TECH TIP #24

SWIMMING POOL HEATING

Heating a swimming pool can be an ongoing maintenance headache, unless a few rules are followed closely. We have recapped a few of the rules that we have determined over the years.

1. Make sure that the chlorine is added to the system on the downstream side of the heating source (either a pool boiler or heat exchanger), sand filters, and pumping equipment. The chemicals are injected into the line at high concentrations and this heavily concentrated solution must have a chance to dilute before it goes into the equipment. Typically this insertion takes place just before reentry into the pool.

2. Since most pools are held a temperature about 82° F, it is very important that a procedure be in place to make sure that the inlet water temperature to any gas fired pool heater never falls below 105° F. 105° F is the condensing temperature for a typical copper finned tube type of pool heater. Failure to keep the inlet water temperature above the condensing temperature will cause the flue gases to condense and the subsequent water will drip onto the heat exchanger causing corrosion. This corrosive acid can eat through a heat exchanger in a matter of a few weeks...and will most likely void the pool heater warranty. Consult with our boiler experts for how to prevent the problem.

3. When using a steam source in a heat exchanger to heat the pool heater, a few very important construction details need to be followed in the materials used in the heat exchanger. The tubesheet needs to be either a solid brass or alternative material to combat the common problem of galvanic corrosion between the typical steel tubesheet and copper tubing.

ADVANCED TECHTIP...Contact our office for further information and possibly a jobsite visit if needed. Pool heaters can be very troublesome...let us help you get off to a good start on your next pool job, or help you correct deficiencies in a current system.

TECH TIP #25

HOW TO ORDER PARTS FOR VALVES, PUMPS, ETC.

More valuable time is wasted on both ends of the phone by not having complete and correct information when calling to check on repair parts. Here're a few pointers on what is normally required to get the correct parts and where to typically find the information.

CONTROL VALVES...Most HVAC valves will have a brass tag on the neck of the valve. Sometimes it is under valve insulation. Remember to get the information off the actuator. Many of us have experience in "backtracking" into the control valve, but all the information you can collect will help us figure out what that tagless valve is.

PUMPS...Most pumps will have a nameplate mounted on the pump itself, usually near the top of the pump volute. Write down all the information off the tag, because we sometimes have to read between the lines. Frequently we are given the info off the motor on the pump. Nine times out of ten the motor info will not be of any help in identifying pump parts. The exception to the motor information is to make sure you have the Hp, voltage, rpm, phase and enclosure. If the tag is missing, measure the pump suction and discharge sizes and with the above motor info we can often figure a new pump.

TECH TIP #26

Need to order a pump? Use this form to gather your information and speed the process when you call.

Date _____

FEDERAL CORPORATION
120 East Main Street, Oklahoma City, OK 73104
405-239-7301 Fax 405-232-5438

Pump Sizing Information Sheet

Name of Firm _____
Address _____City_____ ST____ Zip _____
Phone _____ Fax _____ E-mail _____

System Information

Service _____
Line Size ____Quantity ____ Tag # _____

Flow Conditions

	Minimum	Normal	Maximum	U/M
Flow Rate	_____	_____	_____	____
NPSH	_____	_____	_____	____
Ft Head	_____	_____	_____	____
Temp	_____	_____	_____	____

Media

Name of Liquid _____ Specific Gravity _____ Viscosity_____
Critical Pressure_____ Vapor Pressure _____ Operating Temp _____

Pump

End Connection __Threaded __Flanged __Other _____
Flange Pressure Rating __ 125# __ 150# __ 300# __Other _____
Pump Type __Gear __Diaphragm __Centrifugal __Metering __ Submersible
Case __Iron __Bronze __Stainless Steel __Other _____
Internals __Iron __Bronze __Stainless Steel __Other _____
Shaft __Iron __Carbon Steel __Stainless Steel __Other _____
Seals _____

Motor

Horse Power____ RPM_____ Voltage __ 120 __ 240 __ 480 __ Single Phase __ 3-Phase
Type __ ODP __ TEFC __ Other _____
Efficiency __ Standard __ High __ Premium

Coupling

Type _____ Manufacturer _____ Model _____
Shaft Size _____ pump x _____ motor

Comments:_____
_____
_____

Required Information Specific Gravity & Viscosity can be found on the MSDS

TECH TIP #27

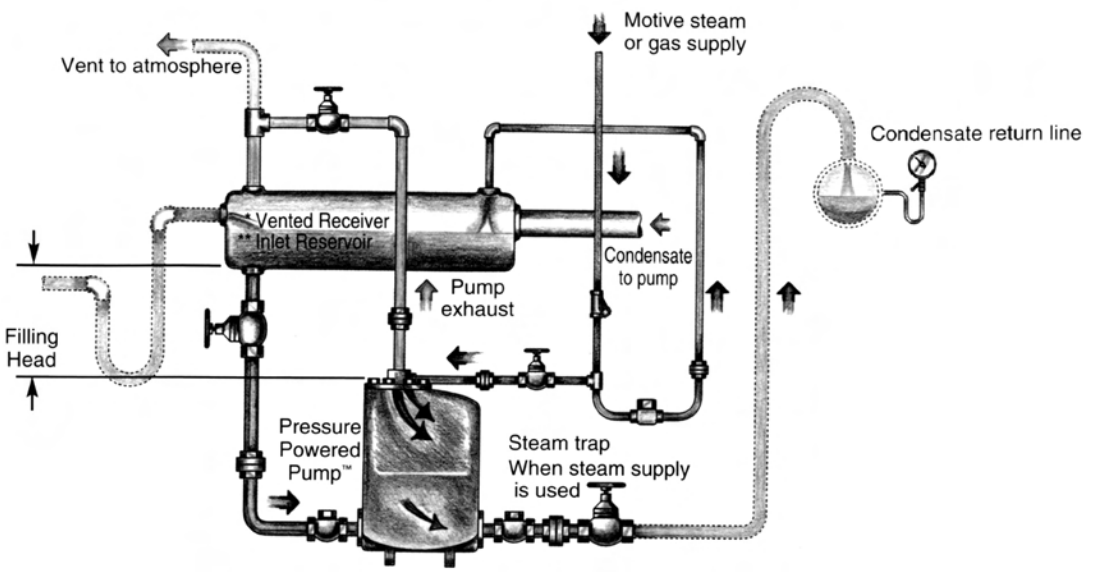
PRESSURE POWERED CONDENSATE PUMPS

Many engineers and central system owners are beginning to standardize on the Pressure Powered Pump (PPP) for returning hot condensate to the boiler plant. First developed by Spirax Sarco over 30 years ago, Spirax Sarco has over 30,000 PPP located all over the world in some of the toughest applications. No motors to burn out, no seals to replace and able to operate in any hazardous

Operators and repair technicians have come to appreciate the PPP ability to handle extremely hot condensate with the problems typically associated with electric condensate pumps. If you have not installed a PPP in your facility yet, just consider a condensate pump that will handle hot condensate at 212F and hotter without complaining. Take time to look over the user benefits listed on the next page.

ADVANCED TECHTIPS.....Federal Corporation has been selling PPP to military bases, university campuses and industrial facilities for many years with fantastic results. Let us come to your plant, survey your condensate return system and show you how you can save money, maintenance headaches and keep your boiler plant operating smoother than ever before with Spirax Sarco's PPP.

Typical installation



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TECH TIP #27 (Cont.)

How it works

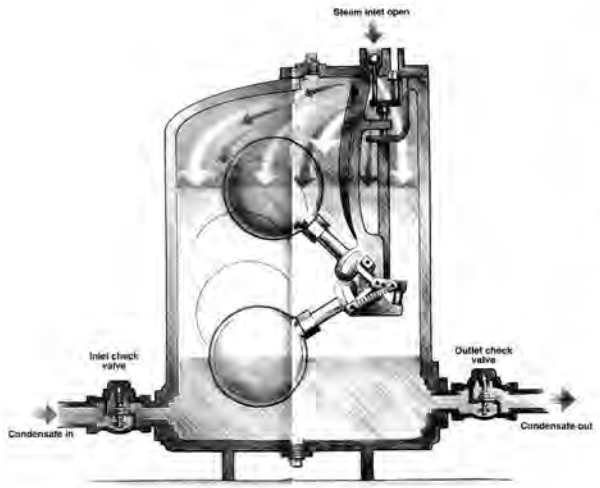
The Pressure Powered Pump ™ operates on a pressure displacement principle.

Liquid enters the pump body through the inlet check valve causing the float to rise. As the chamber fills, the valve changeover linkage is engaged opening the steam inlet valve and closing the exhaust valve. This snap action linkage ensures a rapid change from filling to pumping stroke.

As pressure inside the pump increases above the total back pressure, condensate is forced out through the outlet check valve into the return system.

As the liquid level falls within the pump, the linkage causes the steam inlet valve to close and the exhaust valve to open.

As the pressure inside the pump body falls, condensate re-enters through the inlet check valve and the cycle is repeated.



User benefits

- Removes condensate under all load conditions, even vacuum, ensuring maximum process efficiency.
- No mechanical seals or packing glands to leak, reducing maintenance costs.
- Requires no electrical power. Single trade for installation and repair.
- Wide range of end connections, compatible with sanitary tubing and piping systems.
- Suitable for hazardous and demanding environments.
- Cavitation problems eliminated, reducing maintenance costs.
- Zero emissions. No motive steam loss when installed in a closed system, reducing operating costs.
- Modular maintenance for reduced plant downtime.
- Rugged design for a trouble-free, long life.
- Minimal steam consumption. 3 pounds of motive steam per 1,000 pounds of liquid pumped.
- Metering capability by addition of optional cycle counter for monitoring plant efficiency.
- Proven reliability. More than 30,000 pumps installed worldwide.
- Six-month payback or less. Call your local sales representative for payback analysis.

TECH TIP #28

PUMP CAVITATION

Cavitation? What in the heck is cavitation?

WHAT IS IT? Cavitation occurs when the absolute inlet pressure of a fluid drops below what is required by the pump design to prevent the pumped fluid from vaporizing in the eye of the impeller. Essentially, what happens is the fluid begins to "boil" in the eye (suction inlet) of the impeller. When the partial vapor/fluid hits the higher pressure zone near the outer vanes of the impeller, it collapses back to a liquid. The collapsing, or imploding, is what causes the damage. This sounds like a growling, gurgling, or marbles moving through the pump.

WHAT WILL HAPPEN IF IGNORED? If the condition is not addressed, damage to the pump impeller and casing can happen quite quickly. Some pumps have even been ruined in a matter of a few minutes of severe cavitation. Typically, the impeller will look like it has been sandblasted; the pump volute (casing) may also look this way. The pump capacity will be reduced due to the cavitation. If the wear ring and/or impeller(s) have become eroded, the pump capacity will be greatly reduced. Even if the conditions which caused the cavitation problem are eliminated, the damage will already have been done.

WHAT FACTORS CONTRIBUTE MOST TO CAVITATION? In this TECH TIP we will limit our discussion to boiler feed pump factors.

1. Temperature of the feedwater: The hotter the water, the more problematic cavitation will be.

2. Gauge pressure of the supply tank (feed-water tank or deaerator): If the tank is pressurized as in a deaerator, a sudden pressure drop will immediately cause pump problems. Many times the problems are catastrophic. Provisions must be in place to ensure a 5 lb. deaeration stays at 5 lb. under all operating conditions.

3. Height between the waterline in the tank and the pump suction: The higher the waterline is above the pump, the better.

4. Suction piping arrangement: Sometimes a simple change in the pump suction piping will eliminate cavitation. Avoid 90's or other changes in piping direction within 10X pipe diameters of the pump inlet. For example, a 2" pump secton should have 20" of straight inlet piping.

5. Pump flow is too high: If the feedwater pump is moving too much water and begins to make cavitation noise, throttling a discharge valve may help. Never throttle with a valve on the suction of the pump.

ADVANCED TECHTIPS: We have chosen not to get into the NPSH calculations in this discussion. See Tech Tip #29 for NPSH calculation help. Federal Corporation has years of experience fixing pump application problems. We can help you fix your feedwater systems, ours, and the other guys. Call us; we can help.

TECH TIP #29

NET POSITIVE SUCTION HEAD
(NPSH)

NPSH combines all the factors limiting the suction side of a pump; internal pump losses, static suction lift, friction losses, vapor pressure and atmospheric conditions. It is important to differentiate between REQUIRED NPSH and AVAILABLE NPSH.

NPSH REQUIRED

REQUIRED NPSH is a factor designed into a pump and measurable in the test laboratory by the manufacturer. Testing facilities can determine losses in the suction piping static lift and barometric pressures.

NPSH AVAILABLE

The term for providing sufficient pressure on the suction, at the impeller eye, to prevent "boiling" is known as NPSH AVAILABLE. It is a function of the pumping system and consists of pressure on the liquid at its source, the elevation of the liquid with respect to the impeller centerline, losses in the suction piping and vapor pressure of the liquid.

If the available NPSH is not equal to, or greater than that required by the pump, it must be increased. This is usually done by increasing the static head, Hz.

NPSH FORMULAS

PROPOSED INSTALLATION

To calculate the NPSH available in a proposed application, the following formula is recommended:

$$Hsv = Hp \pm Hz - Hf - Hvp$$

Hsv — Available NPSH expressed in feet of fluid.

Hp — Absolute pressure on the surface of the liquid where the pump takes suction, expressed in feet. This could be atmospheric pressure or vessel pressure (pressurized tank).

Hz — Static elevation of the liquid above, or below the centerline of the impeller, expressed in feet.

Hf — Friction and entrance head loss in the suction piping, expressed in feet.

Hvp — Absolute vapor pressure of the fluid at the pumping temperature, expressed in feet of fluid.

PROPERTIES OF WATER

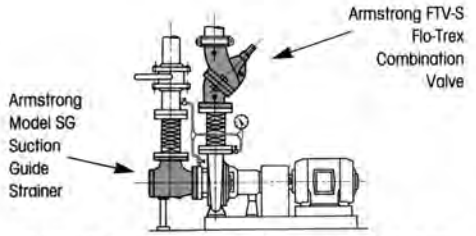
Temp. °F.	Absolute Vapor Pressure		Specific Gravity
	PSI	Ft. Water	
60	0.26	0.59	0.999
85	0.60	1.4	0.996
100	0.95	2.2	0.993
120	1.69	3.9	0.989
130	2.22	5.0	0.986
140	2.89	6.8	0.983
150	3.72	8.8	0.981
160	4.74	11.2	0.977
170	5.99	14.2	0.974
180	7.51	17.8	0.970
185	8.38	20.0	0.969
190	9.34	22.3	0.966
195	10.38	24.9	0.964
200	11.53	27.6	0.963
202	12.01	28.8	0.962
204	12.51	30.0	0.961
206	13.03	31.2	0.960
208	13.57	32.6	0.960
210	14.12	33.9	0.959
212	14.70	35.4	0.958
214	15.29	37.0	0.957
216	15.90	38.4	0.956
218	16.54	40.0	0.956
220	17.19	41.6	0.955
222	17.86	43.3	0.954
224	18.56	45.0	0.953
226	19.28	46.8	0.953
228	20.02	48.6	0.952
230	20.78	50.5	0.951
240	24.97	61.0	0.947
250	29.83	73.2	0.943
300	67.0	168.6	0.918
350	134.60	349.0	0.891

ATMOSPHERIC PRESSURE AND BOILING POINT OF WATER AT VARIOUS ALTITUDES

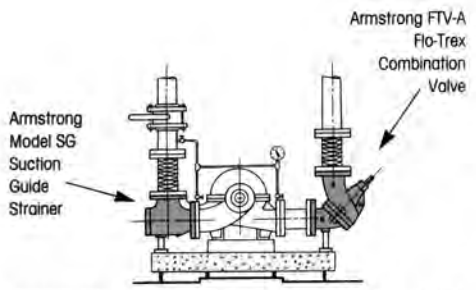
Altitude (feet)	Barometer Inches Mercury	Atmospheric Pressure		Boiling Point °F.
		PSIA	(ft. water)	
−1000	31.0	15.2	35.1	213.8
− 500	30.5	15.0	34.6	212.9
0.0	29.9	14.7	33.9	212.0
+ 500	29.4	14.4	33.3	211.1
+1000	28.9	14.2	32.8	210.2
+1500	28.3	13.9	32.1	209.3
+2000	27.8	13.7	31.5	208.4
+2500	27.3	13.4	31.0	207.4
+3000	26.8	13.2	30.4	206.5
+3500	26.3	12.9	29.8	205.6
+4000	25.8	12.7	29.2	204.7
+4500	25.4	12.4	28.8	203.8
+5000	24.9	12.2	28.2	202.9
+5500	24.4	12.0	27.6	201.9
+6000	24.0	11.8	27.2	201.0
+6500	23.5	11.5	26.7	200.1
+7000	23.1	11.3	26.2	199.2
+7500	22.7	11.1	25.7	198.3
+8000	22.2	10.9	25.2	197.4
+8500	21.8	10.7	24.7	196.5
+9000	21.4	10.5	24.3	195.5
+9500	21.0	10.3	23.8	194.6
+10000	20.6	10.1	23.4	193.7
+15000	16.9	8.3	19.2	184.0

TECH TIP #30

ARMSTRONG METHOD

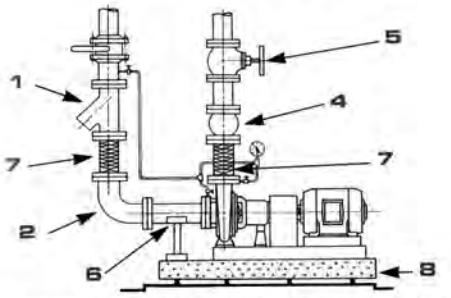


BASE MOUNTED SINGLE SUCTION PUMP

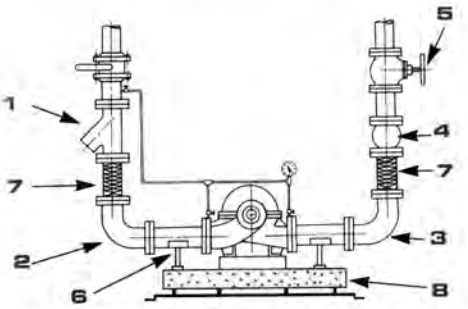


BASE MOUNTED DOUBLE SUCTION PUMP

CONVENTIONAL METHOD



BASE MOUNTED SINGLE SUCTION PUMP

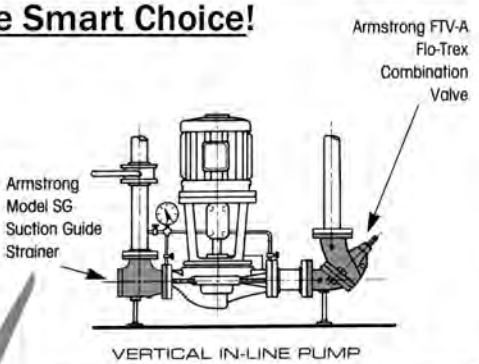


BASE MOUNTED DOUBLE SUCTION PUMP

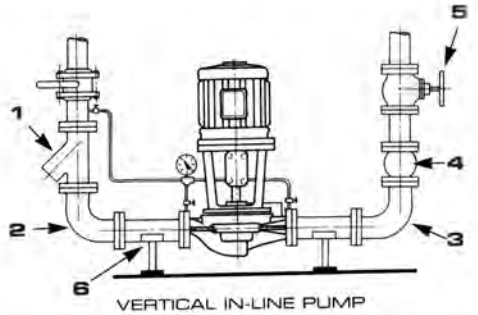
COMPONENTS ELIMINATED USING ARMSTRONG FLO-TREX VALVES AND SUCTION GUIDE STRAINER
(BASE MOUNTED SINGLE AND DOUBLE SUCTION PUMP INSTALLATIONS):

1 "Y" Strainer
2 Suction long radius elbow
3 Discharge long radius elbow
4 Discharge check valve
5 Discharge globe valve
6 Suction spool piece

The Smart Choice!



VERTICAL IN-LINE PUMP



VERTICAL IN-LINE PUMP

COMPONENTS ELIMINATED USING ARMSTRONG FLO-TREX VALVES AND SUCTION GUIDE STRAINER
(VERTICAL IN-LINE PUMP INST INSTALLATIONS):

1 "Y" Strainer
2 Suction long radius elbow
3 Discharge long radius elbow
4 Discharge check valve
5 Discharge globe valve
6 Suction spool piece
7 Flexible connector
8 Inertia base

Your Smart Choice because:
- *Pump is supported by piping, no pad
- *No pump connectors
- *Smallest footprint-save space
- *Overall least installed cost arrangement

7

TECH TIP #31

ELECTRIC CONDENSATE PUMP SELECTION

A condensate pump is used to collect and return condensate directly to a deaerator/boiler feed tank. It is always controlled by the float switch within its receiver and is never controlled by the boiler mounted level controller. The condensate is pumped only when it's receiver is full and not on boiler water level demand. On the other hand, boiler feed pumps are always controlled by the water level controller, typically a McDonnell & Miller #150 LWCO/pump control. See TECHTIPS #10 for a thorough discussion on sizing and selection of boiler feed pumps.

A few important factors to remember when selecting a condensate return pump.

1. The gpm pumping capacity is typically 2-3 times the system condensing rate that the unit will collect. This rule of thumb is typical on small 10-30 gallon receiver tanks. On large condensate collection tanks, a system heat balance is worth reviewing. A capacity of 1-1/2 times the condensing rate may be adequate. This oversizing allows the pump to run 1/3 – ½ of an hour under full load conditions.

2. Consider a duplex unit with two pumps and a mechanical alternator. Although a small system may be fine with a single pump and float switch, the duplex unit affords a back up pump and extra capacity. The typical alternator will alternate the lead-lag pump on each cycle and start the lag pump if the lead pump either can't keep up with the load or fails to run for some reason.

3. When calculating the pump discharge pressure, pay attention to grossly overestimating the system head. Many a condensate pump cavitates itself to an early grave due to the system head being far less than what was specified, see TECHTIPS #28.Cavitation.

4. Pump Accessories: We always recommend these five piping accessories with every condensate pump.

a. Discharge pressure gauge: A gauge installed on the discharge side of the condensate pump will allow you to double check the back pressure the pump is working against; system head. You can determine how many gpm the pump is moving with a pump curve, see if the pump performance has changed over time or if the back pressure has increased.....possibly through a leaking steam trap elsewhere on the condensate return system.
b. A good quality spring-loaded check valve. We always recommend the Durabla SCV stainless steel check valve. The few extra bucks on the front end will save pump seals, electricity and midnight trouble calls.
c. A ball valve or a globe valve on the pump discharge to throttle the pump a bit if need be. If the gauge you installed shows that the pump has far less system head than the pump is designed to work against you will need to throttle back the pump, again see the Cavitation TECHTIPS discussion for details.
d. A thermometer in the condensate tank is always helpful to see if you have leaking traps feeding your condensate pump return unit.
e. A gauge glass set installed on the tank (unless you have Superman's X-ray vision) will help you troubleshoot the system and the return pumps.

ADVANCED TECHTIPS.....Although the above discussion centers on the typical electric condensate pump, Pressure Powered Pumps (PPP) are becoming more and more popular due to their ability to handle extremely hot condensate without cavitation and lack of maintenance. On a typical low pressure system, the PPP may not be economically viable due to their higher cost, but on larger central plant steam systems they are worth a close look. For details, see TECHTIPS#27 & page 184,Section 4 of this catalog.