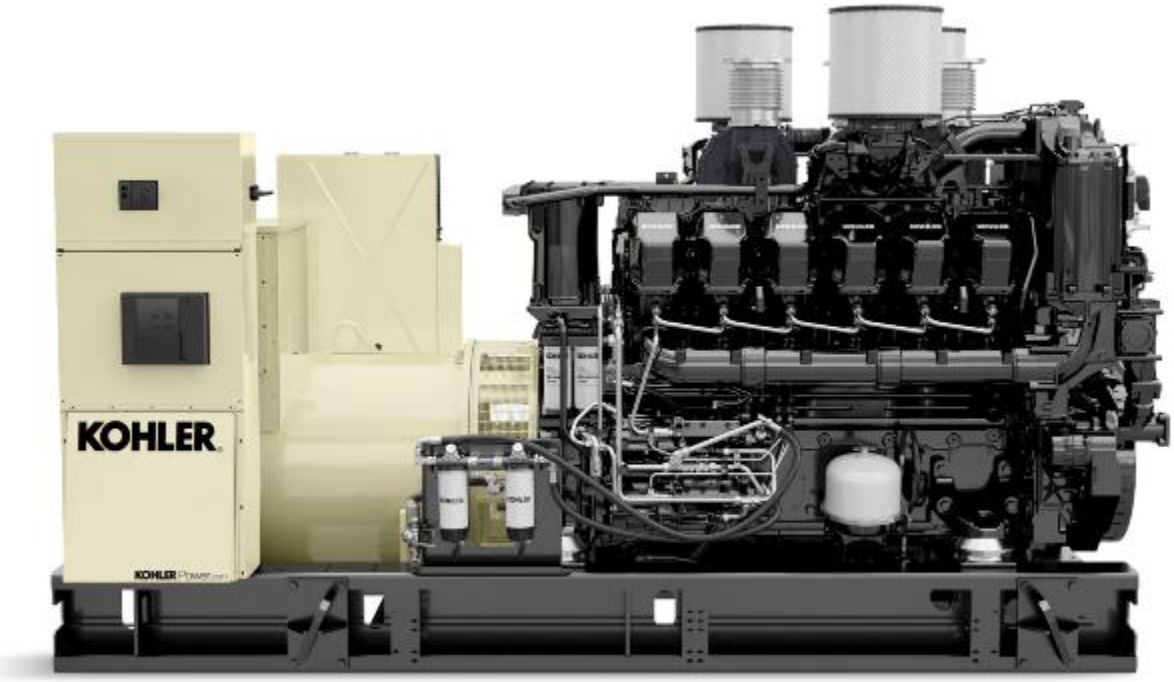
First DFMA Workshop Experience



2019 International Forum on DFMA

Providence, RI

10/1/19 – 10/2/19

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Abstract

DFMA is a new culture to Kohler Power Systems compared to its counterpart, Kohler Faucets. The driving force for DFMA at KPS is an engineer in his “sophomore” season with a ton of “firsts” to still experience. A recent experience was handling a DFMA workshop for a labor-intensive subassembly for a generator’s enclosure. With support from Kohler Faucets, the engineer executed the DFMA workshop in a strategic manner. This story shows the different tools provided such as the DFMA Workshop Prep Guide, DFA/DFM analysis, and how teamwork is crucial for a successful DFMA workshop.

Introduction

Kohler Faucets has been the front-runner for Design for Manufacture and Assembly at Kohler Co. Kohler Power Systems saw the benefits that Kohler Faucets had with DFMA, and KPS decided to use DFMA in their division as well by hiring a new engineer to help lead the new movement. Kohler uses DFMA for product simplification, product costing, and supplier costing. The benefits from using DFMA at Kohler include but are not limited to the following: reducing overall development time in design process, cost reductions, and encouraging cross-functional teamwork. A project for a new generator set was starting, and the Platform Lead knew that DFMA was a tool that was available. The Platform Lead reached out to the DFMA Engineer at KPS, and a DFMA workshop was scheduled for February 2019. Instead of looking at the entire generator set, the DFMA workshop focused on the Intake Louver Assembly of the Enclosure. An example of an intake louver on a Kohler Enclosure can be seen in *Figure 1*.

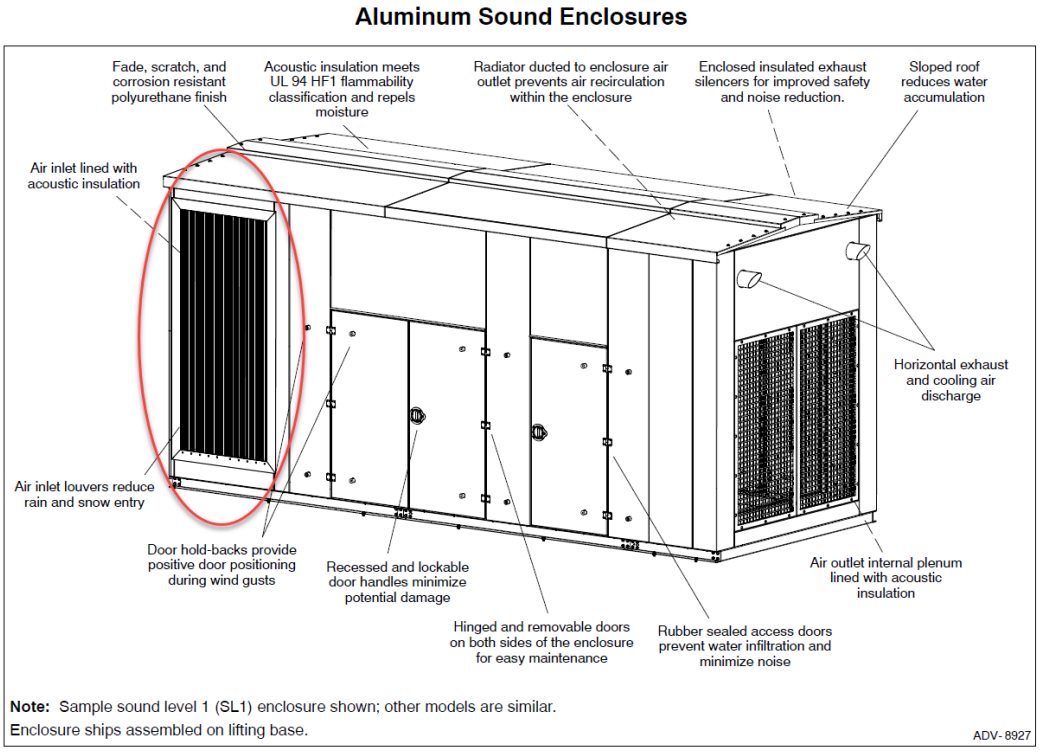

Figure 1: Intake Louver Assy Example #1

An enclosure houses the generator to protect it from external elements, and the louver helps airflow for the generator.

DFMA Workshop Prep

The Kohler Co. DFMA User Group provides resources for associates to prepare for a DFMA workshop. The Global DFMA leader from Kohler Faucets shared the DFMA Workshop Prep Guide to the KPS Engineer to help prep for the event. A screenshot of the DFMA User Group SharePoint site can be seen below in *Figure 2.*

Figure 2: Kohler DFMA User Group SharePoint Site

The DFMA Workshop Prep Guide gathers information such as: the length of the event, objective, scope, boundaries, targets, the facilitator, participants, inputs for the software, and logistics of the event. Regarding length of workshops, a Kohler DFMA workshop can vary between a 2-8-hour event to a 2-3-day workshop. The objective for this DFMA workshop was to analyze the current design rather than create multiple design concepts, and the scope for the current design was a subassembly (Intake Louver Assembly) for the enclosure. Discussing boundaries with the Project Engineer was important to know which parts of the design cannot be changed due to functionality. Moreover, the target for this event was to reduce the overall assembly time. The Global DFMA Leader for Kohler helped facilitate the event, and the participants were from different teams within KPS. As the voice for manufacturing, the

Manufacturing Engineer was included. From the project standpoint, the Platform Lead was a part of the group. The Design Team was important to have as well from the participants' standpoint. The KPS DFMA Engineer represented the Manufacturing Engineering team. The inputs gathered for the software prior to the event include estimated annual volume, CAD models for each individual part, and the Assembly CAD model. The BOM and assembly drawings aided the event as well. The logistics included booking the conference room, setting time on participant's calendars, and to verify whether there was a whiteboard for brainstorming.

First DFMA Workshop

After the DFMA Engineer found dates for the event and filled out the prep guide, then it was time to input all the data into DFA prior to the actual event. This is key to maximize the time during the event. This helped the DFMA event run efficiently because the parts list and all CAD files were updated into DFA prior to the event, so there was no time wasted on extra clicks during the meeting.

Furthermore, some of the parts in the Intake Louver subassembly are made in house. The DFMA Engineer modeled those parts in DFM in order to look at possible different design opportunities during the event and having the DFM models ready led to further conversation during the event. The linking capability between DFM and DFA was convenient for the DFMA Engineer to utilize all the information the software was able to provide. Preparation for an event is inevitably what leads to the success of an event.

The workshop was set for February 18th and 19th. The event had a total of 6 attendees from the different departments mentioned above. The cross-functional team interacted well with different perspectives, which made the event generate dialogue. First, the team arranged all the parts in the

order of assembly. Next, the team went through each part's various fields to fill out in DFA such as: item function, minimum part criteria, handling difficulties, securing process, alignment & resistance difficulties, vision difficulties, and other insertion factors. *Figure 3* below shows the user interface for DFA that the team worked with.

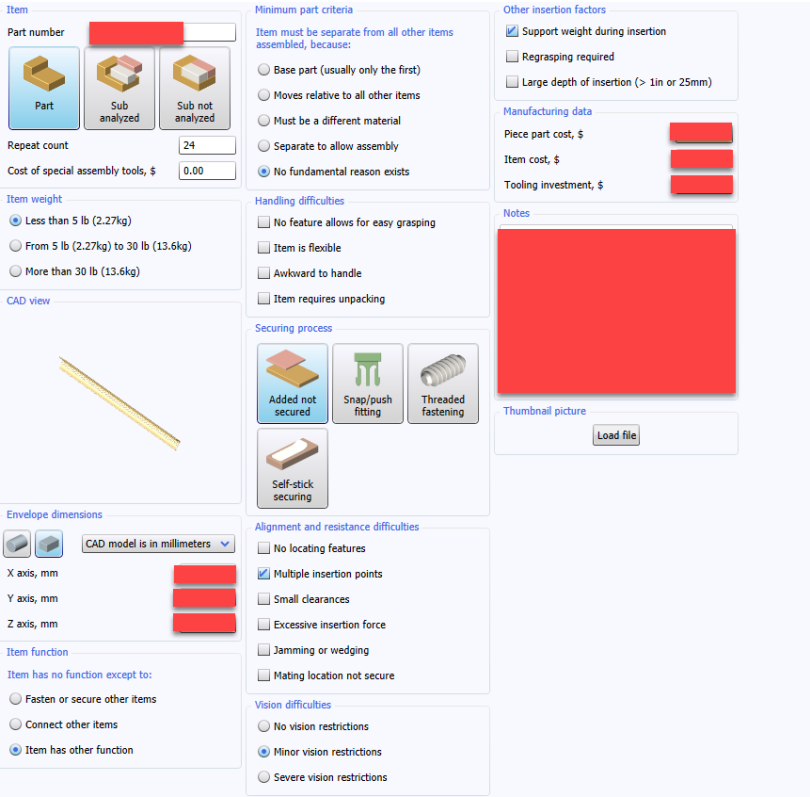

Figure 3: User Interface of DFA

All improvement ideas were noted within DFA after going through each part. In fact, the Manufacturing Engineer helped add different operations that an operator would have to perform to complete the subassembly.

Results from DFMA Workshop

Many ideas generated as a result of the DFMA workshop. As mentioned above, ideas were tracked initially in the DFA Notes section. At the end of the DFA analysis, the team wrote all the ideas on a whiteboard in the conference room. Each idea was defined as safe, reach, or stretch. A safe idea is one that can be implemented with relative ease when it comes to engineering work and low risk. An example of a safe idea from the DFMA workshop was to create a fixture for the intake louver subassembly to minimize the extra steps that the operator would have to take in operation. A reach idea is one that requires a bit more engineering work compared to the safe idea, and there is a bit more risk. An example of a reach idea from the DFMA workshop was to combine some parts together of the assembly rather than having them made individually. A stretch idea requires a significant amount of engineering work, and the risk is very high due to unknowns. A stretch idea that stemmed from the DFMA workshop was to completely change the manufacturing process/materials of the parts used for the intake louver subassembly.

Figure 4: Safe/Reach/Stretch Ideas from DFMA Workshop

Figure 4 above shows the whiteboard used to categorize ideas as safe, reach, or stretch. The safe idea of the fixture was pursued after the workshop. Furthermore, prototypes were developed with different materials that were discussed during the DFMA workshop along with designs meant to reduce hardware. Further DFM & DFA models were created to identify cost impacts of the various ideas. The annual savings from the 7 ideas from the DFMA workshop ranged from $10k to over $100k.

Conclusion

The KPS DFMA Engineer's first DFMA workshop was a great learning experience that returned promising results. The results generated from the workshop created new solutions to the new product design and assembly. Prototypes of the intake louver subassembly were created to do cost comparisons and eliminate extra manufacturing processes. Consequently, more team members have been involved to investigate fixturing & reducing hardware. The DFMA Engineer saw first-hand the collaborative environment fostered through the DFMA workshop with cross-functional teams. The workshop was scheduled before the first prototype generator was assembled, which gave ample time to review the possible ideas from the workshop. As mentioned earlier, the beginning stage of a new product is the optimal time to schedule a DFMA workshop with associates from different areas of the business. Another example of an intake louver can be seen below in *Figure 5* as another reference.

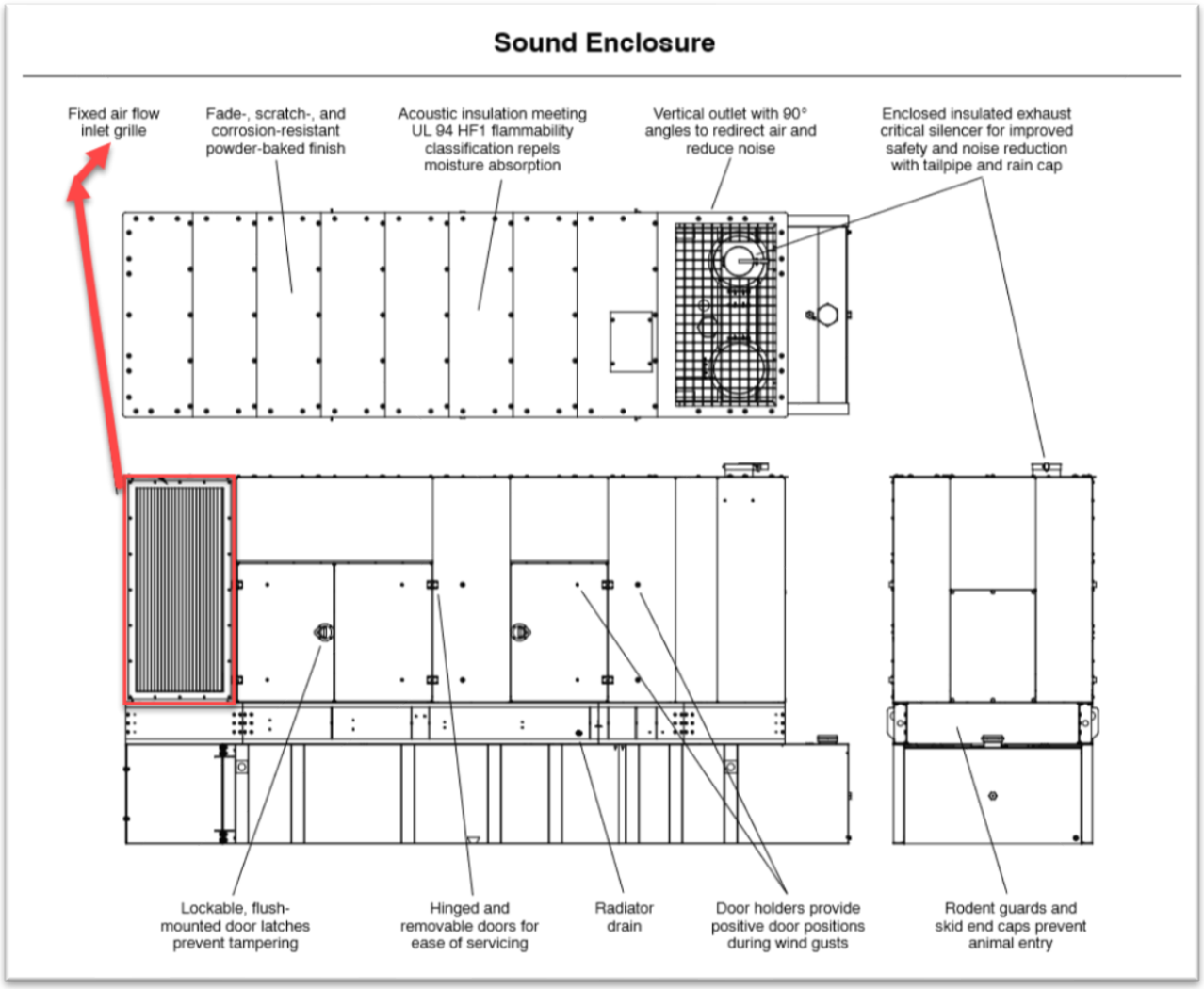

Figure 5: Intake Louver Assembly Example #2

The intake louver subassembly comes with the enclosure above, which is an accessory that can be purchased with a generator. The intake louver subassembly is a heavy-labor assembly, but it was concise enough to have a DFMA workshop in a short period of time. The beginning stage of a new product is the optimal time to use DFMA due to the flexibility of design changes.