

**GUIDELINES AND PROCEDURES
TO
DETERMINE CANDIDATE WELLS
AND THEIR POTENTIAL RESULTS
WITH THE**

**PAAL
CASING PLUNGER**

Please forward your results and contact info to info@defopt.com or give our sales team a call at (855) 933-3678.

ESTABLISHED & KNOWN DATA ABOUT THE WELL.

- > CASING SIZE _____ INCHES
- > VALVE INTERNAL DIAMETER _____ INCHES
- > DEPTH _____ FEET
- > FORMATION PRESSURE _____ PSI
- > FORMATION TEMPERATURE _____ °F
- > WELL MAKES _____ WAX, _____ SCALE _____ BRINE DEPOSITS _____ H₂S _____ CONDENSATE.
- > CASING CONDITION FROM CALIPER LOG _____ GOOD; _____ SPOT PROBLEMS; _____ POOR.
- > LIQUID RATE _____ BARRELS/DAY
- > WATER CUT _____ %
- > GAS RATE _____ MCF/DAY
- > ONE DAY SHUT-IN _____ PSI
- > LINE PRESSURE _____ PSI

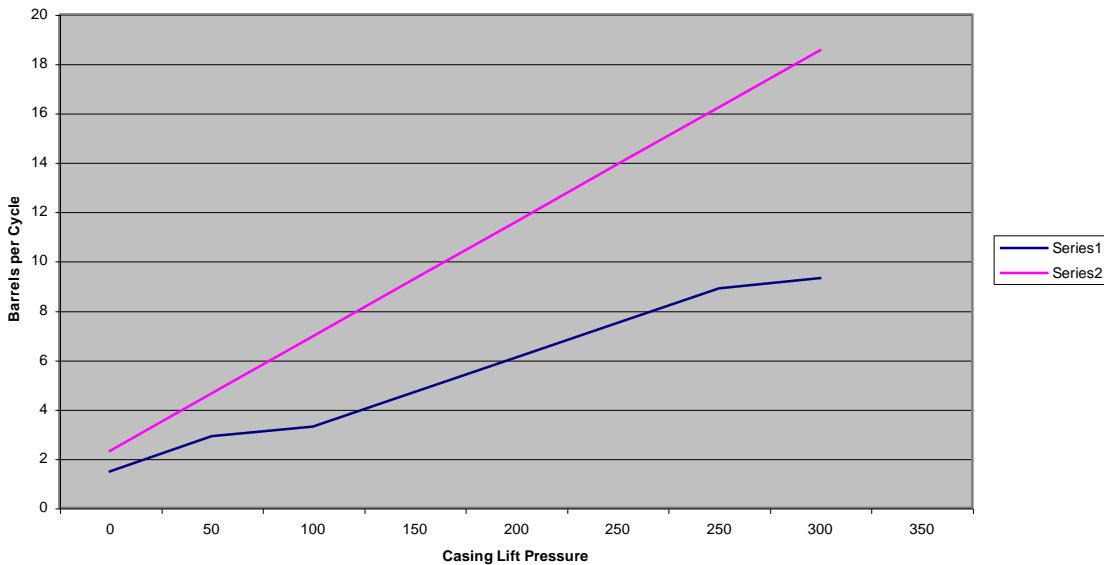
HERE ARE THE ESTABLISHED FACTS FROM THIS DATA THAT CAN BE SUPPORTED. WHILE THESE GUIDELINES ARE CONSERVATIVE, THEY PROVIDE YOU WITH A STANDARD TO RETURN TO IF THERE IS A PROBLEM.

THE QUANTITY OF LIQUIDS THAT CAN BE LIFTED PER CYCLE WITH A PAAL CASING PLUNGER.

AVAILABLE LIFT PRESSURE**	BARRELS PER CYCLE 4 1/2"	BARRELS PER CYCLE 5 1/2"
50	1.48	2.32
100	2.9	4.64
150	3.3	6.96
200	4.7	9.28
250	6.1	11.6
300	7.5	13.92
350	8.9	16.24
400	9.3	18.56

**LINE PRESSURE IS TO BE DEDUCTED FROM THE LIFT PRESSURE.

Barrels per Cycle @ Specific Pressure



THIS IS BASED UPON WEIGHT OF COLUMN TO THE PRESSURE SEALED UNDER THE TOOL.
(HYDRAULICS).

EX: WEIGHT OF GALLON OF WATER = 8 TO 10 LB. PER GALLON. MAX. WEIGHT FOR BRINE WATER IS 420 LB. PER BARREL.

CROSS SECTION OF 4 INCH CASING IS 12.5 IN.².

10 PSI. CAN LIFT 125 LB. USE THIS TO DETERMINE HOW MUCH LIQUID THE PRESSURE OF THE WELL CAN LIFT. THEREFORE, 100 PSI CAN LIFT 1250 LB.

NOTE: *THIS IS NOT USED TO DETERMINE WHEN TO ALLOW THE AUTOMATED SYSTEM TO DROP THE PLUNGER AS MUCH AS WHEN THE PAAL CASING PLUNGER WILL WORK ON A WELL.*

NUMBER OF CYCLES WELL CAN MAKE WITH PAAL CASING PLUNGER PER DAY.

CYCLES = TOTAL OF TIME IN LATCH + TIME TO FALL + TIME TO ASCEND.**

**NOTE: THE TIME THE CASING PLUNGER IS LATCHED AT THE SURFACE IS SAME TIME THE MOTOR VALVE IS OPEN TO SALES.

THE CYCLE IS TOTAL TIME FOR THE PLUNGER FROM ITS ARRIVAL AT THE SURFACE UNTIL IT ARRIVES AGAIN.

THIS IS A FACTOR OF DEPTH THE PLUNGER MUST FALL TO GET TO BOTTOM AND THE TIME IT TAKES FOR IT TO LAND ON THE STOP AND BEGIN ITS ASCENT.

FALL RATE HAS BEEN DETERMINED TO BE BETWEEN 10 AND 14 MINUTES PER THOUSAND FEET OF CASING IN WELLS WITH GOOD INTEGRITY OF THE CASING ID.

FALL TIME = TIME FOR PLUNGER TO FALL FROM SURFACE, WHEN RELEASED, TO THE CASING COLLAR STOP.
ALWAYS USE WORSE CASE FOR THE INITIAL DESCENT OF THE CASING PLUNGER.

TO DETERMINE CYCLE TIME FOR INITIAL SETUP

(CALCULATED FLOW TO LOAD TIME) + (MAXIMUM FALL RATE PER THOUSAND) + (RATE OF ASCENT TO THE SURFACE.) = CYCLE TIME.

EXAMPLE: 300 PSI MEANS A 240 MINUTE WAIT ON THE PLUNGER PLUS A FALL TIME OF (3770/1000 OR) 3.77 X 14 MIN. PER 1000 FOR A TOTAL OF 293 MINUTES PLUS TRAVEL TIME TO THE SURFACE OF ABOUT 20 TO 30 MINUTES = CYCLE TIME.

TO DETERMINE THE NUMBER OF CYCLES PER DAY

CYCLE TIME/1440 = NUMBER OF CYCLES PER DAY.**

**1440 = NUMBER OF MINUTES PER 24 HOUR DAY. DIVIDE CYCLE TIME IN MINUTES INTO THIS TO GET TOTAL CYCLES.

YOU CAN CLEARLY SEE THAT WE ARE AT ABOUT 5 CYCLES PER DAY. THE 300 PSI CASING PRESSURE WILL LIFT 7.5 BARRELS PER CYCLE. THIS MEANS THE PAAL CASING PLUNGER WILL PRODUCE CLOSE TO 40 BARRELS PER DAY. IF THE WELL IS CURRENTLY PRODUCING LESS THAN THIS, YOU SHOULD HAVE GOOD RESULTS FROM THESE VALUES.

POTENTIAL VOLUME OF GAS THAT CAN BE DELIVERED TO THE GATHERING SYSTEM AT A GIVEN CASING PRESSURE WITH A KNOWN LINE PRESSURE WITH USE OF PAAL CASING PLUNGER.

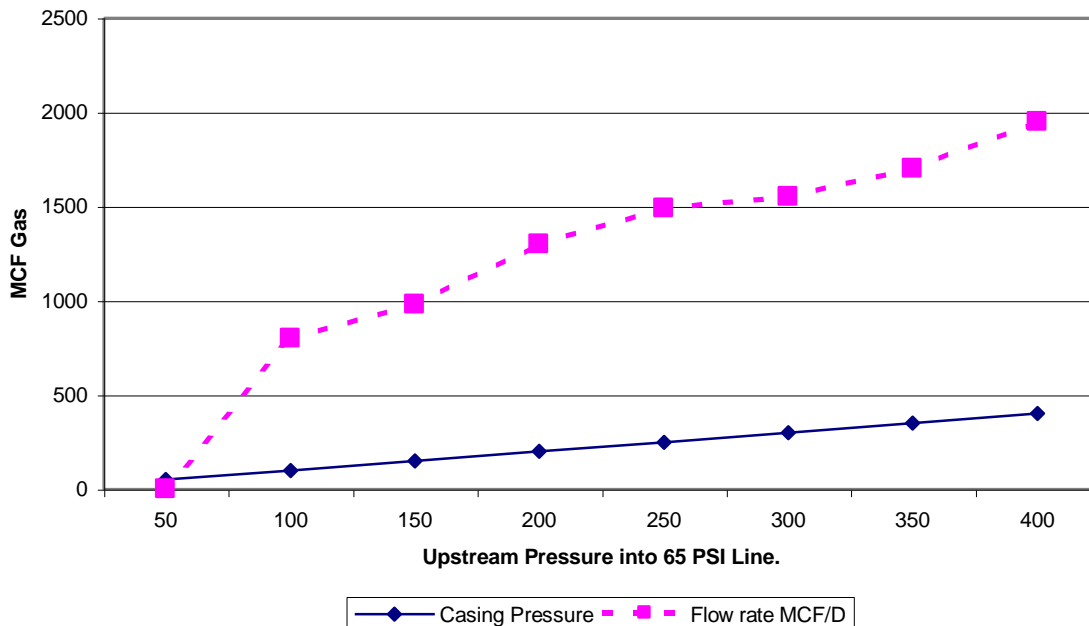
THE PAAL MOTOR VALVE (MULTI) HAS AN FLOW ORIFICE OF 1 1/4". THIS CAPACITY IS THE FACTOR USED TO DETERMINE HOW MUCH GAS CAN BE SOLD TO THE GATHERING SYSTEM. USING THE WELL CRITERIA GIVEN OF 65 PSI LINE PRESSURE AND A CASING PRESSURE OF AN AVERAGE OF THE PSI FROM A LOW TO A HIGH, WE CAN MAKE CHART. THIS CHART IS BASED UPON THE RATE OF FLOW ABLE TO PASS THROUGH A GIVEN ORIFICE WITH A GIVEN LINE PRESSURE.

NOTE: REMEMBER THAT THE HIGHER RATES OCCUR DURING THE TIME THE PAAL CASING PLUNGER IS LATCHED AT THE SURFACE IN THE LUBRICATOR. THIS IS WHEN THE VALVE IS ALLOWED TO OPEN.

WE ARE USING 65 PSI AS LINE PRESSURE WITH ALL FLOW GOING TO THIS LINE. THE FLOW RATE IS CALCULATED TO A 1 1/4" ORIFICE. YOU MUST BE CERTAIN TO DEDUCT LINE PRESSURE FROM THESE CASING PRESSURES.

NOTE: LINE PRESSURES ARE NOT NORMALLY CRITICAL WITH A PAAL AS LONG AS THE PLUNGER WELL HAS SUFFICIENT PRESSURE TO LIFT THE LIQUIDS AGAINST THAT PRESSURE.

Flow of Gas (1 1/4" orifice)



THE POTENTIAL VOLUME OF LIQUID THAT CAN BE DELIVERED TO THE GATHERING SYSTEM AT A GIVEN PRESSURE FROM THE WELL FORMATION WITH THE PAAL CASING PLUNGER FOR 4 1/2".

LIQUID VOLUME/CYCLE = (CASING PRESSURE – LINE PRESSURE) X 12.5 IN.²/420 LBS.

. THE 300 PSI CASING PRESSURE WILL LIFT 7.5 BARRELS PER CYCLE. THIS MEANS THE PAAL 4 1/2" CASING PLUNGER WITH 5 CYCLES WILL PRODUCE CLOSE TO 40 BARRELS PER DAY.

WITH 6 CYCLES 45 BBLS/DAY

WITH 7 CYCLES 52 BBLS/DAY

WITH 8 CYCLES 60 BBLS/DAY

THEREFORE:

13 BARRELS OF LIQUID MADE BY A WELL CAN BE REMOVED IN TWO CYCLES AT 300 PSI

OR

4 TO 5 CYCLES AT 150 PSI.

THE POTENTIAL VOLUME OF LIQUID THAT CAN BE DELIVERED TO THE GATHERING SYSTEM AT A GIVEN PRESSURE FROM THE WELL FORMATION WITH THE PAAL CASING PLUNGER FOR 5 1/2".

LIQUID VOLUME/CYCLE = (CASING PRESSURE – LINE PRESSURE) X 19.6 IN.² /420 LBS.

THEREFORE:

300 PSI CASING PRESSURE WILL LIFT 13.9 BARRELS PER CYCLE. THIS MEANS THE PAAL 5 1/2" CASING PLUNGER WITH 5 CYCLES WILL PRODUCE CLOSE TO 69 BARRELS PER DAY.

WITH 6 CYCLES 83 BBL/DAY

WITH 7 CYCLES 97 BBL/DAY

WITH 8 CYCLES 111 BBL/DAY

CONCLUSIONS

THE WELL SHOWN IN THIS EXAMPLE IS CAPABLE OF SUSTAINING A DEFINITE PRODUCTION INCREASE WITHIN THE FIRST WEEK OF THE OPERATION WITH THE PAAL CASING PLUNGER AUTOMATED SYSTEM. IT WILL SHOW AN INCREASE IN LIQUID PRODUCTION FOR A PERIOD OF TIME THAT COULD BE AS LITTLE AS 48 HOURS AND AS LONG AS A WEEK.

THIS WILL THEN DIMINISH AND GAS RATES WILL ACHIEVE A SIGNIFICANTLY HIGHER RATE THAT CAN BE SUSTAINED FOR THE DURATION.

THE LIFESPAN OF THE SYSTEM ON THE WELL IS QUITE EXTENSIVE. THIS IS DUE TO THE FACT THAT THE CURRENT AVAILABLE PRESSURE ON THE WELL IS MORE THAN SUFFICIENT TO HANDLE THE LIQUIDS AND FLOW AGAINST LINE PRESSURE. THIS WILL SHOWS THAT THE SAME LIQUID LOAD CAN BE HANDLED BY THE PLUNGER UNTIL THE WELL PRESSURE DEPLETES TO BELOW 110 PSI.

THIS IS DUE TO THE FACT THAT LESS TIME IS REQUIRED IN NORMALIZATION AT THAT PRESSURE. THIS MEANS MORE CYCLES.

THIS CRITICAL ISSUE THAT IS YET NOT RESOLVED, IS THE CONDITION OF THE CASING ID AND ITS INTEGRITY. THIS SHOULD BE DETERMINED BEFORE ANY FURTHER EXPENDITURES' ARE MADE. SHOULD THE CONDITION OF THE PIPE BE ACCEPTABLE, THE APPLICATION OF THE SYSTEM EQUIPMENT SHOULD BE COMPLETED SEVERAL HOURS AFTER STARTED.

PENDING THAT APPROVAL AND DETERMINATION, THE RESULTS SHOULD BE VERY MUCH A SUCCESS. THAT CRITERIA USED TO DEFINE FOR SUCCESS NEEDS TO BE CLARIFIED PRIOR TO COMMITMENT. THE DEFINITION OF SUCCESS IS NOT THE SAME WITH ALL PEOPLE AND ORGANIZATIONS. THE ABILITY OF THE WELL TO INCREASE PRODUCTION TO ALLOW THE EQUIPMENT AND COSTS TO BE PAID IN 6 TO 9 MONTHS IS A SUCCESS. THIS WELL SHOULD SEE THIS OCCUR IN A SHORTER TIME FRAME.

PLEASE SCORE YOUR RESULTS OF THE EVALUATION OF THE CANDIDATE WELL.

<i>CRITERIA ITEMS</i>	<i>ACCEPTABLE</i>	<i>QUESTIONABLE</i>	<i>UNACCEPTABLE</i>
<i>OIL QUALITY</i>			
<i>WATER</i>			
<i>LINE PRESSURES</i>			
<i>LINE GATHERING CONDITION</i>			
<i>LIFT PRESSURES</i>			
<i>GAS VOLUMES</i>			
<i>LIQUID VOLUMES</i>			
<i>PIPE CONDITION</i>			
<i>CORROSION PROBLEMS</i>			

SCORING A THE WELL FOR A PAAL IS DONE BY APPLYING THE KNOWN ENTITIES OF THE WELL TO THE STANDARDS PROVIDED TO DETERMINE THE WELL'S SUCCESS WITH A CASING PLUNGER.