"Valvoline Cobalt™ with Pressure Activated Technology™ Performance Claims"

Introduction

Valvoline™ is excited to announce an innovative and unique product to the Heavy Duty world. Valvoline Cobalt™ grease is the only one in the market today with microencapsulated Pressure Activated Technology™ that produces true heavy-duty performance even under harsh loads and in extreme conditions. Extensive laboratory testing has been conducted to support the following claims in comparison to common competitive products currently available:

In Line Contact Conditions*:

Claim 1—Cobalt **reduces friction** by 50% or more.
Claim 2—Cobalt **protects metal surfaces** at least 8 times longer.
Claim 3—Cobalt **reduces operating temperature** up to 130°C.

*Based on testing using the Falex Digital Ring on Block at low speed heavy load conditions within a closed sump for 1 hour.

Line contact conditions refer to any metal-to-metal contact that forms a line, such as a ring spinning on a fixed block, as studied here. Based on proprietary testing using the Falex Digital Ring on Block at low speed heavy load conditions within a closed sump for one hour, Cobalt grease reduces friction by at least 50% or more. This can be seen in Figure 1, which shows the coefficient of friction over time during the Ring on Block test for Cobalt compared to its competitors. As the graph demonstrates, after a break-in period of 30 minutes (1800 s), Cobalt has an average coefficient of friction of 0.02 compared to the closest competitor, Competitor E, at 0.1.

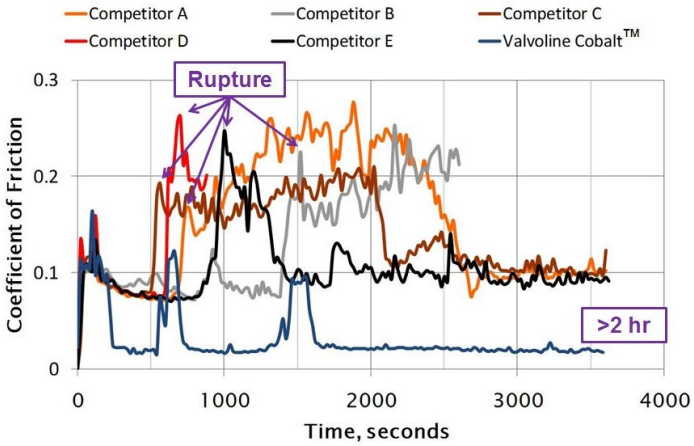

Figure 1: Coefficient of friction vs. time in Ring on Block test

In extended Ring on Block testing**, Cobalt performs at least 8 times longer than the competition before rupture of the fluid film. The point of rupture is determined by a sharp spike in coefficient of friction, as labeled in Figure 1, and marks the point at which severe damage of the metal surfaces begins to occur, as seen in Figure 2.

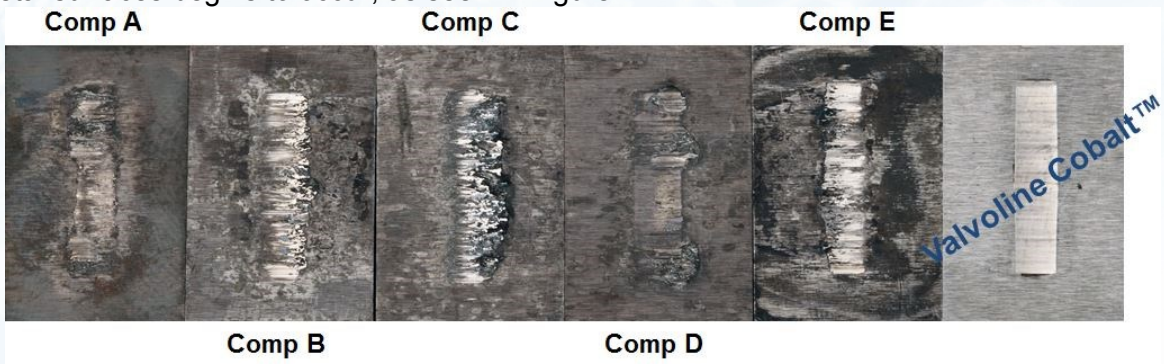

Figure 2: Block scars after the conclusion of Ring on Block testing, 1 hour

**Results not shown.

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The Ring on Block also reveals that Cobalt provides a significant reduction in operating temperature, up to 130°C (266°F), as demonstrated by Figure 3 and measured at the conclusion of the test interval. Furthermore, Figure 3 reveals that Cobalt provides a reduction in the maximum temperature of up to 200°C (392°F) as compared to the maximum temperature reached by each competitive product tested. Like friction, operating temperature has a direct impact on the life and strength of metal parts. Decreased friction and lower temperatures can add up to better performance and longer equipment life.

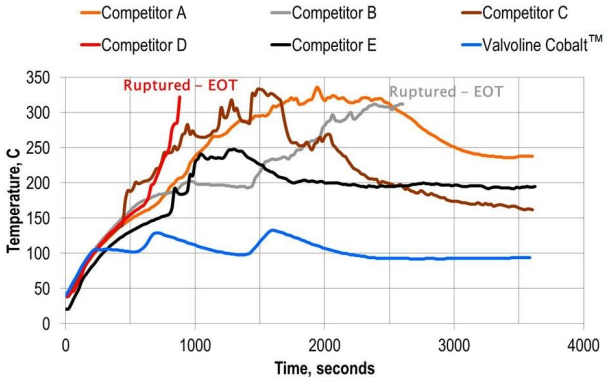

Figure 3: Temperature vs. time in Ring on Block test

In Point Contact Conditions*:**

Claim 4—Cobalt **protects against EP** with double to triple the Load Wear Index.
Claim 5—Cobalt **reduces wear** by up to 50% at moderate loads.
Claim 6—Cobalt **resists catastrophic damage** with double to triple the weld load.

***Based on ASTM D-2596, the Standard Test Method for Measurement of Extreme Pressure Properties by the Four-Ball Method.

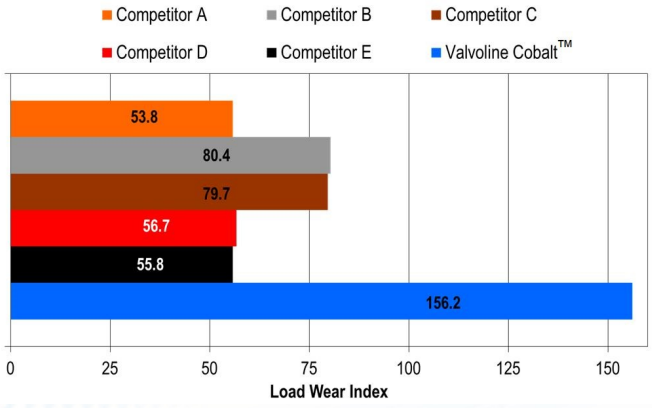

Figure 4: Load Wear Index (LWI) by Four-Ball EP Weld

Point contact conditions refer to any metal-to-metal contact that occurs at a point, as in the contact of two balls. ASTM D-2596, the Standard Test Method for Measurement of Extreme Pressure (EP) Properties by the Four-Ball Method, is the primary tool in studying point contact. This test determines two key parameters of a grease's performance: the weld load and load wear index (LWI). The LWI is an index of the ability of a lubricant to prevent wear at applied loads, while the weld point is the lowest applied load at which the sliding surfaces of four steel balls seize and weld together. For more information on this test method, refer to ASTM D-2596 or the Jan/Feb V Line Newsletter.

In Four-Ball Weld testing, Cobalt scored a LWI of double to triple that of the competitors, as shown in Figure 4, indicating superior protection against extreme pressure and heavy loads. Figure 5 shows a comparison of the wear scars at the varying applied loads. At a moderate load of 200 kg, Cobalt reduces wear by up to half that of some competitors. This translates to reduced wear at non-catastrophic loads. Less wear can equal longer equipment life. Figure 6 displays

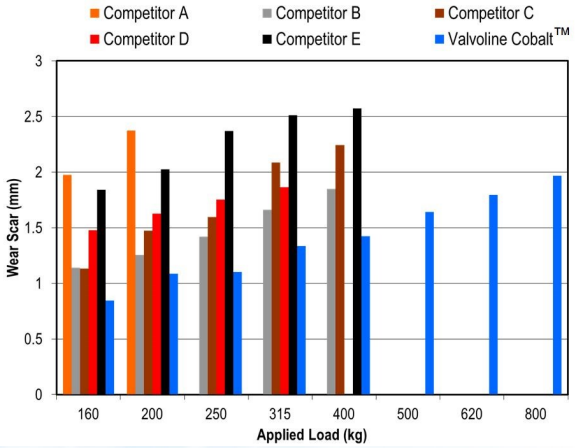

Figure 5: Wear scars at applied loads

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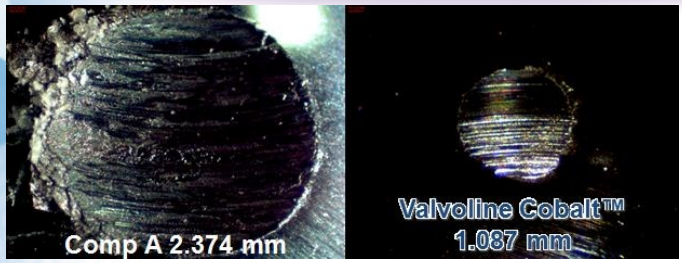

Figure 6: EP wear scars at 200 kg

the comparative wear scars of Cobalt and Competitor A. They are 1.087 mm and 2.374 mm, respectively, with Cobalt providing a reduction in wear of over 50%.

Also included in Figure 5, Cobalt has double to triple the weld load of the competitive products. Competitor A welded at 250 kg. Competitor D welded at 400 kg. The remainder of the competitive greases welded at 500 kg. The highest load studied using this test method is 800 kg; Cobalt did not weld at 800 kg, giving Cobalt a theoretical weld of 1000 kg. The weld load correlates to the load that produces catastrophic failure, signifying that Cobalt increases the margin of safety before catastrophic failure by 2 to 3 times that of the competition.

In Harsh Environments****:

Claim 7—Cobalt **provides unsurpassed corrosion protection** to help extend service life.

****Based on ASTM D-5969, the Standard Test Method for Corrosion-Preventive Properties of Lubricating Grease in 100% synthetic seawater.

Corrosion occurs when metals, such as iron and steel, exposed to moisture and oxygen react to form an oxide. The oxide is not firmly fixed to the metal surface and eventually flakes off, causing pitting. Over time, extensive pitting causes weakness and disintegration of the metal, leading to failure. The presence of salt further increases the rate of corrosion. Thus, the importance of ASTM D-5969, the Standard Test Method for Corrosion-Preventive Properties of Lubricating Grease, which differentiates the relative corrosion-preventive capabilities of greases using roller bearings exposed to various concentrations of dilute synthetic sea water stored under wet conditions. This test can be run with 0%, 5%, 10%, and 100% synthetic seawater, with 100% presenting the harshest conditions. The bearings are greased, then stored in the synthetic sea water for 24 hours at an elevated temperature of 52°C (125.6°F). Figure 7 illustrates the results of the 100% Synthetic Sea Water Corrosion test, demonstrating that Cobalt completely protects the metal bearing from any corrosion while all competitors display some amount of corrosion, ranging from mild to severe.

Figure 7: Bearings from 100% Synthetic Sea Water Corrosion Testing

Conclusion

Valvoline's Cobalt Grease with Pressure Activated Technology delivers top tier heavy duty performance. All testing shows less wear and lower friction, which can add up to longer equipment life, even in harsh environments. For any additional questions or recommendations, please contact Valvoline Engineering and Technical Services.

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