

## WHITE PAPER

# Proper Feeding of a Submersible Pump

### Introduction

Submersible pumps are similar to children. They need to be properly fed. When a submersible pump is installed in a manner which does not permit free flow into the eye of the impeller, the pump may not perform as expected.

### Adverse Performance

ANSI/HI 9.8 Pump Intake Design standard identifies several phenomena that can adversely affect pump performance (9.8.1). These include submerged and free-surface vortices, pre-swirl, non-uniform distribution of velocity at the impeller eye and entrained air or gas bubbles.

These phenomena can be minimized or eliminated if care is taken to ensure the pumps are properly fed. In order for the wastewater to flow freely into the pump suction, sufficient space must be provided between pumps, between pumps and the basin wall and between the pump suction and basin floor. Failure to allow minimum clearances can cause the wastewater to flow in a “non-uniform” manner into the impeller eye, resulting in decreased performance and pump life.

### Pump Placement

ANSI/HI 9.8 gives direction as to proper pump placement in terms of floor clearance, pump to pump clearance, pump to basin wall clearance and basin size. Paragraph 9.8.2.3.2.2 recommends floor clearance (Cf) to be between .3 and .5 the pump volute or suction bell diameter (Db). Excessive floor clearance can lead to stagnant zones where solids may be left behind. Insufficient floor clearance may cause increased inlet head loss and flow separation. Too little clearance may also induce submerged vortices at the inlet, which negatively impacts pump performance.

Often times the pump manufacturer is asked if a certain pump model can be “squeezed” into a given sump diameter. Although the pumps and piping may mechanically fit into the wet well, consideration must be given to minimum clearance requirements between the pump volutes and between pumps and the basin wall. Clearance between pump volutes (Cb) is given in paragraph 9.8.2.3.2.4 as a minimum of .25 times the volute diameter (Db), but at least 4”. Minimum wall clearance (Cw) is also given in paragraph 9.8.2.3.2.3 as .25 times the volute diameter, but not less than 4”.

### Submergence

Surface vortices can be caused by insufficient pump submergence. When a surface vortex is formed, air can be drawn into the pump which results in reduced performance and may lead to cavitation and vibrations. Paragraph 9.8.6.3 indicates the minimum submergence in inches can be calculated as  $S = D + .574 * Q / D^{1.5}$ , where S is in inches, D is the suction inlet diameter and Q is the flow in GPM.

### Basin Size

Basin sizing traditionally considers such factors as peak flow and emergency storage, (Submersible Sewage Pumping Systems Handbook, Chapter 2). It is clear from ANSI/HI 9.8 standard, that the basin must be sufficiently large to not



only accommodate the pumps and piping, but allow for clearance between the pumps and between the pumps and the basin wall. Figure 9.8.4 1A from ANSI/HI 9.8 calculates minimum basin diameter ( $D_{\text{min}}$ ), for pumps mounted off of the basin center line as  $2.5 \cdot D_b + 2 \cdot C_w + C_b$ . Figure 9.8.4 1B calculates minimum basin diameter ( $D_{\text{min}}$ ), for pumps mounted on the basin center line as  $2 \cdot D_b + 2 \cdot C_w + C_b$ .

#### Summary

For submersible wastewater pumps to operate efficiently and to preclude additional maintenance and repairs, they must be properly fed. Following ANSI/HI 9.8 guidelines will help to ensure they never go hungry.

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