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TECHNICAL INFORMATION
Bulletin

NUMBER ONE

GENERAL RECOMMENDATIONS
On Sump Design for Obtaining Optimum Performance from Pumps

"Something is wrong with the pump –
it is pulling in slugs of air."

That remark is frequently made when a poor sump design has caused flow patterns which result in the formation of vortexes. A poor sump design will not only require abnormal submergences to overcome these vortexes, but can also cause cavitation and detrimentally affect pump performance. In many cases the pumps are blamed for something that cannot be controlled in the design of the pumps. The best sump design appears to be also the most economical sump design in that it will insure maximum operating values for the pumping equipment installed.

Factors of good and bad sump design are presented here in a simple diagramatic manner. This *is* a pictorial conclusion of various investigations made by the University of California, Peerless Pump, and others. Until recently, little information was available on sump design, and many features of sump layouts still require additional study. Often the analysis of a given sump design can only be made by testing of a scale model of the sump itself.

1. Whenever possible, make sump layout arrangements per the principles illustrated as shown on page 2 under recommended sump designs. The fundamental element *is* that the water should enter the pump chamber with a m101mum of turbulence.

2. Sump designs, which are not recommended, are shown at the bottom of page 2. Avoid arrangements that will make sudden changes in the direction of flow of water to the pumps. Walls, pump columns, channel openings, etc., can disturb the flow.

3. The configuration of the sump floor should be such that abrupt changes occur at least five diameters from the side of the pump. The more distance from the pump to the change in contour the better. See sketches at the top of page 3.

4. Water must be flowing parallel to the sump walls when it reaches the pump. See sketches at right of page 3.

5. Avoid columns and cross braces in the sump ahead of pump whenever possible. Streamline sump structural supports.

6. A sump design velocity of **1** foot per second at minimum water level is good practice. If some elements of good practice must be violated in a given sump design, the detrimental effects may be reduced by lowering the velocity of flow in the sump.

RECOMMENDED SUMP DESIGNS

Recommended sump designs are illustrated in these diagrams. Whenever possible, make sump layout arrangements in accordance with principles illustrated.

The fundamental requirement is that the water should enter the pump chamber with a minimum of turbulence and at a low velocity.

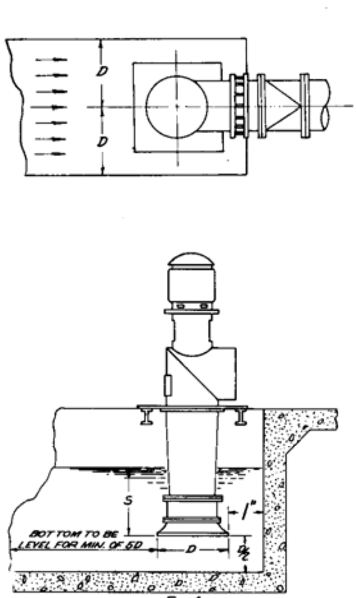


Fig. 1
Recommended Sump Design

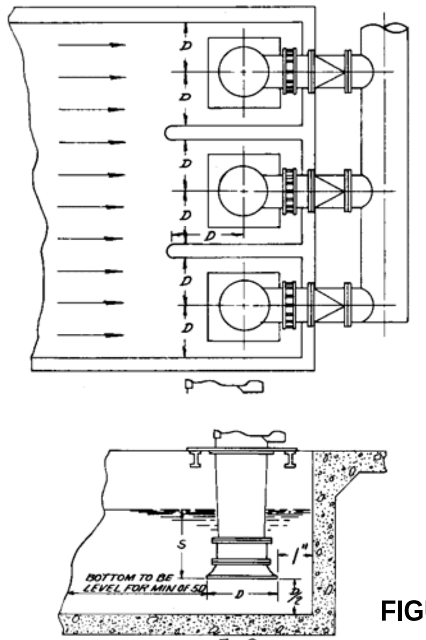


Fig. 2
Recommended Sump Design

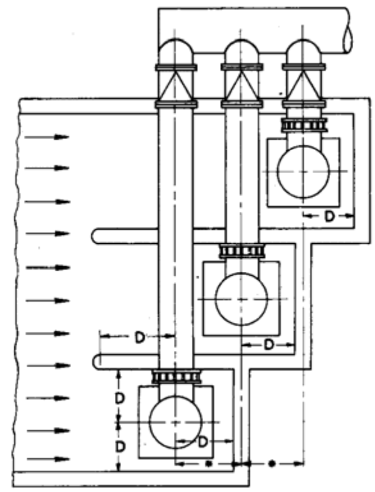
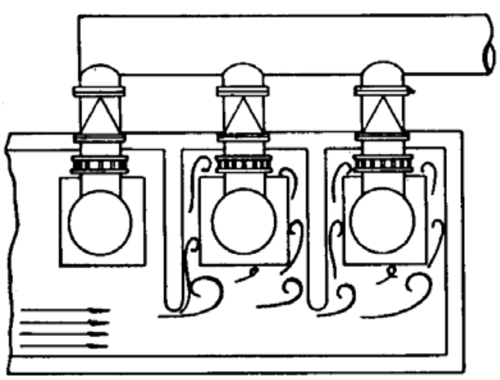
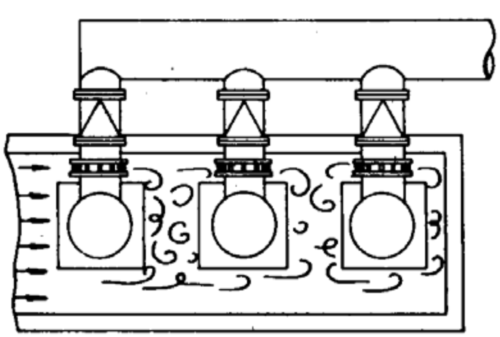
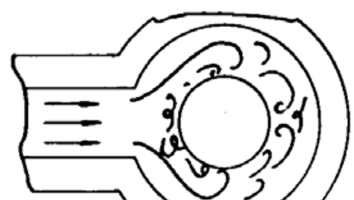


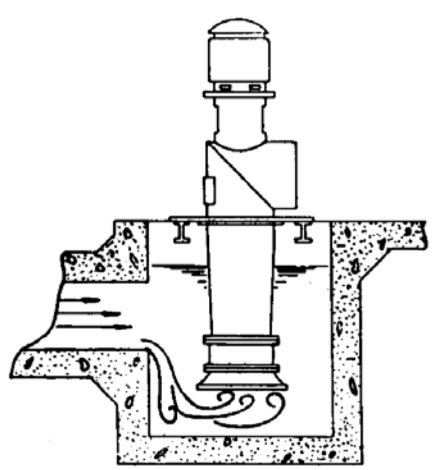
FIGURE 3 RECOMMENDED SUMP DESIGN

SUMP DESIGNS TO BE AVOIDED

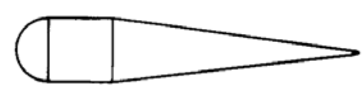




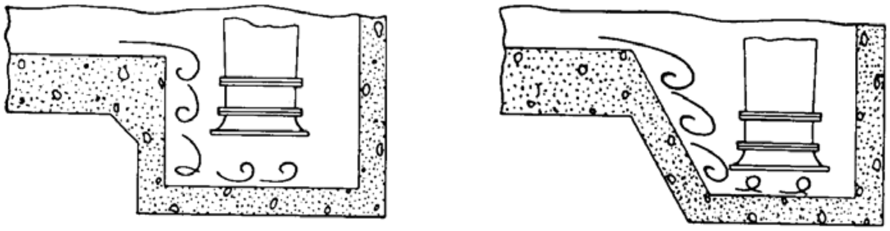




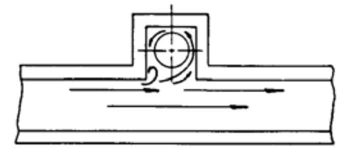
Sump designs which are not recommended are shown in these diagrams. Design arrangements which make sudden changes in the direction of Row of water to the pump are to be avoided. Walls, pump columns, channel openings, etc., can disturb the flow.



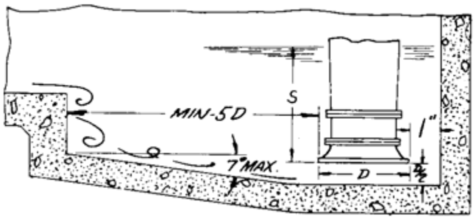
Avoid columns and cross braces in the sump ahead of pumps whenever possible. Streamline the sump structural supports as shown.



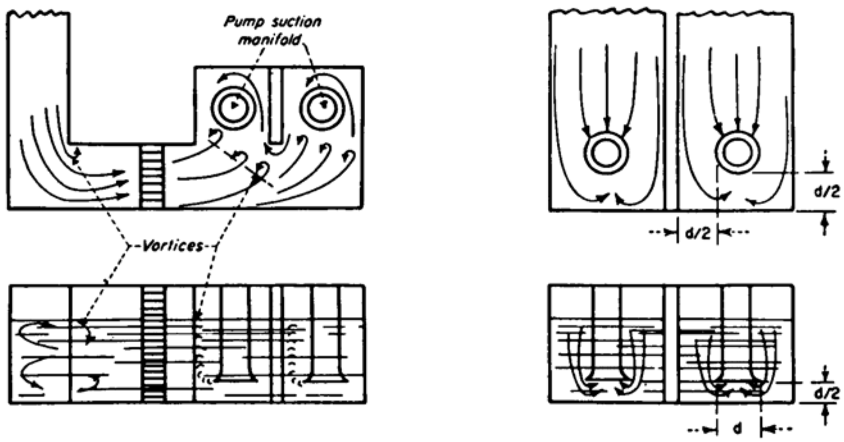
CAVITATION, LOSS OF CAPACITY, NOISY OPERATION and high maintenance expense, due to excessive wear, will result from steep "drop-offs" in approach channels as shown above.



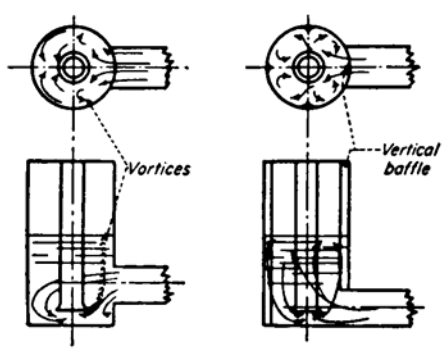
SHARP OR ABRUPT BENDS and restricted areas adjacent to the pump intake invariably cause turbulence with corresponding reduction in efficiency.



The configuration of the sump floor should be such that abrupt changes occur at least five diameters from the side of the pump. The more distance from the pump to the change in contour, the better the pump suction entrance conditions.

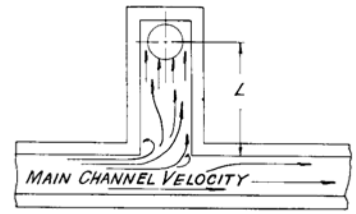


BENDS IN APPROACH CHANNELS to the sumps of large sewage pumps (left) caused serious disturbances of flow and induced vortices that reduced the efficiency of the pumps. A better layout is shown at the right.



A SIDE INLET above the bottom of the circular sump of an irrigation pump resulted in turbulence and vortices.

A sump designed for water velocity of 1 foot per sec. at minimum water level is good practice. If some elements of good practice must be violated in a given sump application, the detrimental effects may be usually reduced by lowering the velocity of flow in the sump.



MAXIMUM MAIN CHANNEL VELOCITY	PUMP CAPACITY GPM	RECOMMENDED MINIMUM "L"
2' /SEC.	5,000	9 FEET
2' /SEC.	10,000	13 FEET
2' /SEC.	20,000	18 FEET
2' /SEC.	30,000	22 FEET
2' /SEC.	50,000	28 FEET
2' /SEC.	100,000	39 FEET
2' /SEC.	150,000	46 FEET
4' /SEC.	5,000	11 FEET
4' /SEC.	10,000	16 FEET
4' /SEC.	20,000	22 FEET
4' /SEC.	30,000	27 FEET
4' /SEC.	50,000	34 FEET
4' /SEC.	100,000	47 FEET
4' /SEC.	150,000	59 FEET

Recommended sump design when flow is parallel to sump walls.

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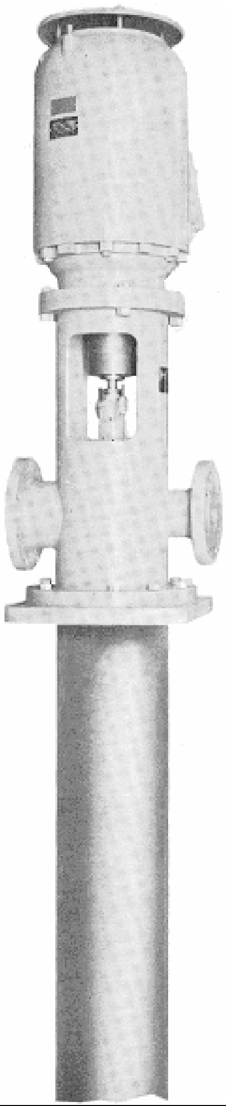

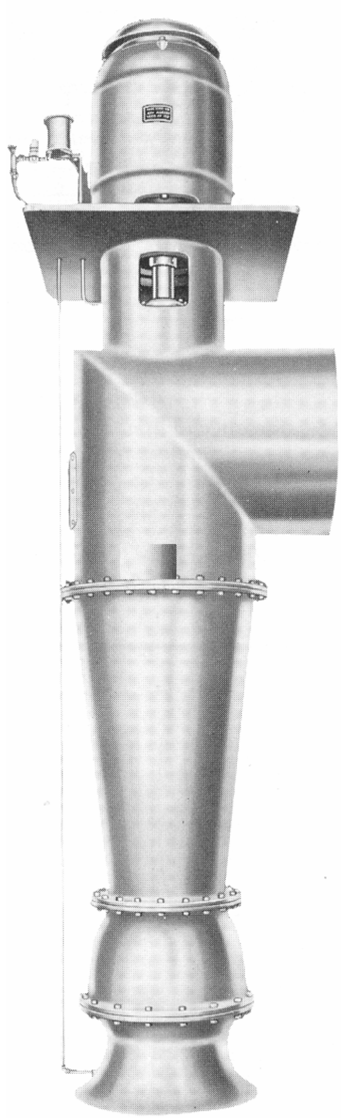

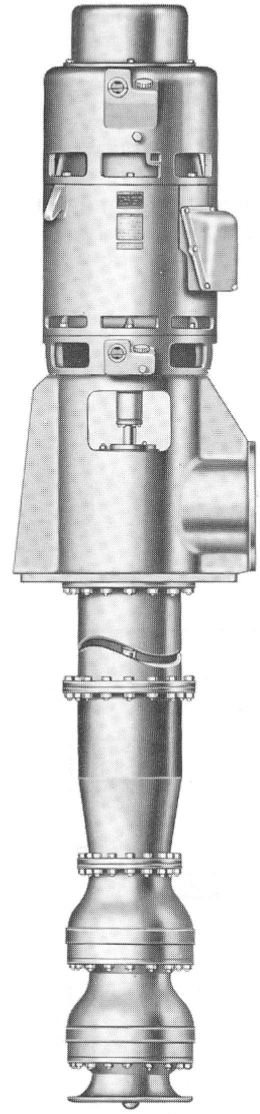

HYDRO-LINE CAN TYPE PROCESS PUMP	**HYDRO-FOIL**	**VERTICAL INDUSTRIAL PROCESS SERVICE PUMP**
Type: Vertical, encased, close-coupled, single or multi-stage centrifugal Described in Bulletin No. B-3400 ***CAPACITIES:*** Up to 3000 gpm ***HEADS:*** Up to 1000 gpm ***DRIVES:*** As required. Standard vertical solid shaft or explosion-proof motors; steam turbine ***LIQUID TEMPERATURE:*** Up to 400°F Especially designed for systems with low available NPSH (net positive suction head)	***Type:*** Single and multi-stage propeller and mixed-flow Described in Bulletin No. B-300 ***CAPACITIES:*** 600 to 220,000 GPM ***HEADS:*** 2 to 60 feet ***DRIVES:*** Direct-connected hollow shaft or solid shaft electric motors, belt and right angle gear drive from stationary engines. ***APPLICATION:*** Drainage, flood control, circulating, industrial wastes; pumping from lakes, rivers, reservoirs, canals, etc. ***LIQUID TEMPERATURE:*** Choice of oil or water lubrication	***Type:*** Vertical, close coupled, single or multi-stage, centrifugal Described in Bulletin No. B-100 ***CAPACITIES:*** Up to 1400 gpm ***HEADS:*** Up to 300 psi ***LIQUIDS HANDLED:*** Hydrocarbons, volatile liquids, chemical solutions, etc. ***APPLICATION:*** Transfer service, pumping from tanks and vessels ***MATERIALS OF CONSTRUCTION:*** Any machinable alloy or application and liquid being pumped.