HRS

DRILL STEM TEST REPORT

HALLIBURTON RESERVOIR SERVICES

A Division of Halliburton Company

RC019

NOMENCLATURE

B	=	Formation Volume Factor	(Res Vol/Std Vol)
c_t	=	System Total Compressibility	(Vol/Vol)/psi
DR	=	Damage Ratio	
h	=	Estimated Net Pay Thickness	Ft

k	=	Permeability	md
m	=	(Liquid) Slope Extrapolated Pressure Plot	psi/cycle
		(Gas) Slope Extrapolated m(P) Plot	MM psi^2/cp/cycle
m(P*)	=	Real Gas Potential at P*	MM psi^2/cp
$m(P_f)$	=	Real Gas Potential at P_f	MM psi^2/cp
AOF_1	=	Maximum Indicated Absolute Open Flow at Test Conditions	MCFD
AOF_2	=	Minimum Indicated Absolute Open Flow at Test Conditions	MCFD
P*	=	Extrapolated Static Pressure	Psig
P_f	=	Final Flow Pressure	Psig
Q	=	Liquid Production Rate During Test	BPD
Q_1	=	Theoretical Liquid Production w/Damage Removed	BPD
Q_g	=	Measured Gas Production Rate	MCFD
r_i	=	Approximate Radius of Investigation	Ft
r_w	=	Radius of Well Bore	Ft
S	=	Skin Factor	
t	=	Total Flow Time Previous to Closed-in	Minutes
Δt	=	Closed-in Time at Data Point	Minutes
T	=	Temperature Rankine	°R
ϕ	=	Porosity (fraction)	
μ	=	Viscosity of Gas or Liquid	cp
Log	=	Common Log	

EQUIPMENT & HOLE DATA

FORMATION TESTED: "J" SAND
NET PAY (ft):
GROSS TESTED FOOTAGE: 31.8
ALL DEPTHS MEASURED FROM: KELLY BUSHING
CASING PERFS. (ft):
HOLE OR CASING SIZE (in): 7.875
ELEVATION (ft): 5034.0 GROUND LEVEL
TOTAL DEPTH (ft): 7626.0
PACKER DEPTH(S) (ft): 7588, 7594
FINAL SURFACE CHOKE (in):
BOTTOM HOLE CHOKE (in): 0.750
MUD WEIGHT (lb/gal): 9.00
MUD VISCOSITY (sec): 65
ESTIMATED HOLE TEMP. (°F):
ACTUAL HOLE TEMP. (°F): 202 @ 7623.0 ft

TICKET NUMBER: 64034400
DATE: 11-9-89 TEST NO: 1
TYPE DST: OPEN HOLE
FIELD CAMP: STERLING
TESTER: J.E. VEDSTED
WITNESS: JERRY MASON
DRILLING CONTRACTOR: EXETER #69

FLUID PROPERTIES FOR RECOVERED MUD & WATER

SOURCE	RESISTIVITY		CHLORIDES
PIT	0.325 @	60 °F	1212 ppm
PIPE	3.000 @	66 °F	1180 ppm
SAMPLER	2.800 @	65 °F	1333 ppm
	@	°F	ppm
	@	°F	ppm
	@	°F	ppm

SAMPLER DATA

Psig AT SURFACE: 14.0
cu.ft. OF GAS: 0.135
cc OF OIL:
cc OF WATER:
cc OF MUD: 1000.0
TOTAL LIQUID cc: 1000.0

HYDROCARBON PROPERTIES

OIL GRAVITY (°API): @ °F
GAS/OIL RATIO (cu.ft. per bbl):
GAS GRAVITY:

CUSHION DATA

TYPE	AMOUNT	WEIGHT

RECOVERED:

400' OF GAS IN DRILL COLLARS
20' OF HEAVY MUD IN DRILL COLLARS

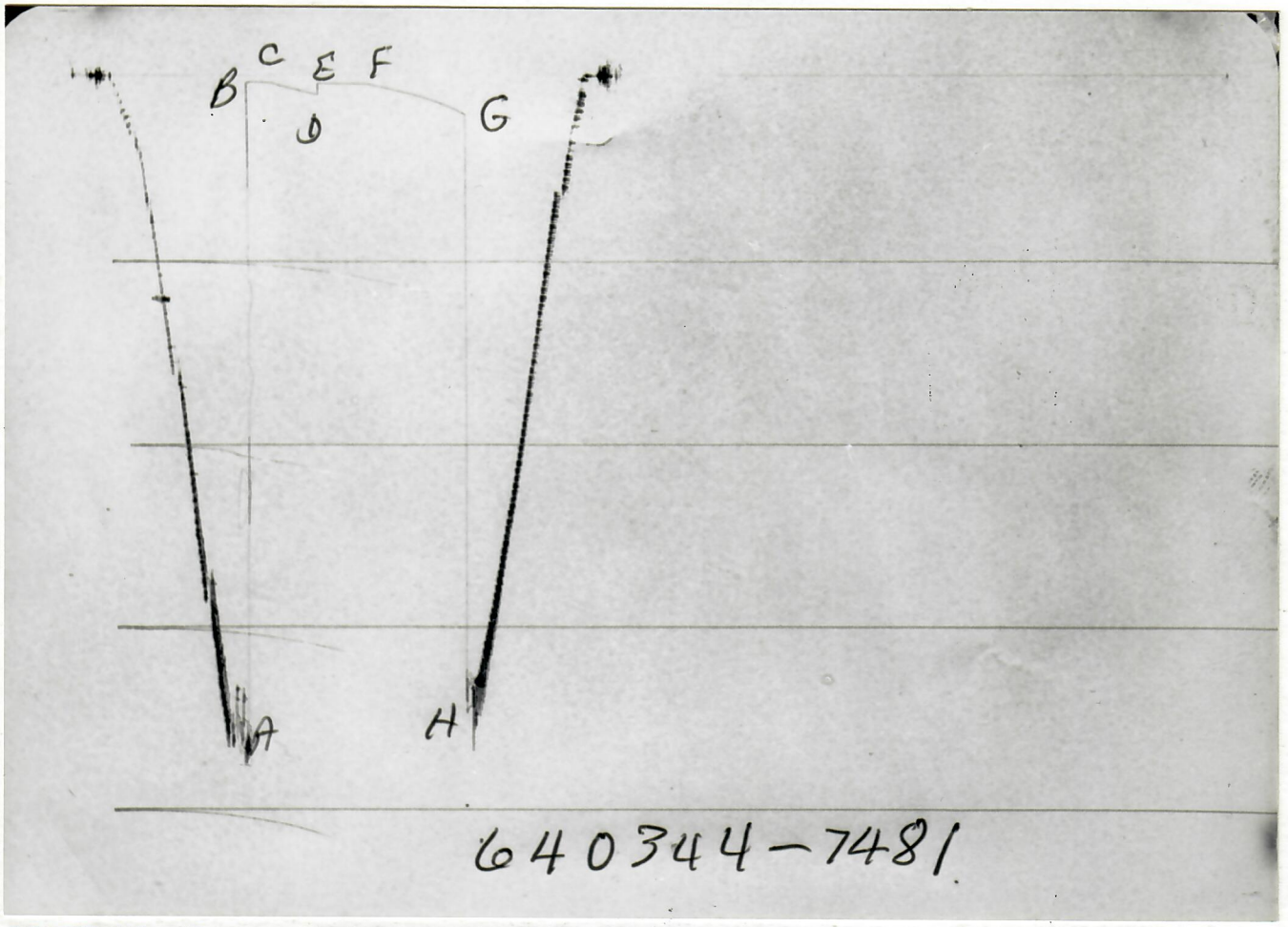
MEASURED FROM TESTER VALVE

REMARKS:

[redacted]

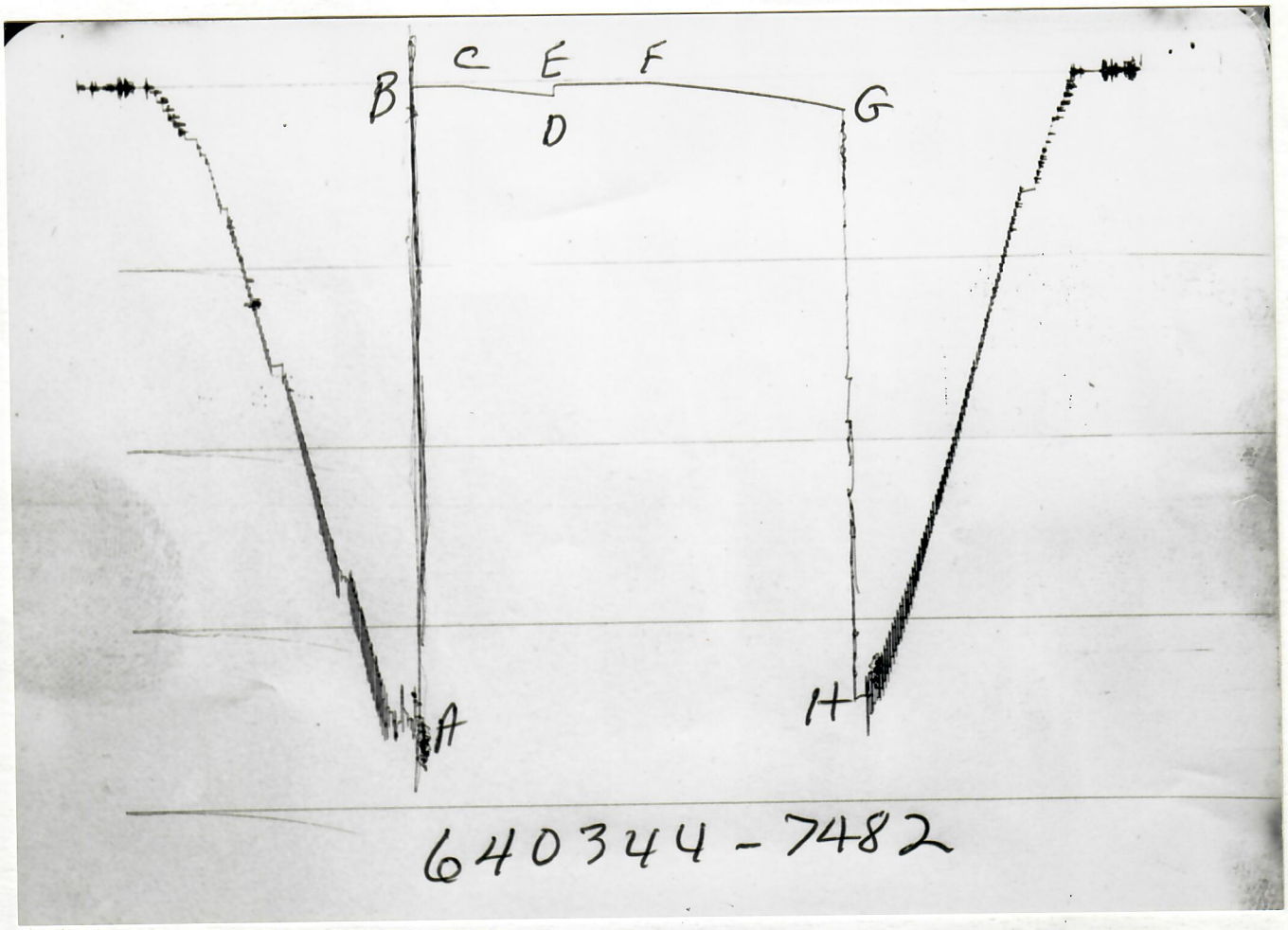
TYPE & SIZE MEASURING DEVICE: _____ TICKET NO: 64034400

TIME	CHOKE SIZE	SURFACE PRESSURE PSI	GAS RATE MCF	LIQUID RATE BPD	REMARKS
11-8-89					
2300					CALLED OUT .
11-9-89					
0200					ON LOCATION
0445					PICKED UP TOOLS
0515					RUN IN HOLE WITH DST #1
0807					TOOLS ON BOTTOM
0808	1/8BH				OPENED TOOL WITH 3.5" BLOW
					IN BUCKET
0811					3.75" BLOW
0814					4" BLOW
0817					4" BLOW
0830					3.75" BLOW
0838					3.5" BLOW, CLOSED TOOL
0938	1/8BH				OPENED TOOL WITH 1" BLOW IN
					BUBBLE BUCKET
0939					1.5" BLOW
0942					1.5" BLOW
0950					1.5" BLOW
1000					1.125" BLOW
1018					1" BLOW
1028					1" BLOW
1038					CLOSED TOOL
1238					OPENED BYPASS
1248					PULLED OUT OF HOLE
1515					TOOLS TO SURFACE



GAUGE NO: 7481 DEPTH: 7623.0 BLANKED OFF: YES HOUR OF CLOCK: 24

ID	DESCRIPTION	PRESSURE		TIME		TYPE
		REPORTED	CALCULATED	REPORTED	CALCULATED	
A	INITIAL HYDROSTATIC	3533	3526.4			
B	INITIAL FIRST FLOW	27	44.0	30.0	30.0	F
C	FINAL FIRST FLOW	27	38.6			
C	INITIAL FIRST CLOSED-IN	27	38.6	60.0	60.0	C
D	FINAL FIRST CLOSED-IN	80	103.4			
E	INITIAL SECOND FLOW	27	44.2	60.0	60.0	F
F	FINAL SECOND FLOW	27	44.2			
F	INITIAL SECOND CLOSED-IN	27	44.2	120.0	120.0	C
G	FINAL SECOND CLOSED-IN	187	208.7			
H	FINAL HYDROSTATIC	3347	3444.0			



GAUGE NO: 7482 DEPTH: 7573.4 BLANKED OFF: NO HOUR OF CLOCK: 12

ID	DESCRIPTION	PRESSURE		TIME		TYPE
		REPORTED	CALCULATED	REPORTED	CALCULATED	
A	INITIAL HYDROSTATIC	3497	3511.5			
B	INITIAL FIRST FLOW	27	29.5	30.0	30.0	F
C	FINAL FIRST FLOW	27	21.5			
C	INITIAL FIRST CLOSED-IN	27	21.5	60.0	60.0	C
D	FINAL FIRST CLOSED-IN	81	81.9			
E	INITIAL SECOND FLOW	27	30.8	60.0	60.0	F
F	FINAL SECOND FLOW	27	22.1			
F	INITIAL SECOND CLOSED-IN	27	22.1	120.0	120.0	C
G	FINAL SECOND CLOSED-IN	188	186.5			
H	FINAL HYDROSTATIC	3444	3423.3			

[redacted]

BOSWELL ENERGY CORPORATION

LEASE : K & M COMPANY

WELL NO.: 1-10

TEST NO.: 1

TICKET NO. 64034400
13-NOV-89
STERLING

LEGAL LOCATION SEC. - TWP. - RNG.	FIELD AREA	COUNTY	STATE
10-7N-67W		WELD	COLORADO DR

LEASE NAME	WELL NO.	TEST NO.	TESTED INTERVAL	LEASE OWNER/COMPANY NAME
K & M COMPANY	1-10	1	7594.2 - 7626.0	BOSWELL ENERGY CORPORATION

[redacted]

TICKET NO. 64034400

			O.D.	I.D.	LENGTH	DEPTH
1		DRILL PIPE	4.500	3.826	7020.3	
3		DRILL COLLARS	6.250	2.250	448.0	
50	D	IMPACT REVERSING SUB	6.000	2.250	1.0	7468.8
3		DRILL COLLARS	6.250	2.250	90.3	
5		CROSSOVER	6.000	2.250	1.0	
13	D	DUAL CIP SAMPLER	5.000	0.750	6.8	
60	D	HYDROSPRING TESTER	5.000	0.750	5.0	7571.4
80		AP RUNNING CASE	5.000	2.250	4.1	7573.4
15		JAR	5.000	1.750	5.0	
16	V	VR SAFETY JOINT	5.000	1.000	2.8	
70		OPEN HOLE PACKER	6.750	1.690	5.8	7588.4
70		OPEN HOLE PACKER	6.750	1.690	5.8	7594.2
20		FLUSH JOINT ANCHOR	5.000	2.370	26.0	
81	D	BLANKED-OFF RUNNING CASE	5.000		4.0	7623.0

TOTAL DEPTH 7626.0

EQUIPMENT DATA

EQUATIONS FOR DST LIQUID WELL ANALYSIS

Transmissibility	$\frac{kh}{\mu} = \frac{162.6\ QB}{m}$	$\frac{md\text{-}ft}{cp}$
Indicated Flow Capacity	$kh = \frac{kh}{\mu}\ \mu$	md-ft
Average Effective Permeability	$k = \frac{kh}{h}$	md
Skin Factor	$S = 1.151\left[\frac{P^*-P_f}{m} - LOG\left(\frac{k\ (t/60)}{\phi\ \mu\ c_t r_w^{\ 2}}\right) + 3.23\right]$	
Damage Ratio	$DR = \frac{P^* - P_f}{P^* - P_f - 0.87\ mS}$	
Theoretical Potential w/Damage Removed	$Q_1 = Q\ DR$	BPD
Approx. Radius of Investigation	$r_i = 0.032\sqrt{\frac{k\ (t/60)}{\phi\mu c_t}}$	ft

EQUATIONS FOR DST GAS WELL ANALYSIS

Indicated Flow Capacity	$kh = \frac{.001637\ Q_g\ T}{m}$	md-ft
Average Effective Permeability	$k = \frac{kh}{h}$	md
Skin Factor	$S = 1.151\left[\frac{m(P^*)-m(P_f)}{m} - LOG\left(\frac{k\ (t/60)}{\phi\ \mu\ c_t r_w^{\ 2}}\right) + 3.23\right]$	
Damage Ratio	$DR = \frac{m(P^*) - m(P_f)}{m(P^*) - m(P_i) - 0.87\ mS}$	
Indicated Flow Rate (Maximum)	$AOF_1 = \frac{Q_g\ m(P^*)}{m(P^*) - m(P_f)}$	MCFD
Indicated Flow Rate (Minimum)	$AOF_2 = Q_g\sqrt{\frac{m(P^*)}{m(P^*) - m(P_f)}}$	MCFD
Approx. Radius of Investigation	$r_i = 0.032\sqrt{\frac{k\ (t/60)}{\phi\ \mu\ c_t}}$	ft