Docket No. SA-534

Exhibit No. 2-AJ

NATIONAL TRANSPORTATION SAFETY BOARD

Washington, D.C.

NTSB_033-006
MILPITAS OPERATIONS & MAINTENANCE

(145 Pages)

Operating and Maintenance Instructions

MILPITAS TERMINAL

		6	12-31-09 11-9-09	Added two separators Modify Chromatograph Racks	30604304 30676979	RCB IO	AAR	AAR	
		5	12-31-08 8-30-07	Replaced position transmitters Replaced air compressors	30603997 7055361	AAR		AAR	
Appvd By		4	6-16-04	PLC & SLDC replacement	7040485	MAB	DEB	AAR	
RSR		3	6-8-99	Installed new instrument air piping	7017950				GKR
		2	11-9-98	Updated for Load Center Consolidation Project	7003341	MAB	GKR	JCG	MMW
		1	7-15-91	Issued for use	12	GEG		RSR	RAH
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Supv			Dwg List
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Section 1. General

1.1 Station Authorization

Milpitas Terminal was originally built in 1929 on GM35300 when gas was first brought to the San Francisco Bay Area from the Kettleman Hills gas fields. The Terminal has been expanded over the years as new gas sources were developed, with much of the work being accomplished between 1944 and 1954. GM 12, authorized in 1985, provided for construction of piping, regulation, and metering systems at a new location on the existing property. Additionally, computer-based instrumentation and control systems were installed and a new control building and a maintenance building were constructed.

Project No. P.00057 was approved on Oct. 16, 1996 to fund the Load Center Consolidation Project. Specific Order No. S.O.7003341, which rolled-up to P.00057, provided for moving the Gas Control Operators from Milpitas Terminal to San Jose Gas Control Center. The work at Milpitas funded by this specific order included providing remote setpoint capability for the process loop controllers and remote operation of gas routing valves. Project S.O. 7040485 replaces the PLC and replaces the SLDC 352 with PAC 353 Controllers.

1.2 Intent of Manual

The intent of this manual is to provide a comprehensive description of station operations at Milpitas Terminal. The manual will assist in training new operators and maintenance personnel and will be a reference document to be maintained at the Terminal.

1.3 Responsibilities

1.3.1 Manual

This manual is issued by the PG&E, California Gas Transmission, Gas System Maintenance (GSM) Department headquartered in Walnut Creek, California. At the completion of a change to the Terminal, this manual shall be updated and all affected drawings and documents shall be revised. The Milpitas District Foreman is responsible for the annual review and updating of this manual.

1.3.2 Station Operation and Maintenance

Operation, periodic inspection, testing and maintenance of equipment at Milpitas Terminal, as well as training of maintenance personnel are the responsibility of the Milpitas District Foreman.

1.3.3 Gas Flows and Pressures

Specifying gas flows and pressures within the PG&E transmission system is the responsibility of the Gas Control Center.

1.3.4 Record Keeping

Record keeping at the Terminal is the responsibility of the Milpitas District Foreman.

Section 2. Description of Station

2.1 Purpose of Station

Milpitas Terminal provides the mixing, metering and regulation facilities necessary to control the bi-directional incoming lines (L-300A, L-300B, L-131, and L-107) and the uni-directional outgoing lines (L-101, L-109,L-132, L-100, and the San Jose DFM). The Terminal supplies pressure and BTU controlled gas to the San Francisco peninsula and the San Jose area. Gas can be supplied to the Terminal from either the Line 300 or Line 400 gas transmission systems.

The Terminal is a sub-master station on the Gas Control Supervisory Control Data Acquisition (SCADA) system. The SCADA system provides supervisory control of Irvington Station and Line 300's Line Rupture Control Valves (LRCV) and Pressure Limiting Stations from Milpitas Terminal to valves V-418.88A and V-419.11B. The Terminal is also a maintenance station for GSM's Hollister District.

2.2 Station Location

Milpitas Terminal is located at 66 Ranch Road at the intersection of highways 880 and 237.

2.3 General Description of Station

The station consists of metering and regulating facilities, a control building, a maintenance building, and other facilities necessary for meeting CGT's maintenance and operational needs.

Four mains (incoming lines) are capable of delivering gas to the Terminal and five mains deliver gas from the Terminal to distribution systems in the San Jose area and to the San Francisco Peninsula. Any of four incoming lines may also be backflowed from the Terminal to meet system requirements.

Separators are provided for Lines 300A and 300B to remove any liquids.

Each of the incoming lines has regulation to provide pressure, backpressure and flow control of gas flowing into and out of the Terminal. Lines 300A, 300B, 107 and 131 feed into a header upstream of a second set of regulation (Station Separators). Cross-tie valves are provided upstream of the Station Separators regulation to allow backflow of un-separated gas through the incoming lines.

The regulation consists of three (17, 17R; 21, 21R; 27, 27R) regulator/monitor runs which are fed from the above header, and a bypass regulator/monitor run. The regulation provides flexibility in establishing flow paths through the station, and provides overpressure protection for three of the outgoing lines. Individual regulation is provided for outgoing Line 109 and the San Jose DFM because these lines operate at a lower pressure than the other three outgoing lines.

Gas flow into and out of the station is metered. Flow metering on the incoming bi-directional lines is accomplished using two bi-directional orifice meter runs for each line. Each outgoing (uni-direction) line has a single orifice meter run. Flow through a station bypass line is measured with an insertion turbine meter.

A station bypass is provided to allow gas from any of the incoming lines to feed one or more outgoing lines under abnormal operating conditions. The bypass is equipped with regulation to allow pressure control.

In normal operation, electronic computers and controllers automatically control gas pressures and flows at the Terminal. Process data is stored electronically and automatically transmitted to the Gas Control SCADA system.

Equipment for station control, data display and data transmission is housed in the Control Building. The 6240 sq.ft. Building contains the control room, a computer room, communications and UPS rooms, a technical maintenance shop, offices, a conference room, a crew room, restrooms, a mechanical / electrical equipment room and storage rooms.

The 4700 sq. ft. Maintenance Building contains a maintenance shop with a 2-ton bridge crane, warehouse and storage areas, an office, restrooms, a tool room, a room for the instrument and utility air compressors, and an electric power distribution room. The station power transformer, two emergency generators, and an instrument air receiver are located on concrete pads next to the building.

Other buildings at the site include four transducer/analyzer buildings and one flammable materials storage building. A concrete pad is provided for temporary storage of hazardous materials.

2.4 Station Design Data

Pressure Requirements

The MOPs, MAOPs, DPs and FDPs listed below are representative of the pressure requirements of the lines at the Milpitas Terminal. Pressure requirements may vary along the length of a line.

Description	MOP (psig)	MAOP (psig)	DP (psig)	FDP (psig)
30” Line 131 (From Antioch Terminal via Irvington Station)	590	595	650	650
36” Line 107 (From Tracy Station via Irvington Station)	477	477	500	720
34” Line 300A (From Kettleman Compressor Station)	558	558	676	676
34” Line 300B (From Kettleman Compressor Station)	600	600	669	669
Station Piping	720	720	720	720
36” Line 101 (To San Francisco Div. Gas Load Center)	375	400	400	400
22” Line 109 (To San Francisco Div. Gas Load Center)	375	375	400	400
24” Line 132 (To San Francisco Div. Gas Load Center	375	400	400	400
20” San Jose DFM	200	200	275	400
20” Line 100 (To PLS 7)	400	400	546	400

Flow Requirements

The flows listed below are the maximums and minimums that may occur under possible present and future operating conditions. The maximum flow information was established based on 1972 cold winter historical data (with input from Gas Control) and from Gas System Planning's APD transient analyses.

Each incoming line has two bi-directional orifice meter runs to provide flow measurement. Both orifice meters are required to measure peak flows.

	Maximum Design Flow		**Minimum Design Flow**	
	Flowrate MMSCFH	**Pressure PSIG**	**Flowrate MMSCFH**	**Pressure PSIG**
Line 300A (M-9 & M-10)				
Incoming	34	410	2.0	558
Outgoing	12	400	2.0	558
Line 300B (M-7 & M-8)				
Incoming	36	410	1.0	600
Outgoing	7	400	1.0	600
Line 131 (M-11 & M-12)				
Incoming	31	410	0.5	595
Outgoing	25	400	0.5	595
Line 107 (M-13 & 24" M-14)				
Incoming	29	410	0.5	720
Outgoing	29	400	0.5	600

Uni-directional orifice meters provide flow measurement for the outgoing lines. An insertion turbine meter measures flow in the station bypass line.

	Maximum Design Flow		**Minimum Design Flow**	
	Flowrate (MMscfh)	**Pressure (psig)**	**Flowrate (MMscfh)**	**Pressure (psig)**
Line 101 (M-32)	19.4	400	2.2	400
Line 109 (M-38)	11	375	4.0	400
Line 132 (M-31)	11	400	2.1	400
Line 100 (M-30)	14	400	0.5	400
SJ DFM (M-34)	14	200	0.5	200
Sta. Bypass (M-1)	30	375	0.5	400

Section 3. Station Operations

3.1 Station Operations

References:

California Gas Transmission Standards Manual Gas System Maintenance Emergency Plan Manual

Gas System Maintenance Clearance Procedure Manual

Hazardous Materials Business Plan (HMBP)

Spill Prevention, Control and Countermeasures (SPCC) Plan

Clearance Procedures

Before any work is done at the Milpitas Terminal, clearance must be obtained as required by the Gas Clearance Process Work Procedure WP4100-10.

Logbook

The date and nature of work performed at the Milpitas Terminal must be entered in a logbook located at the Terminal.

3.2 Normal Operating Conditions

In normal operation, the Terminal may be configured to deliver gas through any of the incoming lines to mix with any other incoming flow, backflow into another incoming line, or both mix and backflow. In addition, mixed gas may be routed to backflow into any of the four incoming lines. The only fixed requirement is that mixed, pressure-regulated gas must be supplied to the five outgoing lines.

Under normal conditions, all monitor valves must be in remote automatic control and will be fully open, all metering and regulation block valves will be fully open, and all blowdown valves and station bypass routing valves will be closed. Electronic controllers for the load/trimmer valves must also be in computer automatic control. Refer to section 3.4 Control Modes for further operational details.

3.3 Abnormal Operating Conditions

Taking Equipment Out of Service

Abnormal operating exists when one or more station elements are taken out of service. Station elements taken out of service might include a meter tube, a Station separator, a regulating valve, or an entire line. Any configuration which necessitates operating the station bypass line is also considered an abnormal operating condition.

Removing a station element from operation frequently requires that the element be isolated from the rest of the station, and may require that the element be blown down. Refer to the isolation valve operating procedures (Appendix A) and blowdown system operating procedures (Appendix C) before attempting to remove or blowdown a station element or line.

Outside (Utility) Power Failure

An outside power failure is considered an abnormal operating condition. However, since the Terminal has back-up power systems, an outside power failure alone will not impact the operation of the Terminal.

Two natural gas-fueled generators provide redundant back-up power to the Terminal and will start automatically when an outside power failure is detected. An uninterruptible power supply (UPS) provides continuous power to critical systems during the period between power failure and generator start-up. See Section 14 for details of the UPS.

3.4 Emergency Operating Conditions

Emergency operating procedures in accordance with California Public Utilities Commission General Order 112E and Title 49 of the Code of Federal Regulations (49 CFR), Section 192.615 are outlined in detail in the Emergency Plan Manual issued by the Gas System Maintenance Department. Copies of the Emergency Plan Manual are located at the Terminal.

Emergency operating conditions include any station configuration which becomes necessary in order to bring an emergency under control. It may be necessary to operate the station manually in an emergency. See Appendix A for manual operation procedures. Emergency operating conditions may be reduced to abnormal operating conditions when the emergency has been brought under control.

Emergencies include, but are not limited to the following:

Line Rupture/Fire

Procedures for operating during a line rupture/fire are given in the Emergency Plan Manual, located at the Terminal.

Loss of Instrument Air Pressure

Upon loss of instrument air pressure, the fifteen pneumatically-operated monitor valves within the station will lose automatic control capability and must be operated manually. Refer to Appendix A for manual operating procedures.

Back-up Power Systems Failure

Should both back-up power generators fail to start after an outside power failure, the station must be operated manually. Refer to Appendix A for manual operating procedures.

The UPS battery power will support the SCADA, programmable logic controllers (PLC's), electronic process loop controllers and process transmitters for about 3 hours. The UPS system does not supply power to the electric motor-driven regulating valves. Portable electric generators should be used if outside power or back-up power cannot be restored .

3.5 Control Modes

In normal operation, gas flow through the Terminal is controlled by electric motor-driven regulating valves. The regulating valves PV-28 and PV-29, the station bypass, and L-109 are single control valves. The regulating valves on each meter run on the incoming lines and on each of the inlet legs to the Station Separators header are arranged in load/trimmer sets. The regulator and monitor valves supplying the SJDFM are pilot-operated regulator valves.

Each electric-motor driven regulator is controlled by an electronic Process Automation Controller (PAC) which may operate in either the "Auto" mode or the "Manual" mode. In the "Auto" mode, a PAC controls the valve automatically in response to process variables. With the PAC in "Manual", the valve is positioned by turning a pulser knob located on the faceplate of the PAC.

The PACs are programmed to maintain pressure and/or flow setpoints established by the Gas Control Center operators. PV-29 regulator PAC is programmed to control downstream pressure for flow in either direction through the bypass. PACs for the Station Separators header regulators, outgoing line regulators and the station bypass regulator are programmed to provide downstream pressure control for one direction only. PACs for the incoming line regulators are programmed to provide both pressure and flow

control when gas flows into or out of the terminal. Pressure control on the incoming lines includes both downstream pressure and backpressure control.

The PACs for the regulators on the incoming lines are programmed to control the valves on the basis of the lowest output of the three control loops (pressure, backpressure and flow), i.e., the loop which requires the valve to be open the least.

The meter runs for the incoming lines (L300A, L300B, L131, & L107) are controlled individually, but each pair of meter runs operates in a lead/lag arrangement. The parallel regulator set for outgoing L109 also operates in a lead/lag arrangement. (The parallel pilot-operated regulator set for the SJDFM also operates in a lead/lag arrangement, but the setpoints of the regulators cannot be changed remotely.)

One meter run on each incoming line is selected by the Operator as the lead run. The other run is then the lag run. In normal operation, the lag run remains closed until its additional capacity is required. To accomplish this, the lag run necessarily operates with a lower (for downstream pressure control) or higher (for backpressure control) PAC setpoint than the lead run.

In downstream pressure control, the setpoints of the lead and lag runs are offset by an operator-selectable value, the lead/lag differential. Downstream pressure setpoints entered by the Operator for a specific line are sent directly to the lead run PACs by the PLC (programmable logic controller). The setpoints for the lag run PACs are calculated in the PLC by subtracting the lead/lag differential from the Operator's downstream pressure setpoint entries. The PLC then sends the lag run setpoints to the lag run PACs. In downstream pressure control, the lag run opens only if the lead run cannot maintain the line pressure above the lag run's control setpoint.

In backpressure control, the setpoints of the lead and lag runs are also offset by an operator-selectable value, the lead/lag differential. Backpressure setpoints entered by the Operator for a specific line are sent directly to the lead run PACs by the PLC. The setpoints for the lag run PACs are calculated in the PLC by adding the lead/lag differential from the Operator's backpressure setpoint entries. The PLC then sends the lag run setpoints to the lag run PACs. In backpressure control, the lag run opens only if the lead run cannot maintain the line pressure below the lag run's control setpoint.

The lead/lag differential should not be set below 5 PSI. Since the lead and lag control valves operate in parallel, they should have a setpoint difference of at least 5 PSI to give each of them room to operate. Otherwise, the lead and lag control loops may fight each other and the valves could continually cycle open and closed. This could yield poor pressure control and result in accelerated valve wear.

NOTE

In pressure control, the PLC limits the differential pressure across the orifice in both the lead and lag runs to 230 inches water column. This limitation should be considered when selecting a lead/lag differential.

In flow control, the PLC calculates differential pressure(dP) control setpoints from the flow setpoint entered by the operator. The PLC assigns the calculated dP setpoint to the lead run unless the calculated value is above 230 inches water column. If the calculated dP setpoint is above 230 inch. w.c., the PLC divides the result by 2 and assigns identical dP setpoints to both the lead and lag run PACs.

In normal operation, the Operator sets the control modes and setpoints through either the SCADA or the Local OIT terminals by entering the following:

a) the flow direction through each incoming line and through PV-29,
b) “Pressure Only” or the “Pressure and Flow” control mode for each incoming line,
c) the lead meter tube on each incoming line, and the lead control valve for L-109 (V-38 or V-40).
d) the lead/lag pressure differential for each incoming line and for L-109 controls,
e) the pressure, backpressure, and/or flow setpoints for each line.

See Section 4 for further details on regulation. Refer to Appendix G for detailed procedures for changing control modes and setpoints using the OIT terminal.

3.6 Summary of Valve Operations and Setpoints (Manual Valves see Exhibit C.)

VALVE	EVENT	VALVE ACTION
ESD, V-1 & V-2	Emergency requiring closing L-300A (V-1) or L-300B (V-2)	Closes when solenoid valve is energized from control panel switch.
Monitors, V-3, V-4	L-300A downstream (outgoing) pressure increases to 558 psig.	Throttles to maintain setpoint.
Monitors, V-5, V-6	L-300B downstream (outgoing) pressure increases to 600 psig.	Throttles to maintain setpoint.
Monitors, V-70, V-71	L-131 downstream (outgoing) pressure increases to 595 psig.	Throttles to maintain setpoint.
Monitors, V-66, V-67	L-107 downstream (outgoing) pressure increases to 477 psig.	Throttles to maintain setpoint.
Monitors, V-16, V-20, V-26, V-28	Station Separators inlet pressure increases to 400 psig.	Throttles to maintain setpoint.
Monitors, V-34, V-35	SJDFM downstream (outgoing) pressure increases to 195 psig.	Throttles to maintain 195 psig setpoint.
Monitors, V-37, V-39	L-109 downstream (outgoing) pressure increases to 375 psig.	Throttles to maintain setpoint.
Monitor, V-63	Station bypass downstream pressure increases to 400 psig.	Throttles to maintain setpoint.
Regulators,	Set to hold downstream	Regulates at

V-7 & V-7R, V-8 & V-8R	pressure, backpressure, and/or flow to or from L-300B (bi-directional).	setpoints set by operator.
Regulators, V-9 & V-9R, V-10 & V-10R	Set to hold downstream pressure, backpressure, and/or flow to or from L-300A (bi-directional).	Regulates at setpoints set by operator.
Regulators, V-11 & V-11R, V-12 & V-12R	Set to hold downstream pressure, backpressure, and/or flow to or from L-131 (bi-directional).	Regulates at setpoints set by operator.
Regulators, V-13 & V-13R, V-14 & V-14R	Set to hold downstream pressure, backpressure, and/or flow to or from L-107 (bi-directional).	Regulates at setpoints set by operator.
Regulators, V-17 & V-17R,	Set to hold pressure from L-107 to Station Separators	Regulates at setpoints set by operator.
Regulators, V-21 & V-21R, V-27 & V-27R	Set to hold pressure from Header #3 to Station Separators	Regulates at setpoints set by operator.
Regulator, V-29	Set to hold downstream pressure to Station Separators	Regulates at setpoints set by operator.
Regulators, V-38 & V-40	Set to hold pressure in L-109.	Regulates at setpoints set by operator.
Regulators, V-34 & V-35	Set to hold pressure in SJDFM.	Regulates at 190 psig (main run) and 187 psig (backup run) setpoints set manually by Milpitas

		Techs
Regulator, V-62	Set to hold downstream pressure in station bypass.	Regulates at setpoints set by operator.
Routing valve, V-15	Flow to Station Separators from L-107	V-15 open, V-18, V-23, or V-24 open.
Routing valve, V-18	Flow to Station Separators from L-131	V-18 open, V-15, V-23, or V-24 open.
Routing valve, V-23	Flow to Station Separators from L-300A	V-23 open, V-15, V-18, or V-24 open.
Routing valve, V-24	Flow to Station Separators from L-300B	V-24 open, V-15, V-18, or V-23 open.

3.7 Requirements and Responsibilities for Inspections, Operation and Maintenance

Inspections, operation and maintenance of the Terminal shall be performed in accordance with Utility Procedure: TD-4430P-02

A PC based program is used to schedule and record maintenance at the Terminal. The program is used to keep records of the status of previous maintenance and the required maintenance frequency for each piece of equipment at the Terminal.

Frequency of, and procedures for inspection, testing and maintenance of the gas chromatographs at the Terminal are given in the CGT standards listed below.

S 4310.3	Gas Chromatograph Calibration Gas
S 4310	Gas Chromatograph - Installation, Maintenance and Calibration
RP 4310.1	Gas Chromatographs - Maintenance and Calibration of Daniel Chromatographs

Lubrication and maintenance of valves shall be performed in accordance with WP 4430-04.

For additional maintenance information on equipment installed at the Terminal, see the manufacturer's literature contained in the foreign print files (see Exhibit B for a list of foreign prints).

Section 4. Regulation

4.1 Incoming Lines Load/Trimmer Valves

(a) References:

Drawings:

488227 thru 488230 Elementary - Diagram; Piping & Instrumentation Diagram (P&ID)
488231 Piping Plot Plan

Foreign Prints:

F3336-W1	Rockwell Plug Valves
F3336-W6	Limitorque Actuators
F3336-W7	
F3336-W8	Valtek Globe Valves

(b) Component Description

Component:	Trimmer Valve - Globe Control Valve, ANSI 300, Flanged, Pressure Balanced Trim, Bi - Linear Trim Form, Rising Stem Type. Actuator - Electric Motor Driven (208V, three-phase), complete with two-wire Position transmitter (4-20 ma output).
Tag Numbers:	FCV-7R, FCV-8R, FCV-9R, FCV-10R, FCV-12R, FCV-14R (12-inch); FCV-11R, FCV-13R (10-inch).
Mfg./Model:	Valve - Valtek, Mark I. Actuator - Limitorque, Model SMC 031-15.

Component:	Load Valve - Plug Valve, ANSI 300, Flanged, Venturi Pattern. Actuator - Electric Motor Driven (208V, three-phase), complete with two-wire position transmitter (4-20 ma output).
Tag Numbers:	FCV-7, FCV-8, FCV-9, FCV-10, FCV-12, FCV-14 (24-inch); FCV-11, FCV-13 (20-inch).
Mfg./Model	Valve - Rockwell, Figure No. 4249. Actuator - Limitorque, Model SMC 031-15/T-500/SGA 7.3.

Component:	Process Automation Controller, see Section 13.2.
Tag Numbers Load Valves	Trimmer Valves - UIC-7R, UIC-8R, UIC-9R,UIC-10R, UIC-11R, UIC-12R, UIC-13R,UIC-14R UIC-7, UIC-8, UIC-9, UIC-10, UIC-11, UIC-12, UIC-13, UIC-14
Mfg./Model:	Siemens Model 353

(c) System Description & Operation

Load/Trimmer valve arrangements are used to provide control of each of the incoming lines. Each meter run on each incoming line is equipped with a load/trimmer regulator set. Pressure control, or pressure and flow control may be selected as control modes for flow entering (Incoming, PB2 Green) or leaving (Exiting, PB2 Red) the Terminal. Refer to section 3.5 for further discussion of control modes.

The load and trimmer valves are controlled automatically by Process Automation Controllers (PACs) located in the Control Room. The pressure and backpressure control algorithms are contained within the trimmer valve PACs while the flow control algorithms are run by the GE Programmable Logic Controller (PLC). The gap action regulation performed by the load/trimmer valve combination can be described as follows:

The trimmer valve controller receives the measured variable input signal from pressure transmitters. The controller also receives a flow control output signal from the PLC.

The load valve is not used until the trimmer valve is commanded 80% open. When this point is reached, the load valve controller sends a digital signal to the load valve to begin opening. The trimmer and load valves then work in tandem, with the load valve opening whenever the trimmer controller output is > 80%, and closing whenever the trimmer controller output is < 20%. The load valve holds its position while the trimmer controller output is between 20% and 80%.

In computer automatic mode, the Operator selects the flow direction, selects one meter run in each set as the lead, selects the control mode (pressure only or pressure and flow), sets the lead/lag differential, and then sets the pressure, backpressure and flow setpoints. The lead/lag run control setpoints are then calculated by the PLC, and all setpoints are downloaded from the PLC when the PACs are in Computer Automatic mode.

The PAC compares the appropriate pressure input signal with the controller setpoint using a PID control algorithm. If the pressure input value is not within a certain deadband of the actual setpoint, the PAC sends a pulse output signal to the actuator to move the valve towards the correct position.

The Operator can set a maximum valve opening limit for all PAC controlled valves. This open limit will prevent the automatic control from opening the valve more than the limit, but will not prevent the controller from closing the valve.

The trimmer or single valve controller may be placed in local automatic mode at the controller's faceplate. In this mode, all setpoints and direction selection will have to be entered at the controller faceplate. **Caution**: The flow control valve output from the PLC is still functioning and could take control of the valve.

Trimmer and load valves can be manually controlled independently from the control room by setting the appropriate PAC to “Local” and “Manual” and turning the pulser knob on the PAC faceplate. **Caution**: Place the load valve controller in manual first. The valves can also be operated at the yard locally with open/close pushbuttons at the valve actuator, or by using the manual override handwheel assembly.

The trimmer valves do not achieve a bubble tight shutoff. Leakage rates of several thousand SCFH can be anticipated if the valve is fully closed. To reduce leakage as much as possible, the trimmer valves are set to seat on torque when closing. (The valves are set to seat on position when opening.) The torque settings are as follows:

10” trimmer valves set to stop closing when torque reaches 100 ft.-lbs.

12” trimmer valves set to stop closing when torque reaches 130 ft.-lbs.

(d) Inspection, Testing and Maintenance

Inspection, testing and maintenance shall be performed as required by section 3.7 of this manual.

4.2 Station Separators Regulation

(a) References: See 4.1 (a)

(b) Component Description

Component:	Trimmer Valve - Globe Control Valve, ANSI 300, Flanged, Pressure Balanced Trim, Bi-Linear Trim Form, Rising Stem Type. Actuator - Electric Motor Driven (208V,three-phase), complete with two-wire position transmitter (4-20 ma output).
Tag Numbers:	FCV-17R, FCV-21R, FCV-27R
Mfg./Model:	Valve - Valtek, Mark I. Actuator - Limitorque, Model SMC 031-15.
Component:	Load Valve - Plug Valve, ANSI 300,Flanged, Venturi Pattern. Actuator - Electric Motor Driven (208V,three-phase), complete with two-wire position transmitter (4-20 ma output).
Tag Numbers:	FCV-17, FCV-21, FCV-27
Mfg./Model:	Valve - Rockwell, Figure No. 4249. Actuator - Limitorque, Model SMC 031-15/T-500/SGA 7.3.
Component:	Process Automation Controller, see Section 13.2.
Tag Numbers:	Trimmer Valves - UIC-17R, UIC-21R, UIC-27R Load Valves - UIC-17, UIC-21, UIC-27

(c) System Description & Operation

Load/Trimmer valve arrangements are used to provide pressure control on each of the three inlet lines to the Station Separators header. The controls on each Station Separators header inlet line operate independently. Thus, pressure setpoints must be entered for each load/trimmer set. By controlling the Station Separators header pressure, these valves also control the pressures in outgoing lines L-100, L-101, and L-132. Therefore, the setpoints for the Station Separators header pressure controls are high limited by the PLC to no higher than the MAOPs of these lines.

The load and trimmer valves are controlled automatically by Process Automation Controllers (PACs) located in the control room. The gap action regulation performed by the load/trimmer combination is the same as described in section 4.1c, except that there is only one PID control algorithm for downstream pressure.

In computer automatic mode, the Operator sets the pressure setpoints for each SLDC trimmer controller.

In local (PB1 Red) and Automatic mode, the trimmer setpoints can be entered at the controller faceplate.

The trimmer and load valves can be controlled independently from the control room by setting the appropriate PAC to “Local” and “Manual” and turning the pulser knob on the PAC faceplate. **Caution:** Place the load valve in manual first to freeze the load valve at its last position. The valves can also be operated locally in the yard with open/close pushbuttons at the valve actuator, or by using the manual override handwheel assembly.

(d) Inspection, Testing and Maintenance

Inspection, testing and maintenance shall be performed as required by section 3.7 of this manual.

4.3 Line 109 and San Jose DFM Regulation

NOTE: The Process Automation Controllers with the tag numbers UIC-34 and UIC-35 were removed and replaced with pilot-operated Mooney regulators.

(a) References: See 4.1 (a).

(b) Component Descriptions

Component:	Valve - 3” single port, pilot-operated regulator valve, ANSI 300#, raised face flanged ends
Tag Number:	PV-34, PV-35
Mfr./Model:	Valve - Mooney Controls/Flowgrid Pilot - Mooney/Series 20 with 100 - 260 psig range spring.
Component:	Valve - 12” plug valve, ANSI 300#, raised faced flanged ends, venturi pattern, lubricated plug. Actuator - Electric Motor Driven (208V, three-phase), complete with two-wire position transmitter (4-20 ma output).
Tag Number:	PV-38, PV-40
Mfr./Model:	Valve: - Rockwell Fig. 4249. Actuator: - Limitorque, Model SMC 041-3/T-325/SGA 4.5
Component	Single Loop Digital Controller, see Section 13.2.
Tag Number:	UIC-38, UIC-40
Mfr./Model:	Siemens Model PAC 353

(c) System Operation and Description

Regulators PV-34, PV-35, PV-38, and PV-40 provide pressure control on L-109 and the SJDFM. Pressure control is necessary on these lines because the MOPs are lower than the MOPs of the other outgoing lines (See Section 2.3 for MOPs of each line.)

PV-34 and PV-35 Pilot loaded Regulator valves control the pressure in the San Jose Distribution Feeder Main (SJDFM). PV-38 and PV-40 control the pressure in line L-109. Each set of control valves operates in a lead/lag arrangement. The lead valve supplies all gas required until the line pressure can not be maintained with one valve. The lag valve then opens, and both valves work together to provide the necessary regulation. For the lead/lag arrangement to function properly, the lead valve must have a higher pressure control setpoint than the lag valve.

The pilot setpoints for PV-34 and PV-35 can only be adjusted manually at the valves. There is no control room or Operator interface for these two valves.

The valve actuators for PVs 38 and 40 are controlled automatically by Process Automation Controllers (PACs) UIC-38, and UIC-40, located in the control room. The valve controllers receive the measured variable input signals from pressure transmitters. The controller compares each measured variable input to the appropriate setpoint using a PID control algorithm and then generates pressure controller output. If the input value is not within a

certain deadband of the actual setpoint, the controller sends a digital signal to the actuator to move the valve towards the correct position.

In Computer (PB1 Green) and Automatic mode, the Operator selects one regulator as the lead regulator, sets the pressure differential between the lead and lag controllers, and then sets the pressure setpoint. The PLC calculates the lag valve setpoint, and downloads the final setpoints to the PACs.

In Local (PB1 Red) and Automatic mode, the setpoints may be set as desired at the controller faceplate.

The valves can be manually controlled independently from the control room by setting the appropriate PAC to “Local” and “Manual” and turning the pulser knob on the PAC faceplate. The valves can also be operated locally in the yard with open/close pushbuttons at the valve actuator, or by using the manual override handwheel assembly.

(d) Inspection, Testing and Maintenance

Inspection, testing and maintenance shall be performed as required by section 3.7 of this manual.

4.4 Station Bypass Regulation

(a) References: See 4.1 (a).

(b) Component Description

Component:	Valve - 24” plug valve, ANSI 300#, raised faced flanged ends, venturi pattern, lubricated plug. Actuator - Electric Motor Driven (208V, three-phase), complete with two-wire position transmitter (4-20 ma output).
Tag Number:	PV-62
Mfr./Model:	Valve - Rockwell Fig. 4249. Actuator - Limitorque, Model SMC 031-15/T-500/SGA 7.3
Component	Process Automation Controller, see Section 13.2.
Tag Numbers:	UIC-62
Mfr./Model	Siemens Model PAC 353

(c) System Description and Operation

Regulator PV-62 provides pressure control on the Station bypass line.

The valve actuator is controlled automatically by a Process Automation Controller (PAC) UIC-62 located in the control room. The controller receives the Process Pressure input signal from pressure transmitter PT-62. The controller compares the pressure input to the setpoint and generates a pressure controller output using a PID control algorithm. If the Process value is not within a certain deadband of the actual setpoint, the controller sends a digital signal to the electric actuator to move the valve towards the correct position.

In computer automatic mode, the Operator sets a pressure setpoint for the bypass.

In local automatic mode, the setpoint can be set at the controller faceplate.

The valve can be manually controlled from the control room by setting the PAC to “Local” and “Manual” and turning the pulser knob on the PAC faceplate. The valve may be controlled locally in the yard with pushbuttons mounted on the valve actuator or by using the manual override handwheel assembly.

(d) Inspection, Testing and Maintenance

Inspection, testing and maintenance shall be performed as required by section 3.7 of this manual.

4.5 PV-29 Regulation

(a) References: See 4.1 (a).

(b) Component Description

Component:	Valve - 20” plug valve, ANSI 300#, raised faced flanged ends, venturi pattern, lubricated plug. Actuator - Electric Motor Driven (208V, three-phase), complete with two-wire position transmitter (4-20 ma output).
Tag Number:	PV-29
Mfr./Model:	Valve - Rockwell Fig. 4249. Actuator - Limitorque, Model SMC 031-10/T-450/SGA 7.3

Component:	Process Automation Controller, see Section 13.2.
Tag Numbers:	UIC-29
Mfr./Model:	Siemens Model PAC 353

(c) System Description & Operation

PV-29 controls the pressure in the Station Separators header. The PV-29 line is bi-directional so two pressure transducers are required to provide pressure control in each direction.

The valve actuator is controlled automatically by a Process Automation Controller (PAC) UIC-29 located in the control room. The controller receives the measured variable input signals from pressure transmitters PT-29A and PT-29B. Depending on the flow direction selected, the controller compares the appropriate input signal with the controller setpoint using a PID control algorithm. If the input value is not within a certain deadband of the actual setpoint, the controller sends a pulse output signal to the actuator to move the valve towards the correct position. In computer automatic mode, the Operator sets the flow direction and then enters a pressure setpoint.

In local automatic mode the flow direction and pressure setpoint can be set at the controller faceplate. Set “E” (PB2 Red) to flow from the Station Separators outlet to the inlet headers or set “I” (PB2 Green) to flow from the inlet headers to the Station Separators outlet.

The valve can be controlled from the control room by setting the PAC to “Local” and “Manual” and turning the pulser knob on the PAC faceplate. The valve may be manually operated locally in the yard with pushbuttons mounted on the actuator or by using the manual override handwheel assembly.

(d) Inspection, Testing and Maintenance

Inspection, testing and maintenance shall be performed as required by section 3.7 of this manual.

4.6 Pneumatically Controlled Monitors

(a) References:

Drawings:

88227 thru 488230	Elementary - Diagram; Piping & Instrumentation Diagram
488231	Piping Plot Plan

Foreign Prints:

F3336-J7	Remote Set Point Regulator

F3336-J29	Pneumatic Valve Positioners
F3336-J30	Pneumatic Low Pressure Select Relay
F3336-J31	Rotary Position Transmitter
F3336-W2	T.K. Plug Valves
F3336-W4	Grove Ball Valves
F3336-W5	Ledeen Pneumatic Actuators

(b) Component Descriptions

There are fifteen pneumatic monitor valves in use at the station. The instrumentation used for control and position indication is identical for each valve, but different size valves are of different manufacture and utilize different sizes of actuators.

Component:	Pneumatic Pressure Indicating Controller
Manufacturer:	Bristol Babcock.
Model:	624-II, Series 5457-OOD
Air Supply:	20 psig
Output:	3-15 psig.
Purpose:	Provide local setpoint selection. Provide valve positioner control signal to low pressure selector relay.

Component	Remote Set Regulator
Manufacturer:	Bristol Babcock.
Model:	Series 9110-00A
Power Supply:	+24 V dc
Elec. Class:	CL.1, Div.1, Grp.D
Air Supply:	20 psig.
Elec. Input:	Raise/Lower Input
Output:	3-15 psig.
Purpose:	Provide remote setpoint selection. Provide valve positioner control signal to low pressure selector relay.

Component:	Low Pressure Selector Relay
Manufacturer:	Fairchild.
Model:	90, Cat. No. 90052V
Output:	3-15 psig.
Purpose:	Select lower of the two control signals from pressure indicating controller and remote set regulator.

Component:	High Limit Relay
Manufacturer:	Fairchild.
Model:	93
Range:	0-60 psig.
Purpose:	Limit the controller feedback signal pressure to prevent controller wind-up.

Component:	Valve Positioner
Manufacturer:	Moore Products Co.
Model:	GC-74G
Range	Spring
Kit No.:	14923-103
Air Supply:	90 psig
Control	Air
Input	Span: 3-15 psig
Purpose:	Control the air supply to valve actuator based on pneumatic control signal and direct (mechanical) position feedback from valve.

Component:	Rotary Position Transmitter
Manufacturer:	Westlock
Model:	9479
Power Supply:	+24 V dc
Elec. Class:	CL.1, Div.2, Group C,D
Input Span:	0-90 degrees
Output:	4-20 ma, with two SPDT limit switches.
Purpose:	Provide current signal to valve position indicator in control room. Provide contact closures for valve open/closed indication in control room.

Component:	Pressure Regulator, Instrument Air Supply
Manufacturer:	Fairchild.
Catalog No.:	101426
Air Supply:	90 psig
Output:	20 psig
Purpose:	Regulates instrument air to 20 psig for supply to controllers, remote set regulators and pressure limiting relays.

Incoming (Bi-directional) Lines

PV-3, PV-4, PV-5, PV-6, PV-70, PV-66

Valve: Grove Model B5-B. 24" ball valve, ANSI 300#, weld ends to match 0.500" wall pipe, with 7'-3" valve extension.

Actuator: Ledeen Model #SY-7H-SD-7H Double acting, single cylinder actuator with hydraulic manual override.

PV-67, PV-71

Valve: Grove Model B5. 20" ball valve, ANSI 300#, weld ends to match 0.500" wall pipe, with 7'-3" valve extension.

Actuator: Ledeen Model #SY-6H-QD-7H Double acting, single cylinder actuator with hydraulic manual override.

Outgoing Lines

PV-16, PV-20, PV-26, PV-28

Valve: Grove Model B5-B. 24" ball valve, ANSI 300#, weld ends to match 0.500" wall pipe, with 7'-3" valve extension.

Actuator: Ledeen Model #SY-7H-SD-7H Double acting, single cylinder actuator with hydraulic manual override.

PV-33, PV-36

Valve: Mooney Controls Flowgrid. 3'" Single Port, Pilot Operated Valve, ANSI 300#, raised face flange ends.

Pilot: Mooney Series 20 Pilot with 100-260 psig range spring.

PV-37, PV-39

Valve: TK Valve and Manufacturing Co. 16"ball valve, ANSI 300#, weld ends to match 0.500" wall pipe, with 7'-3" valve extension.

Actuator: Ledeen Model #SY-5H-QD-7H Double acting, single cylinder actuator with hydraulic manual override.

PV-28

Valve: Grove Model B5. 20" ball valve, ANSI 300#, weld ends to match 0.500" wall pipe, with 7'-3" valve extension.

Actuator: Ledeen Model #SY-6H-QD-7H Double acting, single cylinder actuator with hydraulic manual override.

Station Bypass

PV-63

Valve: Grove Model B5-B. 24" ball valve, ANSI 300#, weld ends to match 0.500" wall pipe, with 7'-3" valve extension.

Actuator: Ledeen Model #SY-7H-SD-7H Double acting, single cylinder actuator with hydraulic manual override.

(c) System Description & Operation

Monitor valves are installed for overpressure protection of the main lines when gas flows out of the station. The valves are not intended to protect the station piping against overpressure, but are designed to limit downstream pressures to the line MAOPs. The monitors can be used as back-up regulators if the motor operated regulators fail.

The monitor valves are pneumatically actuated and are controlled with positioners. Each positioner receives a 3-15 psig control signal from either an indicating pneumatic controller or an electro-pneumatic set regulator. A low pressure selector enables only the lower control signal to reach the valve positioner. The output of the low pressure selector is also tubed to the controller's external feedback connection which assures that the controller output tracks the output established by the remote set regulator when it is in control of the valve. A high limit relay installed on the external feedback signal line prevents integral windup. Position transmitters indicate the valve position on displays in the control room and are also inputs to the PLC and SCADA.

The pneumatic controllers are set at the MAOPs of each line. The remote set regulators may be operated from SCADA through the PLC or from the control room control panel to open or close the valves, as long as the line pressure remains below the MAOP.

The remote setpoint regulators are controlled by OPEN and CLOSE switches from the PLC or from the control panel in the control room. Each valve switch has a Remote position and a Local position. Setting a switch to Remote allows the Operator to position the valve by entering a % open value. Setting a switch to Local, allows the remote setpoint regulator be driven by pressing the open or close pushbuttons at the control panel in the control room. The setpoint regulator is driven as long as a pushbutton is depressed.

NOTE

Because the remote setpoint regulator moves faster than the valve, the control output from the regulator to the valve positioner will always lead the actual valve position. Consequently, the valve continues to move after the Local control switch pushbutton is released, until the valve reaches the position dictated by the regulator output. The delay is especially apparent when closing because venting the actuator takes longer than pressurizing it. The delay between pushbutton release to valve stop when closing the valve is approximately 10% of travel.

The valve positioners and position transmitters are mounted on the valve actuators. The indicating controllers, remote set regulators, and pressure limiting relays are housed in cabinets located near the valves. Each cabinet contains two sets of monitor valve controls, except for one cabinet which contains only the set of controls for monitor valve PV-63.

(d) Inspection, testing and maintenance shall be performed as required by section 3.7 of this manual.

Section 5. Remote Control Valves

5.1 Remote Control Valves

(a) References:

Drawings:

488227 thru 488228	Elementary - Diagram; P&ID
488231	Piping - Plan; Main Gas, Yard

Foreign Prints:

F3336-W3	Cameron Ball Valves
F3336-W4	Grove Ball Valves
F3336-W6	Limitorque Actuators
F3336-J7	Remote Set Point Regulators
F3336-J19	Pneumatic Valve Positioners
F3336-J21	Rotary Position Transmitters

(b) Component Description

Fourteen of the station valves, operational from SCADA and the control panel in the control room, are used for positioning main line valves and for routing gas through PV-29 to the incoming lines.

Seven valves are pneumatically operated valves and seven are electric motor operated. Pneumatically operated valves are located on L-300A and L-300B and on each of the outgoing lines. The pneumatic valves on L-300A and L-300B operate with air supplied through solenoid valves. Those on the outgoing lines are operated with a remote set regulator and a valve positioner. The electric motor operated valves are located on each of the three inlet lines to header #3, and on each of the four interties between the incoming lines and the PV-29 piping.

5.1.1 Pneumatically Operated Valves

L-300A & L-300B

Component:	Ball Valve, 30”, ANSI class 300#, weld ends to match 0.625” wall thick pipe, with 11’-0” valve extension.
Tag No.:	PV-1, PV-2
Mfr./Model	Grove, Model B-5

Component:	Actuator, Pneumatic air powered, spring return, with hydraulic manual override. Actuator to fail close on loss of instrument air.
Tag No.	PZ-1, PZ-2
Mfr./Model:	Ledeen, Model PH635-175/320SR

Component	Solenoid valve,
Tag No.:	SV-1, SV-2
Mfr./Model	ASCO, 3-way, Model #EF8300D68G (Cat.32)

Outgoing Lines

Component:	Ball Valve, 20", ANSI class 300#, weld ends to match 0.500" wall thick pipe, with 10'-6" valve extension.
Tag No.:	PV-45, PV-49
Mfr./Model:	Grove, Model B-4

Component:	Actuator, Pneumatic air powered, double acting, single cylinder with hydraulic manual override.
Tag No.:	PZ-45, PZ-49
Mfr./Model:	Ledeen, Model SY-6H-QD-7H

Component:	Ball Valve, 20", ANSI class 300#, weld ends to match 0.500" wall thick pipe, with 10'-6" valve extension.
Tag No.:	PV-48, PV-50
Mfr./Model:	Cameron

Component:	Actuator, Pneumatic air powered, double acting, single cylinder with hydraulic manual override.
Tag No.	PZ-48, PZ-50
Mfr./Model:	Ledeen, Model SY-6H-QD-7H

Component:	Ball Valve, 20", ANSI class 300# weld ends to match 0.500" wall thick pipe, with 6'-9" valve extension.
Tag No.	PV-64
Mfr./Model:	Grove B-4

Component:	Actuator, Pneumatic air powered, double acting, single cylinder with hydraulic manual override.
Tag No.	PZ-64
Mfr./Model:	Ledeen, Model SY-6H-QD-7H

Component:	Remote Set Regulator
Manufacturer:	Bristol Babcock.
Model	Series 9110-00A
Power Supply:	+24 V dc

Elec. Class:	CL. 1, Div. 1, Grp. D
Air Supply:	20 psig
Elec. Input:	Raise/Lower input
Output:	3-15 psig.
Purpose:	Provide remote setpoint positioning. Provide 3-15 psig valve positioner control signal.

Component:	Valve Positioner
Manufacturer:	Moore Products Co.
Model:	GC-74G
Rotary Action Range	Spring
Kit No.	14923-103
Air Supply	90 psig
Control	Air
Input Span	3-15 psig
Purpose	Control the air supply to the valve actuator based on remote setpoint signal and direct (mechanical) position feedback from the valve.

Component	Rotary Position Transmitter
Manufacturer:	Westlock
Model:	9479
Power Supply:	+24 V dc
Elec. Class:	CL. I, Div. 2, Group C, D.
Input Span:	0-90 degrees
Output:	4-20 ma to PLC & SCADA and position indicator in control room. Provide contact closures for valve open/closed indication in control room.

Component:	Pressure Regulator, Instrument Air Supply
Manufacturer:	Fairchild
Catalog No.	101426
Air Supply:	90 psig
Output:	20 psig
Purpose:	Regulates instrument air to 20 psig for supply remote set regulators.

Station Separators Bypass Valves

Component:	Ball Valve, 24”, ANSI class 300#, weld ends to match 0.500” wall thick pipe, with 10’-0” valve extension.
Tag No.:	HV-19, HV-22, HV-25

Mfr./Model:	Cameron
Component:	Ball Valve, 24”, ANSI class 300#, weld ends to match 0.500” wall thick pipe, with 10’-0” valve extension.
Tag No.:	HV-15, HV-18, HV-23, HV-24
Mfr./Model:	Grove, Model B-4
Component:	Actuator, electric motor driven for on/off service.
Tag No.:	PZ-19, PZ-22, PZ-25, PZ-15, PZ-18, PZ-23, PZ-24.
Mfr./Model:	Limitorque, Model SMC-031-10 with T430/SGA 6.3
Component	Ball Valve, 36”, ANSI class 300#
Tag No:	V-130
Mfr./Model	Grove, Model B-8

(c) System Description and Operation

The remote control valves are installed to provide safety and flexibility in routing gas through the station. These valves are used singularly or in conjunction with others to block a line when necessary, or to set up a particular flow path through the station.

Incoming Lines

PV-1 and PV-2 are line isolation valves for L-300A and L-300B. These valves are used only in an emergency. They are air-to-open with spring return close, and may be operated remotely from the control room or locally at the valve with a hydraulic override.

Air is supplied to each actuator through a three-way solenoid valve which is controlled by a switch on the control panel in the control room. Turning the switch to the OPEN position de-energizes the solenoid which allows instrument air into the actuator and opens the valve. Turning the switch to the CLOSE position energizes the solenoid which vents the actuator, and allows the spring to close the valve.

A support is installed under the end of each actuator’s spring can. They were installed to provide additional support for the spring cans and prevent the cans from deflecting downward from their installed position.

CAUTION

Do not adjust the supports to force the end of the spring cans upward to make the cans parallel with ground level. This would create abnormal stresses on the spring cans.

Outgoing Lines

PV-45, PV-48, PV-49, PV-50, and PV-64 are installed on the outgoing lines and are used to isolate meter runs, to block the station piping when using the station bypass, or to throttle the gas flow if required. These valves are positioner operated air-to-open, and are operated remotely from SCADA and the control room, or locally with a hydraulic override.

Instrument air is supplied to the actuators through a pneumatic positioner. The 3-15 psig control signal to the positioner is provided by a remote setpoint regulator, which in turn is controlled by OPEN and CLOSE switches at the PLC and on the control panel in the control room. Each control panel switch has a Remote position and a Local position. With the panel Remote/Local switches in Remote, the open/close commands come from the PLC/SCADA for remote positioning of the valves by the Operator. With the switches in the Local position, the remote setpoint regulator may be driven by pressing the open or close pushbuttons. The setpoint regulator is driven as long as one of the pushbuttons is held down.

NOTE

Because the remote setpoint regulator moves faster than the valve, the control output from the regulator to the valve positioner will always lead the actual valve position. Consequently, the valve continues to move after the control switch pushbutton is released until the valve reaches the position dictated by the control signal received by the positioner from the regulator. The delay is especially apparent when closing because venting the actuator takes longer than pressurizing it. The delay between pushbutton release to valve stop when closing the valve is approximately 10% of valve travel and approximately 5% of travel when opening the valve.

5.1.2 Separators C-4 and C-5 Inlet Valves and Bypass Valve

V-19, V-22, and V-25, are installed on L-131, L-300A, and L-300B respectively, upstream of header #3. These valves are used in conjunction with valves V-15, V-18, V-23, and V-24 to route gas into the C-4 and C-5 separators inlet header or to bypass these separators through V-130, or to route gas from one line to another during back flow conditions in the incoming lines. These valves are electric motor operated valves, and may be locally positioned with pushbuttons on the valve operator or with a handwheel.

The valves may be positioned Remote via the PLC and SCADA or Local via open or close pushbuttons at the control panel in the control room. Each switch has a Remote position and a Local position. Placing a Remote/Local switch in Remote allows remote positioning of the valves via the PLC and SCADA by the Operator. With a switch in the Local position, the valve may be driven by pressing the open or close

pushbuttons. The valve is driven as long as the pushbutton is depressed and stops immediately when the button is released.

(d) Inspection, Testing and Maintenance

Inspection, testing and maintenance shall be performed as required by section 3.7 of this manual.

Section 6. Manual Valves

6.1 Manual Valves

(a) References:

Drawings:

488227 thru 488228 Elementary - Diagram; P&ID
488231 Piping - Plan; Main Gas, Yard

Foreign Prints:

Refer to Exhibit B - Foreign Print List

(b) Component Description

Refer to Exhibit C - Valve List

(c) System Description and Operation

Refer to Exhibit C - Valve List

(d) Inspection, Testing, and Maintenance

Inspection, testing and maintenance shall be performed as required by section 3.7 of this manual.

Section 7. Metering

7.1 Metering

Flow through each of the four incoming lines is measured with dual, bi-directional meter runs. Flow through each outgoing line is measured with single, uni-directional meter runs.

Flow in the station bypass line is measured with an insertion turbine meter and displayed on UIC-62.

The meter tube assemblies and orifice plates are designed to AGA-3 Standards, with ISO lengths. Their upstream and downstream lengths are honed to AGA-3 Specifications.

Pressure, temperature and differential pressure across the orifice are measured at each meter assembly with transducers located in the meter pits. 4-20 ma output signals transmitted from the transducers are accepted by flow computers where flow is calculated using AGA-3 methods. Refer to Section 11 for transducer details.

7.2 Incoming Flow

(a) References

Drawings:

Refer to Exhibit A, Drawing List.

Foreign Prints:

F3336-L1 Orifice Meters

(b) Component Description

Component:	Orifice Metering Assembly, 24 inch, complete with ANSI Class 300 Senior Orifice fitting, meter runs on each side of orifice fitting with straightening vanes and end flanges.
Tag Numbers:	Meter assemblies: M-7, M-8, M-9, M-10, M-12, M-14.
Orifice plates:	FE-7, FE-8, FE-9, FE-10, FE-12, FE-14.
Manufacturer:	Daniel Industries.

Component:	Orifice Metering Assembly, 20 inch, complete with ANSI Class 300 Senior Orifice fitting, meter runs on each side of orifice fitting with straightening vanes and end flanges.
Tag Numbers:	Metering assemblies: M-11, M-13.
Orifice plates:	FE-11, FE-13.
Manufacturer:	Daniel Industries.

(c) System Description and Operation

Two resistance temperature detectors (RTD), two sets of stacked differential pressure (dP) transmitters, and one static pressure transmitter are installed to measure flow in either direction through the meter runs in the incoming lines. Flow calculations in each case are based on the downstream temperature, on downstream static pressure for incoming flow, and upstream pressure for outgoing flow. One set of dP transmitters is used for measuring incoming flow, and the other set for measuring outgoing flow. Each set of dP transmitters consists of a 0-50" w.c. unit and a 0-250" w.c. unit. The flow computer selects the signal from the 0-50" unit when the dP falls within this range, otherwise the signal from the 0-250" unit is used. Using two sets of stacked dP transmitters increases the measurement accuracy.

(d) Inspection, Testing and Maintenance

Inspection, testing and maintenance shall be performed as required by section 3.8 of this manual.

7.3 Outgoing Flow

(a) References

Foreign Prints:

F3336-L1 Orifice Meters

(b) Component Description

Component	Orifice Metering Assembly, 24 inch, complete with ANSI Class 300 Senior Orifice fitting, meter run on upstream side of orifice fitting with straightening vanes and end flanges.
Tag Numbers:	Metering assemblies: M-32, M-34.
Orifice plates:	FE-32, FE-34.
Manufacturer:	Daniel Industries.

Component	Orifice Metering Assembly, 20 inch, complete with ANSI Class 300 Senior Orifice fitting, meter run on upstream side of orifice fitting with straightening vanes and end flanges.
Tag Numbers:	Metering assemblies: M-30, M-31,M-38.
Orifice plates:	FE-30, FE-31, FE-38.
Manufacturer:	Daniel Industries.

(c) System Description & Operation

One resistance temperature detector, one set of stacked differential pressure (dP) transmitters, and one static pressure transmitter are installed to measure flow through each meter run. Flow calculations in each case are based on the downstream temperature, and on downstream static pressure. The stacked dP transmitters are used in the same way as are those on the incoming lines, except that the five outgoing lines have only one set of transmitters.

(d) Inspection, Testing and Maintenance

Inspection, testing and maintenance shall be performed as required by section 3.7 of this manual.

7.4 Station Bypass

(a) References

Foreign Prints: F3336-J14 Insertion Turbine Meter

(b) Component Description

Component:	Turbine Meter, insertion type with screwjack plain stem type with 30" insertion length, 3" C.S. ASA 300 RF flange. Complete with RTD temperature transmitter, and pre-amplifier.
Tag Number:	FT-1
Mfr./Model:	HYDRIL Model No. 500-1212-04-3
Component:	Flow Computer, with AGA7 calculation for turbine meter.
Tag Number:	UIC-62 (Loop M-1 Flow)
Mfr./Model:	Siemens Model PAC 353

(c) System Description & Operation

The flow computer Loop M-1 of UIC-62 accepts flow pulse inputs from the insertion turbine meter, and temperature from a resistance type device (RTD) located in the shaft of the insertion meter, and pressure from pressure transmitter PT-62. Flow is computed using the AGA7 calculations for turbine meters. The computed flow rate is indicated on UIC-62s faceplate as loop M-1 Flow

(d) Inspection, Testing and Maintenance

Inspection, testing and maintenance shall be performed as required by section 3.7 of this manual.

Section 8. Liquid Removal and Storage

8.1 Liquid Removal and Storage (Lines 300A and L300B Only)

(a) References

Drawings:

488227	Elementary - Diagram, P&ID, Liquid Removal
488232	Piping - Plan; Liquid Removal, Yard
488525	Piping - Isometric; Liquid Removal and Blowdown Compressor
388272	Elementary - Electrical; PLC I/O & Control System

Foreign Prints:

F3336-C1	Gas/Liquid Separator
F3336-C2	Liquid Storage Tank
F3336-J8	Liquid Level Transmitter
F3336-J11	Liquid Level Switches
F3336-J28s	Liquid Level Gages
F3336-W9	Liquid Level Control Valves

(b) Component Description

Component:	Gas/Liquid Separators, horizontal, per PG&E Specification 8066.
Dimensions:	
Separator:	72” ID x 192” S/S
Slug Storage:	42” ID x 192” S/S
Unit Weight:	44123 lbs. (dry)
Flange Size:	30”
Flange Rating:	300 ANSI
Pressure:	410 to 600 psig.
Temperature:	50 to 100 deg. F.
Capacity:	36 MMscfh at 600 psig 1 MMscfh at 410 psig
Performance:	
Liquids:	98% of droplets > 8 microns
Carryover:	< 1/10 gal./MMscf
Slug Storage:	500 gallons
Tag Numbers:	C-1, C-2.
Mfr./Model:	Perry Equipment Co., 95H-72 Custom PECO drawing No. A-36348
Component:	Liquid Storage Tank, horizontal, per PG&E Specification 9620.
Dimensions:	60” ID x 240” S/S
Unit Weight:	24000 lbs. (dry)
Design Press.:	720 psig @ 150 deg. F.

Oper. Press.:	200 psig @ 150 deg. F.
Capacity:	3000 gallons
Tag Number:	C-3
Mfr./Model:	Downey Welding, Proposal No. 121587-1
Component:	Pressure Safety Valve, 2" x 3",
R.F.,	300 lb. x 150 lb. ANSI rating 0.785 sq. in. orifice.
Set pressure:	720 psig.
Tag Number:	PSV-1, PSV-2
Mfr./Model:	Crosby, Model JOS, PN 61220000 with PN X06097 spring.
Component:	Pressure Safety Valve, 2 ½" x 4",
R.F.,	300 lb. x 150 lb. ANSI rating 1.287 sq. in. orifice.
Set pressure:	720 psig.
Tag Number:	PSV-3
Mfr./Model:	Crosby, Model JOS, PN 61220000 with PN X06097 spring.
Component:	Liquid Level Switch, displacer (float) type, with narrow differential, stainless steel displacers, with two DPDT mercury switches. NEMA 4 enclosure (Class I, Div. II).
Tag Numbers:	LSL-1A, LSH-1A, LSL-2A, LSH-2A, LSL-3A, LSH-3A, LSL-4A, LSH-4A, LSL-5A, LSH-5A
Mfr./Model:	Magnetrol, Model No. B15-1E2B-AEF
Component:	Liquid Level Switch, displacer (float) type, with wide differential, porcelain displacers, with two DPDT mercury switches. NEMA 4 enclosure (Class I, Div. II).
Tag Numbers:	LSLL-1B, LSHH-1B, LSLL-2B, LSHH-2B, LSLL-3B, LSHH-3B, LSLL-4B, LSHH-4B, LSLL-5B, LSHH-5B
Mfr./Model:	Magnetrol, Model No. B10-1E2B-AEF
Component:	Liquid Level Transmitter, RF type, with ½" dia. x 42" long probe.
Tag Numbers:	LT-1A, LT-1B, LT-2A, LT-2B, LT-3
Mfr./Model:	Delevan, Inc., Model No. 420-0-THD-042-XP
Component:	Control Valve, 1" with 316 S.S. seat and seat retainer, with electric/spring to close actuator, with two SPDT limit switches.
Tag Numbers:	LCV-1A, LCV-2A, LCV-3A, LCV-4A,
Mfr./Model:	Masoneilan, Camflex II valve with RCS model SR-49 electric actuator (fail close).
Component:	Control Valve, 2" with Teflon seat and 317 chrome plated ball, with electric/spring to close actuator, with two SPDT limit switches.
Tag Numbers:	LCV-3D
Mfr./Model:	Masoneilan, Camflex II valve with RCS model SR-49 electric actuator (fail close).

(c) System Description and Operation

CAUTION

Natural gas condensate is classified as a hazardous material. In the event of a spill, follow reporting and clean-up procedures provided in the Terminal's SPCC plan.

The liquid removal and storage system consists of separators C-1 and C-2 on lines L-300A and L-300B respectively, and a liquid storage tank C-3. The storage tanks designed to contain the maximum monthly liquid accumulation from lines L-300A and L-300B, plus a 20 percent contingency factor. Liquid collected in the separators is dumped automatically to the storage tank. Blanket gas in the storage tank must be removed to the SJDFM before the liquid can be removed. Liquid is removed from the storage tank to a tank truck (see Appendix D for storage tank draining procedure).

Separators C-1 and C-2 are provided with individual liquid holding tanks. Each holding tank consists of two sections and each section is provided with high and low level switches, high/high and low/low level alarms, and continuous 4-20 ma analog level indication. (See Table 8.1 for switch settings.) Each tank section has a separate drain line with a motor operated ball valve. Each motor operated valve on a section drain line is interlocked with the level switches for that section to open on high liquid level, and to close on low level. Drain lines from the holding tank sections tie into a common inlet line to the storage tank C-3.

Instrumentation provided with the storage tank C-3 includes high and low level switches, high/high and low/low level alarms, continuous 4-20 ma analog pressure and liquid level indication, and a pressure switch. Motor valves are installed on the liquid inlet and drain lines. The motor operated valve on the inlet line (LCV-3C) is interlocked with the drain valve (LCV-3D), and with high liquid level switch LSH-5A, to close automatically on high liquid level and to keep the line closed as long as LCV-3D is open. LCV-3C may also be closed with switch HS-3C located at the storage tank control panel. Drain valve LCV-3D is interlocked with pressure switch PSL-3, low liquid level switch LSL-5A, and with LCV-3C to prevent opening the valve when the tank pressure is above 7 psig, when the liquid level is less than 20%, or when inlet valve LCV-3C is open. LCV-3D is operated with switches HS-3D-1 (open) and HS-3D-2 (close) located at the storage tank control panel.

Pressure in C-3 is maintained at 200 psig or less by releasing excess pressure generated by the displacement of gas by liquid while filling the tank to the SJDFM through pressure control valves PCV-95 (diaphragm removed) and PCV-96 (diaphragm removed). Blanket gas, when emptying the tank, is

provided by a return line from the SJDFM after it is reduced to 5 psig through pressure reducing valve PCV-97.

Table 8.1

Liquid Level Switch Settings

Tag	Setting	Description
LSLL-1B	-10%	C-1A, low level alarm.
LSL-1A	10%	C-1A, close dump valve LCV-1A.
LSH-1A	40%	C-1A, open dump valve LCV-1A.
LSHH-1B	90%	C-1A, high level alarm.
LSLL-2B	-10%	C-1B, low level alarm.
LSL-2A	10%	C-1B, close dump valve LCV-2A.
LSH-2A	40%	C-1B, open dump valve LCV-2A.
LSHH-2B	90%	C-1B, high level alarm.
LSLL-3B	-10%	C-2A, low level alarm.
LSL-3A	10%	C-2A, close dump valve LCV-3A.
LSH-3A	40%	C-2A, open dump valve LCV-3A.
LSHH-3B	90%	C-2A, high level alarm.
LSLL-4B	-10%.	C-2B, low level alarm
LSL-4A	10%	C-2B, close dump valve LCV-4A.
LSH-4A	40%	C-2B, open dump valve LCV-4A.
LSHH-4B	90%	C-2B, high level alarm.
LSLL-5	10%	C-3, low level alarm.
LSL-5	25%	C-3, close dump valve LCV-5D.
LSH-5	50%	C-3, close LCV-3C, permit LCV-3D to open.
LSHH-5	75%	C-3, high level alarm.

All percentages are based on the analog indication of the level transmitters LT-1A, LT-1B, LT-2A, LT-2B, and LT-3. The level transmitters are calibrated to the sight gauges. Zero indication of the transmitter corresponds to a level in the sight glass at approximately 33% of the first gauge section (at the third bolt from the bottom of the glass). The maximum output from the transmitter (100%) corresponds to a level in the glass near the top bolt of the top gauge section.

(d) Inspection, Testing, and Maintenance

Inspection, testing and maintenance shall be performed as required by section 3.7 of this manual.

8.2 Liquid Removal and Storage (Station)

(a) References

Drawings:

488228	Elementary - Diagram, P&ID, Metering and Regulation (sheet 4)
488234	Piping - Plan; Regulation Area, Yard
388272	Elementary - Electrical; PLC I/O & Control System

Foreign Prints:

F3336-C10	Gas/Liquid Filter Separators C-4 and C-5
F3336-C12	Liquid Storage Tank C-6
F3336-J47	Liquid Level Transmitter
See F3336-C10	Liquid Level Controllers
F3336-J46	Differential Pressure Transmitters
See F3336-C10	Liquid Level Control Valves

(b) Component Description

Component:	Gas/Liquid Filter Separators, horizontal, per PG&E PO 2500162641
Dimensions:	
Separator:	66” ID x 144” S/S
Liquid Storage:	20” OD x 144” S/S
Unit Weight:	53435 lbs. (dry)
Flange Size:	30”
Flange Rating:	300 ANSI
Pressure:	400 to 600 psig.
Temperature:	-20 to 130 deg. F.
Capacity:	30.6 MMscfh at 600 psig 25.4 MMscfh at 400 psig
Tag Numbers:	C-4, C-5.
Mfr./Model:	Perry Equipment Co., Model PGCPH-81-394-66ID-720

Component:	Liquid Storage Tank, horizontal, per PG&E PO 2500243709
Dimensions:	45.75” ID x 140” S/S
Unit Weight:	10100 lbs. (dry)
Design Press.:	720 psig @ -20 deg. F minimum
Oper. Press.:	720 psig @ 100 deg. F.
Capacity:	1139 gallons
Tag Number:	C-6
Mfr./Model:	Benicia Fabrication & Machine , Inc. Job No. 09-5974

Component: Liquid Level Transmitter,

Tag Numbers: LT-6A
Mfr./Model: Rosemount Model 3301

Component: Differential Pressure Transmitter
Tag Numbers: PDT-4A, PDT-5A
Mfr./Model Rosemount Model 3051CD

Component: Control Valve,2”
Tag Numbers: LCV-4A, LCV-4B, LCV-5A, LCV-5B
Mfr./Model: Norriseal

Component: Liquid Level Controller
Tag Numbers: LC-4A, LC-4B, LC-5A, LC-5B
Mfr./Model: Norriseal

(c) System Description and Operation

CAUTION

Natural gas condensate is classified as a hazardous material. In the event of a spill, follow reporting and clean-up procedures provided in the Terminal’s SPCC plan.

The liquid removal and storage system consists of separators C-4 and C-5 on lines L-300A and L-300B respectively, and a liquid storage tank C-6. The storage tank holds 1139 gallons when completely full. Liquid collected in the separators is dumped automatically to the storage tank. Blanket gas in the storage tank is automatically dumped to the SJDFM. Before the liquid can be removed, the blanket gas must be vented to atmosphere through two carbon filters connected in series. Liquid is removed from the storage tank to a tank truck (see Appendix D for storage tank draining procedure).

Separators C-4 and C-5 are provided with individual liquid holding tanks. Each holding tank consists of two sections and each section is provided with a liquid level controller. Each tank section has a separate drain line with a diaphragm operated Norriseal valve. Each diaphragm operated valve on a section drain line is operated with the level controller for that section to open on high liquid level, and to close on low level. Drain lines from the holding tank sections tie into a common inlet line to the storage tank C-6.

Instrumentation on C-4 and C-5 includes a differential pressure transmitter which indicates and transmits the differential across the separator filters.

Instrumentation provided with the storage tank C-6 includes liquid level indication and a liquid level transmitter.

Pressure in C-6 is maintained at 200 psig or less by releasing excess pressure generated by the displacement of gas by liquid while filling the tank

to the SJDFM through pressure control valves PCV-6A, PCV-6B, PCV-95 (diaphragm removed) and PCV-96 (diaphragm removed).

Table 8.2

Transmitter Settings

Tag	Setting	Description
LT-6A	% of 1139 gallons Alarm at 80% Alarm reset at 50%	C-6 high level alarm.
DPT-4A	Alarm at 15 psi Alarm reset at 12 psi	C-4 high differential pressure alarm
DPT-5A	Alarm at 15 psi Alarm reset at 12 psi	C-5 high pressure differential alarm

(d) Inspection, Testing, and Maintenance

Inspection, testing and maintenance shall be performed as required by section 3.7 of this manual.

Section 9. Blowdown

9.1 Blowdown System

Note# May be removed at a future date

(a) Reference

Drawings:

488227	Elementary - Diagram; P&ID, Liquid Removal
488230	Elementary - Diagram; P&ID, Blowdown Compressor
488525	Piping - Isometric; Liquid Removal and Blowdown Compressor

Foreign Prints:

Component:	Three-way valve with 180 degree turn actuator.
Power supply:	208 VAC, 60 Hz, 3 ph. Torque protection spring: light.
Limit switches:	eight (8) SPDT.
Enclosure:	Explosion proof (NEMA 7)
Tag Numbers:	PY-1
Mfr./Model:	Valve: Rockwell Fig. 4812, 3-way, 180 degree turn, 2” dia. Actuator: Limitorque, model LY200-31121222
Component:	Pressure Reducing Regulator, 2” dia. 250 psig inlet pressure 200 psig outlet pressure.
Tag Numbers:	PCV-95, PCV-96 (diaphragms removed)
Mfr./Model:	Mooney Controls Flowgrid valve
Component:	Back Pressure Regulator, 1” threaded NPT, 200 psig inlet pressure, 5 psig outlet pressure.
Tag Numbers:	PCV-97
Mfr./Model:	Masoneilan, No. 854017-027-012

(c) System Description and Operation

The blowdown system provides a means of depressurizing a) a meter tube prior to maintenance, and b) liquid storage tank C-3 prior to unloading liquid. In normal operation, the system allows pressurized gas from a meter tube or from C-3 to exhaust to the SJDFM through pressure regulators PCV-95 (diaphragm removed) and PCV-96 (diaphragm removed). When the system

has equalized to the SJDFM pressure, the blowdown compressor operates to evacuate a meter tube to 0 psig, or storage tank C-3 to 7 psig, discharging to the SJDFM through PCV-95 and PCV-96.

A motor operated three-way valve automatically sets the blowdown flow path from C-3 to the SJDFM. The flow path from the meter tubes to the SJDFM is established by opening one of the hand operated meter tube blowdown valves.

(d) Inspection, Testing and Maintenance

Inspection, testing and maintenance shall be performed as required by section 3.7 of this manual.

Section 10. Instrument Air System

10.1 Instrument Air

(a) Reference

Drawings:

3800256 Sht 1-3	Electrical - Schematic, Air Compressor Controls
3800257	Panel - Arrangement, Air Compressor Control Cabinet
488229	Elementary - Diagram; P&ID, Instrument Air
488563	Piping - Arrangement; Instrument Air Supply

Foreign Prints:

F3336-C3	Instrument Air Receivers
F3336-J32	Pressure Switches, Instr. Air
F3336-J33	Micro PLC Installation Manual
F3336-J34	Inline Filter, Instr. Air
F3336-J35	Ball Valve, Instr. Air
F3336-K1	Instrument Air Compressors
F3336-V2	Instrument Air Dryers & Filters
F3336-V2-7	Condensate Drain Installation Instructions

(b) Component Descriptions

1. Descriptions of components not listed below may be found on the bills of material for the applicable drawings.

Component:	Air Compressor, Air cooled lubricated rotary screw type with integrated refrigerates air dryer. 55 cfm, 125 psig maximum discharge pressure, 20 HP208 VAC, 3 ph., 60 hz. motor
Tag Numbers:	AK-1, AK-2.
Mfr./Model:	Atlas Copco Plus Series

Component:	Atlas Copcp Coalescer (oil removal) filters with auto drain, filter
Mfr./Model:	has 0.01 micron rating

Component: Air Receiver, 4’-0” x 8’-0” seam to seam, vertically mounted

Tag Numbers: C-4, C-5.
Mfr./Model: Downey Welding Co.

Component: Pressure Safety Valve, 1" x 1", capacity: 200 scfm air, set pressure: 135 psig.
Tag Numbers: PSV-4, PSV-5
Mfr./Model: Crosby, Model No. 38440, with XUD394 spring

Component: Programmable Logic Controller
Tag Numbers: PLC-104, PLC-105
Mfr./Model: GE FANUC, IC693UAA007

Component: Pressure Switch, Air Compressor Discharge Header
Tag Numbers: PSH-1A, PSL-1A, PSLL-1A
Set Points: 120 Psig Incr, 95 Psig Decr, 90 Psig Decr
Mfr./Model: Neo-Dyn, P100 4 2 CC 3

Component: Inline Filters, 5 micron, 150 psig
Mfr./Model: Norgren/F74G

Component: Pressure Transmitter
Tag Number: PT-1
Max. Range: 0 - 1000 psig
Mfr./Model: Schlumberger/PG-3000-01M-42

(c) System Operation and Description

Mechanical System

The mechanical portion of the instrument air system is comprised of two units, each of which includes an air compressor with an integrated refrigerated air dyer and a coalescer filter for oil removal. The instrument air system also has two air receivers. The Instrument Air System supplies air to pneumatic valve actuators, controllers and instrumentation.

A crossover ties together the air compressor discharge lines ahead of the dryers. This crossover allows isolation of one of the compressors and/or one of the dryers without interrupting the instrument air supply to the valve actuators and other users. The compressors operate in a lead/lag arrangement. However, both compressors can operate together to meet system requirement.

The discharge of each compressor passes through an aftercooler and a gas/liquid separator. The discharge is then dried with a refrigeration type air

dryer, and passed through a separator/filter, an air filter, and an oil removal filter. In normal operation, the series of filters provides drying and filtering of the air in addition to the refrigerated air dryer. However, the filters are sized to provide adequate separation and drying of the instrument air should a refrigerated dryer be temporarily removed from service for maintenance or replacement.

The condensate collected by the dryer and the filters will be dumped automatically to the sewer system. Condensate from the air system was tested for hazardous materials and found to be non-hazardous.

Control System

The control system for the instrument air system is comprised of the following:

Controls Unique to each Compressor

Tag	AK-1/AK-2	PLC I/O No.	Description
HM	104 / 105	Q1	Hour Meter
HS	104 / 105	I5	Manual - Off - Auto Selector Switch
HS	104A/105A	NA	Manual Load/Unload Selector Switch (Pneumatic)
HS	104B/105B	NA	Internal Load Modulating Selector Switch. (Pneumatic), **Not Used**
PB	104A/105A	I7	Local Stop Push Button
PB	104B/105B	I9	Local Start Push Button
SOV	104 / 105	Q2	Load Solenoid
TSH	104 / 105	NA	Discharge, Temperature Switch High
TSH X	104 / 105	I6	Discharge, Temperature Switch High Auxiliary Relay
XA	4 / 5	Q4	Air Compressor Failed Auxiliary Relay
XL	104A/105A	NA	Power On Light
XL	104B/105B	Q3	Auto Start Enabled

Controls Common to both Compressors

Tag	PLC I/O No.	Description
HS-1	I1	Compressor Lead / Lag Hand Switch
PSH-1A	I2	Pressure Switch High
PSL-1A	I3	Pressure Switch Low
PSLL-1A	I4	Pressure Switch Low Low

Manual Operation

An air compressor can be operated manually as follows:

To start compressor:

Turn Manual-Off-Auto Switch, (HS-104/105), to the “Manual” position for the compressor to be started.

Switch Manual Load/Unload Selector Switch, (HS-104A/105A), to “Unload”.

Push the Start Push Button, (PB-104B/105B).

If the discharge temperature permissive, (TSH-104/105), is satisfied the compressor motor, (88 M-104/105), will start.

Switch Manual Load/Unload Selector Switch, (HS-104A/105A), to “Load”.

SOV 104/105 will energize and load the compressor.

1. To stop compressor:

- Switch Manual Load/Unload Selector Switch, (HS-104A/105A) to “Unload”.
- Wait 2 min.
- Push the Stop Push Button, (PB-104A/104B).
- Switch Manual Load/Unload Selector Switch, (HS-104A/105A) to “Load”.

Warning

1. Do not restart compressor until the compressor has completed its cool-down cycle after unloading.
2. The manual operating mode is not intended for continuous operation. The compressor will not unload or shut off. The compressor will continue to run and eventually the relief valves may operate.

Automatic Operation

1. Use Lead/Lag Selector Switch, (HS-1), to select the lead compressor. This allows the operator to insure equal wear between air compressor sets.
2. Turn Manual-Off-Auto Switch, (HS-104/105), to the “Auto” position on one or both compressors.
3. Push “Start” pushbutton (PB-104B/105B) on one or both compressors. The “Auto Start Enabled” light (XL-104B/105B) will turn on.

4. As system air pressure drops to 95 psig, (PSL-1A), and the temperature permissive, (TSH-104/105), is satisfied the lead compressor motor, (88 M-104/105), will start.
5. After 10 seconds the lead compressor will load, (SOV-104/105).
6. If the system air pressure drops to 90 psig, (PSLL-1A), and the temperature permissive is satisfied the lag compressor motor will start.
7. After 10 seconds the lag compressor will load.
8. When the system air pressure increases to 120 psig, (PSH-1A), the loaded compressor(s) will unload.
9. After 10 minutes if the system air pressure has stayed above 90 psig, (PSLL-1A), the lag compressor motor, if running will stop. If the air system pressure has stayed above 95 psig., (PSL-1A), the lead compressor motor, if running will stop.
10. While in Automatic Mode the compressors can be stopped locally by pushing the "Stop" Push Button, (PB-104A/105A). To restart after a Local Stop, push the "Start" Push Button, (PB-104B/105B).

Automatic Start After Power Failure

If there is a failure of commercial power, any running compressors will stop due to the loss of 480 VAC. When 480 VAC is restored by the emergency generators or the restoration of commercial power, the air compressors will sequence on as required by the system pressure. If the system pressure is below 85 Psig, (PSLL-1A), the automatic start sequence will be as follows:

20 Sec	AK-1 Start		
20 Sec	10 Sec	AK-1 Load	
20 Sec	20 Sec		AK-2 Start
20 Sec	20 Sec	10 Sec	AK-2 Load

Status Lights

3. Each compressor set has a "Power On" Light, (XL-104A/105A), to indicate AC Power is available.
4. Each compressor set has an "Auto Start Enabled" Light, (XL-104B/105B), to indicate that each compressor set is in Auto, the discharge temperature permissive is satisfied and the unit can start any time based on system demand.

Alarms

LOCAL

FAILED START

Output Q7 LED is used as a local alarm for “Failed Start”. The PLC has given a start command and after a time delay the motor running feedback was not detected. Determine the problem and make proper repairs. The LED will remain on until it is reset manually. To reset Q7:

1. HS-104/105 is turned to “Off” and than back to “Auto.”

HIGH DISCHARGE TEMPERATURE

Output Q8 LED is used as a local alarm for high discharge temperature shutdown. This shutdown is an auto reset. Once TSH-104/105 resets, the unit will start based on system demand. The Q8 LED will remain on until it is manually reset. To reset Q8 do the following:

HS-104/105 is turned to “Off” and than back to “Auto”.

WARNING: For the compressor to resume automatic operation, “Start” Push Button PB-104B/105B must be pressed after performing step no. 1 above.

SCADA & REMOTE

AK-104/105 FAILED

Output Q4 LED is on and energizes Relay XA-4/5 when the PLC-104/105 and corresponding Air Compressors are operating normally. If the PLC-104/105 detects an internal problem, if there is a High Discharge Temperature shutdown or if the compressor motor fails when a run command is given by the PLC, the PLC will turn Q4 off de-energizing Relay XA-104/105. Determine the problem and make proper repairs. The LED will remain on until it is reset manually. To reset Q4 do the following:

1. HS-104/105 is turned to “Off” and than back to “Auto.”

LOW PRESSURE, LOW/LOW PRESSURE

Pressure switches are installed at each air receiver to provide low pressure and low/low pressure alarms at the AIMAX and SCADA terminals. Low/Low alarms are also indicated with an alarm window on the graphic panel in the control room.

When a low-pressure alarm is indicated, verify that all valves (compressors isolation valves, and valves to and from the air receiver) **are**

OPEN. The compressor isolation valve is a 1” ball valve located inside of the compressor room in the Maintenance Building.

AIR DRYER SHUTDOWN

Normally-open contacts installed in each of the air dryers provide for alarm indication when A.C. power is shut off (or when controls are in manual) to any one of the units. Alarms are indicated at the AIMAX and SCADA terminals, and at the graphic panel with an alarm window.

(d) Inspection, Testing and Maintenance

Inspection, testing and maintenance shall be performed as required by section 3.7 of this manual.

The compressor Lead/Lag selector switch, (HS-1) should be toggled following each compressor maintenance.

Pop-up indicators on the air filters activate on high differential across the filter, indicating that the filter cartridges should be replaced.

The filter elements of the inline filters shall be replaced when they are dirty or the service indicator shows approximately one-half red/green.

All low point drain valves of the instrument air system shall be opened to blow off the accumulated liquid at four month intervals. In addition, because the refrigerated air dryer can dry the compressed air to only a 35º F dew point, the low point drain valves shall be opened to blow off accumulated liquid whenever the ambient temperature drops below 35º F.

Section 11. Transducers/Transmitters

11.1 Pressure Transducers

(a) Reference

Foreign Prints: F3336-J12

(b) Component Descriptions

Descriptions of components not listed below may be found on the bills of material for the applicable drawings.

Component	Pressure transmitter. Calibrated span: 0-800 psig. Output: 4-20 ma. Power: 24 VDC, loop powered.
Tag Numbers	PT-3, PT-7, PT-8, PT-9, PT-10, PT-11, PT-12, PT-13, PT-14, PT-7A, PT-8A, PT-9A, PT-10A, PT-11A, PT-12A, PT-13A, PT-14A, PT-7B, PT-8B, PT-9B, PT-10B, PT-11B, PT-12B, PT-13B, PT-14B, PT-17, PT-18, PT-21, PT-27, PT-29A, PT-29B, PT-30, PT-34, PT-38, PT-40, PT-34A, PT-38A, PT-62, PT-83, PT-84, PT-87
Mfr./Model	Rosemount, 3051 Smart Model 3051G5A11S1B1E5 (OLD) Model 3051CG5A52A1AE5B4J2 (NEW)

(c) System Description and Operation

Pressure transmitters are used for three different purposes. PTs 7A, 8A, 9A, 10A, 11A, 12A, 13A, 14A, 30, 31, 32, 34A, and 38A are used for calculating flow through the orifice meters. PTs 3, 18, 83, 84, and 87 are used to display operating pressures in the control room of the liquid storage tank, in header #3 L-101, L-132 and L-100 respectively. The remaining pressure transmitters are used for upstream and downstream pressure control in each of the incoming lines and in PV-29, and for downstream pressure control of the Station Separators header control valves, and for L-109.

Pressure transmitters used for calculating flow rates are installed in the meter pits. All other pressure transmitters are located in the transducer/analyzer buildings.

Output circuits from the transmitters terminate in the computer room. Circuits from transmitters used for flow calculations terminate at the PLC. Circuits from transmitters used for pressure control terminate at the PACs located in the control panel. Circuits from transmitters used only for pressure display terminate at panel meters located in the control panel. Circuits parallel to those terminating in the control panel are installed which terminate at PLC input blocks.

Pressure transmitters are tapped off of the station piping at locations listed in table 11.1.

Table 11.1

MILPITAS TERMINAL - PRESSURE TAPS

Tag No.	Description	MV for Valve	Indicated Location
PT-3	Storage Tank Pressure	NONE (2)	GPI (3)
PT-7	L-300B Pipeline Pressure	V-7R	UIC, PLC
PT-7A	L-300B M-7 Pressure	NONE	PLC
PT-7B	L-300B Header Pressure	V-7R	UIC, PLC
PT-8	L-300B Pipeline Pressure	V-8R	UIC, PLC
PT-8A	L-300B M-8 Pressure	NONE	PLC
PT-8B	L-300B Header Pressure	V-8R	UIC, PLC
PT-9	L-300A Pipeline Pressure	V-9R	UIC, PLC
PT-9A	L-300A M-9 Pressure	NONE	PLC
PT-9B	L-300A Header Pressure	V-9R	UIC, PLC
PT-10	L-300A Pipeline Pressure	V-10R	UIC, PLC
PT-10A	L-300A M-10 Pressure	NONE	PLC
PT-10B	L-300A Header Pressure	V-10R	UIC, PLC
PT-11	L-131 Pipeline Pressure	V-11R	UIC, PLC
PT-11A	L-131 M-11 Pressure	NONE	PLC
PT-11B	L-131 Header Pressure	V-11R	UIC, PLC
PT-12	L-131 Pipeline Pressure	V-12R	UIC, PLC
PT-12A	L-131 M-12 Pressure	NONE	PLC
PT-12B	L-131 Header Pressure	V-12R	UIC, PLC
PT-13	L-107 Pipeline Pressure	V-13R	UIC, PLC
PT-13A	L-107 M-13 Pressure	NONE	PLC
PT-13B	L-107 Header Pressure	V-13R	UIC, PLC
PT-14	L-107 Pipeline Pressure	V-14R	UIC, PLC
PT-14A	L-107 M-14 Pressure	NONE	PLC
PT-14B	L-107 Header Pressure	V-14R	UIC, PLC
PT-17	Pressure D/S Separators (Header #1)	V-17R	UIC, PLC
PT-18	Pressure U/S Separators Reg. (Header #3)	NONE	PLC
PT-21	Pressure D/S Separators (Header #1)	V-21R	UIC, PLC
PT-27	Pressure D/S Separators (Header #1)	V-27R	UIC, PLC
PT-29A	Pressure, U/S V-28	V-29	UIC, PLC
PT-29B	Pressure D/S (Header #1)	V-29	UIC, PLC
PT-30	L-100 M-30 Pressure	NONE	PLC
PT-31	L-132 M-31 Pressure	NONE	PLC
PT-32	L-101 M-32 Pressure	NONE	PLC
PT-34	King Road DFM Pipeline Pressure	V-34 & V-35	PLC GPI
PT-34A	King Road DFM M-34 Pressure	NONE	PLC
PT-35	King Road DFM Pipeline Pressure	V-35	Not Connected
PT-38	L-109 Pipeline Pressure	V-38	UIC, PLC
PT-38A	L-109 M-38 Pressure	NONE	PLC
PT-40	L-109 Pipeline Pressure	V-40	UIC, PLC

PT-62	Station Bypass Pressure, D/S V-62	V-62	UIC, PLC
PT-83	L-101 Pipeline Pressure	NONE	PLC
PT-84	L-132 Pipeline Pressure	NONE	PLC
PT-87	L-100 Pipeline Pressure	NONE	PLC, GPI
PIC-3	L-300A Pipeline Pressure	V-3	PLC, GPI
PIC-4	L-300A Pipeline Pressure	V-4	PLC, GPI
PIC-5	L-300B Pipeline Pressure	V-5	PIC
PIC-6	L-300B Pipeline Pressure	V-6	PIC
PIC-16	Pressure D/S (Header #1)	V-7	PIC
PIC-20	Pressure D/S (Header #1)	V-8	PIC
PIC-26	Pressure D/S (Header #1)	V-26	PIC
PIC-28	Pressure D/S (Header #1)	V-28	PIC
PIC-33	King Road DFM Pressure, U/S M-34	V-33	PIC
PIC-36	King Road DFM Pressure, U/S M-34	V-36	PIC
PIC-37	L-109 Pressure, U/S M-38	V-37	PIC
PIC-39	L-109 Pressure, U/S M-38	V-39	PIC
PIC-63	Station Bypass Pressure, D/S V-62	V-63	PIC
PIC-66	L-107 Pipeline Pressure	V-66	PIC
PIC-67	L-107 Pipeline Pressure	V-67	PIC
PIC-70	L-131 Pipeline Pressure	V-70	PIC
PIC-71	L-131 Pipeline Pressure	V-71	PIC

(1) Measured Variable (Process signal to valve controller)

(2) Storage tank pressure used in V-3D relay logic circuitry.

(3) GPI = Newport or Chessell Indicator, Instrument/Graphic Panel UIC = Siemens 353 Controller, Instrument/Graphic Panel

PLC = GE PLC Genius Blocks

PIC = Bristol Pressure Controller, Instrument Cabinets-Yard

(d) Inspection, Testing and Maintenance

Inspection, testing and maintenance shall be performed as required by section 3.7 of this manual.

11.2 Differential Pressure Transmitters

(a) Reference

Foreign Prints: F3336-J12

(b) Component Descriptions

Descriptions of components not listed below may be found on the bills of material for the applicable drawings.

Component	Differential pressure transmitter.
Calibrated span:	0-50 inches water.
Output:	4-20 ma.
Power:	24 VDC, loop powered.
Tag Numbers	FT-7A, FT-7B, FT-8A, FT-8B, FT-9A, FT-9B, FT-10A, FT-10B, FT-11A, FT-11B, FT-12A, FT-12B, FT-13A, FT-13B, FT-14A, FT-14B, FT-30A, FT-31A, FT-32A, FT-34A, FT-38A
Mfr./Model	Rosemount, 3051D Smart.

Component	Differential pressure transmitter.
Calibrated span	0-250 inches water.
Output:	4-20 ma.
Power	24 VDC, loop powered.
Tag Numbers	FT-7C, FT-7D, FT-8C, FT-8D, FT-9C, FT-9D, FT-10C, FT-10D, FT-11C, FT-11D, FT-12C, FT-12D, FT-13C, FT-13D, FT-14C, FT-14D, FT-30B, FT-31B, FT-32B, FT-34B, FT-38B
Mfr./Model	Rosemount, 3051D Smart.

Component:	Differential pressure transmitter (filter dP for C-4 and C-5)
Calibrated span:	0-1000 inches water
Output:	4-20 ma.
Power:	24 VDC
Tag Numbers:	PDT-4A and PDT-5A
Mfr./Model	Rosemount 3051

(c) System Description and Operation

Differential pressure (dp) transmitters(except for PDT-4A and PDT-5A) are installed to measure differential pressure across each orifice plate for flow measurement and for flow control on the incoming lines. Two dp transmitters, in a stacked configuration (i.e. one 0-50” w.c. and one 0-250” w.c.), are installed to measure flow rates through each meter run. The stacked configuration provides greater accuracy at low flow rates than one transmitter would provide. Each meter run on the incoming lines has two sets of dp transmitters installed, one set for incoming flow and one set for reverse flow.

The dp transmitters on the incoming lines are arranged as follows:

Tag #	**Range**	**Description**
FT-7A	0-50” w.c.	M-7 incoming

FT-7C	0-250” w.c.	M-7 incoming
FT-7B	0-50” w.c.	M-7 outgoing
FT-7D	0-250” w.c.	M-7 outgoing
FT-8A	0-50” w.c.	M-8 incoming
FT-8C	0-250” w.c.	M-8 incoming
FT-8B	0-50” w.c.	M-8 outgoing
FT-8D	0-250” w.c.	M-8 outgoing
FT-9A	0-50” w.c.	M-9 incoming
FT-9C	0-250” w.c.	M-9 incoming
FT-9B	0-50” w.c.	M-9 outgoing
FT-9D	0-250” w.c.	M-9 outgoing
FT-10A	0-50” w.c.	M-10 incoming
FT-10C	0-250” w.c.	M-10 incoming
FT-10B	0-50” w.c.	M-10 outgoing
FT-10D	0-250” w.c.	M-10 outgoing
FT-11A	0-50” w.c.	M-11 incoming
FT-11C	0-250” w.c.	M-11 incoming
FT-11B	0-50” w.c.	M-11 outgoing
FT-11D	0-250” w.c.	M-11 outgoing
FT-12A	0-50” w.c.	M-12 incoming
FT-12C	0-250” w.c.	M-12 incoming
FT-12B	0-50” w.c.	M-12 outgoing
FT-12D	0-250” w.c.	M-12 outgoing
FT-13A	0-50” w.c.	M-13 incoming
FT-13C	0-250” w.c.	M-13 incoming
FT-13B	0-50” w.c.	M-13 outgoing
FT-13D	0-250” w.c.	M-13 outgoing
FT-14A	0-50” w.c.	M-14 incoming
FT-14C	0-250” w.c.	M-14 incoming
FT-14B	0-50” w.c.	M-14 outgoing
FT-14D	0-250” w.c.	M-14 outgoing

The dp transmitters are mounted in the meter run pits. Pressure taps from the flanges on each side of the orifice plate are tubed to expansion bottles and then to the transmitters. The expansion bottles reduce pulsation and allow condensation to drop out before reaching the transmitters.

(d) Inspection, Testing and Maintenance

Inspection, testing and maintenance shall be performed as required by section 3.7 of this manual.

11.3 Temperature Transmitters

(a) Reference

Foreign Prints: F3336-J12

(b) Component Descriptions

Descriptions of components not listed below may be found on the bills of material for the applicable drawings.

Component	RTD temperature transmitter.
Calibrated span:	20-120 psig.
Output	4-20 ma.
Power	24 VDC, loop powered.
Tag Numbers	TT-7A, TT-7B, TT-8A, TT-8B, TT-9A, TT-9B, TT-10A, TT-10B, TT-11A, TT-11B, TT-12A, TT-12B, TT-13A, TT-13B, TT-14A, TT-14B, TT-30, TT-31, TT-32, TT-34, TT-38
Mfr./Model	Rosemount, 3044 Smart
Model No.	3044A1B1E5

Component	RTD head and thermowell assembly.
Tag Numbers	TE-7A, TE-7B, TE-8A, TE-8B, TE-9A, TE-9B, TE-10A, TE-10B, TE-11A, TE-11B, TE-12A, TE-12B, TE-13A, TE-13B, TE-14A, TE-14B, TE-30, TE-31, TE-32, TE-34, TE-38
Mfr./Model	Rosemount,
Model No.:	78F21N00B075T26

(c) System Description and Operation

RTD head and thermowell assemblies and RTD transmitters are installed to measure the gas temperature downstream of each orifice plate. The measured temperature is used in the gas flow calculations.

The RTD head and thermowell assembly is installed on the pipelines at the end of each meter run. The meter runs on the incoming lines have two RTDs installed, one for incoming flow and one for outgoing flow. The RTD transmitters are installed in transducer/analyzer building #2

(d) Inspection, Testing and Maintenance

Inspection, testing and maintenance shall be performed as required by section 3.7 of this manual.

11.4 Hand Held Programmer/Monitor

(a) Reference

Foreign Prints: F3336-J12, F3336-J13

(b) Component Descriptions

Component	Remote Transmitter Interface (Hand Held Programmer/Monitor)
Tag Numbers	HHM-3, HHM-4
Mfr./Model	Rosemount Model No.: 268 with Revision 4.0 software.

(c) System Description and Operation

The Remote Transmitter Interface (RTI) provides a common communications link to the Rosemount family of microprocessor-based instruments. The RTI can communicate with any of the Rosemount smart instruments from almost any wiring termination point in the loop.

The RTI is a hand-held, battery powered unit which can perform diagnostics, configuration and interrogation of the pressure, dp and temperature transmitters at the Terminal. Refer to F3336-J12 or F3336-J13 for operating procedures.

(d) Inspection, Testing and Maintenance

No routine maintenance is required. The software used by the unit may need to be brought to date if new revisions of transmitters are installed at the Terminal. Software upgrades are made by sending the units back to the factory.

11.5 Liquid Level Transmitters

(a) Reference

Drawings: See Exhibit A - Drawing List

Foreign Prints: F3336-J8

(b) Component Descriptions

Descriptions of components not listed below may be found on the bills of material for the applicable drawings.

Component	Liquid level transmitter. Capacitance type, with 42” rigid, Teflon insulated ½” diameter probe.
Output:	4-20 ma.
Power:	24 VDC.
Tag Numbers	LT-1A, LT-1B, LT-2A, LT-2B, LT-3
Mfr./Model	Delevan
Model No.	420-0-THD-042-XP

Component:	Liquid level transmitter, Guided wave radar type
Output:	4-20ma.
Power:	24 VDC
Tag Number:	LT-6A
Mfr./Model No.	Rosemount /3300 Series

(c) System Description and Operation

The level transmitters(except for LT-6A) consist of a sensing probe, a pre-amplifier mounted in an explosion-proof enclosure at the sensing probe, and a remote mounted enclosure that contains a power supply, terminals for signal output, output relay, calibration adjustments and related circuitry. The probes and pre-amps are installed in standpipes located next to the liquid level sight gages and level switch standpipes at each separator and at the liquid storage tank. The transmitter boards are installed in transducer/analyzer building #1.

The sensing probe is energized with a radio frequency signal (about 1 MHz). When the process level changes, a change of capacitance occurs resulting in a very small change of frequency. This change is detected and compared with preset values in the electronic measuring circuit. After proper amplification, this signal is used to operate the 4-20 ma DC signal output.

The analog signals from the transmitters are input to the PLC and to control panel meters for display purposes only.

(d) Inspection, Testing and Maintenance.

No routine maintenance is required. For calibration procedures, refer to F3336-J8.

Section 12. Control and Graphic Panel

12.1 Control Panel

(a) Reference

Drawings:

388274 Instrumentation - Arrangement; Instr & Graphic Panel
388467 Connection - Diagram; Instr/Graphic Panel Termination

Foreign Prints:

F3336-J18

(b) Component Descriptions

Descriptions of components not listed below may be found on the bill of materials listed on drawing 388274.

Component: Mosaic Tile Graphic Panel (see section 12.2)

Component: Process Meter, 3-1/2 digit, Input:1-5 VDC, Power: 120 VAC
Tag Numbers: PI-3, PI-17, PI-18, PI-29A, LI-3, LI-2B, LI-2A, LI-1B, LI-1A, ZI-1, ZI-2, ZI-3, ZI-4, ZI-5, ZI-6, ZI-15, ZI-16, ZI-18, ZI-19, ZI-20, ZI-22, ZI-23, ZI-24, ZI-25, ZI-26, ZI-28, ZI-33, ZI-36, ZI-37, ZI-39, ZI-45, ZI-48, ZI-49, ZI-50, ZI-64, ZI-63, ZI-66, ZI-67, ZI-70, ZI-71
Mfr./Model: Newport, Model 202-P

Component: Process Meter, 5 digit, Hi/Lo alarms, Input: 1-5 VDC, Power:120VAC
PI-38, PI-83, PI-84, PI-87
Mfr./Model: Chessell, Model 750

Component: Process Automation Controllers (see Section 13.2)
Siemens PAC 353

Component: Power Supply, Input: 105-125 VAC, Output: 24 VDC, 10 amps
Tag Numbers: PS-A, PS-B
Mfr./Model: Acopian, Model A24H1200

Component: Power Supply, Input: 105-125 VAC, Output: 24 VDC, 15 amps
Tag Number: PS-C
Mfr./Model: Acopian, Model A24H1500

Component: Indicating Light, Red lens, 24VDC.
Tag Numbers: PL-200, PL-602, PL-705
Mfr./Model: Micro-Switch, PTL-2213-B00

Component: Indicating Light, Amber lens, 24VDC.
Tag Numbers: PL-612, PL-624, PL-636, PL-743, PL-755, PL-768
Mfr./Model: IDI, Model 4611/4633/85

Component: Remote Annunciator Chassis, 8 Modules, with remote power supply
Mfr./Model: Panalarm, Series 90-94RC3/94RC5/90P2

Component: Blower package, 275 CFM, 115 VAC
Mfr./Model: Hoffman, Cat. No. A-DB275

Component: Digital LED Display, 120 VAC
Tag Numbers: PDT-4A, PDT-5A, LT-6A
Mfr./Model: Newport Electronics Inc./202A

(c) System Description and Operation

The control panel contains the mosaic tile graphic panel, and alarm annunciator, the PACs, process meters and push-button switches for remote operation of monitor valves and on/off valves. The instrumentation and controls contained in the control panel provide the capability to operate the station without the use of the PLC or the SCADA systems.

Electrical power to the control panel is provided by the UPS power distribution panel (UPD panel). In a general power failure, the electric valve operators and remote set regulators, will loose power until the emergency generators take over.

Push-button switches located on the panel control the DC powered remote-set regulators used on the air supplies to pneumatic operators on the station “open/close” and monitor valves (see sections 4.6 and 5.0). Two push-buttons are provided for each valve; one for open and one for close. Each switch has two positions, Remote and Local, and has a push-button in the center of the switch. The push-button can only be operated when the switch is in the Local position.

Placing a switch in the Remote position allows remote operation via the PLC and SCADA. When the switch is in the Local position, the push-button must be held down to initiate valve movement. The valve will hold its position when the push-button is released (some coasting of the valve occurs between the time when the push-button is released and when the air pressure equalizes in the valve actuator).

Power supplies located in the control panel provide 24 VDC power to those field transducers providing input signals to the control panel. Analog signals from the transducers to the PACs and process meters are wired in parallel

with the PLC. Therefore, indication of critical process variables (valve positions and pressures), is maintained at the panel if the PLC or SCADA systems fail.

There are four DC power supplies located in the control panel, and one located in the PLC CPU rack. One power supply in the control panel provides power to the annunciator unit. Two other units in the panel, PS-A and PS-B are wired in parallel to provide redundant power to those field transducers which are wired to the PACs and in parallel with the PLC. The third power supply provides power to the valve position switch indicator circuits. The power supply located in the PLC CPU rack provides power to field transducers some of which are wired to the control panel.

Failure of any of the three transducer power supplies is indicated by a red light on the front of the control panel. One light is provided for each transducer power supply.

Failure of any of the fuses on the field transducer circuits is indicated with amber lights located inside the back of the control panel. Each amber indicating light represents ten fuses. If a fuse failure alarm is indicated, isolate the failure by finding the lighted indicator in the back of the panel, and then find and replace the failed fuse.

Two types of process meters are used on the control panel. The Newport units have red digits, while the Chessell units have blue digits. The Chessell units are configured to provide high and low alarm indication for each main line pressure. An alarm is indicated by a flashing display. Refer to F3336-J18 for details on the Newport and Chessell units.

The remote annunciator chassis containing eight modules is mounted inside the front of the control panel, along with its remote power supply. Refer to F3336-J18 for configuration, operating and maintenance instructions.

Two blower units are mounted in the rear doors of the panel. The fans blow air into the panel to expel heat generated by the electronic components mounted in the panel. Air is exhausted from the panel through the vents in the top of the rear doors. The on/off switch is located inside the rear of the panel, on the center vertical frame member.

CAUTION

Blowers must remain on during normal operations. Excess heat in the panel may cause damage to the electronic components contained in the panel.

(d) Inspection, Testing and Maintenance

No routine maintenance is required.

12.2 Graphic Panel

(a) Reference

Drawings:

488558 Instrumentation - Diagram; Control Room Graphic Panel

(b) Component Descriptions

Refer to drawing 488558 for descriptions of graphic panel components.

(c) System Description and Operation

The graphic panel consists of mosaic tiles, indicator lights, push button switches, a digital clock, and alarm indicator windows mounted in a zinc alloy grid which in turn is supported with an aluminum framework.

A schematic diagram of the station piping is painted on the mosaic panel. LED indicator lights located near valve symbols on the panel indicate the position of the valve. Positions of manually operated valves are indicated with two color LEDs, while positions of regulator valves are indicated with tri-color LEDs.

For both the bi-color and tri-color LEDs, a red light indicates an open valve while a green light indicates a closed valve. The yellow light on the tri-color LED indicates a regulator in a throttling position. The tri-color LEDs change states as controlled by limit switches on each of the regulator valve operators. The bi-color lights are controlled by push-button switches located on the graphic panel.

Alarm windows located in the panel display alarm conditions at the terminal. Lights behind a window will flash when an alarm occurs. Alarms are acknowledged by pressing the ACK push-button on the graphic panel. Lights behind the alarm windows stop flashing but remain on when an alarm is acknowledged but has not yet been cleared.

A TEST push-button located on the graphic panel will illuminate all LEDs and alarm windows while depressed.

The digital clock located in the graphic panel is set with push-buttons located directly below the clock faceplate.

(d) Inspection, Testing and Maintenance

The TEST button located on the graphic panel should be pushed periodically to check that all LEDs and alarm window lights illuminate properly. Spare LED assemblies and slide lamps for the alarm windows are available at the terminal.

Section 13. Computer Systems

13.1 Programmable Logic Controller (PLC)

(a) Reference

Drawings:

183502	FLOW.BLK DIAG
388272	Control System Architecture

(b) System Description and Operation

REFER TO SYSTEM ARCHITECTURE DRAWING FOR GENERAL INFORMATION ABOUT SYSTEM COMPONENTS AND THEIR ITERCONNECTIONS.

The PLC system is located in the computer room in the Control Building. The PLC monitors operating data from field transducers and provides automatic flow control algorithms for the incoming lines. The PLC accepts operating setpoints and commands from the local Operator Interface Terminal (OIT) or the SCADA terminals, compares setpoint entries with existing setpoints and transfers valid setpoint values to the single loop controllers. Additionally, the PLC communicates with SCADA terminals to display and record operating data, and with 2 gas chromatographs to receive gas composition and BTU contents for all incoming lines and after the Station Separators.

The PLC system includes a redundant CPU. The back-up CPU (Slave) is maintained in a “hot-standby” mode, meaning that the back-up CPU monitors the operation of the master CPU and takes over operation if it detects a problem.

Field transmitters are hardwired to the I/O blocks. The I/O blocks convert signals from field devices to digital data for use in the PLC. I/O blocks must be configured with the HHM prior to use. The blocks are wired together on a twisted pair “bus” and communicate with the CPU through the Genius Bus Controllers. Bus controllers obtain the status of each I/O block, as well as diagnostic and configuration data from all devices on the bus. Each bus controller accommodates a maximum of 30 I/O blocks. There are two bus controllers in each CPU rack to accommodate all I/O blocks. Each of the bus controller in each rack is also used to transfer data between the master CPU and the back-up CPU to keep both CPUs synchronized and loaded with current data.

The 3 Ethernet Interface modules in each PLC rack are to provide communication with the Process Automation Controllers (PAC). Only the modules in the PLC, which is in control (Master or Slave), are communicating with the PAC controllers.

The serial communication RTU Master module (one in each PLC rack) is used to poll Gas Chromatographs via RS485 serial link using Modbus protocol. The modules act as Masters and the gas chromatographs act as Slaves

The 2 serial Communication Coprocessor modules in each PLC rack are used to provide serial communication interfaces between the PLC and the local HMI and the PLC and SCADA terminal in Gas Control. All ports described in this paragraph are set for RS232 serial link using Modbus protocol. The modules act as Slaves and the OIT and SCADA computers act as Masters. Only the modules (RTU Master and Communication Coprocessor) in the PLC, which is in control (Master or Slave), are communicating with their respective devices. The switching of the communication links for the modules is done through the Relay Output modules installed in the Expansion rack of the Slave PLC.

The PLC may be accessed via programming terminal in the computer room or any PC with the GE VersaPro software. Copies of the program are kept on the hard disk of the programming terminal and the back-up copies of the programs must be kept on a floppy diskette at the Terminal. A hard copy is available at the terminal.

REFER TO THE PLC CONFIGURATION OR A CONFIGURATION PRINTOUT FOR DETAILS ABOUT SPECIFIC MODULES, PART NUMBERS, MODULE AND COMMUNICATION PORT SETTINGS.

(c) Inspection, Testing and Maintenance

No routine maintenance is required. Lithium batteries require changing periodically. When battery power is low in one of these modules, the “Battery Low” or “Battery Failed” alarm will be displayed on the HMI and the “PLC Trouble” alarm will be sent to SCADA. Refer to the PLC hardware manual for battery replacement procedures.

13.2 Process Automation Controller (PAC)

(a) Reference

Drawings:

388065, 388069, 388070, 388072, 388081, 388108, 388110, 388111, 388112, 388113, 388114, 388115, 388116, 388117, 388118, 388119, 388120, 388467, 388274 (See Exhibit A, Drawing List, for titles.)

Foreign Prints:

F3336-J3 Process Automation Controllers, Siemens PAC 353

(b) Component Description

Component:	Process Automation Controllers.
Tag Numbers:	Trimmer Valve Controllers UIC-7R, UIC-8R, UIC-9R, UIC-10R, UIC-11R, UIC-12R, UIC-13R, UIC-14R UIC-17R, UIC-21R, UIC-27R Load Valve Controllers UIC-7, UIC-8, UIC-9, UIC-10, UIC-11, UIC-12, UIC-13, UIC-14 UIC-17, UIC-21, UIC-27 Other Valve Controllers UIC-38, UIC-40, PIC-29, PIC-62
Mfr./Model:	Siemens Model PAC 353

(c) System Description and Operation

The PACs are installed in the control panel in the control room. The PACs control the electrically operated regulating valves.

Refer to Appendix A & E for detailed descriptions and operating instructions.

Each PAC provides digital output signals to open or close its associated valve based on the current valve position and one or more of the process variables (e.g. pressure, back pressure and/or flow).

Trimmer valve controllers UIC-7R, UIC-8R, UIC-9R, UIC-10R, UIC-11R, UIC-12R, UIC-13R, and UIC-14R are configured to provide downstream pressure, backpressure and flow control through each of the bi-directional meter tubes regardless of the direction of flow.

Trimmer valve controllers UIC-17R, UIC-21R, and UIC-27R are configured to provide downstream pressure (Station Separators pressure) control only.

Load valve controllers UIC-7, UIC-8, UIC-9, UIC-10, UIC-11, UIC-12, UIC-13, UIC-14, UIC-17, UIC-21, and UIC-27 are configured to provide control based on the output of their associated trimmer valve controllers.

Controllers UIC-38, UIC-40, and PIC-62 are configured to provide downstream pressure control in one direction only (uni-directional).

Controller UIC-29 is configured to provide downstream pressure control when gas is flowing in either direction through the PV-29 piping.

Refer to Appendix A for Controller Operation & Appendix E for Program Configurations

(d) Inspection, Testing and Maintenance

Refer to Siemens PAC 353 Manual UM353-1 Rev 10

13.3 Gas Chromatographs

(a) Reference

Drawings:

388473	Instrumentation - Diagram; AE-7,9,11,13 (Incoming Lines)
488957	Instrumentation - Arrangement; Gas Chrom., Bldg #2
488959	Instrumentation - Arrangement; Gas Chrom., Bldg #1 (Mixed Gas)

Foreign Prints:

F3336-J10 Gas Chromatographs

(b) Component Description

Descriptions of system components not listed below may be found in the applicable bills of material.

Component:	Regulator, 0-50 psig outlet pressure range.
Tag Numbers:	PCV-52, PCV-57, PCV-58, PCV-59, PCV-60.
Mfr./Model:	GO-Regulators (Go Series)
Model No.	PR1-1C11ACE114

Component:	Regulator, 0-500 psig outlet pressure range.
Tag Numbers:	PCV-51, PCV-53, PCV-54, PCV-55, PCV-56. PCV-61
Mfr./Model:	GO-Regulators (Go Series)
Model No.:	PR1-1C11ACJ114

Component:	Regulator, dual stage, 3-150 psig outlet pressure, with natural gas cylinder connection.
Tag Numbers:	PCV-104, PCV-107, PCV-122, PCV-141.
Mfr./Model:	Tescom Corporation
Model No.:	44-3463S-24 / 4059-0200N/ 4059-3000N / CGA-350

Component:	Regulator, dual stage, 3-150 psig outlet pressure, with helium gas cylinder connection.
Tag Numbers:	PCV-103, PCV-105, PCV-120, PCV-121, PCV-139, PCV-140.
Mfr./Model:	Tescom Corporation
Model No.:	44-3463S-24 / 4059-0200N/ 4059-3000N / CGA-580

Component	Flow Indicator
Tag Numbers:	FI-100, FI-101, FI-102, FI-103, FI-104
Mfr./Model:	Brooks, Model No.: 3750CA1A11BEAAAO

Component:	Sampling System & Analyzer
Tag Numbers:	AT-9 (Incoming Lines), AT-21 (Mixed Gas)
Mfr./Model:	Daniel Electronics Co., Inc.
Model No.:	500

Component:	Chromatograph Controller
Tag Numbers:	AUY-9, AUY-21
Mfr./Model:	Daniel Electronics Co., Inc.
Model 2350A	

(c) System Description and Operation

Gas chromatographs provide on-line measurement of heating value (BTU), specific gravity, and composition of gas sampled from each incoming line and from the mixed gas. Gas samples are analyzed by analyzers located in the transducer/analyzer buildings. Data from the analyzers is transferred via a 4-20 ma signal to the controllers located in the computer room.

Gas samples analyzed by the gas chromatographs are taken from “speed loops”. Speed loops are small diameter lines which are tapped into each gas main to deliver gas to the transducer/analyzer buildings. Samples are taken automatically from the gas flowing through each speed loop. The speed loops discharge to the SJDFM, with the exception of the SJDFM speed loop which discharges to the station gas appliance supply system. Flow indicators in each loop are set to assure that gas flows through the loops at rates sufficient to keep the gas sampled by the analyzers representative of the gas in the pipelines.

Gas samples taken from the speed loops are regulated in two stages to 20 psig before entering the analyzer sampling system. Sampling systems contain pressure and flow regulating instruments which must be set for proper operation. Refer to foreign print F3336-10 for further details.

Each sampling system has the capacity to sample five separate gas streams. The sample streams for each analyzer are assigned as follows:

Analyzer AT-9 & Controller AUY-9

STREAM 1: L-300A: AE-9
STREAM 2: L-300B: AE-7

STREAM 3: L-107: AE-13

STREAM 4: L-131: AE-11

STREAM 5: Calibration gas

Analyzer AT-21 & Controller AUY-21

STREAM 1: Mixed Gas: AE-21

STREAM 2: Sample Bottle

STREAM 3: Sample Bottle

STREAM 4: Sample Bottle

STREAM 5: Calibration Gas

The analyzers send signals to the controllers proportional to the concentration of components detected in the gas samples. The controller then uses the data to compute specific gravity, supercompressibility, and BTU values.

In addition to receiving signals from the analyzer, the chromatograph controller controls the analyzer sampling system solenoid valves. The controllers are programmed to provide sequential sampling of the gas streams, but to allow only one analysis of calibration gas per day.

Each stream analysis takes six minutes. Therefore, new data is obtained every six minutes from the mixed gas and every twenty-four minutes from the samples taken from the other lines.

(d) Inspection, Testing and Maintenance

Inspection, testing and maintenance shall be performed as required by section 3.8 of this manual.

System alarms are indicated by LEDs on the controller faceplates, and identify that maintenance is required. Alarms are acknowledged via the PC Mon PC Program.

Refer to foreign print F3336-J10 for detailed inspection, testing and maintenance procedures.

Periodic maintenance includes maintaining sufficient supplies of calibration gas and carrier gas (helium) to each analyzer. An alarm is indicated at the appropriate controller when either of these gas supplies runs low at a analyzer.

The controllers must be configured with the component data of the calibration gas. A controller must be reconfigured with new data whenever a new bottle

of calibration gas is installed. Controllers are configured with a personal computer using the PC MON interface program provided by Daniel Industries.

Refer to foreign print F3336-10 and to Appendix E for further details.

13.4 Ethernet Switches

(a) Reference

Drawing

388272	Milpitas Terminal System Architecture (Ethernet Connectivity)
388272	Ethernet Switch Port Assignments

(b) Component Description Drawing 388272

(c) System Description & Operation

A Cisco 2950 Ethernet Switch has been installed to allow the master and backup PLCs to communicate with the twenty-six Siemens 353 Controllers. Three GE Ethernet CMM321-GH modules have been installed on each PLC. Hardware version -GH or higher is required on the CMM321 modules.

The first and second CMM321 modules communicate with the first and second groups of eight 353 Controllers respectively. The third CMM321 module communicates with the third group of ten 353 Controllers.

The Cisco 2950 has 48 ports and is set up as three virtual switches. Virtual switches 1, 2 and 3 occupies Ports 1 though 16, 17 through 32, 33 through 48 respectively. The first CMM321 module is connected to virtual switch 1. The second module is connected to virtual switch 2. The third module is connected to virtual switch 3. The Ethernet ports of the CMM321 modules from both the master and backup PLC are always connected to the Cisco. However, only the set of modules from the controlling PLC will be communicating with the PAC 353 Controllers at one time.

The PLC communicates with the PAC 353 Controllers via Ethernet using the Modbus/TCP protocol through the Cisco 2950.

The controlling PLC constantly polls the Controllers for pressure, flow and status information. It also downloads setpoints to the Controllers as required by the PLC logic, or on command from Gas Control.

Three Linksys Hubs provide the backup to the Cisco 2950. Each Linksys Hub has a minimum of 16 Ports. The three Hubs provide the equivalent functionality of three virtual switches on the Cisco. In case of failure of the Cisco, connections made to Ports 1-16, 17-32, and 33-48 should be transferred to Ports 2-16 of the

three Linksys Hubs. All Ports on the Linksys Hubs are equivalent except Port 1 which can be used as an uplink port.

The Linksys Hubs are normally turned off or unplugged to minimize wear on the built-in cooling fans.

13.5 SCADA

(a) Reference

Drawings:

388272 Elementary - Electrical; PLC I/O & Control System

(b) Component Description

The PLC and SCADA communicate with each other via RS-232 communication. The connection at the PLC is made with a Communications Control Coprocessor Modules (CCM) and at the VAX through serial I/O ports.

Refer to Appendix E for switch configuration requirements of the CCM.

(c) System Description and Operation

Milpitas terminal is monitored by the Gas Data SCADA system which has nodes located in the Gas Control Center, as well as System Gas Control and Emergency Gas Control.

Each node consists of a redundant pair of Digital Equipment Company VAX computers running ADACS (Advanced Data Acquisition and Control System) under the VMS (Virtual Memory System) operating system.

The PLC at Milpitas is scanned independently by both the Gas Control nodes of the Gas Data system, and is used for monitoring and control of the gas terminal operations. These two nodes also have identical set of displays and control capabilities.

The net result is that if one of the Gas Control nodes failed, all SCADA operations could be performed from the other node.

(d) Inspection, Testing and Maintenance

Inspection, testing and maintenance shall be performed as required by section 3.7 of this manual.

13.6 Cutler Hammer Operator Interface Terminal (OIT)

(a) Reference

Drawings: 388272, 388476

(b) Component Description

Cutler Hammer OIT Model 5000 with remote keyboard

(c) System Description and Operation

Description

The Cutler Hammer OIT is real-time man-machine interface unit which is connected by a serial link to the PLC(s). It is capable of reading and writing data and provides schematic displays, trends and local setpoint capability.

The OIT communication is passed through a relay which automatically switches the link to the backup (slave) PLC in the event of a failure of the master PLC.

The OIT writes to and reads data from the same register locations as the Gas Data SCADA system.

The displays and trends for the OIT are configured on a PC using Cutler Hammers “PanelMate Configuration Editor” and then loaded into the OIT using the same software. Detailed instructions for reloading the configuration are listed in appendix G.

The displays, trends and operation of the OIT are also listed in appendix G.

Section 14. Station Electrical Power Systems

14.1 Station Electrical Power Systems

(a) Reference

Drawings:

3800220 Electrical - Details, General Notes & Legend
3800221 Electrical - Diagram, Single Line Diagram
3800230 Electrical - Diagrams, Panel Schedules, Control Building
3800231 Electrical - Diagrams, Panel Schedules

(b) Component Description

Component: Utility transformer, 21KV primary and 480-V, 3-wire secondary, with no ground on the secondary side.

Component: Isolation transformer, dry type, 225KVA, 480-V, delta/120/208V, Y, 4 wire, with three-pole main circuit breaker on primary side.

Component: Standby Generator, 100KW (2 units) Kohler, Model 100R282

Component: Standby Generator Transfer Switch 208 V, 400A, 3 ph., 4 wire, 3 pole. Kohler ES 21052-K, S/N K28527 Kohler ES 21127-K, S/N K28528

Component: Uninterruptible Power Supply, 10KVA UPS Systems

(c) System Description and Operation

The electrical service equipment at the Terminal is designed to provide 225 KVA service of which the neutral leg is isolated from the 21KV distribution system ground. Isolation from the distribution system ground is required to minimize the current load requirement for the cathodic protection system (see sections 15 and 16).

The utility transformer provided by Mission Trail Region Service Planning Department is a 21KV primary and 480-V, 3-wire secondary, with no ground on the secondary side. The transformer is installed on a pad near the fence on the west side of the yard, near the Maintenance Building. The primary side of the transformer is grounded locally at the pad.

The second isolation transformer is a 225 KVA, 480-V delta/120/208V Y, 4-wire dry type, with a 400 A three-pole main circuit breaker on the primary

side. The isolation transformer is located on a pad on the south side of the Maintenance Building. The transformer ground is tied to the station ground grid.

The utility meter is connected to the primary side of the isolation transformer, and is located in a NEMA 4 enclosure next to the transformer.

Service is provided from the isolation transformer to the main switchboard (MS) located in the Maintenance Building. From the panel MS, power is fed through a transfer switch to Standby Power Distribution Panels EDP-M and EDP-C.

Power from panel MS is monitored by the transfer switch. If power from panel MS is interrupted, a relay on the transfer switch closes to start both standby power generators. After one of the standby generators has started and the output has reached 115 VAC and 60 Hz, the transfer switch switches the supply to panels EDP-M and EDP-C from panel MS to that standby generator. When power is restored to panel MS, the transfer switch switches the supply to panels EDP-M and EDP-C from the standby generator back to the main switchboard. Then both standby generators time-out and shut off.

Smaller distribution panels are fed from the main switchboard and from panels EDP-M and EDP-C. Only those panels fed from EDP-M and EDP-C are supported by the standby generators.

Circuits **not** supported by the standby power system are as follows:

Blowdown compressor

Welding receptacle, Maintenance Building

Panel LPM, Maintenance Building

The UPS is fed from distribution panel EDP-C. The UPS supports circuits on distribution panel UDP located in the computer room in the control building. The UPS has a battery bank which provides a continuous power supply to specific circuits during the period between main power failure and standby power pick-up. Proper battery maintenance and testing are essential to assure reliable operation in the event of an outside power failure.

Appendix I is the UPS Battery Operating, Maintenance, and Testing Procedures.

Section 15. Station Ground Grid

15.1 Station Ground Grid

(a) Reference

Drawings:

488339 Grounding - Arrangement, Meter & Reg Yards

(b) Component Description

Component: Grounding Anode, zinc, 1.5” x 1.5” x 60”, 30 lb. packaged with 75% gypsum, 20% bentonite, 5% sodium sulfate, with 10ft. of #4/0 AWG cable.
Mfr./Model: Far West Corrosion Control

(c) System Description and Operation

The ground grid at the Terminal consists of zinc grounding anodes which are tied together with a common insulated, stranded No. 4 gage copper cable. Leads from each grounding station are spliced to the cable. Reinforcing steel in underground structures such as pits and building foundations is also tied to the ground grid, and the station piping is also tied to the grid with a lead brazed to the pipe.

Being tied to the cathodically protected steel structures means that the ground grid has a voltage impressed on it from the cathodic protection system rectifier, as does the protected steel. This voltage elevates the electrical ground from a true ground to about 0.64 volts. Zinc rather than copper is used for the grounding rods to reduce the amount of current drawn from the rectifier, and to avoid anodic currents that might develop between steel and copper.

Because it is tied electrically to the cathodic protection system, the ground grid is isolated from the electrical distribution service ground with an isolation transformer (see section 14).

(d) Inspection, Testing and Maintenance

Inspection, testing and maintenance shall be performed as required by section 3.7 of this manual.

Section 16. Cathodic Protection System

16.1 Cathodic Protection System

(a) Reference

Drawings:

488339 Grounding - Arrangement; Meter & Reg Yards

(b) Component Descriptions

Component: Rectifier Primary rating: 120 volts Secondary rating: 30 amps, 40 volts
Mfr./Model: Goodall, Amp O Matic, Model JAAYSA 40-30N, SN 90J1284

Component: Anode, Deep Well bore: 265' Anode Size: 10" dia. x 110' Backfill: Coke breeze
Mfr./Model: Duriclor - TA2

Component: Anode, Distributed Hole bore: 8" dia. x 10' deep Backfill: Coke breeze
Mfr./Model: Duriron

Component: Cathodic Protection Test Station
Mfr./Model: Cott Mfg. Co., "Big Fink"

(c) System Description and Operation

The Terminal is cathodically isolated from the incoming and outgoing pipelines with insulated flanges at the thrust blocks located in the NE and NW corners of the yard. A 120 VAC to 40 VDC rectifier, rated at 30 amperes, is mounted on the outside of the south wall of the Maintenance Building, near the isolation transformer. The rectifier supplies the cathodic protection current necessary to protect the station piping from corrosion. One deep-well graphite anode is installed approximately 21' south and 36' west of the corner of the piping area retaining wall. Four distributed sacrificial graphite anodes are installed in a grid pattern in the metering and regulation area.

The anodes are tied to the positive terminal of a rectifier, and the station piping, reinforcing steel in the building foundations, and station ground grid are tied to the rectifier's negative terminal. Reinforcing bars in the pits are not tied to the system. Every effort was made during construction to keep re-bar in the pits from coming into contact with station piping.

The electrical potential created between the anodes and the protected structures is greater than those created by any localized anodic conditions which may exist. The result is that the protected structures attract electrons from the sacrificial anodes, thereby preventing corrosion caused by localized anodic currents. Test cells installed throughout the yard allow corrosion mechanics to monitor the pipe to soil potential throughout the system.

Because the station's electrical ground grid is under cathodic protection, the station electrical supply is necessarily isolated from the distribution system at the utility transformer so that the cathodic protection current is kept off of the neutral leg of the 21 KV distribution system (see sections 14 and 15).

(d) Inspection, Testing and Maintenance

Inspection, testing and maintenance of the cathodic protection system are performed as required by section 3.7 of this manual.

Section 17. Communications Systems

17.1 Communications Systems

(a) References

Drawings:

493621 Baseband Interconn. Diagram for Communication Equipment
063453 Equipment and Cable Assignment Sheets
064898 PG&E Standard Transmission Levels

(b) Component Description

BAY "A", Rack 1

Component: 24 VDC Fused /Power Distribution Panel
Mfr./Model: Hendry Telephone Products

PRT 06015-05 RV C

S/N: 0009226

Component: Radio Base Station - KMD 638
Mfr./Model: Motorola Micor
Model # C71RCB-3116D C581
S/N: 301CJU0014
FCC XMIT DATA: CL1103
FCC RCVR DATA: RC 13-RC103

Component: Motorola "Starpoint" M/W
Mfr./Model Model: C71RCB-3116D/C581AESP
Serial Number: 301CJU0014
FCC transmitter data: CC1123
FCC receiver data: RCB-R103
Primary voltage: 24 VDC

Component: Order Wire

48 VDC

Mfr./Model: Raven Electronics Corp.
Model 41610D-650-02
Component: Radio Remote Terminal Unit
Mfr./Model: Larse 7420A

Model 1242A-701 ALM 001250

Designation:

LA-1: Motorola Transmitter “A”&”B”

LA-2: Motorola Receiver “A”&”B”
LA-3: GTE Slave Sync SHF
LA-4: Battery Charger Fail
LA-5: Fuse Alarm
LA-6: GTE OMNI PABX Fail

Component: Digital Channel Bank
Mfr./Model: NEC Model ND4E

Component: Larscan Access - T DSU/CSU
Mfr./Model: LARSCAN
Model A-87-0100A-052

S/N: 292411

Component: LYNX CP2 Spread Spectrum Radio
Mfr./Model: WESTERN MUX CORP
Model CP2 - 27000 - A1
S/N: 97 - D03699
FCCID: HZB - LYNX22

BAY “A”, Rack 2

Component: 24 VDC Power Distribution Panel
Mfr./Model: GTE Lenkurt
Model 46820-01, Issue 2 MI

Component: Power Supply
Input: 100/120/215/230-240 VAC
4.9/4.2///2.3/2.1 Amp, 47-63 Hz
Output: 12 VDC/16A or 15 VDC/15A

Mfr./Model: Power One
Model F15-15-A

Component: Channel Shelves

MFR/Model LENTRONICS 36A Channels

XEL DST Term Sets

BAY “A”, Rack 3

Component: Radio Control Panel
Mfr./Model: ZETRON Inc.
Model 4024
S/N: 089-0170, Option No. 901-9059

Component: Westcom Shelf
Mfr./Model: Slot 1: 4202-00 (Rockwell)
Slot 2: 4202-00 (Westcom)
Slot 12: 6124 2W FXD SF (Telltabs)

Designation:

Slot	Ch.	Description	Model
1	A	KMD636	702-9084 Dual Ch.Tone Cntrl
1	B	KMD638 Relay	" " " " "
2	A	KMD638	" " " " "
2	B	Phone	" " " " "
3	A	Topock	" " " " "
3	B	Bristol	" " " " "
4	A	Rodman	" " " " "
4	B	Double Mount.	" " " " "
5	A	Pelato Peak	" " " " "
5	B	Joaquin Ridge	" " " " "
6	A	Tass Peak	" " " " "
6	B	Spare	" " " " "
7	A	Spare	" " " " "
7	B	Spare	" " " " "
14		Console 3 - Aux. Console, Cntrl Rm	702-9091 Console Interface
15		Console 2 - Maint. Ass'ts Rm	" " "
16		Console 1 - Main Console, Cntrl Rm	" " "

Component: Key System Shelf

Designation:

Slot	*Description*
1	6208
2	6211
3	6212
4	6301 ECDS
5	6302 ECDS
6	6303 ECDS
7	6304 ECDS
8	262 0346
9	ANT ATL
10	spare

11 Interrupter

Component: Key System Shelf Power Supply
Mfr./Model: Model PC-1204

Bay A, Rack 4

Component: Power Distribution Panel /Fused

48VDC

Mfr./Model: Hendry

Component: Starlan 10 Network Hub
Mfr./Model: ATT (2 of each)

Component: Shelf
Mfr: Universal Data Systems
Model: 202T Modem - spare
V.3225 modem - idle
202T modem - Loma Prieta
202T modem - Hollister
202T modem - PL7 A/B
202T modem - PL7 Almaden
202T modem - Moss Lndg

Component: Split T Fractional T-1 DSU/CSU
Mfr : Larse
Model: NIM -2V
S/N: 048810

Component: Modem
Mfr./Model: Motorola CODEX 2185
Designations:

Circuit #	Description
To VAX SID #5	TXB-4
(L) To VAX	TXB-1 to DSD Port 0

Bay "A", Rack 5

Component: Modem
Mfr./Model: Motorola CODEX 2680
Designations:

Circuit #	Description
105457	Kettleman 6740

Component: Modem Controller
Mfr./Model: Motorola CODEX 6740

Component: Starlan Network Hub
Mfr./Model: ATT

Component: Modem
Mfr./Model: UDS Motorola RM16M

Component: Micro Server
Mfr./Model: DEC DEMS A-A

Component: CISCO 4000 Routers
Mfr./Model: Cisco Systems
S/N: 45549422, MTMIL 283
45549441, MTMIL 283A

Component: Data Sharing Device (DSD)
Mfr./Model: Motorola CODEX 2185
Designations:

DSD#	Port#	Description
1	0	To VAX TXD 3
1	1	To Rodman Mtn
1	2	To LRCV 21, 21 Topock
2	0	To VAX TXD 0
2	1	To Morro Bay Meter Sta.
2	2	To Kern River Reg Station
3	0	To VAX TXD 6
3	1	To Victorville/Ridgecrest MP 237
3	2	To Estrella River
4	0	To VAX TXD 1
4	1	To Topock PLC
4	2	To Hinkley PLC
4	3	To Kettleman PLC
5	4	To Daget Chromatograph

Bay "A", Rack 6

Component: Power Supply, 48 VDC, 200 A
Mfr./Model: Lorain
Model 1231A2
Spec. 5821-065
S/N: 13241

Component: Fuse Panel, 225 A

Mfr./Model: Lorain

Component: Control Panel
Mfr./Model: Lorain

Component: 48 VDC Distribution Panel
Mfr./Model: Lorain

Component: 48 VDC Distribution Panel
Mfr./Model: Lorain

Component: 24 VDC Distribution Panel
Mfr./Model: Lorain

Component: Two (2) DC-DC Converters
Input: 48 VDC , 21.2 A
Output: -24 VDC, 30 A
Mfr./Model: Lorain HSB30A
Spec. 5645-003
S/N 719, S/N 1357

Component: Rectifier
Input: 208/240 VAC, 60 Hz, 16.4/14.5 A, 1 phase
Output: 58 VDC, 50 A
Mfr./Model: Lorain

Model RL50B50

S/N: 729, 730 & 1098

Bay "B"

Component: Telephone PBX
Mfr./Model: Fujitsu/GTE Business Systems
OMNI Series III
Reference: OMNI Book TL-148300-1001

Component: Recorder/Announcer with ALC & SIT Tones
Mfr./Model: ETC Digicept

ETC1000

Component: Patch Panel for test equipment and troubleshooting

Component: Tru System Solid State Recorder

Mfr/Model: SSR
S/N: 059745

Component: Two (2)Gorden Kapes Power Failure Transfer Panels
Mfr/Model: BP -2

Component: Transmission Test Set
Mfr/Model: Wilcom T318
S/N: 630

Component: Transmission Test Set
Mfr/Model: Design Development Inc.

710C - 1805

S/N: 0288/1715

(c) System Description and Operation

The communication systems at the Terminal consist of the telephone system, the SCADA system, the corporate LAN/WAN system and a radio system. The telephone, SCADA and LAN/WAN systems hardware are maintained and supported by PG&E Telecommunications department. The radio system is maintained by the local terminal maintenance crew.

Three procedures for operating and adjusting the radio system are presented in Appendix H.

Section 18. Fire Protection Systems

18.1 Fire Protection Systems

(a) Reference

Drawings:

3800220 Electrical-Details,General Notes & Legend
3800223 Electrical-Arrangement, Plan, Details & Notes, Maintenance Building

3800225 Electrical-Arrangement, Plan, Details & Notes, Control Building
3800226 Electrical-Arrangement, Plan, Details & Diagram, Control Building

(b) Component Descriptions

Component:	Universal Alarm Control Panel
Mfr./Model:	Pyrotronics System 3
Model	CP-35
Component:	Ionization Smoke Detector - Surface Ceiling Mounted
Mfr./Model:	Pyrotronics
Component:	Remote Alarm Annunciator
Mfr./Model:	Pyrotronics Pyr-A-larm
Component:	Audio/Visual Annunciator Flush Mounted Local Indicator
Mfr.:	Pyrotronics
Component:	Manual Pull Station - Flush Mounted
Mfr.:	Pyrotronics
Component:	Manual Pull Station - Surface Mounted
Mfr.:	Pyrotronics
Component:	Fire Alarm Building Annunciator - Pedestal Mounted
Mfr./Model:	Gamewell Part No. MD129-3 8-Zone Annunciator with Gamewell PC-1 Pedestal

(c) System Description and Operation

A fire hydrant, connected to the City of Milpitas' supply, is located at the entrance to the parking lot in front of the control building.

Fire protection is provided by an alarm system installed in the control and maintenance buildings. The alarm system is not linked to any local municipal emergency service department. In the event of a fire, the station operator must call the local fire department in accordance with PG&E emergency procedures. Fire extinguishers located throughout the facility provide emergency local fire suppression capability. Table 18.1 provides a list of the fire extinguisher inventory for the facility.

Table 18.1

Facility Fire Extinguishers: Locations, Types and Weights

LOCATION	TYPE	WEIGHT
Building A	Badger Dry Chemical	33 #
Building C	Badger Dry Chemical	33 #
Building D	Badger Dry Chemical	33 #
Building E	Badger Dry Chemical	33 #
Communications Room	General Halon	28 #
Control Room East Wall	Badger Dry Chemical	9 #
Control Room South Wall	General Halon	28 #
Engineering Trailer	General Dry Chemical	18 #
Gas Island	Sentry Halon	17 #
Control Building North Door	Buckeye Dry Chemical	9 #
Mechanical Room	General Dry Chemical	20 #
Maintenance Bldg. East Stairs by North Door #6	General Dry Chemical	20 #
Maintenance Bldg. East Stairs	General Dry Chemical	9 #
Maintenance Bldg. South Wall by Door #3	Buckeye Dry Chemical	9 #
Maintenance Bldg. South Exit	Buckeye Dry Chemical	9 #
Maintenance Bldg. South Wall on Table	General Dry Chemical	9 #
Maintenance Bldg. West Wall Welding Cart	Badger Dry Chemical	9 #
Sulfur Analyzer Bldg.	General Halon	28 #
UPS Room	Badger Dry Chemical	33 #

The fire alarm system provides audible and visual indications when an alarm condition is detected at either of two fire alarm control panels. Each control panel contains an integral battery backed power supply. One panel is located

in the Mechanical/Electrical room in the control building and the other is located just outside of the utility room in the maintenance building. Status lights (LEDs) on the front of each control panel indicate the operating conditions of the system including: alarm circuit status, battery trouble, ground fault, audible alarm, AC power failure (running on battery), general system trouble.

Alarms are initiated by smoke detectors and manual push-button stations. Fourteen smoke detectors and five push-button stations are located in the control building. Three smoke detectors and three push-button stations are located in the maintenance building.

Alarms are annunciated at audio/visual stations located next to each manual push-button station, at an annunciator in the control room, and at an annunciator located just outside the main gate.

Alarms from the existing panel have been connected to the PLC for annunciation in San Jose. These are Control Building Fire Alarm, Shop Building Fire Alarm and Fire Detection System Trouble.

Section 19. Surface Drainage

19.1 Surface Drainage

(a) Reference

Drawings:

488331 Area - Plan, Grading & Drainage
488276 Area - Plan, Metering and Regulating Yard
488278 Structure - Sections & Details, Pits 1 & 4
488279 Structure - Sections & Details, Pits 5, 6, & 7
488345 Structure - Sections & Details, Pits 2 & 3
488559 Structure - Sections & Details, Metering and Regulating Yard

(b) System Description and Operation

The surface drainage system consists of a network of catch basins tied together with drainage pipe which empty directly into the storm drain maintained by the City of Milpitas.

Drains from the metering and regulation pits are piped individually to a intermediate sump located outside of the elevated yard area near the stairs on the west retaining wall. Each drain emptying into the sump has a ball valve which can be closed in the event of a hazardous liquid spill in one of the pits. The drain shutoff valves are identified as follows:

(From north end of sump)

Tag #	Description
V-4A	Drain from Pit 4A, L-109 regs V-38, V-40
V-4B	Drain from Pit 4B, SJDFM regs V-34, V-35
V-1A	Drain from Pit 1A, regs V-17/17R, V-21/21R
V-1B	Drain from Pit 1B, regs V-27/27R, V-29
V-2A	Drain from Pit 2A, regs V-13/13R, V-14/14R
V-2B	Drain from Pit 2B, regs V-11/11R, V-12/12R
V-3A	Drain from Pit 3A, regs V-9/9R, V-10/10R
V-3B	Drain from Pit 3B, regs V-7/7R, V-8/8R
V-7A	Drain from Pit 7A, meter runs M-9, M-10
V-7B	Drain from Pit 7B, meter runs M-7, M-8
V-6A	Drain from Pit 6A, meter runs M-11, M-12
V-6B	Drain from Pit 6B, meter runs M-13, M-14
V-5A	Drain from Pit 5A, meter runs M-30, 31, 32
V-5B	Drain from Pit 5B, meter runs M-34, 38

The sump contains an oil/water separator on the outlet. After separation, water drains from the sump to catch basin CB-4.

NOTE

Oil collected in the oil/water separator must be pumped out and disposed as hazardous waste.

Drains from the separator and liquid storage area are piped in common to catch basin CB-10. A single ball valve located in CB-10 can be closed to prevent hazardous liquid from entering the storm drain system in the event of a spill in the separator/liquid storage area.

(c) Testing, Inspection and Maintenance

Check pit drain sump periodically for oil collected in the oil/water separator. Pump out oil and dispose of it as a hazardous waste.

Section 20. ~~Fuel Island~~

~~20.1 Fuel Island~~

Note # Fuel Island has been removed

Section 21. Lighting

21.1 Lighting

(a) Reference

Drawings:

3800224 Electrical - Arrangement, Plan & Diagram, Control Building

488245 Conduit - Arrangement, Outdoor Lighting

(b) Component Description

Lighting system components not listed below may be found on the bill of materials for the applicable drawing.

Component:	Light Standard, 25’ high
Mfr./Model:	General Electric Cat. #C790H68X
Component:	Floodlight, outdoor 400 Watt Lucalox lamp, 208V Beam spread: NEMA 6 x 5
Mfr./Model:	GE HLU Powerflood HLUF40SDA/65DBK
Component:	Light Standard, 20’ high
Mfr./Model:	General Electric ASS420SD4BDB
Component:	Light, 150 Watt Lucalox Lamp, 208V
Mfr./Model:	General Electric Decashield D25S15SOH1GMC3DB

(c) System Description and Operation

Lighting in the metering and regulation area is controlled with switches located on the lighting control panel in the control room. Yard perimeter lighting is controlled by photodiode switches located on the top of each light.

Power to the yard lighting is distributed from panel LPO located in the Maintenance building. Panel LPO is fed from the standby power distribution panel, EDP-M.

Lighting circuits for the control building are taken off of panel MPC located in the Electrical/Mechanical room in the control building. Lighting circuits for the panel LPM in the maintenance building.

(d) Testing, Inspection and Maintenance

No routine maintenance is required.

Section 22. Security Systems

22.1 Security Systems

This section removed in 2010 as the facility security is installed and maintained in accordance with PG&E's Company Security Manual.

Section 23. Miscellaneous

23.1 Static Mixer

The static mixer was removed in 2009 and replaced with a 36-inch valve which is normally closed so that gas is directed through filter/separators C-4 and C-5. The piping upstream of these separators was fabricated using numerous elbow segments to ensure that the gas is well mixed BEFORE entering the separators.

23.2 Utility Air System

(a) References

Drawings

353623 Architectural - Mechanical, Plan, Sects & Sheet Notes, Maintenance Building

488563 Piping - Arrangement, Instrument Air Supply

(b) Component Descriptions

Component:	Air Compressor
Mfr./Model:	Atlas Copco Plus Series

(c) System Description and Operation

The utility air system provides air to the fuel island and to the meter pits. The air supply in the pits is for use with pneumatic tools. The compressor is mounted on top of the vertically oriented receiver, and is located in the

same room as the instrument air compressors in the Maintenance Building.

(d) Inspection, Testing and Maintenance

Maintenance of the compressor should be performed periodically. Refer to maintenance procedures on file at the Terminal.

23.3 Ventilation: Transducer/Analyzer Buildings

(a) References

Drawings

488273 Instrumentation Details, Transducer Bldg #1
488274 Instrumentation Details, Transducer Bldg #2
488275 Instrumentation Details, Transducer Bldg #3
488288 Conduit Details, Transducer Bldg #1
488289 Conduit Details, Transducer Bldg #2
488290 Conduit Details, Transducer Bldg #3

(b) Component Description

Component: Roof-Mounted Turbine Ventilator

(c) System Description and Operation

A turbine ventilator is mounted on the roof of each transducer/analyzer building. The ventilators are wind-assisted and have no motors.

(d) Inspection, Testing and Maintenance

No routine maintenance is required.

APPENDIX A. Process Automation Controller (PAC) Local Auto & Manual Operation

Local Station Operation

The station may be operated Locally from the control panel in the control room. Valves may be positioned from the control panel, and pressure, flow, BTU, differential pressure, temperature and valve position data is displayed on panel meter displays, OIT and PAC faceplates. Valve status lights on the mimic panel indicate position of each automatically positioned valve: green = closed, red = open, yellow = throttling.

Pressure control Setpoints may be entered at the PAC faceplates by setting the PAC to “Local” (PB1 Red), selecting the Control “Loop” then scroll “D” to display the “S” setpoint for downstream pressure or “S” setpoint for backpressure (if applicable), and then turning the pulser knob until the display shows the desired setpoint.

To operate control valves manually, set all PACs to “Local” (PB1 Red) and “Manual”. With the PACs in local and manual, position the control valves by scrolling “D” display to the “V” valve and then turning the pulser knob until the display shows the desired valve position (0-100% open).

NOTE

The “V” valve on the PAC faceplate is actually the controller output, i.e., the intended valve position, not the actual valve position. The “Y” parameter indicates the actual valve position.

If the PACs are not functioning, gas flow may be controlled by throttling the monitor valves. The monitor valves are positioned with the push-button switches on the control panel.

Pressures may also be displayed on the PAC faceplates by scrolling the “Loop” to display the downstream or upstream control loop and looking at the “P” process for downstream or upstream pressures. The “D” display button can be scrolled through Process (usually pressure) (P), Setpoint (S), Valve (V), X & Y. While on one of these displays, pushing the Units button will display the location of that displayed point.

Flow direction through each incoming meter run is indicated and selected by the PB2 pushbutton on the trimmer valve PAC faceplates. An “I” (PB2 Green) status indicates incoming flow, whereas “E” (PB2 Red) status indicates outgoing flow.

Flow and other Process data are displayed on the OIT and are obtained from field devices which are dependent of the PLC.

With the station in local operation, the OIT and SCADA terminals continue to display valid station data provided the PLC is functioning properly.

Manual Operation of Valves

Electrically Operated Valves

The electric motor operated valves may be operated from the control room (remote operation) or at the valve (local operation). The normal operation is remote.

To operate a valve locally with electric power available, set the Remote/Local selector switch on the valve actuator to “Local” and push the “Open” or “Close” push-buttons located on the actuator to move the valve.

To operate a valve locally without electric power, set the Remote/Local selector switch on the valve actuator to “Local” and push the “Manual Operation Lever” in the direction of the arrow to engage the hand wheel. Turn the hand wheel to move the valve.

Pneumatically Operated Valves

Pneumatically operated valves are normally operated from the control room. Pneumatic control may be overridden at the individual actuators by removing the keeper pin from the hydraulic override pump handle and operating the hand pump.

APPENDIX B. Emergency Shutdown

Emergency Shutdown

Valves V-1 and V-2

Valves V-1 and V-2 provide a means of closing lines L-300A and L-300B quickly in an emergency. Each valve is equipped with an air-to-open, spring-to-close actuator. These valves may be operated remotely from the control room by switches on the control panel, or locally by using the hydraulic override pump.

To close one of these valves, turn the OPEN/CLOSE switch on the control panel to CLOSE.

Emergency Shutdown of Computer System

To shutdown the computer systems, push the red ESD button located on the east wall of the computer room, near the door. Pressing this button shuts off power to all circuits on the UDP panel, and to circuits 31 through 42 on the EMC panel. These circuits include the MicroVAX (SCADA) computers and the PLC.

APPENDIX C. Blowdown System Operating Procedure

Note # Blowdown System is not used and may be removed

1.1 Liquid Storage Tank Blowdown

The liquid storage tank C-3 must be depressurized prior to unloading. See Appendix D for storage tank depressurization and unloading procedures.

1.2 Meter Tube Blowdown

Meter tubes must be blown down prior to any inspection or maintenance. To blow down a meter tube, proceed as follows:

1. Isolate the meter tube to be blown from the other station piping by closing the appropriate upstream and downstream valves.
2. Open the manual 2” valve connected to the meter run blowdown piping (refer to Exhibit C, Valve List for blowdown valve designations). Gas in the meter run will flow into the San Jose DFM until the pressure in the meter tube decreases to 200 psig or less.
3. Verify that three -way valve PY-1 is positioned so that the flow path is open from the meter tube to the compressor (Port B to Port C). The dial indicator on top of the actuator should read 50%.

    - Three -way valve PY-1 automatically positions so that the flow path is open from Port B to Port C if the following conditions are met:

- HS-3-3 set to “Meter Tube”.
- HS-3-1 and HS-3-2 set to “on”.
- Meter tube pressure less than 200 psig (PSL-1) and greater than ½ psig (PSL-2).

1.3 Main Line Blowdown.

Clearances for main line blowdowns must be obtained from System Gas Control. See Section 3.0.

The blowdown system is designed to provide for blowdown of main lines or of station piping without venting gas to atmosphere. Blowdown is accomplished by isolating the section to be blowndown, then venting the gas through the station bypass line to a lower pressure line. When the pressure in the section being blowndown equalizes to the pressure in the downstream line, a cross compressor is used to complete the evacuation.

The blowdown procedure includes closing valve V-62 and positioning valves V-A, V-B and V-C to establish a flow path through the station bypass. After the upstream and downstream line pressures have equalized, the cross compressor is operated to draw gas from the upstream line and discharge to the downstream line through valves V-D, V-E and/or V-F.

Appendix D. Liquid Storage Tank Draining Procedure

For C-3 Only
To unload the liquid storage tank, proceed as follows:

1. Blow down the tank to 7 psig as follows:

    a. Set meter run/storage tank selector switch (HS-3-3) on the Compressor Control Panel to “on”.
    b. Set compressor on/off switch (HS-3-1) on the Compressor Control Panel to “on”.
    c. Set compressor on/off switch (HS-3-1) on the Storage Tank Control Panel to “on”.
    d. The compressor starts only if the following conditions are met:

    Both HS-3-1 and HS-3-2 set to “on”.

    compressor discharge temperature is not high.

    compressor oil pressure is not low.

    storage tank pressure greater than 7 psig (PSL-3).

The compressor continues to run until the compressor inlet pressure is less than 7 psig.

    e. Verify that three-way valve PY-1 is positioned so that the flow path is open from the storage tank to the compressor (Port A to Port C). The dial indicator on the top of the actuator should read 100%.

Three-way valve PY-1 automatically positions so that the flow path is open from Port A to Port C if the following conditions are met:

    HS-3-3 set to “Storage Tank”.

    HS-3-1 and HS-3-2 set to “on”.

    Storage tank pressure greater than 7 psig.

    When the storage tank pressure is less than 7 psig, the compressors shut down, the red “Ready to Drain” light on the Storage Tank Control Panel lights, and PY-1 automatically repositions so that the flow path is open from Port A to Port B.

    Verify that “Ready to Drain” light on the Storage Tank Control Panel is lit. If so, proceed with draining the tank.

2. Connect truck hose to the quick disconnect coupling located next to the Storage Tank Control Panel, and connect the truck ground strap.
3. Open the manual isolation valve on the storage tank drain line.
4. Set V-3C open/close switch (HS-3C) on the Storage Tank Control Panel to “Close”.
5. Push V-3D “Open” (HS-3D-1) button on the Storage Tank Control Panel to open the storage tank drain valve V-3D.

   Valve V-3D opens if the following conditions are met:

   - storage tank pressure less than 7 psig.
   - storage tank inlet valve V-3C is closed.
   - storage tank liquid level not low (LSL-5A)
   - Push-button HS-3D pushed.

6. Drain tank into tank truck.

   Drain valve V-3D will close automatically when liquid level in the storage tank falls below 15% (LSL-5A) or when push-button HS-3D-2 is pushed.
7. Verify that valve V-3D is closed.
8. Close manual valve in storage tank drain line.
9. Disconnect truck hose and ground strap.
10. Set valve V-3C selector switch HS-3C to “open”.
11. Set compressor on/off switches HS-3-1 and HS-3-2 to “off”.

FOR LIQUID TO BE DRAINED INTO STORAGE TANK C-3 FROM SEPARATORS C-1 and C-2

This system is entirely automated. The following must occur for liquids to be drained out of each of the separators:

Storage Tank Inlet Valves are Open:

Separator Valves at dump valves are Open:

Then, if high level is detected in one of the separator barrel compartments, the appropriate liquid level device will operate the proper dump valve.

For C-6 Only
To unload the liquid storage tank, proceed as follows:

1. Blow down the tank to atmosphere through the two carbon filter arrangement. Be sure to close the valve on the 2-inch dump line to the SJDFM.
2. Connect truck hose to the quick disconnect coupling located next to the Storage Tank. Be sure grounding strap is connected.
3. Open the manual isolation valves on the storage tank drain line.
4. Drain tank into tank truck.
5. Close manual valve in storage tank drain line.
6. Disconnect truck hose and ground strap.

Note:To load blanket gas into the liquid storage tank, open the valve on the ¾ inch connection line from top of C-5 to the top of the storage tank. When the pressures are equalized, close this valve. The excess blanket gas is regulated and monitored and automatically dumped into the SJDFM

FOR LIQUID TO BE DRAINED INTO STORAGE TANK C-6 FROM SEPARATORS C-4 and C-5

This system is entirely automated. The following must occur for liquids to be drained out of one of the separators:

Storage Tank Inlet Valves are Open:

Separator Valves at Dump Valve are Open:

Then, if high level is detected in one of the separator barrel compartments, the appropriate liquid level controller will operate the proper dump valve.

APPENDIX E. Computer Systems Configuration and Programming

CONTENTS

1. Gas Chromatograph Controllers

a. Description

1) The gas chromatograph controllers control the operations of the gas chromatograph Analyzers. Each controller is configured and calibrated to accurately monitor and control a chromatograph analyzer, and to analyze the raw data received from the chromatograph analyzer. The controller functions can be controlled and the configuration can be changed from a PC using the PC Mon software provided by Daniel Industries. A PC Mon handbook is on file at the station for reference. Copies of configurations for each controller are kept on floppy diskettes at the Terminal. Printed copies of each configuration are also on file at the Terminal.

2. Process Automation Controllers (PAC)

(a) Description

Each Process Automation Controller (PAC) is uniquely configured and tuned to perform the functions specific to the valve it is controlling. Generally, there are six types of PAC configurations in use at the Terminal. These six types are as follows:

1. Trimmer valve control with bi-directional downstream pressure, backpressure and flow control.
2. Trimmer valve control with uni-directional downstream pressure control.
3. Load valve control based on trimmer valve controller output.

4. Control valve with uni-directional downstream pressure control.
5. Control valve with bi-directional downstream pressure control.
5. Control valve with uni-direction downstream pressure control and flow control

(b) The configurations of each controller are referred to as follows:

Config. Type	Config. Title	Valve Tag
1	UIC-7R	V-7R
1	UIC-8R	V-8R
1	UIC-9R	V-9R
1	UIC-10R	V-10R
1	UIC-11R	V-11R
1	UIC-12R	V-12R
1	UIC-13R	V-13R
1	UIC-14R	V-14R
2	UIC-17R	V-17R
2	UIC-21R	V-21R
2	UIC-27R	V-27R
3	UIC-7	V-7
3	UIC-8	V-8
3	UIC-9	V-9
3	UIC-10	V-10
3	UIC-11	V-11
3	UIC-12	V-12
3	UIC-13	V-13
3	UIC-14	V-14
3	UIC-17	V-17
3	UIC-21	V-21
3	UIC-27	V-27
4	UIC-38	V-38
4	UIC-40	V-40
5	UIC-29	V-29
6	UIC-62	V-62

Copies of the PAC configurations are kept on diskettes at the Terminal. Printed copies of each configuration are kept on file at the Terminal & a sample configuration is in Exhibit H within this documentation.

(c) Using PAC Configuration Program

The PAC configuration program (Siemens PAC 353 iConfig) provides a means of downloading new configuration to any PAC. Refer to the Process Automation Controller (PAC) Siemens User's Manual UM353-1 Rev. 10.

APPENDIX F. Daniel Flow Computer Faceplate Operations

This section was removed in 2010.

APPENDIX G. OIT OPERATIONS

1. Using the OIT

Overview of Display Pages

- The OIT displays are called pages. The Milpitas OIT has been configured with the following pages:

Page	Name	Contents
00	Hints and Help Page 1	Users can go to this page to get help on navigating from page to page. It has a list of all displays and in the bottom left the configuration revision number and date
01	Hints and Help Page 2	Users can go to this page to get help on making setpoint changes
02	Station Flow	Overview of the station piping with incoming, outgoing and intermediate flows and pressures indicated.
03	Flow Overview.	Summary of all flow measurements in tabular form.
04	Analyzer Data	Summary of all analyzer data in tabular form
05	L300A Controls	All controller values and detailed schematic for V9R/9/10R/10
06	L300A Setpoints	Pressure, flow, in/out, lead/lag and press only vs. pressure and flow for V9R/9/10R/10
07	L300A Valve Controls	Valve maximum percent open for V9R/9/10R/10, V3 and V4. Valve position setpoints for V22 and V23
08	L300B Controls	All controller values and detailed schematic for V7R/7/8R/8
09	L300B Setpoints	Pressure, flow, in/out, lead/lag and press only vs. pressure and flow for V7R/7/8R/8
10	L300B Valve Controls	Valve maximum percent open for V7R/7/8R/8, V5 and V6. Valve position setpoints for V24 and V25
11	L131 Controls	All controller values and detailed schematic for V11R/11/12R/12
12	L131 Setpoints	Pressure, flow, in/out, lead/lag and press only vs. pressure and flow for V11R/11/12R/12
13	L131 Valve Controls	Valve maximum percent open for V11R/11/12R/12, V70 and V71. Valve position setpoints for V18 and V19.
14	L107 Controls	All controller values and detailed schematic for V13R/13/14R/14
15	L107 Setpoints	Pressure, flow, in/out, lead/lag and press only vs. pressure and flow for V13R/13/14R/14
16	L107 Valve Controls	Valve maximum percent open for V13R/13/14R/14, V66 and V67. Valve position setpoints for V15 and V16
17	Station Separators	All controller values and detailed schematic for V17R/17,

	Controllers	V21R/21, and V27R/27.
18	Station Separators Controller Setpoints	Pressure, flow, in/out, lead/lag and press only vs. pressure and flow for V17R/17, V21R/21, and V27R/27.
19	Station Separators Valve Controls	Valve maximum percent open for V17R/17, V21R/21, V27R/27, V16, V20 and V26.
20	BYPASS Controls	All controller values and detailed schematic for V29 and V62
21	BYPASS Setpoints	Pressure setpoints for V29 and V62
22	BYPASS Valve Controls	Valve maximum percent open for V29, V62, V28 and V63
23	L109 Controls	All controller values and detailed schematic for V29 and V62
24	L109 Setpoints	Pressure setpoints for V29 and V62
25	L109 Valve Controls	Valve maximum percent open for V29, V62, V28 and V63
26	UTILITIES	Alarms for the liquid removal and compressed air systems.
27	Power and Alarms	Alarms for: PLC and Chromatograph Fire and Security Main AC power supply UPS
50	UIC 7R Trend	Trend of measured variable and outputs
51	UIC 7 Trend	Trend of measured variable and outputs
52	UIC 8R Trend	Trend of measured variable and outputs
53	UIC R Trend	Trend of measured variable and outputs
54	UIC 9R Trend	Trend of measured variable and outputs
55	UIC 9 Trend	Trend of measured variable and outputs
56	UIC 10R Trend	Trend of measured variable and outputs
57	UIC 10 Trend	Trend of measured variable and outputs
58	UIC 11R Trend	Trend of measured variable and outputs
59	UIC 11 Trend	Trend of measured variable and outputs
60	UIC 12R Trend	Trend of measured variable and outputs
61	UIC 12 Trend	Trend of measured variable and outputs
62	UIC 13R Trend	Trend of measured variable and outputs
63	UIC 13 Trend	Trend of measured variable and outputs
64	UIC 14R Trend	Trend of measured variable and outputs
65	UIC 14 Trend	Trend of measured variable and outputs
66	UIC 17R Trend	Trend of measured variable and outputs
67	UIC 17 Trend	Trend of measured variable and outputs
68	UIC 21R Trend	Trend of measured variable and outputs

69	UIC 21 Trend	Trend of measured variable and outputs
70	UIC 27R Trend	Trend of measured variable and outputs
71	UIC 27 Trend	Trend of measured variable and outputs
72	UIC 29 Trend	Trend of measured variable and outputs
73	UIC 38 Trend	Trend of measured variable and outputs
74	UIC 40 Trend	Trend of measured variable and outputs
75	UIC 62 Trend	Trend of measured variable and outputs
76	INCOMING AND STATION SEPARATORS PRESSURE Trend	
77	STATION SEPARATORS AND OUTGONG PRESSURE TREND	
78	FLOWS TREND 1	L300A, L300B, L131, L107 in, and Station Bypass flows.
79	FLOWS TREND 2	L300A, L300B, L131, L107 out, and Station Bypass flows.
80	FLOWS TREND 3	L100, L132, L101, L109 and SJDFM flows

2) Navigating Between Pages

The four vertically aligned round buttons on the right of the screen are called “Control Buttons”. The 15 buttons under the display on the left are referred to as the “touch panel” and the cancel and numeric keys to the right of them are called the “numeric entry pad”

To go to another page press the control button to the right of the “Get Page” pointer. If you know the number of the page you want enter it using the numeric keypad. Note that 2 numbers are needed e.g. 03 to get page 3.

If you don’t know the page number press the control button to the right of the “Directory” pointer on the screen and a list will appear.

3) Setpoints

All setpoint controls are implemented using the “control templates”. There are two parts to the control templates:

5. In the top, on a dark blue background is information about what the template is for, what the data in the lower part means, and what to enter to get the desired result
6. In the bottom, on a cyan background, is live data that tells the user what the current state of this control point is.

For each control template on the display there is a button on the touch panel (one of the 15 keys under the screen) that corresponds to it. Control actions begin with pressing the corresponding key on the touch panel.

There are slight differences between the ways some of the control templates are used. All require additional data to be entered. For analog values, for example downstream pressure setpoint, it is the desired setpoint. For discrete values the required data entry is shown in the upper blue section of the control template as mentioned previously.

The following is the sequence of actions for setting a setpoint:

7. Press the touch panel button matching the control template you wish to use
8. Note that the selected control template has a box around it and a pointer with the words “Change Value” appears on the right side of the display
9. Press the control button adjacent to the pointer and two new pointers will appear. The new setpoint can then be entered using the numeric keypad. Once the new setpoint has been entered it can be transmitted to the PLC by pressing the control button adjacent to the “Enter New Value” pointer. The control button adjacent to the “Clear” pointer can be used to abort the numerical entry

10. At any time the cancel button on the left of the numeric keypad can be used to completely cancel the whole setpoint sequence.

4) Using the Trend Page

While looking at the trend page it is possible to scroll through the “pens” and see the color, range, and current value for each of the parameters being trended.

Proceed as follows:

11. Press any key on the touch panel
12. Note a box appears around the trend display and two pointers, “Previous” and “Next” pop up, pointing at control buttons
13. Using the control buttons you can scroll through the six pens
14. As each parameter is selected, the vertical range bar on the left, the descriptor lower left, and the current value, lower center, change
15. Note that the text for the descriptor and current value are the same color as the pen.

The update rate is shown in the lower right; it is set to 5 seconds.

2. Maintaining and Reloading the OIT

1) Overview

When the OIT is first received it has no software other than its own operating system loaded in it. All the displays and data points must be created for the application, and then loaded in to the OIT.

The displays are built in a personal computer using a Cutler Hammer configuration editor. The same program has facilities for exporting the configuration to a file and then downloading the file into the OIT.

The OIT has two serial ports - port 2 is permanently connected to the PLC and serves to acquire data and download setpoints. The other, port 1, is available for connection to a PC for configuration purposes.

The PC to OIT connection requires a special cable, Cutler Hammer part # 90 00366 01. These are supplied with the configuration software.

2) Booting the OIT

The OIT requires no intervention to start up from a complete power down. On application of power it goes through a series of self tests then loads the current configuration and finally displays the start up display, in this system page 00, Hints and Help.

3) Reloading the OIT

3.1) Requirements

3.1.1) PC with the OIT configuration software installed
3.1.2) Current configuration, exported to a .pps file see section 9
3.1.3) Cable as listed above
3.2) Procedure - Set up the OIT to accept the download from the PC by performing the following steps at the OIT

3.2.1) Press the control button adjacent to the “Get Page” pointer on the display

3.2.2) Press the control button adjacent to the “More Buttons” pointer on the display

3.2.3) Press the control button adjacent to the “Setup Page” pointer on the display

3.2.4) Use the touch panel to select “Enter Offline Mode”
3.2.5) Press the control button adjacent to the “Execute” pointer on the display
3.2.6) Use the touch panel to select “Enter Serial Transfer Mode”
3.2.7) Press the control button adjacent to the “Execute” pointer on the display

At this point the text “serial mode” appears in the bottom right of the display indicating that the OIT is waiting for the download from the PLC

3.3) Start the PC transferring the configuration by doing the following

3.3.1) Start the Panel Mate Configuration Editor

3.3.2) Click on File

3.3.3) Click on VCP Transfer, answer yes if you have exported the appropriate configuration or have the exported file. (If not see section 9)

3.3.4) The PanelMate Transfer window will open up, next to “Download Configuration” click on “Add Configuration File to Operation List”

3.3.5) Select the configuration file and click “OK”

3.3.6) The text “Download Configuration” together with the configuration selected will appear in the operation window

3.3.7) Start the download by clicking on the start button

3.3.8) Confirm that the result is a “pass” in the operation window

3.4) At this point the download is complete. The OIT is now returned to normal operation by performing the following steps:

3.4.1) Press the “Cancel” key next to the numeric keypad

3.4.2) Use the touch panel to select “Enter Run Mode”

3.4.3) Press the control button adjacent to the “Execute” pointer on the display

3.4.4) Observe that the OIT loads the configuration and goes to the run mode.

4) Communication Set Up

The table below lists the port 2 settings.

Device use	GE Series 90 Point-to-Point
Name	plc1
Model	782
Remote ID	1
Default PLC Name	plc1
Electrical	RS232
Baud Rate	19200
Data Bits	8
Stop Bits	1
Parity	Odd

5) Exporting the configuration

Configuration of the OIT is beyond the scope of this document but it is helpful to know the steps required to create the file that is downloadable to the OIT.

The first part of this process is to use the PanelMate Configuration Editor to create the display pages, points and other required definitions. These are then exported using the file export utility. The extension (.pps) is unfortunately the same as a Microsoft Power Point File but that is not a problem as long as the user is aware of it.

The pps file is a useful format as it contains the entire configuration in one compact file. This file is typically small enough to fit easily on a floppy or be emailed.

APPENDIX H. UPS BATTERY

MAINTENANCE, OPERATING AND TESTING PROCEDURES

MILPITAS TERMINAL

I. INTRODUCTION

The batteries are an important portion of the UPS System. Under normal operation, the batteries shall be continuously connected to the UPS DC bus. The battery when connected to the UPS DC bus, acts as one of the components in the UPS input filters. The batteries are installed in two banks. This two-bank arrangement will enable testing half of the batteries with minimum impact on the UPS operational system. Each bank is rated at 122 Amps for one hour.

1. Float Charge

In this type of operation, the battery is connected in parallel with a constant voltage charger and the critical load circuits. The charger should be capable of maintaining the required constant voltage at the battery terminals and also supply the normal load where applicable. This sustains the battery in a fully charged condition and also makes it available to assume the emergency power requirements in the event of an AC power interruption or charger failure.

2. Float Voltage

Following is the float voltage range recommended for the battery system. Select the “volts per cell” (VPC) value within the range listed that will result in the battery series string having an average volts per cell equal to that value.

RECOMMENDED FLOAT VOLTAGES:

77^{o}F (25^{o}C) = 2.25VPC to 2.27VPC

NOTE:1 There are 60 cells in each battery bank. The float voltage should be 136 VDC and the UPS should be set to provide float voltage of 136 VDC.

NOTE:2 Upon receiving the Battery, the Battery Bank shall be charged by the Battery charger at 139-140 VDC. The battery charger shall be set for 139-140 VDC.

NOTE:3 When recharging the Battery Bank after completion of the battery discharge test using the battery test load bank, the battery charger shall be used with a charge voltage setting of 139-140 VDC.

NOTE:4 Please read the manufacturer's "Battery System Preventive Maintenance Procedures" prior to start working, on the Battery (See FP-3151-P2-1).

NOTE:5 The battery discharge test shall be performed on fully charged battery. If not sure, connect the battery to the battery charger at a float voltage of 136VDC. When the charger current reach 0 Amps, disconnect the battery from the charger and start the discharge test.

The discharge test shall proceed after the manufacturer's recommended annual maintenance has been performed.

For temperatures other than 77^{o}F (25^{o}C) the following formula can be used to determine the recommended float charge voltage per cell:

V corrected = V25^{o}C - [(T actual - 25^{o}C) x (.0055 V/^{o}C)] or V corrected = V77^{o}F - [(T actual - 77^{o}F) x (.0028 V/^{o}F)]

Minimum Float Voltage is 2.21VPC. Temperature correction does not apply below this value.

NOTE: An equalizing charge is not applicable to this type of battery.

3. Effects of Temperature

Temperature has an adverse effect on the life of a battery. The design life of the battery is based on an average annual temperature of 25^{o}C (77^{o}F). As the temperature increases above 25^{o}C (77^{o}F), the life of the battery decreases. The chart below shows the effects of temperature.

Maximum Annual Average Battery Temperature	Maximum Battery Temperature	Percent Reduction In Battery Life
25^{o}C (77^{o}F)	50^{o}C (122^{o}F)	0%
30^{o}C (86^{o}F)	50^{o}C (122^{o}F)	30%
35^{o}C (95^{o}F)	50^{o}C (122^{o}F)	50%
40^{o}C (104^{o}F)	50^{o}C (122^{o}F)	66%
45^{o}C (113^{o}F)	50^{o}C (122^{o}F)	75%
50^{o}C (122^{o}F)	50^{o}C (122^{o}F)	83%

For example: If a battery has a design life of 10 years at 25°C (77°F), but the actual annual average battery temperature is 35°C (95°F), the projected life of the battery is calculated to be only 5 years [10 years - (10 years X 0.50) = 5 years].

Temperature records shall be maintained by the maintenance Department in accordance with this procedure and schedule. The battery temperature shall not be allowed to exceed the maximum temperature shown above. It is important to maintain the battery temperature as close to 25°C (77°F) as possible to achieve the optimum service life from the battery.

4. Testing and Records

A complete recorded history of the battery operation is most desirable and helpful in obtaining satisfactory performance. Good records will also show when corrective action may be required to eliminate possible charging, maintenance or environmental problems.

The following data should be read and permanently recorded for review by supervisory personnel:

A. Upon completion of the initial charge and with the battery on float charge at the proper voltage for one week, read and record the following:

   1. Individual cell/battery voltages
   2. Battery string terminal voltages
   3. Ambient temperature

B. A complete battery discharge test should be periodically performed and a set of readings taken and recorded as shown on the “Battery Bank Test Data” form. All individual connections should be re-torqued prior to the test. A battery discharge test should be performed once a year for the first five years after installing new batteries. After the fifth year, a discharge test should be performed every six months.

5. Recorded Data Review

Each Battery unit should have an acceptable voltage reading between 13.6 - 10.5 VDC (Fully charged to fully discharged). Data comparison should be made for each unit with previous data recorded. If unit voltage reading continues to decline (when fully discharged) and goes below 10.5 VDC, it is recommended to replace this unit. However, a complete data history review of each unit shall be made prior to replacement. For example, if the discharge current is higher than rated, then it is possible that at the end of the one hour

test the unit may experience discharge voltage of less than 10.5 VDC. This type of reading does not mean that the unit is bad. However, if the battery discharge current is at rated value and at the end of the one hour test the unit voltage is lower than 10.5 VDC, then evaluation is needed to determine its status. The determination shall be made by qualified personnel.

If the battery bank voltage starts to drop below 105 VDC at the end of the one hour test some attention should be given to the battery room temperature and float voltage level. Both battery room temperature and float voltage level affect the battery life and rated ampere-hours. The battery voltage shall never be allowed to go below 105 VDC.

NOTE: At the end of the discharge test, the unit battery voltage shall not be allowed to be lower than 10 VDC.

6. Unit Cleaning

Periodically clean unit covers to remove accumulated dust. If any unit or parts appear to be damp with electrolyte or show signs of corrosion, clean with a solution of baking soda and water or isopropyl alcohol, and re-examine within 30 days to determine if the condition re-occurs. If so, contact your local GNB representative.

Do not clean plastic parts with any solvents, detergents, mineral spirits, or spray-type cleaners other than those mentioned here as these can cause crazing or cracking of the plastic materials.

II. GENERAL

1. Each battery bank must be tested separately.
2. After the first bank is tested, recharge the battery as stated in Section V below, including the float charging, before testing the second bank.
3. After the second bank is tested, recharge this battery bank as stated in Section V.

III. TESTING—BANK A

1. Transfer the UPS to Battery Bank B if necessary, by closing Breaker B-1 on the Battery Transfer Switch.
2. Open Breaker A-1 on the Battery Transfer Switch. It may be necessary to move the key from one Kirk Key Interlock to the other.
3. Close Breaker A-2 on the Battery Transfer Switch.

4. At the Test Load Bank close the auxiliary power circuit breaker and the main circuit breaker. The auxiliary breaker is inside the panel and must be closed first. At Panel EDP-C, close Circuit No. 10. Also, close “ON” switch on the door on the Test Load Bank. Make sure the fans are running.
5. Load the battery to 120-122 amps (or as close as possible) by using the switches on the front of the Test Load Bank.
6. Immediately record the following data on the attached sheets:

   6.1 Battery bank voltage - 136-105 VDC

   6.2 Battery bank current

   6.3 Voltage across each 12-volt battery unit -13.6 -10.5 VDC (never below 10.0 VDC/unit).

   6.4 Ambient temperature

7. Every 10 minutes for one hour, adjust the current to the value stated in Step 5.
8. Immediately after adjusting the current, repeat Step 6 above, recording the data. If it is not possible to get the 120-122A current, take readings with the maximum amperage obtainable.
9. After one hour of testing:

   9.1 Turn off the load using the switches on the Test Load Bank.

   9.2 Let the fans continue to run for at least 10 minutes to cool down the load heater elements.

   9.3 At the end of the 10-minute cool down, open the auxiliary power switch on the Test Load Bank door.

   9.4 Open Breaker A-2 on the Battery Transfer Switch

   9.5 Recharge the battery as stated in Section V below.

IV. TESTING - BANK B

1. Transfer the UPS to Battery Bank A if necessary, by closing Breaker A-1 on the Battery Transfer Switch.
2. Open Breaker B-1 on the Battery Transfer Switch. It may be necessary to move the key from one Kirk Key Interlock to the other.
3. Close Breaker B-2 on the Battery Transfer Switch.
4. At the Test Load Bank, close the auxiliary power circuit breaker and the main circuit breaker. The auxiliary breaker is inside the panel and must be closed first. At Panel EDP-C, close Circuit No. 10. Also,

close the “ON” switch on the door of the Test Load Bank. Make sure the fans are running.

5. Load the battery to 120-122 amps (or as close as possible) by using the switches on the front of the Test Load Bank.
6. Immediately record the following data on the attached sheets:

   6.1 Battery bank voltage - 136-105 VDC

   6.2 Battery bank current

   6.3 Voltage across each 12-volt battery - 13.6 -10.5 VDC (never below 10.0 VDC/unit).

   6.4 Ambient temperature

7. Every 10 minutes for one hour, adjust the current to the value stated in Step 5.
8. Immediately after adjusting the current, repeat Step 6 above, recording the data. If it is not possible to get the 120-122A current, take readings with the maximum amperage obtainable.
9. After one hour of testing:

   9.1 Turn off the load using the switches on the Test Load Bank.

9.2 Let the fans continue to run for at least 10 minutes to cool down the load heater elements.

9.3 At the end of the 10-minute cool down, open the auxiliary power switch on the Test Load Bank Door.

9.4 Open Breaker B-2 on the Battery Transfer Switch

9.5 Recharge the battery as stated below.

V. RECHARGING

NOTE: After each test, the battery bank must be recharged using the auxiliary charger before the bank is connected to the UPS.

1. Make sure the battery is disconnected from both the UPS and the Test Load Bank. Circuit Breaker A-1 and A-2, or B-1 and B-2, must both be open.

2. Close the feeder circuit breaker, Circuit 9 in Panel EDP-C. This will supply power to the charger.

3. Place the Charger Transfer Switch in either the upper position for Battery Bank A, or lower position for Battery Bank B.

4. Turn the charger on. The charging current should increase to 20-25-Amps and start decreasing to zero after the battery is fully charged. Occasionally monitor the voltage and current. The charger float voltage shall be set to 139-140 VDC.

5. As the battery bank reaches fully charged, the current will slowly decrease and the voltage will slowly increase to the set float charge levels.

6. After the float charge condition is reached, continue charging for 8-24 hours.

7. Turn off the charger, return the transfer switch to the center, OFF, position.

NOTE: If the transfer switch is not returned to the OFF position, the UPS will indicate a ground on the D.C. system.

VI. FINAL INSTRUCTIONS

When all testing and recharging is complete, leave both banks operating in parallel, connected to the UPS.

VII. REFERENCES

1. Battery Installation and Operating Instructions - Foreign Print No. FP-3151-P2-1.
2. Charger O & M Manual - Foreign Print No. FP-3151-P1-3.
3. Connection Diagram, UPS System - Drawing No. 4898930.

VIII. SAFETY

In normal use, the batteries will not generate or release hydrogen gas or acid mist, and will not leak acid. This is because these batteries are designed differently than conventional lead acid batteries, in order to operate with low maintenance. Thus, this type of battery is inherently safer than conventional lead acid batteries. However, there is the possibility that under abnormal operating conditions, hydrogen gassing, acid mist, and leaking electrolyte could occur. Therefore, it is recommended that the battery manufacturer's installation and operating instructions be reviewed thoroughly and strictly followed when working with these batteries.

PACIFIC GAS AND ELECTRIC CO.

Milpitas Terminal

BATTERY BANK TEST DATA

Test Date: _____

Battery Bank A

	START	10	20	30	40	50	FINAL

Bank Voltage							
Bank Current							
Temperatures							
Battery Voltages:							
A1							
A2							
A3							
A4							
A5							
A6							
A7							
A8							
A9							
A10							
A11							
A12							
A13							
A14							
A15							
A16							
A17							
A18							
A19							
A20							

PACIFIC GAS AND ELECTRIC CO.

Milpitas Terminal

BATTERY BANK TEST DATA

Test Date: _____

Battery Bank B

	START	10	20	30	40	50	FINAL
Bank Voltage							
Bank Current							
Temperatures							
Battery Voltages:							
B1							
B2							
B3							
B4							
B5							
B6							

B7							
B8							
B9							
B10							
B11							
B12							
B13							
B14							
B15							
B16							
B17							
B18							
B19							
B20							

EXHIBIT A. DRAWING LIST

For a complete station drawing list contact the Records Department in Walnut Creek.

Exhibit B. Foreign print list

FP No.	Description	Manufacturer
F3336-A1	Pipe Stress Analysis (C-4, C-5)	Gulf Interstate Engr.
F3336-A2	Noise Study (2009)	Gulf Interstate Engr.
F3336-C1	Gas/Liquid Separator	Peco
F3336-C2	Liquid Storage Tank C-3	Downey Welding
F3336-C3	Instrument Air Receivers	Downey Welding
F3336-C10	Filter/Separator C-4 and C-5	PECO
F3336-C12	Liquid Storage Tank C-6	Benicia Fab
F3336-J3	Process Automation Controllers	Siemens PAC 353
F3336-J4	Pneumatic Pressure Controllers	Bristol
F3336-J5	Programmable Logic Controller	GE/Fanuc
F3336-J7	Remote Set Point Regulator	Bristol
F3336-J8	Liquid Level Transmitters	Delevan
F3336-J9	Thermowell Assemblies	Rosemount
F3336-J10	Gas Chromatographs	Daniel Industries
F3336-J11	Liquid Level Switches	Magnetrol
F3336-J12	P and dP Transmitters	Rosemount
F3336-J13	RTD Temperature Transmitters	Rosemount
F3336-J14	Turbine Meter and Flow Computer	Hydril & Siemens 353
F3336-J16	Independent Computer Interface	Moore Industries
~~F3336-J17~~	~~Strip Chart Recorders~~	~~Chessell~~ Removed
F3336-J18	Control Panel	AMtec Industries
F3336-J19	Pressure Regulators	Tescom
F3336-J20	Pressure Regulators	Tescom
F3336-J21	Flow Meter, Full View	Emerson-Brooks
F3336-J22	Pressure Reducing Regulator	Roberts High Co.
F3336-J23	Back Pressure Regulator	(P.O. 9017441)
~~F3336-J24~~	~~RS-232/RS-485 Converter~~	~~Black Box Removed~~
~~F3336-J25~~	~~Flow Computers~~	~~Daniel~~ Removed
F3336-J26	Pressure Controllers	Mercoid
~~F3336-J27~~	~~Sulpher Analyzer~~	Removed
F3336-J28	Liquid Level Gages	Daniel Industries
F3336-J29	Pneumatic Valve Positioners	Siemens-Moore Products
F3336-J30	Pneu. Low Pressure Select Relay	Fairchild
F3336-J31	Rotary Position Transmitters	Foxboro/Jordan
F3336-J32	Pressure Switch, Instr. Air	Neo-Dyne
F3336-J33	Series 90 Micro PLC Users Manual	GE Fanuc Automation
F3336-J34	In-Line Filter	Norgren
F3336-J35	Ball Valve, Instr. Air	Watts
F3336-J45	LED Panel Display	Newport Electronics, Inc

FP No.	Description	Manufacturer
F3336-A1	Pipe Stress Analysis (C-4, C-5)	Gulf Interstate Engr.
F3336-A2	Noise Study (2009)	Gulf Interstate Engr.
F3336-J46	Differential Pressure Transmitter	Rosemount 3051
F3336-J47	Liquid Level Transmitter	Rosemount 3300 Series
F3336-K1	Instrument Air Compressors	Ingersoll-Rand
F3336-K2	Natural Gas Compressor	Corken
F3336-L1	Orifice Meters	Daniel Industries
F3336-L2	Insulating Joints	Pacific Pipeline
F3336-L3	Extruded Headers	Taylor Forge
F3336-T1	Static Mixer Removed	Komax Systems
F3336-V1	PLC Development System	GE/Fanuc
F3336-V2	Instrument Air Dryers & Filters	Hankison
F3336-V2-7	Condensate Trap, Instr. Air	Gardner Denver
F3336-W1	Plug Valves	Rockwell
F3336-W2	Ball Valves	T.K. Valve
F3336-W3	Ball Valves	Cameron
F3336-W4	Ball Valves	Grove
F3336-W5	Pneumatic Actuators (Monitors)	Ledeen
F3336-W6	Electric Actuators	Limitorque
F3336-W7	Electric Actuators	Limitorque
F3336-W8	Globe Valves	Valtek
F3336-W9	Control Valves, Liquid Level	Masoneilan/RCS
F3336-W15	Ball Valves	Grove B8
F3336-W16	Ball Valves	Delta (Valvitalia)

EXHIBIT C. VALVE LIST

See following 3 pages

VALVE						ACTUATOR			
TAG #	**SIZE**	**TYPE**	**MANUF**	**FUNCTION**	**SER. #**	**TYPE**	**MANUF**	**MODEL #**	**SER. #**
V-1	30”	BALL	GROVE	ESD	M401340-1	PISTON	LEDEEN	PH635-175-320SR	UD11809-24
V-2	30”	BALL	GROVE	ESD	M401340-2	PISTON	LEDEEN	PH635-175-320SR	UD11809-23
V-3	24”	BALL	GROVE	MONITOR	M401320-2	PISTON	LEDEEN	SY-7H-SD-7H	11809-13
V-4	24”	BALL	GROVE	MONITOR	M401320-1	PISTON	LEDEEN	SY-7H-SD-7H	11809-18
V-5	24”	BALL	GROVE	MONITOR	M401320-3	PISTON	LEDEEN	SY-7H-SD-7H	11809-19
V-6	24”	BALL	GROVE	MONITOR	M401320-4	PISTON	LEDEEN	SY-7H-SD-7H	11809-14
V-7	24”	PLUG	ROCKWELL	LOAD	UY-63	MOTOR	LIMITORQUE	SMC-031	M060342 (MOTOR) 321512 (GEAR)
V-7R	12”	GLOBE	VALTEK	TRIMMER	49340.001-1	MOTOR	LIMITORQUE	SMC-031	M062150 (MOTOR)
V-8	24”	PLUG	ROCKWELL	LOAD	UY-64	MOTOR	LIMITORQUE	SMC-031	M060342 (MOTOR) 321512 (GEAR)
V-8R	12”	GLOBE	VALTEK	TRIMMER	49340.001-2	MOTOR	LIMITORQUE	SMC-031	M062146 (MOTOR)
V-9	24”	PLUG	ROCKWELL	LOAD	UY-73	MOTOR	LIMITORQUE	SMC-031	M060340 (MOTOR) 321511 (GEAR)
V-9R	12”	GLOBE	VALTEK	TRIMMER	49340.001-3	MOTOR	LIMITORQUE	SMC-031	M062156 (MOTOR)
V-10	24”	PLUG	ROCKWELL	LOAD	UY-77	MOTOR	LIMITORQUE	SMC-031	M060334 (MOTOR) 321513 (GEAR)
V-10R	12”	GLOBE	VALTEK	TRIMMER	49340.001-4	MOTOR	LIMITORQUE	SMC-031	M062148 (MOTOR)
V-11	20”	PLUG	ROCKWELL	LOAD	VC-68	MOTOR	LIMITORQUE	SMC-031	M060345 (MOTOR) 321548 (GEAR)
V-11R	10”	GLOBE	VALTEK	TRIMMER	49340.003-1	MOTOR	LIMITORQUE	SMC-031	M062158 (MOTOR)
V-12	24”	PLUG	ROCKWELL	LOAD	UY-83	MOTOR	LIMITORQUE	SMC-031	M060336 (MOTOR) 321510 (GEAR)
V-12R	12”	GLOBE	VALTEK	TRIMMER	49340.001-5	MOTOR	LIMITORQUE	SMC-031	M062155 (MOTOR)
V-13	20”	PLUG	ROCKWELL	LOAD	VC-70	MOTOR	LIMITORQUE	SMC-031	M060346 (MOTOR) 321547 (GEAR)
V-13R	10”	GLOBE	VALTEK	TRIMMER	49340.003-2	MOTOR	LIMITORQUE	SMC-031	M062157 (MOTOR)
V-14	24”	PLUG	ROCKWELL	LOAD	UY-84	MOTOR	LIMITORQUE	SMC-031	M060339 (MOTOR) 321515 (GEAR)
V-14R	12”	GLOBE	VALTEK	TRIMMER	49340.001-6	MOTOR	LIMITORQUE	SMC-031	M062153 (MOTOR)
V-15	20”	BALL	GROVE	ROUTING	M401270-4	MOTOR	LIMITORQUE	SMC-031	M060349 (MOTOR) 321564 (GEAR)
V-16	24”	BALL	GROVE	MONITOR	M401320-5	PISTON	LEDEEN	SY-7H-SD-7H	11809-22
V-17	24”	PLUG	ROCKWELL	LOAD	UY-89	MOTOR	LIMITORQUE	SMC-031	M060343 (MOTOR) 321514 (GEAR)
V-17R	12”	GLOBE	VALTEK	TRIMMER	49340.002-1	MOTOR	LIMITORQUE	SMC-031	M062149
V-18	20”	BALL	GROVE	ROUTING	M401270-5	MOTOR	LIMITORQUE	SMC-031	M060350 (MOTOR) 321565 (GEAR)
V-19	24”	BALL	CAMERON	ROUTING	304974	MOTOR	LIMITORQUE	SMC-031	M060354 (MOTOR) 321571 (GEAR)
V-20	24”	BALL	GROVE	MONITOR	M401320-6	PISTON	LEDEEN	SY-7H-SD-7H	11809-21
V-21	24”	PLUG	ROCKWELL	LOAD	UY-90	MOTOR	LIMITORQUE	SCM-031	M060338 (MOTOR) 321508 OR 321208 (GEAR)
V-21R	12”	GLOBE	VALTEK	TRIMMER	49340.002-2	MOTOR	LIMITORQUE	SCM-031	M062051 (MOTOR)
V-22	24”	BALL	CAMERON	ROUTING	3?5030	MOTOR	LIMITORQUE	SCM-031	M060353 (MOTOR) 321572 (GEAR)
V-23	20”	BALL	GROVE	ROUTING	M401270-6	MOTOR	LIMITORQUE	SCM-031	M060351 (MOTOR) 321566 (GEAR)
V-24	20”	BALL	GROVE	ROUTING	M401270-1	MOTOR	LIMITORQUE	SCM-031	M060352 (MOTOR) 321567 (GEAR)
V-25	24”	BALL	CAMERON	ROUTING	305029	MOTOR	LIMITORQUE	SCM-031	M060355 (MOTOR) 321570 (GEAR)
V-26	24”	BALL	GROVE	MONITOR	M401320-7	PISTON	LEDEEN	SY-7H-SD-7H	118909-16

VALVE						ACTUATOR			
TAG #	**SIZE**	**TYPE**	**MANUF**	**FUNCTION**	**SER. #**	**TYPE**	**MANUF**	**MODEL #**	**SER. #**
V-27	24”	PLUG	ROCKWELL LOAD		UY-88	MOTOR	LIMITORQUE	SMC-031	M063021 (MOTOR) ???? (GEAR) TAG MISSING
V-27R	12”	GLOBE	VALTEK	TRIMMER	49340.002-3	MOTOR	LIMITORQUE	SMC-031	M062147 (MOTOR)
V-28	20”	BALL	GROVE	MONITOR	M401270-2	PISTON	LEDEEN	SY-6H-QD-7H	11809-10
V-29	20”	PLUG	ROCKWELL	STANDBY REG	UY-41	MOTOR	LIMITORQUE	SMC-031	M060344 (MOTOR) 321549 (GEAR)
V-30	20”	BALL	GROVE	BLOCK	M401280-1	NONE			
V-31	20”	BALL	GROVE	BLOCK	M401280-2	NONE			
V-32	24”	BALL	GROVE	BLOCK	M401330-1	NONE			
V-33				REMOVED	87Q0048	PISTON	LEDEEN	SY-5H-QD-7H	11809-1
V-34				REMOVED	49340.004-2	MOTOR	LIMITORQUE	SMC-031	M062154 (MOTOR)
V-35				REMOVED	49340.004-2	MOTOR	LIMITORQUE	SMC-032	M062152 (MOTOR)
V-36				REMOVED		PISTON	LEDEEN	SY-5H-QD-7H	11809-4
V-37	16”	BALL	TK VALVE	MONITOR	87Q0050	PISTON	LEDEEN	SY-5H-QD-7H	11809-3
V-38	12”	PLUG	ROCKWELL	REGULATOR	UU-93	MOTOR	LIMITORQUE	SMC-041	M060317 MOTOR) 321550 (GEAR)
V-39	16”	BALL	TK VALVE	MONITOR	87Q0051	PISTON	LEDEEN	SY-5H-QD-7H	11809-2
V-40	12”	PLUG	ROCKWELL	REGULATOR	UU-63	MOTOR	LIMITORQUE	SMC-041	M060348 (MOTOR) 321551 (GEAR)
V-41	16”	BALL	TK VALVE	BLOCK	87Q0044	NONE			
V-42	16”	BALL	TK VALVE	BLOCK	87Q0047	NONE			
V-43	20”	BALL	GROVE	BLOCK	M901310-2	NONE			
V-44	20”	BALL	GROVE	BLOCK	M901310-1	NONE			
V-45	20”	BALL	GROVE	BLOCK	M401290-1	PISTON	LEDEEN	SY-6H-QD-7H	11809-9
V-46	12”	BALL	GROVE	BYPASS	M310140-1	NONE			
V-47	20”	BALL	GROVE	BYPASS	M401300-1	NONE			
V-48	24”	BALL	CAMERON	BLOCK	304909	PISTON	LEDEEN	SY-6H-QD-7H	11809-7
V-49	20”	BALL	GROVE	BLOCK	M401290-2	PISTON	LEDEEN	SY-6H-QD-7H	11809-11
V-50	24”	BALL	CAMERON	BLOCK	304972	PISTON	LEDEEN	SY-6H-QD-7H	11809-6
V-51	16”	BALL	TK VALVE	BYPASS	87Q0043	NONE			
V-52	12”	BALL	GROVE	BYPASS	M310140-2	NONE			
V-53	12”	BALL	GROVE	BLOCK	M310130-1	NONE			
V-54	12”	BALL	GROVE	BLOCK	M310130-2	NONE			
V-55	12”	BALL	GROVE	BLOCK	M310130-3	NONE			
V-56	12”	BALL	GROVE	BLOCK	M310130-4	NONE			
V-58	2”		TK VLAVE	AUX. BLOCK	76G0695	NONE			
V-59	12”	BALL	GROVE	BLOCK	M310130-6	NONE			
V-60	12”	BALL	GROVE	BLOCK	M310130-5	NONE			
V-61	12”	BALL	GROVE	BLOCK	M310130-7	NONE			
V-62	24”	PLUG	ROCKWELL	STANDBY REG	VA-33xxx	MOTOR	LIMITORQUE	SMC-031	M060337 (MOTOR) 321517 (GEAR)
V-63	24”	BALL	GROVE	MONITOR	M401320-8	PISTON	LEDEEN	SY-7H-SD-7H	11809-20
V-64	20”	BALL	GROVE	BLOCK	M401270-3	PISTON	LEDEEN	SY-6H-QD-7H	11809-12
V-65	10”	BALL	GROVE	BYPASS	M310120-1	NONE			
V-66	24”	BALL	GROVE	MONITOR	M401320-9	PISTON	LEDEEN	SY-7H-SD-7H	11809-15
V-67	20”	BALL	GROVE	MONITOR	M901270-1	PISTON	LEDEEN	SY-6H-QD-7H	11809-5
V-68	16”	BALL	TK VALVE	BYPASS	88Q000-4	NONE			
V-69	16”	BALL	GROVE	BYPASS	87Q0045	NONE			
V-70	24”	BALL	GROVE	MONITOR	M401320-10	PISTON	LEDEEN	SY-7H-SD-7H	11809-17
V-71	20”	BALL	GROVE	MONITOR	M901270-2	PISTON	LEDEEN	SY-6H-QD-7H	11809-H
V-72	24”	BALL	GROVE	BYPASS	M401330-2	NONE			
V-73	24”	BALL	GROVE	BYPASS	M401330-3	NONE			
V-74	12”	BALL	GROVE	BLOCK	M310130-8	NONE			
V-75	12”	BALL	GROVE	BLOCK	M310130-9	NONE			
V-76	6”	BALL	TK VALVE	AUX. BLOCK	87K0251	NONE			
V-77	24”	BALL	GROVE	BLOCK	M401330-4	NONE			
V-78	24”	BALL	GROVE	BLOCK	M401330-5	NONE			
V-79	24”	BALL	GROVE	BLOCK	M401330-6	NONE			
V-80	12”	BALL	GROVE	BLOCK	M310130-10	NONE			
V-81	12”	BALL	GROVE	BLOCK	M310130-11	NONE			

VALVE						ACTUATOR			
TAG #	SIZE	TYPE	MANUF	FUNCTION	SER. #	TYPE	MANUF	MODEL #	SER. #
V-82	12”	BALL	GROVE	BLOCK	M310130-12	NONE			
V-83	10”	BALL	GROVE	BLOCK	M310110-1	NONE			
V-84	10”	BALL	GROVE	BLOCK	M310110-2	NONE			
V-85	12”	BALL	GROVE	BLOCK	M310130-13	NONE			
V-86	12”	BALL	GROVE	BLOCK	M310130-14	NONE			
V-87	12”	BALL	GROVE	BLOCK	M310130-15	NONE			
V-88	12”	BALL	GROVE	BLOCK	M310130-16	NONE			
V-89	10”	BALL	GROVE	BLOCK	M310110-3	NONE			
V-90	10”	BALL	GROVE	BLOCK	M310110-4	NONE			
V-91	12”	BALL	GROVE	BLOCK	M3101340-17	NONE			
V-92	12”	BALL	GROVE	BLOCK	M3101340-18	NONE			
V-93	2”	BALL		AUX. BLOCK		NONE			
V-94	24”	BALL	GROVE	BYPASS	M401330-7	NONE			
V-95	2”	BALL		AUX. BLOCK		NONE			
V-96	2”	BALL		AUX. BLOCK		NONE			
V-97	2”	BALL		AUX. BLOCK		NONE			
V-98	2”	BALL		AUX. BLOCK		NONE			
V-99	2”	BALL		AUX. BLOCK		NONE			
V-100	2”	BALL		AUX. BLOCK		NONE			
V-101	2”	BALL		AUX. BLOCK		NONE			
V-102	2”	BALL		AUX. BLOCK		NONE			
V-103	2”	BALL		AUX. BLOCK		NONE			
V-104	2”	BALL		AUX. BLOCK		NONE			
V-105	2”	BALL		AUX. BLOCK		NONE			
V-106	2”	BALL		AUX. BLOCK		NONE			
V-107	2”	BALL		AUX. BLOCK		NONE			
V-108	2”	BALL		AUX. BLOCK		NONE			
V-109	2”	BALL		AUX. BLOCK		NONE			
V-110	2”	BALL		AUX. BLOCK		NONE			
V-130	36”	BALL	GROVE	BYPASS		NONE			
V-131	30”	BALL	DELTA	BLOCK		NONE			
V-132	30”	BALL	DELTA	BLOCK		NONE			
V-133	30”	BALL	DELTA	BLOCK		NONE			
V-134	30”	BALL	DELTA	BLOCK		NONE			
V-A	6”	BALL	TK VALVE	BLOWDOWN	87K0252	NONE			
V-B	6”	BALL	TK VALVE	BLOWDOWN	88K0439	NONE			
V-C	6”	BALL	TK VALVE	BLOWDOWN	87K0254	NONE			
V-D	6”	BALL	CAMERON	CROSS COMP.	D7968	NONE			
V-E	6”	BALL	CAMERON	CROSS COMP.	D7966	NONE			
V-F	6”	BALL	CAMERON	CROSS COMP.	D7965	NONE			
V-G	8”	BALL	TK VALVE	CROSS COMP.	87L0179	NONE			
V-H	8”	BALL	TK VALVE	BLOWDOWN		NONE			
V-J	8”	BALL	TK VALVE	BLOWDOWN	87L0182	NONE			
V-K	6”	BALL	CAMERON	BLOWDOWN		NONE			
V-L	6”	BALL	CAMERON	BLOWDOWN		NONE			
V-M	6”	BALL	CAMERON	BLOWDOWN		NONE			
V-N	6”	BALL	CAMERON	BLOWDOWN		NONE			
V-P	6”	BALL	CAMERON	BLOWDOWN		NONE			
V-Q	8”	BALL	TK VALVE	BLOWDOWN		NONE			

EXHIBIT D. ELEMENTARY BLOCK DIAGRAM

Drawing No. 387582

EXHIBIT E. OPERATING DIAGRAM

Drawing No. 383510

EXHIBIT F. ELEMENTARY DIAGRAMS

Drawing No. 488227 -P&ID, Liquid Removal
488228 -P&ID, Metering and Regulation
488229 -P&ID, Instrument Air
488230 .-P&ID, Blowdown Compressor