Crane Best Practices

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Agenda

- Crane Modifications
- Crane Modification Specifications
- Load Testing Requirements
- Below the Hook Lifting Devices
- Repairs to Lifting Devices
- What is a Critical Lift
- What is a Engineered Lift
- Resources That You can Trust

Crane Modifications

- What to do
- What not to do
- Specification, controls upgrade

Controls Upgrade Scope

- VFD's for motor control, main and aux hook
- New wiring for controls
- Main hook load cell
- New pendant controller
- New trolley electrical brake
- 125% load testing required due to load bearing component replacement
- Project cost, $200k

What not to do

- Upgrade Scope not fully developed
- Had to select contractor quickly
- Started upgrade late
- Not enough project oversite
- Contractor making key decisions
- Load testing rushed
- No time for crane operator to use controls
- Job finished 1 week before outage
- Near capacity 80 ton rotor lift

What To Do, lessons learned

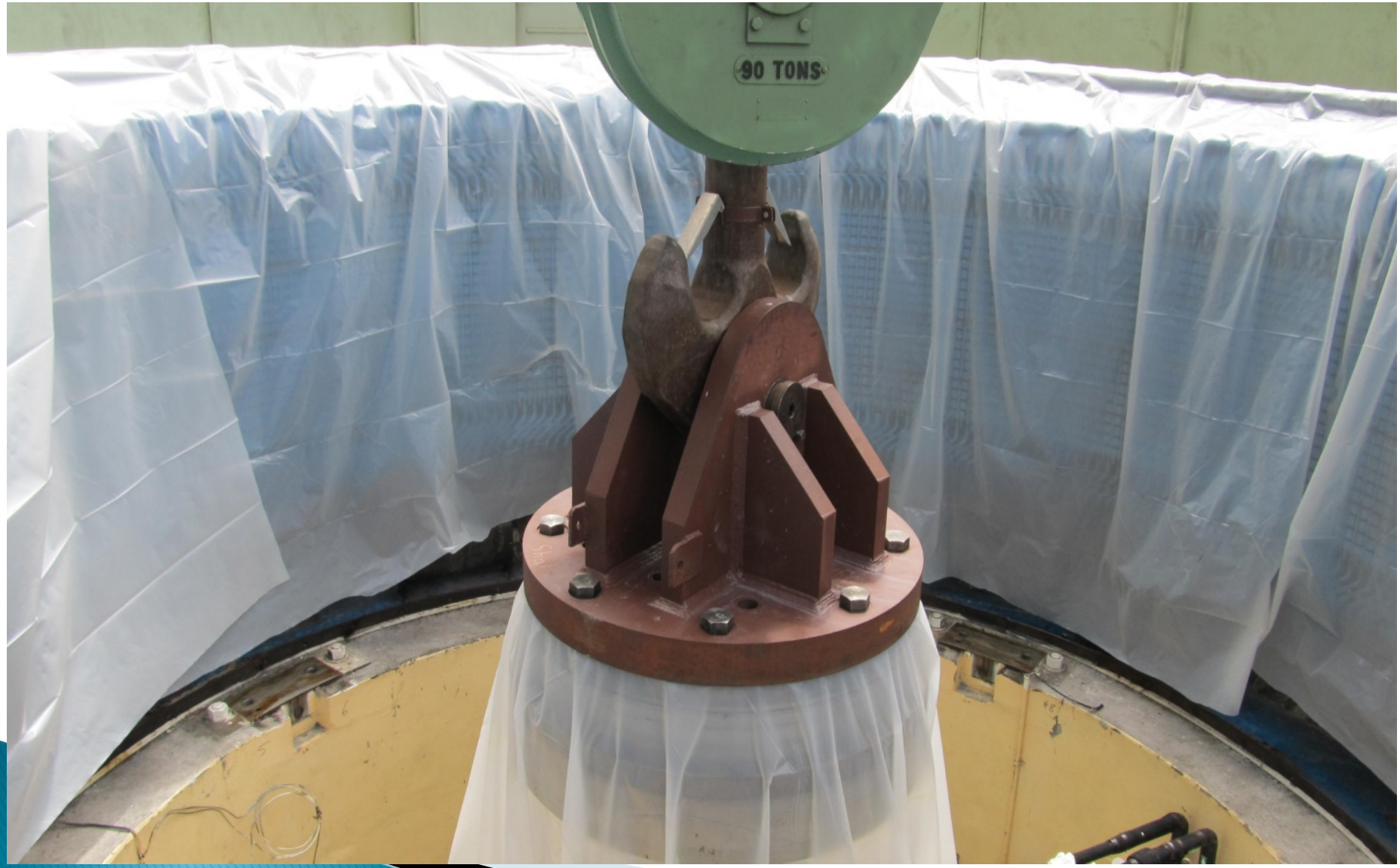
- Plan detailed scope
- Start job 1 year prior to outage
- Have crane operator involved with upgrade
- Schedule time for operator for new controls
- Get plant maintenance and engineering evolved early
- Project manager follow up after key lifts
- Keep records, i.e. work orders
- Post modification meeting

Below the Hook Lifting Devices

- NDE all lifting fixtures and beams prior to use
- Repair lifting devices, NDE, welding and grinding
- 125% test required for modified lifting devices
- Reference DOE-STD-1090-2007
- Very good reference, use it

US CRANE & HOIST
205 TON
2500
BOTTOM
ONLY

Rotor Lifting Device



Lifting Device Repairs

- NDE results indicated cracks in sidewall welds
- Ground out welds and added weld overlay
- NDE results indicated sidewall cracks again
- Developed better weld procedure preheat to 350F and required an intermediate low temperature post heat of 500 – 600 F to remove all hydrogen from the welded areas.
- Repaired with 50 lbs. of E7018 –(H4 designator) filler material limiting the potential hydrogen into the weld pool during the welding cycles

Cause of Sidewall Cracking

- The failure of welds was predominately due to the lack of fusion on original sidewall Fillet weld legs.
- This included the regions where there where gaps greater than 1/8" between the abutting members. This gap reduced the effective throat of the fillet welds and were not able to provide a strong enough bond to resist the stress along the load paths.
- Secondly, where the three pieces are welded to the bottom base plates and merged together cracking was observed. This most likely initiated from this point and propagated along the length of the fillet welds.
- Some fillet weld sizes where increased. Provides a lower stress concentration at the toes of the weld and to reinforce the load paths where required.

Crack in Sidewall

Repaired Lifting Fixture

What is Critical Lift?

- Exceeds 80% of the crane's rated capacity
- Passes over critical equipment
- High susceptibility to damage
- The load item is unique and, if damaged, would be irreplaceable or not repairable and is vital to a system

STORAGE
TRAILER
WASTE
3

Critical Lift Form

Location: North Fork #2
Crane I.D.: North Fork Gantry
Hook capacity: 90 ton,
Date of last load test: 6/15/16
Component to be lifted: Generator rotor
Weight of Component: 85 ton total includes rigging
Method used to determine weight: load cell from previous pick
Weight of lifting devices (all slings, shackles, hooks, etc.): included in total weight
Configuration of slings: No slings, lifting fixture has hook pin
Method used to control crane (cab, pendant, radio control): Pendant
Crane operator name: Shawn Thronson
Lift Plan: Pick rotor up 1/4-1/2" let sit for 10 minutes, perform mag particle of lifting device welds. If Ok procced with lift.
Method used to signal operator: line of sight
Number of tag lines required: 2
Area required to be barricaded: Yes
Present support of load: Installed in place
Future support of load: Crane deck on rotor stand
Pre-lift meeting: Required and will be performed by Rob Adams
Comments: Lift is determined a critical lift due to the requirement to move the rotor over the top of NF #1
When moving rotor NF #1 will be shutdown. This lift will be conducted under maintenance engineer direction.
briefing. There was a 125% load test performed on 6/15/2016 by US Crane.
Test was successful. This lift has been performed in the past 4 times without incident
Signatures

Rigger 1: Rigger 2:

Signalperson: Operator:

Project Manager Rob Adams Manager:

PSES Engineer

What is Engineered Lift?

- When 100% of rated load is required
- Not to exceed 125% of rated load
- Written review of crane service history
- Perform inspection prior to lift
- Operator to pick up load set brakes and verify load does not move, 10 minutes
- Proceed with lift
- Perform post lift inspection
- Document findings

Resources that you can trust

- Cascade Rigging, 503-722-7500
- Wire rope and rigging,
- Crane Consultants, 206-246-7962
- Crane inspections, engineering and rigging consultants,
- K&N Electric 509-838-8000
- Large specialty crane rehabilitation

Key Take A Ways

- Start Control Upgrades Early
- Provide Project Management on Crane Upgrades, Get Out There
- Allow Time for Crane Operators to Use New Controls
- NDE all Lifting Devices Prior to Outage
- Allow Time for Weld Repairs
- Test Repaired Lifting Devices

Questions