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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 diagrammatic 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 minimum 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 pumps 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.

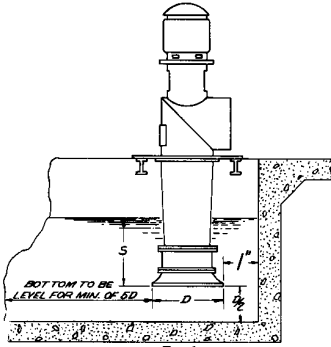
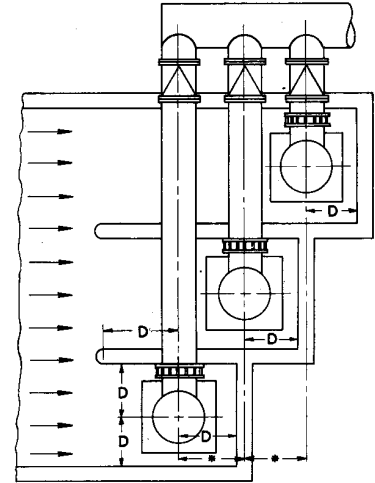
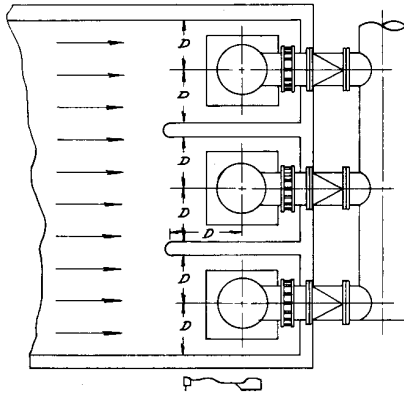
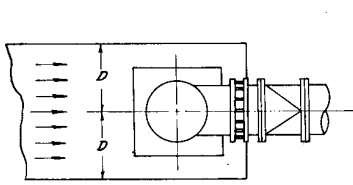


FIG. 1
RECOMMENDED SUMP DESIGN

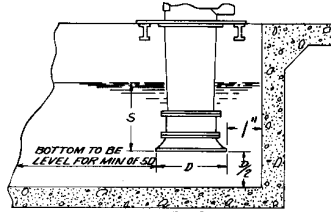
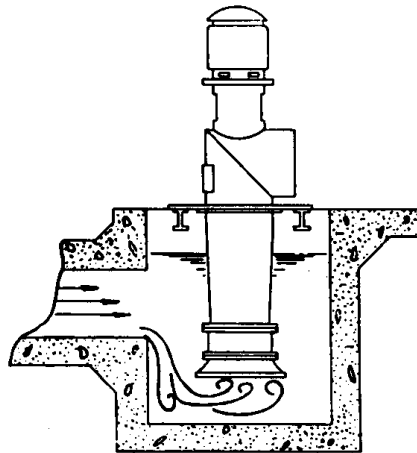
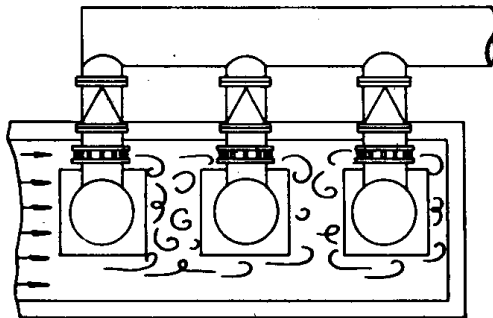
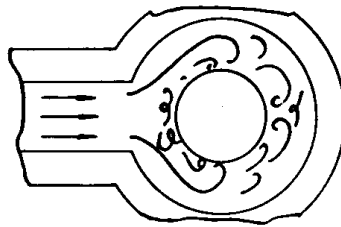
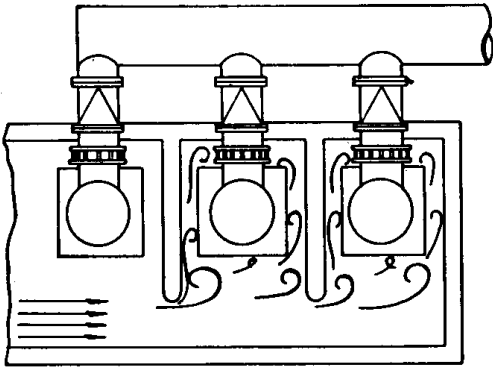


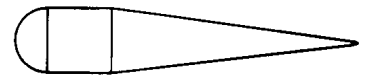
FIG. 2
RECOMMENDED SUMP DESIGN

FIG. 3 RECOMMENDED SUMP DESIGN

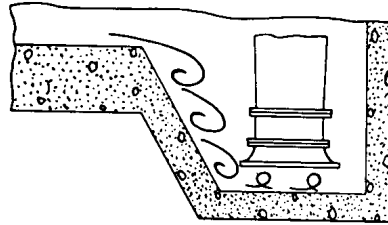
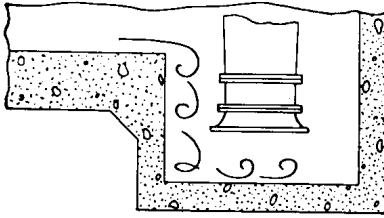
SUMP DESIGNS TO BE AVOIDED



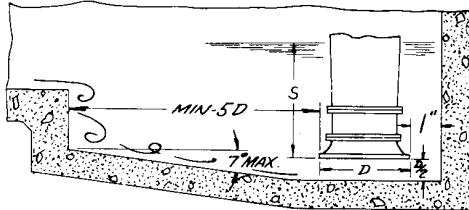
Sump designs which are not recommended are shown in these diagrams. Design arrangements which make sudden changes in the direction of Row of water to the pump are to be avoided. Walls, pump columns, channel openings, etc., can disturb the flow.



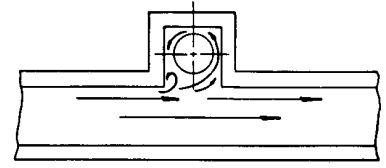
Avoid columns and cross braces in the sump ahead of pumps whenever possible. Streamline the sump structural supports as shown.



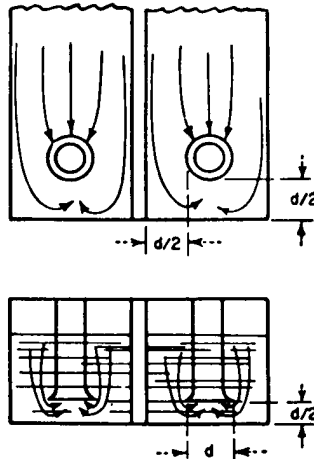
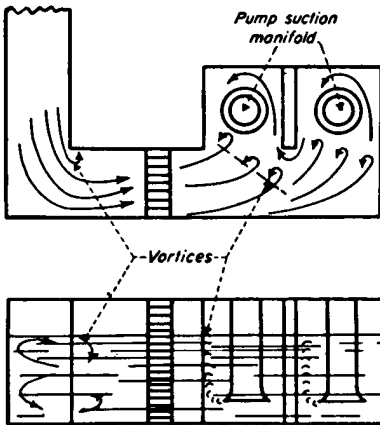
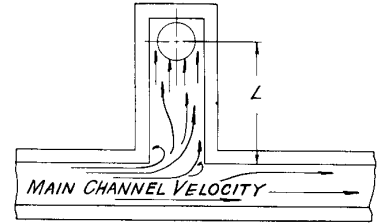
CAVITATION, LOSS OF CAPACITY, NOISY OPERATION and high maintenance expense, due to excessive wear, will result from steep "drop-offs" in approach channels as shown above.



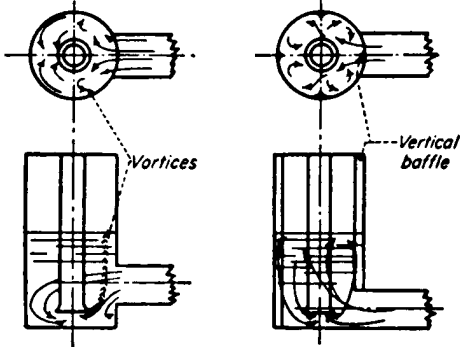
The configuration of the sump floor should be such that abrupt changes occur at least five diameters from the side of the pump. The more distance from the pump to the change in contour the better the pump suction entrance conditions.



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



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

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.

BIBLIOGRAPHY

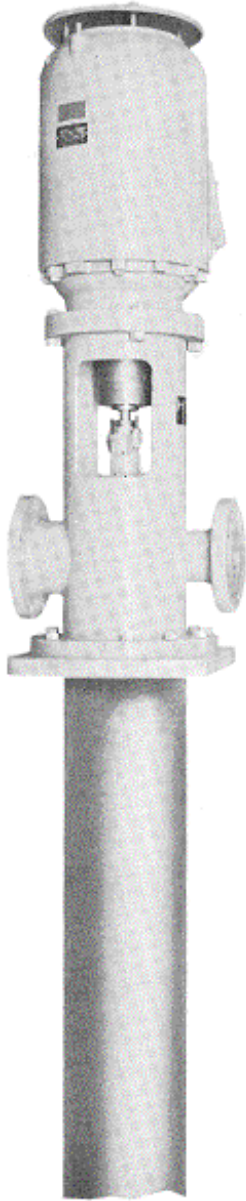
"Model sump tests"; by R. H. Bird, Engineer, Peerless Pump Company

"Air entrainment in pump suction in open sumps"; by H. W. Iverson, Assistant Professor of Mechanical Engineering, University of California, Berkeley, Calif.

"Studies of submergence requirements of high specific speed pumps"; by H. W. Iverson, Assistant Professor of Mechanical Engineering, University of California, Berkeley, Calif. (ASME meeting 6-11-51).

"Hydraulic problems encountered in the intake structures of vertical wet pit pumps, and methods leading to their solution"; by H. W. Fraser, Engineer, Worthington Corp.

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.



**HYDRO-LINE
CAN TYPE PROCESS PUMP**

Type: Vertical, enclosed, close-coupled, single or multi-stage centrifugal

Described in Bulletin No. B-3400

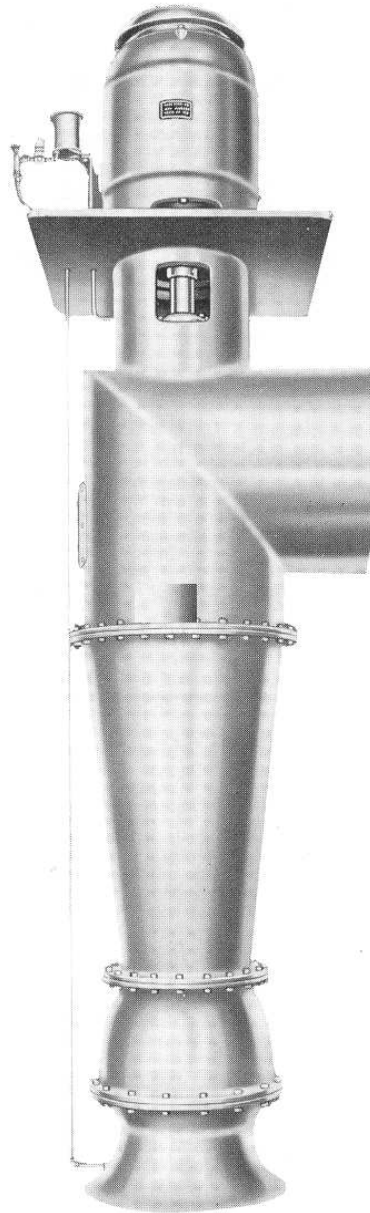
CAPACITIES: Up to 3000 gpm

HEADS: Up to 1000 feet

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)



HYDRO-FOIL

Types: Single and multi-stage
propeller and mixed-flow

Described in Bulletin No. B-300

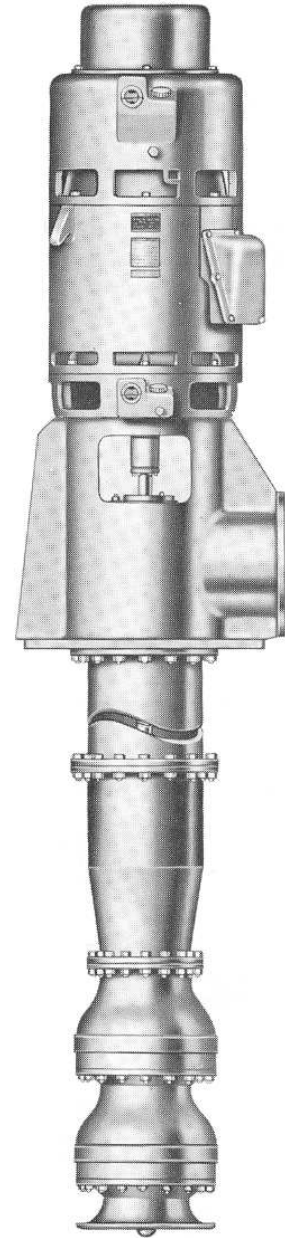
CAPACITIES: 600 to 220,000 GPM

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.

LUBRICATION: Choice of oil or
water lubrication



**VERTICAL INDUSTRIAL
PROCESS SERVICE PUMP**

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: Hydrocarbons,
volatile liquids,
chemical solutions,
etc.

APPLICATION: Transfer service,
pumping from tanks
and vessels

**MATERIALS
OF** Any machinable
alloy or application

CONSTRUCTION: and liquid being
pumped