Bi-directional Offset Lifting Bar

Team 5

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Abstract

Having a swift plan of action for a design project of this caliber is paramount in completing the objective in a timely manner. The objective of this project is to implement a method to lift Danfoss Turbcor's next generation VTT compressor from the ground onto testing position, which utilizes the existing winch and gantry system. In order to accomplish this goal, Team 5 has met with Turbocor to consult with the engineers involved and to record dimensions and retain information needed in order to develop design solutions. With what is known thus far, Team 5 has concluded that the necessary features of their lifting bar design are not attainable in the budget of $1000. Thus, Team 5 plans to propose a new system of lifting, by redirecting the point of lift from the current crane hoist.

1.0 Introduction

1.1 Problem Statement

Danfoss Turbocor technicians have relied on using a manual chain hoist to get their VTT compressor into test position due to extremely tight constraints. This method is undesirable due to the safety concerns of manually lifting and rotating a compressor of considerable mass.

1.2 Background

"Danfoss Turbocor Compressors is transforming the commercial HVAC market with innovative technology that redefines lifetime operating costs for mid-range chiller and rooftop applications." *[1]*

The current gantry system is designed to lift the compressor a height at which was adequate for previous compressor models, but does not lift the new VTT compressor to the appropriate height for testing. As a temporary solution, Turbocor has implemented the use of a manual chain hoist in order to lift the compressor to the appropriate height. This is unsatisfactory, thus Turbocor has sought out alternative methods.

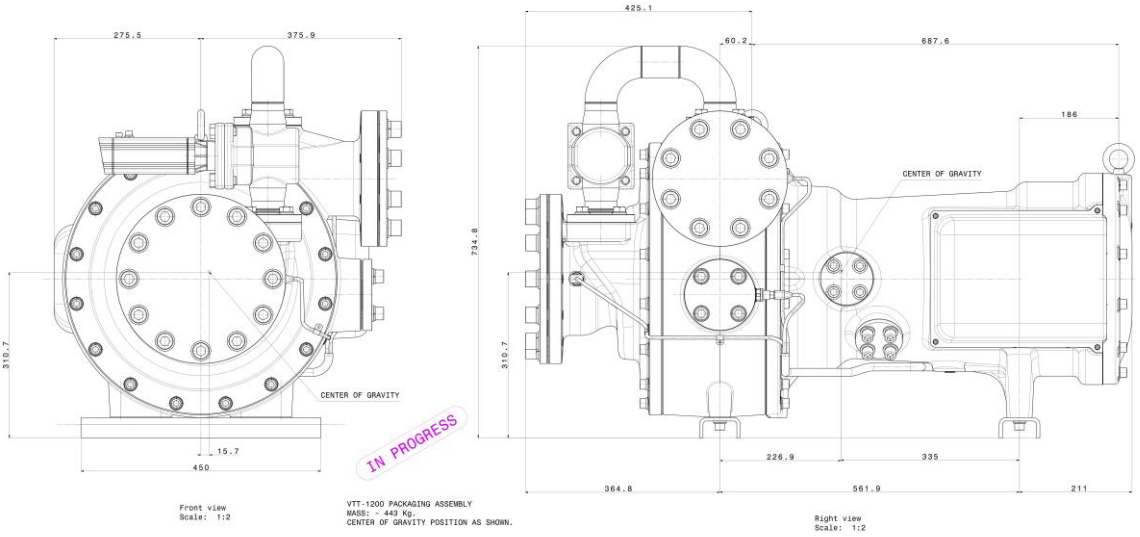

FIGURE 1 - SCHEMATIC OF THE NEW VTT COMPRESSOR

1.3 Objective

Danfoss Turbocor has asked Team 5 to devise a new method to lift the compressor to the appropriate height using the existing winch and gantry system. This must be executed in a manner that is safe and reliable, but not require a new process to achieve the goal.

FIGURE 2 - THE CURRENT GANTRY (LEFT) AND POWERED CHAIN HOIST IN USE (RIGHT)

2.0 Project Definition

2.1 Needs Statement

Danfoss Turbocor requires that each half ton compressor be tested on the chiller system to ensure quality control. One of the three chillers was not designed around the compressor itself, and thus there are some serious spacial constraints involved with installing the compressor on the chiller. The crane that will be used to hoist the compressor into position does not have an adequate vertical displacement in order to properly seat the compressor in place. Thus far, a mechanical engineer has employed the use of a manually driven lifting device in order to lift the compressor to a vertical height that is sufficient for installation. Turbocor is unsatisfied with this method and wishes for Group 5 to design, manufacture, and implement a lifting bar that will offset the compressor from the crane and allow the compressor to be hoisted to an adequate height for installation.

"Currently, the lifting process requires too much manual labor and distracts an engineer from tasks that he could else wise be focusing on." *[2]*

2.2 Goal Statement

"A better lifting system must be designed and implemented in order to more easily install the compressor for testing." *[2]*

2.3 Constraints

- Adjustable to ensure a level lift with a range of Center of Gravity
- Adjustable lifting hooks (dx = 18" to 38")
- Meet OSHA Safety standards
- Maximum Dimensions (L x W x H): 42" x 72" x 24"
- Primary load capacity: 1200 lb
- Maximum operating weight (unloaded): 500 lb
- <$1000 Provided by Danfoss Turbocor
- Limited access to the compressor and chiller due to confidentiality
- Extremely tight dimensions available for compressor/lifting arm movement

2.4 Methodology

The first step in the project plan was to begin communication with Turbocor in order to facilitate a good working relationship. An initial meeting was scheduled on Wednesday, September 10, in order to discuss the preliminary constraints of the project and to visit the task at hand in person. We were allowed access to Chiller 3 system and were able to better understand the difficulty of the project. We then scheduled a meeting that Friday, September 12th, in order to take measurements of the chiller. Turbocor shut down testing for two hours to allow us to do so.

Since those two preliminary meeting, the team has met on a regular basis in order to discuss possible design implementations, budgetary constraints, and project time line. On Friday, September 26, the team met with the team Advisor, Dr. Hollis, in order to discuss the team's possible designs and for new design suggestions. Team 5 will continue to meet every Monday at 4:00 pm and on alternating Tuesdays with Dr. Gupta and Dr. Helzier. Starting the second week of October, Team 5 will meet with Turbocor bi-monthly in order to maintain strong communication and to meet Turbocor's desired deadlines. At the meeting during the second week of October, a complete project plan and timeline will be discussed with Turbocor. Team 5 will also have a preliminary design prototype to present to Turbocor. The team is approaching this issue abstractly and will propose to dismiss the design and implementation of a new lifting bar that accounts for the factor of safety and the forces involved. ***"The estimated weight of lifting beam, shackles, and lines must be included. In addition, the effects of impact, acceleration, deceleration, wear, deterioration, and abuse must be considered…An effective way to account for these unknowns is to apply for an additional factor of safety to the static load."*** [3] Instead, Team 5 intends on redirecting the point of lift so that the crane hoist is able to properly lift the compressor into position with the existing lifting bar. Supplementing that design, a new lifting bar will be proposed that will replace the current prototype bar being used. Both methods will require a larger budget and Team 5 will request more funding in order to do so. Upon approval from Turbocor, development of the design will begin.

3.0 Conclusion

Turbocor is in need of a new lifting system in order to lift the new VTT compressor into place for chiller testing. The current design was sufficient for previous compressors, but is inadequate for the new design. Turbocor has requested that a new, offset lifting bar be designed and implemented with the current crane hoist in order to lift the compressor to the appropriate height. Team 5 will propose that instead of a new lifting bar, the point of lift by the crane should be redirected in order to allow for an increase in total vertical lift. The new proposed plan will be much more realistic of a solution due to its more simplistic nature.

4.0 Gantt Chart

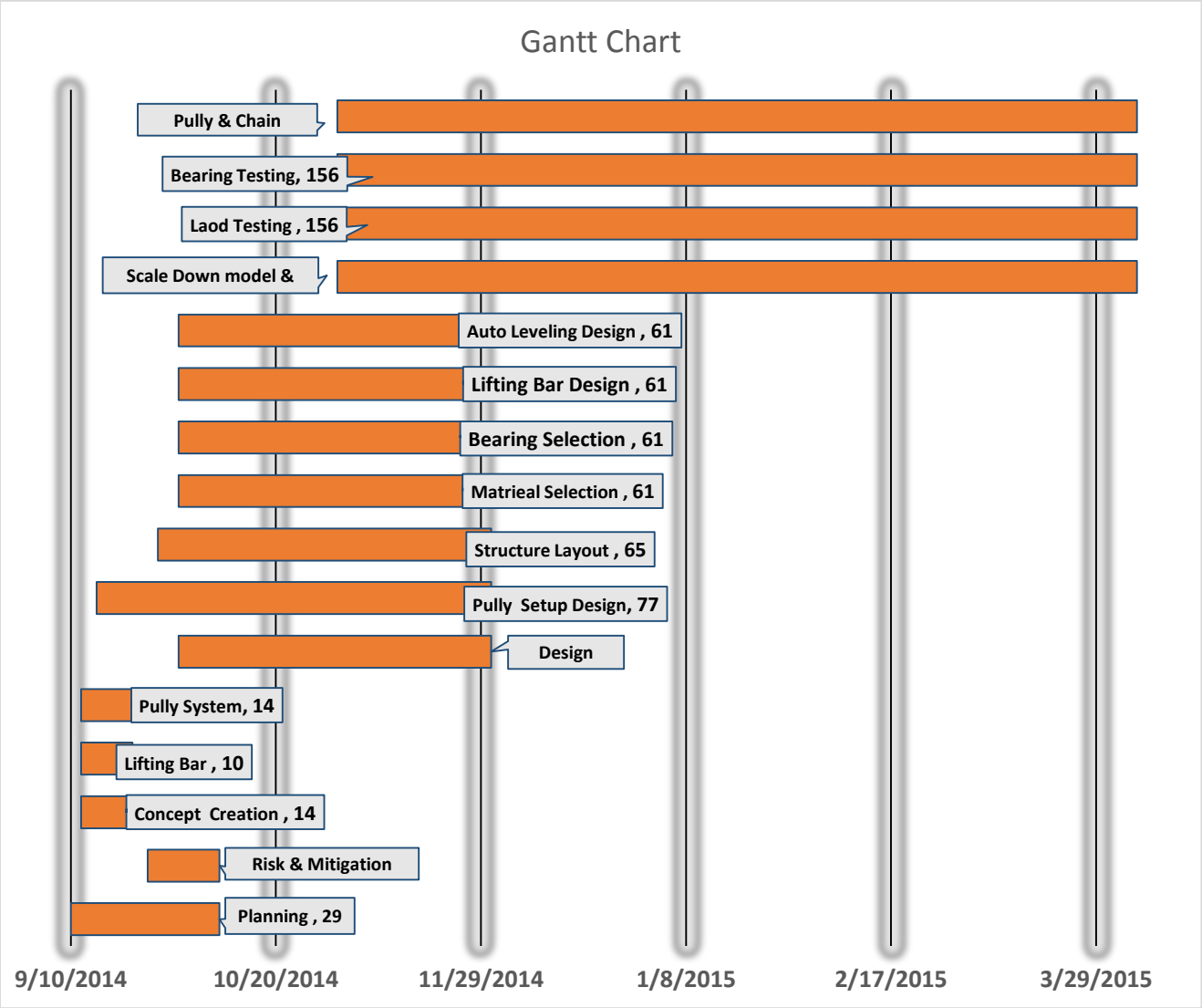

FIGURE 3- GANTT CHART

5.0 References

[1] "OEM Customers." *Danfoss Turbocor Compressors Inc*. N.p., n.d. Web. 23 Sept. 2014.

[2] Lohman, Kevin. "Project 5 - DTC Bi-directional Lifting Bar." *Www.campus.fsu.edu*. Florida State University, 31 Aug. 2014. Web. 26 Sept. 2014.

[3] "Lifting Beams Design." *Lifting Beams Design*. N.p., n.d. Web. 26 Sept. 2014