MEMORANDUM

To: Mike Stogner

From: H. L. Babe Kendrick

Date: October 12, 1987

This copy of "Exhibit A" has been printed for your use in printing the manual for testing of Gas Wells in the San Juan Basin area of New Mexico. This is my understanding of what you, Jerry and I talked about in Santa Fe last week.

This copy was made from the same data that I had in the machine that was used to print the "Exhibit A" for the Order, with the only change being that necessary to cause the right and left margins to line up along a common edge. I also changed the top label of this print-out from "Exhibit A" to "RULES OF PROCEDURE FOR NORTHWEST NEW MEXICO". With these two changes, the remaining text should be identical to what is included in the order as "Exhibit A".

If you have any problems with this, please let me know so that I can make the necessary adjustments, and do it correctly.

Sincerely,

H. L. Babe Kendrick

RULES OF PROCEDURE FOR NORTHWEST NEW MEXICO

CHAPTER I TYPE OF TESTS REQUIRED FOR WELLS COMPLETED IN PRORATED GAS POOLS

SECTION 1: Initial Deliverability and Shut-In Pressure Tests for Newly Completed Well

A. Immediately upon completion of each gas well in northwest New Mexico, a shut-in pressure test of at least seven days duration shall be made. This initial shut-in pressure shall be filed with the Division's Aztec Office on either Form C-122 or C-104.

B. Within 90 days after a well first delivers gas to a gas transportation facility, the well shall have been tested in accordance with Section 1 of Chapter II of these rules, "Initial Deliverability and Shut-In Pressure Test Procedures", and the results of the test filed in triplicate with the Division's Aztec office and one copy filed with the gas transportation facility to which the well is connected. This test is to be filed on Form C-122-A. Failure to file said test within the above-prescribed 90-day period will subject the well to the loss of one day's allowable for each day the test is late.

1. If the newly first delivered well is an infill well on a proration unit, the old well on the unit is not required to be tested provided it has a valid test on file for the current proration year. Testing of the old well follows the regularly assigned test year for the pool in which the wells are located. The new well is required to be tested annually until at least three annual tests are on file and then the well is to be tested biennially with other wells in that pool.

2. If the newly first delivered well is an infill well on a proration unit and the old well on the unit is "exempt", the old well is to be tested along with the new well for the Initial and Annual Deliverability and Shut-In Pressure Test. The old well will lose its "exempt" classification and must be tested biennially along with other wells in that pool. The new infill well is required to be tested annually until at least three annual tests are on file and then the well is to be tested biennially with other wells in that pool.

C. The requirements for Initial Tests and Annual or Biennial Deliverability and Shut-In Pressure Tests and the notification requirements and scheduling of such tests which apply to newly completed wells shall also apply to recompleted wells.

D. Any tests taken for informational purposes prior to pipeline connection shall not be recognized as official tests for the assignment of allowables.

SECTION 2. Annual and Biennial Deliverability and Shut-In Pressure Tests

A. Annual or Biennial Deliverability and Shut-In Pressure Tests shall be made on all gas wells during the period from January 1 through December 31 of that year except as follows:

1. A newly completed well or a recompleted well shall be tested on an annual basis until a minimum of three annual tests have been taken, after which the well shall be tested biennially as is required for other wells in the pool in which the well is located.

2. Wells classified as "exempt" shall not be subject to the requirements of annual or biennial deliverability tests.

   Classification of wells into or out of the "exempt" status shall be done once each year immediately following the reporting of June production and shall be effective for the succeeding annual test period.

   Gas wells completed in the Pictured Cliffs or any shallower formation shall be classified "exempt" if at least three months of production history is available and the well failed to produce, and is incapable of producing, an average of 250 MCF or more per month during the months produced within the preceding 12-month period, and the well is classified as marginal in the August Gas Proration Schedule.

   Gas wells completed in any formation deeper than the Pictured Cliffs formation shall be classified "exempt" if at least three months of production history is available and the well failed to produce, and is incapable of producing, an average of 2000 MCF or more per month during the months produced within the preceding 12-month period, and the well is classified as marginal in the August Gas Proration Schedule.

Gas wells on multiple well Gas Proration Units will not be classified "exempt" unless the Gas Proration Unit is classified as marginal. Any or all wells on a marginal multiple well Gas Proration Unit may be classified as "exempt" provided each Gas Proration Unit so classified meets the qualification for "exempt" status. Gas Proration Units for wells producing from formations deeper than the Pictured Cliffs formation shall be classified "exempt" if at least three months of production history is available and the Gas Proration Unit failed to produce, and is incapable of producing, an average of 2000 MCF or more per month during the months produced within the preceding 12-month period, and the Gas Proration Unit is classified as marginal in the August Gas Proration Schedule. Gas Proration Units are to be classified as "exempt" because of their low producing ability.

The District Supervisor of the Division's Aztec Office may classify a well or Gas Proration Unit as "exempt" at any time if the operator presents sufficient evidence to the District Supervisor indicating that the well or Gas Proration Unit is incapable of producing gas at a higher rate than that rate required for "exempt" classification for wells or Gas Proration Units in that pool.

Once a well or Gas Proration Unit has been declared "exempt" for the following test year, it shall remain classified "exempt" for that test year.

3. If a test is filed on any well on a gas proration unit, the test requirement for the gas proration unit has been met. The deliverability of the unit is taken only as the resulting sum of all wells tested.

4. A shut-in pressure must be filed on Form C-122-A even if no gas is measured during the production phase of the test. The filing of shut-in pressures for "exempt" wells is not required.

B. All Annual and Biennial Deliverability and Shut-In Pressure Tests required by these rules must be filed with the Division's Aztec office and with the appropriate gas transportation facility within 90 days following the completion of each test. Provided however, that any test completed between October 31 of the test year and January 31 of the following year are due no later than January 31. No extension of time for filing tests beyond January 31 will be granted except after notice and hearing.

Failure to file any test within the above-prescribed times will subject the well to the loss of one day's allowable for each day the test is late. A well classified as marginal shall be shut-in one day for each day the test is late.

SECTION 3: Scheduling of Tests

A. Notification of Pools to be Tested

By September 1 of each year, the District Supervisor of the Aztec District Office of the Division shall by memorandum notify each gas transportation facility and each operator of the pools which are to be scheduled for biennial testing during the following testing period from January 1 through the last day of December of that test year. The District Supervisor will also provide a list of "exempt" wells and a list of wells that do not have a minimum of three Annual Deliverability and Shut-In Pressure Tests on file.

Any well scheduled for testing during its test year may have the conditioning period, test flow period, and some of the seven day shut-in period conducted in December of the previous year provided that if the 7 day shut-in period immediately follows the test flow period the 7 day shut-in pressure would be measured in January of the test year. The earliest date that a well could be scheduled for Annual or Biennial Deliverability and Shut-In Pressure Test would be such that the Test Flow Period would end on December 25 of the previous year.

Downhole commingled wells are to be scheduled for tests on dates for pool of the lowermost prorated completion of the well.

B. Annual and Biennial Deliverability Tests

By November 1 of each year, each gas transportation facility shall, in cooperation with the operators involved, prepare and submit a schedule of the wells to which it is connected which are to begin testing in December and January. Said schedule shall be entitled, "Annual and Biennial Deliverability and Shut-In Pressure Test Schedule", and one copy shall be submitted to the Division's Aztec office and to each operator concerned. The schedule shall indicate the date of tests, pool, operator, lease, well number, and location of each well.

At least 30 days prior to the beginning of each succeeding 2-month testing interval, a similar schedule shall be prepared and filed in accordance with the above.

The gas transportation facility and the Aztec District Office of the Division shall be notified immediately by any operator unable to conduct any test as scheduled.

In the event a well is not tested in accordance with the existing test schedule, the well shall be re-scheduled by the gas transportation facility, and the Division and the operator of the well so notified in writing. Every effort should be made to notify the Division of the new schedule prior to the conclusion of the newly assigned 14-day conditioning period.

Notice to the Division of Shut-In Pressure Tests which are scheduled at a time other than immediately following the flow test must be received prior to the time that the well is shut-in.

It shall be the responsibility of each operator to determine that all of its wells are properly scheduled for testing by the gas transportation facility to which they are connected, in order that all annual and biennial tests may be completed during the testing season.

In the event a well is shut-in by the state for over production, the operator may produce the well for a period of time to secure a test after notification to the Division. All gas produced during this testing period will be used in determining the over/under produced status of the well.

C. Deliverability Re-Tests

An operator may, in cooperation with the gas transportation facility, schedule a well for a deliverability re-test upon notification to the Division's Aztec office at least ten days before the test is to be commenced. Such re-test shall be for good and substantial reason and shall be subject to the approval of the Division. Re-tests shall in all ways be conducted in conformance with the Annual and Biennial Deliverability Test Procedures of these rules. The Division, at its discretion, may require the re-testing of any well by notification to the operator to schedule such re-test. These tests as filed on Form C-122-A should be identified as "RETEST" in the remarks column.

SECTION 4: Witnessing of Tests

Any Initial Annual or Biennial Deliverability and Shut-In Pressure Test may be witnessed by any or all of the following: an agent of the Division, an offset operator, a representative of the gas transportation facility connected to the well under test, or a representative of the gas transportation facility taking gas from an offset operator.

CHAPTER II PROCEDURE FOR TESTING

SECTION 1: Initial Deliverability and Shut-In Pressure Test Procedure

A. Within 90 days after a newly completed well is first delivered to a gas transportation facility, the operator shall complete a deliverability and shut-in pressure test of the well in conformance with the "Annual and Biennial Deliverability and Shut-In Pressure Test Procedures", prescribed in Section 2 of this chapter. Results of the test shall be filed as required by Section 1 of Chapter I of these rules.

B. In the event it is impractical to test a newly completed well in conformance with Paragraph A above, the operator may conduct the deliverability and shut-in pressure test in the following manner (provided, however, that any test so conducted will not be accepted as the first annual deliverability and shut-in pressure test as described in Paragraph A-1 of Section 2, Chapter I):

1. A 7-day or 8-day production chart may be used as the basis for determining the well's deliverability, providing the chart so used is preceded by at least 14 days continuous production. The well shall produce through either the casing or tubing, but not both, into a pipeline during these periods. The production valve and the choke settings shall not be changed during either the conditioning or flow period with the exception of the first ten (10) days of the conditioning period when maximum production would over-range the meter chart or location production equipment.

2. A shut-in pressure of at least seven days duration shall be taken. This shall be the shut-in test required in Paragraph A, Section 1 of Chapter I of these rules.

3. The average daily static meter pressure shall be determined in accordance with Section 2 of Chapter II of these rules. This pressure shall be used as P_t in calculating P_w for the Deliverability Calculation.

4. The daily average rate of flow shall be determined in accordance with Section 2 of Chapter II.

5. The static wellhead working pressure (P_w) shall be determined in accordance with Section 2 of Chapter II.

6. The deliverability of the well shall be determined by using the data determined in Paragraphs 1 through 5 above in the deliverability formula in accordance with Section 2 of Chapter II.

7. The data and calculations for Paragraphs 1 through 6 above shall be reported as required in Section 1 of Chapter I of these rules, upon the blue-colored Form C-122-A or on white Form C-122-A and identified as "INITIAL TEST ONLY" in remarks.

SECTION 2: Annual and Biennial Deliverability and Shut-In Pressure Test Procedure

This test shall begin by producing a well in the normal operating manner into the pipeline through either the casing or tubing, but not both, for a period of fourteen consecutive days. This shall be known as the conditioning period. The production valve and choke settings shall not be changed during either the conditioning or flow periods except during the first ten (10) days of the conditioning period when maximum production would over-range the meter chart or location production equipment. The first ten (10) days of said conditioning period shall not have more than forty eight (48) hours of cumulative interruptions of flow. The eleventh to fourteenth days, inclusive, of said conditioning period shall have no interruptions of flow whatsoever. Any interruption of flow that occurs as normal operation of the well as stop-cock flow, intermittent flow, or well blow down will not be counted as shut-in time in either the conditioning or flow period.

The daily flowing rate shall be determined from an average of seven or eight consecutive producing days, following a minimum conditioning period of 14 consecutive days of production. This shall be known as the flow period.

Instantaneous pressures shall be measured by deadweight gauge or other method approved by the Division during the 7-day or 8-day flow period at the casinghead, tubinghead, and orifice meter, and shall be recorded along with instantaneous meter-chart static pressure reading.

If a well is producing through a compressor that is located between the wellhead and the meter run, the meter run pressure and the wellhead casing pressure and the wellhead tubing pressure are to be reported on Form C-122-A. (Neither the suction pressure nor the discharge pressure of the compressor is considered wellhead pressure.) A note shall be entered in the remarks portion on Form C-122-A stating "This well produces through a compressor".

When it is necessary to restrict the flow of gas between the wellhead and orifice meter, the ratio of the downstream pressure, psia, to the upstream pressure, psia shall be determined. When this ratio is 0.57, or less, critical flow conditions shall be considered to exist across the restriction.

When more than one restriction between the wellhead and orifice meter causes the pressures to reflect critical flow between the wellhead and orifice meter, the pressures across each of these restrictions shall be measured to determine whether critical flow exists at any restriction. When critical flow does not exist at any restriction, the pressures taken to disprove critical flow shall be reported to the Division on Form C-122-A in item (n) of the form. When critical flow conditions exist, the instantaneous flowing pressures required hereinabove shall be measured during the last 48 hours of the 7-day or 8-day flow period.

When critical flow exists between the wellhead and orifice meter, the measured wellhead flowing pressure of the string through which the well flowed during test shall be used as P_t when calculating the static wellhead working pressure (P_w) using the method established below.

When critical flow does not exist at any restriction, P_t shall be the corrected average static pressure from the meter chart plus friction loss from the wellhead to the orifice meter.

The static wellhead working pressure (P_w) of any well under test shall be the calculated 7-day or 8-day average static tubing pressure if the well is flowing through the casing; it shall be the calculated 7-day or 8-day average static casing pressure if the well is flowing through the tubing. The static wellhead working pressure (P_w) shall be calculated by applying the tables and procedures set out in this manual.

To obtain the shut-in pressure of a well under test, the well shall be shut in some time during the current testing season for a period of seven to fourteen consecutive days, which have been preceded by a minimum of seven days of uninterrupted production. Such shut-in pressure shall be measured with a deadweight gauge or other method approved by the Division on the seventh to fourteenth day of shut-in of the well. The 7-day shut-in pressure shall be measured on both the tubing and the casing when communication exists between the two strings. The higher of such pressures shall be used as P_c in the deliverability calculation. When any such shut-in pressure is determined by the Division to be abnormally low or the well can not be shut-in due to "HARDSHIP" classification, the shut-in pressure to be used as P_c shall be determined by one of the following methods:

1. A Division-designated value.

2. An average shut-in pressure of all offset wells completed in the same zone. Offset wells include the four side and four corner wells, if available.

3. A calculated surface pressure based on a calculated bottom-hole pressure. Such calculation shall be made in accordance with the examples in this manual.

All Wellhead pressures as well as the flowing meter pressure tests which are to be taken during the 7-day or 8-day deliverability test period as required hereinabove shall be taken with a deadweight gauge or other method approved by the Division. The pressure readings and the date and time according to the chart shall be recorded and maintained in the operator's records with the test information.

Orifice meter charts shall be changed and so arranged as to reflect upon a single chart the flow data for the gas from each well for the full 7-day or 8-day deliverability test period; however, no tests shall be voided if satisfactory explanation is made as to the necessity for using test volumes through two chart periods. Corrections shall be made for pressure base, measured flowing temperature, specific gravity, and supercompressibility; provided however, if the specific gravity of the gas from any well under test is not available, an estimated specific gravity may be assumed therefor, based upon that of gas from near-by wells, the specific gravity of which has been actually determined by measurement.

The average flowing meter pressure for the 7-day or 8-day flow period and the corrected integrated volume shall be determined by the purchasing company that integrates the flow charts and furnished to the operator or testing agency.

The 7-day or 8-day flow period volume shall be calculated from the integrated readings as determined from the flow period orifice meter chart. The volume so calculated shall be divided by the number of testing days on the chart to determine the average daily rate of flow during said flow period. The flow period shall have a minimum of seven and a maximum of eight legibly recorded flowing days to be acceptable for test purposes. The volume used in this calculation shall be corrected to New Mexico Oil Conservation Division standard conditions of 15.025 psia pressure base, 60^{o}F. temperature base and 0.60 specific gravity base.

The daily volume of flow as determined from the flow period chart readings shall be calculated by applying the Basic Orifice Meter Formula or other acceptable industry standard practices.

$$Q = C' (h_w P_f)^{.5}$$

Where:

Q = Metered volume of flow Mcf/d @ 15.025 psia, 60^{0} F., and 0.60 specific gravity.

C' = The 24-hour basic orifice meter flow factor corrected for flowing temperature, gravity, and supercompressibility.

h_w = Daily average differential meter pressure from flow period chart.

P_f = Daily average flowing meter pressure from flow period chart.

The basic orifice meter flow factors, flowing temperature factor, and specific gravity factor shall be determined from the tables in this manual.

The daily flow period average corrected flowing meter pressure, psig, shall be used to determine the supercompressibility factor. Supercompressibility Tables may be obtained from the New Mexico Oil Conservation Division.

When supercompressibility correction is made for a gas containing either nitrogen or carbon dioxide in excess of two percent, the supercompressibility factors of such gas shall be determined by the use of Table V of the C.N.G.A. Bulletin TS-402 for pressures 100-500 psig, or Table II, TS-461 for pressures in excess of 500 psig.

The use of tables for calculating rates of flow from integrator readings which do not specifically conform to the New Mexico Oil Conservation Division "Back Pressure Test Manual", or this manual, may be approved for determining the daily flow period rates of flow upon a showing that such tables are appropriate and necessary.

The daily average integrated rate of flow for the 7-day or 8-day flow period shall be corrected for meter error by multiplication by a correction factor. Said correction factor shall be determined by dividing the square root of the deadweight flowing meter pressure, psia, by the square root of the chart flowing meter pressure, psia.

Deliverability pressure, as used herein, is a defined pressure applied to each well and used in the process of comparing the abilities of wells in a pool to produce at static wellhead working pressures equal to a percentage of the 7-day shut-in pressure of the respective individual wells. Such percentage shall be determined and announced periodically by the Division based on the relationship of the average static wellhead working pressures (P_w) divided by the average 7-day shut-in pressure (P_c) of the pool.

The deliverability of gas at the "deliverability pressure" of any well under test shall be calculated from the test data derived from the tests hereinabove required by use of the following deliverability formula:

$$D = Q\left[\frac{(P_c^2 - P_d^2)}{(P_c^2 - P_w^2)}\right]^n$$

Where:

D = Deliverability Mcf/d at the delivcrability pressure, (P_d), (at Standard Conditions of 15.025 psia, 60°F and 0.60 sp. gr.).

Q = Daily flow rate in Mcf/d, at wellhead pressure (P_w).

P_c = 7-day shut-in Wellhead pressure, psia, determined in accordance with Section 2 of Chapter II.

P_d = Deliverability pressure, psia, as defined above.

P_w = Average static wellhead working pressure, as determined from 7-day or 8-day flow period, psia, and calculated from tables in this manual entitled "Pressure Loss Due to Friction" Tables for northwest New Mexico.

n = Average pool slope of back pressure curves as follows:

For Pictured Cliffs and shallower formations 0.85

For formations deeper than Pictured Cliffs 0.75

(Note: Special rules for any specific pool or formation may supersede the above values. Check special rules if in doubt.)

The value of the multiplier in the above formula (ratio factor after the application of the pool slope) by which Q is multiplied shall not exceed a limiting value to be determined and announced periodically by the Division. Such determination shall be made after a study of the test data of the pool obtained during the previous testing season.

Downhole commingled wells are to be tested in year for pool of lowermost prorated completion of well and shall use pool slope (n), and deliverability pressure of lowermost pool. The total flow rate from the downhole commingled well will be used to calculate a value of deliverability. For each prorated gas zone of a downhole commingled well, a Form C-122-A is required to be filed and in the Summary portion of that form, all zones will indicate the same data for line h, P_c, Q, P_w, and P_d. The value shown for Deliverability (D) will be that percentage of the total deliverability of the well that is applicable to this zone. A note shall be placed in the remarks column that indicates the percentage of deliverability to be allocated to this zone of the well.

Any test prescribed herein will be considered acceptable if the average flow rate for the final 7-day or 8-day deliverability test is not more than ten percent in excess of any consecutive 7-day or 8-day average of the preceding two weeks. A deliverability test not meeting this requirement may be declared invalid, requiring the well to be re-tested.

All charts relative to initial, annual, or biennial deliverability tests or copies thereof shall be made available to the Division upon its request.

All testing agencies, whether individuals, companies, pipeline companies, or operators, shall maintain a log of all tests accomplished by them, including all field test data. The operator shall maintain the above data for a period of not less than two (2) years plus the current test year.

All forms heretofore mentioned are hereby adopted for use in the northwest New Mexico Area in open form subject to such modification as experience may indicate desirable or necessary.

Initial and Annual or Biennial Deliverability and Shut-In Pressure Tests for gas wells in all formations shall be conducted and reported in accordance with these rules and procedures. Provided however, these rules shall be subject to any specific modification or change contained in Special Pool Rules adopted for any pool after notice and hearing.

CHAPTER III INFORMATIONAL TESTS

A. A one-point back pressure test may be taken on newly completed wells before their connection or reconnection to a gas transportation facility. This test shall not be a required official test but may be taken for informational purposes at the option of the operator. When taken, this test must be taken and reported as prescribed below:

ONE-POINT BACK PRESSURE POTENTIAL TEST PROCEDURE

1. This test shall be accomplished after a minimum shut-in of seven days. The shut-in pressure shall be measured with a deadweight gauge or other method approved by the Division.

2. The flow rate shall be that rate in Mcf/d measured at the end of a three hour test flow period. The flow from the well shall be for three hours through a positive choke, which has a 3/4-inch orifice.

3. A 2-inch nipple which provides a mechanical means of accurately measuring the pressure and temperature of the flowing gas shall be installed immediately upstream from the positive choke.

4. The absolute open flow shall be calculated using the conventional back pressure formula as shown in this manual or the New Mexico Oil Conservation Division "Back Pressure Test Manual."

5. The observed data and flow calculations shall be reported in duplicate on Form C-122, "Multi-Point Back Pressure Test for Gas Wells."

6. Non-critical flow shall be considered to exist when the choke pressure is 13 psig or less. When this condition exists the flow rate shall be measured with a pitot tube and nipple as specified in this manual or in the Division's Manual of "Tables and Procedure for Pitot Tests." The pitot test nipple shall be installed immediately downstream from the 3/4-inch positive choke.

7. Any well completed with 2-inch nominal size tubing (1.995-inch ID) or larger shall be tested through the tubing.

B. Other tests for informational purposes may be conducted prior to obtaining a pipeline connection for a newly completed well upon receiving specific approval therefor from the Division's Aztec

office. Approval of these tests shall be based primarily upon the volume of gas to be vented.

CHAPTER IV TYPE OF TESTS REQUIRED FOR WELLS COMPLETED IN NON-PRORATED POOLS

SECTION 1: Initial Shut-In Pressure Tests for Newly Completed Wells

A. (Same as Chapter I, Section 1, A)

SECTION 2: Biennial Shut-In Pressure Tests

A. Non-prorated wells will be tested biennially as required by the District Office except as follows:

1. Wells which meet the "exempt" qualification as shown in Chapter I, Section 2, paragraph A-2 of these rules shall also be exempt from shut-in test requirements.

2. Wells classified as "hardship" wells during the test year shall also be exempt from shut-in test requirements.

B. All shut-in tests required by these rules must be filed with the Division's Aztec office by January 31 of the following year. Failure to file the test will subject the well to being shut-in one day for each day the test is late.

SECTION 3: Scheduling Tests

A. By September 1 of each year, the District Supervisor of the Aztec District Office of the Division shall by memorandum notify each gas transportation facility and each operator of the pools which are to be scheduled for biennial shut-in pressure testing during the following testing period from January 1 through the last day of December of that test year. The District Supervisor will also provide a list of "exempt" wells.

Any well scheduled for testing during its test year may have the test flow period, and some of the seven day shut-in period conducted in December of the previous year. The earliest date that a well could be scheduled for Biennial Shut-In Pressure Test would be such that the Test Flow Period would end on December 25 of the previous year.

Downhole commingled wells are to be scheduled for tests on dates for pool of lowermost completion of well.

SECTION 4: Test Procedure

A. To obtain the shut-in pressure of a well under test, the well shall be shut-in some time during the current testing season for a period of seven to fourteen consecutive days, which have been preceded by a minimum of seven days of uninterrupted production. Such shut-in pressure shall be measured by deadweight gauge or other method approved by the Division on the seventh to fourteenth day of shut-in of the well. The shut-in pressure shall be measured on both the tubing and the casing when communication exists between the two strings. The higher of such pressures shall be reported as the shut-in pressure of the well.

SECTION 5: Filing of Shut-In Pressure Data

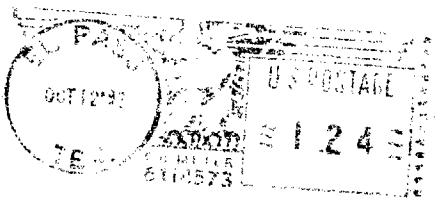
The result of this test shall be reported in the last column of Division Form C-125 showing the pressure in psia and shall be filed in triplicate with the Aztec District Office of the Division.

El Paso

P. O. BOX 1492
EL PASO, TEXAS 79978

FORWARDING AND ADDRESS CORRECTION REQUESTED

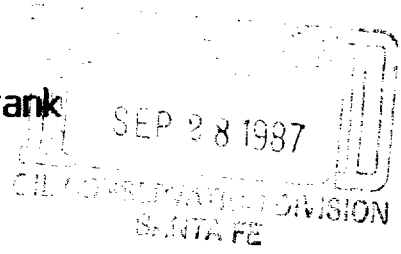
FIRST CLASS



First Class Mail

MICHAEL E. STOGNER
NMOCD
P.O. BOX 2088
SANTA FE, NM 87501

memorandum



To: Florene, Mike, Frank

From: Babe

Date: September 24, 1987

Enclosed is a copy of Order R--333--I printed on "minute" paper for Florene. Also enclosed is a copy of R—333—I printed on continuous form for Mike. These were all printed on the same printer so that each page should be exactly alike. The last time I printed this order, the printer left 2 lines out of the finished text. A copy on the continuous form is also being sent to Frank.

This has all of the corrections in it that I have discussed with Frank and Mike.

I was talking with Frank and we were trying to put a radical sign in the formula on page 11 and it looked good on the screen but when the printer put it on paper it looked like this " ¿ " .. Now, how do you like that?

This reminds me of the guy who was suffering with apathy and paranoia...— — he knew someone was out to get him, but, he just didn't care. (This person may be me.)

I was running all this through the printer and keyboard when all of a sudden ——— all went blank and now Frank will have some pages extra like 2 attempts to print page 14 before the real thing came along.

I also may not get the brackets put on the formula on page 13 like they should be. I sure need to get them on Florene's copy before it goes out. Will try.

Tell me if this copy is good or not.

See you later,

Babe

Exhibit A
Case No. 8586
Order No. R-333-I

RULES OF PROCEDURE FOR NORTHWEST NEW MEXICO

CHAPTER I TYPE OF TESTS REQUIRED FOR WELLS COMPLETED IN PRORATED GAS POOLS

SECTION 1: Initial Deliverability and Shut-In Pressure Tests for Newly Completed Well

A. Immediately upon completion of each gas well in northwest New Mexico, a shut-in pressure test of at least seven days duration shall be made. This initial shut-in pressure shall be filed with the Division's Aztec Office on either Form C-122 or C-104.

B. Within 90 days after a well first delivers gas to a gas transportation facility, the well shall have been tested in accordance with Section 1 of Chapter II of these rules, "Initial Deliverability and Shut-In Pressure Test Procedures", and the results of the test filed in triplicate with the Division's Aztec office and one copy filed with the gas transportation facility to which the well is connected. This test is to be filed on Form C-122-A. Failure to file said test within the above-prescribed 90-day period will subject the well to the loss of one day's allowable for each day the test is late.

1. If the newly first delivered well is an infill well on a proration unit, the old well on the unit is not required to be tested provided it has a valid test on file for the current proration year. Testing of the old well follows the regularly assigned test year for the pool in which the wells are located. The new well is required to be tested annually until at least three annual tests are on file and then the well is to be tested biennially with other wells in that pool.

2. If the newly first delivered well is an infill well on a proration unit and the old well on the

unit is "exempt", the old well is to be tested along with the new well for the Initial and Annual Deliverability and Shut-In Pressure Test. The old well will lose its "exempt" classification and must be tested biennially along with other wells in that pool. The new infill well is required to be tested annually until at least three annual tests are on file and then the well is to be tested biennially with other wells in that pool.

C. The requirements for Initial Tests and Annual or Biennial Deliverability and Shut-In Pressure Tests and the notification requirements and scheduling of such tests which apply to newly completed wells shall also apply to recompleted wells.

D. Any tests taken for informational purposes prior to pipeline connection shall not be recognized as official tests for the assignment of allowables.

SECTION 2. Annual and Biennial Deliverability and Shut-In Pressure Tests

A. Annual or Biennial Deliverability and Shut-In Pressure Tests shall be made on all gas wells during the period from January 1 through December 31 of that year except as follows:

1. A newly completed well or a recompleted well shall be tested on an annual basis until a minimum of three annual tests have been taken, after which the well shall be tested biennially as is required for other wells in the pool in which the well is located.

2. Wells classified as "exempt" shall not be subject to the requirements of annual or biennial deliverability tests.

   Classification of wells into or out of the "exempt" status shall be done once each year immediately following the reporting of June production and shall be effective for the succeeding annual test period.

Gas wells completed in the Pictured Cliffs or any shallower formation shall be classified "exempt" if at least three months of production history is available and the well failed to produce, and is incapable of producing, an average of 250 MCF or more per month during the months produced within the preceding 12-month period, and the well is classified as marginal in the August Gas Proration Schedule.

Gas wells completed in any formation deeper than the Pictured Cliffs formation shall be classified "exempt" if at least three months of production history is available and the well failed to produce, and is incapable of producing, an average of 2000 MCF or more per month during the months produced within the preceding 12-month period, and the well is classified as marginal in the August Gas Proration Schedule.

Gas wells on multiple well Gas Proration Units will not be classified "exempt" unless the Gas Proration Unit is classified as marginal. Any or all wells on a marginal multiple well Gas Proration Unit may be classified as "exempt" provided each Gas Proration Unit so classified meets the qualification for "exempt" status. Gas Proration Units for wells producing from formations deeper than the Pictured Cliffs formation shall be classified "exempt" if at least three months of production history is available and the Gas Proration Unit failed to produce, and is incapable of producing, an average of 2000 MCF or more per month during the months produced within the preceding 12-month period, and the Gas Proration Unit is classified as marginal in the August Gas Proration Schedule. Gas Proration Units are to be classified as "exempt" because of their low producing ability.

The District Supervisor of the Division's Aztec Office may classify a well or Gas Proration Unit as "exempt" at any time if the operator presents sufficient evidence to the District Supervisor indicating that the well or Gas Proration Unit is incapable of producing gas at a higher rate than that rate required for "exempt" classification for wells or Gas Proration Units in that pool.

Once a well or Gas Proration Unit has been declared "exempt" for the following test year, it shall remain classified "exempt" for that test year.

3. If a test is filed on any well on a gas proration unit, the test requirement for the gas proration unit has been met. The deliverability of the unit is taken only as the resulting sum of all wells tested.

4. A shut-in pressure must be filed on Form C-122-A even if no gas is measured during the production phase of the test. The filing of shut-in pressures for "exempt" wells is not required.

B. All Annual and Biennial Deliverability and Shut-In Pressure Tests required by these rules must be filed with the Division's Aztec office and with the appropriate gas transportation facility within 90 days following the completion of each test. Provided however, that any test completed between October 31 of the test year and January 31 of the following year are due no later than January 31. No extension of time for filing tests beyond January 31 will be granted except after notice and hearing.

Failure to file any test within the above-prescribed times will subject the well to the loss of one day's allowable for each day the test is late. A well classified as marginal shall be shut-in one day for each day the test is late.

SECTION 3: Scheduling of Tests

A. Notification of Pools to be Tested

By September 1 of each year, the District Supervisor of the Aztec District Office of the Division shall by memorandum notify each gas transportation facility and each operator of the pools which are to be scheduled for biennial testing during the following testing period from January 1 through the last day of December of that test year. The District Supervisor will also provide a list of "exempt" wells and a list of wells that do not

have a minimum of three Annual Deliverability and Shut-In Pressure Tests on file.

Any well scheduled for testing during its test year may have the conditioning period, test flow period, and some of the seven day shut-in period conducted in December of the previous year provided that if the 7 day shut-in period immediately follows the test flow period the 7 day shut-in pressure would be measured in January of the test year. The earliest date that a well could be scheduled for Annual or Biennial Deliverability and Shut-In Pressure Test would be such that the Test Flow Period would end on December 25 of the previous year.

Downhole commingled wells are to be scheduled for tests on dates for pool of the lowermost prorated completion of the well.

B. Annual and Biennial Deliverability Tests

By November 1 of each year, each gas transportation facility shall, in cooperation with the operators involved, prepare and submit a schedule of the wells to which it is connected which are to begin testing in December and January. Said schedule shall be entitled, "Annual and Biennial Deliverability and Shut-In Pressure Test Schedule", and one copy shall be submitted to the Division's Aztec office and to each operator concerned. The schedule shall indicate the date of tests, pool, operator, lease, well number, and location of each well.

At least 30 days prior to the beginning of each succeeding 2-month testing interval, a similar schedule shall be prepared and filed in accordance with the above.

The gas transportation facility and the Aztec District Office of the Division shall be notified immediately by any operator unable to conduct any test as scheduled.

In the event a well is not tested in accordance with the existing test schedule, the well shall be re-scheduled by the gas transportation facility, and the Division and the operator of the well so notified in writing. Every effort should be made to notify the Division of the new schedule prior to the conclusion of the newly assigned 14-day conditioning period.

Notice to the Division of Shut-In Pressure Tests which are scheduled at a time other than immediately following the flow test must be received prior to the time that the well is shut-in.

It shall be the responsibility of each operator to determine that all of its wells are properly scheduled for testing by the gas transportation facility to which they are connected, in order that all annual and biennial tests may be completed during the testing season.

In the event a well is shut-in by the state for over production, the operator may produce the well for a period of time to secure a test after notification to the Division. All gas produced during this testing period will be used in determining the over/under produced status of the well.

C. Deliverability Re-Tests

An operator may, in cooperation with the gas transportation facility, schedule a well for a deliverability re-test upon notification to the Division's Aztec office at least ten days before the test is to be commenced. Such re-test shall be for good and substantial reason and shall be subject to the approval of the Division. Re-tests shall in all ways be conducted in conformance with the Annual and Biennial Deliverability Test Procedures of these rules. The Division, at its discretion, may require the re-testing of any well by notification to the operator to schedule such re-test. These tests as filed on Form C-122-A should be identified as "RETEST" in the remarks column.

SECTION 4: Witnessing of Tests

Any Initial Annual or Biennial Deliverability and Shut-In Pressure Test may be witnessed by any or all of the following: an agent of the Division, an offset operator, a representative of the gas transportation facility connected to the well under test, or a representative of the gas transportation facility taking gas from an offset operator.

CHAPTER II PROCEDURE FOR TESTING

SECTION 1: Initial Deliverability and Shut-In Pressure Test Procedure

A. Within 90 days after a newly completed well is first delivered to a gas transportation facility, the operator shall complete a deliverability and shut-in pressure test of the well in conformance with the "Annual and Biennial Deliverability and Shut-In Pressure Test Procedures", prescribed in Section 2 of this chapter. Results of the test shall be filed as required by Section 1 of Chapter I of these rules.

B. In the event it is impractical to test a newly completed well in conformance with Paragraph A above, the operator may conduct the deliverability and shut-in pressure test in the following manner (provided, however, that any test so conducted will not be accepted as the first annual deliverability and shut-in pressure test as described in Paragraph A-1 of Section 2, Chapter I):

1. A 7-day or 8-day production chart may be used as the basis for determining the well's deliverability, providing the chart so used is preceded by at least 14 days continuous production. The well shall produce through either the casing or tubing, but not both, into a pipeline during these periods. The production valve and the choke settings shall not be changed during either the conditioning or flow period with the exception of the first ten (10) days of the conditioning period when maximum production would over-range the meter chart or location production equipment.

2. A shut-in pressure of at least seven days duration shall be taken. This shall be the shut-in test required in Paragraph A, Section 1 of Chapter I of these rules.

3. The average daily static meter pressure shall be determined in accordance with Section 2 of Chapter II of these rules. This pressure shall be used as P_t in calculating P_w for the Deliverability Calculation.

4. The daily average rate of flow shall be determined in accordance with Section 2 of Chapter II.

5. The static wellhead working pressure (P_w) shall be determined in accordance with Section 2 of Chapter II.

6. The deliverability of the well shall be determined by using the data determined in Paragraphs 1 through 5 above in the deliverability formula in accordance with Section 2 of Chapter II.

7. The data and calculations for Paragraphs 1 through 6 above shall be reported as required in Section 1 of Chapter I of these rules, upon the blue-colored Form C-122-A or on white Form C-122-A and identified as "INITIAL TEST ONLY" in remarks.

SECTION 2: Annual and Biennial Deliverability and Shut-In Pressure Test Procedure

This test shall begin by producing a well in the normal operating manner into the pipeline through either the casing or tubing, but not both, for a period of fourteen consecutive days. This shall be known as the conditioning period. The production valve and choke settings shall not be changed during either the conditioning or flow periods except during the first ten (10) days of the conditioning period when maximum production would over-range the meter chart or location production equipment. The first ten (10) days of said conditioning period shall not have more than forty eight (48) hours of cumulative interruptions of flow. The eleventh to fourteenth days, inclusive, of said conditioning period shall have no interruptions of flow whatsoever. Any interruption of flow that occurs as normal operation of the well as stop-cock flow, intermittent flow, or well blow down will not be counted as shut-in time in either the conditioning or flow period.

The daily flowing rate shall be determined from an average of seven or eight consecutive producing days,

following a minimum conditioning period of 14 consecutive days of production. This shall be known as the flow period.

Instantaneous pressures shall be measured by deadweight gauge or other method approved by the Division during the 7-day or 8-day flow period at the casinghead, tubinghead, and orifice meter, and shall be recorded along with instantaneous meter-chart static pressure reading.

If a well is producing through a compressor that is located between the wellhead and the meter run, the meter run pressure and the wellhead casing pressure and the wellhead tubing pressure are to be reported on Form C-122-A. (Neither the suction pressure nor the discharge pressure of the compressor is considered wellhead pressure.) A note shall be entered in the remarks portion on Form C-122-A stating "This well produces through a compressor".

When it is necessary to restrict the flow of gas between the wellhead and orifice meter, the ratio of the downstream pressure, psia, to the upstream pressure, psia shall be determined. When this ratio is 0.57, or less, critical flow conditions shall be considered to exist across the restriction.

When more than one restriction between the wellhead and orifice meter causes the pressures to reflect critical flow between the wellhead and orifice meter, the pressures across each of these restrictions shall be measured to determine whether critical flow exists at any restriction. When critical flow does not exist at any restriction, the pressures taken to disprove critical flow shall be reported to the Division on Form C-122-A in item (n) of the form. When critical flow conditions exist, the instantaneous flowing pressures required hereinabove shall be measured during the last 48 hours of the 7-day or 8-day flow period.

When critical flow exists between the wellhead and orifice meter, the measured wellhead flowing pressure of the string through which the well flowed during test shall be used as P_t when calculating the static wellhead working pressure (P_w) using the method established below.

When critical flow does not exist at any restriction, P_t shall be the corrected average static pressure from the meter chart plus friction loss from the wellhead to the orifice meter.

The static wellhead working pressure (P_w) of any well under test shall be the calculated 7-day or 8-day average static tubing pressure if the well is flowing through the casing; it shall be the calculated 7-day or 8-day average static casing pressure if the well is flowing through the tubing. The static wellhead working pressure (P_w) shall be calculated by applying the tables and procedures set out in this manual.

To obtain the shut-in pressure of a well under test, the well shall be shut in some time during the current testing season for a period of seven to fourteen consecutive days, which have been preceded by a minimum of seven days of uninterrupted production. Such shut-in pressure shall be measured with a deadweight gauge or other method approved by the Division on the seventh to fourteenth day of shut-in of the well. The 7-day shut-in pressure shall be measured on both the tubing and the casing when communication exists between the two strings. The higher of such pressures shall be used as P_c in the deliverability calculation. When any such shut-in pressure is determined by the Division to be abnormally low or the well can not be shut-in due to "HARDSHIP" classification, the shut-in pressure to be used as P_c shall be determined by one of the following methods:

1. A Division-designated value.

2. An average shut-in pressure of all offset wells completed in the same zone. Offset wells include the four side and four corner wells, if available.

3. A calculated surface pressure based on a calculated bottom-hole pressure. Such calculation shall be made in accordance with the examples in this manual.

All Wellhead pressures as well as the flowing meter pressure tests which are to be taken during the 7-day or 8-day deliverability test period as required hereinabove

shall be taken with a deadweight gauge or other method approved by the Division. The pressure readings and the date and time according to the chart shall be recorded and maintained in the operator's records with the test information.

Orifice meter charts shall be changed and so arranged as to reflect upon a single chart the flow data for the gas from each well for the full 7-day or 8-day deliverability test period; however, no tests shall be voided if satisfactory explanation is made as to the necessity for using test volumes through two chart periods. Corrections shall be made for pressure base, measured flowing temperature, specific gravity, and supercompressibility; provided however, if the specific gravity of the gas from any well under test is not available, an estimated specific gravity may be assumed therefor, based upon that of gas from near-by wells, the specific gravity of which has been actually determined by measurement.

The average flowing meter pressure for the 7-day or 8-day flow period and the corrected integrated volume shall be determined by the purchasing company that integrates the flow charts and furnished to the operator or testing agency.

The 7-day or 8-day flow period volume shall be calculated from the integrated readings as determined from the flow period orifice meter chart. The volume so calculated shall be divided by the number of testing days on the chart to determine the average daily rate of flow during said flow period. The flow period shall have a minimum of seven and a maximum of eight legibly recorded flowing days to be acceptable for test purposes. The volume used in this calculation shall be corrected to New Mexico Oil Conservation Division standard conditions of 15.025 psia pressure base, 60^{o}F. temperature base and 0.60 specific gravity base.

The daily volume of flow as determined from the flow period chart readings shall be calculated by applying the Basic Orifice Meter Formula or other acceptable industry standard practices.

$$Q = C' (h_w P_f)^{.5}$$

Where:

Q = Metered volume of flow Mcf/d @ 15.025 psia, 60° F., and 0.60 specific gravity.

C' = The 24-hour basic orifice meter flow factor corrected for flowing temperature, gravity, and supercompressibility.

h_w = Daily average differential meter pressure from flow period chart.

P_f = Daily average flowing meter pressure from flow period chart.

The basic orifice meter flow factors, flowing temperature factor, and specific gravity factor shall be determined from the tables in this manual.

The daily flow period average corrected flowing meter pressure, psig, shall be used to determine the supercompressibility factor. Supercompressibility Tables may be obtained from the New Mexico Oil Conservation Division.

When supercompressibility correction is made for a gas containing either nitrogen or carbon dioxide in excess of two percent, the supercompressibility factors of such gas shall be determined by the use of Table V of the C.N.G.A. Bulletin TS-402 for pressures 100-500 psig, or Table II, TS-461 for pressures in excess of 500 psig.

The use of tables for calculating rates of flow from integrator readings which do not specifically conform to the New Mexico Oil Conservation Division "Back Pressure Test Manual", or this manual, may be approved for determining the daily flow period rates of flow upon a showing that such tables are appropriate and necessary.

The daily average integrated rate of flow for the 7-day or 8-day flow period shall be corrected for meter error by multiplication by a correction factor. Said correction factor shall be determined by dividing the square root of the deadweight flowing meter pressure, psia, by the square root of the chart flowing meter pressure, psia.

Deliverability pressure, as used herein, is a defined pressure applied to each well and used in the process of comparing the abilities of wells in a pool to produce at static wellhead working pressures equal to a percentage of the 7-day shut-in pressure of the respective individual wells. Such percentage shall be determined and announced periodically by the Division based on the relationship of the average static wellhead working pressures (P_w) divided by the average 7-day shut-in pressure (P_c) of the pool.

The deliverability of gas at the "deliverability pressure" of any well under test shall be calculated from the test data derived from the tests hereinabove required by use of the following deliverability formula:

$$D = Q \left[\frac{(P_c^2 - P_d^2)}{(P_c^2 - P_w^2)} \right]^n$$

Where:

D = Deliverability Mcf/d at the deliverability pressure, (P_d), (at Standard Conditions of 15.025 psia, 60°F and 0.60 sp. gr.).

Q = Daily flow rate in Mcf/d, at wellhead pressure (P_w).

P_c = 7-day shut-in Wellhead pressure, psia, determined in accordance with Section 2 of Chapter II.

P_d = Deliverability pressure, psia, as defined above.

P_w = Average static wellhead working pressure, as determined from 7-day or 8-day flow period, psia, and calculated from tables in this manual entitled "Pressure Loss Due to Friction" Tables for northwest New Mexico.

n = Average pool slope of back pressure curves as follows:

For Pictured Cliffs and shallower formations
0.85

For formations deeper than Pictured Cliffs
0.75

(Note: Special rules for any specific pool or formation may supersede the above values. Check special rules if in doubt.)

The value of the multiplier in the above formula (ratio factor after the application of the pool slope) by which Q is multiplied shall not exceed a limiting value to be determined and announced periodically by the Division. Such determination shall be made after a study of the test data of the pool obtained during the previous testing season.

Downhole commingled wells are to be tested in year for pool of lowermost prorated completion of well and shall use pool slope (n), and deliverability pressure of lowermost pool. The total flow rate from the downhole commingled well will be used to calculate a value of deliverability. For each prorated gas zone of a downhole commingled well, a Form C-122-A is required to be filed and in the Summary portion of that form, all zones will indicate the same data for line h, P_c, Q, P_w, and P_d. The value shown for Deliverability (D) will be that percentage of the total deliverability of the well that is applicable to this zone. A note shall be placed in the remarks column that indicates the percentage of deliverability to be allocated to this zone of the well.

Any test prescribed herein will be considered acceptable if the average flow rate for the final 7-day or 8-day deliverability test is not more than ten percent in excess of any consecutive 7-day or 8-day average of the preceding two weeks. A deliverability test not meeting this requirement may be declared invalid, requiring the well to be re-tested.

All charts relative to initial, annual, or biennial deliverability tests or copies thereof shall be made available to the Division upon its request.

All testing agencies, whether individuals, companies, pipeline companies, or operators, shall maintain a log of all tests accomplished by them, including all field test data. The operator shall maintain the above data for a period of not less than two (2) years plus the current test year.

All forms heretofore mentioned are hereby adopted for use in the northwest New Mexico Area in open form subject to such modification as experience may indicate desirable or necessary.

Initial and Annual or Biennial Deliverability and Shut-In Pressure Tests for gas wells in all formations shall be conducted and reported in accordance with these rules and procedures. Provided however, these rules shall be subject to any specific modification or change contained in Special Pool Rules adopted for any pool after notice and hearing.

CHAPTER III INFORMATIONAL TESTS

A. A one-point back pressure test may be taken on newly completed wells before their connection or reconnection to a gas transportation facility. This test shall not be a required official test but may be taken for informational purposes at the option of the operator. When taken, this test must be taken and reported as prescribed below:

ONE-POINT BACK PRESSURE POTENTIAL TEST PROCEDURE

1. This test shall be accomplished after a minimum shut-in of seven days. The shut-in pressure shall be measured with a deadweight gauge or other method approved by the Division.

2. The flow rate shall be that rate in Mcf/d measured at the end of a three hour test flow period. The flow from the well shall be for three hours through a positive choke, which has a 3/4-inch orifice.

3. A 2-inch nipple which provides a mechanical means of accurately measuring the pressure and

temperature of the flowing gas shall be installed immediately upstream from the positive choke.

4. The absolute open flow shall be calculated using the conventional back pressure formula as shown in this manual or the New Mexico Oil Conservation Division "Back Pressure Test Manual."

5. The observed data and flow calculations shall be reported in duplicate on Form C-122, "Multi-Point Back Pressure Test for Gas Wells."

6. Non-critical flow shall be considered to exist when the choke pressure is 13 psig or less. When this condition exists the flow rate shall be measured with a pitot tube and nipple as specified in this manual or in the Division's Manual of "Tables and Procedure for Pitot Tests." The pitot test nipple shall be installed immediately downstream from the 3/4-inch positive choke.

7. Any well completed with 2-inch nominal size tubing (1.995-inch ID) or larger shall be tested through the tubing.

B. Other tests for informational purposes may be conducted prior to obtaining a pipeline connection for a newly completed well upon receiving specific approval therefor from the Division's Aztec office. Approval of these tests shall be based primarily upon the volume of gas to be vented.

CHAPTER IV TYPE OF TESTS REQUIRED FOR WELLS COMPLETED IN NON-PRORATED POOLS

SECTION 1: Initial Shut-In Pressure Tests for Newly Completed Wells

A. (Same as Chapter I, Section 1, A)

SECTION 2: Biennial Shut-In Pressure Tests

A. Non-prorated wells will be tested biennially as required by the District Office except as follows:

1. Wells which meet the "exempt" qualification as shown in Chapter I, Section 2, paragraph A-2 of these rules shall also be exempt from shut-in test requirements.

2. Wells classified as "hardship" wells during the test year shall also be exempt from shut-in test requirements.

B. All shut-in tests required by these rules must be filed with the Division's Aztec office by January 31 of the following year. Failure to file the test will subject the well to being shut-in one day for each day the test is late.

SECTION 3: Scheduling Tests

A. By September 1 of each year, the District Supervisor of the Aztec District Office of the Division shall by memorandum notify each gas transportation facility and each operator of the pools which are to be scheduled for biennial shut-in pressure testing during the following testing period from January 1 through the last day of December of that test year. The District Supervisor will also provide a list of "exempt" wells.

Any well scheduled for testing during its test year may have the test flow period, and some of the seven day shut-in period conducted in December of the previous year. The earliest date that a well could be scheduled for Biennial Shut-In Pressure Test would be such that the Test Flow Period would end on December 25 of the previous year.

Downhole commingled wells are to be scheduled for tests on dates for pool of lowermost completion of well.

SECTION 4: Test Procedure

A. To obtain the shut-in pressure of a well under test, the well shall be shut-in some time during the current

testing season for a period of seven to fourteen consecutive days, which have been preceded by a minimum of seven days of uninterrupted production. Such shut-in pressure shall be measured by deadweight gauge or other method approved by the Division on the seventh to fourteenth day of shut-in of the well. The shut-in pressure shall be measured on both the tubing and the casing when communication exists between the two strings. The higher of such pressures shall be reported as the shut-in pressure of the well.

SECTION 5: Filing of Shut-In Pressure Data

The result of this test shall be reported in the last column of Division Form C-125 showing the pressure in psia and shall be filed in triplicate with the Aztec District Office of the Division.

MEMORANDUM

To: NMOCD

From: H. L. Babe

Date: August 14, 1987

Here is my attempt at putting this "Exhibit A" on minute paper. This is my first attempt at such an endeavor. I hope this works.

I am enclosing 2 different prints of this exhibit. The first print that I ran was quite light from an old ribbon that was new when I put it on the machine. Today we searched the company and found some more ribbons and made another run of this paper and obtained some darker prints.

If for any reason this needs to be done over, or any part of it done over, let me know and I think it can be done easily without having to call the Governor's office.

Hopefully most of the words are spelled correctly. (I'm sure glad this was written many days ago because today the keys on the typewriter are in different places and some words look terrible this morning.)

I am sending the finished pages for Florene, the long page of report for Mike and I am also sending a like print of Mike's to Frank in Aztick.

I'll be waiting for your call for corrections.

Babe 

P. S. Frank, for our test book, I think this 18 pages looks great when done in "justify" (with smooth margins on the left and right sides). I think I can do that in short order also. Any problems?

STATE OF NEW MEXICO

ENERGY AND MINERALS DEPARTMENT

OIL CONSERVATION DIVISION

GARREY CARRUTHERS
GOVERNOR

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87501
(505) 827-5800

M E M O R A N D U M

TO: Frank Chaves, District Supervisor
Vic Lyon, Engineering Bureau Chief
✓William J. LeMay, Director
Jeff Taylor, General Counsel
H.L. (Babe) Kendrick, El Paso Natural Gas Co.

WJL - No changes recommended

FROM: Michael E. Stogner, Chief Hearing Officer

SUBJECT: Gas Well Testing Procedures for Northwest New Mexico.

DATE: August 11, 1987

Attached is a copy of the proposed order for Case No. 8586, heard on May 8, 1985 and December 1986. Please make any corrections and/or changes that you feel are necessary and return them to me so that an Order may then be issued. Once this Order is finalized the new testing manual will be ready for final review. Thank you for your assistance in this matter.

TO Mike

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

CASE NO: 8586

ORDER NO: R-333-I

IN THE MATTER OF THE HEARING CALLED BY THE OIL CONSERVATION DIVISION ON ITS OWN MOTION FOR RECISION OF DIVISION ORDER No. R-333, AS AMENDED, AND FOR RECODIFICATION AND REISSUANCE OF GAS WELL TESTING PROCEDURES FOR NORTHWEST NEW MEXICO. APPLICANT FURTHER SEEKS AN EXTENSION OF THE 1986 TESTING PERIOD AND SUSPENSION OF THE 1987 TESTING PERIOD. MCKINLEY, RIO ARRIBA, SANDOVAL, AND SAN JUAN COUNTIES, NEW MEXICO.

BY THE DIVISION:

This cause came on for hearing at 8:00 a.m. on May 8, 1985, and at 8:15 a.m. on December 3, 1986, in Santa Fe,

New Mexico, before Examiners Gilbert P. Quintana and Michael E. Stogner, respectively.

NOW, on this _____ day of July, 1987, the Division Director, having considered the testimony, the record, and the recommendations of the Examiners, and being fully advised in the premises,

FINDS THAT:

(1) Due public notice having been given as required by law, the Division has jurisdiction of this cause and the subject matter thereof.

(2) The applicant in the instant case seeks to rescind Division Order No. R-333, as amended, and to recodify and amend the Special Rules and Regulations for the testing of gas wells in Northwest New Mexico contained therein.

(3) Special rules and regulations for the testing f gas wells in McKinley, Rio Arriba, Sandoval, and San Juan Counties, New Mexico, (Northwest New Mexico) have been adopted and amended by the Division and are embodied in Division Order R-333, as amended.

(4) These existing rules and regulations relating to gas well testing procedures in Northwest New Mexico have been adopted over many years and are collected in numerous orders, therefore, making reference to them somewhat difficult.

(5) In addition some of the gas well testing procedures are out-dated and in need of revision.

(6) Because of the need to review these rules relating to gas well testing in Northwest New Mexico, the Division Director at that time appointed a committee to study the existing rules and to recommend changes.

(7) Harold L. Kendrick, Chairman of the Deliverability Test Committee, appeared on its behalf at the May 8, 1985 (at which time it was taken under advisement, however no order was issued) and December 3, 1987 examiner hearings and made the following recommendations regarding gas well testing procedures in Northwest New Mexico:

(a) recodifying the rules and issuing them as the "Gas Well Testing Manual for Northwest New Mexico";

(b) to require deliverability testing in prorated gas pools on a biennial (every two years) basis;

(c) to require biennial shut-in pressures in non-prorated gas pools with no deliverability testing;

(d) the deliverability test year should be the same as the calendar year.

(e) exemption from deliverability testing in the Blanco-Mesaverde Pool and Basin-Dakota Pool should be based upon the combined producibility of all wells on a gas proration unit;

(f) wells shut-in for over production should be permitted to be produced for deliverability test purposes after the operator notifies the Division District office;

(g) restriction on flow interruptions during the conditioning period should be eased slightly;

(h) the 7-day shut in pressure should be permitted to be measured at a time during the current testing season other than immediately following the test flow period;

(i) deliverability pressure (Pd) assigned as a percentage of the 7-day shut-in pressure should be adjusted in each pool to more nearly approximate the pool average operating conditions;

(j) The 7-day shut-in pressure for wells in non-prorated gas pools should be filed with the Division on proposed Form C-125-A; and

(j) All required tables should be included in the manual.

(8) All of the above proposals are embodied in Exhibit "A" attached hereto and made a part thereof.

(9) A manual for well testing as set out in said supplemental exhibit should be adopted.

(10) Division Order No. R-333 as amended should be rescinded, in its entirety, and a new order designated R-333-I should be promulgated.

(11) It is further sought in this Case to extend the deadline for completing and filing 1986 deliverability tests to March 31, 1987, and for a one year suspension of biennial deliverability testing whereby the deliverability test cycle will begin again in 1988 with those pools which would have been tested in 1987.

(12) No testimony was received in opposition to this request.

(13) Approval of this application is in the best interest of conservation and will not cause waste nor impair correlative rights.

IT IS THEREFORE ORDERED THAT:

(1) Effective _____, the Special Rules and Regulations governing gas well testing in Northwest New Mexico, which includes McKinley, Rio Arriba, Sandoval and San Juan Counties, New Mexico, as described in Exhibit "A" attached hereto and made a part hereof, superseding the rules and regulations contained in its

entirety in Division Order No. R-333, as amended, are hereby promulgated and adopted as an exception to Rules 401 and 402 of the general statewide rules and regulations of this Division relating to gas well testing procedures.

(2) The deadline for completing and filing 1986 deliverability tests is hereby extended to March 31, 1987.

(3) A one year suspension of biennial deliverability testing whereby the deliverablity test cycle will begin again in 1988 with those pools which would have been tested in 1987.

(4) Jurisdiction of this cause is retained for the entry of such further orders as the Division may deem necessary.

DONE, at Santa Fe, New Mexico, on the day and year hereinabove designated.

STATE OF NEW MEXICO

OIL CONSERVATION DIVISION

WILLIAM J. LEMAY

Director

S E A L

EXHIBIT "A"
CASE NO. 8586
ORDER NO. R-333-I

RULES OF PROCEDURE FOR NORTHWEST NEW MEXICO

CHAPTER I TYPE OF TESTS REQUIRED FOR WELLS COMPLETED IN PRORATED GAS POOLS

SECTION 1: Initial Deliverability and Shut-In Pressure Tests for Newly Completed Well

A. Immediately upon completion of each gas well in northwest New Mexico, a shut-in pressure test of at least seven days duration shall be made. This initial shut-in pressure shall be filed with the Division's Aztec Office on either Form C-122 or C-104.

B. Within 90 days ater a well first delivers gas to a gas transportation facility, the well shall have been tested in accordance with Section 1 of Chapter II of these rules, "Initial Deliverability and Shut-In Pressure Test Procedures", and the results of the test filed in triplicate with the Division's Aztec office and one copy filed with the gas transportation facility to which the well is connected. This test is to be filed on Form C-122-A. Failure to file said test within the above-prescribed 90-day period will subject the well to the loss of one day's allowable for each day the test is late.

1. If the newly first delivered well is an infill well on a proration unit, the old well on the unit is not required to be tested provided it has a valid test on file for the current proration year. Testing of the old well follows the regularly assigned test year for the pool in which the wells are located. The new well is required to be tested annually until at least three annual tests are on file and then the well is to be tested biennially with other wells in that pool.

2. If the newly first delivered well is an infill well on a proration unit and the old well on the unit is "exempt", the old well is to be tested along with the new well for the Initial and Annual Deliverability and Shut-In Pressure Test. The old well will lose its "exempt" classification and must be tested biennially along with other wells in that pool. The new infill well is required to be tested annually until at least three annual tests are on file and then the well is to be tested biennially with other wells in that pool.

C. The requirements for Initial Tests and Annual or Biennial Deliverability and Shut-In Pressure Tests and the notification requirements and scheduling of such tests which apply to newly completed wells shall also apply to recompleted wells.

D. Any tests taken for informational purposes prior to pipeline connection shall not be recognized as official tests for the assignment of allowables.

SECTION 2. Annual and Biennial Deliverability and Shut-In Pressure Tests

A. Annual or Biennial Deliverability and Shut-In Pressure Tests shall be made on all gas wells during the period from January 1 through December 31 of that year except as follows:

1. A newly completed well or a recompleted well shall be tested on an annual basis until a minimum of three annual tests have been taken, after which the well shall be tested biennially as is required for other wells in the pool in which the well is located.

2. Wells classified as "exempt" shall not be subject to the requirements of annual or biennial deliverability tests.

   Classification of wells into or out of the "exempt" status shall be done once each year immediately following the reporting of June production and shall be effective for the succeeding annual test period.

   Gas wells completed in the Pictured Cliffs or any shallower formation shall be classified "exempt" if at least three months of production history is available and the well failed to produce, and is incapable of producing, an average of 250 MCF or more per month during the months produced within the preceding 12-month period, and the well is classified as marginal in the August Gas Proration Schedule.

   Gas wells completed in any formation deeper than the Pictured Cliffs formation shall be classified "exempt" if at least three months of production history is available and the well failed to produce, and is incapable of producing, an average of 2000 MCF or more per month during the months produced within the preceding 12-month period, and the well is classified as marginal in the August Gas Proration Schedule.

Gas wells on multiple well Gas Proration Units will not be classified "exempt" unless the Gas Proration Unit is classified as marginal. Any or all wells on a marginal multiple well Gas Proration Unit may be classified as "exempt" provided each Gas Proration Unit so classified meets the qualification for "exempt" status. Gas Proration Units for wells producing from formations deeper than the Pictured Cliffs formation shall be classified "exempt" if at least three months of production history is available and the Gas Proration Unit failed to produce, and is incapable of producing, an average of 2000 MCF or more per month during the months produced within the preceding 12-month period, and the Gas Proration Unit is classified as marginal in the August Gas Proration Schedule. Gas Proration Units are to be classified as "exempt" because of their low producing ability.

The District Supervisor of the Division's Aztec Office may classify a well or Gas Proration Unit as "exempt" at any time if the operator presents sufficient evidence to the District Supervisor indicating that the well or Gas Proration Unit is incapable of producing gas at a higher rate than that rate required for "exempt" classification for wells or Gas Proration Units in that pool.

Once a well or Gas Proration Unit has been declared "exempt" for the following test year, it shall remain classified "exempt" for that test year.

3. If a test is filed on any well on a gas proration unit, the test requirement for the gas proration unit has been met. The deliverability of the unit is taken only as the resulting sum of all wells tested.

4. A shut-in pressure must be filed on Form C-122-A even if no gas is measured during the production phase of the test. "Exempt" wells do not require the filing of a shut-in pressure.

B. All Annual and Biennial Deliverability and Shut-In Pressure Tests required by these rules must be filed with the Division's Aztec office and with the appropriate gas transportation facility within 90 days following the completion of each test. Provided however, that any test completed between October 31 of the test year and January 31 of the following year are due no later than January 31. No extension of time for filing tests beyond January 31 will be granted except after notice and hearing.

Failure to file any test within the above-prescribed times will subject the well to the loss of one day's allowable for each day the test is late. A well classified as marginal shall be shut-in one day for each day the test is late.

SECTION 3: Scheduling of Tests

A. Notification of Pools to be Tested

By September 1 of each year, the District Supervisor of the Aztec District Office of the Division shall by memorandum notify each gas transportation facility and each operator of the pools which are to be scheduled for biennial testing during the following testing period from January 1 through the last day of December of that test year. The District Supervisor will also provide a list of "exempt" wells and a list of wells that do not have a minimum of three Annual Deliverability and Shut-In Pressure Tests on file.

Any well scheduled for testing during its test year may have the conditioning period, test flow period, and some of the seven day shut-in period conducted in December of the previous year provided that if the 7 day shut-in period immediately follows the test flow period the 7 day shut-in pressure would be measured in January of the test year. The earliest date that a well could be scheduled for Annual or Biennial Deliverability and Shut-In Pressure Test would be such that the Test Flow Period would end on December 25 of the previous year.

Downhole commingled wells are to be scheduled for tests on dates for pool of lowermost prorated completion of well.

B. Annual and Biennial Deliverability Tests

By November 1 of each year, each gas transportation facility shall, in cooperation with the operators involved, prepare and submit a schedule of the wells to which it is connected which are to begin testing in December and January. Said schedule shall be entitled, "Annual and Biennial Deliverability and Shut-In Pressure Test Schedule", and one copy shall be submitted to the Division's Aztec office and to each operator concerned. The schedule shall indicate the date of tests, pool, operator, lease, well number, and location of each well.

At least 30 days prior to the beginning of each succeeding 2-month testing interval, a similar schedule shall be prepared and filed in accordance with the above.

The gas transportation facility and the Aztec District Office of the Division shall be notified immediately by any operator unable to conduct any test as scheduled.

In the event a well is not tested in accordance with the existing test schedule, the well shall be re-scheduled by the gas transportation facility, and the Division and the operator of the well so notified in writing. Every effort should be made to notify the Division of the new schedule prior to the conclusion of the newly assigned 14-day conditioning period.

Notice to the Division of Shut-In Pressure Tests which are scheduled at a time other than immediately following the flow test must be received prior to the time that the well is shut-in.

It shall be the responsibility of each operator to determine that all of its wells are properly scheduled for testing by the gas transportation facility to which they are connected, in order that all annual and biennial tests may be completed during the testing season.

In the event a well is shut-in by the state for over production, the operator may produce the well for a period of time to secure a test after notification to the Division. All gas produced during this testing period will be used in determining the over/under produced status of the well.

C. Deliverability Re-Tests

An operator may, in cooperation with the gas transportation facility, schedule a well for a deliverability re-test upon notification to the Division's Aztec office at least ten days before the test is to be commenced. Such re-test shall be for good and substantial reason and shall be subject to the approval of the Division. Re-tests shall in all ways be conducted in conformance with the Annual and Biennial Deliverability Test Procedures of these rules. The Division, at its discretion, may require the re-testing of any well by notification to the operator to schedule such re-test. These tests as filed on Form C-122-A should be identified as "RETEST" in the remarks column.

SECTION 4: Witnessing of Tests

Any Initial Annual or Biennial Deliverability and Shut-In Pressure Test may be witnessed by any or all of the following: an agent of the Division, an offset operator, a representative of the gas transportation facility connected to the well under test, or a

representative of the gas transportation facility taking gas from an offset operator.

CHAPTER II PROCEDURE FOR TESTING

SECTION 1: Initial Deliverability and Shut-In Pressure Test Procedure

A. Within 90 days after a newly completed well is first delivered to a gas transportation facility, the operator shall complete a deliverability and shut-in pressure test of the well in conformance with the "Annual and Biennial Deliverability and Shut-In Pressure Test Procedures", prescribed in Section 2 of this chapter. Results of the test shall be filed as required by Section 1 of Chapter I of these rules.

B. In the event it is impractical to test a newly completed well in conformance with Paragraph A above, the operator may conduct the deliverability and shut-in pressure test in the following manner (provided, however, that any test so conducted will not be accepted as the first annual deliverability and shut-in pressure test as described in Paragraph A-1 of Section 2, Chapter I):

1. A 7-day or 8-day production chart may be used as the basis for determining the well's deliverability, providing the chart so used is preceded by at least 14 days continuous production. The well shall produce through either the casing or tubing, but not both, into a pipeline during these periods. The production valve and the choke settings shall not be changed during either the conditioning or flow period with the exception of the first ten (10) days of the conditioning period when maximum production would over-range the meter chart or location production equipment.

2. A shut-in pressure of at least seven days duration shall be taken. This shall be the shut-in test required in Paragraph A, Section 1 of Chapter I of these rules.

3. The average daily static meter pressure shall be determined in accordance with Section 2 of Chapter II of these rules. This pressure shall be used as P_t in calculating P_w for the Deliverability Calculation.

4. The daily average rate of flow shall be determined in accordance with Section 2 of Chapter II.

5. The static wellhead working pressure (P_w) shall be determined in accordance with Section 2 of Chapter II.

6. The deliverability of the well shall be determined by using the data determined in Paragraphs 1 through 5 above in the deliverability formula in accordance with Section 2 of Chapter II.

7. The data and calculations for Paragraphs 1 through 6 above shall be reported as required in Section 1 of Chapter I of these rules, upon the blue-colored Form C-122-A or on white Form C-122-A and write "INITIAL TEST ONLY" in remarks.

SECTION 2: Annual and Biennial Deliverability and Shut-In Pressure Test Procedure

This test shall begin by producing a well in the normal operating manner into the pipeline through either the casing or tubing, but not both, for a period of fourteen consecutive days. This shall be known as the conditioning period. The production valve and choke settings shall not be changed during either the conditioning or flow periods except during the first ten (10) days of the conditioning period when maximum production would over-range the meter chart or location production equipment. The first ten (10) days of said conditioning period shall not have more than forty eight (48) hours of cumulative interruptions of flow. The eleventh to fourteenth days, inclusive, of said conditioning period shall have no interruptions of flow whatsoever. Any interruption of flow that occurs as normal operation of the well as stop-cock flow, intermittent flow, or well blow down will not be counted as shut-in time in either the conditioning or flow period.

The daily flowing rate shall be determined from an average of seven or eight consecutive producing days, following a minimum conditioning period of 14 consecutive days of production. This shall be known as the flow period.

Instantaneous pressures shall be measured by deadweight gauge or other method approved by the Division during the 7-day or 8-day flow period at the casinghead, tubinghead, and orifice meter, and shall be recorded along with instantaneous meter-chart static pressure reading.

If a well is producing through a compressor that is located between the wellhead and the meter run, the meter run pressure and the wellhead casing pressure and the wellhead tubing pressure are to be reported on Form C-122-A. (Neither the suction pressure nor

the discharge pressure of the compressor is considered wellhead pressure.) A note shall be entered in the remarks portion on Form C-122-A stating "This well produces through a compressor".

When it is necessary to restrict the flow of gas between the wellhead and orifice meter, the ratio of the downstream pressure, psia, to the upstream pressure, psia shall be determined. When this ratio is 0.57, or less, critical flow conditions shall be considered to exist across the restriction.

When more than one restriction between the wellhead and orifice meter causes the pressures to reflect critical flow between the wellhead and orifice meter, the pressures across each of these restrictions shall be measured to determine whether critical flow exists at any restriction. When critical flow does not exist at any restriction, the pressures taken to disprove critical flow shall be reported to the Division on Form C-122-A in item (n) of the form. When critical flow conditions exist, the instantaneous flowing pressures required hereinabove shall be measured during the last 48 hours of the 7-day or 8-day flow period.

When critical flow exists between the wellhead and orifice meter, the measured wellhead flowing pressure of the string through which the well flowed during test shall be used as P_t when calculating the static wellhead working pressure (P_w) using the method established below.

When critical flow does not exist at any restriction, P_t shall be the corrected average static pressure from the meter chart plus friction loss from the wellhead to the orifice meter.

The static wellhead working pressure (P_w) of any well under test shall be the calculated 7-day or 8-day average static tubing pressure if the well is flowing through the casing; it shall be the calculated 7-day or 8-day average static casing pressure if the well is flowing through the tubing. The static wellhead working pressure (P_w) shall be calculated by applying the tables and procedures set out in this manual.

To obtain the shut-in pressure of a well under test, the well shall be shut in some time during the current testing season for a period of seven to fourteen consecutive days, which have been preceded by a minimum of seven days of uninterrupted production. Such shut-in pressure shall be measured with a deadweight gauge or other method approved by the Division on the seventh to fourteenth day of shut-in of the well. The 7-day shut-in pressure shall be measured on both the tubing and the casing when communication exists between the two strings. The higher of such pressures shall be used as P_c in the deliverability calculation. When any such shut-in pressure is determined by the Division to be

abnormally low or the well can not be shut-in due to "HARDSHIP" classification, the shut-in pressure to be used as P_c shall be determined by one of the following methods:

1. A Division-designated value.

2. An average shut-in pressure of all offset wells completed in the same zone. Offset wells include the four side and four corner wells, if available.

3. A calculated surface pressure based on a calculated bottom-hole pressure. Such calculation shall be made in accordance with the examples in this manual.

All Wellhead pressures as well as the flowing meter pressure tests which are to be taken during the 7-day or 8-day deliverability test period as required hereinabove shall be taken with a deadweight gauge or other method approved by the Division. The pressure readings and the date and time according to the chart shall be recorded and maintained in the operator's records with the test information.

Orifice meter charts shall be changed and so arranged as to reflect upon a single chart the flow data for the gas from each well for the full 7-day or 8-day deliverability test period; however, no tests shall be voided if satisfactory explanation is made as to the necessity for using test volumes through two chart periods. Corrections shall be made for pressure base, measured flowing temperature, specific gravity, and supercompressibility; provided however, if the specific gravity of the gas from any well under test is not available, an estimated specific gravity may be assumed therefor, based upon that of gas from near-by wells, the specific gravity of which has been actually determined by measurement.

The average flowing meter pressure for the 7-day or 8-day flow period and the corrected integrated volume shall be determined by the purchasing company that integrates the flow charts and furnished to the operator or testing agency.

The 7-day or 8-day flow period volume shall be calculated from the integrated readings as determined from the flow period orifice meter chart. The volume so calculated shall be divided by the number of testing days on the chart to determine the average daily rate of flow during said flow period. The flow period shall have a minimum of seven and a maximum of eight legibly recorded flowing days to be acceptable for test purposes. The volume used in this calculation shall be corrected to New Mexico Oil Conservation

Division standard conditions of 15.025 psia pressure base, 60°F. temperature base and 0.60 specific gravity base.

The daily volume of flow as determined from the flow period chart readings shall be calculated by applying the Basic Orifice Meter Formula or other acceptable industry standard practices.

$$Q = C' \{h_w P_f\}^{1/2}$$

Where:

Q = Metered volume of flow Mcf/d @ 15.025 psia, 60° F., and 0.60 specific gravity.

C' = The 24-hour basic orifice meter flow factor corrected for flowing temperature, gravity, and supercompressibility.

h_w = Daily average differential meter pressure from flow period chart.

P_f = Daily average flowing meter pressure from flow period chart.

The basic orifice meter flow factors, flowing temperature factor, and specific gravity factor shall be determined from the tables in this manual.

The daily flow period average corrected flowing meter pressure, psig, shall be used to determine the supercompressibility factor. Supercompressibility Tables may be obtained from the New Mexico Oil Conservation Division.

When supercompressibility correction is made for a gas containing either nitrogen or carbon dioxide in excess of two percent, the supercompressibility factors of such gas shall be determined by the use of Table V of the C.N.G.A. Bulletin TS-402 for pressures 100-500 psig, or Table II, TS-461 for pressures in excess of 500 psig.

The use of tables for calculating rates of flow from integrator readings which do not specifically conform to the New Mexico Oil Conservation Division "Back Pressure Test Manual", or this manual, may be approved for determining the daily flow period rates of flow upon a showing that such tables are appropriate and necessary.

The daily average integrated rate of flow for the 7-day or 8-day flow period shall be corrected for meter error by multiplication by a correction factor. Said correction factor shall be determined by dividing the square root of the deadweight flowing meter pressure, psia, by the square root of the chart flowing meter pressure, psia.

Deliverability pressure, as used herein, is a defined pressure applied to each well and used in the process of comparing the abilities of wells in a pool to produce at static wellhead working pressures equal to a percentage of the 7-day shut-in pressure of the respective individual wells. Such percentage shall be determined and announced periodically by the Division based on the relationship of the average static wellhead working pressures (P_w) divided by the average 7-day shut-in pressure (P_c) of the pool.

The deliverability of gas at the "deliverability pressure" of any well under test shall be calculated from the test data derived from the tests hereinabove required by use of the following deliverability formula:

$$D = Q \left[\frac{(P_c^2 - P_d^2)}{(P_c^2 - P_w^2)} \right]^n$$

Where:

D = Deliverability Mcf/d at the deliverability pressure, (P_d), (at Standard Conditions of 15.025 psia, 60°F and 0.60 sp. gr.).

Q = Daily flow rate in Mcf/d, at wellhead pressure (P_w).

P_c = 7-day shut-in Wellhead pressure, psia, determined in accordance with Section 2 of Chapter II.

P_d = Deliverability pressure, psia, as defined above.

P_w = Average static wellhead working pressure, as determined from 7-day or 8-day flow period, psia, and calculated from tables in this manual entitled "Pressure Loss Due to Friction" Tables for northwest New Mexico.

n = Average pool slope of back pressure curves as follows:

For Pictured Cliffs and shallower formations	0.85
For formations deeper than Pictured Cliffs	0.75

(Note: Special rules for any specific pool or formation may supersede the above values. Check special rules if in doubt.)

The value of the multiplier in the above formula (ratio factor after the application of the pool slope) by which Q is multiplied shall not exceed a limiting value to be determined and announced periodically by the Division. Such determination shall be made after a study of the test data of the pool obtained during the previous testing season.

Downhole commingled wells are to be tested in year for pool of lowermost prorated completion of well and shall use pool slope (n), and deliverability pressure of lowermost pool. The total flow rate from the downhole commingled well will be used to calculate a value of deliverability. For each prorated gas zone of a downhole commingled well, a Form C-122-A is required to be filed and in the Summary portion of that form, all zones will indicate the same data for line h, P_c, Q, P_w, and P_d. The value shown for Deliverability (D) will be that percentage of the total deliverability of the well that is applicable to this zone. A note shall be placed in the remarks column that indicates the percentage of deliverability to be allocated to this zone of the well.

Any test prescribed herein will be considered acceptable if the average flow rate for the final 7-day or 8-day deliverability test is not more than ten percent in excess of any consecutive 7-day or 8-day average of the preceding two weeks. A deliverability test not meeting this requirement may be declared invalid, requiring the well to be re-tested.

All charts relative to initial, annual, or biennial deliverability tests or copies thereof shall be made available to the Division upon its request.

All testing agencies, whether individuals, companies, pipeline companies, or operators, shall maintain a log of all tests accomplished by them, including all field test data. The operator shall maintain the above data for a period of not less than two (2) years plus the current test year.

All forms heretofore mentioned are hereby adopted for use in the northwest New Mexico Area in open form subject to such modification as experience may indicate desirable or necessary.

Initial and Annual or Biennial Deliverability and Shut-In Pressure Tests for gas wells in all formations shall be conducted and reported in accordance with these rules and procedures. Provided however, these rules shall be subject to any specific modification or change contained in Special Pool Rules adopted for any pool after notice and hearing.

CHAPTER III INFORMATIONAL TESTS

A. A one-point back pressure test may be taken on newly completed wells before their connection or reconnection to a gas transportation facility. This test shall not be a required official test but may be taken for informational purposes at the option of the operator. When taken, this test must be taken and reported as prescribed below:

ONE-POINT BACK PRESSURE POTENTIAL TEST PROCEDURE

1. This test shall be accomplished after a minimum shut-in of seven days. The shut-in pressure shall be measured with a deadweight gauge or other method approved by the Division.

2. The flow rate shall be that rate in Mcf/d measured at the end of a three hour test flow period. The flow from the well shall be for three hours through a positive choke, which has a 3/4-inch orifice.

3. A 2-inch nipple which provides a mechanical means of accurately measuring the pressure and temperature of the flowing gas shall be installed immediately upstream from the positive choke.

4. The absolute open flow shall be calculated using the conventional back pressure formula as shown in this manual or the New Mexico Oil Conservation Division "Back Pressure Test Manual."

5. The observed data and flow calculations shall be reported in duplicate on Form C-122, "Multi-Point Back Pressure Test for Gas Wells."

6. Non-critical flow shall be considered to exist when the choke pressure is 13 psig or less. When this condition exists the flow rate shall be measured with a pitot tube and nipple as specified in this manual or in the Division's Manual of "Tables and Procedure for Pitot

Tests." The pitot test nipple shall be installed immediately downstream from the 3/4-inch positive choke.

7. Any well completed with 2-inch nominal size tubing (1.995-inch ID) or larger shall be tested through the tubing.

B. Other tests for informational purposes may be conducted prior to obtaining a pipeline connection for a newly completed well upon receiving specific approval therefor from the Division's Aztec office. Approval of these tests shall be based primarily upon the volume of gas to be vented.

CHAPTER IV TYPE OF TESTS REQUIRED FOR WELLS COMPLETED IN NON-PRORATED POOLS

SECTION 1: Initial Shut-In Pressure Tests for Newly Completed Wells

A. (Same as Chapter I, Section 1, A)

SECTION 2: Biennial Shut-In Pressure Tests

A. Non-prorated wells will be tested biennially as required by the District Office except as follows:

1. Wells which meet the "exempt" qualification as shown in Chapter I, Section 2, paragraph A-2 of these rules shall also be exempt from shut-in test requirements.

2. Wells classified as "hardship" wells during the test year shall also be exempt from shut-in test requirements.

B. All shut-in tests required by these rules must be filed with the Division's Aztec office by January 31 of the following year. Failure to file the test will subject the well to being shut-in one day for each day the test is late.

SECTION 3: Scheduling Tests

A. By September 1 of each year, the District Supervisor of the Aztec District Office of the Division shall by memorandum notify each gas transportation facility and each operator of the pools which are to be scheduled for biennial shut-in pressure testing during the following testing period from January 1 through the last day

of December of that test year. The District Supervisor will also provide a list of "exempt" wells.

Any well scheduled for testing during its test year may have the test flow period, and some of the seven day shut-in period conducted in December of the previous year. The earliest date that a well could be scheduled for Biennial Shut-In Pressure Test would be such that the Test Flow Period would end on December 25 of the previous year.

Downhole commingled wells are to be scheduled for tests on dates for pool of lowermost completion of well.

SECTION 4: Test Procedure

A. To obtain the shut-in pressure of a well under test, the well shall be shut-in some time during the current testing season for a period of seven to fourteen consecutive days, which have been preceded by a minimum of seven days of uninterrupted production. Such shut-in pressure shall be measured by deadweight gauge or other method approved by the Division on the seventh to fourteenth day of shut-in of the well. The shut-in pressure shall be measured on both the tubing and the casing when communication exists between the two strings. The higher of such pressures shall be reported as the shut-in pressure of the well

SECTION 5: Filing of Shut-In Pressure Data

The results of this test will be filed in triplicate on Form C-125-B showing the pressures in psia in column labeled "S. I. PRESSURE PSIA (DWT)" with the Aztec District Office.

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION
AZTEC DISTRICT OFFICE

GARREY CARRUTHERS
GOVERNOR

1000 RIO BRAZOS ROAD
AZTEC, NEW MEXICO 87410
(505) 334-6178

June 10, 1987

Mr. Victor T. Lyons
Oil Conservation Div.
P.O. Box 2088
Santa Fe, NM 87504

Re: Delinquent "D" Test Penalties

Dear Vic:

Before the new proration rules (Order R-8170) came out, we were penalizing a proration unit for its full allowable for delinquent tests. Under Rule 5(b)1 only the deliverability portion of the allowable is to be penalized by it not being assigned until a date later than first delivery. This was a significant change and is being reflected on all future supplements.

Sincerely,

Frank T. Chavez
District Supervisor

FTC/dj

xc: File
Harold Garcia
Alice Dugger

MEMORANDUM

TO: SAN JUAN DELIVERABILITY TEST COMMITTEE
SAN JUAN BASIN OPERATORS AND PRODUCERS

FROM: H. L. BABE KENDRICK

DATE: JANUARY 23, 1987

This memorandum is your invitation to attend a meeting of San Juan Basin producers, operators and deliverability testers, to be held in Farmington, New Mexico at THE INN, at 9:00 am on Thursday, February 5, 1987.

The Deliverability Test Committee has been working since January, 1984 trying to remake a test manual for all testing requirements for gas wells in the San Juan Basin. That work is near completion. At the latest meeting of the committee in late 1986, there was a lot of discussion about being able, and not being able, to test wells in the 1987 test year.

At the hearing before the New Mexico Oil Conservation Division in December, 1986, a Committee recommendation was made to the Division to forego deliverability flow testing in the 1987 test year. Since that time, there has been a lot more discussion concerning this problem.

At this meeting we want to:

1. hear from the producers and operators, and
2. hear from the testers, and
3. hear from the pipelines concerning availibility of space necessary to permit test gas to flow during 1987.

This is your meeting, please be there. Please tell others.

Sincerely,

H. L. Babe Kendrick

BLACKWOOD & NICHOLS CO., LTD.
P.O. BOX 1237
DURANGO, COLORADO 81302-1237

(303) 247-0728

December 22, 1986

Mr. Richard Stamets, Director
Oil Conservation Division
P. O. Box 2208
Santa Fe, New Mexico 87504-2208

Re: OCD Case Number 8586 (Reopened)
Division Order R-333

Dear Mr. Stamets:

At the December 3, 1986 Hearing, the referenced case was taken under advisement. Blackwood & Nichols Company, Ltd. wishes to make a statement in this matter.

We commend the members of the Testing Committee for their effort to update the testing rules and manual. All operators as well as the Division will benefit from this work. We support the extension of the 1986 deliverability test period as recommended.

However, suspension of the 1987 deliverability flow test requirement causes us to be concerned. Specifically, this suspension could have contractual ramifications, decrease the quality of a prorated pool's reservoir data, and possibly cause deliverability/allowable inequities. Following is a discussion of these points and then concluding remarks.

Blackwood & Nichols Company's Gas Sales Contract, which I believe is fairly typical in this nature to most of El Paso Natural Gas Company's contracts, makes specific reference to the deliverability tests.

> "... the daily stabilized producing capacity for each well shall be calculated for each year utilizing data obtained from the annual well deliverability test as prescribed by the New Mexico Oil Conservation Commission ..."

Suspending all deliverability tests for one year increases the difficulty of determing a well's daily stabilized producing capacity because the standardization factor is broken.

Obtaining only a shut-in pressure instead of a fully conditioned and controlled test will put an undesirable anomaly in the prorated pools reservoir data records.

It is possible inequities in assigned allowables could be caused under this proposed suspension. Suppose someone has a well which is four years old in 1986 and was last tested in 1985. Under the suspension

proposal this well would be tested in 1988. The 1985 test would be used to calculate allowables for three years - 1986, 1987 and 1988. If this example well is spot market active for these three years, then it might be assigned an unreasonably high allowable as compared to an offset well which is older or less market active.

In summary, we believe there are several factors to be evaluated before a decision is made. During 1986, El Paso's well test gas displaced spot market production and was priced accordingly. If the pipeline companies feel it is too burdensome to flow a well for three weeks out of one hundred and four weeks, then, perhaps, a change is necessary.

Also the advertisement for the referenced case could have been more explicit. This is actually a suspension of the 1987 and 1988 tests, each for one year. The special procedures for new wells, less than three years old, required shut-in pressures and optional testing - determined by the Commission, pipelines or operators? - needs to be clearly stated.

Sincerely,

BLACKWOOD & NICHOLS CO., LTD.

William F. Clark

William F. Clark
Operations Manager

WFC:ew

cc: J. Scott Hall
Campbell & Black

STATE OF NEW MEXICO

ENERGY AND MINERALS DEPARTMENT

OIL CONSERVATION DIVISION

No. 8-86

TONEY ANAYA
GOVERNOR

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87501
(505) 827-5800

M E M O R A N D U M

TO: SAN JUAN BASIN OPERATORS, PURCHASERS, AND TRANSPORTERS

FROM: R. L. STAMETS, DIRECTOR

SUBJECT: EXTENSION OF 1986 DELIVERABILITY TEST PERIOD, SUSPENSION OF BIENNIAL TESTING

Case No. 8586 reopened December 3, 1986 was, in part, an application to extend the deadline for completing and filing 1986 deliverability tests to March 31, 1987, and for a one year suspension of biennial deliverability testing.

No testimony was received in opposition to this application and it will be granted. As completion of work necessary to prepare an order dealing with other matters in Case No. 8586 will take some time, this memorandum is being issued in order that all persons concerned with deliverability testing may be aware of our intentions and may take advantage of the relief to be granted.

The deliverability test cycle will begin again in 1988 with those pools which would have been tested in 1987. The three annual deliverability tests for new wells will continue to be required. Voluntary testing and retests after workover will be handled as at present.

December 15, 1986

/et

SECTION III

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A. Notification of Pools to be Tested III–4
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MEMORANDUM

TO: TEST MANUAL PUTTER-TO-GETHERS

FROM: BABE

DATE: DECEMBER 12, 1986

Yesterday afternoon I mailed to some of you a couple of pages of TABLE OF CONTENTS for the booklet of testing for the northwest NM and then this morning I compared the looks of what I had sent and I thought that I ought to redo the VII table of c. Here it is. I took out the gaps between the VII — # and shrunk them up to VII-606 like TABLE of C. III-2. I also took out the extra spaces between the lines of the page so that it is not as long down the page.

I have seen that the dots following the printed letters across the page do not come out at the same position across the page and it in funny that it don't but these funny machines do funny things. I drew a line from the top of the page to the bottom and tried to get the dots to end at ABOUT the same place on the page.

I will be in Santa Fe on Tuesday and Wednesday and will be able to discuss this with anyone who wants to talk. I think that Mike is working hard on this now and will continue if he is unable to pawn it off on one of the others. (I would pawn it if I could.)

Also, you will note that I put the PITOT TABLES in SECTION VII but after TABLES VIII and IX. And, I will bet that I have not properly counted the pages and some of the page numbers are incorrect. I can fix these when I get back.

See you.

Babe

Dist:
M. Stogner
F. Chavez
E. Marcum
A. Kendrick
M. Turnbaugh
J. Levine
J. Fox

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MEMORANDUM

TO: MEMBERS OF THE NMOCD DELIVERABILITY TEST COMMITTEE

FROM: H. L. BABE KENDRICK

DATE: JUNE 14, 1985

Last week in Santa Fe, Dick Stamets asked how we are doing with the testing manual for the San Juan Basin. Of course I had to tell him that I had been very slow with everything but we are working to get things done. Since that time I have done a little more along the lines of getting everything in shape. Enclosed are some of the things that we have been dealing with that certainly need to be finalized so they can be published.

First, I have rewritten the rules and procedures with the following changes:

OLD COPY	NEW COPY	CHANGES
page 1	page 1	removed the heading about this should be the new Order R-333 and labeled the paper as a "MANUAL".
page 3	page 3	Item A-4. This paragraph was rewritten along with the ideas expressed at the hearing.
page 5	page 5	Chapter II, Section1, Paragraph B. The old reference was to paragraph A-3. I think this should now be to paragraph A-1. (Agree??)
page 8	page 7	top of old page, bottom of new page. The words "or the well can not be shut-in due to "HARDSHIP" classification" were added to take care of wells with "hardship" classification. NOTE: DO YOU THINK WE NEED TO ADD ANY OTHER DATA TO EXCLUDE THE TESTING OF "HARDSHIP" WELLS???
page 8	page 8	paragraph numbered 3. Words in this have been changed to update this to this manual

		and include the examples in this manual.
page 9	page 9	¶ that begins "The basic orifice meter....." was changed to include reference to this manual.
page 9	page 9	¶ that begins "The use of tables for....." was changed to include this manual.
page 10	page 10	¶ about P_w. Changed just to say tables "in this manual".
page 12	page 12	¶ #4. Words were added to say "in this manual".
page 12	page 12	¶ #6. Words were added to say "in this manual". NOTE: I MUST LOOK TO SEE IF I HAVE THE DATA NECESSARY TO ADD TO THIS MANUAL SO THIS WILL BE POSSIBLE.
page 13	page 13	¶ #1. This reference was changed to paragraph A-2 instead of part 2.
page 13	page 13	last ¶. The form number is referenced as C-125-B as was discussed in the hearing so that it is different from the form used in SE New Mexico. This leaves C-125 as the primary form. C-125-A could be the computer print-out for filing in SE New Mexico and then this C-125-B would be for San Juan Basin. Also, the remark is made here to insert the pressure in the column labeled "S. I. PRESSURE PSIA (DWT)" instead of by column number.

Now, I do not say that this finishes this program by any means. I am hopeful that it will be finished soon. Please read, and reread if necessary to see if you can find any boo-boos that have not been addressed to date. What else do we need and from where do we get it?

I just happened to think about the reference that we have used on page 8, Item #3. The reference was made to example 7 in the B-P Manual. That was the one dated in 1956. There is a newer B-P Manual dated in 1966. This 1966 version is the one that I copied forms from to include in <u>this</u> manual.

What else do we need?

WELL, I JUST LOST THE FROSTING OFF THE CAKE.

I was running copies of data to send you to show you what other tables I have at hand. While running the stuff for PITOT TUBE TYPE TESTS, I found the data was fixed around sp. gr. = .65.. Now that is another reason why we should go all out to revise data in our manuals. Anyway; will someone please see it they can recalculate these values on a sp. gr. of 1.000 and make them into a table? The tables from the Back Pressure Manual are on 1.000.

The temperature correction table is based on 60°F. (Hurray, we won one).

Now, things that I do not have at hand:

1. An I. P. Test on C-122 form filled out.

2. Del. Test on C-122-A showing step by step progression through the calculation and the round-off and truncation points. Yes, I know that Frank Chavez supplied us with on in Farmington but I don't have it available and/or in printing form.

3. A Shut-in pressure measured on a non-prorated well and the data filled in on C-125-B.

4. There has to be more that I have forgotten. If you have it, please send it on in.

You have already received the Tables of F_c values and table of $1-e^{-S}$. Those tables go into this manual also.

What else???

Thanks for your help!!!

BABE Babe

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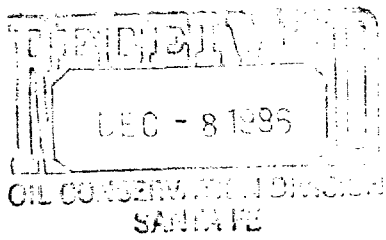
MEMORANDUM



To: Deliverability Test Committee

From: H. L. Babe Kendrick

Date: December 5, 1986

Today I am printing the absolute latest edition of the test procedures for the area of northwest New Mexico. I have done a few things to this order to get it in what I hope is final form. Here are some of the things that I did to what you have read before:

1. Changed the name of this 15 pages to read "RULES OF PROCEDURE FOR NORTHWEST NEW MEXICO". This was done because as this is placed into a booklet, this booklet will look much like the BACK PRESSURE TEST MANUAL for New Mexico and will be placed in the book at page III–1 to 15.

2. Changed the name from San Juan Basin to northwest New Mexico because this will be a booklet that will pertain to all the wells of northwest New Mexico and not to just the San Juan Basin wells.

3. Tried to make sure that the word Commission was replaced with the word Division in all places possible.

4. Tried to clean up any references that were made to other booklets or publications that might be used when the data necessary for testing procedures or tables, etc are all enclosed in this booklet. Now there are words in this that say you can find the data in this booklet or you can find it in the other booklets.

NOW: If you will take your own copy of the "State of New Mexico Oil Conservation Division Manual For Back–Pressure Testing of Natural Gas Wells January 1, 1966 and follow the pages in it you can follow what we are trying to do in this case.

Page –i: OCD Title = OCD tell me what they want

Page i: Acknowledgment = OCD tell me what they want.

Page ii: New Table of Contents – This will be the last thing made.

Page iii: Preface – OCD tell me what they want.

Section I – Introduction:
Page I–1 to 6 – Introduction – OCD tell me what they want.

Section II – Nomenclature:
Page II–1 to 4 – See if Frank Chavez can find time to check to see if this has all the data necessary in it to be up to date with the terms that we have added in our description of the deliverability test.

Section III – Rules of Procedure
We need a First page which will serve as a table of contents for this section and I will try to do this today or next Wednesday.
Pages III–1 to 17 will be removed and replaced with the test I have enclosed to you now.

Section IV – Forms
We need to be sure that this section has a copy of a blank form of everything needed and this list would include the C–122, the C–122–A, and the C–125–B (the latest data page published in Santa Fe for the writing in of the shut–in pressures of wells.

Section V – Basic Calculations – Leave as is.

Section VI – Test Examples – Add into this section a Form C–122–A filled out properly and a description page about how the data is acquired and placed into the slots. Also add in a Form C–125–B filled in with the proper data and a description page of how this data was obtained and entered. I believe there is a Form C–122 page in this section, BUT, it may have some data that needs to be changed. For instance, any of the data shown in this section (or for that matter anywhere in the book) should have LOCATIONS, COUNTY NAMES, POOL NAMES (FAKE OR OTHERWISE) that are within the limits of the northwest New Mexico area. Again, I would like to call on Frank Chavez to supply the C–125–B and necessary descriptions and look for changes to be made to locations, counties, pools, etc. The Form C–122–A that Frank had earlier submitted to the committee was given to Mike Stogner to get this into this section. And, I see this will need a new Table of Contents page at the first of the section also.

Section VII – Tables
Pages 2 to 5 – Leave as is.
Pages 6, 7 and 8 – eliminate.
Pages 9 to 86 – Leave as is.
Pages 87 to 93 – These will be replaced with tables marked C–1 in the last hearing and add title to the pages. These are the $1-e^{-s}$ tables.
Pages 94, 95, 95A, and 96 – Replace these tables with tables marked D–1 in the last hearing and add title to the pages. These are the Friction Factor Tables.
Page 97 is OK as is.

Page A–1 – Leave as is.
Page B–1 – Leave as is
Page C–1 to 5 – Eliminate. Here we need to add the description used by me in the calculation of the F_c values for Friction Calculations.
Page D–1 to 6 – Leave as is but Mike Stogner will get better copies.

AND – WE NEED TO INSERT SOME PAGES OF INITIAL POTENTIAL DATA SUCH AS THE PITOT TUBE IMPACT PRESSURE VS VOLUME TABLES AND THE SPECIFIC GRAVITY CORRECTION TABLES FOR THE PITOT CALCULATIONS. THIS COULD BE ADDED IN SECTION VII RIGHT AFTER PAGE VII–13 (SPECIFIC GRAVITY FACTORS) AND BEFORE PAGE VII–14 (PSEUDOCRITICAL PROPERTIES OF HYDROCARBON GASES).

******Now, Ladies and Gentlemen of the committee, here is your last chance to get this done correctly. Please read everything with the most critical eye looking at each word as if it is wrong and find all the corrections that need to be made. If you then have any extra time on your hands, please help Frank Chavez and Mike Stogner as they try to supply the missing details in making your book read the way that you want it to read. The NMOCD is placed with its back to the wall in trying to get this out by the first of the year (meaning 1987).. If you can help them, please do.*******

I want to express my thanks to each of you that have put up with my foolishness for the past 35 months in trying to make this publication one that will serve our needs for the next few years. THANK YOU!!!!!

See you around.

BABE

RULES OF PROCEDURE FOR NORTHWEST NEW MEXICO

CHAPTER I TYPE OF TESTS REQUIRED FOR WELLS COMPLETED IN PRORATED GAS POOLS

SECTION 1: Initial Deliverability and Shut-In Pressure Tests for Newly Completed Well

A. Immediately upon completion of each gas well in northwest New Mexico, a shut-in pressure test of at least seven days duration shall be made. This initial shut-in pressure shall be filed with the Division's Aztec Office on either Form C-122 or C-104.

B. Within 90 days ater a well first delivers gas to a gas transportation facility, the well shall have been tested in accordance with Section 1 of Chapter II of these rules, "Initial Deliverability and Shut-In Pressure Test Procedures", and the results of the test filed in triplicate with the Division's Aztec office and one copy filed with the gas transportation facility to which the well is connected. This test is to be filed on Form C-122-A. Failure to file said test within the above-prescribed 90-day period will subject the well to the loss of one day's allowable for each day the test is late.

1. If the newly first delivered well is an infill well on a proration unit, the old well on the unit is not required to be tested provided it has a valid test on file for the current proration year. Testing of the old well follows the regularly assigned test year for the pool in which the wells are located. The new well is required to be tested annually until at least three annual tests are on file and then the well is to be tested biennially with other wells in that pool.

2. If the newly first delivered well is an infill well on a proration unit and the old well on the unit is "exempt", the old well is to be tested along with the new well for the Initial and Annual Deliverability and Shut-In Pressure Test. The old well will lose its "exempt" classification and must be tested biennially along with other wells in that pool. The new infill well is required to be tested annually until at least three annual tests are on file and then the well is to be tested biennially with other wells in that pool.

C. The requirements for Initial Tests and Annual or Biennial Deliverability and Shut-In Pressure Tests and the notification requirements and scheduling of such tests which apply to newly completed wells shall also apply to recompleted wells.

D. Any tests taken for informational purposes prior to pipeline connection shall not be recognized as official tests for the assignment of allowables.

SECTION 2. Annual and Biennial Deliverability and Shut-In Pressure Tests

A. Annual or Biennial Deliverability and Shut-In Pressure Tests shall be made on all gas wells during the period from January 1 through December 31 of that year except as follows:

1. A newly completed well or a recompleted well shall be tested on an annual basis until a minimum of three annual tests have been taken, after which the well shall be tested biennially as is required for other wells in the pool in which the well is located.

2. Wells classified as "exempt" shall not be subject to the requirements of annual or biennial deliverability tests.

   Classification of wells into or out of the "exempt" status shall be done once each year immediately following the reporting of June production and shall be effective for the succeeding annual test period.

   Gas wells completed in the Pictured Cliffs or any shallower formation shall be classified "exempt" if at least three months of production history is available and the well failed to produce, and is incapable of producing, an average of 250 MCF or more per month during the months produced within the preceding 12-month period, and the well is classified as marginal in the August Gas Proration Schedule.

   Gas wells completed in any formation deeper than the Pictured Cliffs formation shall be classified "exempt" if at least three months of production history is available and the well failed to produce, and is incapable of producing, an average of 2000 MCF or more per month during the months produced within the preceding 12-month period, and the well is classified as marginal in the August Gas Proration Schedule.

Gas wells on multiple well Gas Proration Units will not be classified "exempt" unless the Gas Proration Unit is classified as marginal. Any or all wells on a marginal multiple well Gas Proration Unit may be classified as "exempt" provided each Gas Proration Unit so classified meets the qualification for "exempt" status. Gas Proration Units for wells producing from formations deeper than the Pictured Cliffs formation shall be classified "exempt" if at least three months of production history is available and the Gas Proration Unit failed to produce, and is incapable of producing, an average of 2000 MCF or more per month during the months produced within the preceding 12-month period, and the Gas Proration Unit is classified as marginal in the August Gas Proration Schedule. Gas Proration Units are to be classified as "exempt" because of their low producing ability.

The District Supervisor of the Division's Aztec Office may classify a well or Gas Proration Unit as "exempt" at any time if the operator presents sufficient evidence to the District Supervisor indicating that the well or Gas Proration Unit is incapable of producing gas at a higher rate than that rate required for "exempt" classification for wells or Gas Proration Units in that pool.

Once a well or Gas Proration Unit has been declared "exempt" for the following test year, it shall remain classified "exempt" for that test year.

3. If a test is filed on any well on a gas proration unit, the test requirement for the gas proration unit has been met. The deliverability of the unit is taken only as the resulting sum of all wells tested.

4. A shut-in pressure must be filed on Form C-122-A even if no gas is measured during the production phase of the test. "Exempt" wells do not require the filing of a shut-in pressure.

B. All Annual and Biennial Deliverability and Shut-In Pressure Tests required by these rules must be filed with the Division's Aztec office and with the appropriate gas transportation facility within 90 days following the completion of each test. Provided however, that any test completed between October 31 of the test year and January 31 of the following year are due no later than January 31. No extension of time for filing tests beyond January 31 will be granted except after notice and hearing.

Failure to file any test within the above-prescribed times will subject the well to the loss of one day's allowable for each day the test is late. A well classified as marginal shall be shut-in one day for each day the test is late.

SECTION 3: Scheduling of Tests

A. Notification of Pools to be Tested

By September 1 of each year, the District Supervisor of the Aztec District Office of the Division shall by memorandum notify each gas transportation facility and each operator of the pools which are to be scheduled for biennial testing during the following testing period from January 1 through the last day of December of that test year. The District Supervisor will also provide a list of "exempt" wells and a list of wells that do not have a minimum of three Annual Deliverability and Shut-In Pressure Tests on file.

Any well scheduled for testing during its test year may have the conditioning period, test flow period, and some of the seven day shut-in period conducted in December of the previous year provided that if the 7 day shut-in period immediately follows the test flow period the 7 day shut-in pressure would be measured in January of the test year. The earliest date that a well could be scheduled for Annual or Biennial Deliverability and Shut-In Pressure Test would be such that the Test Flow Period would end on December 25 of the previous year.

Downhole commingled wells are to be scheduled for tests on dates for pool of lowermost prorated completion of well.

B. Annual and Biennial Deliverability Tests

By November 1 of each year, each gas transportation facility shall, in cooperation with the operators involved, prepare and submit a schedule of the wells to which it is connected which are to begin testing in December and January. Said schedule shall be entitled, "Annual and Biennial Deliverability and Shut-In Pressure Test Schedule", and one copy shall be submitted to the Division's Aztec office and to each operator concerned. The schedule shall indicate the date of tests, pool, operator, lease, well number, and location of each well.

At least 30 days prior to the beginning of each succeeding 2-month testing interval, a similar schedule shall be prepared and filed in accordance with the above.

The gas transportation facility and the Aztec District Office of the Division shall be notified immediately by any operator unable to conduct any test as scheduled.

In the event a well is not tested in accordance with the existing test schedule, the well shall be re-scheduled by the gas transportation facility, and the Division and the operator of the well so notified in writing. Every effort should be made to notify the Division of the new schedule prior to the conclusion of the newly assigned 14-day conditioning period.

Notice to the Division of Shut-In Pressure Tests which are scheduled at a time other than immediately following the flow test must be received prior to the time that the well is shut-in.

It shall be the responsibility of each operator to determine that all of its wells are properly scheduled for testing by the gas transportation facility to which they are connected, in order that all annual and biennial tests may be completed during the testing season.

In the event a well is shut-in by the state for over production, the operator may produce the well for a period of time to secure a test after notification to the Division. All gas produced during this testing period will be used in determining the over/under produced status of the well.

C. Deliverability Re-Tests

An operator may, in cooperation with the gas transportation facility, schedule a well for a deliverability re-test upon notification to the Division's Aztec office at least ten days before the test is to be commenced. Such re-test shall be for good and substantial reason and shall be subject to the approval of the Division. Re-tests shall in all ways be conducted in conformance with the Annual and Biennial Deliverability Test Procedures of these rules. The Division, at its discretion, may require the re-testing of any well by notification to the operator to schedule such re-test. These tests as filed on Form C-122-A should be identified as "RETEST" in the remarks column.

SECTION 4: Witnessing of Tests

Any Initial Annual or Biennial Deliverability and Shut-In Pressure Test may be witnessed by any or all of the following: an agent of the Division, an offset operator, a representative of the gas transportation facility connected to the well under test, or a

representative of the gas transportation facility taking gas from an offset operator.

CHAPTER II PROCEDURE FOR TESTING

SECTION 1: Initial Deliverability and Shut-In Pressure Test Procedure

A. Within 90 days after a newly completed well is first delivered to a gas transportation facility, the operator shall complete a deliverability and shut-in pressure test of the well in conformance with the "Annual and Biennial Deliverability and Shut-In Pressure Test Procedures", prescribed in Section 2 of this chapter. Results of the test shall be filed as required by Section 1 of Chapter I of these rules.

B. In the event it is impractical to test a newly completed well in conformance with Paragraph A above, the operator may conduct the deliverability and shut-in pressure test in the following manner (provided, however, that any test so conducted will not be accepted as the first annual deliverability and shut-in pressure test as described in Paragraph A-1 of Section 2, Chapter I):

1. A 7-day or 8-day production chart may be used as the basis for determining the well's deliverability, providing the chart so used is preceded by at least 14 days continuous production. The well shall produce through either the casing or tubing, but not both, into a pipeline during these periods. The production valve and the choke settings shall not be changed during either the conditioning or flow period with the exception of the first ten (10) days of the conditioning period when maximum production would over-range the meter chart or location production equipment.

2. A shut-in pressure of at least seven days duration shall be taken. This shall be the shut-in test required in Paragraph A, Section 1 of Chapter I of these rules.

3. The average daily static meter pressure shall be determined in accordance with Section 2 of Chapter II of these rules. This pressure shall be used as P_t in calculating P_w for the Deliverability Calculation.

4. The daily average rate of flow shall be determined in accordance with Section 2 of Chapter II.

5. The static wellhead working pressure (P_w) shall be determined in accordance with Section 2 of Chapter II.

6. The deliverability of the well shall be determined by using the data determined in Paragraphs 1 through 5 above in the deliverability formula in accordance with Section 2 of Chapter II.

7. The data and calculations for Paragraphs 1 through 6 above shall be reported as required in Section 1 of Chapter I of these rules, upon the blue-colored Form C-122-A or on white Form C-122-A and write "INITIAL TEST ONLY" in remarks.

SECTION 2: Annual and Biennial Deliverability and Shut-In Pressure Test Procedure

This test shall begin by producing a well in the normal operating manner into the pipeline through either the casing or tubing, but not both, for a period of fourteen consecutive days. This shall be known as the conditioning period. The production valve and choke settings shall not be changed during either the conditioning or flow periods except during the first ten (10) days of the conditioning period when maximum production would over-range the meter chart or location production equipment. The first ten (10) days of said conditioning period shall not have more than forty eight (48) hours of cumulative interruptions of flow. The eleventh to fourteenth days, inclusive, of said conditioning period shall have no interruptions of flow whatsoever. Any interruption of flow that occurs as normal operation of the well as stop-cock flow, intermittent flow, or well blow down will not be counted as shut-in time in either the conditioning or flow period.

The daily flowing rate shall be determined from an average of seven or eight consecutive producing days, following a minimum conditioning period of 14 consecutive days of production. This shall be known as the flow period.

Instantaneous pressures shall be measured by deadweight gauge or other method approved by the Division during the 7-day or 8-day flow period at the casinghead, tubinghead, and orifice meter, and shall be recorded along with instantaneous meter-chart static pressure reading.

If a well is producing through a compressor that is located between the wellhead and the meter run, the meter run pressure and the wellhead casing pressure and the wellhead tubing pressure are to be reported on Form C-122-A. (Neither the suction pressure nor

the discharge pressure of the compressor is considered wellhead pressure.) A note shall be entered in the remarks portion on Form C-122-A stating "This well produces through a compressor".

When it is necessary to restrict the flow of gas between the wellhead and orifice meter, the ratio of the downstream pressure, psia, to the upstream pressure, psia shall be determined. When this ratio is 0.57, or less, critical flow conditions shall be considered to exist across the restriction.

When more than one restriction between the wellhead and orifice meter causes the pressures to reflect critical flow between the wellhead and orifice meter, the pressures across each of these restrictions shall be measured to determine whether critical flow exists at any restriction. When critical flow does not exist at any restriction, the pressures taken to disprove critical flow shall be reported to the Division on Form C-122-A in item (n) of the form. When critical flow conditions exist, the instantaneous flowing pressures required hereinabove shall be measured during the last 48 hours of the 7-day or 8-day flow period.

When critical flow exists between the wellhead and orifice meter, the measured wellhead flowing pressure of the string through which the well flowed during test shall be used as P_t when calculating the static wellhead working pressure (P_w) using the method established below.

When critical flow does not exist at any restriction, P_t shall be the corrected average static pressure from the meter chart plus friction loss from the wellhead to the orifice meter.

The static wellhead working pressure (P_w) of any well under test shall be the calculated 7-day or 8-day average static tubing pressure if the well is flowing through the casing; it shall be the calculated 7-day or 8-day average static casing pressure if the well is flowing through the tubing. The static wellhead working pressure (P_w) shall be calculated by applying the tables and procedures set out in this manual.

To obtain the shut-in pressure of a well under test, the well shall be shut in some time during the current testing season for a period of seven to fourteen consecutive days, which have been preceded by a minimum of seven days of uninterrupted production. Such shut-in pressure shall be measured with a deadweight gauge or other method approved by the Division on the seventh to fourteenth day of shut-in of the well. The 7-day shut-in pressure shall be measured on both the tubing and the casing when communication exists between the two strings. The higher of such pressures shall be used as P_c in the deliverability calculation. When any such shut-in pressure is determined by the Division to be

abnormally low or the well can not be shut-in due to "HARDSHIP" classification, the shut-in pressure to be used as P_c shall be determined by one of the following methods:

1. A Division-designated value.

2. An average shut-in pressure of all offset wells completed in the same zone. Offset wells include the four side and four corner wells, if available.

3. A calculated surface pressure based on a calculated bottom-hole pressure. Such calculation shall be made in accordance with the examples in this manual.

All Wellhead pressures as well as the flowing meter pressure tests which are to be taken during the 7-day or 8-day deliverability test period as required hereinabove shall be taken with a deadweight gauge or other method approved by the Division. The pressure readings and the date and time according to the chart shall be recorded and maintained in the operator's records with the test information.

Orifice meter charts shall be changed and so arranged as to reflect upon a single chart the flow data for the gas from each well for the full 7-day or 8-day deliverability test period; however, no tests shall be voided if satisfactory explanation is made as to the necessity for using test volumes through two chart periods. Corrections shall be made for pressure base, measured flowing temperature, specific gravity, and supercompressibility; provided however, if the specific gravity of the gas from any well under test is not available, an estimated specific gravity may be assumed therefor, based upon that of gas from near-by wells, the specific gravity of which has been actually determined by measurement.

The average flowing meter pressure for the 7-day or 8-day flow period and the corrected integrated volume shall be determined by the purchasing company that integrates the flow charts and furnished to the operator or testing agency.

The 7-day or 8-day flow period volume shall be calculated from the integrated readings as determined from the flow period orifice meter chart. The volume so calculated shall be divided by the number of testing days on the chart to determine the average daily rate of flow during said flow period. The flow period shall have a minimum of seven and a maximum of eight legibly recorded flowing days to be acceptable for test purposes. The volume used in this calculation shall be corrected to New Mexico Oil Conservation

Division standard conditions of 15.025 psia pressure base, 60°F. temperature base and 0.60 specific gravity base.

The daily volume of flow as determined from the flow period chart readings shall be calculated by applying the Basic Orifice Meter Formula or other acceptable industry standard practices.

$$Q = C' \{h_w P_f\}^{1/2}$$

Where:

Q = Metered volume of flow Mcf/d @ 15.025 psia, 60° F., and 0.60 specific gravity.

C' = The 24-hour basic orifice meter flow factor corrected for flowing temperature, gravity, and supercompressibility.

h_w = Daily average differential meter pressure from flow period chart.

P_f = Daily average flowing meter pressure from flow period chart.

The basic orifice meter flow factors, flowing temperature factor, and specific gravity factor shall be determined from the tables in this manual.

The daily flow period average corrected flowing meter pressure, psig, shall be used to determine the supercompressibility factor. Supercompressibility Tables may be obtained from the New Mexico Oil Conservation Division.

When supercompressibility correction is made for a gas containing either nitrogen or carbon dioxide in excess of two percent, the supercompressibility factors of such gas shall be determined by the use of Table V of the C.N.G.A. Bulletin TS-402 for pressures 100-500 psig, or Table II, TS-461 for pressures in excess of 500 psig.

The use of tables for calculating rates of flow from integrator readings which do not specifically conform to the New Mexico Oil Conservation Division "Back Pressure Test Manual", or this manual, may be approved for determining the daily flow period rates of flow upon a showing that such tables are appropriate and necessary.

The daily average integrated rate of flow for the 7-day or 8-day flow period shall be corrected for meter error by multiplication by a correction factor. Said correction factor shall be determined by dividing the square root of the deadweight flowing meter pressure, psia, by the square root of the chart flowing meter pressure, psia.

Deliverability pressure, as used herein, is a defined pressure applied to each well and used in the process of comparing the abilities of wells in a pool to produce at static wellhead working pressures equal to a percentage of the 7-day shut-in pressure of the respective individual wells. Such percentage shall be determined and announced periodically by the Division based on the relationship of the average static wellhead working pressures (P_w) divided by the average 7-day shut-in pressure (P_c) of the pool.

The deliverability of gas at the "deliverability pressure" of any well under test shall be calculated from the test data derived from the tests hereinabove required by use of the following deliverability formula:

$$D = Q \left[\frac{(P_c^2 - P_d^2)}{(P_c^2 - P_w^2)} \right]^n$$

Where:

D = Deliverability Mcf/d at the deliverability pressure, (P_d), (at Standard Conditions of 15.025 psia, 60^0F and 0.60 sp. gr.).

Q = Daily flow rate in Mcf/d, at wellhead pressure (P_w).

P_c = 7-day shut-in Wellhead pressure, psia, determined in accordance with Section 2 of Chapter II.

P_d = Deliverability pressure, psia, as defined above.

P_w = Average static wellhead working pressure, as determined from 7-day or 8-day flow period, psia, and calculated from tables in this manual entitled "Pressure Loss Due to Friction" Tables for northwest New Mexico.

n = Average pool slope of back pressure curves as follows:

For Pictured Cliffs and shallower formations	0.85
For formations deeper than Pictured Cliffs	0.75

(Note: Special rules for any specific pool or formation may supersede the above values. Check special rules if in doubt.)

The value of the multiplier in the above formula (ratio factor after the application of the pool slope) by which Q is multiplied shall not exceed a limiting value to be determined and announced periodically by the Division. Such determination shall be made after a study of the test data of the pool obtained during the previous testing season.

Downhole commingled wells are to be tested in year for pool of lowermost prorated completion of well and shall use pool slope (n), and deliverability pressure of lowermost pool. The total flow rate from the downhole commingled well will be used to calculate a value of deliverability. For each prorated gas zone of a downhole commingled well, a Form C-122-A is required to be filed and in the Summary portion of that form, all zones will indicate the same data for line h, P_c, Q, P_w, and P_d. The value shown for Deliverability (D) will be that percentage of the total deliverability of the well that is applicable to this zone. A note shall be placed in the remarks column that indicates the percentage of deliverability to be allocated to this zone of the well.

Any test prescribed herein will be considered acceptable if the average flow rate for the final 7-day or 8-day deliverability test is not more than ten percent in excess of any consecutive 7-day or 8-day average of the preceding two weeks. A deliverability test not meeting this requirement may be declared invalid, requiring the well to be re-tested.

All charts relative to initial, annual, or biennial deliverability tests or copies thereof shall be made available to the Division upon its request.

All testing agencies, whether individuals, companies, pipeline companies, or operators, shall maintain a log of all tests accomplished by them, including all field test data. The operator shall maintain the above data for a period of not less than two (2) years plus the current test year.

All forms heretofore mentioned are hereby adopted for use in the northwest New Mexico Area in open form subject to such modification as experience may indicate desirable or necessary.

Initial and Annual or Biennial Deliverability and Shut-In Pressure Tests for gas wells in all formations shall be conducted and reported in accordance with these rules and procedures. Provided however, these rules shall be subject to any specific modification or change contained in Special Pool Rules adopted for any pool after notice and hearing.

CHAPTER III INFORMATIONAL TESTS

A. A one-point back pressure test may be taken on newly completed wells before their connection or reconnection to a gas transportation facility. This test shall not be a required official test but may be taken for informational purposes at the option of the operator. When taken, this test must be taken and reported as prescribed below:

ONE-POINT BACK PRESSURE POTENTIAL TEST PROCEDURE

1. This test shall be accomplished after a minimum shut-in of seven days. The shut-in pressure shall be measured with a deadweight gauge or other method approved by the Division.

2. The flow rate shall be that rate in Mcf/d measured at the end of a three hour test flow period. The flow from the well shall be for three hours through a positive choke, which has a 3/4-inch orifice.

3. A 2-inch nipple which provides a mechanical means of accurately measuring the pressure and temperature of the flowing gas shall be installed immediately upstream from the positive choke.

4. The absolute open flow shall be calculated using the conventional back pressure formula as shown in this manual or the New Mexico Oil Conservation Division "Back Pressure Test Manual."

5. The observed data and flow calculations shall be reported in duplicate on Form C-122, "Multi-Point Back Pressure Test for Gas Wells."

6. Non-critical flow shall be considered to exist when the choke pressure is 13 psig or less. When this condition exists the flow rate shall be measured with a pitot tube and nipple as specified in this manual or in the Division's Manual of "Tables and Procedure for Pitot

Tests." The pitot test nipple shall be installed immediately downstream from the 3/4-inch positive choke.

7. Any well completed with 2-inch nominal size tubing (1.995-inch ID) or larger shall be tested through the tubing.

B. Other tests for informational purposes may be conducted prior to obtaining a pipeline connection for a newly completed well upon receiving specific approval therefor from the Division's Aztec office. Approval of these tests shall be based primarily upon the volume of gas to be vented.

CHAPTER IV TYPE OF TESTS REQUIRED FOR WELLS COMPLETED IN NON-PRORATED POOLS

SECTION 1: Initial Shut-In Pressure Tests for Newly Completed Wells

A. (Same as Chapter I, Section 1, A)

SECTION 2: Biennial Shut-In Pressure Tests

A. Non-prorated wells will be tested biennially as required by the District Office except as follows:

1. Wells which meet the "exempt" qualification as shown in Chapter I, Section 2, paragraph A-2 of these rules shall also be exempt from shut-in test requirements.

2. Wells classified as "hardship" wells during the test year shall also be exempt from shut-in test requirements.

B. All shut-in tests required by these rules must be filed with the Division's Aztec office by January 31 of the following year. Failure to file the test will subject the well to being shut-in one day for each day the test is late.

SECTION 3: Scheduling Tests

A. By September 1 of each year, the District Supervisor of the Aztec District Office of the Division shall by memorandum notify each gas transportation facility and each operator of the pools which are to be scheduled for biennial shut-in pressure testing during the following testing period from January 1 through the last day

of December of that test year. The District Supervisor will also provide a list of "exempt" wells.

Any well scheduled for testing during its test year may have the test flow period, and some of the seven day shut-in period conducted in December of the previous year. The earliest date that a well could be scheduled for Biennial Shut-In Pressure Test would be such that the Test Flow Period would end on December 25 of the previous year.

Downhole commingled wells are to be scheduled for tests on dates for pool of lowermost completion of well.

SECTION 4: Test Procedure

A. To obtain the shut-in pressure of a well under test, the well shall be shut-in some time during the current testing season for a period of seven to fourteen consecutive days, which have been preceded by a minimum of seven days of uninterrupted production. Such shut-in pressure shall be measured by deadweight gauge or other method approved by the Division on the seventh to fourteenth day of shut-in of the well. The shut-in pressure shall be measured on both the tubing and the casing when communication exists between the two strings. The higher of such pressures shall be reported as the shut-in pressure of the well

SECTION 5: Filing of Shut-In Pressure Data

The results of this test will be filed in triplicate on Form C-125-B showing the pressures in psia in column labeled "S. I. PRESSURE PSIA (DWT)" with the Aztec District Office.

NOTES FOR TESTIMONY DECEMBER 3, 1986

FIRST, I NEED TO MAKE SOME COMMENTS ABOUT THE PREVIOUS TESTIMONY GIVEN IN THIS CASE ON _____. AT THAT HEARING I WAS SUPPOSEDLY READING INTO THE RECORD SOME OF THE MATERIAL CONTAINED IN THE TEST PROCEDURE THAT WE IN THE COMMITTEE HAVE FORMULATED AND DOING SO, I PARAPHRASED SOME OF THE WORDS FROM THE DOCUMENT. REGARDLESS OF WHAT I READ THAT DAY, OR MAY SAY TODAY, THE WRITTEN TEXT AS WE HAVE IT IS THE TEXT THAT WE WOULD LIKE TO SUBMIT TO THE DIVISION TO BE ENACTED AS THE RULES OF PROCEDURE FOR TESTING IN THE SAN JUAN BASIN, UNLESS IT IS DECIDED AT THIS HEARING TO SPECIFICALLY CHANGE CERTAIN WORDS IN THE WRITTEN TEST.

NOW, WITH THAT OUT OF THE WAY, LET US SEE WHAT WE HAVE TODAY THAT IS DIFFERENT TO WHAT WAS PRESENTED AT THE LAST HEARING.

I BELIEVE THAT THE TEST AS I HAVE IT HERE TODAY IS THE RESULT OF CHANGES SUGGESTED AT THE LAST HEARING PLUS CHANGES THAT WERE MADE BY THE COMMITTEE AT ITS MORE RECENT MEETINGS.

ONE OF THOSE CHANGES IS THE ADDITION OF A PARAGRAPH ON PAGE SEVEN. THIS IS THE SECOND PARAGRAPH ON THE PAGE. I WILL READ THIS PARAGRAPH IN ITS ENTIRETY AS IT IS A SHORT PARAGRAPH. QUOTE:

> "IF A WELL IS PRODUCING THROUGH A COMPRESSOR THAT IS LOCATED BETWEEN THE WELLHEAD AND THE METER RUN, THE METER RUN PRESSURE AND THE WELLHEAD CASING PRESSURE AND THE WELLHEAD TUBING PRESSURE ARE TO BE REPORTED ON FORM C-122-A. (NEITHER THE SUCTION PRESSURE NOR THE DISCHARGE PRESSURE OF THE COMPRESSOR IS CONSIDERED WELLHEAD PRESSURE.) A NOTE SHALL BE ENTERED IN THE REMARKS PORTION ON FORM C-122-A STATING 'THIS WELL PRODUCES THROUGH A COMPRESSOR'."

THIS PARAGRAPH HAS BEEN PLACED INTO THE PROCEDURE BECAUSE WE BELIEVE THAT THERE ARE (OR HAVE BEEN) TESTERS IN THE AREA THAT HAVE NOT FULLY UNDERSTOOD WHAT THE CORRECT PROCEDURE SHOULD BE WHEN A COMPRESSOR IS IN USE ON AN INDIVIDUAL WELL.

THE COMMITTEE BELIEVES THAT THIS TESTING PROCEDURE WILL DEFINE THE TYPES OF TESTS THAT ARE REQUIRED IN THE SAN JUAN BASIN, AND THAT EVERYONE TESTING WELLS IN THE AREA WILL DO IT IN THE SAME MANNER. AT LEAST, THIS IS OUR INTENTION.

ALONG WITH THIS TEXT, WE ARE SUBMITTING A GROUP OF TABLES TO BE INCORPORATED INTO THE TEST MANUAL. THESE TABLES INCLUDE:

1. A TABLE OF VALUES OF $1-e^{-S}$ CALCULATED FOR VARIOUS VALUES OF GRAVITY TIMES LENGTH.

2. A SET OF TABLES FOR FRICTION FACTORS (F_c) FOR SMALL AND LARGE SIZE TUBING AND FOR ANNULAR FLOW WITH VARIOUS COMBINATIONS OF CASING AND TUBING SIZES.

3. A TABLE OF FLOW RATES DETERMINED FROM PITOT TUBE IMPACT PRESSURE READINGS FOR WELL TESTS TO DETERMINE THE OPEN FLOW POTENTIAL OF THE WELL. THESE TABLES HAVE IMPACT PRESSURES MEASURED IN INCHES OF WATER, OUNCES PER SQUARE INCH, INCHES OF MERCURY, AND POUNDS PER SQUARE INCH.

4. THE PITOT TABLES JUST MENTIONED WERE CALCULATED FOR AN ELEVATION OF 6,000 FEET. ALSO THEY WERE CALCULATED USING A GRAVITY OF THE GAS AS 0.600. THEREFORE, TO MAKE CORRECTIONS TO THE FLOW RATE IN THE PITOT TABLES FOR GAS AT OTHER THAN 0.600 A TABLE OF SPECIFIC GRAVITY CORRECTIONS IS SUBMITTED.

5. OTHER TABLES AND EXAMPLES OF CALCULATIONS FOR VARIOUS PROCEDURES ARE TO BE TAKEN FROM THE BACK PRESSURE MANUAL AS PUBLISHED BY THE NMOCC. THE COPY THAT I HAVE IS DATED AS JANUARY 1, 1966. THE PAGES OF MATERIAL THAT SHOULD BE DUPLICATED FROM THIS MANUAL AND PLACED IN THE MANUAL FOR TESTING GAS WELLS IN THE SAN JUAN BASIN ARE LISTED AS FOLLOWS: (see attached list of pages).

6. THERE ARE OTHER PAGES THAT ARE BEING SUBMITTED. ONE IS A COPY OF A FORM C-122-A THAT HAS VALUES WRITTEN IN THE VARIOUS BLANK SPACES INDICATING HOW THE VALUES ARE ENTERED AND A PAGE OF TEXT INDICATING HOW THE VALUES ARE DETERMINED.

7. A FORM C-122 IS INCLUDED WITH A PAGE OF DESCRIPTION INDICATING HOW EACH BLANK IS FILLED IN ON THAT FORM.

8. OTHER DATA?

CASE NO. 9050 AS ADVERTISED ON THE DOCKET FOR DECEMBER 3, 1986 INCLUDES LANGUAGE THAT ASKS TO DEFINE "RETESTS" IN ORDER NO. R-8170. WE FEEL THIS IS NECESSARY TO COVER THE PROCESS APPLIED TO DELIVERABILITY RETESTS AS THEY OCCUR IN THE SAN JUAN BASIN. WE ARE LOOKING FOR A PROCEDURE TO BE APPLIED TO ALL WELLS SO THAT THEY CAN BE TREATED AUTOMATICALLY, AND, ALL IN THE SAME MANNER WHEN SO NEEDED. THE DEFINITION OF DELIVERABILITY RETEST AS WE HAVE IT DEFINED AND AS WE PROPOSE THAT IT REPLACE THE RULE 9(b) THAT IS PRESENTLY IN ORDER NO. R-8170 IS:

> "RULE 9(b) DELIVERABILITY RETESTS: A change in a well's deliverability due to retest after any activity, other than routine

maintenance, which changes the deliverability of the well shall become effective the later of:

(1) the date of redelivery after such activity, such date to be indicated on the sundry notice (if a sundry notice is required) and on the remarks portion of the Form C-122-A; or

(2) 90 days prior to the date of receipt of the appropriate deliverability test report form at the appropriate Division district office.

A change in a well's deliverability due to any other reason shall become effective on the first day of the month following the month during which the retest is approved in the appropriate Division district office."

IN READING THE RULES AS WRITTEN IN ORDER NO. R- 8170, FOR THE FOUR PRORATED GAS POOLS OF NORTHWEST NEW MEXICO, I NOTICE THAT RULE 9(a) IN INCLUDED IN EACH OF THE SPECIAL POOL RULES. I FEEL THAT IT IS NOT NECESSARY TO INCLUDE RULE 9(b) IN EACH OF THE SPECIAL POOL RULES AS IT IS A COMMON RULE TO ALL OF THOSE POOLS.

PLEASE NOTE!!

THERE HAS BEEN A LITTLE BIT OF A PROBLEM IN BEING ABLE TO COMPLETE THE TESTING OF ALL THE WELLS DURING THE 1986 TEST YEAR THAT ARE REQUIRED TO BE TESTED. THE COMMITTEE AT ITS LAST MEETING THOUGHT THAT IT WOULD BE POSSIBLE TO COMPLETE THE 1986 TESTS BY MARCH 31, 1987. WITH THIS LATE COMPLETION DATE, WE THOUGHT IT MIGHT BE NECESSARY TO SUSPEND THE TESTING REQUIREMENTS FOR THOSE WELLS IN THE POOLS THAT WOULD NORMALLY BE REQUIRED TO BE TESTED IN 1987 AND THEN THOSE WELLS IN THOSE POOLS WOULD BE TESTED IN 1988. AFTER MUCH DISCUSSION IT WAS DECIDED TO MAKE THIS RECOMMENDATION TO THE DIVISION. AFTER THIS MEETING, SOME OPERATORS AND PIPELINE COMPANIES HAVE MADE INDICATIONS THAT THEY WOULD PREFER TO GO AHEAD AND TEST IN THE NORMAL MANNER IN 1987. FOR ADDITIONAL DATA CONCERNING THIS POINT I BEG THE EXAMINERS INDULGENCE TO HEAR REPORTS FROM THOSE OPERATORS AND PIPELINES THAT ARE PRESENT AND TAKE ACTION AS FURTHER RECOMMENDED.

THIS TOO!!

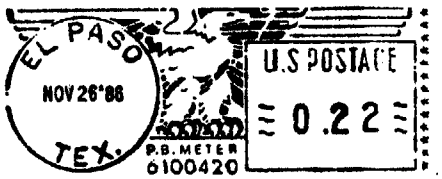
HOWEVER, IN THE EVENT THE DIVISION DOES CHOOSE TO SUSPEND THE TESTING FOR 1987, IT IS OUR FIRM RECOMMENDATION THAT SHUT IN PRESSURE TESTS BE SCHEDULED FOR MEASUREMENT WITH A MINIMUM OF SEVEN DAYS PRE-FLOW PRIOR TO BEING SHUTIN; AND, THAT FULL DELIVERABILITY TESTS BE CONDUCTED ON WELLS THAT HAVE NOT MET THE REQUIREMENT OF HAVING FILED AT LEAST THREE ANNUAL DELIVERABILITY TESTS BEFORE BEING PLACED ON THE BIENNIAL TESTING SCHEDULE OR THE SUSPENSION LIST FOR 1987.

WELL TESTING IN NON-PRORATED POOLS WOULD NOT BE SUSPENDED FOR 1987 AND THE TESTS WOULD BE SCHEDULED AND TESTED ACCORDING TO THE NORMAL PROCEDURE.

I SUBMIT TO THE EXAMINER A LIST OF NAME AND ADDRESSES THAT I HAVE COMBINED AS MEMBERS OF THE NMOCD DELIVERABILITY TEST COMMITTEE AS IT HAS PROGRESSED THROUGH THESE NEARLY 3 YEARS, AND I EXPRESS MY THANKS TO EACH AND ALL OF THEM FOR THEIR PATIENCE AND THOUGHTFUL WORK IN MAKING THIS MANUAL POSSIBLE.

El Paso

P. O. BOX 1492
EL PASO, TEXAS 79978



FM-SS-0013

MICHAEL E. STOGNER
NMOCD
P.O. BOX 2088
SANTA FE, NM 87501

MEMORANDUM

To: **Deliverability Test Committee**

From: **H. L. Babe Kendrick**

Date: **November 18, 1986**

This morning I found the opportunity to write up a couple of tables to be included in the Manual for the San Juan Basin. These tables are for the temperature corrections and for the specific gravity corrections for gas flow through flow nipples measured with a pitot tube or with the pressure on the choke. You will note that the temperature chart has 60°F as the base temperature with a correction of 1.000 and the specific gravity table has a gravity of 0.600 as the base and is not with a 1.000 specific gravity base. In making the tables for Pitot Tube Flow and for Friction Factors for various sizes of flow strings, I tried to make the coefficients using a temperature and specific gravity base of 60°F and 0.600 respectively. I hope that I have done the jobs correctly.

Again I plead with you to look these over very, very carefully to see if they are prepared correctly **and** are they done in the manner that you want them.

For the supercompressibility tables, how about using the first page out of the old publication that was reprinted by the NMOCD that originally came from the California Gas Association (or where—ever they came from). I do not have a copy of it here in El Paso, but as I remember the listing on the first page, it would cover most of the gas tested provided the pressure was above 50 psi or maybe it was 500 psi. What I am getting at is to print the least amount of tables that are necessary to get the job done. If this table is not adequate, then we might have to duplicate the tables that are in the Back Pressure Test Manual for New Mexico. (I think they are only 67 pages.)

So far I have not made the tables for choke coefficients. Do you have one made that can be used??

After today, I will be in the office in El Paso 4 days before the hearing on the 3rd of December. Those dates are November 21, 25, 26, and December 1. If you have things to help us, let me know and send it in. Thank you.

Please look this over good and let me know what changes need to be made.

I have noticed that December 3rd is racing along at an unprecedented speed. I hope that I can get through before it gets me.

Babe

Observed Temp. °F	0	1	2	3	4	5	6	7	8	9
0	1.063	1.062	1.061	1.060	1.059	1.057	1.056	1.055	1.054	1.053
10	1.052	1.051	1.050	1.049	1.047	1.046	1.045	1.044	1.043	1.042
20	1.041	1.040	1.039	1.038	1.037	1.035	1.034	1.033	1.032	1.031
30	1.030	1.029	1.028	1.027	1.026	1.025	1.024	1.023	1.022	1.021
40	1.020	1.019	1.018	1.017	1.016	1.015	1.014	1.013	1.012	1.011
50	1.010	1.009	1.008	1.007	1.006	1.005	1.004	1.003	1.002	1.001
60	1.000	.9990	.9981	.9971	.9962	.9952	.9943	.9933	.9924	.9915
70	.9905	.9896	.9887	.9877	.9868	.9859	.9850	.9840	.9831	.9822
80	.9813	.9804	.9795	.9786	.9777	.9768	.9759	.9750	.9741	.9732
90	.9723	.9715	.9706	.9697	.9688	.9680	.9671	.9662	.9653	.9645
100	.9636	.9628	.9619	.9611	.9602	.9594	.9585	.9577	.9568	.9560
110	.9551	.9543	.9535	.9526	.9518	.9510	.9501	.9493	.9485	.9477
120	.9469	.9460	.9452	.9444	.9436	.9428	.9420	.9412	.9404	.9396
130	.9388	.9380	.9372	.9364	.9356	.9349	.9341	.9333	.9325	.9317
140	.9309	.9302	.9294	.9286	.9279	.9271	.9263	.9256	.9248	.9240
150	.9233	.9225	.9218	.9210	.9203	.9195	.9188	.9180	.9173	.9166
160	.9158	.9151	.9143	.9136	.9129	.9121	.9114	.9107	.9100	.9092
170	.9085	.9078	.9071	.9064	.9056	.9049	.9042	.9035	.9028	.9021
180	.9014	.9007	.9000	.8993	.8986	.8979	.8972	.8965	.8958	.8951
190	.8944	.8937	.8931	.8924	.8917	.8910	.8903	.8896	.8890	.8883
200	.8876	.8870	.8863	.8856	.8849	.8843	.8836	.8830	.8823	.8816
210	.8810	.8803	.8797	.8790	.8784	.8777	.8771	.8764	.8758	.8751
220	.8745	.8738	.8732	.8726	.8719	.8713	.8706	.8700	.8694	.8687
230	.8681	.8675	.8669	.8662	.8656	.8650	.8644	.8637	.8631	.8625
240	.8619	.8613	.8607	.8601	.8594	.8588	.8582	.8576	.8570	.8564
250	.8558	.8552	.8546	.8540	.8534	.8528	.8522	.8516	.8510	.8504

Specific Gravity	0.0	.001	.002	.003	.004	.005	.006	.007	.008	.009
.510	1.085	1.084	1.083	1.081	1.080	1.079	1.078	1.077	1.076	1.075
.520	1.074	1.073	1.072	1.071	1.070	1.069	1.068	1.067	1.066	1.065
.530	1.064	1.063	1.062	1.061	1.060	1.059	1.058	1.057	1.056	1.055
.540	1.054	1.053	1.052	1.051	1.050	1.049	1.048	1.047	1.046	1.045
.550	1.044	1.044	1.043	1.042	1.041	1.040	1.039	1.038	1.037	1.036
.560	1.035	1.034	1.033	1.032	1.031	1.031	1.030	1.029	1.028	1.027
.570	1.026	1.025	1.024	1.023	1.022	1.022	1.021	1.020	1.019	1.018
.580	1.017	1.016	1.015	1.014	1.014	1.013	1.012	1.011	1.010	1.009
.590	1.008	1.008	1.007	1.006	1.005	1.004	1.003	1.003	1.002	1.001
.600	1.000	.9992	.9983	.9975	.9967	.9959	.9950	.9942	.9934	.9926
.610	.9918	.9910	.9901	.9893	.9885	.9877	.9869	.9861	.9853	.9845
.620	.9837	.9829	.9822	.9814	.9806	.9798	.9790	.9782	.9775	.9767
.630	.9759	.9751	.9744	.9736	.9728	.9721	.9713	.9705	.9698	.9690
.640	.9682	.9675	.9667	.9660	.9652	.9645	.9637	.9630	.9623	.9615
.650	.9608	.9600	.9593	.9586	.9578	.9571	.9564	.9556	.9549	.9542
.660	.9535	.9527	.9520	.9513	.9506	.9499	.9492	.9484	.9477	.9470
.670	.9463	.9456	.9449	.9442	.9435	.9428	.9421	.9414	.9407	.9400
.680	.9393	.9386	.9380	.9373	.9366	.9359	.9352	.9345	.9339	.9332
.690	.9325	.9318	.9312	.9305	.9298	.9291	.9285	.9278	.9271	.9265
.700	.9258	.9252	.9245	.9238	.9232	.9225	.9219	.9212	.9206	.9199
.710	.9193	.9186	.9180	.9173	.9167	.9161	.9154	.9148	.9141	.9135
.720	.9129	.9122	.9116	.9110	.9103	.9097	.9091	.9085	.9078	.9072
.730	.9066	.9060	.9054	.9047	.9041	.9035	.9029	.9023	.9017	.9011
.740	.9005	.8998	.8992	.8986	.8980	.8974	.8968	.8962	.8956	.8950
.750	.8944	.8938	.8932	.8926	.8921	.8915	.8909	.8903	.8897	.8891
.760	.8885	.8879	.8874	.8868	.8862	.8856	.8850	.8845	.8839	.8833
.770	.8827	.8822	.8816	.8810	.8805	.8799	.8793	.8787	.8782	.8776
.780	.8771	.8765	.8759	.8754	.8748	.8743	.8737	.8731	.8726	.8720
.790	.8715	.8709	.8704	.8698	.8693	.8687	.8682	.8677	.8671	.8666
.800	.8660	.8655	.8649	.8644	.8639	.8633	.8628	.8623	.8617	.8612
.810	.8607	.8601	.8596	.8591	.8585	.8580	.8575	.8570	.8564	.8559
.820	.8554	.8549	.8544	.8538	.8533	.8528	.8523	.8518	.8513	.8507
.830	.8502	.8497	.8492	.8487	.8482	.8477	.8472	.8467	.8462	.8457
.840	.8452	.8447	.8441	.8436	.8431	.8427	.8422	.8417	.8412	.8407
.850	.8402	.8397	.8392	.8387	.8382	.8377	.8372	.8367	.8362	.8358
.860	.8353	.8348	.8343	.8338	.8333	.8329	.8324	.8319	.8314	.8309
.870	.8305	.8300	.8295	.8290	.8286	.8281	.8276	.8271	.8267	.8262
.880	.8257	.8253	.8248	.8243	.8239	.8234	.8229	.8225	.8220	.8215
.890	.8211	.8206	.8201	.8197	.8192	.8188	.8183	.8179	.8174	.8170
.900	.8165	.8160	.8156	.8151	.8147	.8142	.8138	.8133	.8129	.8124
.910	.8120	.8116	.8111	.8107	.8102	.8098	.8093	.8089	.8085	.8080
.920	.8076	.8071	.8067	.8063	.8058	.8054	.8050	.8045	.8041	.8037
.930	.8032	.8028	.8024	.8019	.8015	.8011	.8006	.8002	.7998	.7994
.940	.7989	.7985	.7981	.7977	.7972	.7968	.7964	.7960	.7956	.7951
.950	.7947	.7943	.7939	.7935	.7931	.7926	.7922	.7918	.7914	.7910
.960	.7906	.7902	.7897	.7893	.7889	.7885	.7881	.7877	.7873	.7869
.970	.7865	.7861	.7857	.7853	.7849	.7845	.7841	.7837	.7833	.7829
.980	.7825	.7821	.7817	.7813	.7809	.7805	.7801	.7797	.7793	.7789
.990	.7785	.7781	.7777	.7773	.7769	.7765	.7762	.7758	.7754	.7750

PITOT TUBE TABLES FOR SAN JUAN BASIN

The Pitot Tube Tables on the accompanying pages were calculated using the equations found in Handbook of Natural Gas Engineering by Katz, Cornell, Kobayashi, Poettmann, Vary, Elenbaas, and Weinaug as published by McGraw-Hill Book Company. The atmospheric pressure at an elevation of 6,000 feet, which was selected as an average elevation for wells in the San Juan Basin area of northwest New Mexico, was calculated using the following equation:

$$P_{atmos} = \frac{55906 - (\text{elevation} - 361)}{55906 + (\text{elevation} - 361)} = 11.88374117$$

Using this pressure in the formula

$$Q = C\, D^2\, (h_v\, P / G)^{0.5}$$ Mcf/day at a pressure base of 14.7 and a gas gravity of 0.600.

where:

$$C = 31.14371055$$

Correcting to a pressure base of 15.025 then

$$Q = 30.47005292\, D^2\, (h_v)^{0.5}$$ Mcf/day

where:

D = pipe diameter in inches
h_v = impact-velocity head in inches of water

Note: The values in the accompanying tables were calculated by use of an Apple Lisa computer and the values shown for C were not individually calculated.

El Paso Natural Gas Company
P. O. Box 1492
El Paso, Texas 79978

April 2, 1986

Mr. Al Greer, P. E.
211 Petroleum Center Building
Farmington, New Mexico 87401

Dear Al:

Thank you for your letter of September 5, 1985 enlightening me about calculations necessary for Pitot Tube Tables for the San Juan Basin.

I have used your data and followed through with the calculations for a set of tables to be used and in this data I arbitrarily used the atmospheric pressure at an elevation of 6,000 feet which calculates to be 11.88.....thinking that a 6,000 foot elevation should be about the average for wells in the San Juan Basin.

Al, if you have an opportunity to look at some of this data, one more time, I would certainly appreciate it.

The pages I have enclosed with this letter are numbered 1, 2, 23, 24, 46, 47, and 58 which are laid out in rectangles with a formula written in to tell what was done to get the answer that is in each block. Each block is identified by a letter and number as: Q1 and Q11. The value in each block can be used to multiply (or + − /) with other values from other blocks. Page 1 would represent the upper left corner of a large page. Page 2 fits immediately below page 1. Page 23 fits immediately to the right of page 1 and page 24 fits to the right of page 2. Then page 45 fits to the right of page 23 and page 46 fits to the right of page 24.

The calculation for atmospheric pressure at 6,000 feet was done in block S7 on page 45. (Data in blocks S5 and S6 was used in block S7.)

Various portions of the flow formulas from Katz appear in blocks Q1, Q3, Q7, Q9, Q10, all on page 45 and in block Q11 on page 46. Block Q12 was used merely to show a value of C = 30.47005292 at a pressure base of 15.025. Block Q12 was not used in the calculations of the tables elsewhere as I had put the pressure base correction to 15.025 into each separate block as you con see in block D7 on page 1.

Page 58 has a value shown in block Q112 which is the conversion factor I used to convert pressure in inches of water to pressure in pounds per square inch. Multiply inches of water times Q112 equals psi.

To convert from pressure in inches of water to pressure in inches of mercury, I divided the reading in inches of water by 13.59.

To convert from pressure in inches of mercury to pressure in psi, I multiplied the reading in inches of mercury by 14.676 divided by 29.92.

When impact pressures exceeded what might be measured in inches of water, the table was made to progress in inches of mercury. To change the formula to calculate these flow rates I multiplied the reading in inches of mercury by 13.59 to convert that reading into inches of water. (From 3" Hg to 30" Hg.)

When impact pressures exceeded what might be measured in inches of mercury, the table was made to progress in pounds per square inch. To change the formula to calculate these flow rates I multiplied the reading in psi by 144 times 12 divided by 62.428 to convert that reading into inches of water. (From 15 psi to end of table.)

All calculated values were made to fourteen significant figures and only the final values in Mcf/day were rounded to the nearest integer.

I have also enclosed 6 pages which will be the table printed in the test manual if these values are correct.

Al, I certainly do appreciate all you have done to help in making these tables as correct as possible and someday soon, I hope to see them in print by the NMOCD.

Sincerely,

H. L. Kendrick

FRICTION FACTORS (Fc) FOR LARGE DIAMETER FLOW STRINGS								
CASING NOMINAL SIZE INCHES	CASING WEIGHT POUNDS PER FT.	CASING INSIDE DIAMETER INCHES	FRICTION FACTOR Fc		CASING NOMINAL SIZE INCHES	CASING WEIGHT POUNDS PER FT.	CASING INSIDE DIAMETER INCHES	FRICTION FACTOR Fc
5.000	15.00	4.408	1.187		7.625	47.10	6.375	.4577
5.000	13.00	4.494	1.129		7.625	45.00	6.445	.4450
5.000	11.50	4.560	1.087		7.625	42.80	6.501	.4352
					7.625	39.00	6.625	.4144
					7.625	33.70	6.765	.3927
5.500	25.00	4.580	1.075		7.625	29.70	6.875	.3766
5.500	23.00	4.670	1.022		7.625	26.40	6.969	.3637
5.500	20.00	4.778	.9637		7.625	24.00	7.025	.3562
5.500	17.00	4.892	.9068					
5.500	15.50	4.950	.8796					
5.500	15.00	4.976	.8678		8.625	49.00	7.511	.2997
5.500	14.00	5.012	.8518		8.625	44.00	7.651	.2858
5.500	13.00	5.044	.8379		8.625	43.00	7.625	.2883
					8.625	40.00	7.725	.2787
					8.625	38.00	7.775	.2741
6.000	26.00	5.140	.7981		8.625	36.00	7.825	.2696
6.000	23.00	5.240	.7594		8.625	32.00	7.907	.2625
6.000	20.00	5.352	.7190		8.625	32.00	7.921	.2613
6.000	18.00	5.424	.6946		8.625	28.00	8.003	.2544
6.000	17.00	5.450	.6861		8.625	28.00	8.017	.2533
6.000	15.00	5.524	.6626		8.625	24.00	8.097	.2469
					8.625	20.00	8.191	.2396
					8.625	17.50	8.249	.2353
6.625	34.00	5.595	.6411					
6.625	32.00	5.675	.6181					
6.625	28.00	5.791	.5866		9.625	58.00	8.435	.2221
6.625	26.00	5.855	.5702		9.625	53.50	8.535	.2155
6.625	24.00	5.921	.5539		9.625	47.00	8.681	.2062
6.625	22.00	5.989	.5378		9.625	43.50	8.755	.2018
6.625	20.00	6.049	.5242		9.625	40.00	8.835	.1971
					9.625	36.00	8.921	.1922
					9.625	32.30	9.001	.1878
7.000	40.00	5.836	.5750					
7.000	38.00	5.920	.5542					
7.000	35.00	6.004	.5344					
7.000	32.00	6.094	.5142					
7.000	30.00	6.154	.5014					
7.000	29.00	6.184	.4951					
7.000	28.00	6.214	.4890					
7.000	26.00	6.276	.4766					
7.000	24.00	6.336	.4650					
7.000	23.00	6.366	.4594					
7.000	22.00	6.398	.4535					
7.000	20.00	6.456	.4430					
7.000	17.00	6.538	.4288					

FRICTION	FACTORS	(Fc)	FOR	ANNUL	AR FLO	W IN	GAS	WELL	FLOW	STRINGS
CASING	CASING	CASING				TUBING		SIZES		
OUTSIDE	WEIGHT	INSIDE			OUTSIDE		DIAMETE	R	INCHES	
DIAMETER	POUNDS	DIAMETER								
INCHES	PER FT.	INCHES		1.050	1.315	1.660	1.900	2.0625	2.375	2.875
2.375	5.95	1.867		27.12	46.77	205.1				
2.375	4.70	1.995		20.54	32.13	91.08	651.7			
2.375	4.00	2.041		18.75	28.51	73.10	340.8			
2.875	8.70	2.259		12.71	17.53	33.29	71.59	182.0		
2.875	6.50	2.441		9.609	12.56	20.74	35.41	60.71	948.2	
3.500	12.95	2.750		6.389	7.848	11.27	15.96	21.71	54.16	
3.500	9.30	2.992		4.846	5.762	7.733	10.13	12.71	23.17	309.3
3.500	7.70	3.068		4.472	5.271	6.957	8.949	11.03	18.95	136.3
4.000	11.60	3.428		3.156	3.605	4.479	5.411	6.295	9.055	23.54
4.000	11.00	3.476		3.024	3.442	4.250	5.102	5.902	8.358	20.43
4.000	10.40	3.500		2.960	3.364	4.141	4.957	5.719	8.039	19.11
4.000	*9.50	3.548		2.839	3.216	3.936	4.685	5.378	7.455	16.83
4.500	15.10	3.826		2.259	2.518	2.995	3.467	3.886	5.054	9.241
4.500	13.50	3.920		2.100	2.331	2.749	3.159	3.518	4.499	7.828
4.500	12.75	3.958		2.040	2.260	2.658	3.045	3.383	4.300	7.349
4.500	11.60	4.000		1.977	2.186	2.563	2.927	3.243	4.095	6.870
4.500	10.50	4.052		1.903	2.099	2.451	2.789	3.081	3.861	6.339
4.500	9.50	4.090		1.851	2.039	2.374	2.694	2.970	3.702	5.990
5.000	24.10	4.000		1.977	2.186	2.563	2.927	3.243	4.095	6.870
5.000	21.40	4.126		1.803	1.984	2.304	2.609	2.870	3.561	5.685
5.000	21.00	4.154		1.768	1.942	2.251	2.545	2.796	3.456	5.464
5.000	18.00	4.276		1.623	1.775	2.042	2.291	2.503	3.048	4.637
5.000	15.00	4.408		1.485	1.616	1.845	2.056	2.233	2.682	3.938
5.000	13.00	4.494		1.403	1.524	1.731	1.921	2.080	2.478	3.564
5.000	11.50	4.560		1.345	1.457	1.650	1.826	1.972	2.336	3.312
5.500	25.00	4.580		1.326	1.436	1.627	1.799	1.941	2.295	3.241
5.500	23.00	4.670		1.249	1.356	1.527	1.682	1.809	2.124	2.948
5.500	20.00	4.778		1.170	1.258	1.418	1.556	1.668	1.943	2.645
5.500	17.00	4.892		1.094	1.173	1.315	1.437	1.536	1.775	2.373
5.500	15.50	4.950		1.058	1.133	1.257	1.381	1.474	1.697	2.250
5.500	15.00	4.976		1.043	1.115	1.237	1.357	1.447	1.664	2.198
5.500	14.00	5.012		1.022	1.092	1.209	1.325	1.412	1.619	2.129
5.500	13.00	5.044		1.003	1.072	1.185	1.298	1.381	1.581	2.070

FRICTION	FACTORS	(Fo)	FOR	ANNUL	AR FLO	w IN	GAS	WELL	FLOW	STRINGS
CASING	CASING	CASING				TUBING		SIZES		
OUTSIDE	WEIGHT	INSIDE			OUTSIDE		DIAMETE	R	INCHES	
DIAMETER	POUNDS	DIAMETER								
INCHES	PER FT.	INCHES		1.050	1.315	1.660	1.900	2.0625	2.375	2.875
6.000	26.00	5.140		.9513	1.014	1.118	1.209	1.295	1.475	1.907
6.000	23.00	5.240		.9011	.9588	1.054	1.136	1.202	1.374	1.757
6.000	20.00	5.352		.8492	.9017	.9875	1.062	1.121	1.260	1.609
6.000	18.00	5.424		.8179	.8674	.9480	1.018	1.073	1.202	1.523
6.000	17.00	5.450		.8071	.8555	.9343	1.002	1.056	1.182	1.493
6.000	15.00	5.524		.7772	.8229	.8968	.9605	1.011	1.127	1.414
6.625	34.00	5.595		.7500	.7931	.8628	.9226	.9697	1.079	1.344
6.625	32.00	5.675		.7209	.7614	.8267	.8825	.9262	1.027	1.254
6.625	28.00	5.791		.6814	.7185	.7780	.8285	.8680	.9588	1.161
6.625	26.00	5.855		.6609	.6963	.7528	.8008	.8381	.9238	1.113
6.625	24.00	5.921		.6407	.6744	.7280	.7735	.8088	.8896	1.067
6.625	22.00	5.989		.6208	.6528	.7037	.7467	.7801	.8563	1.023
6.625	20.00	6.049		.6039	.6345	.6832	.7242	.7560	.8283	.9855
7.000	40.00	5.836		.6669	.7028	.7601	.8089	.8469	.9340	1.127
7.000	38.00	5.920		.6410	.6747	.7284	.7739	.8093	.8901	1.068
7.000	35.00	6.004		.6165	.6481	.6985	.7410	.7740	.8492	1.013
7.000	32.00	6.094		.5916	.6213	.6684	.7080	.7386	.8082	.9590
7.000	30.00	6.154		.5758	.6043	.6493	.6871	.7163	.7825	.9252
7.000	29.00	6.184		.5681	.5960	.6400	.6769	.7055	.7700	.9089
7.000	28.00	6.214		.5606	.5879	.6310	.6670	.6949	.7579	.8931
7.000	26.00	6.276		.5455	.5716	.6128	.6472	.6737	.7336	.8616
7.000	24.00	6.336		.5313	.5564	.5959	.6288	.6541	.7112	.8326
7.000	23.00	6.366		.5245	.5490	.5877	.6199	.6446	.7003	.8187
7.000	22.00	6.398		.5173	.5413	.5791	.6105	.6347	.6890	.8041
7.000	20.00	6.456		.5046	.5277	.5640	.5941	.6173	.6692	.7768
7.000	17.00	6.538		.4874	.5093	.5436	.5720	.5938	.6425	.7448
7.625	47.10	6.375		.5224	.5469	.5852	.6172	.6418	.6971	.8145
7.625	45.00	6.445		.5070	.5303	.5668	.5972	.6205	.6729	.7835
7.625	42.80	6.501		.4951	.5175	.5527	.5818	.6042	.6543	.7599
7.625	39.00	6.625		.4700	.4907	.5230	.5498	.5702	.6158	.7111
7.625	33.70	6.765		.4439	.4628	.4922	.5165	.5349	.5760	.6613
7.625	29.70	6.875		.4247	.4424	.4698	.4923	.5094	.5473	.6256
7.625	26.40	6.969		.4092	.4259	.4517	.4728	.4889	.5244	.5973
7.625	24.00	7.025		.4004	.4165	.4414	.4618	.4772	.5114	.5813

FRICTION	FACTORS	(Fc)	FOR	ANNUL	AR FLO	W IN	GAS	WELL	FLOW	STRINGS
CASING	CASING	CASING				TUBING		SIZES		
OUTSIDE	WEIGHT	INSIDE			OUTSIDE		DIAMETE	R	INCHES	
DIAMETER	POUNDS	DIAMETER								
INCHES	PER FT.	INCHES		1.050	1.315	1.660	1.900	2.0625	2.375	2.875
8.625	49.00	7.511		.3337	.3458	.3644	.3794	.3908	.4155	.4650
8.625	44.00	7.651		.3174	.3286	.3458	.3596	.3700	.3926	.4377
8.625	43.00	7.625		.3203	.3317	.3491	.3632	.3737	.3967	.4426
8.625	40.00	7.725		.3092	.3200	.3364	.3497	.3596	.3812	.4242
8.625	38.00	7.775		.3038	.3144	.3303	.3432	.3528	.3738	.4155
8.625	36.00	7.825		.2986	.3088	.3244	.3369	.3463	.3666	.4069
8.625	32.00	7.907		.2903	.3001	.3149	.3269	.3358	.3552	.3935
8.625	32.00	7.921		.2889	.2986	.3134	.3252	.3341	.3533	.3912
8.625	28.00	8.003		.2810	.2903	.3044	.3157	.3241	.3424	.3785
8.625	28.00	8.017		.2796	.2889	.3029	.3141	.3225	.3406	.3764
8.625	24.00	8.097		.2722	.2811	.2945	.3053	.3133	.3306	.3646
8.625	20.00	8.191		.2639	.2723	.2851	.2953	.3029	.3193	.3515
8.625	17.50	8.249		.2589	.2671	.2795	.2894	.2967	.3126	.3437
9.625	58.00	8.435		.2438	.2513	.2625	.2715	.2781	.2925	.3203
9.625	53.50	8.535		.2362	.2433	.2540	.2625	.2688	.2824	.3087
9.625	47.00	8.681		.2256	.2323	.2422	.2501	.2560	.2685	.2928
9.625	43.50	8.755		.2205	.2269	.2365	.2441	.2498	.2618	.2851
9.625	40.00	8.835		.2152	.2214	.2306	.2379	.2433	.2549	.2772
9.625	36.00	8.921		.2097	.2156	.2245	.2315	.2367	.2477	.2690
9.625	32.30	9.001		.2047	.2104	.2190	.2257	.2307	.2413	.2617

Case File
Dec 3

MEMORANDUM

To: **Deliverability Test Committee**

From: **H. L. Babe Kendrick**

Case 9050

Date: **November 17, 1986**

Attached is a table for Pitot Tube Test Values for your edification. This thing was done quite rapidly from the latest table you have, and I have not had an opportunity to even scan the pages to see just how many things are wrong.

Please look this over good and let me know what changes need to be made.

I have noticed that December 3rd is coming around the corner fast.. I hope that I can out run it.....

Babe

PITOT	TUBE	IMPACT	PRESSURE	FLOW	NIPPLE	INSIDE	DIAMETER
INCHES WATER	OUNCES/ SQ. IN.	INCHES MERCURY	LBS. PER SQ. IN.	1" nominal actual dia.	2" nominal actual dia.	3" nominal actual dia.	4" nominal actual dia.
				1.049	2.067	3.068	4.026
.1				11	41	91	156
.2				15	58	128	221
.3				18	71	157	271
.4				21	82	181	312
.5				24	92	203	349
.6				26	101	222	383
.7				28	109	240	413
.8				30	116	257	442
.9	.52			32	124	272	469
1.0				34	130	287	494
1.1				35	137	301	518
1.2				37	143	314	541
1.3				38	148	327	563
1.4				40	154	339	584
1.5				41	159	351	605
1.6				42	165	363	625
1.7	.98			44	170	374	644
1.8				45	175	385	663
1.9				46	179	395	681
2.0				47	184	406	698
2.1				49	189	416	716
2.2				50	193	425	733
2.3				51	197	435	749
2.4				52	202	444	765
2.5				53	206	453	781
2.6	1.50			54	210	462	796
2.7		.20		55	214	471	812
2.8				56	218	480	826
2.9				57	222	488	841
3.0				58	225	497	855
3.1				59	229	505	870
3.2				60	233	513	883
3.3				61	236	521	897
3.4				62	240	529	911
3.5	2.02			63	244	537	924
3.6				64	247	544	937
3.7				64	250	552	950
3.8				65	254	559	963
3.9				66	257	566	975
4.0				67	260	574	988
4.1		.30		68	264	581	1,000
4.2				69	267	588	1,012
4.3	2.49			70	270	595	1,024
4.4				70	273	602	1,036
4.5				71	276	608	1,048
4.6				72	279	615	1,059

PITOT	TURF	IMPACT	PRESSURE	FLOW	NIPPLE	INSIDE	DIAMETER
INCHES WATER	OUNCES/ SQ. IN.	INCHES MERCURY	LBS. PER SQ. IN.	1" nominal actual dia.	2" nominal actual dia.	3" nominal actual dia.	4" nominal actual dia.
				1.049	2.067	3.068	4.026
4.7				73	282	622	1,071
4.8				73	285	628	1,082
4.9				74	288	635	1,093
5.0				75	291	641	1,104
5.1				76	294	648	1,115
5.2	3.01			76	297	654	1,126
5.3				77	300	660	1,137
5.4		.40		78	303	666	1,148
5.5				79	305	673	1,158
5.6				79	308	679	1,169
5.7				80	311	685	1,179
5.8				81	314	691	1,189
5.9				81	316	697	1,200
6.0				82	319	703	1,210
6.1	3.53			83	322	708	1,220
6.2				83	324	714	1,230
6.3				84	327	720	1,240
6.4				85	329	726	1,249
6.5				85	332	731	1,259
6.6				86	334	737	1,269
6.7				87	337	742	1,278
6.8		.50		87	339	748	1,288
6.9	3.99		.25	88	342	753	1,297
7.0				89	344	759	1,307
7.1				89	347	764	1,316
7.2				90	349	770	1,325
7.3				91	352	775	1,334
7.4				91	354	780	1,343
7.5				92	357	785	1,353
7.6				92	359	791	1,362
7.7				93	361	796	1,370
7.8	4.51			94	364	801	1,379
7.9				94	366	806	1,388
8.0				95	368	811	1,397
8.1				95	371	816	1,406
8.2		.60		96	373	821	1,414
8.3				97	375	826	1,423
8.4				97	377	831	1,431
8.5				98	380	836	1,440
8.6				98	382	841	1,448
8.7	5.03			99	384	846	1,457
8.8				99	386	851	1,465
8.9				100	388	856	1,473
9.0				101	391	860	1,482
9.1				101	393	865	1,490
9.2				102	395	870	1,498

PITOT	TUBE	IMPACT	PRESSURE	FLOW	NIPPLE	INSIDE	DIAMETER
INCHES	OUNCES/	INCHES	LBS. PER	1" nominal	2" nominal	3" nominal	4" nominal
WATER	SQ. IN.	MERCURY	SQ. IN.	actual dia.	actual dia.	actual dia.	actual dia.
				1.049	2.067	3.068	4.026
9.3				102	397	875	1,506
9.4				103	399	879	1,514
9.5	5.49	.70		103	401	884	1,522
9.6				104	403	889	1,530
9.7				104	405	893	1,538
9.8				105	408	898	1,546
9.9				105	410	902	1,554
10.0				106	412	907	1,562
10.1				107	414	911	1,570
10.2		.75		107	416	916	1,577
10.3				108	418	920	1,585
10.4	6.01			108	420	925	1,593
10.5				109	422	929	1,600
10.6				109	424	934	1,608
10.7				110	426	938	1,616
10.8		.79		110	428	943	1,623
10.9		.80		111	430	947	1,631
11.0				111	432	951	1,638
11.1				112	434	956	1,645
11.2				112	436	960	1,653
11.3	6.53			113	438	964	1,660
11.4				113	440	968	1,668
11.5				114	441	973	1,675
11.6				114	443	977	1,682
11.7				115	445	981	1,689
11.8				115	447	985	1,697
11.9				116	449	989	1,704
12.0				116	451	994	1,711
12.1	6.99			117	453	998	1,718
12.2				117	455	1,002	1,725
12.3				118	457	1,006	1,732
12.4				118	458	1,010	1,739
12.5				119	460	1,014	1,746
*13.0	7.50			121	469	1,033	1,779
	7.75	.99		123	477	1,050	1,808
	8.00		.50	125	484	1,067	1,837
	8.25			127	492	1,084	1,866
	8.50			129	499	1,100	1,894
	8.75			130	507	1,116	1,922
	9.00			132	514	1,132	1,949
	9.25			134	521	1,147	1,976
	9.50			136	528	1,163	2,002
	9.75	1.24		138	535	1,178	2,028
	10.00			139	541	1,193	2,054
	10.25			141	548	1,208	2,080
18.2	10.50	1.34	.66	143	555	1,222	2,105

PITOT	TUBE	IMPACT	PRESSURE	FLOW	NIPPLE	INSIDE	DIAMETER
INCHES	OUNCES/	INCHES	LBS. PER	1" nominal	2" nominal	3" nominal	4" nominal
WATER	SQ. IN.	MERCURY	SQ. IN.	actual dia.	actual dia.	actual dia.	actual dia.
				1.049	2.067	3.068	4.026
19.0	11.00	1.40	.69	146	568	1,251	2,154
19.9	11.50			150	581	1,279	2,203
	12.00	1.53	.75	153	593	1,307	2,250
	12.50			156	605	1,334	2,297
	13.00			159	617	1,360	2,342
	13.50			162	629	1,386	2,387
	14.00			165	641	1,411	2,431
25.1	14.50			168	652	1,436	2,474
	15.00			171	663	1,461	2,516
	15.50	1.97		174	674	1,485	2,557
	16.00		1.00	176	685	1,509	2,598
	16.50			179	696	1,532	2,639
	17.00			182	706	1,555	2,678
30.3	17.50			184	716	1,578	2,717
	18.00			187	726	1,600	2,756
	18.50			190	736	1,623	2,794
	19.00			192	746	1,644	2,832
	19.50	2.48		195	756	1,666	2,869
	20.00		1.25	197	766	1,687	2,905
35.5	20.50			200	775	1,708	2,941
	21.00			202	785	1,729	2,977
	21.50			204	794	1,749	3,012
	22.00			207	803	1,769	3,047
	22.50			209	812	1,789	3,081
39.8	23.00			211	821	1,809	3,115
	23.50	2.99		214	830	1,829	3,149
	24.00		1.50	216	839	1,848	3,182
	24.50			218	848	1,867	3,215
	25.00			221	856	1,886	3,248
	25.50			223	865	1,905	3,280
45.0	26.00			225	873	1,924	3,312
	26.50			227	881	1,942	3,344
	27.00			229	890	1,960	3,375
	27.50	3.50		231	898	1,978	3,407
	28.00		1.75	233	906	1,996	3,437
	28.50			235	914	2,014	3,468
50.2	29.00			237	922	2,031	3,498
	29.50			240	930	2,049	3,528
	30.00			242	938	2,066	3,558
	30.50			244	946	2,083	3,588
	31.00			246	953	2,100	3,617
54.5	*31.50	4.00	1.96	247	960	2,115	3,641
		4.20		253	984	2,167	3,731
		4.40		259	1,007	2,218	3,819
		4.60		265	1,029	2,268	3,905
65.2	37.71	4.80	2.35	271	1,051	2,316	3,989

PITOT	TUBE	IMPACT	PRESSURE	FLOW	NIPPLE	INSIDE	DIAMETER
INCHES	OUNCES/	INCHES	LBS. PER	1" nominal	2" nominal	3" nominal	4" nominal
WATER	SQ. IN.	MERCURY	SQ. IN.	actual dia.	actual dia.	actual dia.	actual dia.
				1.049	2.067	3.068	4.026
68.0	39.28	5.00	2.45	276	1,079	2,864	4,071
	40.85	5.20	2.55	282	1,094	2,411	4,152
		5.40		287	1,115	2,457	4,231
		5.60		293	1,136	2,502	4,308
		5.80		298	1,156	2,546	4,385
		6.00		303	1,176	2,590	4,460
		6.20	3.04	308	1,195	2,633	4,533
	50.28	6.40		313	1,214	2,675	4,606
		6.60		318	1,233	2,716	4,677
		6.80		322	1,251	2,757	4,748
		7.00		327	1,270	2,797	4,817
		7.20	3.53	332	1,288	2,837	4,885
		7.40		336	1,306	2,876	4,953
	59.70	7.60		341	1,323	2,915	5,019
		7.80		345	1,340	2,953	5,085
		8.00		350	1,357	2,990	5,150
		8.20	4.02	354	1,374	3,028	5,214
		8.40		358	1,391	3,064	5,277
		8.60		362	1,407	3,101	5,339
		8.80		367	1,424	3,136	5,401
	70.70	9.00		371	1,440	3,172	5,462
		9.20	4.51	375	1,456	3,207	5,522
		9.40		379	1,471	3,242	5,582
	75.41	9.60		383	1,487	3,276	5,641
		9.80		387	1,502	3,310	5,700
		10.00		391	1,518	3,343	5,757
	80.13	10.20	5.00	395	1,533	3,377	5,815
		10.40		399	1,548	3,410	5,871
		10.60		402	1,562	3,442	5,928
	84.84	10.80		406	1,577	3,475	5,983
		11.00		410	1,592	3,507	6,038
		11.20	5.49	414	1,606	3,536	6,093
	89.55	11.40		417	1,620	3,570	6,147
		11.60		421	1,635	3,601	6,201
		11.80		425	1,649	3,632	6,254
	94.27	12.00		428	1,662	3,663	6,307
	95.84	12.20	5.98	432	1,676	3,693	6,359
		12.40		435	1,690	3,723	6,411
		12.60		439	1,704	3,753	6,463
	100.55	12.80		442	1,717	3,783	6,514
		13.00		446	1,730	3,812	6,565
		13.20	6.47	449	1,744	3,841	6,615
	105.26	13.40		452	1,757	3,870	6,665
		13.60		456	1,770	3,899	6,714
		13.80		459	1,783	3,928	6,763
190.3	109.98	14.00	6.87	462	1,796	3,956	6,812

PITOT	TUBE	IMPACT	PRESSURE	FLOW	NIPPLE	INSIDE	DIAMETER
INCHES	OUNCES/	INCHES	LBS. PER	1" nominal	2" nominal	3" nominal	4" nominal
WATER	SQ. IN.	MERCURY	SQ. IN.	actual dia.	actual dia.	actual dia.	actual dia.
				1.049	2.067	3.068	4.026
197.1	113.91	14.50	7.11	471	1,627	4,026	6,933
		15.00		479	1,659	4,095	7,051
		15.50		487	1,689	4,163	7,168
	125.69	16.00		494	1,920	4,229	7,283
		16.50	8.09	502	1,949	4,295	7,396
		17.00		510	1,979	4,359	7,507
		17.50		517	2,008	4,423	7,616
		18.00		524	2,036	4,486	7,724
		18.50	9.07	532	2,064	4,548	7,831
	140.25	19.00		539	2,092	4,609	7,936
		19.50		546	2,119	4,669	8,040
		20.00		553	2,146	4,728	8,142
		20.50	10.06	560	2,173	4,787	8,243
		21.00		566	2,199	4,845	8,343
		21.50		573	2,225	4,902	8,442
		22.00		580	2,251	4,959	8,540
	176.75	22.50	11.04	586	2,276	5,015	8,636
		23.00		593	2,302	5,071	8,732
		23.50		599	2,326	5,125	8,826
		24.00		606	2,351	5,180	8,919
		24.50	12.02	612	2,375	5,233	9,012
		25.00		618	2,400	5,286	9,103
	200.32	25.50		624	2,423	5,339	9,194
		26.00		630	2,447	5,391	9,284
		26.50	13.00	636	2,471	5,443	9,372
		27.00		642	2,494	5,494	9,460
		27.50		648	2,517	5,544	9,548
		28.00		654	2,539	5,595	9,634
	223.88	28.50	13.98	660	2,562	5,644	9,720
		29.00		666	2,584	5,694	9,805
		29.50		671	2,607	5,743	9,889
		30.00		677	2,629	5,791	9,972
	240.22	*30.58	15.00	683	2,653	5,844	10,063
	256.24	32.62	16.00	706	2,740	6,036	10,394
		34.66	17.00	727	2,824	6,221	10,713
		36.70	18.00	748	2,906	6,402	11,024
	304.29	38.74	19.00	769	2,985	6,577	11,326
		40.77	20.00	789	3,063	6,748	11,620
		42.81	21.00	808	3,139	6,915	11,907
		44.85	22.00	827	3,213	7,077	12,187
		46.89	23.00	846	3,285	7,237	12,461
		48.93	24.00	864	3,355	7,392	12,729
692.6	400.36	50.97	25.00	882	3,425	7,545	12,992
		53.01	26.00	899	3,492	7,694	13,249
		55.04	27.00	917	3,559	7,841	13,502
775.8	448.42	57.08	28.00	933	3,624	7,984	13,749

MEMORANDUM

To: **NMOCD Deliverability Test Committee**

From: **H. L. Babe Kendrick**

Date: **November 11, 1986**

At the Farmington meeting on November 6, 1986, it was decided to be ready to submit this testing procedure to the NMOCD for hearing on December 3, 1986. For this to happen, I must get in gear and stay in gear until the job is completed. Your help is very much needed to be a proof-reader and to furnish technical data to make some of the calculations necessary for the data book and to place the tables and other pages in proper sequence.

Today, all that I have ready for you is the documentation for the rules procedure with the paragraph added into it on page 7 as you authorized. Please read the enclosed pages and read carefully to find all the errors that may be contained therein. Please let me know of anything that is incorrect in this portion of this booklet.

Additional data will be submitted to you as I get it in what should be a "final form".

Your comments are solicited.

Babe

GAS WELL TESTING MANUAL FOR SAN JUAN BASIN, NEW MEXICO

CHAPTER I TYPE OF TESTS REQUIRED FOR WELLS COMPLETED IN PRORATED GAS POOLS

SECTION 1: Initial Deliverability and Shut-In Pressure Tests for Newly Completed Well

A. Immediately upon completion of each gas well in the San Juan Basin, a shut-in pressure test of at least seven days duration shall be made. This initial shut-in pressure shall be filed with the Division's Aztec Office on either Form C-122 or C-104.

B. Within 90 days after a well first delivers gas to a gas transportation facility, the well shall have been tested in accordance with Section 1 of Chapter II of these rules, "Initial Deliverability and Shut-In Pressure Test Procedures", and the results of the test filed in triplicate with the Division's Aztec office and one copy filed with the gas transportation facility to which the well is connected. This test is to be filed on Form C-122-A. Failure to file said test within the above-prescribed 90-day period will subject the well to the loss of one day's allowable for each day the test is late.

1. If the newly first delivered well is an infill well on a proration unit, the old well on the unit is not required to be tested provided it has a valid test on file for the current proration year. Testing of the old well follows the regularly assigned test year for the pool in which the wells are located. The new well is required to be tested annually until at least three annual tests are on file and then the well is to be tested biennially with other wells in that pool.

2. If the newly first delivered well is an infill well on a proration unit and the old well on the unit is "exempt", the old well is to be tested along with the new well for the Initial and Annual Deliverability and Shut-In Pressure Test. The old well will lose its "exempt" classification and must be tested biennially along with other wells in that pool. The new infill well is required to be tested annually until at least three annual tests are on file and then the well is to be tested biennially with other wells in that pool.

C. The requirements for Initial Tests and Annual or Biennial Deliverability and Shut-In Pressure Tests and the notification requirements and scheduling of such tests which apply to newly completed wells shall also apply to recompleted wells.

D. Any tests taken for informational purposes prior to pipeline connection shall not be recognized as official tests for the assignment of allowables.

SECTION 2. Annual and Biennial Deliverability and Shut-In Pressure Tests

A. Annual or Biennial Deliverability and Shut-In Pressure Tests shall be made on all gas wells during the period from January 1 through December 31 of that year except as follows:

1. A newly completed well or a recompleted well shall be tested on an annual basis until a minimum of three annual tests have been taken, after which the well shall be tested biennially as is required for other wells in the pool in which the well is located.

2. Wells classified as "exempt" shall not be subject to the requirements of annual or biennial deliverability tests.

   Classification of wells into or out of the "exempt" status shall be done once each year immediately following the reporting of June production and shall be effective for the succeeding annual test period.

   Gas wells completed in the Pictured Cliffs or any shallower formation shall be classified "exempt" if at least three months of production history is available and the well failed to produce, and is incapable of producing, an average of 250 MCF or more per month during the months produced within the preceding 12-month period, and the well is classified as marginal in the August Gas Proration Schedule.

   Gas wells completed in any formation deeper than the Pictured Cliffs formation shall be classified "exempt" if at least three months of production history is available and the well failed to produce, and is incapable of producing, an average of 2000 MCF or more per month during the months produced within the preceding 12-month period, and the well is classified as marginal in the August Gas Proration Schedule.

   Gas wells on multiple well Gas Proration Units will not be classified "exempt" unless the Gas Proration Unit is classified as marginal. Any or all wells on a marginal multiple well Gas Proration Unit may be classified as "exempt" provided each Gas Proration Unit so classified meets the qualification for "exempt" status. Gas Proration Units for wells producing from formations deeper than the Pictured Cliffs formation shall be classified "exempt" if at least three months of production history is available and the Gas Proration Unit failed to produce, and is incapable of producing, an average of 2000 MCF or more per month during the months produced within the preceding 12-month period, and the Gas Proration Unit is classified as marginal in the

August Gas Proration Schedule. Gas Proration Units are to be classified as "exempt" because of their low producing ability.

The District Supervisor of the Division's Aztec Office may classify a well or Gas Proration Unit as "exempt" at any time if the operator presents sufficient evidence to the District Supervisor indicating that the well or Gas Proration Unit is incapable of producing gas at a higher rate than that rate required for "exempt" classification for wells or Gas Proration Units in that pool.

Once a well or Gas Proration Unit has been declared "exempt" for the following test year, it shall remain classified "exempt" for that test year.

3. If a test is filed on any well on a gas proration unit, the test requirement for the gas proration unit has been met. The deliverability of the unit is taken only as the resulting sum of all wells tested.

4. A shut-in pressure must be filed on Form C-122-A even if no gas is measured during the production phase of the test. "Exempt" wells do not require the filing of a shut-in pressure.

B. All Annual and Biennial Deliverability and Shut-In Pressure Tests required by these rules must be filed with the Division's Aztec office and with the appropriate gas transportation facility within 90 days following the completion of each test. Provided however, that any test completed between October 31 of the test year and January 31 of the following year are due no later than January 31. No extension of time for filing tests beyond January 31 will be granted except after notice and hearing.

Failure to file any test within the above-prescribed times will subject the well to the loss of one day's allowable for each day the test is late. A well classified as marginal shall be shut-in one day for each day the test is late.

SECTION 3: Scheduling of Tests

A. Notification of Pools to be Tested

By September 1 of each year, the District Supervisor of the Aztec District Office of the Division shall by memorandum notify each gas transportation facility and each operator of the pools which are to be scheduled for biennial testing during the following testing period from January 1 through the last day of December of that test year. The District Supervisor will also provide a list of "exempt" wells and a list of wells that do not have a minimum of three Annual Deliverability and Shut-In Pressure Tests on file.

Any well scheduled for testing during its test year may have the conditioning period, test flow period, and some of the seven day shut-in period conducted in December of the previous year provided that if the 7 day shut-in period immediately follows the test flow period the 7 day shut-in pressure would be measured in January of the test year. The earliest date that a well could be scheduled for Annual or Biennial Deliverability and Shut-In Pressure Test would be such that the Test Flow Period would end on December 25 of the previous year.

Downhole commingled wells are to be scheduled for tests on dates for pool of lowermost prorated completion of well.

B. Annual and Biennial Deliverability Tests

By November 1 of each year, each gas transportation facility shall, in cooperation with the operators involved, prepare and submit a schedule of the wells to which it is connected which are to begin testing in December and January. Said schedule shall be entitled, "Annual and Biennial Deliverability and Shut-In Pressure Test Schedule", and one copy shall be submitted to the Division's Aztec office and to each operator concerned. The schedule shall indicate the date of tests, pool, operator, lease, well number, and location of each well.

At least 30 days prior to the beginning of each succeeding 2-month testing interval, a similar schedule shall be prepared and filed in accordance with the above.

The gas transportation facility and the Aztec District Office of the Division shall be notified immediately by any operator unable to conduct any test as scheduled.

In the event a well is not tested in accordance with the existing test schedule, the well shall be re-scheduled by the gas transportation facility, and the Division and the operator of the well so notified in writing. Every effort should be made to notify the Division of the new schedule prior to the conclusion of the newly assigned 14-day conditioning period.

Notice to the Division of Shut-In Pressure Tests which are scheduled at a time other than immediately following the flow test must be received prior to the time that the well is shut-in.

It shall be the responsibility of each operator to determine that all of its wells are properly scheduled for testing by the gas transportation facility to which they are connected, in order that all annual and biennial tests may be completed during the testing season.

In the event a well is shut-in by the state for over production, the operator may produce the well for a period of time to secure a test after notification to the Division. All gas produced during this

testing period will be used in determining the over/under produced status of the well.

C. Deliverability Re-Tests

An operator may, in cooperation with the gas transportation facility, schedule a well for a deliverability re-test upon notification to the Division's Aztec office at least ten days before the test is to be commenced. Such re-test shall be for good and substantial reason and shall be subject to the approval of the Division. Re-tests shall in all ways be conducted in conformance with the Annual and Biennial Deliverability Test Procedures of these rules. The Division, at its discretion, may require the re-testing of any well by notification to the operator to schedule such re-test. These tests as filed on Form C-122-A should be identified as "RETEST" in the remarks column.

SECTION 4: Witnessing of Tests

Any Initial Annual or Biennial Deliverability and Shut-In Pressure Test may be witnessed by any or all of the following: an agent of the Division, an offset operator, a representative of the gas transportation facility connected to the well under test, or a representative of the gas transportation facility taking gas from an offset operator.

CHAPTER II PROCEDURE FOR TESTING

SECTION 1: Initial Deliverability and Shut-In Pressure Test Procedure

A. Within 90 days after a newly completed well is first delivered to a gas transportation facility, the operator shall complete a deliverability and shut-in pressure test of the well in conformance with the "Annual and Biennial Deliverability and Shut-In Pressure Test Procedures", prescribed in Section 2 of this chapter. Results of the test shall be filed as required by Section 1 of Chapter I of these rules.

B. In the event it is impractical to test a newly completed well in conformance with Paragraph A above, the operator may conduct the deliverability and shut-in pressure test in the following manner (provided, however, that any test so conducted will not be accepted as the first annual deliverability and shut-in pressure test as described in Paragraph A-1 of Section 2, Chapter I):

1. A 7-day or 8-day production chart may be used as the basis for determining the well's deliverability, providing the chart so used is preceded by at least 14 days continuous production. The well shall produce through either the casing or tubing, but not both, into a pipeline during these periods. The production valve and the choke settings shall not be changed during either the conditioning or flow

period with the exception of the first ten (10) days of the conditioning period when maximum production would over-range the meter chart or location production equipment.

2. A shut-in pressure of at least seven days duration shall be taken. This shall be the shut-in test required in Paragraph A, Section 1 of Chapter I of these rules.

3. The average daily static meter pressure shall be determined in accordance with Section 2 of Chapter II of these rules. This pressure shall be used as P_t in calculating P_w for the Deliverability Calculation.

4. The daily average rate of flow shall be determined in accordance with Section 2 of Chapter II.

5. The static wellhead working pressure (P_w) shall be determined in accordance with Section 2 of Chapter II.

6. The deliverability of the well shall be determined by using the data determined in Paragraphs 1 through 5 above in the deliverability formula in accordance with Section 2 of Chapter II.

7. The data and calculations for Paragraphs 1 through 6 above shall be reported as required in Section 1 of Chapter I of these rules, upon the blue-colored Form C-122-A or on white Form C-122-A and write "INITIAL TEST ONLY" in remarks.

SECTION 2: Annual and Biennial Deliverability and Shut-In Pressure Test Procedure

This test shall begin by producing a well in the normal operating manner into the pipeline through either the casing or tubing, but not both, for a period of fourteen consecutive days. This shall be known as the conditioning period. The production valve and choke settings shall not be changed during either the conditioning or flow periods except during the first ten (10) days of the conditioning period when maximum production would over-range the meter chart or location production equipment. The first ten (10) days of said conditioning period shall not have more than forty eight (48) hours of cumulative interruptions of flow. The eleventh to fourteenth days, inclusive, of said conditioning period shall have no interruptions of flow whatsoever. Any interruption of flow that occurs as normal operation of the well as stop-cock flow, intermittent flow, or well blow down will not be counted as shut-in time in either the conditioning or flow period.

The daily flowing rate shall be determined from an average of seven or eight consecutive producing days, following a minimum conditioning period of 14 consecutive days of production. This shall be known as the flow period.

Instantaneous pressures shall be measured by deadweight gauge or other method approved by the Division during the 7-day or 8-day flow period at the casinghead, tubinghead, and orifice meter, and shall be recorded along with instantaneous meter-chart static pressure reading.

If a well is producing through a compressor that is located between the wellhead and the meter run, the meter run pressure and the wellhead casing pressure and the wellhead tubing pressure are to be reported on Form C-122-A. (Neither the suction pressure nor the discharge pressure of the compressor is considered wellhead pressure.) A note shall be entered in the remarks portion on Form C-122-A stating "This well produces through a compressor".

When it is necessary to restrict the flow of gas between the wellhead and orifice meter, the ratio of the downstream pressure, psia, to the upstream pressure, psia shall be determined. When this ratio is 0.57, or less, critical flow conditions shall be considered to exist across the restriction.

When more than one restriction between the wellhead and orifice meter causes the pressures to reflect critical flow between the wellhead and orifice meter, the pressures across each of these restrictions shall be measured to determine whether critical flow exists at any restriction. When critical flow does not exist at any restriction, the pressures taken to disprove critical flow shall be reported to the Division on Form C-122-A in item (n) of the form. When critical flow conditions exist, the instantaneous flowing pressures required hereinabove shall be measured during the last 48 hours of the 7-day or 8-day flow period.

When critical flow exists between the wellhead and orifice meter, the measured wellhead flowing pressure of the string through which the well flowed during test shall be used as P_t when calculating the static wellhead working pressure (P_w) using the method established below.

When critical flow does not exist at any restriction, P_t shall be the corrected average static pressure from the meter chart plus friction loss from the wellhead to the orifice meter.

The static wellhead working pressure (P_w) of any well under test shall be the calculated 7-day or 8-day average static tubing pressure if the well is flowing through the casing; it shall be the calculated 7-day or 8-day average static casing pressure if the well is flowing through the tubing. The static wellhead working pressure (P_w) shall be calculated by applying the tables and procedures set out in this manual.

To obtain the shut-in pressure of a well under test, the well shall be shut in some time during the current testing season for a period of seven to fourteen consecutive days, which have been preceded by a minimum of seven days of uninterrupted production. Such shut-in

pressure shall be measured with a deadweight gauge or other method approved by the Division on the seventh to fourteenth day of shut-in of the well. The 7-day shut-in pressure shall be measured on both the tubing and the casing when communication exists between the two strings. The higher of such pressures shall be used as P_c in the deliverability calculation. When any such shut-in pressure is determined by the Division to be abnormally low or the well can not be shut-in due to "HARDSHIP" classification, the shut-in pressure to be used as P_c shall be determined by one of the following methods:

1. A Division-designated value.

2. An average shut-in pressure of all offset wells completed in the same zone. Offset wells include the four side and four corner wells, if available.

3. A calculated surface pressure based on a calculated bottom-hole pressure. Such calculation shall be made in accordance with the examples in this manual.

All Wellhead pressures as well as the flowing meter pressure tests which are to be taken during the 7-day or 8-day deliverability test period as required hereinabove shall be taken with a deadweight gauge or other method approved by the Division. The pressure readings and the date and time according to the chart shall be recorded and maintained in the operator's records with the test information.

Orifice meter charts shall be changed and so arranged as to reflect upon a single chart the flow data for the gas from each well for the full 7-day or 8-day deliverability test period; however, no tests shall be voided if satisfactory explanation is made as to the necessity for using test volumes through two chart periods. Corrections shall be made for pressure base, measured flowing temperature, specific gravity, and supercompressibility; provided however, if the specific gravity of the gas from any well under test is not available, an estimated specific gravity may be assumed therefor, based upon that of gas from near-by wells, the specific gravity of which has been actually determined by measurement.

The average flowing meter pressure for the 7-day or 8-day flow period and the corrected integrated volume shall be determined by the purchasing company that integrates the flow charts and furnished to the operator or testing agency.

The 7-day or 8-day flow period volume shall be calculated from the integrated readings as determined from the flow period orifice meter chart. The volume so calculated shall be divided by the number of testing days on the chart to determine the average daily rate of flow during said flow period. The flow period shall have a minimum of seven

and a maximum of eight legibly recorded flowing days to be acceptable for test purposes. The volume used in this calculation shall be corrected to New Mexico Oil Conservation Division standard conditions of 15.025 psia pressure base, 60^{o}F. temperature base and 0.60 specific gravity base.

The daily volume of flow as determined from the flow period chart readings shall be calculated by applying the Basic Orifice Meter Formula or other acceptable industry standard practices.

$$Q = C' \{h_w P_f\}^{1/2}$$

Where:

Q = Metered volume of flow Mcf/d @ 15.025 psia, 60^{o} F., and 0.60 specific gravity.

C' = The 24-hour basic orifice meter flow factor corrected for flowing temperature, gravity, and supercompressibility.

h_w = Daily average differential meter pressure from flow period chart.

P_f = Daily average flowing meter pressure from flow period chart.

The basic orifice meter flow factors, flowing temperature factor, and specific gravity factor shall be determined from the tables in this manual.

The daily flow period average corrected flowing meter pressure, psig, shall be used to determine the supercompressibility factor. Supercompressibility Tables may be obtained from the New Mexico Oil Conservation Division.

When supercompressibility correction is made for a gas containing either nitrogen or carbon dioxide in excess of two percent, the supercompressibility factors of such gas shall be determined by the use of Table V of the C.N.G.A. Bulletin TS-402 for pressures 100-500 psig, or Table II, TS-461 for pressures in excess of 500 psig.

The use of tables for calculating rates of flow from integrator readings which do not specifically conform to the New Mexico Oil Conservation Division "Back Pressure Test Manual", or this manual, may be approved for determining the daily flow period rates of flow upon a showing that such tables are appropriate and necessary.

The daily average integrated rate of flow for the 7-day or 8-day flow period shall be corrected for meter error by multiplication by a

correction factor. Said correction factor shall be determined by dividing the square root of the deadweight flowing meter pressure, psia, by the square root of the chart flowing meter pressure, psia.

Deliverability pressure, as used herein, is a defined pressure applied to each well and used in the process of comparing the abilities of wells in a pool to produce at static wellhead working pressures equal to a percentage of the 7-day shut-in pressure of the respective individual wells. Such percentage shall be determined and announced periodically by the Division based on the relationship of the average static wellhead working pressures (P_w) divided by the average 7-day shut-in pressure (P_c) of the pool.

The deliverability of gas at the "deliverability pressure" of any well under test shall be calculated from the test data derived from the tests hereinabove required by use of the following deliverability formula:

$$D = Q \frac{(P_c^2 - P_d^2)^n}{(P_c^2 - P_w^2)}$$

Where:

D = Deliverability Mcf/d at the deliverability pressure, (P_d), (at Standard Conditions of 15.025 psia, 60°F and 0.60 sp. gr.).

Q = Daily flow rate in Mcf/d, at wellhead pressure (P_w).

P_c = 7-day shut-in Wellhead pressure, psia, determined in accordance with Section 2 of Chapter II.

P_d = Deliverability pressure, psia, as defined above.

P_w = Average static wellhead working pressure, as determined from 7-day or 8-day flow period, psia, and calculated from tables in this manual entitled "Pressure Loss Due to Friction" Tables for San Juan Basin.

n = Average pool slope of back pressure curves as follows:

For Pictured Cliffs and shallower formations	0.85
For formations deeper than Pictured Cliffs	0.75

(Note: Special Rules for Any Specific Pool or Formation May Supersede The Above Values. Check Special Rules If In Doubt.)

The value of the multiplier in the above formula (ratio factor after the application of the pool slope) by which Q is multiplied shall not exceed

a limiting value to be determined and announced periodically by the Division. Such determination shall be made after a study of the test data of the pool obtained during the previous testing season.

Downhole commingled wells are to be tested in year for pool of lowermost prorated completion of well and shall use pool slope (n), and deliverability pressure of lowermost pool. The total flow rate from the downhole commingled well will be used to calculate a value of deliverability. For each prorated gas zone of a downhole commingled well, a Form C-122-A is required to be filed and in the Summary portion of that form, all zones will indicate the same data for line h, P_c, Q, P_w, and P_d. The value shown for Deliverability (D) will be that percentage of the total deliverability of the well that is applicable to this zone. A note shall be placed in the remarks column that indicates the percentage of deliverability to be allocated to this zone of the well.

Any test prescribed herein will be considered acceptable if the average flow rate for the final 7-day or 8-day deliverability test is not more than ten percent in excess of any consecutive 7-day or 8-day average of the preceding two weeks. A deliverability test not meeting this requirement may be declared invalid, requiring the well to be re-tested.

All charts relative to initial, annual, or biennial deliverability tests or copies thereof shall be made available to the Division upon its request.

All testing agencies, whether individuals, companies, pipeline companies, or operators, shall maintain a log of all tests accomplished by them, including all field test data. The operator shall maintain the above data for a period of not less than two (2) years plus the current test year.

All forms heretofore mentioned are hereby adopted for use in the San Juan Basin Area in open form subject to such modification as experience may indicate desirable or necessary.

Initial and Annual or Biennial Deliverability and Shut-In Pressure Tests for gas wells in all formations shall be conducted and reported in accordance with these rules and procedures. Provided however, these rules shall be subject to any specific modification or change contained in Special Pool Rules adopted for any pool after notice and hearing.

CHAPTER III <u>INFORMATIONAL TESTS</u>

A. A one-point back pressure test may be taken on newly completed wells before their connection or reconnection to a gas transportation facility. This test shall not be a required official test but may be

taken for informational purposes at the option of the operator. When taken, this test must be taken and reported as prescribed below:

ONE-POINT BACK PRESSURE POTENTIAL TEST PROCEDURE

1. This test shall be accomplished after a minimum shut-in of seven days. The shut-in pressure shall be measured with a deadweight gauge or other method approved by the Division.

2. The flow rate shall be that rate in Mcf/d measured at the end of a three hour test flow period. The flow from the well shall be for three hours through a positive choke, which has a 3/4-inch orifice.

3. A 2-inch nipple which provides a mechanical means of accurately measuring the pressure and temperature of the flowing gas shall be installed immediately upstream from the positive choke.

4. The absolute open flow shall be calculated using the conventional back pressure formula as shown in this manual or the New Mexico Oil Conservation Division "Back Pressure Test Manual."

5. The observed data and flow calculations shall be reported in duplicate on Form C-122, "Multi-Point Back Pressure Test for Gas Wells."

6. Non-critical flow shall be considered to exist when the choke pressure is 13 psig or less. When this condition exists the flow rate shall be measured with a pitot tube and nipple as specified in this manual or in the Division's Manual of "Tables and Procedure for Pitot Tests." The pitot test nipple shall be installed immediately downstream from the 3/4-inch positive choke.

7. Any well completed with 2-inch nominal size tubing (1.995-inch ID) or larger shall be tested through the tubing.

B. Other tests for informational purposes may be conducted prior to obtaining a pipeline connection for a newly completed well upon receiving specific approval therefor from the Division's Aztec office. Approval of these tests shall be based primarily upon the volume of gas to be vented.

CHAPTER IV Type of Tests Required for Wells Completed in Non-Prorated Pools

SECTION 1: Initial Shut-in Pressure Tests for newly Completed Wells.

A. (Same as Chapter I, Section 1, A)

SECTION 2: Biennial Shut-in Pressure Tests

A. Non-prorated wells will be tested biennially as required by the District Office except as follows:

1. Wells which meet the "exempt" qualification as shown in Chapter I, Section 2, paragraph A-2 of these rules shall also be exempt from shut-in test requirements.

2. Wells classified as "hardship" wells during the test year shall also be exempt from shut-in test requirements.

B. All shut-in tests required by these rules must be filed with the Division's Aztec office by January 31 of the following year. Failure to file the test will subject the well to being shut-in one day for each day the test is late.

SECTION 3: Scheduling Tests

A. By September 1 of each year, the District Supervisor of the Aztec District Office of the Division shall by memorandum notify each gas transportation facility and each operator of the pools which are to be scheduled for biennial shut-in pressure testing during the following testing period from January 1 through the last day of December of that test year. The District Supervisor will also provide a list of "exempt" wells.

Any well scheduled for testing during its test year may have the test flow period, and some of the seven day shut-in period conducted in December of the previous year. The earliest date that a well could be scheduled for Biennial Shut-In Pressure Test would be such that the Test Flow Period would end on December 25 of the previous year.

Downhole commingled wells are to be scheduled for tests on dates for pool of lowermost completion of well.

SECTION 4: Test Procedure

A. To obtain the shut-in pressure of a well under test, the well shall be shut-in some time during the current testing season for a period of seven to fourteen consecutive days, which have been preceded by a minimum of seven days of uninterrupted production. Such shut-in pressure shall be measured by deadweight gauge or other method approved by the Division on the seventh to fourteenth day of shut-in of the well. The shut-in pressure shall be measured on both the tubing and the casing when communication exists between the two strings. The higher of such pressures shall be reported as the shut-in pressure of the well.

SECTION 5: Filing of shut-in Pressure Data

The results of this test will be filed in triplicate on Form C-125-B showing the pressures in psia in column labeled "S. I. PRESSURE PSIA (DWT)" with the Aztec District Office.

END OF THIS PROPOSED MANUAL FOR TESTING IN SJB 11/10/86

MEMORANDUM

To: **NMOCD Deliverability Test Committee**

From: **H. L. Babe Kendrick**

Date: **November 11, 1986**

At the Farmington meeting on November 6, 1986, it was decided to be ready to submit this testing procedure to the NMOCD for hearing on December 3, 1986. For this to happen, I must get in gear and stay in gear until the job is completed. Your help is very much needed to be a proof-reader and to furnish technical data to make some of the calculations necessary for the data book and to place the tables and other pages in proper sequence.

Today, all that I have ready for you is the documentation for the rules procedure with the paragraph added into it on page 7 as you authorized. Please read the enclosed pages and read carefully to find all the errors that may be contained therein. Please let me know of anything that is incorrect in this portion of this booklet.

Additional data will be submitted to you as I get it in what should be a "final form".

Your comments are solicited.

Babe

MEMORANDUM

TO: NMOCD DELIVERABILITY TEST COMMITTEE

FROM: H. L. BABE KENDRICK

DATE: OCTOBER 15,1986

At the Santa Fe meeting on September 30, 1986, it was decided to have the next meeting in Farmington, NM in late October. In arranging a meeting place, and looking further at work schedules, the October meeting must be pushed back to Thursday, November 6, 1986, 8:00 AM, in the El Paso Natural Gas Company building located in Reilly Heights.

As a result of the discussion on producing and testing a well through a compressor, what do you think of adding the following paragraph into the testing instructions as the second paragraph on Page 7?

> If a well is producing through a compressor that is located between the wellhead and the meter run, the meter run pressure and the wellhead casing pressure and the wellhead tubing pressure are to be reported on the C-122-A Form. (Neither the suction pressure nor the discharge pressure of the compressor is considered wellhead pressure.) A note shall be entered in the remarks portion of the C-122-A Form stating "This well produces through a compressor."

At this point we might try to add two definitions into this test procedure which are for workovers and retest. These might include:

> WORKOVER: Anything done to a well to change its productivity.
>
> RESTEST: A test conducted on a well that has a current test on record with the Division that does not reflect the current producing ability of the well.

Your choice of words is important in each of the above descriptions so get out the "correcting pen" and go to work.

See you later.

Babe

G-3 P-7 T-7 9/30/86

G	Frank Busch	OCD Aztec		505-598-9464
G	Vic Lyon	" Santa Fe		827-5809
P	Douglas R Harris	Meridian Oil Co. Farmington		327-0251
T	Joel Levine	Gas Company of New Mexico (AIB, NM)		888-8378
P	R.E. MATHIS	MESA OPERATNG LIMITED PARTNERSHIP		(606) 378-1000
T	Mike Turnbaugh	NWP		505-327-5351
T	Martin Boggs	Southern Union Exp Co.		505-327-4481
T	Stella Whitaker	Gas Company of New Mexico		505 632-3311
T	Sandy Liese	NWP		505-327-5351
T	Ed Marcum	EPNG		325-5870
T	H.L. BABE KENDRICK	EPNG	Box 1492 Elpaso Tx	915-541-6133
P	Louis JONES	TENNECO Oil P.O Box 3249 Englewood Co 80155		303-740 4845
P	Joel Fox	TENNECO Oil P.O. Box 3249 Englewood, CO 80155		303-740 2550
P	Jack Evans	Schalk Development Co.		505-325-5018
P	A.R. Kendrick	4 Corners Gas Producers Box 516 Aztec NM		505-334-2555
P	Wayne Converse	Columbus Energy Corp. P.O. Box 2038 Farmington		505-632-8056
G	Michael E. Stogner	Oil Conservation - Santa Fe		505-827-5811

El Paso Natural Gas Company

MEMORANDUM

TO: NMOCD Deliverability Test Committee

DATE: September 19, 1986

FROM: H. L. "Babe" Kendrick

PLACE: Production Control Department

A meeting has been set for 8:30 am Tuesday, September 30, 1986 in Morgan Hall in the basement of the State Land Office Building in Santa Fe, New Mexico.

This meeting is needed to complete the workings of the prior committee activities and to arrange our data to publish a test manual for the San Juan Basin.

Also, certain topics need to be discussed such as:

individual wells producing through compressors;
where to enter data on C122A;
workovers;
what is a workover;
what is not a workover;
scheduling requirements for tests;
possibility of late tests;
possibility of no test.

The above list is not intended to limit the discussion in any manner. This list may only cover a few of the many items that need discussing.

If you have all of the latest documents we have prepared and the testing order and/or procedure, please bring them along. If anyone can start arranging those in a presentable manner, please do so and help speed the process.

If we have items that you feel need to be discussed with your management prior to further committee action we can recess and meet again to finalize a committee presentation.

See you in Santa Fe.

H. L. Kendrick

je

GARY HUNTER
AMOCO PRODUCTION COMPANY
501 AIRPORT DRIVE
FARMINGTON, NM 87401

H. L. BABE KENDRICK
EL PASO NATURAL GAS CO
P.O. BOX 1492
EL PASO, TX 79978

HAROLD GARCIA
NEW MEXICO OIL CONSERVATION DIV
P.O. BOX 2088
SANTA FE, NM 87501

HUGH INGRAM
CONOCO
P.O. BOX 460
HOBBS, NM 88240

JACK EVANS
SCHALK DEVELOPMENT COMPANY
P.O. BOX 2078
FARMINGTON, NM 87401

JOHN COOK
TENNECO
P.O. BOX 3249
ENGLEWOOD, CO 80155

KEN RODDY
UNION TEXAS PETROLEUM
P.O. BOX 1290
FARMINGTON, NM 87499

[redacted] DON READ
MERIDIAN OIL CO.

GLEN BURLING
GULF
P.O. BOX 1150
MIDLAND, TX 79702

BARBARA REX
U-TEX
6331 BOXWOOD ROAD
SALT LAKE CITY, UT 84121

BARBARA WILLIAMS
INDEPENDENT
P.O. BOX 2038
FARMINGTON, NM 87401

BOB ADKINS
AMOCO PRODUCTION COMPANY
501 AIRPORT DRIVE
FARMINGTON, NM 87401

ED MARCUM
~~MERIDIAN OIL CO.~~ EPNG
P.O. BOX ~~4289~~ 990
FARMINGTON, NM 87499 ~~4289~~

ERNIE BUSCH
NEW MEXICO OIL CONSERVATION DIV
1000 RIO BRAZOS ROAD
AZTEC, NM 87410

FRANK CHAVEZ
NEW MEXICO OIL CONSERVATION DIV
1000 RIO BRAZOS ROAD
AZTEC, NM 87410

GARY HUDGINS
SOUTHERN UNION EXPLORATION

RANDY RICKFORD
AMOCO PRODUCTION COMPANY
501 AIRPORT DRIVE
FARMINGTON, NM 87401

MAX WEBB
ENGINEERING & PRODUCTION SERVICE
P.O. BOX 190
FARMINGTON, NM 87401

ROBERT COVLIN
AMOCO PRODUCTION COMPANY
1670 BROADWAY
DENVER, CO 80202

MICHAEL L. DAVIES
SOUTHERN UNION EXPLORATION
P.O. BOX 2179
~~FARMINGTON, NM 87499~~
DALLAS, Tx

RUDY MOTTO
UNION TEXAS PETROLEUM
P.O. BOX 1290
FARMINGTON, NM 87401

~~MIKE MASER~~
MESA PETROLEUM COMPANY
P.O. BOX 579
FLORA VISTA, NM 87415

SANDY LIESE
NORTHWEST PIPELINE CORP
P.O. BOX 90
FARMINGTON, NM 87401

MIKE TURNBAUGH
NORTHWEST PIPELINE CORP
P.O. BOX 90
FARMINGTON, NM 87401

STELLA WHITAKER
GAS COMPANY OF NEW MEXICO
P.O. BOX 1899
BLOOMFIELD, NM 87413

R. L. STAMETS
NEW MEXICO OIL CONSERVATION DIV
P.O. BOX 2088
SANTA FE, NM 88501

STERGIE KATIRGIS
UNION TEXAS PETROLEUM
P.O. BOX 1290
FARMINGTON, NM 87401

RAEANNE LAMBERT
GULF
P.O. BOX 670
HOBBS, NM 88240

STU McFARLAND
AMOCO PRODUCTION COMPANY
1670 BROADWAY
DENVER, CO 80202

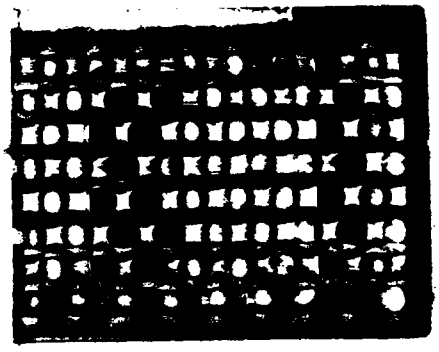
RALPH MONTOYA
AMOCO PRODUCTION COMPANY
501 AIRPORT DRIVE
FARMINGTON, NM 87401

TOM OLLE
[illegible]

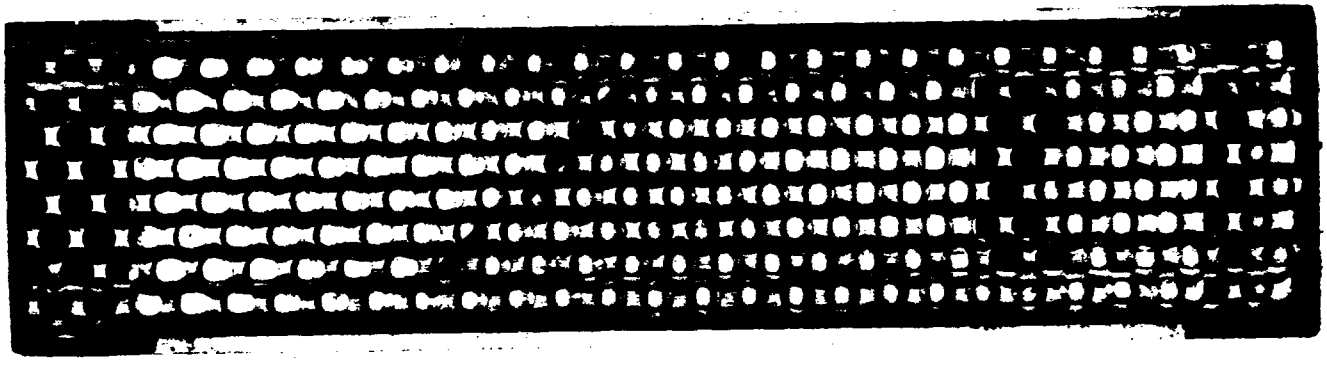
~~RANDY NORDSVEN~~

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

A. R. KENDRICK
FOUR CORNERS GAS PRODUCERS ASSOC.
P.O. BOX 516
AZTEC, NM 87410



AL GREER
BENSON-MONTIN-GREER
221 PETR. CENTER BLDG.
FARMINGTON, NM 87401



name	NAME 2	COMPANY	ADDRESS	CITY	ZIP
MESA PETROLEUM		MESA OPERATING LIMITED PARTNERSHIP	P.O. BOX 579	FLORA VISTA, NM	87415
BOB	ADKINS	AMOCO PRODUCTION COMPANY	501 AIRPORT DRIVE	FARMINGTON, NM	87401
JOHN	BARNETT	AMOCO PRODUCTION COMPANY	2325 E 30TH STREET	FARMINGTON, NM	87401
MARTIN	BOGGS	SOUTHERN UNION EXPLORATION CO	P.O. BOX 2179	FARMINGTON, NM	87499
ALAN	BOHLING	GULF	P.O. BOX 1150	MIDLAND, TX	79702
ERNIE	BUSCH	NEW MEXICO OIL CONSERVATION DIV	1000 RIO BRAZOS ROAD	AZTEC, NM	87410
FRANK	CHAVEZ	NEW MEXICO OIL CONSERVATION DIV	1000 RIO BRAZOS ROAD	AZTEC, NM	87410
WAYNE	CONVERSE	COLUMBUS ENERGY CORP	P.O. BOX 2038	FARMINGTON, NM	87401
ROBERT	COVLIN	AMOCO PRODUCTION COMPANY	1670 BROADWAY	DENVER, CO	80202
WARREN	CURTIS	NORTHWEST PIPELINE CORPORATION	P.O. BOX 8900	SALT LAKE CITY, UT	84108
MICHAEL L.	DAVIES	SOUTHERN UNION EXPLORATION	1217 MAIN, SUITE 400	DALLAS, TX	75202
JACK	EVANS	SCHALK DEVELOPMENT COMPANY	P.O. BOX 2078	FARMINGTON, NM	87401
BRENDA	FLAHERTY	MERIDIAN OIL CO	P.O. BOX 4289	FARMINGTON, NM	87499-4289
JOEL	FOX	TENNECO OIL	P.O. BOX 3249	ENGLEWOOD, CO	80155
HAROLD	GARCIA	NEW MEXICO OIL CONSERVATION DIV	P.O. BOX 2088	SANTA FE, NM	87501
AL	GREER	BENSON-MONTIN-GREER	221 PETR. CENTER BLDG.	FARMINGTON, NM	87401
DOUGLAS	HARRIS	MERIDIAN OIL CO.	P.O. BOX 4289	FARMINGTON, NM	87499-4289
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HUGH	INGRAM	CONOCO	P.O. BOX 460	HOBBS, NM	88240
LOUIS	JONES	TENNECO OIL	P.O. BOX 3249	ENGLEWOOD, CO	80155
A. R.	KENDRICK	FOUR CORNERS GAS PRODUCERS ASSOC.	P.O. BOX 516	AZTEC, NM	87410
H. L. BABE	KENDRICK	EL PASO NATURAL GAS CO	P.O. BOX 1492	EL PASO, TX	79978
JOEL	LEVINE	GAS COMPANY OF NEW MEXICO	2444 LOUISIANA NE	ALBUQUERQUE, NM	87125
SANDY	LIESE	NORTHWEST PIPELINE CORP	P.O. BOX 90	FARMINGTON, NM	87401
VICTOR T.	LYON	NMOCD	P.O. BOX 2088	SANTA FE, NM	87501
ED	MARCUM	EL PASO NATURAL GAS CO	P.O. BOX 990	FARMINGTON, NM	87401
R. E.	MATHIS	MESA OPERATING LIMITED PARTNERSHIP	P.O. BOX 2009	AMARILLO, TX	79189
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TOM	OLLE	SOUTHLAND ROYALTY COMPANY	P.O. DRAWER 570	FARMINGTON, NM	87401
DON	READ	MERIDIAN OIL	P.O. BOX 4289	FARMINGTON, NM	87499-4289
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~~MICHAEL E.~~	~~STOGNER~~	NMOCD	P.O. BOX 2088	SANTA FE, NM	87501

Ordered Rows from ADDRESSES, ALPHA NAME 9/11/86

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BRUCE	WILLIAMS	AMOCO PRODUCTION COMPANY	2325 E 30TH STREET	FARMINGTON, NM	87401

ACKNOWLEDGMENT

The New Mexico Oil Conservation Commission wishes to express its appreciation to the following men for their invaluable counsel and advice as well as their willing and effective work as members of the Industry Committee in analyzing the various materials used in this manual.

H. L. Kendrick, El Paso Natural Gas Company, Chairman
D. H. Rainey, El Paso Natural Gas Company, Chairman
C. E. Bowlin, Interstate Oil Compact Commission
T. M. Boyd, Jr., Consolidated Oil & Gas Company
C. R. Clement, Phillips Petroleum Company
A. J. Evans, Amerada Petroleum Corporation
R. L. Freeborn, Continental Oil Company
G. A. Hickson, El Paso Natural Gas Company
J. W. Meek, Pan American Petroleum Corporation
L. S. Muennick, Southern Union Gas Company
C. W. Rach, Northern Natural Gas Company
L. W. Rogers, Jr., Transwestern Pipeline Company
L. E. Thomas, Amerada Petroleum Corporation
G. L. Tribble, Northern Natural Gas Company
W. H. Williams, Consolidated Oil & Gas Company

Our appreciation is also expressed to the Interstate Oil Compact Commission for their permission to reproduce portions of their Manual of Back-Pressure Testing of Gas Wells.

R. L. Stamets, Director
A. L. PORTER, Jr., Secretary-Director
ELVIS A. UTZ, Gas Engineer

El Paso
Natural Gas Company

P. O. BOX 1492
EL PASO, TEXAS 79978
PHONE (915) 541-2600

September 3, 1986

William F. Carr, Chairman
New Mexico Oil Conservation Division
Gas Advisory Committee

Re: Subcommittee No. 3
Priority of Takes
Recommendations

Dear Mr. Chairman:

As you are aware subcommittee No. 3 convened on August 12, 1986 to discuss the priority of takes to be recommended to the advisory committee.

The committee expressed a desire to submit the following recommendations:

Rule 315 Priorities of Production

To prevent waste of New Mexico gas, producers shall to the extent permitted by operation of Rule 903, observe the following priority production schedule:

(a) gas wells shall be the first restricted or shut in followed by;

(b) downhole commingled wells involving one or more gas zones and one or more oil zones followed by;
NOTE: (This item (b) was discussed and agreed that gas-gas downhole commingled wells would have a classification as gas wells and be viewed as being gas wells under (a) above; and, that gas-oil or oil-oil downhole commingled wells would have a classification as oil wells and would be viewed as being oil wells under (c) below.)

(c) casinghead gas (including gas from associated pools) followed by;

(d) hardship gas wells designated by the Division under Rule 410, Rule 411, or after hearing.

Rule 903 Priorities of Production

To prevent waste of New Mexico gas, purchasers shall observe the following priority production schedule:

(1) gas wells shall be the first restricted or shut in followed by;

(2) downhole commingled wells involving one or more gas zones and one or more oil zones followed by;
NOTE: (This item (2) was discussed and agreed that gas-gas downhole commingled wells would have a classification as gas wells and be viewed as being gas wells under (1) above; and, that gas-oil or oil-oil downhole commingled wells would have a classification as oil wells and would be viewed as being oil wells under (3) below.)

(3) casinghead gas (including gas from associated pools) followed by;
(4) hardship gas wells designated by the Division under Rule 410, Rule 411, or after hearing.

It is the recommendation of the chairman of subcommittee No. 3 that the following be adopted:

Rule 315 Priorities of Production

To prevent waste of New Mexico gas, producers shall to the extent permitted by operation of Rule 903, observe the following priority production schedule:

(a) gas wells shall be the first restricted or shut in followed by;
(b) downhole commingled wells involving one or more gas zones and one or more oil zones followed by;
NOTE: (This item (b) was discussed and agreed that gas-gas downhole commingled wells would have a classification as gas wells and be viewed as being gas wells under (a) above; and, that gas-oil or oil-oil downhole commingled wells would have a classification as oil wells and would be viewed as being oil wells under (c) below.)
(c) casinghead gas (including gas from associated pools) followed by;
(d) hardship gas wells designated by the Division under Rule 410, Rule 411, or after hearing.

Rule 903 Priorities of Production

(a) To prevent waste of New Mexico gas, purchasers shall observe the following priority production schedule:
(1) gas wells shall be the first restricted or shut in followed by;

(2) Downhole commingled wells involving one or more gas zones and one or more oil zones followed by; NOTE: (This item (2) was discussed and agreed that gas-gas downhole commingled wells would have a classification as gas wells and be viewed as being gas wells under (1) above; and, that gas-oil or oil-oil downhole commingled wells would have a classification as oil wells and would be viewed as being oil wells under (3) below.)

(3) casinghead gas (including gas from associated pools) followed by;

(4) hardship gas wells designated by the Division under Rule 410, Rule 411, or after hearing.

(b) Nothing in this rule shall be construed or applied to require, directly or indirectly, any person to purchase gas of a quality or under a pressure or under any other condition by reason of which such gas cannot be economically and satisfactorily used by such purchaser by means of his gas transportation facilities then in service.

(c) Should any purchaser be unable to take gas in accordance with the schedule described in paragraph (a) of this rule because of any of the conditions described in paragraph (b) above, such purchaser shall notify the operator of the affected wells of such condition.

With respect to the chairman's recommendations that (b) and (c) in Rule 903 be added to the committee's recommendations the producers of gas stated that they did not fully understand what paragraph (b) and (c) meant and for this reason preferred to delete these two paragraphs.

The chairman pointed out to the committee that paragraph (b) was quoted from the New Mexico statutes verbatim and he therefore felt that it should be added to Rule 903 for the edification of those who read and work with the rules and not with the statutes.

It is my feeling that paragraph (b) is the basis for the proration of gas in the state of New Mexico in order for the division to remain legal during periods when availability of gas exceeds the demand.

Respectfully,

E. R. Manning

E. R. Manning

je

James C. Allen
William F. Clark
Warren Curtis
Bill Duncan
H. L. Kendrick
Vic Lyon
Ernest Padilla
R. L. Stamets
George Safi
Michael Stogner
Jeff Taylor

El Paso
Natural Gas Company

P. O. BOX 1492
EL PASO, TEXAS 79978

August 20, 1986

Members of Subcommittee No. 3
Priority of Takes of the
New Mexico Gas Advisory Committee

Attached are minutes of the August 12, 1986 meeting in Santa Fe, New Mexico.

If there is anything drastically in error, please so advise.

Very truly yours,

E. R. Manning

E. R. Manning

je

Attachments

NMOCD SUBCOMMITTEE NO. 3
PRIORITY OF TAKES, MINUTES
AUGUST 12, 1986

The Priority of Takes Sub-committee of the Gas Advisory Committee to the NMOCD convened at 9:00 am on August 12, 1986 in the conference room of the State Land Office Building in Santa Fe, NM. A list of the attendees is attached.

Discussions were centered on Rules 315, 902 and 903.

Rule 315 was re-written as follows:

Rule 315 Priorities of Production

To prevent waste of New Mexico gas, producers shall to the extent permitted by operation of Rule 903, observe the following priority production schedule:

(a) gas wells shall be the first restricted or shut in followed by;
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NOTE: (This item (b) was discussed and agreed that gas-gas downhole commingled wells would have a classification as gas wells and be viewed as being gas wells under (a) above; and, that gas-oil or oil-oil downhole commingled wells would have a classification as oil wells and would be viewed as being oil wells under (c) below.)
(c) casinghead gas (including gas from associated pools) followed by;
(d) hardship gas wells designated by the Division under Rule 410, Rule 411, or after hearing.

Rule 903 was rewritten and comments were made concerning paragraphs (b) and (c). The results of a poll taken of those members of the committee present at this meeting indicated:

1. the producers of gas do not fully understand what paragraph (b) and (c) mean; and,
2. the producers would prefer to see Rule 903 written with paragraphs (b) and (c) deleted from the rule; and,
3. the major pipelines represented at the meeting would prefer to have paragraphs (b) and (c) included in the rule.

With the above comments in mind, Rule 903 is written below with changes as preferred shown in paragraph (a) and paragraphs (b) and (c) are included for evaluation purposes:

Rule 903 Priorities of Production

(a) To prevent waste of New Mexico gas, purchasers shall observe the following priority production schedule:
(1) gas wells shall be the first restricted or shut in followed by;
(2) downhole commingled wells involving one or more gas zones and one or more oil zones followed by;

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(c) Should any purchaser be unable to take gas in accordance with the schedule described in paragraph (a) of this rule because of any of the conditions described in paragraph (b) above, such purchaser shall notify the operator of the affected wells of such condition.

A proposal was submitted by Exxon with paragraphs (b) and (c) rewritten. Their proposal was withdrawn pending the assumption that paragraphs (b) and (c) as otherwise written would be eliminated from the rule.

A proposal was submitted by Blackwood & Nichols Co. suggested a change of wording for paragraph (a) of Rule 315 and paragraph (1) of Rule 903 (from that shown above) to indicate "that in prorated gas pools, gas proration units with overproduction shall be restricted or shut in before underproduced units".

A list of wells that have been approved as hardship classification within the State of New Mexico was presented to the committee by Michael Stogner.

Bill Clark submitted a memo dated August 6, 1986 to the group concerning the classification of wells and suggested changes to proration regulations. He asked for each person to read this proposal and give him as much feed back as possible.

The need for an additional meeting of this committee was left open pending the outcome of the poll of members of this committee concerning paragraphs (b) and (c) of Rule 903.

El Paso
Natural Gas Company

P. O. BOX 1492
EL PASO, TEXAS 79978
PHONE 915-541-2600

August 20, 1986

Members of Subcommittee No. 3
Priority of Takes of the
New Mexico Gas Advisory Committee

Attached are minutes of the August 12, 1986 meeting in Santa Fe, New Mexico.

If there is anything drastically in error, please so advise.

Very truly yours,

E. R. Manning

E. R. Manning

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The need for an additional meeting of this committee was left open pending the outcome of the poll of members of this committee concerning paragraphs (b) and (c) of Rule 903.

FIRST NAME	LAST NAME	COMPANY	ADDRESS	CITY	STATE	ZIP
CHAIRMAN*						
JAMES C.	ALLEN	AMOCO PRODUCTION CO.	P. O. BOX 3092	HOUSTON	TX	77253
WILLIAM F.	CLARK	BLACKWOOD & NICHOLS CO. LTD.	P. O. BOX 1237	DURANGO	CO	81301
WARREN	CURTIS	NORTHWEST PIPELINE CORP.	P. O. BOX 8900	SALT LAKE CITY	UT	84108
BILL	DUNCAN	EXXON	P. O. BOX 1600	MIDLAND	TX	79902
H. L. BABE	KENDRICK	EL PASO NATURAL GAS CO.	P. O. BOX 1492	EL PASO	TX	79978
VIC	LYON	NMOCD	P. O. BOX 2088	SANTA FE	NM	87504
E.R.	MANNING*	EL PASO NATURAL GAS CO.	P. O. BOX 1492	EL PASO	TX	79978
ERNEST	PADILLA		P. O. BOX 2523	SANTA FE	NM	87504
GEORGE	SAFI	EXXON	P. O. BOX 1600	MIDLAND	TX	79902
MICHAEL	STOGNER	NMOCD	P. O. BOX 2088	SANTA FE	NM	87504
JEFF	TAYLOR	NMOCD	P. O. BOX 2088	SANTA FE	NM	87504

8/12/86 Priority Committee - Santa Fe

H.L. Babe Kendrick Box 1492 El Paso Tx 79978

Coonye Safi Exxon Box 1600 Midland, TX 79702

Bill Duncan " " " " "

James C. Allen Amoco Box 5092 Houston, Tx 77255

~~E.~~ William Clark B&N PO Box 1257 Durango Co 81302

Warren Curtis NWP P.O. Box 8900 SLC, Utah 84108

Jeff Taylor OCD Santa Fe

ERNEST PADILLA P.O. Box 2523 Santa Fe 87504

Vic Lyon OCD Santa Fe

E.R. Bob MANNING Box 1492 El Paso TX 79978
915/541-5073

Michael E. Stogner NMOCD PO Box 2088 Santa Fe 87504

El Paso Natural Gas Company

MEMORANDUM

TO: Deliverability Test Committee

DATE: April 23, 1986

FROM: H. L. "Babe" Kendrick

PLACE: Production Control

Subject: Additional Work by Committee

Recent discussions with others in the natural gas industry have indicated there is a need for some additional work to be done by this committee.

The work that was done in rewriting the test procedures for gas wells in the San Juan Basin was a job well done. However, there may be a few areas where conditions now exist which tell us that we may wish to add a few words or phrases into these test procedures.

In search of these "other ideas" that you may have, I ask that you write those ideas to me or call me on the phone and express them to me so that I can list each idea and notify the other members. Even just a yes, no or hello.

If there are ideas that you feel need tended to, please rush them to me so we can complete any action on them before we publish the San Juan Basin Test Manual.

Your support is appreciated.

Babe

je

name	company	address	city/state	zip code
BRADLEY SALZMAN	AMOCO PRODUCTION CO.	501 AIRPORT DR.	FARMINGTON, NM	87401
CHARLES BOYCE	AMOCO PRODUCTION CO.	P.O. BOX 800	DENVER, CO	80201
BOB ADKINS	AMOCO PRODUCTION COMPANY	501 AIRPORT DRIVE	FARMINGTON, NM	87401
GARY MUNSON	AMOCO PRODUCTION COMPANY	501 AIRPORT DRIVE	FARMINGTON, NM	87401
RALPH MONTOYA	AMOCO PRODUCTION COMPANY	501 AIRPORT DRIVE	FARMINGTON, NM	87401
RANDY RICKFORD	AMOCO PRODUCTION COMPANY	501 AIRPORT DRIVE	FARMINGTON, NM	87401
ROBERT COVLIN	AMOCO PRODUCTION COMPANY	1670 BROADWAY	DENVER, CO	80202
STU McFARLAND	AMOCO PRODUCTION COMPANY	1670 BROADWAY	DENVER, CO	80202
AL GREER	BENSON-MONTIN-GREER	221 PETR. CENTER BLDG.	FARMINGTON, NM	87401
MIKE CASEY	CHEVRON U.S.A. INC.	P.O. BOX 670	HOBBS, NM	88240
JOSEPH D. STEWART	COLUMBUS ENERGY CORP.	1860 LINCOLN ST.	DENVER, CO	80295
HUGH INGRAM	CONOCO	P.O. BOX 460	HOBBS, NM	88240
STEVE CATHEY	CONOCO, INC	501 AIRPORT #115	FARMINGTON, NM	87401
EMERY C. ARNOLD	CONSULTANT	200 CRANDALL	AZTEC, NM	87410
JOHN ROE	DUGAN PRODUCTION CORP.	P.O. BOX 208	FARMINGTON, NM	87499
H. L. BABE KENDRICK	EL PASO NATURAL GAS CO	P.O. BOX 1492	EL PASO, TX	79978
MAX WEBB	ENGINEERING & PRODUCTION SERVICE	P.O. BOX 190	FARMINGTON, NM	87401
A. R. KENDRICK	FOUR CORNERS GAS PRODUCERS ASSOC.	P.O. BOX 516	AZTEC, NM	87410
STELLA WHITAKER	GAS COMPANY OF NEW MEXICO	P.O. BOX 1899	BLOOMFIELD, NM	87413
BOB LARGE	GAS COMPANY OF NM	P.O. BOX 1899	BLOOMFIELD, NM	87413
CYNDI PERRY	GAS COMPANY OF NM	P.O. BOX 1899	BLOOMFIELD, NM	87413
JOEL LEVINE	GAS COMPANY OF NM	P.O. BOX 26400	ALBUQUERQUE, NM	87110
PAUL MOLLO	GAS COMPANY OF NM	P.O. BOX 26400	ALBUQUERQUE, NM	87110
ALAN BOHLING	GULF	P.O. BOX 1150	MIDLAND, TX	79702
RAEANNE LAMBERT	GULF	P.O. BOX 670	HOBBS, NM	88240
BARBARA WILLIAMS	INDEPENDENT	P.O. BOX 2038	FARMINGTON, NM	87401
JAMES W. SMITH	MERIDIAN OIL CO	P.O. BOX 4289	FARMINGTON, NM	87499
ED MARCUM	MERIDIAN OIL CO.	P.O. BOX 4289	FARMINGTON, NM	87499-4289
L. E. MABE	MERIDIAN OIL CO.	P.O. BOX 4289	FARMINGTON, NM	87499-4289
MIKE MASER	MESA PETROLEUM COMPANY	P.O. BOX 579	FLORA VISTA, NM	87415
RANDY NORDSVEN	MESA PETROLEUM COMPANY	P.O. BOX 2009	AMARILLO, TX	79189
ERNIE BUSCH	NEW MEXICO OIL CONSERVATION DIV	1000 RIO BRAZOS ROAD	AZTEC, NM	87410
FRANK CHAVEZ	NEW MEXICO OIL CONSERVATION DIV	1000 RIO BRAZOS ROAD	AZTEC, NM	87410
HAROLD GARCIA	NEW MEXICO OIL CONSERVATION DIV	P.O. BOX 2088	SANTA FE, NM	87501
R. L. STAMETS	NEW MEXICO OIL CONSERVATION DIV	P.O. BOX 2088	SANTA FE, NM	88501
ALICE DUGGER	NMOCD	1000 RIO BRAZOS ROAD	AZTEC, NM	87410
VICTOR T. LYON	NMOCD	P.O. BOX 2088	SANTA FE, NM	87501
MIKE TURNBAUGH	NORTHWEST PIPELINE CORP	P.O. BOX 90	FARMINGTON, NM	87401

name	company	address	city/state	zip code
SANDY LIESE	NORTHWEST PIPELINE CORP	P.O. BOX 90	FARMINGTON, NM	87401
WARREN CURTIS	NORTHWEST PIPELINE CORP.	295 CHIPETA WAY	SALT LAKE CITY, UT	84108
JACK EVANS	SCHALK DEVELOPMENT COMPANY	P.O. BOX 2078	FARMINGTON, NM	87401
MICHAEL L. DAVIES	SOUTHERN UNION EXPLORATION	1217 MAIN, SUITE 400	DALLAS, TX	75202
GARY HUDGINS	SOUTHERN UNION EXPLORATION	P.O. BOX 2179	FARMINGTON, NM	87401
TOM OLLE	SOUTHLAND ROYALTY COMPANY	P.O. DRAWER 570	FARMINGTON, NM	87401
BOB GIBB	TENNECO	P.O. BOX 3249	ENGLEWOOD, CO	80155
JOHN COOK	TENNECO	P.O. BOX 3249	ENGLEWOOD, CO	80155
BARBARA REX	U-TEX	6331 BOXWOOD ROAD	SALT LAKE CITY, UT	84121
KEN RODDY	UNION TEXAS PETROLEUM	P.O. BOX 1290	FARMINGTON, NM	87499
RUDY MOTTO	UNION TEXAS PETROLEUM	P.O. BOX 1290	FARMINGTON, NM	87401
STERGIE KATIRGIS	UNION TEXAS PETROLEUM	P.O. BOX 1290	FARMINGTON, NM	87401
W. K. COOPER	UNION TEXAS PETROLEUM	375 U.S. HIGHWAY 64	FARMINGTON, NM	87401

MEMORANDUM

TO: DELIVERABILITY TEST COMMITTEE PLACE: EL PASO, TEXAS

FROM: H. L. BABE KENDRICK DATE: AUGUST 23, 1985

SUBJECT: PITOT TUBE FLOW CHART TABLES

Some time ago I sent out a plea for information to a few of you members to obtain data necessary to calculate a new set of flow rates for Pitot Tube Test Tables. What had happened through the years was that a set of values had been published for all to use, but, I was unable to come up with the same values by any method of calculation that I knew. So therefore the request for HELP!. I did get several responses and I have made an attempt at calculating a new set of flow tables for measurement by use of the Pitot Tube for the San Juan Basin of New Mexico. This now sends out another plea for help! I need you to look through these attached tables for any errors, miscalculations, advice, suggestions, whatever that comes to your mind, and let me know how they can best be put together and be published in the booklet of test procedures for the San Juan Basin.

If I have made this table in the manner that I think is correct, then the only corrections to any flow rate as measured by using the Pitot Tube would be to correct the rate for any difference in specific gravity of the gas from 0.600 and adjust the flow rate for any flowing temperature difference from $60^{o}F$..

Also, I do not place much value on showing flow rates in a Pitot Tube Table with MCF/D measured to one-tenth MCF/D. With your approval, I will remake the table with your corrections to show only whole numbers for the flow rates.

Do you have any pictures of any gas production equipment that you would permit us to use on the cover of the Test Manual For the San Juan Basin. I looked for something appropriate and did not have much luck in finding something good. This could be approximately 2 inches high and up to 6.5 inches wide. I looked at the NMOCD stationery and found a picture of a pump jack, which leaves me cold for a gas well test manual. Maybe a hand drawing of gas production equipment or....your suggestions. Thanks.

(I printed the calculation routine tables on 2 sides of the paper to conserve paper and postage. I hope this is OK with you.)

Sincerely,

Babe

EXPLANATION OF CALCULATION OF PITOT TUBE TABLES 8/15/85

THESE PAGES ARE INTENDED TO DESCRIBE THE CALCULATIONS USED IN DETERMINING THE VALUES DISPLAYED IN THE ATTACHED 43 PAGE TABLE OF PITOT TUBE VALUES TO BE USED IN THE SAN JUAN AREA OF NEW MEXICO.

A PAGE LIST DESCRIBES WHAT VALUES CAN BE FOUND ON WHICH PAGE. THE COLUMNS RUN ACROSS THE PAGE FROM LEFT TO RIGHT FROM "A" TO "R". VALUES FOR THE PITOT TABLES WILL BE FOUND ONLY IN COLUMNS "A THRU H". ROWS RUN DOWN THE PAGE FROM 1 TO 255. A "CELL" IS DEFINED AS ONE BOX IN THE CHART THAT CAN BE IDENTIFIED AS "COLUMN NO.—ROW NO.". FOR INSTANCE IF YOU LOOK IN "COLUMN D ROW 5" YOU FIND A VALUE PRINTED AS 1.049 AND THIS "CELL" IS IDENTIFIED AS D5.

NOW FOR SOME OF THE DATA ON THIS CHART.

COLUMN A DISPLAYS THE IMPACT PRESSURE AS MEASURED IN INCHES OF WATER AND "CELL" A7 STARTS THE LIST WITH A VALUE OF 0.1 INCHES AND THE PRESSURE INCREASES AS YOU PROGRESS TO ADDITIONAL ROWS GOING DOWN THE PAGE.

COLUMN B DISPLAYS THE IMPACT PRESSURE AS MEASURED IN INCHES OF MERCURY WITH THE FIRST VALUE ENTERED IN THIS COLUMN BEING IN "CELL" B33 AS A VALUE OF 0.2 INCHES. THE IMPACT PRESSURES SHOWN IN INCHES OF MERCURY ARE ONLY INDICATED SPASMODICALLY UNTIL A PRESSURE OF 1.21 INCHES MERCURY IS FOUND AT "CELL" B119. THESE PRESSURES IN INCHES OF MERCURY ARE SHOWN ONLY AS VALUES ASSOCIATED WITH THE IMPACT PRESSURES IN INCHES OF WATER AS INDICATED IN COLUMN A DOWN TO "CELL" A166. BEGINNING WITH "CELL" B167 THE TABLE PROGRESSES WITH INCREASED PRESSURES SYSTEMATICALLY IN THE B COLUMN USING INCHES OF MERCURY IMPACT PRESSURE.

COLUMN C DISPLAYS THE IMPACT PRESSURE AS MEASURED IN POUNDS PER SQUARE INCH GAUGE. THE FIRST ENTRY IS A VALUE OF 0.25 FOUND IN "CELL" C75. THE VALUES OF PSIG ONLY APPEAR SPASMODICALLY UNTIL "CELL" C175 BEGINS WITH A VALUE OF 2.26 PSIG AND FROM THERE DOWN TO "CELL" C231 THE VALUES CORRESPOND TO THE INCHES OF MERCURY COLUMN.

AT ROW 232 THE SPACING BETWEEN NUMBERS REPRESENTING THE IMPACT PRESSURES PROGRESSES WITH SPACINGS IN THE PSIG COLUMN TO THE END OF THE CHART AT "CELL" C255 WITH AN IMPACT PRESSURE OF 39.00 PSIG.

THE REASONING BEHIND THE CHOSEN VALUES OF IMPACT PRESSURE IS:

1. GENERALLY THE FLOW RATE TO BE MEASURED BY PITOT TUBE TYPE MEASUREMENT WILL BE A VERY SMALL NUMBER SO THE INCHES OF WATER TABLE WAS MADE TO COVER THOSE VALUES.

2. UP TO 30 INCHES OF WATER CAN USUALLY BE MEASURED WITHOUT MUCH TROUBLE. ABOVE THAT POINT THE MEASUREMENT CAN BE MEASURED IN INCHES OF MERCURY.

3. IF THE FLOW RATE IS SUCH THAT THE IMPACT PRESSURE CAN BE MEASURED IN PSIG, THEN THE COLUMN FOR THAT TYPE MEASUREMENT IS PROVIDED.

4. THERE ARE TIMES WHEN THE FLOW RATE THROUGH A FLOW NIPPLE IS QUITE LARGE AND FOR THAT REASON VALUES ARE PROVIDED FOR DETERMINING FLOW RATES THROUGH LARGER FLOW NIPPLES UP TO 6 INCHES.

COLUMNS D, E, F, G AND H ARE PROVIDED TO INDICATE THE FLOW RATE THROUGH FLOW NIPPLES OF NOMINAL SIZES OF 1, 2, 3, 4 AND 6 INCHES.

"CELL" D5 INDICATES A VALUE OF 1.049 INCHES. THIS IS CONSIDERED THE INSIDE DIAMETER OF 1 INCH LINE PIPE. IF THIS VALUE IS INCORRECT, IT CAN BE CHANGED OR THE FLOW RATE CAN BE CORRECTED BY USING THE CORRECT DIAMETER OF THE FLOW NIPPLE.

"CELL" E5 INDICATES A VALUE OF 2.067 INCHES. THIS IS CONSIDERED THE INSIDE DIAMETER OF 2 INCH LINE PIPE. IF THIS VALUE IS INCORRECT, IT CAN BE CHANGED OR THE FLOW RATE CAN BE CORRECTED BY USING THE CORRECT DIAMETER OF THE FLOW NIPPLE.

"CELL" F5 INDICATES A VALUE OF 3.068 INCHES. THIS IS CONSIDERED THE INSIDE DIAMETER OF 3 INCH LINE PIPE. IF THIS VALUE IS INCORRECT, IT CAN BE CHANGED OR THE FLOW RATE CAN BE CORRECTED BY USING THE CORRECT DIAMETER OF THE FLOW NIPPLE.

"CELL" G5 INDICATES A VALUE OF 4.026 INCHES. THIS IS CONSIDERED THE INSIDE DIAMETER OF 4 INCH LINE PIPE. IF THIS VALUE IS INCORRECT, IT CAN BE CHANGED OR THE FLOW RATE CAN BE CORRECTED BY USING THE CORRECT DIAMETER OF THE FLOW NIPPLE.

"CELL" H5 INDICATES A VALUE OF 6.065 INCHES. THIS IS CONSIDERED THE INSIDE DIAMETER OF 6 INCH LINE PIPE. IF THIS VALUE IS INCORRECT, IT CAN BE CHANGED OR THE FLOW RATE CAN BE CORRECTED BY USING THE CORRECT DIAMETER OF THE FLOW NIPPLE.

A TABLE IS ATTACHED TO INDICATE HOW THE PAGES ARE NUMBERED THROUGHOUT THIS REPORT. COLUMNS A THRU F ARE PRINTED ON PAGES 1 THRU 21. COLUMNS G THRU L ARE PRINTED ON PAGES 22 THRU 42 AND COLUMNS M THRU R ARE PRINTED ON PAGES 43 THRU 63. I HAVE ONLY SUBMITTED TO YOU PAGES 1 THRU 43. THESE PAGES CONTAIN ALL THE DATA THAT WAS USED IN CALCULATING THE VALUES OF FLOW NECESSARY TO THESE TABLES.

NOW THAT I HAVE TRIED TO INTRODUCE YOU TO SOME OF THE PECULIARITIES OF THE APPLE LISA COMPUTER, LET ME ASK YOU TO LOOK AT CERTAIN VALUES THAT WERE APPLIED IN THE COMPUTATIONS. START WITH PAGE 22, "CELL" L1. (IN LISA LANGUAGE * MEANS MULTIPLY, / MEANS DIVIDE, = MEANS EQUALS, AND ^ MEANS EXPONENT.)

"CELL" L1: (3600*24*520*π)/1000*4*144*14.7) = 16.6696753
THIS IS PART OF THE FLOW FORMULA FROM THE HANDBOOK OF NATURAL GAS.

"CELL" L3: ((62.4*10.73*64.4)/(12*29))^.5 = 11.13128923
THIS IS ANOTHER PART OF THE FLOW FORMULA FROM THE HANDBOOK OF NATURAL GAS.

"CELL" L7: L1*L3 = 185.5549772
THIS TAKES THE VALUES DETERMINED IN L1 AND L3 ABOVE AND MULTIPLIES THEM TOGETHER.

"CELL" L9: 0.86*((14.7)/(0.6*520))^.5 = .1866722756
AT THIS POINT I PLACED THE EFFICIENCY FACTOR OF 0.86 INTO THE FLOW FORMULA FROM THE NATURAL GAS HANDBOOK AND ALSO APPLIED A GRAVITY OF 0.6 AND A TEMPERATURE OF 60° F (OR 520° Abs.).

"CELL" L11: L7*L9 = 34.63796984
THIS TAKES THE VALUES DETERMINED IN L7 AND L9 ABOVE AND MULTIPLIES THEM TOGETHER. <u>THIS VALUE IS THE ONE THAT HAS BEEN USED TO DETERMINE THE FLOW RATE FOR EACH VALUE OF THE IMPACT PRESSURE.</u>

IN EACH OF THE CELL VALUES OF D7, E7, F7, G7, AND H7 AND ON DOWN THE PAGES THROUGH CELL VALUES OF D255, E255, F255, G255 AND H255, L11 IS THE MAIN MULTIPLYING FACTOR. OTHER FACTORS ARE INCLUDED ALSO. SINCE THE FORMULA FROM THE NATURAL GAS ENGINEERING HANDBOOK CALCULATES THE FLOW RATE AT 14.7 PSIA I ADDED A FACTOR OF (14.7/15.025) TO ADJUST THE FLOW RATE TO A PRESSURE BASE OF 15.025 NECESSARY TO THE STATE OF NEW MEXICO. THIS COULD HAVE BEEN INCORPORATED INTO THE L11 VALUE BUT I DID NOT CHOOSE TO DO SO. **(REALLY I WANTED TO SHOW THE VALUE I USED FOR L11 AS BEING SOMEWHAT DIFFERENT FROM THE VALUE SHOWN IN THE NATURAL GAS ENGINEERING HANDBOOK, AND PROBABLY THE ONLY DIFFERENCE IS BY THE AMOUNT OF ROUND OFF THEY USED IN COMPARISON TO WHAT I HAVE USED. ANYWAY THE VALUES ARE DIFFERENT!)**

ALSO INCLUDED IN EACH "CELL" CALCULATION IS THE VALUE OF THE DIAMETER OF THE FLOW NIPPLE SQUARED TIMES THE SQUARE ROOT OF THE IMPACT PRESSURE IN INCHES OF WATER TIMES THE L11 VALUE TIMES THE CORRECTION FOR PRESSURE BASE.

L11*D5^2*(A7)^.5*(14.7/15.025) = 12 = CELL D7

AT ROW 167 THE CALCULATION ROUTINE WAS CHANGED A LITTLE TO CHANGE THE MULTIPLIER FROM INCHES OF WATER IMPACT DIRECTLY TO INCHES OF MERCURY TIMES 13.59.

L11*D5^2*(B167*13.59)^.5*(14.7/15.025) = 238 = CELL D167

AT ROW 231 THE CALCULATION ROUTINE WAS CHANGED A LITTLE TO CHANGE THE MULTIPLIER FROM INCHES OF MERCURY IMPACT TO POUNDS PER SQUARE INCH IMPACT. THIS WAS DOWN BY TAKING THE POUNDS PER SQUARE INCH IMPACT PRESSURE TIMES 144 TIMES 12 AND DIVIDING BY 62.428.

L11*D5^2*(C231*144*12/62.428)^.5*(14.7/15.025) = 760
= CELL D231

TO DETERMINE THE RATE OF FLOW BY PITOT TUBE MEASUREMENT:

1. MEASURE THE IMPACT PRESSURE AND FLOWING TEMPERATURE AND GAS GRAVITY.

2. FIND THE FLOW RATE IN THESE TABLES CORRESPONDING TO THE MEASURED IMPACT PRESSURE.

3. MULTIPLY THAT FLOW RATE BY THE APPROPRIATE CORRECTION FACTOR FOR TEMPERATURE AND GRAVITY.

NOTES;

EACH CALCULATION FOR EACH CELL VALUE FROM D7–D255 AND E, F, G, AND H FROM 7–255 WERE EACH CALCULATED SEPARATELY AND ONE VALUE WAS NOT ESTABLISHED AS A MULTIPLE OF ANOTHER PREVIOUSLY CALCULATED FLOW RATE VALUE.

NOW FOR THE HARD PART: I NEED EACH OF YOU (OR ANYONE YOU CAN GET) TO LOOK THIS OVER VERY CAREFULLY TO FIND OUT WHAT HAS BEEN DONE WRONG. I THINK THAT I CAN GET PRINTED ANY ANSWER THAT YOU FEEL IS THE CORRECT ANSWER TO BE APPLIED FOR THIS TABLE. IT MAY SEEM STRANGE THAT AFTER ALL THESE YEARS WE NOW ARE UNABLE TO CALCULATE THE SAME ANSWER FOR THESE TABULAR VALUES AS HAS BEEN PUBLISHED FOR THIS AREA.

IF YOU HAVE ANY QUESTIONS WHATEVER ABOUT WHAT I HAVE DONE OR WHY I DID IT THIS WAY PLEASE FEEL FREE TO CALL ME SO WE CAN DISCUSS IT.

ROW NUMBERS	COLUMNS A-F PAGE NO.	COLUMNS G-L PAGE NO.	COLUMNS M-R PAGE NO.
1--17	1	22	43
18--31	2	23	44
32--45	3	24	45
46--59	4	25	46
60--73	5	26	47
74--87	6	27	48
88--101	7	28	49
102--115	8	29	50
116--129	9	30	51
130--143	10	31	52
144--157	11	32	53
158--170	12	33	54
171--181	13	34	55
182--192	14	35	56
193--203	15	36	57
204--214	16	37	58
215--225	17	38	59
226--235	18	39	60
236--244	19	40	61
245--253	20	41	62
254--255	21	42	63

PITOT TUBE IMPACT PRESSURE		FLOW	NIPPLE	INSIDE	DIAMETER	INCHES
INCHES WATER	INCHES MERCURY	LBS. PER SQ. IN.	1" nominal actual dia.	2" nominal actual dia.	3" nominal actual dia.	4" nominal actual dia.	6" nominal actual dia.
			1.049	2.067	3.068	4.026	6.065
.1			12	46	101	174	394
.2			17	65	143	246	557
.3			20	79	175	301	683
.4			24	92	202	347	788
.5			26	102	226	388	881
.6			29	112	247	425	966
.7			31	121	267	460	1,043
.8			33	130	285	491	1,115
.9			35	137	303	521	1,183
1.0			37	145	319	549	1,247
1.1			39	152	335	576	1,307
1.2			41	159	349	602	1,366
1.3			43	165	364	626	1,421
1.4			44	171	377	650	1,475
1.5			46	177	391	673	1,527
1.6			47	183	403	695	1,577
1.7			49	189	416	716	1,625
1.8			50	194	428	737	1,672
1.9			51	200	440	757	1,718
2.0			53	205	451	777	1,763
2.1			54	210	462	796	1,806
2.2			55	215	473	815	1,849
2.3			57	220	484	833	1,891
2.4			58	224	494	851	1,931
2.5			59	229	504	869	1,971
2.6			60	233	514	886	2,010
2.7	.20		61	238	524	903	2,048
2.8			62	242	534	919	2,086
2.9			64	247	543	935	2,123
3.0			65	251	552	951	2,159
3.1			66	255	562	967	2,195
3.2			67	259	571	983	2,230
3.3			68	263	579	998	2,265
3.4			69	267	588	1,013	2,299
3.5			70	271	597	1,028	2,332
3.6			71	275	605	1,042	2,365
3.7			72	279	614	1,057	2,398
3.8			73	282	622	1,071	2,430
3.9			74	286	630	1,085	2,462
4.0			75	290	638	1,099	2,493
4.1	.30		76	293	646	1,112	2,524
4.2			76	297	654	1,126	2,555
4.3			77	300	661	1,139	2,585
4.4			78	304	669	1,152	2,615
4.5			79	307	677	1,165	2,644
4.6			80	311	684	1,178	2,674
4.7			81	314	692	1,191	2,703
4.8			82	317	699	1,203	2,731
4.9			83	321	706	1,216	2,759
5.0			83	324	713	1,228	2,787
5.1			84	327	720	1,240	2,815
5.2			85	330	727	1,253	2,843
5.3			86	333	734	1,265	2,870
5.4	.40		87	336	741	1,276	2,897
5.5			87	340	748	1,288	2,923
5.6			88	343	755	1,300	2,950
5.7			89	346	762	1,311	2,976
5.8			90	349	768	1,323	3,002
5.9			91	352	775	1,334	3,028
6.0			91	355	781	1,345	3,053
6.1			92	358	788	1,357	3,079
6.2			93	361	794	1,368	3,104
6.3			94	363	801	1,379	3,129

6.4			94	366	807	1,390	3,154
6.5			95	369	813	1,400	3,178
6.6			96	372	819	1,411	3,202
6.7			97	375	826	1,422	3,227
6.8	.50		97	378	832	1,432	3,251
6.9		.25	98	380	838	1,443	3,274
7.0			99	383	844	1,453	3,298
7.1			99	386	850	1,464	3,322
7.2			100	389	856	1,474	3,345
7.3			101	391	862	1,484	3,368
7.4			101	394	868	1,494	3,391
7.5			102	397	874	1,504	3,414
7.6			103	399	879	1,514	3,437
7.7			103	402	885	1,524	3,459
7.8			104	404	891	1,534	3,481
7.9			105	407	897	1,544	3,504
8.0			105	410	902	1,554	3,526
8.1			106	412	908	1,563	3,548
8.2	.60		107	415	913	1,573	3,570
8.3			107	417	919	1,582	3,591
8.4			108	420	924	1,592	3,613
8.5			109	422	930	1,601	3,634
8.6			109	425	935	1,611	3,656
8.7			110	427	941	1,620	3,677
8.8			111	430	946	1,629	3,698
8.9			111	432	952	1,639	3,719
9.0			112	434	957	1,648	3,740
9.1			112	437	962	1,657	3,760
9.2			113	439	968	1,666	3,781
9.3			114	442	973	1,675	3,802
9.4			114	444	978	1,684	3,822
9.5	.70		115	446	983	1,693	3,842
9.6			116	449	988	1,702	3,862
9.7			116	451	993	1,711	3,882
9.8			117	453	999	1,720	3,902
9.9			117	456	1,004	1,728	3,922
10.0			118	458	1,009	1,737	3,942
10.5			121	469	1,034	1,780	4,039
11.0	.81		124	480	1,058	1,822	4,134
11.5			126	491	1,082	1,863	4,227
12.0			129	502	1,105	1,903	4,318
12.5			132	512	1,128	1,942	4,407
13.0			134	522	1,150	1,980	4,495
13.5	.99	.49	137	532	1,172	2,018	4,580
14.0			140	542	1,194	2,055	4,664
14.5			142	551	1,215	2,092	4,747
15.0	1.10		144	561	1,235	2,127	4,828
15.5			147	570	1,256	2,163	4,908
16.0			149	579	1,276	2,197	4,986
16.5	1.21		151	588	1,296	2,231	5,064
17.0	1.25		154	597	1,315	2,265	5,140
17.5	1.29		156	606	1,334	2,298	5,215
18.0	1.32		158	614	1,353	2,330	5,289
18.5	1.36		160	623	1,372	2,363	5,362
19.0	1.40		163	631	1,390	2,394	5,434
19.5	1.43		165	639	1,409	2,426	5,505
20.0	1.47		167	648	1,427	2,457	5,575
20.5	1.51		169	656	1,444	2,487	5,644
21.0	1.55	.76	171	664	1,462	2,517	5,713
21.5	1.58		173	671	1,479	2,547	5,780
22.0	1.62		175	679	1,496	2,576	5,847
22.5	1.66		177	687	1,513	2,606	5,913
23.0	1.69		179	694	1,530	2,634	5,978
23.5	1.73		181	702	1,546	2,663	6,043
24.0	1.77		183	709	1,563	2,691	6,107
24.5	1.80		185	717	1,579	2,719	6,170
25.0	1.84		186	724	1,595	2,746	6,233
25.5	1.88		188	731	1,611	2,774	6,295
26.0	1.91		190	738	1,626	2,801	6,356

26.5	1.95		192	745	1,642	2,828	6,417
27.0	1.99		194	752	1,657	2,854	6,477
27.5	2.02	.99	196	759	1,673	2,881	6,537
28.0	2.06		197	766	1,688	2,907	6,596
28.5	2.10		199	773	1,703	2,932	6,655
29.0	2.13		201	780	1,718	2,958	6,713
29.5	2.17		203	786	1,733	2,983	6,771
30.0	2.21		204	793	1,747	3,009	6,828
30.5	2.24		206	800	1,762	3,034	6,884
31.0	2.28		208	806	1,776	3,058	6,941
31.5	2.32		209	813	1,790	3,083	6,996
32.0	2.35		211	819	1,804	3,107	7,052
32.5	2.39		213	825	1,818	3,131	7,107
33.0	2.43		214	832	1,832	3,155	7,161
33.5	2.47		216	838	1,846	3,179	7,215
34.0	2.50		217	844	1,860	3,203	7,269
34.5	2.54	1.25	219	850	1,874	3,226	7,322
35.0	2.58		221	857	1,887	3,250	7,375
35.5	2.61		222	863	1,901	3,273	7,427
36.0	2.65		224	869	1,914	3,296	7,479
36.5	2.69		225	875	1,927	3,319	7,531
37.0	2.72		227	881	1,940	3,341	7,583
37.5	2.76		228	887	1,953	3,364	7,634
38.0	2.80		230	893	1,966	3,386	7,684
38.5	2.83		231	898	1,979	3,408	7,735
39.0	2.87		233	904	1,992	3,430	7,785
39.5	2.91		234	910	2,005	3,452	7,835
40.0	2.94		236	916	2,017	3,474	7,884
*40.8	3.00	1.47	238	924	2,037	3,507	7,960
43.5	3.20		246	955	2,104	3,622	8,221
46.2	3.40		253	984	2,168	3,734	8,474
48.9	3.60		261	1,013	2,231	3,842	8,719
51.6	3.80		268	1,040	2,292	3,947	8,958
54.3	4.00	1.96	275	1,068	2,352	4,050	9,191
57.1	4.20		282	1,094	2,410	4,150	9,418
59.8	4.40		288	1,120	2,467	4,248	9,639
62.5	4.60	2.26	295	1,145	2,522	4,343	9,856
65.2	4.80	2.35	301	1,169	2,576	4,436	10,068
68.0	5.00	2.45	307	1,194	2,629	4,528	10,276
70.7	5.20	2.55	313	1,217	2,681	4,618	10,479
73.4	5.40	2.65	319	1,240	2,733	4,706	10,679
76.1	5.60	2.75	325	1,263	2,783	4,792	10,875
78.8	5.80	2.84	331	1,285	2,832	4,877	11,067
81.5	6.00	2.94	337	1,307	2,880	4,960	11,256
	6.50	3.19	350	1,361	2,998	5,163	11,716
	7.00	3.43	364	1,412	3,111	5,357	12,158
	7.50	3.68	376	1,462	3,220	5,546	12,585
	8.00	3.92	389	1,510	3,326	5,727	12,998
	8.50	4.17	401	1,556	3,428	5,904	13,398
	9.00	4.41	412	1,601	3,528	6,075	13,786
	9.50	4.66	424	1,645	3,624	6,241	14,164
	10.00	4.91	435	1,688	3,719	6,403	14,532
	10.50	5.15	445	1,730	3,810	6,562	14,891
	11.00	5.40	456	1,770	3,900	6,716	15,241
	11.50	5.64	466	1,810	3,988	6,867	15,584
	12.00	5.89	476	1,849	4,073	7,015	15,919
	12.50	6.13	486	1,887	4,157	7,159	16,247
	13.00	6.38	496	1,924	4,240	7,301	16,569
	13.50	6.62	505	1,961	4,321	7,440	16,885
	14.00	6.87	514	1,997	4,400	7,577	17,195
	14.50	7.11	523	2,032	4,478	7,711	17,499
	15.00	7.36	532	2,067	4,554	7,843	17,798
	15.50	7.60	541	2,101	4,630	7,972	18,092
	16.00	7.85	550	2,135	4,704	8,100	18,382
	16.50	8.09	558	2,168	4,777	8,225	18,667
	17.00	8.34	567	2,201	4,848	8,349	18,947
	17.50	8.58	575	2,233	4,919	8,471	19,224
	18.00	8.83	583	2,265	4,989	8,591	19,497
	18.50	9.07	591	2,296	5,058	8,710	19,766

19.00	9.32	599	2,327	5,126	8,827	20,031
19.50	9.56	607	2,357	5,193	8,942	20,293
20.00	9.81	615	2,387	5,259	9,056	20,551
20.50	10.06	622	2,417	5,324	9,168	20,807
21.00	10.30	630	2,446	5,389	9,279	21,059
21.50	10.55	637	2,475	5,452	9,389	21,308
22.00	10.79	645	2,504	5,516	9,498	21,555
22.50	11.04	652	2,532	5,578	9,605	21,798
23.00	11.28	659	2,560	5,639	9,711	22,039
23.50	11.53	666	2,587	5,700	9,816	22,277
24.00	11.77	673	2,615	5,761	9,920	22,513
24.50	12.02	680	2,642	5,820	10,023	22,746
25.00	12.26	687	2,669	5,880	10,125	22,977
25.50	12.51	694	2,695	5,938	10,225	23,206
26.00	12.75	701	2,722	5,996	10,325	23,432
26.50	13.00	708	2,748	6,053	10,424	23,656
27.00	13.24	714	2,773	6,110	10,522	23,879
27.50	13.49	721	2,799	6,167	10,619	24,099
28.00	13.73	727	2,824	6,222	10,715	24,317
28.50	13.98	734	2,849	6,278	10,810	24,533
29.00	14.22	740	2,874	6,332	10,905	24,747
29.50	14.47	747	2,899	6,387	10,998	24,960
30.00	14.72	753	2,924	6,441	11,091	25,170
*30.58	15.00	760	2,950	6,500	11,193	25,401
32.62	16.00	785	3,047	6,713	11,560	26,234
34.66	17.00	809	3,141	6,919	11,915	27,041
36.70	18.00	832	3,232	7,120	12,261	27,825
38.74	19.00	855	3,320	7,315	12,597	28,587
40.77	20.00	877	3,407	7,505	12,924	29,330
42.81	21.00	899	3,491	7,691	13,243	30,054
44.85	22.00	920	3,573	7,872	13,555	30,762
46.89	23.00	941	3,653	8,048	13,860	31,453
48.93	24.00	961	3,732	8,222	14,158	32,130
50.97	25.00	981	3,809	8,391	14,450	32,792
53.01	26.00	1,000	3,884	8,557	14,736	33,441
55.04	27.00	1,019	3,958	8,720	15,016	34,079
57.08	28.00	1,038	4,031	8,880	15,292	34,704
59.12	29.00	1,057	4,102	9,037	15,563	35,318
61.16	30.00	1,075	4,172	9,192	15,829	35,922
63.20	31.00	1,092	4,241	9,344	16,090	36,516
65.24	32.00	1,110	4,309	9,493	16,348	37,100
	33.00	1,127	4,376	9,641	16,601	37,675
	34.00	1,144	4,442	9,786	16,851	38,242
	35.00	1,161	4,507	9,928	17,097	38,800
	36.00	1,177	4,571	10,069	17,339	39,351
	37.00	1,193	4,634	10,208	17,579	39,893
	38.00	1,209	4,696	10,345	17,815	40,429
	39.00	1,225	4,757	10,480	18,048	40,957

	A	B	C	D	E	F
1	PITOT TU	BE IMPACT	PRESSURE	FLOW	NIPPLE	INSIDE
2	INCHES	INCHES	LBS. PER	1" nominal	2" nominal	3" nominal
3	WATER	MERCURY	SQ. IN.	actual dia.	actual dia.	actual dia.
4						
5				1.049	2.067	3.068
6						
7	.1			(L11*D5^2*(A7)^.5)*(14.7/15.025)= 12	(L11*E5^2*(A7)^.5)*(14.7/15.025)= 46	(L11*F5^2*(A7)^.5)*(14.7/15.025)= 101
8	A7+.1= .2			(L11*D5^2*(A8)^.5)*(14.7/15.025)= 17	(L11*E5^2*(A8)^.5)*(14.7/15.025)= 65	(L11*F5^2*(A8)^.5)*(14.7/15.025)= 143
9	A8+.1= .3			(L11*D5^2*(A9)^.5)*(14.7/15.025)= 20	(L11*E5^2*(A9)^.5)*(14.7/15.025)= 79	(L11*F5^2*(A9)^.5)*(14.7/15.025)= 175
10	A9+.1= .4			(L11*D5^2*(A10)^.5)*(14.7/15.025)= 24	(L11*E5^2*(A10)^.5)*(14.7/15.025)= 92	(L11*F5^2*(A10)^.5)*(14.7/15.025)= 202
11	A10+.1= .5			(L11*D5^2*(A11)^.5)*(14.7/15.025)= 26	(L11*E5^2*(A11)^.5)*(14.7/15.025)= 102	(L11*F5^2*(A11)^.5)*(14.7/15.025)= 226
12	A11+.1= .6			(L11*D5^2*(A12)^.5)*(14.7/15.025)= 29	(L11*E5^2*(A12)^.5)*(14.7/15.025)= 112	(L11*F5^2*(A12)^.5)*(14.7/15.025)= 247
13	A12+.1= .7			(L11*D5^2*(A13)^.5)*(14.7/15.025)= 31	(L11*E5^2*(A13)^.5)*(14.7/15.025)= 121	(L11*F5^2*(A13)^.5)*(14.7/15.025)= 267
14	A13+.1= .8			(L11*D5^2*(A14)^.5)*(14.7/15.025)= 33	(L11*E5^2*(A14)^.5)*(14.7/15.025)= 130	(L11*F5^2*(A14)^.5)*(14.7/15.025)= 285
15	A14+.1= .9			(L11*D5^2*(A15)^.5)*(14.7/15.025)= 35	(L11*E5^2*(A15)^.5)*(14.7/15.025)= 137	(L11*F5^2*(A15)^.5)*(14.7/15.025)= 303
16	A15+.1= 1.0			(L11*D5^2*(A16)^.5)*(14.7/15.025)= 37	(L11*E5^2*(A16)^.5)*(14.7/15.025)= 145	(L11*F5^2*(A16)^.5)*(14.7/15.025)= 319
17	A16+.1= 1.1			(L11*D5^2*(A17)^.5)*(14.7/15.025)= 39	(L11*E5^2*(A17)^.5)*(14.7/15.025)= 152	(L11*F5^2*(A17)^.5)*(14.7/15.025)= 335

	A	B	C	D	E	F
18	A17+.1= 1.2			(L11*D5^2*(A 18)^.5)*(14. 7/15.025)= 41	(L11*E5^2*(A 18)^.5)*(14. 7/15.025)= 159	(L11*F5^2*(A 18)^.5)*(14. 7/15.025)= 349
19	A18+.1= 1.3			(L11*D5^2*(A 19)^.5)*(14. 7/15.025)= 43	(L11*E5^2*(A 19)^.5)*(14. 7/15.025)= 165	(L11*F5^2*(A 19)^.5)*(14. 7/15.025)= 364
20	A19+.1= 1.4			(L11*D5^2*(A 20)^.5)*(14. 7/15.025)= 44	(L11*E5^2*(A 20)^.5)*(14. 7/15.025)= 171	(L11*F5^2*(A 20)^.5)*(14. 7/15.025)= 377
21	A20+.1= 1.5			(L11*D5^2*(A 21)^.5)*(14. 7/15.025)= 46	(L11*E5^2*(A 21)^.5)*(14. 7/15.025)= 177	(L11*F5^2*(A 21)^.5)*(14. 7/15.025)= 391
22	A21+.1= 1.6			(L11*D5^2*(A 22)^.5)*(14. 7/15.025)= 47	(L11*E5^2*(A 22)^.5)*(14. 7/15.025)= 183	(L11*F5^2*(A 22)^.5)*(14. 7/15.025)= 403
23	A22+.1= 1.7			(L11*D5^2*(A 23)^.5)*(14. 7/15.025)= 49	(L11*E5^2*(A 23)^.5)*(14. 7/15.025)= 189	(L11*F5^2*(A 23)^.5)*(14. 7/15.025)= 416
24	A23+.1= 1.8			(L11*D5^2*(A 24)^.5)*(14. 7/15.025)= 50	(L11*E5^2*(A 24)^.5)*(14. 7/15.025)= 194	(L11*F5^2*(A 24)^.5)*(14. 7/15.025)= 428
25	A24+.1= 1.9			(L11*D5^2*(A 25)^.5)*(14. 7/15.025)= 51	(L11*E5^2*(A 25)^.5)*(14. 7/15.025)= 200	(L11*F5^2*(A 25)^.5)*(14. 7/15.025)= 440
26	2.0			(L11*D5^2*(A 26)^.5)*(14. 7/15.025)= 53	(L11*E5^2*(A 26)^.5)*(14. 7/15.025)= 205	(L11*F5^2*(A 26)^.5)*(14. 7/15.025)= 451
27	A26+.1= 2.1			(L11*D5^2*(A 27)^.5)*(14. 7/15.025)= 54	(L11*E5^2*(A 27)^.5)*(14. 7/15.025)= 210	(L11*F5^2*(A 27)^.5)*(14. 7/15.025)= 462
28	A27+.1= 2.2			(L11*D5^2*(A 28)^.5)*(14. 7/15.025)= 55	(L11*E5^2*(A 28)^.5)*(14. 7/15.025)= 215	(L11*F5^2*(A 28)^.5)*(14. 7/15.025)= 473
29	A28+.1= 2.3			(L11*D5^2*(A 29)^.5)*(14. 7/15.025)= 57	(L11*E5^2*(A 29)^.5)*(14. 7/15.025)= 220	(L11*F5^2*(A 29)^.5)*(14. 7/15.025)= 484
30	A29+.1= 2.4			(L11*D5^2*(A 30)^.5)*(14. 7/15.025)= 58	(L11*E5^2*(A 30)^.5)*(14. 7/15.025)= 224	(L11*F5^2*(A 30)^.5)*(14. 7/15.025)= 494
31	A30+.1= 2.5			(L11*D5^2*(A 31)^.5)*(14. 7/15.025)= 59	(L11*E5^2*(A 31)^.5)*(14. 7/15.025)= 229	(L11*F5^2*(A 31)^.5)*(14. 7/15.025)= 504

	A	B	C	D	E	F
32	A31+.1= 2.6			(L11*D5^2*(A 32)^.5)*(14. 7/15.025)= 60	(L11*E5^2*(A 32)^.5)*(14. 7/15.025)= 233	(L11*F5^2*(A 32)^.5)*(14. 7/15.025)= 514
33	A32+.1= 2.7	A33/13.59= .20		(L11*D5^2*(A 33)^.5)*(14. 7/15.025)= 61	(L11*E5^2*(A 33)^.5)*(14. 7/15.025)= 238	(L11*F5^2*(A 33)^.5)*(14. 7/15.025)= 524
34	A33+.1= 2.8			(L11*D5^2*(A 34)^.5)*(14. 7/15.025)= 62	(L11*E5^2*(A 34)^.5)*(14. 7/15.025)= 242	(L11*F5^2*(A 34)^.5)*(14. 7/15.025)= 534
35	A34+.1= 2.9			(L11*D5^2*(A 35)^.5)*(14. 7/15.025)= 64	(L11*E5^2*(A 35)^.5)*(14. 7/15.025)= 247	(L11*F5^2*(A 35)^.5)*(14. 7/15.025)= 543
36	3.0			(L11*D5^2*(A 36)^.5)*(14. 7/15.025)= 65	(L11*E5^2*(A 36)^.5)*(14. 7/15.025)= 251	(L11*F5^2*(A 36)^.5)*(14. 7/15.025)= 552
37	A36+.1=' 3.1			(L11*D5^2*(A 37)^.5)*(14. 7/15.025)= 66	(L11*E5^2*(A 37)^.5)*(14. 7/15.025)= 255	(L11*F5^2*(A 37)^.5)*(14. 7/15.025)= 562
38	A37+.1= 3.2			(L11*D5^2*(A 38)^.5)*(14. 7/15.025)= 67	(L11*E5^2*(A 38)^.5)*(14. 7/15.025)= 259	(L11*F5^2*(A 38)^.5)*(14. 7/15.025)= 571
39	A38+.1= 3.3			(L11*D5^2*(A 39)^.5)*(14. 7/15.025)= 68	(L11*E5^2*(A 39)^.5)*(14. 7/15.025)= 263	(L11*F5^2*(A 39)^.5)*(14. 7/15.025)= 579
40	A39+.1= 3.4			(L11*D5^2*(A 40)^.5)*(14. 7/15.025)= 69	(L11*E5^2*(A 40)^.5)*(14. 7/15.025)= 267	(L11*F5^2*(A 40)^.5)*(14. 7/15.025)= 588
41	A40+.1= 3.5			(L11*D5^2*(A 41)^.5)*(14. 7/15.025)= 70	(L11*E5^2*(A 41)^.5)*(14. 7/15.025)= 271	(L11*F5^2*(A 41)^.5)*(14. 7/15.025)= 597
42	A41+.1= 3.6			(L11*D5^2*(A 42)^.5)*(14. 7/15.025)= 71	(L11*E5^2*(A 42)^.5)*(14. 7/15.025)= 275	(L11*F5^2*(A 42)^.5)*(14. 7/15.025)= 605
43	A42+.1= 3.7			(L11*D5^2*(A 43)^.5)*(14. 7/15.025)= 72	(L11*E5^2*(A 43)^.5)*(14. 7/15.025)= 279	(L11*F5^2*(A 43)^.5)*(14. 7/15.025)= 614
44	A43+.1= 3.8			(L11*D5^2*(A 44)^.5)*(14. 7/15.025)= 73	(L11*E5^2*(A 44)^.5)*(14. 7/15.025)= 282	(L11*F5^2*(A 44)^.5)*(14. 7/15.025)= 622
45	A44+.1= 3.9			(L11*D5^2*(A 45)^.5)*(14. 7/15.025)= 74	(L11*E5^2*(A 45)^.5)*(14. 7/15.025)= 286	(L11*F5^2*(A 45)^.5)*(14. 7/15.025)= 630

	A	B	C	D	E	F
46	4.0			(L11*D5^2*(A46)^.5)*(14.7/15.025)= 75	(L11*E5^2*(A46)^.5)*(14.7/15.025)= 290	(L11*F5^2*(A46)^.5)*(14.7/15.025)= 638
47	A46+.1= 4.1	A47/13.59= .30		(L11*D5^2*(A47)^.5)*(14.7/15.025)= 76	(L11*E5^2*(A47)^.5)*(14.7/15.025)= 293	(L11*F5^2*(A47)^.5)*(14.7/15.025)= 646
48	A47+.1= 4.2			(L11*D5^2*(A48)^.5)*(14.7/15.025)= 76	(L11*E5^2*(A48)^.5)*(14.7/15.025)= 297	(L11*F5^2*(A48)^.5)*(14.7/15.025)= 654
49	A48+.1= 4.3			(L11*D5^2*(A49)^.5)*(14.7/15.025)= 77	(L11*E5^2*(A49)^.5)*(14.7/15.025)= 300	(L11*F5^2*(A49)^.5)*(14.7/15.025)= 661
50	A49+.1= 4.4			(L11*D5^2*(A50)^.5)*(14.7/15.025)= 78	(L11*E5^2*(A50)^.5)*(14.7/15.025)= 304	(L11*F5^2*(A50)^.5)*(14.7/15.025)= 669
51	A50+.1= 4.5			(L11*D5^2*(A51)^.5)*(14.7/15.025)= 79	(L11*E5^2*(A51)^.5)*(14.7/15.025)= 307	(L11*F5^2*(A51)^.5)*(14.7/15.025)= 677
52	A51+.1= 4.6			(L11*D5^2*(A52)^.5)*(14.7/15.025)= 80	(L11*E5^2*(A52)^.5)*(14.7/15.025)= 311	(L11*F5^2*(A52)^.5)*(14.7/15.025)= 684
53	A52+.1= 4.7			(L11*D5^2*(A53)^.5)*(14.7/15.025)= 81	(L11*E5^2*(A53)^.5)*(14.7/15.025)= 314	(L11*F5^2*(A53)^.5)*(14.7/15.025)= 692
54	A53+.1= 4.8			(L11*D5^2*(A54)^.5)*(14.7/15.025)= 82	(L11*E5^2*(A54)^.5)*(14.7/15.025)= 317	(L11*F5^2*(A54)^.5)*(14.7/15.025)= 699
55	A54+.1= 4.9			(L11*D5^2*(A55)^.5)*(14.7/15.025)= 83	(L11*E5^2*(A55)^.5)*(14.7/15.025)= 321	(L11*F5^2*(A55)^.5)*(14.7/15.025)= 706
56	A55+.1= 5.0			(L11*D5^2*(A56)^.5)*(14.7/15.025)= 83	(L11*E5^2*(A56)^.5)*(14.7/15.025)= 324	(L11*F5^2*(A56)^.5)*(14.7/15.025)= 713
57	A56+.1= 5.1			(L11*D5^2*(A57)^.5)*(14.7/15.025)= 84	(L11*E5^2*(A57)^.5)*(14.7/15.025)= 327	(L11*F5^2*(A57)^.5)*(14.7/15.025)= 720
58	A57+.1= 5.2			(L11*D5^2*(A58)^.5)*(14.7/15.025)= 85	(L11*E5^2*(A58)^.5)*(14.7/15.025)= 330	(L11*F5^2*(A58)^.5)*(14.7/15.025)= 727
59	A58+.1= 5.3			(L11*D5^2*(A59)^.5)*(14.7/15.025)= 86	(L11*E5^2*(A59)^.5)*(14.7/15.025)= 333	(L11*F5^2*(A59)^.5)*(14.7/15.025)= 734

	A	B	C	D	E	F
60	A59+.1= 5.4	A60/13.59= .40		(L11*D5^2*(A 60)^.5)*(14. 7/15.025)= 87	(L11*E5^2*(A 60)^.5)*(14. 7/15.025)= 336	(L11*F5^2*(A 60)^.5)*(14. 7/15.025)= 741
61	A60+.1= 5.5			(L11*D5^2*(A 61)^.5)*(14. 7/15.025)= 87	(L11*E5^2*(A 61)^.5)*(14. 7/15.025)= 340	(L11*F5^2*(A 61)^.5)*(14. 7/15.025)= 748
62	A61+.1= 5.6			(L11*D5^2*(A 62)^.5)*(14. 7/15.025)= 88	(L11*E5^2*(A 62)^.5)*(14. 7/15.025)= 343	(L11*F5^2*(A 62)^.5)*(14. 7/15.025)= 755
63	A62+.1= 5.7			(L11*D5^2*(A 63)^.5)*(14. 7/15.025)= 89	(L11*E5^2*(A 63)^.5)*(14. 7/15.025)= 346	(L11*F5^2*(A 63)^.5)*(14. 7/15.025)= 762
64	A63+.1= 5.8			(L11*D5^2*(A 64)^.5)*(14. 7/15.025)= 90	(L11*E5^2*(A 64)^.5)*(14. 7/15.025)= 349	(L11*F5^2*(A 64)^.5)*(14. 7/15.025)= 768
65	A64+.1= 5.9			(L11*D5^2*(A 65)^.5)*(14. 7/15.025)= 91	(L11*E5^2*(A 65)^.5)*(14. 7/15.025)= 352	(L11*F5^2*(A 65)^.5)*(14. 7/15.025)= 775
66	A65+.1= 6.0			(L11*D5^2*(A 66)^.5)*(14. 7/15.025)= 91	(L11*E5^2*(A 66)^.5)*(14. 7/15.025)= 355	(L11*F5^2*(A 66)^.5)*(14. 7/15.025)= 781
67	A66+.1= 6.1			(L11*D5^2*(A 67)^.5)*(14. 7/15.025)= 92	(L11*E5^2*(A 67)^.5)*(14. 7/15.025)= 358	(L11*F5^2*(A 67)^.5)*(14. 7/15.025)= 788
68	A67+.1= 6.2			(L11*D5^2*(A 68)^.5)*(14. 7/15.025)= 93	(L11*E5^2*(A 68)^.5)*(14. 7/15.025)= 361	(L11*F5^2*(A 68)^.5)*(14. 7/15.025)= 794
69	A68+.1= 6.3			(L11*D5^2*(A 69)^.5)*(14. 7/15.025)= 94	(L11*E5^2*(A 69)^.5)*(14. 7/15.025)= 363	(L11*F5^2*(A 69)^.5)*(14. 7/15.025)= 801
70	A69+.1= 6.4			(L11*D5^2*(A 70)^.5)*(14. 7/15.025)= 94	(L11*E5^2*(A 70)^.5)*(14. 7/15.025)= 366	(L11*F5^2*(A 70)^.5)*(14. 7/15.025)= 807
71	A70+.1= 6.5			(L11*D5^2*(A 71)^.5)*(14. 7/15.025)= 95	(L11*E5^2*(A 71)^.5)*(14. 7/15.025)= 369	(L11*F5^2*(A 71)^.5)*(14. 7/15.025)= 813
72	A71+.1= 6.6			(L11*D5^2*(A 72)^.5)*(14. 7/15.025)= 96	(L11*E5^2*(A 72)^.5)*(14. 7/15.025)= 372	(L11*F5^2*(A 72)^.5)*(14. 7/15.025)= 819
73	A72+.1= 6.7			(L11*D5^2*(A 73)^.5)*(14. 7/15.025)= 97	(L11*E5^2*(A 73)^.5)*(14. 7/15.025)= 375	(L11*F5^2*(A 73)^.5)*(14. 7/15.025)= 826

	A	B	C	D	E	F
74	A73+.1= 6.8	A74/13.59= .50		(L11*D5^2*(A 74)^.5)*(14. 7/15.025)= 97	(L11*E5^2*(A 74)^.5)*(14. 7/15.025)= 378	(L11*F5^2*(A 74)^.5)*(14. 7/15.025)= 832
75	A74+.1= 6.9		L112*A75= .25	(L11*D5^2*(A 75)^.5)*(14. 7/15.025)= 98	(L11*E5^2*(A 75)^.5)*(14. 7/15.025)= 380	(L11*F5^2*(A 75)^.5)*(14. 7/15.025)= 838
76	A75+.1= 7.0			(L11*D5^2*(A 76)^.5)*(14. 7/15.025)= 99	(L11*E5^2*(A 76)^.5)*(14. 7/15.025)= 383	(L11*F5^2*(A 76)^.5)*(14. 7/15.025)= 844
77	A76+.1= 7.1			(L11*D5^2*(A 77)^.5)*(14. 7/15.025)= 99	(L11*E5^2*(A 77)^.5)*(14. 7/15.025)= 386	(L11*F5^2*(A 77)^.5)*(14. 7/15.025)= 850
78	A77+.1= 7.2			(L11*D5^2*(A 78)^.5)*(14. 7/15.025)= 100	(L11*E5^2*(A 78)^.5)*(14. 7/15.025)= 389	(L11*F5^2*(A 78)^.5)*(14. 7/15.025)= 856
79	A78+.1= 7.3			(L11*D5^2*(A 79)^.5)*(14. 7/15.025)= 101	(L11*E5^2*(A 79)^.5)*(14. 7/15.025)= 391	(L11*F5^2*(A 79)^.5)*(14. 7/15.025)= 862
80	A79+.1= 7.4			(L11*D5^2*(A 80)^.5)*(14. 7/15.025)=	(L11*E5^2*(A 80)^.5)*(14. 7/15.025)= 394	(L11*F5^2*(A 80)^.5)*(14. 7/15.025)= 868
81	A80+.1= 7.5			(L11*D5^2*(A 81)^.5)*(14. 7/15.025)= 102	(L11*E5^2*(A 81)^.5)*(14. 7/15.025)= 397	(L11*F5^2*(A 81)^.5)*(14. 7/15.025)= 874
82	A81+.1= 7.6			(L11*D5^2*(A 82)^.5)*(14. 7/15.025)= 103	(L11*E5^2*(A 82)^.5)*(14. 7/15.025)= 399	(L11*F5^2*(A 82)^.5)*(14. 7/15.025)= 879
83	A82+.1= 7.7			(L11*D5^2*(A 83)^.5)*(14. 7/15.025)= 103	(L11*E5^2*(A 83)^.5)*(14. 7/15.025)= 402	(L11*F5^2*(A 83)^.5)*(14. 7/15.025)= 885
84	A83+.1= 7.8			(L11*D5^2*(A 84)^.5)*(14. 7/15.025)= 104	(L11*E5^2*(A 84)^.5)*(14. 7/15.025)= 404	(L11*F5^2*(A 84)^.5)*(14. 7/15.025)= 891
85	A84+.1= 7.9			(L11*D5^2*(A 85)^.5)*(14. 7/15.025)= 105	(L11*E5^2*(A 85)^.5)*(14. 7/15.025)= 407	(L11*F5^2*(A 85)^.5)*(14. 7/15.025)= 897
86	A85+.1= 8.0			(L11*D5^2*(A 86)^.5)*(14. 7/15.025)= 105	(L11*E5^2*(A 86)^.5)*(14. 7/15.025)= 410	(L11*F5^2*(A 86)^.5)*(14. 7/15.025)= 902
87	A86+.1= 8.1			(L11*D5^2*(A 87)^.5)*(14. 7/15.025)= 106	(L11*E5^2*(A 87)^.5)*(14. 7/15.025)= 412	(L11*F5^2*(A 87)^.5)*(14. 7/15.025)= 908

	A	B	C	D	E	F
88	A87+.1= 8.2	A88/13.59= .60		(L11*D5^2*(A 88)^.5)*(14. 7/15.025)= 107	(L11*E5^2*(A 88)^.5)*(14. 7/15.025)= 415	(L11*F5^2*(A 88)^.5)*(14. 7/15.025)= 913
89	A88+.1= 8.3			(L11*D5^2*(A 89)^.5)*(14. 7/15.025)= 107	(L11*E5^2*(A 89)^.5)*(14. 7/15.025)= 417	(L11*F5^2*(A 89)^.5)*(14. 7/15.025)= 919
90	A89+.1= 8.4			(L11*D5^2*(A 90)^.5)*(14. 7/15.025)= 108	(L11*E5^2*(A 90)^.5)*(14. 7/15.025)= 420	(L11*F5^2*(A 90)^.5)*(14. 7/15.025)= 924
91	A90+.1= 8.5			(L11*D5^2*(A 91)^.5)*(14. 7/15.025)= 109	(L11*E5^2*(A 91)^.5)*(14. 7/15.025)= 422	(L11*F5^2*(A 91)^.5)*(14. 7/15.025)= 930
92	A91+.1= 8.6			(L11*D5^2*(A 92)^.5)*(14. 7/15.025)= 109	(L11*E5^2*(A 92)^.5)*(14. 7/15.025)= 425	(L11*F5^2*(A 92)^.5)*(14. 7/15.025)= 935
93	A92+.1= 8.7			(L11*D5^2*(A 93)^.5)*(14. 7/15.025)= 110	(L11*E5^2*(A 93)^.5)*(14. 7/15.025)= 427	(L11*F5^2*(A 93)^.5)*(14. 7/15.025)= 941
94	A93+.1= 8.8			(L11*D5^2*(A 94)^.5)*(14. 7/15.025)= 111	(L11*E5^2*(A 94)^.5)*(14. 7/15.025)= 430	(L11*F5^2*(A 94)^.5)*(14. 7/15.025)= 945
95	A94+.1= 8.9			(L11*D5^2*(A 95)^.5)*(14. 7/15.025)= 111	(L11*E5^2*(A 95)^.5)*(14. 7/15.025)= 432	(L11*F5^2*(A 95)^.5)*(14. 7/15.025)= 952
96	A95+.1= 9.0			(L11*D5^2*(A 96)^.5)*(14. 7/15.025)= 112	(L11*E5^2*(A 96)^.5)*(14. 7/15.025)= 434	(L11*F5^2*(A 96)^.5)*(14. 7/15.025)= 957
97	A96+.1= 9.1			(L11*D5^2*(A 97)^.5)*(14. 7/15.025)= 112	(L11*E5^2*(A 97)^.5)*(14. 7/15.025)= 437	(L11*F5^2*(A 97)^.5)*(14. 7/15.025)= 962
98	A97+.1= 9.2			(L11*D5^2*(A 98)^.5)*(14. 7/15.025)= 113	(L11*E5^2*(A 98)^.5)*(14. 7/15.025)= 439	(L11*F5^2*(A 98)^.5)*(14. 7/15.025)= 968
99	A98+.1= 9.3			(L11*D5^2*(A 99)^.5)*(14. 7/15.025)= 114	(L11*E5^2*(A 99)^.5)*(14. 7/15.025)= 442	(L11*F5^2*(A 99)^.5)*(14. 7/15.025)= 973
100	A99+.1= 9.4			(L11*D5^2*(A 100)^.5)*(14 .7/15.025)= 114	(L11*E5^2*(A 100)^.5)*(14 .7/15.025)= 444	(L11*F5^2*(A 100)^.5)*(14 .7/15.025)= 978
101	A100+.1= 9.5	A101/13.59= .70		(L11*D5^2*(A 101)^.5)*(14 .7/15.025)= 115	(L11*E5^2*(A 101)^.5)*(14 .7/15.025)= 446	(L11*F5^2*(A 101)^.5)*(14 .7/15.025)= 983

	A	B	C	D	E	F
102	A101+.1= 9.6			(L11*D5^2*(A102)^.5)*(14.7/15.025)= 116	(L11*E5^2*(A102)^.5)*(14.7/15.025)= 449	(L11*F5^2*(A102)^.5)*(14.7/15.025)= 988
103	A102+.1= 9.7			(L11*D5^2*(A103)^.5)*(14.7/15.025)= 116	(L11*E5^2*(A103)^.5)*(14.7/15.025)= 451	(L11*F5^2*(A103)^.5)*(14.7/15.025)= 993
104	A103+.1= 9.8			(L11*D5^2*(A104)^.5)*(14.7/15.025)= 117	(L11*E5^2*(A104)^.5)*(14.7/15.025)= 453	(L11*F5^2*(A104)^.5)*(14.7/15.025)= 999
105	A104+.1= 9.9			(L11*D5^2*(A105)^.5)*(14.7/15.025)= 117	(L11*E5^2*(A105)^.5)*(14.7/15.025)= 456	(L11*F5^2*(A105)^.5)*(14.7/15.025)= 1,004
106	A105+.1= 10.0			(L11*D5^2*(A106)^.5)*(14.7/15.025)= 118	(L11*E5^2*(A106)^.5)*(14.7/15.025)= 458	(L11*F5^2*(A106)^.5)*(14.7/15.025)= 1,009
107	A106+.5= 10.5			(L11*D5^2*(A107)^.5)*(14.7/15.025)= 121	(L11*E5^2*(A107)^.5)*(14.7/15.025)= 469	(L11*F5^2*(A107)^.5)*(14.7/15.025)= 1,034
108	A107+.5= 11.0	A108/13.59= .81		(L11*D5^2*(A108)^.5)*(14.7/15.025)= 124	(L11*E5^2*(A108)^.5)*(14.7/15.025)= 480	(L11*F5^2*(A108)^.5)*(14.7/15.025)= 1,058
109	A108+.5= 11.5			(L11*D5^2*(A109)^.5)*(14.7/15.025)= 126	(L11*E5^2*(A109)^.5)*(14.7/15.025)= 491	(L11*F5^2*(A109)^.5)*(14.7/15.025)= 1,082
110	A109+.5= 12.0			(L11*D5^2*(A110)^.5)*(14.7/15.025)= 129	(L11*E5^2*(A110)^.5)*(14.7/15.025)= 502	(L11*F5^2*(A110)^.5)*(14.7/15.025)= 1,105
111	A110+.5= 12.5			(L11*D5^2*(A111)^.5)*(14.7/15.025)= 132	(L11*E5^2*(A111)^.5)*(14.7/15.025)= 512	(L11*F5^2*(A111)^.5)*(14.7/15.025)= 1,128
112	A111+.5= 13.0			(L11*D5^2*(A112)^.5)*(14.7/15.025)= 134	(L11*E5^2*(A112)^.5)*(14.7/15.025)= 522	(L11*F5^2*(A112)^.5)*(14.7/15.025)= 1,150
113	A112+.5= 13.5	A113/13.59= .99	L112*A113= .49	(L11*D5^2*(A113)^.5)*(14.7/15.025)= 137	(L11*E5^2*(A113)^.5)*(14.7/15.025)= 532	(L11*F5^2*(A113)^.5)*(14.7/15.025)= 1,172
114	A113+.5= 14.0			(L11*D5^2*(A114)^.5)*(14.7/15.025)= 140	(L11*E5^2*(A114)^.5)*(14.7/15.025)= 542	(L11*F5^2*(A114)^.5)*(14.7/15.025)= 1,194
115	A114+.5= 14.5			(L11*D5^2*(A115)^.5)*(14.7/15.025)= 142	(L11*E5^2*(A115)^.5)*(14.7/15.025)= 551	(L11*F5^2*(A115)^.5)*(14.7/15.025)= 1,215

	A	B	C	D	E	F
116	A115+.5= 15.0	A116/13.59= 1.10		(L11*D5^2*(A 116)^.5)*(14 .7/15.025)= 144	(L11*E5^2*(A 116)^.5)*(14 .7/15.025)= 561	(L11*F5^2*(A 116)^.5)*(14 .7/15.025)= 1,235
117	A116+.5= 15.5			(L11*D5^2*(A 117)^.5)*(14 .7/15.025)= 147	(L11*E5^2*(A 117)^.5)*(14 .7/15.025)= 570	(L11*F5^2*(A 117)^.5)*(14 .7/15.025)= 1,256
118	A117+.5= 16.0			(L11*D5^2*(A 118)^.5)*(14 .7/15.025)= 149	(L11*E5^2*(A 118)^.5)*(14 .7/15.025)= 579	(L11*F5^2*(A 118)^.5)*(14 .7/15.025)= 1,276
119	A118+.5= 16.5	A119/13.59= 1.21		(L11*D5^2*(A 119)^.5)*(14 .7/15.025)= 151	(L11*E5^2*(A 119)^.5)*(14 .7/15.025)= 588	(L11*F5^2*(A 119)^.5)*(14 .7/15.025)= 1,296
120	A119+.5= 17.0	A120/13.59= 1.25		(L11*D5^2*(A 120)^.5)*(14 .7/15.025)= 154	(L11*E5^2*(A 120)^.5)*(14 .7/15.025)= 597	(L11*F5^2*(A 120)^.5)*(14 .7/15.025)= 1,315
121	A120+.5= 17.5	A121/13.59= 1.29		(L11*D5^2*(A 121)^.5)*(14 .7/15.025)= 156	(L11*E5^2*(A 121)^.5)*(14 .7/15.025)= 606	(L11*F5^2*(A 121)^.5)*(14 .7/15.025)= 1,334
122	A121+.5= 18.0	A122/13.59= 1.32		(L11*D5^2*(A 122)^.5)*(14 .7/15.025)= 158	(L11*E5^2*(A 122)^.5)*(14 .7/15.025)= 614	(L11*F5^2*(A 122)^.5)*(14 .7/15.025)= 1,353
123	A122+.5= 18.5	A123/13.59= 1.36		(L11*D5^2*(A 123)^.5)*(14 .7/15.025)= 160	(L11*E5^2*(A 123)^.5)*(14 .7/15.025)= 623	(L11*F5^2*(A 123)^.5)*(14 .7/15.025)= 1,372
124	A123+.5= 19.0	A124/13.59= 1.40		(L11*D5^2*(A 124)^.5)*(14 .7/15.025)= 163	(L11*E5^2*(A 124)^.5)*(14 .7/15.025)= 631	(L11*F5^2*(A 124)^.5)*(14 .7/15.025)= 1,390
125	A124+.5= 19.5	A125/13.59= 1.43		(L11*D5^2*(A 125)^.5)*(14 .7/15.025)= 165	(L11*E5^2*(A 125)^.5)*(14 .7/15.025)= 639	(L11*F5^2*(A 125)^.5)*(14 .7/15.025)= 1,409
126	A125+.5= 20.0	A126/13.59= 1.47		(L11*D5^2*(A 126)^.5)*(14 .7/15.025)= 167	(L11*E5^2*(A 126)^.5)*(14 .7/15.025)= 648	(L11*F5^2*(A 126)^.5)*(14 .7/15.025)= 1,427
127	A126+.5= 20.5	A127/13.59= 1.51		(L11*D5^2*(A 127)^.5)*(14 .7/15.025)= 169	(L11*E5^2*(A 127)^.5)*(14 .7/15.025)= 656	(L11*F5^2*(A 127)^.5)*(14 .7/15.025)= 1,444
128	A127+.5= 21.0	A128/13.59= 1.55	L112*A128= .76	(L11*D5^2*(A 128)^.5)*(14 .7/15.025)= 171	(L11*E5^2*(A 128)^.5)*(14 .7/15.025)= 664	(L11*F5^2*(A 128)^.5)*(14 .7/15.025)= 1,462
129	A128+.5= 21.5	A129/13.59= 1.58		(L11*D5^2*(A 129)^.5)*(14 .7/15.025)= 173	(L11*E5^2*(A 129)^.5)*(14 .7/15.025)= 671	(L11*F5^2*(A 129)^.5)*(14 .7/15.025)= 1,479

	A	B	C	D	E	F
130	A129+.5= 22.0	A130/13.59= 1.62		(L11*D5^2*(A 130)^.5)*(14 .7/15.025)= 175	(L11*E5^2*(A 130)^.5)*(14 .7/15.025)= 679	(L11*F5^2*(A 130)^.5)*(14 .7/15.025)= 1,496
131	A130+.5= 22.5	A131/13.59= 1.66		(L11*D5^2*(A 131)^.5)*(14 .7/15.025)= 177	(L11*E5^2*(A 131)^.5)*(14 .7/15.025)= 687	(L11*F5^2*(A 131)^.5)*(14 .7/15.025)= 1,513
132	A131+.5= 23.0	A132/13.59= 1.69		(L11*D5^2*(A 132)^.5)*(14 .7/15.025)= 179	(L11*E5^2*(A 132)^.5)*(14 .7/15.025)= 694	(L11*F5^2*(A 132)^.5)*(14 .7/15.025)= 1,530
133	A132+.5= 23.5	A133/13.59= 1.73		(L11*D5^2*(A 133)^.5)*(14 .7/15.025)= 181	(L11*E5^2*(A 133)^.5)*(14 .7/15.025)= 702	(L11*F5^2*(A 133)^.5)*(14 .7/15.025)= 1,546
134	A133+.5= 24.0	A134/13.59= 1.77		(L11*D5^2*(A 134)^.5)*(14 .7/15.025)= 183	(L11*E5^2*(A 134)^.5)*(14 .7/15.025)= 709	(L11*F5^2*(A 134)^.5)*(14 .7/15.025)= 1,563
135	A134+.5= 24.5	A135/13.59= 1.80		(L11*D5^2*(A 135)^.5)*(14 .7/15.025)= 185	(L11*E5^2*(A 135)^.5)*(14 .7/15.025)= 717	(L11*F5^2*(A 135)^.5)*(14 .7/15.025)= 1,579
136	A135+.5= 25.0	A136/13.59= 1.84		(L11*D5^2*(A 136)^.5)*(14 .7/15.025)= 186	(L11*E5^2*(A 136)^.5)*(14 .7/15.025)= 724	(L11*F5^2*(A 136)^.5)*(14 .7/15.025)= 1,595
137	A136+.5= 25.5	A137/13.59= 1.88		(L11*D5^2*(A 137)^.5)*(14 .7/15.025)= 188	(L11*E5^2*(A 137)^.5)*(14 .7/15.025)= 731	(L11*F5^2*(A 137)^.5)*(14 .7/15.025)= 1,611
138	A137+.5= 26.0	A138/13.59= 1.91		(L11*D5^2*(A 138)^.5)*(14 .7/15.025)= 190	(L11*E5^2*(A 138)^.5)*(14 .7/15.025)= 738	(L11*F5^2*(A 138)^.5)*(14 .7/15.025)= 1,626
139	A138+.5= 26.5	A139/13.59= 1.95		(L11*D5^2*(A 139)^.5)*(14 .7/15.025)= 192	(L11*E5^2*(A 139)^.5)*(14 .7/15.025)= 745	(L11*F5^2*(A 139)^.5)*(14 .7/15.025)= 1,642
140	A139+.5= 27.0	A140/13.59= 1.99		(L11*D5^2*(A 140)^.5)*(14 .7/15.025)= 194	(L11*E5^2*(A 140)^.5)*(14 .7/15.025)= 752	(L11*F5^2*(A 140)^.5)*(14 .7/15.025)= 1,657
141	A140+.5= 27.5	A141/13.59= 2.02	L112*A141= .99	(L11*D5^2*(A 141)^.5)*(14 .7/15.025)= 196	(L11*E5^2*(A 141)^.5)*(14 .7/15.025)= 759	(L11*F5^2*(A 141)^.5)*(14 .7/15.025)= 1,673
142	A141+.5= 28.0	A142/13.59= 2.06		(L11*D5^2*(A 142)^.5)*(14 .7/15.025)= 197	(L11*E5^2*(A 142)^.5)*(14 .7/15.025)= 766	(L11*F5^2*(A 142)^.5)*(14 .7/15.025)= 1,688
143	A142+.5= 28.5	A143/13.59= 2.10		(L11*D5^2*(A 143)^.5)*(14 .7/15.025)= 199	(L11*E5^2*(A 143)^.5)*(14 .7/15.025)= 773	(L11*F5^2*(A 143)^.5)*(14 .7/15.025)= 1,703

	A	B	C	D	E	F
144	A143+.5= 29.0	A144/13.59= 2.13		(L11*D5^2*(A 144)^.5)*(14 .7/15.025)= 201	(L11*E5^2*(A 144)^.5)*(14 .7/15.025)= 780	(L11*F5^2*(A 144)^.5)*(14 .7/15.025)= 1,718
145	A144+.5= 29.5	A145/13.59= 2.17		(L11*D5^2*(A 145)^.5)*(14 .7/15.025)= 203	(L11*E5^2*(A 145)^.5)*(14 .7/15.025)= 786	(L11*F5^2*(A 145)^.5)*(14 .7/15.025)= 1,733
146	A145+.5= 30.0	A146/13.59= 2.21		(L11*D5^2*(A 146)^.5)*(14 .7/15.025)= 204	(L11*E5^2*(A 146)^.5)*(14 .7/15.025)= 793	(L11*F5^2*(A 146)^.5)*(14 .7/15.025)= 1,747
147	A146+.5= 30.5	A147/13.59= 2.24		(L11*D5^2*(A 147)^.5)*(14 .7/15.025)= 206	(L11*E5^2*(A 147)^.5)*(14 .7/15.025)= 800	(L11*F5^2*(A 147)^.5)*(14 .7/15.025)= 1,762
148	A147+.5= 31.0	A148/13.59= 2.28		(L11*D5^2*(A 148)^.5)*(14 .7/15.025)= 208	(L11*E5^2*(A 148)^.5)*(14 .7/15.025)= 806	(L11*F5^2*(A 148)^.5)*(14 .7/15.025)= 1,776
149	A148+.5= 31.5	A149/13.59= 2.32		(L11*D5^2*(A 149)^.5)*(14 .7/15.025)= 209	(L11*E5^2*(A 149)^.5)*(14 .7/15.025)= 813	(L11*F5^2*(A 149)^.5)*(14 .7/15.025)= 1,790
150	A149+.5= 32.0	A150/13.59= 2.35		(L11*D5^2*(A 150)^.5)*(14 .7/15.025)= 211	(L11*E5^2*(A 150)^.5)*(14 .7/15.025)= 819	(L11*F5^2*(A 150)^.5)*(14 .7/15.025)= 1,804
151	A150+.5= 32.5	A151/13.59= 2.39		(L11*D5^2*(A 151)^.5)*(14 .7/15.025)= 213	(L11*E5^2*(A 151)^.5)*(14 .7/15.025)= 825	(L11*F5^2*(A 151)^.5)*(14 .7/15.025)= 1,818
152	A151+.5= 33.0	A152/13.59= 2.43		(L11*D5^2*(A 152)^.5)*(14 .7/15.025)= 214	(L11*E5^2*(A 152)^.5)*(14 .7/15.025)= 832	(L11*F5^2*(A 152)^.5)*(14 .7/15.025)= 1,832
153	A152+.5= 33.5	A153/13.59= 2.47		(L11*D5^2*(A 153)^.5)*(14 .7/15.025)= 216	(L11*E5^2*(A 153)^.5)*(14 .7/15.025)= 838	(L11*F5^2*(A 153)^.5)*(14 .7/15.025)= 1,846
154	A153+.5= 34.0	A154/13.59= 2.50		(L11*D5^2*(A 154)^.5)*(14 .7/15.025)= 217	(L11*E5^2*(A 154)^.5)*(14 .7/15.025)= 844	(L11*F5^2*(A 154)^.5)*(14 .7/15.025)= 1,860
155	A154+.5= 34.5	A155/13.59= 2.54	L112*A155= 1.25	(L11*D5^2*(A 155)^.5)*(14 .7/15.025)= 219	(L11*E5^2*(A 155)^.5)*(14 .7/15.025)= 850	(L11*F5^2*(A 155)^.5)*(14 .7/15.025)= 1,874
156	A155+.5= 35.0	A156/13.59= 2.58		(L11*D5^2*(A 156)^.5)*(14 .7/15.025)= 221	(L11*E5^2*(A 156)^.5)*(14 .7/15.025)= 857	(L11*F5^2*(A 156)^.5)*(14 .7/15.025)= 1,887
157	A156+.5= 35.5	A157/13.59= 2.61		(L11*D5^2*(A 157)^.5)*(14 .7/15.025)= 222	(L11*E5^2*(A 157)^.5)*(14 .7/15.025)= 863	(L11*F5^2*(A 157)^.5)*(14 .7/15.025)= 1,901

	A	B	C	D	E	F
158	A157+.5= 36.0	A158/13.59= 2.65		(L11*D5^2*(A158)^.5)*(14.7/15.025)= 224	(L11*E5^2*(A158)^.5)*(14.7/15.025)= 869	(L11*F5^2*(A158)^.5)*(14.7/15.025)= 1,914
159	A158+.5= 36.5	A159/13.59= 2.69		(L11*D5^2*(A159)^.5)*(14.7/15.025)= 225	(L11*E5^2*(A159)^.5)*(14.7/15.025)= 875	(L11*F5^2*(A159)^.5)*(14.7/15.025)= 1,927
160	A159+.5= 37.0	A160/13.59= 2.72		(L11*D5^2*(A160)^.5)*(14.7/15.025)= 227	(L11*E5^2*(A160)^.5)*(14.7/15.025)= 881	(L11*F5^2*(A160)^.5)*(14.7/15.025)= 1,940
161	A160+.5= 37.5	A161/13.59= 2.76		(L11*D5^2*(A161)^.5)*(14.7/15.025)= 228	(L11*E5^2*(A161)^.5)*(14.7/15.025)= 887	(L11*F5^2*(A161)^.5)*(14.7/15.025)= 1,953
162	A161+.5= 38.0	A162/13.59= 2.80		(L11*D5^2*(A162)^.5)*(14.7/15.025)= 230	(L11*E5^2*(A162)^.5)*(14.7/15.025)= 893	(L11*F5^2*(A162)^.5)*(14.7/15.025)= 1,966
163	A162+.5= 38.5	A163/13.59= 2.83		(L11*D5^2*(A163)^.5)*(14.7/15.025)= 231	(L11*E5^2*(A163)^.5)*(14.7/15.025)= 898	(L11*F5^2*(A163)^.5)*(14.7/15.025)= 1,979
164	A163+.5= 39.0	A164/13.59= 2.87		(L11*D5^2*(A164)^.5)*(14.7/15.025)= 233	(L11*E5^2*(A164)^.5)*(14.7/15.025)= 904	(L11*F5^2*(A164)^.5)*(14.7/15.025)= 1,992
165	A164+.5= 39.5	A165/13.59= 2.91		(L11*D5^2*(A165)^.5)*(14.7/15.025)= 234	(L11*E5^2*(A165)^.5)*(14.7/15.025)= 910	(L11*F5^2*(A165)^.5)*(14.7/15.025)= 2,005
166	A165+.5= 40.0	A166/13.59= 2.94		(L11*D5^2*(A166)^.5)*(14.7/15.025)= 236	(L11*E5^2*(A166)^.5)*(14.7/15.025)= 916	(L11*F5^2*(A166)^.5)*(14.7/15.025)= 2,017
167	*40.8	3.00	(14.676/29.92)*B167= 1.47	(L11*D5^2*(B167*13.59)^.5)*(14.7/15.025)= 238	(L11*E5^2*(B167*13.59)^.5)*(14.7/15.025)= 924	(L11*F5^2*(B167*13.59)^.5)*(14.7/15.025)= 2,037
168	B168*13.59= 43.5	B167+.2= 3.20		(L11*D5^2*(B168*13.59)^.5)*(14.7/15.025)= 246	(L11*E5^2*(B168*13.59)^.5)*(14.7/15.025)= 955	(L11*F5^2*(B168*13.59)^.5)*(14.7/15.025)= 2,104
169	B169*13.59= 46.2	B168+.2= 3.40		(L11*D5^2*(B169*13.59)^.5)*(14.7/15.025)= 253	(L11*E5^2*(B169*13.59)^.5)*(14.7/15.025)= 984	(L11*F5^2*(B169*13.59)^.5)*(14.7/15.025)= 2,168
170	B170*13.59= 48.9	B169+.2= 3.60		(L11*D5^2*(B170*13.59)^.5)*(14.7/15.025)= 261	(L11*E5^2*(B170*13.59)^.5)*(14.7/15.025)= 1,013	(L11*F5^2*(B170*13.59)^.5)*(14.7/15.025)= 2,231

	A	B	C	D	E	F
171	B171*13.59= 51.6	B170+.2= 3.80		(L11*D5^2*(B171*13.59)^.5)*(14.7/15.025)= 268	(L11*E5^2*(B171*13.59)^.5)*(14.7/15.025)= 1,040	(L11*F5^2*(B171*13.59)^.5)*(14.7/15.025)= 2,292
172	B172*13.59= 54.4	B171+.2= 4.00	(14.676/29.92)*B172= 1.96	(L11*D5^2*(B172*13.59)^.5)*(14.7/15.025)= 275	(L11*E5^2*(B172*13.59)^.5)*(14.7/15.025)= 1,068	(L11*F5^2*(B172*13.59)^.5)*(14.7/15.025)= 2,352
173	B173*13.59= 57.1	B172+.2= 4.20		(L11*D5^2*(B173*13.59)^.5)*(14.7/15.025)= 282	(L11*E5^2*(B173*13.59)^.5)*(14.7/15.025)= 1,094	(L11*F5^2*(B173*13.59)^.5)*(14.7/15.025)= 2,410
174	B174*13.59= 59.8	B173+.2= 4.40		(L11*D5^2*(B174*13.59)^.5)*(14.7/15.025)= 288	(L11*E5^2*(B174*13.59)^.5)*(14.7/15.025)= 1,120	(L11*F5^2*(B174*13.59)^.5)*(14.7/15.025)= 2,467
175	B175*13.59= 62.5	B174+.2= 4.60	(14.676/29.92)*B175= 2.26	(L11*D5^2*(B175*13.59)^.5)*(14.7/15.025)= 295	(L11*E5^2*(B175*13.59)^.5)*(14.7/15.025)= 1,145	(L11*F5^2*(B175*13.59)^.5)*(14.7/15.025)= 2,522
176	B176*13.59= 65.2	B175+.2= 4.80	(14.676/29.92)*B176= 2.35	(L11*D5^2*(B176*13.59)^.5)*(14.7/15.025)= 301	(L11*E5^2*(B176*13.59)^.5)*(14.7/15.025)= 1,169	(L11*F5^2*(B176*13.59)^.5)*(14.7/15.025)= 2,576
177	B177*13.59= 68.0	B176+.2= 5.00	(14.676/29.92)*B177= 2.45	(L11*D5^2*(B177*13.59)^.5)*(14.7/15.025)= 307	(L11*E5^2*(B177*13.59)^.5)*(14.7/15.025)= 1,194	(L11*F5^2*(B177*13.59)^.5)*(14.7/15.025)= 2,629
178	B178*13.59= 70.7	B177+.2= 5.20	(14.676/29.92)*B178= 2.55	(L11*D5^2*(B178*13.59)^.5)*(14.7/15.025)= 313	(L11*E5^2*(B178*13.59)^.5)*(14.7/15.025)= 1,217	(L11*F5^2*(B178*13.59)^.5)*(14.7/15.025)= 2,681
179	B179*13.59= 73.4	B178+.2= 5.40	(14.676/29.92)*B179= 2.65	(L11*D5^2*(B179*13.59)^.5)*(14.7/15.025)= 319	(L11*E5^2*(B179*13.59)^.5)*(14.7/15.025)= 1,240	(L11*F5^2*(B179*13.59)^.5)*(14.7/15.025)= 2,733
180	B180*13.59= 76.1	B179+.2= 5.60	(14.676/29.92)*B180= 2.75	(L11*D5^2*(B180*13.59)^.5)*(14.7/15.025)= 325	(L11*E5^2*(B180*13.59)^.5)*(14.7/15.025)= 1,263	(L11*F5^2*(B180*13.59)^.5)*(14.7/15.025)= 2,783
181	B181*13.59= 78.8	B180+.2= 5.80	(14.676/29.92)*B181= 2.84	(L11*D5^2*(B181*13.59)^.5)*(14.7/15.025)= 331	(L11*E5^2*(B181*13.59)^.5)*(14.7/15.025)= 1,285	(L11*F5^2*(B181*13.59)^.5)*(14.7/15.025)= 2,832

	A	B	C	D	E	F
182	B182*13.59= 81.5	B181+.2= 6.00	(14.676/29.92)*B182= 2.94	(L11*D5^2*(B182*13.59)^.5)*(14.7/15.025)= 337	(L11*E5^2*(B182*13.59)^.5)*(14.7/15.025)= 1,307	(L11*F5^2*(B182*13.59)^.5)*(14.7/15.025)= 2,880
183		B182+.5= 6.50	(14.676/29.92)*B183= 3.19	(L11*D5^2*(B183*13.59)^.5)*(14.7/15.025)= 350	(L11*E5^2*(B183*13.59)^.5)*(14.7/15.025)= 1,361	(L11*F5^2*(B183*13.59)^.5)*(14.7/15.025)= 2,998
184		B183+.5= 7.00	(14.676/29.92)*B184= 3.43	(L11*D5^2*(B184*13.59)^.5)*(14.7/15.025)= 364	(L11*E5^2*(B184*13.59)^.5)*(14.7/15.025)= 1,412	(L11*F5^2*(B184*13.59)^.5)*(14.7/15.025)= 3,111
185		B184+.5= 7.50	(14.676/29.92)*B185= 3.68	(L11*D5^2*(B185*13.59)^.5)*(14.7/15.025)= 376	(L11*E5^2*(B185*13.59)^.5)*(14.7/15.025)= 1,462	(L11*F5^2*(B185*13.59)^.5)*(14.7/15.025)= 3,220
186		B185+.5= 8.00	(14.676/29.92)*B186= 3.92	(L11*D5^2*(B186*13.59)^.5)*(14.7/15.025)= 389	(L11*E5^2*(B186*13.59)^.5)*(14.7/15.025)= 1,510	(L11*F5^2*(B186*13.59)^.5)*(14.7/15.025)= 3,326
187		B186+.5= 8.50	(14.676/29.92)*B187= 4.17	(L11*D5^2*(B187*13.59)^.5)*(14.7/15.025)= 401	(L11*E5^2*(B187*13.59)^.5)*(14.7/15.025)= 1,556	(L11*F5^2*(B187*13.59)^.5)*(14.7/15.025)= 3,428
188		B187+.5= 9.00	(14.676/29.92)*B188= 4.41	(L11*D5^2*(B188*13.59)^.5)*(14.7/15.025)= 412	(L11*E5^2*(B188*13.59)^.5)*(14.7/15.025)= 1,601	(L11*F5^2*(B188*13.59)^.5)*(14.7/15.025)= 3,528
189		B188+.5= 9.50	(14.676/29.92)*B189= 4.66	(L11*D5^2*(B189*13.59)^.5)*(14.7/15.025)= 424	(L11*E5^2*(B189*13.59)^.5)*(14.7/15.025)= 1,645	(L11*F5^2*(B189*13.59)^.5)*(14.7/15.025)= 3,624
190		B189+.5= 10.00	(14.676/29.92)*B190= 4.91	(L11*D5^2*(B190*13.59)^.5)*(14.7/15.025)= 435	(L11*E5^2*(B190*13.59)^.5)*(14.7/15.025)= 1,688	(L11*F5^2*(B190*13.59)^.5)*(14.7/15.025)= 3,719
191		B190+.5= 10.50	(14.676/29.92)*B191= 5.15	(L11*D5^2*(B191*13.59)^.5)*(14.7/15.025)= 445	(L11*E5^2*(B191*13.59)^.5)*(14.7/15.025)= 1,730	(L11*F5^2*(B191*13.59)^.5)*(14.7/15.025)= 3,810
192		B191+.5= 11.00	(14.676/29.92)*B192= 5.40	(L11*D5^2*(B192*13.59)^.5)*(14.7/15.025)= 456	(L11*E5^2*(B192*13.59)^.5)*(14.7/15.025)= 1,770	(L11*F5^2*(B192*13.59)^.5)*(14.7/15.025)= 3,900

	A	B	C	D	E	F
193		B192+.5= 11.50	(14.676/29.92)*B193= 5.64	(L11*D5^2*(B193*13.59)^.5)*(14.7/15.025)= 466	(L11*E5^2*(B193*13.59)^.5)*(14.7/15.025)= 1,810	(L11*F5^2*(B193*13.59)^.5)*(14.7/15.025)= 3,988
194		B193+.5= 12.00	(14.676/29.92)*B194= 5.89	(L11*D5^2*(B194*13.59)^.5)*(14.7/15.025)= 476	(L11*E5^2*(B194*13.59)^.5)*(14.7/15.025)= 1,849	(L11*F5^2*(B194*13.59)^.5)*(14.7/15.025)= 4,073
195		B194+.5= 12.50	(14.676/29.92)*B195= 6.13	(L11*D5^2*(B195*13.59)^.5)*(14.7/15.025)= 486	(L11*E5^2*(B195*13.59)^.5)*(14.7/15.025)= 1,887	(L11*F5^2*(B195*13.59)^.5)*(14.7/15.025)= 4,157
196		B195+.5= 13.00	(14.676/29.92)*B196= 6.38	(L11*D5^2*(B196*13.59)^.5)*(14.7/15.025)= 496	(L11*E5^2*(B196*13.59)^.5)*(14.7/15.025)= 1,924	(L11*F5^2*(B196*13.59)^.5)*(14.7/15.025)= 4,240
197		B196+.5= 13.50	(14.676/29.92)*B197= 6.62	(L11*D5^2*(B197*13.59)^.5)*(14.7/15.025)= 505	(L11*E5^2*(B197*13.59)^.5)*(14.7/15.025)= 1,961	(L11*F5^2*(B197*13.59)^.5)*(14.7/15.025)= 4,321
198		B197+.5= 14.00	(14.676/29.92)*B198= 6.87	(L11*D5^2*(B198*13.59)^.5)*(14.7/15.025)= 514	(L11*E5^2*(B198*13.59)^.5)*(14.7/15.025)= 1,997	(L11*F5^2*(B198*13.59)^.5)*(14.7/15.025)= 4,400
199		B198+.5= 14.50	(14.676/29.92)*B199= 7.11	(L11*D5^2*(B199*13.59)^.5)*(14.7/15.025)= 523	(L11*E5^2*(B199*13.59)^.5)*(14.7/15.025)= 2,032	(L11*F5^2*(B199*13.59)^.5)*(14.7/15.025)= 4,478
200		B199+.5= 15.00	(14.676/29.92)*B200= 7.36	(L11*D5^2*(B200*13.59)^.5)*(14.7/15.025)= 532	(L11*E5^2*(B200*13.59)^.5)*(14.7/15.025)= 2,067	(L11*F5^2*(B200*13.59)^.5)*(14.7/15.025)= 4,554
201		B200+.5= 15.50	(14.676/29.92)*B201= 7.60	(L11*D5^2*(B201*13.59)^.5)*(14.7/15.025)= 541	(L11*E5^2*(B201*13.59)^.5)*(14.7/15.025)= 2,101	(L11*F5^2*(B201*13.59)^.5)*(14.7/15.025)= 4,630
202		B201+.5= 16.00	(14.676/29.92)*B202= 7.85	(L11*D5^2*(B202*13.59)^.5)*(14.7/15.025)= 550	(L11*E5^2*(B202*13.59)^.5)*(14.7/15.025)= 2,135	(L11*F5^2*(B202*13.59)^.5)*(14.7/15.025)= 4,704
203		B202+.5= 16.50	(14.676/29.92)*B203= 8.09	(L11*D5^2*(B203*13.59)^.5)*(14.7/15.025)= 558	(L11*E5^2*(B203*13.59)^.5)*(14.7/15.025)= 2,168	(L11*F5^2*(B203*13.59)^.5)*(14.7/15.025)= 4,777

	A	B	C	D	E	F
204		B203+.5= 17.00	(14.676/29.92)*B204= 8.34	(L11*D5^2*(B204*13.59)^.5)*(14.7/15.025)= 567	(L11*E5^2*(B204*13.59)^.5)*(14.7/15.025)= 2,201	(L11*F5^2*(B204*13.59)^.5)*(14.7/15.025)= 4,848
205		B204+.5= 17.50	(14.676/29.92)*B205= 8.58	(L11*D5^2*(B205*13.59)^.5)*(14.7/15.025)= 575	(L11*E5^2*(B205*13.59)^.5)*(14.7/15.025)= 2,233	(L11*F5^2*(B205*13.59)^.5)*(14.7/15.025)= 4,919
206		B205+.5= 18.00	(14.676/29.92)*B206= 8.83	(L11*D5^2*(B206*13.59)^.5)*(14.7/15.025)= 583	(L11*E5^2*(B206*13.59)^.5)*(14.7/15.025)= 2,265	(L11*F5^2*(B206*13.59)^.5)*(14.7/15.025)= 4,989
207		B206+.5= 18.50	(14.676/29.92)*B207= 9.07	(L11*D5^2*(B207*13.59)^.5)*(14.7/15.025)= 591	(L11*E5^2*(B207*13.59)^.5)*(14.7/15.025)= 2,296	(L11*F5^2*(B207*13.59)^.5)*(14.7/15.025)= 5,058
208		B207+.5= 19.00	(14.676/29.92)*B208= 9.32	(L11*D5^2*(B208*13.59)^.5)*(14.7/15.025)= 599	(L11*E5^2*(B208*13.59)^.5)*(14.7/15.025)= 2,327	(L11*F5^2*(B208*13.59)^.5)*(14.7/15.025)= 5,126
209		B208+.5= 19.50	(14.676/29.92)*B209= 9.56	(L11*D5^2*(B209*13.59)^.5)*(14.7/15.025)= 607	(L11*E5^2*(B209*13.59)^.5)*(14.7/15.025)= 2,357	(L11*F5^2*(B209*13.59)^.5)*(14.7/15.025)= 5,193
210		B209+.5= 20.00	(14.676/29.92)*B210= 9.81	(L11*D5^2*(B210*13.59)^.5)*(14.7/15.025)= 615	(L11*E5^2*(B210*13.59)^.5)*(14.7/15.025)= 2,387	(L11*F5^2*(B210*13.59)^.5)*(14.7/15.025)= 5,259
211		B210+.5= 20.50	(14.676/29.92)*B211= 10.06	(L11*D5^2*(B211*13.59)^.5)*(14.7/15.025)= 622	(L11*E5^2*(B211*13.59)^.5)*(14.7/15.025)= 2,417	(L11*F5^2*(B211*13.59)^.5)*(14.7/15.025)= 5,324
212		B211+.5= 21.00	(14.676/29.92)*B212= 10.30	(L11*D5^2*(B212*13.59)^.5)*(14.7/15.025)= 630	(L11*E5^2*(B212*13.59)^.5)*(14.7/15.025)= 2,446	(L11*F5^2*(B212*13.59)^.5)*(14.7/15.025)= 5,389
213		B212+.5= 21.50	(14.676/29.92)*B213= 10.55	(L11*D5^2*(B213*13.59)^.5)*(14.7/15.025)= 637	(L11*E5^2*(B213*13.59)^.5)*(14.7/15.025)= 2,475	(L11*F5^2*(B213*13.59)^.5)*(14.7/15.025)= 5,452
214		B213+.5= 22.00	(14.676/29.92)*B214= 10.79	(L11*D5^2*(B214*13.59)^.5)*(14.7/15.025)= 645	(L11*E5^2*(B214*13.59)^.5)*(14.7/15.025)= 2,504	(L11*F5^2*(B214*13.59)^.5)*(14.7/15.025)= 5,516

	A	B	C	D	E	F
215		B214+.5= 22.50	(14.676/29.92)*B215= 11.04	(L11*D5^2*(B215*13.59)^.5)*(14.7/15.025)= 652	(L11*E5^2*(B215*13.59)^.5)*(14.7/15.025)= 2,532	(L11*F5^2*(B215*13.59)^.5)*(14.7/15.025)= 5,578
216		B215+.5= 23.00	(14.676/29.92)*B216= 11.28	(L11*D5^2*(B216*13.59)^.5)*(14.7/15.025)= 659	(L11*E5^2*(B216*13.59)^.5)*(14.7/15.025)= 2,560	(L11*F5^2*(B216*13.59)^.5)*(14.7/15.025)= 5,639
217		B216+.5= 23.50	(14.676/29.92)*B217= 11.53	(L11*D5^2*(B217*13.59)^.5)*(14.7/15.025)= 666	(L11*E5^2*(B217*13.59)^.5)*(14.7/15.025)= 2,587	(L11*F5^2*(B217*13.59)^.5)*(14.7/15.025)= 5,700
218		B217+.5= 24.00	(14.676/29.92)*B218= 11.77	(L11*D5^2*(B218*13.59)^.5)*(14.7/15.025)= 673	(L11*E5^2*(B218*13.59)^.5)*(14.7/15.025)= 2,615	(L11*F5^2*(B218*13.59)^.5)*(14.7/15.025)= 5,761
219		B218+.5= 24.50	(14.676/29.92)*B219= 12.02	(L11*D5^2*(B219*13.59)^.5)*(14.7/15.025)= 680	(L11*E5^2*(B219*13.59)^.5)*(14.7/15.025)= 2,642	(L11*F5^2*(B219*13.59)^.5)*(14.7/15.025)= 5,820
220		B219+.5= 25.00	(14.676/29.92)*B220= 12.26	(L11*D5^2*(B220*13.59)^.5)*(14.7/15.025)= 687	(L11*E5^2*(B220*13.59)^.5)*(14.7/15.025)= 2,669	(L11*F5^2*(B220*13.59)^.5)*(14.7/15.025)= 5,880
221		B220+.5= 25.50	(14.676/29.92)*B221= 12.51	(L11*D5^2*(B221*13.59)^.5)*(14.7/15.025)= 694	(L11*E5^2*(B221*13.59)^.5)*(14.7/15.025)= 2,695	(L11*F5^2*(B221*13.59)^.5)*(14.7/15.025)= 5,938
222		B221+.5= 26.00	(14.676/29.92)*B222= 12.75	(L11*D5^2*(B222*13.59)^.5)*(14.7/15.025)= 701	(L11*E5^2*(B222*13.59)^.5)*(14.7/15.025)= 2,722	(L11*F5^2*(B222*13.59)^.5)*(14.7/15.025)= 5,996
223		B222+.5= 26.50	(14.676/29.92)*B223= 13.00	(L11*D5^2*(B223*13.59)^.5)*(14.7/15.025)= 708	(L11*E5^2*(B223*13.59)^.5)*(14.7/15.025)= 2,748	(L11*F5^2*(B223*13.59)^.5)*(14.7/15.025)= 6,053
224		B223+.5= 27.00	(14.676/29.92)*B224= 13.24	(L11*D5^2*(B224*13.59)^.5)*(14.7/15.025)= 714	(L11*E5^2*(B224*13.59)^.5)*(14.7/15.025)= 2,773	(L11*F5^2*(B224*13.59)^.5)*(14.7/15.025)= 6,110
225		B224+.5= 27.50	(14.676/29.92)*B225= 13.49	(L11*D5^2*(B225*13.59)^.5)*(14.7/15.025)= 721	(L11*E5^2*(B225*13.59)^.5)*(14.7/15.025)= 2,799	(L11*F5^2*(B225*13.59)^.5)*(14.7/15.025)= 6,167

	A	B	C	D	E	F
226		B225+.5= 28.00	(14.676/29.92)*B226= 13.73	(L11*D5^2*(B226*13.59)^.5)*(14.7/15.025)= 727	(L11*E5^2*(B226*13.59)^.5)*(14.7/15.025)= 2,824	(L11*F5^2*(B226*13.59)^.5)*(14.7/15.025)= 6,222
227		B226+.5= 28.50	(14.676/29.92)*B227= 13.98	(L11*D5^2*(B227*13.59)^.5)*(14.7/15.025)= 734	(L11*E5^2*(B227*13.59)^.5)*(14.7/15.025)= 2,849	(L11*F5^2*(B227*13.59)^.5)*(14.7/15.025)= 6,278
228		B227+.5= 29.00	(14.676/29.92)*B228= 14.22	(L11*D5^2*(B228*13.59)^.5)*(14.7/15.025)= 740	(L11*E5^2*(B228*13.59)^.5)*(14.7/15.025)= 2,874	(L11*F5^2*(B228*13.59)^.5)*(14.7/15.025)= 6,332
229		B228+.5= 29.50	(14.676/29.92)*B229= 14.47	(L11*D5^2*(B229*13.59)^.5)*(14.7/15.025)= 747	(L11*E5^2*(B229*13.59)^.5)*(14.7/15.025)= 2,899	(L11*F5^2*(B229*13.59)^.5)*(14.7/15.025)= 6,387
230		B229+.5= 30.00	(14.676/29.92)*B230= 14.72	(L11*D5^2*(B230*13.59)^.5)*(14.7/15.025)= 753	(L11*E5^2*(B230*13.59)^.5)*(14.7/15.025)= 2,924	(L11*F5^2*(B230*13.59)^.5)*(14.7/15.025)= 6,441
231		*30.58	15.00	(L11*D5^2*(C231*144*12/62.428)^.5)*(14.7/15.025)= 760	(L11*E5^2*(C231*144*12/62.428)^.5)*(14.7/15.025)= 2,950	(L11*F5^2*(C231*144*12/62.428)^.5)*(14.7/15.025)= 6,500
232		C232*(29.92/14.676)= 32.62	C231+1= 16.00	(L11*D5^2*(C232*144*12/62.428)^.5)*(14.7/15.025)= 785	(L11*E5^2*(C232*144*12/62.428)^.5)*(14.7/15.025)= 3,047	(L11*F5^2*(C232*144*12/62.428)^.5)*(14.7/15.025)= 6,713
233		C233*(29.92/14.676)= 34.66	C232+1= 17.00	(L11*D5^2*(C233*144*12/62.428)^.5)*(14.7/15.025)= 809	(L11*E5^2*(C233*144*12/62.428)^.5)*(14.7/15.025)= 3,141	(L11*F5^2*(C233*144*12/62.428)^.5)*(14.7/15.025)= 6,919
234		C234*(29.92/14.676)= 36.70	C233+1= 18.00	(L11*D5^2*(C234*144*12/62.428)^.5)*(14.7/15.025)= 832	(L11*E5^2*(C234*144*12/62.428)^.5)*(14.7/15.025)= 3,232	(L11*F5^2*(C234*144*12/62.428)^.5)*(14.7/15.025)= 7,120
235		C235*(29.92/14.676)= 38.74	C234+1= 19.00	(L11*D5^2*(C235*144*12/62.428)^.5)*(14.7/15.025)= 855	(L11*E5^2*(C235*144*12/62.428)^.5)*(14.7/15.025)= 3,320	(L11*F5^2*(C235*144*12/62.428)^.5)*(14.7/15.025)= 7,315

	A	B	C	D	E	F
236		C236*(29.92/ 14.676)= 40.77	C235+1= 20.00	(L11*D5^2*(C 236*144*12/6 2.428)^.5)*(14.7/15.025) = 877	(L11*E5^2*(C 236*144*12/6 2.428)^.5)*(14.7/15.025) = 3,407	(L11*F5^2*(C 236*144*12/6 2.428)^.5)*(14.7/15.025) = 7,505
237		C237*(29.92/ 14.676)= 42.81	C236+1= 21.00	(L11*D5^2*(C 237*144*12/6 2.428)^.5)*(14.7/15.025) = 899	(L11*E5^2*(C 237*144*12/6 2.428)^.5)*(14.7/15.025) = 3,491	(L11*F5^2*(C 237*144*12/6 2.428)^.5)*(14.7/15.025) = 7,691
238		C238*(29.92/ 14.676)= 44.85	C237+1= 22.00	(L11*D5^2*(C 238*144*12/6 2.428)^.5)*(14.7/15.025) = 920	(L11*E5^2*(C 238*144*12/6 2.428)^.5)*(14.7/15.025) = 3,573	(L11*F5^2*(C 238*144*12/6 2.428)^.5)*(14.7/15.025) = 7,872
239		C239*(29.92/ 14.676)= 46.89	C238+1= 23.00	(L11*D5^2*(C 239*144*12/6 2.428)^.5)*(14.7/15.025) = 941	(L11*E5^2*(C 239*144*12/6 2.428)^.5)*(14.7/15.025) = 3,653	(L11*F5^2*(C 239*144*12/6 2.428)^.5)*(14.7/15.025) = 8,048
240		C240*(29.92/ 14.676)= 48.93	C239+1= 24.00	(L11*D5^2*(C 240*144*12/6 2.428)^.5)*(14.7/15.025) = 961	(L11*E5^2*(C 240*144*12/6 2.428)^.5)*(14.7/15.025) = 3,732	(L11*F5^2*(C 240*144*12/6 2.428)^.5)*(14.7/15.025) = 8,222
241		C241*(29.92/ 14.676)= 50.97	C240+1= 25.00	(L11*D5^2*(C 241*144*12/6 2.428)^.5)*(14.7/15.025) = 981	(L11*E5^2*(C 241*144*12/6 2.428)^.5)*(14.7/15.025) = 3,809	(L11*F5^2*(C 241*144*12/6 2.428)^.5)*(14.7/15.025) = 8,391
242		C242*(29.92/ 14.676)= 53.01	C241+1= 26.00	(L11*D5^2*(C 242*144*12/6 2.428)^.5)*(14.7/15.025) = 1,000	(L11*E5^2*(C 242*144*12/6 2.428)^.5)*(14.7/15.025) = 3,884	(L11*F5^2*(C 242*144*12/6 2.428)^.5)*(14.7/15.025) = 8,557
243		C243*(29.92/ 14.676)= 55.04	C242+1= 27.00	(L11*D5^2*(C 243*144*12/6 2.428)^.5)*(14.7/15.025) = 1,019	(L11*E5^2*(C 243*144*12/6 2.428)^.5)*(14.7/15.025) = 3,958	(L11*F5^2*(C 243*144*12/6 2.428)^.5)*(14.7/15.025) = 8,720
244		C244*(29.92/ 14.676)= 57.08	C243+1= 28.00	(L11*D5^2*(C 244*144*12/6 2.428)^.5)*(14.7/15.025) = 1,038	(L11*E5^2*(C 244*144*12/6 2.428)^.5)*(14.7/15.025) = 4,031	(L11*F5^2*(C 244*144*12/6 2.428)^.5)*(14.7/15.025) = 8,880

	A	B	C	D	E	F
245		C245*(29.92/ 14.676)= 59.12	C244+1= 29.00	(L11*D5^2*(C 245*144*12/6 2.428)^.5)*(14.7/15.025) = 1,057	(L11*E5^2*(C 245*144*12/6 2.428)^.5)*(14.7/15.025) = 4,102	(L11*F5^2*(C 245*144*12/6 2.428)^.5)*(14.7/15.025) = 9,037
246		C246*(29.92/ 14.676)= 61.16	C245+1= 30.00	(L11*D5^2*(C 246*144*12/6 2.428)^.5)*(14.7/15.025) = 1,075	(L11*E5^2*(C 246*144*12/6 2.428)^.5)*(14.7/15.025) = 4,172	(L11*F5^2*(C 246*144*12/6 2.428)^.5)*(14.7/15.025) = 9,192
247		C247*(29.92/ 14.676)= 63.20	C246+1= 31.00	(L11*D5^2*(C 247*144*12/6 2.428)^.5)*(14.7/15.025) = 1,092	(L11*E5^2*(C 247*144*12/6 2.428)^.5)*(14.7/15.025) = 4,241	(L11*F5^2*(C 247*144*12/6 2.428)^.5)*(14.7/15.025) = 9,344
248		C248*(29.92/ 14.676)= 65.24	C247+1= 32.00	(L11*D5^2*(C 248*144*12/6 2.428)^.5)*(14.7/15.025) = 1,110	(L11*E5^2*(C 248*144*12/6 2.428)^.5)*(14.7/15.025) = 4,309	(L11*F5^2*(C 248*144*12/6 2.428)^.5)*(14.7/15.025) = 9,493
249			C248+1= 33.00	(L11*D5^2*(C 249*144*12/6 2.428)^.5)*(14.7/15.025) = 1,127	(L11*E5^2*(C 249*144*12/6 2.428)^.5)*(14.7/15.025) = 4,376	(L11*F5^2*(C 249*144*12/6 2.428)^.5)*(14.7/15.025) = 9,641
250			C249+1= 34.00	(L11*D5^2*(C 250*144*12/6 2.428)^.5)*(14.7/15.025) = 1,144	(L11*E5^2*(C 250*144*12/6 2.428)^.5)*(14.7/15.025) = 4,442	(L11*F5^2*(C 250*144*12/6 2.428)^.5)*(14.7/15.025) = 9,786
251			C250+1= 35.00	(L11*D5^2*(C 251*144*12/6 2.428)^.5)*(14.7/15.025) = 1,161	(L11*E5^2*(C 251*144*12/6 2.428)^.5)*(14.7/15.025) = 4,507	(L11*F5^2*(C 251*144*12/6 2.428)^.5)*(14.7/15.025) = 9,928
252			C251+1= 36.00	(L11*D5^2*(C 252*144*12/6 2.428)^.5)*(14.7/15.025) = 1,177	(L11*E5^2*(C 252*144*12/6 2.428)^.5)*(14.7/15.025) = 4,571	(L11*F5^2*(C 252*144*12/6 2.428)^.5)*(14.7/15.025) = 10,069
253			C252+1= 37.00	(L11*D5^2*(C 253*144*12/6 2.428)^.5)*(14.7/15.025) = 1,193	(L11*E5^2*(C 253*144*12/6 2.428)^.5)*(14.7/15.025) = 4,634	(L11*F5^2*(C 253*144*12/6 2.428)^.5)*(14.7/15.025) = 10,208

	A	B	C	D	E	F
254			C253+1= 38.00	(L11*D5^2*(C 254*144*12/6 2.428)^.5)*(14.7/15.025) = 1,209	(L11*E5^2*(C 254*144*12/6 2.428)^.5)*(14.7/15.025) = 4,696	(L11*F5^2*(C 254*144*12/6 2.428)^.5)*(14.7/15.025) = 10,345
255			C254+1= 39.00	(L11*D5^2*(C 255*144*12/6 2.428)^.5)*(14.7/15.025) = 1,225	(L11*E5^2*(C 255*144*12/6 2.428)^.5)*(14.7/15.025) = 4,757	(L11*F5^2*(C 255*144*12/6 2.428)^.5)*(14.7/15.025) = 10,480

	G	H	I	J	K	L
1	DIAMETER	INCHES				(3600*24*520 *(pi))/(1000 *4*144*14.7) = 16.6696753
2	4" nominal	6" nominal				
3	actual dia.	actual dia.				((62.4*10.73 *64.4)/(12*2 9))^.5= 11.13128923
4						
5	4.026	6.065				
6						
7	(L11*G5^2*(A 7)^.5)*(14.7 /15.025)= 174	(L11*H5^2*(A7)^.5)*(14.7/1 5.025)= 394				L1*L3= 185.5549772
8	(L11*G5^2*(A 8)^.5)*(14.7 /15.025)= 246	(L11*H5^2*(A8)^.5)*(14.7/1 5.025)= 557				
9	(L11*G5^2*(A 9)^.5)*(14.7 /15.025)= 301	(L11*H5^2*(A9)^.5)*(14.7/1 5.025)= 683				.86*((14.7)/ (.6*520))^.5 = .1866722756
10	(L11*G5^2*(A 10)^.5)*(14. 7/15.025)= 347	(L11*H5^2*(A1 0)^.5)*(14.7/ 15.025)= 788				
11	(L11*G5^2*(A 11)^.5)*(14. 7/15.025)= 388	(L11*H5^2*(A1 1)^.5)*(14.7/ 15.025)= 881				L7*L9= 34.63796984
12	(L11*G5^2*(A 12)^.5)*(14. 7/15.025)= 425	(L11*H5^2*(A1 2)^.5)*(14.7/ 15.025)= 966				
13	(L11*G5^2*(A 13)^.5)*(14. 7/15.025)= 460	(L11*H5^2*(A1 3)^.5)*(14.7/ 15.025)= 1,043				
14	(L11*G5^2*(A 14)^.5)*(14. 7/15.025)= 491	(L11*H5^2*(A1 4)^.5)*(14.7/ 15.025)= 1,115				
15	(L11*G5^2*(A 15)^.5)*(14. 7/15.025)= 521	(L11*H5^2*(A1 5)^.5)*(14.7/ 15.025)= 1,183				
16	(L11*G5^2*(A 16)^.5)*(14. 7/15.025)= 549	(L11*H5^2*(A1 6)^.5)*(14.7/ 15.025)= 1,247				
17	(L11*G5^2*(A 17)^.5)*(14. 7/15.025)= 576	(L11*H5^2*(A1 7)^.5)*(14.7/ 15.025)= 1,307				

	G	H	I	J	K	L
18	(L11*G5^2*(A18)^.5)*(14.7/15.025)= 602	(L11*H5^2*(A18)^.5)*(14.7/15.025)= 1,366				
19	(L11*G5^2*(A19)^.5)*(14.7/15.025)= 626	(L11*H5^2*(A19)^.5)*(14.7/15.025)= 1,421				
20	(L11*G5^2*(A20)^.5)*(14.7/15.025)= 650	(L11*H5^2*(A20)^.5)*(14.7/15.025)= 1,475				
21	(L11*G5^2*(A21)^.5)*(14.7/15.025)= 673	(L11*H5^2*(A21)^.5)*(14.7/15.025)= 1,527				
22	(L11*G5^2*(A22)^.5)*(14.7/15.025)= 695	(L11*H5^2*(A22)^.5)*(14.7/15.025)= 1,577				
23	(L11*G5^2*(A23)^.5)*(14.7/15.025)= 716	(L11*H5^2*(A23)^.5)*(14.7/15.025)= 1,625				
24	(L11*G5^2*(A24)^.5)*(14.7/15.025)= 737	(L11*H5^2*(A24)^.5)*(14.7/15.025)= 1,672				
25	(L11*G5^2*(A25)^.5)*(14.7/15.025)= 757	(L11*H5^2*(A25)^.5)*(14.7/15.025)= 1,718				
26	(L11*G5^2*(A26)^.5)*(14.7/15.025)= 777	(L11*H5^2*(A26)^.5)*(14.7/15.025)= 1,763				
27	(L11*G5^2*(A27)^.5)*(14.7/15.025)= 796	(L11*H5^2*(A27)^.5)*(14.7/15.025)= 1,806				
28	(L11*G5^2*(A28)^.5)*(14.7/15.025)= 815	(L11*H5^2*(A28)^.5)*(14.7/15.025)= 1,849				
29	(L11*G5^2*(A29)^.5)*(14.7/15.025)= 833	(L11*H5^2*(A29)^.5)*(14.7/15.025)= 1,891				
30	(L11*G5^2*(A30)^.5)*(14.7/15.025)= 851	(L11*H5^2*(A30)^.5)*(14.7/15.025)= 1,931				
31	(L11*G5^2*(A31)^.5)*(14.7/15.025)= 869	(L11*H5^2*(A31)^.5)*(14.7/15.025)= 1,971				

	G	H	I	J	K	L
32	(L11*G5^2*(A32)^.5)*(14.7/15.025)= 886	(L11*H5^2*(A32)^.5)*(14.7/15.025)= 2,010				
33	(L11*G5^2*(A33)^.5)*(14.7/15.025)= 903	(L11*H5^2*(A33)^.5)*(14.7/15.025)= 2,048				
34	(L11*G5^2*(A34)^.5)*(14.7/15.025)= 919	(L11*H5^2*(A34)^.5)*(14.7/15.025)= 2,086				
35	(L11*G5^2*(A35)^.5)*(14.7/15.025)= 935	(L11*H5^2*(A35)^.5)*(14.7/15.025)= 2,123				
36	(L11*G5^2*(A36)^.5)*(14.7/15.025)= 951	(L11*H5^2*(A36)^.5)*(14.7/15.025)= 2,159				
37	(L11*G5^2*(A37)^.5)*(14.7/15.025)= 967	(L11*H5^2*(A37)^.5)*(14.7/15.025)= 2,195				
38	(L11*G5^2*(A38)^.5)*(14.7/15.025)= 983	(L11*H5^2*(A38)^.5)*(14.7/15.025)= 2,230				
39	(L11*G5^2*(A39)^.5)*(14.7/15.025)= 998	(L11*H5^2*(A39)^.5)*(14.7/15.025)= 2,265				
40	(L11*G5^2*(A40)^.5)*(14.7/15.025)= 1,013	(L11*H5^2*(A40)^.5)*(14.7/15.025)= 2,299				
41	(L11*G5^2*(A41)^.5)*(14.7/15.025)= 1,028	(L11*H5^2*(A41)^.5)*(14.7/15.025)= 2,332				
42	(L11*G5^2*(A42)^.5)*(14.7/15.025)= 1,042	(L11*H5^2*(A42)^.5)*(14.7/15.025)= 2,365				
43	(L11*G5^2*(A43)^.5)*(14.7/15.025)= 1,057	(L11*H5^2*(A43)^.5)*(14.7/15.025)= 2,398				
44	(L11*G5^2*(A44)^.5)*(14.7/15.025)= 1,071	(L11*H5^2*(A44)^.5)*(14.7/15.025)= 2,430				
45	(L11*G5^2*(A45)^.5)*(14.7/15.025)= 1,085	(L11*H5^2*(A45)^.5)*(14.7/15.025)= 2,462				

	G	H	I	J	K	L
46	(L11*G5^2*(A46)^.5)*(14.7/15.025)= 1,099	(L11*H5^2*(A46)^.5)*(14.7/15.025)= 2,493				
47	(L11*G5^2*(A47)^.5)*(14.7/15.025)= 1,112	(L11*H5^2*(A47)^.5)*(14.7/15.025)= 2,524				
48	(L11*G5^2*(A48)^.5)*(14.7/15.025)= 1,126	(L11*H5^2*(A48)^.5)*(14.7/15.025)= 2,555				
49	(L11*G5^2*(A49)^.5)*(14.7/15.025)= 1,139	(L11*H5^2*(A49)^.5)*(14.7/15.025)= 2,585				
50	(L11*G5^2*(A50)^.5)*(14.7/15.025)= 1,152	(L11*H5^2*(A50)^.5)*(14.7/15.025)= 2,615				
51	(L11*G5^2*(A51)^.5)*(14.7/15.025)= 1,165	(L11*H5^2*(A51)^.5)*(14.7/15.025)= 2,644				
52	(L11*G5^2*(A52)^.5)*(14.7/15.025)= 1,178	(L11*H5^2*(A52)^.5)*(14.7/15.025)= 2,674				
53	(L11*G5^2*(A53)^.5)*(14.7/15.025)= 1,191	(L11*H5^2*(A53)^.5)*(14.7/15.025)= 2,703				
54	(L11*G5^2*(A54)^.5)*(14.7/15.025)= 1,203	(L11*H5^2*(A54)^.5)*(14.7/15.025)= 2,731				
55	(L11*G5^2*(A55)^.5)*(14.7/15.025)= 1,216	(L11*H5^2*(A55)^.5)*(14.7/15.025)= 2,759				
56	(L11*G5^2*(A56)^.5)*(14.7/15.025)= 1,228	(L11*H5^2*(A56)^.5)*(14.7/15.025)= 2,787				
57	(L11*G5^2*(A57)^.5)*(14.7/15.025)= 1,240	(L11*H5^2*(A57)^.5)*(14.7/15.025)= 2,815				
58	(L11*G5^2*(A58)^.5)*(14.7/15.025)= 1,253	(L11*H5^2*(A58)^.5)*(14.7/15.025)= 2,843				
59	(L11*G5^2*(A59)^.5)*(14.7/15.025)= 1,265	(L11*H5^2*(A59)^.5)*(14.7/15.025)= 2,870				

	G	H	I	J	K	L
60	(L11*G5^2*(A60)^.5)*(14.7/15.025)= 1,276	(L11*H5^2*(A60)^.5)*(14.7/15.025)= 2,897				
61	(L11*G5^2*(A61)^.5)*(14.7/15.025)= 1,288	(L11*H5^2*(A61)^.5)*(14.7/15.025)= 2,923				
62	(L11*G5^2*(A62)^.5)*(14.7/15.025)= 1,300	(L11*H5^2*(A62)^.5)*(14.7/15.025)= 2,950				
63	(L11*G5^2*(A63)^.5)*(14.7/15.025)= 1,311	(L11*H5^2*(A63)^.5)*(14.7/15.025)= 2,976				
64	(L11*G5^2*(A64)^.5)*(14.7/15.025)= 1,323	(L11*H5^2*(A64)^.5)*(14.7/15.025)= 3,002				
65	(L11*G5^2*(A65)^.5)*(14.7/15.025)= 1,334	(L11*H5^2*(A65)^.5)*(14.7/15.025)= 3,028				
66	(L11*G5^2*(A66)^.5)*(14.7/15.025)= 1,345	(L11*H5^2*(A66)^.5)*(14.7/15.025)= 3,053				
67	(L11*G5^2*(A67)^.5)*(14.7/15.025)= 1,357	(L11*H5^2*(A67)^.5)*(14.7/15.025)= 3,079				
68	(L11*G5^2*(A68)^.5)*(14.7/15.025)= 1,368	(L11*H5^2*(A68)^.5)*(14.7/15.025)= 3,104				
69	(L11*G5^2*(A69)^.5)*(14.7/15.025)= 1,379	(L11*H5^2*(A69)^.5)*(14.7/15.025)= 3,129				
70	(L11*G5^2*(A70)^.5)*(14.7/15.025)= 1,390	(L11*H5^2*(A70)^.5)*(14.7/15.025)= 3,154				
71	(L11*G5^2*(A71)^.5)*(14.7/15.025)= 1,400	(L11*H5^2*(A71)^.5)*(14.7/15.025)= 3,178				
72	(L11*G5^2*(A72)^.5)*(14.7/15.025)= 1,411	(L11*H5^2*(A72)^.5)*(14.7/15.025)= 3,202				
73	(L11*G5^2*(A73)^.5)*(14.7/15.025)= 1,422	(L11*H5^2*(A73)^.5)*(14.7/15.025)= 3,227				

	G	H	I	J	K	L
74	(L11*G5^2*(A74)^.5)*(14.7/15.025)= 1,432	(L11*H5^2*(A74)^.5)*(14.7/15.025)= 3,251				
75	(L11*G5^2*(A75)^.5)*(14.7/15.025)= 1,443	(L11*H5^2*(A75)^.5)*(14.7/15.025)= 3,274				
76	(L11*G5^2*(A76)^.5)*(14.7/15.025)= 1,453	(L11*H5^2*(A76)^.5)*(14.7/15.025)= 3,298				
77	(L11*G5^2*(A77)^.5)*(14.7/15.025)= 1,464	(L11*H5^2*(A77)^.5)*(14.7/15.025)= 3,322				
78	(L11*G5^2*(A78)^.5)*(14.7/15.025)= 1,474	(L11*H5^2*(A78)^.5)*(14.7/15.025)= 3,345				
79	(L11*G5^2*(A79)^.5)*(14.7/15.025)= 1,484	(L11*H5^2*(A79)^.5)*(14.7/15.025)= 3,368				
80	(L11*G5^2*(A80)^.5)*(14.7/15.025)= 1,494	(L11*H5^2*(A80)^.5)*(14.7/15.025)= 3,391				
81	(L11*G5^2*(A81)^.5)*(14.7/15.025)= 1,504	(L11*H5^2*(A81)^.5)*(14.7/15.025)= 3,414				
82	(L11*G5^2*(A82)^.5)*(14.7/15.025)= 1,514	(L11*H5^2*(A82)^.5)*(14.7/15.025)= 3,437				
83	(L11*G5^2*(A83)^.5)*(14.7/15.025)= 1,524	(L11*H5^2*(A83)^.5)*(14.7/15.025)= 3,459				
84	(L11*G5^2*(A84)^.5)*(14.7/15.025)= 1,534	(L11*H5^2*(A84)^.5)*(14.7/15.025)= 3,481				
85	(L11*G5^2*(A85)^.5)*(14.7/15.025)= 1,544	(L11*H5^2*(A85)^.5)*(14.7/15.025)= 3,504				
86	(L11*G5^2*(A86)^.5)*(14.7/15.025)= 1,554	(L11*H5^2*(A86)^.5)*(14.7/15.025)= 3,526				
87	(L11*G5^2*(A87)^.5)*(14.7/15.025)= 1,563	(L11*H5^2*(A87)^.5)*(14.7/15.025)= 3,548				

	G	H	I	J	K	L
88	(L11*G5^2*(A88)^.5)*(14.7/15.025)= 1,573	(L11*H5^2*(A88)^.5)*(14.7/15.025)= 3,570				
89	(L11*G5^2*(A89)^.5)*(14.7/15.025)= 1,582	(L11*H5^2*(A89)^.5)*(14.7/15.025)= 3,591				
90	(L11*G5^2*(A90)^.5)*(14.7/15.025)= 1,592	(L11*H5^2*(A90)^.5)*(14.7/15.025)= 3,613				
91	(L11*G5^2*(A91)^.5)*(14.7/15.025)= 1,601	(L11*H5^2*(A91)^.5)*(14.7/15.025)= 3,634				
92	(L11*G5^2*(A92)^.5)*(14.7/15.025)= 1,611	(L11*H5^2*(A92)^.5)*(14.7/15.025)= 3,656				
93	(L11*G5^2*(A93)^.5)*(14.7/15.025)= 1,620	(L11*H5^2*(A93)^.5)*(14.7/15.025)= 3,677				
94	(L11*G5^2*(A94)^.5)*(14.7/15.025)= 1,629	(L11*H5^2*(A94)^.5)*(14.7/15.025)= 3,698				
95	(L11*G5^2*(A95)^.5)*(14.7/15.025)= 1,639	(L11*H5^2*(A95)^.5)*(14.7/15.025)= 3,719				
96	(L11*G5^2*(A96)^.5)*(14.7/15.025)= 1,648	(L11*H5^2*(A96)^.5)*(14.7/15.025)= 3,740				
97	(L11*G5^2*(A97)^.5)*(14.7/15.025)= 1,657	(L11*H5^2*(A97)^.5)*(14.7/15.025)= 3,760				
98	(L11*G5^2*(A98)^.5)*(14.7/15.025)= 1,666	(L11*H5^2*(A98)^.5)*(14.7/15.025)= 3,781				
99	(L11*G5^2*(A99)^.5)*(14.7/15.025)= 1,675	(L11*H5^2*(A99)^.5)*(14.7/15.025)= 3,802				
100	(L11*G5^2*(A100)^.5)*(14.7/15.025)= 1,684	(L11*H5^2*(A100)^.5)*(14.7/15.025)= 3,822				
101	(L11*G5^2*(A101)^.5)*(14.7/15.025)= 1,693	(L11*H5^2*(A101)^.5)*(14.7/15.025)= 3,842				

	G	H	I	J	K	L
102	(L11*G5^2*(A102)^.5)*(14.7/15.025)= 1,702	(L11*H5^2*(A102)^.5)*(14.7/15.025)= 3,862				
103	(L11*G5^2*(A103)^.5)*(14.7/15.025)= 1,711	(L11*H5^2*(A103)^.5)*(14.7/15.025)= 3,882				
104	(L11*G5^2*(A104)^.5)*(14.7/15.025)= 1,720	(L11*H5^2*(A104)^.5)*(14.7/15.025)= 3,902				
105	(L11*G5^2*(A105)^.5)*(14.7/15.025)= 1,728	(L11*H5^2*(A105)^.5)*(14.7/15.025)= 3,922				
106	(L11*G5^2*(A106)^.5)*(14.7/15.025)= 1,737	(L11*H5^2*(A106)^.5)*(14.7/15.025)= 3,942				
107	(L11*G5^2*(A107)^.5)*(14.7/15.025)= 1,780	(L11*H5^2*(A107)^.5)*(14.7/15.025)= 4,039				
108	(L11*G5^2*(A108)^.5)*(14.7/15.025)= 1,822	(L11*H5^2*(A108)^.5)*(14.7/15.025)= 4,134				
109	(L11*G5^2*(A109)^.5)*(14.7/15.025)= 1,863	(L11*H5^2*(A109)^.5)*(14.7/15.025)= 4,227				
110	(L11*G5^2*(A110)^.5)*(14.7/15.025)= 1,903	(L11*H5^2*(A110)^.5)*(14.7/15.025)= 4,318				
111	(L11*G5^2*(A111)^.5)*(14.7/15.025)= 1,942	(L11*H5^2*(A111)^.5)*(14.7/15.025)= 4,407				62.428/144= .4335278
112	(L11*G5^2*(A112)^.5)*(14.7/15.025)= 1,980	(L11*H5^2*(A112)^.5)*(14.7/15.025)= 4,495				62.428/(144*12)= .0361273
113	(L11*G5^2*(A113)^.5)*(14.7/15.025)= 2,018	(L11*H5^2*(A113)^.5)*(14.7/15.025)= 4,580				
114	(L11*G5^2*(A114)^.5)*(14.7/15.025)= 2,055	(L11*H5^2*(A114)^.5)*(14.7/15.025)= 4,664				
115	(L11*G5^2*(A115)^.5)*(14.7/15.025)= 2,092	(L11*H5^2*(A115)^.5)*(14.7/15.025)= 4,747				

	G	H	I	J	K	L
116	(L11*G5^2*(A116)^.5)*(14.7/15.025)= 2,127	(L11*H5^2*(A116)^.5)*(14.7/15.025)= 4,828				
117	(L11*G5^2*(A117)^.5)*(14.7/15.025)= 2,163	(L11*H5^2*(A117)^.5)*(14.7/15.025)= 4,908				
118	(L11*G5^2*(A118)^.5)*(14.7/15.025)= 2,197	(L11*H5^2*(A118)^.5)*(14.7/15.025)= 4,986				
119	(L11*G5^2*(A119)^.5)*(14.7/15.025)= 2,231	(L11*H5^2*(A119)^.5)*(14.7/15.025)= 5,064				
120	(L11*G5^2*(A120)^.5)*(14.7/15.025)= 2,265	(L11*H5^2*(A120)^.5)*(14.7/15.025)= 5,140				
121	(L11*G5^2*(A121)^.5)*(14.7/15.025)= 2,298	(L11*H5^2*(A121)^.5)*(14.7/15.025)= 5,215				
122	(L11*G5^2*(A122)^.5)*(14.7/15.025)= 2,330	(L11*H5^2*(A122)^.5)*(14.7/15.025)= 5,289				
123	(L11*G5^2*(A123)^.5)*(14.7/15.025)= 2,363	(L11*H5^2*(A123)^.5)*(14.7/15.025)= 5,362				
124	(L11*G5^2*(A124)^.5)*(14.7/15.025)= 2,394	(L11*H5^2*(A124)^.5)*(14.7/15.025)= 5,434				
125	(L11*G5^2*(A125)^.5)*(14.7/15.025)= 2,426	(L11*H5^2*(A125)^.5)*(14.7/15.025)= 5,505				
126	(L11*G5^2*(A126)^.5)*(14.7/15.025)= 2,457	(L11*H5^2*(A126)^.5)*(14.7/15.025)= 5,575				
127	(L11*G5^2*(A127)^.5)*(14.7/15.025)= 2,487	(L11*H5^2*(A127)^.5)*(14.7/15.025)= 5,644				
128	(L11*G5^2*(A128)^.5)*(14.7/15.025)= 2,517	(L11*H5^2*(A128)^.5)*(14.7/15.025)= 5,713				
129	(L11*G5^2*(A129)^.5)*(14.7/15.025)= 2,547	(L11*H5^2*(A129)^.5)*(14.7/15.025)= 5,780				

	G	H	I	J	K	L
130	(L11*G5^2*(A130)^.5)*(14.7/15.025)= 2,576	(L11*H5^2*(A130)^.5)*(14.7/15.025)= 5,847				
131	(L11*G5^2*(A131)^.5)*(14.7/15.025)= 2,606	(L11*H5^2*(A131)^.5)*(14.7/15.025)= 5,913				
132	(L11*G5^2*(A132)^.5)*(14.7/15.025)= 2,634	(L11*H5^2*(A132)^.5)*(14.7/15.025)= 5,978				
133	(L11*G5^2*(A133)^.5)*(14.7/15.025)= 2,663	(L11*H5^2*(A133)^.5)*(14.7/15.025)= 6,043				
134	(L11*G5^2*(A134)^.5)*(14.7/15.025)= 2,691	(L11*H5^2*(A134)^.5)*(14.7/15.025)= 6,107				
135	(L11*G5^2*(A135)^.5)*(14.7/15.025)= 2,719	(L11*H5^2*(A135)^.5)*(14.7/15.025)= 6,170				
136	(L11*G5^2*(A136)^.5)*(14.7/15.025)= 2,746	(L11*H5^2*(A136)^.5)*(14.7/15.025)= 6,233				
137	(L11*G5^2*(A137)^.5)*(14.7/15.025)= 2,774	(L11*H5^2*(A137)^.5)*(14.7/15.025)= 6,295				
138	(L11*G5^2*(A138)^.5)*(14.7/15.025)= 2,801	(L11*H5^2*(A138)^.5)*(14.7/15.025)= 6,356				
139	(L11*G5^2*(A139)^.5)*(14.7/15.025)= 2,828	(L11*H5^2*(A139)^.5)*(14.7/15.025)= 6,417				
140	(L11*G5^2*(A140)^.5)*(14.7/15.025)= 2,854	(L11*H5^2*(A140)^.5)*(14.7/15.025)= 6,477				
141	(L11*G5^2*(A141)^.5)*(14.7/15.025)= 2,881	(L11*H5^2*(A141)^.5)*(14.7/15.025)= 6,537				
142	(L11*G5^2*(A142)^.5)*(14.7/15.025)= 2,907	(L11*H5^2*(A142)^.5)*(14.7/15.025)= 6,596				
143	(L11*G5^2*(A143)^.5)*(14.7/15.025)= 2,932	(L11*H5^2*(A143)^.5)*(14.7/15.025)= 6,655				

	G	H	I	J	K	L
144	(L11*G5^2*(A144)^.5)*(14.7/15.025)= 2,958	(L11*H5^2*(A144)^.5)*(14.7/15.025)= 6,713				
145	(L11*G5^2*(A145)^.5)*(14.7/15.025)= 2,983	(L11*H5^2*(A145)^.5)*(14.7/15.025)= 6,771				
146	(L11*G5^2*(A146)^.5)*(14.7/15.025)= 3,009	(L11*H5^2*(A146)^.5)*(14.7/15.025)= 6,828				
147	(L11*G5^2*(A147)^.5)*(14.7/15.025)= 3,034	(L11*H5^2*(A147)^.5)*(14.7/15.025)= 6,884				
148	(L11*G5^2*(A148)^.5)*(14.7/15.025)= 3,058	(L11*H5^2*(A148)^.5)*(14.7/15.025)= 6,941				
149	(L11*G5^2*(A149)^.5)*(14.7/15.025)= 3,083	(L11*H5^2*(A149)^.5)*(14.7/15.025)= 6,996				
150	(L11*G5^2*(A150)^.5)*(14.7/15.025)= 3,107	(L11*H5^2*(A150)^.5)*(14.7/15.025)= 7,052				
151	(L11*G5^2*(A151)^.5)*(14.7/15.025)= 3,131	(L11*H5^2*(A151)^.5)*(14.7/15.025)= 7,107				
152	(L11*G5^2*(A152)^.5)*(14.7/15.025)= 3,155	(L11*H5^2*(A152)^.5)*(14.7/15.025)= 7,161				
153	(L11*G5^2*(A153)^.5)*(14.7/15.025)= 3,179	(L11*H5^2*(A153)^.5)*(14.7/15.025)= 7,215				
154	(L11*G5^2*(A154)^.5)*(14.7/15.025)= 3,203	(L11*H5^2*(A154)^.5)*(14.7/15.025)= 7,269				
155	(L11*G5^2*(A155)^.5)*(14.7/15.025)= 3,226	(L11*H5^2*(A155)^.5)*(14.7/15.025)= 7,322				
156	(L11*G5^2*(A156)^.5)*(14.7/15.025)= 3,250	(L11*H5^2*(A156)^.5)*(14.7/15.025)= 7,375				
157	(L11*G5^2*(A157)^.5)*(14.7/15.025)= 3,273	(L11*H5^2*(A157)^.5)*(14.7/15.025)= 7,427				

	G	H	I	J	K	L
158	(L11*G5^2*(A158)^.5)*(14.7/15.025)= 3,296	(L11*H5^2*(A158)^.5)*(14.7/15.025)= 7,479				
159	(L11*G5^2*(A159)^.5)*(14.7/15.025)= 3,319	(L11*H5^2*(A159)^.5)*(14.7/15.025)= 7,531				
160	(L11*G5^2*(A160)^.5)*(14.7/15.025)= 3,341	(L11*H5^2*(A160)^.5)*(14.7/15.025)= 7,583				
161	(L11*G5^2*(A161)^.5)*(14.7/15.025)= 3,364	(L11*H5^2*(A161)^.5)*(14.7/15.025)= 7,634				
162	(L11*G5^2*(A162)^.5)*(14.7/15.025)= 3,386	(L11*H5^2*(A162)^.5)*(14.7/15.025)= 7,684				
163	(L11*G5^2*(A163)^.5)*(14.7/15.025)= 3,408	(L11*H5^2*(A163)^.5)*(14.7/15.025)= 7,735				
164	(L11*G5^2*(A164)^.5)*(14.7/15.025)= 3,430	(L11*H5^2*(A164)^.5)*(14.7/15.025)= 7,785				
165	(L11*G5^2*(A165)^.5)*(14.7/15.025)= 3,452	(L11*H5^2*(A165)^.5)*(14.7/15.025)= 7,835				
166	(L11*G5^2*(A166)^.5)*(14.7/15.025)= 3,474	(L11*H5^2*(A166)^.5)*(14.7/15.025)= 7,884				
167	(L11*G5^2*(B167*13.59)^.5)*(14.7/15.025)= 3,507	(L11*H5^2*(B167*13.59)^.5)*(14.7/15.025)= 7,960				
168	(L11*G5^2*(B168*13.59)^.5)*(14.7/15.025)= 3,622	(L11*H5^2*(B168*13.59)^.5)*(14.7/15.025)= 8,221				
169	(L11*G5^2*(B169*13.59)^.5)*(14.7/15.025)= 3,734	(L11*H5^2*(B169*13.59)^.5)*(14.7/15.025)= 8,474				
170	(L11*G5^2*(B170*13.59)^.5)*(14.7/15.025)= 3,842	(L11*H5^2*(B170*13.59)^.5)*(14.7/15.025)= 8,719				

	G	H	I	J	K	L
171	(L11*G5^2*(B171*13.59)^.5)*(14.7/15.025)= 3,947	(L11*H5^2*(B171*13.59)^.5)*(14.7/15.025)= 8,958				
172	(L11*G5^2*(B172*13.59)^.5)*(14.7/15.025)= 4,050	(L11*H5^2*(B172*13.59)^.5)*(14.7/15.025)= 9,191				
173	(L11*G5^2*(B173*13.59)^.5)*(14.7/15.025)= 4,150	(L11*H5^2*(B173*13.59)^.5)*(14.7/15.025)= 9,418				
174	(L11*G5^2*(B174*13.59)^.5)*(14.7/15.025)= 4,248	(L11*H5^2*(B174*13.59)^.5)*(14.7/15.025)= 9,639				
175	(L11*G5^2*(B175*13.59)^.5)*(14.7/15.025)= 4,343	(L11*H5^2*(B175*13.59)^.5)*(14.7/15.025)= 9,856				
176	(L11*G5^2*(B176*13.59)^.5)*(14.7/15.025)= 4,436	(L11*H5^2*(B176*13.59)^.5)*(14.7/15.025)= 10,068				
177	(L11*G5^2*(B177*13.59)^.5)*(14.7/15.025)= 4,528	(L11*H5^2*(B177*13.59)^.5)*(14.7/15.025)= 10,276				
178	(L11*G5^2*(B178*13.59)^.5)*(14.7/15.025)= 4,618	(L11*H5^2*(B178*13.59)^.5)*(14.7/15.025)= 10,479				
179	(L11*G5^2*(B179*13.59)^.5)*(14.7/15.025)= 4,706	(L11*H5^2*(B179*13.59)^.5)*(14.7/15.025)= 10,679				
180	(L11*G5^2*(B180*13.59)^.5)*(14.7/15.025)= 4,792	(L11*H5^2*(B180*13.59)^.5)*(14.7/15.025)= 10,875				
181	(L11*G5^2*(B181*13.59)^.5)*(14.7/15.025)= 4,877	(L11*H5^2*(B181*13.59)^.5)*(14.7/15.025)= 11,067				

	G	H	I	J	K	L
182	(L11*G5^2*(B182*13.59)^.5)*(14.7/15.025)= 4,960	(L11*H5^2*(B182*13.59)^.5)*(14.7/15.025)= 11,256				
183	(L11*G5^2*(B183*13.59)^.5)*(14.7/15.025)= 5,163	(L11*H5^2*(B183*13.59)^.5)*(14.7/15.025)= 11,716				
184	(L11*G5^2*(B184*13.59)^.5)*(14.7/15.025)= 5,357	(L11*H5^2*(B184*13.59)^.5)*(14.7/15.025)= 12,158				
185	(L11*G5^2*(B185*13.59)^.5)*(14.7/15.025)= 5,546	(L11*H5^2*(B185*13.59)^.5)*(14.7/15.025)= 12,585				
186	(L11*G5^2*(B186*13.59)^.5)*(14.7/15.025)= 5,727	(L11*H5^2*(B186*13.59)^.5)*(14.7/15.025)= 12,998				
187	(L11*G5^2*(B187*13.59)^.5)*(14.7/15.025)= 5,904	(L11*H5^2*(B187*13.59)^.5)*(14.7/15.025)= 13,398				
188	(L11*G5^2*(B188*13.59)^.5)*(14.7/15.025)= 6,075	(L11*H5^2*(B188*13.59)^.5)*(14.7/15.025)= 13,786				
189	(L11*G5^2*(B189*13.59)^.5)*(14.7/15.025)= 6,241	(L11*H5^2*(B189*13.59)^.5)*(14.7/15.025)= 14,164				
190	(L11*G5^2*(B190*13.59)^.5)*(14.7/15.025)= 6,403	(L11*H5^2*(B190*13.59)^.5)*(14.7/15.025)= 14,532				
191	(L11*G5^2*(B191*13.59)^.5)*(14.7/15.025)= 6,562	(L11*H5^2*(B191*13.59)^.5)*(14.7/15.025)= 14,891				
192	(L11*G5^2*(B192*13.59)^.5)*(14.7/15.025)= 6,716	(L11*H5^2*(B192*13.59)^.5)*(14.7/15.025)= 15,241				

	G	H	I	J	K	L
193	(L11*G5^2*(B193*13.59)^.5)*(14.7/15.025)= 6,867	(L11*H5^2*(B193*13.59)^.5)*(14.7/15.025)= 15,584				
194	(L11*G5^2*(B194*13.59)^.5)*(14.7/15.025)= 7,015	(L11*H5^2*(B194*13.59)^.5)*(14.7/15.025)= 15,919				
195	(L11*G5^2*(B195*13.59)^.5)*(14.7/15.025)= 7,159	(L11*H5^2*(B195*13.59)^.5)*(14.7/15.025)= 16,247				
196	(L11*G5^2*(B196*13.59)^.5)*(14.7/15.025)= 7,301	(L11*H5^2*(B196*13.59)^.5)*(14.7/15.025)= 16,569				
197	(L11*G5^2*(B197*13.59)^.5)*(14.7/15.025)= 7,440	(L11*H5^2*(B197*13.59)^.5)*(14.7/15.025)= 16,885				
198	(L11*G5^2*(B198*13.59)^.5)*(14.7/15.025)= 7,577	(L11*H5^2*(B198*13.59)^.5)*(14.7/15.025)= 17,195				
199	(L11*G5^2*(B199*13.59)^.5)*(14.7/15.025)= 7,711	(L11*H5^2*(B199*13.59)^.5)*(14.7/15.025)= 17,499				
200	(L11*G5^2*(B200*13.59)^.5)*(14.7/15.025)= 7,843	(L11*H5^2*(B200*13.59)^.5)*(14.7/15.025)= 17,798				
201	(L11*G5^2*(B201*13.59)^.5)*(14.7/15.025)= 7,972	(L11*H5^2*(B201*13.59)^.5)*(14.7/15.025)= 18,092				
202	(L11*G5^2*(B202*13.59)^.5)*(14.7/15.025)= 8,100	(L11*H5^2*(B202*13.59)^.5)*(14.7/15.025)= 18,382				
203	(L11*G5^2*(B203*13.59)^.5)*(14.7/15.025)= 8,225	(L11*H5^2*(B203*13.59)^.5)*(14.7/15.025)= 18,667				

	G	H	I	J	K	L
204	(L11*G5^2*(B204*13.59)^.5)*(14.7/15.025)= 8,349	(L11*H5^2*(B204*13.59)^.5)*(14.7/15.025)= 18,947				
205	(L11*G5^2*(B205*13.59)^.5)*(14.7/15.025)= 8,471	(L11*H5^2*(B205*13.59)^.5)*(14.7/15.025)= 19,224				
206	(L11*G5^2*(B206*13.59)^.5)*(14.7/15.025)= 8,591	(L11*H5^2*(B206*13.59)^.5)*(14.7/15.025)= 19,497				
207	(L11*G5^2*(B207*13.59)^.5)*(14.7/15.025)= 8,710	(L11*H5^2*(B207*13.59)^.5)*(14.7/15.025)= 19,766				
208	(L11*G5^2*(B208*13.59)^.5)*(14.7/15.025)= 8,827	(L11*H5^2*(B208*13.59)^.5)*(14.7/15.025)= 20,031				
209	(L11*G5^2*(B209*13.59)^.5)*(14.7/15.025)= 8,942	(L11*H5^2*(B209*13.59)^.5)*(14.7/15.025)= 20,293				
210	(L11*G5^2*(B210*13.59)^.5)*(14.7/15.025)= 9,056	(L11*H5^2*(B210*13.59)^.5)*(14.7/15.025)= 20,551				
211	(L11*G5^2*(B211*13.59)^.5)*(14.7/15.025)= 9,168	(L11*H5^2*(B211*13.59)^.5)*(14.7/15.025)= 20,807				
212	(L11*G5^2*(B212*13.59)^.5)*(14.7/15.025)= 9,279	(L11*H5^2*(B212*13.59)^.5)*(14.7/15.025)= 21,059				
213	(L11*G5^2*(B213*13.59)^.5)*(14.7/15.025)= 9,389	(L11*H5^2*(B213*13.59)^.5)*(14.7/15.025)= 21,308				
214	(L11*G5^2*(B214*13.59)^.5)*(14.7/15.025)= 9,498	(L11*H5^2*(B214*13.59)^.5)*(14.7/15.025)= 21,555				

	G	H	I	J	K	L
215	(L11*G5^2*(B215*13.59)^.5)*(14.7/15.025)= 9,605	(L11*H5^2*(B215*13.59)^.5)*(14.7/15.025)= 21,798				
216	(L11*G5^2*(B216*13.59)^.5)*(14.7/15.025)= 9,711	(L11*H5^2*(B216*13.59)^.5)*(14.7/15.025)= 22,039				
217	(L11*G5^2*(B217*13.59)^.5)*(14.7/15.025)= 9,816	(L11*H5^2*(B217*13.59)^.5)*(14.7/15.025)= 22,277				
218	(L11*G5^2*(B218*13.59)^.5)*(14.7/15.025)= 9,920	(L11*H5^2*(B218*13.59)^.5)*(14.7/15.025)= 22,513				
219	(L11*G5^2*(B219*13.59)^.5)*(14.7/15.025)= 10,023	(L11*H5^2*(B219*13.59)^.5)*(14.7/15.025)= 22,746				
220	(L11*G5^2*(B220*13.59)^.5)*(14.7/15.025)= 10,125	(L11*H5^2*(B220*13.59)^.5)*(14.7/15.025)= 22,977				
221	(L11*G5^2*(B221*13.59)^.5)*(14.7/15.025)= 10,225	(L11*H5^2*(B221*13.59)^.5)*(14.7/15.025)= 23,206				
222	(L11*G5^2*(B222*13.59)^.5)*(14.7/15.025)= 10,325	(L11*H5^2*(B222*13.59)^.5)*(14.7/15.025)= 23,432				
223	(L11*G5^2*(B223*13.59)^.5)*(14.7/15.025)= 10,424	(L11*H5^2*(B223*13.59)^.5)*(14.7/15.025)= 23,656				
224	(L11*G5^2*(B224*13.59)^.5)*(14.7/15.025)= 10,522	(L11*H5^2*(B224*13.59)^.5)*(14.7/15.025)= 23,879				
225	(L11*G5^2*(B225*13.59)^.5)*(14.7/15.025)= 10,619	(L11*H5^2*(B225*13.59)^.5)*(14.7/15.025)= 24,099				

	G	H	I	J	K	L
226	(L11*G5^2*(B226*13.59)^.5)*(14.7/15.025)= 10,715	(L11*H5^2*(B226*13.59)^.5)*(14.7/15.025)= 24,317				
227	(L11*G5^2*(B227*13.59)^.5)*(14.7/15.025)= 10,810	(L11*H5^2*(B227*13.59)^.5)*(14.7/15.025)= 24,533				
228	(L11*G5^2*(B228*13.59)^.5)*(14.7/15.025)= 10,905	(L11*H5^2*(B228*13.59)^.5)*(14.7/15.025)= 24,747				
229	(L11*G5^2*(B229*13.59)^.5)*(14.7/15.025)= 10,998	(L11*H5^2*(B229*13.59)^.5)*(14.7/15.025)= 24,960				
230	(L11*G5^2*(B230*13.59)^.5)*(14.7/15.025)= 11,091	(L11*H5^2*(B230*13.59)^.5)*(14.7/15.025)= 25,170				
231	(L11*G5^2*(C231*144*12/62.428)^.5)*(14.7/15.025)= 11,193	(L11*H5^2*(C231*144*12/62.428)^.5)*(14.7/15.025)= 25,401				
232	(L11*G5^2*(C232*144*12/62.428)^.5)*(14.7/15.025)= 11,560	(L11*H5^2*(C232*144*12/62.428)^.5)*(14.7/15.025)= 26,234				
233	(L11*G5^2*(C233*144*12/62.428)^.5)*(14.7/15.025)= 11,915	(L11*H5^2*(C233*144*12/62.428)^.5)*(14.7/15.025)= 27,041				
234	(L11*G5^2*(C234*144*12/62.428)^.5)*(14.7/15.025)= 12,261	(L11*H5^2*(C234*144*12/62.428)^.5)*(14.7/15.025)= 27,825				
235	(L11*G5^2*(C235*144*12/62.428)^.5)*(14.7/15.025)= 12,597	(L11*H5^2*(C235*144*12/62.428)^.5)*(14.7/15.025)= 28,587				

	G	H	I	J	K	L
236	(L11*G5^2*(C236*144*12/62.428)^.5)*(14.7/15.025)= 12,924	(L11*H5^2*(C236*144*12/62.428)^.5)*(14.7/15.025)= 29,330				
237	(L11*G5^2*(C237*144*12/62.428)^.5)*(14.7/15.025)= 13,243	(L11*H5^2*(C237*144*12/62.428)^.5)*(14.7/15.025)= 30,054				
238	(L11*G5^2*(C238*144*12/62.428)^.5)*(14.7/15.025)= 13,555	(L11*H5^2*(C238*144*12/62.428)^.5)*(14.7/15.025)= 30,762				
239	(L11*G5^2*(C239*144*12/62.428)^.5)*(14.7/15.025)= 13,860	(L11*H5^2*(C239*144*12/62.428)^.5)*(14.7/15.025)= 31,453				
240	(L11*G5^2*(C240*144*12/62.428)^.5)*(14.7/15.025)= 14,158	(L11*H5^2*(C240*144*12/62.428)^.5)*(14.7/15.025)= 32,130				
241	(L11*G5^2*(C241*144*12/62.428)^.5)*(14.7/15.025)= 14,450	(L11*H5^2*(C241*144*12/62.428)^.5)*(14.7/15.025)= 32,792				
242	(L11*G5^2*(C242*144*12/62.428)^.5)*(14.7/15.025)= 14,736	(L11*H5^2*(C242*144*12/62.428)^.5)*(14.7/15.025)= 33,441				
243	(L11*G5^2*(C243*144*12/62.428)^.5)*(14.7/15.025)= 15,016	(L11*H5^2*(C243*144*12/62.428)^.5)*(14.7/15.025)= 34,079				
244	(L11*G5^2*(C244*144*12/62.428)^.5)*(14.7/15.025)= 15,292	(L11*H5^2*(C244*144*12/62.428)^.5)*(14.7/15.025)= 34,704				

	G	H	I	J	K	L
245	(L11*G5^2*(C245*144*12/62.428)^.5)*(14.7/15.025)= 15,563	(L11*H5^2*(C245*144*12/62.428)^.5)*(14.7/15.025)= 35,318				
246	(L11*G5^2*(C246*144*12/62.428)^.5)*(14.7/15.025)= 15,829	(L11*H5^2*(C246*144*12/62.428)^.5)*(14.7/15.025)= 35,922				
247	(L11*G5^2*(C247*144*12/62.428)^.5)*(14.7/15.025)= 16,090	(L11*H5^2*(C247*144*12/62.428)^.5)*(14.7/15.025)= 36,516				
248	(L11*G5^2*(C248*144*12/62.428)^.5)*(14.7/15.025)= 16,348	(L11*H5^2*(C248*144*12/62.428)^.5)*(14.7/15.025)= 37,100				
249	(L11*G5^2*(C249*144*12/62.428)^.5)*(14.7/15.025)= 16,601	(L11*H5^2*(C249*144*12/62.428)^.5)*(14.7/15.025)= 37,675				
250	(L11*G5^2*(C250*144*12/62.428)^.5)*(14.7/15.025)= 16,851	(L11*H5^2*(C250*144*12/62.428)^.5)*(14.7/15.025)= 38,242				
251	(L11*G5^2*(C251*144*12/62.428)^.5)*(14.7/15.025)= 17,097	(L11*H5^2*(C251*144*12/62.428)^.5)*(14.7/15.025)= 38,800				
252	(L11*G5^2*(C252*144*12/62.428)^.5)*(14.7/15.025)= 17,339	(L11*H5^2*(C252*144*12/62.428)^.5)*(14.7/15.025)= 39,351				
253	(L11*G5^2*(C253*144*12/62.428)^.5)*(14.7/15.025)= 17,579	(L11*H5^2*(C253*144*12/62.428)^.5)*(14.7/15.025)= 39,893				

	G	H	I	J	K	L
254	(L11*G5^2*(C254*144*12/62.428)^.5)*(14.7/15.025)= 17,815	(L11*H5^2*(C254*144*12/62.428)^.5)*(14.7/15.025)= 40,429				
255	(L11*G5^2*(C255*144*12/62.428)^.5)*(14.7/15.025)= 18,048	(L11*H5^2*(C255*144*12/62.428)^.5)*(14.7/15.025)= 40,957				

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