**Hydraulicing Casing**

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These calculations will determine if the casing will hydraulic out (move upward) when cementing

**Determine the difference in pressure gradient (psi/ft) between the cement and the mud**

psi/ft = [(cement wt (ppg) — mud wt (ppg)] x 0.052

**Determine the differential pressure (DP) between the cement and the mud**

DP (psi) = difference in pressure gradient (psi/ft) x casing length (ft)

**Determine the area (sq in.) below the shoe**

Area (sq in.) = casing diameter2 inch x 0.7854

**Determine the Upward Force (F)(lb). This is the weight total force, acting at the bottom of the shoe**

Force = area (sq in.) x differential pressure between cement & mud (psi)  
(lb)

**Determine the Downward Force (W)(lb). This is the weight of the casing**

Weight (lb) = casing wt (lb/ft) x length (ft) x buoyancy factor

**Ðetermine the difference in force (lb)**

Differential force (lb) = upward force (lb) — downward force (lb)

Pressure required to balance the forces so that the casing will not hydraulic out (move upward)

Psi = force (lb) ÷ area (sq in.)

**Mud weight increase to balance pressure**

New mud weight (ppg)

Mud wt (ppg) = mud wt increase (ppg) ÷ mud wt (ppg)

**Check the forces with the new mud weight**

a. psi/ft = [(cement wt (ppg) — mud wt (ppg)] x 0.052  
b. psi = difference in pressure gradients (psi/ft) x casing length (ft)  
c. Upward force (lb) = pressure (psi) x area (sq in.)  
d. Difference in force (lb) = upward force (lb) - downward force (lb)

Sample Case : Casing size = 13-3/8 inch - 54 lb/ft  
 Cement weight = 15.8 ppg  
 Mud weight = 8.8 ppg  
 Buoyancy factor = 0.8656  
 Well depth = 164 ft (50 m)

**Determine the difference in pressure gradient (psi/ft) between the cement and the mud**

psi/ft = (15.8 — 8.8) **x** 0.052

= 0.364

**Determine the differential pressure between the cement and the mud**

psi = 0.364 psi/ft x 164 ft

= **60**

**Determine the area (sq in.) below the shoe**

Area (sq in.) = 13.3752 x 0.7854

= 140.5 sq in.

**Determine the upward force. This is the total force acting at the bottom of the shoe**

Force (lb) = 140.5 sq in. x 60 psi

= 8430 lb

**Determine the downward force. This is the weight of the casing**

Weight (lb) = 54.5 lb/ft x 164 ft x 0.8656

= 7737 lb

**Determine the difference in force (lb)**

Differential force (lb) = downward force (lb) — upward force (lb)  
Differential force (lb) = 7137 lb — 8430 lb  
 = — 693 lb

Therefore : Unless the casing is tied down or stuck it could possibly

hydraulic out (move upward)

**Pressure required to balance the forces so that the casing will not hydraulic out (move upward)**

Psi = 693 lb + 140.5 sq in.

= 4.9

**Mud weight increase to balance pressure**

Mud wt (ppg) = 4.9 psi ÷ 0.052 ÷ 164 ft

= 0.57 ppg

**New mud weight (ppg)**

New mud wt (ppg) = 8.8 ppg + 0.6 ppg

= 9.4 ppg

**Check the forces with the new mud weight**

a. psi/ft = (15.8 — 9.4) x 0.052  
 = 0.3328

b. psi = 0.3328 psi/ft x 164 ft  
 = 54.58

c. Upward force (lb) = 54.58 psi x 140.5 sq in.  
 = 7668 lb

d. Differential force (lb) = downward force (lb) — upward force (lb)  
 = 7737 lb - 7668 lb  
 = + 69 lb