



TECHNICAL INFORMATION

Bulletin

NUMBER Thirty-Four

Peerless Pump Hydroconstant® fluid drive applications in breweries

New brewery techniques, based upon the use of pumps driven by Peerless Pump Hydroconstant® variable speed drives, offer opportunities for savings in operating costs, improvement in product quality and elimination of production bottlenecks.

Peerless Hydroconstant variable speed equipment, in various breweries, is operating successfully in all of the applications described

in this bulletin. Each of these applications is described separately:

- Constant pressure to keggings line
- Constant pressure on water systems
- Constant suction during transfer
- Constant flow through filtration system
- Constant temperature during storage and processing
- Adjustable level control on buffer tanks

Constant pressure to keggings line

! The benefit of transferring beer to the keggings line with CO₂ was that a constant 30 psig head could be maintained. Thus, even though flow demand fluctuated (as flow to the kegs was started and stopped) the pressure head remained constant.

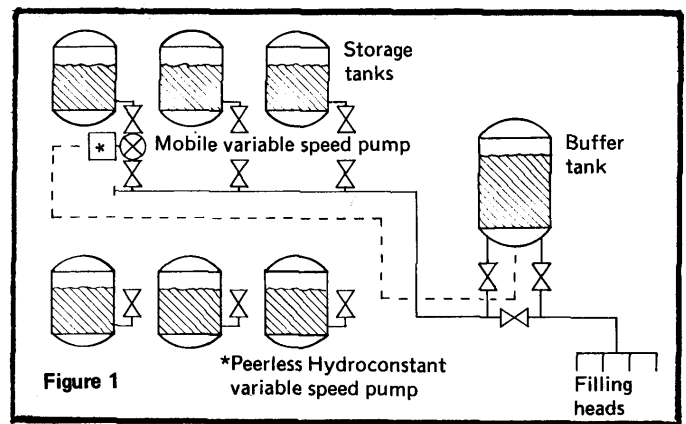
A standard constant speed pump was unsuitable for the transfer function. Its discharge pressure would rise as flow to the filling heads decreased and decline as flow increased.

A variable speed pump composed of an induction motor, a Peerless Pump Hydroconstant variable speed drive and a standard centrifugal pump, now transfers the beer at a constant pressure. The savings in CO₂ consumption would be \$7,452 a year, based upon the Example

in the inset. The system is shown schematically in Figure 1.

The advantages gained from this application are:

- Savings in carbon dioxide usage
- Constant pressure on the filling heads regardless of flow, liquid level in the buffer tank or variations in delivery line length.



Example

CO₂ savings using pumped transfer

The filling heads on the kegging line receive beer from a buffer tank. The beer is driven from storage to the buffer tank by a 30 psig head of CO₂. How much CO₂ could be saved if the beer were pumped?

A. Given:

1. Regardless of the volume of beer in the buffer tank, the CO₂ head is maintained at 30 psig.
2. The storage tank's size is 7ft. dia. x 25ft. high. The beer level is 15 feet; the upper 10 feet are used for CO₂ head.
3. The transfer flow rate is 75 US GPM.
4. Liquid CO₂ costs \$60 per ton.
5. One cubic foot of liquid CO₂ at 0°F expands to 545 cubic feet of gas at 60°F and atmospheric pressure.
6. If the beer were pumped, a constant pressure head of 10 psig of CO₂ would be maintained to prevent the beer from gassing

B. The beer volume in the tank is:

1. $(\pi \times 7^2)/15 = 577$ cu ft
2. $(577 \times 7.48) = 4318$ US gallons

C. At 75 gpm the tank would be emptied in

1. $(4318)/(75-x-60) = 0.96$ hour

D. CO₂ usage would be:

1. $(P_1 \times V_1) = (P_2 \times V_2)$ where P = pressure and V = volume
Gas usage with 30 psiG head; $P_1 = 30 + 14.7 = 44.7$ psiA
 $V_1 = 577$ cu ft
 $P_2 = 0 + 14.7 = 14.7$ psiA
 $(V_2 = (P_1 \times V_1)/P_2 = (44.7 \times 577)/14.7 = 1754$ cu ft
2. $P_3 = 10 + 14.7 = 24.7$ psiA
 $V_3 = 577$ cu ft
 $P_4 = 0 + 14.7 = 14.7$ psiA
 $V_4 = (P_3 \times V_3)/P_4 = (24.7 \times 577)/14.7 = 969$ cu ft

E. The cost saved by reduced CO₂ usage would be:

1. $(1754 - 969)/0.96 = 817$ cu ft per hour CO₂ @ 60°F.
2. $817/5.4-5 = 1.5$ cu ft/hr liquid CO₂ @ 0°F.
3. Annual CO₂ usage is:
 - a. Assume 10 hrs/day 260 days/yr operation
 $(1.5)(10)(260) = 3900$ cu ft/yr CO₂ @ 0°F.
 - b. Liquid CO₂ @ 0°F. weighs 63.7 pounds/cu ft
 $(63.7 \times 3900) = 248,430$ lbs/yr = 124.2 tons/yr.
4. At \$60/ton for CO₂ the annual savings would be $(\$60)(124.2) = \7452 .

Constant pressure on water systems

The earliest uses of Hydroconstant variable speed pumps in breweries were for maintaining constant pressures in

hot water and chilled water systems. As flow to various -- items of equipment (or to various areas of the plant) was started or stopped, the pressure to the remaining items of equipment (or to the remaining areas of the plant) would change. Each change in pressure would cause a change in delivery flow rate which would, in many

cases, create a need to readjust various flow control valves. As shown in Figure 2, a Hydroconstant variable speed pump can be used to maintain a constant pressure at any monitored downstream point. Thus, by carefully selecting the point at which the downstream pressure is monitored, system pressure can be kept constant, within acceptable limits.

Advantages:

Delivery flow rates remain constant

Need to readjust flow control valves is eliminated

Constant suction during transfer

A schematic of this application is shown in Figure 3. A constant speed pump moves the beer through a twin centrifuge and a cooler. Another constant speed pump was previously used to move the beer from the cooler to the storage tanks.

The problem was that either or both sides of the twin centrifuge could shut off the flow of beer while going through an automatic sludge dumping cycle. Thus, the suction pressure of Pump 2 would drop, causing out gassing and foaming detrimental to the quality of the beer.

By adjusting a Peerless Pump Hydroconstant variable speed drive to maintain a suction pressure of at least 10 psig,

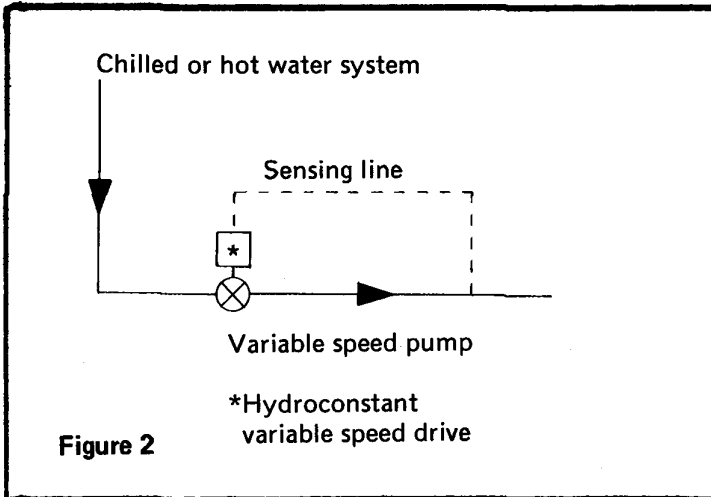


Figure 2

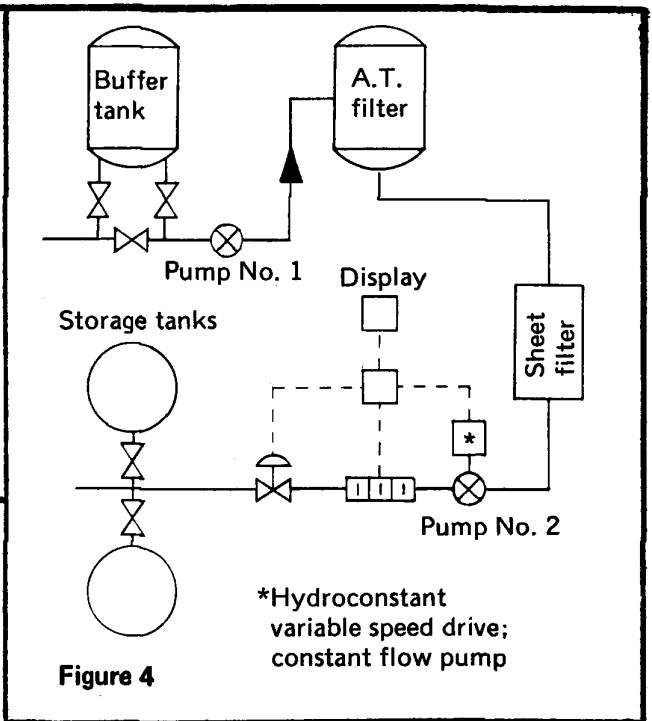


Figure 4

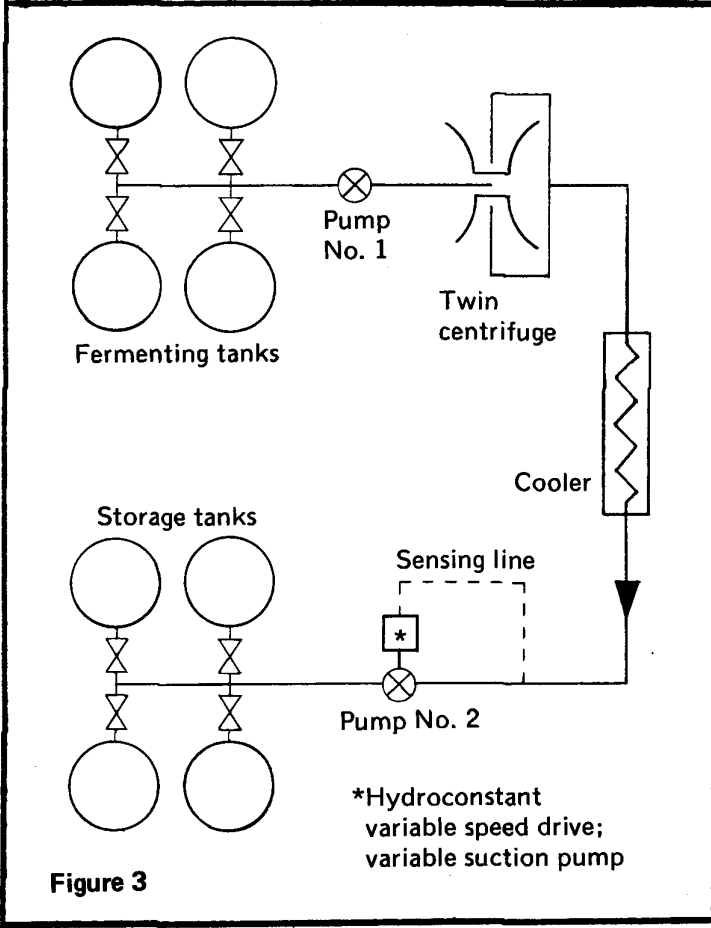


Figure 3

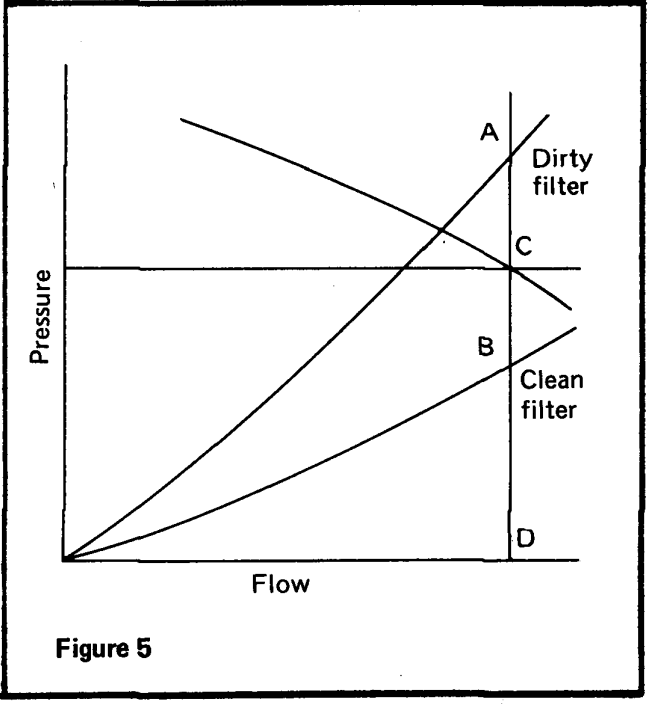


Figure 5

the variable speed pump "waits" for the centrifuge to complete its de-sludge cycle(s), maintaining the quality of the product.

Advantages:

- Immediately solves tank-to-tank transfer problem, maintaining plant throughput
- Improved product quality.
- Easy conversion of existing equipment to variable speed.
- Elimination of cavitation-caused motor/pump damage.

Constant flow through filtration system

Refer to Figures 4 and 5. With a clean A. T. Filter, the constant speed pump produced Flow D with an artificial head (8, C) imposed by a pressure sensing control valve. As the A. T. Filter became loaded, the control valve gradually opened until it was wide open and the head (8, C) was imposed by an increase in pressure drop through the filter.

As the filter became even dirtier, Flow D could not be maintained; the pump could overcome the pressure loss through the system and the loaded filter only at some reduced flow rate.

In order to maintain Flow D, a Hydroconstant variable speed pump was added as shown in Figure 4. The variable speed pump comes on line at Pressure C and runs only fast enough to enable the two pumps to produce Flow D.

A variable speed pump with an increased pressure output might have replaced the constant speed pump. But the A. T. Filter was not rated to withstand the higher pressures.

Advantages:

- Flow can be controlled and maintained as system conditions change.
- The Hydroconstant fluid drive can easily be adjusted to meet changed conditions or phased equipment additions.
- Decreased energy consumption .
- Reduced foaming; improved product quality.

Constant temperature during storage and processing

For certain processing and storage operations, it is desirable for the beer to be kept at a constant chilled temperature. The usual way of accomplishing this is to pump chilled water from a chiller through cooling coils in the beer. A constant speed pump is used and the temperature is maintained by a temperature sensing flow control valve.

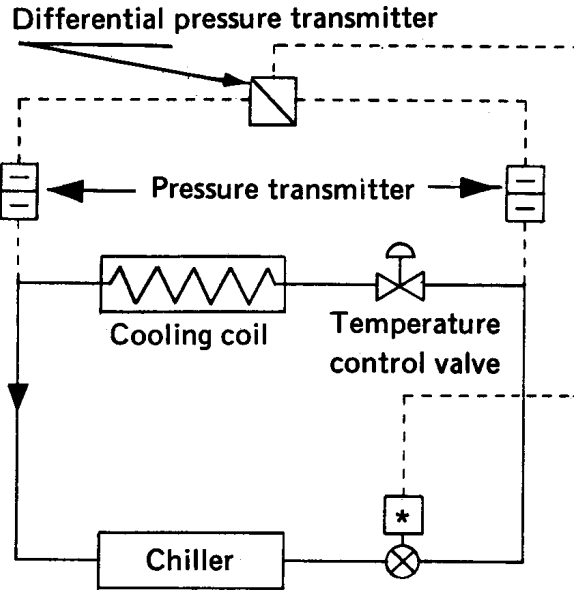
When cooling demand is at its greatest, there is relatively little pressure drop through the control valve and, therefore, relatively little energy waste (assuming no appreciable excess pump capacity). But as cooling demand decreases, pressure loss increases, efficiency is decreased and energy waste approaches 100%.

Figure 6 shows a variable speed system which avoids wasted energy. Two pressure transmitters, a differential pressure transmitter and a variable speed drive are added. When the temperature control valve opens to call for more cooling, the differential pressure transmitter signals the pump to speed up to deliver more flow. As the temperature control valve closes to call for less cooling, the pressure transmitter signals the pump to slow down to deliver less flow.

The pump and the temperature control valve work together as a team. The valve is always in its most open setting which will control the temperature and the pump is always running at its slowest speed which will provide adequate cooling.

Advantages:

- Excess pressure/flow is eliminated
- Significant energy cost savings
- Accurate temperature control



***Hydroconstant variable speed drive; variable speed pump**

Figure 6

Adjustable level control on buffer tanks

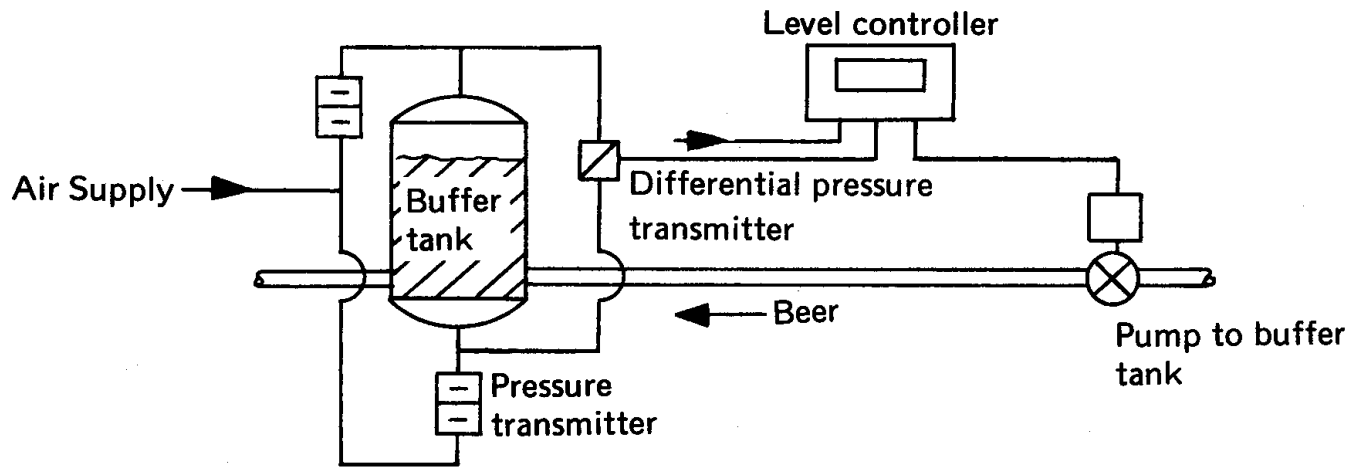
Level control in a buffer tank is both adjustable and repeatable at a given setting with a Hydroconstant drive in the system. In essence, two pressure transmitters (one high, one low) send pneumatic signals to a differential pressure transmitter which sends a pneumatic signal to a pressure controller which, in turn sends a normal 3 to 15 psig pneumatic signal to the Hydroconstant drive, Figure 7.

When the system is first started, the set point of the pressure (level) controller is turned to an appropriate value and the control on the Hydroconstant drive is "backed off." As the Hydroconstant control is turned in, the pump will start to run; steadily turning in the

control will raise the beer level to the set point where upon the pump will slow down and then stop. Once the unit is set up beer should be withdrawn, first slowly and then at a rapid rate. The beer level around the set point can be measured. Usually it will be maintained with an accuracy of about ± 2 inches depending primarily upon the input flow rate relative to the diameter of the tank and the Hydroconstant fluid drive's reaction time. In most cases, if better accuracy is required, it can be achieved by adjusting the proportional band in the pressure controller.

Advantages:

- Relatively simple level control
 - Reduced volumetric change, thus reduced CO₂ consumption if the controlled tank has a pressure head.
 - Better product quality due to less pump starting and stopping.
 - Smaller tanks could be used, designing only to the required set level, because of the controller's accuracy.
- Peerless Hydroconstant variable speed drives can be furnished with Peerless pumps, both horizontal and vertical. They are also easily adaptable to existing pumps and can be used with sanitary pumps. Thus, Peerless Pump can furnish any required equipment from bare Hydroconstant drives to complete variable speed pump packages including motors, Hydroconstant variable speed drives, pumps and controls.



*Hydroconstant variable speed drive

Figure 7