

Chapter 7

Conclusion & Recommendation

Start from the first step of this study, Double Skin Air Handling Unit (AHU) design improvement is necessary for the manufacturer to improve their product status in the market. Defection in old design caused company a major lost in customer satisfaction, market share and revenue. The improved design will set new competition edge and provide opportunities to increase the sales, market share and revenue.

The product improvement process is planned and mapped for Air Handling Unit (AHU) design improvement, Quality Function Deployment (QFD) implementation and 3D CAD system implementation are the paradigm shift in Thailand Air Handling Unit (AHU) design improvements and will lead to further local product improvements. The product design and development process will increase the capability of local manufacturer to improve the competitiveness in product development area.

At the early stage of the product development, the design references are very important information that designer used to verify the design. Since local manufacturer do not have the design reference database and knowledge base, the researcher has to start gathering the government regulation, standards that used for industrial references, technical references and some knowledge base.

The search has been done on for the government regulation that control the design of the Air Handling Unit (AHU), the energy laws, and the environmental laws that regulate the energy consumption, limitation of material and installation regulation. No regulation is found to be directly related to the Air Handling Unit (AHU), design. So in designing the Air Handling Unit (AHU) there is no specific government regulation limit the design.

In order to make the design accepted by customers, national standards and international standards are need to be compiled. From the result of finding the local reference standard on Air Handling Unit (AHU) at Thailand Industrial Standard (TIS), no articles related to the Air Handling Unit (AHU) designs and applications are founded. International Standard from USA is used as the reference standard in design, since Thai customers accept and are familiar with the USA standards of specifying, testing and rating the HVAC equipment.

The local manufacturing facilities are assessed in the capability of Air Handling Unit (AHU) production. The capability of manufacturing facility and capability of the machines are better than world class factory in Kuala Lumpur, Malaysia. So the design is not limited by the manufacturing capability. Instead, the test laboratory is the limitation. Local manufacturing facilities do not have testing facility to test the large Air

Handling Unit (AHU) that have high air flow and high cooling capacity, so some important engineering data of the Air Handling Unit (AHU) is based on the calculation, and the reference data from suppliers.

In improving the Double Skin Air Handling Unit (AHU) design, some material limitation is existing such as unavailable of some aluminum alloy from local suppliers and expensive engineering plastics material.

Customer demand is very important source to design the product. The retrieved customer demands data from the interviews and surveys are analyzed and weighed. The important demand from the customers is the key design focused and used as the input to the Quality Function Deployment (QFD) process. In developing the customer demand to the demand statement that the designer can clearly understand, the Quality Function Deployment (QFD) matrices are used. The output of the Quality Function Deployment (QFD) process is the scope of design (design boundary) that the designer used to generate the concepts for Air Handling Unit (AHU) design improvement.

Four design concepts were generated and then selected by the Matrix E4 of Quality Function Deployment (QFD). The selected model termed "Concept-4" is used as the guideline. The detail design will base on the "Concept-4". In detail design, 3D CAD "Solid Edges 99" is used as the 3D drawing and presentation tools. 3D CAD drawing does the detail design on all major parts. Parts are then assembled together in the computer for management presentation and the mock up Air Handling Unit (AHU) is built for design verification.

The improvements of new design accredit to "Concept-4" compare on the existing design version are:

Structure Improvement:

The structure of Concept-4 have knock down capability and have modularity in both cross section and length of Air Handling Unit (AHU), this feature is the key customer quality demand. The old Air Handling Unit (AHU) used the aluminum extrude structure, in which the limitation in strength and quality of alloy are presented. The new Concept-4 simplified by using the simple sheet metal parts that can easily produce and provide more strength.

Wall and Floor Panel Design:

The wall and floor panels in the "Concept-4" have more flexibility in varying the wall thickness and the variety of the insulation material. Old design must have constant thickness of the wall and the insulation material is limited to polyurethane. The strength of the wall panel and floor is increased to improve the air tightness and reduce the deflection of wall panel during operating under pressure.

Wall and Floor Panel holding,

The wall panel and floor panels in the "Concept-4" are fixed to the structure by means of simple bolt tightening, the bolt is fasten to the structure and press the wall panel secured to the structure. The gasket at both panel and structure provide zero thermal bridge and the no air leakage. There is no metal contacted between the bolt and the panel because of the installed plastic bush and plastic cap.

Access door:

The access door is totally new design, the air tightness and thermal insulation are improved. Door is easy accessed and can be easily removed from the body for safety.

Fan and Drives:

Fan and Drives systems are sub-contracted to suppliers, which have more expertise in improving the fan and drive systems. The quality of the fan and drive systems will be improved based on the supplier ability to deliver the fan and drives systems that having better accuracy of air supply, vibration control and bearing life.

Coil Sliding in/out and the top loading/removing.

In existing design the coil is fixed to the structure. New "Concept 4" structure and coil holder provide the flexibility of the coil access. Coil can slide in/out from both sides for maintenance. When the coil replacement is needed, top removing of the coil can be done by removing the knock down structure, on the top part of the coil section, without interference with other sections.

This Double Skin Air Handling Unit (AHU) design improvement achieves a certain degree of the paradigm shift to better design for using and manufacturing in Thailand. All of the major problems identified are solved and extended the design beyond old design limitations.