Impacting the Bottom Line

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Abstract

Material costs represent a significant portion of the manufacturing costs and have eroded Invensys' competitive advantage in the market place. One of our largest manufacturing plants undertook an initiative to apply BDI's DFMA tools to reduce the material costs of product lines that represented the highest revenue yet provided sub-marginal performance in terms of profit margin. A Value Analysis Value Engineering (VAVE) event ensued, comprising of 2 product lines where DFM and DFA analyses were conducted. The conclusion of the event provided sufficient material and labor cost reductions, thereby resulting in margin performance meeting or exceeding 25%. This was well received by the commercial team as this opened the door for increased sales and further improving profitability.

Introduction

Invensys is a holding company of four business units. One of the business units is the Invensys Appliance group which is a global provider of components, systems, and services used in appliances, heating, air conditioning/cooling, refrigeration, and aftermarket products. The company's products are used in a wide range of industries serving the residential and commercial markets. Its extensive portfolio of established brands is recognized for their long-history of quality products; Robertshaw®, Ranco®, Uni-Line®, and Eliwell™. Invensys Appliance headquarters is located in Carol Stream, Illinois, USA with locations in 16 countries and facilities including 15 manufacturing sites, 2 distribution centers, and 7 engineering centers. Invensys Appliances designs, engineers and manufactures controls for residential and commercial buildings for comfort, safety and automation.

Targeted Products for DFMA

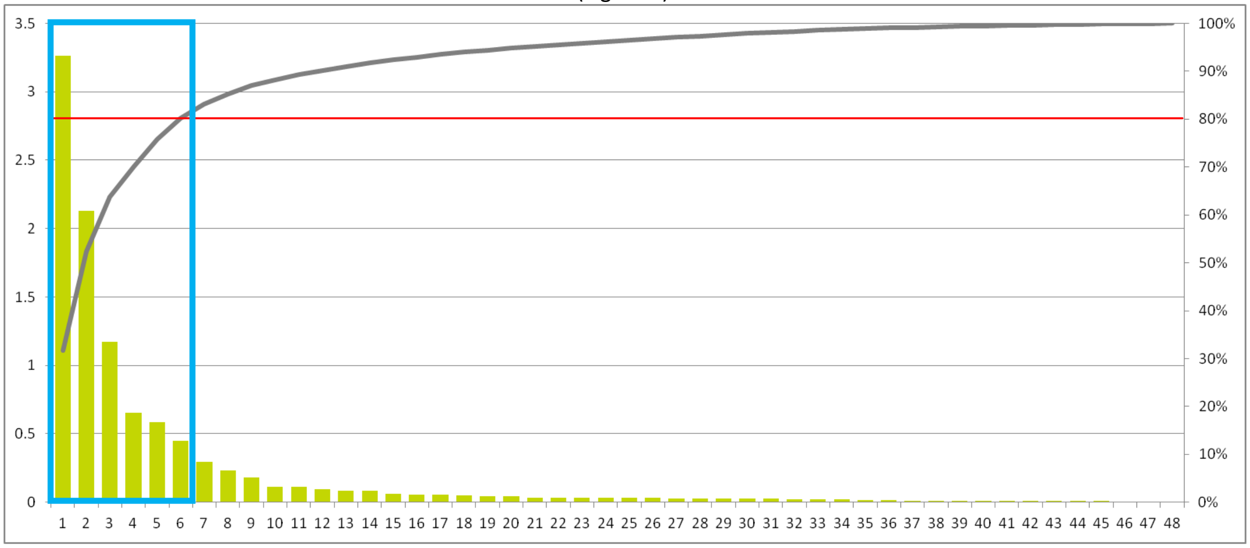
Within the Robertshaw® and Ranco® brands, two product lines were presented with opportunities to improve the gross margin performance. A Value Added Value Analysis (VAVE) and Design for Manufacturing and Assembly (DFMA) event was planned and executed. For sake of simplicity, the activity for one valve, we will reference this as Product A, will be shared in this paper. This valve is a recent new product launched in 2012 for a targeted customer. Considering that this new product was originally released with good cost reduction targets, the team realized the challenges ahead with producing even more cost reduction ideas. Lastly, the commercial team shared that changes made with this product will pave the way towards introducing a derivative product thereby increasing market share as well.

VAVE/DFMA Approach

As an introduction, the commercial team presented their business case and challenged the participants of the event to identify cost reduction opportunities given the targeted go-get savings. The current design has 48 sub-assemblies and parts and applying the Pareto principle, the top 6 parts contributed to 80% of the material costs (see figure 1).

Product A Pareto Chart

(Figure 1)



N	Description	Cost %
1	Subassembly #1	32%
2	Body	21%
3	Magnet	11%
4	Subassembly #2	6%
5	Cover	6%
6	Wire and Terminal	4%

Subassembly #1

Starting with subassembly #1, the baseline parts were evaluated for material properties, the design intent and functionality, and the operations currently performed to produce the subassembly. It comprised of 4 parts and requires extensive processing for assembly. It also requires downstream process re-adjustments for calibration to guarantee the critical functional requirement of the part. The most expensive component of the subassembly is the brass forged bushing and with the expensive commodity price of copper; this part became the primary cost reduction focus.

Idea generation followed with discussions on material substitution, function and part integration. Four design ideas were drawn and evaluated for feasibility and cost reductions. Design for Manufacturing (DFM) analysis was conducted to review the alternative materials and process changes. Doing this provided instant feedback on the feasibility of the idea and the amount of potential cost savings generated without having to get supplier quotes and evaluate several weeks later. To help the team formalize a final decision, a Pugh Matrix was utilized listing all of the positive and negative cost and assembly aspects about each design relative to the current design (baseline).

The final design incorporated two additional parts and much less use of copper such that, the subassembly will generate 30% of the targeted go-get savings. This was primarily accomplished thru material change from forged bronze to injection molded plastic and thru the elimination of the post machining process required to finish the bronze bushing. Counter to DFMA minimum part criteria, two parts were added to ensure the mechanical strength and leak proof requirement of the subassembly.

Body & Cover

These parts are outsourced for casting and machining to finished requirements. As part of the evaluation, the amount of material was investigated for both and found that an additional 6.5% of the material can be reduced through design changes. Due to recent project activities, machine capacity and availability presented an opportunity to in source the machining of these parts. With these improvements, total savings realized 7% of the targeted go-get savings.

Magnet

This part is outsourced and as a result of the current volume of Product A, these parts are produced using an automated line at the supplier. After evaluation of other products and similar parts, no additional cost savings was identified for this part other than thru the additional volume opportunity of the derivative product. This part is also assembled using two screws and through a DFA analysis, an alternative assembly method, staking, was chosen. This operation change deleted two screws that are assembled through a manual screwing and torque operation. With staking, this process can be automated; thereby, reducing the labor content. This change produced a savings of 1% towards the targeted go-get savings and while these savings are negligible, it offered a more desirable assembly method.

Subassembly #2

This subassembly comprised of 4 parts and after detailed discussion of the current design, no changes were made to the subassembly itself. Attaching this subassembly required a washer and a screw that is manually assembled and screwed with a torque driver. To further reduce the labor content of this assembly, two design methods were considered; to incorporate a drive pin or rolling the base such that is forms a rolled over lip that retains this subassembly yet allows it to rotate. Another subassembly (#3) that provides the rotational transfer of subassembly #2 in the valve was evaluated as well. Subassembly #3 used 3 parts that included a screw. The screw was eliminated and the remaining two parts were redesigned to stake as a subassembly. All of these improvements realized a savings of 3% towards the targeted go-get savings.

Wire and Terminal Subassembly

This subassembly provides electrical connection from the valve to the magnet. Currently, the subassembly requires manual assembly and an extensive amount of operation time to connect the wire to the magnet. Ideas about integrating parts helped to eliminate one part and dramatically reduce the operation cycle time of mechanically connecting the subassembly to the magnet (see figures 2 and 3). This final concept eliminated all of the manual assembly and the connection process by introducing an automated assembly. The ideas generated from this redesign subassembly and process produced an additional savings of 7%.

Going Beyond

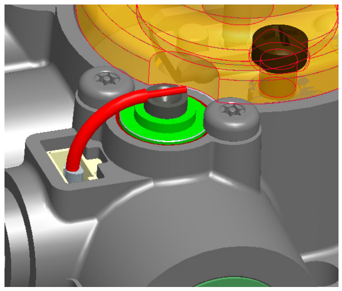
Given the primary focus of the top 6 parts, the improvement ideas generated a total go-get savings of 51%. More savings were generated through further evaluation of other parts as well as reviewing the labor contribution. Some of these are detailed as follows.

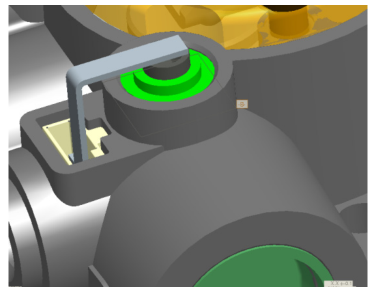
Subassembly #4

Another example where the DFMA analysis provided valuable input was considering this complex set of parts. Traditionally, several of these parts are stamped and already at very low costs, making this very difficult to identify cost reduction opportunities. In this design, there are 5 parts that are assembled as a subassembly that meets a push design function. Using the DFA minimum part criteria, 5 parts were integrated into 1. To meet the leak proof functionality, one part had to be added for a net reduction of 3 parts. Given these improvements, this subassembly produced an additional savings of 4%.

Wire and Terminal Subassembly

(Figures 2 and 3)





Labor Content

Given he manual assembly and several fasteners required for this assembly, a total of 8 fastening parts were eliminated in this event. Recognizing that some of the assembly operations requiring labor were also replaced with improved assembly methods further reduced the labor content of this valve. Providing semi-automation solutions also generated incremental labor reductions; in total, these improvements contributed to 30% of the go-get savings.

Conclusion

When the VAVE/DFMA event was finished, the team identified 102% of the go-get target savings requested from the commercial team (see table below). In total, 12 design and operation improvement actions were identified. While some of the improvements required capital spending for new equipment, the projected payback for the new product is 0.2 years. The event was found to be very successful and leads the way for other products to follow the same event procedure using the DFMA software. Focusing on the bottom line helped the team to zero in on the cost reduction activities and the go-get targets. The cross functional team; commercial, engineering, operations, and supply chain were integral to meeting the challenge and leveraging not only on experience but also the DFMA tool providing the key inputs needed to make real time decisions.

Go-Get Savings and Contribution

N	Description	Cost %	Savings %	Cum %
1	Subassembly #1	32%	30%	30%
2 & 5	Body and Cover	21%	7%	38%
3	Magnet	11%	1%	39%
4	Subassembly #2	6%	3%	42%
6	Wire and Terminal	4%	7%	51%
7	Subassembly #4		4%	55%
8	Labor content		30%	85%
9	Others		17%	102%