Fermilab

Particle Physics Division
Mechanical Department Engineering Note

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Project Internal Reference:

Project: Coupp

Title: Coupp Water Veto Piping and Instrumentation.

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Key Words: Piping Schematic

Abstract Summary:

A water veto system is being designed to surround the 60 kg Coupp bubble chamber. This engineering note provides the piping and instrumentation diagram and some basic calculations. Governing code is ASME/ANSI B31.3 – Group D Service.

Applicable Codes: ASME/ANSI B31.3

Discussion:

Water veto system is specified to operate in a temperature range between room temperature and 40 C (104 F). Because this system uses ordinary water at low pressure and the temperature is less than 366 Fahrenheit, the fluid service (defined by B31.3) is group D service. Group D is for non-hazardous fluids at temperatures and pressures less than 366 F and 150 psig.

Schedule 80 PVC (polyvinyl chloride) material is used for the bulk of the piping. PVC has an allowable temperature of 140 Fahrenheit. The HDPE (high density polyethylene) water veto tank has an allowable temperature of 150 Fahrenheit.

A Parker filter housing made of 304 stainless steel with a maximum allowable working pressure of 150 psig is used on this system. The filter housing holds five (5) 30 inch long filter elements. Elements installed carry a one (1) micron rating.

Water circulation is provided by a 4 HP two speed spa pump. Pump is close coupled to a two speed single phase motor and uses a plastic impeller and housing. Inlet and outlet connections are for two (2) inch socket weld PVC pipe.

Water heater is a 1.4 / 5.5 kilowatt heater which can operate on 120 or 220 VAC. 120 volt operation provides a 1.4 kilowatt output; 220 volt operation provides 5.5 kilowatt output.

Water pump, heater and control mechanism were purchased as a spa replacement package from SpaGuts.com. Internal controls include interlocks to prevent the heater from being energized unless water flow is detected, heater on-off control with adjustable (80 to 105 Fahrenheit) set-point. Controls measure the water temperature near the heater outlet, so actual temperature of the water veto is only measured accurately when the water is being circulated.

Circulation pump is driven by a 4 horsepower motor. Pump curves are not easily found for the spa pumps. But, these pump are usually used to circulate water thru a filter, heater and across a ‘jet’. The water veto application includes a filter, heater, but no ‘jets’. However, the piping runs are a little longer than usually used in spa application, so this should offset the head loss normally associated from the ‘jets’. Pump motor current will be measured during the initial operation to verify that the pump is not running out on the curve and overloading the pump motor. If the pump does run out on the curve, a throttling orifice will be placed on the outlet of the discharge line to reduce flow, and therefore motor horsepower.

A schematic of the piping arrangement is shown in Figure 1:

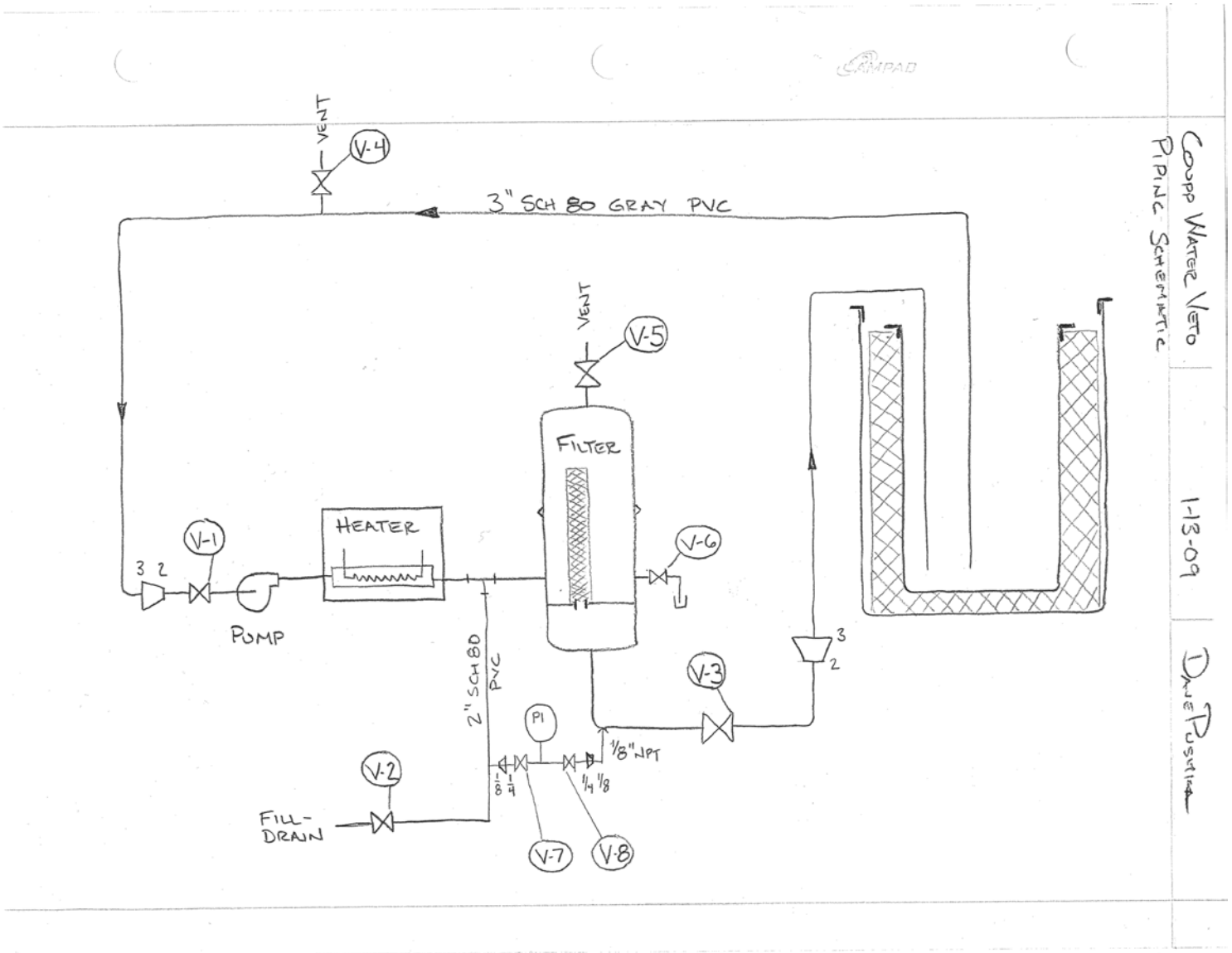

Figure 1, Coupp Water Veto Piping Schematic.