Melissa Aldridge

PE 325
Well Completions
TAKE HOME Exam 3
Sand Control Completions & Completion Installation

15

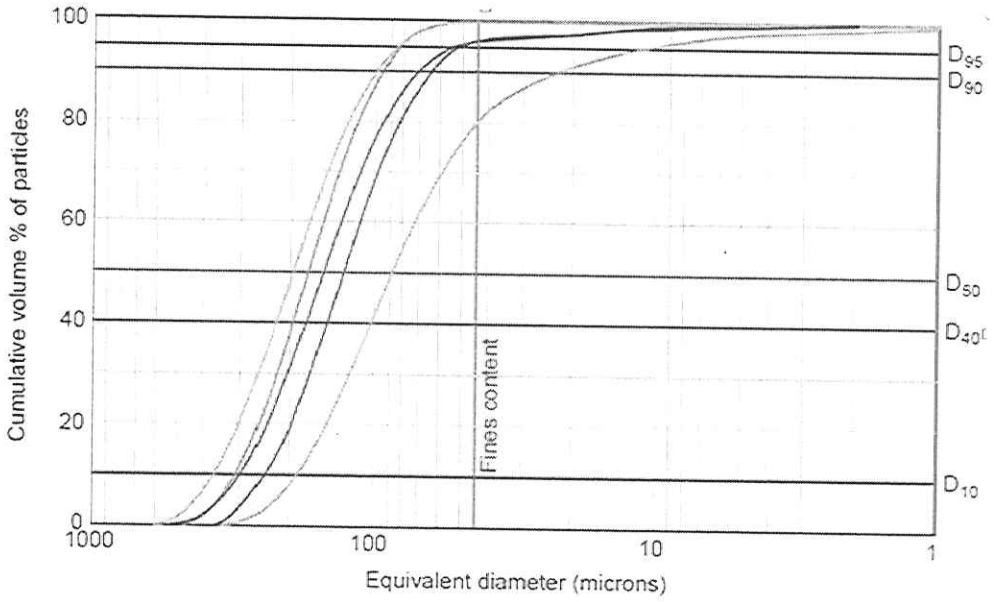
Design a gravel pack completion given the following.

TD 6830 ft
TVD 6820 ft
Openhole through the formation
7" OD, 23 lb/ft production casing set at 6710 ft
The openhole section was drilled with a 5-7/8" roller cone bit

The reservoir formation is expected to be an unconsolidated sand, with the net pay from 6715-6775 ft.

Design a gravel pack completion for this well using either a stand-alone wire wrap screen or a pre-pack screen, hung from the 7" production casing. Use the Baker Hughes document to select an appropriate product.

A laser analysis was performed on several different formation sand samples taken from the well and are shown as follows. You decide to use the data which yields the most conservative answer in sizing the screen openings. Be sure to specify the type of screen, and openings you will use.



Drilling has left the well full of mud. You will need to specify a completion fluid that you feel is appropriate for running the completion. The formation was tested with a shut in pressure of

approximately 3400 psi. BHT is expected to be 260 °F. The well flow tested all oil with a 0.7 b/d PI. You will need to determine a tubing size for the well – one you feel works with the screen specified and maximizes flowrate.

You should prepare a drawing of the completion you will run. Be sure to include at least one packer, a sliding sleeve for circulating the well, one landing nipple (LN) above the packer for pressure testing the tubing, and an SCSSV. YOU DO NOT NEED TO FIND catalogue data and internal diameters....so don't spend time on that unless you really want to.

In your design, be sure to include a brief procedure which details at least the main steps and items used in the completion. Prepare a space out for the completion to be run, and land the SCSSV ~ 500 ft; LN ~ 4000 ft; sleeve ~ 3-4 joints above your packer setting depth.

Typical equipment lengths are:

TRSCSSSV	3.25 ft
WRSCSSSV	2.19 ft
Packer	3.0 ft
Tubing hanger	1.88 ft
Flow coupling	6 ft
Mule shoe/entry guide	0.5 ft
No-go nipple	1.18 ft
Selective nipple	1.05 ft
Side Pocket Mandrel	6.45 ft
Millout extension	23.0 ft
Sliding sleeve	3.0 ft
Stright slot locator	1.39 ft
Perforated Joint	10.0 ft
Travel/Expansion Joint	16 ft
Blast joint	30.0 ft
Screen length	10 ft

Your final project should include (1) a drawing of equipment, neatly labeled with depths, (2) a brief description of the procedure or order in which you will perform the major tasks needed to complete the well, including any fluid displacement, perforating, acidizing, etc. (3) a running tally for the installation spaceout.

Note: If you decided to use actual catalog data for completion equipment ID's, be sure to include that with your project.

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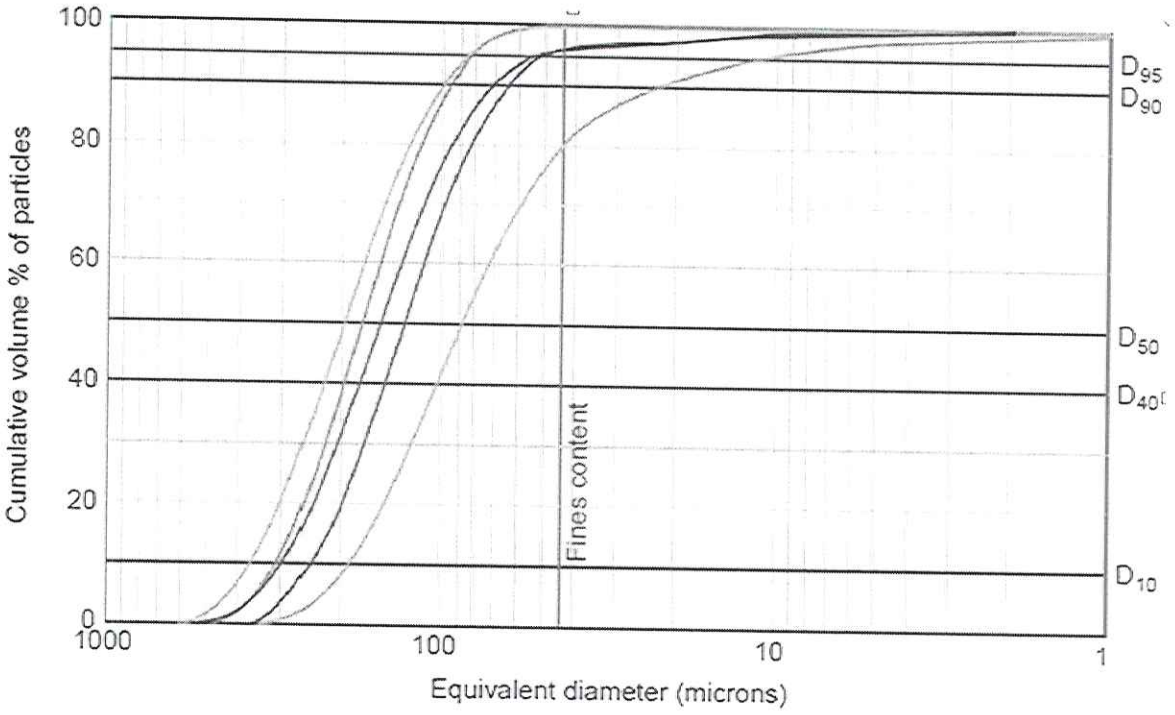
Screen Selection Process

1. The first step in this completion was to choose an appropriate screen system to include in the design. I have chosen to use the BAKERWELD SCREEN SYSTEM for a number of reasons. In this system these screens provide economical, reliable and effective method of preventing gravel-pack sand from entering the tubular and allows production fluid to flow into the well. The wire-wrap design of this screen system has shown to have an inflow area ten times greater than that of the slotted pipe with the same opening size. This will increase the longevity and filtration capacity of the well. These types of screens are constructed with keystone shaped wire and with this type of design, a self-cleaning action for greater flow and less chance of plugging is allowed. It will not separate when pulled or milled because each wire is welded at every point of contact with the underlying rib wire. This provides superior "fishability." In addition, BAKERWELD 105 and 140 screen jackets are welded directly to the base pipe using ASME Section 9 welding procedures and this provides additional strength. This screen is built specifically for oil producing wells, but can be used in gas or water wells as well. The L-80 base pipe offers 45% additional strength over J-55. This enhances specifications such as bending, tensile strength and torque specifications. The premium fit threading provides faster field make-up, tighter bending radius, and greater torque resistance. Because this type of wire-wrap screen is very economical it is often used in conjunction with gravel-packed completions.

Screen Opening Size Selection

2. The first sample chosen from the graph of the Cumulative Volume vs. Equivalent diameter was the sample line on the far right. This is because at the D-10 line the equivalent diameter is approximately 195 microns. This choice is the most conservative answer for the size of screen openings chosen. The type of screen is the lowest value for the type of sand that will be prevented from going through the screen. In the other samples, the highest value is 680 microns which would allow sand to pass through, and this is not desirable. At value D50 and D40 shows a middle value for all samples around 100-200 microns. Since the lowest value was 195 microns with the D10, this is within the range of 100-200 microns and the vector weave is fine. The screen opening size is going to be 150 which correlates with the vector weave size.



Completion Fluid Specifications

3. For the hydrostatic pressure equation P= 0.052 * ρ * h, the drilling mud the density needs to changed in order to switch it to the completion mud density. The calculation is as follows:

what type of fluid?

$$3400 \text{ psi} = 0.052 * \rho * 6830\text{ft}$$

ρ= 9.57 lb/gal

-3

The density value of 9.57 ppg should have from 200-300 psi margin added to it. The final density will be equal to 10.15 ppg. In this case, 200 psi margin was added.

Tubing Size Selection

4. The use of Perform 7.1 program was used to determine appropriate tubing size. Comparison of 3.5 in tubing with 2.875 in tubing was done graphically (see attached) . The determination was made that the 3.5 in tubing had of flow rate of approximately 1500 bbl/day and the flow rate of the 2.875 tubing was approximately 1400 bbl/day. Therefore 3.5 in tubing was chose for the completion.

Rough Running Sheet

5. The requirement for the gravel packing carrier fluid needed to have enough carrying capacity to suspend the gravel and remove the filter cake after the gravel was placed. It also needed to have a low corrosion rate around the sand control screens, since the wells were being completed more than a year before first oil. We should take the pressure setting into consideration as well as the BOP check- up. Finally, cleaning the well is one of the most important parts in doing well completion.

	6775		
32		60	screens
	6715		
	6500		
31		0.5	mule shoe
	6499.5		
30		97.92	Hundrth Joint No 300-298
	6401.58		
29		8	pup Joint
	6393.58		
28		3	packer
	6390.58		
27		6	flow coupling
	6384.58		
26		34.44	Tubing joint No 297
	6350.14		
25		8	pup Joint
	6342.14		
24		1.39	Stright slot locator
	6340.75		
23		8	pup Joint
	6332.75		
22		3	packer
	6329.75		
21		3	sliding Sleevs
	6326.75		
20		236.45	Hundrth Joint No 296-290
	6090.3		
19		8	Pup Joint
	6082.3		
18		3	packer
	6079.3		
17		8	pup Joint
	6071.3		
16		3	sliding Sleevs
	6068.3		
15		3006.07	Hundrth Joint No 289-

			201
	3062.23		
14		8	Pup Joint
	3054.23		
13		1.05	Landing Nipple
	3053.18		
12		8	pup Joint
	3045.18		
11		6	flow coupling
	3039.18		
10		6	pup Joint
	3033.18		
9		2519.31	Hundrth Joint No 200-126
	513.87		
8		8	pup Joint
	505.87		
7		1.05	Landing Nipple
	504.82		
6		6	pup Joint
	498.82		
5		2.19	wrscsssv
	496.63		
4		6	pup Joint
	490.63		
3		418.75	Hundrth Joint No 125-114
	71.88		
2		6.42	pup Joint
	65.46		
1		62.45	tubing joint No113-112
	3.01		
		2	pup Joint
	1.01		
		1.88	Tubing hanger
	0		

OTIS COMPLETION GUIDE

OEC-217-E

OTIS ENGINEERING CORPORATION

A HALLIBURTON Company

PREPARED FOR	COMPANY	TELEPHONE	DATE	
FIELD NAME	WELL NAME	COUNTY	STATE	☐ NEW ☐ COMPLETION ☐ WORKOVER
CASING SIZE	WEIGHT	GRADE	THREAD	DEPTH
LINER SIZE	WEIGHT	GRADE	THREAD	DEPTH
TUBING SIZE UT	MT	LT	THREAD	

DESCRIPTION	I.D.	O.D.	LENGTH	ESTIMATE OR DEPTH

TOTAL ESTIMATE

PREPARED BY	OFFICE	TELEPHONE