Lock & Dam 20
Miter Gate and Tainter Valve Gearbox Maintenance

Larry E. Reever, Lockmaster

Completed April 1936 at a cost of $6,152.000.00

Enviromental Factors

- Lock and Dam 20 is 5 foot lower in elevation than the other locks on the Mississippi River and we are frequently faced with water over our gearboxes.
- We have extreme temperatures ranging from 100 degrees to -15.
- We are subjected to contamination on a regular basis.

Severe Ice Conditions

High Water

High Water

High Water

Oil Filtered Annually

- Lock and Dam 20 has 51 Total Gearboxes
- 4 Gearboxes on Lock Gate Machinery (125 Gallons each) (500 Gal Total)
- 4 Gearboxes on the Tainter Valve Machinery (62.5 Gallons each) (250 Total)
- 43 Gearboxes on the Dam (55 Gal each)
- Total filtered oil is 3115 Gallons ($19.57)
- Total cost to replace oil is $60,960.55

Oil Samples for Records

- All oil samples are taken from mid level of oil reservoir. Oil Samples are sent to a reputable lab (CAT) for testing.
- Before and After Oil Samples are taken to ensure that oil is being filtered properly.
- Gearboxes are pumped dry using a transfer pump and wet/dry shop vacuum and then wiped down with clean rags annually.

Results!

US ARMY CORPS ENG
JEFFREY WAMSLEY
P O BOX 534
PLEASANT VALLEY, IA 52767

FAX: 309-794-4507
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SAMPLE TYPE: OIL

COMPANY NAME : US ARMY CORPS ENG
CUSTOMER EQUIP NUM : VALVE 1 22
COMPARTMENT NAME : GEAR BOX
SERIAL NUMBER : VALVE1LD22
MANUFACTURER : UNKNOWN
MODEL : UNKNOWN
JOB SITE : L&D 22
EXT WARR NUMBER :

SHOP JOB NUM :
COMP SERIAL NUM :
COMPARTMENT MODEL :
COMP MANUFACTURER :
SAMPLE LABEL NUM : PREPAID
FLUID BRAND/WEIGHT : CENPECO/80W
FLUID TYPE :
EXT WARR EXPIRE DATE :
FUEL CONSUMED : 0.0

ALTORFER CAT
TKING@ALTORFER.COM
2600 6th St. SW
Cedar Rapids, IA 52404-3504
319-365-0551 ext. 2237
www://Altorfer.com/

LAB CONTROL NUMBER	SAMPLE DATE	PROCESS DATE	EQUIPMENT METER	METER ON FLUID	FLUID CHANGED	MAKE UP FLUID	MAKE UP FLUID UNITS	FILTER CHANGED
B030-41010-6002	1/6/11	1/10/11			No			
No Action Required	WEAR METAL ANALYSIS RESULTS ARE NORMAL. INFRARED ANALYSIS RESULTS ARE ACCEPTABLE. WATER PHYSICAL TESTS ARE NEGATIVE. PARTICLE COUNT IS ACCEPTABLE. RESAMPLE NEXT SERVICE INTERVAL.							
B030-40284-6005	10/4/10	10/11/10			No			
Monitor Compartment	THIS SAMPLE TESTED POSITIVE FOR WATER CONTAMINATION. WATER CONCENTRATION IS = .63% OR 6,300 PPM. DUE TO THE PHYSICAL HIGH WATER DETECTION THE WEAR METAL & INFRARED ANALYSIS WERE NOT RAN. WATER MOLECULES WILL GIVE A HIGHER/FALSE ANALYSIS. DIAGNOSIS/REPAIRS FOR A WATER ENTRY PROBLEM IS RECOMMENDED. PLEASE KIDNEY LOOP/FILTER THIS SYSTEM WITH WATER REMOVING FILTERS TO REMOVE WATER CONTAMINATION. RESAMPLE AFTER KIDNEY LOOPING IS COMPLETE TO MONITOR/CONFIRM.							
B030-39348-6001	12/8/09	12/14/09			Yes			Yes
Action Required	THIS SAMPLE IS EXTREMELY CONTAMINATED WITH WATER. WATER CONCENTRATION IS = 34.57% OR 345,700 PPM. DUE TO THE PHYSICAL HIGH WATER DETECTION THE WEAR METAL & INFRARED ANALYSIS WERE NOT RAN. WATER MOLECULES WILL GIVE A HIGHER/FALSE ANALYSIS. DIAGNOSIS/REPAIRS FOR A WATER ENTRY PROBLEM IS RECOMMENDED. PLEASE KIDNEY LOOP/FILTER THIS SYSTEM WITH WATER REMOVING FILTERS TO REMOVE WATER CONTAMINATION. RESAMPLE AFTER KIDNEY LOOPING IS COMPLETE TO MONITOR/CONFIRM.							
B030-39292-6006	10/14/09	10/19/09			No			
Action Required	THIS SAMPLE IS POSITIVE FOR WATER CONTAMINATION. WATER CONCENTRATION = 20.88% OR 200,880 PPM. WEAR METAL ANALYSIS RESULTS ARE NORMAL. INFRARED ANALYSIS RESULTS ARE ACCEPTABLE. PLEASE KIDNEY LOOP/FILTER THIS SYSTEM WITH WATER REMOVING FILTERS TO REMOVE WATER CONTAMINATION. RESAMPLE AFTER KIDNEY LOOPING IS COMPLETE TO CONFIRM. INSPECT FOR A POSSIBLE SOURCE OF A WATER ENTRY PROBLEM INTO THE SYSTEM.							

Wear Metals (ppm)	Cu	Fe	Cr	Al	Pb	Sn	Si	Na	K	Mo	Ni	Ca	Mg	Zn	P
B030-41010-6002	0	37	0	1	3	0	4	1	0	0	0	63	3	27	671
B030-39292-6006	0	28	0	0	3	0	9	14	0	0	0	78	1	29	593

Oil Condition / Particle Count (c/ml)	ST	OXI	NIT	SUL	W	H2O	V100	ISO	4µ	6µ	10µ	14µ	18µ	21µ	38µ	50µ
B030-41010-6002	0	5	4	16	N		16.7	19/13	30835	3769	175	44	15	9	2	1
B030-40284-6005					P	0.63		H2O								
B030-39348-6001					E	34.57		H2O								
B030-39292-6006	21	10	6	11	P	20.880		H2O								

Ag = Silver, Al = Aluminum, B = Boron, Ca = Calcium, Cr = Chromium, Cu = Copper, Fe = Iron, P = Phosphorus, K = Potassium, Mg = Magnesium, Mo = Molybdenum, Na = Sodium, Ni = Nickel, Pb = Lead, Si = Silicon, Sn = Tin, V = Vanadium, Zn = Zinc, A = Antifreeze, F = Fuel, W = Water, P = Positive, N = Negative, T = Trace, E = Excessive, NIT = Nitration, OXI = Oxidation, ST = Soot, SUL = Sulfation, ISO = ISO Rating, PFC = Percent Fuel Content, PQI = Particle Quantifying Index , NaW = Salt Water, FL Pt = Flash Point, TAN = Total Acid Number, TBN = Total Base Number, H2O = Karl Fisher result, V100 = Viscosity@100C, V40 = Viscosity@40C

Notice: This analysis is intended as an aid in predicting mechanical wear. No guarantee, expressed or implied, is made against failure of this piece of equipment or a component thereof.

Type of Oil

- CEN-PE-CO Speed Reducer Oil
- 100% Pure Paraffin Base Oil
- Fortified with anti-wear, anti-rust and corrosion, anti foam, oxidation inhibiting
- Demulsifies to separate water to the bottom of the gearbox
- 90 Weight Oil

Equipment

- Harvard Portable Filtration System
  - Model 87DG-T
  - Uses 2 in-line 1-3 Micron Filters.
  - Filters will take out water and impurities
  - Approximate cost $5,500.00 to $6,000.00
  - Filters cost approximately $81.00 each
  - Machine will also by-pass for pumping only
  - Machine works off of a pressure system
  - All quick disconnects installed on system

HARVARD

Transfer Pump

- Oil is removed from the gearboxes using a transfer pump mounted on a cart.
- Oil is pumped into a 100 Gallon lightweight plastic container and taken indoors to set overnight.
- Once the oil has warmed to room temperature it is filtered into a clean 100 gallon container and pumped back into the gearbox.

Transfer Pump Information

- Blackmer # 3592
- Model Number LGF-1C
- Made in USA
- Grand Rapids Michigan
- SN: 359942-S
- Hoener Equipment Company
- All quick disconnects installed on pump

Oil filtering tanks and pumps

Working During Inclement Weather

- We use two portable tents during temperatures well below zero.
- Tents are heated with 480 V electric heaters and portable diesel heaters.
- Conditions inside the portable tents range from 50 to 70 degrees.
- All equipment is kept inside the tent protected from the elements

Danger
60

TL 130
6

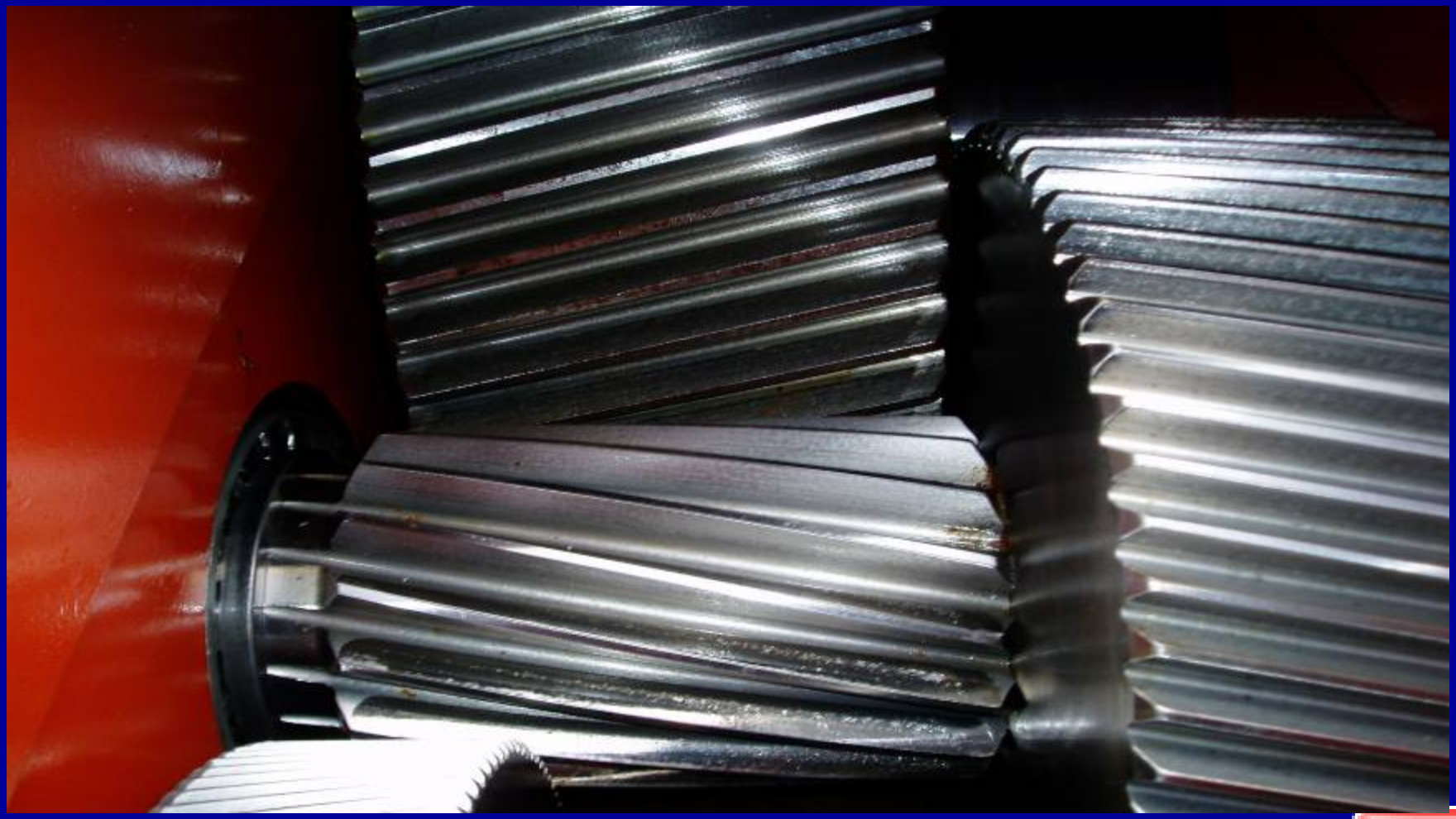
Gearboxes

- Speed Reducers Gearboxes are Horsburgh & Scott for Miter Gates and Tainter Valves
- Speed Reducer Gearboxes were installed during the re-hab in 1988. (23 years)
- Lock and Dam 20 has the oldest gearboxes in the Rock Island District.

Interior Of Miter Gate Gearboxes

Miter Gate Cont

Tainter Valve Gearboxes



Tainter Valve Cont

Benefits / Conclusion

- Cost Savings to the District in thousands of dollars
- Environmentally re-cycled oil reduces the dependency of fossil fuels
- Interior of the gearbox (gears, shafts, bearings) get inspected annually.
- Reduced wear and tear on bearings and gears with clean oil, increases lifespan of equipment.