Calculating Annular Volume of Casing to Perform Cementing Operations

The purpose of these instructions is to learn how to use BJ Services Engineering Handbook cd in order to calculate the annular volume of the casing in a well. The annular volume is used to calculate the amount of sacks of cement needed to fill the annular space. These calculations are usually performed using a hardcopy of the handbook and calculator. Using the cd Handbook, it is much easier and faster to calculate the annular volume because of minimized search time and faster calculation of the answer.

Key Terms:
Annular Volume – The area between either casing - casing or casing – open hole, represented as shaded area on diagram. Represented as cubic feet per foot.

Cement Yield – Amount of cubic feet 1 sack of cement will equal after the addition of additives and water. Represented as sacks per cubic feet.

Engineering Handbook – Common oil-field manual listing several important conversions used for everyday drilling operations.

Ideal Fill-up – Expected minimum amount of cement needed to fill the hole.

Equipment Needed:
Computer
Calculator
Pencil
BJ Services Engineering Handbook CD
1. Preparing to Search for Annular Volumes
   1. Click on icon labeled BJ eEHB on computer desktop.
   2. Under “Select a Topic” heading expand the capacity section by clicking on the plus (+) sign near the left of the word.
   3. Repeat same expanding process by clicking on “Annular” section.

2. Determining Casing in Casing Annular Volume
   1. First, expand the “Pipe in Pipe” section.
   2. Look up the sizes of the Inner Casing String and the Outer Casing String; note the weight of the outer casing string also.
   3. Click on the size of the Inner Casing string from the list.
   4. Scroll as needed to find the size of the Outer Casing String (far left column).
   5. Once the Outer Casing String Size is found, go to the row with the proper weight of the casing.
   6. Click on the proper box in the column labeled “CuFt Per LnFt” and a box should appear near the bottom of the screen.
   7. Enter the height of the Outer Casing String in the left hand side of the box and a number will be calculated on the right. This number is the Annular Volume of the annulus in cubic feet.

3. Determining Casing in Open Hole Annular Volume
   1. First, minimize the “Pipe in Pipe” section, and then expand the “Pipe in Hole” section.
   2. Repeat Steps 2-8 above using the open hole size instead of the Outer Casing String; note that weight is not needed for the open-hole section.

4. Determining the Amount of Cement Needed
   1. Add the two numbers that were calculated from both sections in order to attain the total annular volume of the hole.
   2. Divide this number by the cement yield to determine the ideal amount of cement needed to fill the hole.
Congratulations! You have calculated the ideal amount of cement needed to cement the well. This number will be used to order the cement from the service company. If any problems arose or numbers look larger or smaller than they should, start over and be sure to carefully select the proper column and conversion factor.
**Sample Well**

A well in Washington County needs to be cemented. Since the area has been drilled very heavily, it is known that only the ideal amount annular fill-up is needed. Below is the Drilling and Casing Program for the well:

- **Outer Casing String** – 9 5/8”, 32#/ft., Set @ 5000’
- **Inner Casing String** – 13 3/8”, 54.5#/ft., Set @ 1000’
- The open hole section was drilled with a 12 1/4” bit, there is 4000’ of open hole section.
- The cement to be used has a yield of 1.18 ft³/sack.

Calculate the annular ideal fill-up of this well to be cemented.

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