

CUSTOMER SERVICE REPORT

**EXAMPLE
REPORT**

Report prepared for:
Mount Sunapee

Project/Quote #:
21-014

Project Description:
**Clipper Ship Quad
Gearbox Overhaul**

Report prepared by:
Dan Droegkamp



CUSTOMER SERVICE REPORT

Project #: 21-014

Start of Service: 11-8-21

End of Service: 11-17-21

Customer Name: Mount Sunapee Resort

Main Contact: Scott Crowell

SERVICE WORK INFO

Work Description: Full Gearbox Overhaul

Reason for Work: Damaged High-Speed Gearset causing excessive vibrations, and also due on overall in-service hours for recommended major overhaul maintenance

Lift Name: Clipper Ship Quad

Hours at Time of Service: 25,411

Gearbox Make: Kissling

Gearbox Model: KP-120

Gearbox S/N: 75250.1

Work Completed by: Dan Droegkamp

Ratio: 108.9:1

SERVICE WORK DETAILS

Scope of Work:

- Full disassembly of all gearbox sections and components
- Thorough cleaning and inspection of all internal components (gears, housings, shafts, bushings, seals, etc.)
- Replacement of all bearings, bushings, wear components, etc. with new
- Replacement of mechanical oil pump with new
- Replacement of High-Speed Bevel/Pinion Gear Set (planned due to bad wear and alignment)
- Replacement of 2nd Stage Ring Gear (unplanned – found to have broken gear teeth upon disassembly)
- Replacement of High-Speed Rollback Locking Pin (unplanned – found to be worn upon disassembly)
- Resetting of critical gear and bearing tolerances with new component reassembly
- Thorough documentation of internal conditions
- Full reassembly and perform running inspections

Status After Service:

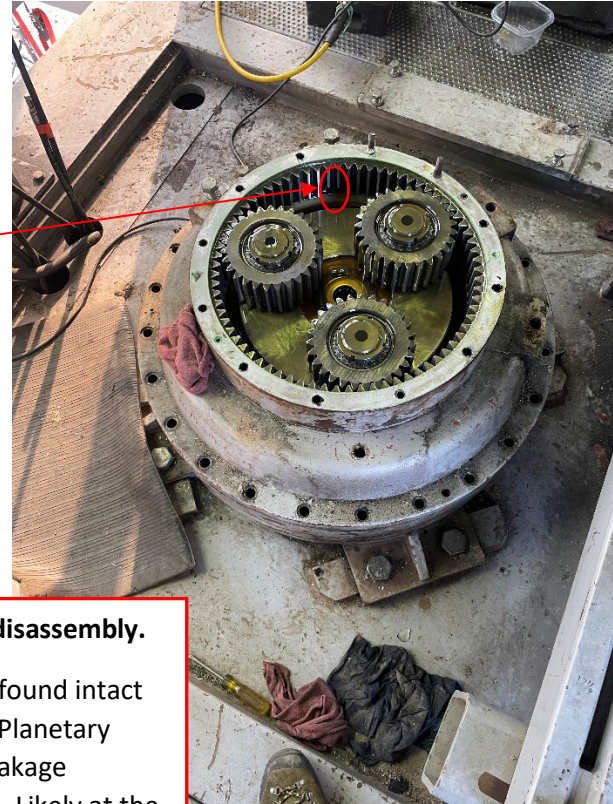
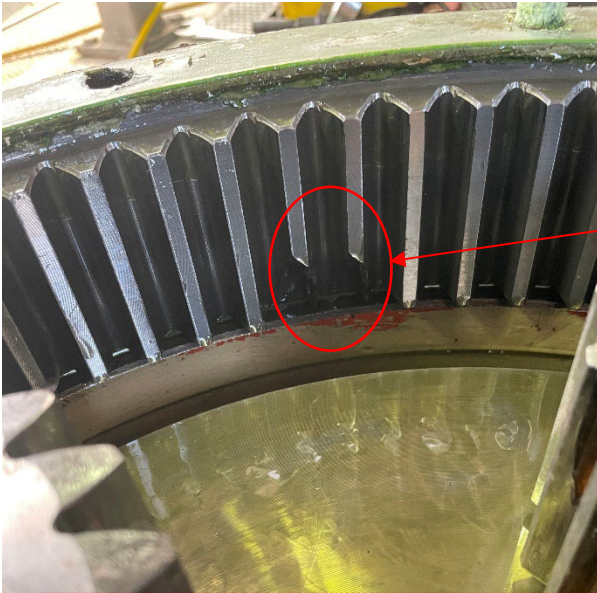
- Re-check oil level (cold and settled) after initial operations
- Continue regular lubrication maintenance of bullwheel hub, Aux. quick coupling, etc.
- The Aux. quick coupling assembly needs to be rebuilt with new wear components (bearing, seal, shaft end nipple).
- Continue to monitor gearbox for irregular noises and vibrations during operations

Remarks:

- Upon disassembly the 2nd Stage Ring Gear was found to have multiple broken gear teeth (pictures included in following).
 - This Ring Gear was replaced with new sourced and supplied from the OEM Kissling of Switzerland
- Upon disassembly the High-Speed Rollback Engaging Pin was found to be worn
 - This was also replaced with new and supplied by the OEM Kissling
 - The original wear allowed excessive play in the Rollback Assembly when engaged
- It was stated that when the lift was built the bullwheel hub did not have grease zerks installed from the factory, so these were drilled and installed after initial assembly in the field. This created metallic debris inside the bullwheel hub cavity, and therefor inevitably created minor damage when removing the bullwheel for the first time since construction assembly.
 - Pictures following include further details.
- Upon the final running inspection it was noticed that there was a rattling noise very inconsistent while operating at 380 FPM and faster.
 - This was extensively investigated with no definite determination at this time. However, it clearly sounds like an auxiliary noise that is present at these certain conditions at this certain speed. Further investigations and monitoring need to continue while operating at these speeds.
 - It is my opinion that these noises are something outside of the gearbox, and it is undeterminable at this time.
 - The recommendations are to operate at 370 FPM or less as needed, and when operating at 380 FPM or higher close monitoring needs to be done to determine and alleviate the noises.
 - There were NO irregular noises or vibrations at 370 FPM or slower during running inspections
- The noise and vibrations overall of the Clipper Ship Quad lift running are night and day different from before the overall compared to after.
 - There are no more violent vibrations while operating.
- All internal hardware were reinstalled with Loctite 243
- All sealing surfaces were thoroughly cleaned and reassembled with Loctite 573
- All bolts were reinstalled with proper torque values

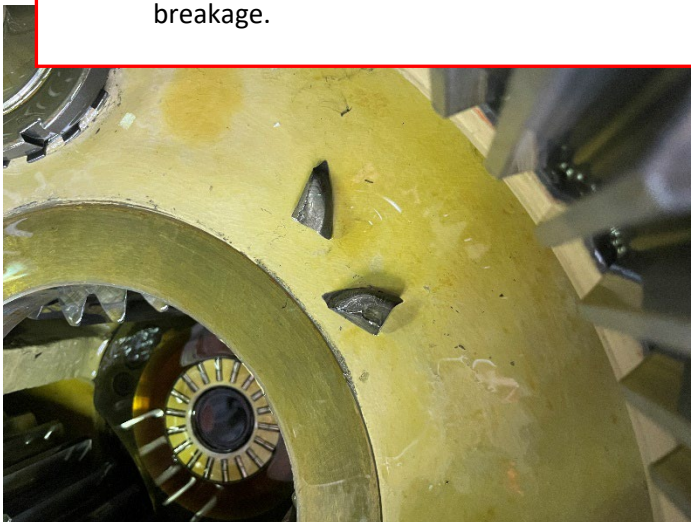
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SERVICE WORK DETAILS



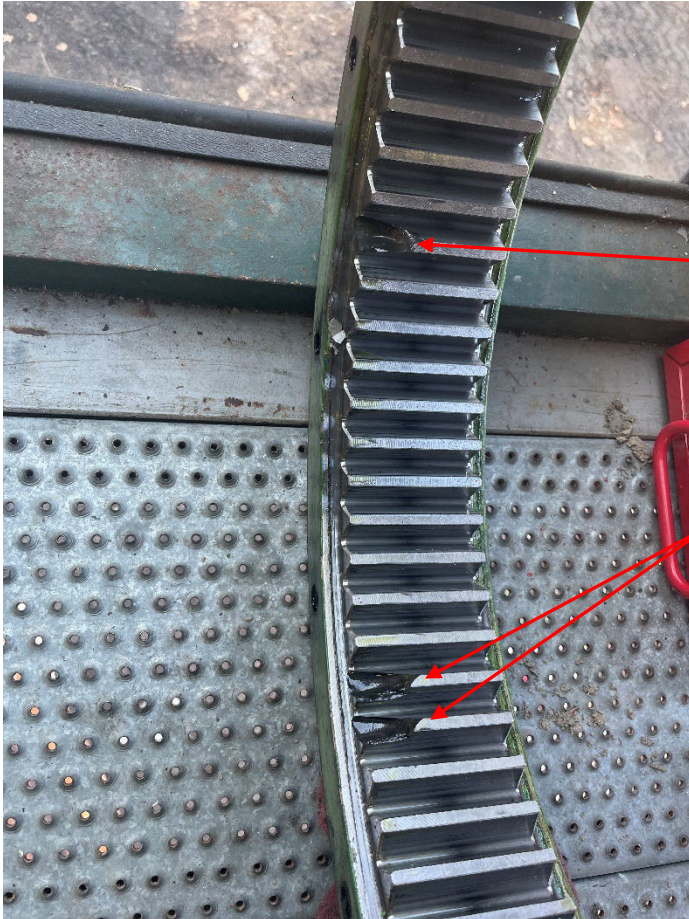
2nd Stage Ring Gear damage found during disassembly.

- The pieces of the broken teeth were found intact laying on top of the lower (1st Stage) Planetary housing indicating that the tooth breakage happened recently during operations. Likely at the very end of summer operations...
- The broken pieces did not show any signs of further damage to themselves, or anywhere else throughout the gearbox from operations after the breakage.



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SERVICE WORK DETAILS



Three teeth total were found broken during disassembly on the 2nd Stage Ring Gear

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SERVICE WORK DETAILS



One burr damage created upon bullwheel removal.

- This is from internal debris (metallic) due to the drilling installation of the two grease zerks needed after initial assembly/construction.
- This was thoroughly cleaned up with a die grinder, and the reassembly went smoothly all the way.
- This is of no major concern for continued use.



Similar damage mirrored in the bullwheel bushings.

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SERVICE WORK DETAILS

PINION GEAR



Damage to the original Bevel/Pinion Gear Set from worn/bad gear contact pattern and backlash setting.

- This created the bad vibrations felt and heard throughout the drive terminal during operations.
- There should not be this amount of scoring wear on these gear teeth. These gears are hardened and should always be very smooth.
- Continued operations would indefinitely result in further damages once these gears reached a failure state of wear.
- These gears were known to be worn beyond acceptable and were replaced with new.

BEVEL GEAR



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At an upper tolerance for the bullwheel bushings measured (after clean-up) as shown below. This is at the maximum end of the acceptable (0.000-0.0015") tolerance for a proper fit to the output shaft. Any further needs for removal of the bullwheel will likely require replacement of these bushings, so it should be noted and be planned accordingly...



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SERVICE WORK DETAILS



Bullwheel and Haul Rope Rigging



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SERVICE WORK DETAILS



The Bevel Gear Hub was pull tested to ~13 tons and proved to have a secure fit remaining.

- The new Bevel Gear was installed with Loctite 243 and the bolts properly torqued

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SERVICE WORK DETAILS

Misc.



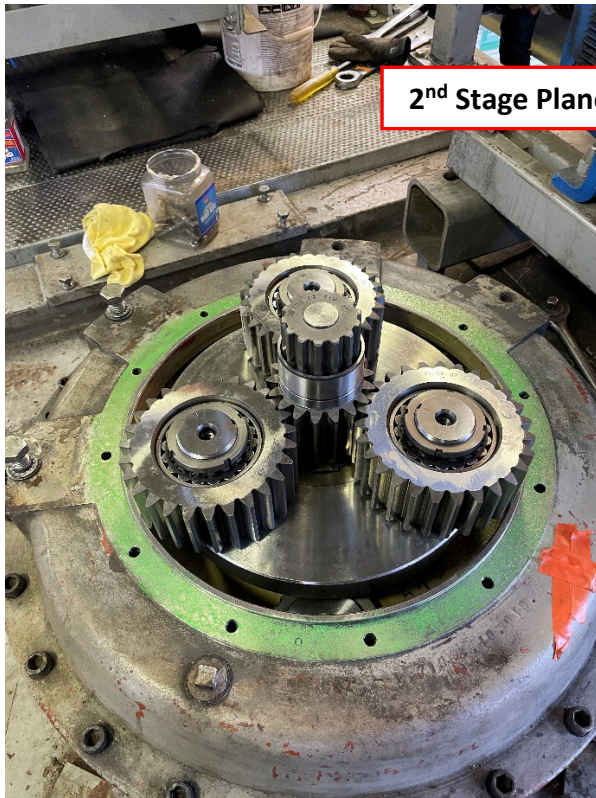
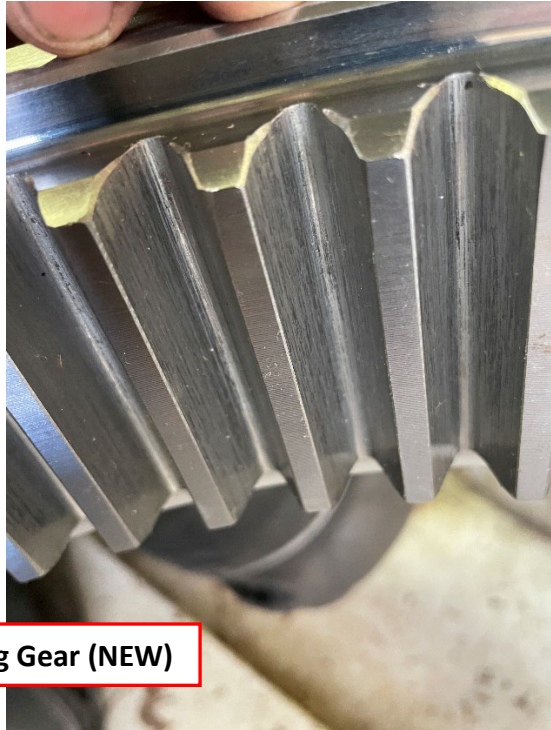
Output Shaft with Bullwheel
reassembled



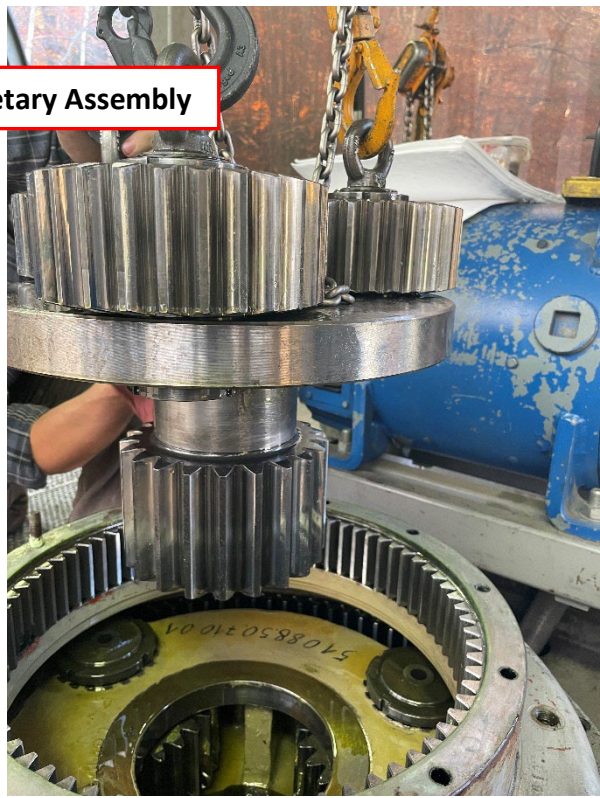
1st Stage Ring Gear



2nd Stage Ring Gear (NEW)

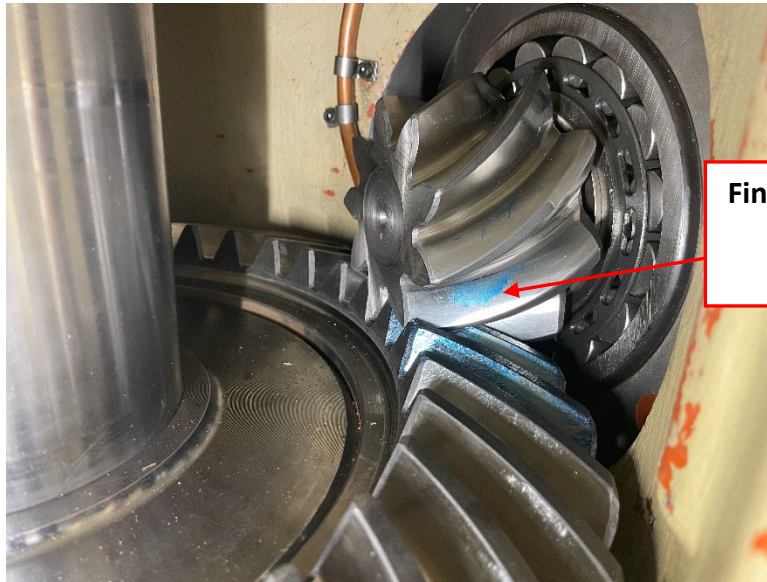


2nd Stage Planetary Assembly



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SERVICE WORK DETAILS



Final gear contact pattern set with a backlash setting of .25mm



Final assembly and paint