FOR NEW OR REPLACEMENT

SEWAGE PUMPS

SIZING GUIDELINES

SUMP AND
SEWAGE PUMP
MANUFACTURERS
ASSOCIATION

SSPMA®

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SUMP AND SEWAGE PUMP MFRS. ASSN. ®

RECOMMENDED GUIDELINES FOR SIZING A NEW OR REPLACEMENT SEWAGE PUMP was prepared by the Sump and Sewage Pump Manufacturers Association (SSPMA) and is intended to be used as a voluntary reference for installers and others in selecting a proper pump for a particular application. SSPMA makes no representations or warranties, express or implied, regarding any particular method of installation, product selection or the maintenance and repair thereof.

SAFETY

Product labels and manufacturer's service and maintenance recommendations must be consulted prior to installation, service or maintenance to ensure that safe procedures are followed. Among potential hazards are the following:

WARNINGS: ELECTRICAL

A. To reduce the risk of shock
   1. Always disconnect the pump from power source before handling.
   2. Pumps furnished with a three-prong plug must connect to a properly grounded receptacle.
   3. Do not remove ground pin on plug.
   4. Three-phase (no plug provided) motor protection and grounding must be provided by installer.
   5. See instruction manual for proper installation.

B. Electrical installations must be in accordance with the National Electrical Code and all applicable local codes and ordinances.

WARNINGS: HEALTH

Effluent and sewage pumps can present a health hazard and must be handled by qualified service personnel.

The Sump and Sewage Pump Manufacturers Association is composed of leading equipment manufacturers. The purpose of SSPMA is to promote wider recognition, understanding and application of sump, effluent and sewage pumps.

CONTENTS

Proper sizing and selection of sewage pumps requires consideration of several factors. A definition and explanation of these follows.

I **PUMP CAPACITY refers to** the rate of flow in gallons per minute (GPM) which is necessary to efficiently maintain the system. The most practical and comprehensive approach to determining this figure is the Fixture Unit method, a means which assigns a relative value to each fixture, or group of fixtures, normally encountered. Determination of the required PUMP CAPACITY involves two steps:

A. List all fixtures involved in the installation and, using Figure A (see appendix), assign a Fixture Unit value to each. Determine the total Fixture Units.

B. Referring to Figure B, locate the total Fixture Unit amount along the horizontal axis of the graph and follow vertically until intersecting the plotted line. Follow this point horizontally and read the PUMP CAPACITY in GPM on the vertical axis at left.

II **TOTAL DYNAMIC HEAD (TDH)** is a combination of two components — Static Head and Friction Head — and is expressed in feet. (Refer to Figure C.)

A. Static Head is the actual vertical distance measured from the minimum water level in the BASIN to the highest point in the discharge piping.

CAUTION: The point of discharge may not be the highest point in the piping system. A pump must be selected that has a shut-off head greater than the highest point in the pipe system.

B. Friction Head is the additional head created in the discharge system due to resistance to flow within its components. All straight pipe, fittings, valves, etc. have a friction factor which must be considered. These friction factors are converted to, and expressed as, equivalent feet of straight pipe, which can then be totalled and translated to Friction Head depending on the flow rate and pipe size. Basically this reduces to four steps:

1. It will be necessary to determine the discharge pipe size. In order to ensure sufficient fluid velocity to carry solids (generally accepted to be 2 feet per second) flows of at least 21 GPM through 2'' pipe, 30 GPM through 2½'' pipe and 46 GPM through 3'' pipe are required.
2. The length of the discharge piping is measured from the discharge opening of the pump to the point of final discharge, following all contours and bends.
3. To determine the equivalent length of discharge piping represented by the various fittings and valves, refer to Figure D and total all values. Add this to the measured length of discharge pipe and divide by 100 to determine the number of 100 ft. increments.
4. Refer to Figure E and find the required PUMP CAPACITY in the left column. Follow across to the number below the pipe size being used, which represents the Friction Head per 100 feet of pipe. Multiply this number by the number of 100 foot increments to determine Friction Head.

C. Add the Static Head and Friction Head to determine TOTAL DYNAMIC HEAD.

Note: Siphon conditions may cause pump overloading. Consult manufacturer for specific recommendations.

III **SOLIDS-HANDLING requirements** may be determined by local codes and/or by the type of application and types of solids anticipated. Unless otherwise specifically stated by applicable codes or pump manufacturer's recommendations, a sewage pump should have the capacity of handling spherical solids of at least 2'' diameter in installations involving water closets, and at least ½'' in installations without water closets.

IV

Selection of the BASIN is again best accomplished by relating to the required PUMP CAPACITY as determined by the Fixture Unit method. Figure F shows the BASIN diameters recommended assuming a pump differential (distance in inches between turn-on and turn-off) of 8''. BASIN depth should be at least 24'' for most pumps, and deeper where greater pumping differentials are anticipated.

V

DUPLEX Systems provide several advantages over SIMPLEX Systems: The pumps alternate and therefore share the load; the lag pump is activated in the event of failure or blockage of the lead pump; the lag pump is activated along with the lead pump in instances of unusually high inflow. The question of whether to use a SIMPLEX System or a DUPLEX System depends on the type of installation and/or local codes requirements. Generally speaking, a determination can be made using the following guidelines:

A. Public or industrial use — DUPLEX System is essential.
B. Commercial — optional depending on the type of business and the need for uninterrupted sanitary drainage facilities.
C. Domestic — SIMPLEX System is adequate in most instances.

VI EXAMPLE

A. What PUMP CAPACITY would be required to handle the drainage from a 4 bathroom home, also including a dishwasher, a washing machine, a laundry tray, a kitchen sink, water softener, basement shower, a 13,000 gallon pool, and a bar sink (1½″ trap)?

1. From Figure A:

Four bathroom groups	24 Fixture Units
Water Softener	4
Dishwasher	2
Washing machine	2
Laundry Tray	2
Kitchen sink with disposal	3
Basement shower	2
Swimming pool	13
Bar sink (unlisted 1½″)	3
Total	55 Fixture Units

2. Refer to Figure B:
   Find 55 Fixture Units on the horizontal axis. Follow vertically until intersecting the line, then horizontally to the left. The PUMP CAPACITY on the vertical axis is 30 GPM.

B. Determine the TDH of the installation illustrated in Figure C.
   1. The Static Head in this instance is 7 feet.
   2. Friction Head
      a. Since the required PUMP CAPACITY in this installation of 30 GPM is less than the 46 GPM necessary to carry solids through 3″ pipe, 2″ or 2½″ pipe should be used. If 3″ pipe is preferred or required, a PUMP CAPACITY of at least 46 GPM is required.
      b. Measurement of the length of discharge pipe totals 200′.
      c. Refer to Figure D and note the friction factor in equivalent feet for each fitting:

3–90° elbows, 2″	16 equivalent feet
1–Gate valve, 2″	1
1–Swing check valve, 2″	17
	34 equivalent feet

Adding 34 feet to the measured pipe length, the total effective pipe length

becomes 234 feet, or 2.34 100-foot increments.

d. Refer to Figure E. Find the 30 GPM required PUMP CAPACITY in the left column and follow across to the 2″ PVC pipe size column. Friction Head is 1.8 × 2.34 = 4.2 feet.

3. TDH = Static Head + Friction Head
   TDH = 7′ + 4.2′
   TDH = 11.2′

C. Due to the existence of water closets in this installation, a pump with 2″ SOLIDS-HANDLING capability should be used, unless otherwise specifically stated by applicable codes, or if not so stated as recommended by the pump manufacturer.

D. To determine the BASIN size, find the PUMP CAPACITY (30 GPM) in the column on the left in Figure F. Any BASIN diameter of 18″ or greater is acceptable.

E. Since this application is domestic, a SIMPLEX System is sufficient.

F. Summary: Recommended selection for this installation would be a SIMPLEX System utilizing an 18″ or greater, diameter BASIN and a 2″ SOLIDS-HANDLING pump capable of delivering at least 30 GPM at 11.2′ TDH.

VII APPENDIX*

FIGURE A

Fixture Description	Fixture Unit Value	Fixture Description	Fixture Unit Value
Bathtub, 1½″ trap	2	Sink, service type	3
Bathtub, 2″ trap	3	Sink, scullery	4
Bidet, 1½″ trap	3	Sink, surgeons	3
Dental unit or cuspidor	1	Swimming pool (per 1000 gal.)	1
Drinking fountain	1	Urinal	4**
Dishwasher, domestic	2	Washing machine	2
Kitchen sink	2	Water closet	3**
Kitchen sink with disposal	3	Water softener	4
Lavatory, 1½″ trap	1	Unlisted fixture, 1¼″ trap	2
Lavatory, barber/beautician	2	Unlisted fixture, 1½″ trap	3
Laundry tray	2	Unlisted fixture, 2″ trap	4
Shower	2	Unlisted fixture, 2½″ trap	5
Shower, group (per head)	3	Unlisted fixture, 3″ trap	6
Bathroom group consisting of lavatory, bathtub or shower, and water closet			6**

*Graph data is taken from ASPE Handbook, Uniform Plumbing Code, Cameron Hydraulic Data and Plastic Pipe Institute.

**Add 4 fixture units for each flush valve fixture.

FIGURE B

PUMP CAPACITY based on total Fixture Units

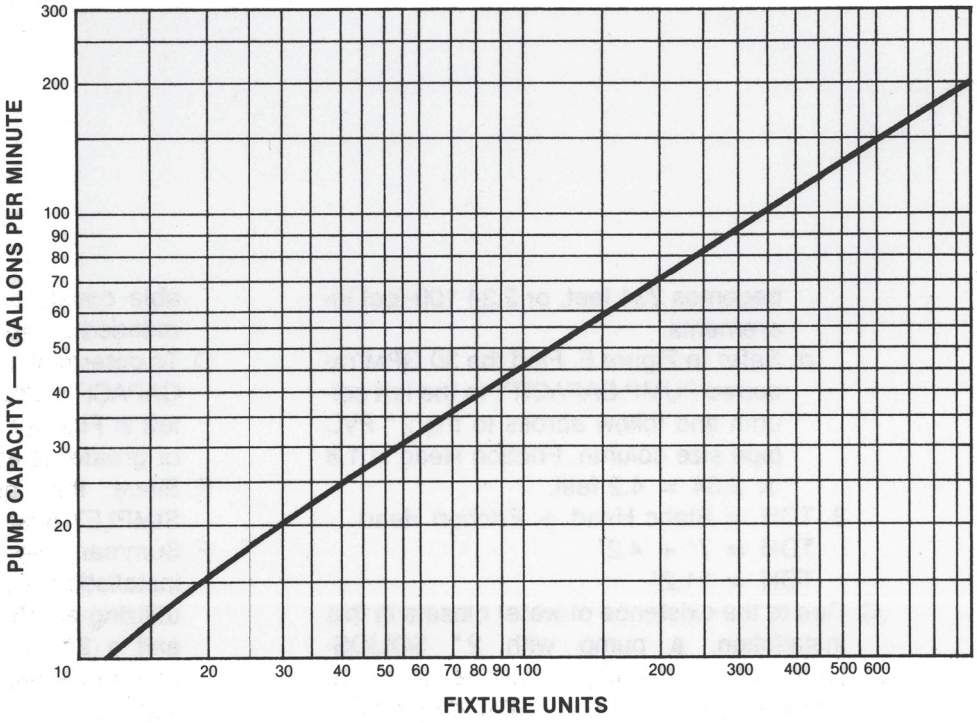


FIGURE C

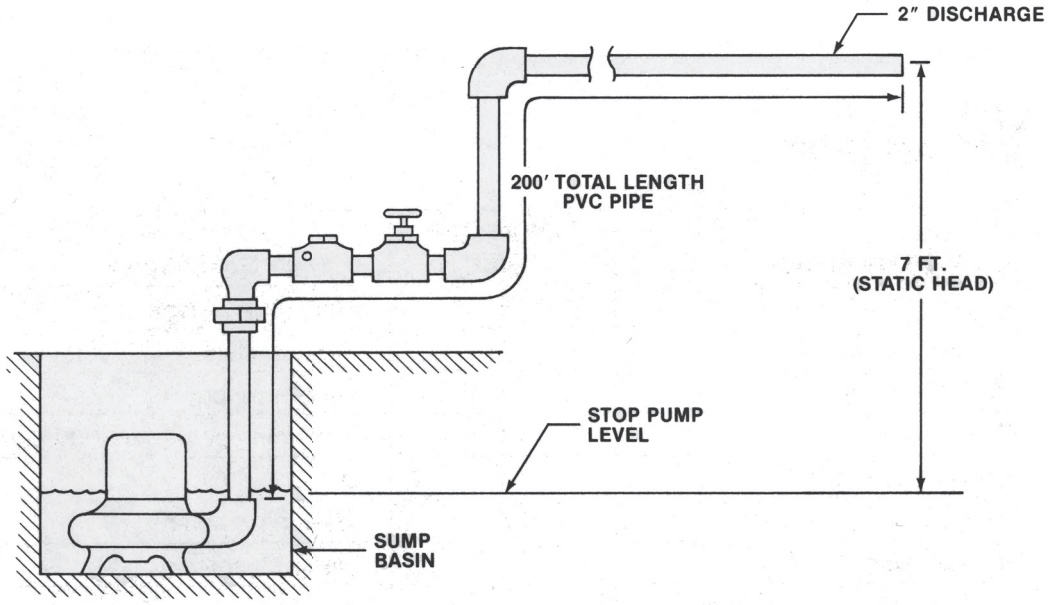


FIGURE D

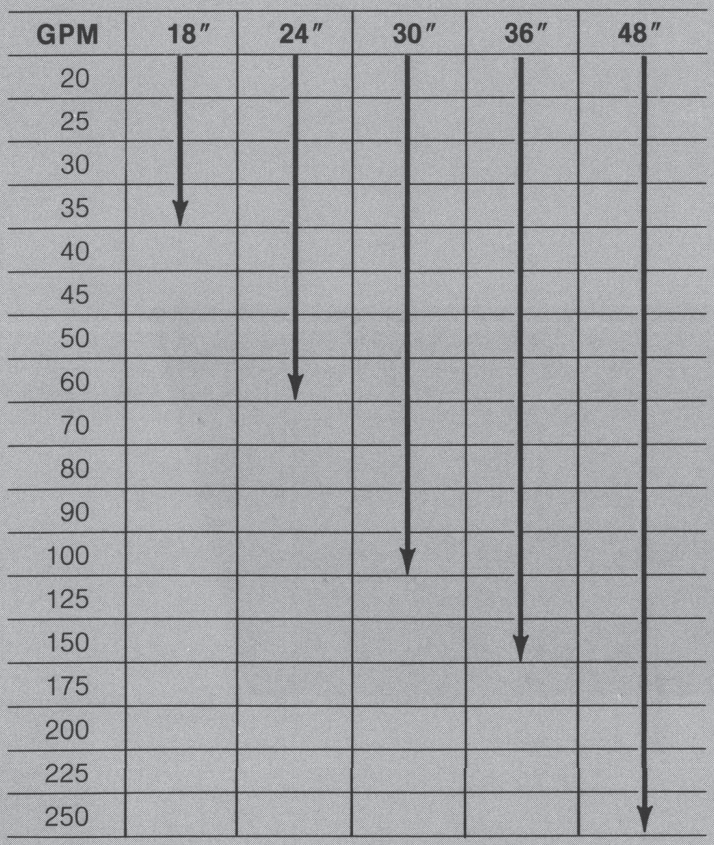
Friction factors for pipe fittings in terms of equivalent feet of straight pipe

Nominal Pipe Size	90 Elbow	45 Elbow	Tee (Thru-flow)	Tee Branch flow	Swing Check Valve	Gate Valve
2"	5.2	2.8	3.5	10.3	17.2	1.4
2½"	6.2	3.3	4.1	12.3	20.6	1.7
3"	7.7	4.1	5.1	15.3	25.5	2.0

GPM	2″		2½″		3″	
	Plastic	Steel	Plastic	Steel	Plastic	Steel
20	.9	.9				
25	1.3	1.3				
30	1.8	1.8	.6	.8		
35	2.4	2.4	.8	1.0		
40	3.1	3.1	1.0	1.3		
45	3.8	3.8	1.3	1.6	.5	.6
50	4.7	4.7	1.6	1.9	.7	.7
60	6.5	6.6	2.2	2.7	.9	.9
70	8.6	8.8	2.9	3.6	1.2	1.2
80	11.1	11.4	3.7	4.6	1.5	1.6
90	13.8	14.3	4.6	5.8	1.9	2.0
100	16.8	17.5	5.6	7.1	2.3	2.4
125			8.3	10.9	3.6	3.6
150			12.0	15.5	4.9	5.1
175			16.4	20.9	6.4	6.9
200					8.4	8.9
225					10.5	11.2

Friction Head in feet per 100′ of Schd. 40 pipe

FIGURE E



Recommended BASIN Diameters

FIGURE F

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