

DVA – AC Motor Data Value Analysis

Summary of Findings – Motors DVA

2,781 motors were reviewed, representing approximately \$123M in annual spend. The motors are AC motors with a range of powers and voltages, in all there were 34 technical attributes and 3 spend attributes.

DFR's Analytic Tools found several sets of duplicates and near duplicates, suggesting ample opportunity for cost savings.

- 32% of the motors were identified as potential duplicates
- 58% were determined to be near duplicates

Summary of potential benefits:

- \$463k annual savings by eliminating new part requests
- \$6M annual savings from pricing rationalization from top cluster groupings – 1,600 motors

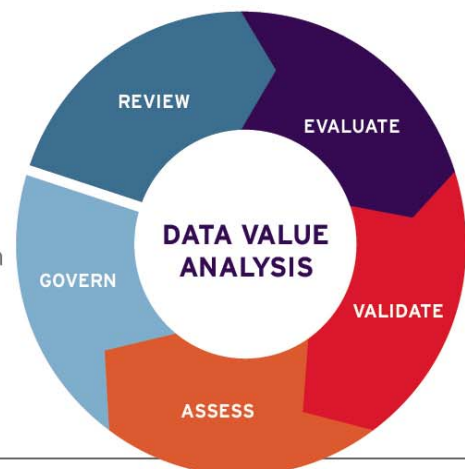
DVA Background – Data Value Analysis by Convergence Data Services

Convergence Data Services (CDS) is a parts data management software company servicing various industries the past 15 years. The DVA is a quick process to analyze a company's data, classify and cleanse the data to estimate the potential value the data could have using Design for Retrieval (DFR). DFR is CDS's parts data management software solution.

KEY COMPONENTS OF A DATA VALUE ANALYSIS

After evaluating your product data, we will generate your customized report. This easy-to-review report includes a/an:

- Review of data format and completeness
- Evaluation of data taxonomy
- Validation of data, including value inconsistencies, description formats, nulls, mixed-value types and data with appropriate ranges
- Assessment of the ease of searching, comparing, sorting and analyzing data
- Review of the data governance process



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Initial Data Assessment – Prior to Data Cleansing

An overview of the quality of the data before and after cleansing. During the cleansing, attributes considered “significant” were cleansed. See the Before and After of the motor data as shown in charts below.

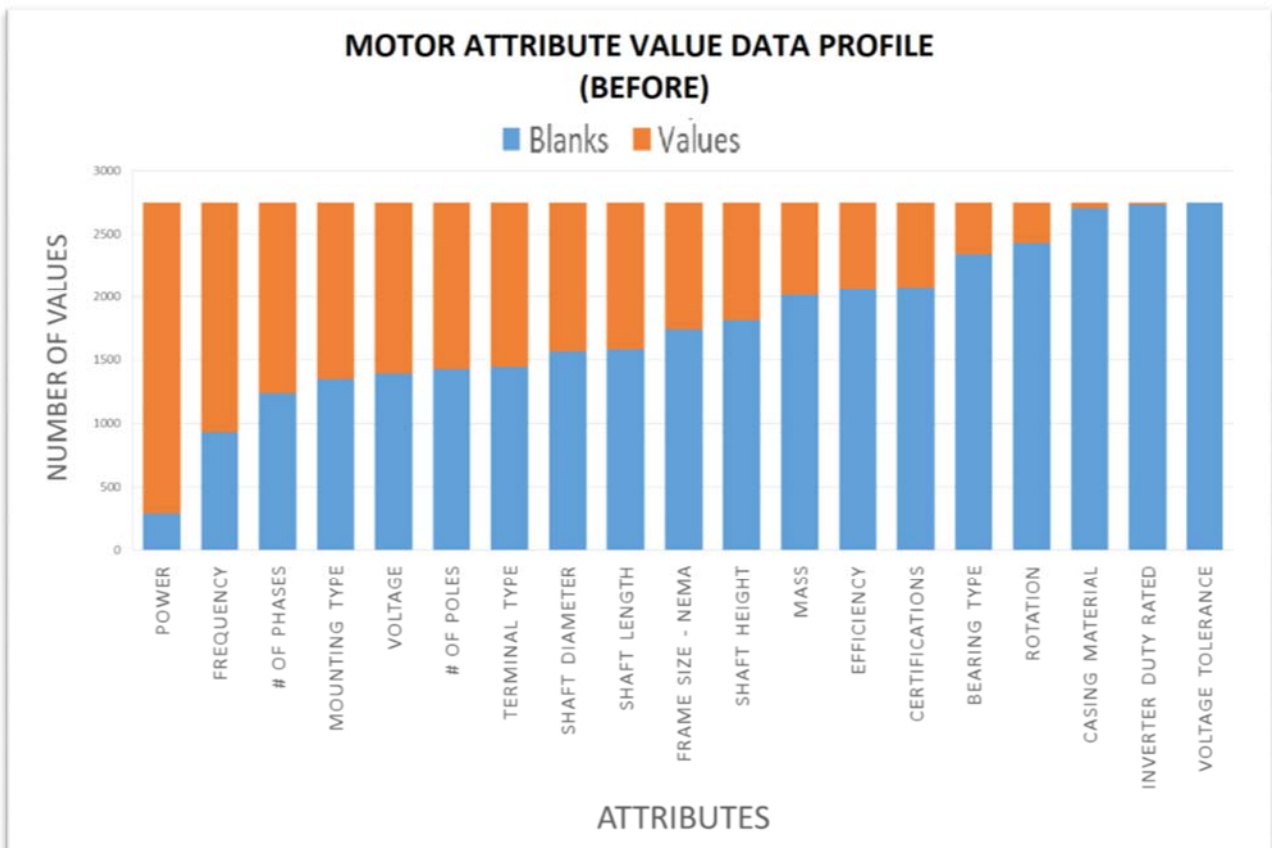


Figure 1 Before data cleansing Motor Attribute Quality

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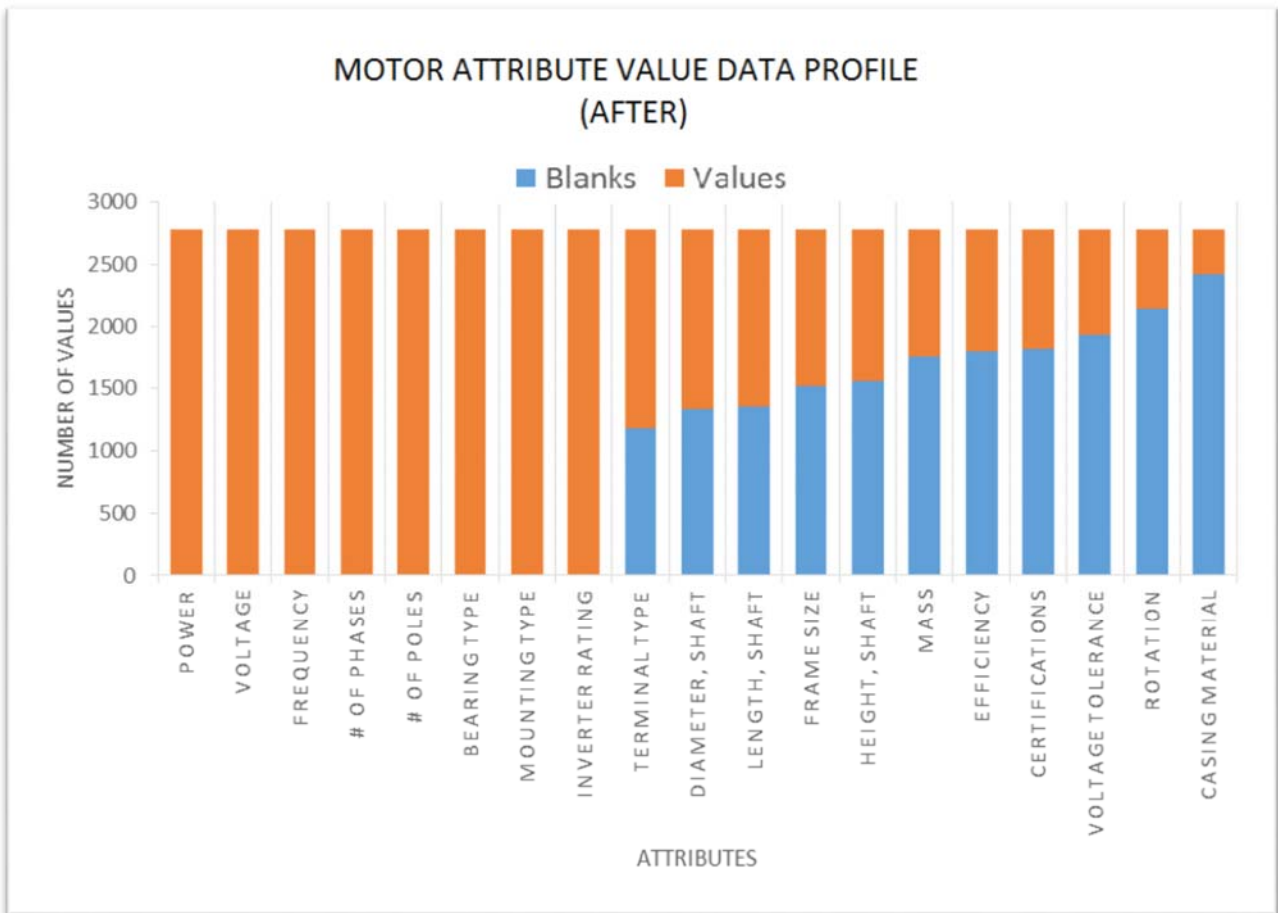


Figure 2 After using DFR - data cleansing Motor Attribute Quality

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The percentage of attributes populated (showing cleansed data) with values is shown in the far right column of the chart below. When performing a duplicate analysis, the initial requirement is to identify critical attributes to perform the analysis. Depending on the point in the product's lifecycle, the critical attributes will likely change. Shown in chart are two sets of critical attributes at two stages of a products lifecycle for a motor: New Part Introduction (NPI) and Aftermarket. The NPI stage occurs early in the product's development and the designer has flexibility in the design, so not many attributes are required. Later in the lifecycle, more attributes are commonly required, as is shown for the Aftermarket stage. Aftermarket items typically have less flexibility in what the attributes can be, since making changes to the design is no longer feasible.

ATTRIBUTE	AFTER MARKET	NPI	Percent Values
POWER	Y	Y	100%
FREQUENCY	Y	Y	100%
# of Phases	Y	Y	100%
VOLTAGE	Y	Y	100%
# OF POLES	Y	Y	100%
INVERTER RATING	Y	Y	100%
EFFICIENCY		Y	35%
CERTIFICATIONS		Y	35%
MOUNTING TYPE	Y		100%
BEARING TYPE	Y		100%
TERMINAL TYPE	Y		57%
DIAMETER, SHAFT	Y		52%
LENGTH, SHAFT	Y		51%
FRAME SIZE	Y		45%
HEIGHT, SHAFT	Y		44%
VOLTAGE TOLERANCE	Y		30%
ROTATION	Y		23%
MASS			37%
CASING MATERIAL			13%

Table 1 Significant attributes for identifying duplicates

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An important step in improving data quality is to normalize the data values. Data which is ungoverned commonly has different values which mean the same thing, see the Before and After results of attribute values for motor bearings in Table 2. Often the values have different spelling, punctuation, and word order making it difficult to organize and locate similar items. DFR provides the Allowed Values Manager which provides the functionality to quickly normalize the data, making it easier to sort, find, and organize the data.

BEFORE	AFTER
1. ANTI-FRICTION BEARINGS	1. ANTIFRICTION
2. BALL - LUBRICATED	2. BALL
3. BALL - SELF LUBRICATED	3. BALL, LUBRICATED
4. BALL (SELF LUBRICATED	4. BALL, DOUBLE SEAL
5. BALL BEARING - ANTI FRICTION	5. BALL, REGREASABLE
6. BALL DOUBLE SEALED	6. BALL, SEALED
7. BALL DOUBLE SEALED FULL CONTACT SEALS	7. ROLLER
8. BALL REGREASABLE	8. ROLLER, REGREASABLE
9. BALL RE-GREASEABLE	9. SLEEVE
10. BALL SEELED	10. SLEEVE, LUBRICATED
11. BALL/ROLLER - RE-GREASEABLE	11. DOUBLE SEALED
12. BEARINGS SEALED	
13. BEARINGS, SLEEVE	
14. DOUBLE SEALED	
15. DOUBLE SEALED BALL BEARINGS	
16. FRICTIONLESS BEARINGS	
17. LUBRICATED ROLLER BEARINGS	
18. ROLLER BEARINGS	
19. SEALED	
20. SEALED BEARINGS	
21. SEALED FULL CONTACT SEALS	
22. SEALED VLS TYPE	
23. SLEEVE - FORCE LUBRICATED	
24. SLEEVE - SELF LUBRICATED	
25. SLEEVE BEARINGS	

Table 2 Attribute values before and after normalization of the attributes

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Data Trend Analysis – AC Motors

Shown in Figure 3 are the quantities of purchased motors relative to the motors' power. Each vertical column of points are motors at a specific power. The number of points in each column indicates the number of motors being purchased at a specific power. The columns with high numbers of points suggests a subset of the data where likely substitutes could be found. The sample set shows purchase orders as small as 1 motor to many well above 10,000. Each column of point should be reviewed to consolidate the number motors at that specific power. In general, consolidating any motors purchased in low volumes, can save money by improving the volume discount from vendors.

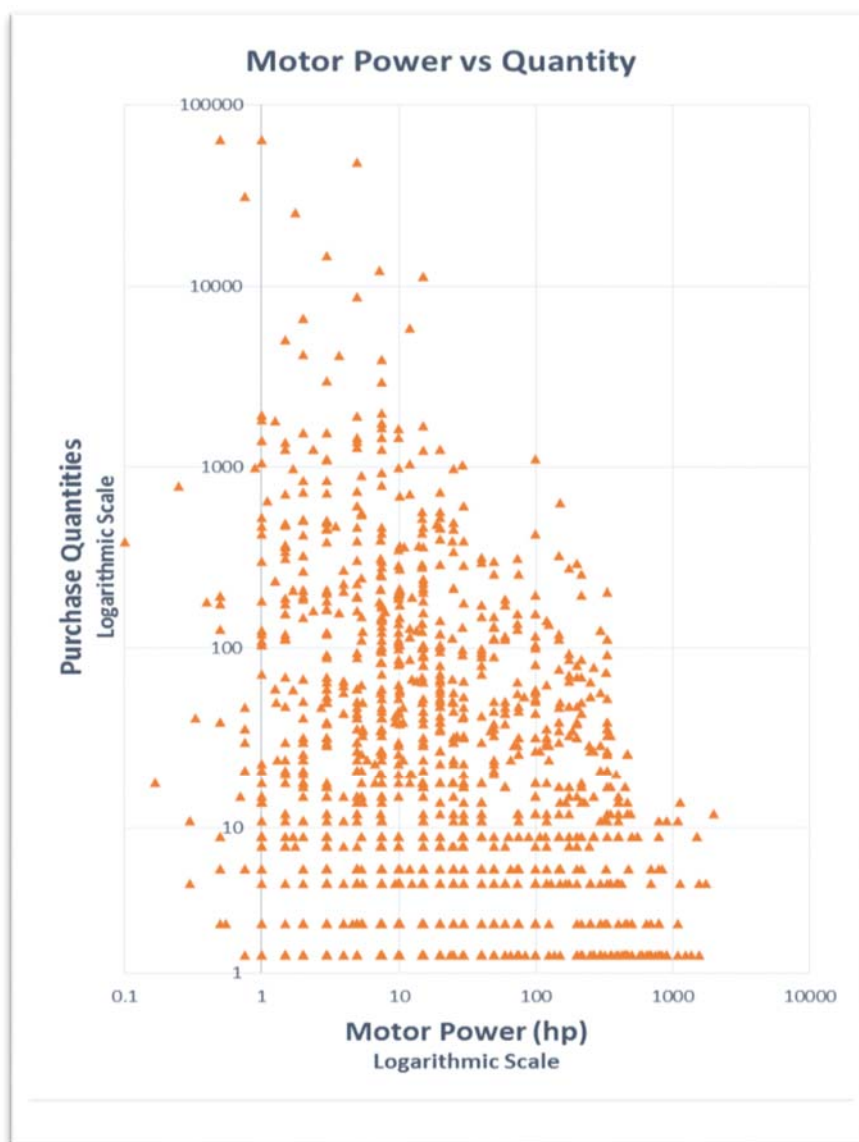


Figure 3 The quantities of motors purchased relative to motor power (hp)

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Duplicates and Near Duplicate Analysis – DFR Analytics

The DFR's Duplicate Finder suggested a large number of potential duplicates, as high as 32%, see Figure 4. The attributes selected for the analysis are Power, Voltage, # of Phases, # of Poles, Bearing Style, and Mounting Type.

Figure 5 shows the top 10 sets of groupings. Any duplicate sets must have identical attributes values for the chosen critical attributes. For the example, each set must have the same power, voltage, # of poles, # of phases, bearing style, and mounting.

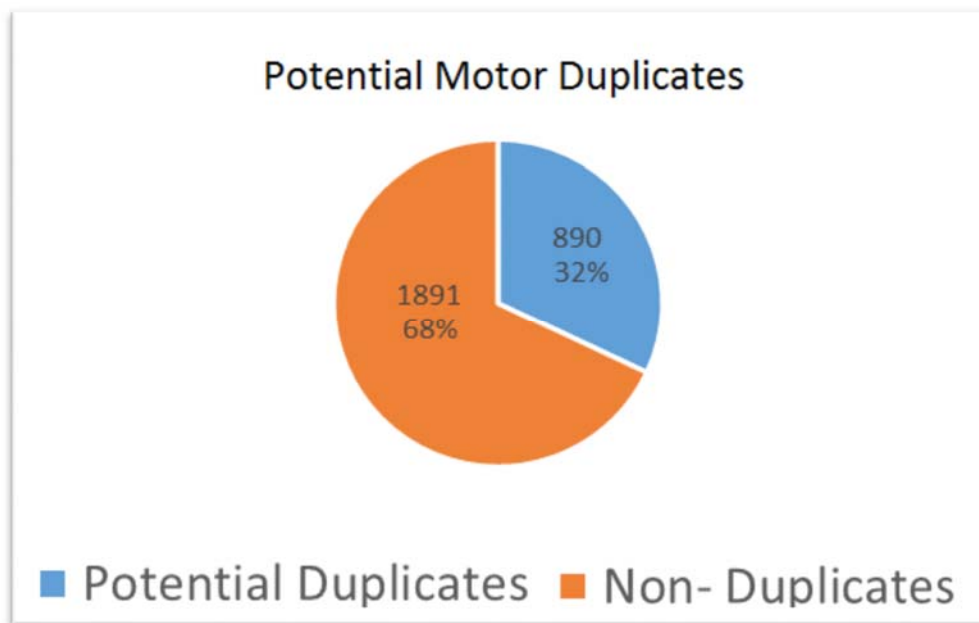


Figure 4 DFR Duplicate Finder Results

Found: 20	BEARING STYLE: BALL	FREQUENCY: 60	MOUNTING TYPE: FOOT	POWER: 7.5	VOLTAGE: 220	NUMBER OF PHASES: 3	NUMBER OF POLES: 4
Found: 20	BEARING STYLE: BALL	FREQUENCY: 60	MOUNTING TYPE: FOOT	POWER: 7.5	VOLTAGE: 220	NUMBER OF PHASES: 3	NUMBER OF POLES: 2
Found: 20	BEARING STYLE: BALL	FREQUENCY: 60	MOUNTING TYPE: FOOT	POWER: 5	VOLTAGE: 220	NUMBER OF PHASES: 3	NUMBER OF POLES: 4
Found: 14	BEARING STYLE: BALL	FREQUENCY: 60	MOUNTING TYPE: FOOT	POWER: 5	VOLTAGE: 120	NUMBER OF PHASES: 3	NUMBER OF POLES: 4
Found: 13	BEARING STYLE: BALL	FREQUENCY: 60	MOUNTING TYPE: FOOT	POWER: 1	VOLTAGE: 120	NUMBER OF PHASES: 3	NUMBER OF POLES: 2
Found: 12	BEARING STYLE: BALL	FREQUENCY: 60	MOUNTING TYPE: FOOT	POWER: 25	VOLTAGE: 120	NUMBER OF PHASES: 3	NUMBER OF POLES: 4
Found: 12	BEARING STYLE: BALL	FREQUENCY: 60	MOUNTING TYPE: FLANGE	POWER: 25	VOLTAGE: 220	NUMBER OF PHASES: 3	NUMBER OF POLES: 2
Found: 12	BEARING STYLE: BALL	FREQUENCY: 60	MOUNTING TYPE: FOOT	POWER: 10	VOLTAGE: 120	NUMBER OF PHASES: 3	NUMBER OF POLES: 2
Found: 11	BEARING STYLE: ANTI-FRICTION	FREQUENCY: 60	MOUNTING TYPE: FOOT AND FLANGE	POWER: 40	VOLTAGE: 220	NUMBER OF PHASES: 3	NUMBER OF POLES: 3
Found: 11	BEARING STYLE: BALL	FREQUENCY: 60	MOUNTING TYPE: FOOT	POWER: 50	VOLTAGE: 220	NUMBER OF PHASES: 3	NUMBER OF POLES: 2

Figure 5 A DFR screen capture of the top 10 duplicate groups

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A clusters analysis was performed using DFR's Item Clusters Tool. A clusters analysis commonly finds more near-duplicates than duplicates because it finds parts which are similar, but not necessarily exact. Using the same attributes as in the duplicates analysis, the clusters analysis identified 58% near duplicates. See Figure 6 and Figure 7.

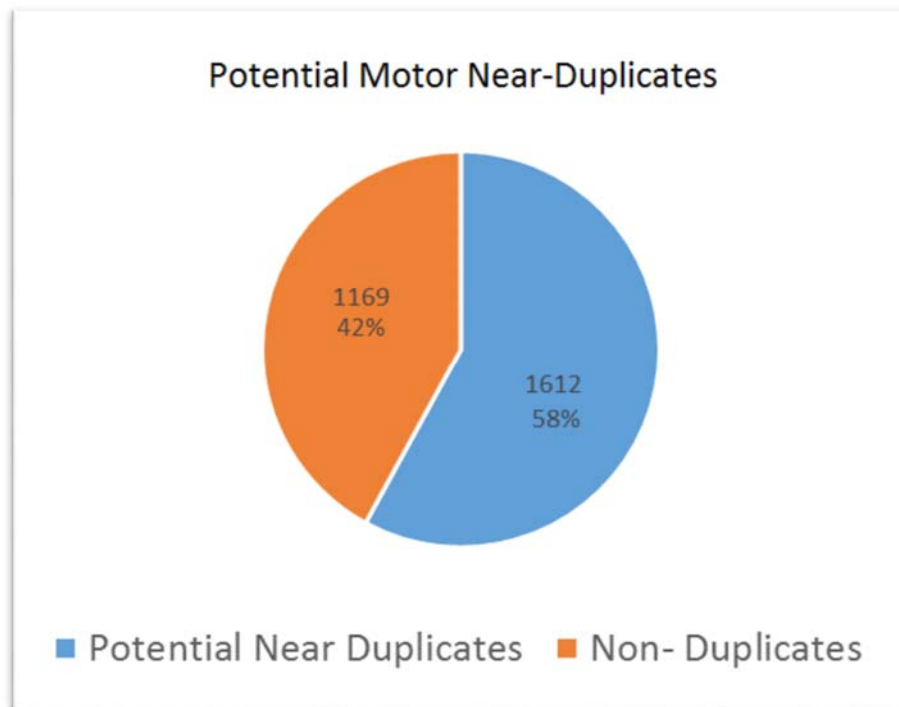


Figure 6 Potential Near Duplicates versus Non-Duplicates

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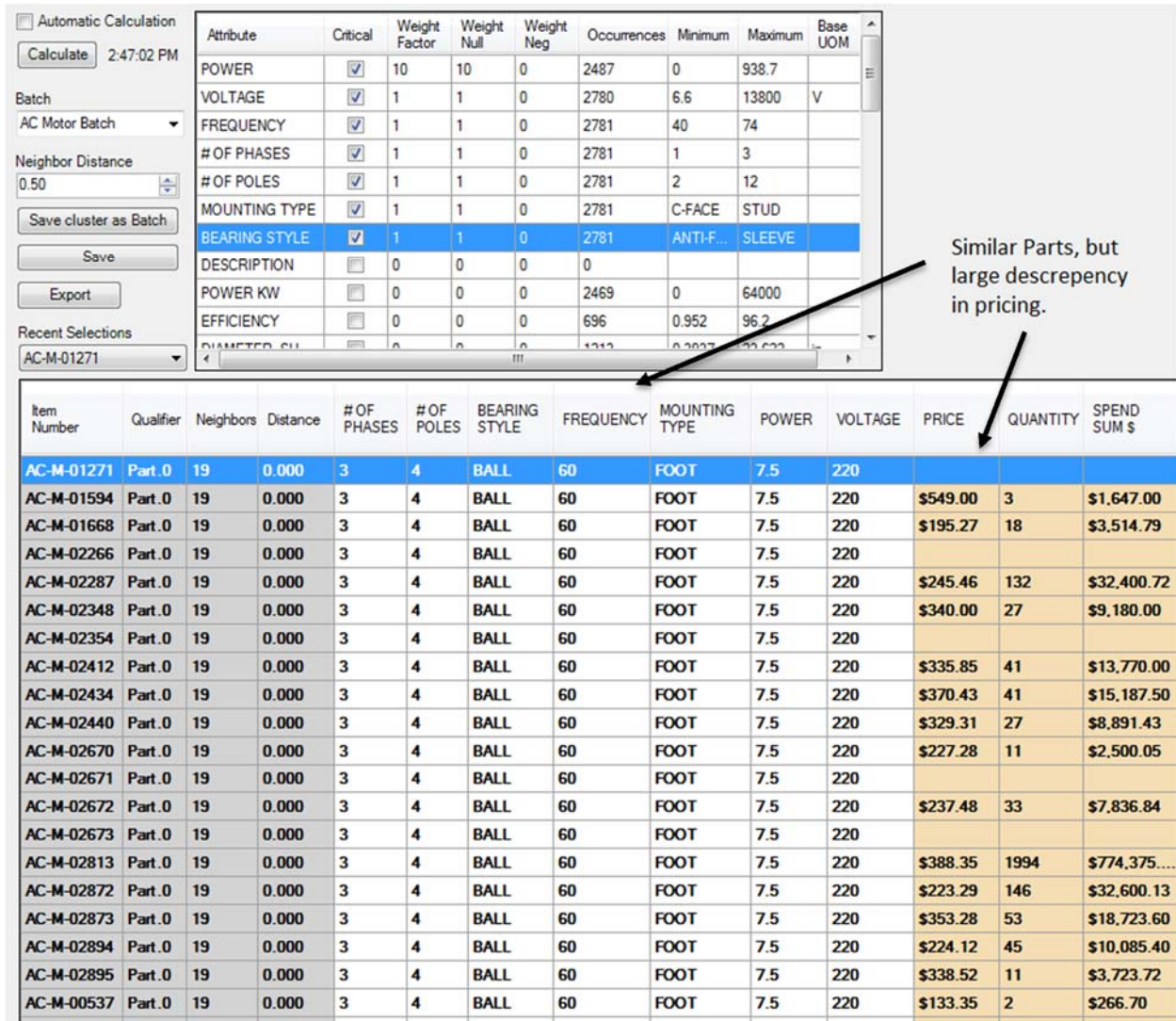


Figure 7 A screen capture of DFR's Cluster Analysis Tool

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2 Potential Areas for Cost Savings

The analysis focused on gaining benefits requiring the least amount of effort. If engineers had better data, they could save money by easily being able to find parts and increase reuse. If procurement had better data, it could increase leverage with suppliers. They could consolidate purchases of similar items with preferred vendors and normalize the pricing differences existing on similar items.

- New Part Request Mitigation:

The motor attribute data was originally too low quality to be able to find duplicates, resulting in new motors being added where an existing motor could have sufficed. After cleansing the data, it becomes easier to find existing motors meeting the design specifications for new designs. As a result part standardization goes up and new parts do not need to be created, saving costs associated with creating new parts.

Approximately 32% were found to be in a duplicate set, suggesting about 1/3 of the new motors being created could use an existing motor.

- Approximately 278 motors are created yearly (10%)
- About 1/3 of those motors could use a previously existing motor
- The cost to create a new part varies from company to company, but a reasonable and conservative estimate is \$5,000 to add a part to the system
- Costs avoided by using existing parts = $278/3 \times \$5,000 = \$463,333$
- **Estimated Annual Cost Savings = \$463,000**

- Supplier Price Rationalization: about 1,600 motors can be grouped (clustered) with a similar motors. Each of these parts have similar attribute characteristics with different pricing.

- 453,000 were purchase in the previous year
- ~ 50 was the average quantity
- 58% or about 1,600 motors of the 2,781 motors are clustered next to at least on other motor
- Average price motors ~ \$200
- Total spend for 1,600 motor clusters – 1,600 items – 50 avg volume/motor – 80,000 total volume x \$200/motor - \$16 M (spend for cluster grouping 1,600 motors)
- Based new spend on best price for cluster – 80,000 x \$125/motor - \$10 M
- Estimated savings - 42% on price (normalize spend on clusters with suppliers)
- Assumptions: 50 volume per motor, \$200 avg motor, \$125 best price, 58% motors in clusters (1,600 motors)
- **Estimated Annual Savings: \$6.0 M**

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Data Before vs. After – DFR Data Cleansing Example

A before and after cleansing look of the data. Notice, with cleansed data, consistent descriptions can be created using the attributes.

SMARTFIND BY CONVERGENCE DATA SERVICES		
After		Before
Item Number	AC-M-01249 ✓	AC-M-01249 ✓
ItemID	158002	158002
Qualifier	Part.0	Part.0
Revision		
Item Description	MTR, 200 hp, 600 V, 60 Hz, 4 POLES, 1 PHASE	
Legacy Part Number		
Update	9/24/2015 11:42:17 AM	9/24/2015 11:53:38 AM
Category	Root\Parts\Electromechanical\Motors, AC	Root\Parts\Electromechanical\Motors, AC
Status	NEW	NEW
Release Date		
BEARING STYLE	SLEEVE	SLEEVE
FREQUENCY	60	60
MOUNTING TYPE	FOOT	FOOT
VOLTAGE	600	600
# OF PHASES	1	
# OF POLES	4	
CERTIFICATION	CUL; UL	
EFFICIENCY	96.2	
INSULATION CLASS DRIVING MOTOR	F	
POWER	200	200
QUANTITY	3	3
TERMINAL TYPE	Flying Lead	
Terminal Placement	F3	
SPEND SUM \$	\$21,765.00	\$21,765.00
POWER KW	149.14	149.14
FRAME SUFFIX	M	
PROTECTION RATING	IP55	
DIAMETER, SHAFT (m)	0.09	
LENGTH, SHAFT (m)	0.12	
PRICE	\$7,255.00	\$7,255.00

SmartFind® 4.1.15.18910 SQL

Figure 9 A screen capture of the SmartFind search tool