Pumps 101

A Short Overview of Pumps

Our Presenter

Steve Sinks

Steve Sinks is an Account Manager with Orenco Systems®, Inc., a wastewater equipment manufacturing firm based in Sutherlin, Oregon. In this role, he works with our dealers and distribution partners to familiarize them with Orenco's products, assist them with logistics, and help them grow their market. He also helps train internal staff and assists the Sales Department with customer interactions.

Previously, Steve was the Senior Pump Technician and Pump Purchaser for Orenco. In 2000, he started with the company in electronics assembly before transitioning to custom control panels and then customer service. Prior to joining Orenco, Steve gained experience with controls systems in the U.S. Marine Corps and at the Department of Defense, where he developed and tested several types of guidance software for aircraft.

Overview

- History
- Basics
- Selection
- Pump Curves
- Troubleshooting
- Pump Repairs
- War Stories
- Do’s and Don’ts

40+ Year History:
Centrifugal Effluent Pumps

40+ Year History:

Centrifugal Turbine Pumps

Centrifugal Pumps in Use Today

- Multiple-stage, high-head pumps
- Single-stage, low-head pump, 3/4” or smaller solids
- Sewage pump, solids 3/4” to 2”
- Grinder pump, produces a slurry (cutter blades)

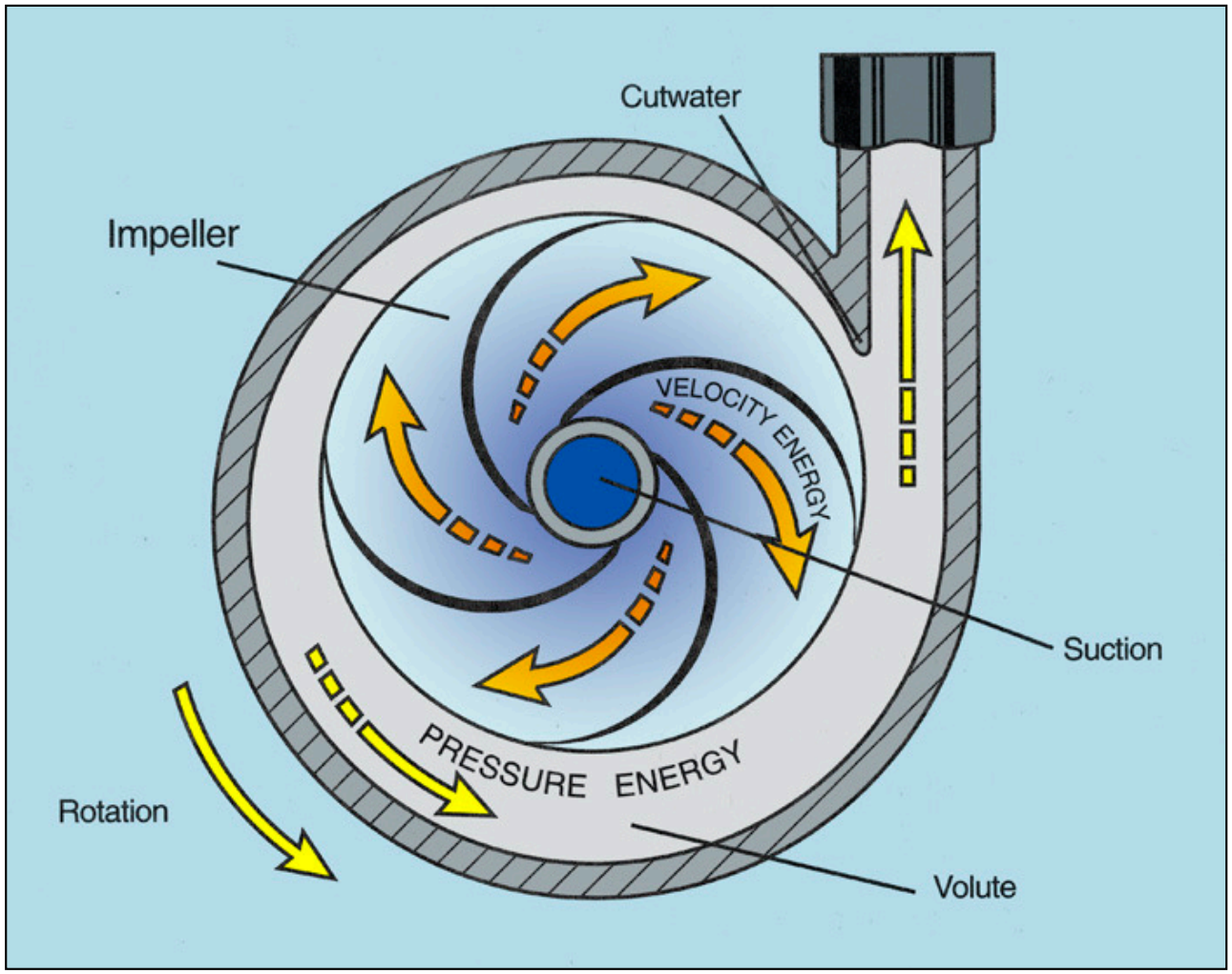
Basic Differences

Single-Stage (Low-Head)

VS.

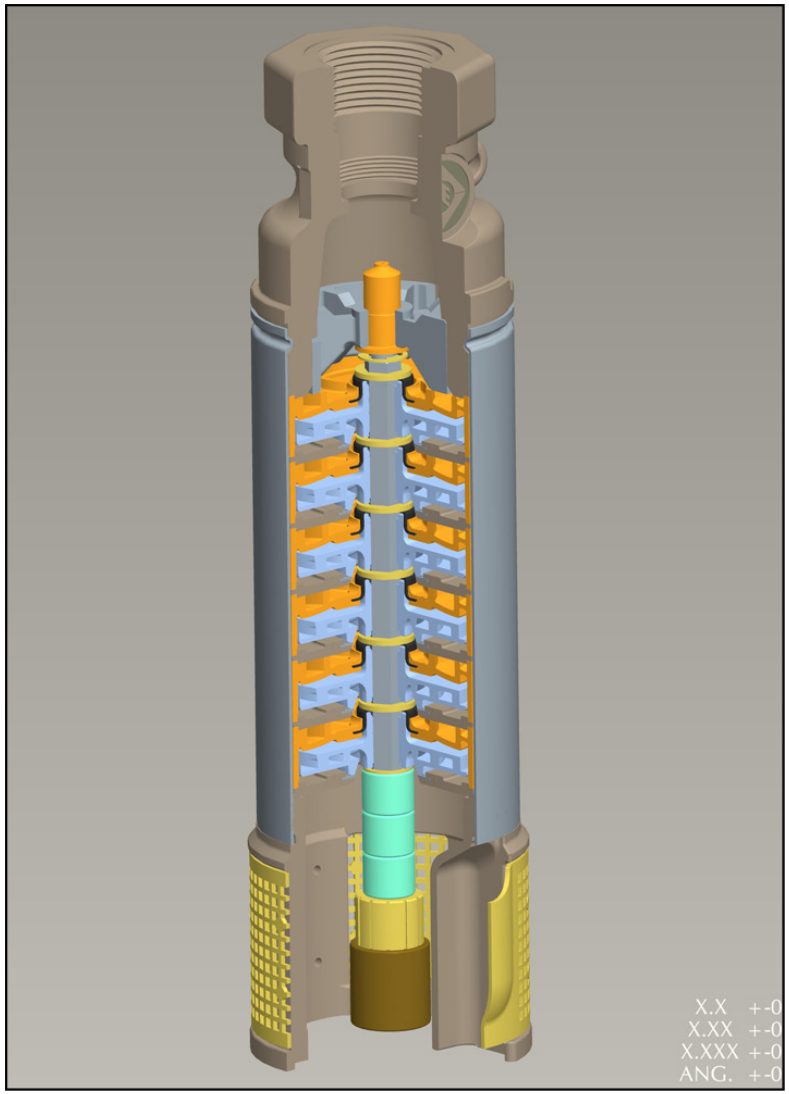
Multi-Stage (High-Head)

Impeller Concept



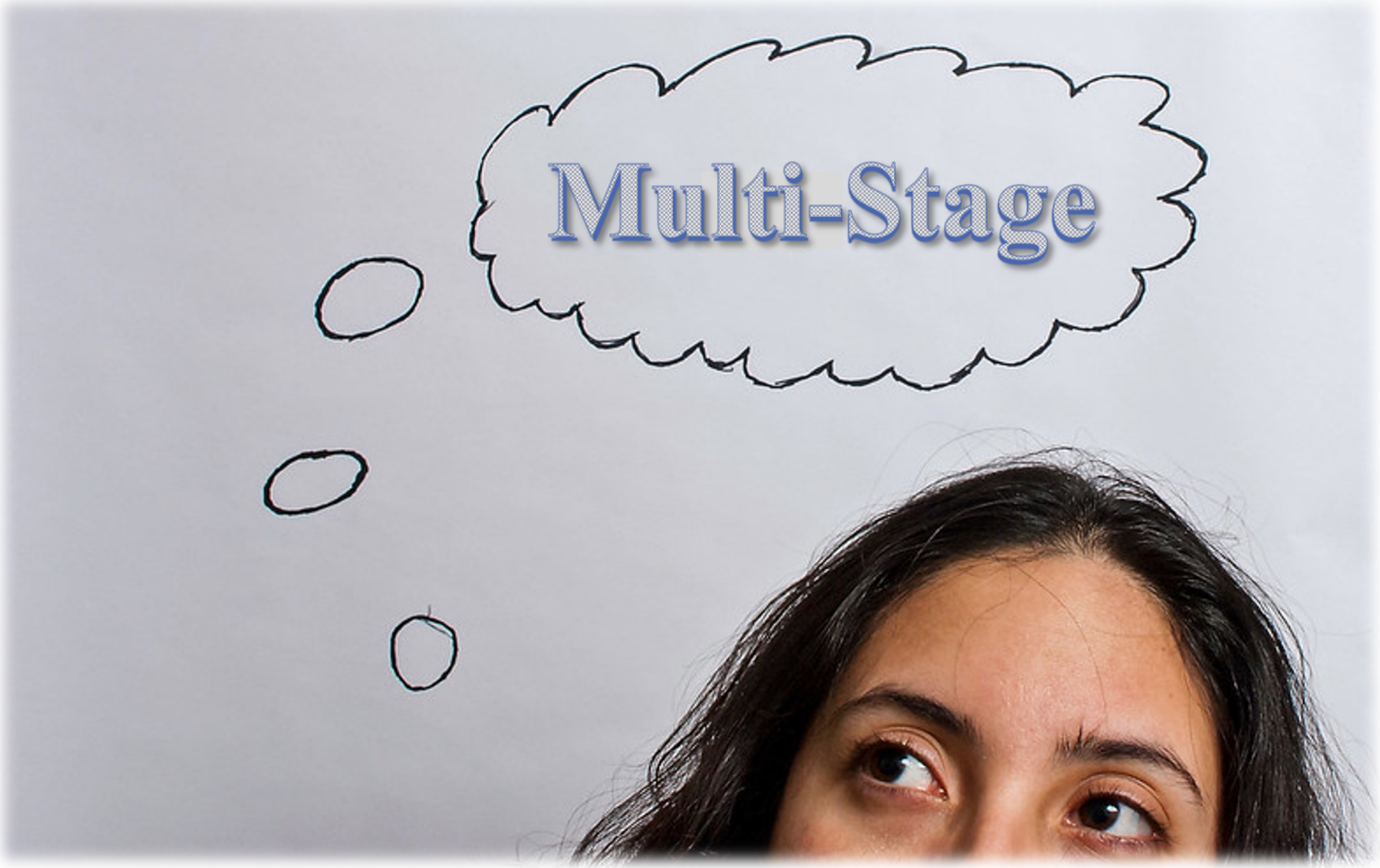
In a pump, impellers create centrifugal force, and the velocity energy is converted to pressure energy.

Impellers and Stages

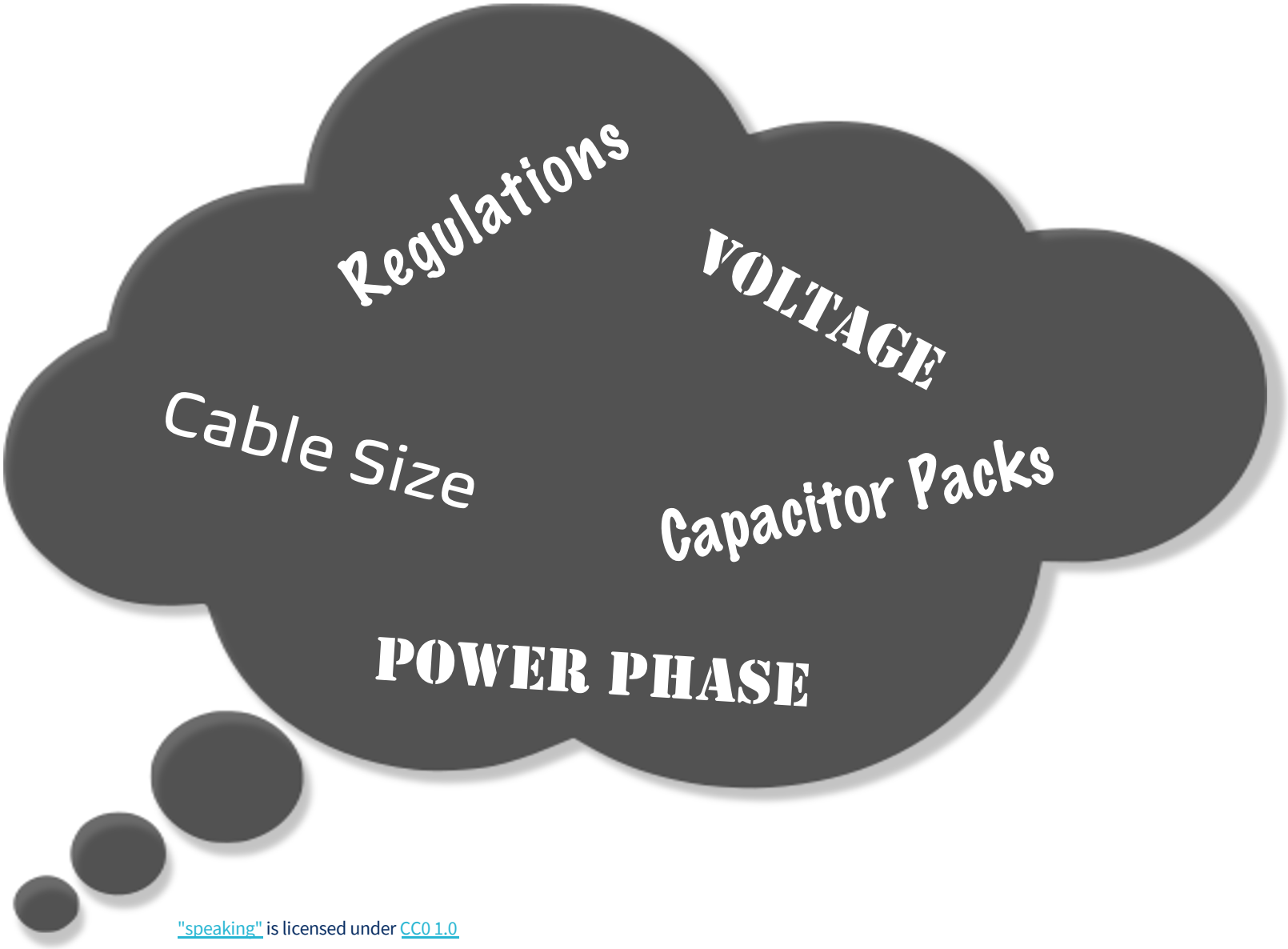


Pump Considerations

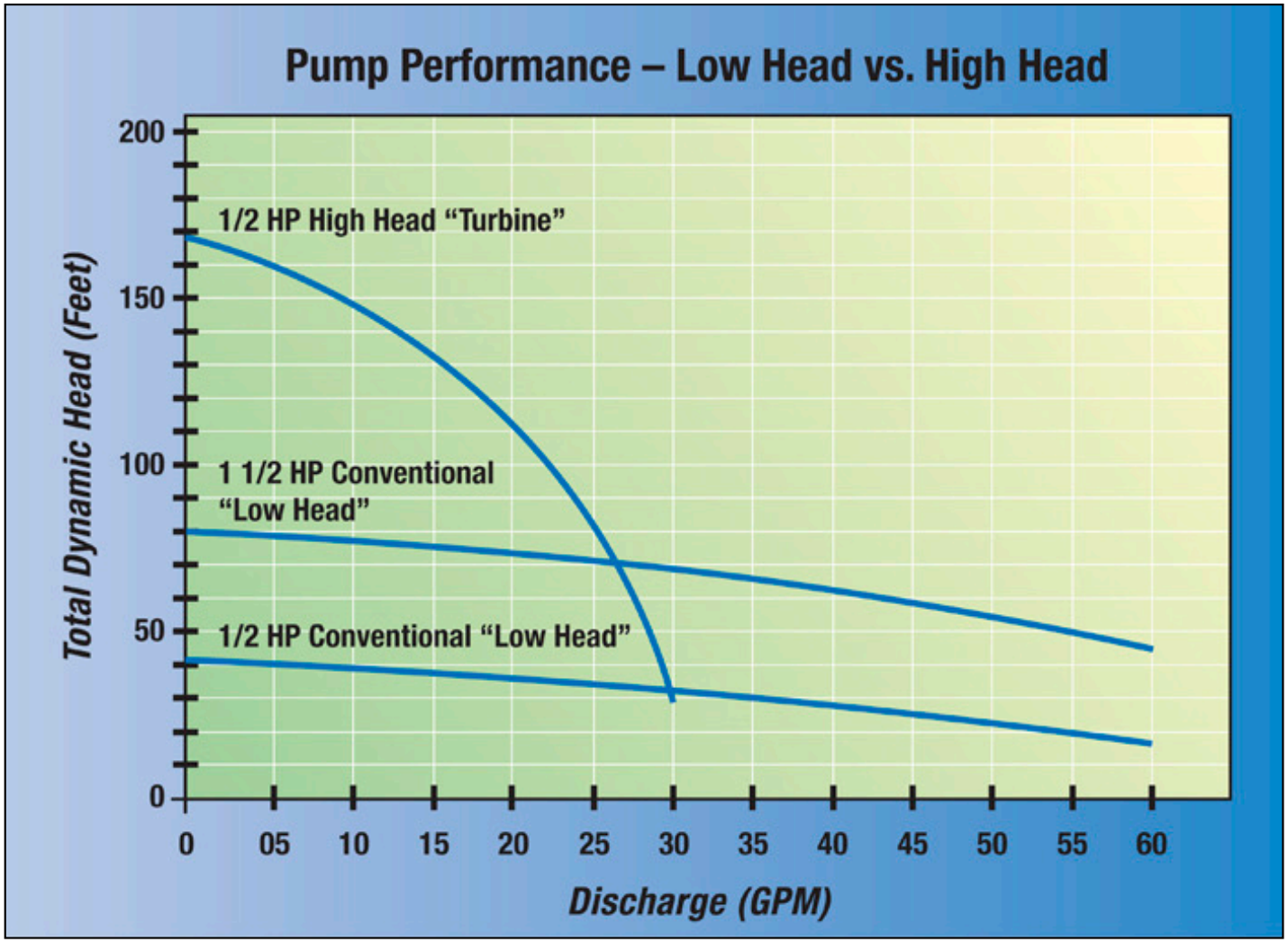
Pump Considerations



Electrical Considerations



Total Dynamic Head (TDH) Requirements



Pump curves show how various pump models perform (measured in Total Dynamic Head).

Troubleshooting Pump Problems

- The pump is often guilty until proven innocent.
- The pump gives you clues.
- Check the most obvious things first.
- Pull the pump and test/inspect it.
- Controls
- Incoming power

Troubleshooting Pump Problems

- Testing the motor for Franklin 2-wire motors

MOTOR MODEL PREFIX	NAMEPLATE HORSE POWER	NAMEPLATE VOLTS	LINE-TO-LINE RESISTANCE OHMS
244504	1/2	115	1.0 - 1.3
244505	1/2	230	4.2 - 5.2
244507	3/4	230	3.0 - 3.6
244508	1	230	2.2 - 2.7
244509	1 1/2	230	1.5 - 1.9

If OHM values are normal, the motor windings are neither shorted nor open.
If OHM value is less than normal, the motor or lead is shorted.
If OHM value is greater than normal, the motor or lead has a poor connection.

Troubleshooting Pump Problems

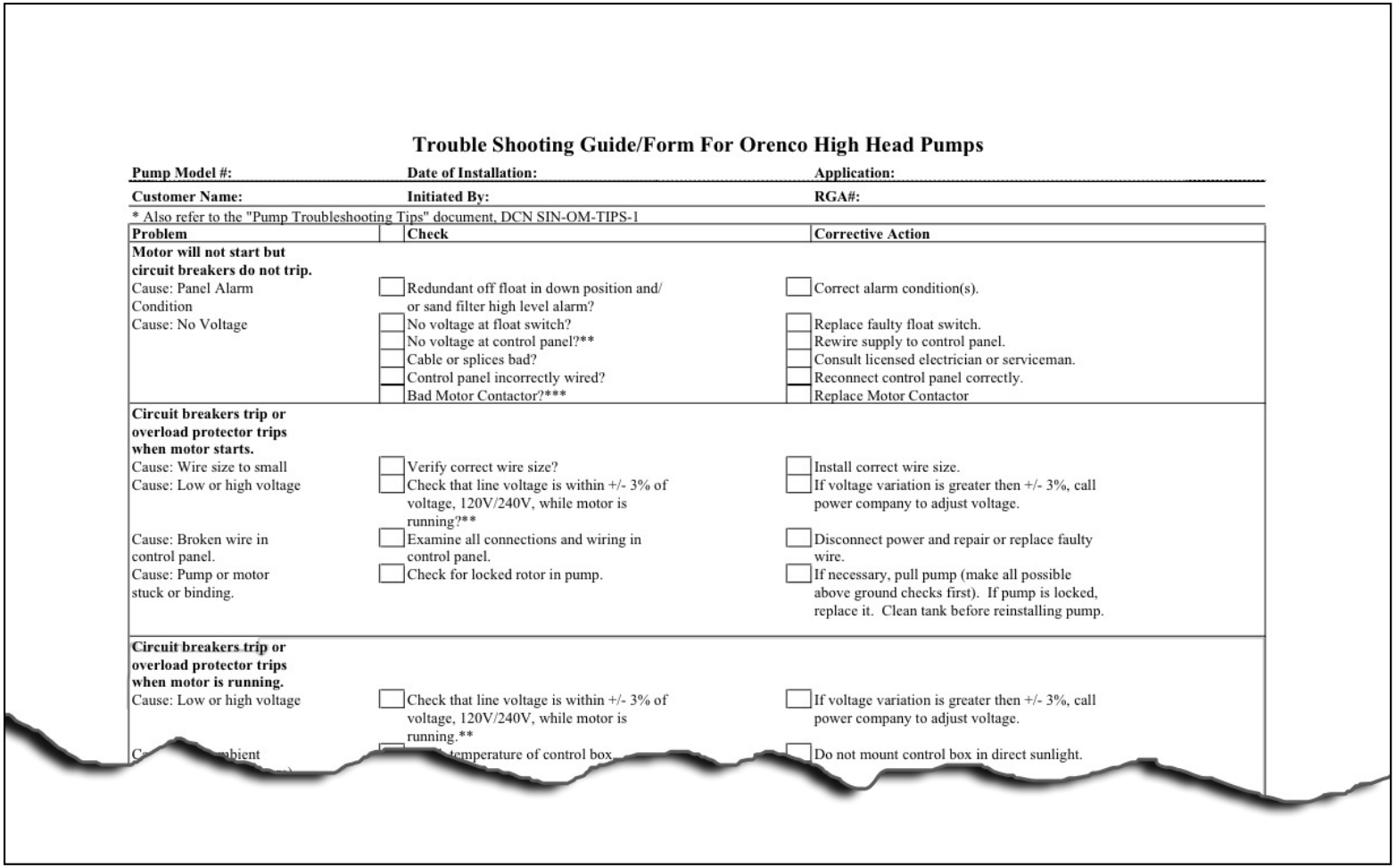
- Generator Use
  - ~ Must be sized to overcome motor start-up torque

Motor Rating *		Minimum Rating of Generator			
HP	KW	Externally Regulated		Internally Regulated	
		KW	KVA	KW	KVA
0.50	0.37	3.0	3.75	2.25	2.85
0.75	0.55	4.5	5.70	3.00	3.75
1.00	0.75	6.0	7.50	3.75	4.69
1.50	1.10	7.5	9.38	4.50	5.70

* *These ratings are for Orenco pumps utilizing Franklin Electric 2-wire motors.*

Troubleshooting Pump Problems

- Guides are available.



Trouble Shooting Guide/Form For Orenco High Head Pumps

Pump Model #: **Date of Installation:** **Application:**

Customer Name: **Initiated By:** **RGA#:**

* Also refer to the "Pump Troubleshooting Tips" document, DCN SIN-OM-TIPS-1

Problem		Check	Corrective Action
Motor will not start but circuit breakers do not trip.			
Cause: Panel Alarm Condition	☐	Redundant off float in down position and/ or sand filter high level alarm?	☐ Correct alarm condition(s).
Cause: No Voltage	☐	No voltage at float switch?	☐ Replace faulty float switch.
	☐	No voltage at control panel?**	☐ Rewire supply to control panel.
	☐	Cable or splices bad?	☐ Consult licensed electrician or serviceman.
	☐	Control panel incorrectly wired?	☐ Reconnect control panel correctly.
	☐	Bad Motor Contactor?***	☐ Replace Motor Contactor
Circuit breakers trip or overload protector trips when motor starts.			
Cause: Wire size to small	☐	Verify correct wire size?	☐ Install correct wire size.
Cause: Low or high voltage	☐	Check that line voltage is within +/- 3% of voltage, 120V/240V, while motor is running?**	☐ If voltage variation is greater then +/- 3%, call power company to adjust voltage.
Cause: Broken wire in control panel.	☐	Examine all connections and wiring in control panel.	☐ Disconnect power and repair or replace faulty wire.
Cause: Pump or motor stuck or binding.	☐	Check for locked rotor in pump.	☐ If necessary, pull pump (make all possible above ground checks first). If pump is locked, replace it. Clean tank before reinstalling pump.
Circuit breakers trip or overload protector trips when motor is running.			
Cause: Low or high voltage	☐	Check that line voltage is within +/- 3% of voltage, 120V/240V, while motor is running.**	☐ If voltage variation is greater then +/- 3%, call power company to adjust voltage.
C[illegible]bient	☐	[illegible]temperature of control box.	☐ Do not mount control box in direct sunlight.

High-Head Pump, Field or Shop Repairs

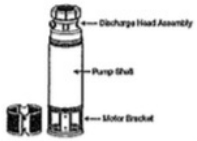
- You can change out …
  - ~ Motor
  - ~ Cord
  - ~ Liquid end
  - ~ Stack (rotating assembly)
- You can clean …
  - ~ Pump screen
  - ~ Pump internals (rotating assembly)
- Maintain a log of all installations, repairs and cleaning.

High-Head Pump, Field or Shop Repairs

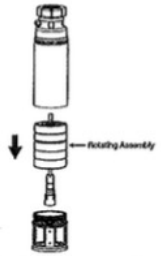
Orenco Systems®
Pump Rotating Assembly Replacement
PF Series 10, 20 and 30 gpm models

Removing Old Rotating Assembly

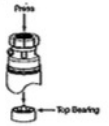
1. Remove suction screen from motor bracket. Unbolt pump end from motor. Clamp motor bracket of pump in a chain vise. Do not clamp around the stainless steel pump shell. Unthread pump shell from the motor bracket by rotating the shell clockwise.



2. Remove old rotating assembly from pump shell. Insure that all parts are removed from the shell/ discharge head assembly.



3. If replacing the top bearing, remove the bearing assembly from the bearing holder in the discharge head by pushing it down from the inlet side of the discharge.

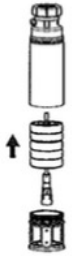


Installing New Rotating Assembly

The new rotating assembly is furnished as a complete unit. No other assembly is required.

1. Install new top bearing assembly into the bearing holder by inserting the bearing up through the pump shell. Make sure the alignment tabs are properly seated in the notches of the bearing holder and the bearing is fully pressed into the holder. A small amount of lubricant should be added to the inside cavity of the bearing.

2. Slide new rotating assembly up through the bottom of the shell making sure the pump shaft fits into the top bearing and the top hydraulic stage seats into the bottom of the discharge head.



3. Thread motor bracket on to the bottom of the shell. Make sure the bracket does not cross thread with the threads on the shell. Turn the motor bracket counter-clock wise to tighten the assembly. Tighten to 70 ft-lbs.

4. Replace inlet suction screen.

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WAR STORIES

Plugged pumps

Upthrust

Chemical damage

Worn splines

Check valves

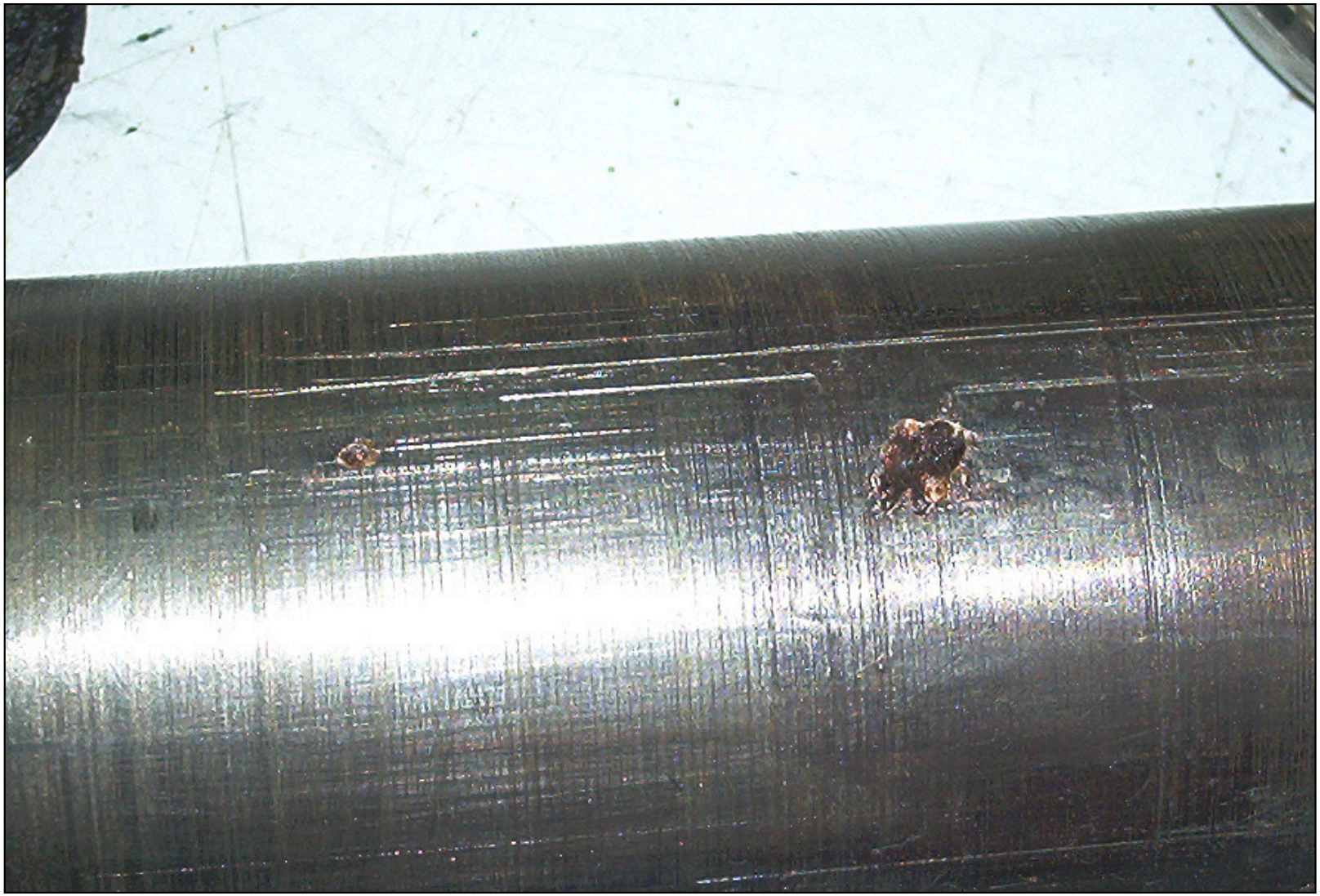
BIAC switch

Insufficient power

Abused and Neglected Pump

Damage Due to Abrasives

Lightning Damage



Corrosion Cracks Due to Salt Water

Blind Screen

Debris in a Pump

Grease-Filled Liquid End

Crusted and Blocked Impellers

Pump Performance Report

Orenco Systems®, Inc. | Pump Performance Report

PA300511 VRS PA300511 Standards

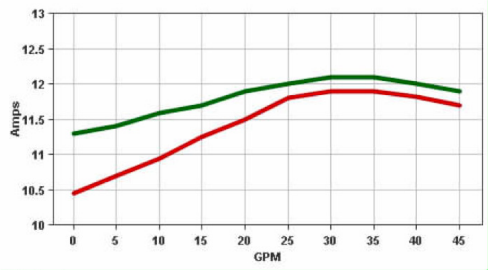
Printed **Oct 27, 2008**

PA300511 Motor S/No: **28-0302** Moter Date Code: **06H14** Liquid End Date Code: **01L07A** RGA Number: **20746**

GPM	HP	Plate Voltage	HZ	Line Voltage	Phase	Station	1/8th Hole	Operator	Date
30	0.5	115	60	120	1	4	Yes	Brad Boisen	07/24/08

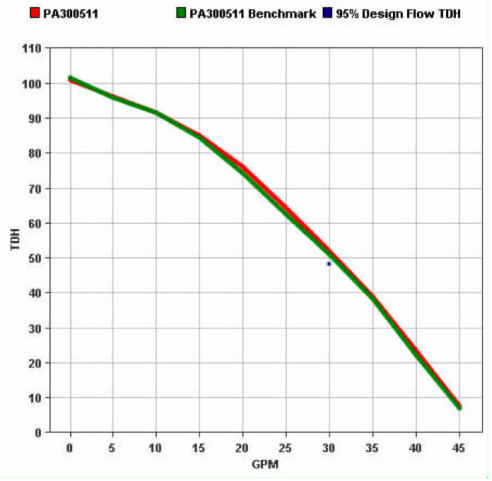
Comments Received with all waterways and both screens blocked with grease. Photos available if you want to see it. Cleaned pump completely and curved against benchmarks. No issues found other than grease blockage.

Amps Chart



	Pump Tested PA300511		Benchmark PA300511	
GPM	AMPS	TDH	AMPS	TDH
0	10.45	100.97	11.30	101.40
5	10.70	96.12	11.40	95.98
10	10.95	91.50	11.60	91.64
15	11.26	85.03	11.70	84.33
20	11.50	76.02	11.90	74.22
25	11.80	64.23	12.00	62.44
30	11.90	51.76	12.10	50.85
35	11.90	38.82	12.10	38.24
40	11.82	23.33	12.00	22.12
45	11.70	7.62	11.90	7.00

TDH Chart



BENCHMARK NOTE:
- All 115 V. nameplate pumps are tested at 119 to 121 V.
- All 200 V. three phase nameplate pumps are tested at 209 to 211 V.
- All 220/230 V. (50HZ) nameplate pumps are tested at 228 to 230 V.
- All 230 V. (60HZ) nameplate pumps are tested at 240 to 242 V.

O-12/20/01

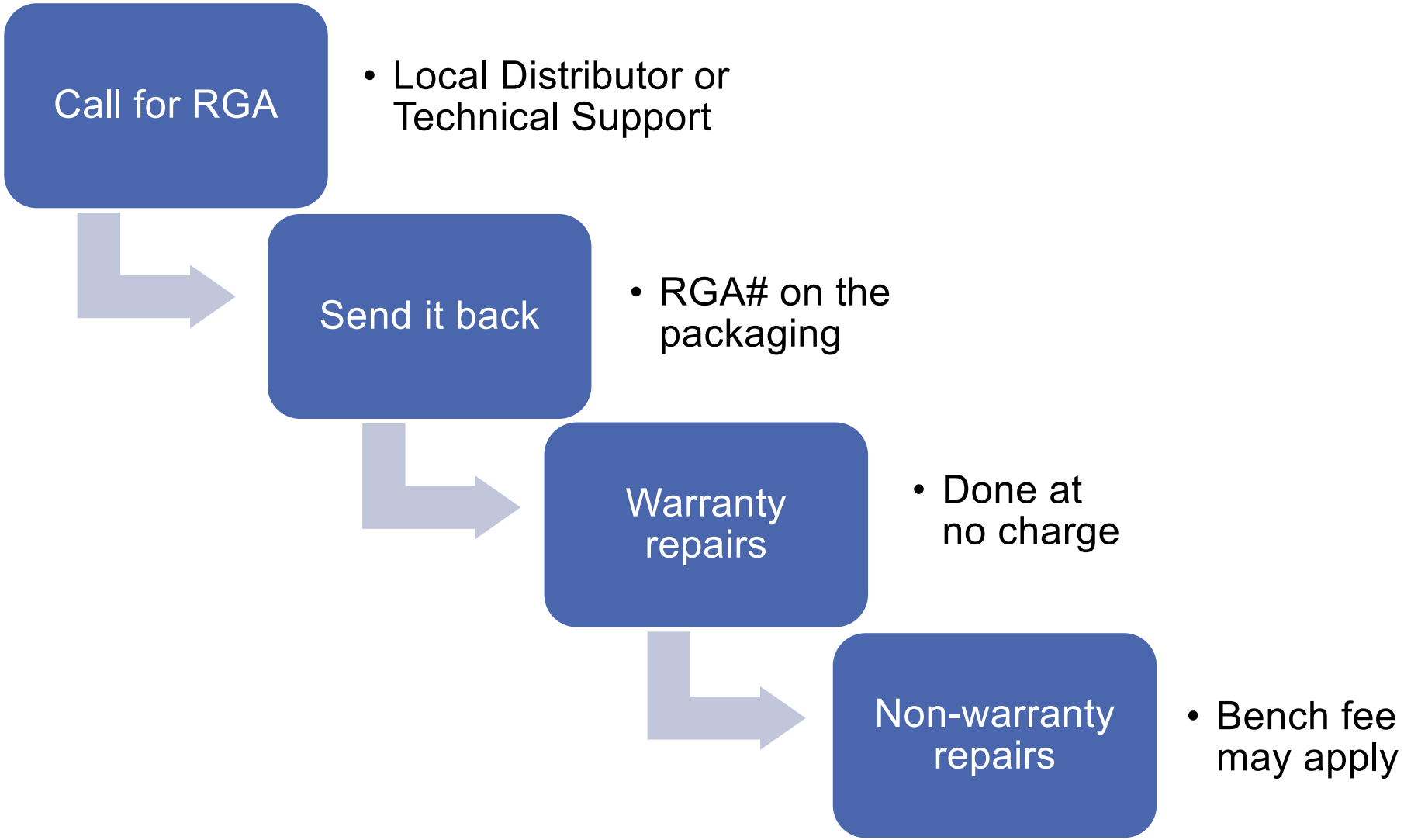
How to Increase Pump Life

- Low-head and high-head
  - Use proper screen
  - Control MLL (measured relative to bottom of pump)
  - Avoid frequent starts
  - Provide proper power
  - Use check valves properly
  - Perform regular inspections, service, and maintenance

How to Increase a Pump's Life

- Additionally, for high-head …
  - ~ Avoid upthrust/downthrust
  - ~ Use flow control disc, if needed
  - ~ Avoid abrasives
  - ~ Use a flow inducer to keep motor cool

Return Good Authorization Process (RGA)



Do ...

- Correctly size the pump
- Use flow control disc (if needed)
- Match pump to application
- Use proper controls
- Perform preventive maintenance

Don’t …

- Neglect your pump, filter or valves
- Lift the pump by its cord
- Rapid cycle the pump
- Use pump discharge plumbing as float hanger
- Compromise on quality

Summary

- History
- Basics
- Selection
- Pump Curves
- Troubleshooting
- Pump Repairs
- War Stories
- Do’s and Don’ts

Solutions for Decentralized Wastewater Treatment

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