APV
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Technical Bulletin

TB# 46

Use of a Product Infeed Gauge

To Determine Proper Feed Pressure

INTRODUCTION

The design of a product feed system for a reciprocating piston pump or homogenizer involves fulfilling several considerations to obtain satisfactory operation. Not only should the system feature a short, straight, direct piping design to minimize the effects of liquid acceleration, but it should also provide adequate product feed pressure to overcome all losses in the pipe and fittings and to satisfy the net positive suction head for your specific machine design, product and process system. Inadequate feed contributes significantly to machine and piping vibration, pressure and capacity fluctuation and inconsistent homogenization.

PRODUCT FEED PRESSURE DEFINED

Product feed pressure relates to the term "net positive suction head" (NPSH). For our purposes it can be defined as the head or pressure that causes a liquid to enter the plunger bore of a piston-type, positive-displacement pump.

The term "NPSH" can be further defined as net positive suction head required (NPSHR) and net positive suction head available (NPSHA). NPSHR is a function of the design of the homogenizer/high pressure pump and will vary with different machine designs and products being homogenized. NPSHA is a function of the processing system in which the machine operates.

SUITABLE INLET SYSTEM

An inlet system for a reciprocating piston pump or homogenizer must provide a constant flow of liquid to the pump at a pressure sufficiently above the product's vapor pressure to prevent flashing as the liquid enters the pumping chambers. If gas bubbles are entrained in the liquid or flashing occurs in the cylinder, excessive vibrations may occur in both inlet and outlet lines, volumetric efficiency will drop and various pump and system components may fail. Small amounts of gas or cavitation will usually be manifested in shortened life of packing, valve springs, valves, seats and gaskets. Larger quantities of gas or more severe cavitation can cause pitting of liquid-end components and catastrophic failure of the liquid pumping cylinder, crankshaft, bearings and drive train components.

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HOW MUCH FEED PRESSURE IS NEEDED?

Pre-assuming that the product is free of entrained air or gas, we can now address the question, "How do I know if my NPSHA is adequate?" Simply stated, based on the Hydraulic Institute Standards, the TB-46 answer is to increase the product feed pressure, until there is no further increase in the homogenizer/ pump output, or with highly viscous products, until the output is within 3% of the calculated capacity of your machine at a specific eccentric shaft speed.

If the viscosity or particulate content of your product is such that feed pressures above 140 are necessary, consult with the APV Homogenizer Group before proceeding.

A feed pressure gauge will help you determine the optimum feed pressure and to allow the machine operator to regularly observe whether the pressure has dropped below the desired point for any reason. An alternative to visual checks would be to install a low-feed-pressure alarm switch set at optimum feed pressure, as determined by the above procedure.

COMPUTING EXACT NPSHA

You can mathematically compute the exact NPSHA for your system, if you wish. For a description of the proper formula and its application, please refer to the Thirteenth Edition of the "Hydraulic Institute Standards for Centrifugal, Rotary and Reciprocating Pumps", Hydraulic Institute, 1230 Keith Building, Cleveland, Ohio 44115.

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Issued: 02/2009 3076-01-08-2008-US

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