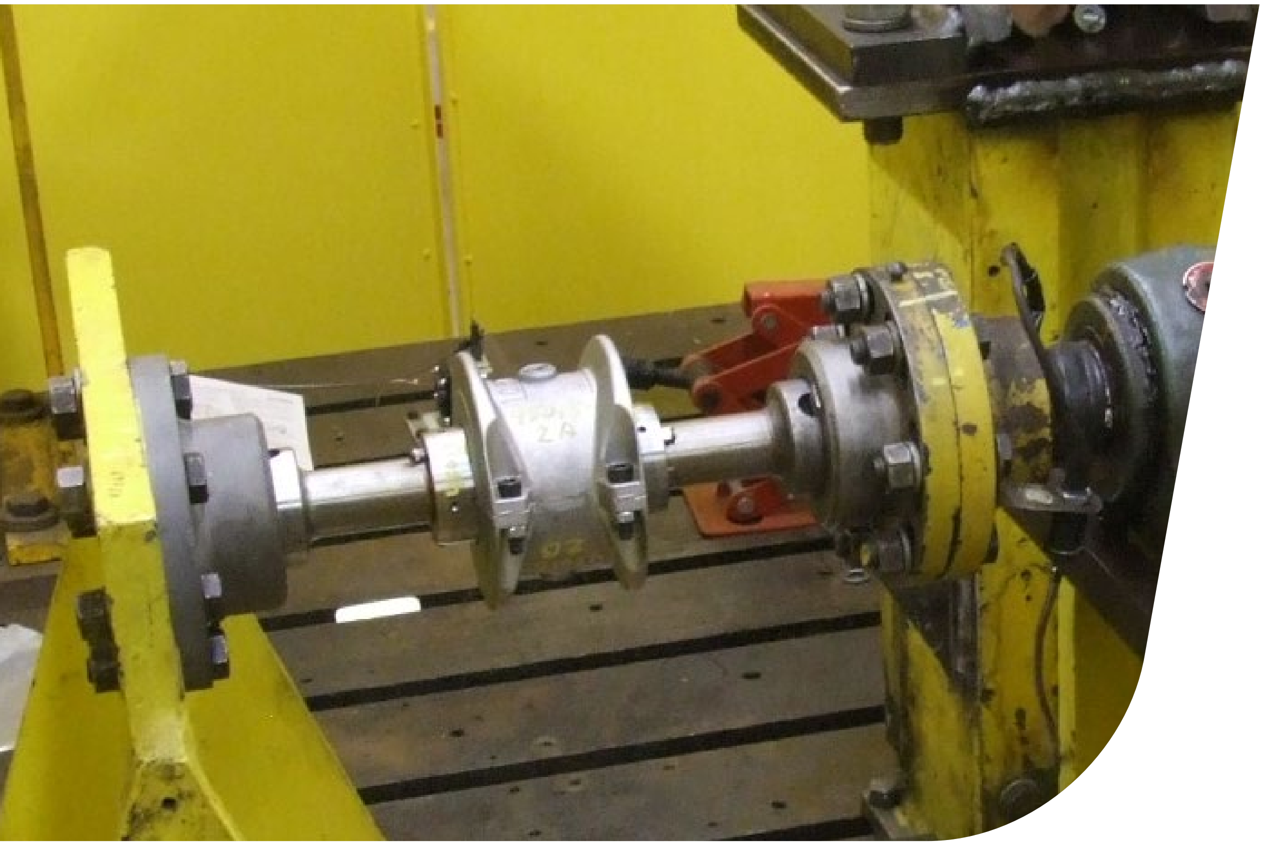
“Fit-for-Fit” Grid Coupling Components Put to the Test



SUMMARY

At first glance, it is difficult to identify the differences between the various brands of grid couplings. Some brands even market their products as "fit-for-fit" or being interchangeable with other branded parts. The important question is not whether they will fit together, but how these parts will affect coupling performance. Third party tests show that coupling brands do not perform at the same level. These tests also prove that interchanging parts between coupling brands will transfer torque, at least initially, but the durability and performance of the highest performing coupling brand is compromised through the use of "fit-for-fit" components.

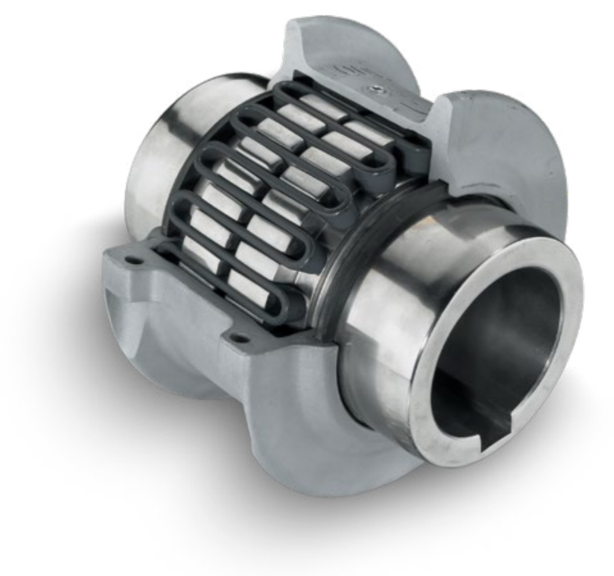
Whether it's for your car or truck at home or the machinery at your place of work, you probably see and hear a lot about so-called "will-fit" parts. While they are not made by the original equipment manufacturer, they claim to be interchangeable.

At first impression, it seems to make a lot of sense to consider using "will-fit" parts to repair your equipment. After all, when a breakdown occurs, everyone wants to get the machine back up and running as fast as possible. But the problem with "will-fit" parts is that there is no guarantee they will match the quality and performance of factory original parts.

"Will-fit" replacement parts, by their own definition, will fit. In fact, they may look like the originals and even install like the originals. But manufacturers of "will-fit" parts usually lack the engineering and manufacturing quality of the original manufacturer. As a result, parts that have been designed and manufactured as part of the original engineered solution will, in nearly every instance, outperform the "will-fit" equivalent.

Grid couplings are a good example of this. In a previous article, we noted that all grid couplings currently on the market appear to have adopted the same product design. We also noted that some brands make and sell "will-fit" replacement parts, such as covers and grid elements, which they claim are interchangeable with the same components sold by other brands.

The grid element within the coupling will wear over time and must eventually be replaced, making it a target for manufacturers of "will-fit" components. It is, therefore, a target for makers of "will-fit" components. We recently conducted third-party testing to see if switching grid elements and covers "fit-for-fit" would change the performance of grid couplings between three major brands: Falk®, Lovejoy®*, and Dodge®*.



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Assessing “fit-for-fit” performance

Grid coupling applications are very demanding, particularly from the high impact and shock loads. Common unplanned misalignment can also significantly limit the life of a coupling. Two separate tests were conducted to assess “fit-for-fit” performance: a reverse torque test **(Figure 1)** and an operating under misalignment test **(Figure 2)**. These tests are designed to simulate the impact of these factors on the couplings in a laboratory setting.

The following tests switched grid elements and covers between couplings to see if interchanging parts between brands would affect performance on a size 1030 coupling. We then put them alongside previous benchmark tests of each coupling to see how they compare.

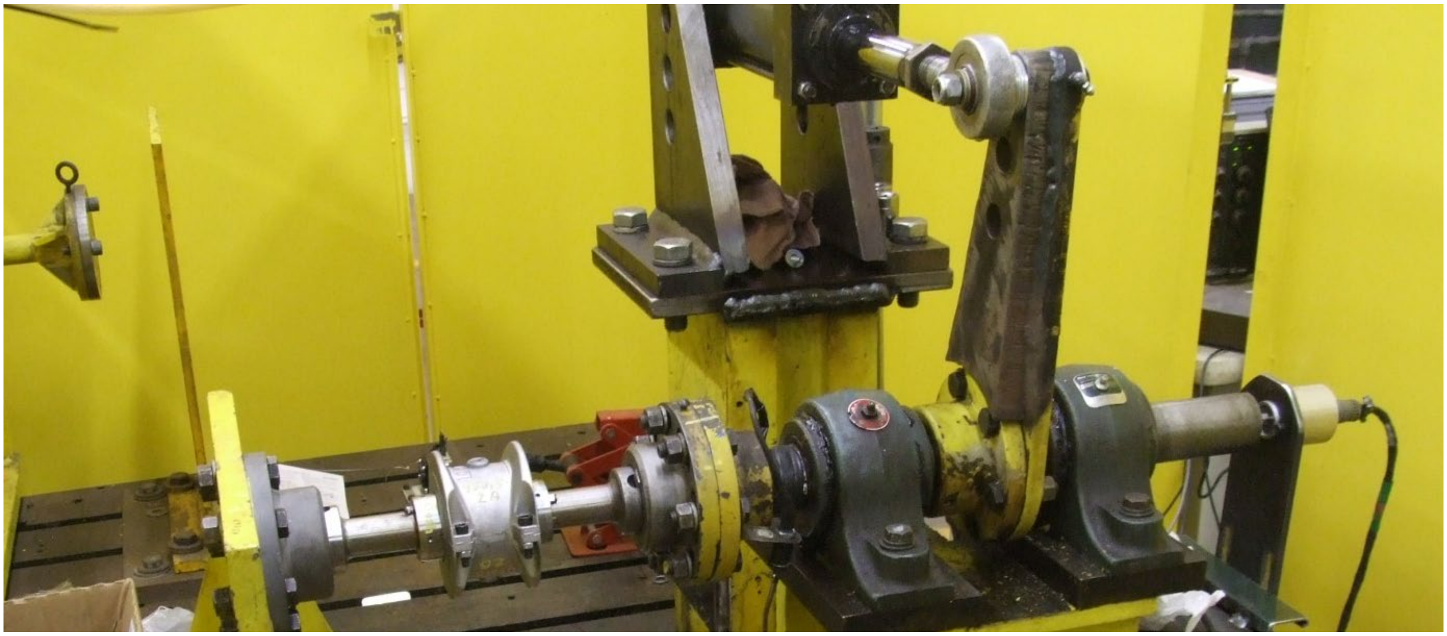


FIGURE 1 — Reverse torque test stand *(photo above)*

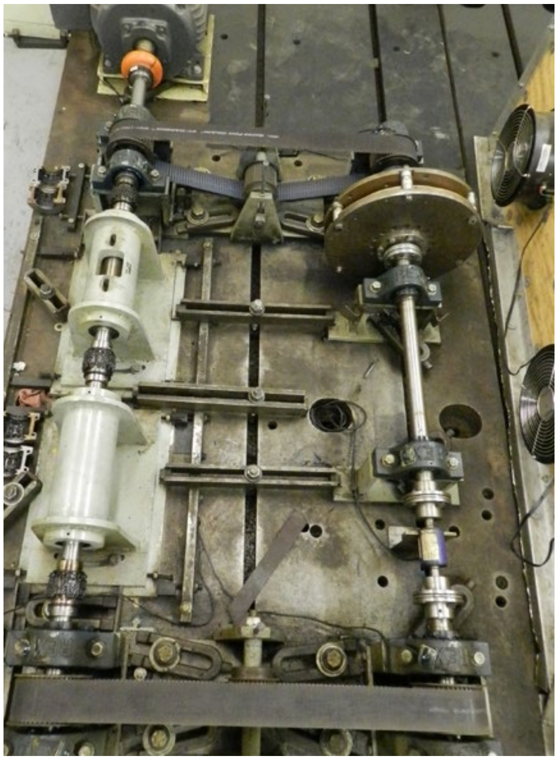
This is an accelerated test performed on a static test stand. A pneumatic cylinder applies torque to the shaft in both the positive and negative directions. Couplings are installed and operated per the manufacturers' instructions unless otherwise noted.

- **Torque:** 2,904 in-lbs (220% of maximum rating)
- **Misalignment:** minimal (within ¼ degree)
- **Failure Identification:** The components show cracking or fracturing upon inspection
- **Maximum Cycles:** 400,000

FIGURE 2 — Operating under misalignment test stand *(photo right)*

This is an accelerated test performed on a rotating test stand. Couplings are installed and operated per the manufacturers' instructions unless otherwise noted.

- **Continuous Torque:** 1,790 in-lbs
- **Peak Torque:** 2,700 in-lbs at startup
- **Speed:** 3,558 rpm
- **Misalignment:** ½ degree (200% of recommended limit)
- **Failure Identification:** The components show cracking or fracturing upon inspection
- **Maximum Cycles:** 100,000,000



For reference, **Table 1** shows benchmark results of the reverse torque test discussed in a previous paper.

While grid couplings may continue to operate with a crack or fracture in the grid element, this will lead to wear and destruction of the hub teeth. Replacing hubs with broken teeth is a costly process and significantly impacts the coupling's total cost of ownership. Cracking or fracturing of the components is identified as a failure in these tests.

Table 2 shows the results of the "fit-for-fit" reverse torque tests **(Figure 1)**. When Lovejoy®* and Dodge®* grid elements were switched for Falk grids, the Falk® Steelflex® couplings showed a significant decline in performance compared to the previous benchmark coupling tests. The Falk couplings with "fit-for-fit" grid elements failed after 50,000 cycles compared to up to 400,000 cycles in the benchmark tests.

Conversely, when Falk grid elements were switched for Lovejoy and Dodge grids, the Lovejoy and Dodge couplings showed a significant improvement in performance compared to the previous complete coupling tests.

The second test, operating under misalignment **(Figure 2)**, was designed to check coupling performance under real-life alignment conditions. While all grid coupling manufacturers specify a shaft alignment range, misalignment outside that range is often present due to human error or natural settling of foundations on which equipment sits.

Again for reference, **Table 3** shows the results of the benchmark operating under misalignment tests for three coupling brands. The Falk Steelflex coupling survived 100 million cycles without failure while both Lovejoy and Dodge couplings failed after less than 325,000 cycles each.

All three brands of hubs were tested, and the grids and covers were interchanged between brands. **Table 4** shows the results of the "fit-for-fit" operating under misalignment tests. When Falk hubs were tested with Lovejoy and Dodge grid elements, the Falk couplings showed a significant decline in performance compared to the previous tests with complete couplings. The Falk couplings with "fit-for-fit" grids failed after 3,543,768 cycles, compared to no failure after 100 million cycles in the previous test.

On the other hand, when Lovejoy and Dodge hubs were tested with Falk grid elements, these couplings showed a significant improvement in performance compared to the previous complete coupling tests. No failures occurred within the 100 million cycle test limit.

TABLE 1 — Cycle Test Results of the Six Samples Tested

Brand	Cycles on Test Stand	Type of Failure
Falk (Sample #1)	400,000	None
Falk (Sample #2)	400,000	Grid Failure
Lovejoy (Sample #1)	30,000	Grid Failure
Lovejoy (Sample #2)	20,000	Grid Failure
Dodge (Sample #1)	100,000	Grid Failure
Dodge (Sample #2)	70,000	Grid Failure

TABLE 2 — Results of "Fit-for-Fit" Reverse Torque Tests

Hub Brand	Grid/Cover Brand	Cycles on Test Stand	Type of Failure
Falk	Lovejoy	50,000	Grid Failure
Falk	Dodge	50,000	Grid Failure
Lovejoy	Falk	400,000	Grid Failure
Dodge	Falk	400,000	None

TABLE 3 — Benchmark Coupling Operating Under Misalignment Test Results

Brand	Starts/Stops	Cycles on Test Stand	Type of Failure
Falk	18	100,000,000	None
Lovejoy	7	320,000	Grid Failure
Dodge	7	320,000	Grid Failure

TABLE 4 — Results of "Fit-for-Fit" Operating Under Misalignment Tests

Hub Brand	Grid/Cover Brand	Starts/ Stops	Cycles to Failure	Type of Failure
Falk	Lovejoy	1	3,543,768	Grid Failure
Falk	Dodge	1	3,543,768	Grid Failure
Lovejoy	Falk	10	100,000,000	None
Dodge	Falk	10	100,000,000	None

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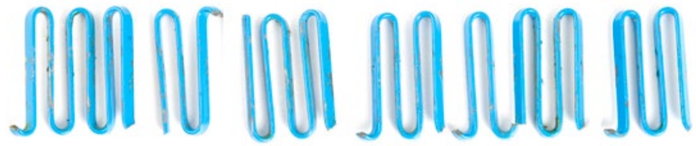
"Will-fit" parts fail to measure up

"Will-fit" grid and cover brands claim that their components are fully interchangeable with other manufacturers' components. However, while their components do fit together and will initially transmit torque, tests conducted in a controlled laboratory environment showed that the interchange caused significant changes to the overall product performance.

Previous tests have demonstrated wide variation in performance between grid coupling brands. Testing discussed in this paper has shown that mixing components of a low performing coupling brand with those of a high performing brand will result in a coupling that performs somewhere in between. The grid element and cover were shown to be particularly important to coupling performance.

While in some cases there were performance improvements, this testing shows that not all grid coupling brands are created equally. It is clear from these results that while "will-fit" parts may look the same, they are not the same. The components of a high performing grid coupling are engineered to work together as a system. Material selection, product design, manufacturing processes and quality controls will also impact how long a grid coupling is able to stand up to the high stresses inherent in mining and heavy industrial applications. Poor design and manufacturing can limit a grid element's life.

While it may be tempting to mix "will-fit" grid coupling components, testing proves that doing so simply does not provide the same results. Choosing proper components that are designed to work together will lower total cost of ownership and limit unplanned downtime. In most cases, a "fit-for-fit" component will not stand the test of time and will not be worth the implied convenience that manufacturers market.



Lovejoy®* grid element after 30,000 cycles

Lovejoy grid element after 320,000 cycles

Dodge®* grid element after 70,000 cycles

Falk® grid element after 400,000 cycles

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