0.33%	18.7C	180	64.8	29.3

AVERAGE:	1.0012	0.08%
RANGE:	0.0062	0.32%
STD. DEV.:	0.0023	0.14%

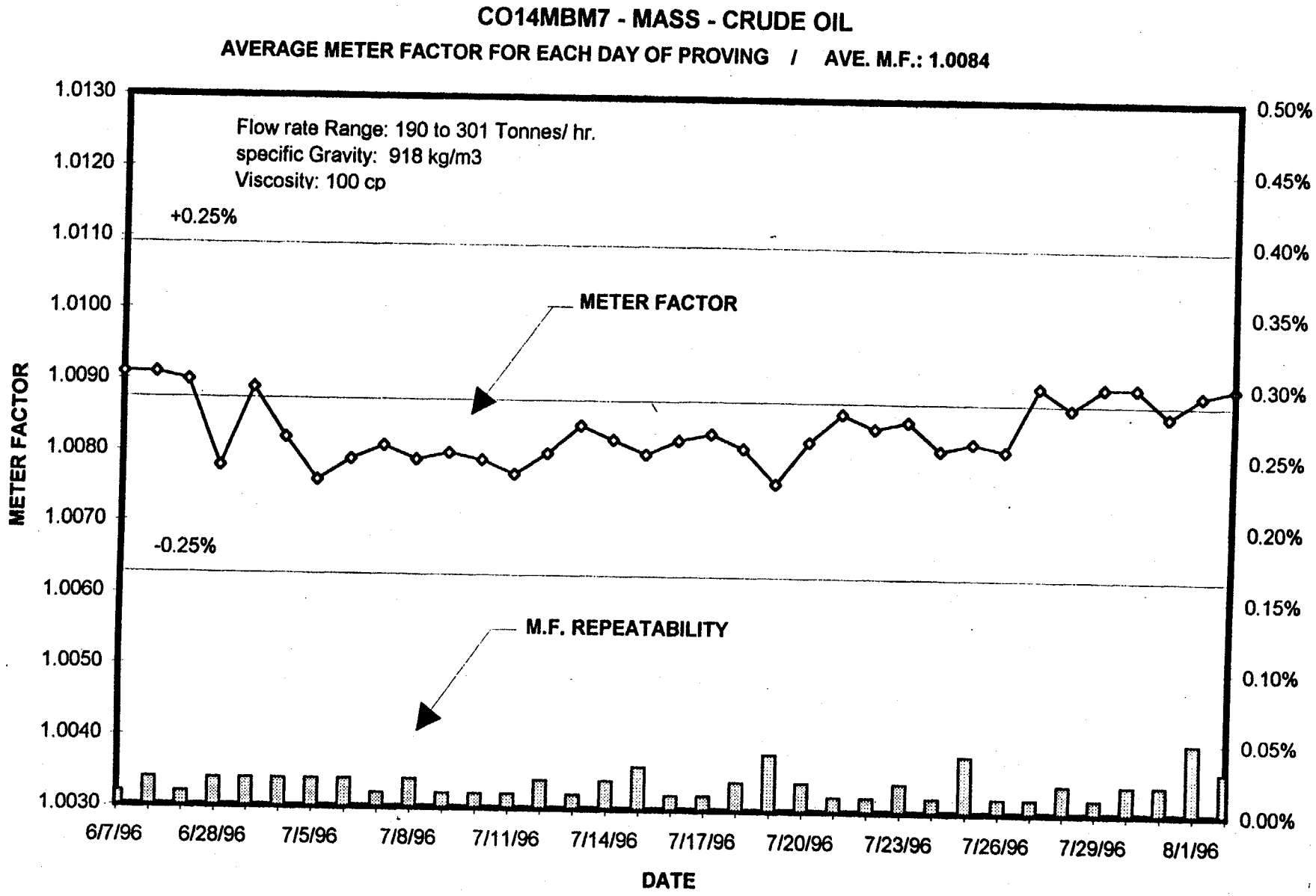

CO8MBV2 - VOLUME - CRUDE OIL
AVERAGE METER FACTOR: 1.0012
AVERAGE PULSE REPEATABILITY: 0.08%
+0.25%
-0.25%
PRESS RANGE: 100 - 250 KPa
DENSITY: 900 Kg/M3
TEMP. RANGE: 9 - 18.7C
VISCOSITY: 220 CP.
METER FACTOR
PULSE REPEATABILITY
METER FACTOR
REPEATABILITY
1.004
1.003
1.002
1.001
1
0.999
0.998
0.997
0.996
0.995
0.994
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
4/10/95
5/11/95
7/10/95
10/16/95
6/13/96
DATE

MASS METER FACTOR CONTROL CHART

Company No. 14 / Meter Type B / M7

Average Meter Factors and M.F. repeatability for each day of proving.

Proving Date	Prove No.	Ave. M.F.	Ave. Rep'ty	Ave. Tn/hr	GPM
6/7/96	1 to 10	1.0091	0.01%	190	911
6/8/96	11 to 20	1.0091	0.02%	192	920
6/15/96	21	1.0090	0.01%	191	915
6/28/96	22 to 27	1.0078	0.02%	261	1251
6/29/96	28 to 36	1.0089	0.02%	280	1342
7/4/96	37	1.0082	0.02%	291	1395
7/5/96	38	1.0076	0.02%	296	1419
7/6/96	39	1.0079	0.02%	293	1404
7/7/96	40	1.0081	0.01%	292	1400
7/8/96	41	1.0079	0.02%	293	1404
7/9/96	42	1.0080	0.01%	294	1409
7/10/96	43	1.0079	0.01%	294	1409
7/11/96	44	1.0077	0.01%	293	1404
7/12/96	45	1.0080	0.02%	295	1414
7/13/96	46	1.0084	0.01%	293	1404
7/14/96	47	1.0082	0.02%	293	1404
7/15/96	48	1.0080	0.03%	296	1419
7/16/96	49	1.0082	0.01%	293	1404
7/17/96	50	1.0083	0.01%	291	1395
7/18/96	51	1.0081	0.02%	297	1424
7/19/96	52	1.0076	0.04%	293	1404
7/20/96	53	1.0082	0.02%	297	1424
7/21/96	54	1.0086	0.01%	295	1414
7/22/96	55	1.0084	0.01%	297	1424
7/23/96	56	1.0085	0.02%	291	1395
7/24/96	57	1.0081	0.01%	301	1443
7/25/96	58	1.0082	0.04%	277	1328
7/26/96	59	1.0081	0.01%	278	1332
7/27/96	60	1.0090	0.01%	294	1409
7/28/96	61	1.0087	0.02%	293	1404
7/29/96	62	1.0090	0.01%	293	1404
7/30/96	63	1.0090	0.02%	293	1404
7/31/96	64	1.0086	0.02%	294	1409
8/1/96	65	1.0089	0.05%	292	1400
8/2/96	66	1.0090	0.03%	291	1395
AVERAGE:		1.0084	0.02%		
RANGE:		0.0015	0.04%		
STD. DEV.		0.0005	0.01%		


CO14MBM7 - MASS - CRUDE OIL
AVERAGE METER FACTOR FOR EACH DAY OF PROVING / AVE. M.F.: 1.0084
Flow rate Range: 190 to 301 Tonnes/ hr.
specific Gravity: 918 kg/m3
Viscosity: 100 cp
+0.25%
-0.25%
METER FACTOR
M.F. REPEATABILITY
METER FACTOR
1.0130
1.0120
1.0110
1.0100
1.0090
1.0080
1.0070
1.0060
1.0050
1.0040
1.0030
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
6/7/96
6/28/96
7/5/96
7/8/96
7/11/96
7/14/96
7/17/96
7/20/96
7/23/96
7/26/96
7/29/96
8/1/96
DATE

CO30MB2V1 - V6

Company No. 30 / Meter Type B
Service: LPG
Small Volume Prover

6 - 3 inch meters
zeros set @ startup
3 runs of 10 passes/run

Proving Date	Meter No.	Proving No.	Meter Factor	Rep'ty (%)	Press.(KPa)	Temp(C)	M3/HR
4/8/95	V1	1	0.9998	0.04%	1880	30.6	113
4/8/95	V1	2	1.0005	0.04%	1835	30.5	100
4/8/95	V1	3	1.0005	0.03%	1785	30.5	90
4/8/95	V2	1	1.0000	0.02%	1855	30.6	126
4/8/95	V2	2	0.9997	0.03%	1820	30.5	112
4/8/95	V2	3	0.9996	0.01%	1800	30.5	104
4/8/95	V3	1	1.0000	0.04%	1900	30.5	135
4/8/95	V3	2	1.0001	0.05%	1875	30.3	115
4/8/95	V3	3	1.0002	0.04%	1850	30.3	107
4/9/95	V4	1	0.9996	0.05%	1910	30.4	128
4/9/95	V4	2	0.9998	0.01%	1870	30.4	110
4/9/95	V4	3	0.9996	0.04%	1820	30.3	103
4/8/95	V5	1	1.0000	0.02%	2010	30.6	110
4/8/95	V5	2	1.0005	0.02%	2090	30.6	98
4/8/95	V5	3	1.0004	0.02%	2000	30.7	87
4/10/95	V6	1	1.0002	0.02%	2120	30.8	101
4/10/95	V6	2	1.0000	0.04%	2130	30.8	97
4/10/95	V6	3	1.0010	0.02%	1960	30.8	83

AVERAGE: 0.03%
MAX.: 0.05%
MIN.: 0.01%

Provings w/ Repeatabilities within 0.05%: 18 of 18 for 100% of provings

V1	**AVERAGE**	1.0003
	Range	0.0007
	STD DEV	0.0004
V2	**AVERAGE**	0.9998
	Range	0.0004
	STD DEV	0.0002
V3	**AVERAGE**	1.0001
	Range	0.0002
	STD DEV	0.0001
V4	**AVERAGE**	0.9997
	Range	0.0002
	STD DEV	0.0001
V5	**AVERAGE**	1.0003
	Range	0.0005
	STD DEV	0.0003
V6	**AVERAGE**	1.0004
	Range	0.001
	STD DEV	0.0005

CO38MDM1

Company No. 38 / Meter Type D	2 inch meter
Service: Propane / 0.501 to 0.508kg/m3	Density: 501 - 508 kg/m3
Conventional Pipe Prover	5 R.T. passes/proving
Density by hydrometer	Zero set @ startup

Proving Date	Proving No.	Meter Factor	Rep'ty (%)	Press.(kPa)	Temp(C)	M3/H
7/20/94	1	0.9996	0.01%	1525	19.4	43.9
7/20/94	2	0.9997	0.04%	1550	20.0	42.6
7/20/94	3	0.9990	0.03%	1600	23	44.8
7/20/94	4	0.9960	0.17%	1375	24.4	19.6
7/20/94	5	0.9976	0.03%	1400	24.6	18.9
7/20/94	6	0.9982	0.06%	1350	24.6	19.5
7/20/94	7	1.0053	0.03%	1700	23.5	41.2
	AVERAGE:	0.9993	0.05%			
	MAX.:	1.0053	0.17%			
	MIN.:	0.996	0.01%			

Provings w/ Meter Factors within ±0.25%: 6 of 7 for 86% of provings
Provings w/ Repeatbilities within 0.05%: 5 of 7 for 71% of provings

AVERAGE	0.9993
Range	0.0093
STD DEV	0.0029

CO39MCV1 - V15

Company No. 39 / Meter Type C	2 inch meters except V6,V7&V8 are 1 inch
Service: Crude oil & NGL	zero set @ startup
Conventional Prover	5 R.T. passes / proving

Proving Date	Meter No.	Prove	M.F.	Rep'ty (%)	Fluid	psig	Temp(F)	B/HR	% Max F.R.
5/2/96	V1	1	1.0088	0.03%	Cr. oil	22	81.1	200	27.4
5/2/96	V1	2	1.0091	0.02%	Cr. oil	22	81.1	200	27.4
5/2/96	V1	3	1.0094	0.03%	Cr. oil	22	81.3	200	27.4
9/4/96	V2	1	1.0042	0.01%	NGL	94	85.9	205	23.4
9/16/96	V2	2	1.0049	0.03%	NGL	94	89.3	206	23.6
10/8/96	V2	3	1.0041	0.02%	NGL	90	82.7	206	23.6
10/23/96	V2	4	1.0051	0.03%	NGL	90	80.1	200	22.9
9/4/96	V3	1	1.0049	0.03%	NGL	44	77.5	205	23.4
9/18/96	V3	2	1.0046	0.03%	NGL	45	76.1	206	23.6
10/8/96	V3	3	1.0047	0.02%	NGL	45	72.9	206	23.6
10/23/96	V3	4	1.0049	0.03%	NGL	46	71.5	200	22.9
10/23/96	V4	1	1.0005	0.05%	Cr. oil	72	60.3	50	6.8
11/12/96	V4	2	1.0028	0.04%	Cr. oil	60	57	72	9.8
12/31/96	V4	3	1.0214	0.05%	Cr. oil	61	52.5	50	6.8
1/28/97	V4	4	0.9988	0.05%	Cr. oil	58	38.2	40	5.4
9/22/97	V4	12	1.0018	0.04%	Cr. oil	60	77	53	7.2
10/20/97	V4	13	1.0020	0.05%	Cr. oil	54	64	68	9.2
11/21/97	V4	14	1.0030	0.05%	Cr. oil	55	65	51	6.9
12/16/97	V4	15	1.0000	0.04%	Cr. oil	45	46.5	39	5.3
2/3/98	V4	1	1.0026	0.04%	Cr. oil	61	46.5	33	4.5
3/4/98	V4	2	1.0030	0.04%	Cr. oil	50	49.5	39	5.3
4/3/98	V4	3	1.0021	0.04%	Cr. oil	55	59.9	41	5.6
5/12/98	V4	4	1.0032	0.04%	Cr. oil	55	72.2	41	5.6
10/24/96	V5	1	1.0066	0.04%	Cr. oil	38	53	125	16.2
12/30/96	V5	2	1.0046	0.04%	Cr. oil	32	43	134	17.3
1/27/97	V5	3	1.0070	0.05%	Cr. oil	40	41.8	125	16.2
6/4/97	V5	1	1.0069	0.45%	Cr. oil	82	73.5	628	81.2
9/15/97	V5	9	1.0053	0.04%	Cr. oil	58	80	471	60.9
10/14/97	V5	10	1.0064	0.43%	Cr. oil	82	62.3	552	71.4
11/14/97	V5	11	1.0066	0.03%	Cr. oil	77	44.5	540	69.8
12/15/97	V5	12	1.0066	0.04%	Cr. oil	68	42.5	555	71.8
1/16/98	V5	1	1.0060	0.04%	Cr. oil	72	40.5	541	69.9
2/17/98	V5	2	1.0059	0.03%	Cr. oil	80	45.5	525	67.9
3/13/98	V5	3	1.0059	0.05%	Cr. oil	75	39.5	557	72.0
4/9/98	V5	4	1.0068	0.04%	Cr. oil	120	58.2	390	50.4
5/14/98	V5	5	1.0072	0.03%	Cr. oil	122	70.4	389	50.3
10/23/96	V6	1	1.0074	0.04%	Cr. oil	45	56.2	75	41.0
12/18/96	V6	2	1.0019	0.04%	Cr. oil	40	33.4	130	71.0
1/23/97	V6	3	1.0039	0.04%	Cr. oil	45	51	125	68.3
10/23/96	V7	1	1.0022	0.04%	Cr. oil	54	57.6	21	11.4
11/21/96	V7	2	1.0027	0.03%	Cr. oil	53	51.4	21	11.4
1/23/97	V7	3	1.0035	0.02%	Cr. oil	54	46.5	22	12.0
9/22/97	V7	9	0.9993	0.03%	Cr. oil	50	79.5	22	12.0
10/20/97	V7	10	1.0008	0.03%	Cr. oil	40	66	22	12.0
11/26/97	V7	11	1.0007	0.03%	Cr. oil	10	56.5	22	12.0
12/16/97	V7	12	1.0030	0.05%	Cr. oil	58	45	22	12.0
1/28/98	V7	1	1.0029	0.03%	Cr. oil	50	50	22	12.0
2/18/98	V7	2	1.0011	0.05%	Cr. oil	45	50.5	22	12.0
3/25/98	V7	3	1.0029	0.05%	Cr. oil	50	61.6	22	12.0
4/3/98	V7	4	1.0011	0.05%	Cr. oil	51	47.4	22	12.0
5/12/98	V7	5	1.0018	0.03%	Cr. oil	55	73.3	22	12.0
6/18/98	V7	6	1.0016	0.04%	Cr. oil	50	90.4	22	12.0

10/23/96	V8	1	1.0019	0.02%	Cr. oil	48	58.5	80	44.8
11/21/96	V8	2	1.0024	0.02%	Cr. oil	48	54.6	83	46.4
12/18/96	V8	3	1.0028	0.04%	Cr. oil	49	41.3	80	44.8
1/23/97	V8	4	1.0023	0.03%	Cr. oil	49	49	76	41.4
8/13/97	V8	8	0.9994	0.01%	Cr. oil	48	77.4	75	40.8
9/22/97	V8	9	0.9999	0.04%	Cr. oil	50	77	75	40.8
10/20/97	V8	10	0.9994	0.05%	Cr. oil	51	68.5	66	35.9
11/21/97	V8	11	1.0011	0.03%	Cr. oil	50	56	67	36.5
12/16/97	V8	12	1.0012	0.03%	Cr. oil	45	53.5	68	37.0
2/3/98	V8	1	1.0023	0.04%	Cr. oil	51	48.5	67	36.5
3/6/98	V8	2	1.0021	0.04%	Cr. oil	45	49	77	41.9
5/12/98	V8	4	1.0010	0.02%	Cr. oil	48	64.6	75	40.8
6/18/98	V8	5	1.0015	0.02%	Cr. oil	48	83.3	77	41.9
8/15/96	V9A	1	1.0026	0.77%	Cr. oil	19	76.4	94	13.3
11/23/96	V9B	1	1.0028	0.10%	Cr. oil	12	47	410	58.1
8/16/96	V10	1	1.0010	0.03%	Cr. oil	12	72.6	54	7.7
11/20/96	V10	2	1.0002	0.02%	Cr. oil	20	49.7	113	16.1
8/16/96	V11	1	1.0011	0.02%	Cr. oil	211	73.9	207	29.6
8/16/96	V12	1	1.0055	0.04%	Cr. oil	123	71.4	197	28.3
11/20/96	V12	2	0.9989	0.41%	Cr. oil	15	50.8	225	32.4
8/16/96	V13	1	1.0001	0.05%	Cr. oil	11	73.5	65	9.1
8/16/96	V14	1	1.0058	0.04%	Cr. oil	68	77.6	37	5.3
11/20/96	V14	2	1.0045	0.15%	Cr. oil	150	47.4	117	16.8
11/21/96	V15	1	1.0009	0.04%	Cr. oil	25	50.2	345	49.5
	AVERAGE:			0.06%					
	MAX.:			0.77%					
	MIN.:			0.01%					

Provings w/ Repeatabilities within 0.05%: 26 of 30 for 87% of provings

V4	**AVERAGE:**	1.0034
	RANGE:	0.0226
	STD. DEV.	0.0058
V5	**AVERAGE:**	1.0063
	RANGE:	0.0026
	STD. DEV.	0.0007
V7	**AVERAGE:**	1.0018
	RANGE:	0.0042
	STD. DEV.	0.0012
V8	**AVERAGE:**	1.0013
	RANGE:	0.0034
	STD. DEV.	0.0011

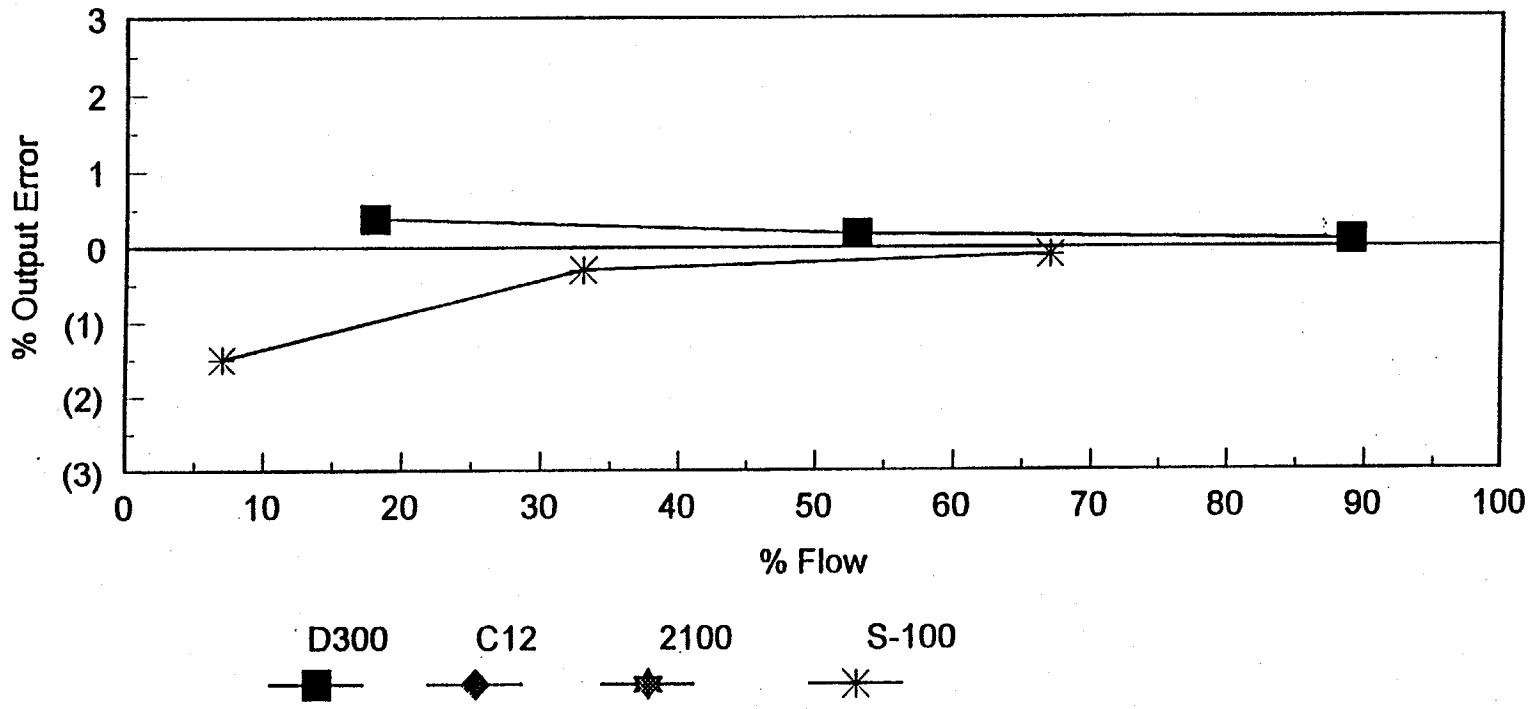
APPENDIX B

SWIRL AND ASYMMETRIC EFFECTS

Coriolis Force Flowmeters

Installation Conditions

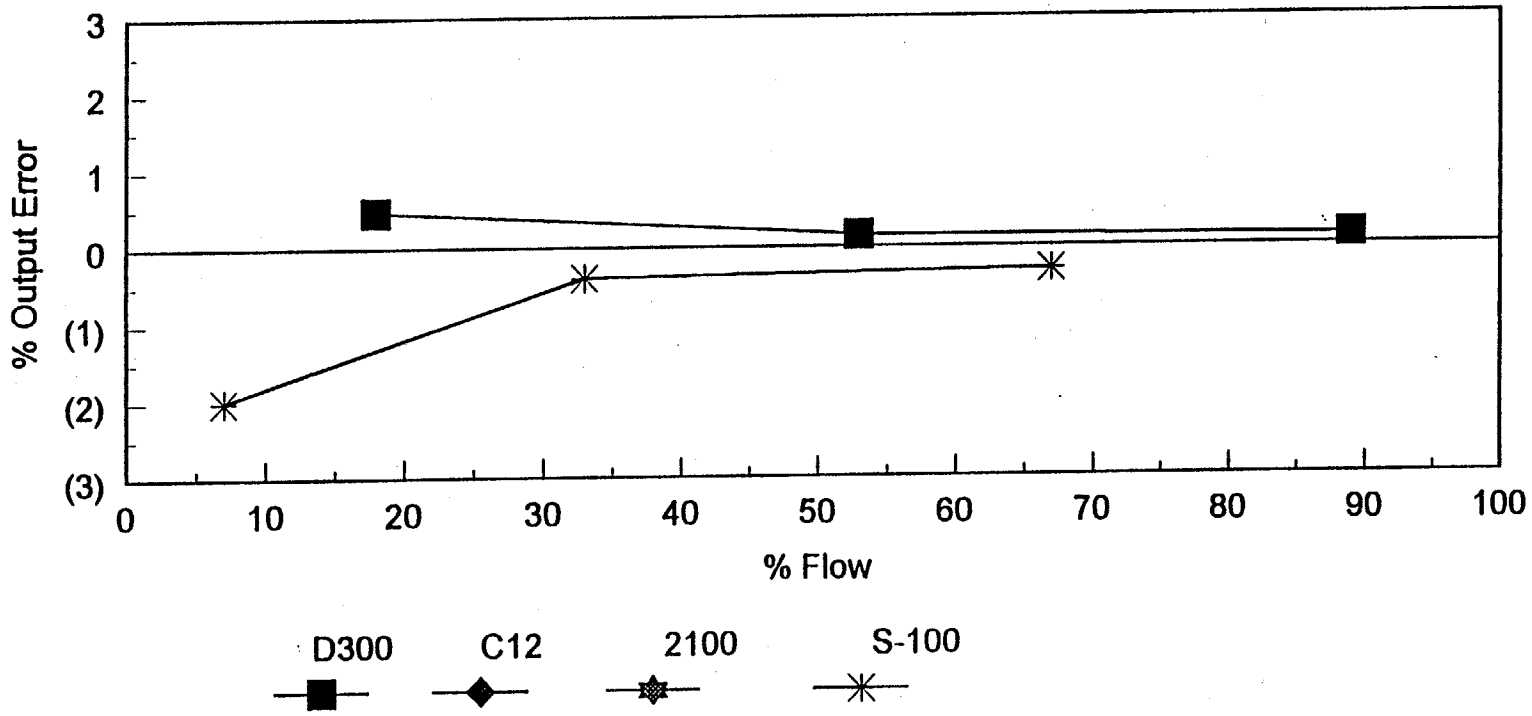
Swirl Test



Coriolis Force Flowmeters

Installation Conditions

Asymetric Test



APPENDIX C

PROVING REPORT ANOMALIES

Co1MAV1

Data Points	**18**
K-Factor	**100,000 pulses/m^3**
Density and Source	**803-820 Kg/m^3 ; source not specified, probably from mass meter**
Anomalies	**Missing one report out of 18**
Layout drawing/sketch available	**Yes**

Co1MBV2

Data Points	**14**
K-Factor	**100,000 pulses/m^3**
Density and Source	**844-899 Kg/m^3 ;source not specified, probably from mass meter**
Anomalies	**Same meter used at two different locations, missing one report from second location**
Layout drawing/sketch available	**Yes**

Co1MBV3

Data Points	**7**
K-Factor	**100,000 pulses/m^3**
Density and Source	**540-542 Kg/m^3 ;source not specified, probably from mass meter**
Anomalies	
Layout drawing/sketch available	**Yes**

Co2MBV1

Data Points	**18**
K-Factor	**36000 pulses/Bbl**
Density and Source	**19.7-25.6 API; source not specified, probably from mass meter**
Anomalies	**Test installation, using non-sequential passes for proving**
Layout drawing/sketch available	**Yes**

Co2MBM1

Data Points	**4**
K-Factor	**60 pulses/lb.**
Density and Source	**21.3-25.6 API; density from NOC, appears to be fixed with +0.0005 g/cc added to match RFT's**
Anomalies	**Using non-sequential passes for proving temperature assumed the same in meter and prover.**
Layout drawing/sketch available	**Yes**

Co3MBM1

Data Points	**14**
K-Factor	**61.xxxx to 63.xxxx p/lb. (solving for k-factor)**
Density and Source	**0.597-0.622; from meter**
Anomalies	**Zero adjusted periodically, no records Solving for k-factor**
Layout drawing/sketch available	**No**

Co3MBM2

Data Points	**15**
K-Factor	**28.xxxx p/lb. (solving for K-factor)**
Density and Source	**0.466-0.477; from meter**
Anomalies	**Zero adjusted periodically, no records Solving for k-factor**
Layout drawing/sketch available	**No**

Co3MBM3

Data Points	**13**
K-Factor	**58.xxxx-59.xxxx p/lb.(solving for K-factor)**
Density and Source	**0.544-0.559; from meter**
Anomalies	**Zero adjusted periodically, no records Solving for k-factor**
Layout drawing/sketch available	**No**

Co4MBV1

Data Points	**30**
K-Factor	**60 p/lb. (13,104 p/bbl)**
Density and Source	**0.604-0.617; from meter**
Anomalies	**Pulses varied with density** **Missing two of thirty proving reports**
Layout drawing/sketch available	**Yes**

Co5MBM1

Data Points	**36**
K-Factor	**60 p/lb. (13,104 p/bbl)**
Density and Source	**6.630 #/gal; fixed**
Anomalies	
Layout drawing/sketch available	**Yes**

Co5MBM2

Data Points	**3**
K-Factor	**60 p/lb. (13,104 p/bbl)**
Density and Source	**6.630 #/gal; fixed**
Anomalies	
Layout drawing/sketch available	**No**

Co6MBV1

Data Points	**9**
K-Factor	**100,000 p/m^3**
Density and Source	**0556-0.612 ; from meter**
Anomalies	**One extreme outliner, which was first proving. Pulse per unit volume changed, next proving standardized on 100,000 p/m^3.**
Layout drawing/sketch available	**Yes**

Co6MBV2

Data Points	**9**
K-Factor	**100,000 p/m^3**
Density and Source	**0.560-0.612; from meter**
Anomalies	**Same comment as for Co6MBV1, initial proving experienced large deviation on repeatability until standardized on pulse/unit volume.**
Layout drawing/sketch available	**Yes**

Co6MBV3

Data Points	**4**
K-Factor	**50,000 p/m^3 and 100,000 p/m^3**
Density and Source	**0.565-0.596; source not specified, probably from meter**
Anomalies	**Pulse per unit volume changed after second prove**
Layout drawing/sketch available	**Yes**

Co6MBV4

Data Points	**4**
K-Factor	**50.000 p/m^3 and 100,000 p/m^3**
Density and Source	**0.565-0.624; source not specified, probably from meter**
Anomalies	**Pulse per unit volume changed after second prove**
Layout drawing/sketch available	**Yes**

Co7MBM1

Data Points	**7**
K-Factor	**60 p/lb.**
Density and Source	**0.555-0.593; source not specified, probably from meter**
Anomalies	**Temperature sensor not in service on first prove, when corrected the density was changed**
Layout drawing/sketch available	**No**

Co7MBM2

Data Points	**7**
K-Factor	**60 p/lb.**
Density and Source	**0.555-0.593;source not specified, probably from meter**
Anomalies	
Layout drawing/sketch available	**No**

Co7MBV3

Data Points	**7**
K-Factor	**598.8 p/bbl**
Density and Source	**0.555-0.590; source not specified, probably from meter**
Anomalies	**First proving used different pulse per unit volume(252,000 p/bbl)**
Layout drawing/sketch available	**No**

Co8MBV1

Data Points	**5**
K-Factor	**100,000 p/m^3**
Density and Source	**887-896 Kg/m^3; source not specified, probably from meter**
Anomalies	**Fifth proving done with a different prover, volume only 1/12th of original. Pulse repeatability stayed in line. MF only dropped 0.0006.**
Layout drawing/sketch available	**Yes**

Co8MBV2

Data Points	**5**
K-Factor	**100,000 p/m^3**
Density and Source	**887-896 Kg/m^3; source not specified, probably from meter**
Anomalies	**Same comment as for Co8MBV1, fifth proving accomplished with a smaller prover, however repeatability and reproducibility both suffered. Pulse repeatability was 0.29% and MF dropped 0.45% Possible proving problems as both previous and next meters were proved with this same prover and while they all experienced an increase in pulse repeatability from 0.02-0.04 to 0.18% their meter factors changed 0.05-0.06% not the 0.45% this meter experienced.**
Layout drawing/sketch available	**Yes**

Co8MBV3

Data Points	**5**
K-Factor	**100,000 p/m^3**
Density and Source	**887-896 Kg/m^3; source not specified, probably from meter**
Anomalies	**Same comment as for Co8MBV1, fifth proving used a much smaller prover and pulse repeatability increased to 0.19% from 0.04% and meter factor increased 0.05%**
Layout drawing/sketch available	**Yes**

Co8MBV4

Data Points	**1**
K-Factor	**100,000 p/m^3**
Density and Source	**927.5 Kg/m^3; source not specified, probably from meter**
Anomalies	**Insufficient data to analyze for repeatability or reproducibility**
Layout drawing/sketch available	**No**

Co8MBV5

Data Points	**1**
K-Factor	**100,000 p/m^3**
Density and Source	**927.5 Kg/m^3; source not specified, probably from meter**
Anomalies	**Insufficient data to analyze for repeatability or reproducibility**
Layout drawing/sketch available	**No**

Co9MBV1

Data Points	**26**
K-Factor	**25,200 p/bbl**
Density and Source	**36-45 API; source not specified, probably from meter**
Anomalies	**Very tight grouping of both meter factor reproducibility and pulse repeatability**
Layout drawing/sketch available	**No (no contact available)**

Co9MBV2

Data Points	**25**
K-Factor	**25,200 p/bbl**
Density and Source	**32-45 API; source not specified, probably from meter**
Anomalies	**Comments indicate that calibration factor changed on some proving's, which were not identified.**
Layout drawing/sketch available	**No(no contact available)**

Co10MBV1

Data Points	**33**
K-Factor	**36,000 p/bbl**
Density and Source	**Not identified**
Anomalies	**Meter factor developed at flowing conditions, no CPL & CTL corrections, unless done internally.**
Layout drawing/sketch available	**Yes**

Co11MBV1

Data Points	**17**
K-Factor	**10,000 p/bbl**
Density and Source	**13.5-20.1 API fixed**
Anomalies	**Meter handled three different types of hydrocarbon, each with their own gravity. Two reports showed pulse repeatability that was over twice the average, both occurring with large increases in pressure. However the meter factors only changed 0.0005 and 0.0019 respectfully, possibly due to entrained vapor.**
Layout drawing/sketch available	**Yes**

Co11MCV2

Data Points	**6**
K-Factor	**15,953 p/bbl**
Density and Source	**51-57 API; source not specified, possible hydrometer**
Anomalies	
Layout drawing/sketch available	**Yes**

Co11MCV3

Data Points	**11**
K-Factor	**15,843 p/bbl**
Density and Source	**52-57 API; source not specified, possible hydrometer**
Anomalies	
Layout drawing/sketch available	**Yes**

Co11MCV4

Data Points	**2**
K-Factor	**15,816 p/bbl**
Density and Source	**39 API; source not identified, possible hydrometer**
Anomalies	**Facility no longer in service**
Layout drawing/sketch available	**No**

Co12MBV1

Data Points	**87 total proving reports (41 w/meter improperly zeroed) (46 w/meter properly zeroed)**
K-Factor	**18,000 p/bbl**
Density and Source	**546-554 Kg/m^3; density fixed(manual entry)**
Anomalies	**SVP used to prove using three runs of twelve passes each. Large variation in pulse repeatability and meter factor reproducibility. Only analyzed proving's after meter was properly zeroed.**
Layout drawing/sketch available	**No**

Co13MBV1

Data Points	**17**
K-Factor	**3600 p/bbl**
Density and Source	**34-36 API; source not specified, probably from meter**
Anomalies	**Very high operating temperature-170 F. One report missing**
Layout drawing/sketch available	**Yes**

Co13MBV2

Data Points	**14**
K-Factor	**3600 p/bbl**
Density and Source	**34-36 API; source not specified, probably from meter**
Anomalies	**Very high operating temperature-170 F. Two reports missing.**
Layout drawing/sketch available	**Yes**

Co13MBV3

Data Points	**14**
K-Factor	**3600 p/bbl**
Density and Source	**34-36 API; source not specified, probably from meter**
Anomalies	**Very high operating temperature-170 F. One report missing in sequence**
Layout drawing/sketch available	**Yes**

Co13MBV4

Data Points	**17**
K-Factor	**3600 p/bbl**
Density and Source	**34-36 API; source not specified, probably from meter**
Anomalies	**Very high operating temperature-170 F. One report missing out of sequence.**
Layout drawing/sketch available	**Yes**

Co13MBV5

Data Points	**18**
K-Factor	**3600 p/bbl**
Density and Source	**34-36 API; source not specified, probably from meter**
Anomalies	**Very high operating temperature-168 F. One report missing out of sequence.**
Layout drawing/sketch available	**Yes**

Co13MBV6

Data Points	**19**
K-Factor	**3600 p/bbl**
Density and Source	**34-36 API; source not specified, probably from meter**
Anomalies	**Very high operating temperature-165 F. One report missing out of sequence.**
Layout drawing/sketch available	**Yes**

Co13MBV7

Data Points	**17**
K-Factor	**3600 p/bbl**
Density and Source	**34-36 API; source not specified, probably from meter**
Anomalies	**Very high operating temperature-172 F. Two reports missing out of sequence.**
Layout drawing/sketch available	**Yes**

Co13MBV8

Data Points	**18**
K-Factor	**3600 p/bbl**
Density and Source	**34-36 API; source not specified, probably from meter**
Anomalies	**Very high operating temperature-168 F. One report missing out of sequence.**
Layout drawing/sketch available	**Yes**

Co13MBV9

Data Points	**17**
K-Factor	**3600 p/bbl**
Density and Source	**34-36 API; source not specified, probably from meter**
Anomalies	**Very high operating temperature-170 F. One report missing out of sequence. The above nine meters all have at least one proving report missing. The same month's proving report is missing for all nine meters, therefore one can conclude that the owner lost an entire months file, because a few other meters have other varying months missing also.**
Layout drawing/sketch available	**Yes**

Co14MBM1

Data Points	**36**
K-Factor	**Variable (35600-35800 p/ton)**
Density and Source	**918 Kg/m^3 (fixed)**
Anomalies	**Solving for k-factor, multiple proves during each shipment. Proved w/SVP @ 2 runs of 10 passes each.**
Layout drawing/sketch available	**Yes**

Co14MBM2

Data Points	**32**
K-Factor	**Variable (35700-35820 p/ton)**
Density and Source	**918 Kg/m^3 (fixed)**
Anomalies	**Solving for k-factor, multiple proves during each shipment. Proved w/SVP @ 2 runs of 10 passes each.**
Layout drawing/sketch available	**Yes**

Co14MBM3

Data Points	**31**
K-Factor	**Variable (35690-35820 p/ton)**
Density and Source	**918 Kg/m^3 (fixed)**
Anomalies	**Solving for k-factor, multiple proves during each shipment. Proved w/SVP @ 2 runs of 10 passes each.**
Layout drawing/sketch available	**Yes**

Co14MBM4

Data Points	**32**
K-Factor	**Variable (35775-35840 p/ton)**
Density and Source	**918 Kg/m^3 (fixed)**
Anomalies	**Solving for k-factor, multiple proves during each shipment. Proved w/SVP @ 2 runs of 10 passes each.**
Layout drawing/sketch available	**Yes**

Co14MBM5

Data Points	**31**
K-Factor	**Variable (35750-35890 p/ton)**
Density and Source	**918 Kg/m^3 (fixed)**
Anomalies	**Solving for k-factor, multiple proves during each shipment. Proved w/SVP @ 2 runs of 10 passes each.**
Layout drawing/sketch available	**Yes**

Co14MBM6

Data Points	**32**
K-Factor	**Variable 35750-35915 p/ton)**
Density and Source	**918 Kg/m^3 (fixed)**
Anomalies	**Solving for k-factor, multiple proves during each shipment. Proved w/SVP @ 2 runs of 10 passes each.**
Layout drawing/sketch available	**Yes**

Co14MBM7

Data Points	**66**
K-Factor	**Variable (36200-36300 p/ton)**
Density and Source	**918 Kg/m^3 (fixed)**
Anomalies	**Solving for k-factor, multiple proves during each shipment. Proved w/SVP @ 2 runs of 10 passes each.**
Layout drawing/sketch available	**Yes**

Co39MCV1 thru V15

Data Points	**75 (15 separate meters)**
K-Factor	**Variable depending on meter size --16,556 p/bbl --16,118 p/bbl --40,788 p/bbl --42,258 p/bbl**
Density and Source	**Variable (37-55 API)**
Anomalies	**40,000+ p/bbl k-factor's are for 1" meters and 16,000+ p/bbl are for 2" meters Large number of meters at multiple locations, only, some of which have four or less proving's submitted. However four meters have eight or more proving's and they will be analyzed**
Layout drawing/sketch available	**No**

Co38MDM1

Data Points	**7**
K-Factor	
Density and Source	**Variable (501-508 kg/m^3); source – hydrometer**
Anomalies	
Layout drawing/sketch available	**No**

Co37Mprv

Data Points	**6**
K-Factor	**10 p/gallon (420 p/bbl)**
Density and Source	**0.510 SG**
Anomalies	**Insufficient data to analyze; only two reports for each of the three meters**
Layout drawing/sketch available	**No**

Co36Mprv

Data Points	**2**
K-Factor	
Density and Source	**Fixed (8.11 kg/m^3)**
Anomalies	**Insufficient data to analyze; only two reports using SVP with 3 runs of 5 passes each**
Layout drawing/sketch available	**No**

Co35Vprv

Data Points	**3**
K-Factor	
Density and Source	**Variable (0.505 and 0.390)**
Anomalies	**Insufficient data to analyze; only three reports (one each on three meters) using SVP with 3 runs of 10 passes each**
Layout drawing/sketch available	**No**

Co33Vprv

Data Points	**6**
K-Factor	
Density and Source	**Variable depending on meter and product**
Anomalies	**Insufficient data to analyze; only one report per meter (5 meters) using SVP with 2 runs of 20 passes each.**
Layout drawing/sketch available	**No**

Co32Vprv

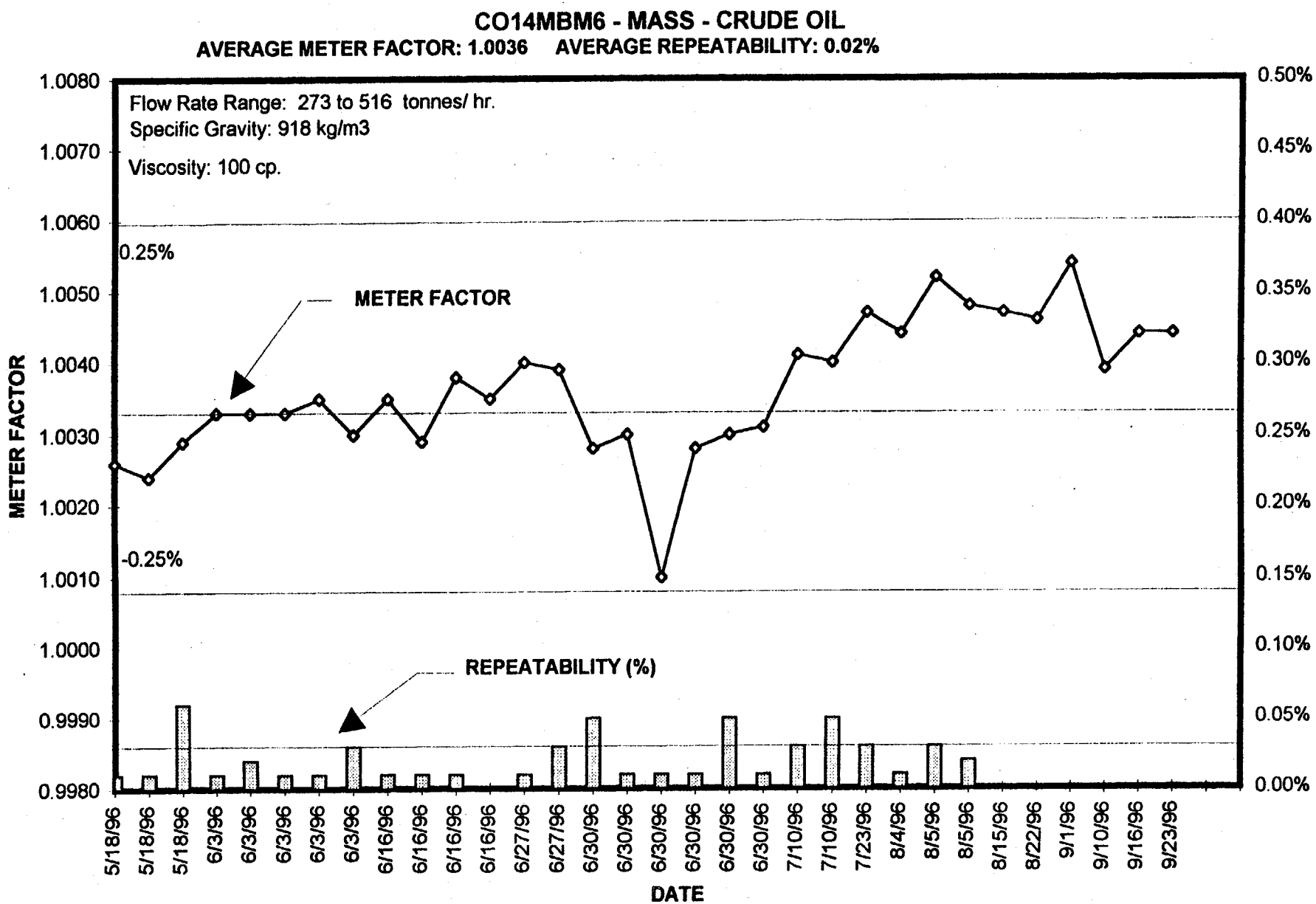
Data Points	**7**
K-Factor	
Density and Source	**Variable (0.564-0.576)**
Anomalies	**Insufficient data to analyze; only one or two reports on each of five meters, using SVP with 3 runs of 10 passes each.**
Layout drawing/sketch available	**No**

Co31Vprv

Data Points	**8**
K-Factor	
Density and Source	**Fixed 70 API**
Anomalies	**Insufficient data to analyze; only one report on each of eight meters, using SVP with 2 runs of 10 passes each.**
Layout drawing/sketch available	**No**

Co30Vprv

Data Points	**18**
K-Factor	
Density and Source	**Variable**
Anomalies	**Insufficient data to analyze; only one report on each of six meters, using SVP with 3 runs of 10 passes each.**
Layout drawing/sketch available	**No**

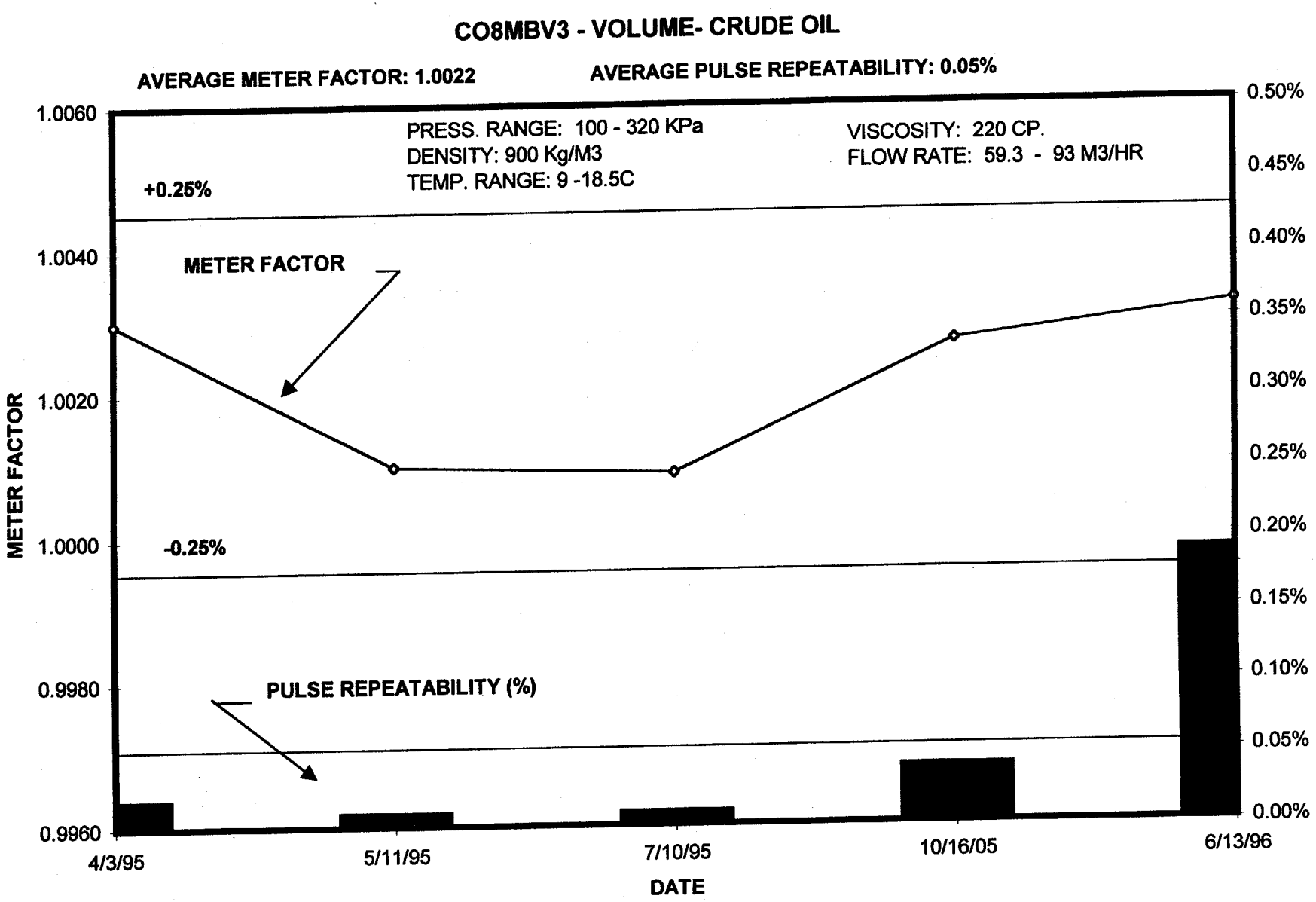

CO14MBM6 - MASS - CRUDE OIL
AVERAGE METER FACTOR: 1.0036 AVERAGE REPEATABILITY: 0.02%
Flow Rate Range: 273 to 516 tonnes/ hr.
Specific Gravity: 918 kg/m3
Viscosity: 100 cp.
0.25%
-0.25%
METER FACTOR
REPEATABILITY (%)
METER FACTOR
1.0080
1.0070
1.0060
1.0050
1.0040
1.0030
1.0020
1.0010
1.0000
0.9990
0.9980
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
5/18/96
5/18/96
5/18/96
6/3/96
6/3/96
6/3/96
6/3/96
6/3/96
6/16/96
6/16/96
6/16/96
6/16/96
6/27/96
6/27/96
6/30/96
6/30/96
6/30/96
6/30/96
6/30/96
6/30/96
6/30/96
7/10/96
7/10/96
7/23/96
8/4/96
8/5/96
8/5/96
8/15/96
8/22/96
9/1/96
9/10/96
9/16/96
9/23/96
DATE

Volume Meter Factor Control Chart

Company No. 8 Meter Type B V3
Meter Size: 3 inch
Fluid: Crude Oil V.395 - 900 Kg/m3
Viscosity: 200 [illegible]
Conventional Pipe Prov [illegible]

Proving Date	Meter Factor	Pulse Rep'y	Temp	[illegible]	[illegible] m3/hr	% Max F.R.
4/3/95	1.0030	0.02%	9.2C	320	91	41.2
5/11/95	1.0010	0.01%	13.5C	100	83	37.6
7/10/95	1.0009	0.01%	18.5C	140	92.5	41.9
10/16/05	1.0027	0.04%	16.3C	127	83.4	37.8
6/13/96	1.0032	0.19%	18.3C	180	59.3	26.8

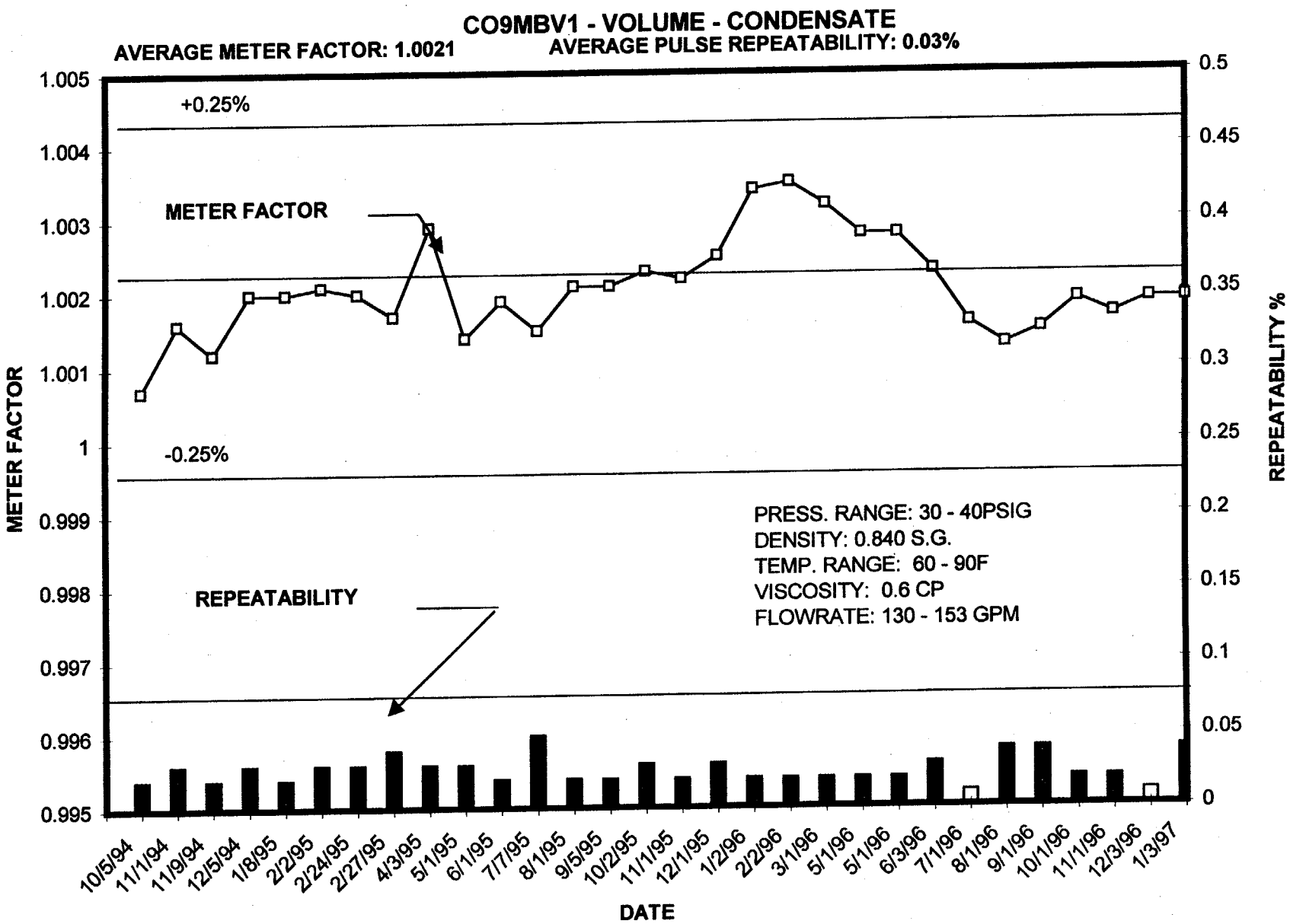
AVERAGE:	1.0022	0.05%
RANGE:	0.0023	0.18%
STD. DEV.:	0.0011	0.08%


CO8MBV3 - VOLUME- CRUDE OIL
AVERAGE METER FACTOR: 1.0022
AVERAGE PULSE REPEATABILITY: 0.05%
PRESS. RANGE: 100 - 320 KPa
DENSITY: 900 Kg/M3
TEMP. RANGE: 9 -18.5C
VISCOSITY: 220 CP.
FLOW RATE: 59.3 - 93 M3/HR
+0.25%
-0.25%
METER FACTOR
PULSE REPEATABILITY (%)
METER FACTOR
1.0060
1.0040
1.0020
1.0000
0.9980
0.9960
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
4/3/95
5/11/95
7/10/95
10/16/05
6/13/96
DATE

VOLUME METER FACTOR CONTROL CHART

Company No. 9 / Meter Type B / V1
Meter size: 2 inch
Fluid: Condensate / Density: 0.824 S.G.
Viscosity: 0.6 cp
Conventional Pipe Prover

Proving Date	Meter Factor	Pulse Rep'ty	Temp (F)	psig	GPM	% Max FR
10/5/94	1.0007	0.02	81	37	135	29.6
11/1/94	1.0016	0.03	86	40	136	29.9
11/9/94	1.0012	0.02	86	42	137	30.0
12/5/94	1.0020	0.03	69	40	131	28.6
1/8/95	1.0020	0.02	62	38	150	32.9
2/2/95	1.0021	0.03	60	38	153	33.5
2/24/95	1.0020	0.03	65	38	153	33.4
2/27/95	1.0017	0.04	64	37	152	33.2
4/3/95	1.0029	0.03	67	40	146	32.1
5/1/95	1.0014	0.03	78	38	153	33.6
6/1/95	1.0019	0.02	83	29	154	33.7
7/7/95	1.0015	0.05	91	30	152	33.3
8/1/95	1.0021	0.02	88	30	150	32.9
9/5/95	1.0021	0.02	90	30	153	33.4
10/2/95	1.0023	0.03	85	39	153	33.5
11/1/95	1.0022	0.02	76	40	143	31.3
12/1/95	1.0025	0.03	69	40	146	32.0
1/2/96	1.0034	0.02	67	42	150	32.9
2/2/96	1.0035	0.02	63	40	148	32.4
3/1/96	1.0032	0.02	72	40	154	33.7
5/1/96	1.0028	0.02	75	41	152	33.3
6/3/96	1.0023	0.03	85	41	156	34.2
7/1/96	1.0016	0.01	88	40	158	34.6
8/1/96	1.0013	0.04	89	40	N.A.	N.A.
9/1/96	1.0015	0.04	86	40	N.A.	N.A.
10/1/96	1.0019	0.02	81	41	N.A.	N.A.
11/1/96	1.0017	0.02	78	39	161	N.A.
12/3/96	1.0019	0.01	66	41	160	N.A.
1/3/97	1.0019	0.04	68	40	160	N.A.
AVERAGE	1.0020	0.03				
RANGE	0.0028	0.04				
STD. DEV.	0.0006	0.01				

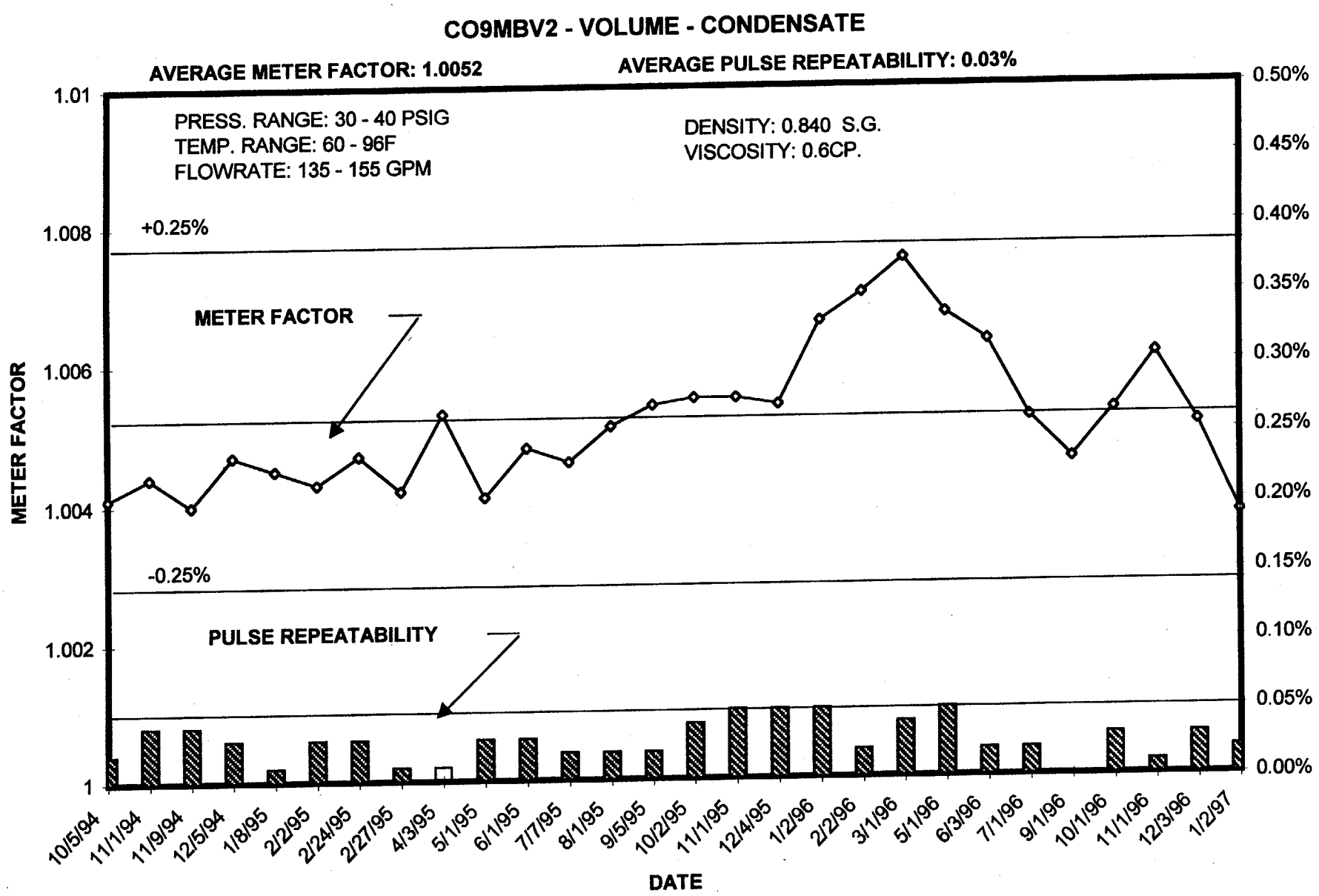

CO9MBV1 - VOLUME - CONDENSATE
AVERAGE METER FACTOR: 1.0021
AVERAGE PULSE REPEATABILITY: 0.03%
+0.25%
-0.25%
METER FACTOR
REPEATABILITY
PRESS. RANGE: 30 - 40PSIG
DENSITY: 0.840 S.G.
TEMP. RANGE: 60 - 90F
VISCOSITY: 0.6 CP
FLOWRATE: 130 - 153 GPM
METER FACTOR
REPEATABILITY %
DATE
1.005
1.004
1.003
1.002
1.001
1
0.999
0.998
0.997
0.996
0.995
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
10/5/94
11/1/94
11/9/94
12/5/94
1/8/95
2/2/95
2/24/95
2/27/95
4/3/95
5/1/95
6/1/95
7/7/95
8/1/95
9/5/95
10/2/95
11/1/95
12/1/95
1/2/96
2/2/96
3/1/96
5/1/96
5/1/96
6/3/96
7/1/96
8/1/96
9/1/96
10/1/96
11/1/96
12/3/96
1/3/97

VOLUME METER FACTOR CONTROL CHART

Company No. 9 / Meter Type R / V2
Meter size: 2 inch
Fluid: Condensate / Density: [illegible] S.G.
Viscosity: [illegible] cp
Conventional Pipe Prover

Proving Date	Meter Factor	Pulse Rep'ty	Temp.(F)	psig	GPM	% Max FR
10/5/94	1.0041	0.02%	82	37	139	30.4
11/1/94	1.0044	0.04%	96	39	134	29.4
11/9/94	1.0040	0.04%	85	41	138	30.2
12/5/94	1.0047	0.03%	69	39	135	29.6
1/8/95	1.0045	0.01%	62	37	154	33.7
2/2/95	1.0043	0.03%	60	38	154	33.7
2/24/95	1.0047	0.03%	64	37	153	33.5
2/27/95	1.0042	0.01%	65	38	154	33.7
4/3/95	1.0053	0.01%	67	39	152	33.3
5/1/95	1.0041	0.03%	79	37	154	33.7
6/1/95	1.0048	0.03%	82	30	155	34.0
7/7/95	1.0046	0.02%	90	30	148	32.4
8/1/95	1.0051	0.02%	89	30	150	32.9
9/5/95	1.0054	0.02%	90	29	151	33.1
10/2/95	1.0055	0.04%	84	29	153	33.5
11/1/95	1.0055	0.05%	75	39	144	31.5
12/4/95	1.0054	0.05%	68	40	136	29.8
1/2/96	1.0066	0.05%	66	42	150	32.9
2/2/96	1.0070	0.02%	63	39	153	33.5
3/1/96	1.0075	0.04%	71	39	158	34.6
5/1/96	1.0067	0.05%	74	31	150	32.9
6/3/96	1.0063	0.02%	84	41	145	31.8
7/1/96	1.0052	0.02%	89	40	156	34.2
9/1/96	1.0046	0.00%	86	39	N.A.	N.A.
10/1/96	1.0053	0.03%	81	40	N.A	N.A.
11/1/96	1.0061	0.01%	81	39	N.A.	N.A.
12/3/96	1.0051	0.03%	66	40	147	32.2
1/2/97	1.0038	0.02%	66	40	162	35.5

AVERAGE:	1.0052	0.03%
RANGE:	0.0037	0.05%
STD. DEV.:	0.0010	0.01%


CO9MBV2 - VOLUME - CONDENSATE
AVERAGE METER FACTOR: 1.0052
AVERAGE PULSE REPEATABILITY: 0.03%
PRESS. RANGE: 30 - 40 PSIG
TEMP. RANGE: 60 - 96F
FLOWRATE: 135 - 155 GPM
DENSITY: 0.840 S.G.
VISCOSITY: 0.6CP.
+0.25%
-0.25%
METER FACTOR
PULSE REPEATABILITY
METER FACTOR
1.01
1.008
1.006
1.004
1.002
1
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
10/5/94
11/1/94
11/9/94
12/5/94
1/8/95
2/2/95
2/24/95
2/27/95
4/3/95
5/1/95
6/1/95
7/7/95
8/1/95
9/5/95
10/2/95
11/1/95
12/4/95
1/2/96
2/2/96
3/1/96
5/1/96
6/3/96
7/1/96
9/1/96
10/1/96
11/1/96
12/3/96
1/2/97
DATE

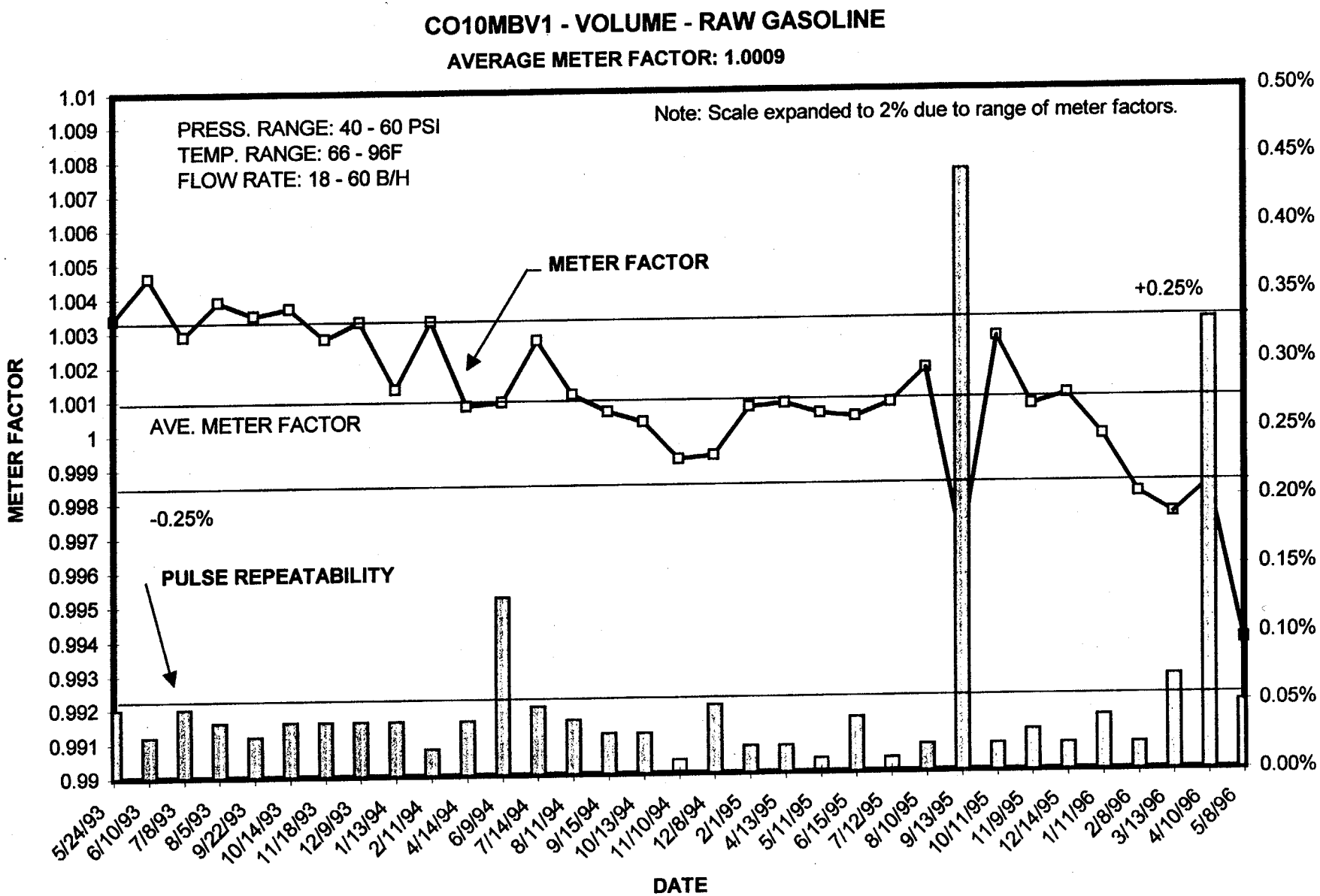
VOLUME METER FACTOR CONTROL CHART

Company No. 10 / Meter Type B / V1
Meter size: 1 inch
Fluid: Raw Gasoline
Viscosity:
Conventional Pipe Prover

Proving Date	M.F.	Ave R.T. Pulses	Pulse Repty. (%)	Temp.(F)	Press.	B/H
5/24/93	1.0034	58791	0.05%	77	50	43
6/10/93	1.0046	12890	0.03%	88	50	28
7/8/93	1.0029	12911	0.05%	85	40	42
8/5/93	1.0039	12900	0.04%	92	40	41
9/22/93	1.0035	12895	0.03%	87	50	46
10/14/93	1.0037	12899	0.04%	80	50	50
11/18/93	1.0028	12902	0.04%	79	40	35
12/9/93	1.0033	12895	0.04%	81	40	53
1/13/94	1.0013	12918	0.04%	72	40	53
2/11/94	1.0033	12893	0.02%	69	50	45
4/14/94	1.0008	12929	0.04%	80	50	45
6/9/94	1.0009	12928	0.13%	89	50	41
7/14/94	1.0027	12906	0.05%	94	50	18
8/11/94	1.0011	12926	0.04%	90	40	53
9/15/94	1.0006	12935	0.03%	92	50	51
10/13/94	1.0003	12934	0.03%	76	50	33
11/10/94	0.9992	12945	0.01%	66	50	31
12/8/94	0.9993	12946	0.05%	82	50	48
2/1/95	1.0007	12930	0.02%	80	50	39
4/13/95	1.0008	12927	0.02%	75	50	38
5/11/95	1.0005	12931	0.01%	75	50	52
6/15/95	1.0004	12931	0.04%	73	40	43
7/12/95	1.0008	12932	0.01%	96	65	54
8/10/95	1.0018	12915	0.02%	83	50	50
9/13/95	0.9966	12985	0.44%	87	65	60
10/11/95	1.0027	12914	0.02%	79	60	44
11/9/95	1.0007	12925	0.03%	65	65	40
12/14/95	1.0010	12926	0.02%	79	55	50
1/11/96	0.9998	12936	0.04%	67	45	50
2/8/96	0.9981	12962	0.02%	77	50	50
3/13/96	0.9975	12970	0.07%	79	45	47
4/10/96	0.9984	12957	0.33%	74	45	32
5/8/96	0.9938	13018	0.05%	83	40	30

AVERAGE:	1.0009	12928	0.06%
RANGE:	0.0108	128	0.43%
STD. DEV.	0.0023	28	0.09%

Note:Pulses for 5/24/93 was not included in the Ave., Range and Std. Dev for the R.T. Pulse column.


CO10MBV1 - VOLUME - RAW GASOLINE
AVERAGE METER FACTOR: 1.0009
PRESS. RANGE: 40 - 60 PSI
TEMP. RANGE: 66 - 96F
FLOW RATE: 18 - 60 B/H
Note: Scale expanded to 2% due to range of meter factors.
METER FACTOR
+0.25%
AVE. METER FACTOR
-0.25%
PULSE REPEATABILITY
METER FACTOR
1.01
1.009
1.008
1.007
1.006
1.005
1.004
1.003
1.002
1.001
1
0.999
0.998
0.997
0.996
0.995
0.994
0.993
0.992
0.991
0.99
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
5/24/93
6/10/93
7/8/93
8/5/93
9/22/93
10/14/93
11/18/93
12/9/93
1/13/94
2/11/94
4/14/94
6/9/94
7/14/94
8/11/94
9/15/94
10/13/94
11/10/94
12/8/94
2/1/95
4/13/95
5/11/95
6/15/95
7/12/95
8/10/95
9/13/95
10/11/95
11/9/95
12/14/95
1/11/96
2/8/96
3/13/96
4/10/96
5/8/96
DATE

Company No. 11 / Meter Type B / V1 — **Conventional Pipe Prover**

TABLE OF PROVING RESULTS FOR SJV CRUDE:

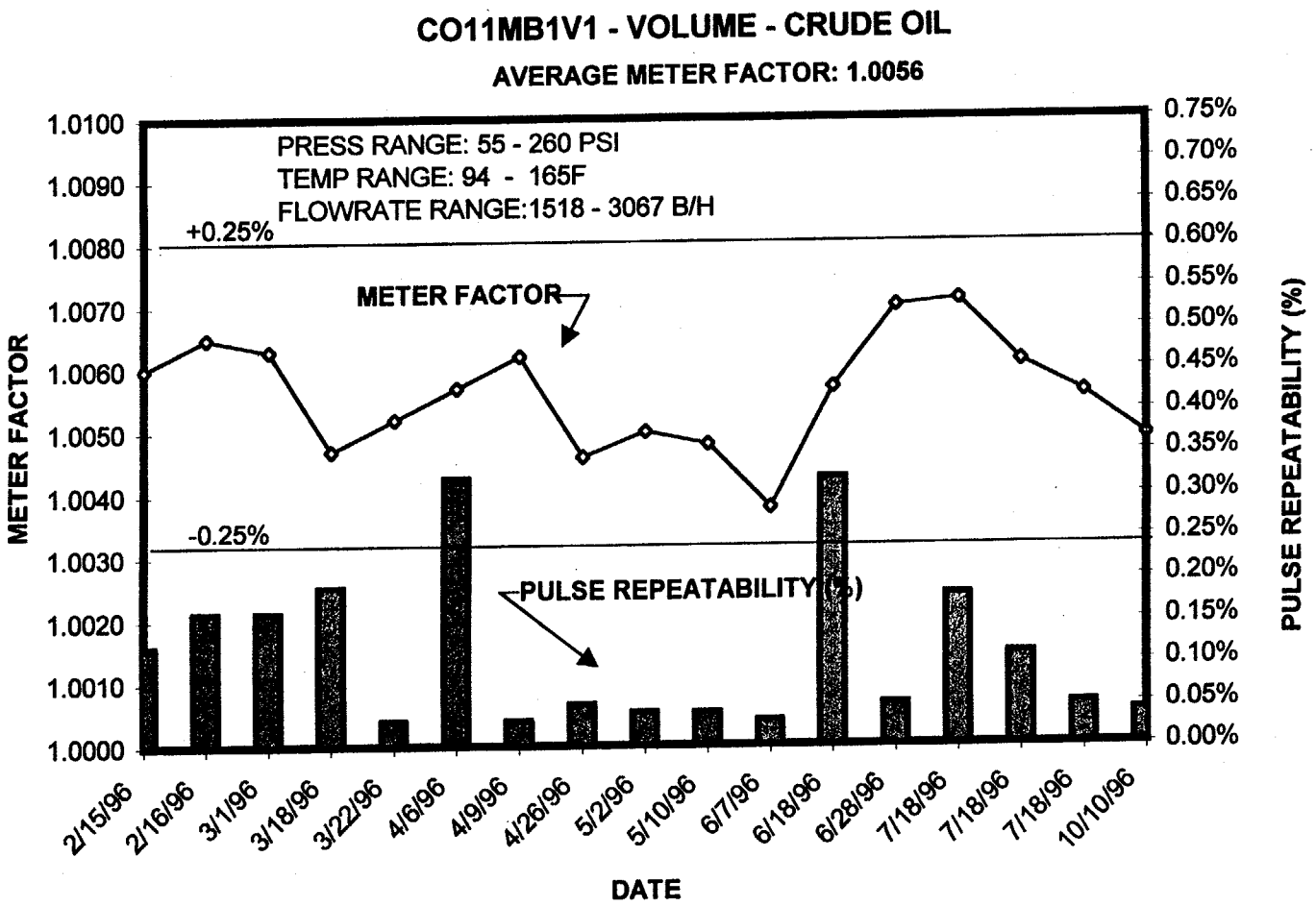
Proving Date	Meter Factor	Pulse Rep'ty	Crude	API Gr.	Temp.(F)	Press.	B/H
2/15/96	1.0060	0.12%	SJV	13.3	160	85	2985
3/18/96	1.0047	0.19%	SJV	13.5	165	85	3004
4/26/96	1.0046	0.05%	SJV	13.5	161	78	2878
5/10/96	1.0048	0.04%	SJV	13.5	152	79	2394
6/28/96	1.0070	0.05%	SJV	13.5	143	77	1518
7/18/96	1.0071	0.18%	SJV	13.5	148	133	2951
7/18/96	1.0061	0.11%	SJV	13.5	144	120	2590
7/18/96	1.0056	0.05%	SJV	13.5	145	85	1659
10/10/96	1.0049	0.04%	SJV	13.5	166	55	2566
AVERAGE:	1.0056	0.09%					
RANGE:	0.0025	0.15%					
STD. DEV.	0.0010	0.06%					

TABLE OF PROVING RESULTS FOR DGO CRUDE:

Proving Date	Meter Factor	Pulse Rep'ty	Crude	API Gr.	Temp.(F)	Press.	B/H
4/6/96	1.0057	0.32%	DGO	19.6	132	260	3695
5/2/96	1.0050	0.04%	DGO	19.7	130	147	2489
6/18/96	1.0057	0.32%	DGO	19.6	127	109	2483
AVERAGE:	1.0055	0.23%					
RANGE:	0.0007	0.28%					
STD. DEV.	0.0004	0.16%					

TABLE OF PROVING RESULTS FOR OCS CRUDE:

Proving Date	Meter Factor	Pulse Rep'ty	Crude	API Gr.	Temp.(F)	Press.	B/H
2/16/96	1.0065	0.16%	OCS	19.5	95	85	3067
3/1/96	1.0063	0.16%	OCS	19.5	94	70	2662
3/22/96	1.0052	0.03%	OCS	19.9	101	63	2554
4/9/96	1.0062	0.03%	OCS	20.1	97	88	2966
6/7/96	1.0038	0.03%	OCS	20.0	159	55	2340
AVERAGE:	1.0056	0.08%					
RANGE:	0.0027	0.13%					
STD. DEV.	0.0011	0.07%					


CO11MB1V1 - VOLUME - CRUDE OIL
AVERAGE METER FACTOR: 1.0056
PRESS RANGE: 55 - 260 PSI
TEMP RANGE: 94 - 165F
FLOWRATE RANGE:1518 - 3067 B/H
+0.25%
-0.25%
METER FACTOR
PULSE REPEATABILITY (%)
METER FACTOR
PULSE REPEATABILITY (%)
1.0100
1.0090
1.0080
1.0070
1.0060
1.0050
1.0040
1.0030
1.0020
1.0010
1.0000
0.75%
0.70%
0.65%
0.60%
0.55%
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
2/15/96
2/16/96
3/1/96
3/18/96
3/22/96
4/6/96
4/9/96
4/26/96
5/2/96
5/10/96
6/7/96
6/18/96
6/28/96
7/18/96
7/18/96
7/18/96
10/10/96
DATE

COMPARISON OF MASTER METER PROVINGS TO CONVENTIONAL PROVINGS

Company No. 11 / Meter Type B / V1
Meter size: 6 Inch
Fluid: Crude Oil / Range
Viscosity Range:
Three crude types
Conventional Pipe Prover

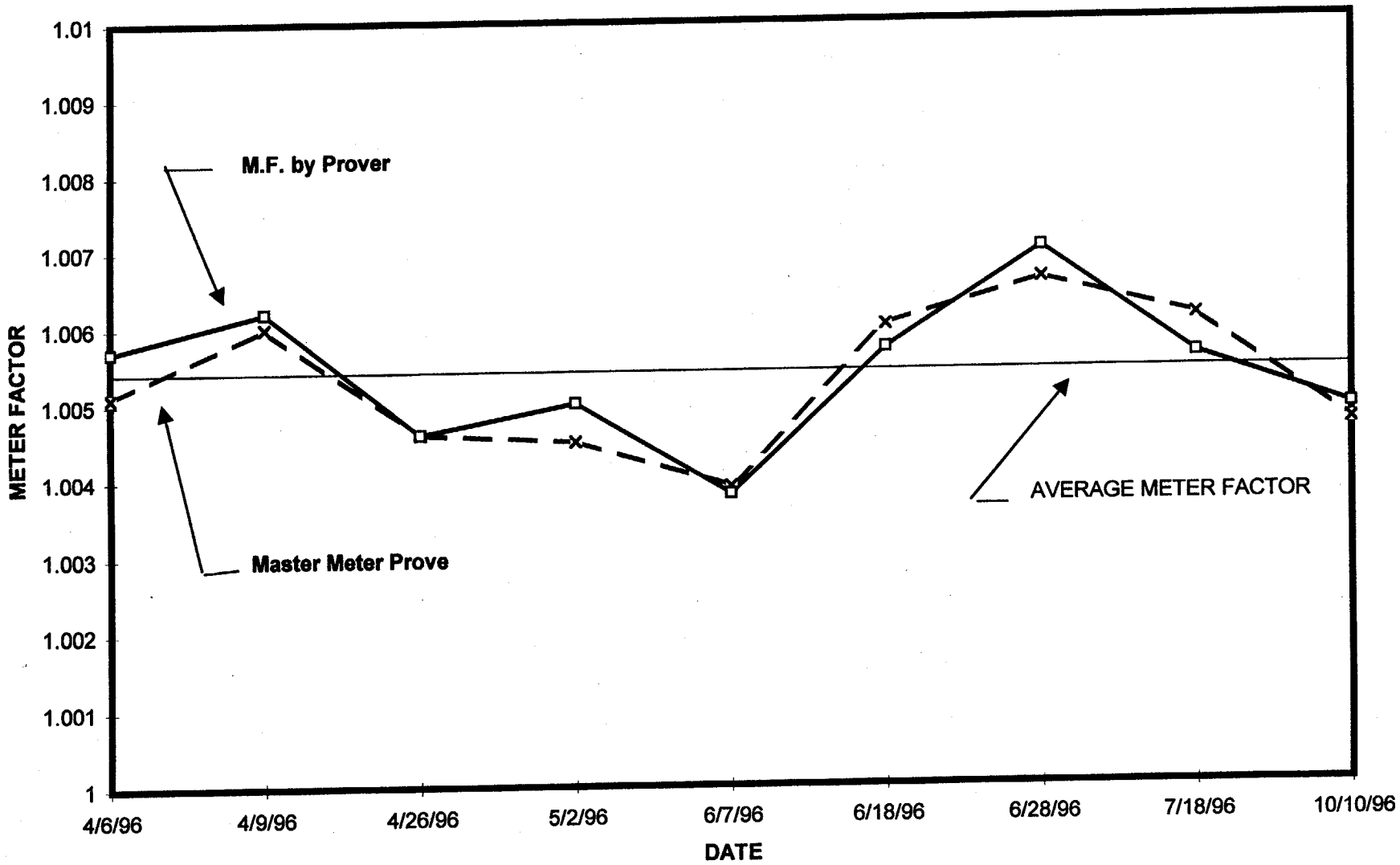
TABLE OF PROVING RESULTS FOR MASTER METER VS. CONVENTIONAL PROVING:

Proving Date	Crude	API Gr	[illegible]	[illegible]	[illegible]
4/6/96	DGO	19.6	1.0051	1.0057	-0.06
4/9/96	OCS	20.1	1.0060	1.0062	-0.02
4/26/96	SJV	13.5	1.0046	1.0046	0.00
5/2/96	DGO	19.7	1.0045	1.0050	-0.05
6/7/96	OCS	20.0	1.0039	1.0038	0.01
6/18/96	DGO	19.7	1.0060	1.0057	0.03
6/28/96	SJV	13.5	1.0066	1.0070	-0.04
7/18/96	SJV	13.5	1.0061	1.0056	0.05
10/10/96	SJV	13.5	1.0047	1.0049	0.02

AVERAGE	1.0053	1.0054	-0.01
RANGE	0.0027	0.0032	
STD. DEV.	0.0009	0.0009	

CO11MBV1 / MASTER METER VS. PROVER

COMPARISON OF METER FACTORS FOR 4/6/96 TO 7/18/96 / AVE M.F. : 1.0053 / 1.0054

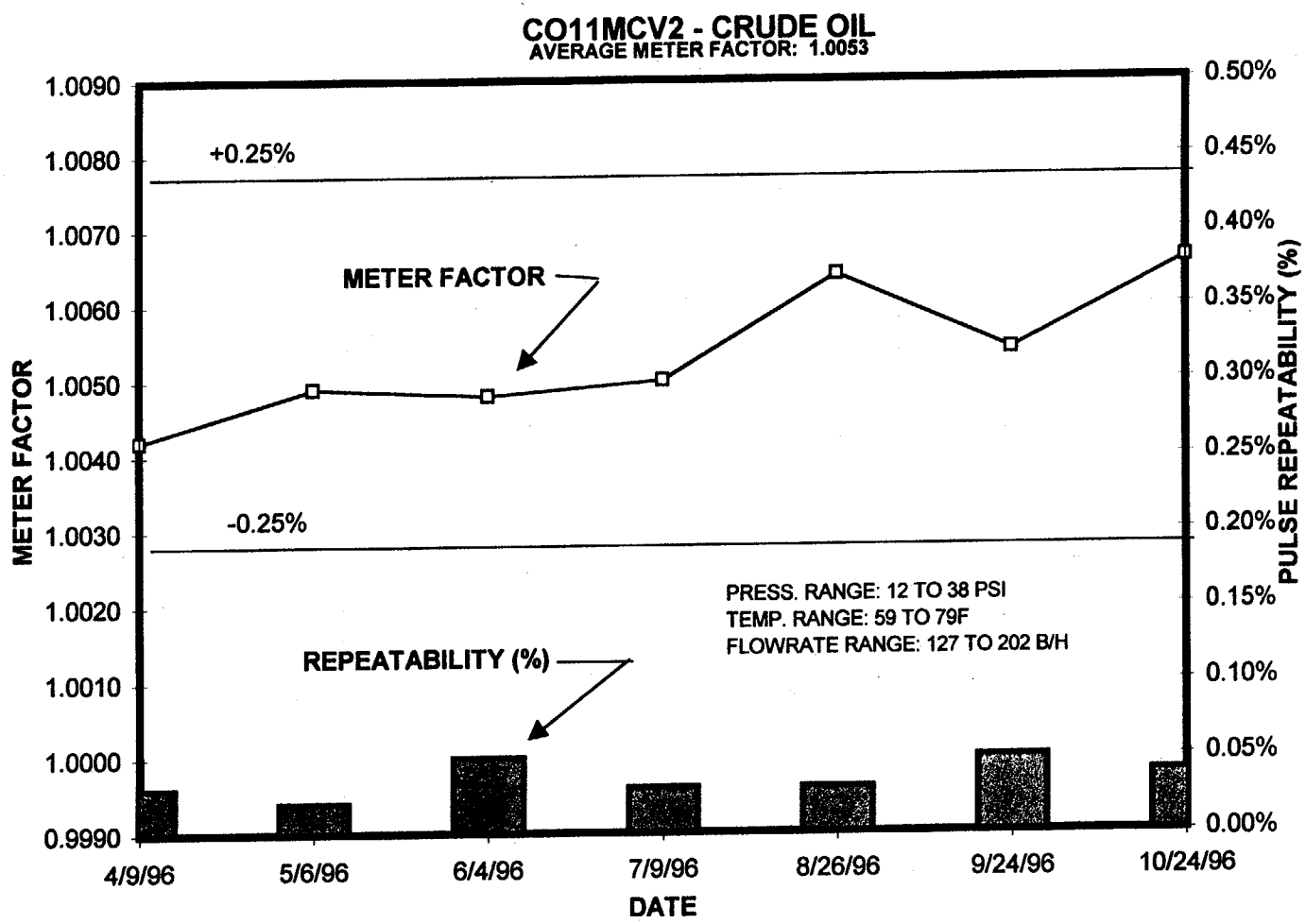


VOLUME METER FACTOR CONTROL CHART

Company No. 11 / Meter Type C / V2
Fluid: Crude Oil
API Gravity Range: 51 to 57
5 Round Trip passes per proving
Conventional Pipe Prover

Proving Date	Meter Factor	Pulse Rep'ty	Temp.	Press.	B/H	API Gr.
4/9/96	1.0043	0.03%	59	12	202	56.8
5/6/96	1.0051	0.02%	73	30	136	51.9
6/4/96	1.0050	0.05%	74	30	128	51.2
7/6/96	1.0052	0.03%	79	35	127	52.4
8/26/96	1.0067	0.03%	78	38	127	51.3

AVERAGE:	1.0053	0.03%
RANGE:	0.0024	0.03%
STD. DEV.	0.0009	0.01%

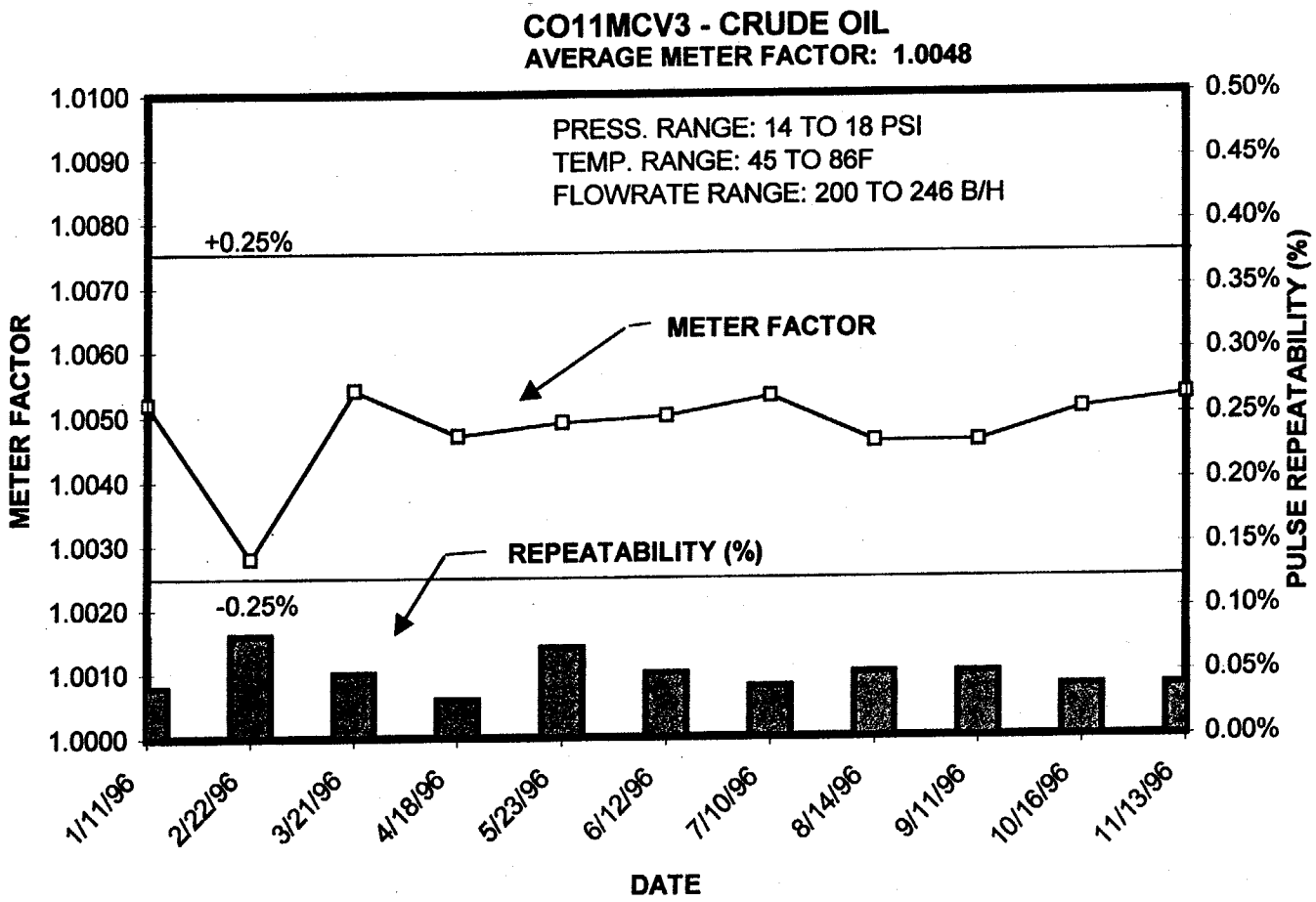

CO11MCV2 - CRUDE OIL
AVERAGE METER FACTOR: 1.0053
METER FACTOR
PULSE REPEATABILITY (%)
+0.25%
-0.25%
METER FACTOR
REPEATABILITY (%)
PRESS. RANGE: 12 TO 38 PSI
TEMP. RANGE: 59 TO 79F
FLOWRATE RANGE: 127 TO 202 B/H
1.0090
1.0080
1.0070
1.0060
1.0050
1.0040
1.0030
1.0020
1.0010
1.0000
0.9990
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
4/9/96
5/6/96
6/4/96
7/9/96
8/26/96
9/24/96
10/24/96
DATE

VOLUME METER FACTOR CONTROL CHART

Company No. 11 / Meter Type C / V3
Meter size: 2 inch
Fluid: Crude Oil
API Gravity Range: 52 to 57
10 Round Trip passes per proving
Conventional Pipe Prover

Proving Date	Meter Factor	Pulse Rep'ty	Temp.	psig	API Gr.	B/H	% Max F.R.
1/11/96	1.0052	0.04%	46.2	18	55.5	246	34.1
2/22/96	1.0028	0.08%	65.9	17	52.1	240	33.8
3/21/96	1.0054	0.05%	52.8	16	55.7	232	32.1
4/18/96	1.0047	0.03%	73.5	14	57.6	215	29.4
5/23/96	1.0049	0.07%	85.6	15	55.4	218	30.2
6/12/96	1.0050	0.05%	79.9	16	53.8	220	30.7
7/10/96	1.0053	0.04%	68.6	17	57	218	29.9
8/14/96	1.0046	0.05%	79.3	16	56.3	223	30.8
9/11/96	1.0046	0.05%	79.5	14	55.3	226	31.3
10/16/96	1.0051	0.04%	71.5	15	55.7	200	27.7
11/13/96	1.0053	0.04%	45.1	17	54.5	225	31.2

AVERAGE:	1.0048	0.05%
RANGE:	0.0026	0.05%
STD. DEV.	0.0007	0.01%


CO11MCV3 - CRUDE OIL
AVERAGE METER FACTOR: 1.0048
PRESS. RANGE: 14 TO 18 PSI
TEMP. RANGE: 45 TO 86F
FLOWRATE RANGE: 200 TO 246 B/H
+0.25%
-0.25%
METER FACTOR
REPEATABILITY (%)
METER FACTOR
PULSE REPEATABILITY (%)
1.0100
1.0090
1.0080
1.0070
1.0060
1.0050
1.0040
1.0030
1.0020
1.0010
1.0000
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
1/11/96
2/22/96
3/21/96
4/18/96
5/23/96
6/12/96
7/10/96
8/14/96
9/11/96
10/16/96
11/13/96
DATE

VOLUME METER FACTOR CONTROL CHART

Company No. 11 / Meter Type: [illegible]
Fluid: Crude Oil
API Gravity Range: [illegible]
5 Round Trip [illegible]
Conventional Pipe Prover

Proving Date	Meter Factor	Pulse Repty	Temp	Press	B/H	API Gr.
5/14/96	1.0104	0.05%	70	9	300	38.6
5/14/96	1.0110	0.04%	70	9	278	38.6

AVERAGE:	1.0107	0.05%
RANGE:	0.0006	0.01%
STD. DEV.	0.0004	0.01%

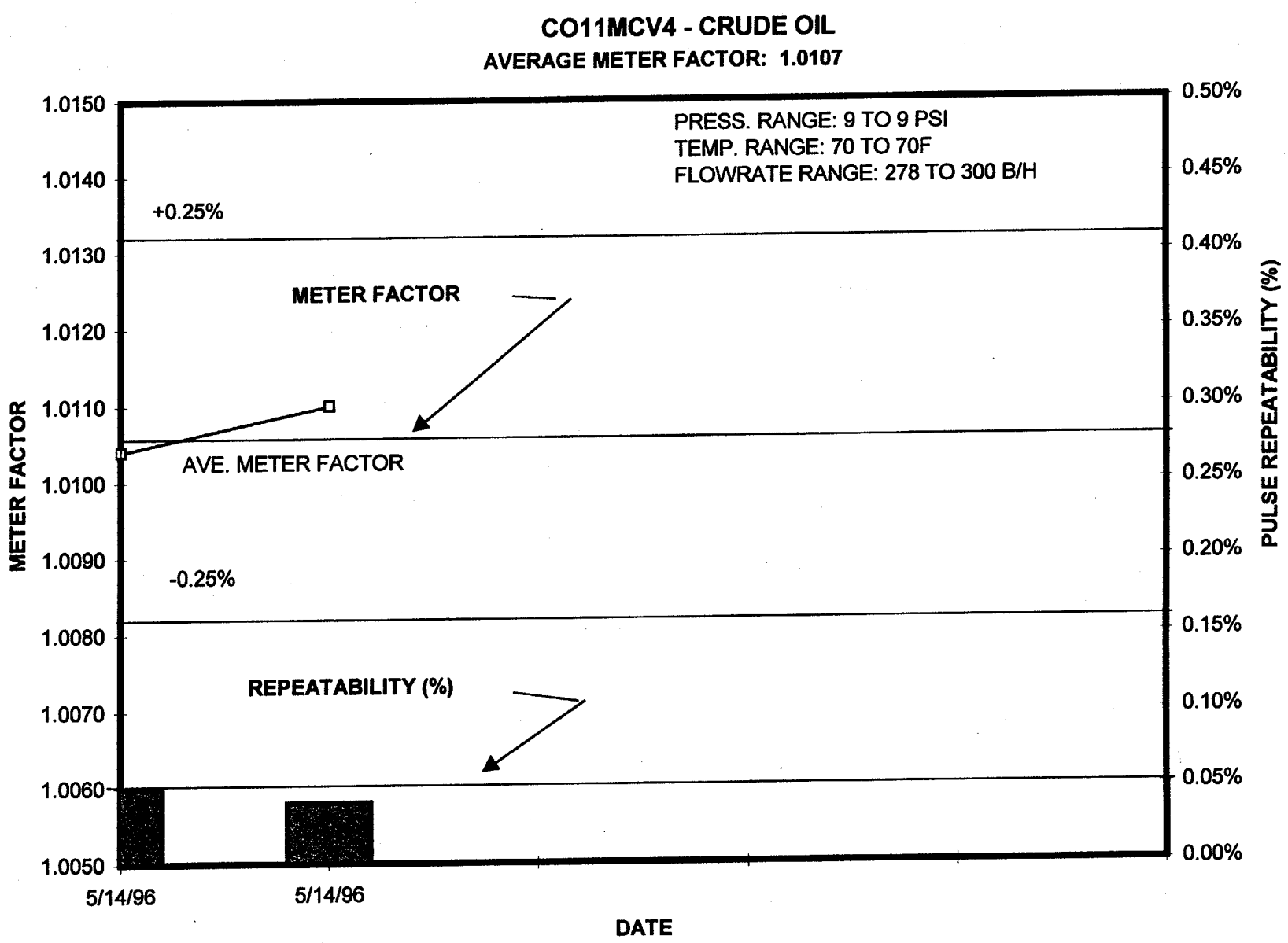

CO11MCV4 - CRUDE OIL
AVERAGE METER FACTOR: 1.0107
PRESS. RANGE: 9 TO 9 PSI
TEMP. RANGE: 70 TO 70F
FLOWRATE RANGE: 278 TO 300 B/H
+0.25%
METER FACTOR
AVE. METER FACTOR
-0.25%
REPEATABILITY (%)
METER FACTOR
1.0150
1.0140
1.0130
1.0120
1.0110
1.0100
1.0090
1.0080
1.0070
1.0060
1.0050
PULSE REPEATABILITY (%)
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
5/14/96
5/14/96
DATE

TABLE I-A

VOLUME METER FACTOR CONTROL CHART

Company No. 12 / Meter Type B / V1
Meter size: 3inch
Fluid: LPG
Prove: 3 runs of 12 passes
Brooks Small Volume Prover

FOLLOWING DATA COVERS PERIOD FROM JUNE 29, 1995 TO JAN. 5, 1996:
NOTE: THIS TABLE DOES NOT CONTAIN PROVINGS 6, 7, 10, & 11.
NOTE: THE METER ZERO WAS NOT PROPERLY SET DURING THIS PERIOD OF TIME.

Prove No.	Date	Time	M.F.	Rep'ty(%)	Temp.C	Pc(KPa)	MS/H	S.G.U.	% Max.
1	6/29/95	1425	1.0105	0.01%	29.7	1019	190	0.553	38.6
2	6/29/95	1430	1.0110	0.02%	29.6	1071	185	0.553	37.6
3	6/29/95	1740	1.0122	0.02%	26.5	1015	168	0.553	34.1
4	7/12/95	1720	1.0112	0.07%	31.5	1130	173	0.549	34.9
5	7/12/95	1740	1.0113	0.01%	29.7	1085	178	0.549	35.9
8	7/12/95	1830	1.0134	0.07%	25.0	1165	158	0.549	31.9
9	7/12/95	1845	1.0120	0.03%	24.8	960	171	0.549	34.5
12	7/12/95	1925	1.0122	0.01%	23.3	1017	166	0.549	33.5
13	7/26/95	NA	1.0109	0.05%	29.2	1131	179	0.550	36.2
14	7/26/95	NA	1.0109	0.03%	30.0	1107	183	0.550	37.0
15	7/27/95	1010	1.0115	0.01%	27.3	931	183	0.554	37.3
16	7/27/95	1020	1.0124	0.06%	27.7	1073	171	0.554	34.8
17	7/27/95	1030	1.0123	0.04%	27.9	1125	168	0.554	34.2
18	7/27/95	1040	1.0130	0.03%	28.4	1185	163	0.554	33.2
19	7/27/95	1055	1.0120	0.03%	29.2	1250	166	0.554	33.8
20	7/27/95	1105	1.0135	0.04%	29.6	1075	163	0.554	33.2
21	7/27/95	1115	1.0121	0.04%	30.2	1089	171	0.554	34.8
22	8/9/95	1130	1.0108	0.04%	33.0	1013	181	0.552	36.7
23	8/9/95	1140	1.0110	0.03%	33.0	1047	179	0.552	36.3
24	8/9/95	1150	1.0113	0.03%	34.9	1267	162	0.552	32.9
25	8/9/95	1520	1.0103	0.03%	35.6	1272	175	0.547	35.2
26	8/9/95	1550	1.0107	0.03%	35.3	1296	173	0.547	34.8
27	9/13/95	2315	1.0125	0.03%	25.3	1107	165	0.552	33.5
28	9/14/95	110	1.0097	0.05%	24.5	810	199	0.552	40.4
29	9/28/95	1025	1.0105	0.04%	24.5	887	192	0.550	38.8
30	9/28/95	1040	1.0118	0.03%	24.3	867	172	0.550	34.8
31	9/28/95	1050	1.0116	0.01%	24.1	880	172	0.550	34.8
32	9/28/95	1055	1.0102	0.06%	24.6	862	193	0.550	39.0
33	9/28/95	1100	1.0119	0.02%	24.0	886	172	0.550	34.8
34	10/10/95	1650	1.0089	0.05%	33.7	1345	205	0.549	41.4
35	10/10/95	1845	1.0125	0.03%	29.9	981	158	0.549	31.9
36	10/10/95	1925	1.0134	0.04%	29.3	1046	153	0.549	30.9
37	10/10/95	1930	1.0142	0.03%	29.3	1124	147	0.549	29.7
38	10/10/95	1958	1.0127	0.02%	28.7	974	159	0.549	32.1
39	12/8/95	1205	1.0111	0.02%	29.4	1424	185	0.547	37.2
40	12/8/95	1230	1.0105	0.02%	29.2	1236	201	0.547	40.4
41	12/8/95	1250	1.0106	0.07%	29.1	1306	195	0.547	39.2

42	1/5/96	1545	1.0134	0.04%	39.7	1117	151	0.547	30.4
43	1/5/96	1555	1.0134	0.03%	39.7	1114	150	0.547	30.2
44	1/5/96	2300	1.0143	0.05%	25.6	992	144	0.547	28.9
45	1/5/96	2305	1.0147	0.01%	25.7	1077	140	0.547	28.1
AVERAGE:			1.0118	0.03%					
RANGE:			0.0058	0.06%					
STD. DEV.			0.0013	0.02%					

TABLE II-A / AVERAGE VALUES FOR EACH DATE BASED ON ABOVE TABLE OF INFORMATIO

NOTE: 7/12/95 DATA DOES NOT INCLUDE PROVING 6,7,10 & 11

Date	M.F.	Rsd.W/A	Tank ID	Rate	[illegible]	[illegible]	Height
6/29/95	1.0112	0.02%	28.6	1035	181	0.553	36.8
7/12/95	1.0120	0.04%	26.9	1071	169	0.549	34.1
7/26/95	1.0109	0.04%	29.6	1119	181	0.550	36.6
7/27/95	1.0125	0.04%	28.6	1104	169	0.554	34.4
8/9/95	1.0108	0.03%	34.4	1179	174	0.550	35.2
9/13/95	1.0111	0.04%	24.9	959	182	0.552	36.9
9/28/95	1.0112	0.03%	24.3	876	180	0.550	36.4
10/10/95	1.0123	0.03%	30.2	1094	164	0.549	33.1
12/8/95	1.0107	0.03%	29.2	1322	194	0.547	39.0
1/5/96	1.0140	0.04%	32.7	1035	147	0.547	29.6

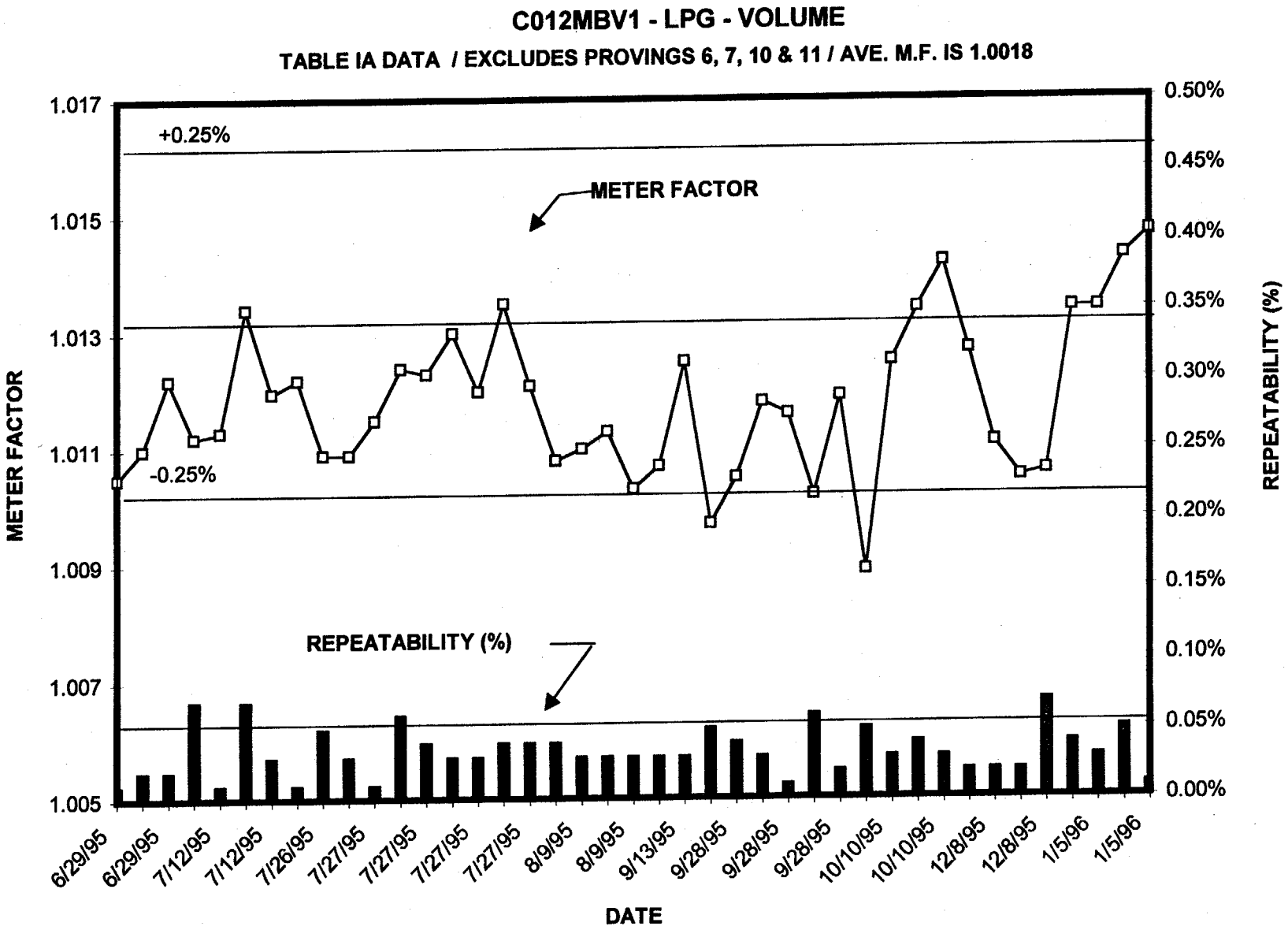

C012MBV1 - LPG - VOLUME
TABLE IA DATA / EXCLUDES PROVINGS 6, 7, 10 & 11 / AVE. M.F. IS 1.0018
+0.25%
-0.25%
METER FACTOR
REPEATABILITY (%)
METER FACTOR
REPEATABILITY (%)
DATE
1.017
1.015
1.013
1.011
1.009
1.007
1.005
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
6/29/95
6/29/95
7/12/95
7/12/95
7/26/95
7/27/95
7/27/95
7/27/95
7/27/95
8/9/95
8/9/95
9/13/95
9/28/95
9/28/95
9/28/95
10/10/95
10/10/95
12/8/95
12/8/95
1/5/96
1/5/96

TABLE III

VOLUME METER FACTOR CONTROL CHART

Company No. 12 / Meter Type B / V1
Meter size: 3 inch
Fluid: LPG
Prove: 3 runs of 12 passes
Brooks Small Volume Prover

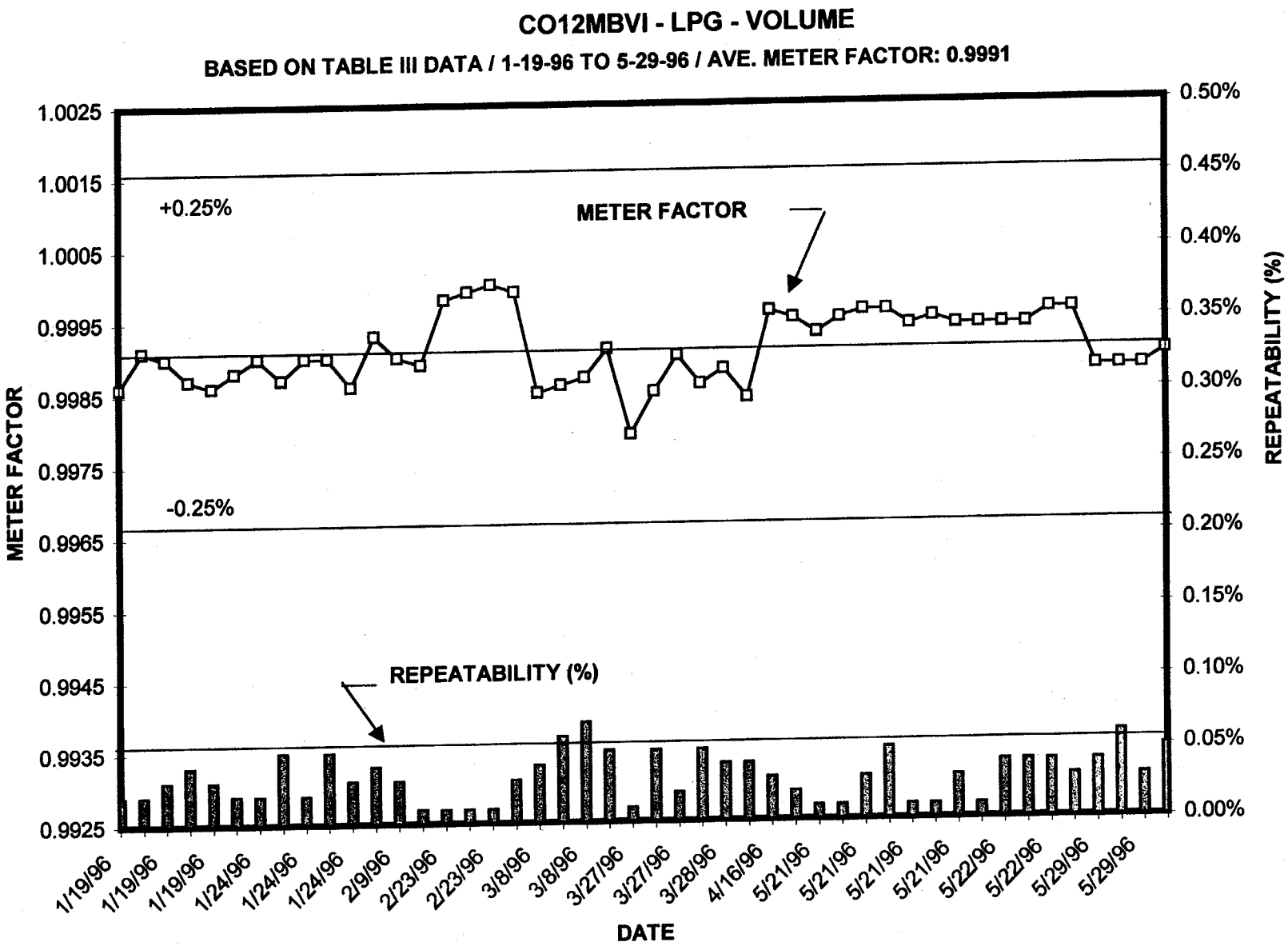
FOLLOWING DATA STARTS ON JAN. 19, 1996 AFTER METER PROPERLY ZEROED

Prove No.	Date	Time	M.F.	Rep'ty (%)	Temp C.	Pr. (KPa)	M3/H	[illegible]	[illegible]
1	1/19/96	1645	0.9986	0.02%	31.5	1260	188	0.548	37.9
2	1/19/96	1650	0.9991	0.02%	31.1	1320	184	0.548	37.1
3	1/19/96	1703	0.9990	0.03%	30.6	1426	197	0.548	39.7
4	1/19/96	1710	0.9987	0.04%	30.2	1436	196	0.548	39.5
5	1/19/96	1718	0.9986	0.03%	29.8	1164	134	0.548	27.0
6	1/19/96	1730	0.9988	0.02%	29.8	1216	129	0.548	26.0
7	1/24/96	1405	0.9990	0.02%	44.6	1435	182	0.552	36.9
8	1/24/96	1415	0.9987	0.05%	41.4	1389	182	0.552	36.9
9	1/24/96	1420	0.9990	0.02%	40.5	1403	179	0.552	36.3
10	1/24/96	1430	0.9990	0.05%	39.5	1273	192	0.552	39.0
11	1/24/96	1525	0.9986	0.03%	39.5	1290	185	0.552	37.5
12	2/9/96	1215	0.9993	0.04%	36.1	1267	187	0.549	37.7
13	2/9/96	1225	0.9990	0.03%	36.6	1325	183	0.549	36.9
14	2/9/96	1235	0.9989	0.01%	36.8	1370	180	0.549	36.3
15	2/23/96	1004	0.9998	0.01%	30.2	1236	118	0.567	24.6
16	2/23/96	1010	0.9999	0.01%	30.5	1271	117	0.567	24.4
17	2/23/96	1020	1.0000	0.01%	30.8	1396	109	0.567	22.7
18	2/23/96	1025	0.9999	0.03%	31.0	1516	103	0.567	21.5
19	3/8/96	1430	0.9985	0.04%	33.3	1100	187	0.55	37.8
20	3/8/96	1445	0.9986	0.06%	33.3	1130	185	0.55	37.4
21	3/8/96	1450	0.9987	0.07%	32.7	1200	179	0.55	36.2
22	3/8/96	1500	0.9991	0.05%	32.3	1280	171	0.55	34.6
23	3/27/96	1700	0.9979	0.01%	35.7	1420	194	0.552	39.4
24	3/27/96	1710	0.9985	0.05%	35.4	1530	189	0.552	38.3
25	3/27/96	1715	0.9990	0.02%	35.2	1530	202	0.552	41.0
26	3/27/96	1723	0.9986	0.05%	35.1	1340	205	0.552	41.6
27	3/28/96	1737	0.9988	0.04%	31.6	1255	192	0.548	38.7
28	3/28/96	1745	0.9984	0.04%	31.6	1282	188	0.548	37.9
29	4/16/96	1450	0.9996	0.03%	28.1	1253	143	0.552	29.0
30	4/16/96	1510	0.9995	0.02%	27.1	1228	148	0.552	30.0
31	5/21/96	1410	0.9993	0.01%	27.9	1274	165	0.544	33.0
32	5/21/96	1415	0.9995	0.01%	27.7	1318	161	0.544	32.2
33	5/21/96	1425	0.9996	0.03%	27.8	1371	157	0.544	31.4
34	5/21/96	1440	0.9996	0.05%	27.8	1309	161	0.544	32.2
35	5/21/96	1445	0.9994	0.01%	27.7	1299	161	0.544	32.2
36	5/21/96	1615	0.9995	0.01%	26.6	1353	154	0.544	30.8
37	5/21/96	1620	0.9994	0.03%	26.1	1298	158	0.544	31.6

38	5/22/96	1535	0.9994	0.01%	30.5	1745	180	0.542	35.9
39	5/22/96	1555	0.9994	0.04%	30.6	1755	178	0.542	35.5
40	5/22/96	1610	0.9994	0.04%	30.2	1742	179	0.542	35.7
41	5/22/96	1620	0.9996	0.04%	29.9	1755	177	0.542	35.3
42	5/22/96	1630	0.9996	0.03%	29.6	1753	178	0.542	35.5
43	5/29/96	1545	0.9988	0.04%	27.9	1420	208	0.544	41.6
44	5/29/96	1555	0.9988	0.06%	27.7	1422	207	0.544	41.4
45	5/29/96	1605	0.9988	0.03%	27.6	1433	205	0.544	41.0
46	5/29/96	1625	0.9990	0.05%	27.3	1475	199	0.544	39.8
AVERAGE:			0.9991	0.03%					
RANGE:			0.0021	0.06%					
STD. DEV			0.0005	0.02%					

TABLE IV / AVERAGE VALUES FOR EACH DATE BASED ON ABOVE TABLE OF INFORMATIO

Date	Motor Eac	Error %	Temp C	Pa (KPa)	Vol	Vol/Pa
#####	0.9988	0.03%	30.5	1303	171	0.548
#####	0.9989	0.03%	41.1	1358	184	0.552
2/9/96	0.9991	0.03%	36.5	1321	183	0.549
#####	0.9999	0.02%	30.6	1355	112	0.567
3/8/96	0.9987	0.05%	32.9	1178	181	0.550
#####	0.9985	0.03%	35.4	1455	198	0.552
#####	0.9996	0.03%	27.6	1241	146	0.552
#####	0.9994	0.03%	27.4	1317	160	0.544
#####	0.9995	0.03%	30.2	1750	178	0.542
#####	0.9988	0.04%	27.4	1438	205	0.544


CO12MBVI - LPG - VOLUME
BASED ON TABLE III DATA / 1-19-96 TO 5-29-96 / AVE. METER FACTOR: 0.9991
METER FACTOR
REPEATABILITY (%)
+0.25%
-0.25%
1.0025
1.0015
1.0005
0.9995
0.9985
0.9975
0.9965
0.9955
0.9945
0.9935
0.9925
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
1/19/96
1/19/96
1/19/96
1/24/96
1/24/96
1/24/96
2/9/96
2/23/96
2/23/96
3/8/96
3/8/96
3/27/96
3/27/96
3/28/96
4/16/96
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5/22/96
5/22/96
5/29/96
5/29/96
DATE

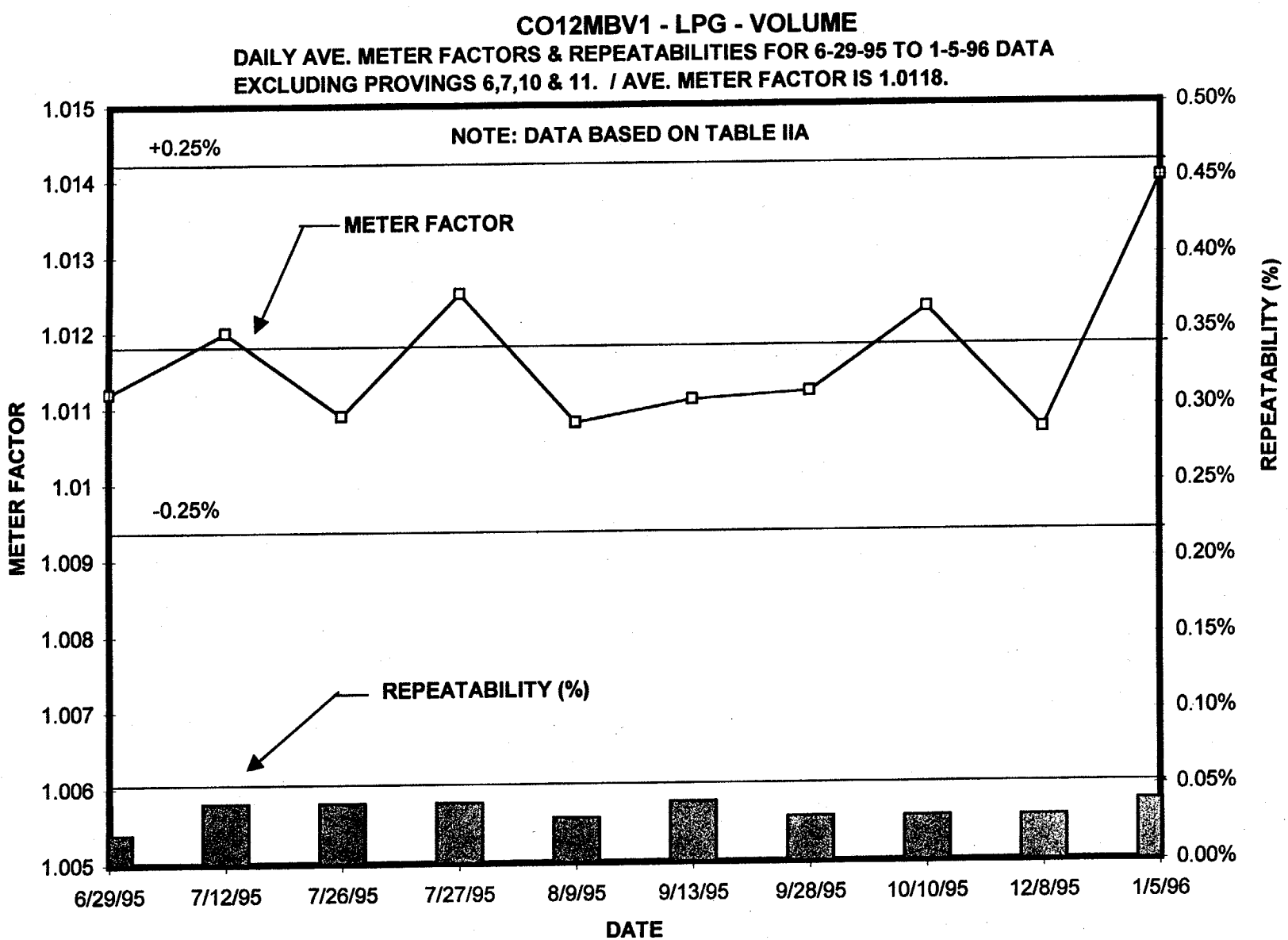

CO12MBV1 - LPG - VOLUME
DAILY AVE. METER FACTORS & REPEATABILITIES FOR 6-29-95 TO 1-5-96 DATA
EXCLUDING PROVINGS 6,7,10 & 11. / AVE. METER FACTOR IS 1.0118.
NOTE: DATA BASED ON TABLE IIA
+0.25%
-0.25%
METER FACTOR
REPEATABILITY (%)
METER FACTOR
REPEATABILITY (%)
1.015
1.014
1.013
1.012
1.011
1.01
1.009
1.008
1.007
1.006
1.005
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
6/29/95
7/12/95
7/26/95
7/27/95
8/9/95
9/13/95
9/28/95
10/10/95
12/8/95
1/5/96
DATE

TABLE V

VOLUME METER FACTOR CONTROL CHART

Company No. 12 / Meter Type B / V1
Meter size: 3 inch
Fluid: LPG
Prove: 3 runs of 12 passes(except Prove No.4 & 5)
Brooks Small Volume Prover

FOLLOWING DATA COVERS PERIOD OF PROVING FROM 6-29-95 TO 1-5-96
METER ZERO WAS NOT PROPERLY SET DURING THESE PROVINGS.

THIS TABLE OF DATA FOR PROVINGS DONE AT HIGH FLOW RATES

Prove No.	Date	Time	M.F.	Rep (%)	Temp	[illegible]	[illegible]	[illegible]	[illegible]
1	9/13/95	2338	1.0080	0.12%	25.2	1083	236	0.552	47.9
2	9/28/95	955	1.0058	0.17%	25.0	1264	300	0.550	60.6
3	8/12/95	1105	1.0083	0.10%	29.8	1290	244	0.547	49.1
4	8/12/95	1125	1.0084	0.17%	30.0	1353	237	0.547	47.6
5	8/12/95	1235	1.0106	0.12%	29.2	1265	198	0.547	39.8
6	12/9/95	100	1.0093	0.07%	29.0	1032	215	0.547	43.2

NOTE: PROVE NO. 4 & 5 CONSISTED OF 5 RUNS OF 4 PASSES PER RUN.

AVERAGE:			1.0084	0.13%					
RANGE:			0.0048	0.10%					
STD DEV:			0.0016	0.04%					

TABLE VI

VOLUME METER FACTOR CONTROL CHART

Company No. 12 / Meter Type B / V1
Fluid: LPG
Prove: 3 runs of 12 passes(except Prove No. 5)
Brooks Small Volume Prover

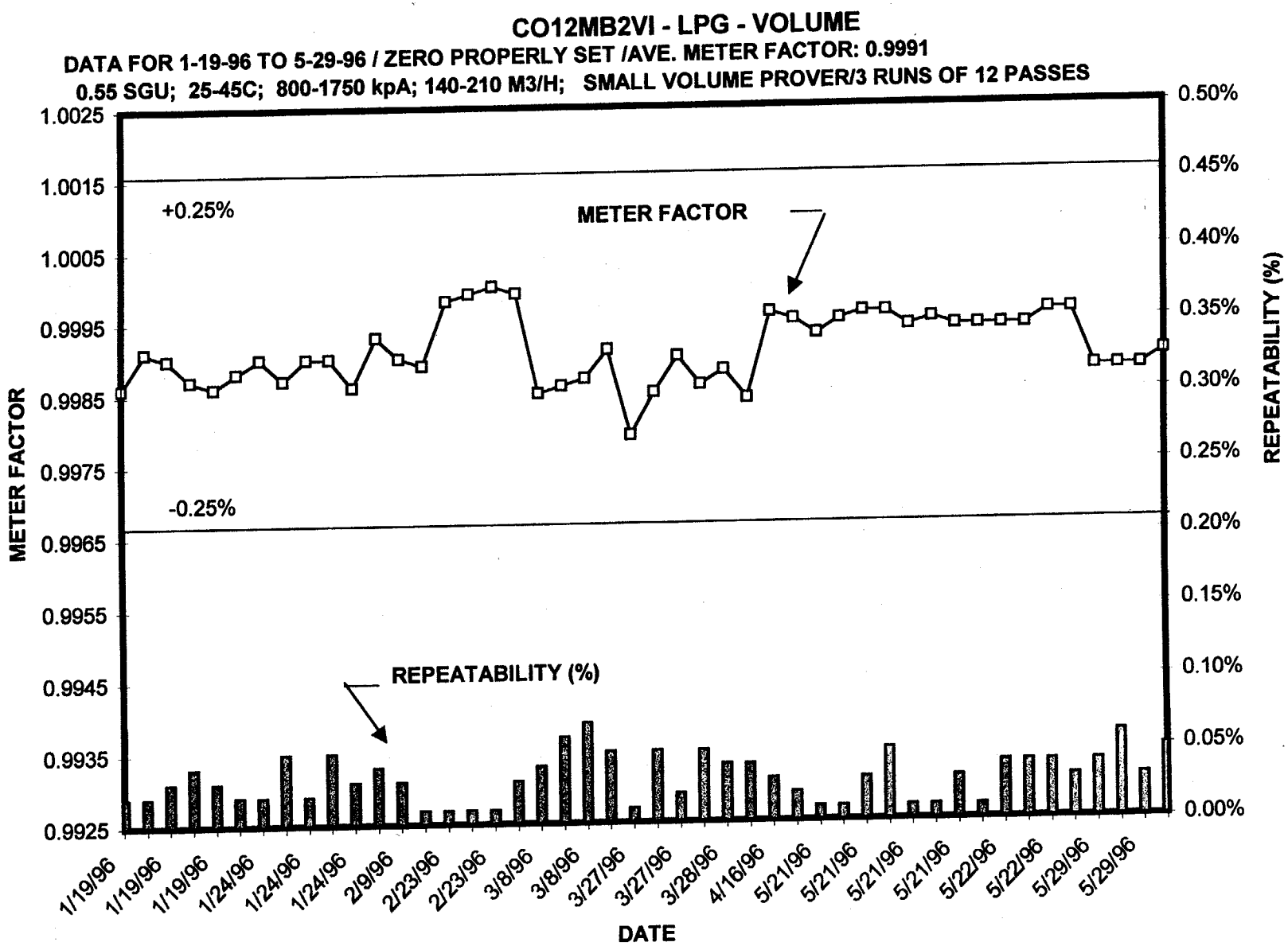
FOLLOWING DATA STARTS ON JAN. 19, 1996 AFTER METER PROPERLY ZEROED

THIS TABLE OF DATA FOR PROVINGS DONE AT HIGH FLOW RATES

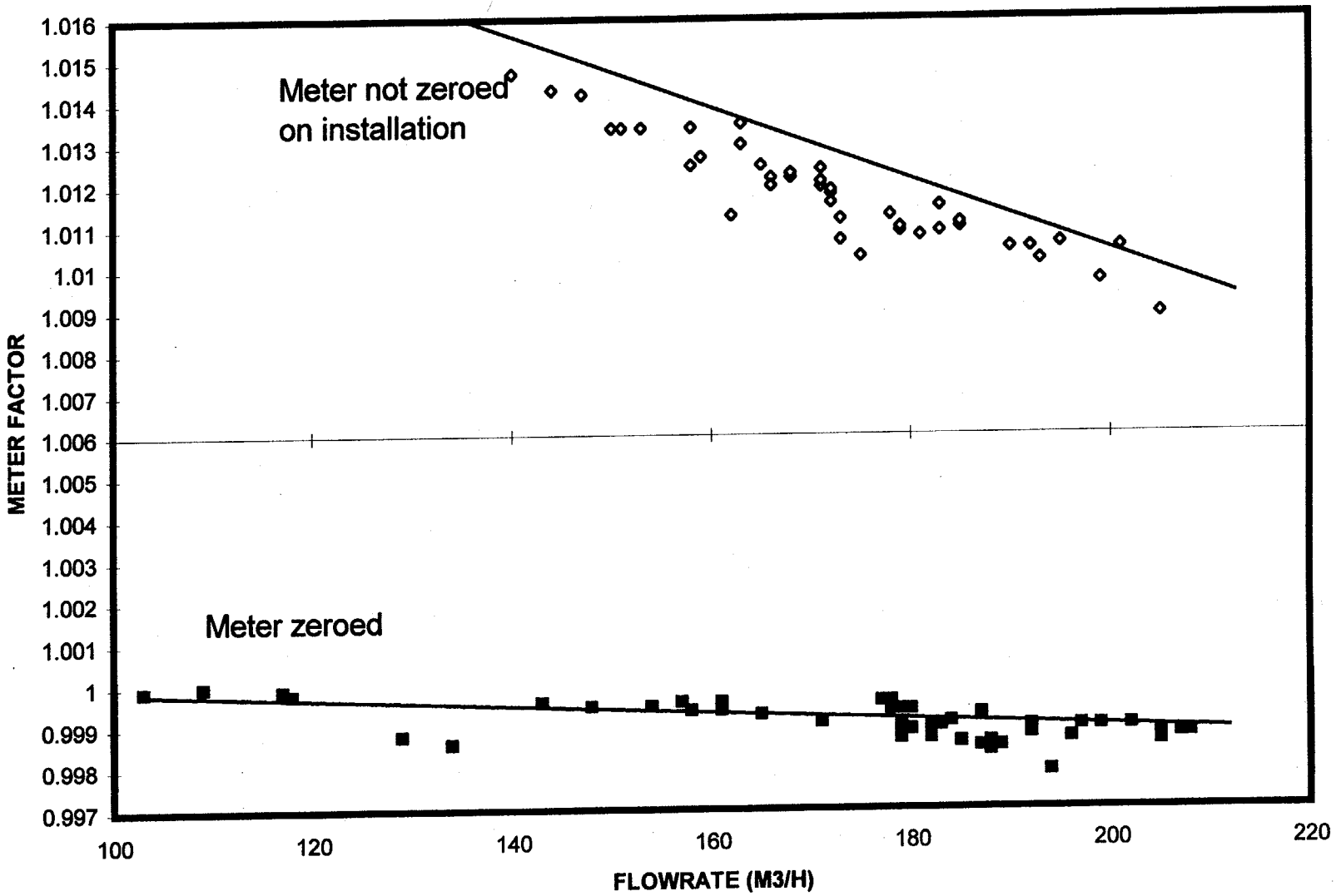
Prove No.	Date	Time	Meter Fac	Rep'ty(%)	Temp C	Pr (KPa)	[illegible]	[illegible]
1	1/24/96	1330	0.9987	0.13%	43.6	1285	224	0.552
2	1/24/96	1345	0.9988	0.12%	43.3	1379	217	0.552
3	2/9/96	945	0.9985	0.10%	32.4	1316	220	0.549
4	2/9/96	950	0.9988	0.07%	32.8	1425	210	0.549
5	5/21/96	1455	0.9990	0.07%	27.6	1278	162	0.544
6	5/29/96	1535	0.9988	0.06%	28.2	1325	223	0.544
7	5/29/96	1540	0.9989	0.06%	28.1	1408	211	0.544

NOTE: PROVE NO. 5 CONSISTED OF 5 RUNS OF 4 PASSES PER RUN.

AVERAGE:			0.9988	0.09%				
RANGE:			0.0005	0.07%				
STD DEV:			0.0002	0.03%				


CO12MB2VI - LPG - VOLUME
DATA FOR 1-19-96 TO 5-29-96 / ZERO PROPERLY SET /AVE. METER FACTOR: 0.9991
0.55 SGU; 25-45C; 800-1750 kpA; 140-210 M3/H; SMALL VOLUME PROVER/3 RUNS OF 12 PASSES
METER FACTOR
REPEATABILITY (%)
+0.25%
-0.25%
1.0025
1.0015
1.0005
0.9995
0.9985
0.9975
0.9965
0.9955
0.9945
0.9935
0.9925
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
1/19/96
1/19/96
1/19/96
1/24/96
1/24/96
1/24/96
2/9/96
2/23/96
2/23/96
3/8/96
3/8/96
3/27/96
3/27/96
3/28/96
4/16/96
5/21/96
5/21/96
5/21/96
5/21/96
5/22/96
5/22/96
5/29/96
5/29/96
DATE

CO12MB2V1 - M.F. VS FLOWRATE - 3"

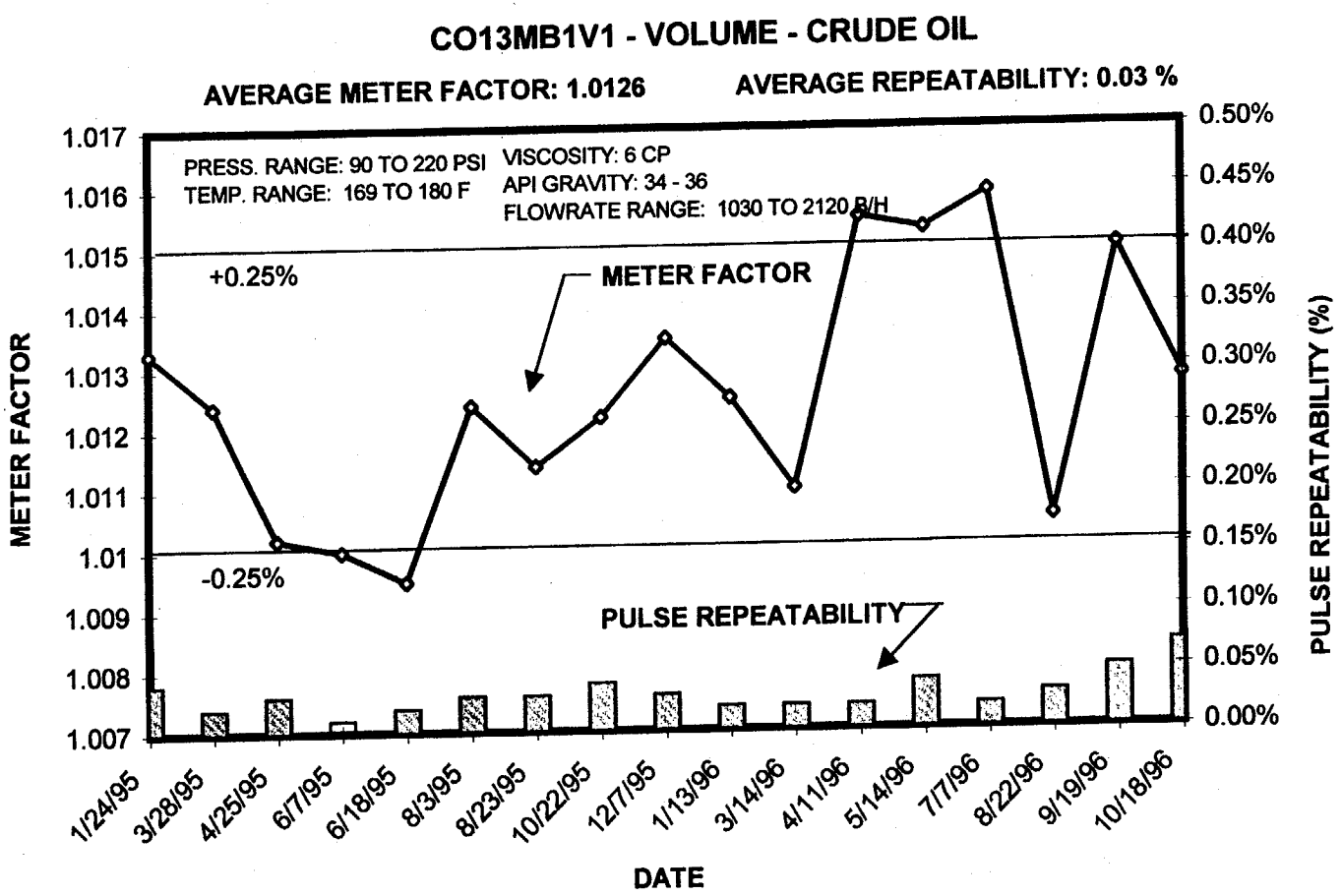


VOLUME METER FACTOR CONTROL CHART

Company No. 13 / Meter Type B / V1
Meter size: 6 Inch
Fluid: Crude Oil / API Gravity: 34 - 36
Viscosity: 6 cp.
Conventional Pipe Prover

Proving Date	Meter Factor	Pulse Rep'ty	Temp.(F)	Press.	B/H	% Max F.R.
1/24/95	1.0133	0.04%	169	180	N.A.	
3/28/95	1.0124	0.02%	173	160	N.A.	
4/25/95	1.0102	0.03%	172	145	1280	25.5
6/7/95	1.0100	0.01%	173	150	N.A.	
6/18/95	1.0095	0.02%	173	90	N.A.	
8/3/95	1.0124	0.03%	176	180	N.A.	
8/23/95	1.0114	0.03%	176	140	1030	20.5
10/22/95	1.0122	0.04%	177	190	N.A.	
12/7/95	1.0135	0.03%	175	200	1240	24.7
1/13/96	1.0125	0.02%	172	175	1290	25.7
3/14/96	1.0110	0.02%	172	120	1140	22.7
4/11/96	1.0155	0.02%	174	195	1452	28.9
5/14/96	1.0153	0.04%	175	190	1460	29.1
7/7/96	1.0159	0.02%	180	220	2120	42.2
8/22/96	1.0105	0.03%	175	200	1827	36.4
9/19/96	1.0150	0.05%	176	210	1840	36.6
10/18/96	1.0128	0.07%	172	175	1701	33.9

AVERAGE:	1.0126	0.03%
RANGE:	0.0064	0.06%
STD. DEV.	0.0020	0.01%

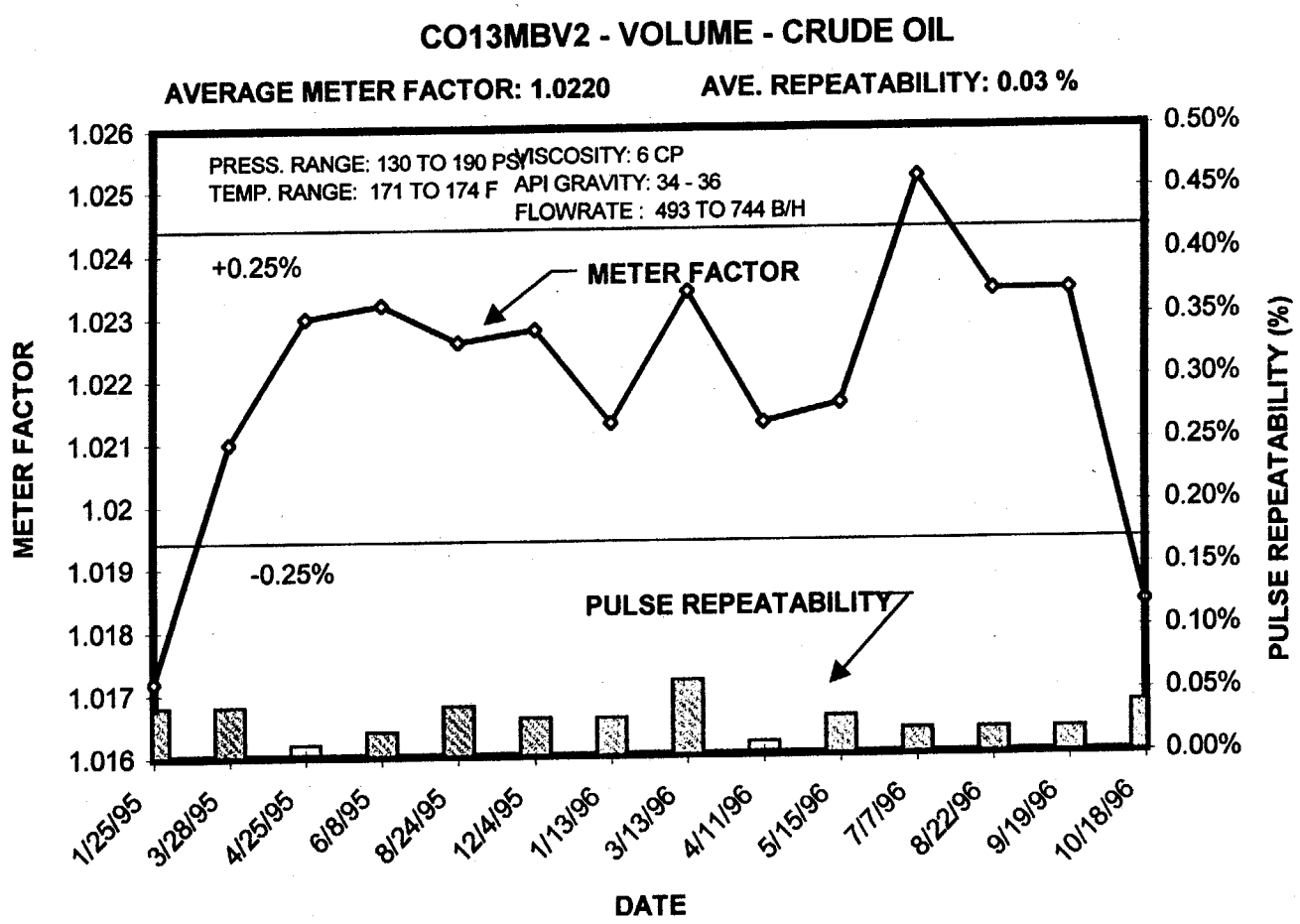

CO13MB1V1 - VOLUME - CRUDE OIL
AVERAGE METER FACTOR: 1.0126
AVERAGE REPEATABILITY: 0.03 %
PRESS. RANGE: 90 TO 220 PSI
TEMP. RANGE: 169 TO 180 F
VISCOSITY: 6 CP
API GRAVITY: 34 - 36
FLOWRATE RANGE: 1030 TO 2120 B/H
+0.25%
-0.25%
METER FACTOR
PULSE REPEATABILITY
METER FACTOR
PULSE REPEATABILITY (%)
DATE
1.017
1.016
1.015
1.014
1.013
1.012
1.011
1.01
1.009
1.008
1.007
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
1/24/95
3/28/95
4/25/95
6/7/95
6/18/95
8/3/95
8/23/95
10/22/95
12/7/95
1/13/96
3/14/96
4/11/96
5/14/96
7/7/96
8/22/96
9/19/96
10/18/96

VOLUME METER FACTOR CONTROL CHART

Company No. 13 / Meter Type B / V2
Meter size: 3 inch
Fluid: Crude Oil / API Gravity: 34 - 36
Viscosity: 6 cp.
Conventional Pipe Prover

Proving Date	Meter Factor	Pulse Rep'ty	Temp.(F)	Press.	B/H	% Max F.R.
1/25/95	1.0172	0.04%	172	130	N.A.	
3/28/95	1.0210	0.04%	174	170	N.A.	
4/25/95	1.0230	0.01%	174	175	671	47.7
6/8/95	1.0232	0.02%	172	175	N.A.	
8/24/95	1.0226	0.04%	170	178	493	35.0
12/4/95	1.0228	0.03%	170	185	524	37.2
1/13/96	1.0213	0.03%	170	170	510	36.2
3/13/96	1.0234	0.06%	170	180	535	38.0
4/11/96	1.0213	0.01%	174	175	540	38.4
5/15/96	1.0216	0.03%	170	180	620	44.1
7/7/96	1.0252	0.02%	171	190	525	37.3
8/22/96	1.0234	0.02%	170	185	663	47.1
9/19/96	1.0234	0.02%	170	185	744	52.9
10/18/96	1.0184	0.04%	166	150	695	49.4

AVERAGE:	1.0220	0.03%
RANGE:	0.0080	0.05%
STD. DEV.	0.0021	0.01%

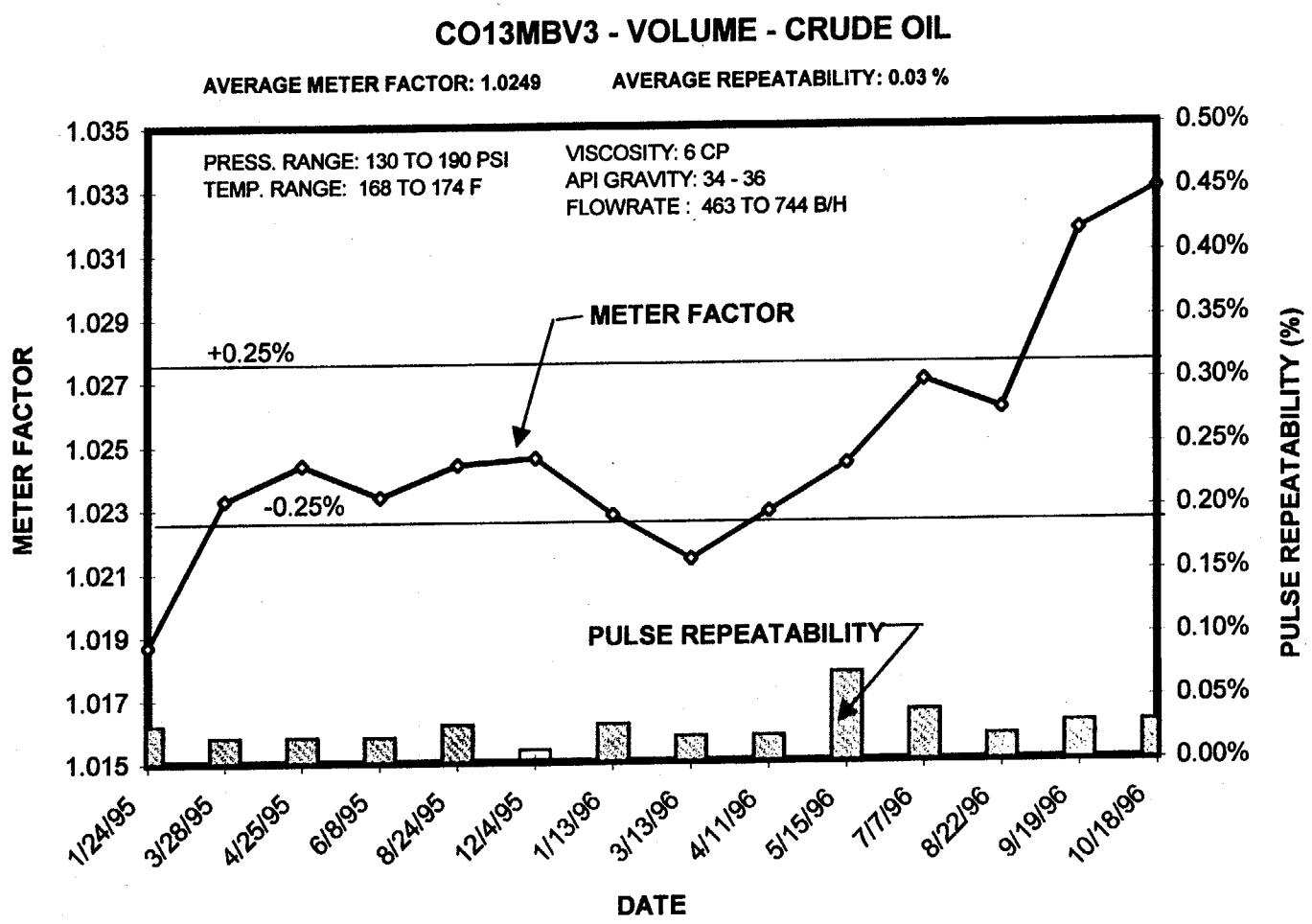

CO13MBV2 - VOLUME - CRUDE OIL
AVERAGE METER FACTOR: 1.0220
AVE. REPEATABILITY: 0.03 %
PRESS. RANGE: 130 TO 190 PSI
TEMP. RANGE: 171 TO 174 F
VISCOSITY: 6 CP
API GRAVITY: 34 - 36
FLOWRATE : 493 TO 744 B/H
+0.25%
-0.25%
METER FACTOR
PULSE REPEATABILITY
METER FACTOR
PULSE REPEATABILITY (%)
DATE
1.026
1.025
1.024
1.023
1.022
1.021
1.02
1.019
1.018
1.017
1.016
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
1/25/95
3/28/95
4/25/95
6/8/95
8/24/95
12/4/95
1/13/96
3/13/96
4/11/96
5/15/96
7/7/96
8/22/96
9/19/96
10/18/96

VOLUME METER FACTOR CONTROL CHART

Company No. 13 / Meter Type B / V3
Meter size: 3 inch
Fluid: Crude Oil / API Gravity: 34 - 36
Viscosity: 6 cp.
Conventional Pipe Prover

Proving Date	Meter Factor	Pulse Rep'ty	Temp.(F)	psig	B/H	% Max F.R.
1/24/95	1.0187	0.03%	172	130	N.A.	
3/28/95	1.0233	0.02%	174	170	N.A.	
4/25/95	1.0244	0.02%	174	175	675	48.0
6/8/95	1.0234	0.02%	172	175	N.A.	
8/24/95	1.0244	0.03%	170	178	485	34.5
12/4/95	1.0246	0.01%	170	185	532	37.8
1/13/96	1.0228	0.03%	170	170	529	37.6
3/13/96	1.0214	0.02%	170	182	540	38.4
4/11/96	1.0229	0.02%	174	175	553	39.3
5/15/96	1.0244	0.07%	170	180	640	45.5
7/7/96	1.0270	0.04%	171	190	530	37.7
8/22/96	1.0261	0.02%	168	130	463	32.9
9/19/96	1.0317	0.03%	170	185	744	52.9
10/18/96	1.0330	0.03%	166	185	740	52.6

AVERAGE:	1.0249	0.03%
RANGE:	0.0143	0.06%
STD. DEV.	0.0037	0.01%

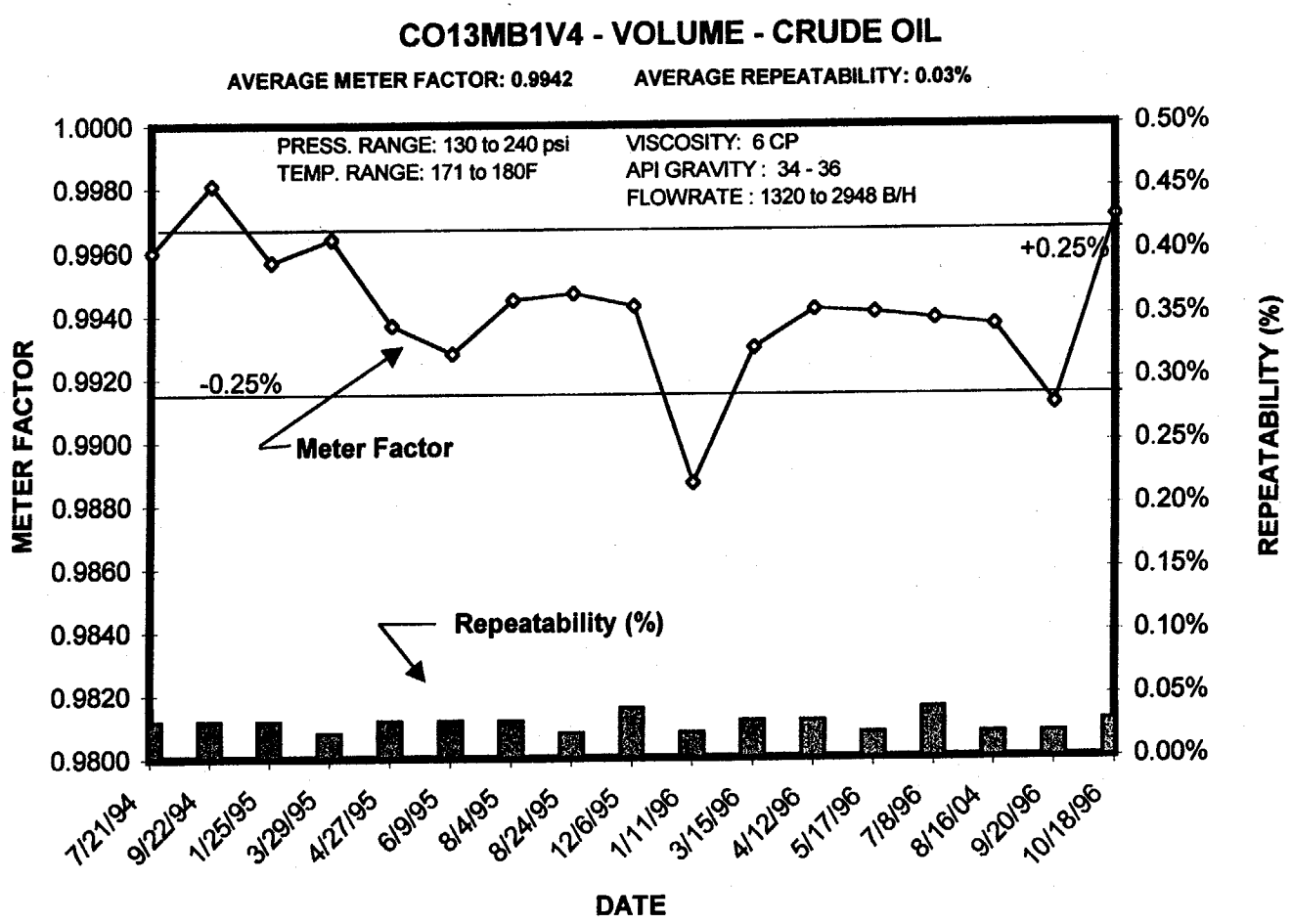

CO13MBV3 - VOLUME - CRUDE OIL
AVERAGE METER FACTOR: 1.0249
AVERAGE REPEATABILITY: 0.03 %
PRESS. RANGE: 130 TO 190 PSI
TEMP. RANGE: 168 TO 174 F
VISCOSITY: 6 CP
API GRAVITY: 34 - 36
FLOWRATE : 463 TO 744 B/H
METER FACTOR
+0.25%
-0.25%
PULSE REPEATABILITY
METER FACTOR
PULSE REPEATABILITY (%)
DATE
1.035
1.033
1.031
1.029
1.027
1.025
1.023
1.021
1.019
1.017
1.015
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
1/24/95
3/28/95
4/25/95
6/8/95
8/24/95
12/4/95
1/13/96
3/13/96
4/11/96
5/15/96
7/7/96
8/22/96
9/19/96
10/18/96

VOLUME METER FACTOR CONTROL CHART

Company No. 13 / Meter Type B / V4
Meter size: 6 inch
Fluid: Crude Oil / API Gravity: 34 - 36
Viscosity: 6 cp.
Conventional Pipe Prover

Proving Date	Meter Factor	Pulse Rep'ty	Temp.(F)	psig	B/H	% Max F.R.
7/21/94	0.9960	0.03%	177	195	N.A.	
9/22/94	0.9981	0.03%	175	150	N.A.	
1/25/95	0.9957	0.03%	180	225	N.A.	
3/29/95	0.9964	0.02%	171	210	N.A.	
4/27/95	0.9937	0.03%	176	195	N.A.	
6/9/95	0.9928	0.03%	173	190	N.A.	
8/4/95	0.9945	0.03%	172	230	2747	54.7
8/24/95	0.9947	0.02%	174	220	1650	32.8
12/6/95	0.9943	0.04%	175	220	2948	58.7
1/11/96	0.9887	0.02%	170	130	1730	34.4
3/15/96	0.9930	0.03%	175	200	2230	44.4
4/12/96	0.9942	0.03%	173	185	2452	48.8
5/17/96	0.9941	0.02%	177	185	1440	28.7
7/8/96	0.9939	0.04%	175	170	1650	32.8
8/16/04	0.9937	0.02%	178	200	1690	33.6
9/20/96	0.9912	0.02%	174	210	1320	26.3
10/18/96	0.9971	0.03%	180	240	2320	46.2

AVERAGE:	0.9942	0.03%
RANGE:	0.0094	0.02%
STD. DEV.	0.0022	0.01%

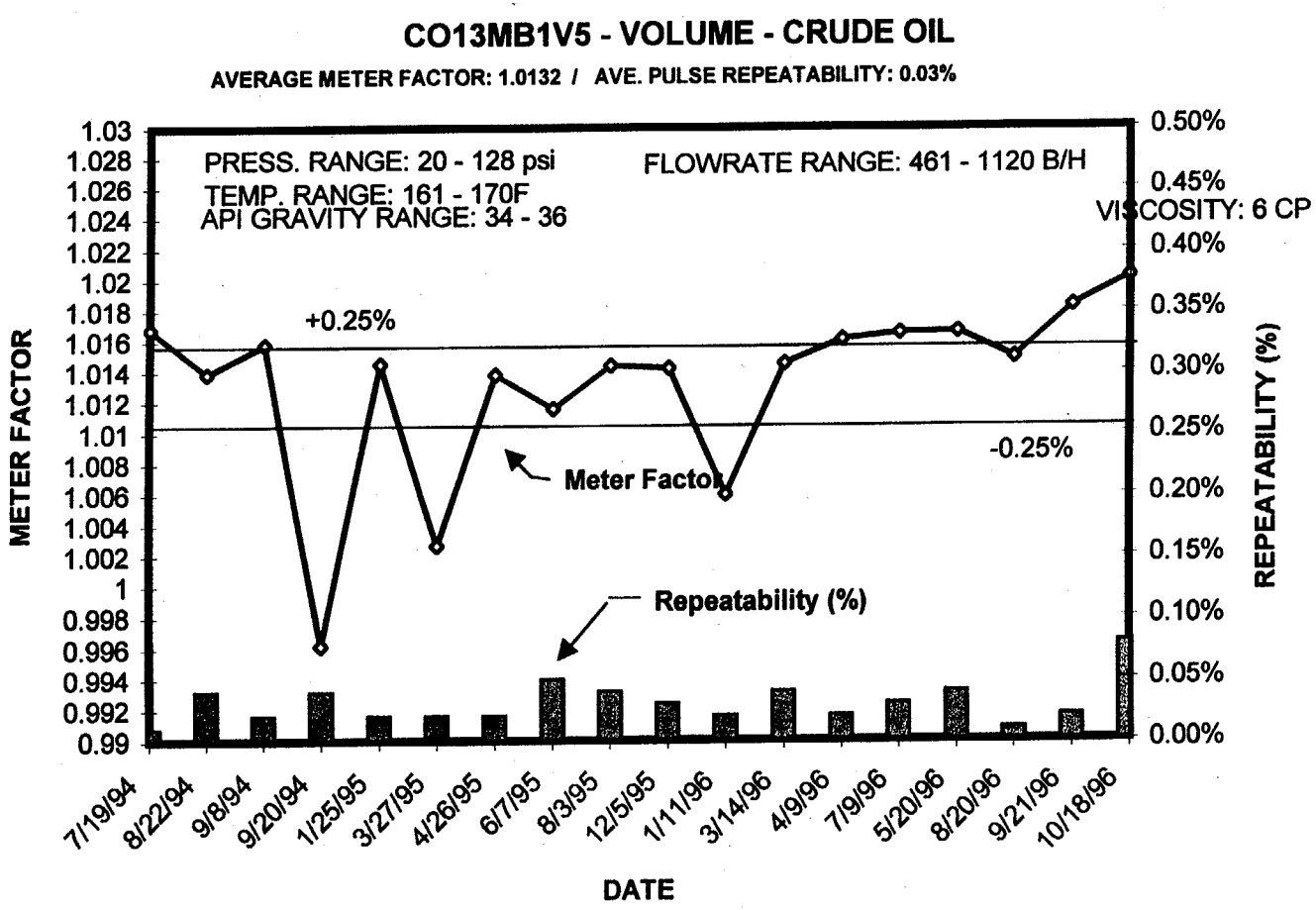

CO13MB1V4 - VOLUME - CRUDE OIL
AVERAGE METER FACTOR: 0.9942
AVERAGE REPEATABILITY: 0.03%
PRESS. RANGE: 130 to 240 psi
TEMP. RANGE: 171 to 180F
VISCOSITY: 6 CP
API GRAVITY : 34 - 36
FLOWRATE : 1320 to 2948 B/H
+0.25%
-0.25%
Meter Factor
Repeatability (%)
METER FACTOR
REPEATABILITY (%)
1.0000
0.9980
0.9960
0.9940
0.9920
0.9900
0.9880
0.9860
0.9840
0.9820
0.9800
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
7/21/94
9/22/94
1/25/95
3/29/95
4/27/95
6/9/95
8/4/95
8/24/95
12/6/95
1/11/96
3/15/96
4/12/96
5/17/96
7/8/96
8/16/04
9/20/96
10/18/96
DATE

VOLUME METER FACTOR CONTROL CHART

Company No. 13 / Meter Type B / V5
Meter size: 3 inch
Fluid: Crude Oil / API Gravity: 34 - 36
Viscosity: 6 cp.
Conventional Pipe Prover

Proving Date	Meter Factor	Pulse Rep'ty	Temp.(F)	psig	B/H	% Max F.R.
7/19/94	1.0168	0.01%	167	125	N.A.	
8/22/94	1.0139	0.04%	167	100	N.A.	
9/8/94	1.0158	0.02%	168	120	N.A.	
9/20/94	0.9962	0.04%	167	100	N.A.	
1/25/95	1.0145	0.02%	166	120	N.A.	
3/27/95	1.0027	0.02%	160	100	N.A.	
4/26/95	1.0138	0.02%	161	105	N.A.	
6/7/95	1.0116	0.05%	166	90	N.A.	
8/3/95	1.0144	0.04%	166	105	N.A.	
12/5/95	1.0142	0.03%	156	122	385	27.4
1/11/96	1.0060	0.02%	159	20	532	37.8
3/14/96	1.0145	0.04%	170	90	1113	79.1
4/9/96	1.0161	0.02%	166	128	532	37.8
7/9/96	1.0165	0.03%	170	100	530	37.7
5/20/96	1.0166	0.04%	170	100	1120	79.6
8/20/96	1.0149	0.01%	167	95	461	32.8
9/21/96	1.0183	0.02%	170	125	972	69.1
10/18/96	1.0202	0.08%	170	115	880	62.5

AVERAGE:	1.0132	0.03%
RANGE:	0.0240	0.07%
STD. DEV.	0.0059	0.02%

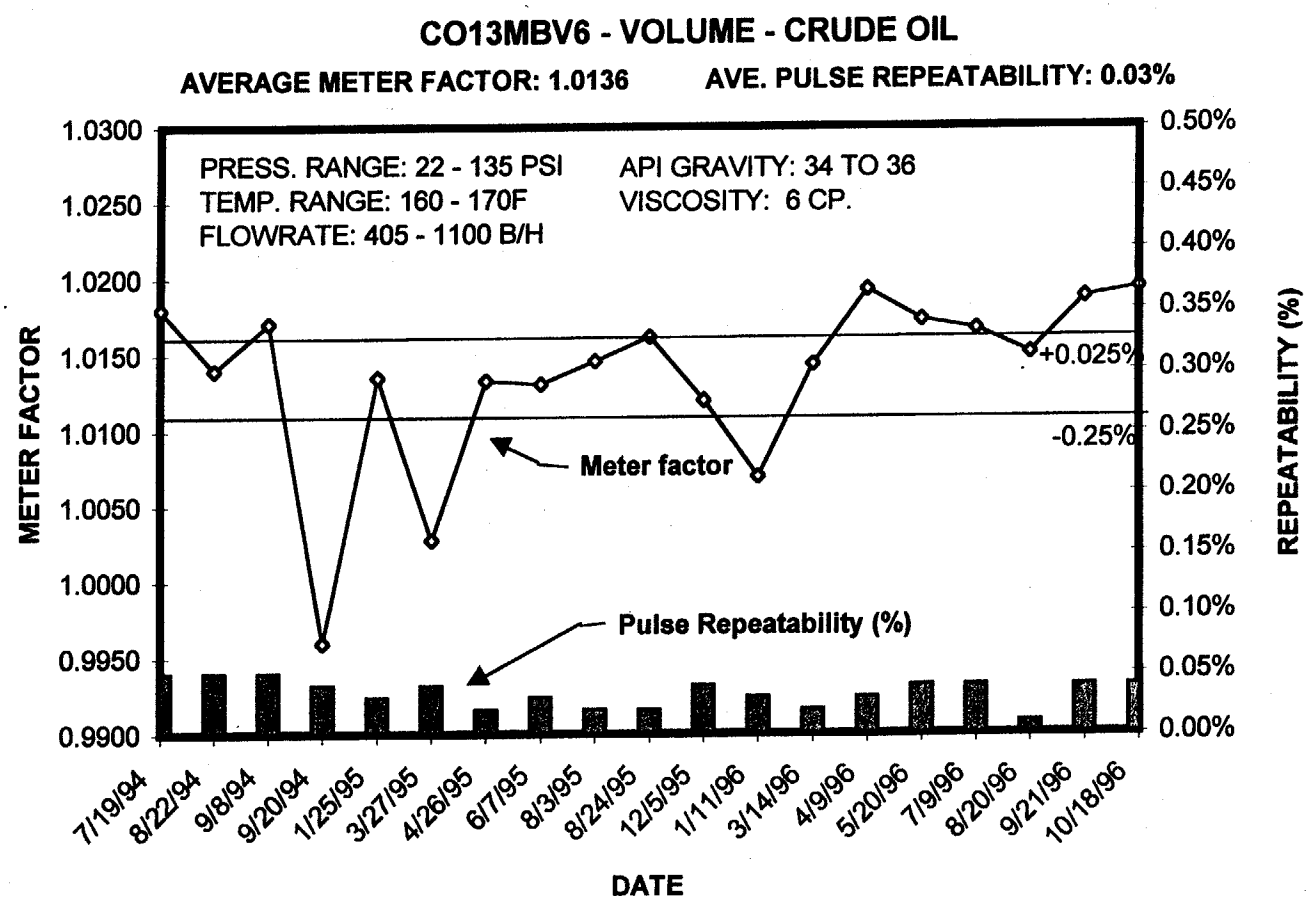

CO13MB1V5 - VOLUME - CRUDE OIL
AVERAGE METER FACTOR: 1.0132 / AVE. PULSE REPEATABILITY: 0.03%
PRESS. RANGE: 20 - 128 psi
TEMP. RANGE: 161 - 170F
API GRAVITY RANGE: 34 - 36
FLOWRATE RANGE: 461 - 1120 B/H
VISCOSITY: 6 CP
+0.25%
-0.25%
Meter Factor
Repeatability (%)
METER FACTOR
REPEATABILITY (%)
DATE
1.03
1.028
1.026
1.024
1.022
1.02
1.018
1.016
1.014
1.012
1.01
1.008
1.006
1.004
1.002
1
0.998
0.996
0.994
0.992
0.99
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
7/19/94
8/22/94
9/8/94
9/20/94
1/25/95
3/27/95
4/26/95
6/7/95
8/3/95
12/5/95
1/11/96
3/14/96
4/9/96
7/9/96
5/20/96
8/20/96
9/21/96
10/18/96

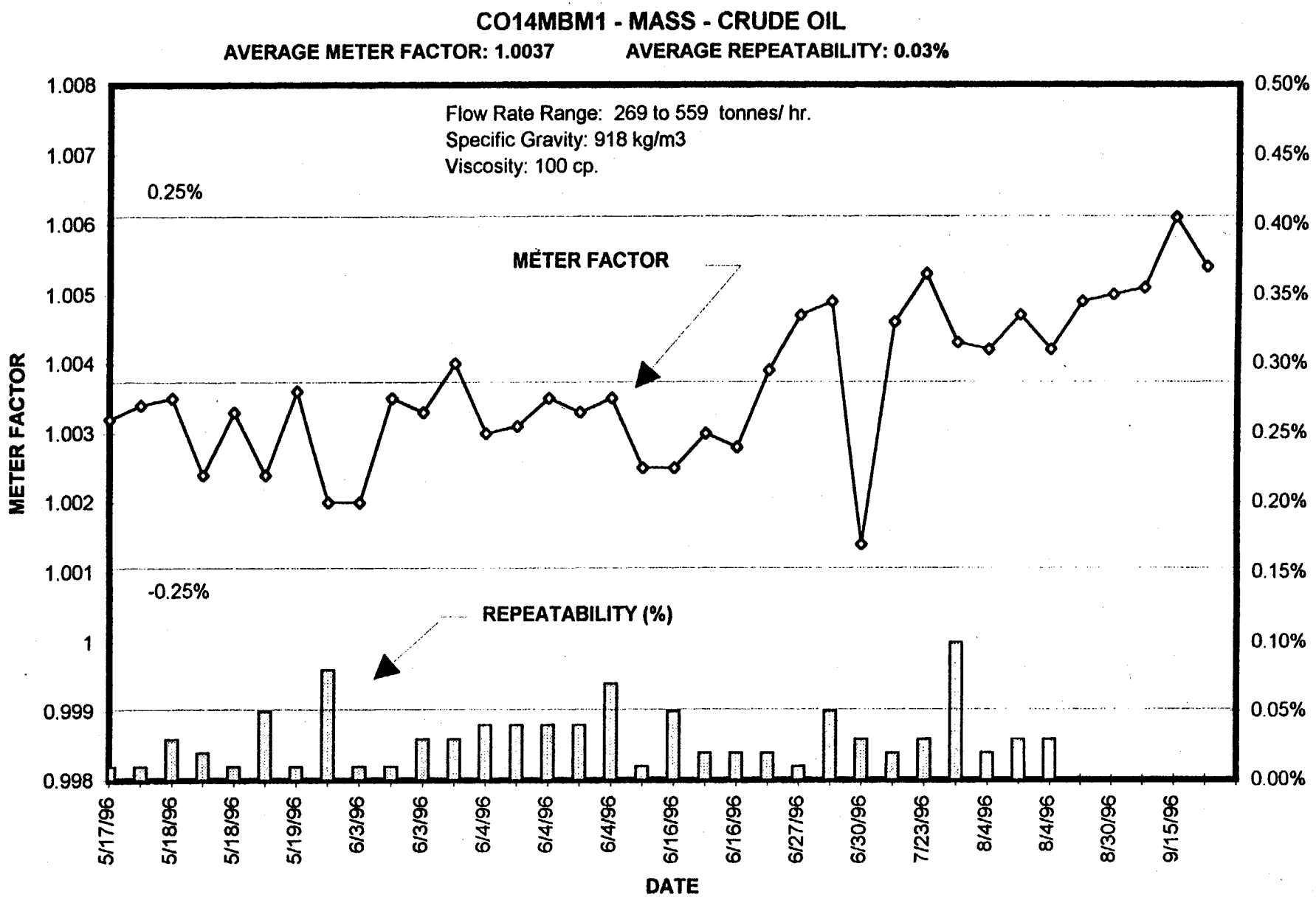
VOLUME METER FACTOR CONTROL CHART

Company No. 13 / Meter Type B / V6
Meter size: 3 inch
Fluid: Crude Oil / API Gravity: 34 - 36
Viscosity: 6 cp.
Conventional Pipe Prover

Proving Date	Meter Factor	Pulse Rep'ty	Temp.(F)	psig	B/H	% Max. F.R.
7/19/94	1.0180	0.05%	167	125	N.A.	
8/22/94	1.0140	0.05%	167	100	N.A.	
9/8/94	1.0171	0.05%	168	120	N.A.	
9/20/94	0.9960	0.04%	168	70	N.A.	
1/25/95	1.0135	0.03%	165	75	N.A.	
3/27/95	1.0028	0.04%	160	100	N.A.	
4/26/95	1.0133	0.02%	160	90	N.A.	
6/7/95	1.0131	0.03%	166	90	N.A.	
8/3/95	1.0146	0.02%	166	105	N.A.	
8/24/95	1.0162	0.02%	161	120	425	30.2
12/5/95	1.0120	0.04%	156	110	405	28.8
1/11/96	1.0070	0.03%	159	22	544	38.7
3/14/96	1.0144	0.02%	164	130	1100	78.2
4/9/96	1.0193	0.03%	166	128	540	38.4
5/20/96	1.0173	0.04%	170	100	1125	80.0
7/9/96	1.0167	0.04%	170	100	543	38.6
8/20/96	1.0151	0.01%	168	100	470	33.4
9/21/96	1.0188	0.04%	170	125	1092	77.6
10/18/96	1.0194	0.04%	170	135	802	57.0

AVERAGE:	1.0136	0.03%
RANGE:	0.0234	0.04%
STD. DEV.	0.0059	0.01%


CO13MBV6 - VOLUME - CRUDE OIL
AVERAGE METER FACTOR: 1.0136
AVE. PULSE REPEATABILITY: 0.03%
PRESS. RANGE: 22 - 135 PSI
TEMP. RANGE: 160 - 170F
FLOWRATE: 405 - 1100 B/H
API GRAVITY: 34 TO 36
VISCOSITY: 6 CP.
+0.025%
-0.25%
Meter factor
Pulse Repeatability (%)
METER FACTOR
REPEATABILITY (%)
1.0300
1.0250
1.0200
1.0150
1.0100
1.0050
1.0000
0.9950
0.9900
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
7/19/94
8/22/94
9/8/94
9/20/94
1/25/95
3/27/95
4/26/95
6/7/95
8/3/95
8/24/95
12/5/95
1/11/96
3/14/96
4/9/96
5/20/96
7/9/96
8/20/96
9/21/96
10/18/96
DATE


CO14MBM1 - MASS - CRUDE OIL
AVERAGE METER FACTOR: 1.0037
AVERAGE REPEATABILITY: 0.03%
Flow Rate Range: 269 to 559 tonnes/ hr.
Specific Gravity: 918 kg/m3
Viscosity: 100 cp.
0.25%
-0.25%
METER FACTOR
REPEATABILITY (%)
METER FACTOR
1.008
1.007
1.006
1.005
1.004
1.003
1.002
1.001
1
0.999
0.998
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
5/17/96
5/18/96
5/18/96
5/19/96
6/3/96
6/3/96
6/4/96
6/4/96
6/4/96
6/16/96
6/16/96
6/27/96
6/30/96
7/23/96
8/4/96
8/4/96
8/30/96
9/15/96
DATE

MASS METER FACTOR CONTROL CHART

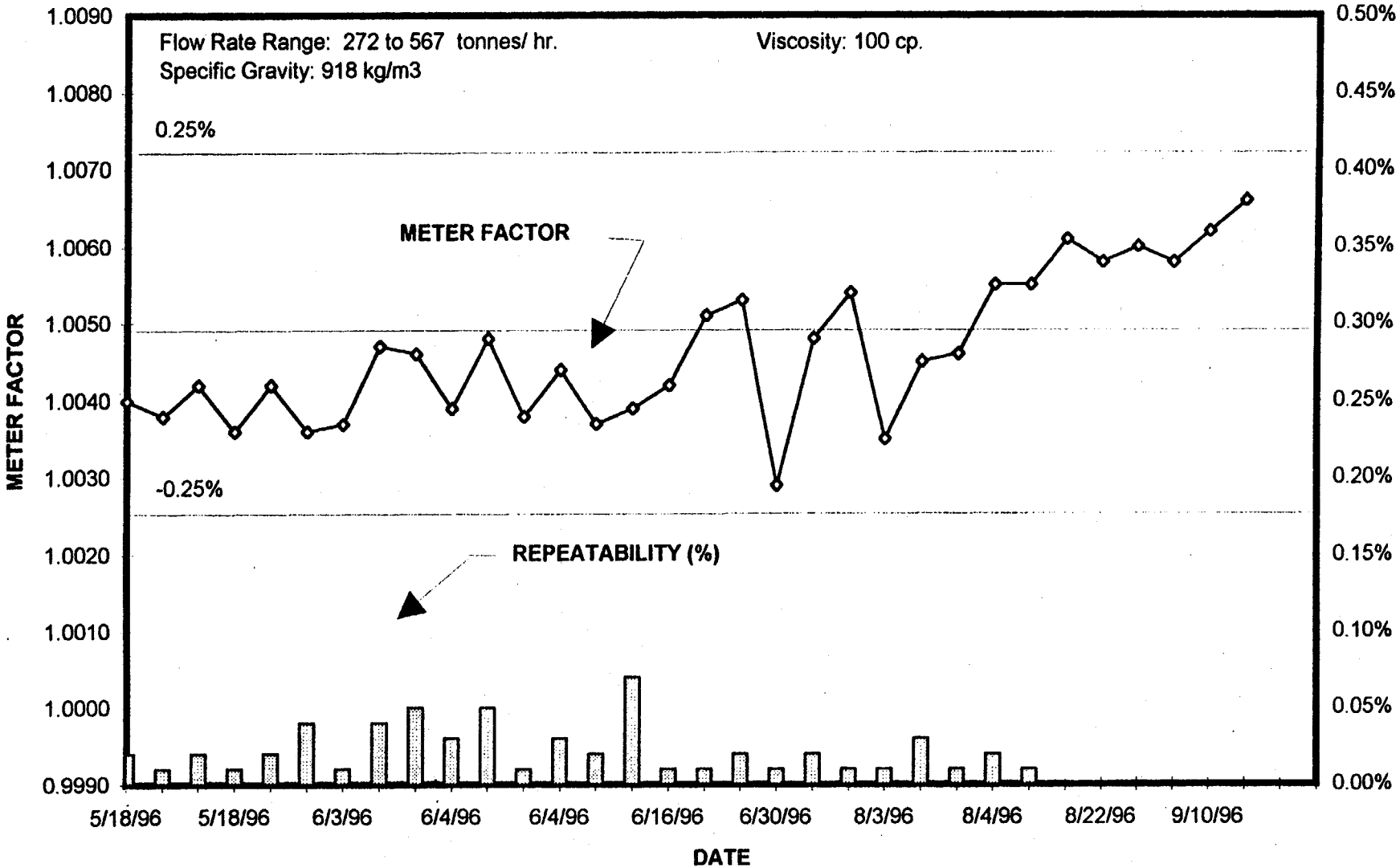
Company No. 14 / Meter Type B / M2
Meter size: 6 Inch
Fluid: Crude Oil / Density: 918 kg/m3
Viscosity: 100 cp.
Brooks Compact Prover
Two Runs of 10 passes/run

Proving Date	Prove No.	K-Factor	M.F.	M.F. Rep'ty	Tonnes/hr.	GPM	% Max F.R.
5/18/96	1	35806.6	1.0040	0.02%	345	1655	50.7
5/18/96	2	35813.1	1.0038	0.01%	344	1651	50.6
5/18/96	3	35798.8	1.0042	0.02%	369	1770	54.2
5/18/96	4	35820.0	1.0036	0.01%	379	1818	55.7
5/19/96	5	35799.7	1.0042	0.02%	532	2552	78.2
5/19/96	6	35820.0	1.0036	0.04%	379	1818	55.7
6/3/96	7	35818.5	1.0037	0.01%	335	1606	49.2
6/4/96	8	35782.8	1.0047	0.04%	386	1850	56.7
6/4/96	9	35783.9	1.0046	0.05%	533	2555	78.3
6/4/96	10	35810.3	1.0039	0.03%	532	2550	78.2
6/4/96	11	35779.8	1.0048	0.05%	488	2339	71.7
6/4/96	12	35815.2	1.0038	0.01%	487	2334	71.6
6/4/96	13	35792.5	1.0044	0.03%	410	1965	60.3
6/4/96	14	35817.3	1.0037	0.02%	411	1970	60.4
6/16/96	15	35808.8	1.0039	0.07%	508	2435	74.7
6/16/96	16	35801.4	1.0042	0.01%	510	2444	75.0
6/27/96	17	35767.0	1.0051	0.01%	404	1936	59.4
6/27/96	18	35760.6	1.0053	0.02%	404	1936	59.4
6/30/96	19	35847.1	1.0029	0.01%	413	1980	60.7
7/10/96	20	35779.7	1.0048	0.02%	477	2285	70.1
7/23/96	21	35755.2	1.0054	0.01%	321	1538	47.2
8/3/96	22	35825.3	1.0035	0.01%	566	2712	83.2
8/3/96	23	35790.4	1.0045	0.03%	567	2715	83.3
8/3/96	24	35783.7	1.0046	0.01%	567	2719	83.3
8/4/96	25	35751.7	1.0055	0.02%	444	2127	65.3
8/4/96	26	35754.4	1.0055	0.01%	300	1438	44.1
8/15/96	27	35730.0	1.0061	n.a.	272	1305	40.0
8/22/96	28	35741.1	1.0058	n.a.	367	1760	53.9
8/31/96	29	35735.6	1.006	n.a.	258	1238	37.9
9/9/96	30	35742.2	1.0058	n.a.	364	1746	53.5
9/10/96	31	35726.9	1.0062	n.a.	357	1713	52.5
9/23/96	32	35715.2	1.0066	n.a.	368	1765	54.1

AVERAGE:	1.0046	0.02%
RANGE:	0.0037	0.06%
STD. DEV.	0.0009	0.02%

CO14MBM2 - MASS - CRUDE OIL

AVERAGE METER FACTOR: 1.0046 **AVERAGE REPEATABILITY: 0.02%**

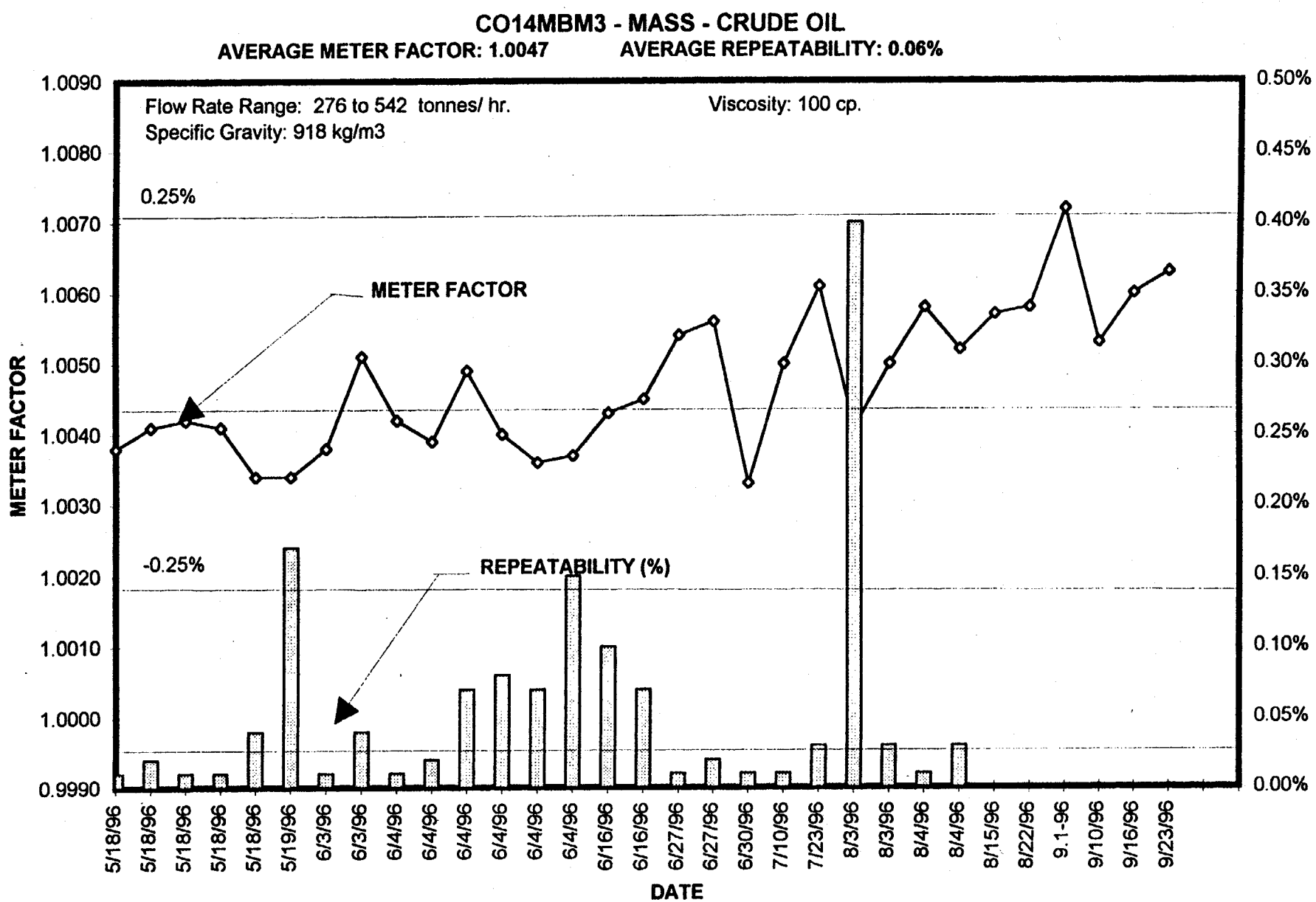


MASS METER FACTOR CONTROL CHART

Company No. 14 / Meter Type B / M3
Meter size: 6 inch
Fluid: Crude Oil / Density: 918 kg/m3
Viscosity: 100 cp.
Brooks Compact Prover
Two Runs of 10 passes/run

Proving Date	Prove No.	K-Factor	M.F.	M.F. Rep'ty	Tonnes/hr.	GPM	% Max F.R.
5/18/96	1	35813.4	1.0038	0.01%	330	1581	48.5
5/18/96	2	35803.2	1.0041	0.02%	329	1576	48.4
5/18/96	3	35798.3	1.0042	0.01%	319	1527	46.9
5/18/96	4	35802.9	1.0041	0.01%	318	1526	46.7
5/18/96	5	35829.4	1.0034	0.04%	472	2263	69.4
5/19/96	6	35829.4	1.0034	0.17%	525	2517	77.2
6/3/96	7	35815.0	1.0038	0.01%	321	1539	47.2
6/3/96	8	35769.0	1.0051	0.04%	369	1769	54.2
6/4/96	9	35800.5	1.0042	0.01%	428	2051	62.9
6/4/96	10	35810.7	1.0039	0.02%	420	2051	61.7
6/4/96	11	35733.8	1.0049	0.07%	492	2358	72.3
6/4/96	12	35805.4	1.0040	0.08%	491	2353	72.2
6/4/96	13	35819.8	1.0036	0.07%	492	2358	72.3
6/4/96	14	35816.9	1.0037	0.15%	542	2598	79.7
6/16/96	15	35796.2	1.0043	0.10%	504	2416	74.1
6/16/96	16	35787.7	1.0045	0.07%	504	2416	74.1
6/27/96	17	35765.1	1.0054	0.01%	367	1759	53.9
6/27/96	18	35748.4	1.0056	0.02%	364	1745	53.5
6/30/96	19	35830.1	1.0033	0.01%	373	1788	54.8
7/10/96	20	35772.7	1.0050	0.01%	439	2103	64.5
7/23/96	21	35731.3	1.0061	0.03%	367	1760	53.9
8/3/96	22	35802.0	1.0041	0.40%	359	1719	52.8
8/3/96	23	35769.5	1.0050	0.03%	360	1726	52.9
8/4/96	24	35743.2	1.0058	0.01%	275	1320	40.4
8/4/96	25	35765.0	1.0052	0.03%	297	1425	43.7
8/15/96	26	35746.4	1.0057	n.a.	410	1967	60.3
8/22/96	27	35740.7	1.0058	n.a.	356	1708	52.3
9.1-96	28	35694.0	1.0072	n.a.	310	1487	45.6
9/10/96	29	35761.8	1.0053	n.a.	364	1746	53.5
9/16/96	30	35735.4	1.0060	n.a.	344	1650	50.6
9/23/96	31	35726.6	1.0063	n.a.	358	1717	52.6

AVERAGE:	1.0047	0.06%
RANGE:	0.0039	0.39%
STD. DEV.	0.0010	0.08%

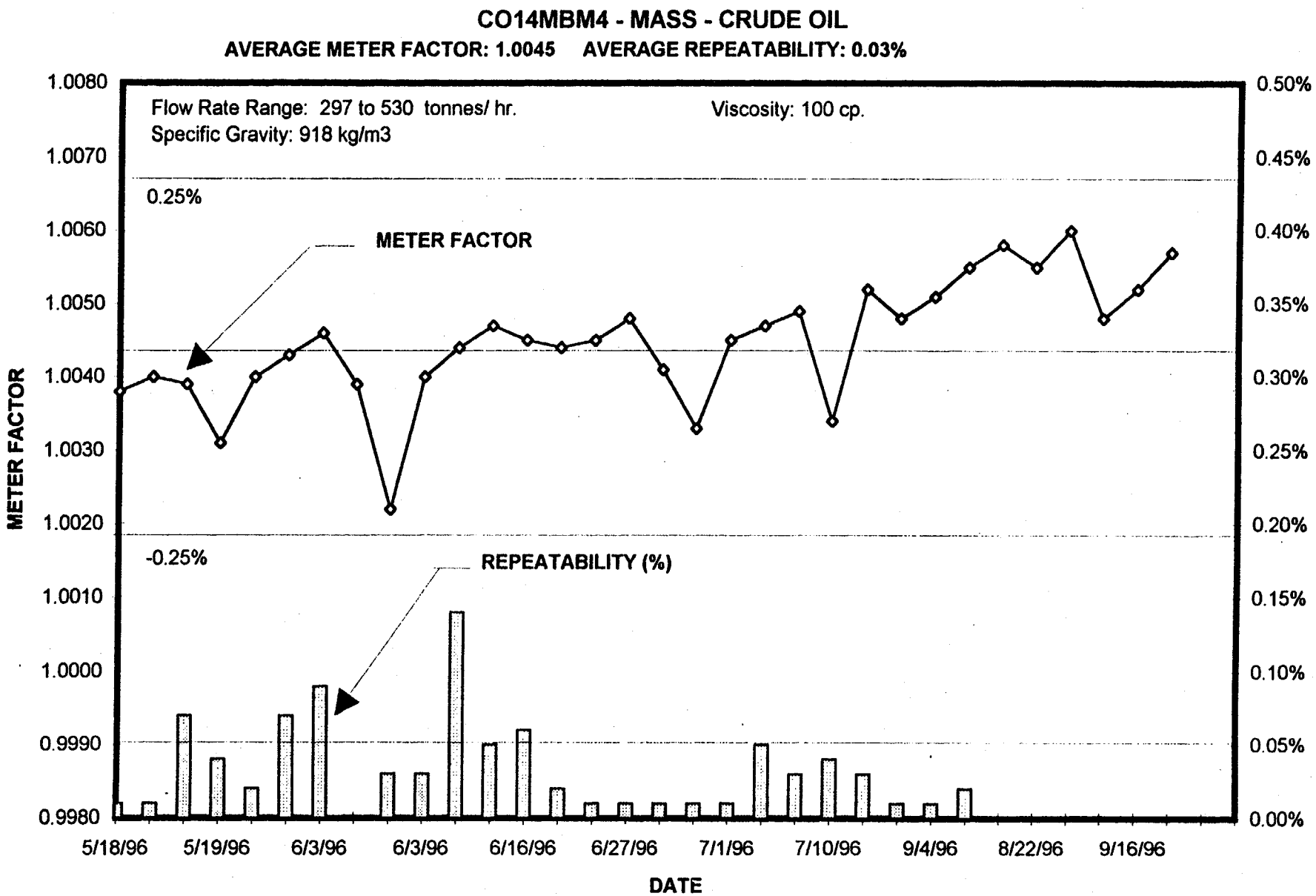

CO14MBM3 - MASS - CRUDE OIL
AVERAGE METER FACTOR: 1.0047
AVERAGE REPEATABILITY: 0.06%
Flow Rate Range: 276 to 542 tonnes/ hr.
Viscosity: 100 cp.
Specific Gravity: 918 kg/m3
0.25%
-0.25%
METER FACTOR
REPEATABILITY (%)
METER FACTOR
DATE
1.0090
1.0080
1.0070
1.0060
1.0050
1.0040
1.0030
1.0020
1.0010
1.0000
0.9990
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
5/18/96
5/18/96
5/18/96
5/18/96
5/18/96
5/19/96
6/3/96
6/3/96
6/4/96
6/4/96
6/4/96
6/4/96
6/4/96
6/4/96
6/16/96
6/16/96
6/27/96
6/27/96
6/30/96
7/10/96
7/23/96
8/3/96
8/3/96
8/4/96
8/4/96
8/15/96
8/22/96
9.1-96
9/10/96
9/16/96
9/23/96

MASS METER FACTOR CONTROL CHART

Company No. 14 / Meter Type B / M4
Meter size: 6 inch
Fluid: Crude Oil / Density: 918 kg/m3
Viscosity: 100 cp.
Brooks Compact Prover
Two Runs of 10 passes/run

Proving Date	Prove No.	K-Factor	M.F.	M.F. Rep'ty	Tonnes/hr.	GPM	% Max F.R.
5/18/96	1	35812.8	1.0038	0.01%	331	1588	48.6
5/18/96	2	35807.0	1.0040	0.01%	331	1586	48.6
5/18/96	3	35809.0	1.0039	0.07%	457	2191	67.2
5/19/96	4	35838.9	1.0031	0.04%	530	2539	77.9
6/3/96	5	35808.1	1.0040	0.02%	323	1548	47.5
6/3/96	6	35796.0	1.0043	0.07%	324	1553	47.6
6/3/96	7	35785.7	1.0046	0.09%	323	1548	47.5
6/3/96	8	35809.2	1.0039	0.00%	379	1817	55.7
6/3/96	9	35871.5	1.0022	0.03%	430	2061	63.2
6/3/96	10	35808.5	1.0040	0.03%	488	2339	71.7
6/3/96	11	35791.8	1.0044	0.14%	519	2488	76.3
6/4/96	12	35780.0	1.0047	0.05%	520	2492	76.4
6/16/96	13	35789.4	1.0045	0.06%	433	2075	63.6
6/16/96	14	35791.4	1.0044	0.02%	476	2281	70.0
6/16/96	15	35787.7	1.0045	0.01%	501	2401	73.6
6/27/96	16	35779.8	1.0048	0.01%	396	1898	58.2
6/27/96	17	35801.7	1.0041	0.01%	392	1879	57.6
6/30/96	18	35831.7	1.0033	0.01%	414	1984	60.8
7/1/96	19	35787.7	1.0045	0.01%	397	1903	58.3
7/1/96	20	35782.3	1.0047	0.05%	396	1898	58.2
7/1/96	21	35776.5	1.0049	0.03%	395	1893	58.1
7/10/96	22	35828.4	1.0034	0.04%	489	2342	71.9
7/23/96	23	35762.4	1.0052	0.03%	321	1540	47.2
8/4/96	24	35778.0	1.0048	0.01%	455	2181	66.9
9/4/96	25	35768.8	1.0051	0.01%	297	1422	43.7
8/4/96	26	35753.7	1.0055	0.02%	297	1422	43.7
8/15/96	27	35744.0	1.0058	n.a.	348	1669	51.1
8/22/96	28	35754.6	1.0055	n.a.	364	1746	53.5
9/1/96	29	35734.1	1.0060	n.a.	303	1453	44.5
9/10/96	30	35776.9	1.0048	n.a.	368	1765	54.1
9/16/96	31	35762.4	1.0052	n.a.	345	1655	50.7
9/23/96	32	35744.4	1.0057	n.a.	357	1713	52.5

AVERAGE:	1.0045	0.03%
RANGE:	0.0038	0.14%
STD. DEV.	0.0008	0.03%

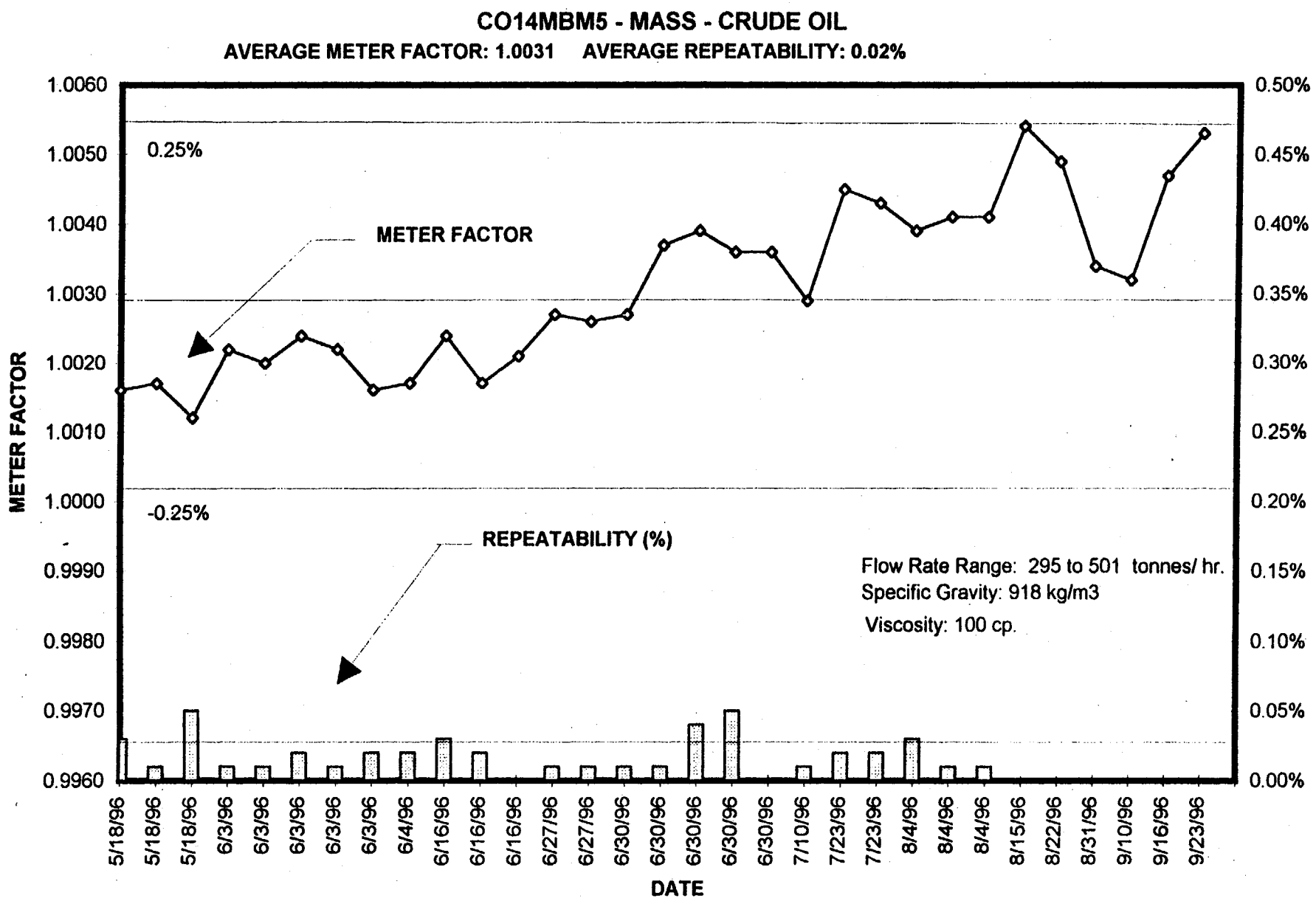

CO14MBM4 - MASS - CRUDE OIL
AVERAGE METER FACTOR: 1.0045 AVERAGE REPEATABILITY: 0.03%
Flow Rate Range: 297 to 530 tonnes/ hr.
Viscosity: 100 cp.
Specific Gravity: 918 kg/m3
0.25%
-0.25%
METER FACTOR
REPEATABILITY (%)
1.0080
1.0070
1.0060
1.0050
1.0040
1.0030
1.0020
1.0010
1.0000
0.9990
0.9980
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
5/18/96
5/19/96
6/3/96
6/3/96
6/16/96
6/27/96
7/1/96
7/10/96
9/4/96
8/22/96
9/16/96
DATE

MASS METER FACTOR CONTROL CHART

Company No. 14 / Meter Type B / M5
Meter size: 6 inch
Fluid: Crude Oil / Density: 918 kg/m3
Viscosity: 100 cp.
Brooks Compact Prover
Two Runs of 10 passes/run

Proving Date	Prove No.	K-Factor	M.F.	M.F. Rep'ty	Tonnes/hr.	GPM	% Max F.R.
5/18/96	1	35891.1	1.0016	0.03%	336	1613	49.4
5/18/96	2	35889.3	1.0017	0.01%	336	1609	49.4
5/18/96	3	35907.4	1.0012	0.05%	451	2160	66.3
6/3/96	4	35872.7	1.0022	0.01%	327	1567	48.1
6/3/96	5	35877.8	1.0020	0.01%	327	1567	48.1
6/3/96	6	35864.2	1.0024	0.02%	327	1567	48.1
6/3/96	7	35871.3	1.0022	0.01%	327	1567	48.1
6/3/96	8	35891.3	1.0016	0.02%	382	1831	56.1
6/4/96	9	35889.3	1.0017	0.02%	427	2047	62.8
6/16/96	10	35863.4	1.0024	0.03%	380	1821	55.8
6/16/96	11	35887.3	1.0017	0.02%	501	2401	73.6
6/16/96	12	35875.8	1.0021	0.00%	460	2205	67.6
6/27/96	13	35853.2	1.0027	0.01%	391	1874	57.5
6/27/96	14	35847.1	1.0026	0.01%	391	1874	57.5
6/30/96	15	35853.5	1.0027	0.01%	418	2003	61.4
6/30/96	16	35818.0	1.0037	0.01%	402	1927	59.1
6/30/96	17	35811.2	1.0039	0.04%	401	1922	58.9
6/30/96	18	35819.6	1.0036	0.05%	398	1908	58.5
6/30/96	19	35819.3	1.0036	0.00%	388	1860	57.0
7/10/96	20	35845.7	1.0029	0.01%	422	2023	62.0
7/23/96	21	35790.2	1.0045	0.02%	326	1561	47.9
7/23/96	22	35794.6	1.0043	0.02%	325	1560	47.8
8/4/96	23	35810.3	1.0039	0.03%	439	2104	64.5
8/4/96	24	35801.0	1.0041	0.01%	296	1417	43.5
8/4/96	25	35803.4	1.0041	0.01%	295	1414	43.4
8/15/96	26	35758.4	1.0054	n.a.	311	1492	45.7
8/22/96	27	35773.7	1.0049	n.a.	367	1760	53.9
8/31/96	28	35827.8	1.0034	n.a.	314	1506	46.1
9/10/96	29	35835.7	1.0032	n.a.	370	1775	54.4
9/16/96	30	35780.4	1.0047	n.a.	347	1665	51.0
9/23/96	31	35761.1	1.0053	n.a.	363	1741	53.4

AVERAGE:	1.0031	0.02%
RANGE:	0.0042	0.05%
STD. DEV.	0.0012	0.01%


CO14MBM5 - MASS - CRUDE OIL
AVERAGE METER FACTOR: 1.0031 AVERAGE REPEATABILITY: 0.02%
METER FACTOR
REPEATABILITY (%)
0.25%
-0.25%
Flow Rate Range: 295 to 501 tonnes/ hr.
Specific Gravity: 918 kg/m3
Viscosity: 100 cp.
1.0060
1.0050
1.0040
1.0030
1.0020
1.0010
1.0000
0.9990
0.9980
0.9970
0.9960
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
5/18/96
5/18/96
5/18/96
6/3/96
6/3/96
6/3/96
6/3/96
6/3/96
6/4/96
6/16/96
6/16/96
6/16/96
6/27/96
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8/22/96
8/31/96
9/10/96
9/16/96
9/23/96
DATE

MASS METER FACTOR CONTROL CHART

Company No. 14 / Meter Type B / M6
Meter size: 6 inch
Fluid: Crude Oil / Density: 918 kg/m3
Viscosity: 100 cp.
Brooks Compact Prover
Two Runs of 10 passes/run

Proving Date	Prove No.	K-Factor	M.F.	M.F. Rep'ty	Tonnes/hr.	GPM	% Max F.R.
5/18/96	1	35856.6	1.0026	0.01%	326	1563	47.9
5/18/96	2	35863.2	1.0024	0.01%	327	1567	48.1
5/18/96	3	35846.2	1.0029	0.06%	438	2099	64.4
6/3/96	4	35830.8	1.0033	0.01%	319	1529	46.9
6/3/96	5	35833.1	1.0033	0.02%	320	1534	47.0
6/3/96	6	35833.2	1.0033	0.01%	320	1534	47.0
6/3/96	7	35825.5	1.0035	0.01%	320	1534	47.0
6/3/96	8	35841.6	1.0030	0.03%	377	1807	55.4
6/16/96	9	35823.9	1.0035	0.01%	384	1841	56.4
6/16/96	10	35846.8	1.0029	0.01%	516	2473	75.8
6/16/96	11	35813.3	1.0038	0.01%	516	2473	75.8
6/16/96	12	35825.7	1.0035	0.00%	463	2219	68.0
6/27/96	13	35805.3	1.0040	0.01%	391	1874	57.5
6/27/96	14	35809.7	1.0039	0.03%	390	1869	57.3
6/30/96	15	35848.0	1.0028	0.05%	412	1975	60.6
6/30/96	16	35843.3	1.0030	0.01%	411	1970	60.4
6/30/96	17	35912.8	1.0010	0.01%	406	1946	59.7
6/30/96	18	35848.7	1.0028	0.01%	404	1936	59.4
6/30/96	19	35840.8	1.0030	0.05%	403	1932	59.2
6/30/96	20	35838.6	1.0031	0.01%	402	1927	59.1
7/10/96	21	35801.5	1.0041	0.03%	426	2042	62.6
7/10/96	22	35807.0	1.0040	0.05%	531	2545	78.0
7/23/96	23	35780.8	1.0047	0.03%	423	2027	62.2
8/4/96	24	35794.1	1.0044	0.01%	372	1783	54.7
8/5/96	25	35762.3	1.0052	0.03%	293	1404	43.1
8/5/96	26	35777.2	1.0048	0.02%	273	1308	40.1
8/15/96	27	35780.4	1.0047	n.a.	309	1482	45.4
8/22/96	28	35784.4	1.0046	n.a.	363	1741	53.4
9/1/96	29	35757.0	1.0054	n.a.	305	1463	44.8
9/10/96	30	35811.6	1.0039	n.a.	367	1760	53.9
9/16/96	31	35791.7	1.0044	n.a.	289	1386	42.5
9/23/96	32	35791.5	1.0044	n.a.	347	1665	51.0

AVERAGE:	1.0036	0.02%
RANGE:	0.0044	0.06%
STD. DEV.	0.0009	0.02%

CO14MBM7 Page 2

Proving Date	Prove No.	K-Factor	Meter Factor	M.F. Rep'ty	Tonnes/hr.	GPM
7/6/96	39	36259.3	1.0079	0.02%	293	1404
7/7/96	40	36252.4	1.0081	0.01%	292	1400
7/8/96	41	36258.0	1.0079	0.02%	293	1404
7/9/96	42	36253.6	1.0080	0.01%	294	1409
7/10/96	43	36257.4	1.0079	0.01%	294	1409
7/11/96	44	36264.9	1.0077	0.01%	293	1404
7/12/96	45	36255.5	1.0080	0.02%	295	1414
7/13/96	46	36242.0	1.0084	0.01%	293	1404
7/14/96	47	36246.2	1.0082	0.02%	293	1404
7/15/96	48	36256.7	1.0080	0.03%	296	1419
7/16/96	49	36248.0	1.0082	0.01%	293	1404
7/17/96	50	36245.2	1.0083	0.01%	291	1395
7/18/96	51	36252.4	1.0081	0.02%	297	1424
7/19/96	52	36271.2	1.0076	0.04%	293	1404
7/20/96	53	36249.2	1.0082	0.02%	297	1424
7/21/96	54	36234.5	1.0086	0.01%	295	1414
7/22/96	55	36239.1	1.0084	0.01%	297	1424
7/23/96	56	36238.0	1.0085	0.02%	291	1395
7/24/96	57	36250.2	1.0081	0.01%	301	1443
7/25/96	58	36247.2	1.0082	0.04%	277	1328
7/26/96	59	36253.0	1.0081	0.01%	278	1332
7/27/96	60	36218.8	1.0090	0.01%	294	1409
7/28/96	61	36231.1	1.0087	0.02%	293	1404
7/29/96	62	36219.4	1.0090	0.01%	293	1404
7/30/96	63	36218.8	1.0090	0.02%	293	1404
7/31/96	64	36233.4	1.0086	0.02%	294	1409
8/1/96	65	36224.4	1.0089	0.05%	292	1400
8/2/96	66	36217.4	1.0090	0.03%	291	1395

AVERAGE:	1.0086	0.02%
RANGE:	0.0031	0.05%
STD. DEV.	0.0006	0.01%

MASS METER FACTOR CONTROL CHART

Company No. 14 / Meter Type B / M7
Fluid: Crude Oil / Density: 918 kg/m3
Viscosity: 100 cp.
Brooks Compact Prover
Two Runs of 10 passes/run

Proving Date	Prove No.	K-Factor	Meter Factor	M.F. Rep'ty	Tonnes/hr.	GPM
6/7/96	1	36204.0	1.0094	0.01%	193	925
6/7/96	2	36207.4	1.0093	0.01%	190	911
6/7/96	3	36215.3	1.0091	0.01%	189	906
6/7/96	4	36220.1	1.0090	0.01%	190	911
6/7/96	5	36217.9	1.0090	0.01%	191	915
6/7/96	6	36212.3	1.0091	0.01%	191	915
6/7/96	7	36213.1	1.0092	0.01%	186	891
6/7/96	8	36214.9	1.0091	0.00%	191	915
6/7/96	9	36216.6	1.0091	0.01%	191	915
6/7/96	10	36221.0	1.0089	0.01%	190	911
6/8/96	11	36191.6	1.0098	0.03%	190	911
6/8/96	12	36205.5	1.0094	0.01%	192	920
6/8/96	13	36202.1	1.0095	0.05%	192	920
6/8/96	14	36222.6	1.0089	0.00%	193	925
6/8/96	15	36216.4	1.0091	0.01%	193	925
6/8/96	16	36225.2	1.0088	0.01%	191	915
6/8/96	17	36228.6	1.0087	0.01%	194	930
6/8/96	18	36220.4	1.0090	0.01%	191	915
6/8/96	19	36211.8	1.0092	0.01%	193	925
6/8/96	20	36217.1	1.0091	0.02%	190	911
6/15/96	21	36219.9	1.0090	0.01%	191	915
6/28/96	22	36302.5	1.0067	0.01%	279	1337
6/28/96	23	36290.1	1.0070	0.01%	277	1328
6/28/96	24	36285.6	1.0072	0.01%	284	1361
6/28/96	25	36215.8	1.0091	0.02%	154	738
6/28/96	26	36244.9	1.0083	0.03%	284	1361
6/28/96	27	36234.8	1.0086	0.01%	285	1366
6/29/96	28	36213.2	1.0092	0.01%	282	1352
6/29/96	29	36228.4	1.0087	0.04%	282	1352
6/29/96	30	36226.2	1.0088	0.02%	283	1356
6/29/96	31	36232.9	1.0086	0.02%	284	1361
6/29/96	32	36217.6	1.0090	0.04%	274	1313
6/29/96	33	36231.1	1.0087	0.03%	278	1332
6/29/96	34	36212.7	1.0092	0.02%	277	1328
6/29/96	35	36211.8	1.0092	0.01%	281	1347
6/29/96	36	36227.0	1.0088	0.04%	280	1342
7/4/96	37	36246.9	1.0082	0.02%	291	1395
7/5/96	38	36270.0	1.0076	0.02%	296	1419