



N.E.R.D.™ WIRELESS DYNAMOMETER

Through the years, the polished rod dynamometer has been the principal tool for evaluating, analyzing and optimizing the operation of sucker rod pumping systems. It is also a helpful tool in the design and selection of the pumping equipment.

Through extensive research and comprehensive field testing, Nelgar Oilfield Services Ltd. has developed the world's first wireless dynamometer - **N.E.R.D.™ Wireless Dynamometer**. It features the following technological advancements over other major competitors'.

- **72 data samples collected per second** (the highest in industry) – provides thorough and accurate polished rod loading relative to its position.
- **Wireless data transmitting** (the world's first) – eliminates cable entanglement for improved safety of operating personnel and equipment.

With each dynamometer test, you will get a **@color coded report** that is concise and offers distinctive visual identification of equipment loading/stress and ensures easy interpretation of the test results in the following areas:


- loading of the surface equipment – polished rod, speed reducer, prime mover and pumping unit structure
- loading of the downhole equipment – rod string
- conditions, performance and efficiencies of downhole pump
- fluid level and field observations

We provide detailed recommendations on how to **increase production, reduce operating expenses** and extend equipment run-life. Pressure survey candidates can also be identified.

An average payout of 3.5 weeks on our dynamometer test recommendations.

Golden Company
100/00-00-000-00 WOM/00
Surface: 00-00-000-00 WOM

Foreman's Report/Work Order

Work Ordered By: William Domore	Type of work: Dynamometer.
Date work completed: xxxx-01-07	Work completed by: 
Reason for Dynamometer: Production optimization.	Comments: Good pump function. Severe gas interference.

Work requested:

To improve production, increase stroke length from pitman #2 to #1. Monitor production, allow the well to stabilize and re-dyno to evaluate the increased equipment loading and counterbalance requirement.

To reduce the effects of gas interference and increase production, equalize the casing (832 kPa) and tubing (652 kPa) pressure.

Ensure that the well is connected to the 30 hp connection (possible savings of \$1060.00 per month in electricity, prime mover rating: 30-40-50 hp). Horsepower requirements at present time are 15.6 hp.

Work order requested by:	_____
Date requested:	_____
Work performed by:	_____
Date completed:	_____
Comments/results	

100/00-00-000-00 WOM/00
Surface: 00-00-000-00 WOM

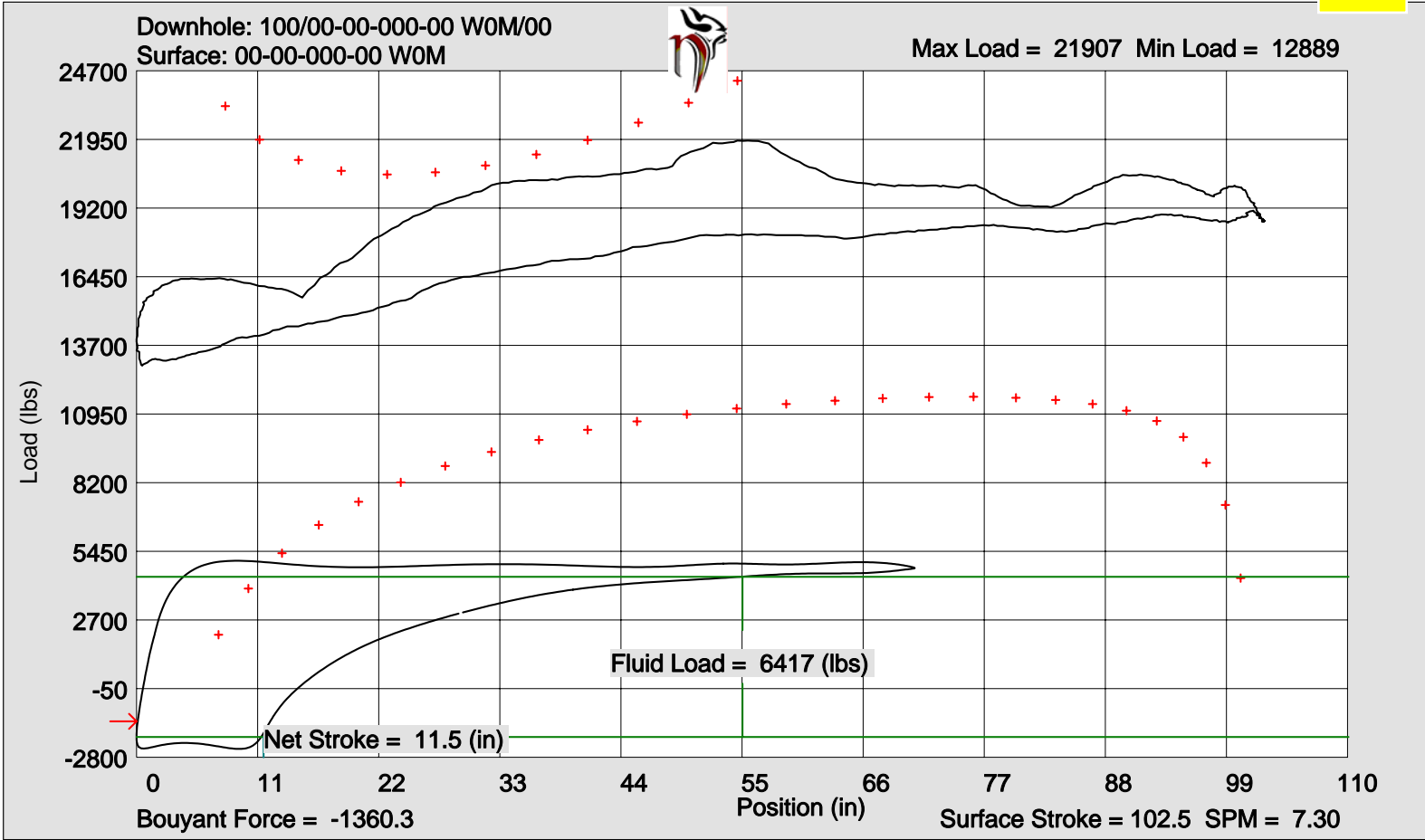
Prepared For
William Domore

N.E.R.D.™ Dynamometer Analysis

1. A producing bottomhole pressure of 2506 kPa and an average fluid gradient of 4.43 kPa/m are calculated from a fluid depression test. An IPR calculation is also conducted. See attached reports for details. A pump intake pressure of 2448 kPa is calculated from the dynamometer test.
2. The depression test results indicate a foamy fluid gradient. The dynamometer test results indicate good pump function with severe gas interference. To improve production, consider increasing the stroke length from pitman #2 to #1. Monitor production, allow the well to stabilize and re-dyno to evaluate the increased equipment loading and counterbalance requirement.
3. Consider equalizing the casing (832 kPa) and tubing (652 kPa) pressure. This will help increase well inflow by reducing the back pressure on reservoir and allow better gas separation in annulus.
4. Horsepower requirements at present time are 15.6 hp. Ensure that the well is connected to the 30 hp connection (possible savings of \$1060.00 per month in electricity, prime mover rating: 30-40-50 hp).
5. Under existing conditions the gearbox torque is at 84.6% of unit rating (balanced torque at 62.4%). The unit is underbalanced.

Field Observations
Belts are tight and in good condition.
Brakes are in good condition.
Gearbox backlash is not evident.
Polished rod is in good condition.
Check valve is holding properly.
The downhole pump pressured up from 652 kPa to 1388 kPa in 11 minutes without activating the high pressure shutdown.
Casing pressure: 832 kPa Tubing Pressure: 652 kPa Initial Fluid level was at 208.8 joints from surface.

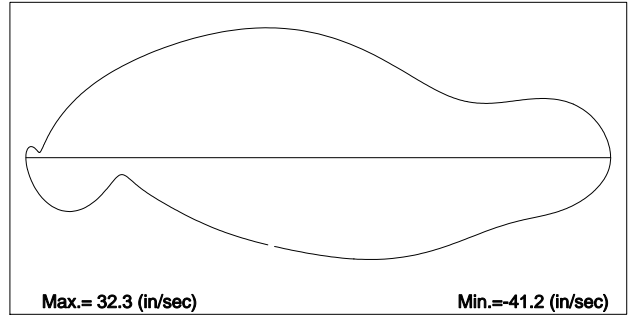




Rod Loading

Depth (m)	Rod Size (mm)	Loads		% Goodman Range Service Factor of		
		Max (lbs)	Min (lbs)	(1.0)	(0.9)	(0.8)
				0.00	38.1	21807.1
9.81	25.4	21383.6	13001.3	26.9	31.4	37.6
483.47	22.2	16898.9	8327.0	34.5	39.8	47.0
1199.75	19.0	11512.3	3251.0	41.2	46.6	53.7
2274.17	19.0	5075.6	-2463.1	31.9	35.0	38.9

Pump Velocity



Pump Efficiencies

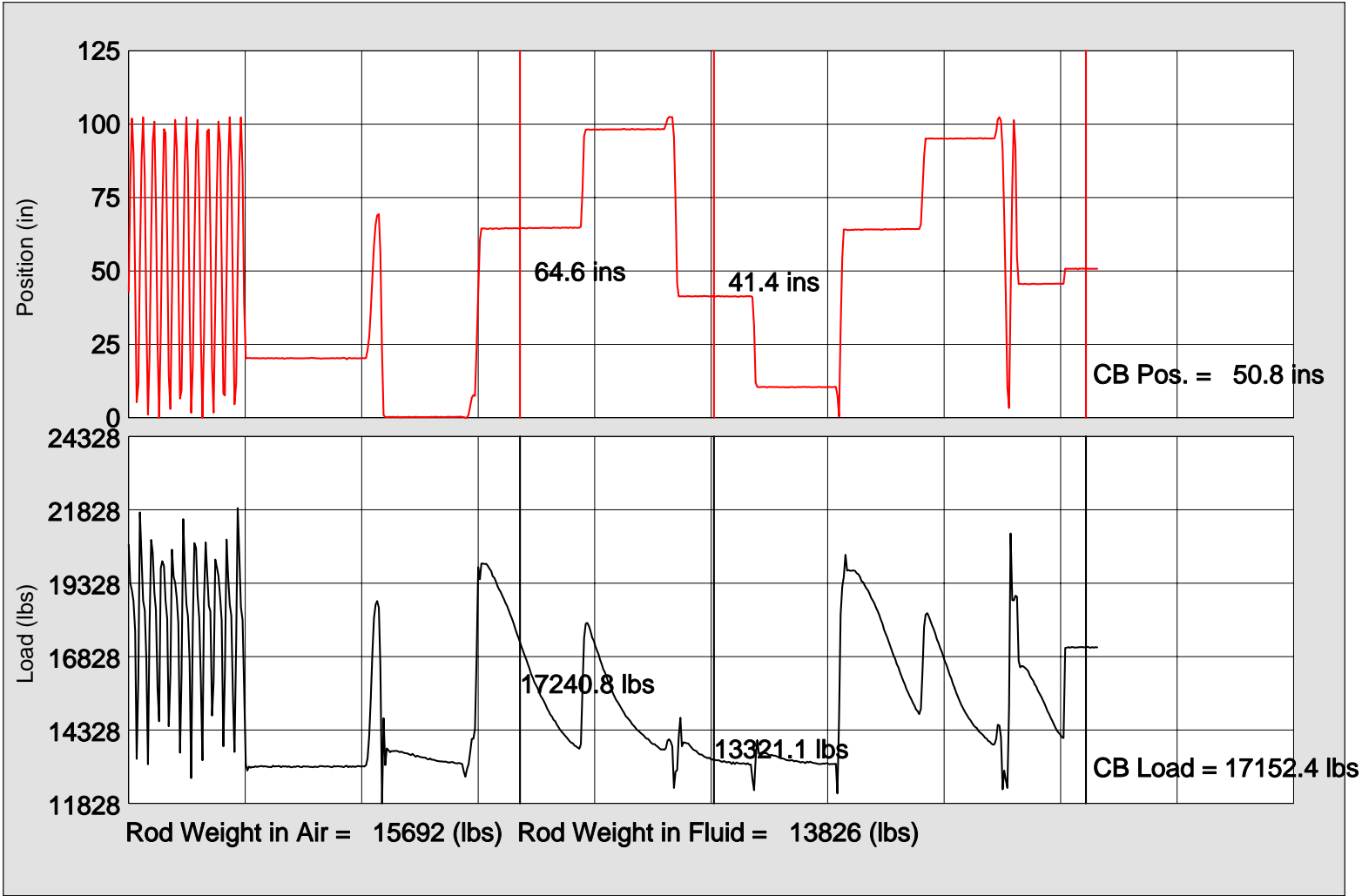
Pump Size (in): 2.00	Gross	Net
Downhole Stroke (in):	70.69	11.54
Displacement (m3/day):	38.25	6.25
Efficiency (%)	12.26	75.09

Current Production

Oil (m3/day):	0.70
Water (m3/day):	3.99
Gas (E3m3/day):	3.75

Comments

The downhole pumpcard indicates good pump function with severe gas interference.



Comments

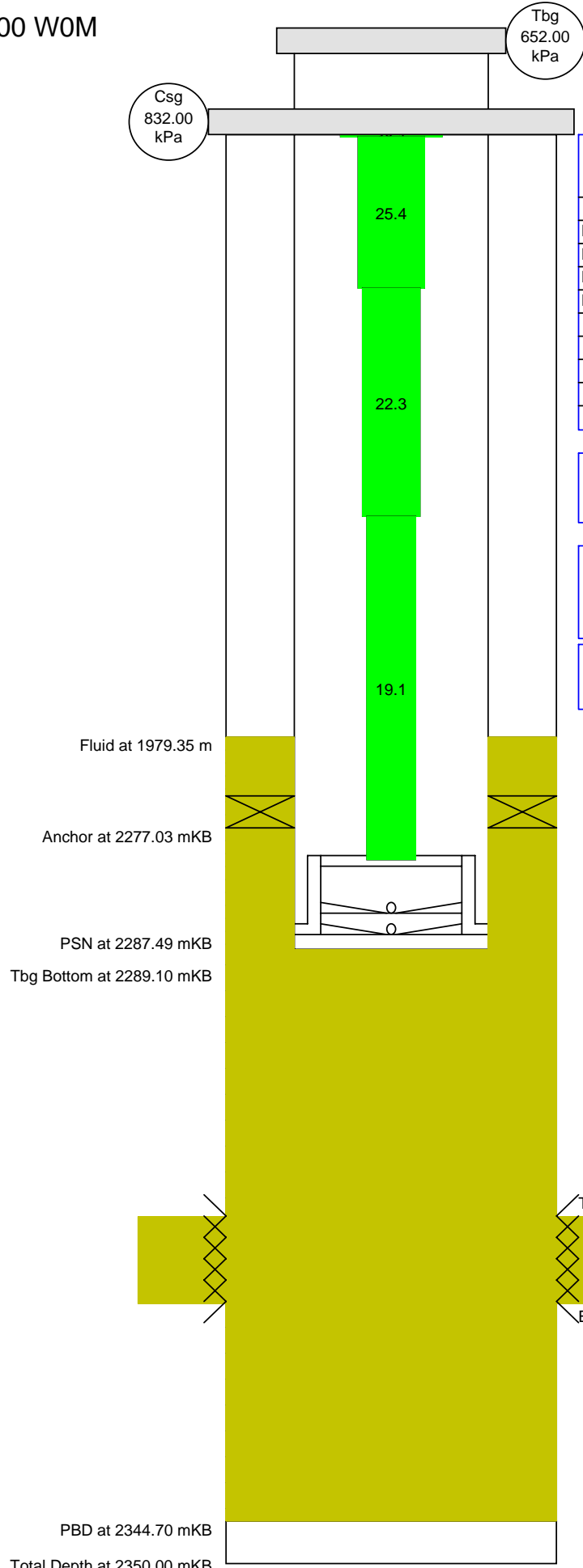
The valve checks indicate that the downhole pump has a slight trave valve leak. This is considered normal for high watercut wells.

Elevations:
 KB (m): 984.00
 CF (m): 979.50

Casing:
 OD (mm): 139.70
 ID (mm): 122.58
 Weight(kg/m): 23.10
 Depth (mKB): 2350.00

Tubing:
 OD (mm): 73.00
 ID (mm): 62.00
 Weight(kg/m): 9.67
 Depth (mKB): 2289.10
 Number of Jts: 241

Liner:
 ID (mm): 0.00
 Top (mKB): 0.00
 Bottom(mKB): 0.00

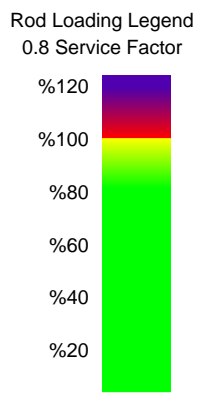


Type	Scraper	Rod String Rod Dia. (mm)	# Rods	Length (m)
STEEL C	No	38.10	1	9.81
NORRIS 97	No	25.40	2	1.22
NORRIS 97	Yes	25.40	62	472.44
NORRIS 97	No	22.20	94	716.28
NORRIS 97	No	19.10	141	1074.42

API Pump Description: 25-200 RWBC 20.0- 5.0- 0.0
 PSN (mKB): 2287.49

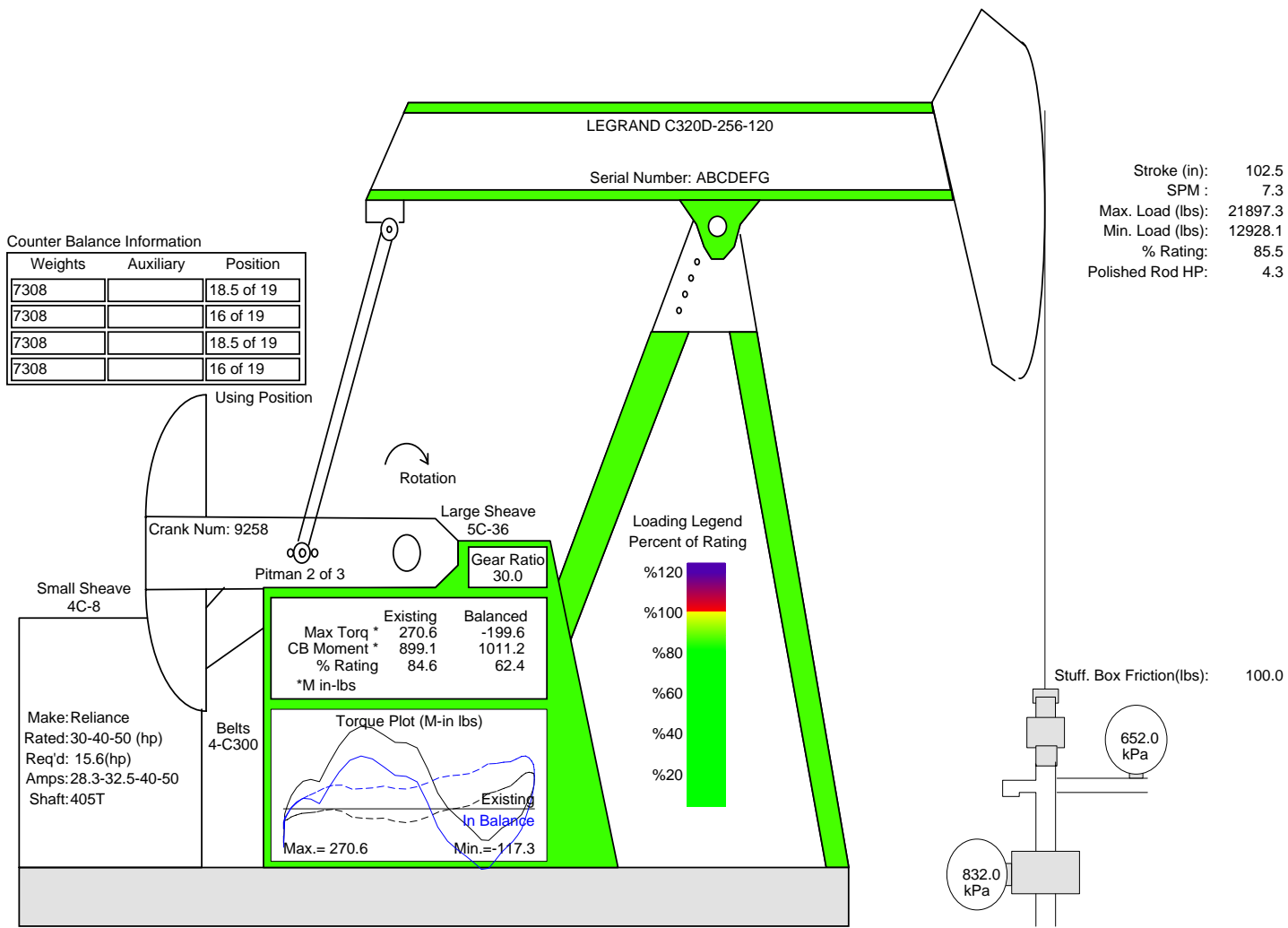
Perforations:
 From (mKB) 2315.00 to 2323.50

A fish top @ 2289.98 mKB. The producing string has a perforated pup and the bottom is bull plugged.



Downhole: 100/00-00-000-00 WOM/00

Surface: 00-00-000-00 WOM



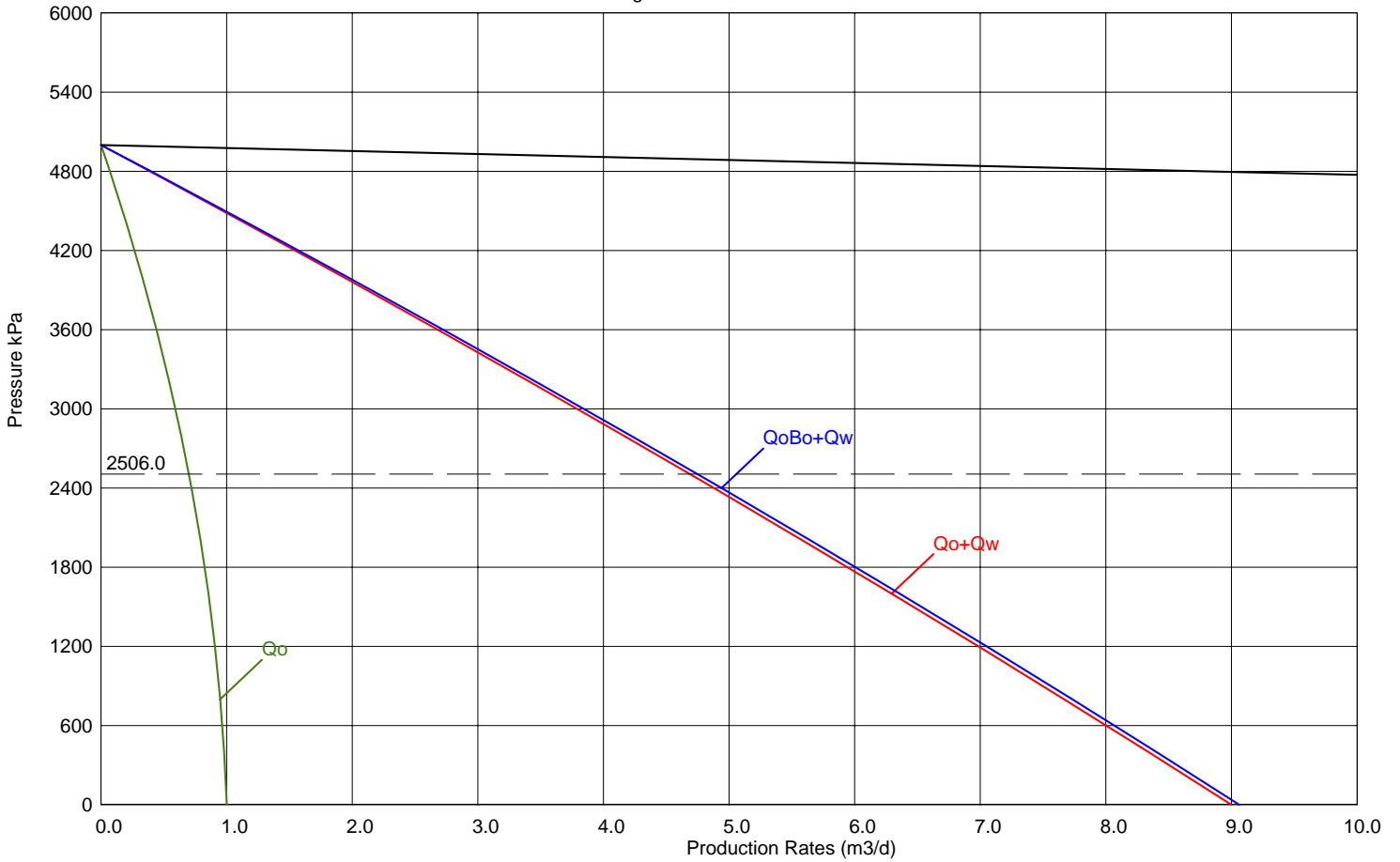
Inflow Performance Relationship

Golden Company Ltd.
100/00-00-000-00 WOM/00
xxxx-01-07

IPR for Dyno/Dep #1



Producing Pressure vs. Production Rate



Pressure (kPa)	At Surface			At Reservoir Depth			
	Oil(Qo) (m3/d)	Water(Qw) (m3/d)	Qo+Qw (m3/d)	QoBo (m3/d)	QoBo+Qw (m3/d)	Gas(Qfg) (m3/d)	QoBo+Qw+Qfg (m3/d)
0	1.0	8.0	9.0	1.1	9.1	6338.9	6348.0
400	1.0	7.4	8.3	1.0	8.4	1244.3	1252.7
800	0.9	6.7	7.7	1.0	7.7	664.5	672.2
1200	0.9	6.1	7.0	1.0	7.1	436.5	443.5
1600	0.9	5.4	6.3	0.9	6.4	312.2	318.5
2000	0.8	4.8	5.6	0.9	5.7	232.4	238.1
2400	0.7	4.2	4.9	0.8	4.9	176.0	180.9
2800	0.6	3.5	4.2	0.7	4.2	133.2	137.4
3200	0.5	2.9	3.4	0.6	3.5	99.2	102.7
3600	0.4	2.2	2.7	0.5	2.7	71.1	73.9
4000	0.3	1.6	1.9	0.4	2.0	47.3	49.3
4400	0.2	1.0	1.2	0.2	1.2	26.7	27.9
4800	0.1	0.3	0.4	0.1	0.4	8.4	8.8
5000	0.0	0.0	0.0	0.0	0.0	0.0	0.0


Production(m3/d)
Oil 0.70
Water 3.99
Gas (E3) 3.75

Pressures(kPa)
Reservoir 5000.00
PBHP 2506.00

Well Parameters
Gas Gravity 0.73
Oil Gravity (API) 26.80
Res. Temp (C) 68.00

Golden Company Ltd.
100/00-00-000-00 WOM/00
Surface: 00-00-000-00 WOM

Foreman's Report/Work Order

Work Ordered By: William Domore	Type of work: Dynamometer.
Date work completed: xxxx-11-24	Work completed by:  (403)309-2620
Reason for Dynamometer: Production optimization.	Comments: Production potential. System functioning well. Gross pump efficiency 76.2%.

Work requested:

- Increase stroke length from pitman #3 to #1 and
- increase pumping speed from 3.5 spm to 4.7 spm by replacing the existing 4C-6.0 inch prime mover sheave with a 4C-8.0 inch sheave.

Replace the existing 40 hp prime mover with a 20 hp motor (savings of \$1060 per month in power bill).

The next time the well is serviced, land the pump intake deeper at 2150 mKB.

Work order requested by:	_____
Date requested:	_____
Work performed by:	_____
Date completed:	_____
Comments/results	

100/00-00-000-00 WOM/00
Surface: 00-00-000-00 WOM

Prepared For
William Domore

Dynamometer Analysis

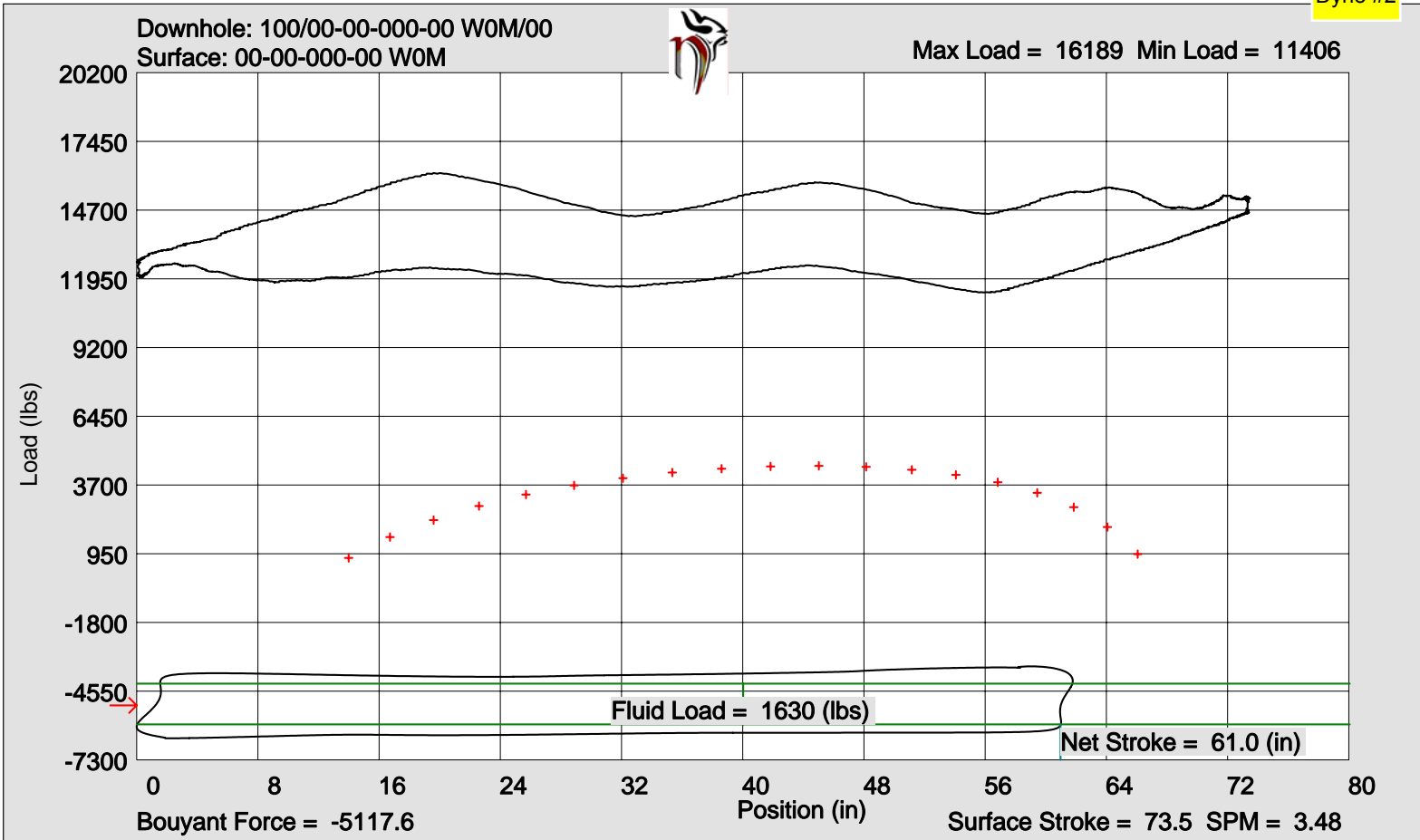
1. The well appears to be capable of additional production. The pumping system is functioning well. The gross pump efficiency is 76.2%. Consider increasing the stroke length from pitman #3 to #1 and pumping speed from 3.5 spm to 4.7 spm by replacing the existing 4C-6.0 inch prime mover sheave with a 4C-8.0 inch sheave. Monitor production, allow the well to stabilize and re-dyno to evaluate the increased equipment loading and counterbalance requirement.
2. Horsepower requirements at present time are 3.9 hp. Consider replacing the existing 40 hp prime mover with a 20 hp motor (savings of \$1060 per month in power bill).
3. The next time the well is serviced, to improve production, consider landing the pump intake deeper at 2150 mKB.
4. Under existing conditions the gearbox torque is at 53.2% of unit rating.
5. The rod string is loaded to a maximum of 24.8% (%Goodman, using a 0.8 service factor).
6. The unit structure is loaded to 63.1% of the unit rating.

Field Observations
Belts are tight and in good condition.
Brakes are in good condition.
Gearbox backlash is not evident.
Polished rod is in good condition.
Check valve is holding properly.
The downhole pump pressured up from 452 kPa to 2242 kPa in 1.5 minutes before activating the high pressure shutdown.
Casing pressure: 455 kPa Tubing Pressure: 452 kPa Initial Fluid level was at 41.9 joints from surface.



Prepared by: Scott Finnestad (403)309-2620

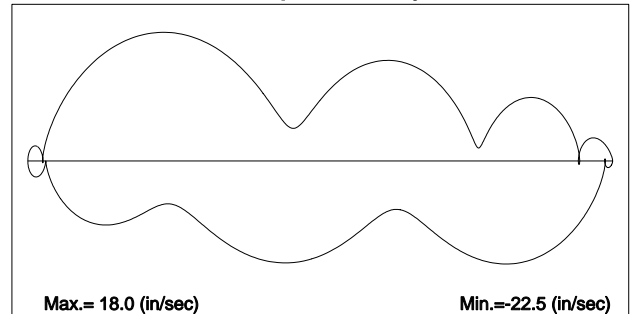
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Rod Loading

Depth (m)	Rod Size (mm)	Loads		% Goodman Range Service Factor of		
		Max (lbs)	Min (lbs)	(1.0)	(0.9)	(0.8)
		0.00	38.1	16144.1	11172.3	14.3
7.92	22.2	15609.3	11841.4	16.9	20.0	24.4
952.80	19.0	8728.7	5335.2	18.4	21.1	24.8
2034.84	38.1	-960.3	-3890.4	7.5	8.2	9.1
2156.76	38.1	-3554.9	-6433.7	7.1	7.8	8.6

Pump Velocity



Pump Efficiencies

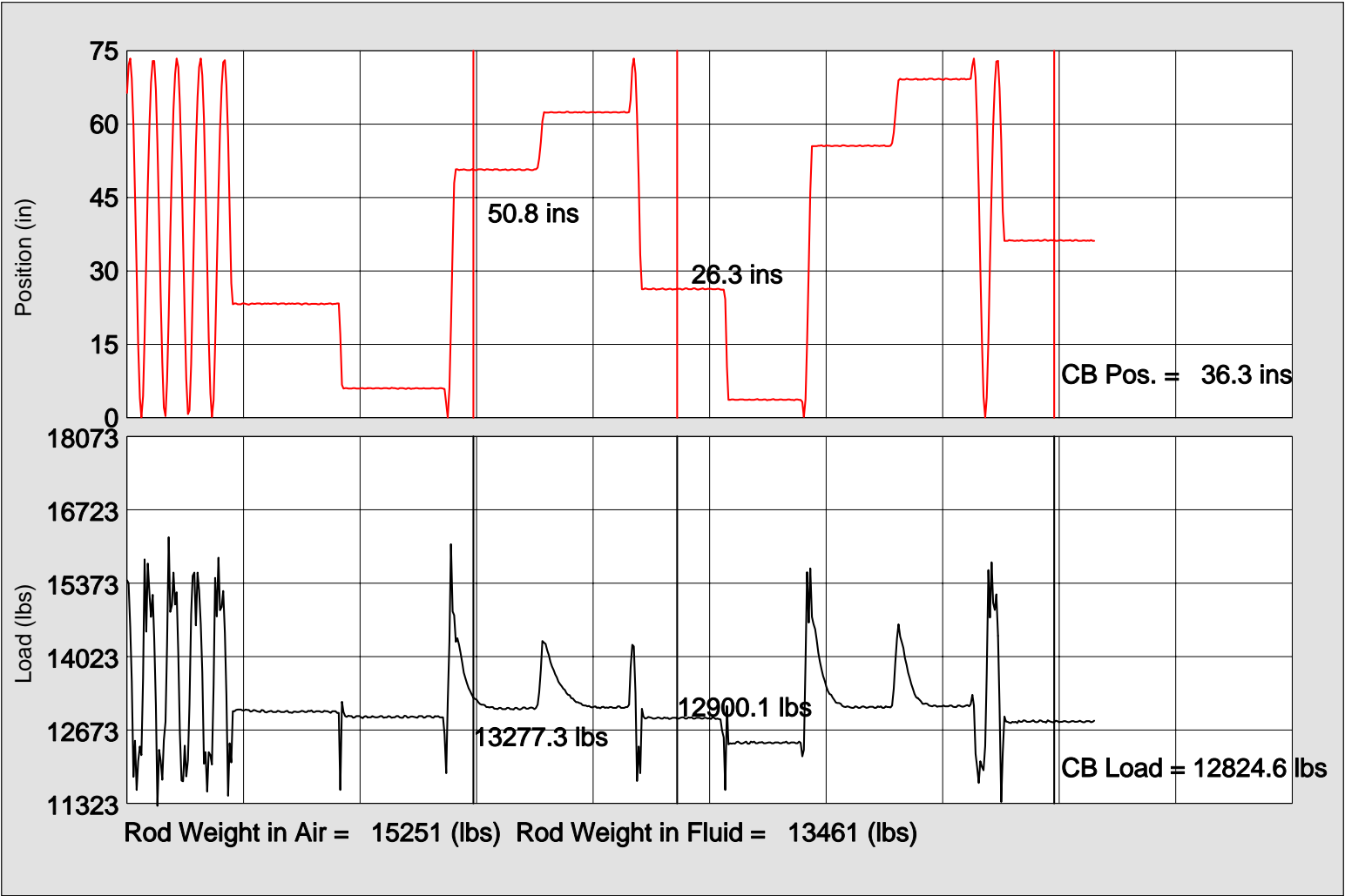
Pump Size (in): 2.00	Gross	Net
Downhole Stroke (in):	61.79	60.98
Displacement (m3/day):	15.94	15.73
Efficiency (%)	76.16	77.16

Current Production

Oil (m3/day):	5.32
Water (m3/day):	6.82
Gas (E3m3/day):	0.62

Comments

The downhole pumpcard indicates good pump function. Stuffing box friction is evident and adds at least 400 lbs to the polished rod loading. Consider inspecting and lubricating stuffing box.



Comments

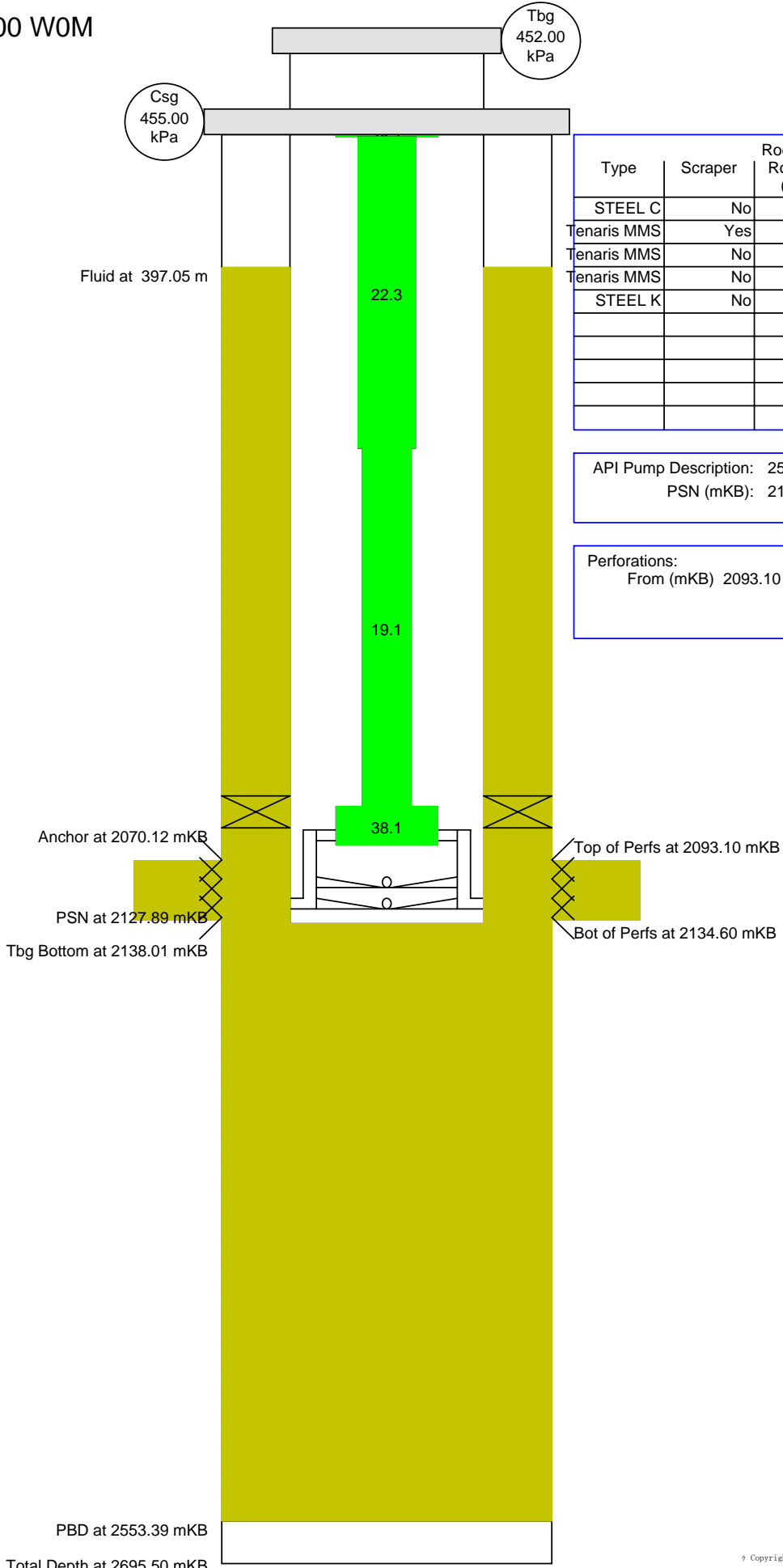
Valve checks indicate that the downhole pump has a slight travel valve leak. This is considered normal for high watercut wells.

Elevations:
 KB (m): 1073.10
 CF (m): 1067.20

Casing:
 OD (mm): 139.70
 ID (mm): 122.58
 Weight(kg/m): 23.10
 Depth (mKB): 2695.50

Tubing:
 OD (mm): 73.00
 ID (mm): 62.00
 Weight(kg/m): 9.67
 Depth (mKB): 2138.01
 Number of Jts: 225

Liner:
 ID (mm): 0.00
 Top (mKB): 0.00
 Bottom(mKB): 0.00



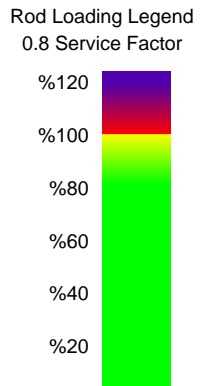
Tbg
452.00
kPa

Csg
455.00
kPa

Type	Scraper	Rod String Rod Dia. (mm)	# Rods	Length (m)
STEEL C	No	38.10	1	7.92
Tenaris MMS	Yes	22.20	92	701.04
Tenaris MMS	No	22.20	32	243.84
Tenaris MMS	No	19.10	142	1082.04
STEEL K	No	38.10	16	121.92

API Pump Description: 25-200 RWBC 18.0- 6.0- 0.0
 PSN (mKB): 2127.89

Perforations:
 From (mKB) 2093.10 to 2134.60



PBD at 2553.39 mKB
 Total Depth at 2695.50 mKB

Downhole: 100/00-00-000-00 WOM/00

Surface: 00-00-000-00 WOM

