**Stuck Pipe Calculation**

**Determine the feet of free pipe and the free point constant**

**Method 1**

The depth at which the pipe is stuck and the number of feet of free pipe can be estimated by the drill pipe stretch table below and the following formula.

**Drill Pipe Stretch Table**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **ID inch** | **Nominal Weight (lb/ft)** | **ID inch** | **Wall Area (sq. in)** | **Stretch Constant in/1000 lb**  **/1000 ft** | **Free Point Constant** |
| 2-3/8 | 4.85 | 1.995 | 1.304 | 0.30675 | 3260.0 |
|  | 6.65 | 1.815 | 1.843 | 0.21704 | 4607.7 |
| 2-7/8 | 6.85 | 2.241 | 1.812 | 0.22075 | 4530.0 |
|  | 10.40 | 2.151 | 2.858 | 0.13996 | 7145.0 |
| 3-1/2 | 9.50 | 2.995 | 2.590 | 0.15444 | 6475.0 |
|  | 13.30 | 2.764 | 3.621 | 0.11047 | 9052.5 |
|  | 15.50 | 2.602 | 4.304 | 0.09294 | 10760.0 |
| 4.0 | 11.85 | 3.476 | 3.077 | 0.13000 | 7692.5 |
|  | 14.00 | 3.340 | 3.805 | 0.10512 | 9512.5 |
| 4-1/2 | 13.75 | 3.958 | 3.600 | 0.11111 | 9000.0 |
|  | 16.60 | 3.826 | 4.407 | 0.09076 | 1017.5 |
|  | 18.10 | 3.754 | 4.836 | 0.08271 | 12090.0 |
|  | 20.00 | 3.640 | 5.498 | 0.07275 | 13745.0 |
| 5.0 | 16.25 | 4.408 | 4.374 | 0.09145 | 10935.0 |
|  | 19.50 | 4.276 | 5.275 | 0.07583 | 13187.5 |
| 5-1/2 | 21.90 | 4.778 | 5.828 | 0.06863 | 14570.0 |
|  | 24.70 | 4.670 | 6.630 | 0.06033 | 16575.0 |
| 6-5/8 | 25.20 | 5.965 | 6.526 | 0.06129 | 16315.0 |

Sample Case : 3-1/2 inch- 13.30 lb/ft drill pipe  
 20 inch of stretch with 35,000 lb of pull force

From drill pipe stretch table :

Free point constant = 9052.5 for 3-1/2 inch drill pipe 13.30 lb/ft

**Determine free point constant (FPC)**

The free point constant can be determined for any type of steel drill pipe

the outside diameter (inch) and inside diameter (inch) are known :

FPC = AS x 2500

Where ;

AS = pipe wall cross sectional area (sq in.)

Sample Case 1 : From the drill pipe stretch table :  
 4-1/2 inch drill pipe 16.6 lb/ft — ID = 3.826 inch

FPC = (4.52 - 3.8262 x 0.7854) x 2500

= 4.407 x 2500

= 11,017.5

Sample Case 2 : Determine the free point constant and the depth the pipe is

stuck using the following data :

2-3/8 inch tubing — 6.5 lb/ft — ID = 2.441 inch  
25 inch of stretch with 20,000 lb of pull force

a. Determine free point constant (FPC):

FPC = (2.8752 - 2.4412 x 0.7854) x 2500

= 1.820 x 2500

= 4530

b. Determine the depth of stuck pipe :

**Method 2**

Where :

e = pipe stretch (inch)

Wdp = drill pipe weight (lb/ft) (plain end)

Plain end weight (lb/ft) is the weight of drill pipe excluding tool joints:

Weight (lb/ft) = 2.67 x pipe OD2 inch — pipe ID2 inch

Sample Case : Determine the feet of free pipe using the following data :  
 5.0 inch drill pipe ; ID — 4.276 inch ; 19.5 lb/ft  
 Differential stretch of pipe = 24 inch  
 Differential pull to obtain stretch = 30,000 lb

Weight (lb/ft) = 2.67 x (5.02 - 4.2762)

= 17.93 lb/ft

**Determine the height (ft) of unweighted spotting fluid that will balance formation pressure in the annulus :**

a. Determine the difference in pressure gradient psi/ft between the mud

weight and the spotting fluid :

*psi/ft = [(mud wt (ppg) — spotting fluid wt (ppg)] x 0.052*

b. Determine the height (ft) of unweighted spotting fluid that will balance

formation pressure in the annulus :

Sample Case : Use the following data to determine the height (ft) of

Spotting fluid that will balance formation pressure in the

annulus :

Data : Mud weight = 11.2 ppg  
 Weight of spotting fluid = 7.0 ppg  
 Amount of overbalance = 225.0 psi

a. Difference in pressure gradient (psi/ft):

psi/ft = (112 ppg — 7.0 ppg) x 0.052

= 0.2184

b. Determine the height (ft) of unweighted spotting fluid that wi1 balance

formation pressure in the annulus :

Height (ft) = 225 psi ÷ 0.2184 psi/ft

= 1030 ft

Therefore : Less than 1030 ft of spotting fluid should be used to maintain

a safety factor to prevent a kick or blow out