

Subject: HPI Findings AC3E/AC3W/R3E Bearing Replacement

Date: 31 Dec11

Org: FESS

The WH 16th Floor AC3E/AC3W/R3E Bearing Replacement Job, has gone very well. It did end up being a 2 day job, (13 hours on Friday 12/30/11 and 9 hours on Saturday 12/31/11.

From a preliminary HPI perspective, some interesting error precursors and organizational weaknesses have already been identified; see commentary and photos, attached. As a result of the findings AC3E and AC3W motors have been labeled with the proper lube type, both the Rotating Equipment and FESS/Ops personnel were directed to use the "Turn of the Nut" Method to torque all bolts, were directed to apply Loctite Thread-locker to all fasteners and match-mark all bolts. To this end, the attached "Turn of the Nut" Torque procedure was provided to both crews.

We did have difficulty with the Guard on AC3W due to rectifying a nearly 2" misalignment between the Motor and Fan Sheaves and had to modify the Guard brackets to gain clearance. Both the AC3E and AC3W Guards require at least 2 personnel to R&R, and should be modified/replaced with guards that do not require complete removal for belt or sheave replacement, i.e. the guard stays in place but the face of the guard is removable.

Mike Oheron from Rotating Equipment Specialists will have a comprehensive report of their findings to be presented at the January PMP review. In the interim, please find preliminary findings below and attached.

AC3W:

1. Inboard (Drive End) Bearing
 - a. Greased with Red Grease (Currently use Blue Synthetic Mobil Polyrex EM or Brown Mobil Lithium Base EP2)
 - b. No lube label on motor
2. Outboard Bearing
 - a. Shielded on one side
 - b. Lubricated with Green Grease (Currently use Blue Synthetic Mobil Polyrex EM or Brown Mobil Lithium Base EP2)
 - c. No lube or bearing type label on motor or in history

AC3E:

1. Inboard (Drive End) Bearing
 - a. Relief plug not removed during greasing or plugged and unable to relieve
 - b. Resulted in grease forced into motor between rotor and stator

- c. Grease hardened, color indeterminate (Currently use Blue Synthetic Mobil Polyrex EM or Brown Mobil Lithium Base EP2)
- d. No lube or bearing type label on motor or lube info in history
- 2. Outboard Bearing
 - a. Shielded both sides, grease zert on motor, brown grease packed around bearing
 - b. No lube or bearing type label on motor or lube info in history

R3E:

- 1. Inboard (Drive End) Bearing
 - a. Pillow Block Retaining bolts found loose
- 2. Outboard Bearing
 - a. Pillow Block Retaining bolts found loose

Error Precursors/Organizational Weaknesses Identified (to date)

- 1. Error Precursors:
 - a. Interpretation requirements-
 - I. Motor Lube is Electrician task
 - II. What is the proper lube?
 - III. How do we lube (with motor on or off, how long do we warm up, remove relief plug?, how long do we run after?)
- 2. Latent Conditions/Organizational Weaknesses
 - a. No Lubrication type identified on Motors
 - b. No Bearing Type identified on Motors
 - I. Motors had shielded, unshielded and partially shielded Bearings installed
 - II. All Motors had grease zerts inboard and outboard and were greased (including the bearing shielded on both sides)
 - c. Inboard Bearings on AC3E and AC3W did not have grease relief ports extended, (AC3W still needs to be extended)
 - d. Standard Lubrication Procedure not integrated
 - e. Synthetic Lubrication procedure changes not integrated (motor does not need to be running per Rotating Equipment)
 - f. Loctite Procedures not integrated across all levels, job plans, crafts
 - I. Use of thread-locker and retaining compound not completely integrated
 - II. Use of "Turn of the Nut" torque method not completely integrated
 - g. Generic PM Tasks do not require checking for loose bolts, see attached
 - h. No match-marking on bolts to identify if they were loose

Photos:

A: AC3E Drive End 3
B: AC3E Outboard 4
C: AC3W Drive End 5
D: AC3W Motor Drive End 6
E: AC3W Motor 7
F: AC3W Outboard Bearing 8
G: R3E Drive End 9
H: R3E Outboard Bearing 10
I: R3E Pillow Block Bearing 11
J: R3E Semi and Annual PM 11
K: Turn Off Nut Torque Method 12

A: AC3E Drive End



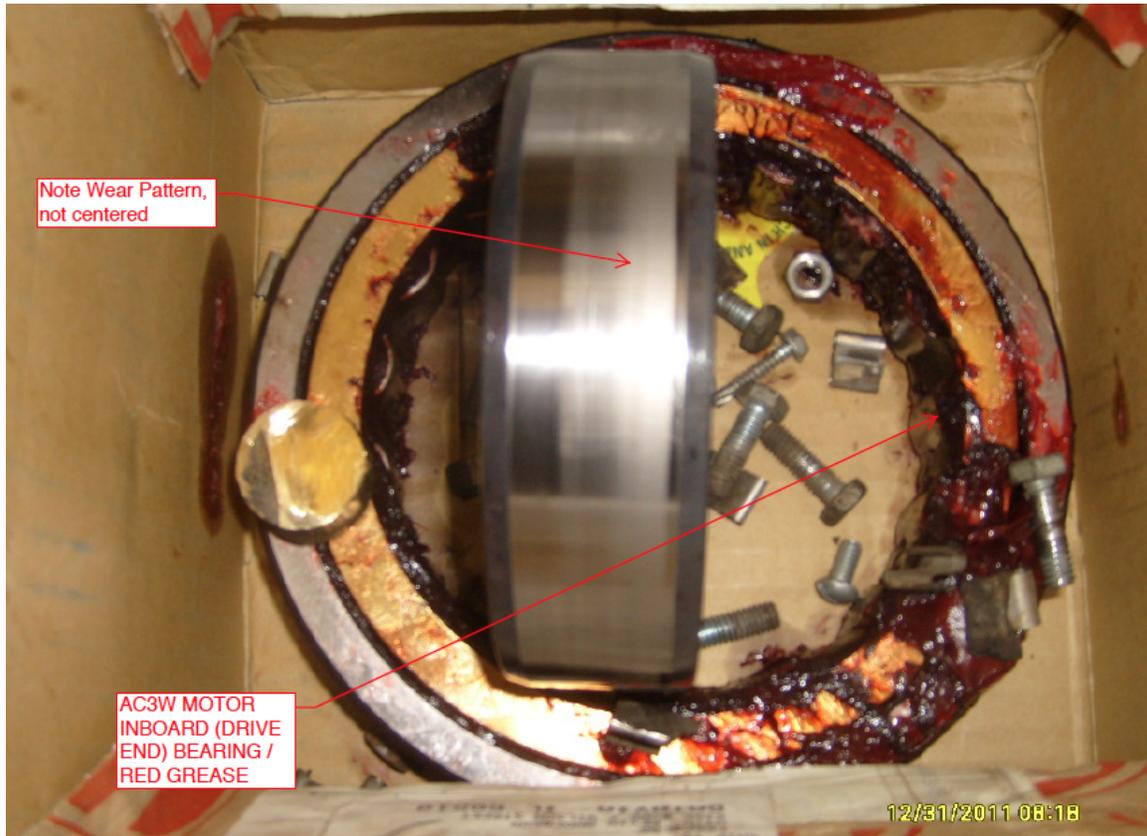
B: AC3E Outboard



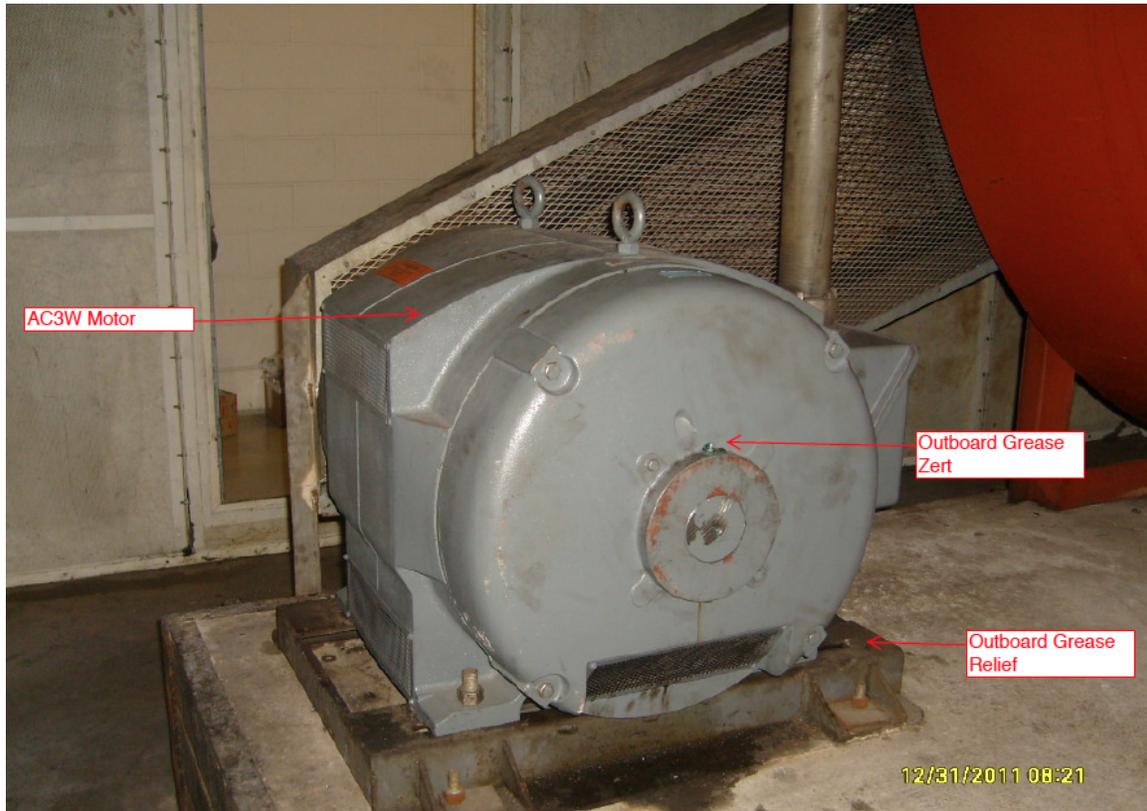
C: AC3W Drive End



D: AC3W Motor Drive End



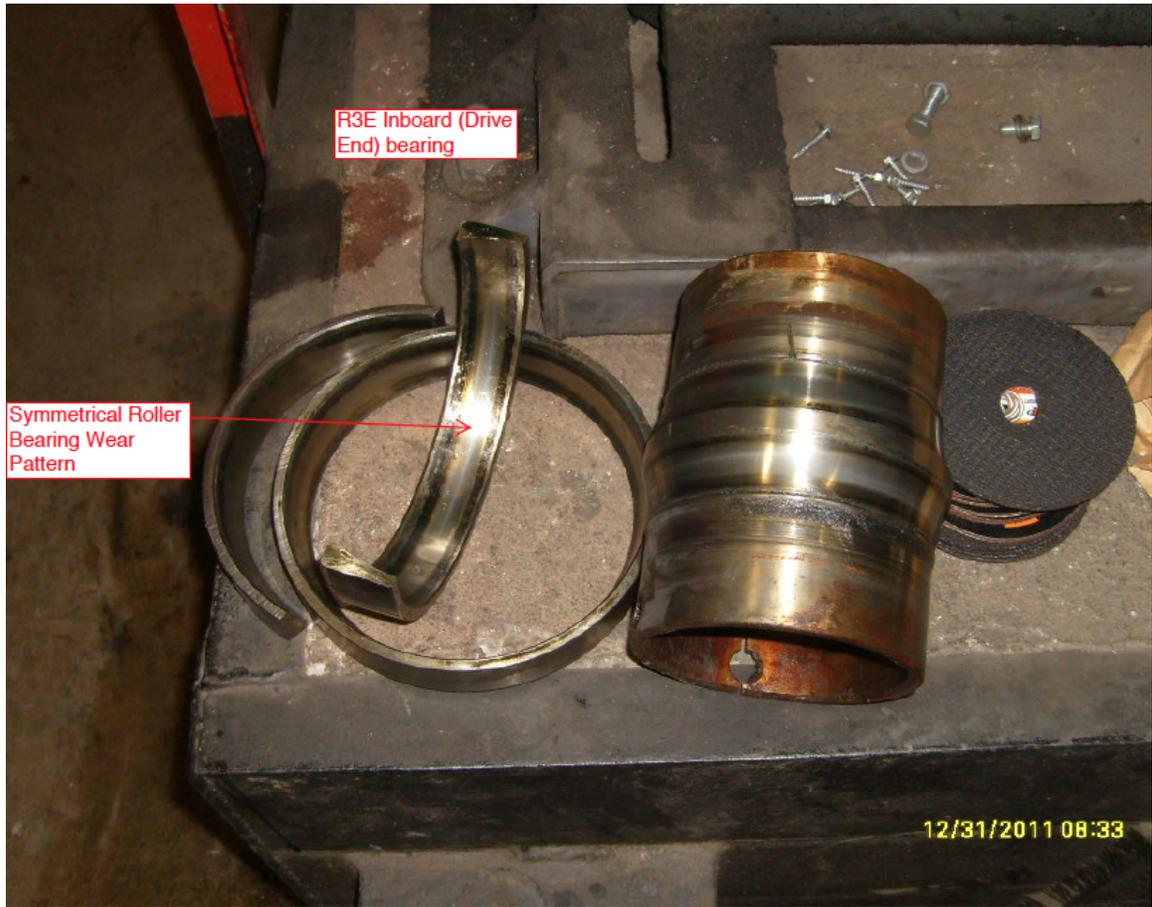
E: AC3W Motor



F: AC3W Outboard Bearing



G: R3E Drive End



H: R3E Outboard Bearing



I: R3E Pillow Block Bearing



J: R3E Semi and Annual PM

Work Order	
WO Number	WO498172 RETURN AIR FAN-ANN
Parent WO	
Main Attributes Tasks Crews Parts Tools PO's Routing Readings Closing	
1. LUBE MOTOR BEARINGS. CAUTION! DO NOT OVER LUBRICATE. RECORD TYPE AND AMOUNT OF LUBRICANT. 2. LUBE FAN SHAFT BEARINGS. 3. CLEAN SCREENS AND LOUVERS FOR PROPER AIR MOVEMENT AND EXERCISE DAMPERS. 4. INSPECT DRIVE BELT AND ADJUST OR REPLACE AS REQUIRED. INSPECT BELT GUARD FOR PROPER POSITION. 5. OBSERVE OPERATION AND CORRECT OR REPORT ANY PROBLEMS. 6. GIVE UNIT A GOOD GENERAL CLEANUP INCLUDING SURROUNDING AREA.	

K: Turn Off Nut Torque Method

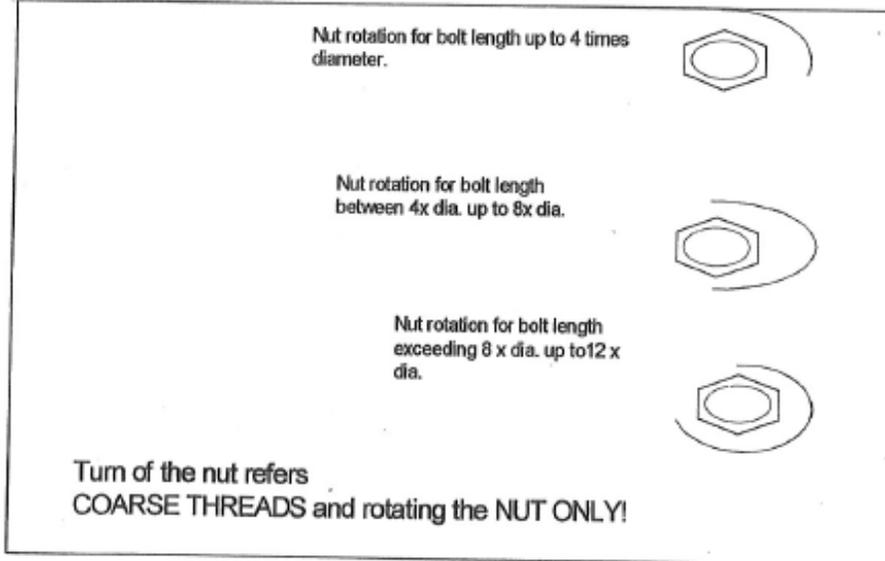


Single Point Lesson No. 000601

For: FERMI LAB FESS OPS

Topic: FASTENERS: TURN OF NUT METHOD

1. Advance the nut to contact with the work surface.
(In the case of several bolts in the connection, advance them all.)
2. Using a short handled wrench to avoid high leverage, snug the nuts against the work surface so the parts are together.
(This will apply an initial pre load)
3. Without allowing the bolt head to turn, rotate the nut the indicated amount per the attached sketch. 1/3 rotation, 1/2 rotation, or 2/3 rotation.



MATCH MARK ALL FASTENERS PER SINGLE POINT LESSON #GA 601

NOTE:

This method will bring bolt tension close to the proof load of the bolt.

This method is not dependent on bolt grade, or thread lubrication.

The ratio of bolt Diameter to Length refers to the grip length, NOT the overall length of the bolt.

This method was developed by the American Association of Railroads, and is now a standard in the building construction industry.

This method only applies to COARSE THREADS AND TURNING THE NUT!

This method is only applicable when matching grades of nuts and bolts are used.

Bolt length refers to the grip length between the bolt head and the nut.



Small Group: _____
Dept.: _____ Date: _____
Prepared By: _____



Are the parts already assembled? **YES** — Wicking Grade 290

No

What strength do you require?

Low - Purple	Medium - Blue	Medium - Blue	High - Red
222MS	242°	243 (Improved Oil Tolerance)	262
Up to 1/4"	1/4" to 3/4"	1/4" to 3/4"	Up to 3/4"
Low	Medium	Medium	High
20 min./24 hr.	10 min./24 hr.	10 min./24 hr.	20 min./24 hr.
53/30	110/43	180/62	189/275
300°F (150°C)	300°F (150°C)	300°F (150°C)	300°F (150°C)
10 ml, 50 ml, 250 ml	10 ml, 50 ml, 250 ml	10 ml, 50 ml, 250 ml	10 ml, 50 ml, 250 ml



Loctite® 222MS Low Strength Threadlocker
Recommended for low-strength threadlocking of adjusting screws, countersunk head screws, and set screws; on collars, pulleys, tool holders, and controllers. Also for low strength metals such as aluminum or brass which could break during disassembly. Mil-Spec (S-46163A) Type II, Grade M.



Loctite® 242° Removable Threadlocker
Effective on all types of metal threaded fasteners. Prevents loosening on vibrating parts such as pumps, motor mounting bolts, gear boxes, or presses. Recommended for use where disassembly with hand tools is required for servicing. NSF®/ANSI 61. ABS Approved.



Loctite® 243 Threadlocker
Effective on all types of metal threaded fasteners. Prevents loosening on vibrating parts such as pumps, motor mounting bolts, gear boxes, or presses. Recommended for use where disassembly with hand tools is required for servicing and where parts are contaminated with oil. NSF®/ANSI 61. Agriculture Canada Approved.



Loctite® 262 High Strength Threadlocker
Red 262 is a high strength product that is applied to fasteners up to 3/4" (20mm) in size before assembly. Localized heating and hand tools are required to separate parts. Solvents will not weaken the adhesive bond. Mil-Specs (S-46163A) Type II, Grade O. ABS Approved. Agriculture Canada Approved.