PARKER PRECISION FLUIDICS DIVISION

PARKER HANNIFIN CORPORATION

Engineering Document Number ER1291

Title:
11 Ohm Coil Supplier Qualification

DESIGN VERIFICATION PLAN and REPORT

Revision - 1

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ABSTRACT

The executive summary of the report.
This report documents the verification testing for qualifying a secondary supplier for leaded coils that are used to produced valves across several product lines. The testing procedures and results documented in this report were done to prove conformance to product specifications under the documented operating conditions. The procedures used to verify the product as well as the test results are presented in this report. The actual files use for data analysis and reduction are attached in the appendix for reference.

This testing verifies that the leaded coils as manufactured by a secondary source are ready for commercial release.

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1.0 PURPOSE

The intent of this report is to document the qualification of coils as manufactured from a new supplier. This supplier is being added as an approved source for the coils under test. This document demonstrates that the new coils meet intended design and performance specifications. This qualification includes an evaluation of functional performance as it pertains to the valves.

2.0 SCOPE

Design verification testing was performed on three configurations of the 11 Ohm coil used across several product lines. A list of affected product lines can be seen below.

Coil Part Number	Description	Parent Part Tested	Product Lines Affected
390-000013-006	COIL, VALVE, 11 OHMS, MAG COUPLING W/18"-19" LEADS	VSO MAX HP	VSO, MDPRO, LW, HFPRO, VSO MAX, Series 11, Series 25, V2, VLV
390-001071-001	COIL, VALVE, 11 OHMS, W/MOLEX CONN.	MDPRO	MDPRO
390-000013-015	COIL, 11 OHMS, W/MOLEX CONN.	HFPRO	HFPRO

Each unit tested was built with components manufactured using production processes. Specific tests are outlined that evaluate performance criteria. Coil component parts were verified through inspection as conforming to drawing requirements. All testing is performed on calibrated equipment.

3.0 APPLICABLE DOCUMENTS

3.1	920-000500-001 Assembly Drawing	Rev D
3.2	921-200500-012 Assembly Drawing	Rev D
3.3	920-000600-005 Assembly Drawing	Rev B
3.4	390-000013-015 Assembly Drawing	Rev -
3.5	390-000013-006 Assembly Drawing	Rev F
3.6	390-001071-001 Assembly Drawing	Rev F
3.7	790-002206-001 Performance Specification	Rev D
3.8	790-002243-002 Performance Specification	Rev D
3.9	790-002616-001 Performance Specification	Rev B

4.0 EQUIPMENT / TOOLS

Standard production equipment and fixturing used in the Production cells.

5.0 DESIGN VERIFICATION PLAN (Insert from TEMPL-0006)

	Product Design Requirement	Procedure Reference	Sample Size	Test Completed	Passed Requirement
Design Requirements	First Article Inspection	6.1.1	30	Per Component Drawings	Yes
	Resistance Measurement	6.2.1	30	Per Component Drawings	Yes
Functional Requirements	Flow Rate	6.2.1-6.2.3	30	Per Specified Performance	Yes
	Gain	6.2.1-6.2.3	30	Per Specified Performance	Yes
Notes:	N/A				

6.0 DESIGN VERIFICATION PROCEDURE AND RESULTS

The Design Verification was divided into two sections as described below:

6.1 Mechanical Design

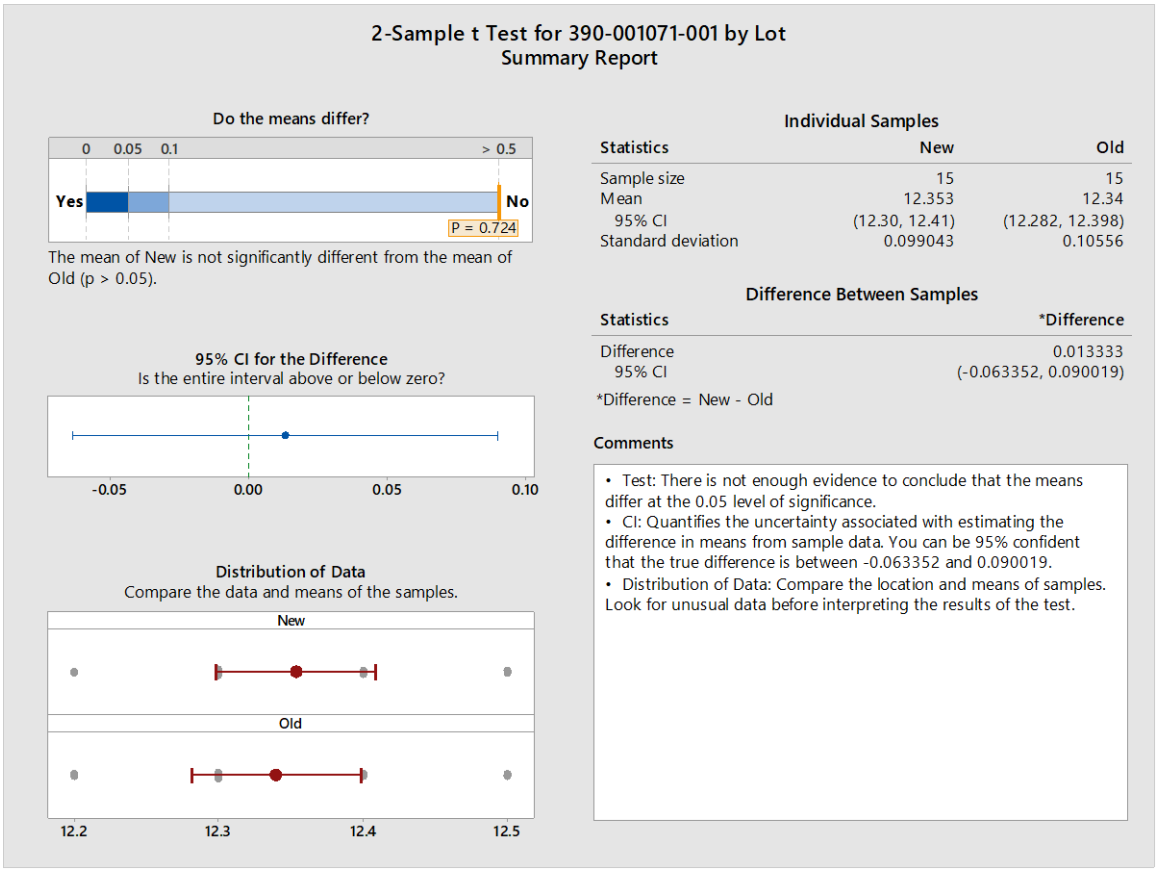
6.2 Product Functionality

6.1 Mechanical Design

6.1.1 First Article Inspection: Each component underwent First article inspection to ensure that the component meets design intent.

First Article Inspection	
Part Number	**Passed Dimensional Requirements**
195-000084-003	Yes
390-000013-006	Yes
390-000013-015	Yes
390-001071-001	Yes

6.2.1 Resistance Measurement: A 2-Sample t Test was performed on each part number do determine if there was significant difference between the new and old lots of material. There was no significant difference found in the resistances between the two lots tested.



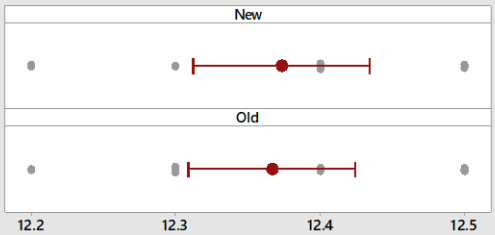
2-Sample t Test for 390-000013-015 by Lot
Summary Report

Do the means differ?

The mean of New is not significantly different from the mean of Old (p > 0.05).

95% CI for the Difference
Is the entire interval above or below zero?

Distribution of Data
Compare the data and means of the samples.



Individual Samples

Statistics	New	Old
Sample size	15	15
Mean	12.373	12.367
95% CI	(12.31, 12.43)	(12.309, 12.425)
Standard deviation	0.10998	0.10465

Difference Between Samples

Statistics	*Difference
Difference	0.0066667
95% CI	(-0.073762, 0.087095)

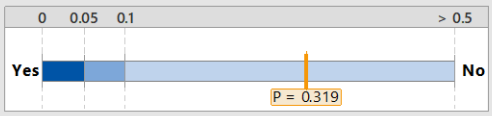
*Difference = New - Old

Comments

- Test: There is not enough evidence to conclude that the means differ at the 0.05 level of significance.
- CI: Quantifies the uncertainty associated with estimating the difference in means from sample data. You can be 95% confident that the true difference is between -0.073762 and 0.087095.
- Distribution of Data: Compare the location and means of samples. Look for unusual data before interpreting the results of the test.

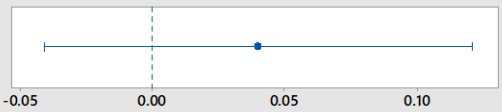
2-Sample t Test for 390-000013-006 by Lot
Summary Report

Do the means differ?

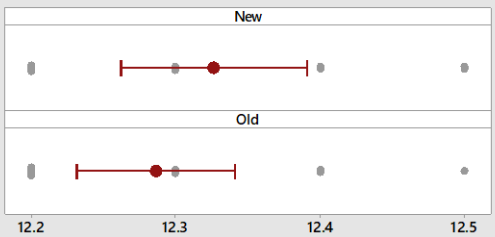


The mean of New is not significantly different from the mean of Old (p > 0.05).

95% CI for the Difference
Is the entire interval above or below zero?



Distribution of Data
Compare the data and means of the samples.



Individual Samples

Statistics	New	Old
Sample size	15	15
Mean	12.327	12.287
95% CI	(12.26, 12.39)	(12.232, 12.342)
Standard deviation	0.11629	0.099043

Difference Between Samples

Statistics	*Difference
Difference	0.04
95% CI	(-0.040925, 0.12093)

*Difference = New - Old

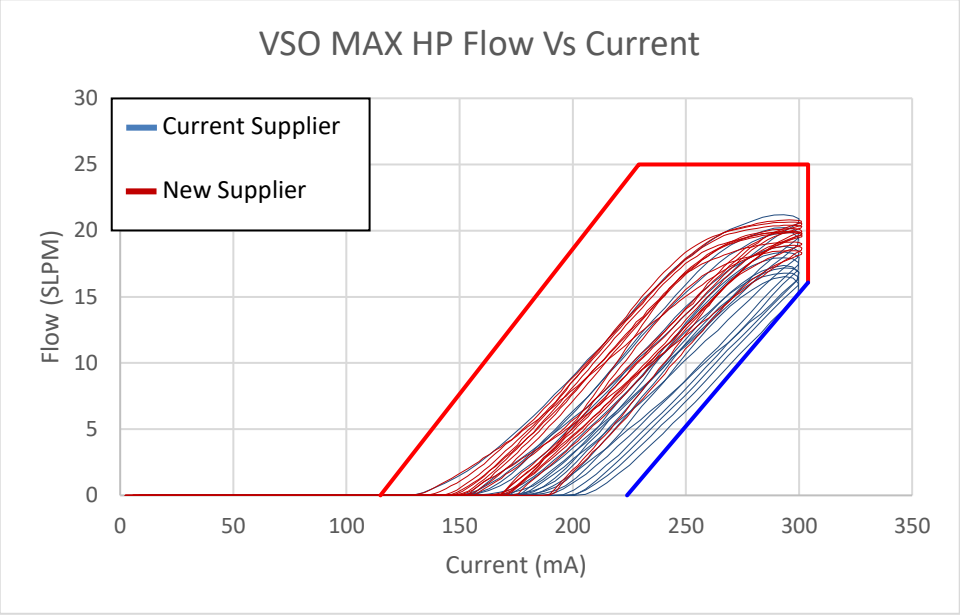
Comments

- Test: There is not enough evidence to conclude that the means differ at the 0.05 level of significance.
- CI: Quantifies the uncertainty associated with estimating the difference in means from sample data. You can be 95% confident that the true difference is between -0.040925 and 0.12093.
- Distribution of Data: Compare the location and means of samples. Look for unusual data before interpreting the results of the test.

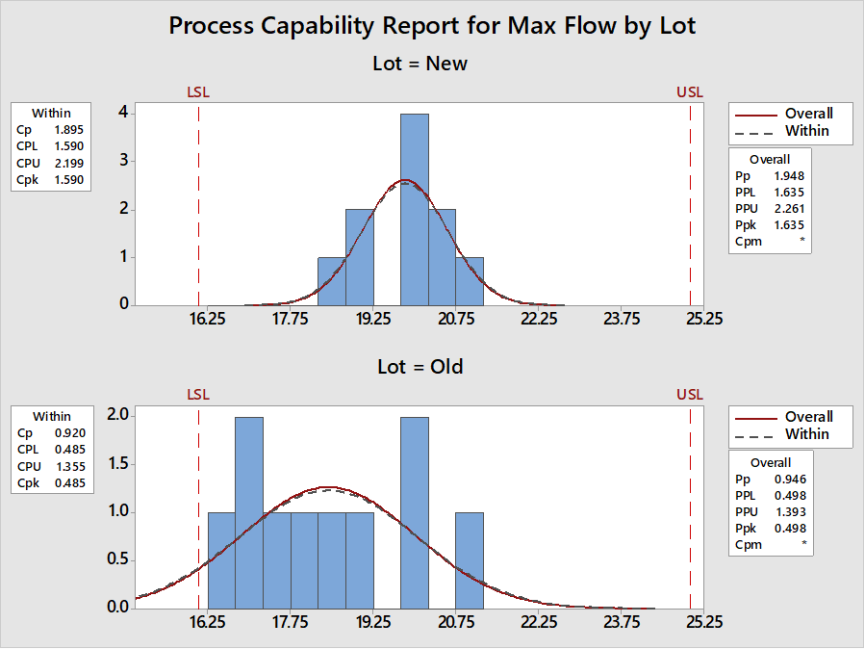
6.2 Product Functionality

Testing was performed on production equipment. Product functionality was measured across 3 parents part numbers that utilize the 11 ohm coil. The performance of products made with the new coils was graphed against products made using existing coils. Performance characteristics were then compared to ensure that they were equal to or better than existing product.

6.2.1 VSO MAX HP

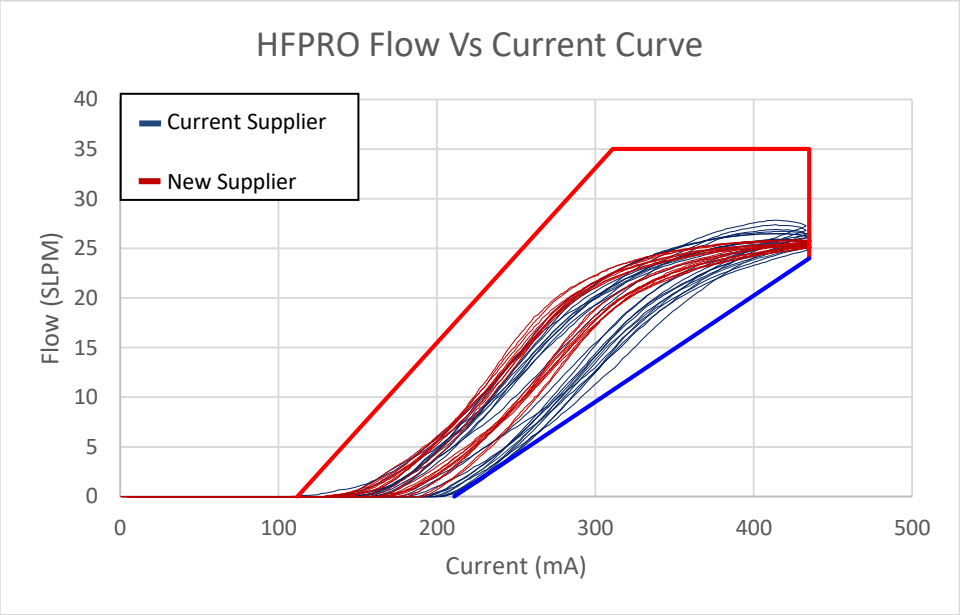


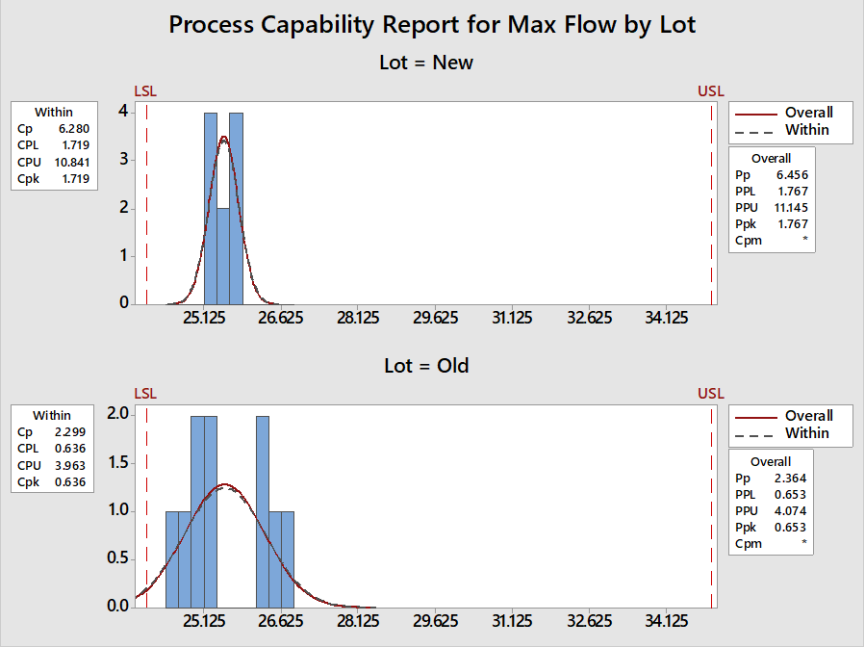
10 valves were built using components from both the new supplier and the current supplier. The graph of those valves can be seen above. Flow curves between the two lots demonstrate comparable performance. Maximum flow output at rated voltage was then measured for the two lots to compare capability.



While both lots had passing results, the new lot of components produced valves with a better capability. The capability for the new lot is suitable for production use.

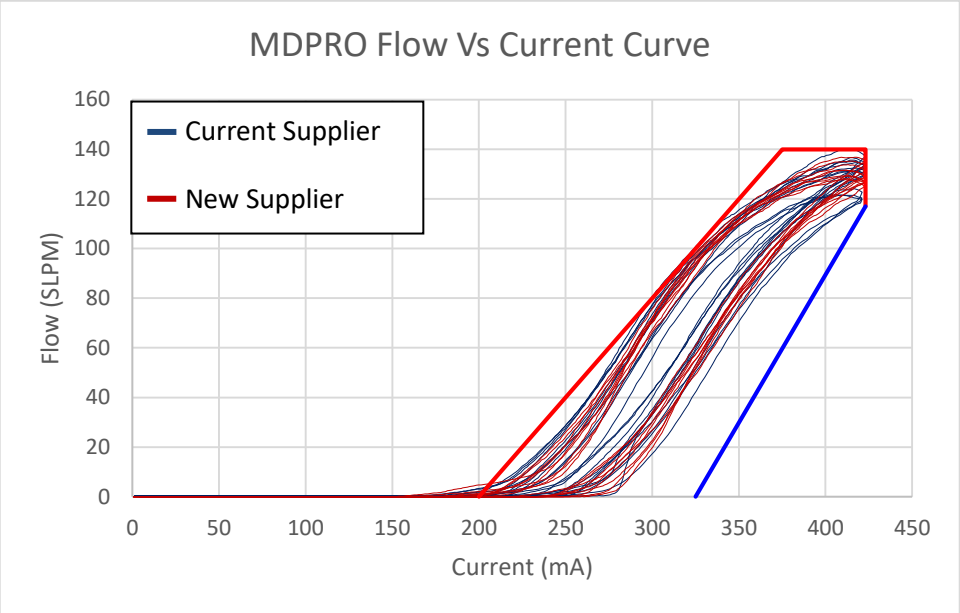
6.2.2 HFPRO

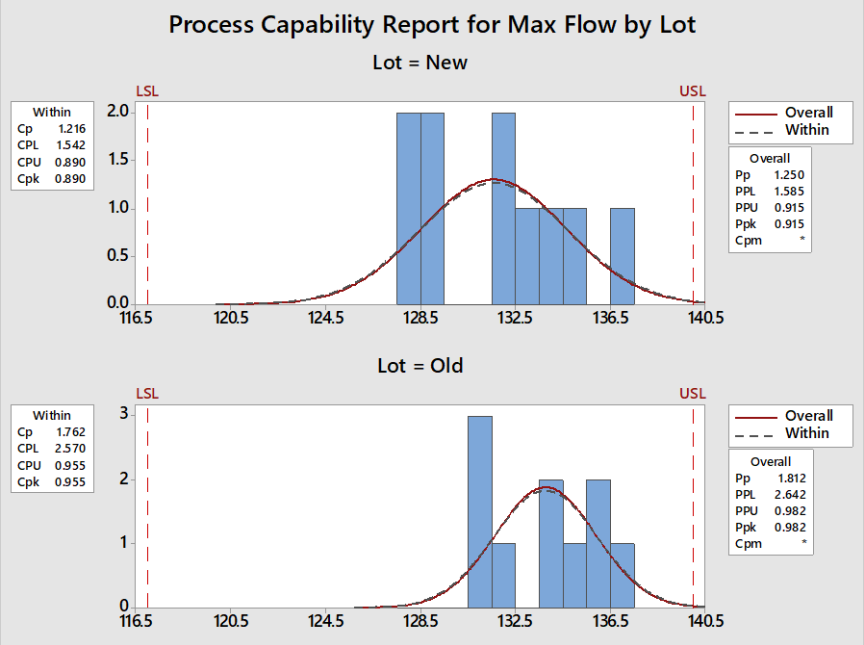




All units built while testing this part number passed performance criteria. Flow curves above show comparable performance between the two lots of material. Comparing the capability between the two lots, we see that the max flow capability for the new components is higher than the capability for the current ones.

6.2.3 MDPRO





Flow curves for the two lots can be seen above. The curves show comparable performance between the two lots. While the Cpk for this part number was slightly lower than using the current lot, the Cpk for the new components is found to be acceptable.

7.0 CONCLUSIONS

The lot of coils from the new supplier were found to perform sufficiently under the specified performance parameters. Each above test shows that the flow curve using the new coils is comparable to the flow curve using the current one, and capability using the new coils is suitable for production use.

	Product Design Requirement	Procedure Reference	Sample Size	Test Completed	Passed Requirement
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