

# Shaun's Pump School

Basic pumps class 101

## About Shaun Stokes

- ▶ Been married for almost 24 years
- ▶ Four children; oldest being 26 and the youngest 16
- ▶ Three boys and the 3<sup>rd</sup> child is a girl.
- ▶ Went out on my own about 2 plus years ago.
- ▶ Worked for the same company for over 20 some years
- ▶ I was a manager, GM, and just a tech and trained many other technicians
- ▶ I have my SEO license but have don't have any municipalities
- ▶ PSMA certified and apart of the education board.
- ▶ Pumps are one of my favorite things to work on

- ▶ Started working at a septic company around 1993 as a teenager off and on.
- ▶ Came on full time around the age of 22 where I started working on septic systems and other things.
- ▶ I did not get a lot of training before taking over as technician; I learned the hard way.
- ▶ I was good at asking questions and finding mentors to help me and the owner(s) of the company I worked with were extremely patient with me learning this way.
- ▶ “you WILL figure this out”
- ▶ If I could not solve the issues I would sub someone else and learn from them.
- ▶ We had a lot of pumps we worked on from septic to large commercial and industry accounts.

# Goals

- ▶ Teach you basic knowledge of types of pumps and parts
- ▶ Teach you some basic knowledge on electrical skills
- ▶ Help you think, plan, diagnose, and talk to customers about there issues.
- ▶ Show you how I've done it and taught many to do the same thing.
- ▶ It is a process I feel anyone can learn - show these techniques .
- ▶ Have fun. “I like to joke around”
- ▶ You are a pump detective and will be able to solve pump problems.
- ▶ Answer questions along the way. I am hear to help you learn

“There is no such thing as a dumb question”

I don't believe this to be true or at least many have put this statement to the test.

Most dumb questions are just uninformed questions OR need to be worded in a way that can be understood better by both parties. So I may ask you questions back to understand the question better. I want you to learn. So ask questions.

“I can tell a lot about a student by the questions that ask” which help me teach you.

My PHD student wife verse my high school diploma self.

# Disclaimer

- ▶ *“DEP has approved this conference for SEO continuing education conference credits. The approval is based on the organization’s narrative for the overall conference and each breakout session. DEP has not reviewed the content of the conference and does not guarantee that the sessions provide complete and accurate information about Pennsylvania’s Sewage Facilities Act, the regulations promulgated thereunder, and DEP policy.”*

# Types of pumps

## ▶ Sewage

- ▶ Ground water or sump transfer (1/2" solids or less)
- ▶ Grey water or effluent (1/2" to 3/8" solids)
- ▶ Sewage ejector pumps (2" in most residential)
- ▶ Grinders (higher head pumps that grind the sewage up) typically 1.25" discharge

## ▶ Water

- ▶ Transfer / jet
  - ▶ Shallow well single pipe
  - ▶ Deep well double pipe with jet assembly
  - ▶ Submersible (staged pumps)



# Sump pumps

Submersible with float



Pedestal pump



# Pumps

Grey water or Effluent



Sewage ejector pumps



# Grinder pumps

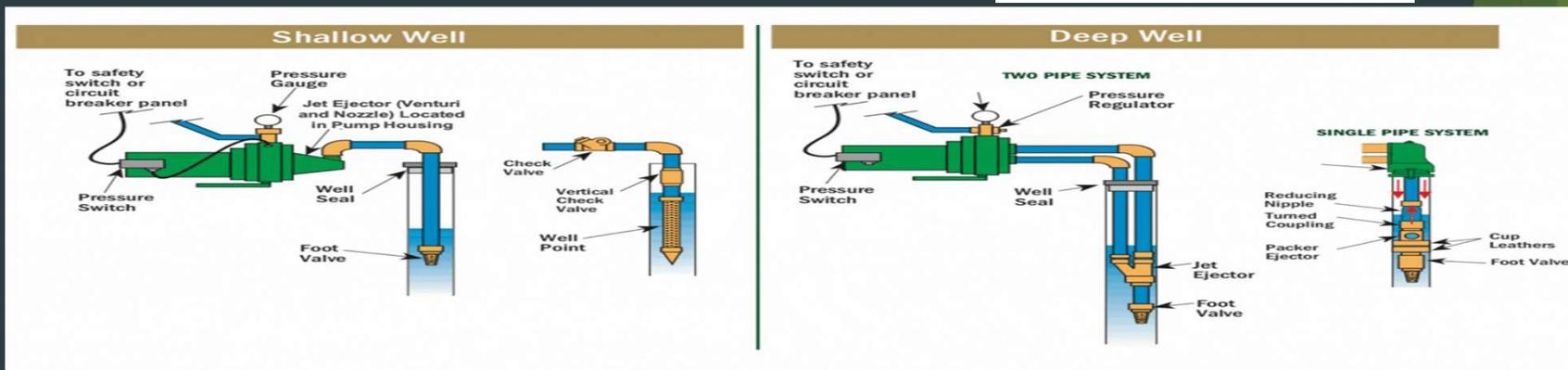


# Jet Pumps

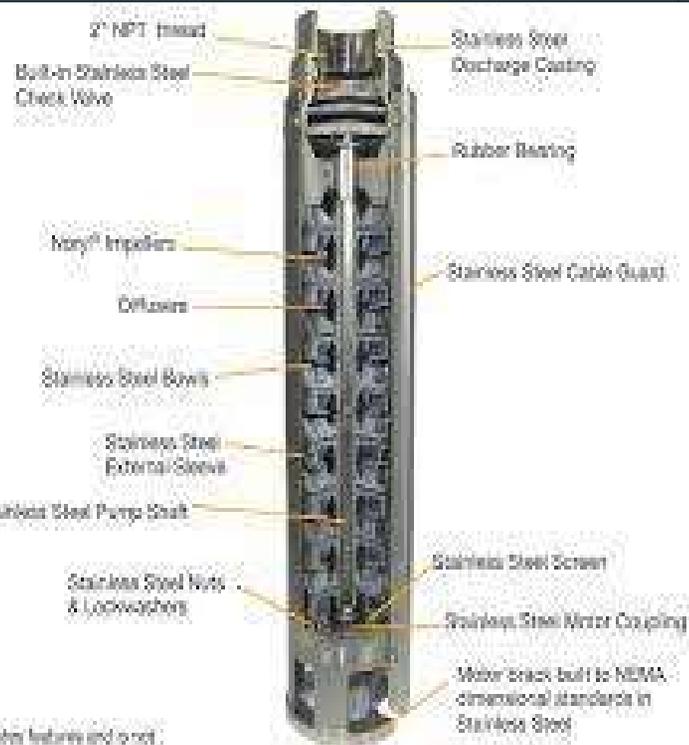
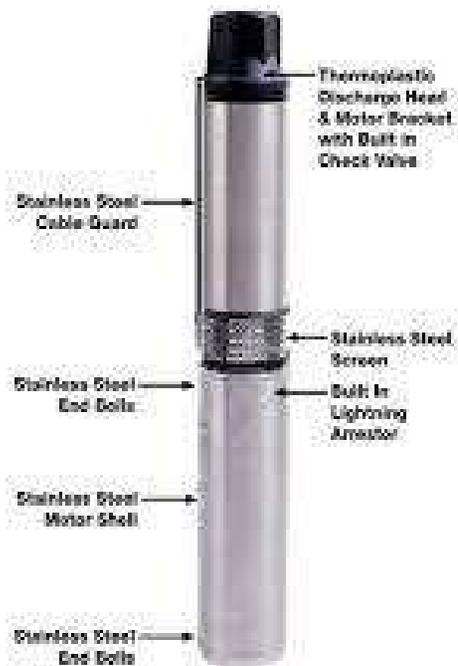
Single pipe shallow well



Two pipe deep well

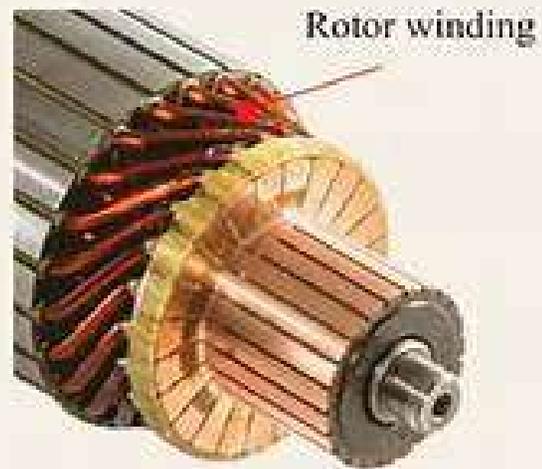
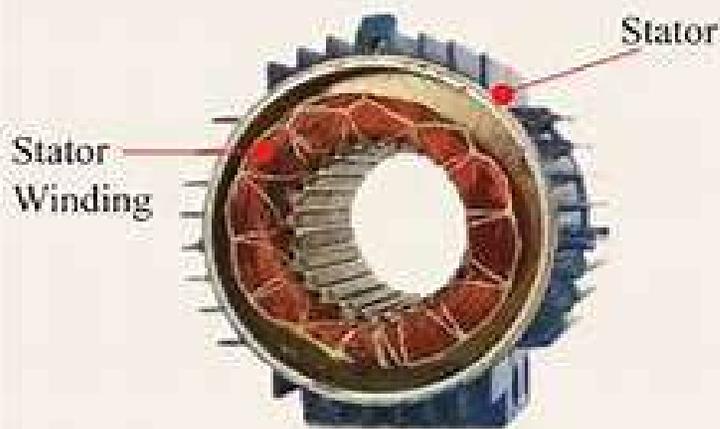


# Submersible Well Pumps



Capacity & runtime features and is not indicative of specific model performance.

# Electric Motor Winding



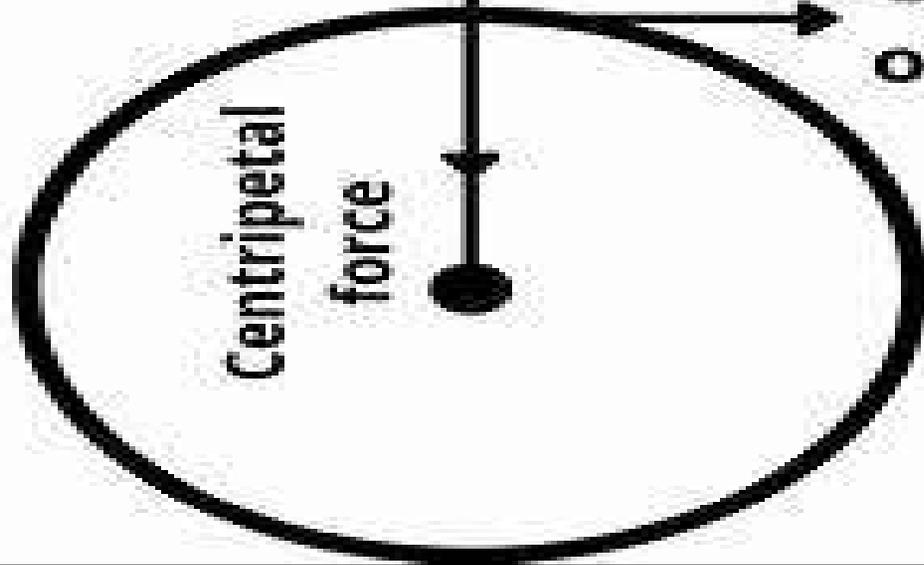
## How pumps work

- ▶ **Pumps don't suck they create centrifugal**

**Centrifugal  
force**



**Direction  
of motion**



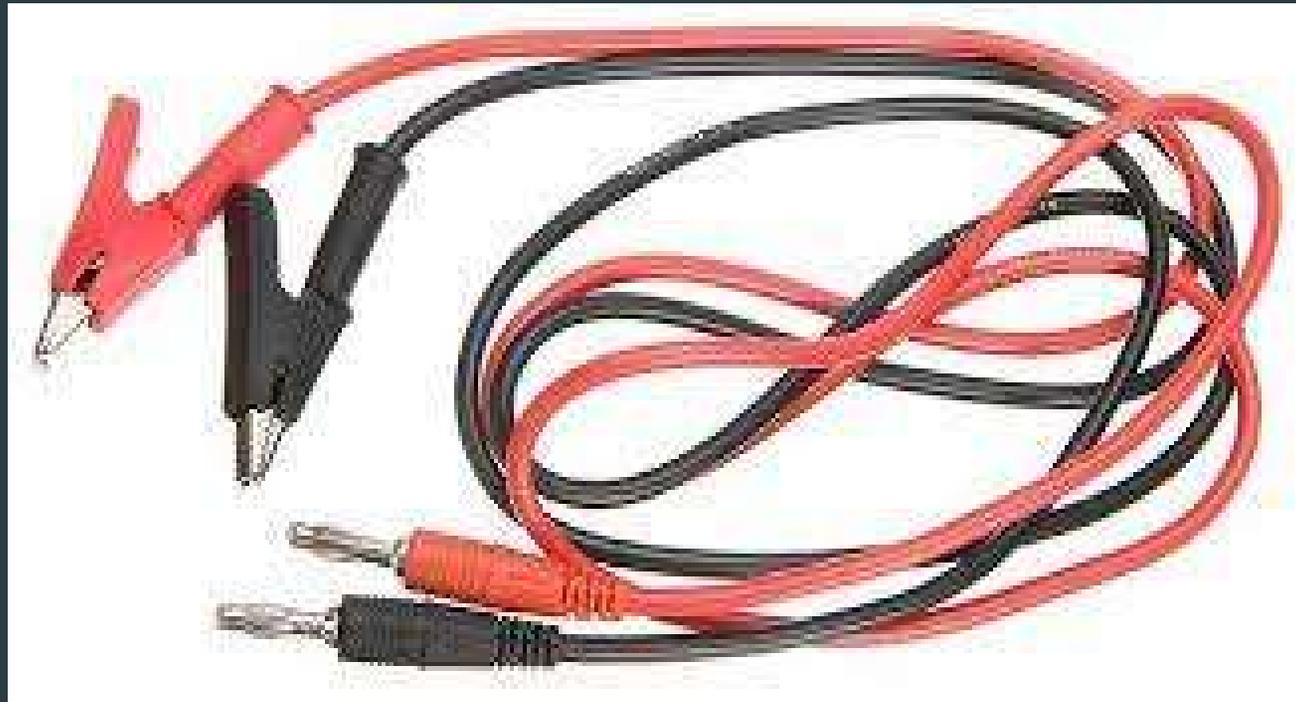
# Electric Meters



# Electrical multi meter

- ▶ What should you buy
  - ▶ Read AC/DC current
  - ▶ Read amps with an amp clip
  - ▶ Ohm reader
  - ▶ CAPACITOR TESTER If your advance or plan on becoming advanced

# Alligator clips “Saftey”



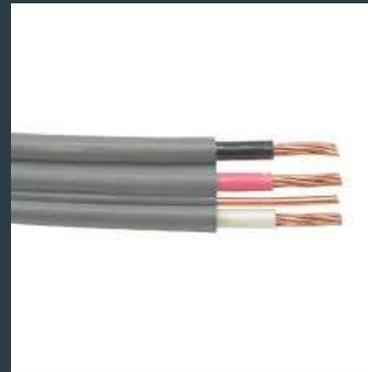
# Electric

- ▶ Single phase (115v, 208v , 230v)
  - ▶ 115v has one hot leg (wire)
  - ▶ 208 & 230 volt has two hot legs (wires)
  - ▶ You will typically only see 208v in commercial applications (but be aware of it)
- ▶ 3 phrase (200v, 230v, 460v, 575V) - *(advance class)*
  - ▶ *Three hot legs that if you don't get the "PHASE" (order) of wire right the impeller will spin in the opposite direction (THE WRONG WAY)*

# Two wire with ground 115 volt and 230 volt single phase



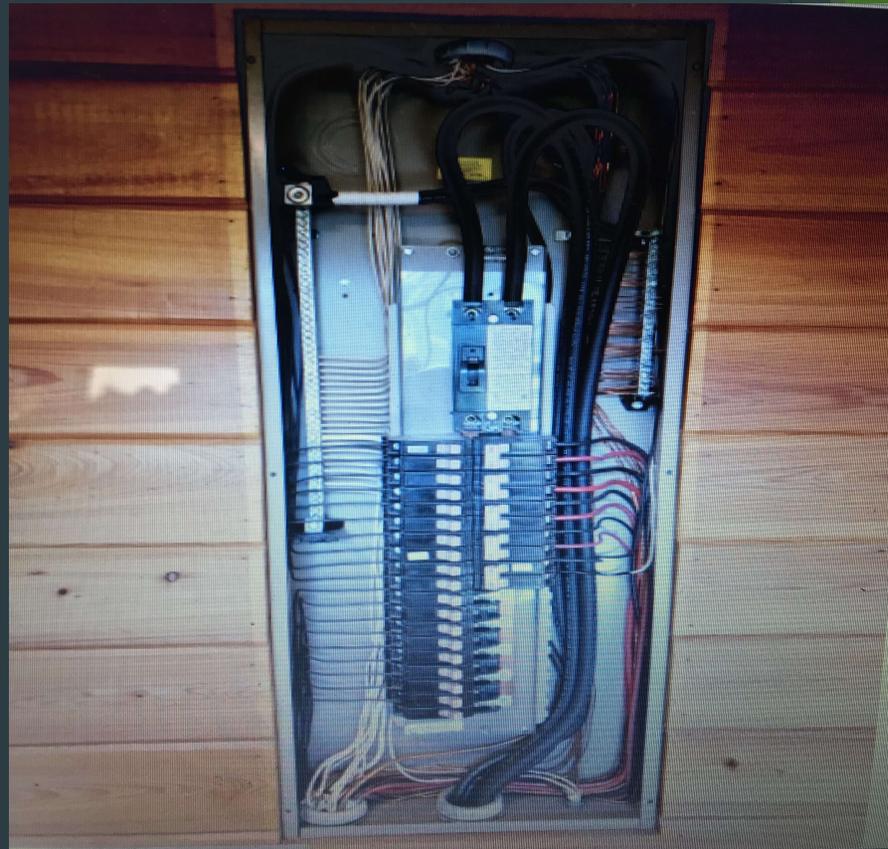
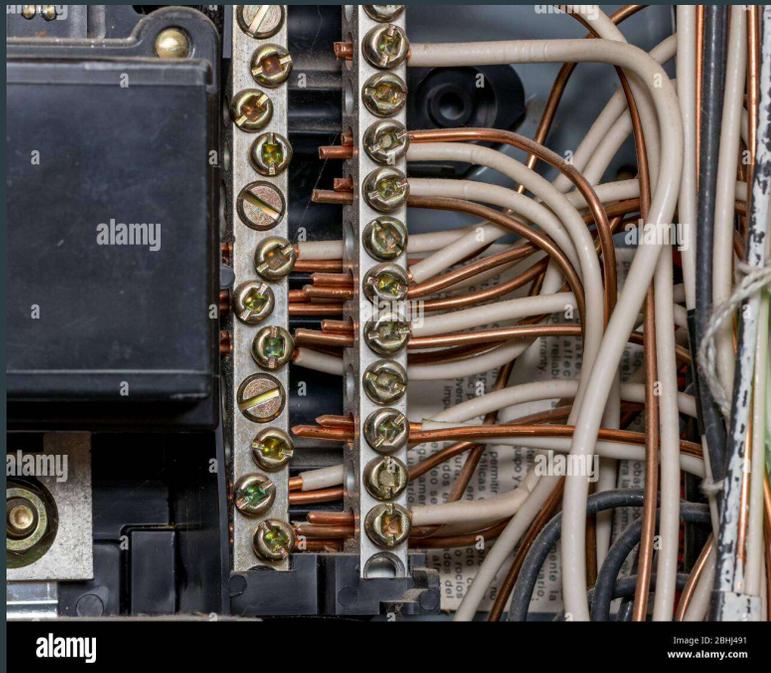
# Three Wire with ground 230 volt single and three phase



# Electricity - the circuit

- ▶ AC & DC - WE will focus on AC or alternating current
- ▶ HOT - [power] typically black or red
- ▶ Neutral - [is a circuit conductor that normally completes the circuit back to the source] typically white.
- ▶ Ground - [Ground or earth in a mains (AC power) electrical wiring system is a conductor that provides a low-impedance path to the earth to prevent hazardous voltages from appearing on equipment (high voltage spikes)] typically green or bare wire
- ▶ **Ground and Neutral are sort of the same thing just serves different purposes**

# Breaker box



# Understanding AMPS

- ▶ Shaun's simplified definition of Amps - Is a measurement of heat generated when a motor is running or volts are consumed
- ▶ The motor must be running, trying to run, or running inefficiently to get an amp reading
- ▶ If the motor isn't running you will not get amps
- ▶ Simplified Example: a light bulb will not have an amp reading if it is either blown or off or doesn't have electric. Same with a motor in a pump.
- ▶ All motors have a max amp draw or lock rotor
  - ▶ The max current rating refers to **the maximum amount of current that a motor is able to handle safely**. This current is measured in Amps. The continuous current rating of a motor is the Amps that a motor can handle safely over a long period of time

## How to check amps

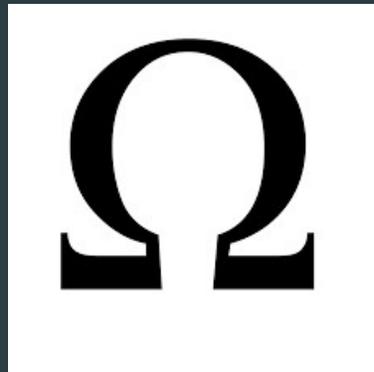


# YOUR AMP CLAMP MUST GO OVER THE HOT WIRE ONLY



# What's the difference between Amps, Watts and Volts?





# Resistance or OHM

- ▶ Resistance is the **measure of electrical “friction” as charges move through a conductor**. ... The resistance function is usually denoted by the unit symbol for resistance: the Greek letter omega ( $\Omega$ ), or sometimes by the word “ohms.” Touch the two test probes of your meter together.
- ▶ Shaun’s simplified definition
  - ▶ Is something connected or not and the measurement of connection.
  - ▶ Importance - if you know what is supposed to be touching and what is not supposed to be touching you will be able to diagnose a lot of things.
- ▶ Meter has a reading or number which means they touch
- ▶ Meter doesn’t have a reading and has OL on the display which means they don’t touch

# Ohms - What should touch and what shouldn't touch

- ▶ Power source from the house, breaker, or other source
  - ▶ Ground and Neutral wire, they are the same thing just serve two different purposes - so they should touch or get a reading of Ohms when coming from the breaker
  - ▶ Hot should not touch anything! If it does this will cause a spark or arcing or worse a fire you should see "OL" on your screen
- ▶ The Pump Or other item using electricity
  - ▶ Ground should not touch or read anything - you should get "OL" as your reading
  - ▶ You should get a reading from neutral to hot - check your manufacture pump book for details
- ▶ FLOAT
  - ▶ No reading to ground
  - ▶ Smallest steady reading as close to 0.01 as possible (*especially with panels*) when closed (ON) position but OL for open (OFF) position

# Switches

- ▶ Floats - turn a pump on or off
  - ▶ Mercury
  - ▶ Mechanical
  - ▶ piggyback float plug
  - ▶ Wired float
  - ▶ Slide float
  - ▶ Single
  - ▶ Double
    - ▶ Attached
    - ▶ Separate through panel
- ▶ Pressure switch
  - ▶ Low water cut off switch
- ▶ Transducer
- ▶ Diaphragm

## Mechanical floats

Piggyback plug



Piggyback Plug



# Mercury Floats



# Slide Floats



## Double Floats



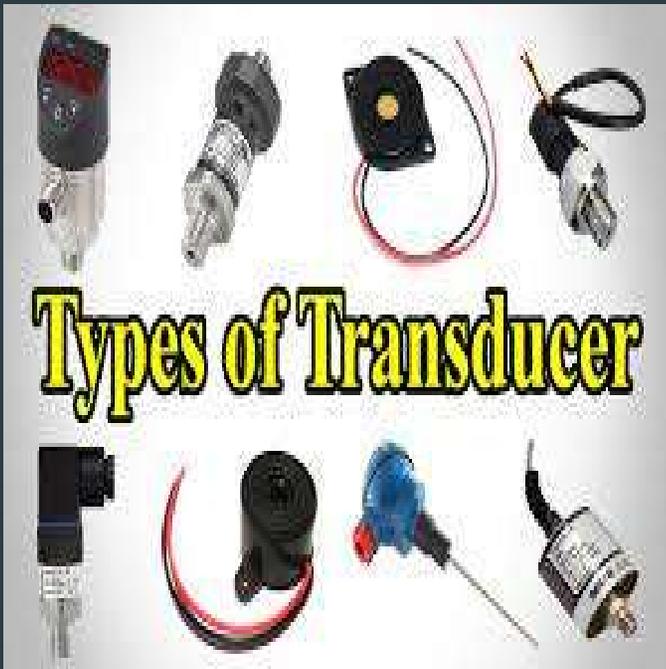
# Pressure switches



# Diaphragm



# Pressure Transducers



# Floats Have a max Amp rating T00

- ▶ Floats don't produce amps but they have a max amp rating
- ▶ SEE THE TAG ON THE FLOAT
- ▶ It Should be greater than the max amps on the pump.
- ▶ If a float has gone bad it could be from high amp draw
  - ▶ check pump's amps while it is running

# PIPE & Impellers

- ▶ Pipe and Impellers can get clogged even if they are under pressure
  - ▶ Even if there is a pump involved - by what?
    - ▶ Rust, Iron, foreign objects, AIR (*air Locked*), animals, ETC.
- ▶ In a pressurized system; if a pipe becomes clogged after the pump's discharge it is called "DEAD HEADING" and may give you lower amp reading than normal.
- ▶ If an impeller becomes clogged, blocked, or jammed - you will see high amp reading or what we call "LOCKED ROTOR" most pumps have a locked rotor reading.

Tip from Shaun on diagnosing

Just because a pump or motor is working  
does not mean the pump is OKAY

You may pause but don't stop

Use all Five steps don't stop

Finish Your diagnosis

# Step ONE

- ▶ Investigate with your eyes and use a camera take pictures
  - ▶ You don't need any tools other than
    - ▶ Question to customer
    - ▶ Eyes
    - ▶ ears
    - ▶ Camera
      - ▶ Take pictures before you touch things why?
    - ▶ Expertise
- ▶ Is the switch even calling for the pump to be on
  - ▶ One of the biggest mistakes is to dive too far into a diagnosis with out making sure the pump is even is being called to turn on.
    - ▶ I have no water - my pump isn't working - someone shut off a valve...

## Step Two

- ▶ GET YOUR MULTI METER
- ▶ Start with the base or the foundation
  - ▶ If the pump doesn't have electricity - it will not work
  - ▶ What voltage is it suppose to be?
  - ▶ DO I HAVE ELECTRCITY?
  - ▶ How much electricity
  - ▶ If I don't have electricity - WHY?
    - ▶ Is the breaker on/off/tripped
    - ▶ Where do I have electricity and where do I not - trace
- ▶ If I have electricity do I have the right voltage needed
- ▶ Are there obstructions to getting a volt reading
  - ▶ Why
  - ▶ What will it take to get a reading

## Step three

- ▶ Is the pump running
  - ▶ We have electric and the right voltage now what?
  - ▶ We need to know if the pump is running or not
  - ▶ We do this with an amp meter
    - ▶ What is the amp reading
- ▶ Are there obstructions to getting an amp reading
  - ▶ Why
  - ▶ What will it take to get a reading

## Step four

- ▶ Ohm / resistance check
  - ▶ Check the power source wires
  - ▶ Check the pump wires
  - ▶ Check the float or switch wires
  - ▶ What is grounded
  - ▶ Should it be grounded
  - ▶ Wires that are showing a reading that are supposed to; is the reading normal?

## Step Five

- ▶ You may need to check other things after you have gone through your diagnosis of all five steps.
- ▶ Simplify your findings
- ▶ Compare your findings with other information
- ▶ What does your investigation of all five steps tell you
- ▶ They should tell you a lot of things, pro's and con's
- ▶ Form your FULL diagnosis
- ▶ OPTIONS
- ▶ Present

# Expansion tanks

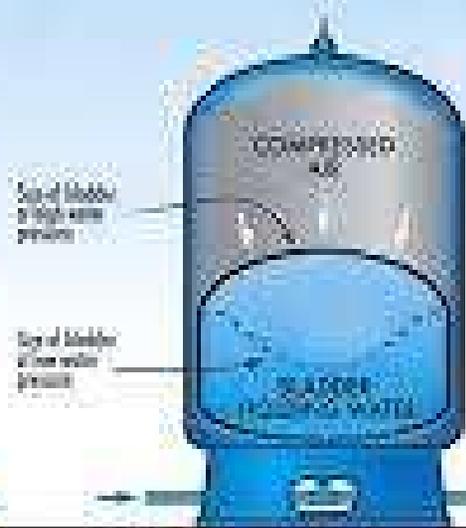


# Examples of tanks

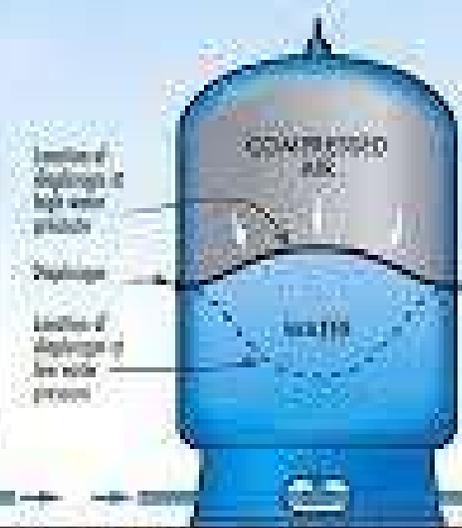
**ONE COMPARTMENT  
PRESSURE TANK (OLD STYLE)**



**BLADDER  
PRESSURE TANK**



**DIAPHRAGM  
PRESSURE TANK**



# How to check an expansion tank

- ▶ Schrader valve have water or air come out of it?
- ▶ With power off and tank empty; how much pressure is in the tank
- ▶ What is the cut on pressure (see under pressure switch)
- ▶ Pressure in tank should be less than the on pressure (2-3 psi)
- ▶ Too much air pressure in the tank will prevent the switch from turn the pump on and off properly
- ▶ Too little pressure in the tank may not be noticed
- ▶ If water squirts out your Schrader valve; most likely the tank is bad.



Thermal  
Couplings  
Give me a  
break

Q & A