Blackmer C-Series Mouvex Principle Eccentric Disc Sealless Pump Technology

Unique Eccentric Disc Concept Provides Low Shear, Clean-In-Place and High Volumetric Efficiency

By Wayne Harris, Market Segment Manager

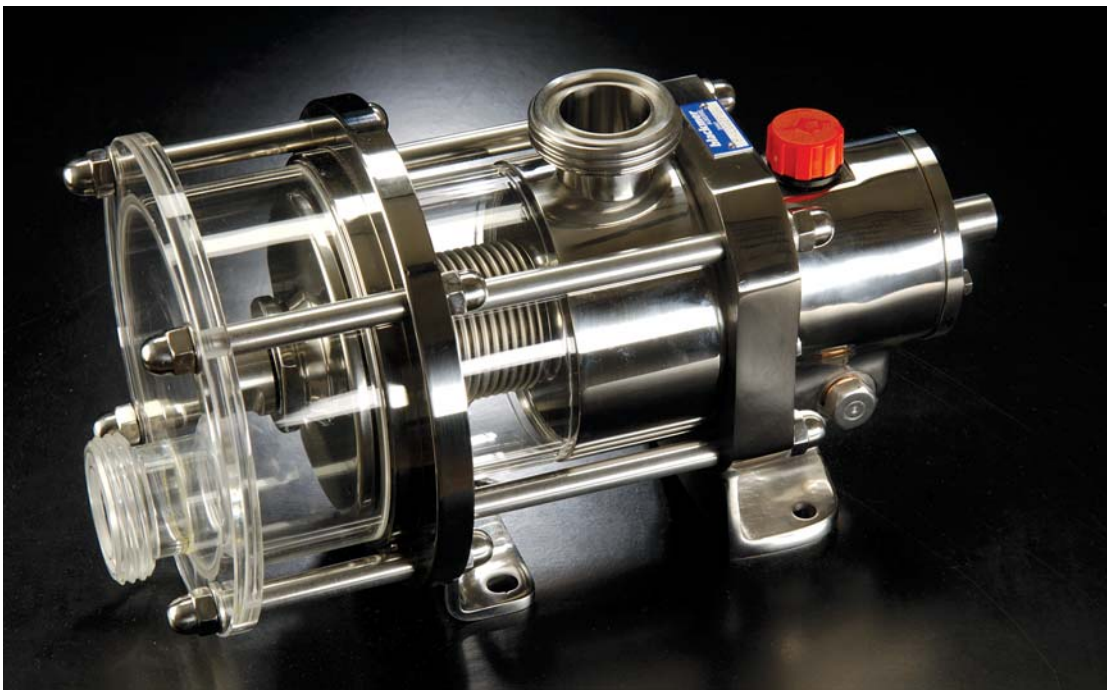


Figure 1

Over the past decade, global competitive pressure and environmental protection regulations have forced companies to improve operating economics, pioneer new and sophisticated processing techniques and refine fluid transfer processes, pollution control, and sanitary standards. As a result, the global demand for highly reliable pumps that can eliminate leaks, provide gentle handling of liquids and provide high volumetric efficiencies and economic advantages has substantially increased. Eccentric disc technology pumps are uniquely qualified to meet all of these demands. (Figure 1).

Key Design Benefits

- **Sealless –** there are no mechanical seals, magnets, rubber or PTFE diaphragms
- **Low Shear –** gentle handling of product, low slip, lower internal velocities and ultra-low agitation
- **Clean-In-Place (CIP) –** can be completely drained, flushed and cleaned in place without disassembly
- **Self Priming and Draining –** able to dry-run for up to 10 minutes; capable of complete line stripping of suction and discharge lines of residual liquid
- **High Volumetric Efficiency –** able to maintain a constant flow rate at a given viscosity throughout its pressure range
- **Self-Adjusting –** maintains delivery/pressure performance over time with a self-adjusting radial and axial disc/cylinder

Blackmer Mouvex eccentric disc pumps are used in a wide variety of applications in the Soap and Detergents industries, including all types of surfactants, amines, enzymes, concentrated dyes, concentrated perfumes, glycerin and builders, to name a few.

The Eccentric Disc Principle

Eccentric disc technology employs an oscillating eccentric piston to produce the pumping performance of a positive displacement pump, creating a constant flow that is independent of both pressure and viscosity (Figure 2). The oscillating piston motion of the pump cylinder and disc causes very low internal velocity (Figures 3, 4, and 5). The result:

- Gentle pumping action with very low slip
- No tip speed
- Extremely low shear
- Lower energy consumption

Figure 2

Figure 3

Velocities Within Pumps

Speed of Contact Point Within a C-Series Pump =

$$(2\pi)\frac{rpm}{60}e$$

e = the eccentricity of the pump

Speed of Gear Teeth or Rotor Tips of a Gear, Lobe, Circumferential or PC Pump =

$$(2\pi)\frac{rpm}{60}r$$

r = the radius of the rotating element(s)

Figure 4

Eccentricity of a C-Series

C1 / C2	e = 4.5 mm (.177 inches)
C4 / C8	e = 6 mm (.236 inches)
C12 / C18	e = 10 mm (.394 inches)
C24 / C36	e = 13.5 mm (.531 inches)

Figure 5

Velocity Examples

10 GPM @ 100 PSI
Viscosity = 1000 cps

C-Series Pump Size 4 Turning 420 rpm
Velocity of Disc = .87 ft/sec

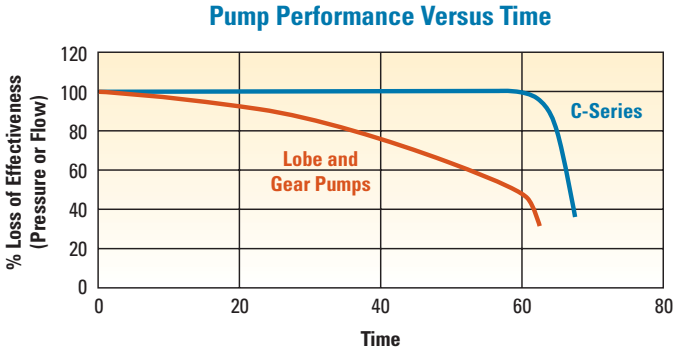
Typical Lobe Pump Size 18 Turning 340 rpm
Velocity of Rotor = 3.15 ft/sec
(based on a rotor diameter of 4.25 inches)

Typical Gear Pump Turning 220 rpm
Velocity of Main Gear = 3.84 ft/sec
(based on a gear diameter of 4 inches)

Performance Characteristics

Eccentric disc pumps can be used as metering pumps because of their special radial and axial self-adjusting design features. Because the pump is automatically self-adjusting it maintains greater efficiency and repeatability over time than traditional lobe or gear pumps (Figure 6).

Figure 6



All Blackmer Mouvex C-Series eccentric disc pumps have a shear rate of sec^{-1} = 0.9rpm; lower than circumferential piston, lobe and gear pumps (Figure 7). This is due in part to the gentle, oscillating action of the disc and cylinder, and the extremely low slip rate of the pump. Unlike lobe and gear pumps, eccentric disc pumps do not have close clearances which can cause slip. Slip is the portion of the pumped product that is forced back to the suction side of the pump due to pressure through the clearances. The smallest clearance on the C-Series eccentric disc pump is 1/16" (.157 cm). On C-Series pumps, the discharge pressure exerts itself against the eccentric disc which prevents it from slipping. This low slip between the disc and cylinder gives the C-Series the ability to self prime and line strip. Lobe and gear pumps have internal clearances, tip speeds, and high internal velocities to contend with that affect fluid dynamics and can result in shear and slip. In lobe and gear pumps, as pressures and clearances increase and viscosities decrease, slip increases. (See Figure 8 on following page).

Figure 7

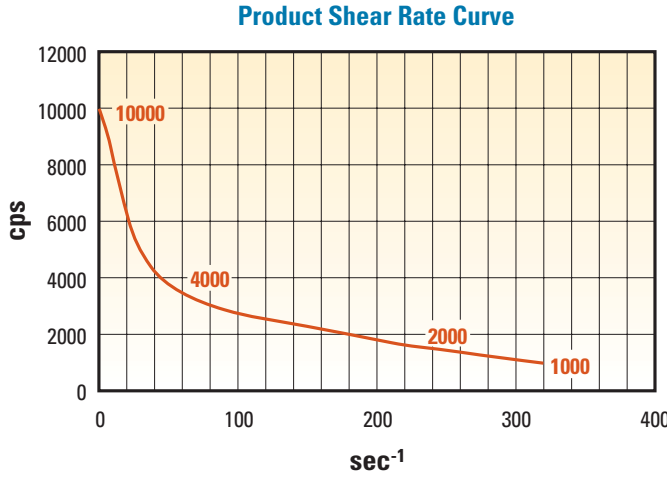
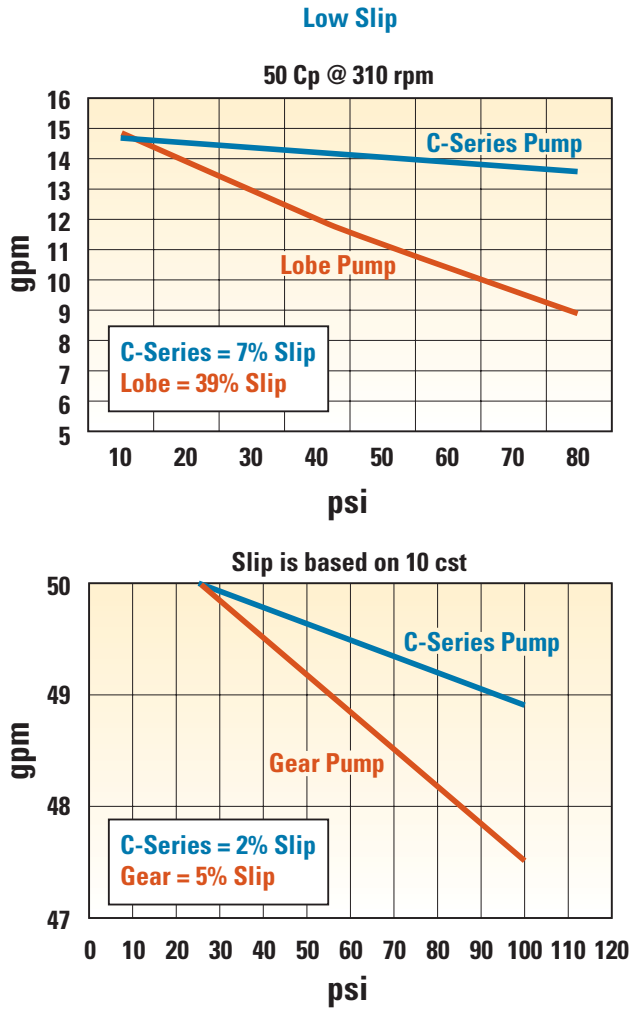


Figure 8



Blackmer Mouvex C-Series Eccentric Disc pumps are capable of handling viscosities up to 10,000 Cp, working pressures to 130 psi (9 Bar), capacities of 4 to 158 gpm (15.14-598.09 lpm), operating temperatures up to 176° F (80° C), and a particle size capability range of 1-3 mm. The C-Series is also very effective at handling suspended solids with mild abrasives.

The pump is available in both stainless steel and ductile iron construction and is available with an optional heating jacket.

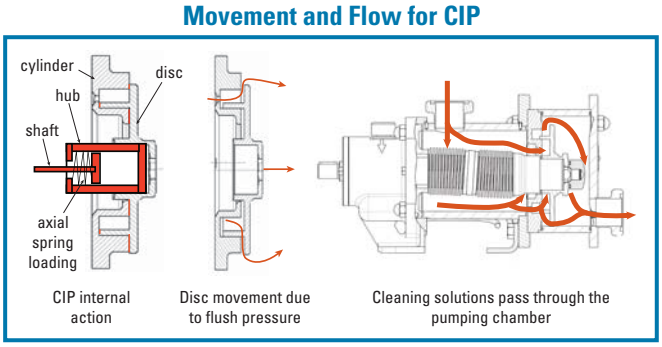
Clean-In-Place

The stainless steel model of the Blackmer Mouvex C-Series Eccentric Disc pump, which holds 3A Approval Certification, is designed per EHEDG (European Hygienic Equipment Design Group) recommendations and designed specifically to be flushed and cleaned in place.

No bypass valve or special mechanical seal is required. Lobe pumps may experience a 15-20% loss of volumetric efficiency resulting from low pressure drop in the pump chamber caused by vertical drain porting. The C-Series, by comparison experiences no loss of performance due to porting, and does not need to be bypassed to clean-in-place.

Pressure is introduced to the back of the eccentric disc, through the pump chamber. When the flush pressure overcomes the spring, the disc moves away from the cylinder, allowing the cleaning solutions to pass through the pumping chamber (Figure 9). The C-Series can be self-cleaned or cleaned by an external circulation pump.

Figure 9

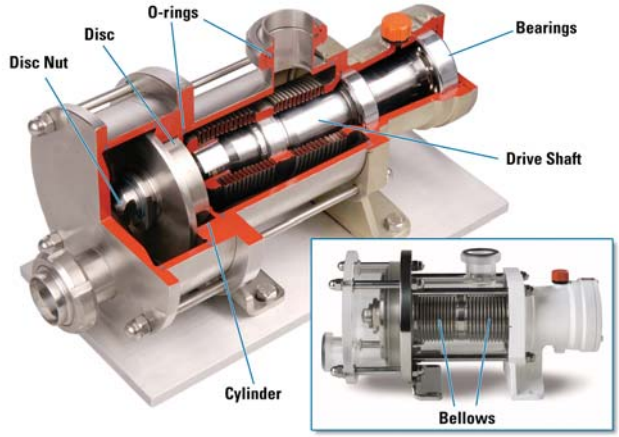


Construction

The C-Series eccentric disc pump consists of very few parts (Figure 10):

- A single drive shaft, machined on four (4) different planes
- A single or double set of bellows that also acts as a pressure retaining element
- Four (4) bearings that are separated from the liquid
- One (1) disc made of acteon. A special metallic composition has been used in the construction (Carbon 0.05, Nickel 70, Chrome 13, and Molybdenum 3) to ensure high corrosion resistance.
- One (1) cylinder
- One (1) gear case
- One (1) disc nut
- Seven (7) O-rings
- Two (2) lip seals

Figure 10



Used In a Wide Variety of Soap and Detergent Applications

For Soap and Detergent applications from surfactants to dyes, eccentric disc technology is being used worldwide to solve everything from seal, suction, product shear and volumetric efficiency problems to offering unique benefits such as leak-free assurance, line stripping capabilities, metering and non-pulsating flow. Its eccentric principle makes the pump extremely flexible, capable of pumping low viscosity, high viscosity and highly abrasive materials within a single process, all with the same pump, demonstrating that output is not affected by viscosity variations. Even at low speeds the suction capability of the pump allows for perfect priming and draining of mobile tanks and stationary pipes. Beyond the uniqueness of its eccentric disc pumping motion, its sealless design makes it particularly suitable for a broad range of mediums—from sticky and highly viscous liquid polymers to toxic chemicals and extremely thin products such as perfumes. Gentle handling, high volumetric capability and sealless technology all wrapped into one. Eccentric disc technology is the answer for difficult pumping applications in the Soap and Detergents industry (Figures 11 and 12).

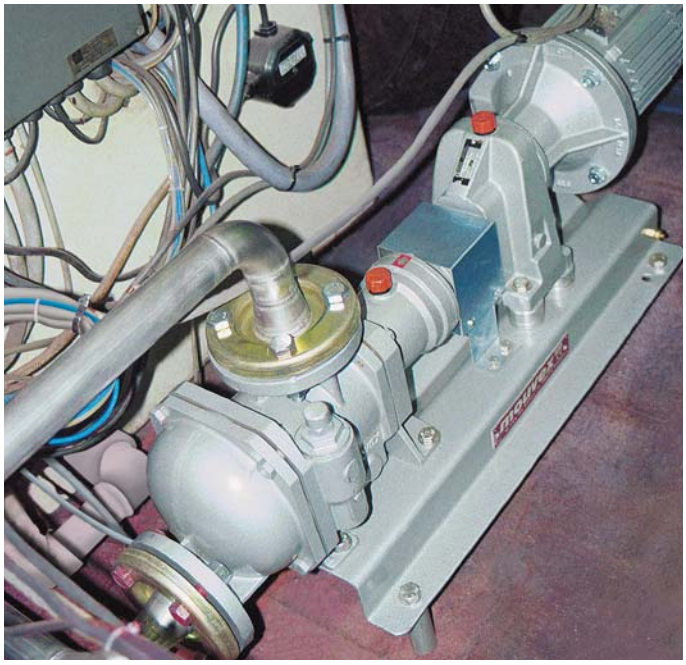


Figure 11

Figure 12