1. Purpose

A. **To provide instructions for the following operations of the Two Stage CL_2 Compressor:**

1. **Pre-Start Lube System Check**
2. **Compressor Start-Up**
3. **Compressor Shutdown**
4. **Compressor Testing**

B. **Field Operators and Console Operators are responsible for the performance of this procedure.**

C. **If All 3 of the Chlorine compressors are shutdown, the 12-inch Cl2 gas outlet valves on the Dry Mist Eliminators, XV1541035 (Diaphragm) and/or XV3541057 (Membrane) will CLOSE as well as XV2561049 to Liquefaction.**

2. Safety and Health Hazards

Review Safety Data Sheet and Brine Recovery PPE Requirements for:

- **Chlorine – (CL2) BKV-1558**
- **Perchloroethylene Liquid – (Perchlor) BVK-1250**
- **Nitrogen (N2) – BKV-1191**

Safety Equipment:

A. **An SCBA is required, as well as the normal safety gear.**

Other Hazards:

A. **Failure to check facemask for leakage, after donning SCBA, could result in inhalation of toxic or inert gas concentrations. Removal of the SCBA facemask in an Enclosure could be life threatening.**

NOTE: DONNED SCBA means wearing the SCBA, air cylinder turned on, with a full facemask donned and air flowing (not just having the SCBA accessible or air-pack on one's back without wearing the facemask).

B. Chlorine gas exposure can cause minor to severe respiratory issues. Strict adherence to guidelines in SDS for handling of Chlorine is required.

Items Required:

- **Use the following Qualtrax documents:**
  - **Brine Recovery PPE Matrix #114696**
  - **Brine Recovery Chemical Hazards List #114545**

3. Safety Systems

Safety Systems ID and Description	
V-1811; V-3816	**Caustic Spray Tower and Packed Tower:** The Process Scrubber is the safety system designed to neutralize excessive chlorine during upset conditions to prevent a potential release to the atmosphere.
Ambient Area Chlorine Monitors	Multiple chlorine monitors are located internal to the Brine Plant for detection of chlorine in the atmosphere during isolated upset conditions.
Enclosure Chlorine Monitors: AI-1931-69; 72; 70; 73; 35; 35; 71; 74	Multiple chlorine monitors located inside the chlorine compressor enclosure for detection of chlorine leaks inside the enclosure.
V-1511; V-3511	**Chlorine Header Seals**: The chlorine seals are the primary safety systems for the Cell Lines. The seals are relief devices designed to prevent overpressure or excessive vacuum conditions in the chlorine header during compressor upsets, etc.

Safety Systems ID and Description	
GCs: AI-1571-091; 092; 093; 094; 095; 096 App: AI-2343-050A/66A; AI-2575-15B/31A; AI-2575-49B/31C	**Hydrogen in Chlorine Analyzers:** Measures amount/concentration of hydrogen in the chlorine stream.
PLC Hard-wired Shutdown Interlocks	The chlorine compressor PLC contains numerous switches and settings that will automatically shutdown the compressor should abnormal running conditions be experienced.
PC-3341-116; PDI-3341-117; (Membrane Line) PC-1511-01C (Diaphragm Line) Software Interlocks	DCS software interlocks designed to shutdown both diaphragm and membrane rectifiers should the chlorine header pressures exceed the safe operating limits.
Chlorine Knockout Pot Level Devices: ~~Transmitters:~~ LI3571014 - Radar; ~~LI3571064; &~~ LI3571066 – Nuclear LSH3571016 – (Level High Switch)	Detects a HIHI liquid chlorine level in the Chlorine Knockout Pot and triggers the interlock to shutdown the chlorine compressors and initiate Process Scrubber Emergency Scrub function.

4. Initial Start-up

See Startup Following Turnaround or Emergency Shutdown

5. Normal Operations

A. Prerequisites

Initials	Prerequisites	Keypoint/Notes
	1. None	

B. Acceptance Criteria, Operating Limits, Consequences of Deviation and Steps Taken to Avoid Deviation

WARNING: Deviation from this procedure could result in the release of toxic material, injury or death to personnel, damage to equipment or an environmental non-conformance.

Measured Parameter	Limit Description	Consequence of Deviation	Actions Taken to Correct or Avoid Deviation
Suction Temp. **TI-3561-02, 1ST stage TI-3561-37, 2nd stageTI-2562-57/TI-2561-57**	75 to 90° F Target Value=80° F	**Low temperature:** if moisture is present then chlorine hydrate can form which will plug piping. **Too high:** reduces compressor Capacity.	**Too high:** Check operation of Titanium Cl2 Coolers and Drying Towers.
Discharge Temp. **TI-3561-10, 1st stage/TI-3561-40, 2ND stage TI-2562-69/TI-2561-69**	160° to 260° F Target Value=230° F to 245° F	**Too low:** not a problem. **Too high:** provides extra load on Cooler and Liquefaction. Very high temps in excess of 400°F can cause a chlorine iron fire.	**Too high:** If "A, B or C" compressor, check Perchlor Filter differential for dirty/plugged filter. Check suction Temp, if high, THEN refer to above. If temperature is trending up quickly or approaches 400°F then shut the compressor down.
Oil Pressure **PI-3561-44**	15 to 30 psig 25 to 35 psig Target Value=25 psig to 30 psig	**Too low:** indicates pump or filter problems. **Too high:** indicates oil is cold or internal relief valve problems.	**Too high:** Check oil filters D/P, If high; refer to section on filter problems. Aux. Oil pump is running and filter D/P is OK, notify Team Lead.
Oil Level	1/4 to ¾ full Target Value=1/2 full	**Too Low:** could result in possible equipment damage.	**Too Low:** Notify Team Lead AND/OR Maintenance Lead ASAP.

Measured Parameter	Limit Description	Consequence of Deviation	Actions Taken to Correct or Avoid Deviation
Oil temperature **TI-3561-45**	+90° - 135°F Target Value=> 90° F	**Too Low:** The compressor will not run if the oil temperature low alarm is made.	**Too Low:** Check oil heater to ensure it's operational. Contact maintenance for assistance if necessary. **Too High:** Turn off oil heater.
Oil Filter Differential **PDI-3561-45**	1 to 9 psid Target Value=2 psid	**Too high:** filter possibly dirty.	**Too low:** verify filters are not bypassed. **Too high:** Check position of filter switching valve. If D/P is high, switch filter and write work request.
N2 Filter Differential **PDI-3561-125**	Hi: 5 psig HiHi: 10 psig Target= <5 psig	**Too high:** Filter may restrict N2 flow to compressor seals causing them to heat up. Filter may also have such a pressure drop that the supply nitrogen pressure is less than the discharge pressure of the 2nd stage of K3561A, which will allow Cl2 to interface with the seal.	**Too high**: Utilize the spare filter by swapping the filter handle to the other side. Complete this slowly, as one must avoid swinging the seal system by valving in too much N2 at once. Slowly = 30 seconds from online filter to the spare filter
"A" Comp Discharge Press. **P1-3561-71, 1st stage & P1-3561-78, 2nd stage**	8 to 10 psig 18 to 30 psig Target Value= 9 psig 26.0 psig	**Too low:** control valve problems or machine in surge. **Too high:** Liquefaction problems. 20 for 1st stage and 38 for 2nd stage.	**Too high:** Check system pressure control valve and compressor for surge condition. Check Liquefier temperature and level.

Measured Parameter	Limit Description	Consequence of Deviation	Actions Taken to Correct or Avoid Deviation
L5-PDI-3561-119 Differential Pressure Transmitter for Chlorine Compressor, L5-K-3561'A' 1st Stage	8 – 14 psig Target Value=12 psig	Pressure too high will affect the compressor seal system.	Open system pressure valves in Liquefaction to lower pressure.
L5-PDI-3561-120 Differential Pressure Transmitter for Chlorine Compressor, L5-K-3561'A' 2nd Stage	15 - 20 psig Target Value=18 psig	Pressure too high will affect the compressor seal system.	Open system pressure valves in Liquefaction to lower pressure.
NOTE: If the compressor has been locked out for maintenance then contact a maintenance person to verify the proper nitrogen l flow on the compressor seals prior to starting up the compressor.			
"A" Comp. N2 Seal Pressure PI-3561-11 & 30	Range .5 to 8 psig Target Value=1.0 psig	**Low:** 0 psig, Cl2 Compressor will shutdown.	**High**: 10 psig - Verify the Cl2 compressor discharge pressure is normal. Inform maintenance of potential compressor seal gas issues and potential for Cl2 to get into the compressor seal and cause equipment damage. Verify there no Cl2 at the breather vent. If Cl2 is present, Shutdown the online Cl2 Compressor.

Measured Parameter	Limit Description	Consequence of Deviation	Actions Taken to Correct or Avoid Deviation
"A" Comp.1st stage N2 Seal Pressure PDI-3561-08 & -27	Range 15 to 35" WC Target Value= 28" WC	**Low Low:** 5" WC, Cl2 Compressor will shutdown.	**Low:** 10" WC - Verify the Cl2 compressor discharge pressure is normal. Inform maintenance of potential compressor seal gas issues and potential for Cl2 to get into the compressor seal and cause equipment damage. Verify there no Cl2 at the breather vent. If Cl2 is present, Shutdown the online Cl2 Compressor. To raise PDI, decrease Cl2 flow through the compressor.
"A" Comp. 2nd stage N2 Seal Pressure PDI-3561-14 & -32	Range 25-30" WC Target Value= 28" WC	**Low Low:** 5" WC, Cl2 Compressor will shutdown.	**Low:** 10" WC – Verify the Cl2 compressor discharge pressure is normal. Inform maintenance of potential compressor seal gas issues and potential for Cl2 to get into the compressor seal and cause equipment damage. Verify there is no Cl2 at the oil breather vent. If Cl2 is present, Shutdown the online Cl2 Compressor. To raise PDI, decrease Cl2 flow through the compressor.
"B & C" Comp Discharge Press. **PI-2561-42** **P1-2562-42**	Range 8 to 10 psig Target Value= 9 psig	**Too low:** control valve problems or machine in surge. **Too high:** Liquefaction problems.	**Too high:** Check system pressure control valve and compressor for surge condition. Check Liquefier temperature and level.

Measured Parameter	Limit Description	Consequence of Deviation	Actions Taken to Correct or Avoid Deviation
Discharge/After Cooler **TI-3561-82, TI-2561-44, & TI-2561-47**	Range 200 to 260° F 80 to 90° F Target Value=225° F 85° F	**Low temp** difference **or high** outlet temperature indicates Cooler fouling.	Check Perchlor pump and filter D/P.
Cl2 gas outlet valves on the Dry Mist Eliminators – XV-1541-35 (Dia.) & XV-3541-57 (Mem.).	CLOSED when all 3 Cl2 Compressors are shutdown. Target Value= OPEN BEFORE starting a Cl2 Compressor.	If All 3 of the Chlorine compressors shutdown, the 12-inch Cl2 gas outlet valves on the Dry Mist Eliminators, XV-1541-35 (Diaphragm) and/or XV-3541-57 (Membrane) will CLOSE as well as XV-2561-49 to liquefaction.	Open prior to startup.
Nitrogen Jacket Purge from CL2 Compressors to CL2 Liquefaction **FI-2561-136**	Target = 8 SCFM Operating Range 5 to 10 SCFM	If AI-1931-76 (Cl2 Al in Liq.) alarms, then there is a potential piping integrity issue with the core pipe allowing Cl2 to get into the N2 Jacket.	Low flow alarm at 3 SCFM: Adjust flow in the field to return to flow target. Notify Team Lead. Investigate potential leak source.

Measured Parameter	Limit Description	Consequence of Deviation	Actions Taken to Correct or Avoid Deviation
Cl2 K.O. Pot V3582 Level Devices ~~Transmitters~~ **Radar Transmitter LI3571014** **~~LI3571064~~** **Nuclear Transmitter LI3571066** **Level High Switch LAH3571016** **~~NOTE:~~** ~~Operations will use a selector switch to insure that the on-line transmitter is selected for the interlock function.~~	Level Transmitters Target < 5% Level Operating Limits <5% Level HI Alarm: 5% HIHI Alarm: 10% Interlock Trip: 50% Level **SWITCH** will Alarm on DCS if high chlorine liquid level is detected. **SWITCH** is also tied to the interlock functions.	**INTERLOCK**: ~~A level of 50% will trip the interlock function on the Cl2 K.O. Pot and~~ **2** out of the **3** level devices must reach a **TRIP** state (Transmitters **≥50%,** Switch **made**) to initiate the interlock that will shutdown all 3 Cl2 compressors **AND** put the Process Scrubber in Emergency Scrub. **HIHI Alarm:** Activates alarm re-ring timer for every 10 minutes the level remains above 10%. High chlorine liquid level in V3582 and/or shutdown of all 3 compressors could potentially result in a chlorine release affecting the environment and personnel in the surrounding area.	**HI Alarm** - 5% if the K.O. Pot level starts to quickly increase in level then, verify the Cl2 Flash Tank and Cl2 Bullet vent lines to the K.O. Pot are not iced up, indicating that the vessel/tank is full, and that vessel outlet valves are open in the field. **HIHI Alarm/Interlock Function:** Check K.O. Pot for ice on the outside of the vessel. The cell lines may have to be shut down

Measured Parameter	Limit Description	Consequence of Deviation	Actions Taken to Correct or Avoid Deviation
~~**Cl2 K.O. Pot V3582 Level High Switch LAH3571016**~~	~~Alarms Only~~	~~**LAH3571016:** This switch will only alarm on the DCS if it detects a high liquid chlorine level in the Knockout Pot.~~	~~**NOTE:** The Level High Switch was interlocked per/TMOC BRI 090-2017. The TMOC was CLOSED on 5/31/2018 and the interlocked removed from the Level Switch.~~

C. Procedure

Instrument Tag	Engineering Units	Description	Setpoint Normal Operation	Normal Operating Range	
			Expected Setpoint	Hi	Lo
Included in Consequence of Deviation Table, Section 5B.					

Initials	Procedure Steps	Keypoint/Notes
	A. Preparing "A" Chlorine Compressor for Maintenance:	
NOTE: Cl_2 WORK PRACTICE required for this section.		
	1. VERIFY that the following valves on the suction of the 1st Stage are tightly CLOSED. LOCKOUT following:	
	A. The 12-inch suction valve.	
	B. The 8-inch discharge valve.	
	2. VERIFY that the following valves on the suction of the 2nd Stage are tightly CLOSED. LOCKOUT following:	

Initials	Procedure Steps	Keypoint/Notes
	A. The 8-inch valve from the CL_2 Compressor Discharge Cooler (**E-2562**).	
	B. The two 8-inch valves from the CL_2 Compressor After cooler (**E-3562**).	
	C. The 8-inch valve from the Compressor Intercooler (**E-3560**).	
	3. VERIFY that the 8-inch valve on the line from the discharge of the 2^{nd} Stage to the CL_2 Compressor After cooler (**E-3562**) is tightly CLOSED. LOCKOUT these valves:	
	A. CLOSE AND LOCKOUT the Nitrogen purge valves.	
	B. CLOSE valves for Nitrogen to compressor internal seals AND LOCKOUT the valves.	
	C. CLOSE AND LOCKOUT the valve to the CL_2 Compressor After cooler (**E-3562**).	
	4. LOCKOUT the electrical breaker in MCC.	
	5. If isolation of the oil system is required, PERFORM the following:	
	A. CLOSE suction and discharge valves for Auxiliary Oil pumps, (**P-3562A/B**) AND LOCKOUT the valves.	*Only close valves and lockout if working on this piping.*
	B. LOCKOUT electrical breaker for both pumps in MCC.	
	6. Team Lead to NOTIFY maintenance that machine is ready for repairs.	
	B. Compressor Testing on Nitrogen (if Required):	

Initials	Procedure Steps	Keypoint/Notes
	1. Notify Console Operator to perform the following:	
	A. Place inlet guide vane controllers (HC-3561-03 & HC-3561-19) in manual and set at 25% Open.	
	B. Open K-3561A 1st and 2nd stage discharge vent valves (HV-3561-72A & HV-3561-81A) to 100% Open.	
	2. Field Operator to perform the following:	
	A. Don SCBA and check fit, enter the Compressor enclosure and verify the 12" suction valve to the suction of the 1st stage (piping upstairs) is CLOSED.	
	B. Insure the 8" ball valve on the discharge of "A" compressor is CLOSED (piping upstairs).	
	C. OPEN the 1" nitrogen purge valves on the 1st and 2nd stage headers to approximately 50% on each.	
	D. When ALL interlocks are clear and a "Ready" light indicates a start can be initiated by the Console operator.	
	E. The Console Operator will slowly CLOSE the HV-3561-72A and HV-3561-81A simultaneously at 5% intervals to start slowly building discharge pressure on the 1st and 2nd stage.	

Initials	Procedure Steps	Keypoint/Notes
	F. When the discharge pressure reads approximately 7 to 10 psig, then STOP Closing the valves.	
	G. The two stage Cl2 Compressor is now running on nitrogen to the Vent Header.	

D. Normal Operating Tasks

1. Chlorine Area Operator will don a SCBA once each week and check the oil level of each compressor as well as listen for any unusual noise or vibration.
2. Console Operator will monitor the flow, amps and overall setup of all running Cl2 compressors.

6. Temporary Operations

Temporary Operations require a TMOC.

7. Normal Shutdown

A. Prerequisites

Initials	Prerequisites	Keypoint/Notes
	1. SCBA trained.	
	2. Enclosure entry trained.	

B. Acceptance Criteria, Operating Limits, Consequences of Deviation and Steps Taken to Avoid Deviation

WARNING: Deviation from this procedure could result in the release of toxic material, injury or death to personnel, damage to equipment or an environmental non-conformance.

See COD Table under Normal Operations

C. Procedure

Initials	Procedure Steps	Keypoint/Notes
	A. Compressor Shutdown:	
NOTE: This section assumes "A" compressor is running as well as either "B" or "C" compressor.		
	1. Field Operator: DON SCBA, CHECK face fit, AND ENTER the Chlorine Compressor Piping Enclosure, ESTABLISH communication with Console Operator AND REQUEST notification when the Compressor is to be stopped.	
	2. WHEN Console Operator provides notification that compressor has been stopped, THEN:	*The following steps should be done quickly to minimize upset of single stage compressor.*
	A. OPEN "B"/"C" discharge valve to Liquefiers. Valve is located in top of piping enclosure.	
	B. CLOSE "B"/"C" discharge valve to **K-3561A** 2nd stage suction. Valve is located in top of piping enclosure.	
	C. CLOSE 12-inch block valve to the inlet of **K-3561A, 1st Stage**.	
	D. CLOSE **K-3561A** discharge ball valve to Liquefiers. Valve is located in top of piping enclosure.	
	3. VERIFY suction and discharge valves on compressor to be purged are tightly CLOSED to ENSURE Nitrogen does not bleed into Chlorine System.	

Initials	Procedure Steps	Keypoint/Notes
	4. REQUEST Console Operator to OPEN **HV-3561-81A** and **HV-3561-72A** to vent header to 20-40%. DCS screen **C531**.	
	5. **Very SLOWLY** OPEN the 1-inch Nitrogen addition valves located in the Piping Enclosure (upstairs), until a minimal flow of Nitrogen can be **audibly** detected flowing through the 1st and 2nd stages of the Compressor.	
	6. If compressor is NOT shutdown for maintenance, THEN ENSURE Lube oil system is still operating and Nitrogen seal face purges are at operating parameters (3 to 7 SCFM) to allow for a 'Quick Start' of compressor when necessary, OTHERWISE, PREPARE compressor for maintenance.	

8. Emergency Shutdown

NOTE: Operating technicians who have completed their training requirements and are documented as being qualified or certified to operate this process area, have authority to initiate an emergency shutdown of that process and equipment per approved and documented Emergency Shutdown procedures.

See Normal Shutdown

9. Emergency Operations

See Normal Operations

10. Startup Following Turnaround or Emergency Shutdown

A. Prerequisites

Initials	Prerequisites	Keypoint/Notes
	A. Preliminary Actions:	
	1. None	
	B. Personnel Requirements:	
	1. ENSURE that at least one Field Operator, one Console Operator AND a Team Lead are available to perform this procedure.	
	C. Tools, Equipment, and Supplies:	
	1. Hand Held Radio.	
	2. Hand Tools and a Flashlight.	
	D. Field Preparations:	
	1. Each Field Operator to NOTIFY Console Operator to PLACE their name on Chlorine Compressor Enclosure in accordance with Qualtrax #1481 “ENCLOSURE ENTRY POLICY”.	
	2. ENSURE sufficient Scrubber charges are in the Vent Scrubber (minimum of 15% Caustic on Vent Scrubber).	
	3. Team Lead RECONCILE with Maintenance Lead that all Work Orders initiated for Chlorine System are completed AND all locks and piping blinds are removed.	
	4. If the compressor has been locked out for maintenance then contact a maintenance person to verify the proper nitrogen l flow on the compressor seals.	
	5. Operator to VERIFY that the main electrical breaker for the compressor is “CLOSED” at MCC.	

Initials	Prerequisites	Keypoint/Notes
	6. ENSURE Oil heaters are "ON" especially during the winter moths per Atlas Copco recommendations: - The oil reservoir temp should be 140 degrees F., bearing supply temp should be 120 degrees F. and bearing drain temp should be 150 degrees F.	
	7. Verify nitrogen purge is turned on the jacketed pipe from CL2 Compression to CL2 Liquefaction and nitrogen flow has been established.	

B. Acceptance Criteria, Operating Limits, Consequences of Deviation and Steps Taken to Avoid Deviation

WARNING: Deviation from this procedure could result in the release of toxic material, injury or death to personnel, damage to equipment or an environmental non-conformance.

See COD Table under Normal Operations

C. Procedure

Initials	Procedure Steps	Keypoint/Notes
	A. Pre-Start Lube System Check:	
	1. DON SCBA AND CHECK face fit, THEN ENTER Compressor Enclosure.	
	2. VERIFY instrument air is valved in for all instrumentation.	
	3. REMOVE all loose material, such as tools, rags, and loose parts, from the compressor area.	
	4. CHECK Lube oil reservoir level.	

Initials	Procedure Steps	Keypoint/Notes
	A. Oil should be at the FULL mark on the reservoir sight-glass. If not, NOTIFY maintenance before PRECEDING any further.	
	5. CHECK motor bearing Lube oil level using sight glass.	*Located on both ends of the motor.*
	6. VERIFY the block valves for Main Lube Oil Pump (**P-3561**) are OPEN.	
	7. VERIFY the block valves on suction and discharges for Auxiliary Lube Oil Pumps (**P-3562A/B**) are OPEN.	
NOTE: 3-way valves for Oil Coolers and Filters are designed so that one of the units is on-line at all times with the other on stand-by, as determined by pointer indicator.		
	8. POSITION the 3-way valve for the Oil Coolers to allow flow of oil through the selected Cooler (**E-3564A** or **E-3564B**).	
	9. VERIFY the 2-inch block valves on cooling water supply and return for selected Oil Cooler (**E-3564A** or **E-3564B**) are OPEN.	
	10. POSITION the 3-way valve to allow oil flow through Oil Filter (**F-3561A** or **F-3561B**).	
	11. VERIFY the 6-inch block valves on the Perchlor inlet and outlet lines of the CL_2 Compressor After cooler (**E-3562**) are OPEN.	*Located in compressor enclosure.*
	12. Verify the 4-inch block valve on the Perchlor outlet of the CL2 Intercooler **(E-3560)** is OPEN.	*Located in piping enclosure.*
	13. At the Local Panel outside the enclosure, PLACE the hand switch for selected Auxiliary Oil Pump in “AUTO” Position to start the Pump.	

Initials	Procedure Steps	Keypoint/Notes
	14. CHECK the Lube Oil System for leaks and proper pressures outside as well as inside the Enclosure.	
	15. When satisfied that pressures are in the normal range, AND THEN NOTIFY Console Operator that the Lube oil system and Perchlor system is ready.	*Normal operating pressure range is 25 - 35 psig.*
	B. Compressor Start-Up:	
NOTE: THIS SECTION ASSUMES THAT NO COMPRESSORS OR CELL LINES ARE RUNNING.		
	1. NOTIFY Console Operator to perform the following:	
	A. PLACE Inlet Guide Vane Controllers (**HC-3561-03** and **HC-3561-39**) in "MANUAL" AND SET vanes at 20% OPEN.	*Located on DCS screen **C531** or **C530**.*
	B. OPEN **K-3561A** 1st and 2nd stage discharge vent valves (**HV-3561-72A** and **HV-3561-81A**) to 20%.	*Used for purging inerts out of the system during startup. Located on DCS screen **C531**.*
	C. Using the hand switch **HS-1571-63** (hard wired in the Control room), PLACE the Liquefaction isolation valve (**XCV-1571-61**) in "NORMAL" position, AND VERIFY valve is OPEN.	
	D. **OPEN** the Cl2 gas outlet valves on the Dry Mist Eliminators, **XV-1541-35** (Diaphragm) and/or **XV-3541-57** (Membrane).	*If **all** 3 of the Chlorine compressors are shutdown, DCS interlock will **CLOSE** XV-1541-35 (Diaphragm) and XV-3541-57 (Membrane).*

Initials	Procedure Steps	Keypoint/Notes
	E. **OPEN XV-2561-49** on the discharge of the chlorine compressors to Liquefaction.	*If **all** 3 of the Chlorine compressors are shutdown DCS interlock will **CLOSE** XV-2561-49.*
	F. PLACE **PV-3561-01** in "MANUAL" AND **OPEN** suction header pressure control valve from 75% to 100%.	*Located on DCS screen **C531** or **C530**.* *During start-up conditions, recycle valve position is critical so the compressor(s) will not starve for flow and go into a "surge" condition.*
	G. PLACE **FV-3561-86, K-3561A** 2nd stage recycle valve in "MANUAL" and **OPEN** from 75% to 100%.	*Used to keep 2nd stage out of "surge" condition during startup. Located on DCS screen **C531** or **C530**.*
	H. OPEN **PC-1511-01C** to approximately **50%**.	
	I. OPEN dump valve (**HC1574-48** if the FES is valved in or **HC2571-69** if the Frick is valved in) approximately **75%**.	

Initials	Procedure Steps	Keypoint/Notes
	J. **OPEN** compressor recycles approximately 75% to 100% on **C530**.	***ZV-1511-01, PV-1511-01B, FV-3561-86, PV-3561-01, & ZC-3561-96.*** *During start-up conditions, recycle valve position is critical so the compressor(s) will not starve for flow and go into a surge condition.*
	2. Field Operator: DON SCBA AND CHECK face fit, THEN ENTER the Compressor Enclosure to PERFORM the following:	
	A. CHECK compressors oil level.	
NOTE: If the compressor has been locked out for maintenance then contact a maintenance person to verify the proper nitrogen flow on the compressor seals.		
	B. VERIFY Nitrogen supply to the following:	
	1) CL2 Compressor (**K-3561A**) first and second stages dry face seals.	*Need to check seal N2 flows **FI-3561-11, FI-3561-24, FI-3561-16, and FI-3561-34.***
NOTE: Bypass around 2nd Stage A to B Nitrogen flow indicator should be OPEN for proper function of the nitrogen seal on the 2nd stage.		
	2) Inlets guide vane housing. Also ENSURE block valve on top of vent header in compressor enclosure is OPEN.	*Need to check Inlet guide vane rotometers for adequate flow.*
	3) All control cabinet purges are car-sealed **OPEN**.	*One cabinet is located on the south side of K3561A; two cabinetsare on the west end of K3561A.*

Initials	Procedure Steps	Keypoint/Notes
	C. VERIFY Auxiliary Oil Pump hand switch, located on local PLC panel, is in "AUTO" position and pump is running.	*Discharge pressure should operate near 30 psig. During the colder months of the year the Oil Heaters will need to be turned on to get the oil temp up to the operating level.*
NOTE: It is very important that the Oil Temperature is at a minimum of 90 degrees F. before starting the Compressor. This is interlocked and the compressor will not "START" until this temp is met.		
	D. Go to MCC room and RESET Loadtrak if the TRIP light is lit.	***The compressor will not start if the Loadtrak trip light is lit.***
	E. VERIFY all interlocks for start-up of **K-3561A** are satisfied as indicated by ready signal at local PLC panel.	***A "READY" signal will be sent from the PLC to the DCS when all PLC interlocks are satisfied.***
	F. VERIFY Perchlor System valved in and operating.	
	G. PROCEED Upstairs to the compressor Piping Enclosure AND NOTIFY Console Operator of intent to valve in the compressor, THEN:	
	1) ENSURE 8" block valve from 1st/2nd stage discharge to vent scrubber is OPEN in piping enclosure.	*This valve should remain open at all times to allow N2 from inlet guide vanes to remain on purge.*

Initials	Procedure Steps	Keypoint/Notes
	2) CLOSE or VERIFY 1-inch Nitrogen purge block valves to suction of **K-3561A, 1st Stage & 2nd Stage.**	*N2 valves are located in piping enclosure near N2 regulators.*
	Proceed downstairs into A Compressor Enclosure for the following steps:	
	3) OPEN or VERIFY the 8-inch block valve from the 1st stage discharge into the 2nd stage suction in compressor enclosure.	*Valve is located onvalve tree on east wall of A Compressor Enclosure*
	4) VERIFY 8" ball valve on discharge of 2nd stage of **K-3561A** to the Liquefiers is **OPEN**.	*Valve is located onvalve tree on east wall of A Compressor Enclosure*
	5) ENSURE the 1st stage recycle valve for testing valve is **CLOSED** in compressor enclosure.	*Valve is located on valve tree on east wall of A Compressor Enclosure*
	6) VERIFY 8" suction butterfly valve in compressor enclosure allowing discharge for "B" and/or "C" discharge to enter **K-3561A** 2nd stage suction is OPEN.	*Valve is located on valve tree on east wall of A Compressor Enclosure*
	7) ENSURE the 2nd stage recycle valve for testing valve is CLOSED.	*Valve is located on valve tree on east wall of A Compressor Enclosure*

Initials	Procedure Steps	Keypoint/Notes
	8) ENSURE upstream and downstream block valves around the 2nd stage recycle control valve station are OPEN and the bypass is CLOSED in compressor enclosure. Also OPEN 4” ball valve on discharge of control valve station to 2nd stage suction line in compressor enclosure.	*FV-3561-86*
	9) ENSURE upstream and downstream block valves around the suction pressure control valve station are OPEN and the bypass is CLOSED in the piping enclosure. Also OPEN 4” ball valve downstream of control valve station in piping enclosure. Also OPEN 4” ball valve downstream of control valve station at the suction header.	*PV-3561-01* *Valve is located just inside the DOWNSTAIRS door of Piping Enclosure.*
-	10) **OPEN** or **VERIFY** open 8” ball valve on inlet to **K-3561A** After cooler, **E-3562** in DOWNSTAIRS Piping Enclosure.	
	Proceed upstairs into Piping Enclosure for the following steps:	
	11) **OPEN K3561A** 12” butterfly valve on the suction of the 1st Stage	*Valve is located on north end of upstairs piping enclosure and is wheel operated.*

Initials	Procedure Steps	Keypoint/Notes
	12) Slowly **OPEN** 8" ball valve in piping enclosure on outlet of **K-3561A** to the Liquefiers.	*Valve is located in piping enclosure on south end facing the Lexan window into C Compressor Enclosure.*
	13)Slowly **OPEN** 8" suction ball valve in piping enclosure-allowing discharge for "B" and/or "C" discharge to enter **K-3561A** 2nd stage suction.	*At this point, CL2 from the "B"/"C" discharge will be fed into the 2nd stage of **K-3561A**. This is used to purge inerts from the **K-3561A** machine.*
	14) VERIFY closed or CLOSE the 8" discharge valve from B/C Compressor to Liquefaction.	*Valve is located in piping enclosure on south end*
	H. NOTIFY Console Operator to ISSUE a "RUN" for **K-3561A**.	***K-3561A can only be started from the DCS.***
	I. MONITOR Compressor suction header pressure (**PC-3561-01**), 1st Stage discharge pressure (**PI-3561-52**), 2nd Stage discharge pressure (**PI-3561-53**), and total gas flow through each stage (**FI-3561-94** and **FI-3561-86**) on Graph **C531**, AND ADJUST as needed to avoid surge conditions.	***Use Graph C530 to compare flows for all compressors. All 1st stage machines need to operate at similar flow rates in order to keep one machine from taking too much flow from the other. Adjust inlet guide vanes to help balance flow rates. The manual recycle around the 1st stage of K-3561A may need to be adjusted.***

Initials	Procedure Steps	Keypoint/Notes
NOTE: As system pressure builds, the Frick & FES units will have to be unloaded. At low production rates, it may become necessary to either totally unload the FES OR Frick units, or to take one down. Freon levels may also have to be lowered.		
	J. MONITOR Chlorine System pressure on **PC-1571-55** and valve position on **HC-1571-48** (DCS screen **C542**); ADJUST pressure to MAINTAIN 20 PSIG.	
	K. GRADUALLY CLOSE vent valves **HV-3561-81A** and/or **HV-3561-72A** DCS screen **C531**, AND ADJUST **PC-1571-55** on DCS screen **C542** to return Chlorine system pressure to control point.	
C. Starting "A" Compressor on the Fly:		
NOTE: This section assumes either B or C Cl2 Compressor is running and at least one cell line.		
	1. DON SCBA and NOTIFY Console Operator of intent to enter compression enclosure.	
	2. If lube system is not running then PERFORM Pre-Start Lube Stem Check section of this procedure.	
	3. PLACE auxiliary oil pump in auto and VERIFY oil temp is at least 90°F.	
	4. VERIFY oil level in compressor.	
	5. VERIFY Perchlor coolers **E-3560** and **E-3562** are valved in.	
	6. VERIFY N2 gas on compressor seals are valved in.	
	7. VERIFY block valves around **PV-3561-01**, **ZC-3561-96** and **FV-3561-86** are open.	

Initials	Procedure Steps	Keypoint/Notes
	8. SLOWLY CLOSE the N2 purge.	
	9. CLOSE **XV-3561-72A** and **XV-3561-81A** to Vent Scrubber.	
	10. VERIFY 1st stage recycle "test" valve is cracked open.	*This valve is located inside A compression.*
	11. OPEN guide vanes on first and second stage to 50%.	
	12. OPEN 2nd stage recycle **FV-3561-86** to 100%.	
	13. VERIFY A compressor is racked in the MCC and ESTOP is not made.	
	14. VERIFY all interlocks are cleared and all common alarms and DCS permissives are clear.	
	15. VALVE IN the compressor by:	
NOTE: The following steps should be done quickly to minimize system upset.		
	A. OPEN "A" chlorine compressor 12-inch suction valve to the first stage.	*Valve is located on north end of upstairs piping enclosure and is wheel operated.*
	B. OPEN "A" compressor 8-inch valve to liquefaction.	*Valve is located in piping enclosure on south end facing the Lexan window into C Compressor Enclosure.*
	C. OPEN B and C to 2nd stage of "A" compressor valve.	*Valve is located in piping enclosure on south end*
	D. CLOSE B and C to liquefaction valve.	*Valve is located in piping enclosure on south end*

Initials	Procedure Steps	Keypoint/Notes
	16. NOTIFY Console Operator to start compressor.	

11. Post-Performance Activities

Initials	Post-Performance Activities	Keypoint/Notes
	1. CONTINUE purging Compressor until Compressor is ready to be returned to service.	
	2. If necessary, INITIATE work orders for any repair or replacement parts that may be needed.	
	3. NOTIFY Console Operator to REMOVE your name(s) from the Chlorine Compressor Enclosure in accordance with #1481, "BRINE RECOVERY ENCLOSURE ENTRY POLICY".	
	4. RETURN SCBA to its proper storage area in a clean and dry condition.	
	5. REPORT AND VERIFY that any deficiencies encountered during the performance of this SOP are resolved.	

12. Records

A. **DOCUMENT time AND actions taken in Control Room Log Book in accordance with #1166, "BRINE RECOVERY LOG BOOK".**

13. References

A. **USE:**

1. #1166, "BRINE RECOVERY LOG BOOK".
2. #1481, "ENCLOSURE ENTRY POLICY".

3. #1211, “HANDLING UPSETS WITH CHLORINE COMPRESSOR”.
4. **Atlas Copco Operation Manuals.**

B. **SOURCE:**

1. **EFD L-5D-2561**
2. **EFD L-5D-2562**
3. **EFD L-5D-3561/1**
4. **EFD L-5D-3561/2**
5. **EFD L-5D-3562/2**

14. Attachments

~~None~~

15. Upon Completion of This Course, The Trainee Will Be Able To:

A. **Startup and shutdown the Two-Stage Chlorine Compressor.**

16. Equipment Overview

Equipment Number:	DCS Designation:	Description:
L5-P-3561	P-3561	MAIN LUBE OIL PUMP
L5-P-3562A/B	P-3562A/B	AUXILIARY LUBE OIL PUMPS
L5-E-3564A/B	E-3564A/B	CL_2 COMPRESSOR OIL COOLERS
L5-F-3561A/B	F-3561A/B	CL_2 COMPRESSOR OIL FILTERS
L5-F-3561	F-3561	Cl2 Compressor Seal N2 Filter
L5-E-3560	E-3560	CL_2 COMPRESSOR INTERCOOLER
L5-E-3562	E-3562	CL_2 COMPRESSOR AFTERCOOLER

L5-E-3563	E-3563	PERCHLOR COOLER
L5-K-3561A	K-3561A	CHLORINE COMPRESSOR

17. Prerequisite Courses

None

18. Troubleshooting

None