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Memorandum (This sample assignment is followed by a sample memo.)

To: Fluids Dept. Staff

From: Roger Wallace, Dept. Manager

Date: 11/4/2002

Re: Application of the hydrostatic equations

Request for information

Sarah Chen, from Contracts & Specifications, has received an RFP (request for proposal) for a new line of ultra-light tanks. These tanks will be used in an experiment that determines how high a jet of buoyant fluid will rise through a static fluid that is stratified (fluid density increases with depth). She knows we have been running experiments at our hydraulic benches to determine the forces and pressures acting on the walls of smaller tanks using fresh water. She wants to know whether the equations we have used in our experiments would also be appropriate in determining the forces and pressures acting on the walls of these new tanks.

These tanks are to be 5ft (l) x 3ft (w) x 5ft (h). In this experiment the tank is filled with salt water. The water's specific gravity varies linearly over the 5ft depth from 1.025 at the bottom of the tank to 1.000 at the surface.

Your assignment

Please draft a memo to Sarah that addresses the following:

1. Would it be appropriate to use the equations for force and pressure employed in our current experiments in the new design as well? Explain why or why not. If not, can you suggest an alternative. In either case, determine whether this new situation presents conditions that violate assumptions made in development of the equations you have been using and explain the significance of any such violation.

2. Remember that Sarah is not an engineer and she likes her memos concise (1 page maximum) and in plain, correct English. Nonetheless, make sure your information is technically sound. She *will* have it checked. Remember the flak we took for those sloppy calculations we sent her last year; they caused a two-week delay in completing a proposal.

3. Use this company-standard memo format.

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- ***The writer summarizes her conclusions in the first sentence.***
- ***She identifies the reasons for her answer being something other than a straight "yes" or "no."***
- ***She then uses a list to detail her conclusions.***
- ***She even uses the subject line to identify the specific topic.***

Memorandum

November 6, 2001

To: Sarah Chen
From: XXX , Laboratory Manager
Re: Application of the hydrostatic equations to your tank design

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The equations we have used for predicting the forces and pressures on submerged planar surfaces *might or might not* satisfy your current testing requirements. The applicability of these equations depends upon the precise degree of differences between the system you propose and the setup we have used in the laboratory, as well as the degree of accuracy you require.

The problem is two-fold.

1. Our equations for predicting pressure (p_c = pgH) and force ($F = p_cA$) depend on the fluid having a constant density, which is the case in our freshwater system. Your system uses salt water, which introduces linearly varying density. This varying density (in your system from 1.025 to 1.000) might cause an error of ~2%.

2. The equations our laboratory has been working with are dependent on a static system. Your system may not be truly static since it involves a jet that may produce fluid movement and acceleration in the previously static layers of salt water. If such movement occurs, then your system could violate a key assumption used in our equations, and these equations may no longer be accurate predictors.

By using the maximum density of the salt water, we can calculate the force acting on each tank face. Please note that these numbers will be slightly larger than the actual forces felt on each face. However the precise effect of the jet remains unclear since we do not know its size or position in the tank. If the jet in your system is quite small, or is localized, then our equations might still yield a useful estimate of the pressures and forces your tanks will experience. The attached calculations support these conclusions.

Please contact me at extension 165 if you wish further information.

- ***Notice that the style is less formal than in a lab report.***

Encl.

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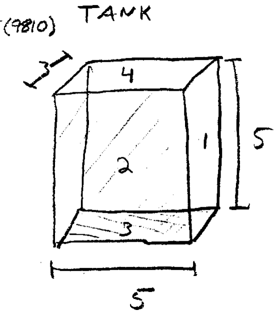
Estimated Values:

Assume: Static fluid; constant $\gamma_{salt\ water} = 1.025(9810)$

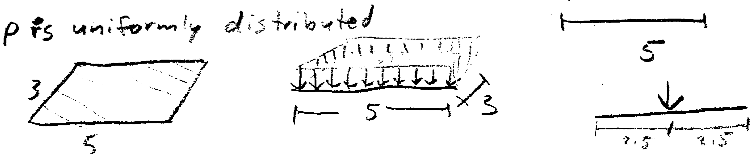


pressure on Top face (4) is 0

∴ Force on Top face = 0

pressure on bottom face:

p is uniformly distributed



h = depth to bottom plane = 5m

$p = (\gamma_{saltwater})(h)$

$p = (10055.25\ \mathrm{N/m^3})(5m)$

$p = 50276\ pa$

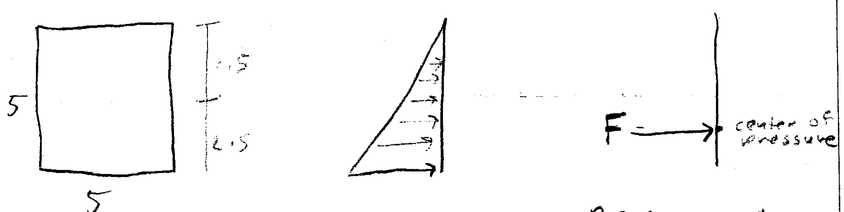
$p = 50.28\ Kpa$

$F = p(A)$

$F = (50.28)(3)(5)$

$F = 754.2\ KN$

pressure on front face



p_c = pressure at center of pressure

$\bar{h}$ = depth to center of pressure.

$p_c = \gamma_{salt\ water}(\bar{h})$

$p_c = (10055.25\ \mathrm{Kg/m^3})(5/2)$

$p_c = 25138.125$

$p_c = 25.13\ Kpa$

A = Area over wich pressure acts

$F = p_c A$

$= 25.13(5)(5)$

$F = 628.25\ KN$

Pressure on back face = Pressure on front ∴ = 628.25 KN

Pressure on side face

$p_c = \gamma_{salt\ water}(\bar{h})$

$p_c = (10055.25)(2.5)$

$p_c = 25.13\ Kpa$

$F = p_c(A)$

$F = 25.13(5)(3)$

$F = 376.95\ KN$

note: The other side face has the same Forces