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Recommendations

Buoyancy Calculations for Concrete Ballast

SCOPE

This recommendation is intended to help determine the amount of uplift created by water table and the amount of ballast in cubic yards of concrete required to offset that uplift.

Example: 48" dia. x 120" deep basin holds 940 gallons. The basin displaces 940 gallons of water when installed with water table to the top of the ground.

$$940 \text{ gal} \times 8.33 \text{ (weight of water)} = 7,830.2 \text{ lbs uplift}$$

Weight of concrete:	137.3 lbs per cu ft
Weight of water:	- <u>62.4</u> lbs per cu ft
Equivalent weight of concrete under water:	74.9 lbs per cu ft

Concrete ballast required to keep basin anchored in the ground:

$$\frac{7,830.2 \text{ lbs uplift}}{(74.9 \times 27) 2,022.3 \text{ lbs /cu yd}} = 3.87 \text{ yards} \times \text{SF of } 1.2 = 4.64 \text{ cu yd concrete}$$

Complete Formula:

$$\frac{(\text{Basin gallons}) \times 8.33}{2,022.3 \text{ lbs per cu yd}} = (\text{Cu yd}) \times \text{SF } (1.2) = \text{Cu yd concrete}$$

Constants:

- Water = 8.33 pounds per gallon
- Water = 62.42 pounds per cubic foot
- Concrete above ground has a SG of 2.2 (Ref. Machinery's Handbook)
- Concrete above ground weighs 137.324 pounds per cubic foot
- Concrete equivalent ballast under water = 74.9 lbs per cu ft. (2,022.3 lbs per cu yd)

Factors not considered:

- Weight of basin
- Weight of cover
- Weight of piping, pumps and accessories
- Shear strength and weight of soil around anti-float ring
- Water level inside basin
- Design assumes that the basin will fill with water if tank should ever become flooded

Installation Notes:

- Concrete backfill must be poured evenly around the basin and in no more than 12 inch lifts per curing cycle.
- Concrete backfills of greater than 12 inches per curing cycle run the risk of collapsing the basin.
- Fiberglass basins are designed to be buried with the top of the basin at ground level. The backfill is required to have a minimum soil modulus of 700. This soil modulus, or soil support, adds strength to the basin wall enabling it to withstand hydrostatic loads of water table.
- Concrete in its liquid state has no modulus and with a SG of 2.2 is over 2 times the weight of water. Remember, the basin is not designed to withstand water table or water backfill without the added support of soil modulus. Therefore any concrete backfill should be handled with care. It must be evenly distributed around the basin in pours of no more than 12 inches at a time and allowed to set. Once the concrete has set, the basin wall support has been established and it is ok to continue the next pour.
- Please note that this procedure is the same as the "Recommended Basin Install Instructions" laminated to the wall of the basin. Under Backfill Requirements, number two states "Place backfill material in 12" lifts around the basin and compact to 700 soil modulus."
- Additional factor: When making first concrete pour, basin must be filled with water or other ballast which is equal to the weight of concrete if it were displacing the first 12 inches of the inside of the basin. Otherwise, basin lift may occur. If filling with water, that would be 2.2 times the volume of concrete.