AAA FAY

PUMP SERVICE ELECTRIC MOTORS

Septic Pumps; An Introduction

Septic Pumps; an Introduction

Presented By: AAA Pump Service, Inc

Manchester & Somersworth, NH

Sponsored By: MHOE

Septic Pumps; an Introduction

Factors that go into proper septic pump selection and application:

- Selecting a Pump
- Controls
- Structure setup

Septic Pumps; an Introduction
Selecting a Pump

When selecting a pump, we need to know:

- What are we pumping?
- How much are we pumping?
- Where are we pumping to?
- How are we getting from the pump to the destination?

What Are We Pumping?

What physical objects are in the water?

- ***Ideally*** the pump will only see toilet paper, human waste & water

- ***Reality*** is sewerage has changed with time:

  - More solids & less liquids
  - Increase in “flushable” items

What Are We Pumping?

Effluent Pumps

- If our pump is after a septic tank, we are pumping mostly fluids
- What happens to the pump if the baffle fails? Do we want the pump to do the same?
- Opinions differ if an effluent pump should pass items that get past the baffle

What Are We Pumping?

Effluent Pumps

- Items septic tanks have trouble removing are:
  - Finely ground solids
  - Solids close to the density of water
  - Oil & grease
  - Anything dissolved in the water

What Are We Pumping?

Effluent Pumps

- How do we protect the effluent pump?
- With a properly sized septic tank
- Utilizing auxiliary items:

Additional tanks
Grease separators
Filters

What Are We Pumping?

IMPELLER TYPES

Vortex Impeller

Mono Vane Enclosed Impeller

Dual Vane Open Impeller

What Are We Pumping?

Sewage Ejector Pumps

- Capable of handling ***limited*** solids involved with toilet paper, human waste & water
- Typically can handle 2” solids but do not chop or grind what they pump
- A common application is the addition of a bathroom in a residential basement

What Are We Pumping?

Sewage Ejector Pumps

- 2” solids does not mean the pump will handle “flushable” items we now find in today’s systems
- Can work in a single family home with occupants that are careful about what they flush
- Likely to clog in rental properties, commercial bathrooms or multi-family residence applications; unless after septic tank

What Are We Pumping?

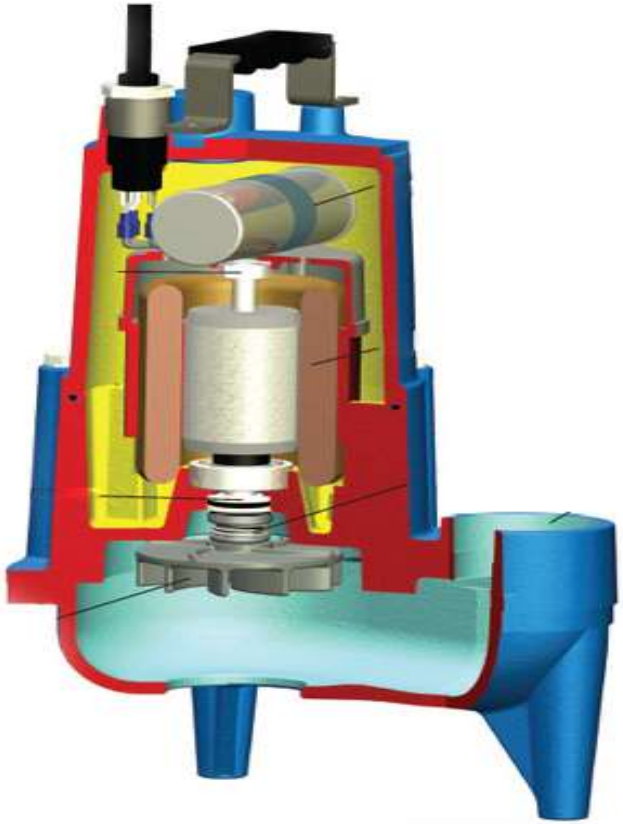
Sewage Ejector Pumps – SEV412

Model	SEV412
Motor	1/2hp PSC
RPM	3450
Cord Length	20' SJTOW 14/3 gauge
Construction	Cast Iron
Impeller	Cast Iron Vortex
Discharge	2.00" NPT, Female, Vertical
Solids	2.00"
Automatic Operation	Mechanical Float Vertical Float
Seal Design	Single Mechanical, Oil Filled Reservoir
Weight	44 lbs. (manual) 45 lbs. (with float)
Liquid Temperature	77°F (25°C) Continuous
Dimensions	9.63L x 7.00W x 16.30H

- **Cast iron motor housing & volute**
- **416 SS shaft for aggressive effluent**
- **Upper & lower ball bearing for quieter run and longer life**
- **Permanent split capacitor motor for more efficient operation**
- **High temperature overload on motor for single phase operation**
- **Oil filled motor**

What Are We Pumping?

Sewage Ejector Pumps – SEV412



What Are We Pumping?

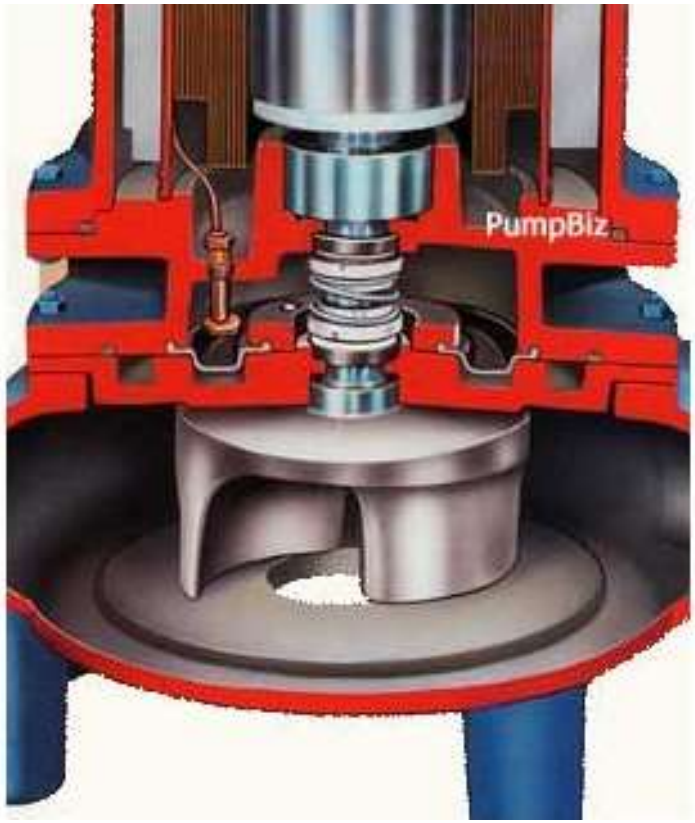
Sewage Ejector Pumps – SE51

Model	*SE*
Motor	1/2hp, 3/4hp, 1hp PSC
RPM	1750
Cord Length	20'
Construction	Cast Iron
Impeller	Cast Iron
Discharge	2.00" NPT, Female, Vertical, Bolt-on Flange
Solids	2.00"
Automatic Operation	Mechanical Float (1/2hp Only)
Seal Design	Single Mechanical
Weight	85 lbs. (1/2 hp) (3/4 hp) 90 lbs. (1 hp)
Liquid Temperature	104°F (40°C) Continuous
Dimensions	12.63L x 9.75W x 18.63H

- Oil filled motor for better heat dissipation
- Oil lubricated bearings for quieter run and longer life
- Cast iron construction, SS hardware, Buna-N o-rings
- Standard carbon/ceramic, Buna-N seals

What Are We Pumping?

Sewage Ejector Pumps – SE51



What Are We Pumping?

Solids Handling Pumps; 3” plus solids

- Designed to pass solids without grinding or cutting utilizing large passages through pump / impeller
- Multi Vane & Dual Vane Impellers
- Single Vane Impellers
- Vortex Impellers

What Are We Pumping?

Grinder Pumps

- Used in low-pressure collection systems
- Grinding of waste into approximately 1/8” size
- With new & sharp cutters, these pumps can handle occasional non-toilet paper / human waste / water
- Like a pair of scissors, the more it cuts the quicker it dulls
- Slurry discharge takes time to settle out

What Are We Pumping?

Grinder Pumps

- Additional Maintenance: Require periodic part adjustment and replacement

What Are We Pumping?

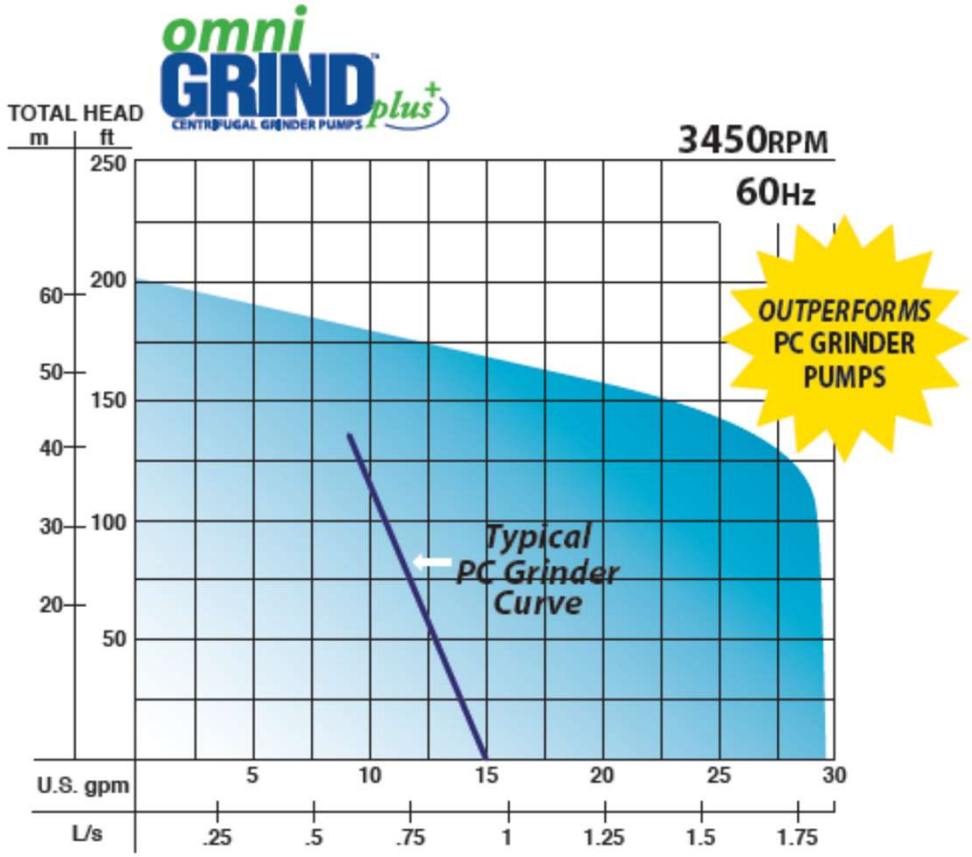
Other Pumps:

High Head Centrifugal Grinder

- **Replacement for Progressive Cavity Pumps**
- **Used in residential low pressure sewer applications**
- **Utilizes small pipe sizes in sewer system**
- **Achieves high head performance of Progressive Cavity Pumps utilizing 2-stage grinder assembly**

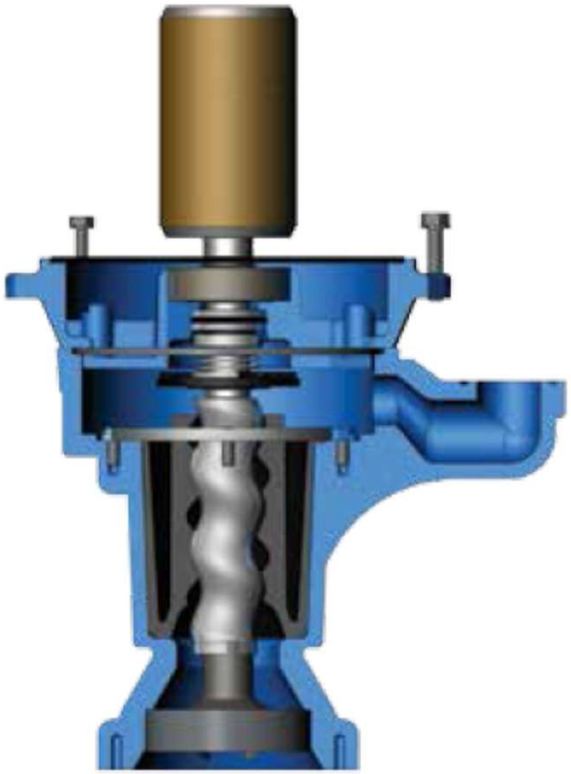
What Are We Pumping?

Other Pumps: High Head Centrifugal Grinder

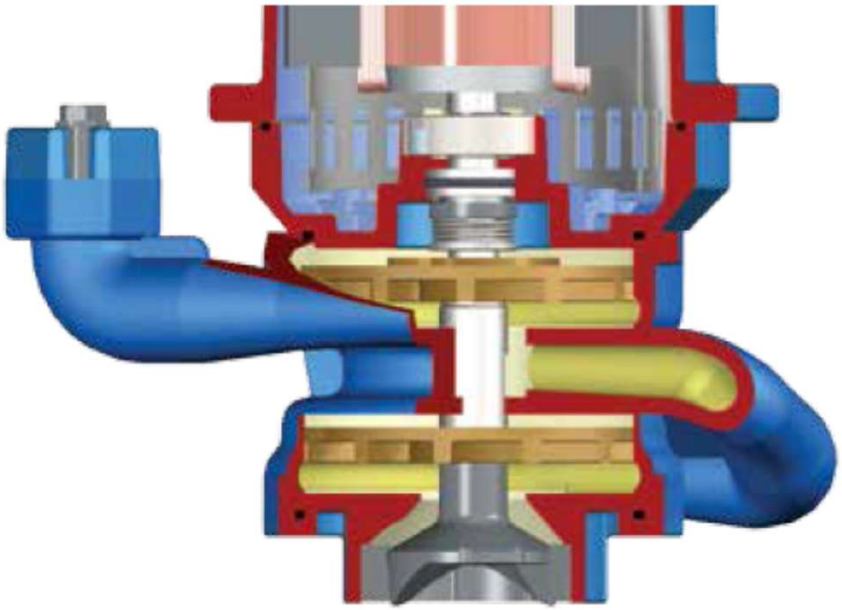


What Are We Pumping?

Other Pumps: High Head Centrifugal Grinder



Progressing Cavity Pump



Two-Stage Centrifugal Pump

Septic Pumps; an Introduction
Selecting a Pump

We have jumped into the ***types*** of pumps while only looking at the first of our (4) criteria for selection:

What are we pumping?

- How much are we pumping?
- Where are we pumping to?
- How are we getting from the pump to the destination?

How Much Are We Pumping?

Regulations

- PRESCRIPTIVE TABLES
- FLOW MONITORING WITH SAFETY FACTORS

How Much Are We Pumping?

Other Data Sources

- Designer's Intent
- Customer Input
- Existing Conditions

How Much Are We Pumping?

Expected Pumping Rate

- If we do not pump at the maximum incoming rate we must calculate to ensure we do not overflow
- Must compare incoming GPM to GPM of pump

How Much Are We Pumping?

Expected Pumping Rate

- 6.0 Taken as “Peaking Factor” average to peak

How Much Are We Pumping?

Cycles (Dosing)

- Pumps like to run and are rated for maximum starts per hour
- Waste will go septic if not moved before sitting around too long

How Much Are We Pumping?

Cycles (Dosing)

- Look at volume in forcemain – 2” SDR21 is 18.8 gallons per 100’ of pipe; try to turn over forcemain in each dose

Septic Pumps; an Introduction
Selecting a Pump

We have now considered the first two of our (4) criteria for selection:

What are we pumping?

How much are we pumping?

- Where are we pumping to?
- How are we getting from the pump to the destination?

Where Are We Pumping To?

Regulations & System Capacity

- So, where is our wastewater going?
- Municipal System – May require explosion-proof pumps, etc
- Septic System – Ensure not pumping too fast to field
- Pumping to Tank – Do we want to stir up chamber?

Where Are We Pumping To?

Effluent Disposal Areas

- Don’t forget to detail velocity reducers/redirectors such as elbows and tees to help even distribution
- Rule of thumb, 10-15 gallons per minute per lateral from distribution box

Wastewater Pump Selection & Application

We now know *WHAT* we are pumping, *HOW MUCH* of it we are pumping & *WHERE* we are pumping it to. The last of our (4) criteria considers *HOW* we are getting there:

- ✓ What are we pumping?
- ✓ How much are we pumping?
- ✓ Where are we pumping to?

- How are we getting from the pump to the destination?

How Are We Getting There?

Forcemain

- Pipe Type
- Pipe Size
- Number of Pipes / Shared Systems
- Vertical Profile

How Are We Getting There?

Pipe Type

- SDR PVC pipe is most common for forcemains piping
- Polyethylene (PE) is becoming more common for forcemain use

How Are We Getting There?

Pipe Size

- Solid passing capability of pump is limited by forcemain size

How Are We Getting There?

Pipe Size

- For effluent & sewage ejector applications, start with 2” piping

How Are We Getting There?

Pipe Size

Cleaning Velocity

The larger the pipe size the greater flow rate of water needed for cleaning action of the pipe interior

How Are We Getting There?

Pipe Size

Cleaning Velocity

Typically 3 Feet Per Second

- 1.5” SDR 21 PVC = 22 GPM
- 2” SDR 21 PVC = 35 GPM
- 3” SDR 21 PVC = 75 GPM
- 4” SDR 21 PVC = 125 GPM

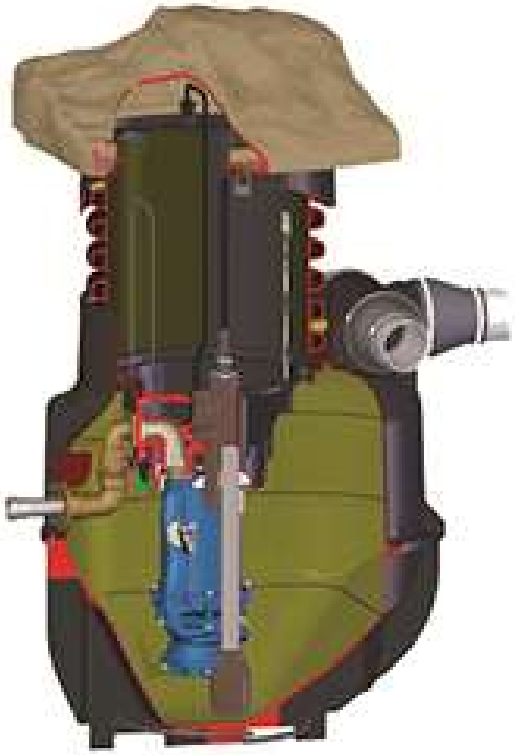
How Are We Getting There?

Number of Pipes

- Dedicated forcemain or shared?
- Normal systems have one pump running at any given time
- Some systems have multiple pumps running at one time
- What happens after a power outage?

How Are We Getting There?

Number of Pipes – Shared Forcemain



How Are We Getting There?

Forcemain Vertical Profile

- High Point / Low Point
- Uphill / Downhill
- Siphoning

How Are We Getting There?

Forcemain Vertical Profile

- High Point / Low Point

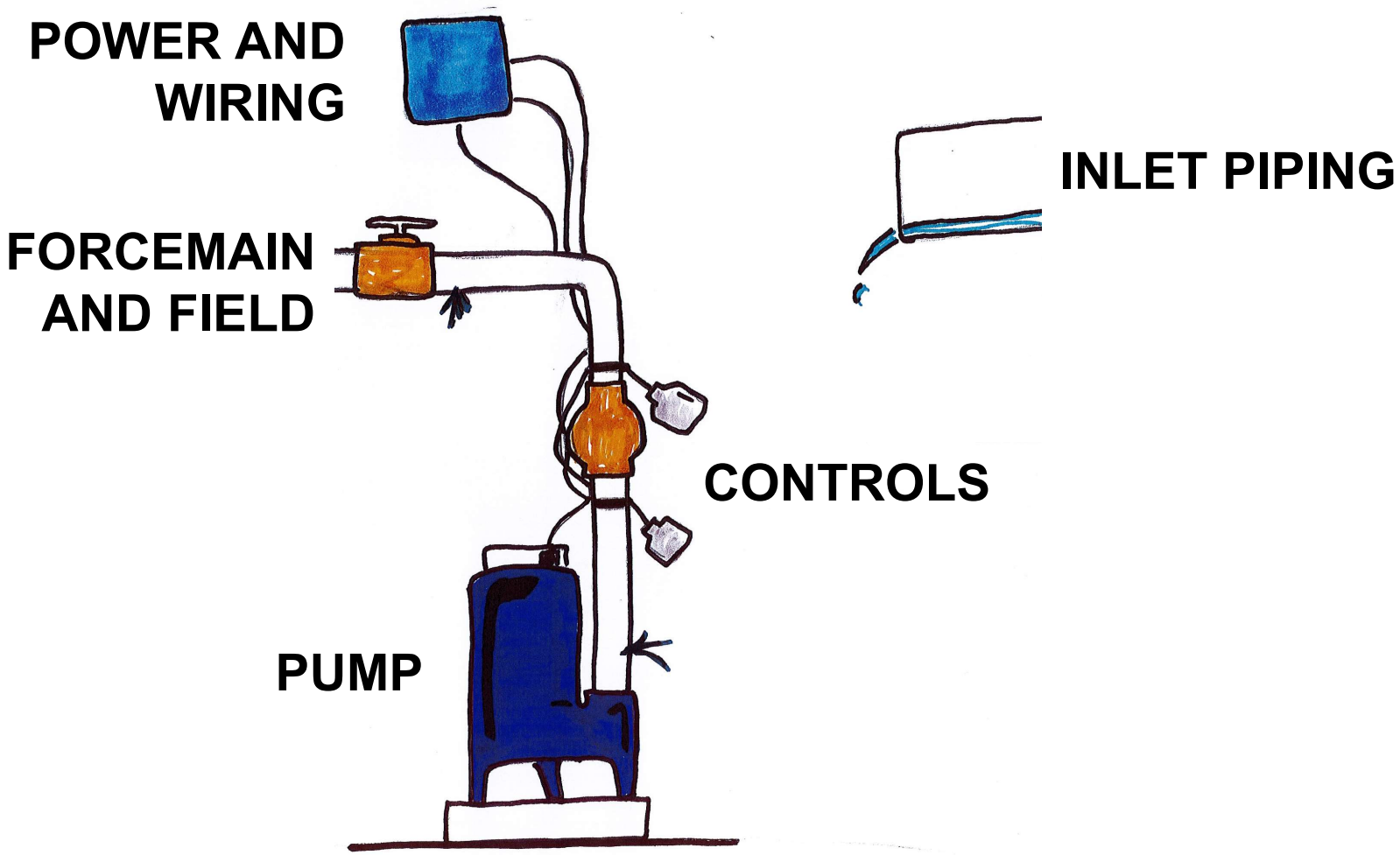
- Are we pumping to a location higher or lower than where our pump is?
  - Are we pumping up then downhill?
  - Are we pumping downhill then uphill?
  - Air release / Vacuum break required?

Septic Pumps; an Introduction Controls

Pumps do not run constantly; we need something to tell them to run when they need to.

- Piggy Back float and High Water Alarm
- Simple Control Panel
- Complex Control Panels

Piggy Back Float and High Water Alarm



PIGGY BACK FLOAT AND HIGH WATER ALARM

Consists of a normally open float wired in series with the pump power. A separate normally open float is wired to an alarm that goes off when the alarm float closes.

Normally the power goes out to the tank from a dedicated breaker in the main circuit breaker panel of the house.

Normally the alarm wire runs to the tank and the alarm is plugged in and mounted in the house

PIGGY BACK FLOAT AND HIGH WATER ALARM

ADVANTAGES

- MINIMAL WIRING
- LOWEST COST

DISADVANTAGES

- LACK OF ACCESIBLE TEST POINTS, NORMALLY NEED TO GO INTO TANK TO DETERMINE IF FLOAT OR PUMP PROBLEM

SIMPLE ALARM PANEL

A CONTROL PANEL WITH

- CIRCUIT BREAKERS
- CONTACTOR(S)/MOTOR STARTER
- ALARM LIGHT AND HORN
- CONTROL RELAYS
- HAND/OFF/AUTO SWITCH EACH PUMP – HOA
- ALARM ON/OFF/TEST SWITCH

SIMPLE ALARM PANEL

POWER FROM THE HOUSES CIRCUIT BREAKER PANEL IS BROUGHT TO THE CONTROL PANEL.

THE PANEL SHOULD HAVE ITS OWN CIRCUIT BREAKERS PLURAL ONE FOR EACH PUMP AND ONE FOR THE CONTROLS/ALARM; IF A PUMP TRIPS DUE TO PROBLEMS THE CONTROLS AND ALARM STILL WORK

SIMPLE ALARM PANEL

EACH PUMP AND FLOAT IS WIRED SEPARETLY FROM THE PANEL TO THE PUMP CHAMBER; SO MORE WIRES THAN A PIGGY-BACK SYSTEM

A TECHNICIAN CAN TEST THE PUMP AND FLOATS FROM THE PUMP PANEL WITH THE PUMP CHAMBER FULL OF WATER

SIMPLE ALARM PANEL

- IDEALLY THE PANEL IS NEMA 4X AND MOUNTED OUTSIDE SO TECHNICIANS DO NOT "TRACK" THROUGH THE HOUSE WHILE WORKING ON THE STATION
- PANEL SHOULD BE UL LISTED – 508A
- WE PREFER RELAY LOGIC TO TRANSISTORS; MUCH MORE OBSELESANCE PROOF

SIMPLE CONTROL PANEL

ADVANTAGES

- ACCESIBLE HOA AND ALARM CONTROL
- TECHNICIANS CAN TEST MANY PARTS OF THE SYSTEM FROM THE PANEL

DISADVANTAGES

- MORE WIRES FROM PANEL TO PUMP CHAMBER
- MODERATE COST AT INSTALL TIME

COMPLEX CONTROL PANEL

PANELS THAT INCORPORATE A “PLC” – PROGRAMABLE LOGIC CONTROLLER TO DOSE THE EFFLUENT FIELD WITH MORE NUANCE THAN TURN ON WHEN REACH THE ON FLOAT HEIGHT AND TURN OFF WHEN REACH THE OFF FLOAT HEIGHT

COMPLEX CONTROL PANEL

EXAMPLES INCLUDE

DOSE A FIELD EVERY HOUR FOR 5-MINUTES WHEN WATER IS AVAILABLE

BALANCE FLOW BETWEEN EFFLUENT FIELDS OF DIFFERENT SIZES

ONLY RUN AT CERTAIN TIMES OF THE DAY

COMPLEX CONTROL PANEL

ADVANTAGES

- TECHNICIANS CAN TEST MANY PARTS OF THE SYSTEM FROM THE PANEL
- COMPLEX

DISADVANTAGES

- COMPLEX

PUMP CHAMBER SETUP

Pump chamber needs to be designed and installed with an idea towards future maintenance.

Access to

Access into

Working space inside

Putting holes in piping

PUMP CHAMBER SETUP Access to

- Pump chambers need to be accessible for a septic hauler to pump out.
- In the middle of winter how will a pump technician get to the chamber to swap a pump?
- Is it in the basement past a room with a white carpet?
- Can you see the pump chamber from the control panel?

PUMP CHAMBER SETUP
Access into

To enter a pump chamber we need a technician tethered to a safety tripod, possibly a blower hose, and room for material and equipment.

The hole the technician goes in we have to be able to pull them back out of if they are unconscious. For our techs

One – Minimum 30”

Two or more – 24” Minimum

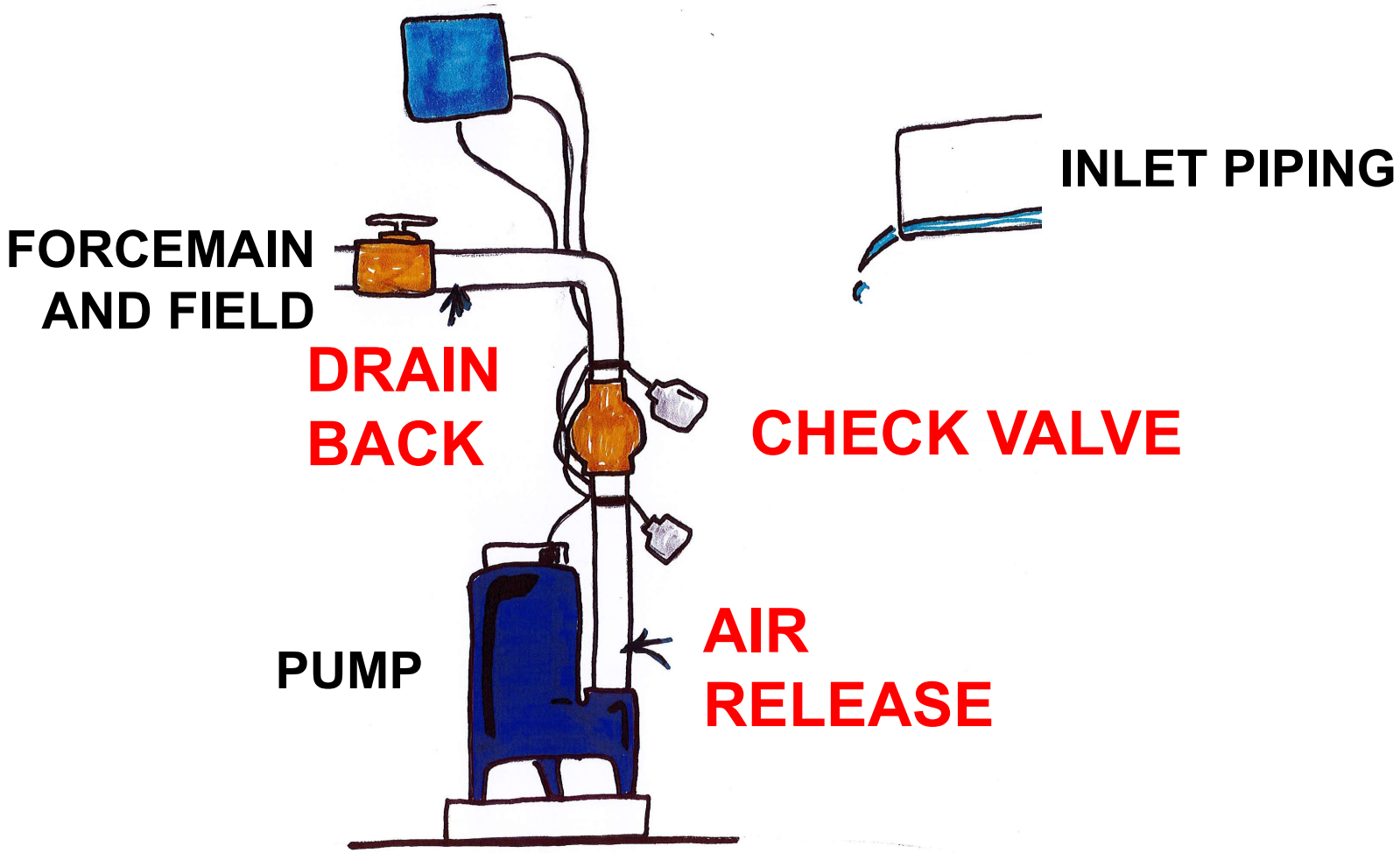
PUMP CHAMBER SETUP
Working Space Inside

When the tank is buried can we “stand” and “walk” to everything that needs to be serviced in the pump chamber?

5’ Clear Height while not comfortable is accessible

Cluster everything below access hatch is an alternative

PUMP CHAMBER SETUP
Putting Holes in Piping



QUESTIONS

THANK YOU HAVE A GREAT DAY