APPENDIX G – COMPRESSED NATURAL GAS SYSTEM OPERATIONS

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G.1 NORMAL STARTUP

To conduct normal startup, proceed as follows:

1. Open the supply from Southwest Gas (V-101) and activate AOV-102.
   a. Open one filter (V-105/V-108 or V-109/V-112), with the other filter line closed and filter drains closed.
   b. Verify that the SWG supply pressure is 30 psi (PI 104 and PI 118).
   c. Verify that the blowdown filter is set to drain.
2. Open the by-pass supply to Gemini V-119 and V-18.
3. Gemini discharge valve configuration:
   a. Open V-19, -20, -20A.
   b. Valve into operation one set of coalescening filters:

      Open V-21 and V-22 and Close V-23 and V-24

      Or Close V-21 and V-22 and Open V-23 and V-24.
4. Open V-25 at fill and dispenser cabinet 1.
5. Optional the booster blower or Hy-Bon compressor:
   a. Open the suction valve to the booster compressor (V- 116) and booster compressor discharge valve V-120.
   b. Go to electric panel HB; put breaker 7 to ON, local disconnect to ON at Hy-Bon compressor.
   c. Start the booster compressor by pushing ON at the compressor; observe discharge pressure at 55 psig.
6. Go to electric panel H1; put switch breaker to ON, local disconnect switched to ON.
7. Go to the Murphy panel; reset the alarm panel, switch key to H (hand) or A (automatic).
   a. When power is first applied to the Murphy panel, there is a power up delay of 30 s. This delay is to ensure that line voltage is within parameters; if there is a momentary loss of power during this delay, the sequence will reset and start over automatically.
   b. The air-operated valve on the Gemini compressor will activate the buffer tank to by-pass.
   c. The compressor inlet valve will open and the compressor will start. The first stage should reach 180 psi immediately.
   d. The Gemini compressor output bypass to the buffer tank will open SV 13.
   e. The compressor starts (run signal failure timer is 5 s, fixed). The hour meter is started after the run signal failure timer expires.
   f. The inlet valve opens SV-14.
   g. The buffer tank blowdown valve closes SV-11 (blowdown timer is 30 s, adjustable).
   h. The compressor output by-pass closes SV-13, and SV-12 opens.

i. The compressor is now running loaded.

j. The blowdown valve (SV-14) will automatically open after 45 minutes (adjustable) for 5 seconds (adjustable), and then close. The blowdown valve will continue to automatically cycle through the compressor operation. While the blowdown valve is open, the Class P shutdowns will be disarmed; when the blowdown valve closes, the Class P timer will time and rearm the Class P shutdowns.

k. The compressor will operate until a Stop signal is initiated at the Murphy panel, or there is an automatic shut down, or the key switch on the Murphy panel is turned to OFF.

l. The Stop signal will initiate the cool-down timer (5 s), as the blowdown valve is opened. The compressor suction inlet closes (time adjustable) with the command to close the blowdown valve. By adjusting these delays, the inlet valve can be closed while the motor is still running, or after the motor stops. The blowdown valve can be closed any time after the motor stops.

To resume operation after an abnormal shutdown, the condition creating the shutdown must be corrected. Then, the system must be reset by turning the OFF/HAND/AUTO from the AUTO or HAND position to the OFF position; wait for at least 2 s, then switch back to AUTO or HAND.

When more than five complete START – STOP cycles occur, a common short-cycle shutdown will initiate (number of cycles is adjustable. High START-STOP cycles usually indicate a leak in the downstream piping.

System parameters under normal and shutdown conditions are shown in Table G-1.

Table G-1. Normal operation.

	Normal	Shutdown
Booster Blower		
Booster suction pressure	30 psi	
Booster discharge pressure	55 psi	
Gemini Compressor		
Oil pressure	45–55 psi	25 psi
Gemini suction pressure	55 psi	30 psi
Gemini suction temperature	80ºF	
Gemini 1st stage discharge pressure	237 psi	Lo 180 psi; Hi 300 psi
Gemini 1st stage discharge temperature	300ºF	
Gemini 2nd stage suction temperature	120ºF	
Gemini 2nd stage discharge pressure	593 psi	Lo 500 psi; Hi 600 psi
Gemini 2nd stage discharge temperature	249ºF	
Gemini 3rd stage suction temperature	120ºF	
Gemini 3rd stage discharge pressure	1674 psi	Lo 1550 psi; Hi 1800 psi
Gemini 3rd stage discharge temperature	266ºF	
Gemini 4th stage suction temperature	120ºF	
Gemini 4th stage discharge pressure	5069 psi	
Gemini 4th stage discharge temperature	277ºF	
CNG compressor discharge temperature	120ºF	
CNG compressor discharge pressure	5000 psi	

G.2 ROUTINE MAINTENANCE

Daily maintenance requirements are as follows:

- Check the Gemini compressor oil level in the sight glass and makeup tank. Add oil as required.
- Check the Gemini lubricator cycle indicator for operation. Adjust as necessary.
- Check the Gemini oil pressure. If it is below 25 psi, shut down the compressor and contact a service representative.
- Check the differential pressure in the natural gas supply filters and blowdown.
- Check each discharge temperature gauge of the Gemini Compressor for abnormal operating temperature. If it is consistently above 325ºF, contact a service representative.
- Check the compressors for oil and gas leaks. If leaks are detected, identify the location, shut down equipment, and repair the leak.
- Check the differential pressure across the compressor outlet filters and blowdown.
- Check for normal operating pressures from each compressor stage and storage tanks.
- Blow down each tank of gas storage as needed.
- Check the differential pressure across dispenser filters and blowdown.

Table G-2 lists the equipment lubrication requirements.

Table G-2. Equipment lubrication.

Equipment Mfg	Model	Lubricant	Quantity
Compressor Gemini	Model HPSS-125 Unit No. 11316 SN C4708 4-stage, 300 cfm	Normal operation: SAE 40 weight, ISO 150 grade rust and corrosion inhibited, anti-wear.	Crankcase: 23 quarts
Compressor Motor U.S. Motors	125 hp, 1760 rpm 480 V, 200 amp, 3 phase SN X783119	Grease:	As required
Blower ac compressor (Hy-Bon Assembly)	Model 8 DB (AC8DB) SN 4002-79606-1 Hy Bon SN 7302	Normal operation: ISO 50 grade, rust and corrosion inhibited	Crankcase 8 quarts
Motor Blower Worldwide Electric Corporation (China)	40 hp, 1775 rpm 480 V, 46 amp, 3 phase TEFC Class F Model WW40 324T	Grease:	As required
Instrument Air Quincy Compressor	Model 0005012D00173 SN 5143613 5 hp, 120-gal storage vessel Duplex 3 phase	0–32 F SAE 10W ISO 32 32–80 F SAE 20 ISO 68 60–104 F SAE 30 ISO 100	1.5-liter each
Motor Instr. Air (2) Baldor	Model EM3218T SN F0103264539 SN F0103264594 5 hp, 480 V 3-phase 6.4 amps	Grease:	As required