

**FLUOR**

Fluor Federal Services, Inc. Paducah Deactivation Project

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**1.0 PURPOSE AND SCOPE**

**1.1 Purpose**

This procedure provides instruction in the use of the C-337 dual speed purge and evacuation (P&E) station for evacuating cells and equipment.

**1.2 Scope**

This procedure applies to Facility Operations personnel participating in the use of the dual speed P&E station.

**2.0 REFERENCES**

**2.1 Use References**

- CP3-OP-0315, *Breaker Removal and Return to Service*
- CP3-WM-1037, *Generation and Temporary Storage of Waste Materials*
- CP4-OP-0117, *Vibration Detection*
- CP4-OP-1121, *Cascade Valve and Leak Rating Operations*
- Job Hazard Analysis (JHA) JHA-7347, *General Work Evolutions for Operations Controlled Facilities (excluding High Voltage Switchyards)*

**2.2 Source References**

- CP4-OP-0111, *Cascade Seal Systems*
- KY/D-5137, *Technetium Control and Monitoring Guidelines*

**3.0 COMMITMENTS**

- CP1-NS-3001, *Technical Safety Requirements for the Department of Energy Paducah Site Deactivation Project*
- Nuclear Criticality Safety Approval CAS-021, *Operation and Shutdown of the Diffusion Cascade*

**4.0 PRECAUTIONS AND LIMITATIONS**

**4.1 Precautions**

- 4.1.1 Due to the installation of differential pressure (DP) alarms, operating the Cooling Water control valve on manual may result in a DP alarm. This should be considered any time the system contains R-114 **and** the Cooling Water system has **NOT** been isolated and drained.
- 4.1.2 Adjustments to the coolant setpoint should be made in small incremental changes to prevent DP alarms.
- 4.1.3 Prolonged operation of a centrifugal compressor without gas flow should be avoided. The recycle valve should be open while off line **unless** directed by Front Line Manager (FLM) **or** in emergency situations.

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- 4.1.4 Due to pumps coasting during shutdown, lube oil shall be left on for a **minimum of 10 minutes** after shutdown to assure proper bearing lubrication.
- 4.1.5 To prevent motor damage, compressors are to be running in low speed mode for a **minimum of 30 minutes before** starting in high speed mode.
- 4.1.6 Compressors should **NOT** be operated in high speed mode with their discharge valve closed.
- 4.1.7 **If** an onstream compressor trips, **then** the associated discharge valve will automatically go to the CLOSE position.

## 4.2 Limitations

TSR  
5.6.9.1

4.2.1 Purge and Evacuation (P&E) pumps shall **NOT** be used to evacuate any material containing Chlorine Trifluoride/Fluorine (ClF<sub>3</sub>/F<sub>2</sub>) **unless** combined ClF<sub>3</sub> and F<sub>2</sub> concentration has been confirmed to be **less than 8 mole %** by Laboratory analysis.

TSR  
5.6.8.3

4.2.2 P&Es shall **NOT** be used to transfer ClF<sub>3</sub>/F<sub>2</sub> from the ClF<sub>3</sub>/F<sub>2</sub> receiving volume to the Insitu Cell Treatment target location.

4.2.3 Dual speed P&E station pressure shall be maintained **below 13.5 pounds per square inch absolute (psia)** at all times during operation.

## 5.0 PREREQUISITES

- 5.1 Review JHA-7347, *General Work Evolutions for Operations Controlled Facilities (excluding High Voltage Switchyards)*.
- 5.2 Confirm a **minimum of one** qualified operator in building during checkout and operation of the compressor(s) **and a minimum of two** qualified operators in building during starting of compressor(s).
- 5.3 Review Alarm Status Log to ensure alarms are **NOT** disabled **and** Automatic Data Processing (ADP) alarm points are set to ACTIVE ALARM.

## 6.0 INSTRUCTIONS

### NOTES:

Additional information on the lube oil skid can be found in Appendix B, *Lube Oil Skid Information*.

The time needed to heat up oil to desired setpoint could take two to five hours.

### CAUTION:

Bypassing heater set point to attempt to warm oil faster may damage heater.

## 6.1 Operation of the Lube Oil Skid

### Facility Operations Personnel

- 6.1.1 **If** starting up lube oil skid, **then** perform the following:
  - A. Ensure upper and lower lube oil tank sightglass valves are OPEN.
  - B. Ensure level in lube oil tank sightglass is above minimum.

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- C.** Ensure the following valves are closed:
- MV-104 (No. 1 Cooler Bypass)
  - MV-204(No. 2 Cooler Bypass)
  - MV-105 (No. 1 Filter Vent)
  - MV-205 (No 2 Filter Vent)
- D.** Ensure the following valves are open:
- IV-101 (Pump Discharge P1 Isolation Valve)
  - MV-101 (No. 1 Pump Discharge)
  - MV-201 (No. 2 Pump Discharge)
  - IV-102 (DP Filter Inlet Block Valve)
  - IV-103 (DP Filter Outlet Block Valve)
  - IV-104 (No. 1 Cooler Outlet – PI Block Valve)
  - IV-204 (No. 2 Cooler Outlet – PI Block Valve)
  - MV-102 (No. 1 Cooler Inlet)
  - MV-103 (No. 1 Cooler Outlet)
  - MV-202 (No. 2 Cooler Inlet)
  - MV-203 (No. 2 Cooler Outlet)
  - A-1 (Air Supply at R-114 Station)
  - SA-1 (Air Supply to AV-201)
  - SA-2 (Air Supply to AV-101)
  - SA-3 (Air Supply to AV-102)
  - SA-4 (Air Supply to AV-202)
- E.** Ensure **one** of the following valve sets are OPEN to align oil through filter:
- FV-101 (No. 1 Filter Inlet) **and** FV-102 (No. 1 Filter Outlet)
  - FV-201 (No. 2 Filter Inlet) **and** FV-202 (No. 2 Filter Outlet)
- F.** Ensure the following disconnect switches are in the ON position:
- Disconnect at back of 72A2-2V CONTROL CENTER (for Lube Oil Skid 480 Volt 3 Ph)
  - Disconnect on LUBE OIL SKID operating panel
  - PUMP 1 DISCONNECT
  - PUMP 2 DISCONNECT

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- COOLER 1 DISCONNECT
- COOLER 2 DISCONNECT

- G.** Ensure EMERGENCY STOP button on LUBE OIL SKID operating panel is pulled out.
- H.** Ensure the following on the Human Machine Interface (HMI) are in Auto **unless** directed otherwise by FLM (see Appendix B for more information):
- HX101
  - HX201
  - P101
  - P201
- I.** Ensure lube oil supply pressure is set at **25 psig** on SETUP page of HMI.
- J.** Ensure Oil Set Point on the Oil Heater page of HMI is set to **120°F** and if oil heater is **OFF**, **then** place oil heater selector switch to the ON position.
- K.** **When** Oil Temp reading on main page of HMI indicates **greater than or equal to 115°F**, **then** depress Start Circulation button on HMI.

**6.1.2** Perform the following **until** lube oil skid is shutdown:

- A.** Complete CP4-OP-0208-F01, C-337 *DSP&E Data Sheet* shiftly.
- B.** **If** filter differential pressure is **greater than 10 psia**, **then** perform the following:
1. Crack open vent valve (MV-105 or MV-205) on isolated filter.
  2. Crack open outlet valve (FV-102 or FV-202) to vent isolated strainer.
  3. **When** oil discharges from vent, **then** close vent valve (MV-105 or MV-205) **and** fully open outlet valve (FV-102 or FV-202).
  4. Slowly open isolated filter inlet valve (FV-101 or FV-201) to place filter in service.
  5. Isolate previous in service filter by closing the following applicable pair of valves:
    - FV-101 and FV-102
    - FV-201 and FV-202
  6. Crack open vent valve (MV-105 or MV-205) on isolated filter **until** oil no longer discharges from vent, **then** close vent valve (MV-105 or MV-205).

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7. Open isolated filter basket.

**CAUTION:**

**If inner mesh bag is NOT seated in filter basket, then debris in oil can bypass filter and cause bearing wear and damage.**

8. Replace inner mesh bag **and** ensure seated in filter basket.
9. Dispose of used inner mesh bag according to CP3-WM-1037, *Generation and Temporary Storage of Waste Materials*.
10. Close filter basket.

**NOTE:**

The Low-Low Oil Level and High Lube Oil Discharge Pressure alarms will cause a shutdown of the lube oil skid.

- 6.1.3 **If** an alarm is received on the HMI, **then** perform the following:

- A. Depress red stripe on top of HMI screen.
- B. On alarm screen, depress alarm to acknowledge.
- C. **If** alarm does **NOT** disappear, **then** perform the following:
  1. **If** alarm is Low Lube Oil Level alarm, **then** notify FLM lube oil skid oil tank needs to be filled.
  2. **If** alarm is Lube Oil High Temperature alarm, **then** ensure lube oil heater is off.
  3. **If** alarm is **NOT** expected, **then** contact FLM for further instructions.

- 6.1.4 **If** desired to change pump/heat exchanger alignment, **then** place pumps/heat exchangers in desired configuration on HMI (see Appendix B for more information).

**NOTE:**

The lube oil skid should be shut down any time the Dual Speed P&E compressors are shut down for longer than an hour.

- 6.1.5 **If** desired to shut down lube oil skid, **then** perform the following:

- A. Depress Stop Circulation button on the HMI.
- B. **If** desired to shut off lube oil heater, **then** place oil heater selector switch on the Oil Heater page of HMI to the OFF position.

NOTE:

Steps **6.2.1** through **6.2.13** may be performed in any order or in conjunction with each other to facilitate start-up.

Steps **6.2.1** through **6.2.5** and Step **6.2.13** are performed from the ground floor. Steps **6.2.6** through **6.2.12** are performed from the cell floor. If two qualified operators are available for checkout of the compressor(s), the operators may perform the checkout at each level in conjunction with each other. Steps **6.2.13** through **6.2.24** require two qualified operators to be available to start the compressor(s), one being stationed on the cell floor and the other on the ground floor.

**6.2 Compressor Start-up**

**Facility Operations Personnel**

NOTE:

Breaker racking operations are performed according to CP3-OP-0315, *Breaker Removal and Return to Service*.

**6.2.1** Ensure motor breakers are racked in **and** relay targets clear for the appropriate compressor(s) at the applicable substation(s):

COMPRESSOR NUMBER	RELAY TARGET	BREAKER	SUBSTATION
1	51-G 51 A 51 C	NO. 1 DUAL SPEED P&E HI SPEED BREAKER	71B1
		NO. 1 DUAL SPEED P&E LO SPEED BREAKER	
2	51-G 51 A 51 C	NO. 2 DUAL SPEED P&E HI SPEED BREAKER	71B1
		NO. 2 DUAL SPEED P&E LO SPEED BREAKER	
3	51-G 51 A 51 C	NO. 3 DUAL SPEED P&E HI SPEED BREAKER	76B1
		NO. 3 DUAL SPEED P&E LO SPEED BREAKER	

**6.2.2** Ensure the following for seal exhaust to compressor(s) as follows:

- A.** Building seal exhaust pressure is **less than or equal to 0.75 psia** as read on SEAL EXHAUST PI on seal exhaust station catwalk.
- B.** NO.♦ P&E Seal exhaust control valve inlet block valve is open.
- C.** NO.♦ P&E Seal exhaust control valve outlet block valve is open.
- D.** NO.♦ P&E Seal exhaust control valve bypass block valve is closed **unless** directed otherwise by FLM.

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**6.2.3** Ensure the following at the old P&E panel:

- A.** No. ♦ SEAL EXHAUST DIFF. PIC set point is **between 33 and 37 divisions (1.7 psia) and** in AUTO.
- B.** No. ♦ COOLANT PRESSURE PIC set point is at a **minimum of 30 divisions and** in AUTO.
- C.** A **minimum of 5 psia** is read on CV BUFFER.

**6.2.4** Perform the following at P&E panel in Area Control Room (ACR):

- A.** Ensure MOTOR-OPERATED P&E CONDENSERS COOLING WATER SUPPLY selector switch on ACR control panel is set to OPEN.
- B.** Confirm **one** of the following:
  - C337 MOTOR-OPERATED P&E CONDENSERS COOLING WATER SUPPLY red indicator is illuminated on ACR P&E panel
  - Valve indicates open at condenser
  - C337 MOTOR-OPERATED P&E CONDENSERS COOLING WATER SUPPLY red indicator is illuminated old P&E panel
- C.** Check NO.♦ P&E BRAKE POTENTIAL light illuminated.
  - 1.** **If** NO.♦ P&E BRAKE POTENTIAL light is extinguished, **then** attempt to relamp.
  - 2.** **If** NO. ♦ P&E BRAKE POTENTIAL light is **NOT** illuminated after attempting to relamp, **then** contact FLM for further instructions.

**6.2.5** Evacuate system to **less than 0.50 psia and** perform a static leak rate according to CP4-OP-1121, *Cascade Valve and Leak Rating Operations*.

**6.2.6** Visually inspect compressor to be started for the following:

- A.** Compressor components are free of visual defects.
- B.** Accelerometers are intact on thrust and load bearings.
- C.** Brake mechanism markings are aligned.

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NOTE:

An example of the typical lube oil system, with valve numbering, for **all** the dual speed P&E compressors is located in Appendix C, *Typical Dual Speed P&E Station Lube Oil Diagram*.

**6.2.7** Ensure the following valves are open:

- DSLO-4, shaft bearing lube oil supply valve (No. 1 dual speed P&E only)
- DSLO-5, motor bearing lube oil supply valve
- DSLO-3, PI isolation for DSLO-PI2
- DSLO-1, lube oil supply valve

**6.2.8** Ensure seal systems associated with No.♦ compressor are aligned as follows:

- A. Seal feed supply P-nut valve at seal panel is open.
- B. Seal feed choke bypass P-nut valve at seal panel is closed.
- C. Seal feed test connection is aligned for normal operation.
- D. Atmospheric seal feed selector aligned to feed from atmospheric air line.
- E. Flange buffer supply P-nut valve at seal panel is open.
- F. Atmospheric seal feed choke bypass P-nut valve at seal panel is closed.
- G. Atmospheric seal feed test connection is aligned for normal operation.
- H. Seal exhaust block valve at seal panel is open.
- I. Seal exhaust test connection is aligned for normal operation.

**6.2.9** Ensure PE-D buffer cabinet is buffer pressure is set to **5** psig **and** PE3 and PE4 subpanels are set to BUFFER.

**6.2.10** Ensure the following valves on back side of compressor housing are open:

- CV-764
- CV-774
- CV-784
- CV 815

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**6.2.11** Ensure the following are set to BUFFER on BLOCK VALVE BUFFER SYSTEM panel:

- A.** PE4:
  - EEB7
  - EEB8
  - EEB9
- B.** PE3:
  - EE-4
  - EE-5
  - EE-6

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**6.2.12** Ensure the following for the R-114/Cooling Water system associated with No.♦ compressor:

- A.** R-114/Cooling Water differential panel is valved in by opening the following:
  - V-1A
  - V-1B
  - V-2A
  - V-2B
- B.** No.♦ P&E COOLANT DRAIN VALVE is closed.
- C.** Upper and lower R-114 sight glass block valves are open.
- D.** R-114 level is greater than or equal to **72 inches**.
- E.** The following conditions on C-337 COOLANT MELETRON No. ♦ HIGH/LOW P&E BOOSTER:
  1. Air Valve to Cooling Water CV **and** Transaire Transmitter (TAT) is open.
  2. R-114 to pressure transmitter block valve is open.
  3. R-114 high pressure coolant relay block valve is sealed open for both low and high speed coolant melatrons.
  4. R-114 high pressure coolant relay has been reset for both low and high speed coolant melatrons.
- F.** NO.♦ rupture disc block valve is sealed open.

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**G.** The following valves are closed:

- NO.♦ lab sample block valve is closed
- NO.♦ lab sample P-nut valve is closed

**H.** The following cooling water block valves are open:

- P&E CONDENSER COOLING WATER RETURN TO STORM DRAIN
- P&E CONDENSER COOLING WATER SUPPLY VALVE

**6.2.13** ENSURE lube oil skid is running according to Section **6.1**.

**6.2.14** **If either** of the following is illuminated, **then** depress PG-N2 COMPRESSOR No. ♦ PERMISSIVE START on old P&E panel **until** light is extinguished **and** ensure NO. ♦A P&E BOOSTER “LO” LUBE OIL PRESS amber light on ACR P&E panel in ACR is extinguished.

- PG-N2 COMPRESSOR No. ♦ “EXTREME LO” LUBE OIL PRESSURE LUBE OIL BLOCK VALVE CLOSED on old P&E panel
- NO. ♦A P&E BOOSTER “EXTREME LO” LUBE OIL PRESSURE LUBE OIL BLOCK VALVE CLOSED red light on P&E panel in ACR

**NOTE:**

Step **6.2.15** may be performed in conjunction with Steps **6.2.16** through **6.2.21**.

**6.2.15** Ensure lube oil is supplied to bearings as follows:

- A.** DSLO-1 is fully open **and** lube oil regulator is adjusted to achieve **7.5 to 8.5 psig** as read on DSLO-PI-13.
- B.** DSLO-6 and DSLO-8, lube oil Getz fittings, are adjusted to **20 to 40 drops per minute**.
- C.** Flow is observed in the drain line through DSLO-F12 bulls-eye.

**6.2.16** Check VIBRATION MONITORING SYSTEM cabinet for DUAL SPEED P&E PUMP NO. ♦A as follows:

- A.** **If** MONITOR POWER (green light) is extinguished, **then** contact FLM for further instructions.
- B.** **If** CELL TRIP HI FREQ or LO FREQ (red light) is illuminated, **then** perform the following:
  - 1.** Place toggle switch TRIP SUPPLY to down position, **then** return to up position.
  - 2.** Depress TRIP ENABLE button **and** confirm TRIP ENABLED (amber light) is illuminated.

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- C. **If** TRIP ENABLED (amber light) is extinguished, **then** depress TRIP ENABLED button **until** TRIP ENABLED light illuminates.

**6.2.17** **If** starting No. 1 compressor, **then** perform the following:

- A. Ensure the following on ACR control panel are in the CLOSE position:
- EEB-1, No. 1 compressor inlet valve
  - EEB-5, No. 1 compressor outlet valve
  - EEB-7, No. 1 compressor bypass outlet valve
  - Trickle Valve (HV-142) Controller CLOSED **or** on “0” divisions
- B. Ensure HV-106(1), No. 1 compressor recycle valve, on ACR control panel, is adjusted to **30** divisions **or** less as read on HIC-106-1. (The instrumentation is reverse acting. Thirty divisions is the equivalent of 70 percent open.)

**6.2.18** **If** starting No. 2 compressor, **then** perform the following:

- A. Ensure the following on ACR control panel are in the CLOSE position:
- EEB-2, No. 2 compressor inlet valve
  - EEB-6, No. 2 compressor outlet valve
  - EEB-8, No. 2 compressor bypass outlet valve
- B. Ensure HV-106(2), No. 2 compressor recycle valve, on ACR control panel, is adjusted to **30** divisions **or** less as read on HIC-106-2. (The instrumentation is reverse acting. Thirty divisions is the equivalent of 70 percent open.)

**6.2.19** **If** starting No. 3 compressor, **then** perform the following:

- A. Ensure the following on ACR control panel are in the CLOSE position:
- EEB-3, No. 3 compressor inlet valve
  - EEB-6, No. 3 compressor outlet valve
  - EEB-9, No. 3 compressor outlet valve
- B. Ensure HV-106(3), No. 3 compressor recycle valve, on ACR control panel, is adjusted to **30** divisions **or** less as read on HIC-106-3. (The instrumentation is reverse acting. Thirty divisions is the equivalent of 70 percent open.)

**6.2.20** Ensure AUTOMATIC SEAL FLOOD toggle switch on ACR control panel is in MANUAL.

**6.2.21** Place SEAL FLOOD switch on ACR control panel in the ON position.

**6.2.22** Ensure all unnecessary personnel are clear of the area in which the compressor is to be started.

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**WARNING:**

During compressor motor start-up, a rotating equipment hazard and the potential for an equipment failure exist. Personnel are advised to stand clear of the compressor motor during start-up.

- 6.2.23 **While** in contact with operator on cell floor, place PUMP ♦A-L switch on ACR control panel in START **until** ammeter indication stabilizes, **then** release.
- 6.2.24 Ensure a **minimum** of **one** operator remains in building **while** compressor(s) are running.
- 6.2.25 Monitor started compressor(s) for abnormal conditions (e.g. pressures, temperature, vibration, oil flows) for a **minimum** of **5 minutes**.
- 6.2.26 Ensure lube oil pressure is **7.5 to 8.5 psig** as read on DSLO-PI2.
- 6.2.27 Confirm a **minimum** of **600 RPM** as read on DUAL SPEED TACHOMETER with DUAL SPEED PUMP RPM selector switch in PUMP No. ♦ position on ACR control panel **and/or** that pump motor loads have stabilized.
- 6.2.28 Place SEAL FLOOD switch on ACR control panel in OFF.
- 6.2.29 Monitor started compressor(s) pressure for a **minimum of 10 minutes**.
- 6.2.30 **If** started compressor(s) pressure has risen **greater than 0.30 psia/hr**, **then** contact FLM for further instructions.

### 6.3 Operation of Compressors in Low Speed Mode

#### Facility Operations Personnel

- 6.3.1 Ensure Section 6.2 has been performed for compressor(s) to be used.
- 6.3.2 Ensure Shift Coordinator has approved evacuation and discharge of material.
- 6.3.3 Line up discharge header **and** evacuation route to P&E station according to CP4-OP-1121, *Cascade Valve and Leak Rating Operations*.
  - Document valves to be used as discharge point block valve and system evacuation block valve in Remarks section of CP4-OP-1121-F01, *Valve Line-Up Sheet*.
  - Perform header leak rate according to CP4-OP-1121.

**NOTE:**

Appendix D, *Dual Speed P&E Valve Line-up*, can be used in obtaining the correct valve line-up for various compressor configurations.

- 6.3.4 Perform applicable lineup from Appendix D, *Dual Speed P&E Valve Line-up*, for desired compressor configuration.

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- 6.3.5 Open discharge point block valve identified in Remarks section of the CP4-OP-1121-F01 completed in Step 6.3.3.
- 6.3.6 Open system evacuation block valve identified in Remarks section of the CP4-OP-1121-F01 completed in Step 6.3.3.
- 6.3.7 Evacuate system as follows:

- A. **If** evacuating a system that has been charged with ClF<sub>3</sub> and/or F<sub>2</sub>, **then** ensure Laboratory personnel have sampled system **and** confirm results for combined ClF<sub>3</sub> and F<sub>2</sub> concentration is **less than 8 mole %**.

TSR  
5.6.9.1

**NOTE:**  
 The compressor inlet valve is a 12 inch gate valve and provides poor throttle control. Because of this, it may be required to pinch closed other valves that are open in the flowpath in order to reduce the pressure to the suction valve thereby providing better control of evacuation rate.

- B. Slowly open/adjust the following compressor inlet valve **and** any other valves used for control to obtain desired evacuation rate:
  - **If** using No. 1 compressor **and** it is desired to use the trickle valve for greater flow control, **then** HV-142, TRICKLE VALVE may be used in lieu of EEB-1, No. 1 compressor inlet.
  - **If** using No. 1 compressor, **then** EEB-1.
  - **If** using No. 2 compressor **without** No. 1 compressor, **then** EEB-2.
  - **If** using No. 3 compressor **only**, **then** EEB-3.

**CAUTION:**  
 Opening HV-106(♦) too quickly can result in motor load exceeding **20 AC AMPERES** which can cause damage to the compressor motor.

- C. Slowly adjust HIC-106(♦) on ACR control panel **until one** of the following occur:
  1. Valve is a maximum **80 divisions** as read on HIC-106-♦ (The instrumentation is reverse acting. Eighty divisions is the equivalent of 20 percent open.),

**OR**

  2. Motor load is stable as read on PUMP ♦A-L meter.
- D. Monitor No. ♦ compressor discharge temperature.
- E. **If** No. ♦ compressor discharge temperature reaches **385°F**, **then** perform the following:
  1. Close the following compressor inlet valve:
    - **If** using No. 1 compressor, **then** EEB-1 and HV-142 trickle valve.

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- **If** using No. 2 compressor **without** No. 1 compressor, **then** EEB-2.
  - **If** using No. 3 compressor **only**, **then** EEB-3.
2. Place PUMP ♦A-L in TRIP.
  3. Contact FLM for further instructions.
- F.** **If** desired to switch P&E discharge points, **then** perform the following:
1. Close the following compressor inlet valve:
    - HV-142 and/or trickle valve.
    - **If** using No. 1 compressor, **then** EEB-1.
    - **If** using No. 2 compressor **without** No. 1 compressor, **then** EEB-2.
    - **If** using No. 3 compressor **only**, **then** EEB-3.
  2. Adjust HIC-106(♦) on ACR control panel to between **0 and 50 divisions**.
  3. Line up header to be used for compressor discharge according to CP4-OP-1121.
    - Document valve to be used as discharge point block valve in Remarks section of CP4-OP-1121-F01, *Valve Line-Up Sheet*.
    - Perform leak rate of any headers added to valve lineup according to CP4-OP-1121.
  4. Open discharge point block valve identified in Remarks section of the CP4-OP-1121-F01 completed in Step **6.3.7.F.3**.
  5. Go to Step **6.3.7.B**.

#### **6.4 Operation of Compressors in High Speed Mode**

- 6.4.1** Ensure No.♦ compressor(s) has been running in low speed mode for a **minimum 30 minutes**.
- 6.4.2** Ensure Shift Coordinator has approved evacuation and discharge of material.

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NOTE:

Appendix E, *Dual Speed P&E Valve Line-up*, can be used in obtaining the correct valve line-up for various compressor configurations.

**6.4.3** If discharge and evacuation routes **NOT** already aligned, **then** perform the following:

- A. Line up discharge header **and** evacuation route to P&E station according to CP4-OP-1121, *Cascade Valve and Leak Rating Operations*.
  - Document valves to be used as discharge point block valve and system evacuation block valve in Remarks section of CP4-OP-1121-F01, *Valve Line-Up Sheet*.
  - Perform leak rate of headers according to CP4-OP-1121.
- B. Perform applicable lineup from Appendix D, *Dual Speed P&E Valve Line-up*, for desired compressor configuration.
- C. Open discharge point block valve identified in Remarks section of the CP4-OP-1121-F01 completed in Step **6.4.3.A**.
- D. Open system evacuation block valve identified in Remarks section of the CP4-OP-1121-F01 completed in Step **6.4.3.A**.

**6.4.4** Ensure the following compressor inlet valve is closed:

- **If** using No. 1 compressor **and** it is desired to use the trickle valve for greater flow control, **then** HV-142, TRICKLE VALVE may be used in lieu of EEB-1, No. 1 compressor inlet.
- **If** using No. 1 compressor, **then** EEB-1.
- **If** using No. 2 compressor **without** No. 1 compressor, **then** EEB-2.
- **If** using No. 3 compressor **only**, **then** EEB-3.

**6.4.5** Ensure AUTOMATIC SEAL FLOOD toggle switch on ACR control panel is in MANUAL.

**6.4.6** Place SEAL FLOOD switch on ACR control panel in ON.

NOTE:

Steps **6.4.7** through **6.4.9** may be performed simultaneously on all pumps needed to be started.

**6.4.7** Place PUMP ♦A-L switch on ACR control panel in TRIP.

**6.4.8** Ensure the following compressor outlet valve is open:

- **If** using NO. 3 compressor, **then** EEB-9.
- **If** using NO. 2 compressor **without** NO. 3 compressor, **then** EEB-8.

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- **If using NO. 1 compressor only, then EEB-7.**

**6.4.9** Place PUMP ♦A-H switch on ACR control panel in START.

**6.4.10** **When** RPM stabilizes as read on DUAL SPEED P&E TACHOMETER with PUMP RPM selector switch in PUMP No. ♦ position on ACR control panel **or after a minimum of 15 seconds, then** place SEAL FLOOD switch in OFF.

**6.4.11** Evacuate system as follows:

- A.** **If** evacuating a system that has been charged with  $\text{ClF}_3$  and/or  $\text{F}_2$ , **then** ensure Laboratory personnel have sampled system **and** confirm results for combined  $\text{ClF}_3$  and  $\text{F}_2$  concentration is **less than 8 mole %**.

TSR  
5.6.9.1

**NOTE:**

The compressor inlet valve is a 12 inch gate valve and provides poor throttle control. Because of this, it may be required to pinch closed other valves that are open in the flowpath in order to reduce the pressure to the suction valve thereby providing better control of evacuation rate.

- B.** Slowly open/adjust the following compressor inlet valve **and** any other valves used for control to obtain desired evacuation rate:
- **If** using No. 1 compressor **and** it is desired to use the trickle valve for greater flow control, **then** HV-142, TRICKLE VALVE may be used in lieu of EEB-1, No. 1 compressor inlet.
  - **If** using No. 1 compressor, **then** EEB-1.
  - **If** using No. 2 compressor **without** No. 1 compressor, **then** EEB-2.
  - **If** using No. 3 compressor **only, then** EEB-3.

**CAUTION:**

Opening HV-106(♦) too quickly can result in motor load exceeding **47 AC AMPERES** which can cause damage to the compressor motor.

**C.** Slowly adjust HIC-106(♦) on ACR control panel **until one** of the following occur:

1. Valve is a maximum **80 divisions** as read on HIC-106-♦ (The instrumentation is reverse acting. Eighty divisions is the equivalent of 20 percent open.),

**OR**

2. Motor load is stable as read on PUMP ♦A-H meter.

**D.** Monitor No. ♦ compressor discharge temperature.

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E. **If** No. ♦ compressor discharge temperature rises at a rate of **30°F** or greater per minute **when** operating above **300°F**, OR compressor discharge temperature reaches **385°F**, **then** perform the following:

1. Close the following compressor inlet valve:

- **If** using No. 1 compressor, **then** EEB-1 and HV-142 TRICKLE VALVE.
- **If** using No. 2 compressor **without** No. 1 compressor, **then** EEB-2.
- **If** using No. 3 compressor **only**, **then** EEB-3.

2. Place PUMP ♦A-H in TRIP for each pump to be tripped.

3. **If** desired to place compressor in low speed mode, **then** perform the following:

a) **When one** of the following occurs place PUMP ♦A-L switch on ACR control panel in START:

- DUAL SPEED P&E TACHOMETER with PUMP RPM selector switch in PUMP No. ♦ position is reading **less than 720 RPM**.

**OR**

- **If** DUAL SPEED P&E TACHOMETER is **NOT** working, **60 to 70 seconds after** pump trip.

b) Ensure the following compressor outlet valve is closed:

- **If** using NO. 3 compressor, **then** EEB-9.
- **If** using NO. 2 compressor **without** NO. 3 compressor, **then** EEB-8.
- **If** using NO. 1 compressor **only**, **then** EEB-7.

4. Contact FLM for further instructions.

**6.4.12** **If** placing compressors back in low speed mode, **then** perform the following:

A. Close the following compressor inlet valve:

- **If** using No. 1 compressor, **then** EEB-1 and HV-142 TRICKLE VALVE.
- **If** using No. 2 compressor **without** No. 1 compressor, **then** EEB-2.
- **If** using No. 3 compressor **only**, **then** EEB-3.

B. Ensure AUTOMATIC SEAL FLOOD toggle switch on ACR control panel is in MANUAL.

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- C. Place SEAL FLOOD switch on ACR control panel in ON.
- D. Place PUMP ♦A-H switch on ACR control panel in TRIP for each pump to be tripped.
- E. **When one** of the following occurs, **then** place PUMP ♦A-L switch on ACR control panel in START:
  - DUAL SPEED P&E TACHOMETER with PUMP RPM selector switch in PUMP No. ♦ position is reading **less than 720 RPM**.

**OR**

  - **If** DUAL SPEED P&E TACHOMETER is **NOT** working, **60 to 70** seconds **after** pump trip.
- F. Ensure the following compressor outlet valve is closed:
  - **If** using NO. 3 compressor, **then** EEB-9.
  - **If** using NO. 2 compressor **without** NO. 3 compressor, **then** EEB-8.
  - **If** using NO. 1 compressor **only**, **then** EEB-7.
- G. Place SEAL FLOOD switch on ACR control panel in OFF.

## 6.5 Taking Compressor Off-line

- 6.5.1 Close the following compressor inlet valve:
  - **If** using No. 1 compressor, **then** EEB-1 and HV-142 TRICKLE VALVE.
  - **If** using No. 2 compressor **without** No. 1 compressor, **then** EEB-2.
  - **If** using No. 3 compressor **only**, **then** EEB-3.
- 6.5.2 Adjust HIC-106(♦) on ACR control panel to **between 0 and of 50 divisions**.
- 6.5.3 **When** directed by FLM, **then** isolate compressor(s) as follows:
  - A. Close all valves in OPEN position on Appendix D, *Dual Speed P&E Valve Line-up*, for applicable compressor configuration.
  - B. Isolate headers no longer required for use.

## 6.6 Compressor Shutdown

- 6.6.1 Ensure Section 6.5 has been completed to take compressor(s) off-line.
- 6.6.2 Ensure AUTOMATIC SEAL FLOOD toggle switch on ACR control panel is in MANUAL.
- 6.6.3 Place SEAL FLOOD switch on ACR control panel to the ON position.
- 6.6.4 Place PUMP ♦A-L or PUMP ♦A-H switch, as applicable, in TRIP for each pump to be tripped.

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**6.6.5** After a **minimum** of **one minute**, place SEAL FLOOD switch on ACR control panel in OFF.

**6.6.6** If desired to isolate oil to compressor **and after** No. ♦ compressor has been tripped for a **minimum** of **10** minutes, **then** perform the following:

**A.** Place NO.♦A P&E BOOSTER EMERG. SHUTDOWN & CLOSE LUBE OIL BLOCK VALVE switch on ACR control panel in EMERG.

**B.** **When** the following illuminate, **then** release NO.♦A P&E BOOSTER EMERG. SHUTDOWN & CLOSE LUBE OIL BLOCK VALVE switch **and** ensure switch returns to NORMAL:

- NO. ♦A P&E BOOSTER “LO” LUBE OIL PRESS amber light
- NO. ♦A P&E BOOSTER “EXTREME LO” LUBE OIL PRESSURE LUBE OIL BLOCK VALVE CLOSED red light

## **7.0 ACCEPTANCE CRITERIA**

None

## **8.0 POST PERFORMANCE WORK ACTIVITIES**

None

## **9.0 RECORDS**

### **9.1 Records Generated**

The following records may be generated by this procedure:

CP4-OP-0208-F01, C-337 *DSP&E Data Sheet*

### **9.2 Records Disposition**

The records are to be maintained in accordance with CP3-RD-0010, *Records Management Process*.

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## Appendix A – Acronyms/Definitions

### ACRONYMS

**ADP** — Automatic Data Processing

**ClF<sub>3</sub>** — Chlorine Trifluoride

**FLM** — Front Line Manager

**HMI** — Human Machine Interface

**P&E** — Purge and Evacuation

**VFD** — Variable Frequency Drive

### DEFINITIONS

◆ — Denotes compressor number.

**Continuous Monitoring** — An operator stationed at equipment or assigned full-time to walk down a group of panels. For the purpose of this procedure, the maximum number of pumps are those which are on a single panel or on multiple panels which are connected.

**Leak Rate** — A change in pressure over a specified period of time in an isolated section of piping and/or equipment.

**Lites** — Lite gas contaminants (air, nitrogen (N<sub>2</sub>), fluorine (F<sub>2</sub>), chlorine trifluoride (ClF<sub>3</sub>), etc.) in the UF<sub>6</sub> process gas stream.

**Proper Operation** — Functioning without abnormal affects (i.e. excessive noise, vibration, or deformation).



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### **Appendix B – Lube Oil Skid Information (Continued)**

Due to the shutdown of the Cascade building lube oil systems, a different system had to be added to provide lube oil to the DSP&E compressors during operation. The lube oil skid is a platform which has been designed and placed between Unit 2 Cell 2 panel and the C-337 R-114 station on the ground floor. The system contains a 300 gallon lube oil storage tank with installed heater, two variable frequency drive (VFD) pumps, two filters, and two VFD forced air cooled heat exchangers. The system is controlled through a Human Machine Interface (HMI) and is designed to operate automatically to maintain required operating parameters (pressure and temperature).

Normally, the pumps and the fans (for the heat exchangers) will be selected to the Auto position on the HMI. In this configuration, the system will automatically control one pump and one heat exchanger and their associated automatic valves. The pump and heat exchanger controlled will be determined from the last ones used. The system automatically selects the pump and heat exchanger opposite the ones that were running last, unless this feature is disabled in the programming (to disable this feature, Engineering will need to be contacted). If for some reason the normally selected pump/heat exchanger is unavailable, the HMI would start the backup pump/fan to maintain operation. The pump speed and heat exchanger fan speed will be automatically controlled by the HMI to maintain the inputted pressure and temperature setpoints. The HMI will also control the lube oil tank heater as necessary to maintain the tank temperature.

In addition to automatic operation, the HMI allows the pumps/fans to be placed in Hand position. This will cause the pump/fan selected to run continuously, regardless of other alignments. In this position, the VFD would operate at a predetermined speed, and automatic control of pressure and temperature would no longer occur. Hand operation can be selected by depressing the desired component button (HX101, HX201, P101, P202) on the HMI home screen and then selecting the desired configuration for the components on its individual HMI screen.

By depressing the Setup button on the HMI home screen, adjustments to the pressure and temperature setpoints can be performed. By depressing the desired parameter to adjust, the desired value can be entered. By depressing the Main button on this screen, the HMI will take you back to the home screen.

The lube oil tank heater is capable of heating the oil to extreme temperatures. Due to this, a heater high limit was installed. The HEATER HIGH LIMIT controller on the LUBE OIL SKID operating panel displays the temperature the heater is running at. If the temperature reaches a predetermined setpoint, the HMI will shut down the heater. If this fails, the HEATER HIGH LIMIT controller will shut down the heater at 185°F. In order to reset the heater high limit, the Reset button on the controller will need to be depressed.

Another safety feature installed on the lube oil skid is an EMERGENCY STOP pushbutton. Depressing this button will shut down all equipment on the skid. Power to the lube oil skid can also be shut down by opening the disconnect switch on the LUBE OIL SKID operating panel or at the power supply.

To start up the lube oil skid, the oil heater should first be energized to heat the oil to the desired setpoint (usually between 115 to 125°F). With oil in the tank heated to the desired temperature, the Start Circulation button on the HMI is depressed to start up the system. In automatic operation, the HMI will cause the applicable pump to start and its associated block valve and the selected heat exchanger automatic block valve to open. The heater in the lube oil tank will operate as necessary to maintain the oil temperature at its setpoint (+/- 5°F). If lube oil line temperature reaches its setpoint, the selected fan will start and maintain the desired operating temperature of the lube oil.

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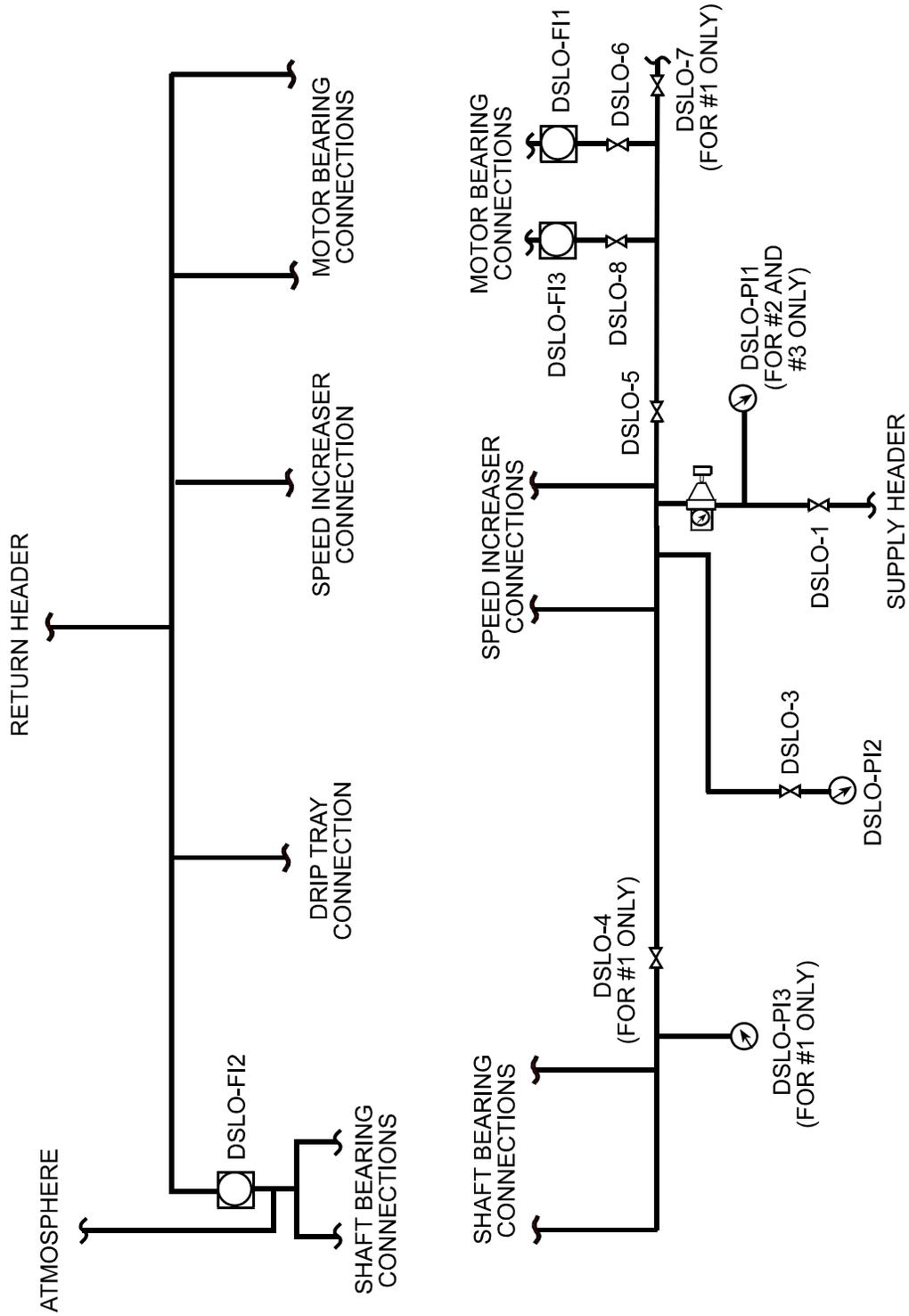
### **Appendix B – Lube Oil Skid Information (Continued)**

The HMI will display alarms received by the system. The most recent alarm will be displayed on the red bar on the top of the HMI screen. The alarm page can be accessed by depressing the red strip at the top of the page. The system only displays alarms visually – there is no audible indication of an alarm. The following is a list of alarms that can come in on the HMI:

- Low-Low Oil Level
- High Lube Oil Discharge Pressure
- Low Lube Oil Level
- Valve 101 Fault
- Valve 102 Fault
- Valve 201 Fault
- Valve 202 Fault
- VFD1 Fault
- VFD 2 Fault
- VFD 3 Fault
- VFD 4 Fault
- Lube Oil Temperature High

The Low-Low Oil Level and High Lube Oil Discharge Pressure alarms will cause the lube oil skid to shut down.

**Appendix C – Typical Dual Speed P&E Station Lube Oil Diagram**



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### Appendix D - Dual Speed P&E Valve Line-up

#### No. 1 compressor

Valve Number	Valve Description	Position
HV-142	TRICKLE VALVE	CLOSE
EEB-1	No. 1 compressor inlet	CLOSE
EEB-4	No. 1 compressor bypass	CLOSE
EEB-2	No. 2 compressor inlet	CLOSE
EEB-6	No. 2 compressor outlet	CLOSE
<b>EEB-7</b>	<b>No. 1 compressor bypass outlet</b>	<b>OPEN</b>
EEB-8	No. 2 compressor bypass outlet	CLOSE
EEB-5	No. 1 compressor outlet	CLOSE
EEB-3	No. 3 compressor inlet	CLOSE
EEB-9	No. 3 compressor outlet	CLOSE

#### No. 2 compressor

Valve Number	Valve Description	Position
HV-142	TRICKLE VALVE	CLOSE
EEB-1	No. 1 compressor inlet	CLOSE
<b>EEB-4</b>	<b>No. 1 compressor bypass</b>	<b>OPEN</b>
EEB-2	No. 2 compressor inlet	CLOSE
EEB-6	No. 2 compressor outlet	CLOSE
EEB-7	No. 1 compressor bypass outlet	CLOSE
<b>EEB-8</b>	<b>No. 2 compressor bypass outlet</b>	<b>OPEN</b>
EEB-5	No. 1 compressor outlet	CLOSE
EEB-3	No. 3 compressor inlet	CLOSE
EEB-9	No. 3 compressor outlet	CLOSE

**Appendix D - Dual Speed P&E Valve Line-up (Continued)**

**No. 3 compressor**

<b>Valve Number</b>	<b>Valve Description</b>	<b>Position</b>
HV-142	TRICKLE VALVE	CLOSE
EEB-1	No. 1 compressor inlet	CLOSE
<b>EEB-4</b>	<b>No. 1 compressor bypass</b>	<b>OPEN</b>
EEB-2	No. 2 compressor inlet	CLOSE
EEB-6	No. 2 compressor outlet	CLOSE
EEB-7	No. 1 compressor bypass outlet	CLOSE
EEB-8	No. 2 compressor bypass outlet	CLOSE
EEB-5	No. 1 compressor outlet	CLOSE
EEB-3	No. 3 compressor inlet	CLOSE
<b>EEB-9</b>	<b>No. 3 compressor outlet</b>	<b>OPEN</b>

**No. 1, 2, and 3 compressors**

<b>Valve Number</b>	<b>Valve Description</b>	<b>Position</b>
HV-142	TRICKLE VALVE	CLOSE
EEB-1	No. 1 compressor inlet	CLOSE
EEB-4	No. 1 compressor bypass	CLOSE
<b>EEB-2</b>	<b>No. 2 compressor inlet</b>	<b>OPEN</b>
<b>EEB-6</b>	<b>No. 2 compressor outlet</b>	<b>OPEN</b>
EEB-7	No. 1 compressor bypass outlet	CLOSE
EEB-8	No. 2 compressor bypass outlet	CLOSE
<b>EEB-5</b>	<b>No. 1 compressor outlet</b>	<b>OPEN</b>
EEB-3	No. 3 compressor inlet	CLOSE
<b>EEB-9</b>	<b>No. 3 compressor outlet</b>	<b>OPEN</b>

**Appendix D - Dual Speed P&E Valve Line-up (Continued)**

**No. 1 and 2 compressors**

<b>Valve Number</b>	<b>Valve Description</b>	<b>Position</b>
HV-142	TRICKLE VALVE	CLOSE
EEB-1	No. 1 compressor inlet	CLOSE
EEB-4	No. 1 compressor bypass	CLOSE
<b>EEB-2</b>	<b>No. 2 compressor inlet</b>	<b>OPEN</b>
EEB-6	No. 2 compressor outlet	CLOSE
EEB-7	No. 1 compressor bypass outlet	CLOSE
<b>EEB-8</b>	<b>No. 2 compressor bypass outlet</b>	<b>OPEN</b>
<b>EEB-5</b>	<b>No. 1 compressor outlet</b>	<b>OPEN</b>
EEB-3	No. 3 compressor inlet	CLOSE
EEB-9	No. 3 compressor outlet	CLOSE

**No. 2 and 3 compressors**

<b>Valve Number</b>	<b>Valve Description</b>	<b>Position</b>
HV-142	TRICKLE VALVE	CLOSE
EEB-1	No. 1 compressor inlet	CLOSE
<b>EEB-4</b>	<b>No. 1 compressor bypass</b>	<b>OPEN</b>
EEB-2	No. 2 compressor inlet	CLOSE
<b>EEB-6</b>	<b>No. 2 compressor outlet</b>	<b>OPEN</b>
EEB-7	No. 1 compressor bypass outlet	CLOSE
EEB-8	No. 2 compressor bypass outlet	CLOSE
EEB-5	No. 1 compressor outlet	CLOSE
EEB-3	No. 3 compressor inlet	CLOSE
<b>EEB-9</b>	<b>No. 3 compressor outlet</b>	<b>OPEN</b>

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**Appendix D - Dual Speed P&E Valve Line-up (Continued)**

**No. 1 and 3 compressors**

<b>Valve Number</b>	<b>Valve Description</b>	<b>Position</b>
HV-142	TRICKLE VALVE	CLOSE
EEB-1	No. 1 compressor inlet	CLOSE
EEB-4	No. 1 compressor bypass	CLOSE
EEB-2	No. 2 compressor inlet	CLOSE
EEB-6	No. 2 compressor outlet	CLOSE
EEB-7	No. 1 compressor bypass outlet	CLOSE
EEB-8	No. 2 compressor bypass outlet	CLOSE
<b>EEB-5</b>	<b>No. 1 compressor outlet</b>	<b>OPEN</b>
<b>EEB-3</b>	<b>No. 3 compressor inlet</b>	<b>OPEN</b>
<b>EEB-9</b>	<b>No. 3 compressor outlet</b>	<b>OPEN</b>

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**CP4-OP-0208-F01 – C-337 DSP&E DATA SHEET**

**Date:** \_\_\_\_\_

Place (✓) if reading is within range or a circled (X) if reading is not within range.

<b>Lube Oil Skid</b>	<b>1900-0700</b>			<b>0700-1900</b>		
Lube Oil Skid Pressure 20 – 30 psig						
Lube Oil Skid Temp. 115°F – 125°F						
Filter Differential Press. ≤ 10 psi						
<b>DSP&amp;E Pumps</b>	<b>No. 1</b>	<b>No. 2</b>	<b>No. 3</b>	<b>No. 1</b>	<b>No. 2</b>	<b>No. 3</b>
Pump Bearing Oil Press. 7.5 – 8.5 psig						
Motor Drip (Comp. End) 20 – 40 drops/min.						
Motor Drip (Motor End) 20 – 40 drops/min.						
<b>Operator</b>  (Signature/Badge No.)						
<b>FLM</b>  (Signature/Badge No.)						

\* Lube Oil Skid Pressure as read from the HMI screen.