DRILL STEM TESTS

DRILL STEM TEST #1

Interval: 7725' - 7921 1.34 MMcfd
Gas to surface - 6 minutes 20' flare
Final shut-in pressure - 2894 psi
Bottom hole temperature - 167°F

DRILL STEM TEST #2

Interval: 11630' - 11690' 1.8 MMcfd
Using 3500' water cushion
Initial hydrostatic pressure - 5976 psi, preflow 1619 psi,
Initial shut-in pressure - 5680 psi
Initial flowing pressure - 1748 psi
Final flowing pressure - 659 psi
Final shut-in pressure - 5680 psi
Final hydrostatic pressure - 5976 psi

DRILL STEM TEST #3

Interval: 11680' - 11890' Misrun
Using 2500' water cushion
Fair blow on preflow
1 hour shut-in
Lost seat

DRILL STEM TEST #4

Interval: 11695' - 11890' Misrun
Using 3500' water cushion
No seat

DRILL STEM TEST #5

Interval: 11695' - 11890'
Gas to surface - 45 minutes
Initial hydrostatic pressure - 5886 psi
Preflow 1665 psi
Initial shut-in pressure - 5608 psi
Initial flowing pressure - 1831 psi
Final flowing pressure - 906 psi
Final shut-in pressure - 5608 psi
Final hydrostatic pressure - 5850 psi
Flow characteristics: 50 minutes - 8.5 MMcfd
60 minutes - 8 MMcfd
70 minutes - 7.2 MMcfd
80 minutes - 6.4 MMcfd
90 minutes - 3.8 MMcfd
100 minutes - 3.8 MMcfd

JOHNSTON TESTERS

A DIVISION OF SCHLUMBERGER CANADA LIMITED
321 - 50th AVENUE S.E. CALGARY, ALBERTA T2G 2B3

District	Fort St. John	Ticket No. E15042	Company Columbia Gas Development of Canada Ltd.
Address	c/o D & S Consultants, 550 - 6 Avenue S.W.		Test No. 1 J.T. No. 1
	Calgary, Alberta T2P 0S2	Well Name	Columbia Gas Cotoneely
Field	Cotoneely	Number	YT H-38
Province	British Columbia	Date	August 10, 1977
Co. Rep.		Formation	Thickness
Technician	T. Thompson	Interval	7725 - 7920' TD 7921'

TEST DATA

Type of Test	Open hole, Bottom hole.				
Time Started in Hole	0330	Hrs.	Tool Opened	0828	Hrs.
First Flow	10	Min.	Initial Shut-In	30	Min.
Second Flow	64	Min.	Second Shut In	128	Min.
Third Flow		Min.	Final Shut In		Min.
Pulled Loose @	1330	Hrs.	Out of Hole	1900	Hrs.
Wt. Set/on Packers	30,000	#	Pulled Loose Wt.		#

Description of Blow During Test: Strong initial puff with gas to surface in 6 minutes on preflow. Fair gas blow on valve opening increasing to good in 10 minutes, began unloading mud in 25 minutes of flow period.

FLUID RECOVERY Was Test Reverse Circulated Yes ☐ No ☒

Total Fluid Recovered 1,350 Ft.

Description of Fluid Recovered

1,350' Gas cut, drilling fluid.

GAS BLOW MEASUREMENT

Measured With Critical Flow Prover Gauge 2" I.D. Riser

Time	Sfce. Choke	Reading psi	M Cubic Feet/Day
0918	1"	48	1300
0928	1"	52	1390
0938	1"	50	1360
Began unloading mud, choked back to 15 psi on gauge opened 4" valve to allow mud to escape.			
0948	1/8"	37	820
0958	1/8"	37	820
1009	1/8"	32	740
Still unloading mud.			

REMARKS: Test satisfactory.
Lost approximately 15' of mud on preflow.

RESISTIVITY			SALT CONTENT
Recovery Water	@	°F.	ppm.
Mud Pit sample filtrate	@	°F. 36,500	ppm.

TOOL SEQUENCE

Tool	Length	O.D.
P.O. Sub	1.00	
D.P. Sub	.65	
MFE Tool	9.30	
Bypass Tool	2.85	
Safety Joint	1.75	
S.S. & Packer	11.50	11 1/2"
T.C. & Packer	6.00	11 1/2"
Total	33.05	
Packer Stub	1.50	
Perfs	9.00	
Recorder	4.25	
Recorder	4.30	
Sub	2.50	
Drill Collars	172.54	
Sub	.75	
Bull Nose	1.50	
Total Interval	196.34	
TOTAL LENGTH		

Elevation G.L. 2250 K.B. 2275
Bottom Hole Choke Size. 1/2"
Fluid Cushion Type Nil Amt.

MUD AND HOLE DATA

Mud Type Gel Chem W.L.
Filter Cake 4½/32" Visc. 40 Wt. 9.8
Time Taken 2400 hours
Contractor Nabors Drilling Rig No. 9
Drill Pipe Size 4 1/2" IF
Drill Collar Size 4 1/2" XH &
Drill Collar Length 406' &
Main Hole Size 12 1/4" Rat Hole

Distribution of Reports 10 - Calgary Attention: Mr. L. Kerkoff

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JOHNSTON TESTERS

A DIVISION OF SCHLUMBERGER CANADA LIMITED

321 - 50th AVENUE S.E. CALGARY, ALBERTA T2G 2B3

E15042

PRESSURE DATA

FLUID SAMPLE REPORT

INSTRUMENT No.		AK1-2100	AK1-4367			
CAPACITY (psig)		7000	7000			
INSTRUMENT DEPTH FT.		7736	7740			
INSTRUMENT OPENING		Outside	Outside			
WELL TEMP. °F.	186					
INITIAL HYDROSTATIC	A	3994#	4008#			
FIRST FLOW	B	Unreadable	Unreadable			
	B-1	Unreadable	1549#			
INITIAL SHUT-IN	C	3361#	3368#			
SECOND FLOW	D	737#	739#			
	D-1	667#	673#			
SECOND SHUT-IN	E	/				
THIRD FLOW	F					
	F-1					
FINAL SHUT-IN	G	2912#	2918#			
FINAL HYDROSTATIC	H	3847#	Unreadable			

Sample No. 521
Type 5"
Depth 7703'
Volume 2500 cc

Sample Pressure: psig. at Surface
Gravity API @ °F
Gas/Oil Ratio Cu.Ft./bbl.

Recovery:
Cu. Ft. Gas
cc. Oil
cc. Water
cc. Mud
Total Liquid cc.

REMARKS: MFE sample #521 and fluid sample #6395 was sent to Core Labs., in Calgary, Alberta.

PRESSURE INCREMENTS ON RECORDER

POINT MINUTES	PRESSURE	$\frac{T + \Delta t}{\Delta t}$	POINT MINUTES	PRESSURE	$\frac{T + \Delta t}{\Delta t}$	POINT MINUTES	PRESSURE	$\frac{T + \Delta t}{\Delta t}$

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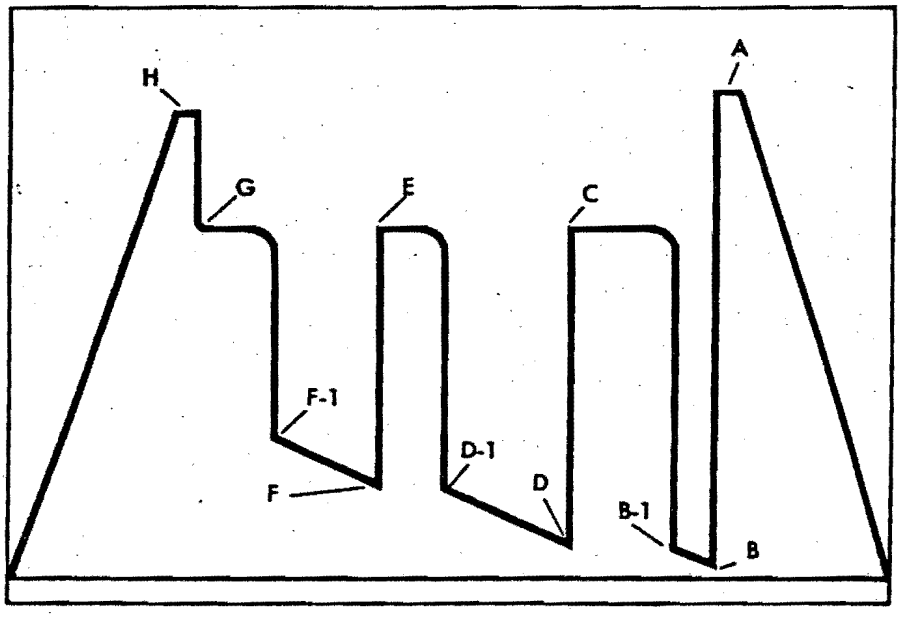
321 - 50TH AVENUE S.E. • CALGARY, ALBERTA T2G 2B3 • PH. (403) 255-1151

GUIDE TO IDENTIFICATION OF DRILL STEM TEST PRESSURE CHARTS

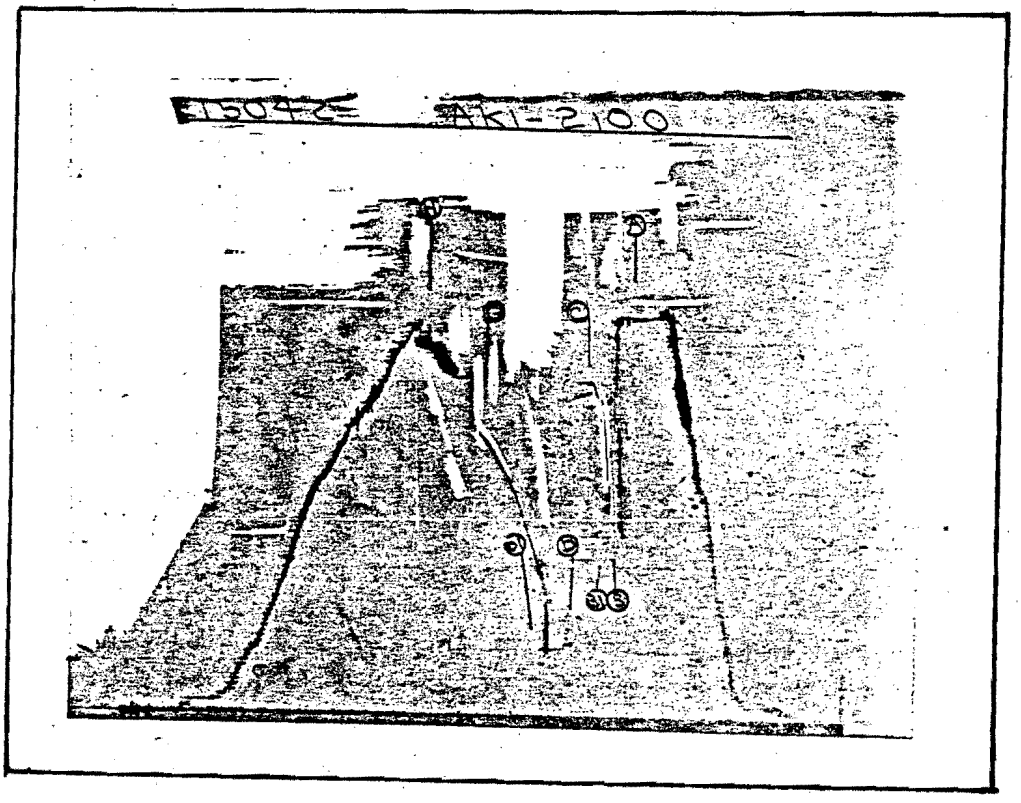
FIELD REPORT NO.	RECORDER NO.
E15042	AK1-2100



A. Initial Hyd. Mud
B. First Flow
C. Initial Shut-In
D. Second Flow
E. Second Shut-In
F. Third Flow
G. Final Shut-In
H. Final Hyd. Mud

The following points are either fluctuating pressures or points indicating other packer settings (testing different zones).

A-1, A-2, A-3, etc. Initial Hyd. Pressures
Z — Special pressure points such as pumping pressures recorded for formation breakdown.



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DRILL STEM TEST SPECIAL DATA ANALYSIS

Columbia Gas Limited DST #2
Columbia Gas et al Kotaneelee E15085
11,630 - 11,690' 11,690'
September 28, 1977

October 4, 1977

ATTENTION: RICK SMITH

Gentlemen:

The enclosed test appears to be a good mechanical drill stem test during which the tools functioned properly, and the formation produced enough reservoir fluid for proper identification. Reservoir pressure drawdown was sufficient and adequate shut-in build-ups occurred for reliable quantitative analysis.

1. Flow Rate: A flow rate of ~~1824~~ 2300 MCF/day of gas was noted during this test.

2. Reservoir Pressure: Mechanical Stabilization of the inital shut-in pressure build-up indicates a maximum reservoir pressure of 5689 psig at recorder depth. Mechanical stabilization of the final shut-in pressure build-up indicates a maximum reservoir pressure of 5691 psig at recorder depth.

3. Permeability: The calculated transmissibility factor of 4739 md.ft./cp. indicates an average effective permeability to gas of 2.37 md. for the reported 50 foot porous interval. The calculations were based on a slope of 505,000 psi^{2}/ log cycle obtained from the final shut-in build-up plot. It was assumed for these calculations: (A) gas gravity 0.70, (B) viscosity 0.025 cp., (C) and gas deviation factor 1.07. These figures were obtained from the available technical literature.

4. Well Bore Damage: The calculated estimated damage ratio of 12.32 indicates that high well bore damage is present at the time and conditions of this test. This value appears to be excessive and may be due to the partial penetration of the net production interval by the test interval. If subsequent information confirms this possibility then the value for D.R. should be discounted.

5. Radius of Investigation: The calculated radius of investigation of this test is 162.6 feet based on an assumed porosity of 7.5%, compressibility of 1.12 X 10^{-4} vol/vol/psi, and other assumptions made in number 3 above.

6. General Comments: The formation exhibits the characteristics of relatively low permeability effective to the reservoir fluid and well bore damage is indicated. No unusual characteristics were noted from the analysis of the test data presented. The main feature of this test is that an assumed horner plot slope was utilized to obtain reservoir calculations.

Yours truly,

Jose Cuesta
Technical Analyst

JC/jmh

WELL: COLUMBIA GAS ET AL KOTANEELEE DST #2

FLOW RATE PRIOR TO SHUT IN	(MCF/DAY)	1824.000
COMPRESSIBILITY FACTOR Z		1.0700
HORNER PLOT SLOPE	(PSI^2/LOG CYCLE)	505000.
VISCOSITY	(CP)	0.025
NET THICKNESS	(FT)	50.000
MAX RESERVOIR PRESSURE	(PSIG)	5691.0
FLOWING PRESSURE	(PSIG)	1672.0
FLOW TIME	(MIN)	135.0
POROSITY		0.075
COMPRESSIBILITY	(1/PSI)	0.00011200
WELL BORE RADIUS	(IN)	6.13
WELL ELEVATION	(FT)	2275.0
RECORDER DEPTH	(FT)	11650.0
TEMPERATURE	(DF)	289.0

TRANSMISSIBILITY	(MD-FT/CP)	4738.57
FLOW CAPACITY	(MD-FT)	118.46
AVERAGE EFF. PERMEABILITY	(MD)	2.37
DAMAGE RATIO		12.32
FLOW RATE WITH DAMAGE REMOVED	(MCF/DAY)	22471.092
POTENTIOMETRIC SURFACE	(FT)	3765.5
RADIUS OF INVESTIGATION	(FT)	162.6

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USED    12.81 UNITS
PURGE PRESDAT
FILE NOT SAVED
READY
PURGE BLD2DATA

READY
BYE
00015.98  CRU     0000.05  TCH     0002.07  KC

OFF AT 13:49MDT 10/04/77
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RESERVOIR PRESSURE PLOT

JOHNSTON
Schlumberger

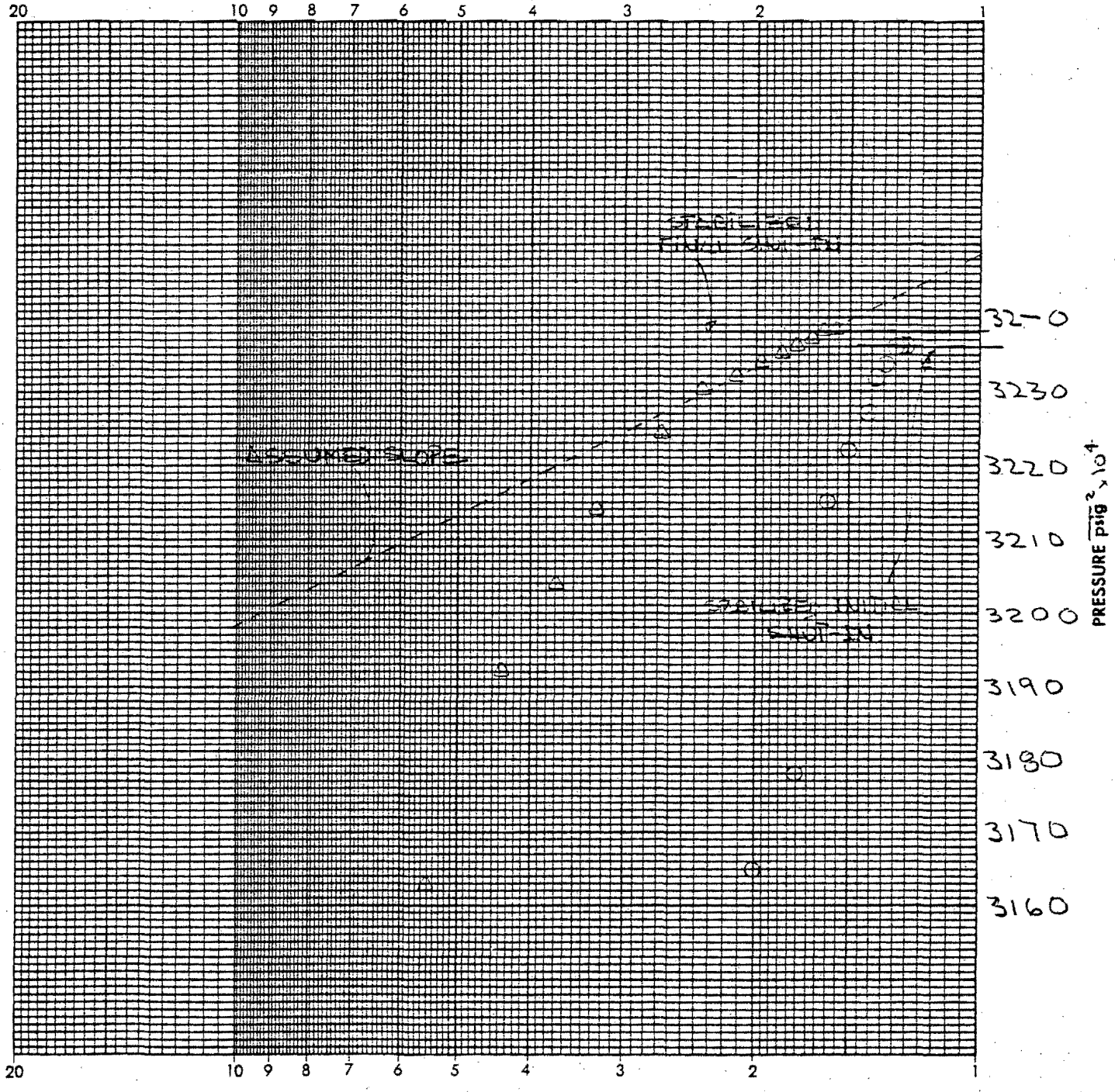
R. ORDER No. AK1 5025 CAPACITY 8650 FIELD REPORT No.

MAXIMUM RESERVOIR PRESSURE P_o = psig INITIAL SHUT-IN = 5689 PSIG

SLOPE OF SHUT-IN CURVE M1 = psig/LOG CYCLE FINAL SHUT-IN = 5691 PSIG

SLOPE M1 = P_1 3248.5 x 10^4 P_{10} 3198.0 x 10^4 = psig/LOG CYCLE 505000

SLOPE M2 = P_1 P_{10} = psig/LOG CYCLE



JOHNSTON TESTERS

A DIVISION OF SCHLUMBERGER CANADA LIMITED
321 - 50th AVENUE S.E. CALGARY, ALBERTA T2G 2B3

District	Calgary	Ticket No. E15085	Company Columbia Gas Limited
Address	1420 Standard Life Building, 639 - 5 Avenue S.W., Calgary, Alberta T2P 0M9		Test No. 2 J.T. No. 2
		Well Name	Columbia Gas et al Kotaneelee
Field	Kotaneelee	Number	H-28-60-10-124
Province	Yukon Territory	Date	September 28, 1977
Co. Rep.	J. Dortch	Formation	Thickness
Technician	T. Thompson	Interval	11,630 - 11,690' TD 11,690'

TEST DATA

Type of Test	Open hole, Bottom hole.		
Time Started in Hole	0830 Hrs.	Tool Opened	1512 Hrs.
First Flow	15 Min.	Initial Shut-In	60 Min.
Second Flow	120 Min.	Second Shut In	240 Min.
Third Flow	Min.	Final Shut In	Min.
Pulled Loose @	2245 Hrs.	Out of Hole	0700 Hrs.
Wt. Set/on Packers	30,000 #	Pulled Loose Wt.	30,000 #

Description of Blow During Test: Fair initial aie puff on preflow. Fair air blow on final flow period with gas to surface in 25 minutes.

FLUID RECOVERY

Was Test Reverse Circulated Yes XX No ☐

Total Fluid Recovered 755 Ft.

Description of Fluid Recovered

755' Gasified water.

GAS BLOW MEASUREMENT

Measured With Critical Flow Prover Gauge. 2" I.D. Riser

Time	Sfce. Choke	Reading psi	M Cubic Feet/Day
1735	64	180	5090
1745	64	170	4700
1755	54	170	2580
1805	54	160	2450
1815	54	155	2390
1825	54	150	2300

REMARKS: Test satisfactory.

RESISTIVITY			SALT CONTENT
Recovery Water	@	°F.	ppm.
Mud Pit sample filtrate	@	°F.	ppm.

TOOL SEQUENCE

Tool	Length	O.D.
P.O. Sub	1.00	
D.P. Sub	.65	
MFE Tool	12.55	
Bypass Tool	2.85	
Recorder	4.40	
Safety Joint	1.75	
S.S. & Packer	9.30	7 1/2"
T.C. & Packer	6.55	7 1/2"
Total	39.05	
Packer Stub	1.00	
Perfs	15.00	
Recorder	4.40	
Recorder	4.40	
Perf	3.00	
Sub	1.00	
Drill Collar	28.55	
Sub	1.00	
Packer Stub	2.00	
Total Interval	60.35	
TOTAL LENGTH		

Elevation G.L. 2250 K.B. 2275

Bottom Hole Choke Size. 1/2"

Fluid Cushion Type Water Amt. 3500'

MUD AND HOLE DATA

Mud Type KCL W.L.

Filter Cake 2/32 Visc. 70 Wt. 9,8

Time Taken 2400 hours

Contractor Nabours Drilling Rig No. 9

Drill Pipe Size 4 1/2" IF

Drill Collar Size 4 1/2" XH &

Drill Collar Length 605' &

Main Hole Size 12 1/4" Rat Hole

Distribution of Reports 12 - Calgary Attention: Rick Smith

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JOHNSTON TESTERS

A DIVISION OF SCHLUMBERGER CANADA LIMITED
321 - 50th AVENUE S.E. CALGARY, ALBERTA T2G 2B3

E15085

PRESSURE DATA

INSTRUMENT No.		AK1-4371	AK1-2095	AK1-5025	T-5365
CAPACITY (psig)		7400	7450	8650	220 - 549 °F
INSTRUMENT DEPTH FT.		11608	11646	11650	11659
INSTRUMENT OPENING		Inside	Outside	Outside	Outside
WELL TEMP. °F.					
INITIAL HYDROSTATIC	A	5982#	6006#	6014#	
FIRST FLOW	B	1650#	1643#	1644#	
	B-1	1688#	1677#	1681#	
INITIAL SHUT-IN	C	5689#		5692#	
SECOND FLOW	D	1752#		1734#	
	D-1	650#		643#	
SECOND SHUT-IN	E		Clock		
THIRD FLOW	F		Stopped		
	F-1				
FINAL SHUT-IN	G	5689#		5692#	
FINAL HYDROSTATIC	H	5971#		6014#	

FLUID SAMPLE REPORT

Sample No.	103421 & 110267
Type	5"
Depth	11,593'
Volume	2500 cc
Sample Pressure:	psig. at Surface
Gravity	API @ °F
Gas/Oil Ratio	Cu.Ft./bbl.
Recovery:	
Cu. Ft. Gas	
cc. Oil	
cc. Water	
cc. Mud	
Total Liquid cc.	

REMARKS: Temperature recorder #5365 - 0.101 Defl. = 289 °F
MFE samples #103421 & #110267 and fluid sample #6445 sent to C & G Labs, Calgary, Alberta.

PRESSURE INCREMENTS ON RECORDER

Initial Shut-in

POINT MINUTES	PRESSURE	$\frac{T + \Delta t}{\Delta t}$
0	1679	-----
5	3947	4.000
10	5485	2.500
15	5626	2.000
20	5637	1.750
25	5670	1.600
30	5676	1.500
35	5681	1.428
40	5685	1.375
45	5687	1.333
50	5689	1.300
55	5689	1.273
60	5689	1.250

Final Shut-in

POINT MINUTES	PRESSURE	$\frac{T + \Delta t}{\Delta t}$
0	1672	------
10	5029	14.500
20	5546	7.750
30	5624	5.500
40	5650	4.375
50	5661	3.700
60	5670	3.250
80	5678	2.687
100	5683	2.350
120	5685	2.125
140	5687	1.964
160	5688	1.843
180	5689	1.750
200	5690	1.675
220	5691	1.614
240	5691	1.562

POINT MINUTES	PRESSURE	$\frac{T + \Delta t}{\Delta t}$

IT-1&E-5B

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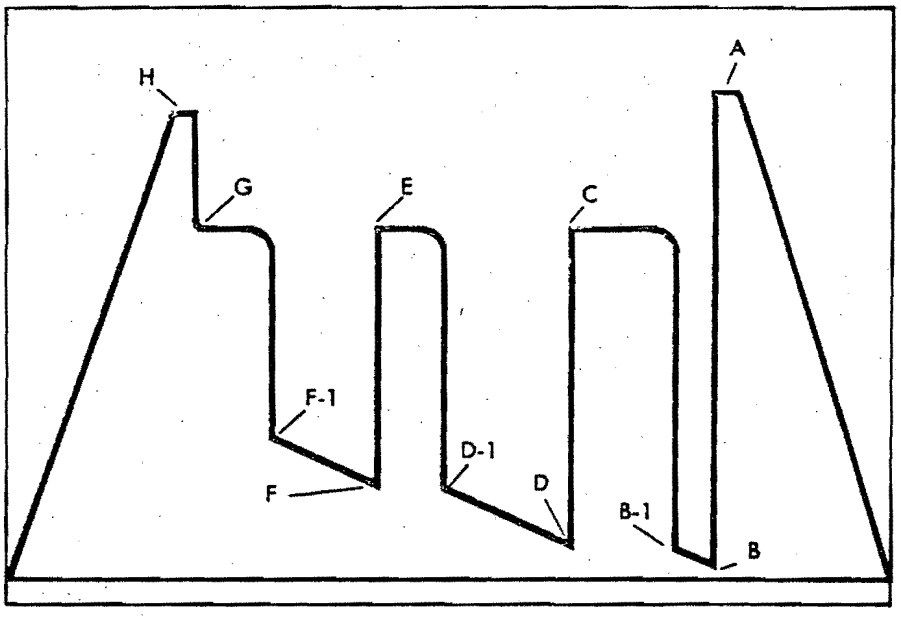
321 - 50TH AVENUE S.E. • CALGARY, ALBERTA T2G 2B3 • PH. (403) 255-1151

GUIDE TO IDENTIFICATION OF DRILL STEM TEST PRESSURE CHARTS

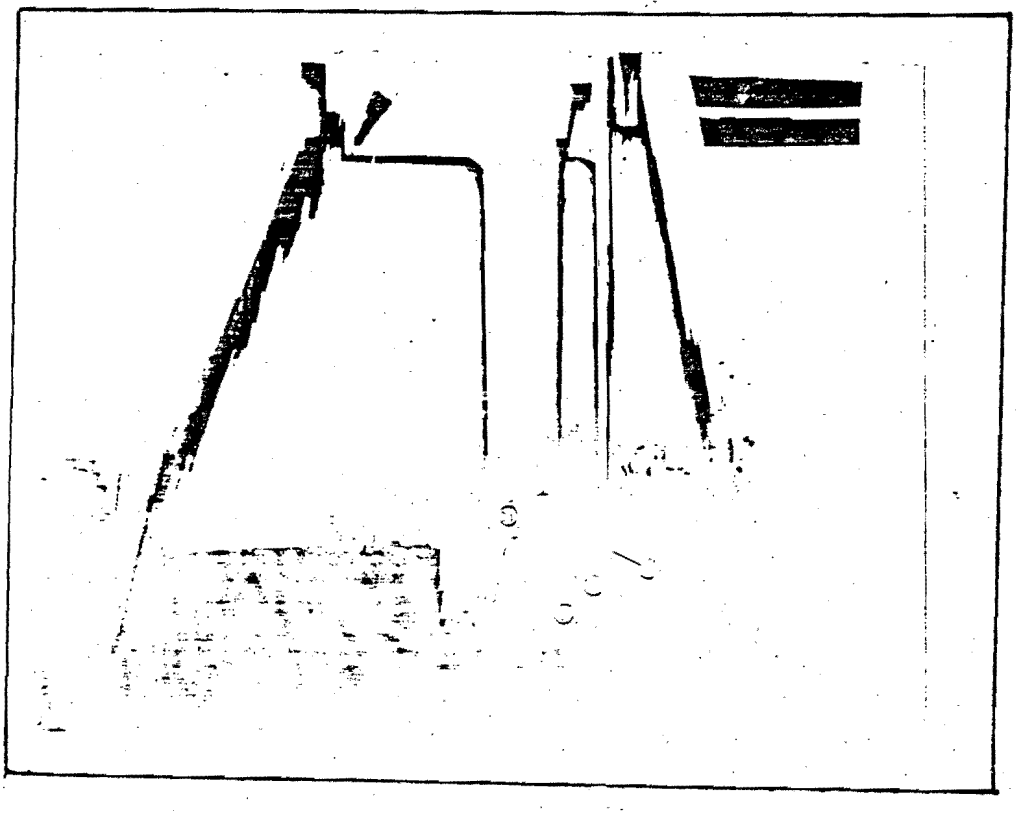
FIELD REPORT NO.	RECORDER NO.
E15085	AK1-4371



A. Initial Hyd. Mud
B. First Flow
C. Initial Shut-In
D. Second Flow
E. Second Shut-In
F. Third Flow
G. Final Shut-In
H. Final Hyd. Mud

The following points are either fluctuating pressures or points indicating other packer settings (testing different zones).

A-1, A-2, A-3, etc. Initial Hyd. Pressures
Z — Special pressure points such as pumping pressures recorded for formation breakdown.



JOHNSTON TESTERS

A DIVISION OF SCHLUMBERGER CANADA LIMITED
321 - 50th AVENUE S.E. CALGARY, ALBERTA T2G 2B3

District	Fort St. John	Ticket No. E15086	Company: Columbia Gas Development Ltd.
Address	c/o D & S Consultants, #600, 633 - 6 Avenue S.W., Calgary, Alberta T2P 0S2		Test No. 3 J.T. No. 3
Field	Kotaneelee	Well Name	Columbia Gas et al Kotaneelee
Province	Yukon Territory	Number	H-38-60-10-124
Co. Rep.	J. Dortch	Date	October 2, 1977
Technician	T. Thompson	Formation	Nahanni
		Interval	11,680 - 11,890'
		Thickness	TD 11,890'

TEST DATA

Type of Test	Open hole, Bottom hole.				
Time Started in Hole	0300	Hrs.	Tool Opened	0840	Hrs.
First Flow	10	Min.	Initial Shut-In	60	Min.
Second Flow		Min.	Second Shut In	60	Min.
Third Flow		Min.	Final Shut In		Min.
Pulled Loose @	1115	Hrs.	Out of Hole	2400	Hrs.
Wt. Set/on Packers	30,000	#	Pulled Loose Wt.	30,000	#

Description of Blow During Test: Fair initial puff on pre-flow increasing to good. Gas to surface in 45 minutes of initial shut-in. No packer seat on value opening. Strong gas spray for 2 hours after shut-in.

FLUID RECOVERY Was Test Reverse Circulated Yes XX No ☐

Total Fluid Recovered: N/A Ft.

Description of Fluid Recovered: N/A' Water & drilling fluid.

GAS BLOW MEASUREMENT

Measured With: I.D. Riser

Time	Sfce. Choke		M Cubic Feet/Day
		NIL	

REMARKS: Misrun, packer was leaking.

RESISTIVITY			SALT CONTENT
Recovery Water	@	°F.	ppm.
Mud Pit sample filtrate	@	°F.	ppm.

TOOL SEQUENCE

Tool	Length	O.D.
P.O. Sub	1.00	
D.P. Sub	.65	
MFE Tool	12.55	
Bypass Tool	2.85	
Recorder	4.40	
Safety Joint	1.75	
S.S. & Packer	9.30	7 1/2"
T.C. & Packer	6.55	7 1/2"
Total	39.05	
Packer Stub	1.00	
Perfs	18.00	
Recorder	4.40	
Recorder	4.40	
Sub	1.20	
Drill Collars	177.55	
Sub	1.10	
Bull Nose & Perf	2.00	
Total Interval	209.65	
TOTAL LENGTH		

Elevation G.L. 2750 K.B. 2275

Bottom Hole Choke Size 1/2"

Fluid Cushion Type Nil Amt.

MUD AND HOLE DATA

Mud Type KCL W.L. 23.0

Filter Cake 2/32 Visc. 41 Wt. 9.9

Time Taken 1400 hours

Contractor Nabors Drilling Rig No. 9

Drill Pipe Size 4 1/2" IF

Drill Collar Size 4 1/2" XH &

Drill Collar Length 435' &

Main Hole Size 8 1/2" Rat Hole

Distribution of Reports: 12 - Calgary Attention: Mrs. Wiebe

3 JOHNSTON Schlumberger

JOHNSTON TESTERS

A DIVISION OF SCHLUMBERGER CANADA LIMITED
321 - 50th AVENUE S.E. CALGARY, ALBERTA T2G 2B3

E15086

PRESSURE DATA

INSTRUMENT No.		AK1-4371	AK1-2095	AK1-5025	T-5365
CAPACITY (psig)		7400	7450	8650	200-549 °F
INSTRUMENT DEPTH FT.		11658	11699	11703	11717
INSTRUMENT OPENING		Inside	Outside	Outside	Outside
WELL TEMP. °F.					
INITIAL HYDROSTATIC	A	5895#	5946#	5940#	
FIRST FLOW	B	1589#	1617#	1603#	
	B-1	1583#	1608#	1598#	
INITIAL SHUT-IN	C	5642#	5658#	5659#	
SECOND FLOW	D	2079#	2103#	2096#	
	D-1	2533#	2563#	2549#	
SECOND SHUT-IN	E				
THIRD FLOW	F				
	F-1				
FINAL SHUT-IN	G	5642#	5657#	5657#	
FINAL HYDROSTATIC	H	6126#	6148#	6144#	

FLUID SAMPLE REPORT

Sample No.
Type 5"
Depth 11,643'
Volume 2500 cc

Sample Pressure:
psig. at Surface
Gravity API @ °F
Gas/Oil Ratio Cu.Ft./bbl.

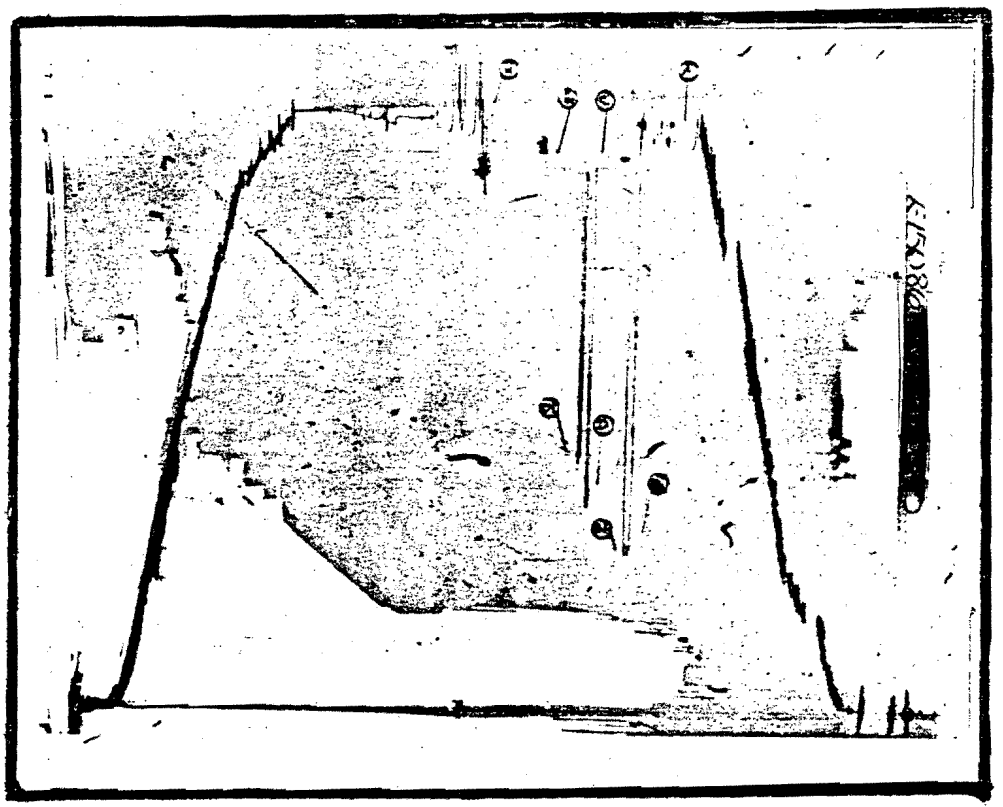
Recovery:
Cu. Ft. Gas
cc. Oil
cc. Water
cc. Mud
Total Liquid cc.

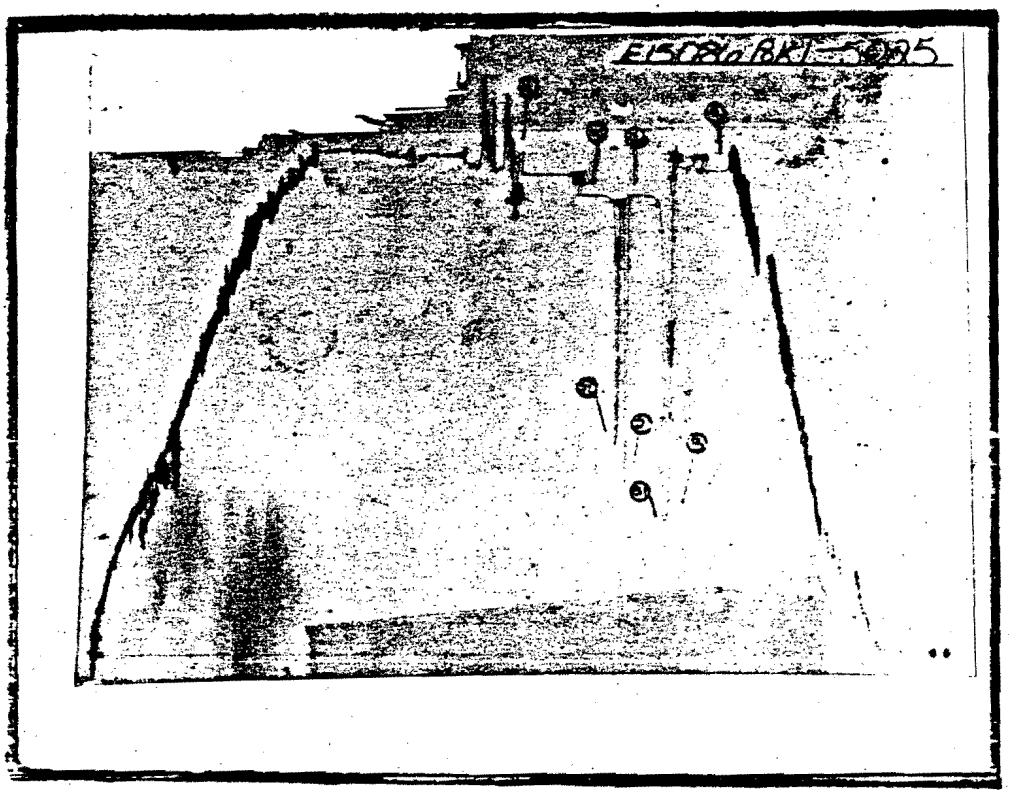
REMARKS: Temperature recorder #5365 - 0.113 Defl. - 297 °F.
MFE smaple and fluid sample #6203 sent to Fort St. John, British Columbia.

PRESSURE INCREMENTS ON RECORDER

POINT MINUTES	PRESSURE	$\frac{T + \Delta t}{\Delta t}$	POINT MINUTES	PRESSURE	$\frac{T + \Delta t}{\Delta t}$	POINT MINUTES	PRESSURE	$\frac{T + \Delta t}{\Delta t}$

JT-16E-5B




E1508a RKJ 5085

JOHNSTON TESTERS

A DIVISION OF SCHLUMBERGER CANADA LIMITED

321 50th AVENUE S.E CALGARY, ALBERTA T2G 2B3

District	Fort St. John	Ticket No.	E15087
Company	Columbia Gas Development Ltd.		
Address	c/o D & S Consultants, #600, 633 - 6 Avenue S.W., Calgary, Alberta T2P 0S2	Test No.	4
J.T. No.	4		
Well Name	Columbia Gas et al Kotaneelee		
Field	Kotaneelee	Number	H-38-60-10-124
Province	Yukon Territory	Date	October 3, 1977
Co. Rep.	J. Dortch	Formation	Nahanni
Thickness			
Technician		Interval	11,695 - 11,890'
TD	11,890'		

TEST DATA

Type of Test	Open hole, Bottom hole.				
Time Started in Hole	0300	Hrs.	Tool Opened	0751	Hrs.
First Flow	5	Min.	Initial Shut-In	60	Min.
Second Flow		Min.	Second Shut In		Min.
Third Flow		Min.	Final Shut In		Min.
Pulled Loose @	0915	Hrs.	Out of Hole	2300	Hrs.
Wt. Set/on Packers	30,000	#	Pulled Loose Wt.	30,000	#

Description of Blow During Test: Gas to surface after 15 minutes after 2nd flow.

FLUID RECOVERY Was Test Reverse Circulated Yes ☐ No ☒

Total Fluid Recovered: 4,200 Ft.

Description of Fluid Recovered:

3,500' Cushion

700' Drilling fluid.

GAS BLOW MEASUREMENT

Measured With: I.D. Riser

Time	Sfce. Choke		M Cubic Feet/Day
		NIL	

REMARKS: Misrun, lost packer seat.

RESISTIVITY			SALT CONTENT
Recovery Water	@	°F.	ppm.
Mud Pit sample filtrate	@	°F.	ppm.

TOOL SEQUENCE

Tool	Length	O.D.
P.O. Sub	1.00	
D P. Sub	.65	
MFE Tool	12.55	
Bypass Tool	2.85	
Recorder	4.40	
Safety Joint	1.75	
S.S. & Packer	9.30	7 1/2"
T.C. & Packer	6.55	7 1/2"
Total	39.05	
Packer Stub	1.00	
Perfs	18.00	
Recorder	4.40	
Recorder	4.40	
Sub	1.00	
Drill Collars	162.76	
Sub	1.00	
Bull Nose & Perf	2.00	
Total Interval	194.56	

TOTAL LENGTH

Elevation G.L. 2250 K.B. 2275

Bottom Hole Choke Size 1/2"

Fluid Cushion Type Water Amt. 3500'

MUD AND HOLE DATA

Mud Type KCL W.L.

Filter Cake Visc. 41 Wt. 9.9

Time Taken 1800 hours

Contractor Nabors Drilling Rig No. 9

Drill Pipe Size 4 1/2" IF

Drill Collar Size 4 1/2" XH &

Drill Collar Length 462' &

Main Hole Size 8 1/2" Rat Hole

Distribution of Reports: 12 - Calgary Attention: Mrs. Wiebe

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E15087

PRESSURE DATA

INSTRUMENT No.		AK1-4371	AK1-2095	AK1-5025	T-5365
APACITY (psig)		7400	7450	8650	200-549 °F
NSTRUMENT DEPTH FT.		11673	11714	11718	11731
INSTRUMENT OPENING		Inside	Outside	Outside	Outside
VELL TEMP. °F.					
INITIAL HYDROSTATIC	A	5873#	5919#	5933#	
FIRST FLOW	B	2360#	2370#	2370#	
	B-1	2545#	2545#	2544#	
NITIAL SHUT-IN	C	5622#	5631#	5631#	
SECOND FLOW	D	2733#	2732#	2725#	
	D-1	2829#	2841#	2841#	
ECOND SHUT-IN	E				
THIRD FLOW	F				
	F-1				
INAL SHUT-IN	G				
FINAL HYDROSTATIC	H	5893#	5937#	5944#	

FLUID SAMPLE REPORT

Sample No. 561 & 519
Type 5"
Depth 11,658'
Volume 2500 cc

Sample Pressure:
psig. at Surface
Gravity API @ °F
Gas/Oil Ratio Cu.Ft./bbl.

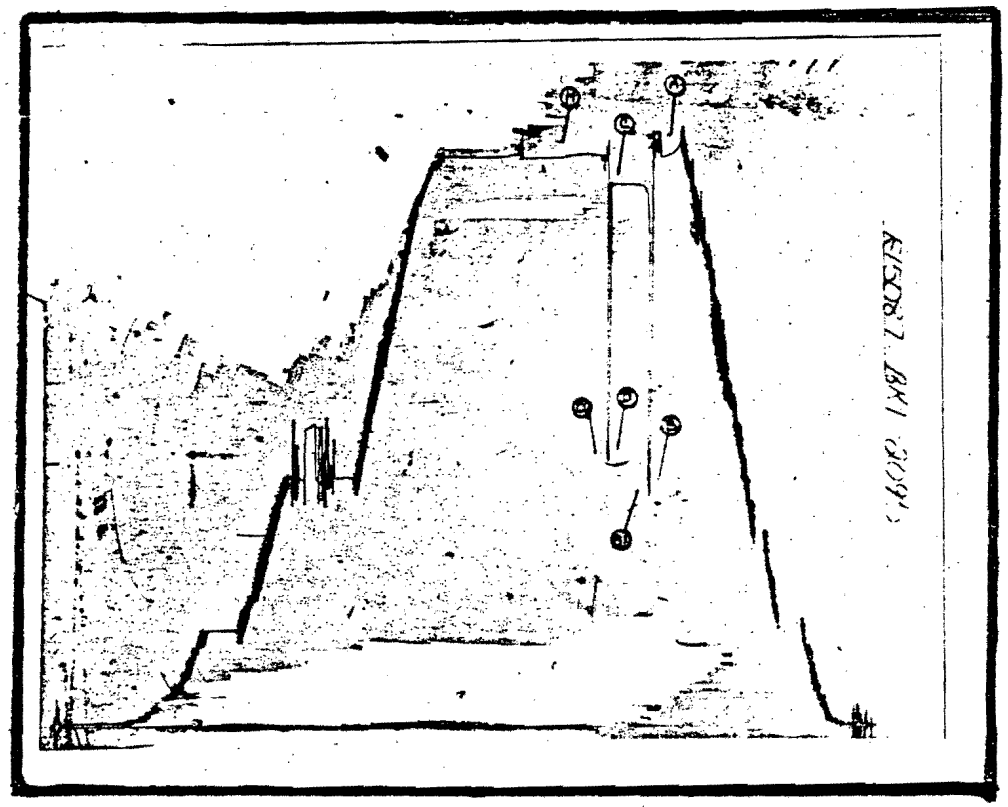
Recovery:
Cu. Ft. Gas
cc. Oil
cc. Water
cc. Mud
Total Liquid cc.

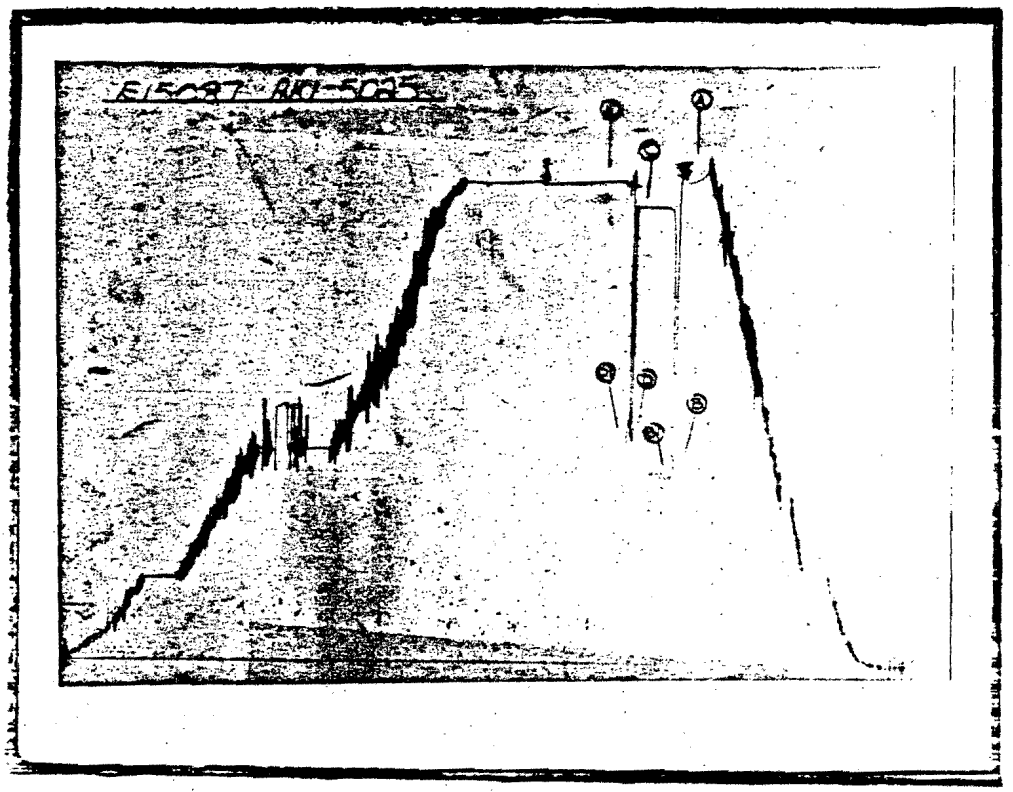
REMARKS: Temperature recorder #5635 - 0.127 - 307 °F.

PRESSURE INCREMENTS ON RECORDER

POINT MINUTES	PRESSURE	$\frac{T + \Delta t}{\Delta t}$	POINT MINUTES	PRESSURE	$\frac{T + \Delta t}{\Delta t}$	POINT MINUTES	PRESSURE	$\frac{T + \Delta t}{\Delta t}$

JT-18E-5B

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5.

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DRILL STEM TEST SPECIAL DATA ANALYSIS

Columbia Gas Development DST #5
Columbia Gas et al Kotaneelee H-38-60-10-124
E15088 'Nahanni 11,625 - 11,890' 11,890'
October 4, 1977

October 12, 1977

ATTENTION: JIM MACDONALD

Gentlemen:.

The enclosed test appears to be a good mechanical drill stem test during which the tools functioned properly, and the formation produced enough reservoir fluid for proper identification. Reservoir pressure drawdown was sufficient and adequate shut-in build-ups occurred for reliable quantitative analysis.

1. Flow Rate: A flow rate of 4700 MCF/day of gas was noted during this test.

2. Reservoir Pressure: Extrapolation of the initial shut-in pressure build-up indicates a maximum reservoir pressure of 5655 psig at recorder depth. Extrapolation of the final shut-in pressure build-up indicates a maximum reservoir pressure of 5638 psig at recorder depth. The difference between the initial and final shut-in pressure of 17 psi is insignificant.

3. Permeability: The calculated transmissibility factor of 5879 md.ft./cp. indicates an average effective permeability to gas of .59 md. for the reported 250 foot porous interval. The calculations were based on a slope of 1,060,000 psi^2/ log cycle obtained from the final shut-in build-up plot. It was assumed for these calculations: (a) gas gravity 0.70, (b) viscosity .025 cp., (c) and gas deviation factor 1.07. These figure were obtained from the available technical literature.

4. Well Bore Damage: The calculated damage ratio of 6.40 indicates that well bore damage is present at the time and conditions of this test. This value appears to be excessive and may be due to the partial penetration of the net productive interval by the test interval. If subsequent information confirms this possibility then the value D.T. should be discounted.

5. Radius of Investigation: The calculated radius of investigation of relatively low permeability effective to the reservoir fluid and well nore damage is indicated. No unusual characteristics were noted from the analysis of the test data presented.

Yours truly,

Jose Cuesta

JC/jmb

WELL: COLUMBIA GAS ET AL KOTANEELE H38 JT5

FLOW RATE PRIOR TO SHUT IN (MCF/DAY)		4700.000
COMPRESSIBILITY FACTOR Z		1.0700
HORNER PLOT SLOPE (PSI^2/LOG CYCLE)		1060000.
VISCOSITY	(CP)	0.025
NET THICKNESS	(FT)	250.000
MAX RESERVOIR PRESSURE	(PSIG)	5655.0
FLOWING PRESSURE	(PSIG)	895.0
FLOW TIME	(MIN)	130.0
POROSITY		0.050
COMPRESSIBILITY	(1/PSI)	0.00012200
WELL BORE RADIUS	(IN)	4.25
WELL ELEVATION	(FT)	2275.0
RECORDER DEPTH	(FT)	11645.0
TEMPERATURE	(DF)	297.0

TRANSMISSIBILITY	(MD-FT/CP)	5879.23
FLOW CAPACITY	(MD-FT)	146.98
AVERAGE EFF. PERMEABILITY	(MD)	0.59
DAMAGE RATIO		6.40
FLOW RATE WITH DAMAGE REMOVED	(MCF/DAY)	30058.81
POTENTIOMETRIC SURFACE	(FT)	3687.4
RADIUS OF INVESTIGATION	(FT)	94.1

5

RESERVOIR PRESSURE PLOT

JOHNSTON Schlumberger

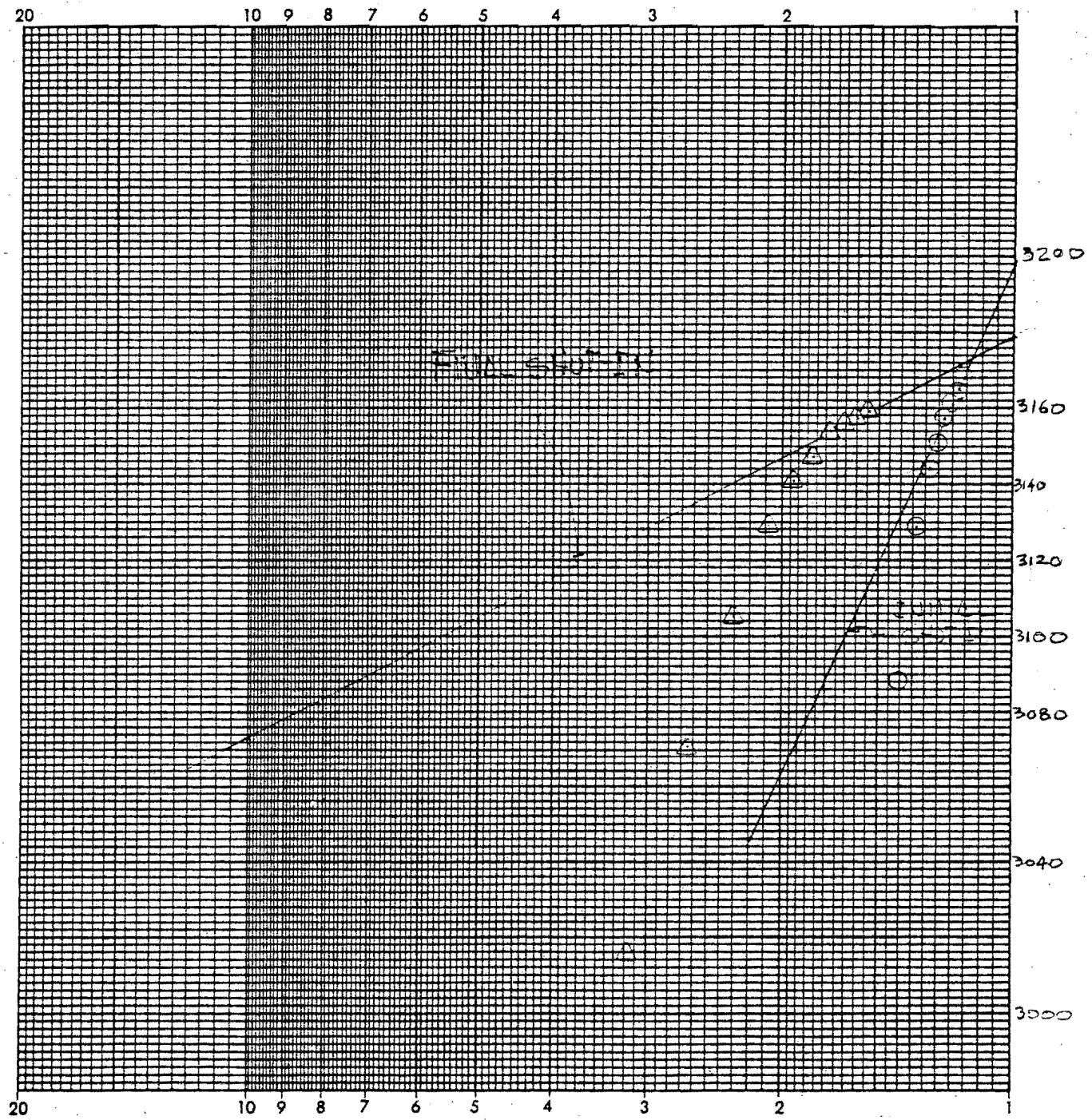
ECORDER No. AM-2025 CAPACITY 7450 FIELD REPORT No. E15098

MAXIMUM RESERVOIR PRESSURE P_o = 5635 psig INITIAL SHUT-IN = 5655

SLOPE OF SHUT-IN CURVE M 1 = 1060000 psig/LOG CYCLE FINAL SHUT-IN = 5638

LOPE M 1 = P_1 3179000 P_{10} 3073000 = psig/LOG CYCLE 1060000

SLOPE M 2 = P_1 ..... P_{10} ..... = ... psig/LOG CYCLE .....



$$\frac{T + \Delta t}{\Delta t}$$

JT.CU:2M

JT-1&E-49

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District	Fort St. John	Ticket No. E15088	Company: Columbia Gas Development Ltd.
Address	c/o D & S Consultants, 600, 633 -6 Avenue S.W., Calgary, Alberta T2P 0S2		Test No. 5 J.T. No. 5
Field	Kotaneelee	Well Name	Columbia Gas et al Kotaneelee
Province	British Columbia	Number	H-38-60-10-124
Co. Rep.	J. Dortch	Date	October 4, 1977
Technician	T. Thompson	Formation	Nahanni
		Interval	11,625 - 11,890
		Thickness TD	11,890'

TEST DATA

Type of Test	Open hole, Bottom hole.				
Time Started in Hole	0430	Hrs.	Tool Opened	1128	Hrs.
First Flow	10	Min.	Initial Shut-In	60	Min.
Second Flow	120	Min.	Second Shut In	240	Min.
Third Flow		Min.	Final Shut In		Min.
Pulled Loose @	1830	Hrs.	Out of Hole	0200	Hrs.
Wt. Set/on Packers	30,000	#	Pulled Loose Wt.	30,000	#

Description of Blow During Test: Good initial puff on preflow with gas to surface in 45 minutes of initial shut-in. Water to surface in 10 minutes of value opening with good gas flow in 5 minutes. Increasing to strong gas and water blow in 20 minutes.

FLUID RECOVERY

Was Test Reverse Circulated Yes ☐ No ☒

Total Fluid Recovered: 80 Ft.

Description of Fluid Recovered:

80' Gasified mud cut water.

GAS BLOW MEASUREMENT

Measured With Willis Choke 2 " I.D. Riser

Time	Sfce. Choke	Reading Psi	M Cubic Feet/Day
1320	64	380	10,000 Wet gas flow
1330	64	350	9,300 Wet gas flow
1340	64	320	8,600 Wet gas flow
1350	64	280	7,100 Wet gas flow
1400	48	320	4,700 Wet gas flow
1410	48	320	4,700 Wet gas flow
1420	48	320	4,700 Wet gas flow
1430	48	320	4,700 Wet gas flow

REMARKS: Test satisfactory.

	RESISTIVITY		Chloride CONTENT	
Recovery Water	@	°F.	44,500	ppm.
Mud Pit sample filtrate	@	°F.		ppm.

TOOL SEQUENCE

Tool	Length	O.D.
P.O. Sub	1.00	
D.P. Sub	.65	
MFE Tool	12.55	
Bypass Tool	2.85	
Recorder	4.40	
Safety Joint	1.75	
S.S. & Packer	9.30	7 1/2"
T.C. & Packer	5.35	7 1/2"
Packer	4.35	7 1/2"
Total	42.20	
Packer Stub	1.00	
Perfs	15.00	
Recorder	4.40	
Recorder	4.40	
Sub	1.00	
Drill Collars	236.48	
Sub	1.00	
Bull Nose & Perf	2.00	
Total Interval	265.28	
TOTAL LENGTH		

Elevation G.L. 2250 K.B. 2275

Bottom Hole Choke Size 1/2"

Fluid Cushion Type Water Amt. 3500'

MUD AND HOLE DATA

Mud Type KCL W.L.

Filter Cake Visc. 41 Wt. 9.9

Time Taken 2400 hours

Contractor NaborsDrilling Rig No. 9

Drill Pipe Size 4 1/2" IF

Drill Collar Size 4 1/2" XH &

Drill Collar Length 365' &

Main Hole Size Rat Hole 8 1/2"

Distribution of Reports: 12 - Calgary Attention: MRS. WIEBE

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E15088

PRESSURE DATA

INSTRUMENT No.		AK1-4371	AK1-2095	AK1-5025	T-5365
CAPACITY (psig)		7400	7450	8650	200-549 °F
INSTRUMENT DEPTH FT.		11604	11641	11645	11650
INSTRUMENT OPENING		Inside		Outside	Outside
WELL TEMP. °F.	297				
INITIAL HYDROSTATIC	A	5860#	5893#	5885#	
FIRST FLOW	B	1598#	1618#	1590#	
	B-1	1624#	1653#	1618#	
INITIAL SHUT-IN	C	5585#	5616#	5589#	
SECOND FLOW	D	1795#	1821#	*	
	D-1	871#	895#		
SECOND SHUT-IN	E				
THIRD FLOW	F				
	F-1				
FINAL SHUT-IN	G	5575#	5608#		
FINAL HYDROSTATIC	H	5794#	5839#		

FLUID SAMPLE REPORT

Sample No. 561 & 556

Type

Depth 11,597'

Volume

Sample Pressure:

psig. at Surface

Gravity API @ °F

Gas/Oil Ratio Cu.Ft./bbl.

Recovery:

Cu. Ft. Gas

cc. Oil

cc. Water

cc. Mud

Total Liquid cc.

REMARKS: *False pressures, initial shut-in still building when clock stopped.

Temperature recorder #5365 - 0.113 Defl. = 297°F.

MFE sample 561 and fluid sample #6203 sent to C & G Labs., Fort St. John.

PRESSURE INCREMENTS ON RECORDER

Initial Shut-in			Final Shut-in					
POINT MINUTES	PRESSURE	$\frac{T + \Delta t}{\Delta t}$	POINT MINUTES	PRESSURE	$\frac{T + \Delta t}{\Delta t}$	POINT MINUTES	PRESSURE	$\frac{T + \Delta t}{\Delta t}$
0	1884	-----	0	895	------			
5	2936	3.000	10	3396	14.000			
10	4338	2.000	20	4937	7.500			
15	5170	1.666	30	5246	5.333			
20	5444	1.500	40	5378	4.250			
25	5557	1.400	50	5447	3.600			
30	5594	1.333	60	5492	3.166			
35	5608	1.285	80	5542	2.625			
40	5614	1.250	100	5573	2.300			
45	5619	1.222	120	5594	2.083			
50	5623	1.200	140	5605	1.928			
55	5626	1.181	160	5610	1.812			
60	5629	1.166	180	5616	1.722			
			200	5618	1.650			
			220	5619	1.590			
			240	5621	1.541			

JT-18E-5B

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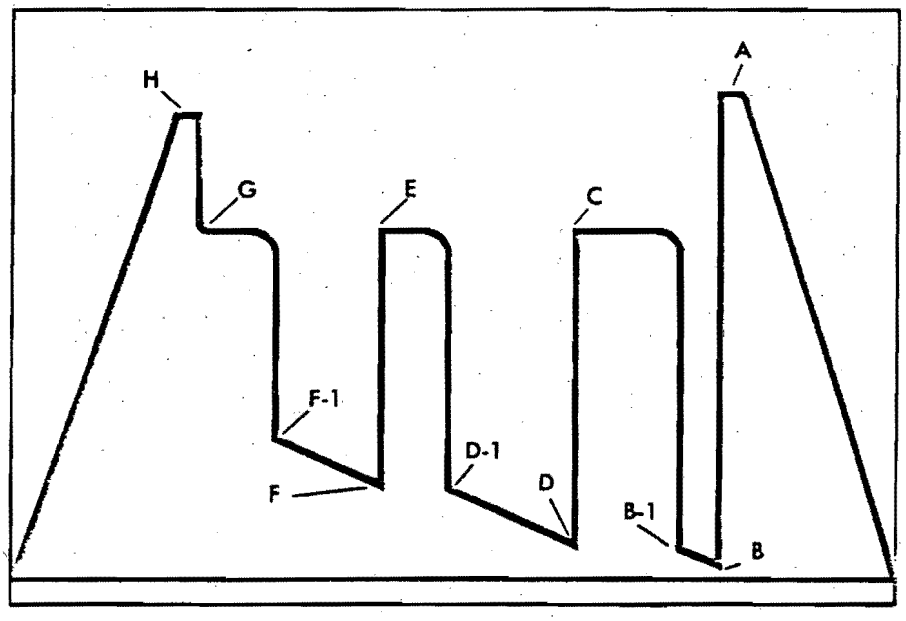
GUIDE TO IDENTIFICATION OF DRILL STEM TEST PRESSURE CHARTS

FIELD REPORT NO.	RECORDER NO.
E15088	AK1-4371



A. Initial Hyd. Mud
B. First Flow
C. Initial Shut-In
D. Second Flow
E. Second Shut-In
F. Third Flow
G. Final Shut-In
H. Final Hyd. Mud

The following points are either fluctuating pressures or points indicating other packer settings (testing different zones).

A-1, A-2, A-3, etc. Initial Hyd. Pressures
Z — Special pressure points such as pumping pressures recorded for formation breakdown.