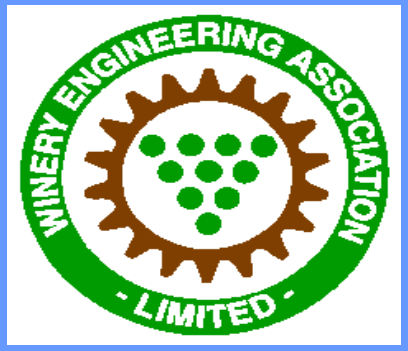
Pumping Sparkling wine

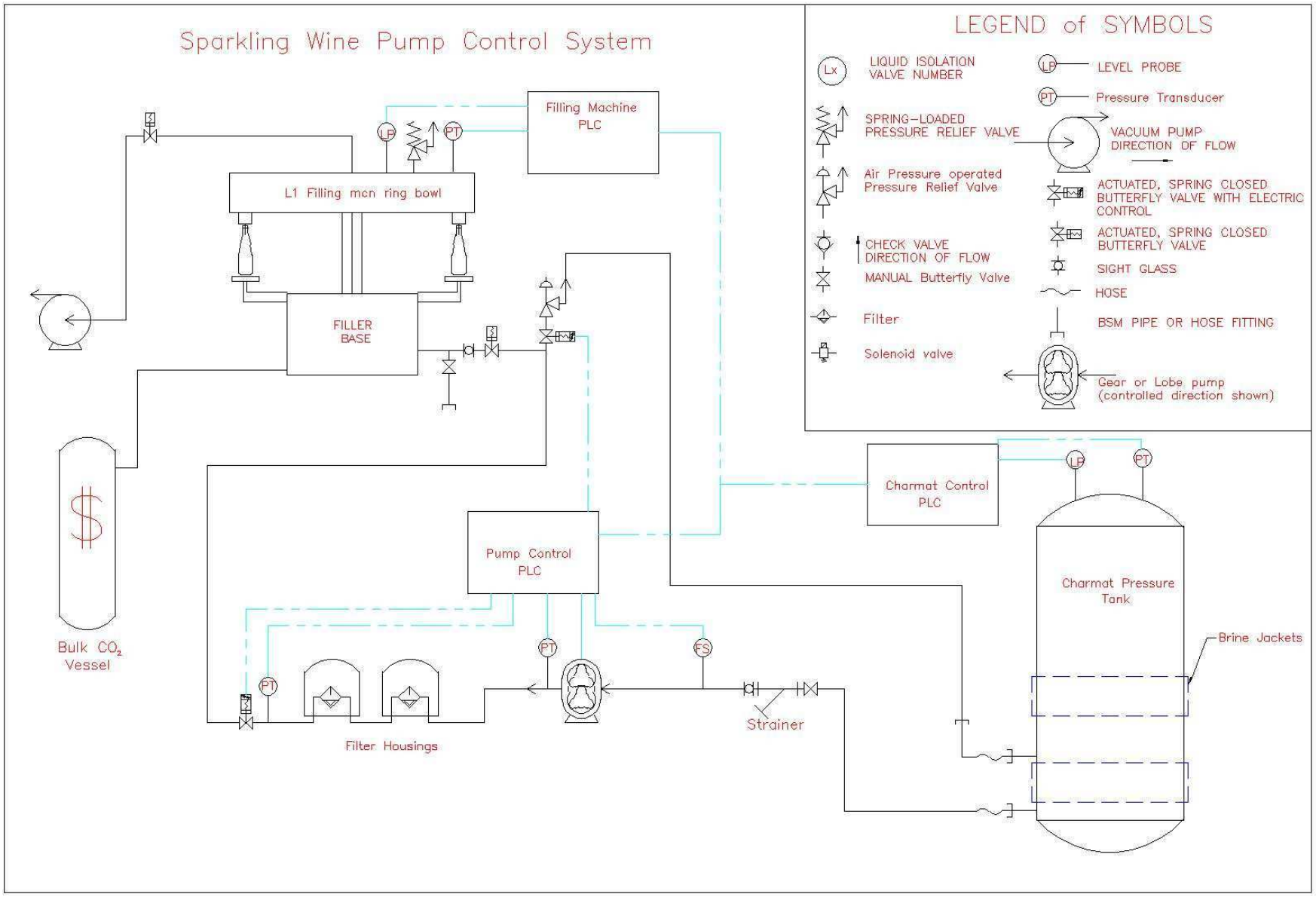
Andrew Byles
Constellation Wines Australia

(From Monday 27/6/2011 the company name will be Accolade Wines)



Overview of the system

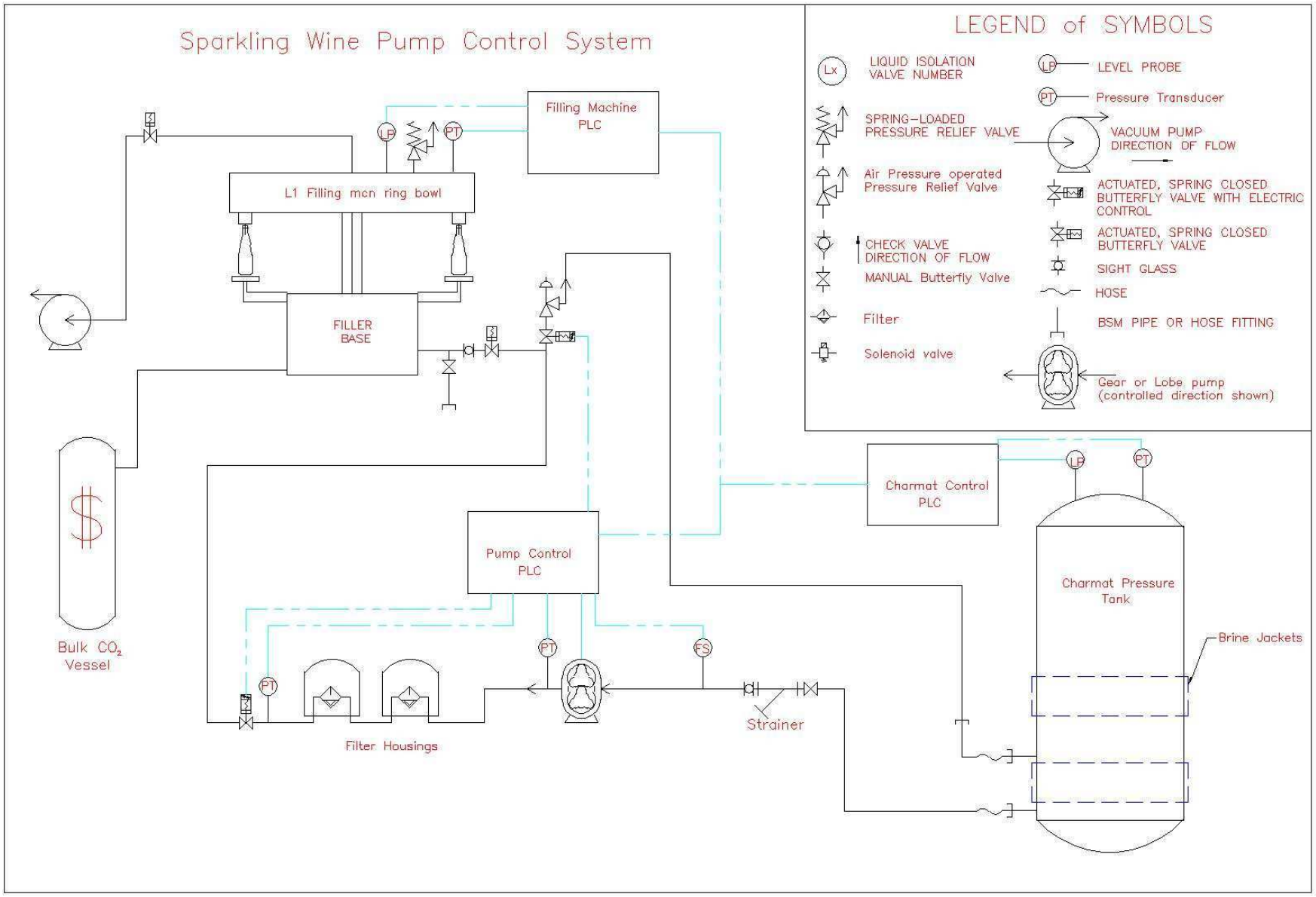
- Sparkling wine has requirements of a pumping system not normally required of a still wine pumping system
- Refinements to pressure control are the key to improved bottle filling performance.
- The desire to reduced energy costs has driven the development of higher than normal filling temperatures. This has increased the importance of wine handling under pressure.
- The system presented uses a lobe pump controlled with a frequency converter to achieve the flexibility.
- 3 different PLCs (Programmable Logic Controllers) are shown. This is only for independent operation of each system. On a smaller system this work could be done by 1 PLC


Sparkling Wine Pump Control System
Filling Machine PLC
LP
PT
L1 Filling mcn ring bowl
FILLER BASE
Bulk CO_2 Vessel
Pump Control PLC
Charmat Control PLC
Charmat Pressure Tank
Brine Jackets
PT
FS
Strainer
Filter Housings
LEGEND of SYMBOLS
LIQUID ISOLATION VALVE NUMBER
LEVEL PROBE
Pressure Transducer
SPRING-LOADED PRESSURE RELIEF VALVE
VACUUM PUMP DIRECTION OF FLOW
Air Pressure operated Pressure Relief Valve
ACTUATED, SPRING CLOSED BUTTERFLY VALVE WITH ELECTRIC CONTROL
CHECK VALVE DIRECTION OF FLOW
ACTUATED, SPRING CLOSED BUTTERFLY VALVE
MANUAL Butterfly Valve
SIGHT GLASS
HOSE
Filter
BSM PIPE OR HOSE FITTING
Solenoid valve
Gear or Lobe pump (controlled direction shown)

Maintaining Temperature

Prior to starting bottling process the ring bowl and pipe-work is cooled by pumping wine to the filling machine, then increasing the ring bowl pressure to push the wine back to the Charmat tank via the recirculation pipe-work.

This process can be repeated to cool the filling machine and pipe-work to the desired operational temperature.

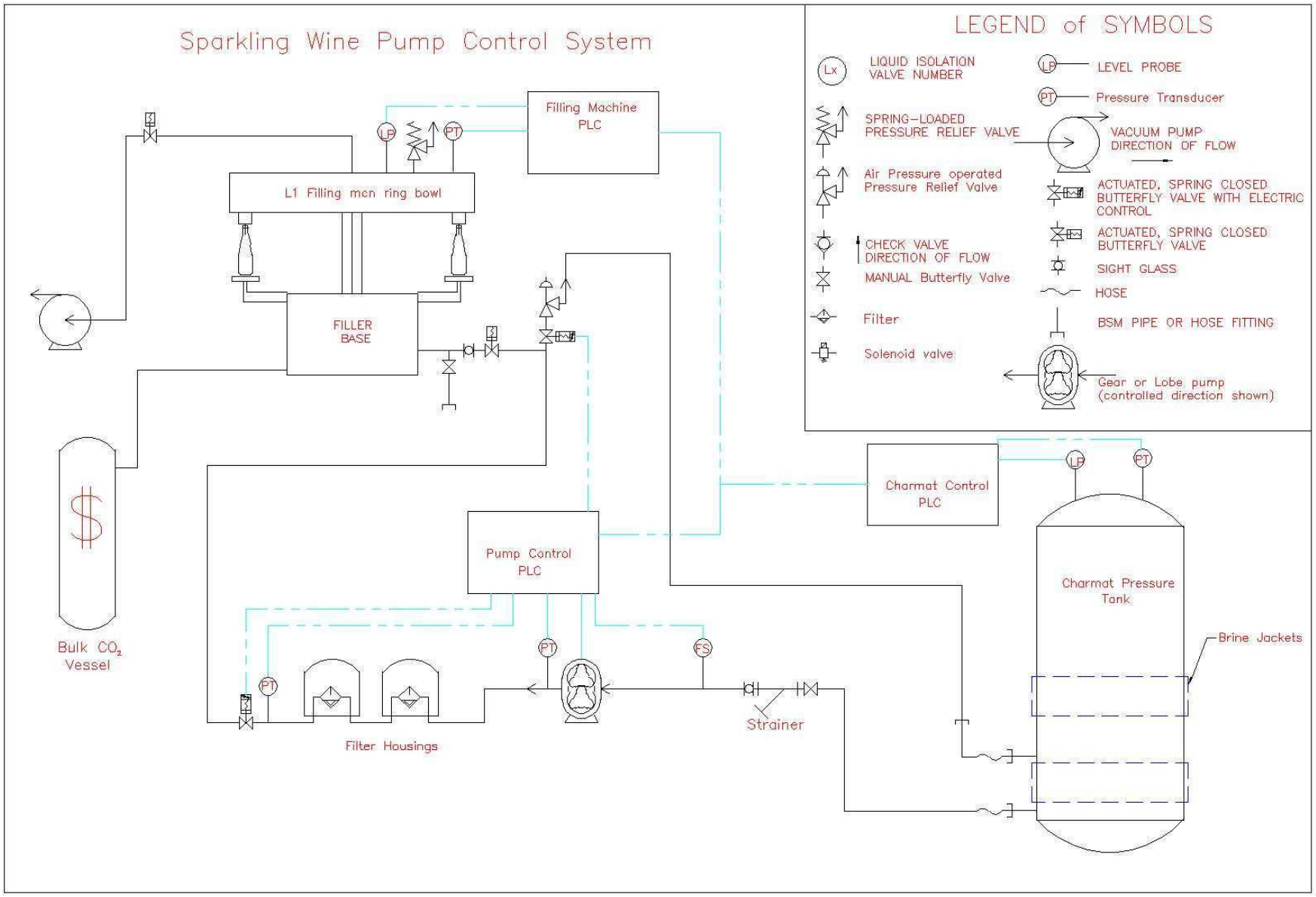

Sparkling Wine Pump Control System
Filling Machine PLC
LP
PT
L1 Filling mcn ring bowl
FILLER BASE
Bulk CO_2 Vessel
Pump Control PLC
Charmat Control PLC
Charmat Pressure Tank
Brine Jackets
PT
FS
Strainer
Filter Housings
LEGEND of SYMBOLS
LIQUID ISOLATION VALVE NUMBER
LEVEL PROBE
Pressure Transducer
SPRING-LOADED PRESSURE RELIEF VALVE
VACUUM PUMP DIRECTION OF FLOW
Air Pressure operated Pressure Relief Valve
ACTUATED, SPRING CLOSED BUTTERFLY VALVE WITH ELECTRIC CONTROL
CHECK VALVE DIRECTION OF FLOW
ACTUATED, SPRING CLOSED BUTTERFLY VALVE
MANUAL Butterfly Valve
SIGHT GLASS
HOSE
Filter
BSM PIPE OR HOSE FITTING
Solenoid valve
Gear or Lobe pump (controlled direction shown)

Maintaining pressure.

Pressure is the primary control in this pump control system

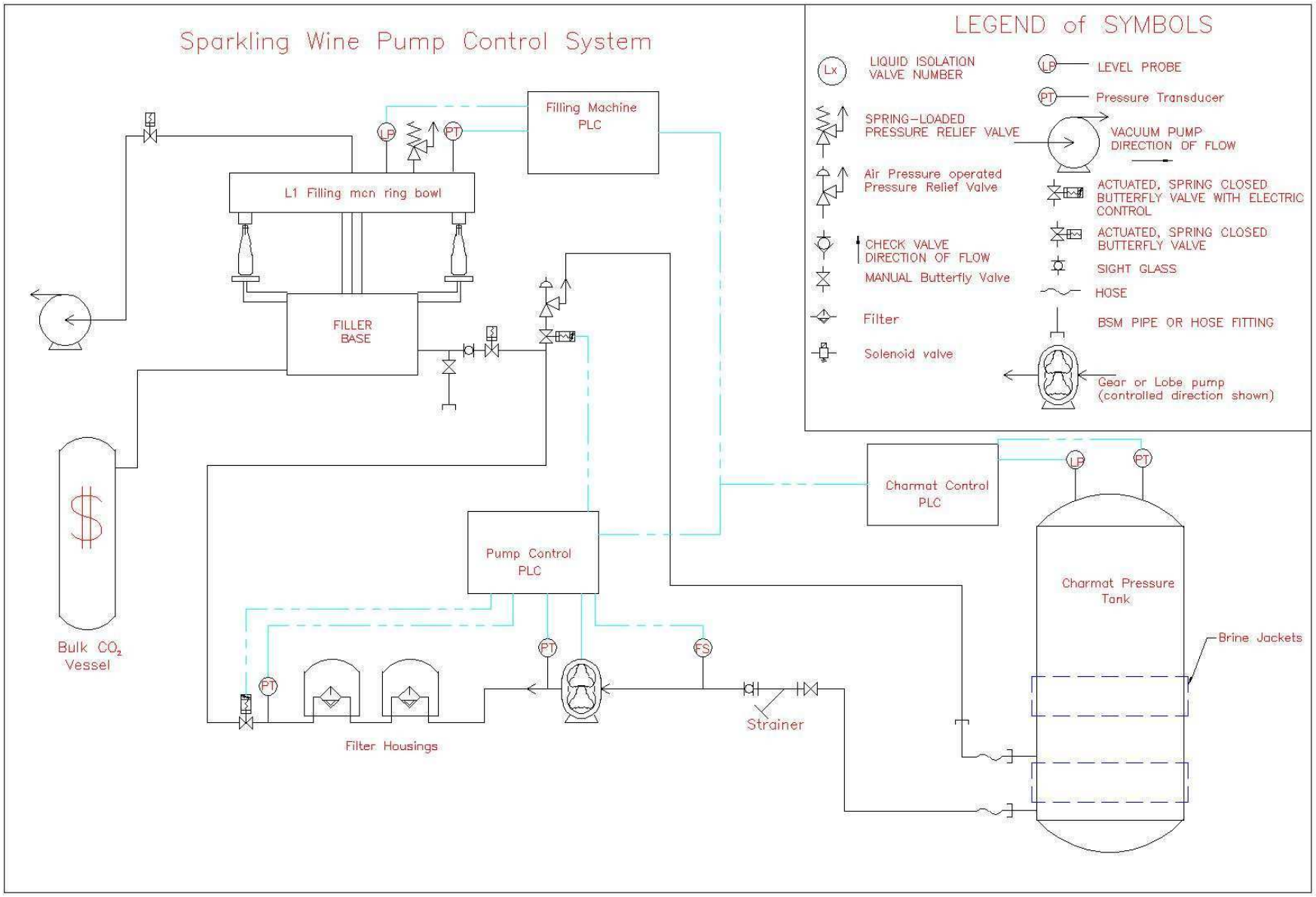
Pressure transducers are used:

- Downstream of pumping - pump protection
- Downstream of filtration – Monitor pressure drop across filters to prevent bursting of filters should they be blocked. This stage is referenced to maintain system pressure to balance the ring bowl filling system
- On the Ring bowl – Used by this system to match the input pressure after all losses from pipe-work, bends and gravity.


Sparkling Wine Pump Control System
Filling Machine PLC
LP
PT
L1 Filling mcn ring bowl
FILLER BASE
Bulk CO_2 Vessel
Pump Control PLC
Charmat Control PLC
Charmat Pressure Tank
Brine Jackets
PT
FS
Strainer
Filter Housings
LEGEND of SYMBOLS
LIQUID ISOLATION VALVE NUMBER
LEVEL PROBE
Pressure Transducer
SPRING-LOADED PRESSURE RELIEF VALVE
VACUUM PUMP DIRECTION OF FLOW
Air Pressure operated Pressure Relief Valve
ACTUATED, SPRING CLOSED BUTTERFLY VALVE WITH ELECTRIC CONTROL
CHECK VALVE DIRECTION OF FLOW
ACTUATED, SPRING CLOSED BUTTERFLY VALVE
MANUAL Butterfly Valve
SIGHT GLASS
HOSE
Filter
BSM PIPE OR HOSE FITTING
Solenoid valve
Gear or Lobe pump (controlled direction shown)

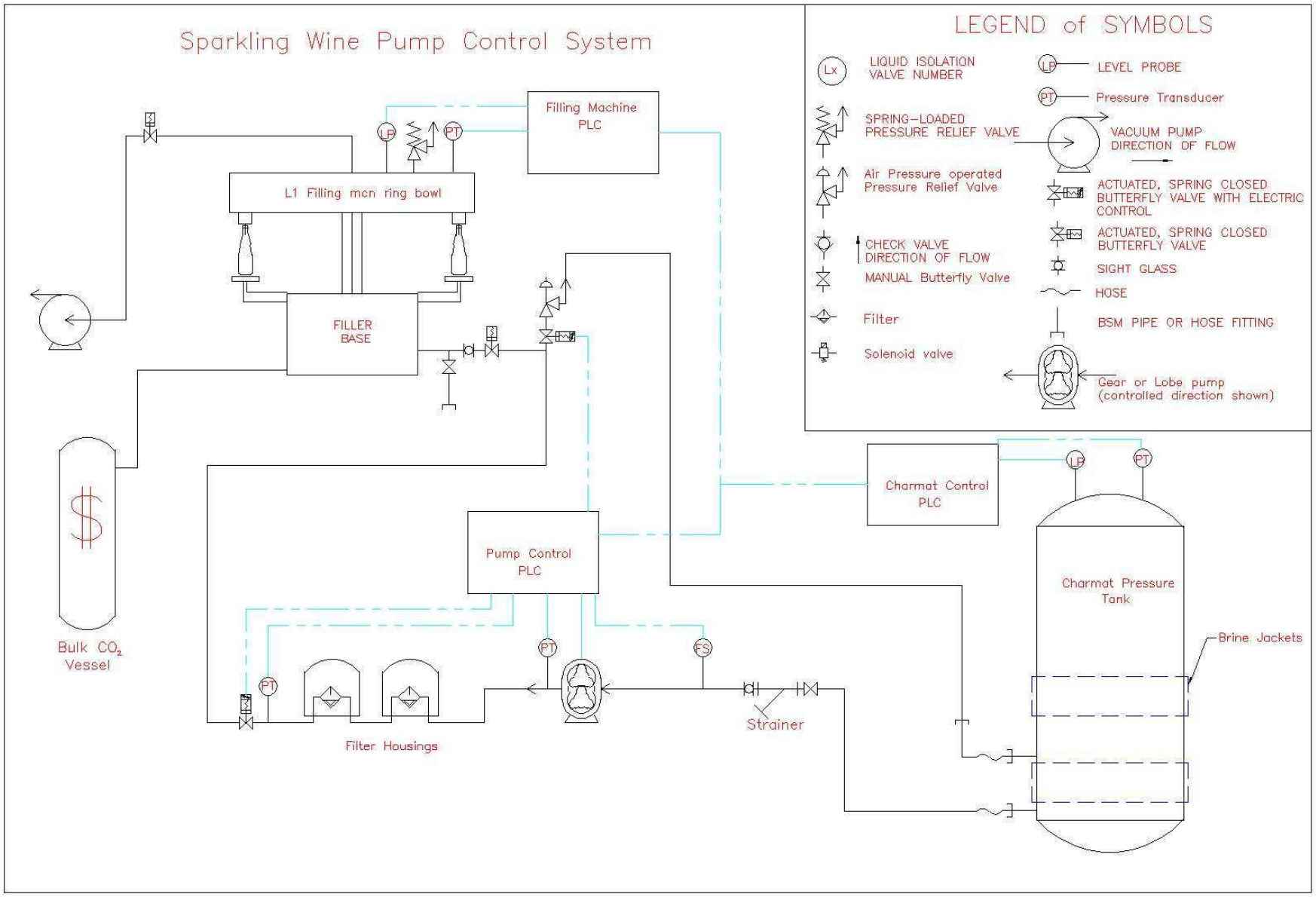
Minimising blanket gas usage.

- When the ring bowl level is maintained precisely there is less blanket gas used than when the level varies wildly.
- A precisely controlled level will also limit wine agitation caused by pressure change. On a mechanical counter pressure filling machine this can improve throughput by more than 20% as less foam is generated when snifting (depressurisation of bottles when filling completed).
- Interestingly the control of pressure before level will give a more steady run speed for the pump and a precise level control of the ring bowl. This control system will also work well for still wines filled with a counter-pressure filling machine.


Sparkling Wine Pump Control System
Filling Machine PLC
LP
PT
L1 Filling mcn ring bowl
FILLER BASE
Bulk CO_2 Vessel
Pump Control PLC
Charmat Control PLC
Charmat Pressure Tank
Brine Jackets
PT
FS
Strainer
Filter Housings
LEGEND of SYMBOLS
LIQUID ISOLATION VALVE NUMBER
LEVEL PROBE
Pressure Transducer
SPRING-LOADED PRESSURE RELIEF VALVE
VACUUM PUMP DIRECTION OF FLOW
Air Pressure operated Pressure Relief Valve
ACTUATED, SPRING CLOSED BUTTERFLY VALVE WITH ELECTRIC CONTROL
CHECK VALVE DIRECTION OF FLOW
ACTUATED, SPRING CLOSED BUTTERFLY VALVE
MANUAL Butterfly Valve
SIGHT GLASS
HOSE
Filter
BSM PIPE OR HOSE FITTING
Solenoid valve
Gear or Lobe pump (controlled direction shown)

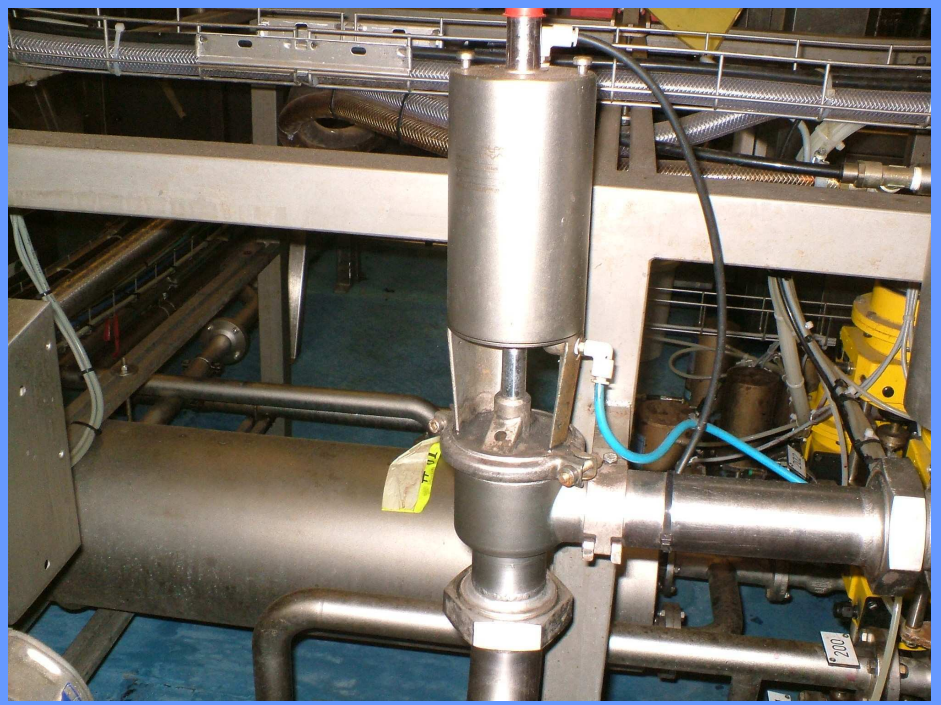
Controlling agitation and foam.

- Agitation and foam is a precursor to poor snifting with the resulting throughput loss.
- When wine is pumped through a small orifice into a larger area of lower pressure (such as a ball float valve) foam is created.
- On older style filling machines without level correction the snifting process created foam in the bottle. This occurred in the area beneath the vent tube as the pressure in the vent tube is released by bubbling through the wine as the bottle is depressurised.
- When a pause in the filling process occurs eg meal breaks, the wine is recirculated to the Charmat tank. The Charmat tank is usually lower pressure than the filler and pumping system. The wine is pumped slowly through a pressure relief valve to ensure the pump speed does not change.
- If the wine level is below the recirculation return point, recirculation is omitted as the return pipe will have gas pockets which will cause foam. (Of course the tank will have a large gas pocket above the return port!)

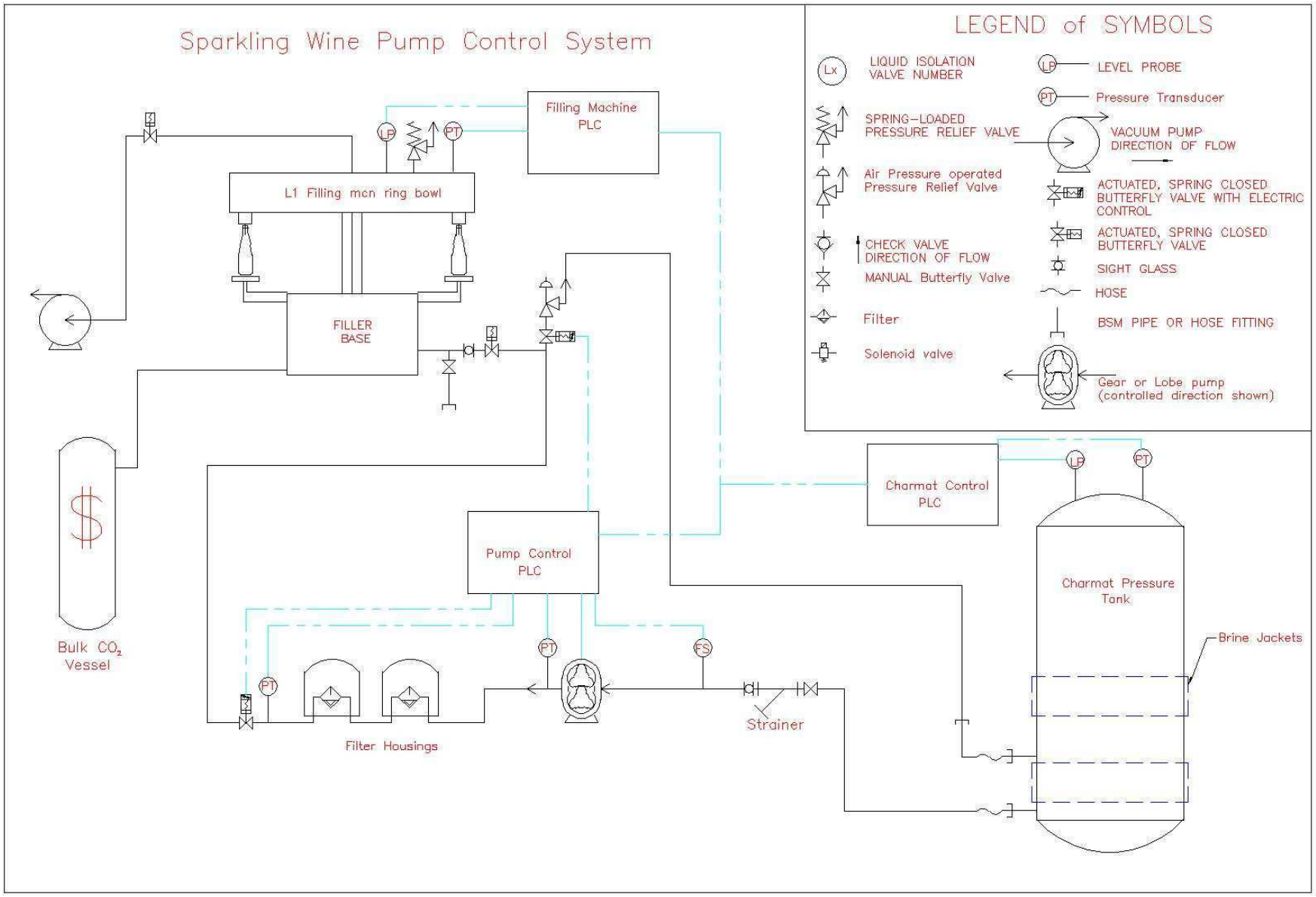

Sparkling Wine Pump Control System
Filling Machine PLC
LP
PT
L1 Filling mcn ring bowl
FILLER BASE
Bulk CO_2 Vessel
Pump Control PLC
Charmat Control PLC
Charmat Pressure Tank
Brine Jackets
PT
FS
Strainer
Filter Housings
LEGEND of SYMBOLS
LIQUID ISOLATION VALVE NUMBER
LEVEL PROBE
Pressure Transducer
SPRING-LOADED PRESSURE RELIEF VALVE
VACUUM PUMP DIRECTION OF FLOW
Air Pressure operated Pressure Relief Valve
ACTUATED, SPRING CLOSED BUTTERFLY VALVE WITH ELECTRIC CONTROL
CHECK VALVE DIRECTION OF FLOW
ACTUATED, SPRING CLOSED BUTTERFLY VALVE
MANUAL Butterfly Valve
SIGHT GLASS
HOSE
Filter
BSM PIPE OR HOSE FITTING
Solenoid valve
Gear or Lobe pump (controlled direction shown)

Cleaning of the pipe-work and supply system.

- A pneumatic controlled pressure relief valve is used in the wine recirculation pipe-work to facilitate cleaning. The air pressure is released allowing full flow of cleaning fluids. (The relief valve “seat” is cleanable.)

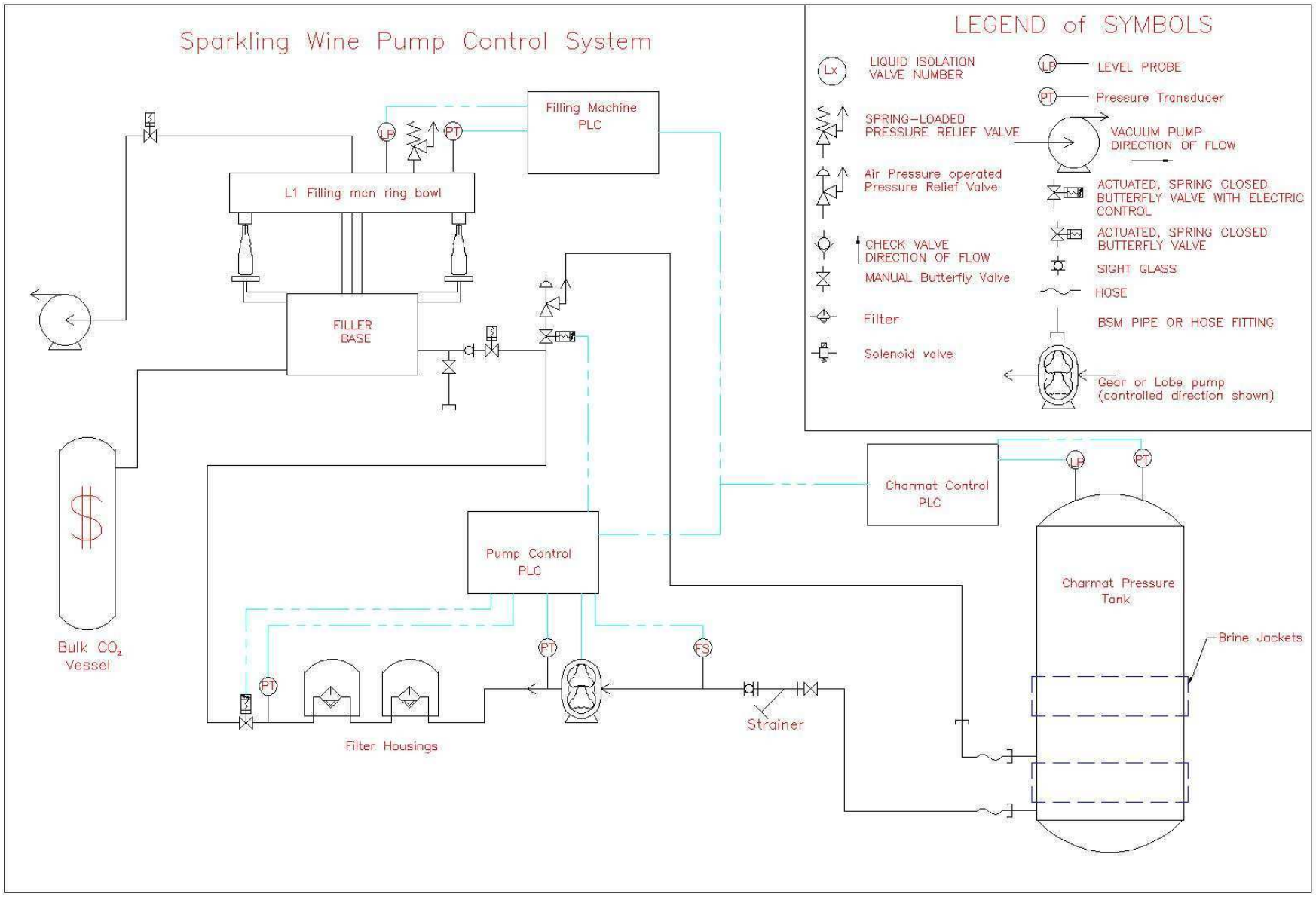


- A traditional mechanical spring relief valve is not easy to clean.


Sparkling Wine Pump Control System
Filling Machine PLC
LP
PT
L1 Filling mcn ring bowl
FILLER BASE
Bulk CO_2 Vessel
Pump Control PLC
Charmat Control PLC
Charmat Pressure Tank
Brine Jackets
PT
FS
Strainer
Filter Housings
LEGEND of SYMBOLS
LIQUID ISOLATION VALVE NUMBER
LEVEL PROBE
Pressure Transducer
SPRING-LOADED PRESSURE RELIEF VALVE
VACUUM PUMP DIRECTION OF FLOW
Air Pressure operated Pressure Relief Valve
ACTUATED, SPRING CLOSED BUTTERFLY VALVE WITH ELECTRIC CONTROL
CHECK VALVE DIRECTION OF FLOW
ACTUATED, SPRING CLOSED BUTTERFLY VALVE
MANUAL Butterfly Valve
SIGHT GLASS
HOSE
Filter
BSM PIPE OR HOSE FITTING
Solenoid valve
Gear or Lobe pump (controlled direction shown)

Clearing water droplets from the system after cleaning. Staining filters

- The system affords the ability to push wine from the filling machine to the Charmat tank via the return pipe-work. Water is diluted from the system with wine.
- Staining filters is achieved simultaneously to cooling the filtration & filling machine by recirculating the wine.
- A common check for filters being stained sufficiently and water diluted from system is by “BRIX” testing. This method is being replaced by mid infrared scanning.


Sparkling Wine Pump Control System
Filling Machine PLC
LP
PT
L1 Filling mcn ring bowl
FILLER BASE
Bulk CO_2 Vessel
Pump Control PLC
Charmat Control PLC
Charmat Pressure Tank
Brine Jackets
PT
FS
Strainer
Filter Housings
LEGEND of SYMBOLS
LIQUID ISOLATION VALVE NUMBER
LEVEL PROBE
Pressure Transducer
SPRING-LOADED PRESSURE RELIEF VALVE
VACUUM PUMP DIRECTION OF FLOW
Air Pressure operated Pressure Relief Valve
ACTUATED, SPRING CLOSED BUTTERFLY VALVE WITH ELECTRIC CONTROL
CHECK VALVE DIRECTION OF FLOW
ACTUATED, SPRING CLOSED BUTTERFLY VALVE
MANUAL Butterfly Valve
SIGHT GLASS
HOSE
Filter
BSM PIPE OR HOSE FITTING
Solenoid valve
Gear or Lobe pump (controlled direction shown)