

NORTHERN NATURAL GAS COMPANY

BACK-PRESSURE CALCULATION SHEET

0.4517

TYPE TEST: 4PT + pt. ☒ INITIAL ☐ ANNUAL ☐ RETEST ☐ SPECIAL TEST DATE: 6-6-67

OPERATOR Glen Rupp LEASE Bordewick WELL NO. 1
SEC. 24 TWP. 26 RNG. 18 COUNTY Edwards STA. NO. NONE PIPELINE CONN. NONE
GA SYSTEM NO CLAVANNA FIELD N/A RESERVOIR Landed Sand

CSG. SIZE 4 1/2 WT. N/A TBG. SIZE 2 3/8 WT. N/A PERFS: 3200 TO 3222
TYPE COMPLETION Single - GAS PACKER@ NONE ft. AVG. VERTICAL DEPTH 3211 ft.

TYPE LIQUID PRODUCED Light mist LIQUID COMPOSITION _____ API GRAVITY N/A
GAS GRAVITY (G_g)(G_m) 0.615 (100) CO₂ N/A % N₂ N/A % H₂S NONE W/S P_{cr} 671 psia T_{cr} 362 °R
PRODUCING THRU Tubing TYPE TAPS _____ (PROVER)(METER) SIZE 2" BAR. PRESS. 14.4

METER OR PROVER DATA

RATE NO.	ORIFICE SIZE IN.	OBSERVED DATA				COMPRESSIBILITY FACTOR			REMARKS (QUALITY OF MEASUREMENT)
		(METER) (PROVER) TEMP °F	(METER) (PROVER) PRESSURE PSIG	(P _m)(P _p) PSIA	DIFF. (H ₂)	(P _m)(P _p) / P _{cr}	(T _m)(T _p) / T _{cr}	Z	
1	7/32	90	735.5	749.9	X	1.12	1.52	0.896	
2	5/16	82	633.0	647.4		0.96	1.50	0.905	
3	3/8	80	542.5	562.9		0.84	1.49	0.915	
4	1/2	80	394.5	408.9		0.69	1.49	0.929	
5	1/2	77	619.5	633.9		0.94	1.47	0.900	one point

FLOW RATE CALCULATION

RATE NO.	COEFF. MCF/DAY	(P _m H _w) (P _p)	EXTENSION $\sqrt{P_m H_w}$	GRAVITY FACTOR	METER TEMP FACTOR	DEVIATION FACTOR	FLOW RATE MCF/DAY	LENGTH OF FLOW	REMARKS (TYPE OF FLOW)
1	0.8608	749.9	X	1.275	0.9723	1.056	845	1.0 hr	
2	1.714	647.4		1.275	0.9795	1.051	1456	1.0 hr	
3	2.439	512.9		1.275	0.9813	1.045	1795	1.0 hr	
4	4.388	408.9		1.275	0.9813	1.033	2288	1.0 hr	
5	1.115	633.9		1.275	0.9887	1.054	939	1.0 hr	

WELLHEAD SHUT-IN AND FLOWING DATA

RATE NO.	CASING PRESSURE DATA				TUBING PRESSURE DATA				WELL-HEAD TEMP °F	REMARKS (QUALITY OF PRESSURES)
	PSIG	(P _c) & (P _w)(P _p) PSIA	(P _w)(P _p) / P _c	(P _c ²) & (P _w ²)(P _p ²)	PSIG	(P _c) & (P _w)(P _p) PSIA	(P _w)(P _p) / P _c	(P _c ²) & (P _w ²)(P _p ²)		
SHUT IN	826.0	840.4	—	706.3	826.0	840.4	—	706.3		Hours shut in: 472
1	742.0	756.4	0.9200	572.1	735.5	749.9	0.8923	562.4		
2	654.5	668.9	0.7959	447.4	633.0	647.4	0.7703	419.1		
3	582.5	602.9	0.7173	363.5	542.5	562.9	0.6692	316.9		
4	480.5	494.9	0.5888	244.9	394.5	408.9	0.4865	167.2		
5	659.5	673.9	0.8006	452.8	619.5	633.9	0.7842	421.8		one point

SUMMARY

RATE NO.	WATER PROD. BBLs.	LIQUID PETR. BBLs.	GOR MCF/BBL	(P _c ² - P _w ²)	Q	(P _c ² - P _p ²)	WH slope (n):	ABS slope (n):
1	0	0	0	134.2	845	143.9	0.778	0.783
2	0	0	0	258.9	1456	287.2	1807	69.0 hr.
3	Light mist	0	0	342.9	1795	389.4	2095	69.0 hr.
4	Heavy fog	0	0	461.4	2288	539.1	72 hr. WH potential	1807 MCF/D
5	Light mist	0	0	253.5	939	304.5	Stabl. WH potential	1623 MCF/D

REMARKS:

DEL @ 80% after 69.0 hr: 816 MCF/D
DEL @ 0.8 P_c after 72 hr: 816 MCF/D
Stabl. DEL @ P_c = 650 psig: 840 MCF/D
72 hr to t₀ hr stabl factor: 0.887
69.0 hr to 72 hr stabl factor: 1.000

TESTED BY: Ed Haskinson - Harold Donaldson

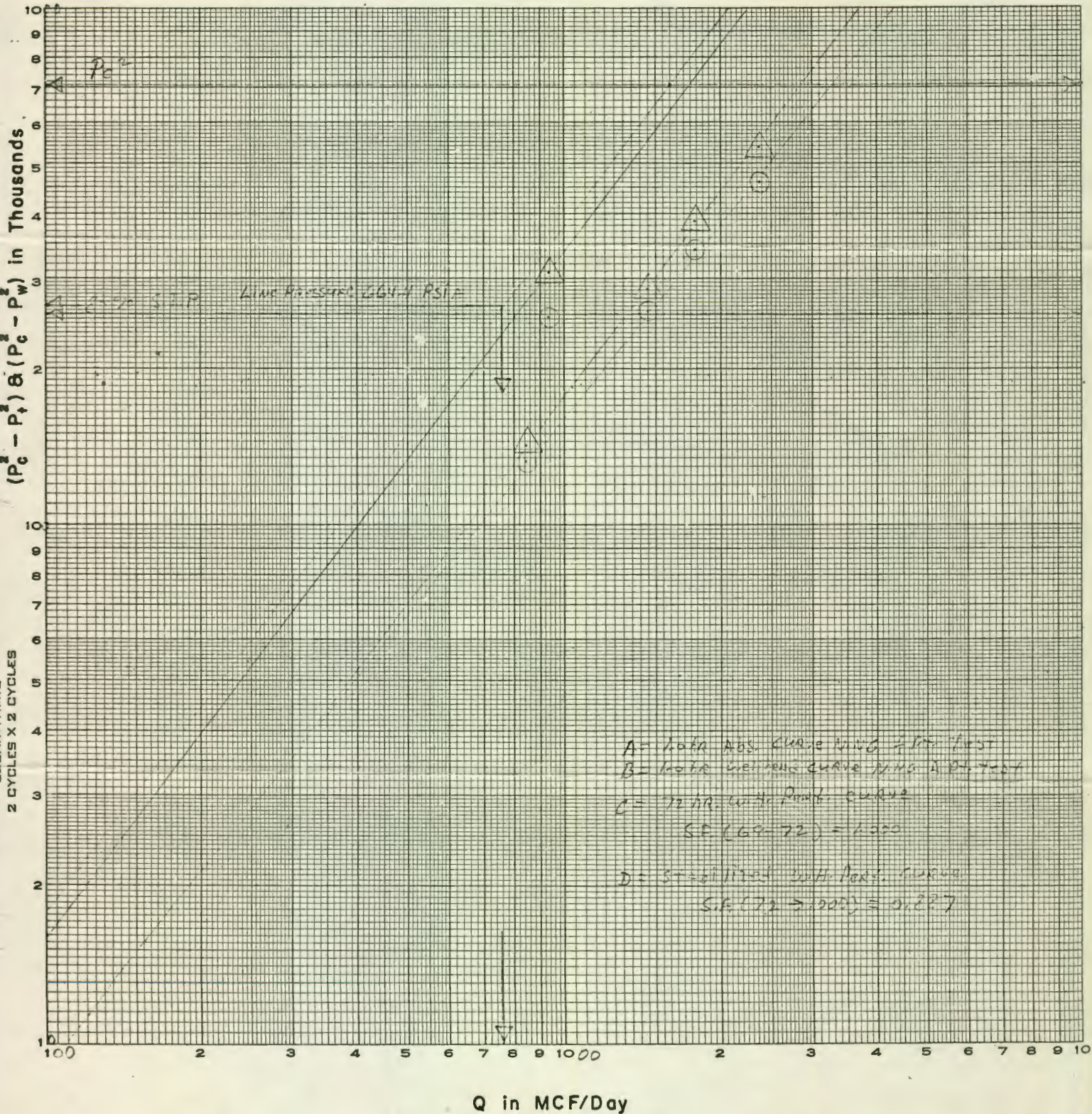
WITNESSED BY: 10.12

CALCULATED BY: Herbert E. Dixon NUG.

CHECKED BY:

BACK PRESSURE CURVE

Operator Glenn Kapp Lease Bordewick Well No. 1
 County Edwards Field N/A Location 24-26-18
 Date of Test 6-6-67 Slope "n" 0.762 W.H. 0.814 Abs.
 Calc. W.H. Potential 1777 MCF/D Calc. Abs. Potential 2155 MCF/D

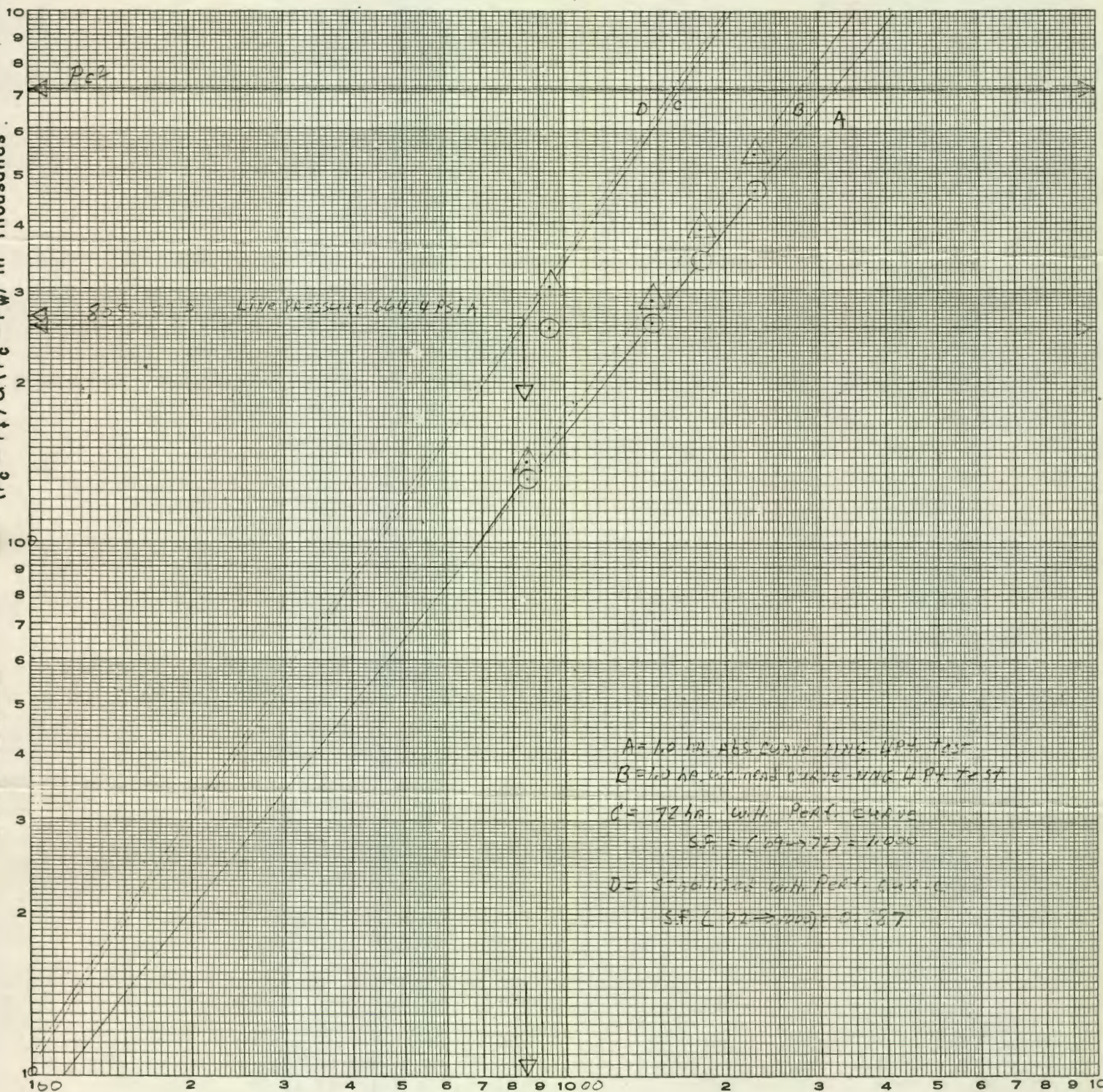
EUGENE DIETZGEN CO.
MADE IN U. S. A.NO. 341-L-22 DIETZGEN GRAPH PAPER
LOGARITHMIC
2 CYCLES X 2 CYCLES

BACK PRESSURE CURVE

Operator Glenn-Rupp Lease Bordewick Well No. 1
 County Edwards Field N/A Location 24-26-18
 Date of Test 6-6-67 Slope "n" 0.778 W.H. 0.783 Abs.
 Calc. W.H. Potential 1807 MCF/D Calc. Abs. Potential 2095 MCF/D

EUGENE DIETZGEN CO.
 MADE IN U.S.A.
 NO. 341-L22 DIETZGEN GRAPH PAPER
 LOGARITHMIC
 2 CYCLES X 2 CYCLES

$(P_c^2 - P_w^2) \& (P_c^2 - P_w^2)$ in Thousands



STATE OF KANSAS - CORPORATION COMMISSION
ONE POINT STABILIZED OPEN FLOW OR DELIVERABILITY TEST

FORM G-2
8-7-58

TYPE TEST: ☐ Deliverability ☒ Open Flow TEST DATE: 9-29-67

COMPANY Rupe Oil Co. LEASE Bordewick WELL NO. 1

COUNTY Edwards LOCATION C-SW-SW SECTION 24 TWP 26 RNO 18 ACRES

FIELD RESERVOIR Langdon Sand PIPELINE CONNECTION

COMPLETION DATE PLUG BACK TOTAL DEPTH PACKER SET AT

CASING SIZE 4-1/2 WT. I.D. SET AT PERF. 3209-3214 & TO 3220-3228

TUBING SIZE 2-3/8 WT. I.D. SET AT PERF. TO

TYPE COMPLETION (Describe) TYPE FLUID PRODUCTION

PRODUCING THRU Casing RESERVOIR TEMPERATURE F BAR. PRESS - P_a 14.4 Psia

GAS GRAVITY - G_g .653 % CARBON DIOXIDE % NITROGEN API GRAVITY OF LIQUID

VERTICAL DEPTH (H) TYPE METER CONN. (METER) (PROVER) SIZE 2"

SHUT-IN PRESSURE: SHUT IN 19 AT (AM)(PM) TAKEN 19 AT (AM)(PM)

FLOW TEST: STARTED 19 AT (AM)(PM) TAKEN 19 AT (AM)(PM)

OBSERVED DATA

DURATION OF SHUT-IN HR.

SHUT-IN OR FLOW	ORIFICE SIZE in.	(METER) (PROVER) PRESSURE psig	DIFF. in. (h _w)(h _d)	FLOWING TEMP. t	WELL-HEAD TEMP. t	CASING WELLHEAD PRESS.		TUBING WELLHEAD PRESS.		DURATION HOURS	LIQUID PROD. Bbls.
						psig	(P _w)(P _t)(P _c) psia	psig	(P _w)(P _t)(P _c) psia		
SHUT-IN						859	873.4	859			
FLOW	1/8	818		70		823	837.4			6-1/2	

RATE OF FLOW CALCULATIONS

COEFFICIENT (F _p)(F _d) Mcfd	(METER) (PROVER) PRESSURE psia	EXTENSION $\sqrt{P_m \times h_w}$	GRAVITY FACTOR F _g	FLOWING TEMP. FACTOR F _t	DEVIATION FACTOR F _{pv}	RATE OF FLOW R Mcfd	GOR	G _m
.2716	832.4		1.237	.9905	1.085	301		

(OPEN FLOW) (DELIVERABILITY) CALCULATIONS

(P_e)² = 762.8 ; (P_w)² = 701.2 ; P_d = % (P_c - 14.4) + 14.4 = ; (P_e)² = 0.207 (P_d)² =

$\frac{(P_e)^2 - (P_d)^2}{(P_c)^2 - (P_w)^2}$	$(P_c)^2 - (P_w)^2$	$\frac{P_c^2 - P_d^2}{P_c^2 - P_w^2}$	LOG []	"n"	n x LOG []	ANTILOG	OPEN FLOW DELIVERABILITY EQUALS R x ANTILOG Mcfd
762.6	61.6	12.38	1.0927	.700	.7649	5.820	1752

OPEN FLOW 1,752 Mcfd @ 14.65 psia DELIVERABILITY Mcfd @ 14.65 psia

The undersigned authority, on behalf of the Company, states that he is duly authorized to make the above report and that he has knowledge of the facts stated therein, and that said report is true and correct.

Executed this the 2 day of October, 1967.

Wilbur Sipe

For Company

Witness (if any)

Checked by

PANHANDLE EASTERN PIPE LINE COMPANY

LIBERAL LABORATORY

REPORT OF ANALYSIS

Laboratory No. C67-1019 Date July 18, 1967
 Sample of Natural Gas Date Sampled _____
 Company Kansas Nebraska Natural Gas Co.
 Description Clen-Rupes-Bordewick Sec. 24-26-18 Edwards Co. Kansas
 Well Name _____ Location _____
 County _____ State _____ Zone _____
 Perf. From _____ To _____ Sampled From _____

CHROMATOGRAPH METHOD

Component	Mol %	Liq. Vol. %	Calculated V.P. _____
Helium	<u>0.35</u>	_____	Reid V.P. _____
Hydrogen	<u>0.057</u>	_____	L.P.G. V.P. _____
Carbon Dioxide	_____	_____	Vapor Volume _____ cu. ft./gal.
Nitrogen	<u>12.77</u>	_____	e _____
Methane	<u>89.03</u>	_____	Requested by _____
Ethane	<u>3.21</u>	_____	Sampled by _____
Propane	<u>1.84</u>	<u>0.505</u>	
i-Butane	<u>0.35</u>	<u>0.114</u>	
n-Butane	<u>0.69</u>	<u>0.217</u>	
i-Pentane	<u>0.20</u>	<u>0.073</u>	
n-Pentane	<u>0.24</u>	<u>0.087</u>	
Hexanes - Plus	<u>0.31</u>	<u>0.131</u>	
_____	<u>100.00</u>	_____	
TOTALS	<u>100.00</u>	_____	

G.P.M. 26 lb. R. V. P. Gasoline .439 Liq. Vol. % Pentanes - Plus _____

Gross B.T.U. per cu. ft. @ 60° F - 30" Hg dry 983.6
 Gross B.T.U. per cu. ft. @ 60° F - 30" Hg sat. 966.4
 Net B.T.U. per cu. ft. @ 60° F - 30" Hg dry 988.7
 Net B.T.U. per cu. ft. @ 60° F - 30" Hg sat. 973.2
 Specific Gravity .6715

Gross B.T.U. per cu. ft. @ 60° F - 30" Hg sat.
 determined by recording calorimeter 966

Remarks _____

Fred Foster
 Fred Foster

Analyst

ONE POINT STABILIZED OPEN FLOW OR DELIVERABILITY TEST

TYPE TEST: ☒ Deliverability ☐ Open Flow

DATE: 20 Oct 1970

COMPANY

LEASE

WELL NO.

GLEN RUPE

BORDWICK

COUNTY

LOCATION

SECTION

TWP

RNG

ACRES

EDWARDS

KS

24

26

18

FIELD

RESERVOIR

PIPELINE CONNECTION

Langdon sd

COMPLETION DATE

PLUG BACK
TOTAL DEPTH

PACKER SET AT

CASING SIZE

WT.

I.D.

SET AT

PERF.

TO

TUBING SIZE

WT.

I.D.

SET AT

PERF.

TO

TYPE COMPLETION (Describe)

TYPE FLUID PRODUCTION

PRODUCING THRU

RESERVOIR TEMPERATURE F

BAR. PRESS - P_a

14.4 Psia

GAS GRAVITY - G_g

% CARBON DIOXIDE

% NITROGEN

API GRAVITY OF LIQUID

67.8

VERTICAL DEPTH (H)

TYPE METER CONN.

(METER RUN) (PROVER) SIZE

FLANGE

4"

SHUT-IN PRESSURE: SHUT IN

23 Oct

1970 AT

(AM)(PM) TAKEN

26 Oct

1970 AT

(AM)(PM)

FLOW TEST: STARTED

26 Oct

1970 AT

(AM)(PM) TAKEN

27 Oct

1970 AT

(AM)(PM)

OBSERVED DATA

DURATION OF SHUT-IN 72 hr.

SHUT-IN OR FLOW	ORIFICE SIZE in.	(METER) (PROVER) PRESSURE psig	DIFF. in. (h _w)(h _d)	FLOWING TEMP. t	WELL- HEAD TEMP. t	CASINO WELLHEAD PRESS. psig	(P _w)(P _d)(P _c) psia	TUBING WELLHEAD PRESS. psig	(P _w)(P _d)(P _c) psia	DURATION HOURS	LIQUID PROD. Bbls.
SHUT-IN						476	490.4	21 tubing			72
FLOW	.750	344	14"	60°		376	390.4				24

RATE OF FLOW CALCULATIONS

COEFFICIENT (F _p)(F _d) Mcfd	(METER) (PROVER) PRESSURE psia	EXTENSION $\sqrt{P_m \times h_w}$	GRAVITY FACTOR F _g	FLOWING TEMP. FACTOR F _t	DEVIATION FACTOR F _{pv}	RATE OF FLOW R Mcfd	GOR	G _m
2.729	358.4	70.83	1.214	1.000	1.027	241		

(OPEN FLOW) (DELIVERABILITY) CALCULATIONS

$(P_c)^2 = 240.4$		$(P_w)^2 = 152.4$		$P_d =$ _____ %	$(P_c - 14.4) + 14.4 =$ _____	$(P_c)^2 = 0.207$	$(P_d)^2 =$ _____
$\frac{(P_c)^2 - (P_d)^2}{(P_c)^2 - (P_w)^2}$	$\frac{(P_c)^2 - (P_w)^2}{(P_c)^2 - (P_d)^2}$	$\frac{P_c^2 - P_d^2}{P_c^2 - P_w^2}$	LOG []	"n"	n x LOG []	ANTILOG	OPEN FLOW DELIVERABILITY EQUALS R x ANTILOG Mcfd
240.2	88.0	2.729	.4360	.700	.3052	2.019	487

OPEN FLOW 487

Mcfd @ 14.65 psia

DELIVERABILITY

Mcfd @ 14.65 psia

The undersigned authority, on behalf of the Company, states that he is duly authorized to make the above report and that he has knowledge of the facts stated therein, and that said report is true and correct.

Executed this the _____ day of _____ 1970

William E. Turner
For Company

Witness (if any)

For Commission

Checked by

STATE OF KANSAS - CORPORATION COMMISSION
ONE POINT STABILIZED OPEN FLOW OR DELIVERABILITY TEST

FROM: Kansas-Nebraska Natural Gas Co. Inc.
8-7-58
Pawnee Rock, Kansas

TYPE TEST: ☒ Deliverability ☐ Open Flow

TEST DATE: 5 Aug 76

COMPANY: GLEN RUPPE LEASE: SCORDEWICK WELL NO.:
COUNTY: EDWARDS LOCATION: KANSAS SECTION: 24 TWP: 26 RNG: 18 ACRES:
FIELD: RESERVOIR: PIPELINE CONNECTION: K.D.D.S.

COMPLETION DATE: PLUG BACK TOTAL DEPTH: PACKER SET AT:
CASING SIZE: WT. I.D. SET AT: PERF. TO:
TUBING SIZE: WT. I.D. SET AT: PERF. TO:

TYPE COMPLETION (Describe): SINGLE (445) TYPE FLUID PRODUCTION:
PRODUCING THRU: CASING RESERVOIR TEMPERATURE F: BAR. PRESS - P_a: 14.4 Psia

GAS GRAVITY - G: 0.678 % CARBON DIOXIDE: % NITROGEN: API GRAVITY OF LIQUID:

VERTICAL DEPTH (H): TYPE METER CONN.: FLANGE (METER RUN) (BROWER) SIZE: 4"

SHUT-IN PRESSURE: SHUT IN 2 Aug 1976 AT 10:00 (AM)(PM) TAKEN 2 Aug 1976 AT 10:00 (AM)(PM)
FLOW TEST: STARTED 5 Aug 1976 AT 10:00 (AM)(PM) TAKEN 5 Aug 1976 AT 10:00 (AM)(PM)

OBSERVED DATA

DURATION OF SHUT-IN: 22 hr.

SHUT-IN OR FLOW	ORIFICE SIZE in.	(METER) (BROWER) PRESSURE psig	DIFF. in. (h _w)(h _d)	FLOWING TEMP. t	WELL-HEAD TEMP. t	CASING WELL-HEAD PRESS psig	(P _w)(P _d)(P _c) psia	TUBING WELL-HEAD PRESS psig	(P _w)(P _d)(P _c) psia	DURATION HOURS	LIQUID PROD. Bbls.
SHUT-IN				EST		205	219.4	PUMP			
FLOW	1.500	125	2	70°		135	139.4			24	

RATE OF FLOW CALCULATIONS

COEFFICIENT (F _p)(F _d) Mcfd	(METER) (BROWER) PRESSURE psia	EXTENSION $\sqrt{P_m \times h_w}$	GRAVITY FACTOR F _g	FLOWING TEMP. FACTOR F _t	DEVIATION FACTOR F _{pv}	RATE OF FLOW R Mcfd	GOR	Q _m
1.212	139.4	16.70	1.214	.9905	1.015	25		

(OPEN FLOW) (DELIVERABILITY) CALCULATIONS

$(P_c)^2 = 48.1$;		$(P_w)^2 = 19.4$;		$P_d =$ _____ %	$(P_c - 14.4) + 14.4 =$ _____ ;	$(P_d)^2 = 0.207$	$(P_d)^2 =$ _____
$\frac{(P_c)^2 - (P_d)^2}{(P_c)^2 - (P_w)^2}$	$(P_c)^2 - (P_w)^2$	$\frac{P_c^2 - P_d^2}{P_c^2 - P_w^2}$	LOG []	"n"	$n \times$ LOG []	ANTILOG	OPEN FLOW DELIVERABILITY EQUALS R x ANTILOG Mcfd
47.9	28.7	269	2.45	.700	1.557	1.431	36

OPEN FLOW

Mcfd @ 14.65 psia

DELIVERABILITY

36

Mcfd @ 14.65 psia

The undersigned authority, on behalf of the Company, states that he is duly authorized to make the above report and that he has knowledge of the facts stated therein, and that said report is true and correct.

Executed this the _____ day of August, 1976.

Witness (if any)

For omission

For Company

Checked by

File 8/17/76
Do not send
Investigative
CNR

STATE OF KANSAS - CORPORATION COMMISSION
ONE POINT STABILIZED OPEN FLOW OR DELIVERABILITY TEST

FORM G-2
8-7-58

TYPE TEST: ☒ Deliverability ☐ Open Flow TEST DATE: 10 JULY 75

COMPANY WELLEN ROPE LEASE BORDEWICK WELL NO. 1

COUNTY EDWARDS LOCATION KANSAS SECTION 24 TWP 26 RNG 18 ACRES

FIELD RESERVOIR PIPELINE CONNECTION K.N.V.C.

COMPLETION DATE PLUG BACK TOTAL DEPTH PACKER SET AT

CASING SIZE WT. I.D. SET AT PERP. TO

TUBING SIZE WT. I.D. SET AT PERP. TO

TYPE COMPLETION (Describe) SINGLE (WAS) TYPE FLUID PRODUCTION

PRODUCING THRU CASING RESERVOIR TEMPERATURE F BAR. PRESS - P_a 14.4 Psia

GAS GRAVITY - G_g 1.680 % CARBON DIOXIDE % NITROGEN API GRAVITY OF LIQUID

VERTICAL DEPTH (H) TYPE METER CONN. FLANGE (METER RUN) (PROVER) SIZE 4"

SHUT-IN PRESSURE: SHUT IN 7 JULY 1975 AT 10:20 (AM)(PM) TAKEN 10 JULY 1975 AT 10:25 (AM)(PM)

FLOW TEST: STARTED 10 JULY 1975 AT 3:30 (AM)(PM) TAKEN 10 JULY 1975 AT 10:30 (AM)(PM)

OBSERVED DATA

DURATION OF SHUT-IN 72 HR.

SHUT-IN OR FLOW	ORIFICE SIZE in.	(METER) PRESSURE psig	DIFF. in. (h _w)(h _d)	FLOWING TEMP. t	WELL-HEAD TEMP. t	CASINO WELLHEAD PRESS. psig	(P _w)(P _i)(P _c) psia	TUBING WELLHEAD PRESS. psig	(P _w)(P _i)(P _c) psia	DURATION HOURS	LIQUID PROD. Bbls.
SHUT-IN				<u>EST</u>		<u>191</u>	<u>205M</u>	<u>PUMP</u>			
FLOW	<u>1500</u>	<u>68</u>	<u>20</u>	<u>70°</u>		<u>70</u>	<u>84.4</u>			<u>19</u>	

RATE OF FLOW CALCULATIONS

COEFFICIENT (F ₁)(F ₂) Mcfd	(METER) PRESSURE psia	EXTENSION $\sqrt{P_m h_w}$	GRAVITY FACTOR F _g	FLOWING TEMP. FACTOR F _t	DEVIATION FACTOR F _{pv}	RATE OF FLOW R Mcfd	GOR	Q _m
<u>1.212</u>	<u>82.4</u>	<u>40.60</u>	<u>1.213</u>	<u>.9905</u>	<u>—</u>	<u>59</u>		

(OPEN FLOW) (DELIVERABILITY) CALCULATIONS

$(P_c)^2 = 42.2$		$(P_w)^2 = 7.1$		$P_d = \text{---} \%$		$(P_c - 14.4) + 14.4 = \text{---}$		$(P_w)^2 = 0.207$		$(P_d)^2 = \text{---}$	
$\frac{(P_c)^2 - (P_d)^2}{(P_c)^2 - (P_w)^2}$	$(P_c)^2 - (P_w)^2$	$\frac{P_c^2 - P_d^2}{P_c^2 - P_w^2}$	LOG []	"n"	n x LOG []	ANTILOG	OPEN FLOW DELIVERABILITY EQUALS R x ANTILOG Mcfd				
42.0	35.1	1.197	0.779	.700	.0546	1.134	67				

OPEN FLOW

Mcfd @ 14.65 psia

DELIVERABILITY 67

Mcfd @ 14.65 psia

The undersigned authority, on behalf of the Company, states that he is duly authorized to make the above report and that he has knowledge of the facts stated therein, and that said report is true and correct.

Executed this the 14 day of July, 1975.

William E. Turner
For Company