

# Well Entry Modelling Report (WEM)

**CLIENT:**            Petronas Carigali Sdn Bhd (SBA)  
**FIELD:**             Dulang  
**WELL:**                A-11  
**SAND:**                H1.0

<b>Prepared By:</b>				
	Name:		Name:	
	Position:		Position:	
<b>Reviewed By:</b>				
	Name:		Name:	
	Position:		Position:	
<b>Agreed By (Client Representative):</b>				
	Name:		Name:	
	Position:		Position:	

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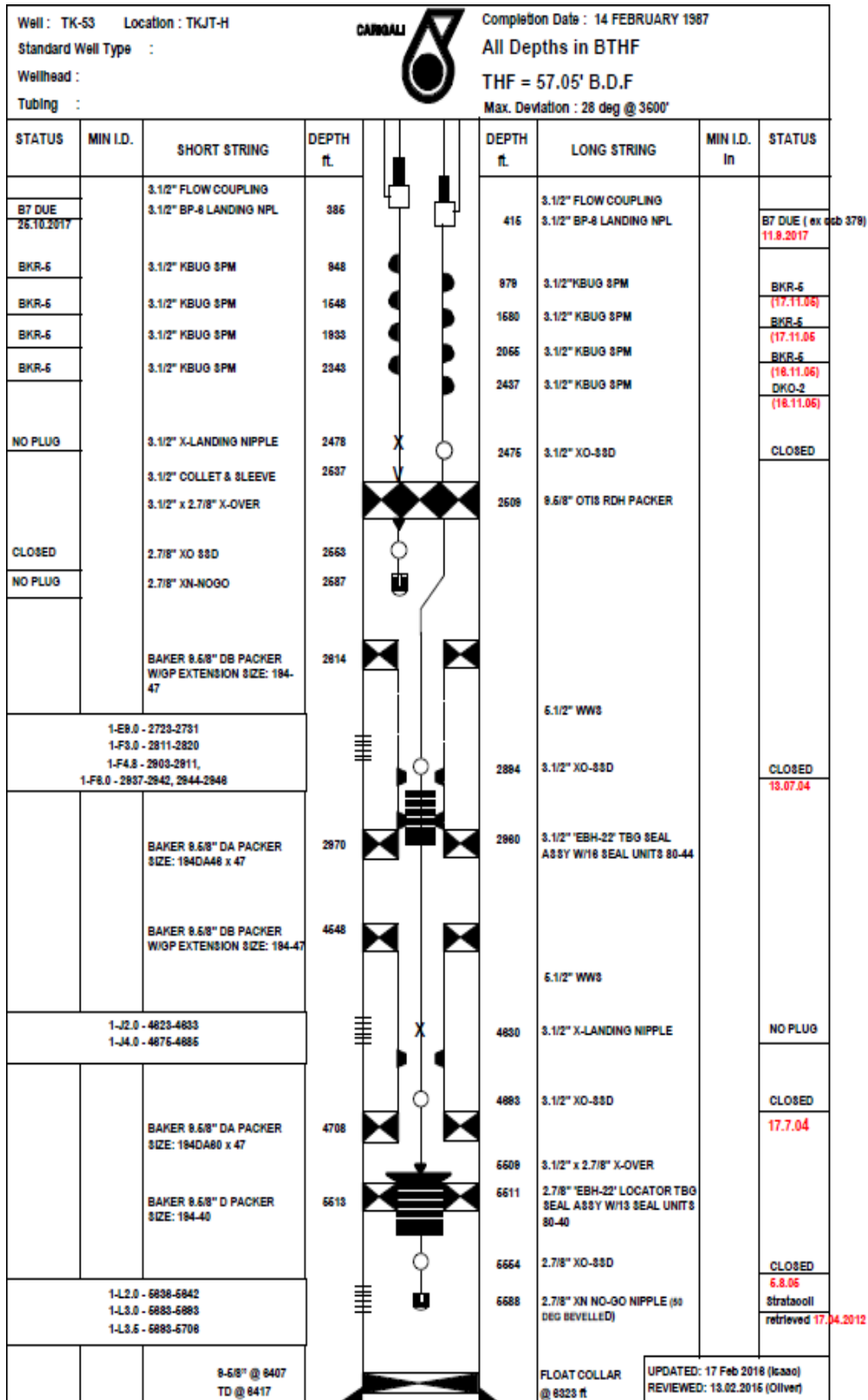
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# 1. 0 Well Schematics



## 2.0 Well Summary

Well Name: Petronas Carigali Sdn Bhd (SBA)  
Tubing Size:  
Casing Size:  
Max Deviation  
Min ID:  
Sand Name:  
Proposed Interval (m-MDDF):  
Proposed Interval (m-TVDDF):

## 3.0 Simulated Gun Details

*(Please add the next Gun #<no> table if any)*

### Gun #1

Type	Hollow Carrier Gun
Manufacturer	DynaEnergetic
Size/SPM/Phasing	2.00" (51MM) / 6 SPF / 60 DEG
Shaped Charge	
Max Swell	
TTP*	
EHD*	

### Gun #2

Type	Hollow Carrier Gun
Manufacturer	Titan
Size/SPM/Phasing	2.00" (51MM) / 6 SPF / 60 DEG
Shaped Charge	
Max Swell	
TTP*	
EHD*	

***\*TTP & EHD are based on API report. See Appendix 8.1.***

#### 4.0 WEM Input

##### Reservoir & PVT Parameters for WEM Plus Perf Design

###### Reservoir Data

<b>Well Name</b>	BO-214S01-LS				
<b>Sand name</b>	J9.0				
<b>Reservoir Interval (MD)</b>	6012-6062	mMDDF	<b>Drainage area</b>	40.6	acres
<b>Reservoir Interval (TVD)</b>	5277-5310	mTVD	<b>Net Pay</b>	9.87	ftTVD
<b>Net Thickness</b>	14.95	mMD	<b>Reservoir Pressure</b>	2263	Psig
<b>Lithology</b>	SS		<b>Flowing THP</b>	136	Psig
<b>Porosity</b>	24	%	<b>Shut in THP</b>	No info	Psia
<b>Compressive strength, f</b>	700-1800	Psi	<b>Reservoir temp</b>	146	degF
<b>Permeability</b>	71.00	mD	<b>Well head temp</b>	107	degF
<b>Net/Gross</b>	30	%	<b>Wellbore Fluid</b>	Crude Oil @ 51% watercut	
<b>kd/k</b>	No info		<b>Wellbore Density</b>	No info ppg	
<b>kh/kv</b>	No info		<b>Wellbore Damage</b>	No info in	

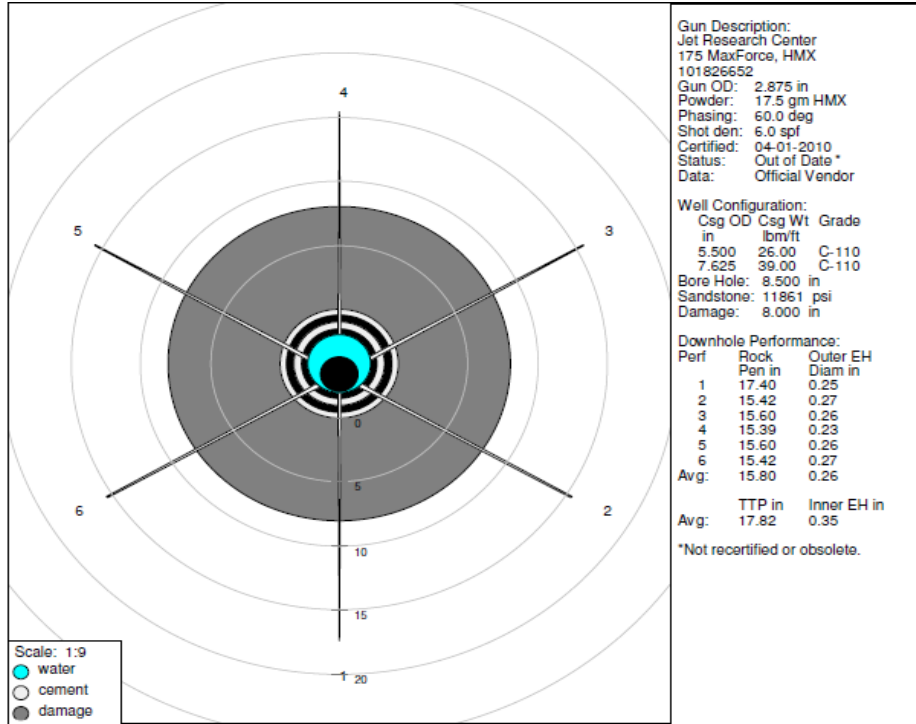
###### PVT Data

<b>Gas Mixture</b>		
<b>Gas Gravity</b>	0.68	
<b>Mole % CO2</b>	0	%
<b>Mole % N2</b>	0	%
<b>Mole % H2S</b>	0	%
<b>Separator</b>		
<b>Separator Pressure</b>	No info	psig
<b>Sep Temp</b>	No info	degF
<b>Stk Oil/ SepGas</b>	No info	bb/MMscf
<b>Stk Water/SepGas</b>	No info	bb/MMscf
<b>Stock tank liquid gravity</b>		
<b>Oil gravity</b>	28	deg API
<b>Water Gravity</b>	No info	
<b>GOR</b>	0.41	Mscf/stb

**5.0 Perforating Design Result**

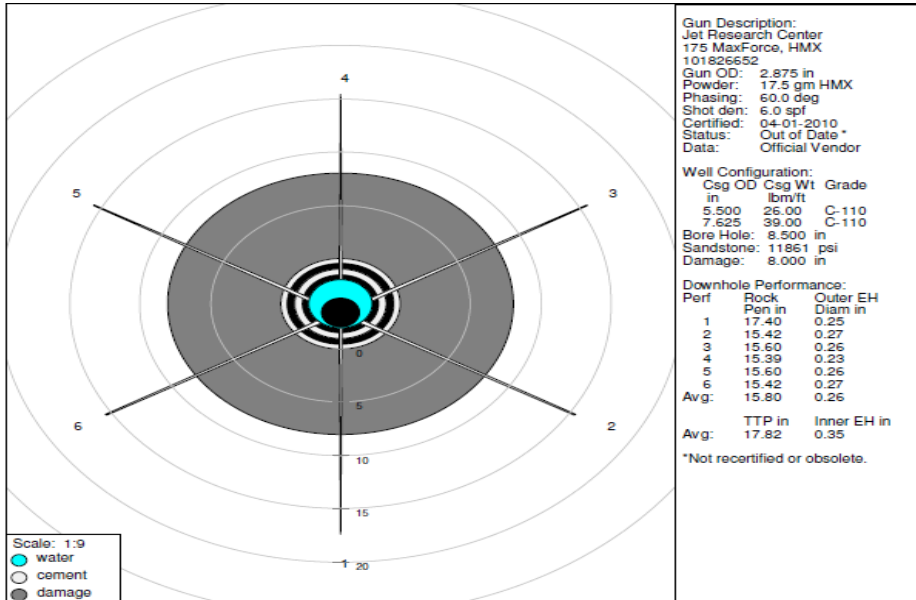
Sand	Dulang
Gun	Gun #1
Manufacturer	DynaEnergetic
Size / SPM / Phasing	2.00" (51MM) / 6 SPF / 60 DEG
Shape Charges	0

**Gun Plot Result**



Sand	Dulang
Gun	Gun #2
Manufacturer	Titan
Size / SPM / Phasing	1MM) / 6 SPF / 60 DEG
Shape Charges	0

**Gun Plot Result**



## 6.0 Gun Performance Details

Date : 12/ 5/2019

Time : 15:46:21

>> Gun Identification <<

Service Co : Jet Research Center  
 Trade Name : 175 MaxForce, HMX  
 Charge Name : 175 MaxForce, HMX  
 Charge Type : DP  
 Part No. : 101826652  
 Gun Type : Hollow Carrier, Expendable  
 Exp Wt (gm) : 17.5  
 Powder Type : HMX

>> Test Configuration <<

Gun Diameter (in) : 2.875  
 Phasing (deg) : 60  
 Shots/ft : 6.0  
 Gun Position : ECCENTERED  
 Charge Pattern : SPIRAL  
 Gun Rotation (deg) : 0.0

>> Gun Rating <<

Max Time (hr)	Temp (deg F)	Max Pressure (psi) =	20000.
1	400.	Min ID for Running Gun (in) =	
3			
24			
100	300.		
200			

>> API RP-43 Section 1 Test <<

Casing OD (in) =	4.500	Briq Comp Strength (psi) =	5405.0
Casing Wt (lbm/ft) =	11.6	Casing Grade =	L-80
Test Date =	07-09-2010	Data Source :	Official Vendor Entry
Certification Date =	04-01-2010	Certification :	Out of Date*
		* Gun may not be available.	

Shot No.	Clearance (in)	Total Depth (in)*	Csg Hole Dia (in)
1	.0000	38.900	.340
2	.2210	36.400	.400
3	.7835	42.300	.390
4	1.1250	40.800	.360
5	.7835	40.100	.385
6	.2210	33.800	.385
7	.0000	42.100	.340
8	.2210	36.600	.385
9	.7835	42.700	.395
10	1.1250	35.500	.360
11	.7835	40.800	.385
12	.2210	36.300	.370
13	.0000	42.100	.365
14	.2210	41.100	.375
15	.7835	38.300	.395
16	1.1250	35.300	.355
17	.7835	40.100	.380
18	.2210	32.800	.330

\* 0.0 entered when data are not available  
 (shoot out, damaged target, shot not loaded, etc.)

>> Statistical Analysis of Section 1 Test <<  
(By Plane)

Plane	Clearance (in)	Total Depth		Csg Hole Dia	
		Avg (in)	Std Dev	Avg (in)	Std Dev
1	.000	45.137	1.659	.348	.012
2	.221	41.937	2.387	.387	.010
3	.784	45.210	2.185	.393	.002
4	1.125	40.920	2.802	.358	.002
5	.784	44.367	.363	.383	.002
6	.221	37.730	1.619	.362	.023

>> Statistical Analysis of Section 1 Test <<  
(By Clearance)

Clearance (in)	Total Depth		Csg Hole Dia	
	Avg (in)	Std Dev	Avg (in)	Std Dev
.000	45.137	1.659	.348	.012
.221	39.783	2.894	.374	.022
.784	44.788	1.622	.388	.006
1.125	40.920	2.802	.358	.002

Avg Total Depth = 42.533 in  
 Normalized Avg Total Depth (@5000 psi) = 43.142 in  
 Avg Casing Hole Dia = .372 in

>> Well Configuration <<

Rock Type	=	SANDSTONE	True Vertical Depth (ft)	=	14010.3		
Porosity (%)	=	12.0	Reservoir Pressure (psig)	=	4100.0		
Compressive Str (psi)	=	11861	Overburden Gradnt (psi/ft)	=	.62		
Borehole Diameter (in)	=	8.500	Effective Stress (psi)	=	4642		
Cased Hole	=	YES	Perforated Tubing	=	NO		
Centralized Casing	=	YES	No. Casings	=	2		
Completion Fluid Type	=	Water	Completion Fl Den (lbm/gal)	=	8.34		
			Den (lbm/gal)				
			-or-				
Steel	OD (in)	Wt (lbm/ft)	ID (in)	Casing Grade	Annular Medium	Comp Str (psi)	Std Off (in)
Inner Csg	5.500	26.000	4.548	C-110	Cement	3500.00	calc'd
Outer Csg	7.625	39.000	6.625	C-110	Cement	3500.00	calc'd

>> Downhole Gun Configuration <<

Shots/ft (spf)	=	6.0	Gun Position	=	ECCENTERED
Phasing (degrees)	=	60	Charge Pattern	=	SPIRAL
			Gun Rotation (degrees)	=	0.0

>> Predicted Downhole Gun Performance <<

Plane	(1)	Rock	(2)			Casing /Cement Penetration (in)	Total Target Penetration (in)
	Clearance (in)	Penetration (in)	Casing Hole Csg 1	Hole Diameter Csg 2	Diameter (in) Csg 3		
1	.000	17.399	0.348	0.254		1.976	19.375
2	.300	15.419	0.376	0.275		2.032	17.451
3	1.136	15.596	0.357	0.261		2.032	17.628
4	1.673	15.394	0.310	0.226		1.976	17.370
5	1.136	15.596	0.357	0.261		2.032	17.628
6	.300	15.419	0.376	0.275		2.032	17.451

(1) Maximum clearance in Section 1 Test is 1.1250 in.

(2) Hole Diameters in the 2nd, 3rd, 4th, 5th & 6th casing strings are rough approximations. Actual test data are recommended when these hole sizes are critical.

Avg Rock Penetration = 15.804 in  
 Avg Casing Hole Dia (1) = .354 in  
 Avg Casing Hole Dia (2) = .259 in

## 7.0 Gun Summary


Sand: H1.0

	Gun 1	Gun 2
Manufacturer	DynaEnergetic	0
Size / SPF / Phasing	2.00" (51MM) / 6 SPF / 60 DEG	0
Shape Charges	0	0
Average TTP		
Average EHD		

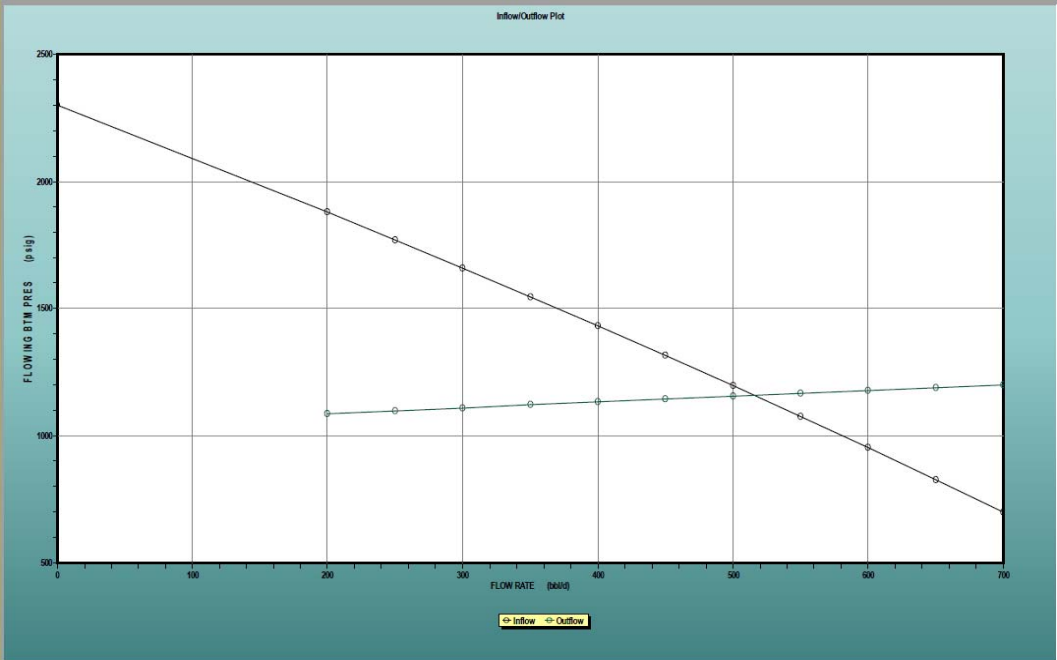
## 8.0 Skin result

Skin Results ×

Laminar Skin		Turbulence Coefficient (d/bbl)	
Partial Interval Skin (Sc)	=	-0.00	
Formation Damage Skin (Sd)	=	1.02	Formation Turb (Df) = 0.00000268
Perforation Skin (Spc)	=	1.08	Perforation Turb (Dp) = 0.00005797
Perf Damage Skin (Spd)	=	1.60	Gravel Pack Turb (Dg) = N/A
Gravel Pack Skin (Sg)	=	N/A	
Fracture Skin (Sf)	=	N/A	
Total Laminar Skin	=	3.70	Total Turbulence Coeff = 0.00006065

 OK

9.0 Inflow / Outflow Plot





>> CASING/TUBING DESCRIPTION <<

Measured Depth (ft)	Vertical Depth (ft)	Casing OD (in)	Casing ID (in)	Tubing OD (in)	Tubing ID (in)	Flow Path	Vert Dev (deg)
0.00	0.00						
5588.00	5588.00	9.625	8.755	2.875	2.441	TUBING	.0
6417.00	6417.00	9.625	8.755			CASING	.0

Perf Depth --- Meas (ft) = 5947.5 Perf Depth --- TVD (ft) = 5947.5  
 Flow Correlation = Hage/Brown Absolute Roughness (in) = .00180

Beggs/Brill Incl Factor = Yes Pressure Solution Method = RIGOROUS  
 B/B for Near Horz Flow = Yes Deviation from Vertical (deg) = 75.0  
 Static Liq in Btm of Well = No

>> HEAT TRANSFER MODEL <<

Heat Trans Solution Method = IDEAL  
 U Coeff (B/h/ft2/F) = 2.2920

TVD (ft)	Static Temp (deg F)
.00	70.0
5947.50	183.0

=====| RESERVOIR DESCRIPTION |=====

Radial Flow Model  
 MD: Top of Reservoir (ft) = 5913.0 MD: Btm of Reservoir(ft) = 5982.0  
 Reservoir Pressure (psig) = 2300.0 Reservoir Temp (deg F) = 183.0

PVT @ Res Pres & Temp :

Bo	= 1.3051	Viso (cp)	= .5552
Bw	= 1.0297	Visw (cp)	= .4528
Bg	= .0069	Visg (cp)	= .0173
Pbp (psig)	= 7805.4		

Net Stratigraphic Pay (ft) = 34.5 Ext Drainage Radius (ft) = 500.0  
 Measured Net Pay (ft) = 34.5 Borehole Diameter (in) = 12.250  
 Shape Factor Skin (Sa) = .000

>> Interval Profile <<

MD to Top (ft)	MD to Bottom (ft)	Lithology	Net/Gross (%)	Permeability (md)	Porosity (%)
5913.0	5982.0	SandStone	50.0	30.0	16.0

Avg Eff Perm : Ko @ Pr (md) = 30.000 Avg Eff Porosity (%) = 16.0  
Kh / Kv = 10.00

>> Future IPR Effects <<

Oil/Water Flow =Segregated Kw / Ko = .250  
Oil/Gas Flow = Pseudo Pr Gas Saturation Factor = 2.60

Ref Pressure (psig) = 2300.0 Ref WLR (%) = 70.0

=====| NEAR WELLBORE DATA (Natural Perf) |=====

Skin Option = Theory  
Damaged Zone Perm Ratio = .400 Damaged Zone Thickness (in)= 4.00  
Res Turb Beta (1/ft) = .3920427E+09

Meas Perforated Interval (ft) = 34.5 Form Top To Perf Top (ft) = .0  
Compressive Str (psi) = 2000.0  
Gun Phasing (deg) = 60 Perf Density (shots/ft) = 6.00

>> Downhole Performance (Bank Averages) <<

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Plane	Rock Penetration (in)	Hole Size (in)
1	13.393	.172
2	12.037	.177
3	7.947	.091
4	5.050	.091
5	7.947	.091
6	12.037	.177

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Avg Entrance Hole Size = .133 (in)  
Avg Rock Penetration = 9.735 (in)

Crushed Zone Thickness (in) = .50    Crushed Zone Perm Ratio = .30  
Casing/Cement Thickness (in) = 1.75    Crush Zone Turb Option = Dmg\*Crush  
Cru Turb Beta (1/ft) = .2338597E+10

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*****
* *
* *   W E L L   E V A L U A T I O N   M O D E L   ( W E M )   * *
* *
* *   I P R / T U B I N G   P E R F O R M A N C E   R E P O R T   * *
* *
* *                               W E M   R e l e a s e   V 1 1 . 2 . 1 1
* *
*****

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Software by P.E. Moseley & Associates (<http://www.pmoseley.com>)

Lse/Fld : Date : 5/ 2/2019  
 Well : Time : 8:32:55

=====| INFLOW/OUTFLOW SENSITIVITY INPUT TABLE |=====

>> INFLOW SENSITIVITY VARIABLE <<

N O N E

>> OUTFLOW SENSITIVITY VARIABLE <<

N O N E

>> WELLBORE SUMMARY <<

Liq Rate (bbl/d)	FBHP (psig)	(FBHP-WHP) (psi )	Whd Vel (ft/sec)	Whd Temp (deg F)
200.000	1086.1	836.1	2.7	87.4
250.000	1098.0	848.0	3.5	91.7
300.000	1109.8	859.8	4.2	95.8
350.000	1121.5	871.5	4.9	99.7
400.000	1132.5	882.5	5.7	103.5
450.000	1143.7	893.7	6.4	107.0
500.000	1154.8	904.8	7.2	110.2
550.000	1165.6	915.6	7.9	113.3
600.000	1176.5	926.5	8.7	116.2
650.000	1188.1	938.1	9.5	118.8
700.000	1199.5	949.5	10.2	121.3

FBHP = Flowing Pressure @ Producing Depth  
 WHP = Wellhead Pressure

>> IPR PRESSURE DROP SUMMARY <<

Liq Rate (bbl/d)	FBHP (psig)	Formation Pres Drop (psi )	Perf Damage Pres Drop (psi )	Gravel Pack Pres Drop (psi )	WLR ( % )
200.000	1879.37	349.9	70.76	.0	71.94
250.000	1770.25	440.3	89.42	.0	72.47
300.000	1659.39	531.6	108.96	.0	73.01
350.000	1546.72	624.1	129.14	.0	73.56
400.000	1432.14	717.8	150.01	.0	74.14
450.000	1315.56	812.8	171.60	.0	74.73
500.000	1196.87	909.1	193.98	.0	75.35
550.000	1075.94	1006.8	217.22	.0	75.98
600.000	952.56	1106.0	241.48	.0	76.64
650.000	826.79	1206.6	266.61	.0	77.33
700.000	698.33	1308.9	292.79	.0	78.05

AOFP = 952.690 (bbl/d)  
 FBHP = Flowing Bottomhole Pressure @ Producing Depth  
 Form Pres Drop = Pr - P<sub>sf</sub> (including near wellbore skin)  
 Perf Pres Drop = P<sub>sf</sub> - P<sub>perf</sub>  
 Gravel Pack Pres Drop = P<sub>perf</sub> - P<sub>wf</sub>

>> COMPLETION SKIN ANALYSIS <<

Q	Near Wellbore Skin			Perforation Skin			Total Skin
	Sc	Sd	Df*Q	Spc	Spd	Dp*Q	
200.0	.00	1.02	.00054	1.08	1.60	.01166	3.71
250.0	.00	1.02	.00067	1.08	1.60	.01460	3.72
300.0	.00	1.02	.00081	1.08	1.60	.01755	3.72
350.0	.00	1.02	.00094	1.08	1.60	.02052	3.72
400.0	.00	1.02	.00108	1.08	1.60	.02350	3.73
450.0	.00	1.02	.00122	1.08	1.60	.02651	3.73
500.0	.00	1.02	.00136	1.08	1.60	.02953	3.73
550.0	.00	1.02	.00149	1.08	1.60	.03258	3.74
600.0	.00	1.02	.00163	1.08	1.60	.03566	3.74
650.0	.00	1.02	.00177	1.08	1.60	.03876	3.74
700.0	.00	1.02	.00191	1.08	1.60	.04190	3.75

Sc = Partial Comp/Dev      Sd = Damage      Df\*Q = Formation Turb  
 Spc = Perf Convrq Skin      Spd = Perf Damage Skin      Dp\*Q = Perf Turb  
 Sg = Gravel Pack      Sf = Fracture Skin      Dg\*Q = Gravel Pack Turb  
 Q = Rate (bbl/d)

>> PRODUCING RATES (bbl/d) <<

Intersection Point @ Inflow and Outflow (BaseCase) = 515.97

===== | Solution Points | =====

-----  
Intersection Point @ Inflow and Outflow (BasCase)  
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Qtot	=	515.97 bbl/d
Pwf	=	1158.24 psig
Qoil	=	126.16 bbl/d
Qh2o	=	389.82 bbl/d
Qgas	=	205.64 Mscf/d
WLR	=	75.55 %
GOR	=	1630.01 scf/bbl

11.0 API Certification Datasheet



Registered Data Sheet Performing System Evaluation, API RP 19B Section 1

API Form 19B-Section 1  Conforms to All Requirements of Section 1  Special Test - See Remarks/Exceptions below

Service Company Available to all from Titan Specialties Ltd Explosive weight 7.0 gm, HMX powder, Case Material Steel

Gun OD & Trade Name 2" RTG Gun 8 SPF 60 Degree Max Temp, °F 400 1 hr 3 hr 24 hr 100 hr 200 hr

Charge Name 2" 7G HMX SDP Maximum Pressure Rating 20,000 psi, Carrier Material H.T. Steel

Manufacturer Charge Part No. RTG-2107-421T Date of Manufacture 13 July 2009 Shot Density Tested 6 Shots/ft 6

Gun Type Hollow Steel Carrier, Expendable (HC, E) Recommended Minimum ID for Running 2.25 in.

Phasing Tested 60 degrees, Firing Order:  Top down  Bottom up Available Firing Mode:  Selective  Simultaneous

Debris Description Small steel chips, usually retained in carrier Debris Weight n/a gm/charge, Debris n/a in<sup>3</sup>/charge

Remarks/Exceptions per Section 1.11

Casing Data 2-7/8" OD, Weight 6.4# lb/ft, API Grade, L-80 Date of Section 1 Test 17 December 2009

Target Data 72" OD, Amount of Cement 5.377 lb, Amount of Sand 10.754 lb, Amount of Water 2.819 lb.

Date of Compressive Strength Test 17 December 2009 Briquette Compressive Strength 7,760 psi, Age of Target 28 days

Shot No.	No 1	No 2	No 3	No 4	No 5	No 6	No 7	No 8	No 9	No 10	No 11
Clearance, in.	0.00	0.10	0.32	0.44	0.32	0.10	0.06	0.10	0.32	0.44	0.32
Casing Hole Diameter, Short Axis, in.	0.23	0.28	0.28	0.31	0.28	0.25	0.23	0.27	0.27	0.31	0.30
Casing Hole Diameter, Long Axis, in.	0.25	0.27	0.32	0.33	0.30	0.26	0.23	0.28	0.30	0.32	0.32
Average Casing Hole Diameter, in.	0.24	0.28	0.30	0.32	0.29	0.26	0.23	0.28	0.29	0.32	0.31
Total Depth, in.	23.22	30.72	25.22	26.22	27.22	27.72	30.47	30.72	25.72	27.72	22.72
Burr Height, in.	0.05	0.05	0.05	0.05	0.07	0.04	0.04	0.05	0.05	0.07	0.05

Shot No.	No 12	No 13	No 14	No 15	No 16	No 17	No 18	No 19	No 20	No 21	No 22	Average
Clearance, in.	0.10	0.09	0.10	0.32	0.44	0.32	0.10	0.00	0.10	0.32	0.44	XXXXXX
Casing Hole Diameter, Short Axis, in.	0.28	0.25	0.30	0.29	0.31	0.29	0.20	0.27	0.28	0.28	0.31	0.28
Casing Hole Diameter, Long Axis, in.	0.28	0.28	0.30	0.30	0.32	0.31	0.29	0.28	0.28	0.29	0.34	0.29
Average Casing Hole Diameter, in.	0.28	0.28	0.30	0.30	0.32	0.30	0.29	0.28	0.28	0.29	0.33	0.29
Total Depth, in.	26.22	26.72	21.47	27.72	26.72	27.22	26.72	23.45	25.22	22.97	27.22	26.97
Burr Height, in.	0.05	0.05	0.06	0.05	0.06	0.07	0.05	0.06	0.04	0.06	0.04	0.05

Remarks

**Manufacturer's Certification**

Type of Certification:  Self  Third Party API Witness: Jim Stout

I certify that these tests were made according to the procedures as outlined in API 19B: Recommended Practice for Evaluation of Well Perforators, Second Edition, September 2006. All of the equipment used in these tests, such as the guns, jet charges detonator cord, etc., was standard equipment with our company for the use in the gun being tested and was not changed in any manner for the test. Furthermore, the equipment was chosen at random from stock and therefore will be substantially the same as the equipment that would be furnished to perforate a well for any operator. API neither endorses these tests nor recommends the use of the perforator system described.

CERTIFIED BY Kenneth B. Babcock CEO 23 December 2009 Titan Specialties Ltd. 143 HCR 4361, Milford, TX 76670

RECERTIFIED (Company Official) (Title) (Date) (Company) (Address)

Name of test as it should appear on website: 2.00-in. RTG 6 SPF w/ DP RTG-2107-421T

Name of test as it appears on application and application date: RTG-2107-421T, Charge, 2" 7G HMX SDP (Appl: 20 Nov. 2009)



Registered Data Sheet Perforating System Evaluation, API RP 19B Section 1

Service Company <u>Available to all from Titan Specialties Ltd.</u>		Explosive weight <u>7.0</u> gm, <u>HMX</u> powder, Case Material <u>Steel</u>
Gun OD & Trade Name <u>2" RTG Gun, 8 SPF 60 Degree</u>	Max Temp, °F <u>400</u> 1 hr <u>3</u> hr <u>24</u> hr <u>100</u> hr <u>200</u> hr	
Charge Name <u>2" 7G HMX SDP</u>	Maximum Pressure Rating <u>20,000</u> psi, Carrier Material <u>H.T. Steel</u>	
Manufacturer Charge Part No. <u>RTG-2107-421T</u> Date of Manufacture <u>13 July 2009</u>	Shot Density Tested <u>6</u> Shots/ft <u>6</u>	
Gun Type <u>Hollow Steel Carrier, Expendable (HC, E)</u>	Recommended Minimum ID for Running <u>2.25</u> in.	
Phasing Tested <u>60</u> degrees, Firing Order: <input checked="" type="checkbox"/> Top down <input type="checkbox"/> Bottom up	Available Firing Mode: <input checked="" type="checkbox"/> Selective <input checked="" type="checkbox"/> Simultaneous	
Debris Description <u>Small steel chips, usually retained in carrier</u>	Debris Weight <u>n/a</u> gm/charge, Debris <u>n/a</u> in <sup>3</sup> /charge	
Remarks/Exceptions per Section 1.11 _____		
Casing Data <u>2-7/8"</u> OD, Weight <u>6.4#</u> lb/ft, API Grade, <u>L-80</u> Date of Section 1 Test <u>17 December 2009</u>	Target Data <u>72"</u> OD, Amount of Cement <u>5,377</u> lb, Amount of Sand <u>10,754</u> lb, Amount of Water <u>2,819</u> lb.	
Date of Compressive Strength Test <u>17 December 2009</u>	Briquette Compressive Strength <u>7,760</u> psi, Age of Target <u>28</u> days	
Shot No. ....	No 23 No 24 No 25 No 26 No 27 No 28 No 29 No 30 No 31 No 32 No 33	
Clearance, in. ....	<u>0.32</u> <u>0.10</u> _____	
Casing Hole Diameter, Short Axis, in. ....	<u>0.30</u> <u>0.27</u> _____	
Casing Hole Diameter, Long Axis, in. ....	<u>0.32</u> <u>0.28</u> _____	
Average Casing Hole Diameter, in. ....	<u>0.31</u> <u>0.28</u> _____	
Total Depth, in. ....	<u>23.72</u> <u>23.72</u> _____	
Burr Height, in. ....	<u>0.05</u> <u>0.06</u> _____	
Shot No. ....	No 34 No 35 No 36 No 37 No 38 No 39 No 40 No 41 No 42 No 43 No 44 Average	
Clearance, in. ....	_____	
Casing Hole Diameter, Short Axis, in. ....	_____	<u>XXXXXXXX</u>
Casing Hole Diameter, Long Axis, in. ....	_____	<u>0.26</u>
Average Casing Hole Diameter, in. ....	_____	<u>0.26</u>
Total Depth, in. ....	_____	<u>26.07</u>
Burr Height, in. ....	_____	<u>0.05</u>
Remarks _____		
<b>Manufacturer's Certification</b>		
Type of Certification: _____ Self <input checked="" type="checkbox"/> Third Party API Witness: <u>Jim Stout</u>		
I certify that these tests were made according to the procedures as outlined in API 19B, Recommended Practice for Evaluation of Well Perforators, Second Edition, September 2006. All of the equipment used in these tests, such as the guns, jet charges detonator cord, etc., was standard equipment with our company for the use in the gun being tested and was not changed in any manner for the test. Furthermore, the equipment was chosen at random from stock and therefore will be substantially the same as the equipment that would be furnished to perforate a well for any operator. API neither endorses these tests nor recommends the use of the perforator system described.		
<input checked="" type="checkbox"/> CERTIFIED BY <u>Kenneth B. Babcock</u> CEO <u>23 December 2009</u> <u>Titan Specialties Ltd.</u> <u>143 HCR 4361, Milford, TX 76670</u>	(Company Official)	(Title) (Date) (Company) (Address)
Name of test as it should appear on website: <u>2.00-in. RTG 6 SPF w/ DP RTG-2107-421T</u>		
Name of test as it appears on application and application date: <u>RTG-2107-421T, Charge, 2" 7G HMX SDP (Appl: 20 Nov. 2009)</u>		