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COMPANY JACK MC CLELLAN WELL FEDERAL B. J. #1 TEST NO. 3 COUNTY CHAVES STATE NEW MEXICO

JOHNSTON

Schlumberger

computerized data analysis

F. R. # 20193 B

DRESSER ATLAS

PRESSURE RECORDER LOG*

Field Report No. 20179.38

Instrument: Number J-0128

Capacity 6400 p.s.i.

Depth 6468 ft.

*a continuous tracing of the original chart

Form

COMPUTERIZED DATA ANALYSIS

JULY 21, 1971

JOHNSTON

GENTLEMEN:

THE ENCLOSED TEST APPEARS TO BE A GOOD MECHANICAL DRILL STEM TEST DURING WHICH THE TOOLS DID FUNCTION PROPERLY. THE FORMATION PRODUCED ENOUGH RESERVOIR FLUID FOR PROPER IDENTIFICATION. RESERVOIR PRESSURE DRAWDOWN WAS SUFFICIENT AND ADEQUATE SHUT-IN BUILD-UPS DID OCCUR FOR RELIABLE QUANTITATIVE ANALYSIS.

1. FLOW RATE: A FLOW RATE OF 582 BBLS/DAY OF OIL WAS NOTED DURING THIS TEST.

2. RESERVOIR PRESSURE: MECHANICAL STABILIZATION OF THE INITIAL SHUT-IN PRESSURE BUILD-UP INDICATES A MAXIMUM RESERVOIR PRESSURE OF 2861 P.S.I.G. AT RECORDER DEPTH. MECHANICAL STABILIZATION OF THE FINAL SHUT-IN PRESSURE BUILD-UP INDICATES A MAXIMUM RESERVOIR PRESSURE OF 2855 P.S.I.G. AT RECORDER DEPTH. THE DIFFERENCE BETWEEN THE INITIAL AND FINAL SHUT-IN PRESSURE OF 6 P.S.I.G. IS INSIGNIFICANT.

3. PERMEABILITY: THE CALCULATED TRANSMISSIBILITY FACTOR OF 4302 MD.-FT./CP. INDICATES AN AVERAGE EFFECTIVE PERMEABILITY TO OIL OF 36.2 MD. FOR THE REPORTED 106 FOOT TEST INTERVAL. THE CALCULATIONS WERE BASED ON A SLOPE OF 22 P.S.I./LOG CYCLE OBTAINED FROM THE FINAL SHUT-IN BUILD-UP PLOT. IT WAS ASSUMED FOR THESE CALCULATIONS: (A) THE 39°API AT 60°F. OIL CONTAINED 840 CU.FT./BBL. OF ORIGINAL DISSOLVED GAS (B) VISCOSITY .62 CP., (C) FORMATION VOLUME FACTOR 1.44 BBL/BBL. THESE FIGURES WERE OBTAINED FROM THE AVAILABLE TECHNICAL LITERATURE.

4. WELL BORE DAMAGE: THE CALCULATED ESTIMATED DAMAGE RATIO OF 17 INDICATES THAT EXTENSIVE WELL BORE DAMAGE IS PRESENT AT THE TIME AND CONDITIONS OF THIS TEST. THIS VALUE INFERS THAT THE RATE OF PRODUCTION OBSERVED AT THE FORMATION FACE DURING THIS TEST MAY BE INCREASED 17 TIMES IF THE WELL BORE DAMAGE ALONE WERE REMOVED.

5. RADIUS OF INVESTIGATION: THE CALCULATED RADIUS OF INVESTIGATION OF THIS TEST IS 204 FEET BASED ON AN ASSUMED POROSITY OF 20%, COMPRESSIBILITY OF 12.8×10^{-6}, AND OTHER ASSUMPTIONS MADE IN NUMBER 3 ABOVE.

6. GENERAL COMMENTS: THE FORMATION EXHIBITS THE CHARACTERISTICS OF RELATIVELY HIGH PERMEABILITY EFFECTIVE TO THE RESERVOIR FLUID AND INDICATES THE PRESENCE OF WELL BORE DAMAGE.

THE WELL BORE DAMAGE SHOULD BE REMOVED BEFORE PUTTING THIS WELL ON PRODUCTION.

JACK MC CLELLAN
FEDERAL B. J. #1; CHAVES COUNTY, NEW MEXICO
TEST #3; 6374' TO 6480'

FIELD REPORT # 20193 B

Reservoir Engineering Data

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Recorder No. J-028 Field Report No. 20193 B

Estimated Damage Ratio	EDR	17		Effective Transmissibility OIL	$\frac{Kh}{\mu B}$	4302	$\frac{Md\text{-}ft.}{Cp.}$
Maximum Reservoir Pressure INITIAL SHUT-IN	P_o	2861	P.S.I.G.	Effective Transmissability	$\frac{Kh}{\mu B}$		$\frac{Md\text{-}ft.}{Cp.}$
Slope of Shut-in Curve FINAL SHUT-IN	M	22	PSI/log cycle	Flow Rate OIL	Q	582	Bbl./day
Potentiometric Surface (Datum Plane, Sea Level)	PS		ft.	Pressure Gradient		.442	PSI/ft.
Productivity Index	PI	.335	Bbl./day/PSI	Gas Oil Ratio FROM "MFE" SAMPLER	GOR	840	CF/Bbl.
Radius of Investigation		204	ft.	K (Effective to OIL)		36.2	Md.

SLOPE M = 2855 - 2833 = 22

Assumptions made for Calculations for Liquid Recoveries

1. Q is averaged at a constant rate.
2. P_f is formation flowing pressure at a constant rate.
3. Formation flow is taken as single phase flow.
   If gas is produced at surface, phase separation is assumed to have occurred in drill pipe.
4. Radial flow is assumed.
5. For the purpose of calculating EDR where specific reservoir parameters are not available it is assumed that:

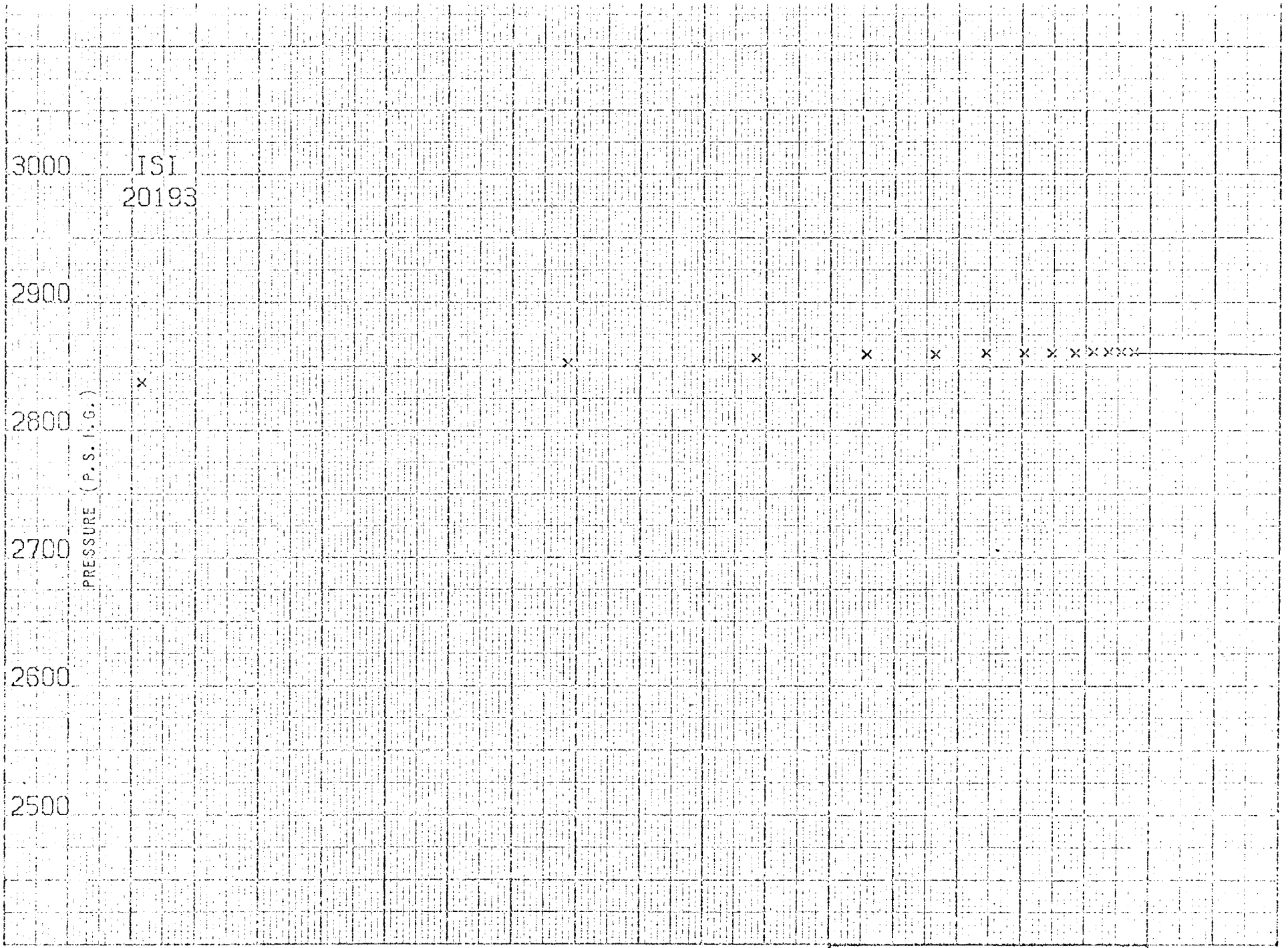
Effective permeability, K, will fall between	1 to 200 md
Formation porosity, ϕ, will fall between	0.1 to 0.3
Fluid compressibility, c, will fall between	10^{-4} to 10^{-6}
Fluid viscosity, μ, will fall between	0.05 to 50 cp.
Well bore radius, r_w, will fall between	$3\frac{7}{8}$" to $4\frac{3}{8}$"
Which gives an average value for the function $\log \frac{K}{\phi\mu c r_w^2}$ of	5.5

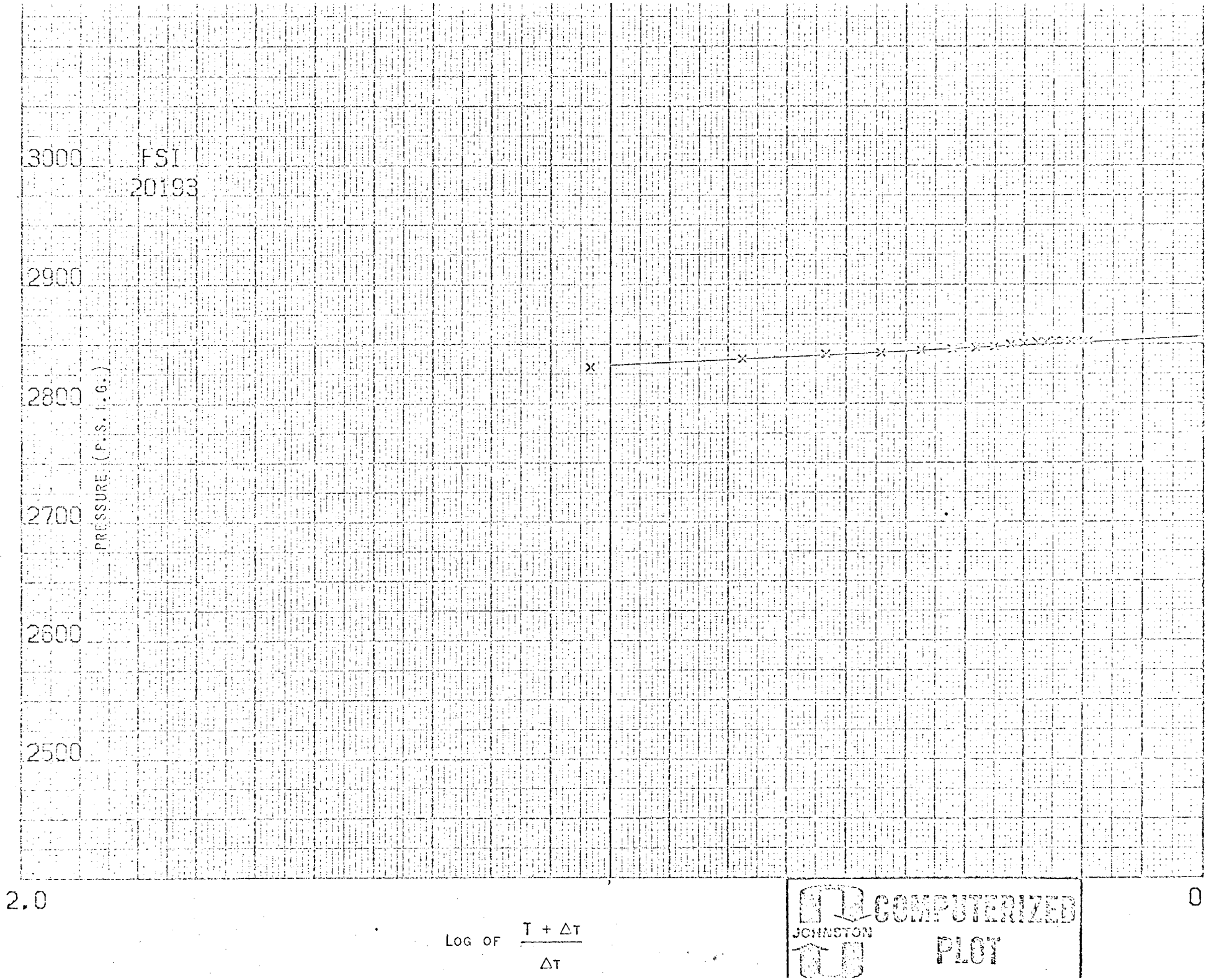
6. Other standard radial flow, equilibrium assumptions.

Empirical Equations:

1. $EDR = \frac{P_o - P_f}{M(\log T + 2.65)}$ where $M = \frac{P_1 - P_{10}}{\text{Log Cycle}}$
2. Transmissibility $\frac{Kh}{\mu\beta} = \frac{162.6\,Q}{M}$
3. DST $J = \frac{Q}{P_o - P_f}$ Theoretical $J = \frac{7.08 \times 10^{-3}\,Kh}{\mu\beta \ln (r_e/r_w)}$ Assumed $\ln (r_e/r_w) = 7.60$
4. P.S. = [$P_o \times 2.309$ ft./PSI] − [Recorder depth to sea level.]
5. Radius of investigation, $r_i = \sqrt{\frac{Kt}{40\phi\mu c}}$ where t = time in days

In making any interpretation, our employees will give Customer the benefit of their best judgment as to the correct interpretation. Nevertheless, since all interpretations are opinions based on inferences from electrical, mechanical or other measurements, we cannot, and do not guarantee the accuracy or correctness of any interpretations, and we shall not be liable or responsible, except in the case of gross or wilful negligence on our part, for any loss, costs, damages or expenses incurred or sustained by Customer resulting from any interpretation made by any of our agents or employees.


ISI
20193
3000
2900
2800
2700
2600
2500
PRESSURE (P.S.I.G.)
0.5
0
Log of $\frac{T + \Delta T}{\Delta T}$
JOHNSTON
COMPUTERIZED
PLOT


3000
FSI
20193
2900
2800
2700
2600
2500
PRESSURE (P.S.I.G.)
2.0
0
LOG OF (T + ΔT) / ΔT
JOHNSTON
COMPUTERIZED
PLOT

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SURFACE INFORMATION

Description (Rate of Flow)	Time	Pressure (P.S.I.G.)	Surface Choke
Opened Tool	1543	0	1/8"
GOOD BLOW			
CLOSED FOR INITIAL SHUT-IN	1553	-	"
FINISHED SHUT-IN	1653	-	"
RE-OPENED TOOL	1654	-	"
STRONG BLOW			
GAS TO SURFACE	1655	0	"
	1715	6	1/2"
	1730	6	"
	1810	4	"
CLOSED FOR FINAL SHUT-IN	1824	-	"
FINISHED SHUT-IN	2124	-	"
PULLED PACKER LOOSE	2127	-	"

ESTIMATED GAS RATE,
120 MCF/DAY

Cushion Type	Amount	Pressure	Bottom Choke
	-		Size 5/8"

MUD DATA

Mud Type SALT WATER GEL Wt. 9.7
Viscosity 41 Water Loss 18.6 C.C.
Resist: of Mud .08 @ 85 °F; of Filtrate .08 @ 85 °F
Chloride Content 83000 PPM

EQUIPMENT & HOLE DATA

Type Test M. F. E. OPEN HOLE
Formation Tested DEVONIAN
Elevation - Ft.
Net Productive Interval - Ft.
Estimated Porosity - %
All Depths Measured From KELLY BUSHING
Total Depth 6480 Ft.
Main Hole/Casing Size 7 7/8"
Rat Hole/Liner Size -
Drill Collar Length 619' I.D. 2.5"
Drill Pipe Length 5722' I.D. 3.8"
Packer Depth(s) 6368 & 6374 Ft.

MULTI-FLOW EVALUATOR FLUID SAMPLE DATA

Sampler Pressure * 1600 P.S.I.G. at Surface
Recovery: Cu. Ft. Gas 7
cc. Oil 1820
cc. Water -
cc. Mud -
Tot. Liquid cc. 1820
Gravity 39.1 °API @ 60 °F.
Gas/Oil Ratio 840 cu. ft./bbl.

		RESISTIVITY	CHLORIDE CONTENT
Recovery Water	- @ - °F.	-	ppm
Recovery Mud	- @ - °F.		
Recovery Mud Filtrate	- @ - °F.	-	ppm
Mud Pit Sample	.08 @ 85 °F.		
Mud Pit Sample Filtrate	.08 @ 85 °F.	83000	ppm

RECOVERY DESCRIPTION	FEET	BARRELS	% OIL	% WATER	% OTHERS	API GRAVITY	RESISTIVITY	CHL. PPM
HEAVILY OIL CUT MUD	276	3.92				@ °F.	@ °F.	
FREE OIL	2379	33.05				38.6 @ 60 °F.	@ °F.	
MUD CUT OIL	529	3.23				@ °F.	@ °F.	
						@ °F.	@ °F.	
						@ °F.	@ °F.	
						@ °F.	@ °F.	
						@ °F.	@ °F.	
						@ °F.	@ °F.	

Remarks: * THE SAMPLER PRESSURE INDICATES THE BOTTOM SEAL OF THE M.F.E. SAMPLER CHAMBER LEAKED. THE GAS-OIL RATIO SHOULD BE USED WITH CAUTION.

Address BOX 848; ROSWELL, NEW MEXICO 88201
Company JACK MC CLELLAN Field HAY STACK
Well FEDERAL S. J. #1 Location -
Test Interval 6374' TO 6480' Test # 3 Date 7-16-71
County CHAVES State NEW MEXICO
Technician ADKINS (HOBBS) Test Approved By MR. NOBERT D. MC INTIR
Field Report No. 20193 B
No. Reports Requested 5

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PRESSURE DATA

Instrument No.		J-028			Field Report No.	20193 B
Capacity (P.S.I.G.)		6400				
Instrument Depth		6468'				
Instrument Opening		INSIDE				
Pressure Gradient P.S.I./Ft.					TIME DATA	
Well Temperature °F.		124				
					Time Given	Time Computed
Initial Hydrostatic Mud	A	3391.7				
Initial Shut-in	B	2861.3			60 Mins.	62 Mins.
Initial Flow	C	500.1			10 Mins.	9 Mins.
	C-1	514.0			- Mins.	- Mins.
	C-2	539.4			- Mins.	- Mins.
Final Flow	D	1123.0			90 Mins.	90 Mins.
Final Shut-in	E	2852.4			180 Mins.	180 Mins.
Final Hydrostatic Mud	F	3358.7				
Remarks:	C-3	510.2				

*Shut in pressure did not reach static reservoir pressure.

Clock Travel 0.02054 inches per min.

PRESSURE INCREMENTS

	DT	PSI	LØG		DT	PSI	LØG
			INITIAL SHUT IN BREAKDØWN				
C	1 0	514.0	0.000		35	2860.0	0.099
	5	2837.2	0.447		40	2860.0	0.088
	10	2852.4	0.279		45	2860.0	0.079
	15	2856.2	0.204		50	2861.3	0.072
	20	2858.8	0.161		55	2861.3	0.066
	25	2858.8	0.134		60	2861.3	0.061
	30	2860.0	0.114	B	62	2861.3	0.056
			FINAL SHUT IN BREAKDØWN				
D	0	1123.0	0.000		100	2849.9	0.299
	10	2829.6	1.037		110	2851.2	0.279
	20	2837.2	0.775		120	2851.2	0.261
	30	2841.0	0.633		130	2852.4	0.246
	40	2842.3	0.541		140	2852.4	0.232
	50	2843.5	0.474		150	2852.4	0.220
	60	2844.8	0.423		160	2852.4	0.209
	70	2846.1	0.383		170	2852.4	0.199
	80	2847.3	0.350	E	180	2852.4	0.190
	90	2848.6	0.322				

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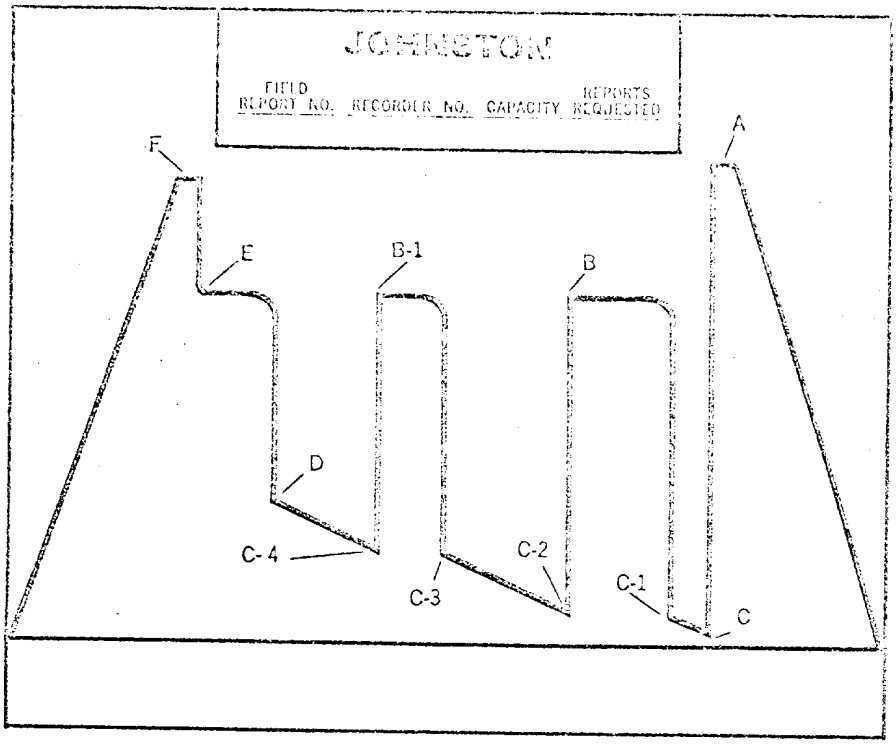
GUIDE TO IDENTIFICATION OF DRILL STEM TEST PRESSURE CHARTS



A. Initial Hyd. Mud
B. Initial Shut-in
C. Initial Flow
D. Final Flow
E. Final Shut-in
F. 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
B-1, B-2, B-3, etc. Subsequent Shut-in Pressures
C-1, C-2, C-3, etc. Flowing Pressures
D-1, D-2, D-3, etc. Subsequent Final Flow Pressures
E-1, E-2, E-3, etc. Subsequent Final Shut-in Pressures
F-1, F-2, F-3, etc. Final Hyd. Mud Pressures
Z — Special pressure points such as pumping pressure recorded for formation breakdown.

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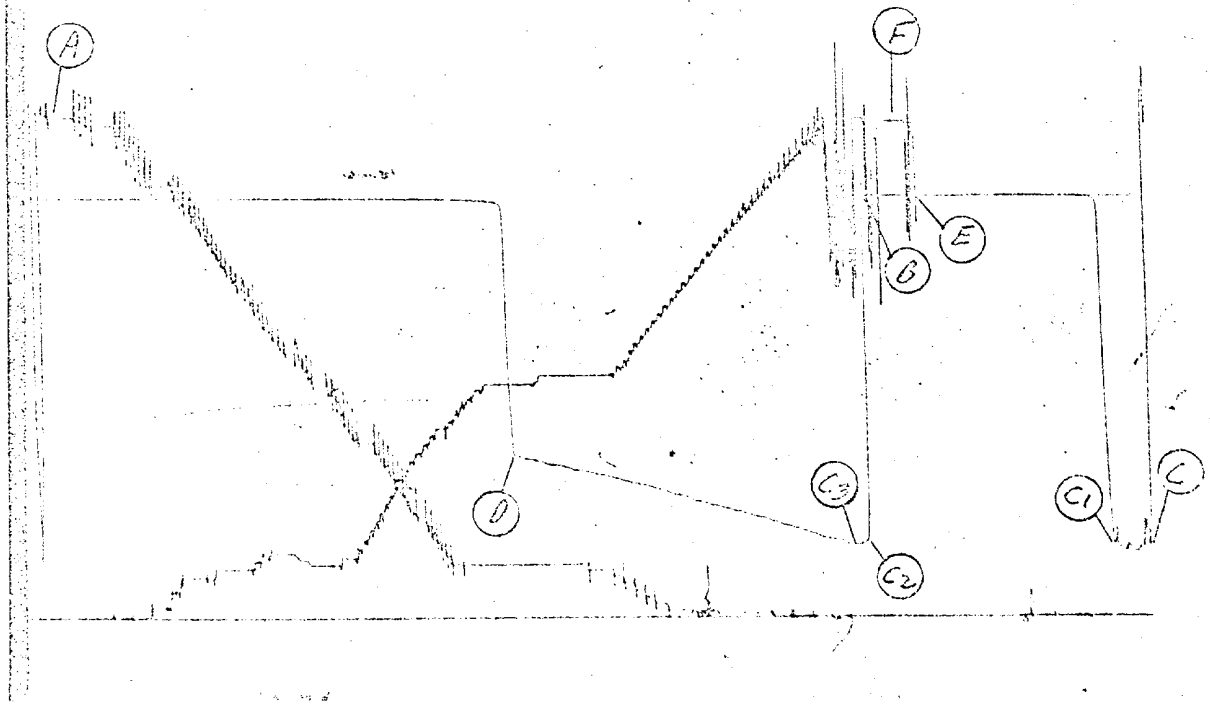
FIELD REPORT NO.	RECORDER NO.
20193 B	J-028
CAPACITY	**REPORTS REQUESTED**
6400#	5-