Fan Inspection and Belt Replacement

Table Farm Maintenance Procedure

USQ # N/A-4

CHANGE HISTORY (≤ LAST 5 REV-MODS)

<table>
<thead>
<tr>
<th>Rev-Mod</th>
<th>Release Date</th>
<th>Justification</th>
<th>Summary of Changes</th>
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<tr>
<td>G-4</td>
<td>09/17/2018</td>
<td>Maintenance Request</td>
<td>Added &quot;IF Lock and Tag was performed,&quot; to Step 5.1.8.</td>
</tr>
<tr>
<td>G-3</td>
<td>01/24/2018</td>
<td>Closeout of WRPS-PER-2017-1742</td>
<td>Remove Monthly from Procedure Title. Add to Section 5.7 “Complete PM Data Sheets are sent to HVAC Engineering for review and evaluation.”</td>
</tr>
<tr>
<td>G-2</td>
<td>09/06/2016</td>
<td>Maintenance Management Request, per management place keeping is not a requirement.</td>
<td>Modified the special instruction in front of section 5.1, added &quot;or&quot; in front of independently and deleted &quot;or N/A'ed&quot; after independently. Removed the place keeping lines steps 5.1.1 through 5.2.11. (This change could not be struck out, they were just deleted.)</td>
</tr>
<tr>
<td>G-1</td>
<td>06/21/2016</td>
<td>Maintenance Request</td>
<td>Added Bullet to Section 4.1 and Added Sections 5.3 and 5.4</td>
</tr>
<tr>
<td>G-0</td>
<td>03/28/2016</td>
<td>Periodic Review</td>
<td>Globally struck Shock Pulse Monitoring. REWORD 1.1, Note 1 thru 5 under 1.1, Steps 4.3.2, 5.1.4, 5.1.4.2, 5.1.4.6, 5.1.6.5, 5.1.6.9, 5.1.6.10, 5.1.8, 5.2.2, 5.2.5.3, 5.2.5.8, 5.2.8. ADDED Note prior to Step 5.1.4.1, and sub-steps a &amp; b. Note with Steps 5.1.4.3-5.1.4.6, 5.2.4, 5.3.1, 5.3.2. STRUCK 2.1, 3rd &amp; 4th bullets under 4.1, Note with Steps 4.3.2 – 4.3.4, Section 5.1 Table 1, 5.4.1 &amp; 5.4.2.</td>
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1.0 PURPOSE AND SCOPE

1.1 Purpose

This procedure provides instructions for bearing lubrication, inspection of fans and fan belt replacement at Tank Farms and Facilities.

1.2 Scope

This procedure applies to inspection of fans and fan belt replacement at tank farms and facilities.

2.0 INFORMATION

NONE
3.0 PRECAUTIONS AND LIMITATIONS

3.1 Personnel Safety

3.1.1 Follow controls as specified in Work Package.

3.1.2 Comply with DOE-0336, Hanford Site Lockout/Tagout Procedure.

3.1.3 Control loose clothing, gloves, and long hair. Remove jewelry that may come in contact with equipment.

3.2 Radiation and Contamination Control

Work in radiological areas will be performed using a Radiological Work Permit (RWP) following review by Radiological Control per ALARA Work Planning procedure TFC-ESHQ-RP_RWP-C-03.

3.3 Environmental Compliance

3.3.1 HPT coverage will be performed as specified in the Radiological Work Permit and/or Radiological Monitoring Plan.

3.3.2 Equipment with removable contamination and/or work with removable contamination will be contained per the latest revision of the Containment Selection guide, Attachment A, in TFC-ESHQ-RP_RWP-C-02.

3.3.3 If system is breached to exposed tank atmosphere, pre- and post-job surveys (smears) shall be taken (TFC-ESHQ-STD-C-06).
4.0 PREREQUISITES

4.1 Special Tools Equipment and Supplies

NOTE - Limiting the amount of material taken into contaminated areas will minimize radioactive waste and future decontamination.

The following supplies may be needed to perform this procedure:

- Shell Gadus S2 V100 2, Shell Gadus S2 V220 2, Shell Gadus S3 V220C 2, Mobilith SHC 100.
- Clean wiping rags
- Portable strobe tach
- Other tools, equipment and supplies as identified by Shift Manager/OE/FWS/User.
- SKF CMAS 100-SL Machine Condition Advisor (Vibration Pen) with external accelerometer probe (M&TE)
- Fluke 568 handheld infrared thermometer (M&TE)
- Monarch 6204-013 Nova-Strobe handheld strobe tach (M&TE)

4.2 Performance Documents

- The applicable operating procedure for the component being inspected
- DOE-0336, Hanford Site Lockout/Tagout Procedure
- TFC-ESHQ-STD-C-06, Environmental Requirements Standard

4.3 Field Preparation

4.3.1 CONFIRM fan to be inspected is in operable condition.

4.3.2 CONTACT facility manager to identify if any equipment is in the following status:
- Lay-Up
- Out of Service
- Pre Start-Up.
5.0 PROCEDURE

NOTE - Data Sheets are tailored for individual components.

Special Instructions

As field conditions dictate, Sections and Activities may be performed in any logical order, in parallel, or independently to complete individual task(s) when directed by FWS and with those directions recorded on work record.

5.1 Inspection of Fans

NOTE - Steps 5.1.1 through 5.1.5 may be worked in any logical order or simultaneously.

5.1.1 INSPECT fans for the following:
- Proper operation
- Unusual noise
- Excessive vibration.

5.1.2 INSPECT ducting for the following:
- Loose Fasteners
- Poor integrity
- Excessive vibration.

5.1.3 IF required, GREASE bearings.

5.1.4 IF unit(s) has a “MEMOLUB® HPS” or other type of automatic lubricator, PERFORM the following:

NOTE - Grease cartridge should not be refilled more than four (4) times before replacement to ensure it doesn’t fail during operations.

5.1.4.1 CHECK level in grease cartridge.

a. IF grease cartridge is less than 1/3\textsuperscript{rd} full, REFILL cartridge with grease,
   OR
   REPLACE with new cartridge.

b. IF cartridge is refilled. PLACE check-mark on top of cartridge for each refill using a permanent black marker.
5.1 Inspection of Fans (Cont.)

5.1.4.2 MONITOR auto-lubricator for proper Operating Condition.

NOTE - Auto lubricator can fail to operate due to unit failure, low batteries, plugged grease hose, high grease viscosity, etc.

5.1.4.3 CHECK function of auto lubricator by backing off the MEMOLUB® HPS ¼ turn from the MEMO base, THEN

TURN it back down, hand tight (which immediately triggers MEMOLUBE to go through an output cycle).

5.1.4.4 IF the MEMOLUB® HPS does not go through an output cycle, REPLACE battery pack AND

RE-CHECK function of auto lubricator.

5.1.4.5 IF automatic lubricator still fails to operate properly, REPLACE it AND

CHECK function of the new unit.

OR

REMOVE auto lubricator and using a maintenance adapter or suitable zerk fitting, LUBE bearing with a grease gun.

5.1.4.6 RECORD results on Data Sheet.

NOTE - A portable strobe tachometer can be used to aid in checking for belt slippage.

5.1.5 CHECK drive belt on units being inspected for the following:

- Belt slap
- Slippage
- Squealing.
5.1 Inspection of Fans (Cont.)

5.1.6 IF FWS determines further inspection is needed (i.e. minor corrective activities such as: tightening fasteners, adjusting belt, etc.), **PERFORM** the following:

5.1.6.1 **REQUEST** Operations to shut down fan per applicable operating procedure.

5.1.6.2 **REQUEST** installation of Lock and Tag or Authorized worker Lockout/Tagout.

5.1.6.3 **CONFIRM** fan is de-energized.

5.1.6.4 **REMOVE** belt guard.

**NOTE** - Steps 5.1.6.5 through 5.1.6.12 may be worked in any logical order or simultaneously.

5.1.6.5 **INSPECT** drive belts and sheaves, or couplers (direct drive units) for wear, corrosion and damage.

5.1.6.6 IF replacement is required, **RECORD** on appropriate Data Sheet **AND** **NOTIFY** FWS.

5.1.6.7 IF FWS determines fan belt replacement is needed **REPLACE** the belt(s) **AND** **RECORD** the belt replacement on Data Sheet.

5.1.6.8 **CLEAN** off excess grease.

5.1.6.9 **INSPECT** alignment of belts and sheaves **AND** IF out of alignment, **ADJUST** belts and sheaves.
5.1 Inspection of Fans (Cont.)

5.1.6.10 INSPECT belt tension AND

IF belt tension is not correct, ADJUST tension.

5.1.6.11 INSTALL belt guard.

5.1.6.12 CLEAN around fan and motor.

5.1.6.13 RECORD inspection results on Data Sheet AND

DESCRIBE findings and corrective actions in Comments/Remarks Section.

5.1.7 CHECK all safety guards are in good condition AND

RE-INSTALL at original location.

5.1.7.1 RECORD on Data Sheet

5.1.8 IF Lock and Tag was performed, REQUEST removal of Lock and Tag or Authorized Lockout/Tagout.

5.1.9 REQUEST operations to return the equipment to its’ operable configuration per operating procedure for the equipment being worked.

5.1.10 OBSERVE drive for squealing, belt slap, or slippage as fan comes up to speed.

5.1.11 CONFIRM fan is operating normally AND

RECORD on applicable Data Sheet.

5.1.12 RECORD in the Data Sheet Comment Section any deficiencies identified during inspection/monitoring and corrective actions performed.
Fan Inspection and Belt Replacement

5.2 Inspection of Fans in “Pre-Start up” status

NOTE - Steps 5.2.1 and 5.2.2 may be worked in any logical order or simultaneously.

5.2.1 INSPECT ducting for the following:
- Loose Fasteners
- Poor integrity
- Excessive vibration.

5.2.2 IF bearings need greased, GREASE the bearings.

5.2.3 REQUEST installation of Lock and tag or Authorized worker Lockout/Tagout.

5.2.4 IF checking Direct Drive Fans, INSPECT fan and motor drive shaft AND CHECK coupling for wear or damage as follows:

5.2.4.1 CONFIRM fan is de-energized.

5.2.4.2 REMOVE shaft guard.

5.2.4.3 CHECK for coupling wear by manually twisting each side of coupling to check for rotational slack.

5.2.4.4 WIPE excess grease from fan bearings.

5.2.5 IF FWS determines further inspection is needed (i.e. adjusting belts, tightening fasteners, etc.), PERFORM the following:

5.2.5.1 CONFIRM fan is de-energized.

5.2.5.2 REMOVE belt guard.

NOTE - Steps 5.2.5.3 through 5.2.5.11 may be worked in any logical order or simultaneously.

5.2.5.3 INSPECT drive belts and sheaves, or couplers (direct drive units) for the following:
- Wear
- Corrosion
- Damage.

5.2.5.4 IF fan belt replacement is required RECORD on appropriate Data Sheet AND NOTIFY FWS.
5.2 Inspection of Fans in “Pre-Start up” status (Cont.)

5.2.5.5 IF FWS determines fan belt replacement is needed REPLACE the belt(s) AND RECORD belt replacement on Data Sheet.

5.2.5.6 CLEAN off excess grease.

5.2.5.7 INSPECT alignment of belts and sheaves AND IF out of alignment, ADJUST belts and sheaves.

5.2.5.8 INSPECT belt tension AND IF belt tension is not correct, ADJUST tension.

5.2.5.9 INSTALL belt guard.

5.2.5.10 CLEAN around fan and motor.

5.2.5.11 RECORD inspection results on Data Sheet AND DESCRIBE findings and corrective actions in Comments/Remarks Section.

5.2.6 CHECK all safety guards are in good condition AND RE-INSTALL at original location.

5.2.6.1 RECORD results on Data Sheet.

5.2.7 REQUEST removal of Lock and Tag or Authorized Lockout/Tagout.

5.2.8 REQUEST operations to return equipment to its’ operable configuration per operating procedure for the equipment being worked.

5.2.9 OBSERVE drive for squealing, belt slap, or slippage as fan comes up to speed.

5.2.10 ENSURE fan is operating normally AND RECORD on applicable Data Sheet.

5.2.11 RECORD in the Data Sheet Comment Section any deficiencies identified during inspection/monitoring and corrective actions performed.
### 5.3 Bearing #3 Condition Monitoring

**NOTE** - This section provides instructions for obtaining vibration, enveloped acceleration, temperature and speed of exhauster fan shaft bearings.

- Bearing #3 is the bearing closest to the motor. Bearing #4 is the bearing closest to the fan.
- Vibration pen battery should display a minimum of 3 green lights (75% of charge remaining) or more at time of use.
- If for any reason this section or any portions thereof are not performed, write “N/A” in the corresponding locations of the PM data sheet, as applicable, and record the reason in the comments section.

5.3.1 **ENSURE** battery for SKF CMAS 100-SL vibration pen has 75% or more charge prior to start.

5.3.2 **INSPECT** SKF CMAS 100-SL vibration pen or stinger for loose or damaged cable **AND**

**ENSURE** probe tip is clean, free of damage and properly connected.

5.3.3 **ENSURE** fan to be inspected is in operable condition and has been running for at least 30 minutes.

5.3.4 **OBTAIN** vibration and temperature readings for bearing #3.

5.3.5 **PLACE** Vibration Pen or stinger on bearing #3 through the machine guard at the Vertical Test Point position.

5.3.6 **CHECK** that “RUN” mode is displayed on the vibration pen.

5.3.6.1 **IF** “RUN” mode is not displayed, **PRESS** the Machine Condition Advisor’s “Select” button until “RUN” mode is displayed.

5.3.7 **WAIT** for the readings to stabilize.

5.3.8 **PRESS** the Machine Condition Advisor’s “Select” button to hold the displayed readings.

5.3.9 **RECORD** the vertical velocity (ips) and enveloped acceleration (gE) of fan shaft bearing #3 on the data sheet.
5.3 Bearing #3 Condition Monitoring (Cont.)

5.3.10 **TAKE** temperature reading (°F) from top (Vertical Test Point position) of bearing #3, **AND**

**RECORD** results on the data sheet.

5.3.11 **PLACE** Vibration Pen or stinger on bearing #3 through the machine guard at the Horizontal Test Point position

5.3.12 **CHECK** that “RUN” mode is displayed.

5.3.12.1 **IF** “RUN” mode is not displayed, **PRESS** the Machine Condition Advisor’s “Select” button until “RUN” mode is displayed.

5.3.13 **WAIT** for the readings to stabilize.

5.3.14 **PRESS** the Machine Condition Advisor’s “Select” button to hold the displayed readings.

5.3.15 **RECORD** the horizontal velocity (ips) and enveloped acceleration (gE) of fan shaft bearing #3 on the data sheet.

5.3.16 **RECORD** fan shaft speed on the data sheet.

5.3.17 **RECORD** M&TE information on the data sheet.
5.4 Bearing #4 Condition Monitoring

NOTE - This section provides instructions for obtaining vibration, enveloped acceleration, temperature and speed of exhauster fan shaft bearings.

- Bearing #3 is the bearing closest to the motor. Bearing #4 is the bearing closest to the fan.
- Vibration pen battery should display a minimum of 3 green lights (75% of charge remaining) or more at time of use.
- If for any reason this section or any portions thereof are not performed, write “N/A” in the corresponding locations of the PM data sheet, as applicable, and record the reason in the comments section.

5.4.1 ENSURE battery for SKF CMAS 100-SL vibration pen has 75% or more charge prior to start.

5.4.2 INSPECT SKF CMAS 100-SL vibration pen or stinger for loose or damaged cable AND

ENSURE probe tip is clean, free of damage and properly connected.

5.4.3 ENSURE fan to be inspected is in operable condition and has been running for at least 30 minutes.

5.4.4 OBTAIN vibration and temperature readings for bearing #4.

5.4.5 PLACE Vibration Pen or stinger on bearing #4 through the machine guard at the Vertical Test Point position.

5.4.6 CHECK that “RUN” mode is displayed on the vibration pen.

5.4.6.1 IF “RUN” mode is not displayed, PRESS the Machine Condition Advisor’s “Select” button until “RUN” mode is displayed.

5.4.7 WAIT for the readings to stabilize.

5.4.8 PRESS the Machine Condition Advisor’s “Select” button to hold the displayed readings.

5.4.9 RECORD the vertical velocity (ips) and enveloped acceleration (gE) of fan shaft bearing #4 on the data sheet.
5.4 Bearing #4 Condition Monitoring (Cont.)

5.4.10 **TAKE** temperature reading (°F) from top (Vertical Test Point position) of bearing #4, **AND**

**RECORD** results on the data sheet.

5.4.11 **PLACE** Vibration Pen or stinger on bearing #4 through the machine guard at the Horizontal Test Point position

5.4.12 **CHECK** that “RUN” mode is displayed.

5.4.12.1 **IF** “RUN” mode is not displayed, **PRESS** the Machine Condition Advisor’s “Select” button until “RUN” mode is displayed.

5.4.13 **WAIT** for the readings to stabilize.

5.4.14 **PRESS** the Machine Condition Advisor’s “Select” button to hold the displayed readings.

5.4.15 **RECORD** the horizontal velocity (ips) and enveloped acceleration (gE) of fan shaft bearing #4 on the data sheet.

5.4.16 **RECORD** fan shaft speed on the data sheet.

5.4.17 **RECORD** M&TE information on the data sheet.
5.5  **Restoration**

5.5.1  **IF** any problems were encountered, **INFORM** FWS.

5.5.2  **NOTIFY** Operations that Work is complete and system may be returned to desired configuration.

5.5.3  **IF** readings were taken, **RECORD** on Data Sheet AND **RECORD** exceptions.

5.6  **Acceptance Criteria**

Acceptance criteria are met when equipment operates normally with no unusual noise or vibration.

5.7  **Review**

5.7.1  **INFORM** FWS work is complete.

5.7.2  **FWS REVIEW AND ENSURE** the following:

- Comment Sections are filled out appropriately
- Work Requests needed as a result of this procedure are identified and generated
- Work request number(s) of any work documents generated as a result of this procedure, are recorded in the Data Sheet Comments/Remarks Section
- Complete PM Data Sheets are sent to HVAC Engineering for review and evaluation.

5.8  **Records**

The performance of this procedure generates no records. However, PM Data Sheets associated with the procedure, are records and are maintained in the work package as record material.

The record custodian identified in the Company-level Records Inventory and Disposition Schedule (RIDS) is responsible for record retention in accordance with TFC-BSM-IRM_DC-C-02.