

# Proper Support: A Look at Blackmer's Between-the-Bearing Design on E Series Magnetic Drive Gear Pump

MULTIPLE SUPPORT POINTS KEEP DEFLECTION AT BAY

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## Shaft Deflection

Pumps are an essential piece of mechanical technology critical to the function of many industries. The need to move fluids stretches back to 6000 B.C. in Egypt and Mesopotamia when early civilizations dug canals to move flood waters to crops for irrigation. The earliest evidence of a pump dates to 2000 BC, while modern positive displacement pumps like vane and internal gear came along in the late 1800's. Throughout human history, pumps and the movement of fluid have been crucial to survival and progress.

While pump technology is designed with longevity in mind, there are common problems that can knock them offline and even cause catastrophic failure. One of those problems is the deflection of components in and around the pumping chamber. Deflection occurs when the effects of pumping forces on the rotor causes the shaft to bend.

Pumps are designed to deal with some level of deflection during rotation, but it can become severe or catastrophic when the shaft does not have adequate support. Shaft deflection, if left unaddressed, can create larger problems, such as bearing damage and failure, mechanical seal leaks and failure, excessive

vibrations, premature and excessive component wear and failure, and even broken shafts.

But shaft deflection doesn't have to be a catastrophic problem, so long as the pump apparatus provides proper support across the shaft. This whitepaper looks at Blackmer's E Series patented between-the-bearing support system as part of their seal less mag-drive internal gear pump, specifically how it minimizes deflection to keep the pump and its critical components running longer.

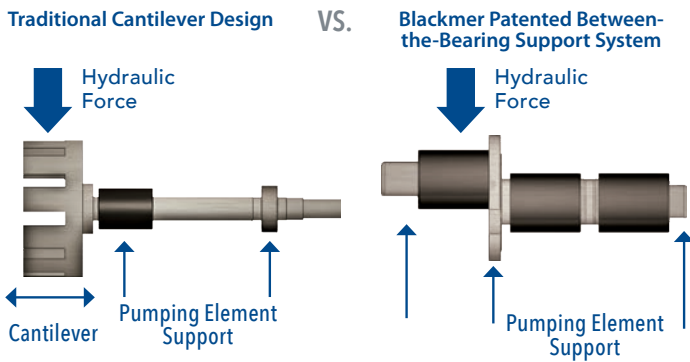
## Strong Support System

Blackmer's between-the-bearing support system uses an eccentric spindle supported at three crucial points – the head, the crescent location and the back of the containment canister. In addition to the three main points of contact, the spindle system includes two radial bushings and a thrust bushing. Once installed it sits stationary in the pump while the rotor turns around it.

Instead of mirroring the design of competitor internal gear pumps, which default to a longer shaft and overhung load, the eccentric spindle features a shorter shaft, larger diameter and three bushings. These

elements ensure that hydraulic forces are supported across the spindle rather than centered on the weakest points. Working together this spindle system is designed to virtually eliminate the deflection issues typical of traditional cantilevered load designs.

The traditional cantilever design on internal gear pumps has support shortcomings across the shaft. The typical bushing placement is near the rotor, with a single bearing on the other end of the shaft. This leaves the remaining segments of the shaft poorly supported, allowing those areas to suffer deflection during operation or upset conditions leading to premature component wear and failure.



With Blackmer's between-the-bearing support system, a staple on its E Series Seal-less Magnetic Drive Internal Gear Pumps, extended radial bushings support the entire length of the rotating element spread out across three spots, which minimizes deflection and maximizes the life of the bushings.

With this support system and the 2 in. (50.8 mm) spindle design (on our 3" 69 size pump), deflection is minimal to the tune of 0.005 in. (0.13 mm). Comparatively, using the same pump size, deflection in one 0.44 in. (11.1 mm) shaft deflects 0.056 in. (1.4 mm). That amount of deflection in the traditional setup is prone to causing rotor and casing wear/contact, head wear and early shaft seal failure. Premature wear with the between-the-bearing support system is nonexistent.

## Conclusion

Pumps are an effective technology, but they are only as effective as their design and the performance that stems from it. Without proper shaft support, internal gear pumps are bound to suffer from deflection and all the problems that come from it, including rotor or shaft failure. These problems, especially repeated over time, create unnecessary downtime and costly repairs, as well as lost revenues.

With the Blackmer E Series Seal-less Magnetic Drive Internal Gear Pump between-the-bearing support system, operators have one less common pump pitfall to worry about and can focus on keeping their industrial processes functioning optimally for longer periods of time.

## About the Author:

Michael Coburn is the Product Manager for Blackmer® Gear. He can be reached at [Michael.Coburn@psgdover.com](mailto:Michael.Coburn@psgdover.com). Blackmer is the leading global brand of sliding vane, gear, regenerative turbine, and centrifugal pump, and reciprocating compressor technologies for the transfer of liquids and gases. Blackmer is a brand of PSG®, a Dover company, Oakbrook Terrace, IL, USA. PSG is comprised of several leading pump brands, including Abaque®, All-Flo™, Almatec®, Blackmer, Ebsray®, em-tec®, Griswold®, Hydro™, Malema, Mouvex®, Neptune®, Quantex™, Quattroflow®, RedScrew™, and Wilden®. You can find more information on Blackmer at [psgdover.com/blackmer](http://psgdover.com/blackmer) and on PSG at [psgdover.com](http://psgdover.com).

