

Bi-directional Offset Lifting Bar

Danfoss Turbocor

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Team 5

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Outline

- Background
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- Summary



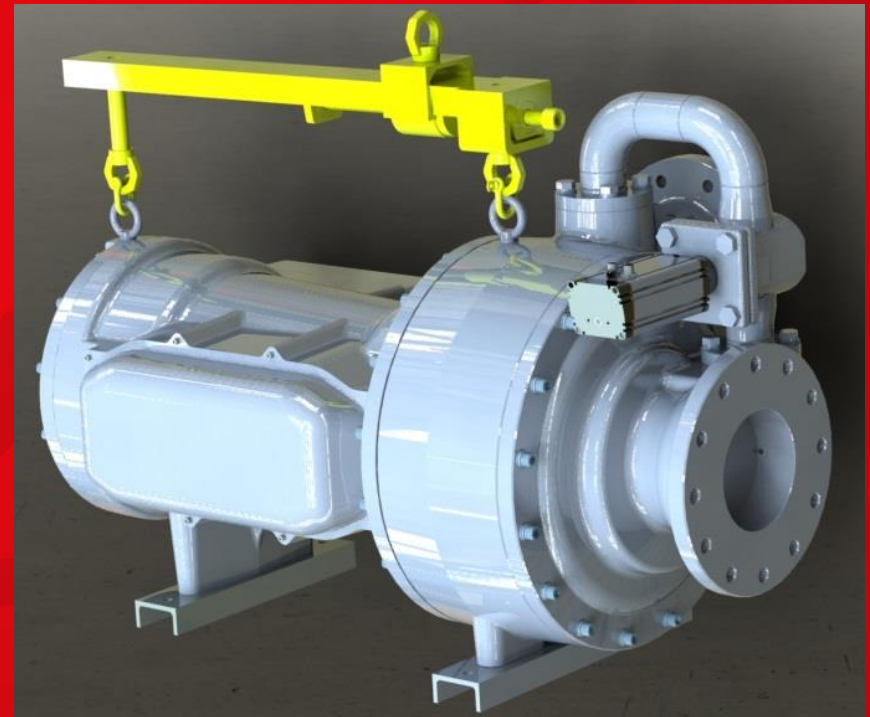
Background

- Danfoss Turbocor is the world leader in oil-free centrifugal compressors used for cooling applications
- All compressors must be tested prior to distribution
- Since Chiller 3 was built Turbocor has developed a new line of VTT Compressors which have a greater height than can be installed with the current gantry and hoist system
- Turbocor asked Team 5 to develop a lifting bar that can be used with the current facility crane hoist and gantry



Project Description

- A better lifting system must be designed and implemented in order to conveniently install the compressor for testing
- Lifting bar to include:
 - Auto-leveling
 - Adjustable lifting positions
 - 1 Ton load capacity
 - Less than 500lb operating weight
 - OSHA Compliant



Fall Recap: Current Hoist and Gantry

- Crane hoist hangs below gantry
- Wasted space
- Can't be used for VTT Compressor

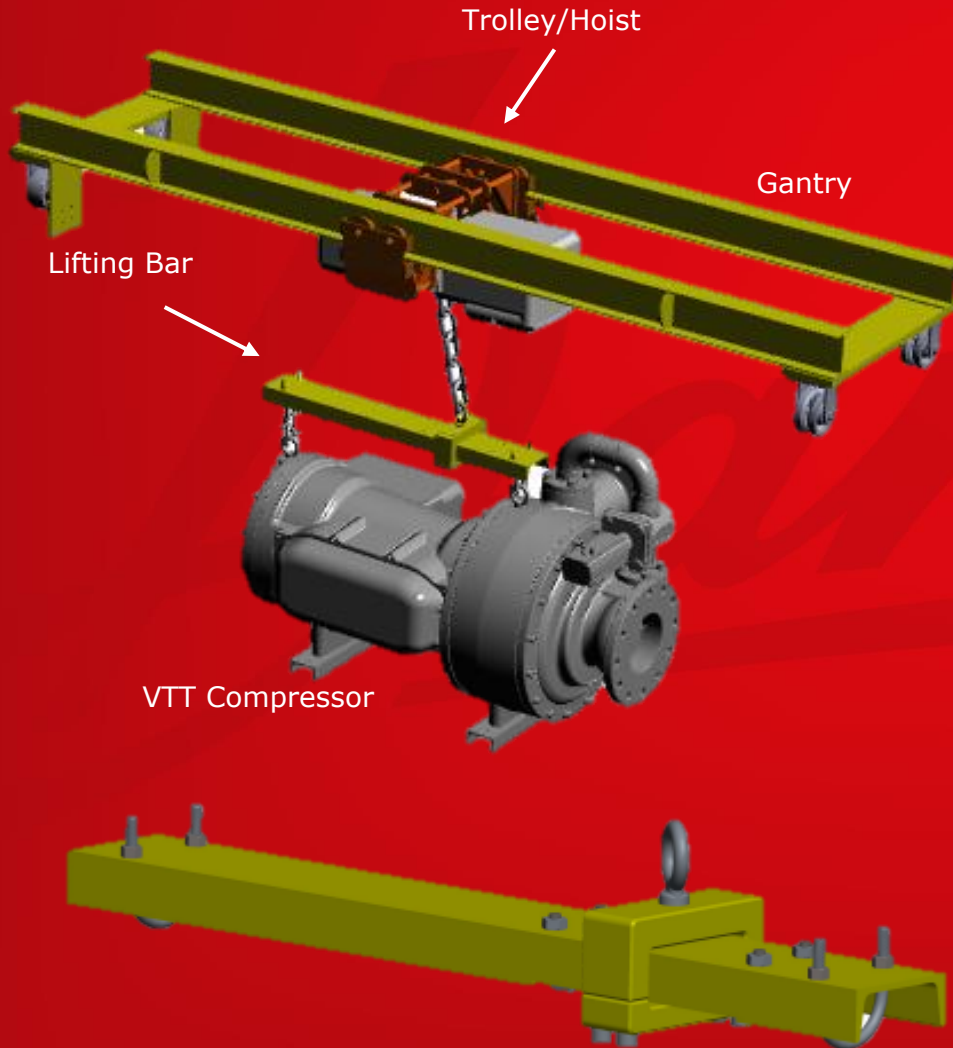


Fall Recap: Current VTT Lifting Bar

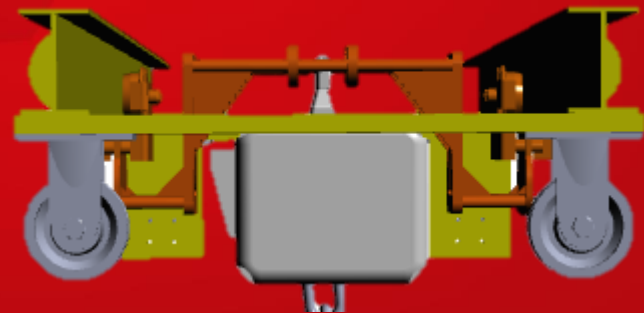
- Non-adjustable lifting hook positions
- Non-adjustable lifting point for variable center of gravity
- Suboptimal vertical height between lifting points



Fall Recap: Final Design



- Approved by Turbocor
- Increase vertical height of hoist (Approx. 177mm)
- Meets design requirements and OSHA standards
- Within budget constraints



Procurement

- Originally budgeted \$1,000 by Turbocor
- Budget extended to \$1,500 after justification
- Procurement Complete
- Parts inventoried

Component	Part #	Vendor	Cost	Qty.	Total
Adjustable Lifting Bar					
Eyebolt for lifting - M12 x 1.75, 30 mm eye	3040T15	McMaster-Carr	\$6.63	1	\$6.63
Steel Shackle - 3/8" x 1 7/16"	3560T47	McMaster-Carr	11.14	2	\$22.28
U-Bolt - 3/8" x 16, for 2" pipe	3043T41	McMaster-Carr	6.33	2	\$12.66
4" x 8" x 2" Steel Block (4"x4"X12")block	N/A	Speedy Metals	103	1	\$103.00
63 mm of chain		McMaster-Carr	10.64	1	\$10.64
Block Ball Screw	BSBR1505-250	Misumi	245.92	1	\$245.92
Support Bearing - Fixed Side	BSWE12	Misumi	87.14	1	\$87.14
Support Bearing - Support Side	BTN12	Misumi	90.59	1	\$90.59
Delrin Sheet, 2" x 12" x 1/8"	8662K13	McMaster-Carr	4.2	1	\$4.20
U-channel C4x5.4 (roughly 31 inches)	N/A	Speedy Metals		1	\$25.55
Total Cost					\$608.61
Trolley System					
1/2" x 24" x 24" Steel Plate	P112	Metals Depot	110.24	1	\$110.24
3/4" x 6' A36 Round Bar	R134	Metals Depot	14.82	1	\$14.82
Grade 9, 3/4" x 5" bolt	90201A660	McMaster-Carr	11.25	1	\$11.25
Hoist Trolley	3267T62	McMaster-Carr	160.17	2	\$320.34
Total Cost					\$456.65
Gantry					
I Beam 4" x 3" x 20'		Trident	240.00	1	\$240.00
4" Track Wheels	8745T89	McMaster-Carr	31.99	2	\$63.98
4" Caster Wheels	2453T1	McMaster-Carr	26.63	2	\$53.26
1/4" x 12" x 24" Steel Plate guide and bumpers	P114	Metals Depot	31.02	1	\$31.02
Delrin Sheet, 3" x 12" x 3/8"	8662K35	McMaster-Carr	13.83	1	\$13.83
Total Cost					\$402.09
Total Cost					\$1,467.35

Fabrication

- FEA and drawings were presented and approved by Turbocor
- Minor fabrication changes
- Team 5 will be water jetting simple components
- Complex machining will be completed by Turbocor certified machinist
- Team 5 will complete assembly with help of welder

OSHA Requirements

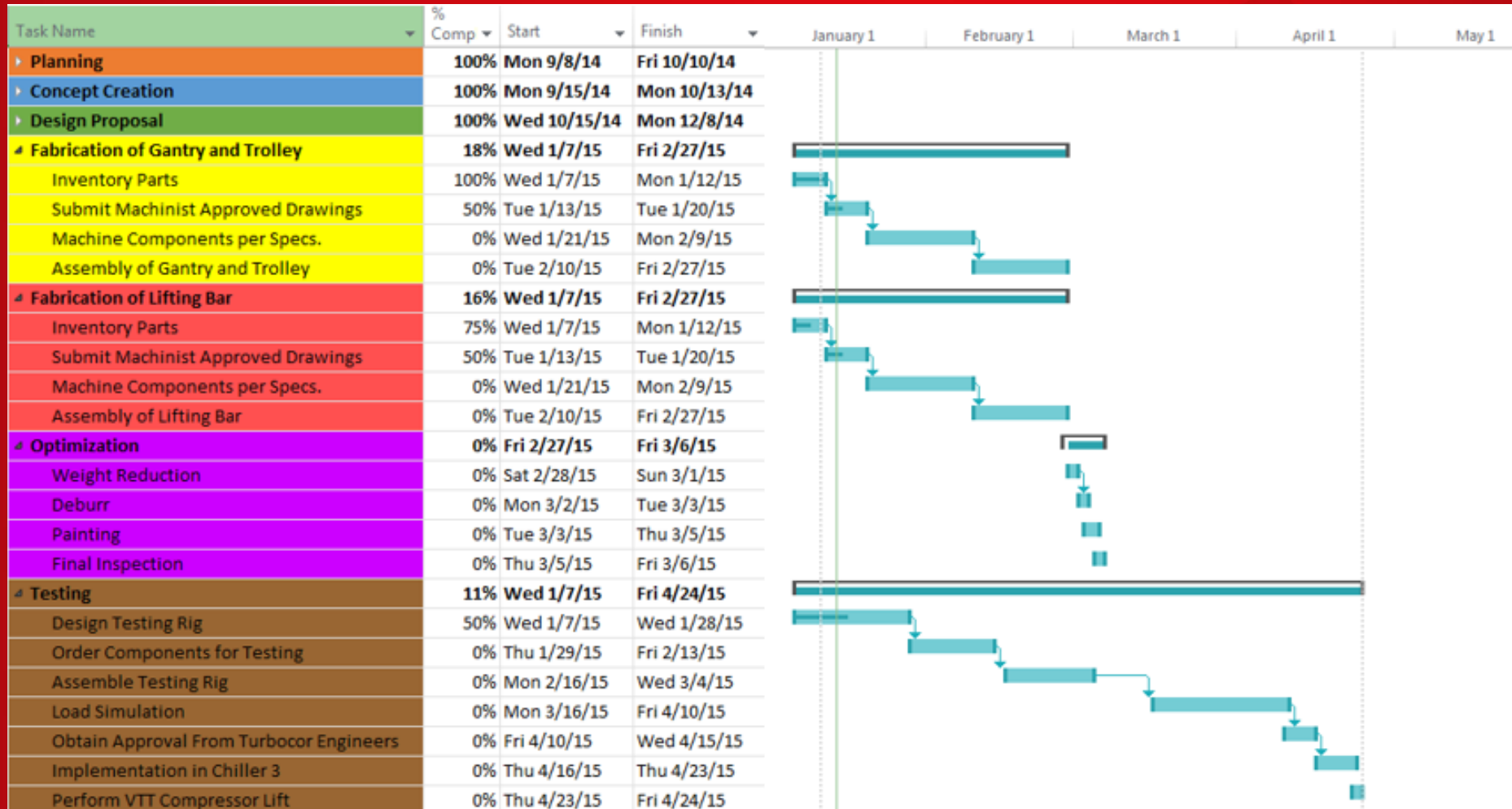
- Team 5 has been asked to follow OSHA standards for lifting equipment:
- OSHA Standards (1910.179- Overhead and gantry cranes):
 - Trolley Bumpers & Stops
 - Safety Yellow Paint
 - Tested to 125% of Max Weight Load Limit
 - 3" (76mm) overhead clearance, 2" (51mm) of lateral clearance
 - No direct shear on bumper bolts

Schedule

Spring 2015

- Biweekly meetings with Turbocor; weekly team meetings
- All parts have been delivered and inventoried
- Fabrication set to begin
- Assembly of all components & mitigation of unforeseen issues
- Prototype testing with dummy-weight
- Full onsite implementation at Turbocor

Gantt Chart



Summary

- Original project description asked for offset lifting bar
- True goal was to increase lifting height of the compressor
- Developed Redesigned gantry system and lifting bar
- Engineering drawings have been submitted and approved by Turbocor
- Raw materials have been delivered and inventoried
- Manufacturing scheduled to begin
- Team 5 is developing methods to safely and effectively perform prototype testing

Questions?

More information available online at:

http://eng.fsu.edu/me/senior_design/2015/team05