DISC PUMP-TYPE PUMP TECHNOLOGY FOR HARD-TO-PUMP APPLICATIONS

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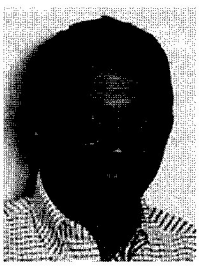

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ABSTRACT

This paper describes a unique pumping concept based on a noncontact mechanism operating solely using the principles of boundary layer and viscous drag. The first section focuses on the pumping technology itself, describing how the pump mechanism operates, while the second section examines how the pump functions in problem applications, such as handling abrasive, viscous, high solids, air-entrained, and shear sensitive fluids. The next section describes the pump operating and design characteristics, including information on the pump's NPSH requirement and other standard pump performance data. The final section describes an end-user's experience with the disc pump in an oil refinery application.

The disc pump system operates solely using the principles of boundary layer and viscous drag, two phenomenona well-known in fluid engineering. Although superficially the disc pump looks like a centrifugal unit, it has no impeller in the traditional sense, and uses instead a series of parallel, rotating discs, referred to in this paper as the "disc assembly," to generate the energy necessary to move product.

The key difference between the disc assembly and a standard centrifugal pump impeller is that, with the disc assembly, the pumpage does not impinge on the rotating pump mechanism, so that it generates a pulsation-free, laminar flow pattern through the pump. The disc pump can operate effectively in hard-to-pump applications because it lacks an "impingement" device, which results in minimal contact between the pump and pumpage.

INTRODUCTION

Hard-to-pump applications, such as pumping highly abrasive slurries, viscous slurries, slurries with a high solids content, fluids with entrained air, and fluids containing delicate or shear sensitive products, can lead to problems of frequent downtime, high maintenance, and damaged product. In this paper, the authors propose that many of these problems can be alleviated by minimizing the contact between the pump and the product being pumped, and that the "disc pump," which operates using a noncontact mechanism, is well suited to these types of applications.

The disc pump's noncontact pumping ability stems from its unique method of pumping: it operates solely using the principles of boundary layer and viscous drag and does not use an "impingement" device—such as a vane, paddle, screw—to move product. The mechanism itself is a series of parallel discs, herein called the "disc assembly," rotating in a plane perpendicular to the pump inlet. The energy from the rotating discs is transferred via viscous drag—in essence, friction—to the fluid, and the fluid spirals out to the outer edge of the discs and through the discharge.

The section, END-USER'S EXPERIENCE WITH THE DISC PUMP, contains information concerning the El Dorado Refining Company, of which the coauthor is an employee. It is a division of Equilon Enterprises LLC, a joint venture of Texaco Inc. and Shell Oil Company.

DISC PUMP PRINCIPLE

Disc pumps operate on the principles of boundary layer and viscous drag. These principles and their application are relatively new to the world of pumps, but they are well-known in other areas