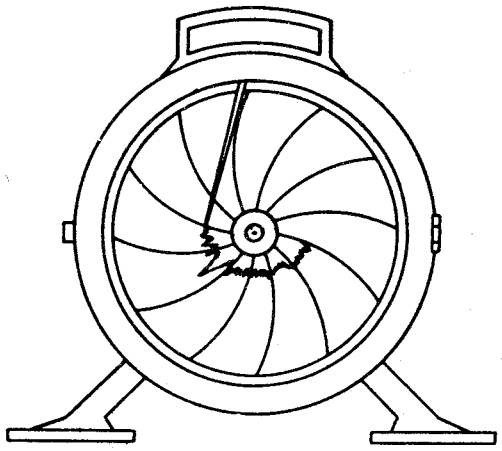
Michigan Department of Conservation

OUTLINE OF PROCEDURES FOR DETERMINING GAS-OIL RATIOS AND SUBSURFACE PRESSURES



Geological Survey

Circular 4

1966

With a view to the ultimate recovery of the maximum production of oil and gas and the prevention of waste, the Supervisor of Wells is specifically empowered

> ...to examine, check, and test and gauge oil and gas wells,
>
> ...to require the operation of wells with efficient gas-oil ratios and to fix such ratios.

(Compiled Laws Mich. 1948, s.319.1 and 319.6)

Geological Survey

CIRCULAR 4

OUTLINE OF PROCEDURES FOR DETERMINING GAS-OIL RATIOS AND SUBSURFACE PRESSURES

by

J. S. Lorenz and T. L. Culver

Lansing

1966

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PREFACE

The purpose of this manual is to set forth recommended procedures, and to establish uniform standards for recording gas-oil ratios and subsurface pressures. These instructions shall serve as a guide for obtaining uniform results and assuring compliance with Michigan regulations. This circular in no way replaces such standard technical manuals as Handbook E-2 and Bulletin E-7 of the American Meter Company.

Conducting tests is costly, especially when they must be repeated because of inadequate charts, insufficient data, failure to provide advance notice, or other nullifying factors. Many of these pitfalls can be avoided by observing the practices recommended in the manual. Becoming familiar with these procedures, therefore, is a matter of importance.

No statement in the manual alters the authority of Act No. 61, Public Acts of 1939, as amended, and the General Rules and Regulations governing oil and gas operations in Michigan.

The contents are organized into three main parts: gas-oil ratio tests, bottom-hole pressure tests, and computation tables.

Review and criticism by fellow members of the petroleum industry played an important role in the preparation of this handbook. Further suggestions will be welcome at any time.

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Production and Proration Unit
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Geological Survey Division

Mt. Pleasant
June, 1966

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GAS-OIL RATIO TESTS

Gas-oil ratio tests must be filed with the Department of Conservation, Geological Survey Division, on Form 7103 revised (page 10). Only persons qualified by training and experience shall conduct such tests. Testing procedures are similar to those described in "Pamphlet for Determination of the Volume of Gas Used in Computing Operating Gas-Oil Ratios" by the Texas Railroad Commission, or in the American Meter Company's Handbook E-2 or Bulletin E-7. Other methods of equal accuracy may be used when based on American Gas Association Report No. 3.

Gas-oil ratio test schedules must be received by the Production and Proration Unit of the Geological Survey Division at least 72 hours in advance of test date. The beginning or ending of test period must not fall on a week-end or holiday, without prior approval.

Condition Of Well To Be Tested

1. The computed 24-hour oil production rate, based on the test rate and normal production schedule, should not exceed 120% of the established daily field well allowable. Those wells of a multiple well lease which produce less than 90% of the established field well allowable shall be prorated at the amount established by the test.

2. Prior to the test, the well should be produced for a minimum of 48 hours at its regular producing method and schedule.

3. After normal maintenance such as hot oiling, hooking, and pump change, the well should be produced for a minimum of 48 hours prior to testing. Special tests taken after rework such as acidizing and fracturing, should be rescheduled for testing not less than 15 nor more than 30 days after rework completion.

4. Wells produced under a special Department-approved schedule, or shut-in for a considerable period of time, should be tested only during stabilized producing conditions.

Condition Of Lease Equipment

1. Surface equipment should be regulated so that the only gas vented shall be incident to the test.

2. Stock volumes at beginning of the test should be sufficient to allow an uninterrupted measurement of oil for a minimum of 24 hours.

3. Equipment for accurately measuring all fluids produced should be installed (fig. 1).

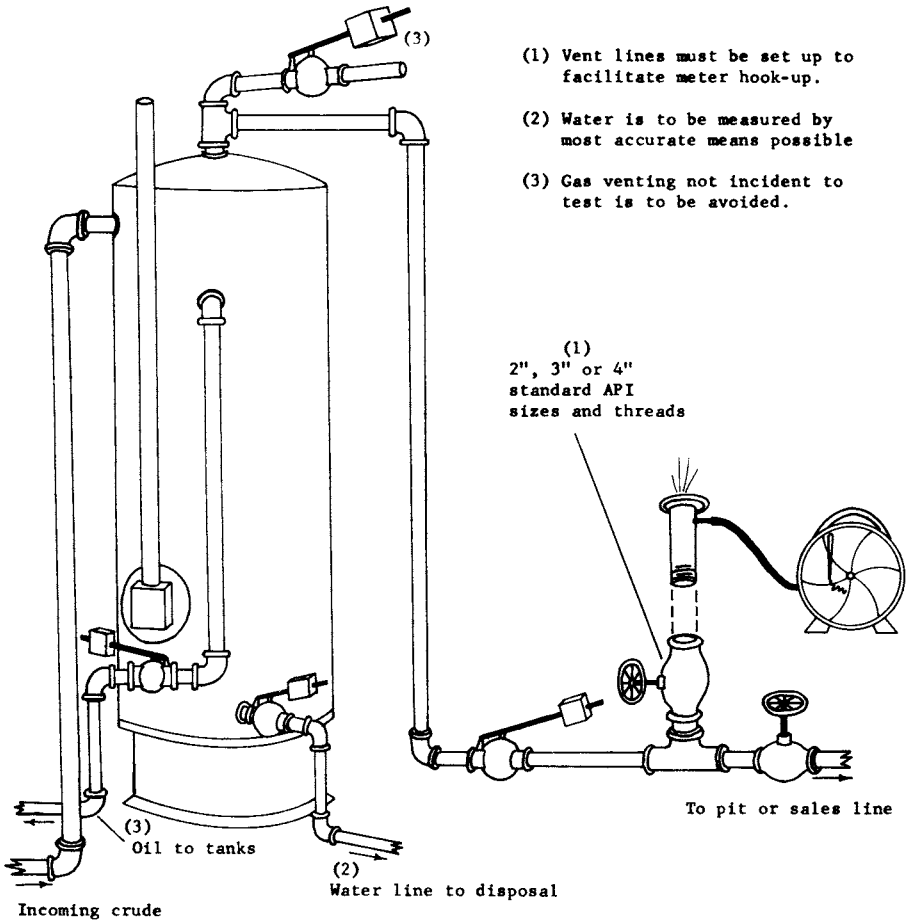

Figure 1. Standard installation of test equipment

Testing Equipment

1. Meters should be calibrated and adjusted periodically to assure accuracy. Pens should zero and track the same arc as the chart. Chart drives should be periodically checked for accurate timing.

2. Orifice plates should be sharp-edge, 1/8" thick, and should be centered in the tester with no leaks around the fittings.

3. Pitot tubes should be formed from 1/8" internal diameter pipe. The end exposed to the flow of gas should be tapered to a fine edge. The tube should be bent in a curve so the end is perpendicular to the center of the testing pipe. The end of the pitot tube should be centered and level with the end of the test pipe.

4. Testing equipment capacities should conform to recommended ranges for volumes being tested. All hoses, nipples, valves and other fittings should be tight.

5. The chart's pressure range should be the same as the meter's pressure range.

6. Testers should be equipped to gauge all oil, water and gas incident to the test.

Testing Procedures

1. Several methods of testing are available. The pitot tube should not be used for volumes below 150 MCF per day or whenever other means are available. The inline Orifice meter is preferable to other methods and should be used when available.

2. If special separation equipment is not available to segregate the well to be tested, all other wells on that lease should be shut-in at both the tubing and casing. All field service lines that may interfere with the test should be shut-in.

3. Orifice plate sizes should be clearly identified in the field. For tests requiring several orifice plates, the limits of each plate should be delineated on the chart.

4. The minimum test period is 3 hours for "steady" produced wells, or 3 flows for intermittently flowed wells unless a longer test is necessary to develop a representative chart.

5. The start time of the test should coincide with the time indicated on each chart. If a fast chart

FIELD WORK SHEET FOR GAS-OIL RATIO TEST

Lease & Well No._____ Date_____

Company_____ Tested By_____

Witnessed By_____

PRODUCTION METHOD

Prod. Method_____ Choke Size_____Inches

No. flows/day_____ Tub. Press._____psig

Length of flow_____ Csg. Press._____psig

Pump Barrel Size_____ Sep. Press._____psig

Stroke per minute_____ H. T. Press._____psig

Length of Stroke_____ H. T. Temp._____^{o}F

TEST DATA

Gas Temp._____ ^{o}F Gas Gravity_____

Total Tank Cap._____ Bbls OWT ☐ Sales M ☐ Other ☐ _____

Tank Size_____ Pipe Size____Flange Tap ☐ Pipe Tap ☐

Tanks / Gauges: Open_____ Clock Speed_____Meter Range_____

_____ Orifice Size_____

Close_____ Water Gauges: Open_____

_____ Close_____

Total Inches_____ % or Bbls. Measured_____

Remarks

_____

_____

_____

_____

_____

Figure 2. Typical field work sheet for gas-oil ratio test.

drive is used, the starting time of the flow should be noted.

6. The chart readings should not exceed the chart limits for any significant amount of the total test period. The chart reading in all methods should be at least 5% of the maximum extension of the pressure element, except when the smallest orifice is used.

7. A fast chart drive should be used to establish average differential for short flow periods, and for wells with erratic flow characteristics.

8. If pressure differentials fluctuate greatly over a normal test period, the test should be extended until average producing conditions are established.

9. Gas temperature and gravity should be recorded when feasible. Gravity can usually be obtained from the gas purchaser.

10. All tanks in which oil or water is collected should be gauged before, during, and after the test.

11. Water volumes should be measured by the most accurate means feasible.

Reporting Procedures

1. The following information should be recorded on the test chart: Date and time of the test, lease and well name, orifice size, meter range, speed of chart drive, element used (e.g. inches mercury, inches water, or psi) and method of test (e.g. OWT, inline flange, or pipe taps). It is also a good practive to note on the back of the test chart, or on field work sheet, all other pertinent data such as oil and water gauges, tank sizes, tubing and casing pressure, choke size, number and length of each flow, gas temperature, and gravity.

2. Before filing results with the State of Michigan, Form 7103 (fig. 3) should be executed according to instructions on the form, with special attention given the following points:

   a. Casing and tubing pressures should be recorded during test period. Indicate if shut-in pressures are shown.

   b. Note separator or heater-treater pressure and temperature when the well is under test.

CONS. 7103
REV. 12/65

MICHIGAN DEPARTMENT OF CONSERVATION

GAS - OIL RATIO TEST

FIELD NAME _____

Operator		Lease & Well Name
County	Township	Location
Prod. Form.	Completion Date	Permit No.

TEST DATA

(Base Press. 14.65 psig - Temp. 60° F.)

Testing Company	Tested & Computed By (Name)	
Test Date	Length Test	Prod Method
No. Flows/Day	Length Flow	Choke Size
Length Stroke	Strokes per Min.	Pump Barrel Size
Casing Press. psig	Tubing Press. psig	Sep or H.T. Press. psig
Gas Temp. °F.	Gas Gravity °	H.T. Temp. °F.

☆

Tank Size	Method of Test ☐ OWT ☐ Sales Meter ☐ Other		Meter Range
Tank Coeff.	Pipe Size	Tap: Flange ☐ Pipe ☐	Clock Speed
Tank Gauges: Open	Orifice Size		Pitot
	Orifice Coeff.		
Close	Coeff. Tables Used		
	Diff. Press. Avg.	☐ Mercury	☐ Water ☐ psi
Total In. Prod.	Static Press. Avg.		☐ psig ☐ psia

☆

Total Oil - Test, Bbls	Gas Prod. - Test, MCF
Oil per Hr. or Flow, Bbls	Gas Prod. per Hr. or Flow, MCF
Oil Prod. per Day, Bbls	Gas Prod. per Day, MCF

☆

Water Prod per Day, Bbls	G.O.R. c.f.p.b.
Prev. G.O.R. c.f.p.b.	Date of Prev. G.O.R.

(Make remarks and calculations on reverse side)

Figure 3. Gas Oil ratio test Form #7103 (front side).

GENERAL INSTRUCTIONS

The following list of rules represent the minimum requirements for conducting and filing of gas-oil ratio tests with this agency. Failure to adhere to these requirements can result in rejection of the test.

(1) Provide all pertinent information called for; e.g., gas gravity, flow method, meter range, oil gauges, chart readings, etc.

(2) Test chart, or reproduction, must accompany test data. (Includes sales meter charts.)

(3) Charts must be legible with a minimum differential extension of 5% of instrument range. Exceptions only when test conditions require use of minimum orifice.

(4) Minimum test time will be three (3) hours, or three intermittent flows, whichever is greater, or actual flow time necessary to develop a representative chart.

(5) Gas temperatures and gravities must not be assumed when obtainable.

(6) Show method and principal calculations in determining gas volumes.

(7) Gas vented to the atmosphere, or otherwise diverted, other than that incident to conduction of the test will invalidate the test.

Note: A notarized copy of this test must be filed no later than the 15th of the month subsequent to the month test was completed. Mail to: Michigan Department of Conservation, 204 Court St. Mt. Pleasant, Michigan.

AFFIDAVIT BY OPERATOR OR SERVICE COMPANY

I, _____ *, the undersigned, a duly authorized representative of* _____ *responsible for and having knowledge of the test reported herein do hereby certify that the said test is true and accurate to the best of my knowledge and belief.*

Test Witnessed by _____ Representing _____

Test Witnessed by _____ Representing _____

Subscribed and sworn to me this
_____ day _____ , 19____ _____

_____ _____ By _____

Notary Public _____ County, State of _____

My Commission expires _____

REMARKS AND CALCULATIONS _____

Figure 3, continued

c. Gas gravity recorded should be from the well or lease being tested -- unless it has not been established.

d. Note the orifice coefficient if an in-line orifice meter is being used.

e. Give name or source of tables used in calculating the gas.

f. Show differential and static pressure averages if the chart is integrated or if differential and static pressure are obvious from sight reading of the chart. When differential and/or static pressure fluctuate, observe instructions in the next paragraph.

3. Pertinent calculations should be shown on the back of the form. Show basic data used in deriving the final gas and oil figures, particularly when the chart has to be segregated into several parts and each part computed separately in calculating total gas volume.

4. Any facts clarifying the test should be noted under remarks.

5. Notarize signature on Form 7103 and submit to the Department of Conservation no later than the fifteenth of the month following the month of the test. The test chart, or a copy thereof, must accompany the report.

* * *

SUBSURFACE PRESSURE TESTS

Subsurface pressure tests must be filed with the Department of Conservation, Geological Survey Division on Form 7104 (page 15). Only persons qualified by training and experience shall conduct such tests.

Condition Of The Well

1. Static pressure tests.

a. The tubing, casing, and all other possible outlets must be shut-in for a period specified by the Department.

b. The well should be free of paraffin or hydrates. All rods and plungers shall be removed from the tubing before the well is shut-in.

c. Casing and tubing should be equipped so surface pressures can be obtained by a dead weight tester or a calibrated spring gauge.

2. Flow pressure tests.

a. All obstacles, as rods and plungers, should be removed from the tubing before the well is shut-in.

b. The well should be equipped with calibrated flow regulating device such as a choke. Casing and tubing should be equipped so surface pressure can be obtained by a dead weight tester or a calibrated spring gauge.

c. Separator equipment and adequate storage facilities should be provided to measure fluids accurately for at least 8 hours.

d. A gas-oil ratio test should be made if flowing pressure is being recorded on a discovery or development well.

Testing Equipment

1. Subsurface and surface pressure gauges would be calibrated before and after each general field survey. For other types of testing these gauges should be calibrated after either six static tests, one five-day build-up test, or four flowing tests, or, if the gauge has not been used for six months. All parts of the subsurface gauge should be in good working order.

2. The tester should have all equipment and information to complete the test. He should also arrange for stand-by equipment in case of failures.

Testing Procedure

All subsurface pressure survey schedules issued by the Department of Conservation should be adhered to.

1. Static Pressure Tests.

a. Sufficient stops, at selected depths, should be made to establish fluid gradients. Stops should be made on the down hole run to avoid the effect of hysteresis, and of sufficient duration to insure a readable chart. The instrument handbook should be consulted to avoid operating errors as hysteresis effect and failure to exercise spring coil.

b. Final stop should be as near as possible to prescribed recording datum.

c. At the start and finish of each test, tubing and casing pressures should be measured with a dead-weight tester, or a calibrated spring gauge of suitable range.

d. Bottom-hole temperatures should be taken as required, or when feasible.

2. Flowing Pressure Tests.

a. Gauge and record oil and water at beginning of test and at 30-minute intervals thereafter.

b. At beginning of test and at 15-minute intervals thereafter until surface pressures indicate stabilization for a period of at least one hour, measure and record tubing and casing pressures with a dead weight tester or calibrated spring gauge. To achieve stabilization of the oil rate and surface pressures, the choking device must be kept free of ice or paraffin throughout the test. "Stabilization" is that point at which well head pressures and oil rates show no indication of progressive increase or decrease.

c. If more than one stabilized flow rate is planned, begin with the lower and increase to the higher. If stabilized surface pressures are not achieved after a reasonable period of time, the rate should be adjusted, higher or lower, in an attempt to achieve stabilization. Do not,

CONS. 7104
5/63

MICHIGAN DEPARTMENT OF CONSERVATION

BOTTOM HOLE PRESSURE TEST

FIELD NAME _____

Operator		Lease & Well No.
County	Township	Location
Permit No.	Prod. Form.	Total Depth
Well Elev. R.B. R.F. G.L. Tub.Val.		Completion Date
Tested By		Employed By
Make of B.H.P. Gauge	Range of Press. Element psig	Date of Last Calibration

STATIC TEST

Date & Time of Shut-in	Date & Time of Test	No. of Hrs. Shut-in
Bottom-hole Temp. °F.	Tub. Press., psig In Out	Casing Press., psig In Out
Gas-Oil Contact	Oil-Water Contact	Common Test Datum for Field

Recording Depth Ft.	Datum Ft.	Chart Reading - inches	Calculated Press. psig	Fluid Grad.	Type of Fluid

B.H.P. @ Common Datum	Elev. Used	Fluid Grad. Used

FLOW TEST

Recording Depth, Ft.	Datum, Ft.	Length of Test	Stabilization Reached Yes No
Tubing Press., psig Static	Flowing; Start	End	
Casing Press., psig Static	Flowing; Start	End	
Stock Tank Size	Stock Tank Coeff.		Choke Size
Tank Gauge: Open	Total Inches Prod.		Static B.H.P., psig
	Total Oil Prod. - Test, Bbls		Flowing B.H.P., psig
Close	Total Oil Prod. - Day, Bbls		Press. Diff., psig
	PRODUCTIVE INDEX: (BOPD per pound differential)		

(Make remarks and calculations on reverse side)

Figure 4. Bottom hole pressure test Form #7104

however, flow a well at such a high rate that damage to the well or reservoir may result.

Reporting Procedure

Results of the subsurface pressure tests requested by the Department of Conservation should be filed on Form 7104 (fig. 4) or one providing the same data. To provide a more comprehensive report, the following information should also be included in the report.

1. Static Test.

a. Date of latest calibration of the subsurface gauge and spring gauge should be reported.

b. The actual hours of shut-in (not scheduled shut-in) should be recorded.

c. Indicate if the tubing and casing pressures were determined by a dead-weight tester (D.W.T.) or a calibrated spring gauge (S.G.).

d. Each stop in the well and its related data, as depth and pressure should be reported.

e. If the common datum pressure was derived by using a gradient other than the one for the last interval tested, show which gradient was used and why.

2. Flowing Test.

For the purpose of establishing well productivity index (P.I.) the 24-hour oil production rate should be based on the rate established during stabilized flow -- that point at which well head pressures and oil rates show no indication of progressive increase or decrease. If several stabilized flow rates are determined each rate should be considered a separate test and reported separately.

* * *

COMPUTATION TABLES

TABLE 1

2" Orifice Well Tester Flow Rate - MCF/Day
Based On: 14.65 PSIA, 60° F., 0.60 Specific Gravity

Pressure, Inches of Water	Orifice Size, Inches							
	1/8"	1/4"	3/8"	1/2"	3/4"	1"	1-1/4"	1-1/2"(*)
1.0	.528	1.68	3.56	6.27	14.2	25.8	43.9	69.6
1.2	.578	1.85	3.91	6.87	15.5	28.3	48.0	76.2
1.4	.625	1.99	4.22	7.42	16.8	30.6	51.9	82.3
1.6	.669	2.13	4.52	7.94	17.9	32.7	55.5	88.0
1.8	.709	2.26	4.79	8.43	19.0	34.6	58.9	93.3
2.0	.747	2.37	5.05	8.87	20.0	36.5	62.0	98.5
2.2	.784	2.49	5.29	9.31	21.0	38.3	65.1	103.
2.4	.818	2.61	5.52	9.72	21.9	40.0	67.9	108.
2.6	.852	2.71	5.76	10.1	22.9	41.6	70.7	112.
2.8	.884	2.81	5.98	10.5	23.8	43.2	73.3	116.
3.0	.915	2.92	6.18	10.9	24.5	44.7	76.0	121.
3.2	.945	3.01	6.39	11.2	25.3	46.2	78.5	124.
3.4	.975	3.11	6.58	11.6	26.1	47.6	80.9	128.
3.6	1.00	3.19	6.78	11.9	26.9	48.9	83.3	132.
3.8	1.03	3.28	6.96	12.2	27.6	50.3	85.5	136.
4.0	1.06	3.37	7.14	12.5	28.3	51.6	87.8	139.
4.5	1.12	3.58	7.58	13.3	30.1	54.7	93.1	148.
5.0	1.18	3.71	7.98	14.1	31.6	57.7	98.1	156.
5.5	1.24	3.95	8.37	14.7	33.2	60.5	103.	163.
6.0	1.29	4.12	8.74	15.4	34.7	63.3	107.	170.
6.5	1.34	4.30	9.10	16.0	36.1	65.8	112.	177.
7.0	1.39	4.45	9.45	16.7	37.4	68.3	116.	184.
8.0	1.50	4.76	10.1	17.2	40.0	73.1	124.	197.
9.0	1.59	5.05	10.7	18.8	42.5	77.5	132.	209.
10.0	1.67	5.32	11.3	19.9	44.8	81.6	138.	220.
11.	1.75	5.60	11.9	20.9	47.2	85.9	145.	231.
12.	1.83	5.86	12.4	21.9	49.3	89.8	152.	241.
13.	1.91	6.10	12.9	22.8	51.4	93.6	158.	251.
14.	1.98	6.33	13.4	23.7	53.3	97.3	164.	260.
15.	2.05	6.55	13.9	24.5	55.2	101.	170.	270.
16.	2.11	6.72	14.2	25.1	56.8	103.	176.	278.
17.	2.18	6.93	14.7	25.8	58.5	106.	181.	287.
18.	2.24	7.12	15.1	26.6	60.2	110.	186.	295.
19.	2.30	7.32	15.5	27.3	61.9	113.	191.	303.
20.	2.36	7.51	15.9	28.0	63.5	115.	196.	311.

(*) Note: The 1-1/2" plate to be used only when smaller plates will not handle the volume satisfactorily.

Table 1 continued

2" Orifice Well Tester Flow Rate - MCF/Day
Based On: 14.65 PSIA, 60° F., 0.60 Specific Gravity

Pressure, Inches of Water	Orifice Size, Inches							
	1/8"	1/4"	3/8"	1/2"	3/4"	1"	1-1/4"	1-1/2"(*)
22.	2.48	7.88	16.7	29.4	66.6	121	206	326
24.	2.59	8.22	17.4	30.7	69.5	126	215	341
26.	2.69	8.56	18.1	31.9	72.4	132	224	355
28.	2.79	8.89	18.8	33.2	75.1	137	233	368
30.	2.89	9.20	19.5	34.3	77.8	141	241	381
32.	2.99	9.50	20.1	35.5	80.3	146	248	394
34.	3.08	9.79	20.8	36.5	82.8	151	256	406
36.	3.17	10.1	21.3	37.6	85.2	155	264	418
38.	3.25	10.4	21.9	38.6	87.5	159	271	429
40.	3.34	10.6	22.5	39.6	89.8	163	278	440
42.	3.42	10.9	23.1	40.7	92.0	167	285	451
44.	3.50	11.1	23.6	41.6	94.1	171	291	462
46.	3.58	11.4	24.1	42.5	96.3	175	298	473
48.	3.66	11.6	24.7	43.4	98.4	179	304	482
50.	3.73	11.9	25.2	44.3	100.	183	311	493
52.	3.81	12.1	25.7	45.2	102.	186	317	502
54.	3.88	12.3	26.2	46.1	104.	190	323	511
56.	3.95	12.6	26.6	46.9	106.	193	329	521
58	4.02	12.8	27.1	47.8	108.	197	335	530
60.	4.09	13.0	27.6	48.6	110.	200	340	539
62.	4.16	13.2	28.0	49.4	112.	203	346	549
64.	4.23	13.4	28.5	50.2	114.	207	352	557
66.	4.28	13.6	28.9	50.9	115.	210	357	565
68.	4.35	13.9	29.4	51.7	117.	213	362	575
70.	4.42	14.1	29.8	52.4	119.	216	368	583
72.	4.48	14.3	30.2	53.2	120.	219	373	
74.	4.54	14.4	30.6	53.9	122.	222	378	
76.	4.60	14.6	31.0	54.7	123.	225	383	
78.	4.66	14.8	31.4	55.3	125.	228	388	
80.	4.72	15.0	31.8	56.1	127.	231	393	
82.	4.78	15.2	32.2	56.8	128.	233	398	
84.	4.84	15.4	32.6	57.4	130.	236	403	
86.	4.90	15.5	33.0	58.1	131.	239	407	
88.	4.96	15.7	33.4	58.8	133.	242	412	
90.	5.01	15.9	33.8	59.5	134.	244	417	
92.	5.06	16.1	34.1	60.1	136.	247	422	
94.	5.12	16.3	34.5	60.8	137.	250	426	
96.	5.17	16.4	34.9	61.5	139.	253	431	
98.	5.23	16.6	35.2	62.1	140.	255	435	
100.	5.28	16.8	35.6	62.7	142.	258	439	

(*) Note: The 1-1/2" plate to be used only when smaller plates will not handle the volume satisfactorily.

TABLE 2

2" Orifice Well Tester Flow Rate - MCF/Day
Based On: 14.65 PSIA, 60° F., 0.60 Specific Gravity

Pressure, Inches of Mercury	Orifice Size, Inches							
	1/8"	1/4"	3/8"	1/2"	3/4"	1"	1-1/4"	1-1/2"(*)
1.0	1.91	6.23	13.2	23.1	52	96	162	258
1.1	2.01	6.53	13.8	24.2	55	100	170	271
1.2	2.11	6.83	14.5	25.2	58	105	178	283
1.3	2.19	7.14	15.1	26.3	60	109	185	295
1.4	2.26	7.37	15.6	27.4	62	113	192	306
1.5	2.36	7.67	16.3	28.4	64	117	199	317
1.6	2.42	7.89	16.7	29.5	67	121	206	328
1.7	2.50	8.11	17.2	30.5	69	125	212	338
1.8	2.59	8.41	17.9	31.6	71	129	219	348
1.9	2.65	8.63	18.3	32.6	73	132	225	358
2.0	2.73	8.86	18.8	33.7	75	136	231	367
2.2	2.86	9.31	19.8	34.7	78	143	242	386
2.4	2.98	9.69	20.5	35.8	82	149	253	403
2.6	3.12	10.1	21.5	37.9	85	155	264	420
2.8	3.23	10.5	22.3	38.9	89	161	274	446
3.0	3.35	10.9	23.1	40.0	92	167	284	451
3.2	3.47	11.3	23.9	43.1	95	173	293	467
3.4	3.58	11.6	24.7	44.2	98	179	303	482
3.6	3.68	11.9	25.3	45.2	101	184	312	497
3.8	3.79	12.3	26.2	46.3	104	189	321	510
4.0	3.89	12.6	26.8	47.4	107	194	330	524
4.5	4.14	13.4	28.5	50.5	113	206	350	558
5.0	4.37	14.2	30.1	52.6	120	218	370	589
5.5	4.60	14.9	31.7	56.8	126	229	389	619
6.0	4.80	15.6	33.2	59.0	132	240	407	648
6.5	5.01	16.3	34.6	61.0	137	251	425	676
7.0	5.22	17.0	36.0	63.5	143	261	442	704
8.	5.59	18.3	38.6	68.1	154	280	475	756
9.	5.95	19.3	41.2	72.8	164	298	506	806
10.	6.33	20.5	43.8	77.4	173	316	536	854
11.	6.65	21.6	45.9	80.9	183	333	565	899
12.	7.00	22.7	48.3	85.5	192	349	593	944
13.	7.29	23.6	50.4	89.0	200	365	620	986
14.	7.62	24.8	52.7	93.6	209	381	646	1025
15.	7.93	25.8	54.7	97.0	217	396	672	1068
16.	8.22	26.8	56.8	100.0	225	411	691	1110
17.	8.49	27.6	58.6	104.	233	425	721	1148
18.	8.80	28.7	60.8	107.	241	439	746	1185
19.	9.08	29.5	62.7	110.	249	453	769	1223
20.	9.36	30.5	64.6	115.	256	467	793	1262

Based on tables appearing in American Meter Company's Bulletin E-7. (*) Note: The 1-1/2" plate to be used only when smaller plates will not handle the volume satisfactorily.

Table 2 continued

2" Orifice Well Tester Flow Rate - MCF/Day
Based On: 14.65 PSIA, 60° F., 0.60 Specific Gravity

Pressure, Inches of Mercury	Orifice Size, Inches							
	1/8"	1/4"	3/8"	1/2"	3/4"	1"	1-1/4"	1-1/2"(*)
21.	9.60	31.2	66.4	118	264	481	816	1296
22.	9.89	32.1	68.4	120	271	494	838	1333
23.	10.1	32.9	70.0	123	278	507	861	1370
24.	10.4	33.9	71.9	127	285	520	883	1404
25.	10.6	34.6	73.6	131	292	533	905	1440
26.	10.9	35.5	75.4	133	300	546	927	1474
27.	11.2	36.4	77.2	136	306	559	948	1508
28.	11.5	37.2	78.9	140	313	571	969	1540
29.	11.7	37.9	80.5	142	320	583	990	1576
30.	11.9	38.7	82.2	145	327	596	1011	1608
31.	12.2	39.6	84.0	150	334	608	1032	1640
32.	12.4	40.5	86.0	152	340	620	1052	1673
33.	12.6	41.2	87.4	155	347	632	1073	1709
34.	12.9	42.0	89.0	157	353	644	1093	1740
35.	13.2	42.7	90.6	160	360	656	1113	1771
36.	13.4	43.5	92.2	164	366	668	1133	1802
37.	13.6	44.2	93.9	167	373	679	1153	1835
38.	13.8	45.0	95.5	169	379	691	1173	1865
39.	14.1	45.7	97.0	172	386	703	1193	1896
40.	14.3	46.4	98.7	175	392	714	1212	1928
41.	14.7	47.5	101	178	400	729	1240	1957
42.	14.9	48.2	102	180	406	740	1250	1990
43.	15.1	48.9	104	184	413	752	1270	2019
44.	15.3	49.6	105	187	418	763	1300	2052
45.	15.5	50.3	107	189	426	775	1320	2080
46.	15.7	51.2	108	191	431	787	1337	2112
47.	15.9	51.9	109	193	437	798	1348	2145
48.	16.3	52.6	112	198	442	809	1369	2172
49.	16.5	53.3	113	200	450	819	1390	2203
50.	16.7	54.1	115	202	455	830	1411	2230
51.	16.9	54.7	116	205	461	841	1422	2260
52.	17.1	55.4	118	207	466	853	1441	2293
53.	17.3	56.3	119	211	473	865	1463	2320
54.	17.6	57.0	121	213	480	877	1485	2350
55.	17.8	57.7	122	216	487	887	1506	2380
56.	18.0	58.3	124	219	492	897	1527	2410
57.	18.2	59.0	125	222	497	907	1538	2440
58.	18.4	59.7	126	224	504	918	1559	2470
59.	18.6	60.4	129	226	509	929	1578	2500
60.	18.8	61.1	130	229	515	940	1590	2530

Based on tables appearing in American Meter Company's Bulletin E-7. (*) Note: The 1-1/2" plate to be used only when smaller plates will not handle the volume satisfactorily.

Table 2 concluded

2" Orifice Well Tester Flow Rate - MCF/Day
Based On: 14.65 PSIA, 60° F., 0.60 Specific Gravity

Pressure, Inches of Mercury	Orifice Size, Inches							
	1/8"	1/4"	3/8"	1/2"	3/4"	1"	1-1/4"	1-1/2"(*)
61.	19.0	61.8	132	231	521	950	1610	2555
62.	19.2	62.5	133	235	526	962	1632	2585
63.	19.4	63.1	134	237	533	971	1653	2615
64.	19.6	63.9	136	240	538	985	1664	2640
65.	19.9	64.5	137	242	545	993	1686	2670
66.	20.1	65.3	139	245	552	1000	1706	2700
67.	20.3	66.0	140	247	557	1010	1727	2730
68.	20.5	66.7	141	250	563	1020	1738	2760
69.	20.7	67.4	143	253	568	1040	1759	2785
70.	20.9	68.0	144	255	573	1050	1780	2810
71.	21.1	68.8	146	259	579	1055	1790	2845
72.	21.3	69.4	148	261	585	1062	1812	2870
73.	21.6	70.1	149	263	591	1072	1832	2900
74.	21.8	70.7	151	266	595	1083	1843	2930
75.	22.0	71.6	152	269	603	1094	1864	2955
76.	22.2	72.2	154	272	609	1104	1885	
77.	22.4	72.8	155	274	615	1115	1907	
78.	22.6	73.4	156	276	619	1126	1917	
79.	22.8	74.1	158	278	624	1136	1939	
80.	23.0	75.0	159	280	632	1147	1959	
81.	23.3	75.5	160	284	636	1157	1970	
82.	23.4	76.0	162	286	642	1168	1991	
83.	23.7	77.0	163	289	650	1179	2011	
84.	23.9	77.5	165	291	654	1188	2025	
85.	24.0	78.1	167	294	658	1198	2045	
86.	24.3	79.0	168	297	665	1210	2065	
87.	24.4	79.6	169	299	670	1220	2073	
88.	24.6	80.2	171	302	676	1230	2093	
89.	24.9	81.0	172	305	683	1241	2116	
90.	25.1	81.4	173	307	687	1251	2127	
91.	25.3	82.3	175	309	693	1262	2148	
92.	25.5	82.9	176	312	700	1273	2170	
93.	25.7	83.5	177	313	704	1284	2180	
94.	25.9	84.3	179	316	710	1294	2200	
95.	26.1	84.9	180	318	715	1305	2222	
96.	26.3	85.7	183	321	722	1314	2232	
97.	26.5	86.3	184	324	727	1325	2255	
98.	26.8	87.0	186	326	734	1335	2275	
99.	27.0	87.5	187	329	739	1346	2286	
100.	27.2	88.3	188	331	744	1357	2306	

Based on tables appearing in American Meter Company's Bulletin E-7. (*) Note: The 1-1/2" plate to be used only when smaller plates will not handle the volume satisfactorily.

TABLE 3

2" ORIFICE WELL TESTER FLOW RATE - MCF/DAY
BASED ON: 14.65 P.S.I.A., 60° F, 0.60 SP. GR.

Pressure, PSIG	Orifice Diameter, Inches							
	1/8	1/4	3/8	1/2	3/4	1	1-1/4	1-1/2
1.0	2.76	8.95	19.0	33.9	76	137	233	371
1.5	3.39	11.02	23.3	41.0	93	169	287	456
2.0	3.92	12.7	27.0	47.7	108	195	332	527
2.5	4.42	14.3	31.4	53.4	121	220	374	595
3.0	4.84	15.7	33.5	59.2	133	242	411	654
3.5	5.26	17.1	36.3	64.0	144	263	445	709
4.0	5.64	18.5	39.0	68.8	156	283	480	764
4.5	6.01	19.5	41.6	73.6	166	301	511	814
5.0	6.39	20.7	44.2	78.1	175	319	542	863
5.5	6.72	21.8	46.4	81.8	185	336	571	908
6.0	7.06	22.9	48.8	86.3	194	353	599	953
6.5	7.37	23.9	51.0	90.1	202	369	626	995
7.0	7.70	25.0	53.2	94.5	211	385	653	1036
7.5	8.01	26.1	55.3	97.8	219	400	677	1080
8.0	8.30	27.0	57.3	101	227	415	700	1123
8.								
8.5	8.59	28.0	59.3	105	236	429	729	1160
9.0	8.89	29.0	61.4	108	245	442	754	1198
9.5	9.18	29.9	63.4	112	251	458	777	1237
10	9.45	30.8	65.3	116	259	472	802	1274
11	10.0	32.4	69.4	121	274	499	847	1348
12	10.5	34.0	72.6	129	288	526	893	1420
13	11.0	35.9	76.3	134	303	552	937	1490
14	11.6	37.6	79.7	141	317	577	980	1559
15	12.1	39.2	83.2	147	331	603	1023	1626
16	12.5	40.9	86.8	153	344	627	1064	1694
17	13.1	42.4	90.0	159	357	652	1105	1760
18	13.5	43.9	93.3	166	370	687	1146	1824
19	14.0	45.5	97.2	171	384	699	1187	1887
20	14.6	47.1	100	177	398	725	1233	1949
21	15.1	48.7	104	183	411	749	1270	2012
22	15.5	50.2	107	189	424	773	1316	2075
23	15.9	51.8	109	193	436	796	1346	2140
24	16.5	53.2	113	200	449	817	1388	2200
25	16.9	54.7	116	205	461	840	1421	2258
26	17.3	56.3	119	211	473	865	1462	2319
27	17.8	57.7	122	216	487	887	1506	2380
28	18.2	59.0	125	222	497	907	1539	2441
29	18.6	60.4	129	226	510	930	1579	2503
30	19.0	61.9	132	231	522	951	1612	2558
31	19.4	63.2	134	237	534	973	1656	2619

Table 3 continued

2" ORIFICE WELL TESTER FLOW RATE - MCF/DAY
BASED ON: 14.65 P.S.I.A., 60° F, 0.60 SP. GR.

Pressure,	Orifice Diameter, Inches							
PSIG	1/8	1/4	3/8	1/2	3/4	1	1-1/4	1-1/2
32	19.9	64.6	137	243	546	994	1690	2675
33	20.3	66.2	140	248	558	1012	1729	2737
34	20.7	67.5	143	253	569	1043	1764	2798
35	21.2	69.0	147	260	581	1057	1797	2858
36	21.7	70.3	150	265	594	1076	1836	2916
37	22.1	71.8	153	270	605	1098	1872	2976
38	22.5	73.0	155	275	617	1120	1911	3036
39	22.9	74.4	158	279	628	1141	1948	3095
40	23.3	75.8	161	285	639	1162	1980	3155
41	23.8	77.3	164	290	652	1184	2028	3215
42	24.2	78.6	168	296	662	1205	2056	3274
43	24.5	80.0	170	301	674	1226	2085	3334
44	25.0	81.2	173	306	685	1247	2122	3394
45	25.4	82.7	176	311	697	1269	2163	3454
46	25.8	83.9	178	315	708	1291	2194	3513
47	26.2	85.5	182	320	720	1312	2229	3573
48	26.8	86.8	185	326	732	1333	2271	3633
49	27.2	88.3	188	331	744	1357	2306	3692
50	27.6	89.7	191	337	756	1379	2341	3752
51	28.0	91.1	193	342	767	1401	2377	3811
52	28.5	92.5	196	347	779	1422	2413	3871
53	28.9	93.9	199	352	790	1444	2449	3931
54	29.3	95.3	202	357	802	1466	2485	3991
55	29.7	96.7	205	362	814	1488	2522	4051
56	30.2	98.1	208	367	825	1509	2558	4110
57	30.6	99.5	211	373	837	1531	2594	4170
58	31.0	100.9	214	378	848	1553	2630	4230
59	31.5	102.3	217	383	860	1573	2666	4289
60	31.9	103.6	220	388	872	1596	2702	4349
61	32.3	105.0	223	393	883	1618	2738	4409
62	32.8	106.4	226	398	895	1639	2774	4468
63	33.2	107.8	229	403	906	1661	2810	4528
64	33.6	109.2	232	409	918	1683	2846	4588
65	34.0	110.6	235	414	930	1705	2883	4647
66	34.5	112.0	238	419	941	1726	2919	4707
67	34.9	113.4	241	424	953	1748	2955	4767
68	35.3	114.8	244	429	965	1770	2991	4827
69	35.8	116.2	247	434	976	1791	3027	4886
70	36.2	117.5	250	440	988	1813	3063	4946
71	36.6	118.9	252	445	999	1835	3099	5006

Table 3 concluded

2" ORIFICE WELL TESTER FLOW RATE - MCF/DAY
BASED ON: 14.65 P.S.I.A., 60° F, 0.60 SP. GR.

Pressure,	Orifice Diameter, Inches							
PSIG	1/8	1/4	3/8	1/2	3/4	1	1-1/4	1-1/2
72	37.1	120.3	255	450	1011	1856	3135	5065
73	37.5	121.7	258	455	1023	1878	3171	5125
74	37.9	123.1	261	460	1034	1900	3207	5185
75	38.3	124.5	264	465	1046	1922	3244	5245
76	38.8	125.9	267	470	1057	1943	3280	5304
77	39.2	127.3	270	476	1069	1965	3316	5364
78	39.6	128.7	273	481	1081	1987	3352	5424
79	40.1	130.1	276	486	1092	2008	3388	5483
80	40.5	131.4	279	491	1104	2030	3424	5543
81	40.9	132.8	282	496	1115	2052	3460	5603
82	41.4	134.2	285	501	1127	2073	3496	5662
83	41.8	135.6	288	506	1139	2095	3532	5722
84	42.2	137.0	291	512	1150	2117	3568	5782
85	42.7	138.4	294	517	1162	2139	3605	5842
86	43.1	139.8	297	522	1174	2161	3641	5901
87	43.5	141.2	300	527	1185	2182	3677	5961
88	43.9	142.6	303	532	1197	2204	3713	6021
89	44.4	144.0	306	537	1208	2225	3749	6080
90	44.8	145.3	309	543	1220	2247	3786	6140
91	45.2	146.7	312	548	1232	2269	3821	6200
92	45.7	148.1	314	553	1243	2290	3857	6259
93	46.1	149.5	317	558	1255	2312	3893	6319
94	46.5	150.9	320	563	1266	2334	3929	6379
95	47.0	152.3	323	568	1278	2356	3966	6439
96	47.4	153.7	326	573	1290	2377	4002	6498
97	47.8	155.1	329	579	1301	2399	4038	6558
98	48.2	156.5	332	584	1313	2421	4074	6618
99	48.7	157.9	335	589	1324	2442	4110	6677
100	49.1	159.2	338	594	1336	2464	4146	6737

TABLE 4

3" Orifice Well Tester Flow Rate - MCF/Day
Based On: 14.65 PSIA, 60° F., 0.60 Specific Gravity

Pressure, Inches of Mercury	Orifice Size, Inches				
	3/4"	1"	1-1/4"	1-1/2"	2"
1.0	50	90	143	211	419
1.1	53	94	150	222	440
1.2	55	99	157	232	460
1.3	57	103	163	241	479
1.4	59	106	169	251	497
1.5	62	110	175	259	515
1.6	64	114	181	268	533
1.7	66	118	187	277	549
1.8	68	121	192	285	565
1.9	70	124	198	293	581
2.0	71	128	203	301	597
2.2	75	134	213	315	626
2.4	78	140	223	330	655
2.6	82	146	232	344	682
2.8	85	152	241	357	709
3.0	88	157	250	370	734
3.2	91	162	258	382	759
3.4	94	168	266	395	783
3.6	96	173	274	406	807
3.8	99	178	282	418	830
4.0	102	182	290	429	852
4.5	108	194	308	456	906
5.0	114	205	325	482	957
5.5	120	215	342	507	1010
6.0	126	226	358	531	1050
6.5	131	235	374	554	1100
7.0	137	245	389	576	1140
8.	147	263	418	619	1230
9.	157	280	445	660	1310
10.	166	297	471	698	1390
11.	175	313	497	736	1460
12.	183	328	521	772	1530
13.	192	343	545	807	1600
14.	200	358	568	841	1670
15.	208	372	590	875	1740
16.	215	386	613	908	1800
17.	223	399	634	940	1870
18.	230	413	656	971	1930
19.	238	426	676	1010	1990
20.	245	439	697	1030	2050

Actual pipe diameter - 3.068 inches.
Table taken from American Meter Company's Bulletin E-7

Table 4 continued

3" Orifice Well Tester Flow Rate - MCF/Day
Based On: 14.65 PSIA, 60° F., 0.60 Specific Gravity

Pressure, Inches of Mercury	Orifice Size - Inches				
	3/4"	1"	1-1/4"	1-1/2"	2"
21.	252	452	717	1060	2110
22.	259	464	737	1100	2170
23.	266	476	757	1120	2230
24.	273	489	776	1150	2280
25.	280	501	796	1180	2340
26.	286	513	815	1210	2400
27.	293	525	834	1230	2450
28.	300	537	852	1260	2510
29.	306	548	871	1290	2560
30.	313	560	889	1320	2610
31.	319	571	907	1340	2670
32.	325	583	925	1370	2720
33.	332	594	943	1400	2770
34.	338	605	961	1420	2830
35.	344	616	979	1450	2880
36.	350	627	996	1480	2930
37.	356	638	1010	1500	2980
38.	363	650	1030	1530	3030
39.	369	660	1050	1550	3080
40.	375	671	1070	1580	3130
41.	383	686	1090	1615	3188
42.	389	698	1108	1641	3240
43.	396	709	1126	1668	3294
44.	403	721	1145	1696	3348
45.	409	733	1163	1723	3402
46.	416	744	1181	1750	3456
47.	422	755	1199	1776	3506
48.	428	767	1217	1803	3560
49.	435	778	1236	1830	3614
50.	441	789	1253	1856	3665
51.	447	801	1272	1884	3721
52.	453	812	1289	1910	3771
53.	460	823	1307	1936	3822
54.	466	834	1324	1962	3873
55.	472	845	1341	1987	3924
56.	478	856	1359	2013	3975
57.	484	867	1376	2039	4026
58.	490	878	1394	2065	4077
59.	497	889	1412	2091	4129
60.	502	899	1427	2115	4176

Actual pipe diameter - 3.068 inches

Table 4 concluded

3" Orifice Well Tester Flow Rate - MCF/Day
Based On: 14.65 PSIA, 60° F., 0.60 Specific Gravity

Pressure, Inches of Mercury	Orifice Size - Inches				
	3/4"	1"	1-1/4"	1-1/2"	2"
61.	508	910	1445	2141	4227
62.	515	921	1463	2167	4279
63.	521	933	1480	2193	4330
64.	526	943	1497	2217	4378
65.	532	954	1514	2243	4429
66.	538	964	1530	2267	4476
67.	544	975	1548	2293	4529
68.	550	985	1564	2317	4575
69.	556	996	1582	2343	4627
70.	562	1007	1598	2367	4674
71.	568	1017	1614	2391	4721
72.	574	1028	1632	2418	4774
73.	580	1038	1648	2441	4821
74.	586	1049	1666	2468	4874
75.	592	1059	1682	2492	4920
76.	598	1071	1700	2518	4973
77.	604	1081	1716	2542	5020
78.	610	1092	1734	2569	5073
79.	616	1103	1750	2593	5121
80.	622	1114	1769	2620	5174
81.	628	1124	1785	2644	5221
82.	634	1134	1801	2667	5268
83.	640	1146	1819	2695	5321
84.	646	1156	1835	2719	5369
85.	651	1166	1851	2743	5416
86.	657	1176	1867	2766	5463
87.	663	1188	1886	2794	5517
88.	669	1198	1902	2818	5564
89.	675	1208	1918	2842	5611
90.	680	1218	1934	2866	5659
91.	687	1230	1953	2893	5712
92.	693	1240	1969	2917	5760
93.	699	1251	1985	2941	5807
94.	705	1262	2004	2968	5861
95.	711	1272	2020	2992	5909
96.	716	1283	2036	3016	5960
97.	723	1294	2055	3044	6010
98.	728	1304	2070	3068	6058
99.	734	1315	2087	3092	6105
100.	741	1326	2106	3120	6160

Actual pipe diameter - 3.068 inches

TABLE 5

3" Orifice Well Tester Flow Rate - MCF/Day
Based On: 14.65 PSIA, 60° F., 0.60 Specific Gravity

Pressure PSIG	Orifice Diameter - Inches				
	3/4"	1"	1-1/4"	1-1/2"	2"
1.0	70	128	204	300	600
1.5	88	163	256	370	760
2.0	102	185	295	430	870
2.5	114	207	330	480	960
3.0	127	227	365	530	1055
3.5	138	246	395	580	1155
4.0	149	265	425	625	1240
4.5	158	283	452	668	1320
5.0	167	300	479	718	1400
5.5.	175	315	500	745	1470
6.0	184	330	525	782	1550
6.5	193	345	548	815	1615
7.0	201	361	572	848	1685
7.5	209	376	596	879	1750
8.0	217	390	619	915	1820
8.5	225	405	640	947	1890
9.0	232	418	660	977	1945
9.5	240	430	680	1007	2005
10.0	247	443	702	1040	2065
11.	261	467	742	1100	2180
12.	275	493	782	1160	2300
13.	290	518	822	1220	2420
14.	303	543	860	1280	2535
15.	316	565	900	1330	2640
16.	329	587	938	1385	2750
17.	342	610	975	1440	2860
18.	355	632	1013	1495	2965
19.	368	658	1050	1550	3070
20.	381	682	1087	1605	3180
21.	394	705	1123	1665	3285
22.	407	728	1160	1715	3390
23.	420	752	1195	1770	3495
24.	433	778	1232	1825	3610
25.	447	804	1268	1880	3715

Table 5 continued

3" Orifice Well Tester Flow Rate - MCF/Day
Based On: 14.65 PSIA. 60° F., 0.60 Specific Gravity

Pressure PSIG	Orifice Diameter - Inches				
	3/4"	1"	1-1/4"	1-1/2"	2"
26.	459	826	1305	1930	3820
27.	472	849	1340	1983	3925
28.	484	870	1376	2038	4030
29.	497	891	1411	2090	4130
30.	509	912	1445	2142	4230
31.	522	935	1477	2195	4335
32.	534	956	1515	2250	4440
33.	546	978	1550	2295	4540
34.	558	1000	1585	2345	4635
35.	571	1021	1622	2400	4740
36.	583	1043	1655	2452	4840
37.	595	1064	1690	2505	4930
38.	607	1085	1725	2555	5035
39.	619	1107	1760	2605	5140
40.	631	1128	1793	2655	5240
41.	642	1150	1828	2705	5340
42.	655	1172	1860	2755	5440
43.	667	1192	1895	2805	5540
44.	679	1215	1930	2855	5640
45.	691	1237	1965	2905	5740
46.	703	1258	2000	2955	5840
47.	715	1278	2035	3007	5940
48.	727	1298	2068	3057	6040
49.	739	1321	2100	3110	6140
50.	751	1343	2134	3160	6240

TABLE 6

4" Orifice Well Tester Flow Rate - MCF/Day
Based On: 14.65 PSIA, 60° F., 0.60 Specific Gravity

Pressure, Inches of Mercury	Orifice Size - Inches				
	1"	1-1/4"	1-1/2"	2"	2-1/2"
1.0	89	140	204	377	638
1.1	94	147	214	396	669
1.2	98	154	224	414	700
1.3	102	160	233	430	728
1.4	106	166	242	447	756
1.5	109	172	250	463	783
1.6	113	178	259	479	810
1.7	117	183	267	493	835
1.8	120	189	275	508	859
1.9	124	194	282	523	884
2.0	127	199	290	536	907
2.2	133	209	304	563	952
2.4	139	219	318	588	995
2.6	145	228	331	613	1040
2.8	151	237	344	637	1080
3.0	156	245	357	660	1120
3.2	161	253	369	682	1150
3.4	167	262	380	704	1190
3.6	171	269	392	725	1230
3.8	176	277	403	746	1260
4.0	181	285	414	766	1300
4.5	193	303	440	814	1380
5.0	203	320	465	860	1450
5.5	214	336	489	904	1530
6.0	224	352	512	947	1600
6.5	234	367	534	988	1670
7.0	243	382	555	1030	1740
8.	261	410	597	1100	1870
9.	278	437	636	1180	1990
10.	295	463	673	1250	2110
11.	310	488	709	1310	2220
12.	326	512	745	1380	2330
13.	341	535	778	1440	2440
14.	355	558	811	1500	2540
15.	369	580	843	1560	2640
16.	383	602	875	1620	2740
17.	396	623	906	1680	2840
18.	410	644	936	1730	2930
19.	423	664	966	1790	3020
20.	436	684	995	1840	3120

Actual pipe diameter - 4.026 inches

Table 6 continued

4" Orifice Well Tester Flow Rate - MCF/Day
Based On: 14.65 PSIA, 60° F., 0.60 Specific Gravity

Pressure, Inches of Mercury	Orifice Size - Inches				
	1"	1-1/4"	1-1/2"	2"	2-1/2"
21.	448	704	1020	1900	3210
22.	461	724	1050	1950	3300
23.	473	743	1080	2000	3380
24.	485	762	1110	2050	3470
25.	497	781	1140	2100	3560
26.	509	800	1160	2150	3640
27.	521	819	1190	2200	3730
28.	533	837	1220	2250	3810
29.	544	855	1240	2300	3890
30.	556	873	1270	2350	3980
31.	567	891	1300	2400	4060
32.	578	909	1320	2450	4140
33.	590	926	1350	2490	4220
34.	601	944	1370	2540	4300
35.	612	961	1400	2590	4380
36.	623	979	1420	2630	4450
37.	634	996	1450	2680	4530
38.	645	1010	1470	2730	4610
39.	656	1030	1500	2770	4690
40.	666	1050	1520	2820	4770
41.	678	1068	1551	2873	4855
42.	689	1085	1576	2921	4935
43.	701	1103	1602	2969	5017
44.	713	1121	1628	3018	5099
45.	724	1139	1655	3066	5181
46.	736	1157	1681	3115	5263
47.	746	1174	1705	3160	5339
48.	758	1192	1732	3209	5422
49.	769	1210	1758	3258	5505
50.	780	1227	1783	3304	5582
51.	792	1246	1809	3353	5666
52.	803	1263	1834	3399	5743
53.	814	1280	1859	3445	5820
54.	824	1297	1884	3491	5898
55.	835	1314	1908	3537	5975
56.	846	1331	1933	3583	6054
57.	857	1348	1958	3629	6132
58.	868	1365	1983	3675	6209
59.	879	1382	2008	3722	6288
60.	889	1398	2031	3764	6359

Actual pipe diameter - 4.026 inches

Table 6 concluded

4" Orifice Well Tester Flow Rate - MCF/Day
Based On: 14.65 PSIA, 60° F., 0.60 Specific Gravity

Pressure, Inches of Mercury	Orifice Size - Inches				
	1"	1-1/4"	1-1/2"	2"	2-1/2"
61.	900	1415	2056	3810	6437
62.	911	1433	2081	3857	6516
63.	922	1450	2106	3903	6595
64.	932	1466	2129	3946	6666
65.	943	1483	2154	3992	6745
66.	953	1499	2177	4035	6817
67.	964	1516	2202	4082	6896
68.	974	1532	2225	4124	6967
69.	985	1549	2250	4171	7047
70.	995	1565	2273	4213	7118
71.	1005	1581	2296	4255	7189
72.	1016	1598	2322	4303	7270
73.	1026	1614	2345	4345	7341
74.	1037	1632	2370	4393	7422
75.	1047	1647	2393	4435	7493
76.	1059	1665	2419	4482	7573
77.	1069	1681	2441	4525	7645
78.	1080	1699	2467	4573	7726
79.	1090	1714	2490	4615	7798
80.	1101	1732	2516	4663	7879
81.	1111	1748	2539	4706	7951
82.	1121	1764	2562	4748	8022
83.	1133	1782	2588	4796	8104
84.	1143	1797	2611	4839	8175
85.	1153	1813	2634	4881	8247
86.	1163	1829	2657	4924	8319
87.	1174	1847	2683	4972	8401
88.	1184	1863	2706	5015	8473
89.	1194	1879	2729	5057	8544
90.	1205	1895	2752	5100	8617
91.	1216	1913	2778	5149	8699
92.	1226	1928	2801	5191	8770
93.	1236	1944	2824	5234	8843
94.	1247	1962	2851	5283	8925
95.	1258	1978	2874	5326	8998
96.	1268	1994	2897	5368	9070
97.	1279	2012	2923	5417	9153
98.	1290	2028	2946	5460	9225
99.	1300	2044	2969	5503	9297
100.	1311	2062	2996	5552	9380

Actual pipe size -4.026 inches

TABLE 7

CAPACITIES FOR OPEN-FLOW PITOT TUBE*
Mcf PER DAY; PRESSURE BASE, 14.65 P.S.I.A.
SP. GR. 0.60; BASE AND FLOWING TEMPERATURE, 60° F
(Volumes are for 1.000 inch I.D. pipe; Refer to TABLE 8: FOR Multiple)

Press., Ins. of Water	Volume, Mcf per Day	Press., Ins. of Mercury	Volume, Mcf per Day	Pressure, P.S.I.G.	Volume, Mcf per Day
.10	11.01	.10	40.59	15	702
.20	15.57	.20	57.40	16	726
.30	19.06	.30	70.25	17	750
.40	22.02	.40	81.18	18	774
.50	24.61	.50	90.79	19	798
.60	26.98	.60	99.54	20	822
.70	29.13	.70	107.4	21	846
.80	31.13	.80	114.9	22	870
.90	33.03	.90	121.8	23	893
1.00	34.81	1.00	129.6	24	917
1.50	42.64	1.50	157.2	25	941
2.00	49.17	2.00	181.5	26	965
2.50	55.03	2.50	203.1	27	989
3.00	60.22	3.00	222.4	28	1013
3.50	65.13	3.50	240.3	29	1037
4.00	69.62	4.00	256.8	30	1061
4.50	73.85	4.50	272.4	32	1108
5.00	77.83	5.00	287.1	34	1156
5.50	81,63	5.50	301.2	36	1204
6.00	85.20	6.00	314.5	38	1252
7.00	92.11	7.00	339.9	40	1300
8	98.44	8	363.2	45	1419
9	104.4	9	385.3	50	1539
10	110.1	10	406.1	55	1658
11	115.5	11	426.0	60	1777
12	120.5	12	444.9	65	1897
13	125.5	13	463.2	70	2016
14	130.3	14	480.6	75	2136
15	134.7	15	497.4	80	2255
16	139.2	16	513.8	85	2375
18	147.7	17	529.6	90	2494
20	155.7	18	545.0	95	2614
25	174.1	19	559.9	100	2733
30	190.7	20	574.4	. . .	. . .

*Based on Reid's Formulae.

TABLE 8

MULTIPLIERS FOR PIPE AND CASING

For use with the Open Flow Pitot Tube for determining gas volumes through various diameter openings.

A. P. I. LINE PIPE

Nominal Size, In.	Inside Diameter, D, In.	Multiple, D^2
1	1.049	1.100
1-1/4	1.380	1.904
1-1/2	1.610	2.592
2	2.067	4.272
2-1/2	2.469	6.096
3	3.068	9.413
3-1/2	3.548	12.588
4	4.026	16.209
5	5.047	25.472
6	6.065	36.784
8 (25 lb.)	8.071	65.141
8 (29 lb.)	7.981	63.696
10 (33 lb.)	10.192	103.877
10 (36 lb.)	10.136	102.738
10 (42 lb.)	10.020	100.400

A.P.I. CASING

Nominal Size, In.	Weight Lb./ft.	Inside Diameter, D, In.	Multiple, D^2
4-1/2	9.50	4.090	16.728
	11.60	4.000	16.000
5	13.00	4.494	20.196
	15.00	4.408	19.430
	18.00	4.276	18.284
5-1/2	14.00	5.012	25.120
	15.50	4.950	24.503
	17.00	4.892	23.932
	20.00	4.778	22.829
6	18.00	5.424	29.420
	20.00	5.352	28.644
	23.00	5.240	27.458
6-5/8	20.00	6.049	36.590
	24.00	5.921	35.058
	28.00	5.791	33.536
7	23.00	6.366	40.526
	26.00	6.276	39.388
	29.00	6.184	38.242
	32.00	6.094	37.137
	35.00	6.004	36.048
7-5/8	24.00	7.025	49.351
	26.40	6.969	48.567
	29.70	6.875	47.266
	33.70	6.765	45.765
8-5/8	28.00	8.017	64.272
	32.00	7.921	62.742
	36.00	7.825	61.231
	40.00	7.725	59.676

TABLE 9

ORIFICE COEFFICIENTS - FLANGE TAPS*
CUBIC FEET PER DAY; PRESSURE BASE, 14.65 P.S.I.A.
SP. GR. 0.60; BASE AND FLOWING TEMPERATURE, 60° F

Orifice Diameter, Inches	Nominal Pipe Size, Inches 2 (2.067)	3 (3.068)	4 (4.026)	6 (6.065)
0.250	395.97	395.78	395.11	
0.375	885.57	883.96	882.84	
0.500	1573.87	1566.68	1564.61	1563.15
0.625	2470.72	2449.31	2442.97	2438.77
0.750	3586.59	3537.56	3522.63	3511.37
0.875	4936.93	4833.08	4805.97	4783.74
1.000	6548.87	6340.86	6292.44	6256.81
1.125	8464.13	8069.44	7985.39	7929.96
1.250	10751.54	10031.91	9889.08	9804.11
1.375	13504.60	12245.62	12009.60	11880.48
1.500	16893.23	14733.73	14354.57	14160.58
1.625		17525.46	16934.35	16646.86
1.750		20666.51	19762.63	19341.75
1.875		24210.76	22855.86	22248.30
2.000		28223.71	26233.83	25370.15
2.125		32786.96	29921.23	28713.11
2.250		38104.26	33953.36	32281.42
2.375			38369.21	36085.15
2.500			43214.47	40129.46
2.625			48540.91	44423.50
2.750			54412.47	48979.45
2.875			60917.48	53812.52
3.000			68378.76	58934.92
3.125				64361.85
3.250				70117.69

*Based on Basic Orifice Coefficients using American Gas Association Committee Report Number 2.

TABLE 10

ORIFICE COEFFICIENTS - PIPE TAPS*
CUBIC FEET PER DAY; PRESSURE BASE, 14.65 P.S.I.A.
SP. GR. 0.60; BASE AND FLOWING TEMPERATURE, 60° F

Orifice Diameter, Inches	Nominal Pipe Size, Inches 2 (2.067)	3 (3.068)	4 (4.026)	6 (6.065)
0.250	398.74	397.12	396.33	
0.375	903.58	893.49	890.45	
0.500	1634.90	1596.32	1585.20	1577.16
0.625	2619.36	2518.16	2487.01	2466.09
0.750	3893.57	3675.82	3605.17	3557.66
0.875	5516.47	5087.37	4951.24	4856.22
1.000	7578.52	6776.36	6539.12	6367.66
1.125	10217.38	8774.46	8382.82	8098.98
1.250	13644.38	11125.21	10499.69	10057.80
1.375	18191.80	13885.58	12912.57	12252.93
1.500		17131.69	15650.10	14694.14
1.625		20963.74	18747.28	17390.25
1.750		25514.81	22247.38	20352.52
1.875		30965.80	26204.90	23594.37
2.000		37556.09	30685.63	27131.32
2.125		45641.67	35774.52	30981.03
2.250			41569.95	35165.43
2.375			48202.87	39706.15
2.500			55834.68	44633.64
2.625			64669.44	49975.30
2.750			74984.27	55770.73
2.875				62062.56
3.000				68896.48
3.125				76327.30
3.250				84418.97

*Based on Basic Orifice Coefficients using American Gas Asscciation Committee Report Number 2.

TABLE 11

METER FACTORS, M, FOR L-10 CHARTS

Differential Range of	Maximum Pressure Range of Meter in Pounds Absolute; for gas or air at varying pressure						
Meter, Inches	24.7	50	100	250	500	1000	1500
2½	0.0786						
10	0.1572	0.2236					
20	0.2223	0.3162	0.4472	0.7071	1.0000		
50	0.3514	0.5000	0.7071	1.1180	1.5810	2.2360	2.7390
100		0.7071	1.0000	1.5810	2.2360	3.1620	3.8730

$$M = 0.01 \ (R_h \times R_s)^{\frac{1}{2}}$$

R_h is maximum differential range, inches

R_s is maximum static range, pounds

TABLE 12

FLOWING TEMPERATURE FACTORS

$$\text{FACTOR} = \sqrt{\frac{520}{460^\circ + T}}$$

Temp. °F.	Factor	Temp. °F.	Factor	Temp. °F.	Factor	Temp. °F.	Factor
20	1.0408	65	0.9952	110	0.9551	155	0.9195
21	1.0398	66	0.9943	111	0.9543	156	0.9187
22	1.0387	67	0.9933	112	0.9534	157	0.9180
23	1.0376	68	0.9924	113	0.9526	158	0.9173
24	1.0365	69	0.9915	114	0.9518	159	0.9165
25	1.0355	70	0.9905	115	0.9510	160	0.9158
26	1.0344	71	0.9896	116	0.9501	161	0.9150
27	1.0333	72	0.9887	117	0.9493	162	0.9143
28	1.0323	73	0.9877	118	0.9485	163	0.9135
29	1.0312	74	0.9868	119	0.9477	164	0.9128
30	1.0302	75	0.9859	120	0.9469	165	0.9121
31	1.0291	76	0.9850	121	0.9460	166	0.9112
32	1.0281	77	0.9840	122	0.9452	167	0.9106
33	1.0270	78	0.9831	123	0.9444	168	0.9099
34	1.0260	79	0.9822	124	0.9436	169	0.9092
35	1.0249	80	0.9813	125	0.9428	170	0.9085
36	1.0239	81	0.9804	126	0.9420	171	0.9077
37	1.0229	82	0.9795	127	0.9412	172	0.9069
38	1.0219	83	0.9786	128	0.9404	173	0.9063
39	1.0208	84	0.9777	129	0.9396	174	0.9055
40	1.0198	85	0.9766	130	0.9388	175	0.9048
41	1.0188	86	0.9759	131	0.9380	176	0.9042
42	1.0178	87	0.9750	132	0.9372	177	0.9035
43	1.0168	88	0.9741	133	0.9364	178	0.9028
44	1.0157	89	0.9732	134	0.9356	179	0.9020
45	1.0.47	90	0.9723	135	0.9348	180	0.9014
46	1.0137	91	0.9715	136	0.9341	181	0.9007
47	1.0127	92	0.9706	137	0.9333	182	0.9000
48	1.0117	93	0.9697	138	0.9325	183	0.8992
49	1.0107	94	0.9688	139	0.9317	184	0.8985
50	1.0098	95	0.9680	140	0.9309	185	0.8979
51	1.0088	96	0.9671	141	0.9301	186	0.8972
52	1.0078	97	0.9662	142	0.9293	187	0.8965
53	1.0068	98	0.9653	143	0.9284	188	0.8958
54	1.0058	99	0.9645	144	0.9279	189	0.8951
55	1.0048	100	0.9636	145	0.9271	190	0.8944
56	1.0039	101	0.9627	146	0.9263	191	0.8937
57	1.0029	102	0.9618	147	0.9255	192	0.8931
58	1.0019	103	0.9610	148	0.9247	193	0.8923
59	1.0010	104	0.9602	149	0.9240	194	0.8916
60	1.0000	105	0.9592	150	0.9233	195	0.8910
61	0.9990	106	0.9585	151	0.9225	196	0.8903
62	0.9981	107	0.9576	152	0.9217	197	0.8896
63	0.9971	108	0.9568	153	0.9210	198	0.8889
64	0.9962	109	0.9559	154	0.9202	199	0.8882
						200	0.8876

TABLE 13

SPECIFIC GRAVITY FACTORS

$$\text{FACTOR} = \sqrt{\frac{0.60}{\text{Sp. Gr.}}}$$

SPECIFIC GRAVITY	FACTOR	SPECIFIC GRAVITY	FACTOR
0.500	1.0954	0.725	0.9097
0.505	1.0900	0.730	0.9066
0.510	1.0847	0.735	0.9035
0.515	1.0794	0.740	0.9005
0.520	1.0742	0.745	0.8974
0.525	1.0690	0.750	0.8944
0.530	1.0640	0.755	0.8914
0.535	1.0590	0.760	0.8885
0.540	1.0541	0.765	0.8856
0.545	1.0492	0.770	0.8827
0.550	1.0445	0.775	0.8793
0.555	1.0398	0.780	0.8771
0.560	1.0351	0.785	0.8743
0.565	1.0304	0.790	0.8715
0.570	1.0260	0.795	0.8687
0.575	1.0215	0.800	0.8660
0.580	1.0171	0.805	0.8635
0.585	1.0127	0.810	0.8607
0.590	1.0084	0.815	0.8580
0.595	1.0041	0.820	0.8554
0.600	1.0000	0.825	0.8528
0.605	0.9958	0.830	0.8502
0.610	0.9918	0.835	0.8476
0.615	0.9877	0.840	0.8452
0.620	0.9837	0.860	0.8353
0.625	0.9798	0.880	0.8257
0.630	0.9759	0.900	0.8165
0.635	0.9721	0.920	0.8076
0.640	0.9682	0.940	0.7989
0.645	0.9645	0.960	0.7906
0.650	0.9608	0.980	0.7825
0.655	0.9571	1.000	0.7746
0.660	0.9535	1.020	0.7669
0.665	0.9498	1.040	0.7595
0.670	0.9463	1.060	0.7523
0.675	0.9427	1.080	0.7453
0.680	0.9393	1.100	0.7385
0.685	0.9359	1.120	0.7319
0.690	0.9325	1.140	0.7255
0.695	0.9292	1.160	0.7192
0.700	0.9258	1.180	0.7131
0.705	0.9225	1.200	0.7071
0.710	0.9193	1.220	0.7013
0.715	0.9161	1.240	0.6956
0.720	0.9129	1.260	0.6901

TABLE 14

Specifications for A.P.I. Bolted Tanks (B) and Vertical Welded Tanks (W) Commonly Used in Michigan

CAPACITY (42-gal. bbls.)		DIMENSIONS		AVERAGE VOLUME*	
Nominal	Actual	Diameter	Height	Bbls/ft.	Bbls/in.
100 B	95.80	9'-2 3/4"	8'-1/2"	11.916	.993
100 W	100.96	9'-6"	8'	12.620	1.052
200 B	191.64	9'-2 3/4"	16'-1"	11.916	.993
200 W	201.43	12'	10'	20.148	1.679
210 W	209.83	10'	15'	13.992	1.166
250 B	266.28	15'-4 5/8"	8'-1/2"	33.108	2.759
300 W	302.15	12'	15'	20.148	1.679
500 B	532.56	15'-4 5/8"	16'-1"	33.108	2.759

*This value to be used in oil production calculations only when actual tank strappings are not readily available.

TABLE 15

COMBINATION SPECIFIC GRAVITY-TEMPERATURE MULTIPLIERS

These values are used as multipliers when the coefficient is based on specific gravity, 0.60; and flowing temperature, 60 degrees F.

Sp. Gravity	0°F.	10°F.	20°F.	30°F.	40°F.	50°F.	60°F.	70°F.	80°F.	90°F.	100°F.	110°F.	Sp. Gravity
.50	1.1640	1.1522	1.1402	1.1285	1.1171	1.1061	1.0954	1.0851	1.0750	1.0652	1.0556	1.0463	.50
.51	1.1526	1.1409	1.1289	1.1174	1.1061	1.0952	1.0847	1.0744	1.0644	1.0547	1.0452	1.0360	.51
.52	1.1414	1.1299	1.1180	1.1066	1.0954	1.0847	1.0742	1.0640	1.0541	1.0445	1.0351	1.0260	.52
.53	1.1306	1.1192	1.1074	1.0961	1.0851	1.0744	1.0640	1.0539	1.0441	1.0346	1.0253	1.0163	.53
.54	1.1201	1.1087	1.0971	1.0859	1.0750	1.0644	1.0541	1.0441	1.0344	1.0249	1.0157	1.0068	.54
.55	1.1099	1.0986	1.0871	1.0760	1.0652	1.0547	1.0445	1.0346	1.0249	1.0156	1.0065	0.9976	.55
.56	1.0999	1.0888	1.0774	1.0663	1.0556	1.0452	1.0351	1.0253	1.0157	1.0065	0.9974	0.9887	.56
.57	1.0902	1.0792	1.0679	1.0569	1.0463	1.0360	1.0260	1.0163	1.0068	0.9976	0.9887	0.9799	.57
.58	1.0808	1.0698	1.0586	1.0478	1.0372	1.0270	1.0717	1.0075	0.9981	0.9890	0.9801	0.9715	.58
.59	1.0716	1.0607	1.0496	1.0389	1.0284	1.0183	1.0084	0.9989	0.9896	0.9806	0.9718	0.9632	.59
.60	1.0626	1.0518	1.0408	1.0302	1.0198	1.0098	1.0000	0.9905	0.9813	0.9723	0.9636	0.9551	.60
.61	1.0539	1.0432	1.0323	1.0217	1.0114	1.0014	0.9918	0.9824	0.9732	0.9643	0.9557	0.9473	.61
.62	1.0453	1.0347	1.0239	1.0134	1.0032	0.9933	0.9837	0.9744	0.9653	0.9565	0.9480	0.9396	.62
.63	1.0370	1.0265	1.0157	1.0053	0.9952	0.9854	0.9759	0.9667	0.9577	0.9489	0.9404	0.9321	.63
.64	1.0289	1.0184	1.0078	0.9974	0.9874	0.9777	0.9682	0.9591	0.9501	0.9415	0.9330	0.9248	.64
.65	1.0209	1.0106	1.0106	0.9897	0.9798	0.9701	0.9608	0.9517	0.9428	0.9342	0.9258	0.9177	.65
.66	1.0132	1.0029	0.9924	0.9822	0.9723	0.9628	0.9535	0.9444	0.9356	0.9271	0.9188	0.9107	.66
.67	1.0056	0.9954	0.9850	0.9749	0.9651	0.9556	0.9463	0.9374	0.9286	0.9202	0.9119	0.9039	.67
.68	0.9982	0.9880	0.9777	0.9677	0.9579	0.9485	0.9393	0.9304	0.9218	0.9134	0.9052	0.8972	.68
.69	0.9909	0.9809	0.9706	0.9606	0.9510	0.9416	0.9325	0.9237	0.9151	0.9067	0.8986	0.8907	.69
.70	0.9838	0.9738	0.9636	0.9537	0.9442	0.9349	0.9258	0.9170	0.9085	0.9002	0.8921	0.8843	.70
.71	0.9768	0.9669	0.9568	0.9470	0.9375	0.9282	0.9193	0.9106	0.9021	0.8939	0.8858	0.8780	.71
.72	0.9700	0.9602	0.9501	0.9404	0.9309	0.9218	0.9129	0.9042	0.8958	0.8876	0.8797	0.8719	.72
.73	0.9634	0.9536	0.9436	0.9339	0.9246	0.9154	0.9066	0.8980	0.8897	0.8815	0.8736	0.8659	.73
.74	0.9568	0.9471	0.9372	0.9276	0.9183	0.9092	0.9005	0.8919	0.8836	0.8755	0.8677	0.8601	.74
.75	0.9504	0.9408	0.9309	0.9214	0.9121	0.9032	0.8944	0.8859	0.8770	0.8697	0.8619	0.8543	.75
.76	0.9442	0.9346	0.9248	0.9153	0.9061	0.8972	0.8885	0.8801	0.8718	0.8640	0.8562	0.8487	.76
.77	0.9380	0.9285	0.9188	0.9094	0.9002	0.8913	0.8827	0.8744	0.8662	0.8583	0.8506	0.8431	.77
.78	0.9320	0.9225	0.9129	0.9035	0.8944	0.8856	0.8771	0.8687	0.8607	0.8528	0.8452	0.8377	.78
.79	0.9261	0.9167	0.9071	0.8978	0.8887	0.8800	0.8715	0.8632	0.8552	0.8474	0.8398	0.8324	.79
.80	0.9203	0.9109	0.9014	0.8921	0.8832	0.8745	0.8660	0.8578	0.8498	0.8421	0.8345	0.8272	.80
.81	0.9146	0.9053	0.8958	0.8866	0.8777	0.8691	0.8607	0.8525	0.8446	0.8369	0.8294	0.8220	.81
.82	0.9090	0.8997	0.8903	0.8812	0.8723	0.8637	0.8554	0.8473	0.8394	0.8317	0.8243	0.8170	.82
.83	0.9035	0.8943	0.8849	0.8759	0.8671	0.8585	0.8502	0.8422	0.8343	0.8267	0.8193	0.8121	.83
.84	0.8981	0.8890	0.8797	0.8706	0.8620	0.8534	0.8452	0.8371	0.8294	0.8218	0.8144	0.8072	.84
.85	0.8928	0.8837	0.8745	0.8655	0.8569	0.8484	0.8402	0.8322	0.8245	0.8169	0.8096	0.8025	.85
.86	0.8876	0.8786	0.8694	0.8605	0.8518	0.8434	0.8353	0.8274	0.8197	0.8122	0.8049	0.7978	.86
.87	0.8825	0.8735	0.8644	0.8555	0.8469	0.8386	0.8305	0.8226	0.8149	0.8075	0.8002	0.7932	.87
.88	0.8774	0.8685	0.8594	0.8506	0.8421	0.8338	0.8257	0.8179	0.8103	0.8029	0.7957	0.7887	.88
.89	0.8725	0.8636	0.8546	0.8458	0.8373	0.8291	0.8211	0.8133	0.8057	0.7984	0.7912	0.7842	.89
.90	0.8676	0.8588	0.8498	0.8411	0.8327	0.8245	0.8165	0.8088	0.8012	0.7939	0.7868	0.7799	.90
.91	0.8629	0.8541	0.8452	0.8365	0.8281	0.8199	0.8120	0.8043	0.7968	0.7895	0.7825	0.7756	.91
.92	0.8581	0.8494	0.8405	0.8319	0.8236	0.8155	0.8076	0.7999	0.7925	0.7852	0.7782	0.7713	.92
.93	0.8535	0.8449	0.8360	0.8274	0.8191	0.8111	0.8032	0.7956	0.7882	0.7810	0.7740	0.7672	.93
.94	0.8490	0.8404	0.8316	0.8230	0.8148	0.8067	0.7989	0.7914	0.7840	0.7768	0.7699	0.7631	.94
.95	0.8445	0.8359	0.8272	0.8187	0.8105	0.8025	0.7947	0.7872	0.7799	0.7727	0.7658	0.7591	.95
.96	0.8401	0.8316	0.8229	0.8144	0.8062	0.7983	0.7906	0.7831	0.7758	0.7687	0.7618	0.7551	.96
.97	0.8357	0.8273	0.8186	0.8102	0.8021	0.7942	0.7865	0.7790	0.7718	0.7647	0.7579	0.7512	.97
.98	0.8315	0.8230	0.8144	0.8061	0.7980	0.7901	0.7825	0.7750	0.7678	0.7608	0.7540	0.7474	.98
.99	0.8273	0.8189	0.8103	0.8020	0.7939	0.7861	0.7785	0.7711	0.7639	0.7570	0.7502	0.7436	.99
1.00	0.8231	0.8148	0.8062	0.7980	0.7899	0.7822	0.7746	0.7673	0.7601	0.7532	0.7464	0.7398	1.00
1.01	0.8190	0.8107	0.8022	0.7940	0.7860	0.7783	0.7708	0.7634	0.7563	0.7494	0.7427	0.7362	1.01
1.02	0.8150	0.8067	0.7983	0.7901	0.7822	0.7744	0.7670	0.7597	0.7526	0.7458	0.7391	0.7326	1.02
1.03	0.8110	0.8028	0.7944	0.7862	0.7783	0.7707	0.7632	0.7560	0.7490	0.7421	0.7355	0.7290	1.03
1.04	0.8071	0.7989	0.7906	0.7825	0.7746	0.7670	0.7596	0.7524	0.7454	0.7386	0.7319	0.7255	1.04

TABLE 16

Gauge Table for 10 Ft. Diameter Wood Tanks
Readings are to the nearest barrel.

In. / Ft.	0	1	2	3	4	5	6	7	8	9	10	11
0	0	1	2	4	5	6	7	9	10	11	12	13
1	15	16	17	18	20	21	22	23	24	26	27	28
2	29	31	32	33	34	35	37	38	39	40	41	43
3	44	45	46	48	49	50	51	52	54	55	56	57
4	59	60	61	62	63	65	66	67	68	69	71	72
5	73	74	76	77	78	79	81	82	83	84	85	87
6	88	89	90	92	93	94	95	96	98	99	100	101
7	102	104	105	106	107	109	110	111	112	113	115	116
8	117	118	120	121	122	123	124	126	127	128	129	131
9	132	133	134	135	137	138	139	140	142	143	144	145
10	146	148	149	150	151	153	154	155	156	157	159	160
11	161	162	163	165	166	167	168	170	171	172	173	174
12	176	177	178	179	181	182	183	184	185	187	188	189
13	190	192	193	194	195	196	198	199	200	201	203	204
14	205	206	207	209	210	211	212	214	215	216	217	218
15	220	221	222	223	224	226	227	228	229	231	232	233
16	234	235	237	238	239	240	242	243	244	245	246	248
17	249	250	251	253	254	255	256	257	259	260	261	262
18	264	265	266	267	268	270	271	272	273	275	276	277
19	278	280	281	282	283	284	285	287	288	289	290	292
20	293	294	295	296	298	299	300	301	303	304	305	306
21	307	309	310	311	312	314	315	316	317	318	320	321
22	322	323	325	326	327	328	329	331	332	333	334	335

Gauge Table for 16 Ft. Diameter Wood Tanks
Readings are to the nearest barrel.

In. / Ft.	0	1	2	3	4	5	6	7	8	9	10	11
0	0	3	6	9	12	15	18	21	24	27	30	33
1	36	39	42	45	48	51	54	57	60	63	66	69
2	72	75	78	81	84	87	89	92	95	98	101	104
3	107	110	113	116	119	122	125	128	131	134	137	140
4	143	146	149	152	155	158	161	164	167	170	173	176
5	179	182	185	188	191	194	197	200	203	206	209	212
6	215	218	221	224	227	230	233	236	239	242	245	248
7	251	254	257	260	263	266	269	272	275	278	281	284
8	286	289	292	295	298	301	304	307	310	313	316	319
9	322	325	328	331	334	337	340	343	346	349	352	355
10	358	361	364	367	370	373	376	379	382	385	388	391
11	394	397	400	403	406	409	412	415	418	421	424	427
12	430	433	436	439	442	445	448	451	454	457	460	463
13	466	469	472	475	478	481	484	487	490	493	496	499
14	502	505	507	510	513	516	519	522	525	528	531	534
15	537	540	543	546	549	552	555	558	561	564	567	569
16	573	576	579	582	585	588	591	594	597	600	603	606
17	609	612	615	618	621	624	627	630	633	636	639	642
18	645	648	651	654	657	660	663	666	669	672	675	677
19	680	683	686	689	692	695	698	701	704	707	710	713
20	716	719	722	725	728	731	734	737	740	743	746	749
21	752	755	758	761	764	767	770	773	776	779	782	785
22	788	791	794	797	800	803	806	809	812	815	818	821

Gauge Table for 20 Ft. Diameter Wood Tanks
Readings are to the nearest barrel

In. / Ft.	0	1	2	3	4	5	6	7	8	9	10	11
0	0	5	10	14	19	24	28	33	38	42	47	52
1	56	61	66	70	75	80	84	89	94	98	103	108
2	112	117	122	126	131	136	140	145	150	154	159	164
3	168	173	178	182	187	192	196	201	206	210	215	220
4	224	229	234	238	243	248	252	257	262	266	271	276
5	280	285	290	294	299	304	308	313	318	322	327	332
6	336	341	346	350	355	360	364	369	374	378	383	388
7	392	397	402	406	411	416	420	425	430	434	439	444
8	448	453	458	462	467	472	476	481	486	490	495	500
9	504	519	524	528	533	538	542	547	552	556	561	566
10	570	575	580	584	589	594	598	603	608	612	617	622
11	626	631	636	640	645	650	654	659	664	668	673	678
12	682	687	692	696	701	706	710	715	720	724	729	734
13	738	743	748	752	757	762	766	771	776	780	785	790
14	794	799	804	808	813	818	822	827	832	836	841	846

Gauge Table for 22 Ft. Diameter Wood Tanks
Readings are to the nearest barrel.

In. / Ft.	0	1	2	3	4	5	6	7	8	9	10	11
0	0	6	11	17	23	29	34	40	46	51	57	63
1	68	74	80	86	91	97	103	108	114	120	126	131
2	137	143	148	154	160	165	171	177	183	188	194	200
3	205	211	217	223	228	234	240	245	251	257	262	268
4	274	280	285	291	297	302	308	314	320	325	331	337
5	342	348	354	359	365	371	377	382	388	394	399	405
6	411	417	422	428	434	439	445	451	456	462	468	474
7	479	485	491	496	502	508	514	519	525	531	536	542
8	548	553	559	565	571	576	582	588	593	599	605	611
9	616	622	628	633	639	645	650	656	662	668	673	679
10	685	690	696	702	708	713	719	725	730	736	742	747
11	753	759	765	770	776	782	787	793	799	805	810	816
12	822	827	833	839	844	850	856	862	867	873	879	884
13	890	896	902	907	913	919	924	930	941	947	953	959
14	964	970	976	981	987	993	999	1004	1010	1016	1021	1027

TABLE 17

MISCELLANEOUS CONVERSION FACTORS

Acre	43,560 square feet
Acre foot	7,758 barrels
Atmosphere	33.94 feet of water
Atmosphere	29.92 inches of mercury
Atmosphere	760 millimeters of mercury
Atmosphere	14.70 pounds per square inch
Barrel	5.6146 cubic feet
Barrel	42.0 gallons
Barrel per hour	0.0936 cubic feet per minute
Barrel per hour	0.700 gallons per minute
Barrel per day	0.02917 gallon per minute
Cubic foot	0.1781 barrel
Cubic foot	7.4805 gallons
Cubic foot per minute	10.686 barrels per hour
Cubic foot per minute	7.481 gallons per minute
Cubic inch	16.387 cubic centimeters
Cubic yard	4.8089 barrels
Foot	30.48 centimeters
Foot-pound	0.001286 B. T. U.
Gallon	0.02381 barrel
Gallon	0.1337 cubic feet
Gallon	231.0 cubic inches
Gallon	3.785 liters
Gallon per minute	34.286 barrels per day
Horse-power	42.44 B. T. U. per minute
Horse-power	33,000 foot-pounds per minute
Horse-power	550 foot-pounds per second
Horse-power	0.7457 kilowatt
Horse-power hour	2547 B. T. U.
Inch	2.54 centimeters
Inch of Mercury	1.134 feet of water
Inch of Mercury	0.4912 pound per square inch

Table 17 continued

Miscellaneous Conversion Factors (continued)

Kilogram	2.2046 pounds
Kilometer	3,281 feet
Kilometer	0.6214 mile
Kilowatt	1.341 horse-power
Liter	0.2642 gallon
Liter	1.0567 quarts
Meter	3.281 feet
Meter	39.37 inches
Mile	5,280 feet
Mile per hour	1.4667 feet per second
Ounce (Avoirdupois)	437.5 grains
Ounce (Avoirdupois)	28.3495 grams
Part per million	0.058 grain per gallon
Pound	453.6 grams
Pound per square inch	2.0353 inches of mercury
Quart (liquid)	0.946 liter
Rod	16.5 feet
Square Centimeter	0.1550 square inch
Square meter	10.76 square feet
Watt-hour	3.415 B. T. U.
Bbls/100' 2" tubing	0.387 bbls.
Bbls/100' 2½" tubing	0.579 bbls.
Bbls/100' 3" tubing	0.870 bbls. (2.992" ID)

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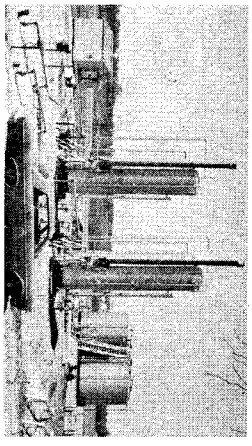
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