Run Times
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In last month's issue we described a problem where one of our customers experienced recurring priming problems at start-up. This month we'll take a look at the cause of the problem and discuss what we feel is the most practical solution. A number of readers responded that the system described was poorly laid out. Piping layouts that cause pump difficulties are all too often something that users are forced to endure and work around. This is one of those cases.

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For a review of the problem described in last month's issue click [here].

The pump will not prime because there is a pocket of gas between suction valve A and discharge valve C [Fig 1]. The gas pocket is created when the pump is reinstalled after it has been removed for maintenance. The gas pocket is at atmospheric pressure (101.3 kPa, 14.7 psia) up until the moment when suction valve A is opened in preparation for starting the pump. Because the suction vessel operates in a vacuum, the absolute pressure in the suction line is less than the absolute pressure of the gas pocket. When suction valve A is opened, the pressure on each side of the valve equalizes lowering the pressure in the gas pocket.

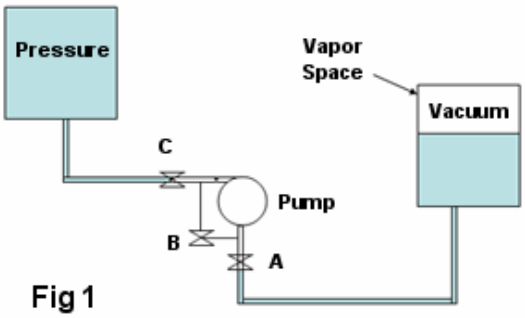

Fig 1


Fig 2

Lowering the pressure of a gas bubble will cause it to expand proportionately. Instead of liquid flowing towards the pump, the gas pocket actually grows and pushes liquid further away from the suction [Fig 2]. Similar to an empty water glass that is inverted in a pail of water, the vertical orientation of the pump inlet forms an un-vented trap that prevents liquid from entering the impeller.

When the pump is started nothing happens. Centrifugal pumps will not self-prime without special design provisions to prevent gas that passes through the impeller from returning to the inlet. The operators' manipulation of discharge valve C and recirculation valve B serve to prime the pump, forming a

temporary liquid seal at the impeller and displacing some of the gas into the discharge line. Each subsequent priming attempt moves an additional portion of the gas into the discharge line, until enough gas is displaced at the inlet so that the pump is permanently primed. This start-up procedure is tough on the equipment, the operators, and the maintenance staff.

The most practical solution is to take advantage of the vapor space at the top of the suction vessel. Installation of a vent line, equipped with suitable valves, between the vapor space at the top of the suction vessel and the discharge of the pump (on the pump side of valve C) will allow for complete venting of the gas pocket prior to start-up [Fig 3]. Opening valve D, in conjunction with suction valve A, prior to start-up, will cause the liquid column in the suction vessel to displace the gas pocket in the pump to the top of the suction vessel. Once the pump has been flooded, the vent may be secured and the pump started. The recirculation line and valve B can be eliminated as they are no longer required for start-up.

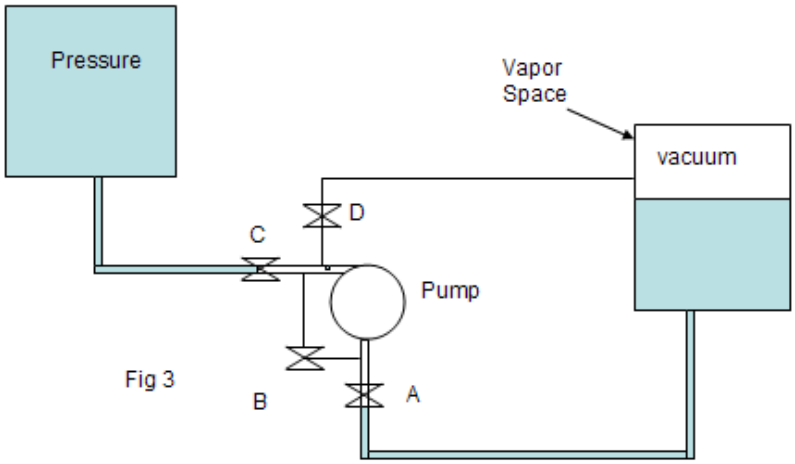

Fig 3