



ALTON UNDERGROUND NATURAL GAS STORAGE

Permit to Construct

GAS COMPRESSION and GAS WITHDRAWAL FACILITIES

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Table of Contents

Project Description	3
Project Purpose	3
Project Location and Background	3
Public and Stakeholder Consultations	4
Project Description.....	5
1.0 SCOPE OF WORK	6
2.0 ENVIRONMENTAL	8
3.0 ARCHITECTURAL AND CIVIL	10
4.0 PROCESS PIPING AND SPECIALTIES.....	13
5.0 PRESSURE VESSELS.....	19
6.0 ELECTRICAL.....	20
7.0 INSTRUMENTATION	23
8.0 EMERGENCY SHUTDOWN (ESD) SYSTEM	25
9.0 OTHER SHUTDOWN AND SAFETY SYSTEMS.....	27
10.0 GAS SYSTEMS DESIGN	29
11.0 ENGINE AUXILIARIES.....	35
12.0 STATION SUPPORT SYSTEMS.....	40
Quality Management Plan	41
Environmental Plan	43
Employment Plan	43
Goods and Services Procurement Plan	43
Contract Strategy.....	43
Procurement Plan.....	44
Process Safety Management Plan	44
Monthly Reporting	45
Auditing Plan	45
Abandonment.....	45
List of Appendices	46
Appendix 5: Existing AltaGas Owned and Operating Storage Facilities	47

Project Description

Project Purpose

Alton Natural Gas Storage (Alton) is making an application to the Nova Scotia Utility and Review Board for installation and operation of an underground natural gas storage facility in Colchester County. The solution mining facilities have been mostly constructed, and three (3) wells have been drilled for the start of solution mining of the underground storage caverns. Operation of the solution mining facilities has been delayed due to issues with consultation of First Nations groups. After the underground storage caverns have been solution mined, they will be utilized to store natural gas. The customers will utilize the gas storage facilities to allow for purchase and injection of natural gas into the caverns during summer when prices are lower, and withdrawal of the natural gas from the caverns during the winter when demand and prices are higher.

Alton is currently designing the gas storage compression and gas withdrawal facilities associated with the gas storage operations for Alton's underground salt caverns. Initially, the project will involve solution mining caverns capable of storing approximately 127,400 e³m³ (4.5 BCF) of natural gas. The facility will store gas during periods of low demand, and will be capable of readily supplying the gas during periods of high demand. By storing natural gas, excess supply during summer months is available to meet increased demand during winter months. Alton Natural Gas Storage will improve Nova Scotia's gas supply security, and help maintain reasonable gas prices in the province.

Project Location and Background

The proposed underground salt cavern storage facility will store natural gas by creating underground caverns in a naturally occurring salt deposit located near Alton in Colchester County, Nova Scotia. The storage caverns will be located within the confines of the Hydrocarbon Storage-Area Lease obtained by Alton, while the surface facilities will be located within surface lands owned by Alton. For a location map of the Alton Natural Gas Storage Cavern Development site, please see **Appendix 1: Cavern Site Overall Site Plan** (Drawing 111-2678 Sheet 13). Also attached to this application are a plot plan of the gas facilities (**Appendix 2: Plot Plan of Alton Gas Facilities**), Process Flow Diagrams (**Appendix 3: Alton Process Flow Diagrams**), Piping and Instrument Drawings (P&IDs) for the gas facilities (**Appendix 4: Alton Gas Facilities Piping and Instrumentation Diagrams**), photographs of AltaGas owned and operating gas storage facilities (**Appendix 5: Existing AltaGas Owned and Operating Storage Facilities**), and a map of Alton Natural Gas Storage Project (**Appendix 6: Location Map of Alton Natural Gas Storage Project**) that support this application.

The gas supply to the caverns will be delivered from the Maritimes and Northeast Pipeline (M&NP). The M&NP is a 1,440 km long, 762 mm (30") and 610 mm (24") diameters gas transmission line that transports natural gas from Goldboro, Nova Scotia to the US-Canada border in Maine, terminating in Beverly, Massachusetts. The M&NP pipeline, with a design pressure of 10,200 kPa(g) (1480 psig), typically operates between 4,825 to 8,275 kPa(g) (700 to 1200 psig) near our pipeline interconnect. The operating pressures of the M&NP may change in the future, as the supply of gas may be from other sources or directions. Alton will modify the compressor design in accordance with the M&NP future operating conditions. The cavern site will be connected to the 324 mm (12") diameter M&NP Halifax lateral via a new 406 mm (16") diameter gas pipeline. The new gas pipeline and the custody transfer meter station for

transfer of natural gas to and from the gas storage facilities will be a separate application to the Utility and Review Board.

The facilities will be designed to handle a maximum injection rate of 6,200,000 m³/d (220 MMSCFD) during free-flow injection and 4,285,000 m³/d (150 MMSCFD) during compression injection. This rate may be increased in the future with installation of additional compressor units as the market for storage services expands. The gas withdrawal facilities will be designed for a maximum withdrawal rate of 6,200,000 m³/d (220 MMSCFD) during free-flow withdrawal and 4,285,000 m³/d (150 MMSCFD) during compression withdrawal.

The Alton Natural Gas Storage Project is currently in the Cavern Development Phase. The Cavern Development Phase involves developing caverns in the relatively pure salt zone, the top of which lies approximately between 593 m and 915 m beneath the surface at Alton. The first three-four caverns will be capable of storing a cumulative volume of approximately 127,400 e³m³ (4.5 BCF) (to be confirmed pending drilling, coring, geological testing and modeling) of natural gas.

The Cavern Development Phase comprises of the River Intake Facilities, Non-potable Water and Brine Return Pipelines, Cavern Facilities and the Brine Handling Facilities. For an overview map of the project, please see **Appendix 6: Alton Natural Gas Storage Project** (Drawing 111-2678 Sheet 1). The River Intake Facilities are located at the River Site, accessed from Riverside Road in Fort Ellis and comprises of the Gabion Intake Structure, Observation Well, Transfer Pumps, Fresh Water Pond, and the Brine Retention Pond. The Transfer Pumps provide sufficient head to transport water to the Cavern Site. The Cavern Site is located 12 km northeast of the River Site, accessed from Brentwood Road in Brookside, and is linked to the River Site via 12 km pipelines transporting non-potable water to the Cavern Site and returning brine to the River Site.

At the Cavern Site, leach water is injected with high pressure pumps into each of the wells to dissolve salt deposits to create the desired size of caverns, in accordance with a leaching program that is currently being finalized. This program will be monitored and modified as appropriate during the leaching phase to ensure proper cavern development.

A nitrogen supply will provide nitrogen to inject into the cavern wells to prevent dissolution of the roof of the cavern.

The Brine will be transported via the Brine Return Pipeline back to the River Site where the brine is stored in the Brine Retention Pond until it is released back into the Mixing Channel.

Public and Stakeholder Consultations

Public and stakeholder consultations for the project to date specifically included:

- Regular project updates with government and KMKMO's office.
- Responding to Landowners questions in a timely manner.
- Distribution of project updates via community mail-outs and emails.
- Providing information through the Alton Gas web-site, and through public access to the Project with details provided in the application to the NSUARB.
- Presentations in the regional business community.

- The following Public Open House sessions were held in the local area:
 - October 12, 2006 – Public presentation held at Don Henderson Sportsplex, Brookfield, Nova Scotia.
 - November 22, 2006 – Open House held at Brookfield Fire Hall (4:00 PM to 8:00 PM)
 - April 15, 2008 – Open House held at Brookfield Fire Hall (4:00 PM to 8:00 PM)
 - November 30, 2011 – Open House at Alton Stewiacke Office (4:00 PM to 8:00 PM)
 - December 2014 – Launch Alton Project Website: AltonNaturalGasStorage.com
 - March 12, 2015 – Open House to be held at Brookfield Fire Hall (4:00 PM to 8:00 PM)

All Open House events provided information on Alton’s Underground Gas Storage Project, related pipeline project, environmental, natural gas and safety. Alton is presently attempting to establish a Community Liaison Committee.

In response to an increase of community questions and concerns during the construction of Alton’s brining facilities and drilling, Alton Natural Gas has engaged in community meetings, and meetings with local stakeholders to address questions about the Project. Local Meetings recently attended include:

- Stewiacke Town Council Meeting, September 25, 2014
- Brookfield Community Meeting, September 29, 2014
- Truro Town Council Meeting, October 9, 2014
- Meeting with representatives from the Striped Bass Anglers Association, October 15, 2014.
- Shubenacadie Commercial Fisheries Association, October 17, 2014
- DFO Fisheries Officers, October 30, 2014.
- Men’s Club in Brookfield, November 17, 2014.
- Zodiac Companies operating on the Shubenacadie River, November 18, 2014.
- Mi’kmaq Conservation Group, November 20, 2014.

Alton will continue to communicate and answer questions from interested parties as the Alton Natural Gas Storage Project continues.

Alton is actively engaging the MI’KMAQ community in conjunction with the government of Nova Scotia.

Project Description

Alton Natural Gas Storage is applying for a Permit to construct for the Gas Facility. The Gas Facility Phase description will contain the following subsections:

1. Scope of Work
2. Environmental
3. Architectural and Civil
4. Process Piping and Specialties
5. Pressure Vessels
6. Electrical
7. Instrumentation
8. Emergency Shutdown Systems
9. Other Shutdown and Safety

- 10. Gas Systems Design
- 11. Engine Auxiliaries
- 12. Station Support Systems

1.0 SCOPE OF WORK

The Alton Natural Gas Storage Project includes the gas storage station, well pad facilities, the gathering pipe headers between the station and the well pads, and the pipe interconnect between the station and the existing Maritimes and Northeast Pipeline (M&NP). The interconnect pipeline to M&NP and the associated custody transfer meter station associated with this pipeline are not included in this application.

The storage station includes gas injection facilities (compression, and compressor support facilities), gas withdrawal facilities (separators, heating, dehydration and pressure reduction), and station support facilities (air compression, heating, motor control, switchgear, and storage tanks).

The well pad facilities include the gathering laterals to the three wells, the pressure, temperature and flow instrumentation associated with each well, safety shutoff valves on the wellhead and on the well lateral.

The gathering pipe headers are 324 mm (12") diameter and will connect the storage station to the initial three well pad facilities.

- 1.1 Three or four wells will be utilized to inject the gas into and withdraw the gas from the Alton gas storage caverns. Each of the wells will have a safety shut-off valve on the wellhead operated by hydraulic fluid, a 324 mm (12") well lateral pipe that includes a gas meter, pressure, temperature and flow instruments and a block valve with an electric motor operator. The lateral size may be revised after the salt geo-mechanical tests have been completed and the maximum withdrawal rate from a cavern is finalized. All of the piping, valves and equipment in the gathering area to the wellhead are rated for 17,225 kPa (2,500 psig) at 45° C. The maximum pipe design pressure may change in accordance to the final geo-mechanical testing of the salt. The well laterals will be supported above ground on concrete piers to grade and adjustable pipe supports. The well lateral piping, valves, instruments and the well heads will be heat traced and insulated.
- 1.2 Each of the well laterals will connect to a below ground, 324 mm (12") diameter pipe header that will connect to the storage station. Cavern Well #1 will be approximately 185 meters from the station withdrawal facilities inlet. Cavern Well #2 will be 200 meters, and Cavern Well #3 will be 400 meters from the withdrawal facilities inlet.
- 1.3 The Gas Storage Station will consist of the gas injection facilities, the gas withdrawal facilities and the station support facilities. The design for the gas injection and the gas withdrawal facilities is a flow rate of 6,200,000 m³/d (220 MMSCFD). The design pressures of the station facilities include 10,200 kPa(g) (1480 psig) (MAOP) for the low pressure

gas facilities and 17,225 kPa (2,500 psig) for the high pressure gas facilities. The low pressure gas facilities include piping and equipment connected to the incoming pipeline, through the Filter-Separator and to the first stage suction compressor cylinders, and the gas withdrawal equipment and piping downstream of the pressure reduction valve, through the Final Gas Separator to the gas pipeline.

- 1.4 The compressor first stage discharge piping and equipment are to be designed for 12,400 kPa (1,800 psig) at 100°C. This extends through the Inter-stage Scrubber and to the second stage suction compressor cylinders. The second stage compressor discharge piping and equipment, including the Compressor Gas After-Coolers are to be designed for 17,225 kPa (2,500 psig) at the highest compressor discharge temperature (120°C). This equipment and piping will have ANSI 1500# flanges. The piping, valves and equipment downstream of the Compressor Gas after-Coolers, and piping to the gathering header are also to be designed for 17,225 kPa (2,500 psig) at 120°C. All of the gas withdrawal piping and equipment upstream and including the pressure reduction valve manifold are designed for 17,225 kPa (2,500 psig). This equipment and piping will also have ANSI 1500# rated flanges.
- 1.5 The gas injection facilities include two 2,370 BHp Class (1,750 KW Class) natural gas fired reciprocating engines driving two stage reciprocating compressors, the engine support facilities, the compressor unit piping, routing valves, Inter-Stage Gas Coolers, the Gas After-Coolers, the Filter Separator vessel, and a bi-directional Gas Meter. The engine-compressor units, and the station Fuel gas Skid will be located in the Compressor Building.
- 1.6 The gas withdrawal facilities consist of the Field Inlet Separator (1,422 mm I.D. x 5m SS) (56" I.D. x 16' SS), The Withdrawal Gas Heater (6,000,000 e³ Joules (6 MM BTU/Hr) output), the Gas Dehydration Contactor Tower (1,828 mm I.D. x 8.5 m SS) (72" I.D. x 28' SS), the Pressure Reduction Valve (203 mm (8"), 1500# ANSI) and manifold, and a Final Gas Separator (1,066 mm. x 3.65 m SS) (42" I.D. x 12' SS). The equipment sizes are preliminary and are subject to change during detailed design engineering. All of the equipment other than the Final Gas Separator is designed for 17,225 kPa (2,500 psig) at 100°C. The pipes connecting the high pressure gas withdrawal equipment shall be routed below grade between equipment except where the distances are small. A Glycol Regeneration Skid will be installed to supply and continuously clean and concentrate tri-ethylene-glycol for use to adsorb water from the gas in the Dehydration Contactor Tower. The Glycol Regeneration Skid will be located in a building with screen sides. All vents from the skid will be routed out-doors.
- 1.7 The station support facilities consist of the support equipment necessary to accomplish the gas injection and gas withdrawal. This includes an air compression and drying system, heating system, motor control, switchgear, station control, emergency shutdown (ESD), fire

detection, gas detection, and storage tanks for lube oil, coolant, waste oil, brine, and glycol. The air compression / drying system, the heating system, the motor control center, the switchgear, the control system with the ESD, gas detection and fire detection systems will be located in the Auxiliary Building. The waste oil, brine, and glycol storage tanks are located in dikes. The lube oil and coolant will be stored in 344 kPa (50 psig) design pressure vessels and are located in a dike.

The Gas Injection and the Station Support equipment will be installed as the highest priority as this equipment is required to be in-service in April, 2017. The Gas Withdrawal equipment will need to be in-service by November 1, 2017.

Attached in **Appendix 5: Existing AltaGas Owned and Operating Storage Facilities** are aerial photographs of two similar sized natural gas storage injection and withdrawal stations, Cook Inlet Natural Gas Storage Project and Eaton Rapids Gas Storage Project. These gas storage projects are 50% owned by AltaGas. AltaGas is the Operator of the Cook Inlet Natural Gas Storage Project in Kenai, Alaska. Both of these storage projects were designed and constructed with the same safety systems and support facilities as is proposed for the Alton Natural Gas Storage Project, as the Project Manager is the same. The Cook Inlet Natural Gas Storage Station started operation in April 2012. The Eaton Rapids Gas Storage Project went in service in 1989, and has been operating safely for 25 years.

2.0 ENVIRONMENTAL

2.1 Ambient temperature (dry bulb)

Summer: Highest recorded maximum: 35°C
 Normal daily maximum: 24°C
 # Days/yr. over 30°C: 3 days

Winter: Lowest recorded minimum: -28°C
 Normal daily minimum: -10°C
 # Days/yr below -20°C: 3 days

Ambient temperature data based on climatological table for Halifax, Nova Scotia.

2.2 Design temperature (Ambient dry bulb)

Summer: High 35°C. (95 °F)

Winter: Low -28°C. (-20 °F)

2.3 Design Snow and Rainfall

Snow load: Ground Snow Load (S_s = 1.8kPa), Associated Snow load

($S_r = 0.6$ kPa).
One Day Rain (1 in 50 years) = 128mm
Fifteen Minute Rain (1 in 50 years) = 18mm
Annual Rain = 1050mm

Frost Level: 1.2 m
Normal yearly Snowfall: 58.5 cm
Extreme yearly Snowfall; 66 cm

2.4 Wind Pressure

Maximum Recorded: 0.524 KPa
Design of Facilities (1 in 50 years): 0.50 KPa
Wind Speed Maximum; 18.3 Km/Hr

Wind design based on requirements of International Building Code 2006.

Prevailing Wind Direction

Summer: South

Winter: Northwest

2.5 Seismic Zone

Considerations: Seismic calculations will be performed in accordance with the National Building Code of Canada (2010). The spectral response acceleration (S_a) and the peak ground acceleration (PGA) factors for the location of the facility are 0.21 and 0.085 respectively. .

2.6 Noise Abatement

Engine Exhaust Silencers: Special Hospital Grade Rated at 41 dBA @ 120 meters.

Maximum noise level at nearest residence: 39 dBA from the compressor station, and a maximum of 5 dBA about ambient sound levels - residence is approximately 500 meters northwest of the station engine-compressor units.

Compressor Unit Gas Vents: Silencer required for 63 dBA @ 60 meters.

2.7 Facilities Locations and Elevations:

The storage station site is a 200 meters by 120 meters parcel of land within a 203 acre parcel that the Company has purchased, adjacent to Brentwood Road, Brookfield, Colchester County, Nova Scotia. Existing grade level is approximately 48 meters ASL. Detailed survey drawings

have been completed to 1' contours and are available upon request.

Access to the Station site will be the existing Brentwood Road entrance that is approximately 3km east of Highway 2.

The site for the gas storage facilities has been cleared and graded. It has been utilized for equipment and pipe storage during construction of the solution mining facilities and well drilling. After excavation of soil for the equipment and building foundations, and installation of these foundations, gravel will be brought to site and spread and compacted to establish a uniform flat rough grade for the entire 200 meter length (north-south direction) by 120 meter width (east-west direction). The purpose of the gravel is to allow for a good work surface during construction. This rough grade will be established at 0.30 m above the existing highest grade elevation of the site (48.2 meter ASL).

Final grade plan for the station will include any necessary culverts and use of gravel and stone to slope rain away from the buildings and equipment. A site grading plan will be developed as part of detailed design. The top of concrete for building foundations and for equipment foundations will be 0.45 m above rough grade to allow for final gravel and stone addition and sloping to direct the water to our adjacent land.

Each of the three well pads is 110 meters by 110 meters cleared area with a dirt berm around the perimeter. The finished grades of the pads are different due to the sloping terrain of the site. Well Pad #1 has a grade of 50.5 meters. Well pad #2 has a final grade of 44 meters and well pad #3 has a final grade of 50 meters.

3.0 ARCHITECTURAL AND CIVIL

3.1 General Design Codes

CSA Z341- Series 10: Storage of Hydrocarbons in Underground Formations

CSA S16: Design of Steel Structures

CSA A660 – Certification of Manufacturers of Steel Building Systems

CSA S136: North American Specification for the design of cold formed structural steel members.

Canadian Institute of Steel Construction-Handbook

AISC Specification for Structural Steel Buildings

AISC Serviceability Design Considerations for Low-Rise Buildings

ANSI B30.17: Overhead and Gantry Cranes

Canadian Safety and Health Administration Rulemakings

3.2 Soil Investigation Report: (Supplemental Report to be completed in summer of 2015)

3.3 Foundation Design: Spread footings for Major Equipment and

Buildings located outdoors with excavation to 150 mm below the design frost level for Colchester County, N.S. Install drain tile around each foundation, fill with engineered soil to proper depth. Use the Geotechnical Report for final design details. The top of concrete for all buildings, enclosures and major equipment foundations will be at 0.5 meters above rough grade.

3.3.1 Concrete Design:
Cement Association of Canada – Concrete Design Handbook

3.3.2 Reinforcing Steel for Concrete Specifications:
ASTM A615 - Standard Specification for Deformed Billet Steel Bars for Concrete Reinforcement

ASTM A185 - Standard Specification for Welded Steel Wire Fabric for Concrete Reinforcement.

ASTM A82 - Standard Specification for Cold Drawn Steel Wire for Concrete Reinforcement, ASTM A82.

CSA G30.18 – Billet-Steel Bars for Concrete Reinforcement

3.3.3 Structural Steel for Concrete Specifications
ASTM A36 - Standard Specifications for Structural Steel

3.3.4 Anchor Bolts and Concrete Anchors Specifications
ASTM A307 - Standard Specifications for Carbon Steel Externally and Internally Threaded Standard Fasteners.

3.3.5 Equipment foundations and pipe supports will include a cap of epoxy grout of 25 mm thick above the top of concrete.

3.4 Building Design

3.4.1 General Design Specification and Codes
National Building Code of Canada (2010)
AISC Specification for Design, Fabrication, and Erection of Structural Steel for Buildings

3.4.2 Building Descriptions

The Compressor Building (approximately 27 meters length x 18 meters width and 8.5 meters Eave height) will accommodate two engine-compressor units, and the fuel gas skid. The building shall be a pre-engineered structure

meeting the seismic zone criteria for the Alton area and the requirements of the Building Specification. The compressor building will be supplied with an electric motor driven 10 ton crane.

Inlet air and exhaust of air from the compressor building will be accomplished by electric motor driven fans. The inlet Air will be heated with unit heaters. The building air changes will be designed to maintain the building as a Class 1 Division 2 Group D area. The exhaust fans will automatically start upon high gas detection and ESD of the compressor station. The electric motor powered fans will also be utilized to circulate hot air during the winter and to evacuate hot air during the summer.

The Auxiliary Building (approximately 24 meters length x 15 meters width x 6 meters eave height) will house the two air compressor/dryer units, the building heating system, the motor control center and the station switchgear. Gas detectors and fire detectors will be installed in the building. The maximum fuel gas pressure in the building will be 35 kPa (5 psig) for the hot water heating system. The building will be rated general purpose. The building shall be a pre-engineered structure meeting the seismic zone criteria for the Alton area and the requirements of the Building Specification.

The Glycol Regeneration Building (approximately 17 meters length x 7.3 width x 6 meters eave height) will house the glycol regeneration skid. This building will be classified Class 1 Division 2 and will be equipped with gas detectors. The building shall be a pre-engineered structure with screen sides meeting the seismic zone criteria for the Alton area and the requirements of the Building Specification.

Personal protection canopies shall be located at each exterior building door for all of the buildings. These canopies shall extend to cover the width of the door plus 0.67 meters for a two meter length. Design the canopies for the snow and ice load expected in Alton.

A building design and material supply specification will be prepared by the Engineering and Design Contractor. All materials utilized in construction of the building shall be non-combustible.

3.4.3

Structural Steel and Bolting:

ASTM A36: "Standard Specification for Structural Steel"
ASTM A325 – Standard Specification for Structural Bolts,
Steel, Heat Treated, 120/10 ksi Minimum
Tensile Strength..

3.4.4 Structural Pipe and Tubing:
ASTM A501: Hot formed welded and seamless carbon steel structural tubing.

3.5 Plumbing and Drain Systems:

3.5.1 Design Codes
National Building Code of Canada (2010)
Nova Scotia Building Code and Colchester County Municipal Codes
Nova Scotia On-Site Sewage Disposal Systems: Technical Guidelines
Guidelines for Canadian Drinking Water Quality

We will drill a well for non-potable uses such as equipment cleanup and sanitary facilities. Drinking water will be delivered on site for personnel.

3.5.3 Sanitary System:

A septic tank & leach Field will be installed at the Station.

4.0 PROCESS PIPING AND SPECIALTIES

4.1 Design Code

CSA Z341: Storage of hydrocarbons in underground formations
ANSI/ASME B31.3, Process Piping.

The Compressor Station, well laterals and gathering headers gas piping shall be designed to meet or exceed the wall thicknesses in ANSI B31.3.

A pipe list has been established for the Alton Inlet facilities during preliminary engineering. The list will be finalized during detailed engineering and the appropriate pipe size, wall thickness and grade from this list will be utilized for the services indicated on the P&ID drawings.

4.2 Pipe Process Design

4.2.1 Compressor Unit gas piping, compressor suction header and compressor discharge header piping are to be designed to have a maximum velocity of 457 meters/minute (1500 ft/minute) and to have a maximum pressure drop less than or equal to 2.8 kPa per 100 meters (0.12 psi per 100 feet) of pipe length. The Alton Inlet compressor unit piping and equipment layout will be checked and modified as required by the digital analysis at a Digital Specialist to be contracted by Company.

- 4.2.2 The remainder of the gas piping in the compressor station is to be designed to have a maximum velocity of 609 meters/minute (2,000 feet/minute) and to have a maximum pressure drop of 5.6 kPa per 100 meters (0.25 psi per 100 feet) of pipe length.
- 4.2.3 Compressor second stage discharge piping through the gas after cooler shall have design pressure of 17,225 kPa (2500 psig) at the highest compressor discharge temperature. This will require 1500# ANSI flanges. The compression discharge header piping (downstream of the Gas After-Cooler), all high pressure station piping and gathering system will also have a maximum allowable operating pressure (MAOP) of 17,225 kPa (2,500 psig) (ANSI 1500#).
- 4.2.4 All compressor suction piping, all station low pressure piping and the compressor station to the M&NP pipeline will have a MAOP of 10,200 kPa (1,480 psig) at 40 degrees C. The 10,200 kPa MAOP for the station low pressure piping matches the MAOP for the M&NP pipeline.
- 4.2.5 The compressor inter-stage piping will have a design pressure of 12,222 kPa (1,775 psig) at 200° F. or higher to match the MAOP of the first stage compressor cylinders. All flanges in the inter-stage piping system shall be 900# ANSI RF.
- 4.2.6 All outdoor above-grade instrumentation, relief valves, valve operators and equipment other than straight piping shall be located a minimum of 3 meters from the compressor or auxiliary building walls. This will minimize damage to equipment caused by ice and snow falling from the building roofs.
- 4.2.7 Suction header pipe, discharge header pipe and most of the compressor station gas pipe shall be installed below grade. Above grade pipe shall only include compressor lead lines, pressure reduction manifold and small sections of pipe between adjacent equipment.
- 4.2.8 The small station support piping from equipment will be installed above ground on pipe racks. Electrical cables shall be installed in cable trays and located on or below the pipe racks.

4.3 Pipe Material

API-5L latest edition: Line Pipe (seamless). The minimum design temperature for all of the piping will be negative 28° C (-28° C).

ASTM A333 Type 6: Seamless carbon steel pipe (Grade B) for low temperature service. This pipe is to be utilized for 203 mm nominal size and below, and for special Grade B choke tubes for the pulsation vessels.

High yield line pipe shall be predominantly used for ANSI Class 600 and above. See the Alton Natural Gas Storage Pipe List for the sizes, wall thicknesses and grades to utilize. This pipe shall be purchased to meet AltaGas Company purchase specifications (ANGS-SP-400) in addition to API-5L. A preliminary pipe list has been prepared.

Line I.D. system will be developed by Company and Engineer.

All storage station, well pad and gathering header pipe shall be designed for -28°C. Any pipe that does not meet the minimum temperature specification shall be heat traced and insulated.

4.4 Pipe Fittings

ASTM A420 GR WPL6: Forging carbon steel for low temperature piping components.

MSS-SP-75 WPH: Pipe fittings for high yield piping components mating to API 5L pipe.

ASTM A350 Gr. L7: Alloy steel and stainless steel bolting materials for low temperature service. All Carbon Steel Bolts are to be coated with Xylan.

ASTM A320 2B Gr. LH: Carbon and alloy steel nuts for bolts for high pressure and low temperature service. All carbon steel nuts are to be coated with Xylan.

Purchase specifications for pipe fittings of material must meet requirements for ANGS-SP-420, "Specification for High Strength Wrought Welding fittings".

Purchase specifications for materials A333, A420, A350 Gr. L7, A320 2B Gr. LH do not have additional requirements.

All gas and hydrocarbon service fittings and all utility service fittings shall be designed for -28°C as a minimum. Any fittings that do not meet the minimum temperature specification shall be heat traced and insulated.

4.5 Pipe Flanges

MSS-SP-44: Carbon steel pipe flanges for piping components for low temperature service.

ASTM A350LF2: Pipe flanges for ASTM A333 Type 6 piping components.

High strength flanges for gas service 600# ANSI and higher shall meet all requirements of ANGS Specification ANGS-SP-421.

4.6 Pipe Welding Specifications

API 1104 Standard for Welding Pipelines and Related Facilities, current edition.

All gas piping butt welds will be 100% radiographed. All other gas piping welds shall be tested by magnetic particle or ultrasonic methods. All natural gas piping and equipment with design pressures above 700 kPa (100 psig) shall be hydro-tested to 1.5 times the MAOP for 8 hours.

4.7 Valves in Major Gas Piping

A listing of all major gas valves as to location, size, pressure rating, type and function will be prepared by Company.

API 6D Pipeline Valves

Ball valves shall be used in all locations except as noted in Section 4.8.

Purchase List for station main valves has been prepared by Company. These valves will be purchased to meet API 6D Valve Specification.

Use of flanged-end valves shall be maximized above ground in all applications. All buried valves to be weld-end.

Valves larger than 203mm (8") in all 600# ANSI service and higher ANSI classifications, and all valves in ESD service shall be equipped with pneumatic operators. Compressor lead line valve shall be equipped with electric motor operators.

The pneumatic valve operators will be opened and closed by a power gas header supplied from the main gas pipeline with gas pressure ranging from 4800 kPa to 8300 kPa (700 psig to 1200 psig).

Buried valves shall be equipped with high head extensions such that the horizontal centerline of the hand wheel or valve operator is located at one meter (3 feet 4 inches) above finished grade. All grease fittings for below grade valves shall be equipped with high head extensions. All fittings for these extensions shall be socket welded.

4.8 Valves for Supporting Services

Ball valves shall be used for block valves requiring positive shut-off except in domestic water service, and for the hot water boiler.

Butterfly valves may be used for hot water and lube oil services for

throttle control and applications where absolute positive shut-off is not required.

Gate valves shall be used in domestic water service, and as inlet, outlet and bypass valves associated with the hot water boiler.

4.9 Buried pipe coat and wrap material

All piping for the compressor station, gathering pipeline, gathering laterals and dehydrator area shall be coated in a coating factory with a two-part fusion bond epoxy coating. All above ground piping with FBE coating to receive a field coating of Carboline Carbonmastic 14, or similar coating material. See Construction specifications for details on application of coatings.

4.10 Paint for Above-Ground Equipment

Primer - Carboline - Carbo Zinc 11

Top Coat - Carboline - Carboline 133HB

Above ground piping within operating temperature range of -20°C to 121°C shall have a top coat of Carboline 133 HB applied.

Company may allow the contractor to utilize alternate similar coatings.

4.11 Insulation

Insulation shall be provided for heating medium supply, heating medium return piping, lube oil piping located outdoors, glycol contactor piping, glycol lines to and from the regeneration skid, glycol still overhead line to/from condenser and outdoor liquid piping above-grade. All of this piping shall also be heat traced. All insulated piping located outdoors to have aluminum jacketing, except for special designated areas like the well heads and the removable spools associated with the well laterals. These applications will utilize insulation blankets with Velcro fasteners. Aluminum jackets to be provided with weep holes on the bottom to let moisture escape. Insulation materials and thickness shall be as indicated in Construction specifications. All storage tanks, gas vessels that have moisture and equipment and piping identified on the P&ID's shall be heat traced and insulated also – with aluminum jacketing or removable insulation blankets.

4.12 Pressure Relieving Devices

ASME Code Section VIII, Part UG, Nos. 125 to 135.

All pressure safety valves shall be pilot operated, and complete with test connections. A block valve with locking provisions shall be installed at the inlet of the pressure safety valve.

Pressure safety valves shall be installed on all pipe, and pressure vessels that can be isolated from pipe, where there is a potential of over

pressure. Pressure safety valves shall have sufficient capacity to relieve the maximum throughput of the upstream pressure regulator.

Pressure safety valves on vessels shall be sized for over pressure caused by vaporization of contained liquid when exposed to fire. The set pressure of the pressure safety valve shall be at or below the maximum working pressure of the vessel. Piping and Vessels with a MAOP of 10,200 kPa (1,480 psig) shall have the pressure safety valves set at or below 10,200 kPa. High pressure shutdowns on the 10,200 kPa MAOP system shall shut off compression and shut the gas flow from the field when this piping or equipment reaches 9,500 kPa (1380 psig).

The compressor discharge piping of each stage shall be equipped with a discharge pressure transmitter with a shutdown setting in software that shall shut down the compressor unit when the discharge pressure is 689 kPa (100 psig) less than the MAOP of each piping system. The first stage discharge compressor system will have a MAOP of 12,400 kPa (1,800 psig). The compressor unit will shut-down when the inter-stage piping reaches 11,713 kPa (1,700 psig). The second stage discharge piping and equipment will have a MAOP of 17,225 kPa (2,500 psig). The compressor unit will shut down when the second stage discharge piping pressure reaches 16,536 kPa (2,400 psig).

Pressure safety valves on pipe sized for over pressure caused by blocked flow shall open at a pressure of no greater than the design pressure of the pipe or system. These pressure safety valves must have sufficient capacity to insure that the maximum operating pressure of the station piping and equipment is not exceeded by 10%. The second stage compressor discharge piping and equipment, the compressor discharge header, the pressure-reduction manifold and the Station Inlet Separator will have a design pressure and MAOP of 17,225 kPa (2,500 psig). The pressure safety valves on this system will open at 16,880 kPa (2,449 psig).

Exhaust stacks from pressure safety valves must extend outdoors to a minimum height of two meters (7') vertically above finished ground elevation. A rain and snow cap must be installed on each exhaust stack.

4.13 Pipe Installation

Buried pipe depth under roads shall be a minimum of 1.5 meters (5') to top of pipe, unless steel plates are installed above the pipe. The gathering header pipe shall be buried a minimum of 1.2 meters (4') below grade to the top of the pipe at all other locations.

Buried pipe in the remainder of the Storage Station shall be a minimum of 1.2 meters to top of pipe. The detailed piping construction drawings will identify the depth of the pipe below grade in all locations.

Wherever possible, the pipe shall be installed at the minimum depths indicated above, except for any underground liquid drain piping and water supply and sewer lines that should be installed at depths in accordance with the geotechnical report.

5.0 PRESSURE VESSELS

5.1 Design Codes

ASME Boiler and Pressure Vessel Code
Section 2 Material Specification
Section 5 Non-Destructive Examination
Section 8 Construction of Pressure Vessels
Section 9 Welding and Brazing Qualifications
ANGS Specification ANGS-SP-100, Pressure Vessels
Nova Scotia Technical Safety Act, Boiler and Pressure Vessels

5.2 All vessels shall have an ASME code stamp and a CRN Code Stamp for Nova Scotia.

5.3 All vessels located outdoors shall have a minimum design temperature rating of -28°C . All vessels installed indoors in heated buildings where the temperature will be maintained at $+5^{\circ}\text{C}$ and above, can be designed for $+0^{\circ}\text{C}$.

5.4 Fabrication Special Requirements

5.4.1 Nozzles greater than 38 mm (1.5") diameter shall have flanged connections. Nozzles 38 mm and smaller shall be 3,000# full couplings.

5.4.2 All vessels shall have ASME padded construction for nozzle connection design.

5.4.3 Connections on vessels are to be minimized when possible, especially on pulsation suppressors.

5.5 Hydrostatic Testing

Shop test pressures and duration shall be at 1.5 times the design pressure for 8 hours. All vessels shall also be tested in the field with the piping system that they are a part of for 8 hours. Some equipment that has been hydro-tested in the shop for 8 hours at 1.5 times the design pressure will not be again tested in the field, as the construction schedule may not permit it.

5.6 Miscellaneous External Piping

All liquid drain piping, liquid bridle piping, and liquid instrumentation piping located outdoors and above ground shall be heat traced and

insulated.

6.0 ELECTRICAL

6.1 Design Codes

CEC: Canadian Electrical Code, latest edition

Applicable Electrical Codes of the Province of Nova Scotia

API Recommended Practice RP505: Classification of Gas Utility Areas for Electrical Installations at Petroleum facilities; Class 1 Zone 0, Zone 1 and Zone 2.

NFPA: National Fire Protection Association, latest edition.

6.2.1 Power System

(a) The Station facilities power systems will consist of a 600 V feeder from the Solution Mining Facilities Electrical Room. Two 300 AMP circuits are available to feed the gas storage compression and withdrawal facilities. A new motor control center, power panels, and equipment racks will be installed in the Auxiliary building to feed plant loads.

(b) An AC-DC-AC uninterruptable power supply in the Auxiliary Building will provide power for critical control and alarm circuits and for the remote notification system.

(c) Electric motors:

600V, 3 phase, 60Hz, 0.56 Kw (3/4 hp), and above

220V, single phase, 60Hz, 0.375 Kw (1/2 hp), and smaller.

6.2.2 Alarm System

(a) UV/IR fire detectors and combustible gas detectors will be provided in the Compressor Building, and in the Auxiliary Building. The Glycol Regeneration Skid Building will be equipped with gas detectors. The fire detector and gas detector controllers will be located in a separate panel that will feed the station control panel, which will initiate station alarms and shutdowns. At each exterior door of the compressor building and at each of other buildings containing gas detectors shall have a high-gas-in-building warning alarm. Each building and enclosure shall have a minimum of 2 personnel doors for entry and exit.

- (b) Emergency lights will be provided in the compressor building, auxiliary building, office / control building, and in all of the other buildings and enclosures in the Station to illuminate ways to the exits in case of loss of normal lighting, or in case of ESD for the Station.
- (c) An intruder alarm system will be provided to detect unauthorized entry into the Station main buildings (Compressor, Auxiliary, and Office / Control).
- (d) A remote notification system will be provided to inform the Station Operating Supervisor that a malfunction or unauthorized entry has occurred.

6.2.3 Control System

- (a) The Station computer control system will be an Allen Bradley Control Logic PLC system to control the facilities. Instruments will be hard wired to I/O cabinets placed strategically in the yard and communication with the Station PLC will be by fiber optic cable. The number and location of the I/O cabinets is to be determined during detailed engineering phase of the project.
- (b) Control power will be 24 VDC uninterruptible power supply.

6.2.4 Lighting

(a) General Lighting

Ceiling and wall side directional lighting will be installed inside the compressor building and auxiliary buildings. Outdoor lighting (directional type) will be located on poles that can be lowered to change light bulbs. Lighting shall be installed to illuminate the Major Equipment and the valve areas where people will need to work. Lights will also be installed along the main station roads. Outdoor lighting is to be minimized and only for areas where the Operations personnel need to see important details of the equipment. Outdoor lights in the station must be 20' maximum height.

(b) Emergency Lighting

Separate emergency lighting with battery packs shall be installed in all buildings to permit safe exit when power is lost. These lights must meet all Area

Classification Codes, and all Local Building Codes.

6.2.5 Area Classification

The areas of the plant will be classified for electrical installations in accordance with the API Recommended Practice RP505 cited in 6.1 above.

- (a) Compressor building area shall be Class I, Division 2, Group D, to a distance of 3 meters (10 feet) from the building.
- (b) All equipment on the gas side of compressor building, all piping and equipment associated with the station vent silencer and associated with gas injection and gas withdrawal systems, to a distance of 4 meters from any piece of equipment shall be Class I, Division 2, Group D.
- (c) Waste Oil storage tank, compressor oil vessels, coolant vessels, and the associated containment dike shall be General Purpose.
- (d) Around hydrocarbon vents to atmosphere within 1.5 meters radius shall be Class I, Division 1, Group D; from 1.5 meters to 4 meters radius shall be Class I, Division 2, Group D. The entire gas withdrawal equipment area shall be Class 1, Division 2, Group D, except for equipment vents that shall be Class 1, Division 1.
- (e) Glycol storage tanks for dehydration unit and Brine tanks, within retaining wall and within 4 meters of tank walls, shall be Class I, Division 2, Group D.
- (f) The auxiliary building throughout, the non-gas side of the compressor building (where the inlet air silencer, exhaust silencer and jacket water cooler are located), the office/shop/control building, and the Warehouse Building shall be classified 'General Purpose'.
- (g) The gas dehydration Glycol Regeneration skid unit and the Withdrawal Gas Heater shall be located a minimum of 10 meters from any other major gas equipment to minimize risk of igniting gas possibly leaking from the equipment.

6.2.6 Grounding System

A grounding system shall be installed throughout the Storage Station. The grounding system shall consist of a

ground grid (to connect various vessels, machinery, and structures) and ground conductors carried with phase conductors to ground electrical equipment. No buried bare ground cable shall be utilized.

6.2.7 Cathodic Protection

An impressed current type cathodic protection system shall be installed throughout the station. The cathodic protection system will be designed and installed within one-year after Start-up, to allow field tests of the completed facility to be performed. The wells will be isolated from the above ground facilities by using insulating kits on the wellhead flanged valves. The M&NP pipeline will be isolated from the connecting pipe and Station by an insulation joint or flange. The remainder of the station, connecting pipe and gathering system will be cathodically protected together.

6.2.8 Heat Tracing

All above ground piping and vessels in the Station that contain water, water vapor, and hydrocarbon liquid will be heat traced and insulated. In general, all vessel bridles, sight glasses, liquid piping, drain lines, Brine storage tanks, Waste Liquid Storage tank, and associated piping that will be subjected to cold temperatures will be heat traced and insulated.

The supply piping associated with the lube oil storage vessels shall be heat traced and insulated from the truck loading lines to these vessels and into the compressor building.

Heat tracing material shall be of the automatic temperature control type.

6.2.9 Electric Immersion Heaters

Electric immersion heaters shall be installed in the lube oil storage vessels at the station and in the brine, glycol, and waste tanks located in the Station. Heaters shall be temperature controlled to maintain a fluid temperature at 16°C in the tank, but, the maximum temperature of the fluid in contact with the heater elements shall not be greater than 90°C.

7.0 INSTRUMENTATION

7.1 Applicable Codes

ASME/ANSI "Instrument, Control and Sampling Pipe and Components."

7.2 Station Control Panel Instrumentation

- 7.2.1 The control system shall be based on an Allen Bradley Control Logic PLC system with HMI interfaces in the Auxiliary Building and in the Office/Shop/Warehouse Building. Each engine-compressor control panel is to have a separate AB control Logic PLC computer and a separate enclosure, adjacent to each unit. All control devices sending signals to the station control panel shall have electronic output of 4 to 20 ma. for continuous signals or shall have closed contacts for alarms. A graphic display of the new station equipment and piping and valves with indicating status lights will be provided with the computer software.
- 7.2.2 The engine-compressor units will be able to be started, stopped and changed in operating speed and flow from the engine control panel in the compressor building and from the Station PLC.
- 7.2.3 The glycol regeneration skid will also be equipped with an Allen Bradley PLC to control skid operations. This PLC will communicate with the Station PLC and important skid set-point parameters will be able to be changed from the Station PLC.
- 7.2.4 All fire detectors and gas detectors shall be hard wired to a fire and gas panel that shall alarm in the control room and initiate a signal to the station control panel to shut-down the station and blowdown the above ground gas piping systems.
- 7.3 Engine Compressor Unit Control Panel Instrumentation shall be electronic except where Compressor Unit manufacturer requires pneumatic functions. All switches to indicate engine compressor unit malfunctions shall be electronic. All engine sequence valve limit switches shall be electric.
- 7.4 Yard instrumentation will normally send signals with transmitters by hard wire to the strategic I/O cabinets and these will tie in to the Station PLC with fiber optics cable and the PLC will initiate appropriate control functions. A minor number of yard instruments will be controlled by pneumatic controllers with local indication or local control action.
- 7.5 Station gas flow control shall be electronic. For normal compression injection or withdrawal, a flow signal from the gas meter and flow computer shall be input into the master control computer that will direct the compressor unit control computer to control or load the compressor units. For free flow withdrawal, flow control shall be accomplished from the master control computer in the control room. Individual well flows, pressures and temperatures will be transmitted from the wells to the Station-PLC.

8.0 EMERGENCY SHUTDOWN (ESD) SYSTEM

8.1 Applicable Codes

CSA Z341 Series 10; Storage of hydrocarbons in underground formations.

Canadian Electric Code
National Fire Protection Association (NFPA)

8.2 System Description

8.2.1 There are two ESD systems associated with the project: (1) Compressor Building ESD that blocks and vents all gas in the compressor building and in the compressor area, and (2) Station ESD that vents all natural gas from the entire station piping and equipment in case of high gas in the Glycol Regeneration Skid building, or a station operator observes a fire or unsafe condition in the plant.

A Compressor Building ESD, initiates shut-down of the engine-compressor units, shuts off all electrical circuits in the compressor area except for vent fans and emergency lighting, blocks in the station from the gas pipeline and from the gathering headers, and initiates venting of all gas in the compressor building, the compressor lead lines, compressor suction header, compressor discharge header, filter separator, fuel gas piping, starting gas piping and the injection piping to the field injection block valves. ESD vent valves located at the Station Vent Silencer will open to vent this gas. XCV 1023 A and B (compressor unit vent valves), XCV-1022 (Suction header vent valve) and XCV-1024 A,B (Discharge Header Vent valves) will open. The Compressor Building ESD System is designed to vent all natural gas contained in pipes and equipment inside these areas through the Station Vent Silencer to remove all fuel that could catch fire.

8.2.2 The gas piping between the field inlet valve (XCV-1001 A,B,C), through the Field Inlet Separator vessel through the Withdrawal Gas Heater, the Dehydration Contactor Tower, the pressure reduction manifold, through the Final Separator

and gas meter to the station/pipeline block valve (XCV-1007) will remain pressurized when a Compressor Building ESD occurs. This is to prevent unnecessary venting of station gas away from the compressor building.

- 8.2.3 The Station ESD system for the Alton Inlet Station facilities will include venting the gas withdrawal piping if the gas detectors in the Glycol Regeneration Skid Building indicate high-high gas, an Operator observes a fire, or other dangerous situation occurs in the gas withdrawal area. It will include shutting down the compressor units, plus closing the gas block valves at the compressor station limits (XCV-1007 and XCV-1001A,B,C), at the filter separator inlet valve (XCV-1008), at the injection block valves (XCV-1011 A-1, A-2, A-3, B-1, B-2, and B-3), at the pressure reduction valve outlet and bypass (XCV-1004 and XCV-1005), at the Final Separator inlet valve (XCV-1012), at the fuel gas block valve (XCV-1026), and at the Utility fuel gas to the yard (XCV-1036), at the high pressure PCV Inlet valve (XCV-1003), then opening the same vent valves for a Compressor ESD plus opening the two withdrawal piping vent valves (XCV-1025 and XCV-1028). This vents all gas in the entire Station. The engine-compressor units also shut down and the electric power for all services except emergency circuits are turned off.
- 8.2.4 A Compressor Building ESD will be automatically activated by a high concentration of natural gas in the compressor building, or by a fire in the compressor building or manually activated by station personnel. Compressor Building ESD activation valves will be located at the compressor panels and outside the compressor building doors. A Compressor Building ESD will also automatically start ventilation fans in the walls of the compressor building that are on a special emergency circuit, and cause electricity to the compressor area to be shut off except for emergency circuits that are to remain energized for critical equipment.
- 8.2.5 The Station ESD will be initiated by high gas detection in the Regeneration Skid building, ESD activation valves at two gates, at the Regeneration Skid building and from the control room. The Plant Operators will initiate a Station ESD by operation of the ESD Activation valves.
- 8.2.6 During any ESD scenario all gas will be vented through the Station Vent Silencer. The silencer will reduce the noise associated with venting high pressure gas, trap any

entrained liquid mist, and ensure the gas is vented at a safe height above grade.

8.2.7 The wells are equipped with surface shutdown valves that will close on high well pressure and in case of a well fire. If the wells shut in due to a well fire, the Station Operators will then initiate a station ESD.

8.3 ESD Valve Description

8.3.1 All ESD valves shall have pneumatic operators, complete with limit switches for remote status indication.

9.0 OTHER SHUTDOWN AND SAFETY SYSTEMS

9.1 Engine Compressor Unit Shutdown System

The engine-compressor units will be protected from severe damage by automatic malfunction shutdowns resulting from the following:

Engine Shutdowns

Compressor Shutdowns

Engine Overspeed

High Pressure Gas Discharge
(each stage of compression)

Engine Crankcase pressure High

Low Crank Case Oil Level

Turbo Oil Pressure Low

High Lube Oil Temperature
(Each stage of compression)

High Temperature Engine Lube Oil

Low Engine Lube Oil Pressure

High Temperature Power Cylinders
(each cylinder exhaust)

High Temperature Compressor
(each cylinder outlet)

Low Crankcase Oil Level

High Jacket Water Temperature

High Main Bearing Temperature

Low Pressure Gas Suction
(each stage of compression)

Low Pressure Jacket Water

High Press. at Gas Meter

Low Pressure Lube Oil

High Compressor Vibration

High Engine Vibration

High Level Filter Separator

Turbo-Charger Overspeed

Cylinder Lubrication no Flow

The complete list of engine-compressor alarms and shutdowns will be shown in the Engine-Compressor Specification.

9.2 Station Gas Withdrawal Shutdown

Gas withdrawal during free flow will be automatically stopped by closing the station field block valves (XCV-1001 A,B,C) and the PRV Outlet Valve (XCV-1004), if the gas pressure downstream of the pressure reduction valve increases to near the maximum allowable operating pressure of 10,200 kPa (1,480 psig), we will shut down gas withdrawal at 9,500 kPa (1380 psig).

9.3 Pressure Limiting Devices

Pressure Limiting (Relieving) Device design is discussed in Section 4.12. There are two main gas withdrawal pressure safety valves, PSV-1005 (installed downstream of PCV-1103) and PSV-1006 (installed on the 10,200 kPa piping downstream of XCV-1010A,B). Together these pressure safety valves are designed for blocked discharge of the low pressure piping system with the maximum gas withdrawal flow rate ((6,200,000 m³ per day (220 MMSCFD) at 9,500 kPa (1380 psig)).

The compressor units also have blocked flow pressure relief valves on each stage. These are PSV-1114A, B (first stage) and PSV-1120A, B (second stage).

There are also pressure safety valves on ASME vessels per code sized for fire.

We also utilize high pressure switches in the brine piping and the waste oil piping to the respective storage tanks to close isolation valves to prevent overpressure of the storage tanks.

9.4 Gas Detectors

Gas Detectors shall be located in the compressor building, auxiliary building, and the glycol regeneration building. The controller for the gas detectors shall be a Fire and Gas Panel that will alarm and send a shutdown signal to the PLC system, located at the station control room. Gas detectors shall be manufactured by General Monitors or MSA. Gas detector limit of 20% LEL shall trigger a high gas alarm, and in the

Compressor Building shall start exhaust fans. Gas detection of 40% LEL in the compressor building shall cause a Compressor Building ESD.

9.5 Fire Protection System

The Fire Protection System will include:

- (a) Ultraviolet-infrared fire detectors which shall be located in the compressor building, and the auxiliary building. We will install 8 sensors in the compressor building, and two in the auxiliary building. The controllers for the fire detectors will be located in the Fire and Gas Panel that will initiate a signal to the station control PLC that will shut-down the equipment and block and vent the ESD valves. The UV-IR fire detectors shall be manufactured by General Monitors. A detected fire by the UV-IR system in the Compressor building will cause a Compressor Building ESD.
- (b) A 150 pound dry chemical cart system, for both the Station equipment area and at the Well Pad area, quantity as required by local building codes.
- (c) Fire extinguishers, 15 pound dry chemical type, to be located inside all buildings and enclosures , quantity, as required by local building codes. The new buildings in the Well Pad area shall also be equipped with 15 pound dry chemical type extinguishers.

10.0 GAS SYSTEMS DESIGN

10.1 Compression

- 10.1.1 Equipment to be two 1750 Kw (2370 Bhp) engine-compressor units, each consisting of a separable two-stage compressor with spark ignited internal combustion drivers. Units to be capable of operating in single-stage compression or two stage compression for both injection and withdrawal. The gas inter-coolers, gas after-coolers and engine jacket-water coolers will be electric motor driven. Engine compressor units will be maintained in a ready-to-start mode during the injection and withdrawal seasons by circulating warm lube oil through the engine.

10.2 Gas Metering

- 10.2.1 Gas metering at the Alton Inlet Gas Storage Station will be used for station operating indication, and station flow control. The custody transfer meter for the storage project will be located at the interconnect point with the M&NE Halifax Lateral Pipeline.
- 10.2.2 A bolt-on bi-directional Ultrasonic gas meter run to be located on the low pressure gas piping (600# ANSI class). Pressure, temperature and differential pressure transmitters will be mounted on the piping. This flow meter will measure gas volumes entering and leaving the gas storage station.
- 10.2.4 Instantaneous flow and totaled flow will be calculated and displayed by the station computer utilizing gas flow (differential pressure), pressure and temperature inputs.

10.3 Gas Dehydration

- 10.3.1 A regenerative tri-ethylene glycol dehydration system will be utilized. The dehydration contactor column will be located in the Station downstream of the Withdrawal Gas Heater.
- 10.3.2 Gas withdrawn from the salt caverns is expected to have as much as 40 # water/MMSCF gas during early years of operation.
- 10.3.3 Gas quality required at the custody transfer meter at the M&NE 12" pipeline is a maximum water concentration of 4# water/MMSCF gas.
- 10.3.4 Dehydration equipment will be rated for 17,225 kPa (2,500 psig) pressure at 40°C, and -28°C minimum design temperature and shall be sized to remove water vapor from the gas to a remaining concentration of 2.5# water/MMSCF gas at 3,100 kPa (500 psig) or above withdrawal gas operating pressures.
- 10.3.5 The glycol regeneration skid equipment will include a flash three-phase separator, a glycol pre-filter, an activated charcoal filter, an after filter, two electric motor pumps, the reboiler, still and the surge tank. The still reboiler will be sized for 2,000 Btu/gal. of pump capacity. Pumps shall be capable of the supplying 2 to 3 gallons TEG/pound of water vapor to be removed from the gas.

The overhead vapors from the still column will be condensed, collected in a small tank and pumped to the condensed liquid/brine storage tank. The non-condensable vapors from the still overhead will flow to a Thermal Oxidizer where all hydrocarbons will be destructively burned. The Thermal Oxidizer operates with natural gas fuel and will combust 99%+ of hydrocarbons. The condensed liquid/brine tank shall be a 70 cubic meter (442 BBL) vertical tank. The fresh TEG glycol tank shall be a 40 cubic meter (250 BBL) vertical tank. Both tanks will be located in a secondary containment dike. The above ground piping and equipment from the outlet of the still column to the overhead condenser to the brine storage tank shall be heat traced and insulated.

10.4 Gas Heating and Regulation

- 10.4.1 An approximate 6,000,000 e³ Joules (6 MMBTU/HR) output per hour Withdrawal Gas Heater will be provided upstream of the Contactor Tower to allow gas dehydration to operate at 25°C. Gas temperature from the Alton Inlet Wells on withdrawal is expected to be 15°C at the lowest when it flows into the Alton Station. Maximum pressure will be 16,300 kPa (2,365 psig). After reduction in pressure to 5,512 kPa (800 psig) or below, the lowest temperature without heating could be as low as -15°C. We want to maintain a target temperature of +11°C downstream of the pressure reduction valve.
- 10.4.3 One pressure reduction manifold will be installed. A by-pass line will also be installed in parallel. The pressure reduction valve will be 203 mm, 1500# ANSI rated valve, disk stack type, angle valve designed for low noise levels as manufactured by Control Components, Inc.
- 10.4.4 Pressure regulation equipment for the Alton Inlet field will be installed downstream of the Dehydration Contactor Tower vessel.
- 10.4.5 Block valves will be installed upstream and downstream of the pressure reduction valve. They will be rated at 1500# ANSI. The upstream block valve and downstream block valve shall also be used as an automatic shut off valve in case the pressure reduction valve malfunctions. This was discussed further in Section 9.2.
- 10.4.6 Pressure classification change from 1500# ANSI to 600#

ANSI will be designated at the block valve downstream of the pressure reduction valve and on the downstream side of the pressure reduction by-pass valve.

10.5 Other Major Gas Process Equipment

10.5.1 Filter Separator

Vessel to be fabricated to ASME Section VIII, code stamped and registered with a CRN for Nova Scotia.

Vessel shall be horizontal and equipped with sock filters in addition to a vane mist eliminator section.

Each chamber shall have a separate sump. Each sump shall be equipped with an automatic level transmitter, level valve, high level switch, and a level sight glass assembly.

There shall be a differential pressure indicator across the major vessel chambers.

Vessel shall be equipped with a fire-sized relief valve.

Vessel sizing shall be based on the maximum compression flow rates. A Purchase Specification will be prepared to outline vessel design and fabrication details.

Design pressure will be 10,200 kPa (1480 psig) at 40°C maximum and -28°C minimum design temperature. Flanges shall be rated 600# ANSI.

Inlet to filter separator shall be from the side and not the top to minimize vibration effects.

The concrete support shall be one solid block base to prevent vibration-pulsation induced lateral movement. No piers shall be utilized for this design.

Vessel manufacturer shall provide support bracing to the vessel in such a manner so as not to interfere with sump and drain piping.

10.5.2 Compressor Gas Inter-cooler and Gas After-cooler

Gas Inter-cooler and gas after-cooler to be designed to API

Spec. 661, TEMA standards and ASME Section VIII, Division I, and Canada OSHA standards.

Design pressure for the gas inter-cooler will be 12,400 kPa (1,800 psig) at 94°C. Inlet and outlet flanges for the gas inter-cooler shall be 900# ANSI RF. Design pressure for the gas after-cooler will be 17,225 kPa (2,500 psig) at 150°C. Inlet and outlet flanges shall be 1,500# ANSI RF.

Fan motors to be belt driven from electric motors. A minimum of two motors per cooler are required. The maximum fan tip speed shall be 2,100 meters/min.

An additional 10% of bare tube surface area shall be provided above the calculated bare tube area required for the operating conditions of the coolers.

Cooler assembly shall have an even number of passes incorporated into its design.

Cooler shall be designed with a 8°C approach between ambient air temperature (35°C) and gas outlet temperature.

10.5.3 Field Inlet Gas Separator

Vessel shall be vertical. A centrifugal type mist eliminator will be utilized to separate liquid from the gas during withdrawal. This type of mist eliminator was chosen to permit better flow turndown.

Fabrication shall be done in accordance with ASME Section VIII, Division 1 and registered with a CRN for Nova Scotia.

Design pressure shall be 17,225 kPa (2,500 psig) at 40°C maximum temperature and -28°C (-20°F) minimum temperature. Flange connections shall be rated 1500# ANSI.

The vessel shall be equipped with a liquid level transmitter, a high level alarm, a level glass, and a drain connection with an automatic pneumatic drain valve. The vessel shall be sized to separate 20 liters/minute water from the gas. Liquid retention in the vessel shall be 1200 liters or larger.

Vessel shall be equipped with a fire-sized relief valve.

Vessel sizing shall be based on maximum gas withdrawal design conditions.

Vessel design and fabrication details shall be outlined in a Purchase Specification.

10.5.4 Final Gas Separator

A gas separator shall be installed upstream of the outlet station valve to the Gas Pipeline on gas withdrawal to collect liquid hydrocarbons (tri-ethylene glycol from the Gas Contactor Tower). The vessel shall not be utilized on gas injection. This will require a bypass valve and inlet and outlet block valves to be installed to route the gas on withdrawal through the vessel. This vessel shall be a two chamber coalescing separator with a coalescing filter type mist eliminator.

Fabrication shall be done in accordance with ASME Section VIII, Division 1 and registered with a CRN for Nova Scotia.

Design pressure shall be 10,200 kPa (1480 psig) at 40°C maximum temperature and -28°C minimum temperature. Flange connections shall be rated 600# ANSI.

The vessel shall be equipped with two sets of level equipment including liquid level transmitters, high level switches, sight glasses and drain connections with automatic valves. The vessel shall be sized to separate up to 1.5 liters per minute of triethylene glycol or water. Liquid retention in the vessel shall be 1600 liters minimum.

10.5.6 Pulsation Suppressors

Compressor unit pulsation suppressors shall be designed by the SGA Digital System Utilizing API 618 Section 3.3 design approach 3. The peak to peak pulsation's throughout the compressor unit piping, equipment and headers shall be limited to a maximum of 0.5% of the average operating pressure.

The digital pulsation analysis will be included with the Engine-Compressor Unit Specification and is the responsibility of the Engine-Compressor Unit Packager.

The pulsation suppressors shall be designed and

manufactured to ASME Code Sections 2, 5, 8 and 9. The vessels shall be code stamped and contain a CRN for Nova Scotia registration.

The MAOP of each vessel shall match the MAOP of the piping system that it flows into or from. The First Stage Pulsation Suppressors shall have a design pressure of 12,400 kPa (1,800 psig) to match the compressor first stage cylinder design pressure. The Second Stage Pulsation Suppressors shall have a design pressure of 17,225 kPa (2,500 psig). The minimum design temperature of these vessels shall be 0°C for all vessels located indoors. All of these pulsation suppressor vessels will be located in the Compressor Building.

Minimize the number of thermos-well, pressure indicator or test connections on each pulsation suppressor. However, one vent and drain connection in each suppressor is necessary for hydrotest purposes.

11.0 ENGINE AUXILIARIES

11.1 General

11.1.1 Two (2) 1,768 Kw (2,370 Bhp) engine compressor units will be pre-packaged and skid mounted. The units will require the following self-contained systems, all of which shall be provided by the engine manufacturer, except the Jacket Water Cooler.

- Starting Air System
- Fuel Gas System
- Inlet Air System
- Exhaust System
- Jacket Water and Cooling Water System
- Lubrication System
- Ignition System
- Safety Shutdown and Controls System

11.1.2 Major engine auxiliary equipment associated with the unit that will be supplied by the manufacturer is listed below:
All items except those listed as shipped loose will be mounted on the engine compressor unit or auxiliary skid.

(a) Turbo charger package (includes pre-heater, turbo oil

drain/air separator, lube oil filter, and turbo air aftercooler).

- (b) Starting Air Motors, including a lubricator, inlet and outlet expansion joints and a starting air vent silencer.
- (c) Lube Oil System (includes lube oil filters and strainers, lube oil coolers, main line oil pump, lube oil temperature control valve, pre/post lube oil pump, and hot start system).
- (d) Jacket Water Pump, Jacket Water Surge Tank (shipped loose), Jacket Water Temperature Control Valve, Engine and Compressor Cylinder Jacket Water Piping and Valves.
- (e) Exhaust System consisting of engine mounted pre-insulated exhaust manifold and exhaust expansion joints that are shipped loose. Company will supply the Exhaust Silencer.
- (f) Ignition system; Solid State, Low Tension, Breakerless with primary wiring and coils shielded and secondary unshielded.
- (g) Compressor Lube oil system consisting of a pump, filters and Kim Hotstart. The compressor will have a separate Cylinder Lube Oil Distribution Block System.
- (h) Inlet Air System: Company to supply inlet air filter and inlet air silencer. These items will be shipped loose for the Station Installation contractor to install.
- (i) Control Panel (shipped loose).

11.2 Fuel Gas System

A Station Fuel Gas Skid shall be designed during detailed Engineering and a specification shall be prepared to fabricate the skid.

Gas from the pipeline will be heated by hot water prior to regulation.

Gas for fuel is then be regulated to operate at 700 kPa (100 psig) utilizing two regulators in series, one a backup and set to control at 70 kPa (10 psig) higher pressure. The sensing lines from both regulators take signals from the gas pipe down-stream of a fuel gas filter separator bottle located on the downstream piping. The fuel gas piping system downstream of the pressure regulators is to be designed for 1210 kPa (175 psig).

Fuel gas to the end-users is to be filtered by a filter-separator vessel

located downstream of the regulators.

Orifice metering is utilized to measure total station fuel gas flow. The station computer will compute and displays instantaneous and total daily flow at the station control computer.

Fuel gas will be distributed to the engine-compressor units from this skid and to the Withdrawal Gas Heater, the Glycol Regeneration Skid Heater, the Thermal Oxidizer, the Hot Water Heater and to the Office/Shop/Warehouse Building FAU.

There will be a Fuel Gas ESD Shutoff valve and an ESD Vent valve to isolate and vent the fuel gas system if a station ESD occurs. See Section 8.2 for details.

All vents from the engine fuel gas system shall be routed outside the compressor building. A pressure safety valve shall be provided on the 1210 kPa engine fuel gas piping to protect the system from overpressure. This is provided on the engine-compressor skid. The Installation contractor will route the outlet of the pressure safety valve outside to the eave of the compressor building.

11.3 Inlet Air System

An inlet air filter, located outside, will filter incoming air to the engine compressor unit.

This air will be silenced prior to reaching the on skid mounted turbo-charger. An inlet air silencer will be installed to reduce the noise generated by the inlet air.

After passing through the turbo-charger, the hot air is then cooled in the turbo-charger air after-cooler before it flows into the engine inlet air manifold.

11.5 Exhaust System

Exhaust gases from the combustion chambers flow through a dry exhaust manifold and then into the turbo-charger. This provides the force required to compress the inlet air stream.

This exhaust gas then flows through expansion joints and through the exhaust silencer and stack before being vented to the atmosphere. Noise levels will be in accordance with special hospital grade standards of 42 dBA at 125 meters.

On the engine skid, there will also be an automatic turbo exhaust bypass valve and line installed to permit proper operation of the air-fuel ratio controller.

The exhaust silencer shall be a vertical type mounted on support legs. A stack that will exhaust the gas approximately 30' above grade shall be mounted on top of the silencer. The silencer must be designed to withstand the weight, seismic loads, and wind loading of the stack without the use of guide wires.

11.6 Jacket Water and Cooling Water System

A closed-loop 50% ethylene glycol 50% water by volume system utilizing heat rejection through an individual air cooled heat exchanger per engine unit, will be located outside the compressor building and will supply cooling for all necessary engine auxiliaries. The coolant shall be purchased from Dow Chemical, or Northern Petrochemicals as these companies have yearly analytical programs to monitor the quality of the coolant.

The engine auxiliaries serviced by this cooling system will include the following:

- (a) Jacket Water Cooling
- (b) Lube Oil Cooling
- (c) Turbo-Charger Air After Cooling
- (d) Compressor Cylinder Jacket Water Cooling
- (e) Power Cylinder Jacket Water Cooling

Cooler fan will be belt driven by electric motors, 25 BHP maximum each, 600V, 3 phase, and shall be designed using a 8°C approach using ambient temperatures supplied in Section 1.1. Maximum fan tip speed is 7000 ft/min.

Coolant will be supplied from an existing coolant storage vessel located outdoors on non-gas side of the compressor building.

11.7 Engine Lubrication System

Engine lube oil system will be pre-packaged and skidded by the engine manufacturer.

Lube oil will be supplied to the system from the lube oil storage vessel located outside on the non-gas side of the compressor building.

Lube oil will be pressurized from this tank to the compressor building

engine compressor units by supplying 140 kPa (20 psig) air at the top of the vessel.

A Recycle Lube Oil vessel will take spent lube oil from the engine during maintenance. This recycle lube oil shall be pumped to the recycle lube oil storage tank using the engine pre/post lube oil pump. Recycle oil to be returned from the vessel will be transferred by pressurizing the tank with instrument air.

The Lube Oil Storage Tank and the Recycle Oil Storage Tank and associated piping located outdoors will be heat traced and insulated. Tank heaters, electric type, shall also be installed in this vessel to maintain warm lube oil.

The engine and compressor pre/post lube oil pump will be operated by an electric motor. This pump shall also operate when the engine-compressor is on standby to circulate warm oil. The engine will be equipped with a heat exchanger, which will warm the engine lube oil utilizing electric heat. The pre/post lube oil pumps will also be piped to allow emptying of the engine-compressor unit for maintenance purposes. The lube oil shall be pumped to the lube oil recycle vessel.

11.8 Compressor Lubrication System

This system will be packaged and supplied by engine compressor manufacturer. The system shall include a Ren level controller and slow flow meter.

This system will provide lubrication to the compressor cylinder bores and packing as well as the power valve stem lubrication system.

The system will be a distribution block type only. No point-to-point lubrication will be incorporated into our design.

The lube oil for the compressors shall be the same as that used in the engine lubrication system.

11.9 Safety Shutdown and Controls System

Each engine shall be equipped with controls for start-up, normal shutdown of the engine, and a safety shutdown system that will automatically stop the engine should an abnormal condition exist in any of the monitored functions. Starting controls shall include gas valve sequencing operation, fuel gas permissive, cranking of the engine, ignition permissive, coolant permissive, lubrication permissive, and operating controllers. The electronic shutdown system shall be

designed to ground the ignition, shut off and vent the fuel gas piping and initiate gas system valve sequencing. Units shall operate on both speed control and flow control.

12.0 STATION SUPPORT SYSTEMS

12.1 Air System

Two air compressor/dryer units shall be installed in the Auxiliary Building. One unit will be in operation and the other a standby spare that is also on lead-lag controls for times when the air pressure is low. The air dryers will be a heated type designed for -40°C.

All air piping shall be carbon steel using threaded joints for above ground locations and welded for below grade.

Air system piping to be designed for 1,250 kPa (180 psig) maximum @ 40°C. The air system will also be utilized for starting the engine-compressor units.

There will be three instrument air receivers in the Station.

12.2 Hot Water System

A hot water heater (Boiler) system, rated at approximately 3,400,000 KJoules/hr (3.4 MMBTU/HR), will be installed in the Alton Inlet Station to heat the Compressor Building, the Auxiliary Building, and the fuel gas Meter Skid. The number of heating units in each building is shown on the P&ID's.

The hot water piping system shall be designed for 1,050 kPa (150 psig) @ 130°C.

12.3 Drain System and Waste Fluids Tanks

All lube oil, waste oil, liquid hydrocarbon, coolant,, and water, drains shall be collected from the compressor building via a drain header system and transferred to a 40 cubic meter waste oil collection tank. The Compressor Inter-stage Scrubber (V-1116 A, B) drains will also be routed to the waste oil tank.

Atmospheric drains in the compressor building will flow by gravity into two sumps located in the floor of the compressor building. Sump pumps will be installed to transfer the waste liquid from the sumps into a low-pressure drain header and into the waste oil collection tank.

Brine from the Field Inlet Gas Separator, the Filter Separator, and the Final Gas Separator shall be collected in two drain headers, one high pressure (17,225 kPa) (2,500 psig) and one medium pressure (10,200kPa) (1,480 psig). The Field Inlet Gas Separator drain flows into the high pressure drain header, whereas the Final Gas Separator and Filter Separator drains flow into the medium pressure drain header. Both headers will enter into the 70 cubic meter brine tank. The Glycol Contactor Tower will also have a vessel drain connected to the Glycol Recycle storage tank.

12.4 Power Gas System

There will be a closed-loop power gas system to operate the pneumatic actuator equipped valves. The gas source for this system will be from the station fuel upstream of the fuel gas regulators. This system will operate from 4,800 kPa (700 psig) to 8,500 kPa 1,230 psig).

Quality Management Plan

AltaGas' subsidiary Companies own four and operate three natural gas storage facilities in North America. One of these is the Cook Inlet Natural Gas Storage Alaska Facility (CINGSA) located in Kenai, Alaska. CINGSA is similar in size and pressure ratings to the Alton Natural Gas Storage facility. CINGSA was constructed and started operating in 2012. The Alton Natural Gas Storage facility will be engineered and constructed with the same or similar equipment, piping materials and safety systems that have proven operating experience. The as-built design for the CINGSA project will be the starting point for the design of the Alton Natural Gas Storage Project.

All engineering and design will follow all design codes itemized in Sections 1 to 12 above. All lead design engineers from each discipline will have previous experience of designing and engineering at least one natural gas storage facility in North America. All design engineering and construction drawings will be signed by Professional Engineers licensed in Nova Scotia.

During the engineering design, the Owner will initiate a Process Hazard Analysis (PHA), also known as a HAZOP with an outside licensed firm. Personnel that will participate in this PHA will be Alton Gas Storage Management, AltaGas engineers, AltaGas Operations Supervisors, the design engineers, and the Superintendent of the Alton Natural gas Storage Facility. This PHA will review each and every gas system control and determine if installed safety devices will protect people and equipment if the control system fails. A probability analysis and a severity analysis will be completed. Any control system found to have a high probability of occurrence with a high severity of result of failure will be modified to increase the safety reliability.

Construction Management will consist of an on-site management team who will be responsible for ensuring that all work is done to the highest level of quality control.

Qualified field superintendents will oversee all aspects of the construction, installation, startup/commissioning and testing of all equipment, including turnover packages as necessary. Surface facilities will be designed and constructed in accordance with the requirements of ASME Standard B31.3, Process Piping, and the appropriate sections of the ASME Boilers and Pressure Vessels Code. Full time inspectors for welding, electrical, civil and coating will be employed during construction of the gas facilities. The inspectors will be responsible to insure all welding, electrical, foundations and pipe coating meet the construction specifications, standards and construction codes.

All natural gas piping with a design pressure of 700 kPa and above will be 100% radiographed. All natural gas piping and equipment will be hydro-tested to 1.5 times the maximum allowable operating pressure for 8 hours.

To assure that quality is built into the project, three key elements will be implemented: Quality Management, Quality Control and Quality Assurance.

- Quality Management: Quality Management is part of the contract documents and holds contractors, vendors and craft workers to quality specifications for materials, equipment and workmanship. This will ensure the Project is built to the expectations for completion, performance and reliability. All natural gas equipment that has a design pressure of over 700 kPa will be inspected in the Manufacturing facility by certified inspectors.
- Quality Control: Quality Control governs the surveillance, evaluation and test processes and mechanisms necessary to ensure that contractors, vendors and craft workers build the Project to quality specifications. Quality Control is to provide the mechanisms and processes to verify that Project quality is meeting the Project expectations. Quality control will be verified daily during construction by the full time inspectors. Weekly meetings will take place between Alton Natural Gas Storage on-site construction management and each contractor and our certified inspectors to review all construction installation quality. All items not installed in accordance with the plans, specifications, standards and codes will be redone to meet the requirements.
- Quality Assurance: Quality Assurance governs the auditing and assessment processes necessary to ensure that these control processes are being executed and are effective in providing the level of quality the Project requires. The purpose of Quality Assurance is to assure that the mechanisms and process put into place are being implemented properly to control the quality of the Project. Written quality assurance plans will be developed for the project that outline the quality verification procedures. All inspection records of welding, concrete foundations, electrical testing, radiography, hydro-tests, and pipeline coating will be saved in the project permanent records.

All design changes will be tracked and communicated to appropriate project members. All discrepancies found between specifications, codes and standards and the actual installation by the Contractors will be corrected prior to the gas storage facilities are started operating.

Environmental Plan

Alton Natural Gas Storage will implement an environmental plan prior to construction that will outline procedures to address environmental issues including but not limited to air emissions during operation, storm water runoff during both construction and operation, fluids produced during operation and the final disposition of these fluids. The plan will be submitted to and approved by Nova Scotia Environment. All Requirements of Nova Scotia Environment will be implemented.

Employment Plan

The Alton Natural Gas Storage project will open employment opportunities to qualified local labour forces. Nova Scotia labour services will be given preferential treatment if qualified and competitive. Operation of the Alton Natural Gas Storage facilities will require at least one operator, 24 hours per day, 365 days per year, or 4.25 man-year personnel. In addition, a Station Superintendent and a maintenance/instrument technician are required during normal day work shift. All Operations personnel will be certified for operating natural gas plants in Nova Scotia. Prior to start-up of the natural gas storage facilities, Operators will be trained for all equipment and control systems.

Additional maintenance, geologic, engineering, and services personnel will be contracted over the life of the project. Local Nova Scotia Companies and residents will be interviewed for all of these positions. In addition to the operations of the facilities, some engineering services and construction services will be completed by Nova Scotia based companies.

Goods and Services Procurement Plan

The Alton Natural Gas Storage project will purchase equipment or contract services from qualified suppliers. Purchase specifications for equipment and piping materials will detail the quality requirements. The natural gas equipment and piping must meet high quality specifications, and must be installed and welded by experienced specialty contractors. A bid process will be used, unless extenuating circumstances apply, in which case a sole source justification process will be followed. Nova Scotia companies will be given sufficient time to participate in the bid process. If a Nova Scotia company has the experience to manufacture the equipment and bids a competitive price, preferential treatment will be given to local companies.

Contract Strategy

The Alton Project Team will utilize contracts that balance risk and financial control. This is likely to consist of a blend of Time and Material contracts, with a Not-to-Exceed price, as well as selective use of firm-price contracts to reduce cost risk. Additionally incentive/penalty type contracts may be considered depending on the work package. The Alton Project Team will then monitor progress, quality and cost for these contracts directly. Only Mechanical contractors that have constructed high pressure natural gas processing and gas storage stations with a staff of experienced qualified welders will be allowed to bid the gas facilities construction.

The success of the Contracting Strategy will require the Alton team to:

- Develop discrete, well defined scope of works for the contractors on site.
- Select and utilize qualified, reputable contractors.
- Provide internal oversight on cost, schedule and quality for each contract.

Procurement Plan

The procurement of material, equipment and service contracts for the Alton Project will be performed jointly by the Project Manager and the AltaGas Procurement group. The Project Manager is responsible for determining that the materials and equipment manufacturers are qualified to supply the required items and that the quality of the manufactured products meet Company Specifications, Standards and Codes. The Project Manager is also responsible verifying all service contractors are qualified to provide the requested services, and have provided the services in according to the specifications, codes and standards. The Procurement group will be responsible for negotiations and maintenance of all major owner equipment and material purchases, and labor contracts for engineering, environmental permitting, civil, mechanical, and electrical installation.

Process Safety Management Plan

To address safety concerns during construction, a Site Safety Plan will be developed. To promote a safe workplace for all employees and contractors working on-site, Alton Natural Gas Storage will prequalify contractors and require that they comply with the Site Safety Plan, the AltaGas corporate safety plan, and all provincial safety requirements.

AltaGas is committed to the protection of its workers, the public, and the environment as demonstrated in both the *AltaGas Occupational Health & Safety Management Policy* and the *AltaGas Environmental Management Policy*. The Alton Natural Gas Storage Project will fall under the *Gas Division Environmental, Occupational Health and Safety Management System*. The management system applies to all Gas Division and subsidiary company offices and field activities, all employees, and all contractors performing work. The policy consists of the following elements:

1. Management Commitment Leadership
2. Organizational Structure Responsibilities
3. Hazard Identification and Control
4. Management of Change
5. Emergency Preparedness
6. Incident Investigation
7. Work Procedures
8. Critical Tasks
9. Training
10. Communication
11. Performance Monitoring and Measurement
12. Planning and Objectives
13. Documents and Records Management
14. Management Review

The Codes of Practice within the Safety Management System are administered by the Gas Division EOH&S sub-committee and are updated on an annual basis. All Codes of Practice will be made available to the Board upon request. There are currently 112 Codes of Practice and they are divided into the following categories:

- A. Communications
- B. Emergency Preparedness
- C. Personal Protective Equipment
- D. Hazard Identification & Control
- E. Hazardous Materials
- F. Occupational Health
- G. Critical Tasks
- H. Environmental Stewardship

All employees and contractors performing work at AltaGas operations will conduct their work in accordance with the health, safety and environmental laws of any jurisdiction in which they are working, as well as the Elements and Codes of Practice outlined above.

Monthly Reporting

Alton Natural Gas Storage will file with the Board a monthly report stating the volume of gas received into the storage facility, and the volume of gas discharged from the storage facility. All reported volumes will be in cubic meters. This report will be filed no later than the 15th day of each month.

Auditing Plan

As directed by the Board, Alton Natural Gas Storage will conduct and document audits and inspections to ensure the facility is adequately designed, constructed, operated or abandoned. All audit documentation will be filed with the Board and will document any non-compliances and the corrective actions.

Abandonment

Alton Natural Gas Storage will develop an abandonment plan and submit to the Board no later than 6 months prior to a proposed abandonment.

List of Appendices

The drawings that encompass the majority of the Appendices are too large to include in this document and will be submitted as separate files. A list of the Appendices is below. Only Appendix 5 is presented in this document.

- Appendix 1: Location Map of Alton Natural Gas Storage Cavern Development Site
 - Drawing 111-2678 Sheet 13
- Appendix 2: Plot Plan of Alton Gas Facilities
- Appendix 3: Alton Process Flow Diagrams
- Appendix 4: Alton Gas Facilities Piping and Instrumentation Diagrams
- Appendix 5: Existing AltaGas Owned and Operating Storage Facility
- Appendix 6: Alton Natural Gas Storage Project
 - Drawing 111-2678 Sheet 1

Appendix 5: Existing AltaGas Owned and Operating Storage Facilities



Cook Inlet Natural Gas Storage Facility; Kenai, Alaska; In-Service April 2012



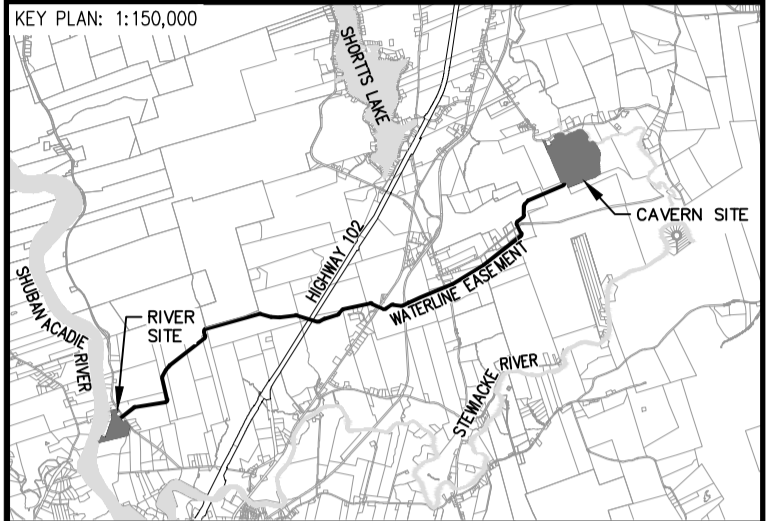
Eaton Rapids Gas Storage Facility; Eaton Rapids, MI; In-Service June 1989



WSP Canada Inc.
1 Spectacle Lake Drive
Dartmouth, Nova Scotia, Canada B3B 1X7
T 902-835-9955 F 902-835-1645 www.wspgroup.com

SEAL:

KEY PLAN: 1:150,000



LEGEND:	PROPOSED	EXISTING
EDGE OF PAVEMENT		
LOTLINE		
EDGE OF GRAVEL		
TOP OF SLOPE		
SWALE / DITCH		
UTILITY LINES & POLE		
STREET BOUNDARY		
PROPERTY BOUNDARY		
EASEMENT		
LIGHT STANDARD		
FLOW DIRECTION ARROW		
	CULVERT	HEADWALL
		FENCE
		ROAD SIGN
		GUIDE RAIL

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REVISION:

NO.	DATE	YYYY/MM/DD	DESCRIPTION
4	2015/03/06		ISSUED FOR NSURB APPLICATION
3	2014/03/13		ISSUED FOR REVIEW
2	2014/03/06		ISSUED FOR REVIEW
1	2014/02/21		ISSUED FOR APPROVAL
0	2013/11/22		ISSUED FOR DISCUSSION

PROJECT NO:	111-26678	DATE: (YYYY/MM/DD)	2014/02/21
ORIGINAL SCALE:		HORIZONTAL:	VERTICAL:
DESIGNED BY:	M. WALLACE, E.I.T./R.STEPHENSON, P.ENG		
DRAWN BY:	D. MACINNIS		
CHECKED BY:	M. WALLACE, E.I.T./R.STEPHENSON, P.ENG		
			25mm

CLIENT:
ALTON NATURAL GAS STORAGE LIMITED

PROJECT:
**ALTON NATURAL GAS STORAGE PROJECT
ALTON, NOVA SCOTIA**

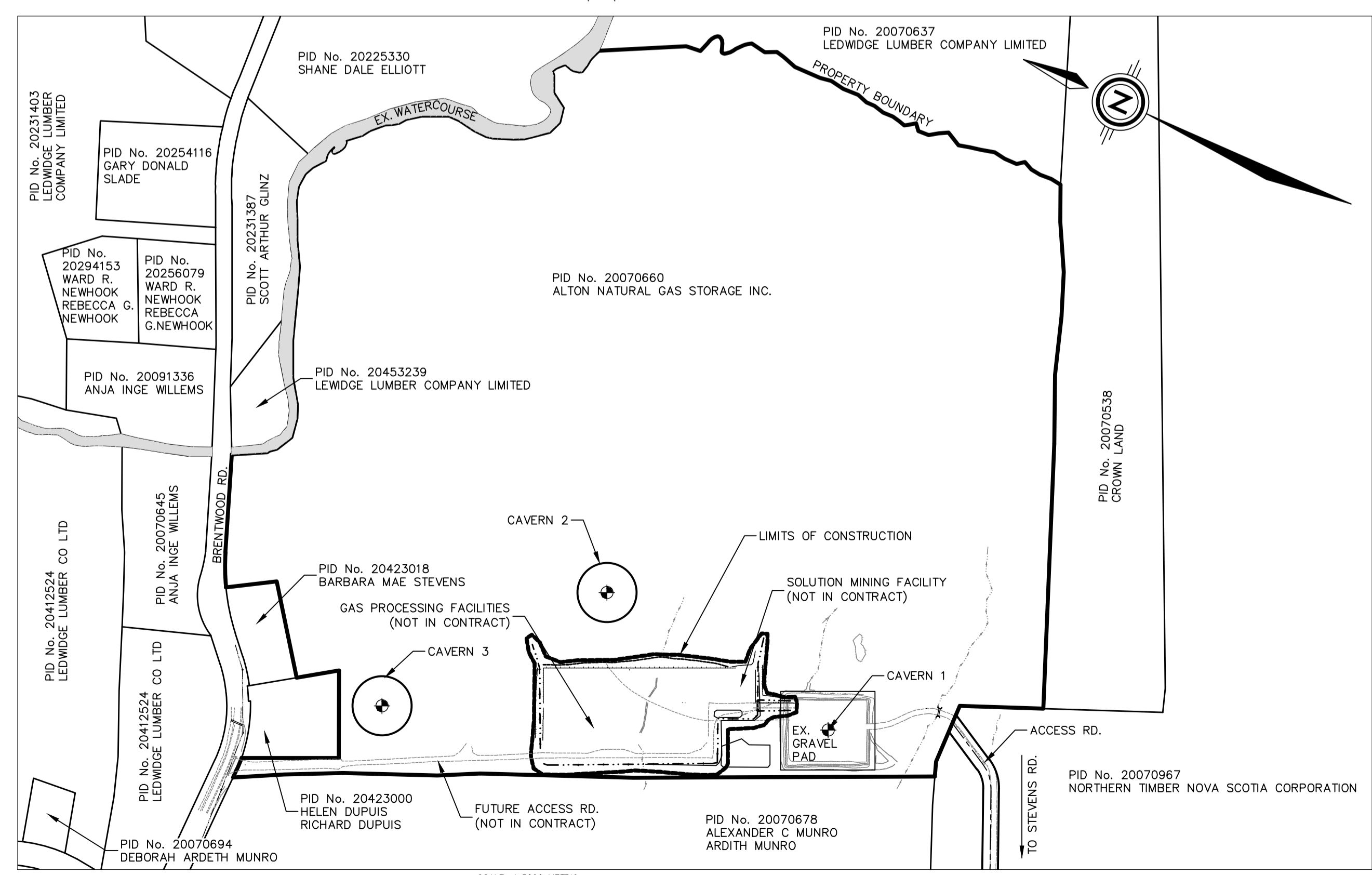
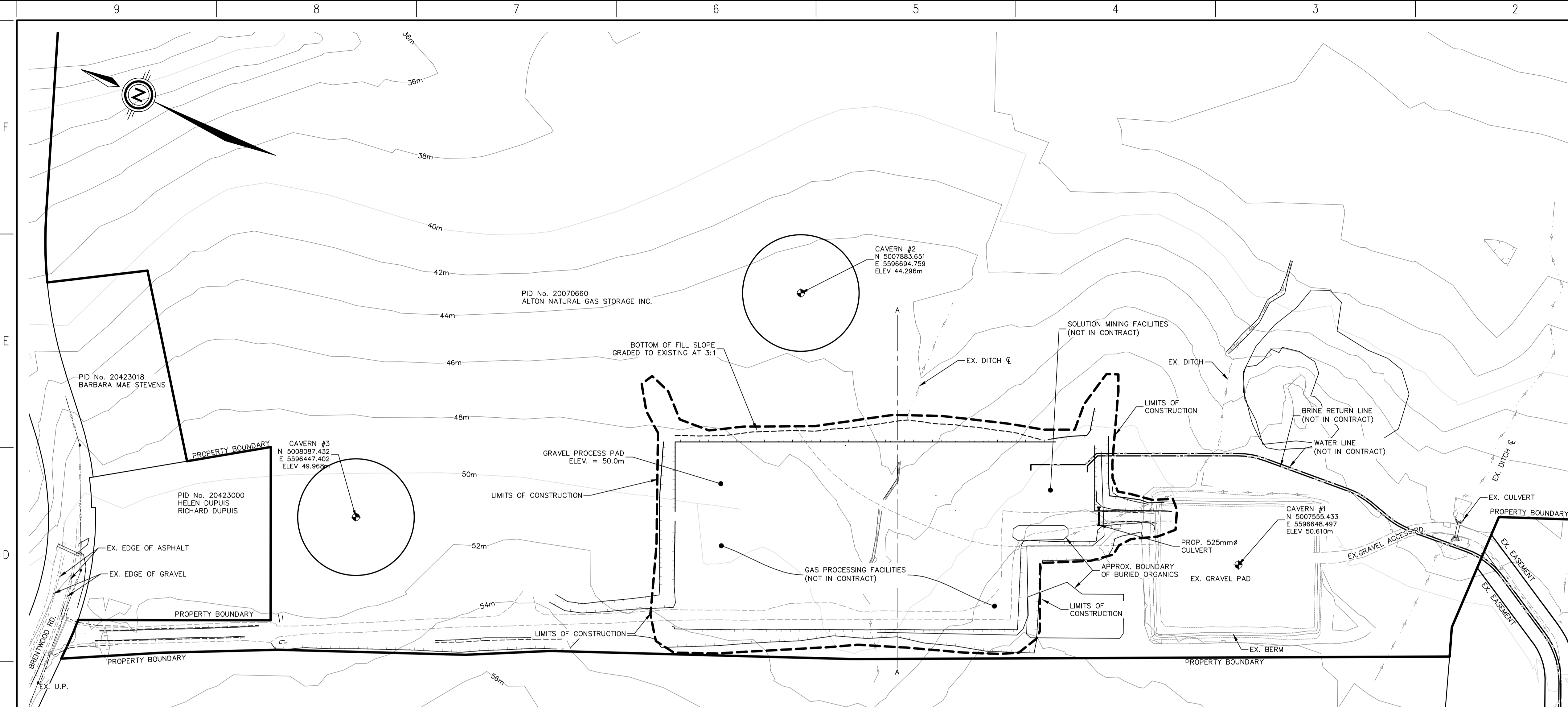
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OVERALL SITE PLAN**

SHEET NUMBER:
111-2678-SHEET 13

ISSUE:
ISSUED FOR NSURB APPLICATION

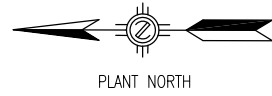
DATE OF: 2015/03/06

REV #
4

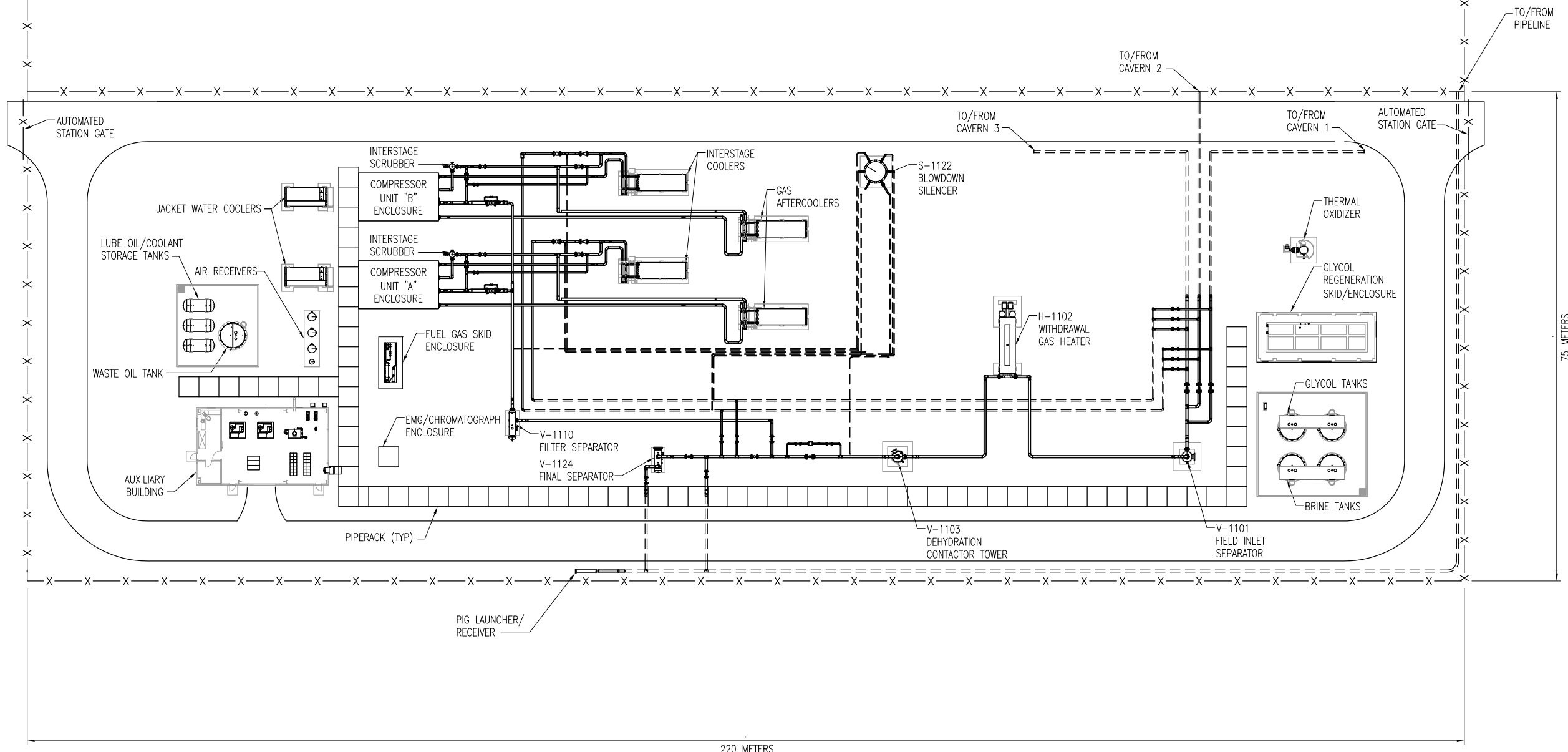


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PRINTED: 2:20 PM 2015/03/11 BY: DONALD MACINNIS



SOLUTION MINING FACILITIES



PLANT NORTH

TO/FROM PIPELINE

TO/FROM CAVERN 2

TO/FROM CAVERN 3

TO/FROM CAVERN 1

AUTOMATED STATION GATE

AUTOMATED STATION GATE

75 METERS

220 METERS

PIG LAUNCHER/RECEIVER

PIPERACK (TYP)

GLYCOL TANKS

BRINE TANKS

THERMAL OXIDIZER

GLYCOL REGENERATION SKID/ENCLOSURE

H-1102 WITHDRAWAL GAS HEATER

S-1122 BLOWDOWN SILENCER

GAS AFTERCOOLERS

INTERSTAGE COOLERS

INTERSTAGE SCRUBBER

INTERSTAGE SCRUBBER

COMPRESSOR UNIT "A" ENCLOSURE

COMPRESSOR UNIT "B" ENCLOSURE

FUEL GAS SKID ENCLOSURE

EMG/CHROMATOGRAPH ENCLOSURE

V-1110 FILTER SEPARATOR

V-1124 FINAL SEPARATOR

V-1103 DEHYDRATION CONTACTOR TOWER

V-1101 FIELD INLET SEPARATOR

JACKET WATER COOLERS

LUBE OIL/COOLANT STORAGE TANKS

AIR RECEIVERS

WASTE OIL TANK

AUXILIARY BUILDING



2101 WEBSTER STREET SUITE 1800
OAKLAND, CA 94612-3960

PROJECT NO.
60310138

REFERENCE DRAWINGS

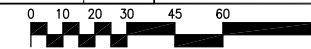
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NO.	DATE	REVISION	DES	DWN	CHK	APPR
B	11/25/13	REISSUED FOR REVIEW	MD	MD		
A	11/7/13	ISSUED FOR REVIEW	WE	WE		

PROFESSIONAL SEAL

SCALE:	1" = 30'-0"	DATE
DESIGNED BY	W EKREN	11/7/13
DRAWN BY		
CHECKED BY		
APPROVED BY		
APPROVED BY		

1" = 30'-0"



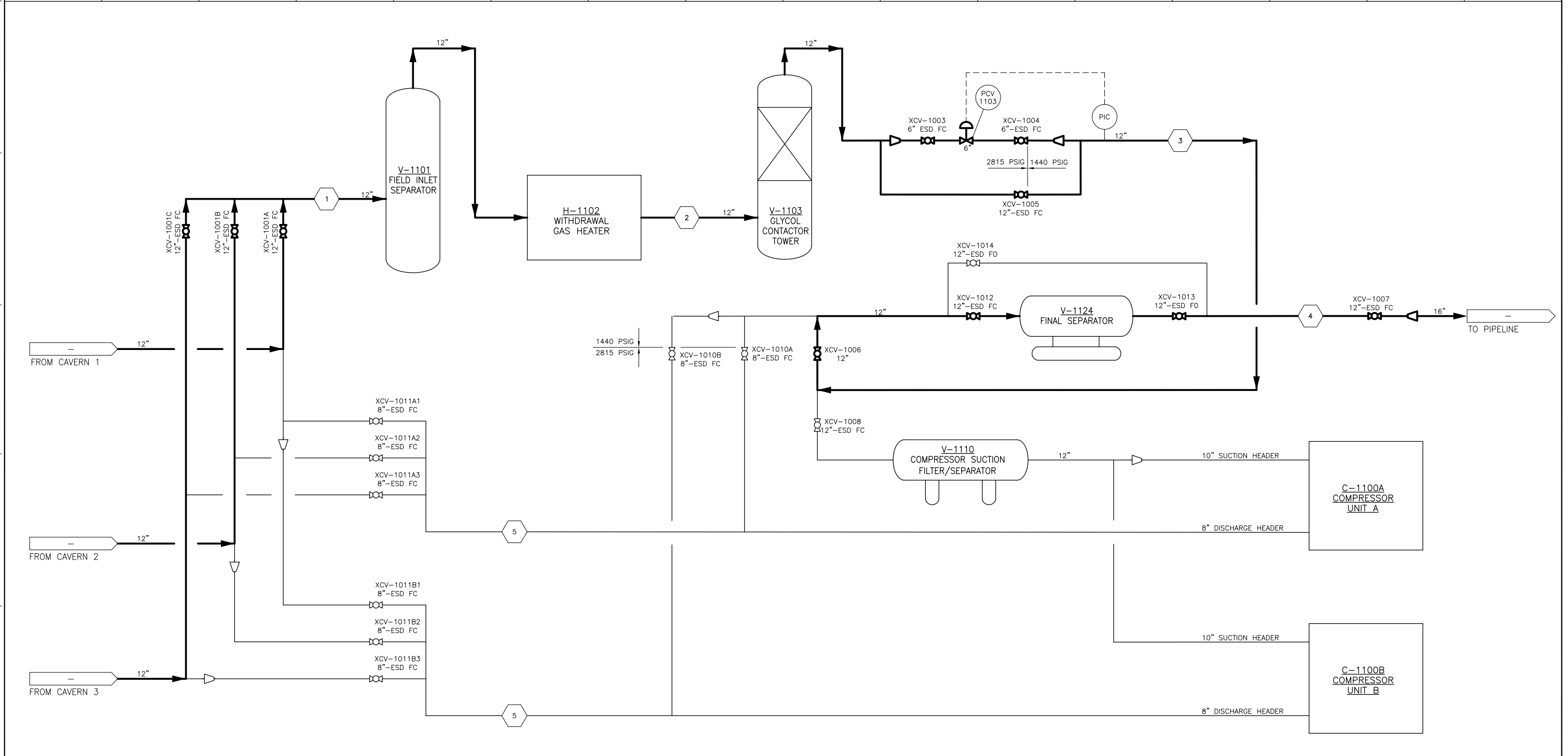
PLOT PLAN
COMPRESSOR STATION

ALTON GAS STORAGE

DWG NO. SK-PLOT-001

REV
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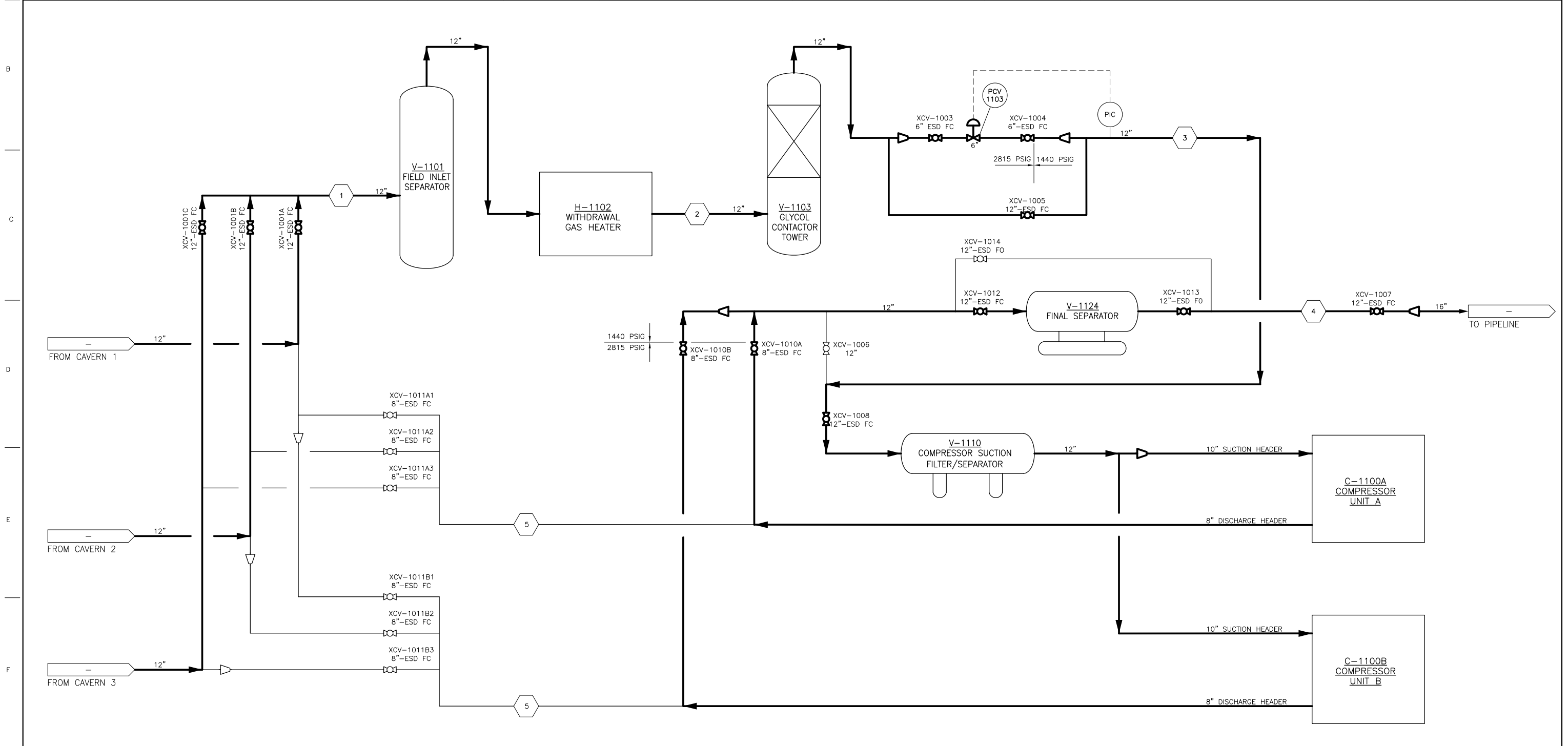
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A	2800	60	100	2800	94	100	1150	40	100	1150	40	100			
B	2300	60	100	2300	83	100	1150	40	100	1150	40	100			
C	1800	60	100	1800	75	100	1150	48	100	1150	48	100			
D	1300	60	100	1300	75	100	1150	68	100	1150	68	100			



AECOM <small>2101 WEBSTER STREET SUITE 1800 OAKLAND, CA 94612-3060</small> PROJECT NO. 60310138	REFERENCE DRAWINGS	NOTES	<table border="1"> <tr> <th>NO.</th> <th>DATE</th> <th>REVISION</th> <th>DES</th> <th>DWN</th> <th>CHK</th> <th>APPR</th> </tr> <tr> <td>E</td> <td>12/09/13</td> <td>ISSUED FOR COST ESTIMATE</td> <td>MD</td> <td>MD</td> <td>RS</td> <td>SP</td> </tr> <tr> <td>D</td> <td>11/15/13</td> <td>ADDED VALVE TAGS</td> <td>MD</td> <td>MD</td> <td></td> <td></td> </tr> <tr> <td>C</td> <td>11/04/13</td> <td>REVISED AND REISSUED FOR FINAL REVIEW</td> <td>MD</td> <td>MD</td> <td></td> <td></td> </tr> <tr> <td>B</td> <td>10/28/13</td> <td>REVISED AND REISSUED FOR REVIEW</td> <td>MD</td> <td>MD</td> <td></td> <td></td> </tr> <tr> <td>A</td> <td>10/25/13</td> <td>ISSUED FOR REVIEW</td> <td>MD</td> <td>MD</td> <td></td> <td></td> </tr> </table>	NO.	DATE	REVISION	DES	DWN	CHK	APPR	E	12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP	D	11/15/13	ADDED VALVE TAGS	MD	MD			C	11/04/13	REVISED AND REISSUED FOR FINAL REVIEW	MD	MD			B	10/28/13	REVISED AND REISSUED FOR REVIEW	MD	MD			A	10/25/13	ISSUED FOR REVIEW	MD	MD			PROFESSIONAL SEAL SCALE: NONE DESIGNED BY: M DAVIS DRAWN BY: M DAVIS CHECKED BY: R SEIBERT APPROVED BY: S PETTO DATE: 10/18/13 DATE: 10/18/13 DATE: 12/06/13 DATE: 12/06/13	PROCESS FLOW DIAGRAM WITHDRAWAL FREE FLOW ALTON NATURAL GAS STORAGE DWG NO. SK-PFD-001	REV E
	NO.	DATE	REVISION	DES	DWN	CHK	APPR																																									
	E	12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP																																									
	D	11/15/13	ADDED VALVE TAGS	MD	MD																																											
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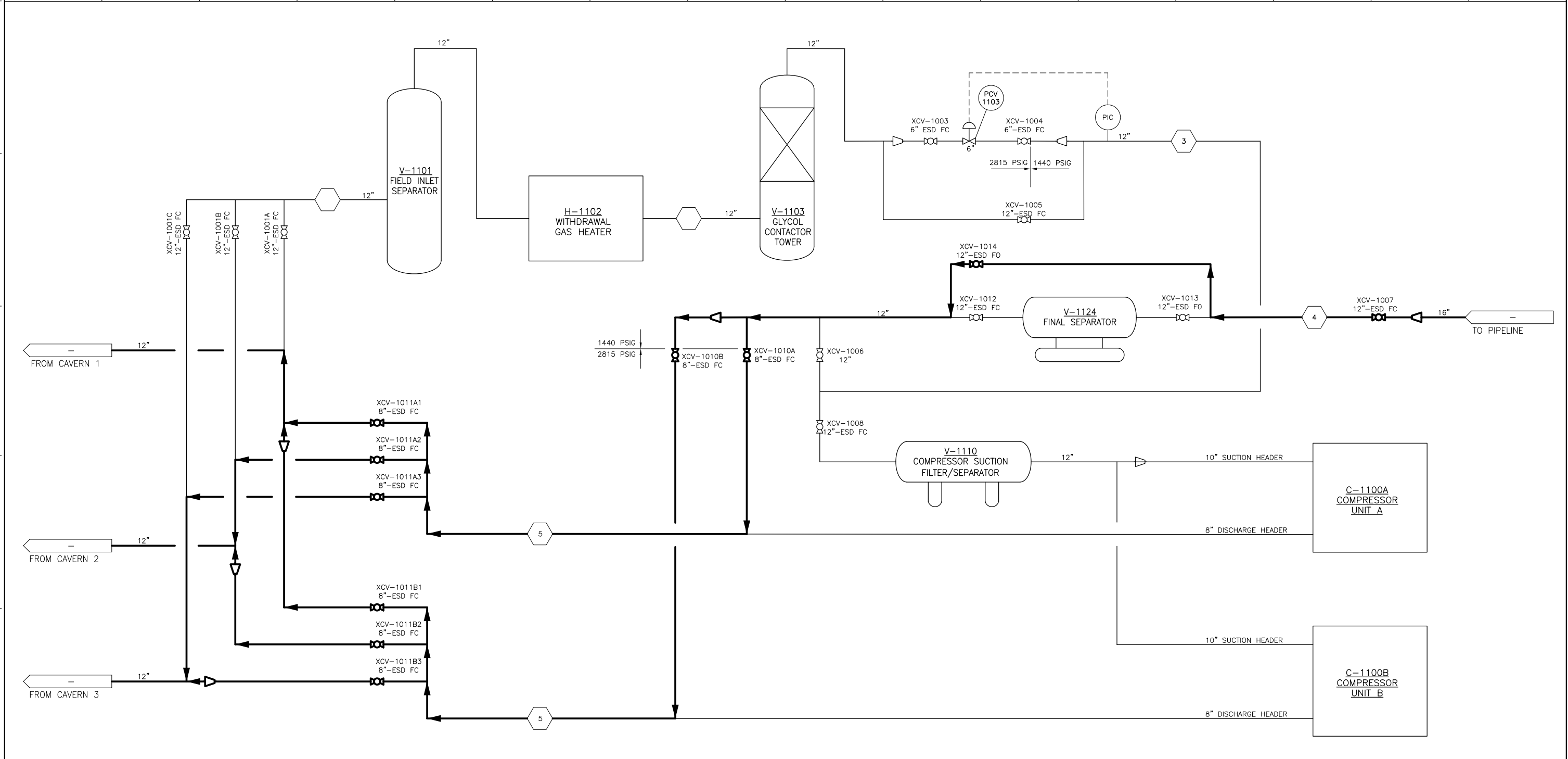
CONDITION	STREAM 1			STREAM 2			STREAM 3			STREAM 4			STREAM 5		
	PRESSURE (PSIG)	TEMPERATURE (°F)	FLOW (MMSCF/DAY)	PRESSURE (PSIG)	TEMPERATURE (°F)	FLOW (MMSCF/DAY)	PRESSURE (PSIG)	TEMPERATURE (°F)	FLOW (MMSCF/DAY)	PRESSURE (PSIG)	TEMPERATURE (°F)	FLOW (MMSCF/DAY)	PRESSURE (PSIG)	TEMPERATURE (°F)	FLOW (MMSCF/DAY)
A	875	60	100	875	75	100	825	75	100	1150	100	100			
B	800	60	88	800	75	100	750	75	88	1150	100	88			
C	650	60	63	650	75	100	600	75	63	1150	100	63			
D	600	60	56	600	75	100	550	75	56	1150	100	56			



AECOM <small>2101 WEBSTER STREET SUITE 1800 OAKLAND, CA 94612-3060</small> PROJECT NO. 60310138	REFERENCE DRAWINGS	NOTES	<table border="1"> <tr> <th>NO.</th> <th>DATE</th> <th>REVISION</th> <th>DES</th> <th>DWN</th> <th>CHK</th> <th>APPR</th> </tr> <tr> <td>E</td> <td>12/09/13</td> <td>ISSUED FOR COST ESTIMATE</td> <td>MD</td> <td>MD</td> <td>RS</td> <td>SP</td> </tr> <tr> <td>D</td> <td>11/15/13</td> <td>ADDED VALVE TAGS</td> <td>MD</td> <td>MD</td> <td></td> <td></td> </tr> <tr> <td>C</td> <td>11/04/13</td> <td>REVISED AND REISSUED FOR FINAL REVIEW</td> <td>MD</td> <td>MD</td> <td></td> <td></td> </tr> <tr> <td>B</td> <td>10/28/13</td> <td>REVISED AND REISSUED FOR REVIEW</td> <td>MD</td> <td>MD</td> <td></td> <td></td> </tr> <tr> <td>A</td> <td>10/25/13</td> <td>ISSUED FOR REVIEW</td> <td>MD</td> <td>MD</td> <td></td> <td></td> </tr> </table>	NO.	DATE	REVISION	DES	DWN	CHK	APPR	E	12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP	D	11/15/13	ADDED VALVE TAGS	MD	MD			C	11/04/13	REVISED AND REISSUED FOR FINAL REVIEW	MD	MD			B	10/28/13	REVISED AND REISSUED FOR REVIEW	MD	MD			A	10/25/13	ISSUED FOR REVIEW	MD	MD			PROFESSIONAL SEAL SCALE: NONE DESIGNED BY: M DAVIS DRAWN BY: M DAVIS CHECKED BY: R SEIBERT APPROVED BY: S PETTO DATE: 10/18/13 DATE: 10/18/13 DATE: 12/06/13 DATE: 12/06/13	PROCESS FLOW DIAGRAM WITHDRAWAL COMPRESSION ALTON NATURAL GAS STORAGE DWG NO. SK-PFD-002	REV E
	NO.	DATE	REVISION	DES	DWN	CHK	APPR																																									
	E	12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP																																									
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CONDITION	STREAM 1			STREAM 2			STREAM 3			STREAM 4			STREAM 5		
	PRESSURE (PSIG)	TEMPERATURE (°F)	FLOW (MMSCF/DAY)	PRESSURE (PSIG)	TEMPERATURE (°F)	FLOW (MMSCF/DAY)	PRESSURE (PSIG)	TEMPERATURE (°F)	FLOW (MMSCF/DAY)	PRESSURE (PSIG)	TEMPERATURE (°F)	FLOW (MMSCF/DAY)	PRESSURE (PSIG)	TEMPERATURE (°F)	FLOW (MMSCF/DAY)
A										725	70	100	450	100	100
B										725	70	100	550	100	100
C										725	70	100	650	100	100
D										725	70	100	700	100	100

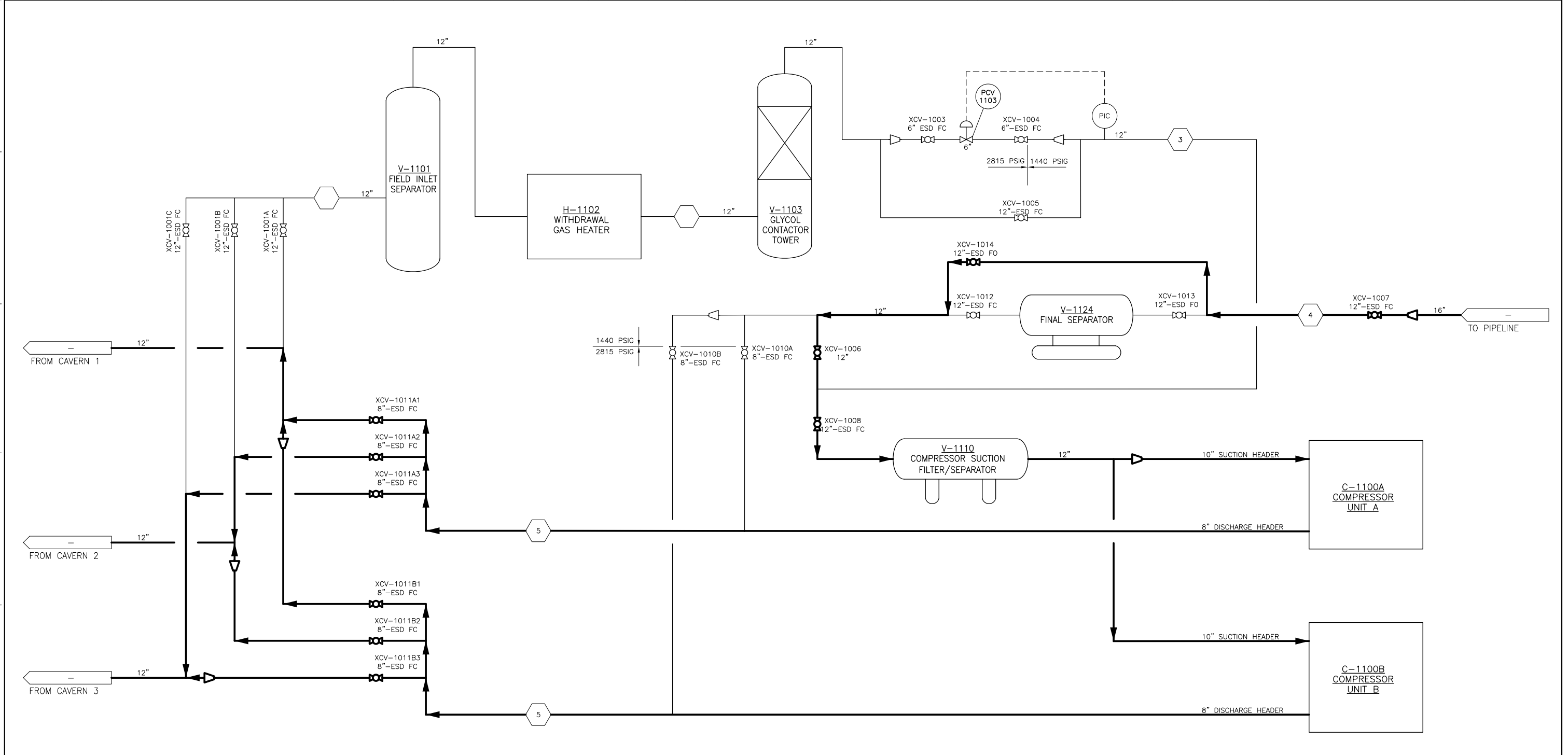


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	NO.	DATE	REVISION	DES	DWN	CHK	APPR																																								
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CONDITION	STREAM 1			STREAM 2			STREAM 3			STREAM 4			STREAM 5		
	PRESSURE (PSIG)	TEMPERATURE (°F)	FLOW (MMSCF/DAY)	PRESSURE (PSIG)	TEMPERATURE (°F)	FLOW (MMSCF/DAY)	PRESSURE (PSIG)	TEMPERATURE (°F)	FLOW (MMSCF/DAY)	PRESSURE (PSIG)	TEMPERATURE (°F)	FLOW (MMSCF/DAY)	PRESSURE (PSIG)	TEMPERATURE (°F)	FLOW (MMSCF/DAY)
A										725	70	80	1000	100	40
B										725	70	74	1500	100	37
C										725	70	54	2000	100	27
D										725	70	40	2800	100	20



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	NO.	DATE	REVISION	DES	DWN	CHK	APPR																																		
	D	12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP																																		
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INSTRUMENT ABBREVIATIONS (INSIDE INSTRUMENT BALLOONS)
AA* ANALYSIS ALARM
AC ANALYSIS CONTROLLER (SAMPLER)
AE ANALYSIS ELEMENT (SAMPLER)
AI ANALYSIS INDICATOR
AIC ANALYSIS INDICATING CONTROLLER
AIS* ANALYSIS INDICATING SWITCH
AIT ANALYSIS INDICATING TRANSMITTER
AP ANALYSIS POINT (CHROMATOGRAPH)
AR ANALYSIS RECORDER
AS* ANALYSIS SWITCH
AT ANALYSIS TRANSMITTER (CHROMATOGRAPH)
AV ANALYSIS CONTROL VALVE
AY ANALYSIS RELAY
BA* BURNER ALARM
BE BURNER ELEMENT
BS BURNER SWITCH
ET VOLTAGE INDICATOR
ES* VOLTAGE SWITCH
FA* FLOW ALARM
FC FLOW CONTROLLER
FCV FLOW CONTROL VALVE
FE FLOW ELEMENT
FFC FLOW RATIO CONTROLLER
FI FLOW INDICATOR
FIC FLOW INDICATING CONTROLLER
FO FLOW ORIFICE (RESTRICTION ORIFICE)
FQ FLOW TOTALIZER/FLOW COMPUTER
FQI FLOW TOTALIZING INDICATOR
FQS* FLOW TOTALIZING SWITCH
FR FLOW RECORDER
FRCV FLOW RECORDING CONTROL VALVE
FS* FLOW SWITCH
FT FLOW TRANSMITTER
FV FLOW VALVE
FX FLOW STRAIGHTENING VANE
FY FLOW RELAY
FYY FLOW COMPUTING RELAY (MASS)
HC HAND CONTROLLER
HCV HAND CONTROL VALVE
HS HAND SWITCH
HV HAND SELECTOR VALVE
L LEVEL DEVICE
LA* LEVEL ALARM
LC LEVEL CONTROLLER
LCV LEVEL CONTROL VALVE
LG LEVEL GAUGE GLASS
LI LEVEL INDICATOR (OTHER THAN LG)
LIC LEVEL INDICATING CONTROLLER
LR LEVEL RECORDER
LS* LEVEL SWITCH
LT LEVEL TRANSMITTER
LV LEVEL VALVE
MA* MOISTURE ALARM
MC MOISTURE CONTROLLER
ME MOISTURE ELEMENT
MI MOISTURE INDICATOR
MR MOISTURE RECORDER
MS* MOISTURE SWITCH
MT MOISTURE ANALYZER/TRANSMITTER
NM NOISE MONITOR
OSA* OVER SPEED ALARM
OSS* OVER SPEED SWITCH
PA* PRESSURE ALARM
PC PRESSURE CONTROLLER
PCV PRESSURE CONTROL VALVE
PDA* PRESSURE DIFFERENTIAL ALARM
PDCV PRESSURE DIFFERENTIAL CONTROL VALVE
PDI PRESSURE DIFFERENTIAL INDICATOR
PDIS PRESSURE DIFFERENTIAL INDICATING CONTROLLER
PDR PRESSURE DIFFERENTIAL RECORDER
PDS* PRESSURE DIFFERENTIAL SWITCH
PDT PRESSURE DIFFERENTIAL TRANSMITTER
PG PRESSURE GAUGE
PI PRESSURE INDICATOR
PIC PRESSURE INDICATING CONTROLLER
PIT PRESSURE INDICATING TRANSMITTER
PR PRESSURE RECORDER
PRC PRESSURE RECORDING CONTROLLER
PRV PRESSURE REGULATING VALVE
PS* PRESSURE SWITCH
PSE PRESSURE SAFETY HEAD
PSV PRESSURE SAFETY/RELIEF VALVE
PT PRESSURE TRANSMITTER
PV PRESSURE CONTROL VALVE
PVSU PRESSURE VACUUM SAFETY VALVE
PRY PRESSURE RELAY
SA* SPEED ALARM
SDV SHUTDOWN VALVE
SE SPEED ELEMENT (TACHOMETER PICK-UP)
SS* SPEED SWITCH
ST SPEED TRANSMITTER
STR STRAINER
SY SPEED CONTROL
TA* TEMPERATURE ALARM
TC TEMPERATURE CONTROLLER
TCV TEMPERATURE CONTROL VALVE (SELF-CONTAINED)
TDI TEMPERATURE DIFFERENTIAL INDICATOR
TE TEMPERATURE ELEMENT (WITH THERMOWELL)
TG TEMPERATURE GAUGE
TI TEMPERATURE INDICATOR (WITH THERMOWELL)
TIC TEMPERATURE INDICATING CONTROLLER
TICV TEMPERATURE INDICATING CONTROL VALVE
TR TEMPERATURE RECORDER
TRC TEMPERATURE RECORDING CONTROLLER
TRCV TEMPERATURE RECORDING CONTROL VALVE
TS* TEMPERATURE SWITCH
TT TEMPERATURE TRANSMITTER
TV TEMPERATURE CONTROL VALVE
TW TEMPERATURE TEST CONNECTION (THERMOWELL)
VA* VIBRATION ALARM
VE VIBRATION ELEMENT
VS* VIBRATION SWITCH

INSTRUMENT LINE SYMBOLS
LOCAL PANEL MOUNTED
FIELD MOUNTED
REMOTE PANEL MOUNTED
INSTRUMENTS
SHARED DISPLAY, SHARED CONTROLLER
COMPUTER FUNCTION STATION
PROGRAMMABLE LOGIC CONTROL (PLC OR RTV)
ADDITIONAL SYMBOLS
HEAT TRACED INSTRUMENTS
UNDEFINED INTERLOCKING LOGIC
INDICATING OR PILOT LIGHT
MOTOR CONTROL CENTER
INSTRUMENT SHARING COMMON FUNCTION OR VARIABLE
PROCESS FLOW DIAGRAM STREAM DESIGNATION
LINE LEGEND
PRIMARY
SECONDARY
ELECTRICAL
MECHANICAL INTERLOCK
DATA LINK
UTILITY LINE
PNEUMATIC LINE
INSTRUMENT CAPILLARY LINE
FILTER OPTIC COMMUNICATION
HYDRAULIC LINE
ELECTROMAGNETIC OR SONIC (GUIDED)
ELECTROMAGNETIC OR SONIC (NOT GUIDED)
FUSIBLE LOOP
RESERVED FOR SHUTDOWN DEVICE
ANNUNCIATOR POINT
PIG PASSAGE INDICATOR
ALARM STATUS
FAULT STATUS
STATUS
SOL CLOSED
SOL OPEN
SPECIAL RELAY (USUALLY A SOLENOID)
DEVICE: I/P, SDV, RELAY, ETC.
POSITION ALARM (MOTION)
POSITION DETECTOR (MOTION)
POSITION INDICATOR LAMP (VALVE CLOSED)
POSITION INDICATOR LAMP (VALVE OPEN)
POSITION SWITCH (MOTION)
POSITION INDICATOR SWITCH (VALVE CLOSED)
POSITION INDICATOR SWITCH (VALVE OPEN)
INSTRUMENTS FURNISHED WITH EQUIPMENT

MANUALLY OPERATED VALVES
GATE VALVE, PLAIN END
GATE VALVE, FLANGED END
BALL VALVE, PLAIN END
BALL VALVE, FLANGED END
BALL VALVE, WELD x FLANGED END
CHECK VALVE, PLAIN END
CHECK VALVE, FLANGED END
BUTTERFLY VLV., PLAIN END
BUTTERFLY VLV., FLANGED END
ANGLE VALVE, PLAIN END
ANGLE VALVE, FLANGED END
ANGLE CHECK VALVE, PLAIN END
ANGLE CHECK VALVE, FLANGED END
ANGLE CHOKE VALVE, PLAIN END
ANGLE CHOKE VALVE, FLANGED END
INSTRUMENT VALVE, NEEDLE
INSTRUMENT VALVE, GATE
INSTRUMENT VALVE, PLUG
INSTRUMENT VALVE, 3-WAY
3 VALVE MANIFOLD
GLOBE VALVE, PLAIN END
GLOBE VALVE, FLANGED END
PLUG VALVE, PLAIN END
PLUG VALVE, FLANGED END
3-WAY VALVE, PLAIN END
3-WAY VALVE, FLANGED END
4-WAY VALVE, PLAIN END
4-WAY VALVE, FLANGED END
EXCESS FLOW VALVE, PLAIN END
EXCESS FLOW VALVE, FLANGED END
VACUUM SAFETY VALVE
PRESSURE/VACUUM SAFETY VALVE
INSTRUMENT VALVE, GAGE
INSTRUMENT VALVE, BALL
INSTRUMENT VALVE, 3-WAY SOLENOID
INSTRUMENT VALVE, 4-WAY
5 VALVE MANIFOLD
BALANCING VALVE

INSTRUMENT FUNCTION DESIGNATIONS
SELECT LOW SIGNAL
SELECT HIGH SIGNAL
SELECT HIGH/LOW SIGNAL
MOTOR TO PNEUMATIC TRANSDUCER
PNEUMATIC TO CURRENT TRANSDUCER
CURRENT TO PNEUMATIC TRANSDUCER
TOTALIZER
SQUARE ROOT
RESISTANCE TO CURRENT TRANSDUCER
ELECTROHYDRAULIC TRANSDUCER
AUTO/MANUAL LOADING STATION

VALVE ACTUATORS
DIAPHRAGM
DIAPHRAGM W/ MANUAL OVERRIDE
DIAPHRAGM W/ POSITIONER
ELECTROHYDRAULIC OPERATED VALVE
PISTON OPERATED VALVE, SINGLE ACTING
PISTON OPERATED VALVE, DOUBLE ACTING
REGULATOR, SELF-CONTAINED
REGULATOR WITH EXTERNAL PRESSURE TAP
REGULATOR, W/ INTEGRAL OUTLET PRESSURE RELIEF VALVE
MOTOR OPERATED VALVE
DOUBLE ACTING PISTON, SPRING RETURN
SOLENOID OPERATED VALVE
PISTON OPERATED VALVE, W/ SPRING RETURN

IN-LINE SYMBOLS
POSITIVE DISPLACEMENT METER
SENIOR ORIFICE
ORIFICE METER
DIAPHRAGM SEAL
CONCENTRIC REDUCER
BLEED RING W/ GATE VALVE
LINE CAP
PLUG
HORN
EXPANSION JOINT
INSULATING SET
SPECTACLE BLIND: OPEN
ROTAMETER TYPE FLOW INDICATOR
FLOW NOZZLE
PITOT TUBE OR PITOT-VENTURI TUBE
IN-LINE MIXER
DRAIN: CS = CHEMICAL SEWER, HS = SANITARY SEWER, OS = OILY SEWER, SS = STORM SEWER
SILENCER
CENTRIFUGAL PUMP
PULSATION DAMPENER
POSITIVE DISPLACEMENT PUMP
LIFT PUMP
RECIPROCATING PUMP
CLAMP ON ULTRASONIC FLOW METER
STRAIGHTENING VANES
ULTRASONIC FLOW METER
TURBINE METER (FLANGED)
IN-LINE FILTER STRAINER
FILTER/DRYER
Y STRAINER
FLANGES
FLAME ARRESTOR
FLEXIBLE HOSE
SPECTACLE BLIND: CLOSED
VENTURI TUBE
MAG FLOW METER
CHOKE TUBE
UNION
SPECIALTY ITEM (ITEM NUMBER)
RUPTURE DISC
HOSE CONNECTION
HOSE REEL
TEMPORARY STRAINER
TRUCK GROUNDING REEL
DIAPHRAGM PUMP

LINE LEGEND
ELECTRICAL HEAT TRACE
STEAM HEAT TRACING
INSULATION
BATTERY LIMIT
SKID LIMITS
EQUIPMENT I.D. NUMBER
LINE CONTINUATION BOX WITH I.D. AND DWG. NO.
DIRECTIONAL ARROW
LINE SPEC CHANGE
TIE-IN

MISCELLANEOUS ABBREVIATIONS
ATC AIR TO CLOSE
AG ABOVE GROUND
ATO AIR TO OPEN
AOV AIR OPERATED VALVE
AS AIR SUPPLY
ATM ATMOSPHERE
BDV BLOW DOWN VALVE
BG BELOW GROUND
BI BIOCIDIC STRAINER
BS CORROSION COUPON
CC COMPRESSOR BUILDING
COND. CONDUCTIVITY
CSC CAR SEAL CLOSED
CSO CAR SEAL OPEN
DM DEMISTER
EL ELEVATION
ESD EMERGENCY SHUTDOWN
FA FLAME ARRESTOR
(FBO) FURNISHED BY OWNER
FC FAIL CLOSED
FE FLANGED END
FLP FAIL LAST POSITION
FO FAIL OPEN
GOV GAS OPERATED VALVE
GOY GAS OPERATED SOLENOID
GS GAS SUPPLY
HC HOSE CONNECTION
HS HYDRAULIC SUPPLY
LC LOCK CLOSED
LO LOCK OPEN
MCC MOTOR CONTROL CENTER
MFG MASTER FUEL GAS
MW MANWAY
MAOP MAXIMUM ALLOWABLE OPERATING PRESSURE
NC NORMALLY CLOSED
NO NORMALLY OPEN
NS NITROGEN SUPPLY
OP OPERATING PRESSURE
OPP OVER PRESSURE PROTECTION
OT OPERATING TEMPERATURE
PH PH (ACIDITY)
RA REVERSE ACTING
RO RESTRICTION ORIFICE
RTU REMOTE TELEMETRY UNIT
SC SAMPLE CONNECTION
SD SHUTDOWN
SOL SOLENOID
SP SETPOINT
S/S SEAM TO SEAM
SS STAINLESS STEEL
SSV SURFACE SAFETY VALVE
SSV SURFACE SAFETY VALVE
STA STATION
STP STOPPLE
T/T TANGENT TO TANGENT
TUBG TUBING
V VOLT
VF VENDOR FURNISHED
VTA VENT TO ATMOSPHERE
W WITH
WE WELD END
WFX WELD BY FLANGE
WXS WELD BY SCREWED

LINE NUMBER IDENTIFICATION
SERVICE SYMBOL
SERVICE
AC INTAKE AIR (COMBUSTION)
AE EXHAUST AIR
AF ANTIFREEZE
AW AUXILIARY WATER
CW COOLING WATER
DS SANITARY DRAIN
DVA DRAINS & VENTS - ATMOSPHERIC
DVL DRAINS & VENTS - LOW PRESSURE
DVM DRAINS & VENTS - MED. PRESSURE
DVH DRAINS & VENTS - HIGH PRESSURE
DW DOMESTIC WATER
EGHP HIGH PRESSURE ETHYLENE GLYCOL
EGMP MED. PRESSURE ETHYLENE GLYCOL
EGLP LOW PRESSURE ETHYLENE GLYCOL
FW FIRE WATER
GFU FUEL GAS
GHP GAS HIGH PRESSURE
GMP GAS MEDIUM PRESSURE
GLP GAS LOW PRESSURE
GLY GLYCOL
GMS MAIN GAS (SOOR)
GPW POWER GAS
GS STARTING GAS
GUT UTILITY GAS
GV GAS VENT
GW WASTE GAS
HB BUTANE
HCHP HIGH PRESSURE HYDROCARBON COND.
HCOMP MED. PRESSURE HYDROCARBON COND.
HCLP LOW PRESSURE HYDROCARBON COND.
HE ETHANE
HM HYDROCARBON MIX (GASOLINE)
HO HYDRAULIC OIL
HP PROPANE (EXCEPT REFRIGERATION)
HW HEATING WATER
IA INSTRUMENT AIR
JW JACKET WATER
LO LUBE OIL
P PROCESS
PA1 PILOT AIR - COMPR BLDG ESD
PA2 PILOT AIR - STATION ESD
PA3 PILOT AIR - WELL PAD ESD
PH HEAT TRANSFER FLUID (LEAN OIL)
PP* BOILER & POWER PIPING
ALL (STEAM, OIL, AIR & WATER) REFRIGERATION (PROPANE)
PR POTABLE WATER
PW STARTING AIR
ST UTILITY STEAM
RW RAW WATER
UA UTILITY AIR

MATERIAL SPECIFICATION
MATERIAL SPEC. CLASS DESIGN PRESSURE & TEMP. SERVICE
1A 150# 250 PSIG @ 100 F AF, AW, DVA, GFU, GUT, GW, HW, IA, JW, LO, PA1, PA2, PA3
6JL 600# 1440 PSIG @ 100 F GLP, GFU, GPW, DVL
9JH 900# 2025 PSIG @ 250 F GMP, DVM
9JL 900# 2025 PSIG @ 100 F GMP, DVM
9JL 900# 2815 PSIG @ 100 F GHP, DVH
15JH 1500# 2815 PSIG @ 250 F GHP, DVH
NOTE: ALL MATERIALS @ DESIGN FACTOR OF 50% SMYS

AECOM
2101 WEBSTER STREET SUITE 1800
OAKLAND, CA 94612-3060
PROJECT NO. 60310138

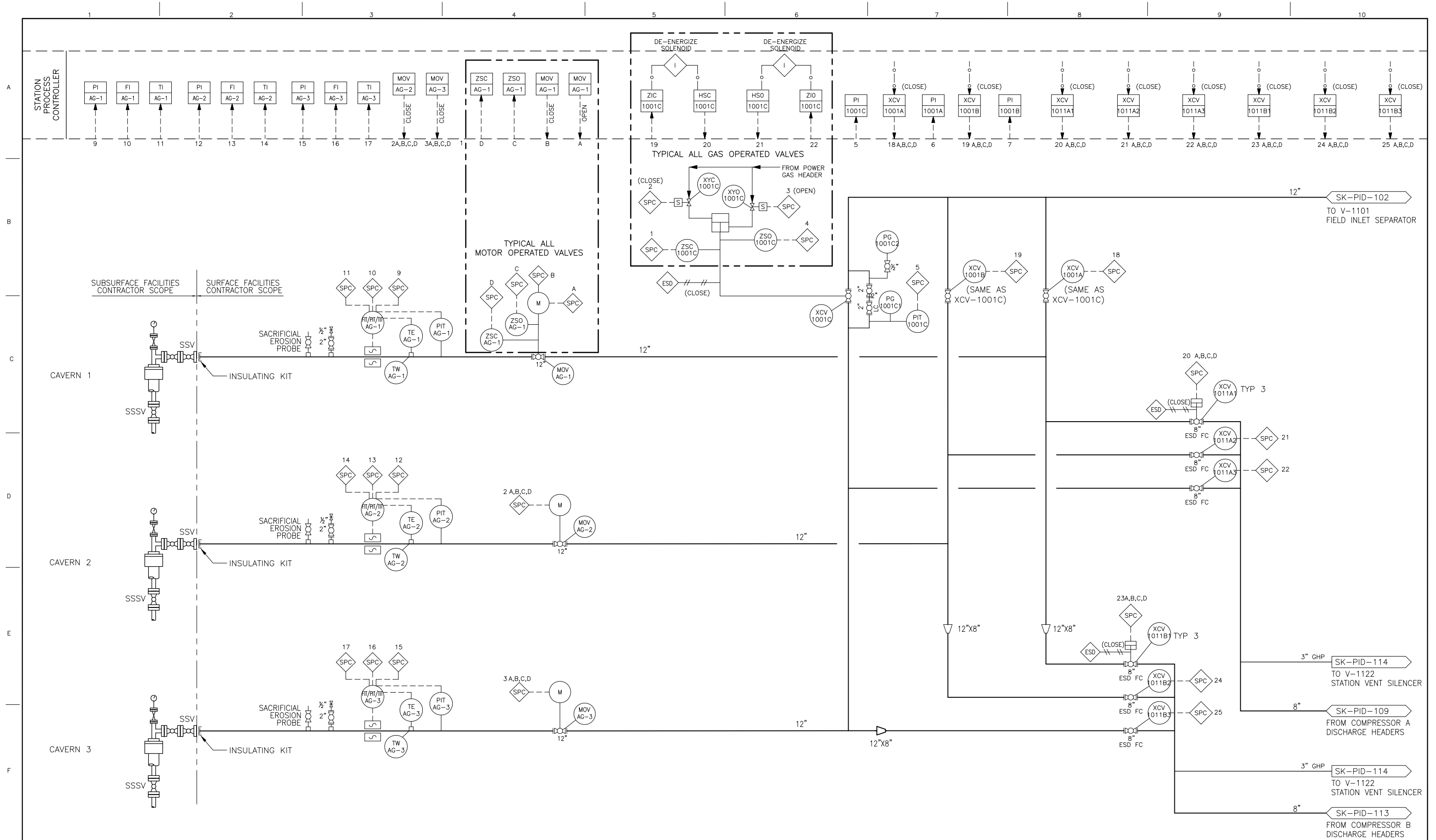
NOTES:
* IDENTIFICATION OF INSTRUMENTS NOT COVERED IN THE LISTINGS ABOVE SHALL CONFORM TO ANSI/ISA S5.1 "INSTRUMENTATION SYMBOLS AND IDENTIFICATION".
* ALARMS, SWITCHES AND ANNUNCIATORS MAY HAVE SUFFIX LETTERS AS FOLLOWS:
L DENOTES LOW ALARM
LL DENOTES LOW SHUTDOWN
H DENOTES HIGH ALARM
HH DENOTES HIGH SHUTDOWN

REVISIONS
NO. DATE REVISION DES DWN CHK APPR
C 12/09/13 ISSUED FOR COST ESTIMATE MD MD RS SP
B 11/14/13 REISSUED FOR REVIEW MD MD
A 11/04/13 ISSUED FOR PRELIMINARY REVIEW MD MD

PROFESSIONAL SEAL
SCALE: NONE
DATE
DESIGNED BY M DAVIS 10/24/13
DRAWN BY M DAVIS 10/24/13
CHECKED BY R SEIBERT 12/06/13
APPROVED BY S PETTO 12/06/13

PIPING & INSTRUMENTATION DIAGRAM SYMBOLS & LEGEND
ALTON NATURAL GAS STORAGE
DWG NO. SK-PID-100
REV C

P:\60310138-Alton Gas Storage\900-CAD-GIS\905 PIDs\SK-PID-101.dwg - Dec 04, 2013 12:10pm



2101 WEBSTER STREET SUITE 1800
OAKLAND, CA 94612-3060

PROJECT NO.
60310138

NO.	DATE	REVISION	DES	DWN	CHK	APPR
C	12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP
B	11/14/13	REISSUED FOR REVIEW	MD	MD		
A	11/04/13	ISSUED FOR PRELIMINARY REVIEW	MD	MD		

NO.	DATE	REVISION	DES	DWN	CHK	APPR
C	12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP
B	11/14/13	REISSUED FOR REVIEW	MD	MD		
A	11/04/13	ISSUED FOR PRELIMINARY REVIEW	MD	MD		

NO.	DATE	REVISION	DES	DWN	CHK	APPR
C	12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP
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A	11/04/13	ISSUED FOR PRELIMINARY REVIEW	MD	MD		

SCALE:	DATE:
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DESIGNED BY: M DAVIS	10/24/13
DRAWN BY: M DAVIS	12/06/13
CHECKED BY: R SEIBERT	12/06/13
APPROVED BY: S PETTO	12/06/13
APPROVED BY:	

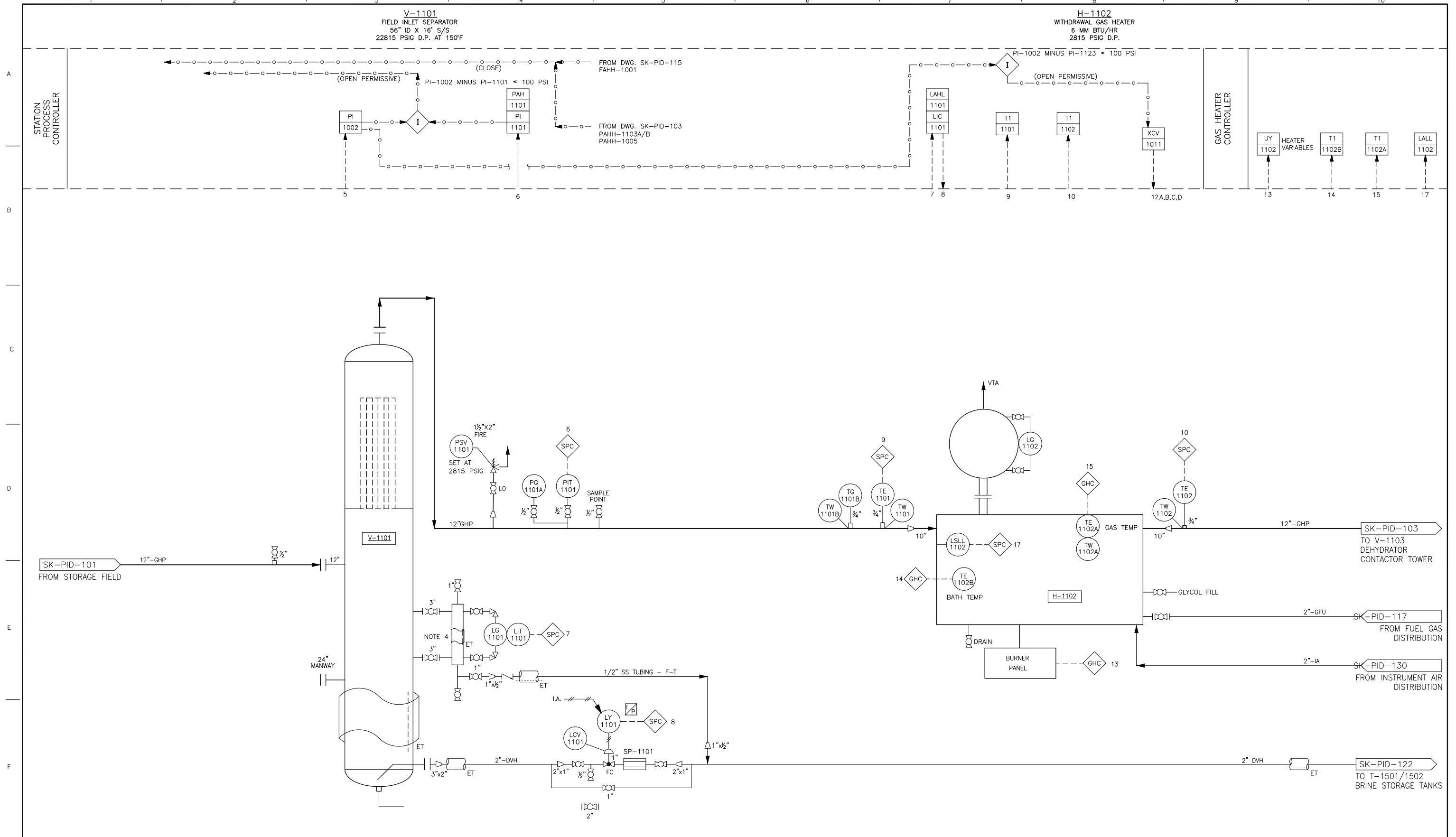
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MAIN GAS
CAVERN LATERALS

ALTON NATURAL GAS STORAGE

DWG NO. SK-PID-101

REV C

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AECOM
 2101 WEBSTER STREET SUITE 1800
 OAKLAND, CA 94612-3060

PROJECT NO.
 60310138

REFERENCE DRAWINGS

NOTES

NO.	DATE	REVISION	DES	DWN	CHK	APPR
C	12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP
B	11/14/13	REISSUED FOR REVIEW	MD	MD		
A	11/04/13	ISSUED FOR PRELIMINARY REVIEW	MD	MD		

PROFESSIONAL SEAL

SCALE:	DATE
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DESIGNED BY: M DAVIS	10/24/13
DRAWN BY: M DAVIS	10/24/13
CHECKED BY: R SEIBERT	12/06/13
APPROVED BY: S PETTO	12/06/13
APPROVED BY:	

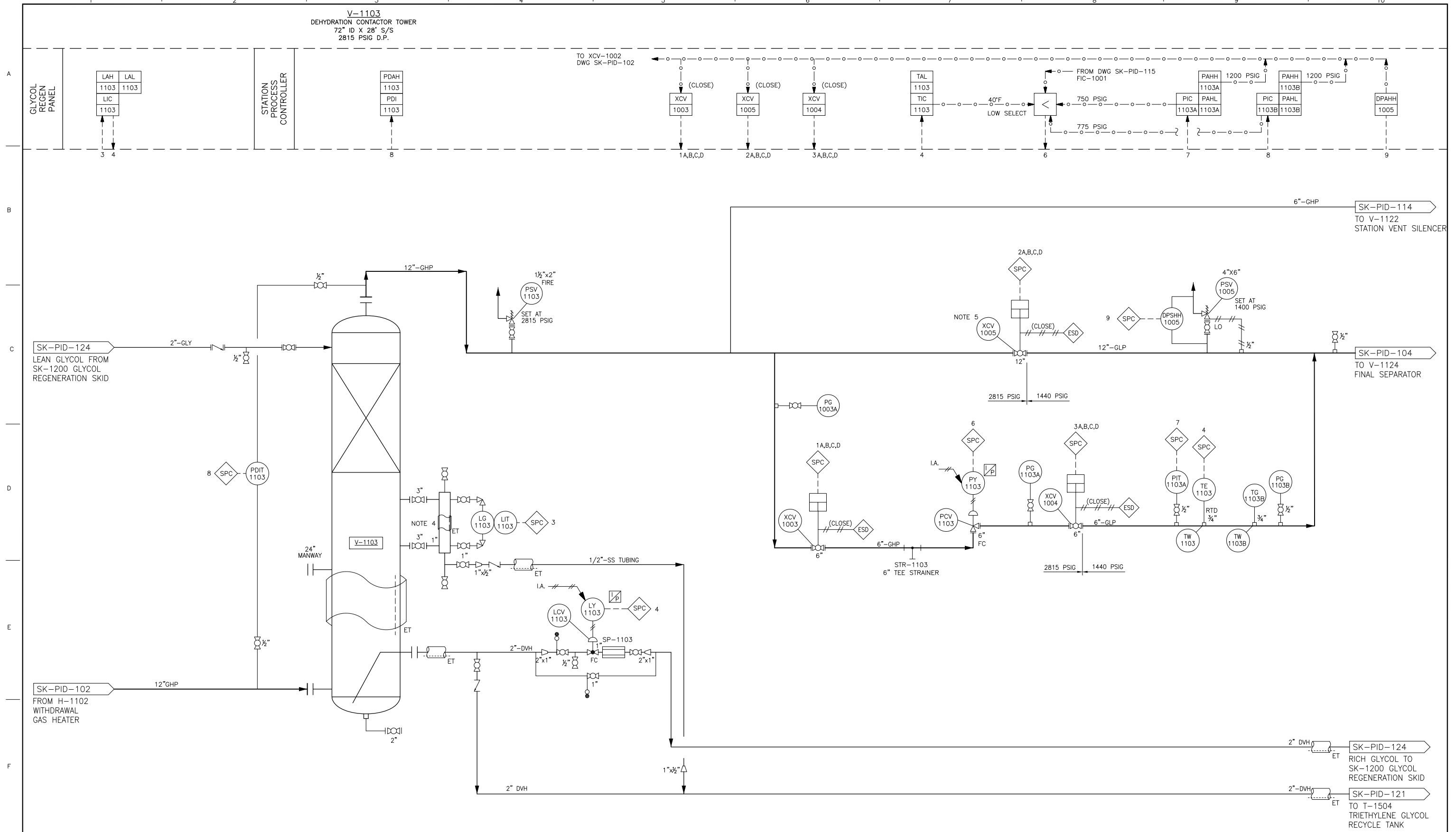
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MAIN GAS
FIELD INLET SEPARATOR

ALTON NATURAL GAS STORAGE

DWG NO. SK-PID-102

REV C

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AECOM
 2101 WEBSTER STREET SUITE 1800
 OAKLAND, CA 94612-3060
PROJECT NO.
60310138

NO.	DATE	REVISION	DES	DWN	CHK	APPR
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B	11/14/13	REISSUED FOR REVIEW	MD	MD		
A	11/04/13	ISSUED FOR PRELIMINARY REVIEW	MD	MD		

NO.	DATE	REVISION	DES	DWN	CHK	APPR

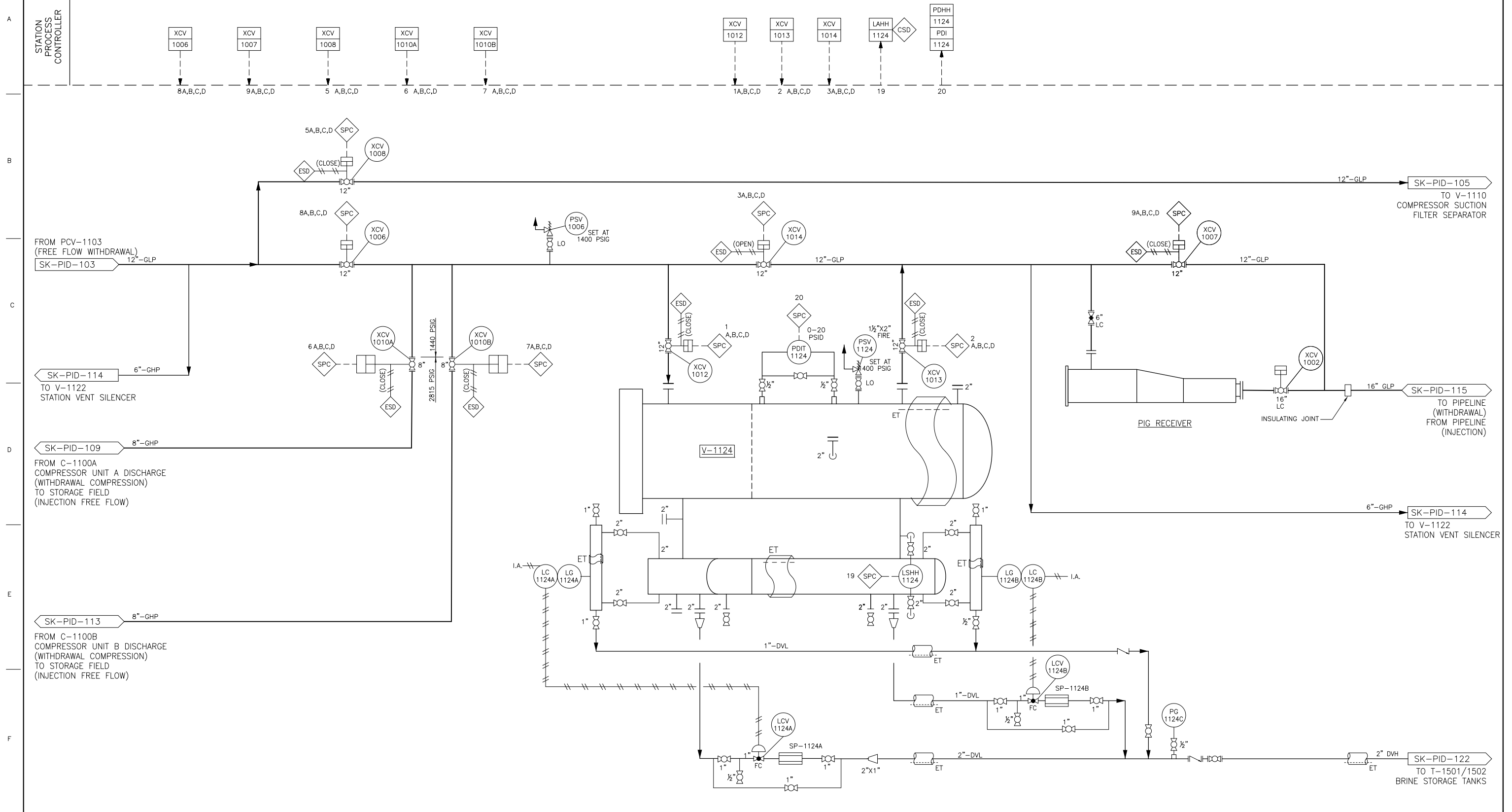
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DESIGNED BY	10/24/13
DRAWN BY	10/24/13
CHECKED BY	12/06/13
APPROVED BY	12/06/13

PIPING & INSTRUMENTATION DIAGRAM
 MAIN GAS
 DEHYDRATION CONTACTOR TOWER
 ALTON NATURAL GAS STORAGE
 DWG NO. SK-PID-103

REV
C

V-1124
FINAL SEPARATOR
42" ID X 124" S/S
1440 PSIG D.P.



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2101 WEBSTER STREET SUITE 1800
OAKLAND, CA 94612-3060

PROJECT NO.
60310138

REFERENCE DRAWINGS

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NO.	DATE	REVISION	DES	DWN	CHK	APPR
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A	11/04/13	ISSUED FOR PRELIMINARY REVIEW	MD	MD		

PROFESSIONAL SEAL

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DESIGNED BY: M DAVIS	10/24/13
DRAWN BY: M DAVIS	10/24/13
CHECKED BY: R SEIBERT	12/06/13
APPROVED BY: S PETTO	12/06/13

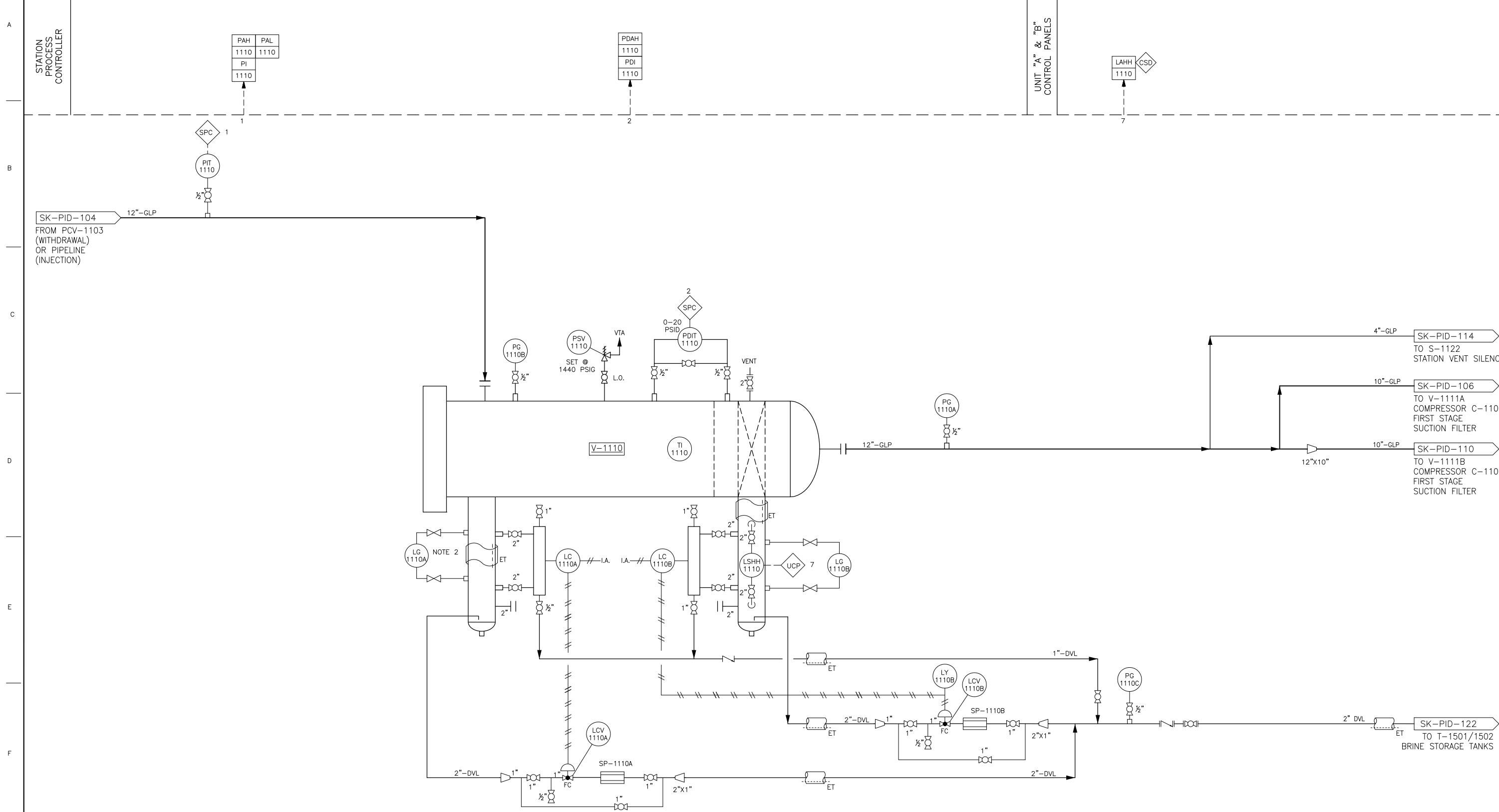
PIPING & INSTRUMENTATION DIAGRAM
MAIN GAS
FINAL SEPARATOR

ALTON NATURAL GAS STORAGE

DWG NO. SK-PID-104

REV
C

V-1110
 COMPRESSOR SUCTION FILTER/SEPARATOR
 34" ID X 10' S/S
 1440 PSIG D.P. AT 100°F



2101 WEBSTER STREET SUITE 1800
 OAKLAND, CA 94612-3060

PROJECT NO.
 60310138

NO.	DATE	REVISION	DES	DWN	CHK	APPR
C	12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP
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A	11/04/13	ISSUED FOR PRELIMINARY REVIEW	MD	MD		

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PROFESSIONAL SEAL

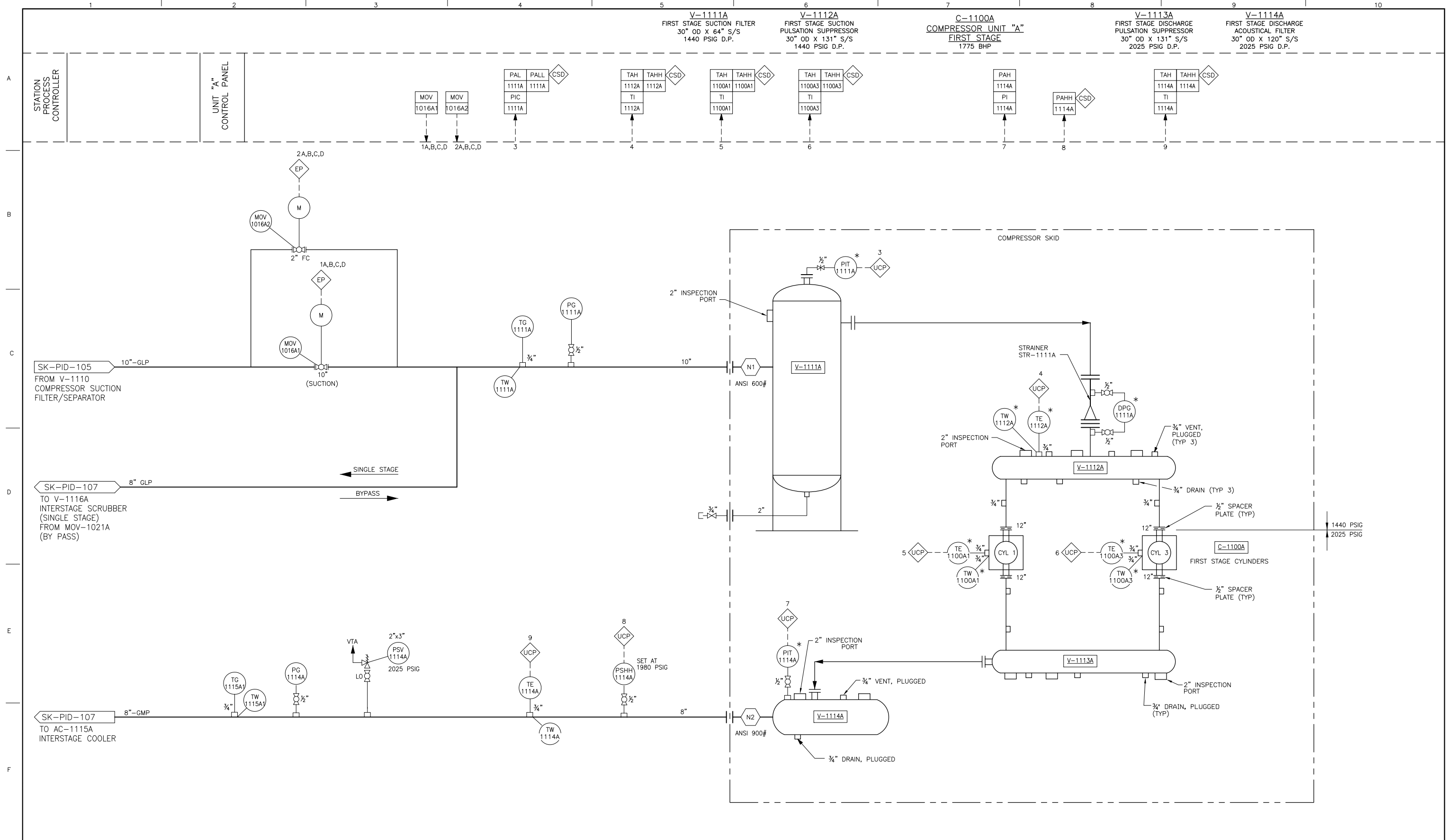
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CHECKED BY R SEIBERT	12/06/13
APPROVED BY S PETTO	12/06/13
APPROVED BY	

PIPING & INSTRUMENTATION DIAGRAM
 MAIN GAS
 FILTER SEPARATOR

ALTON NATURAL GAS STORAGE

DWG NO. SK-PID-105 REV C

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AECOM
 2101 WEBSTER STREET SUITE 1800
 OAKLAND, CA 94612-3060
PROJECT NO.
60310138

NO.	DATE	REVISION	DES	DWN	CHK	APPR
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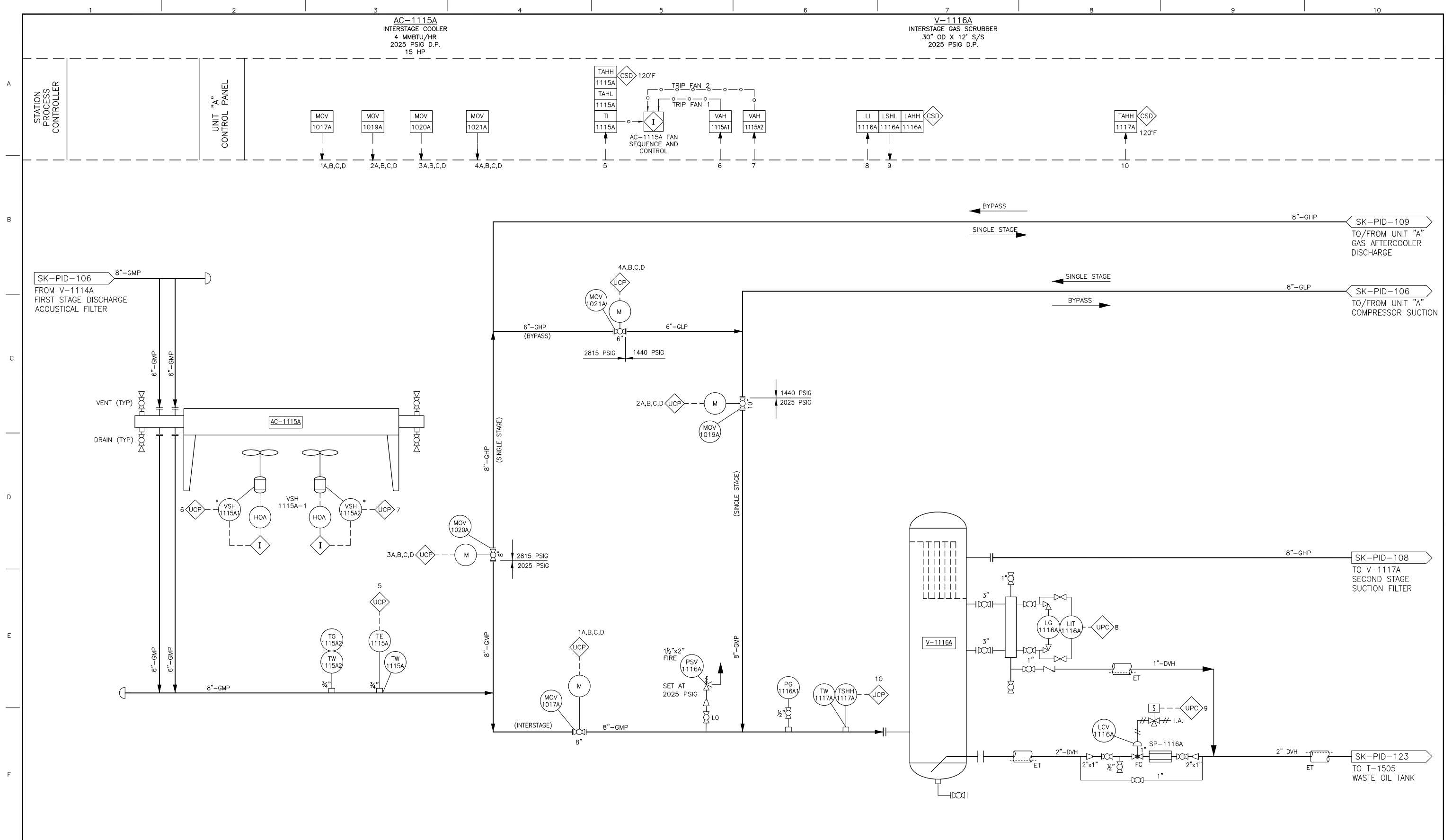
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SCALE:	DATE
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DESIGNED BY	10/24/13
DRAWN BY	10/24/13
CHECKED BY	12/06/13
APPROVED BY	12/06/13

PIPING & INSTRUMENTATION DIAGRAM
 MAIN GAS
 COMPRESSOR UNIT "A" FIRST STAGE
 ALTON NATURAL GAS STORAGE
 DWG NO. SK-PID-106
 REV C

P:\60310138-Alton Gas Storage\900-CAD-GIS\905 PIDs\SK-PID-107.dwg - Dec 04, 2013 12:11pm



AECOM
2101 WEBSTER STREET SUITE 1800
OAKLAND, CA 94612-3060
PROJECT NO.
60310138

NO.	DATE	REVISION	DES	DWN	CHK	APPR
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NO.	DATE	REVISION	DES	DWN	CHK	APPR

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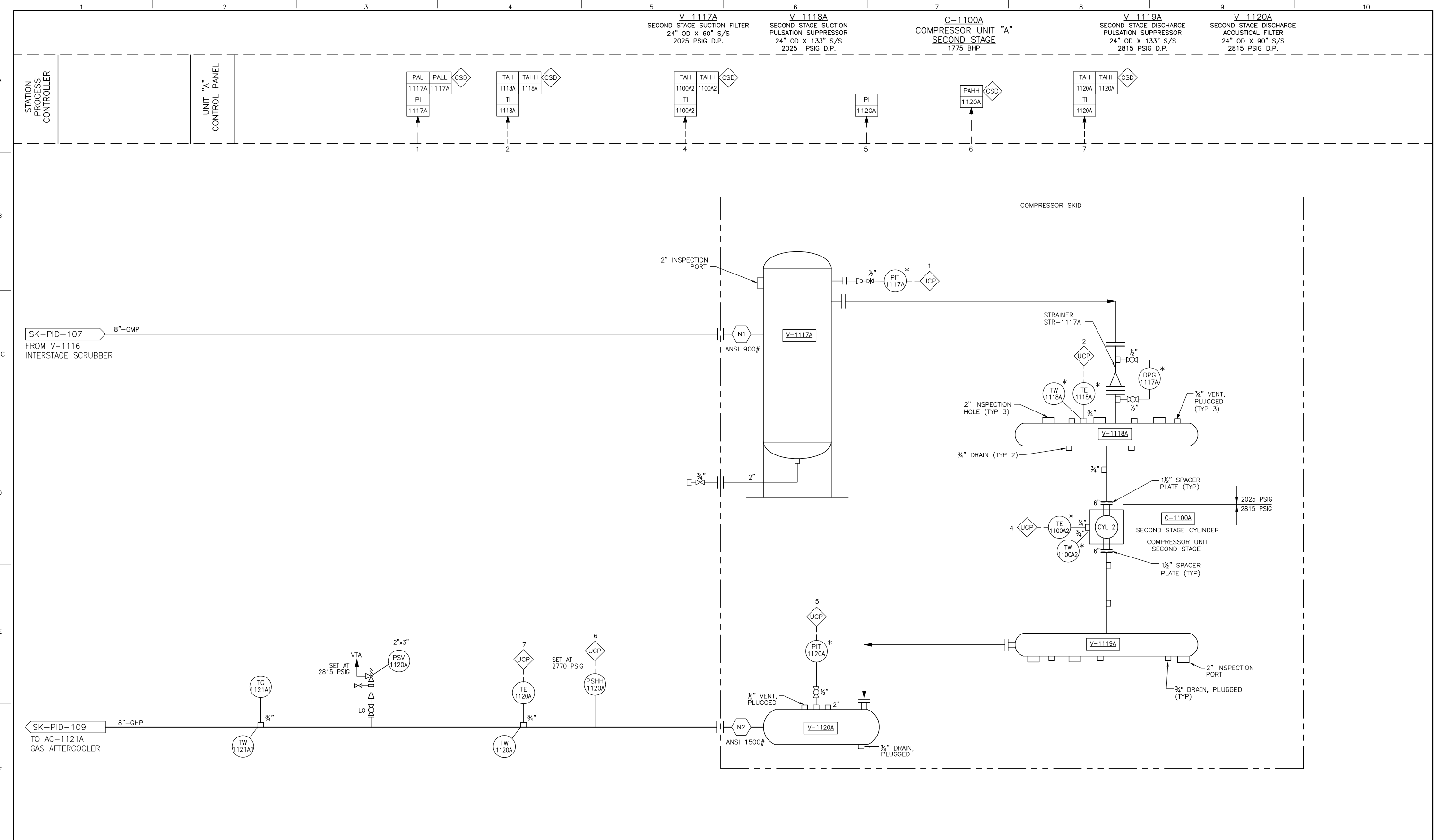
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DATE	10/24/13
CHECKED BY	R SEIBERT
DATE	12/06/13
APPROVED BY	S PETTO
DATE	12/06/13

PIPING & INSTRUMENTATION DIAGRAM
MAIN GAS
COMPRESSOR UNIT "A" INTERSTAGE

ALTON NATURAL GAS STORAGE
DWG NO. SK-PID-107

REV
C

P:\60310138-Alton Gas Storage\900-CAD-GIS\905 PIDs\SK-PID-108.dwg - Dec 04, 2013 12:11pm



AECOM

2101 WEBSTER STREET SUITE 1800
OAKLAND, CA 94612-3060

PROJECT NO.
60310138

REFERENCE DRAWINGS

NOTES

NO.	DATE	REVISION	DES	DWN	CHK	APPR
C	12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP
B	11/14/13	REISSUED FOR REVIEW	MD	MD		
A	11/04/13	ISSUED FOR PRELIMINARY REVIEW	MD	MD		

PROFESSIONAL SEAL

SCALE:	DATE
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DESIGNED BY: M DAVIS	10/24/13
DRAWN BY: M DAVIS	10/24/13
CHECKED BY: R SEIBERT	12/06/13
APPROVED BY: S PETTO	12/06/13

PIPING & INSTRUMENTATION DIAGRAM
MAIN GAS
COMPRESSOR UNIT "A" SECOND STAGE

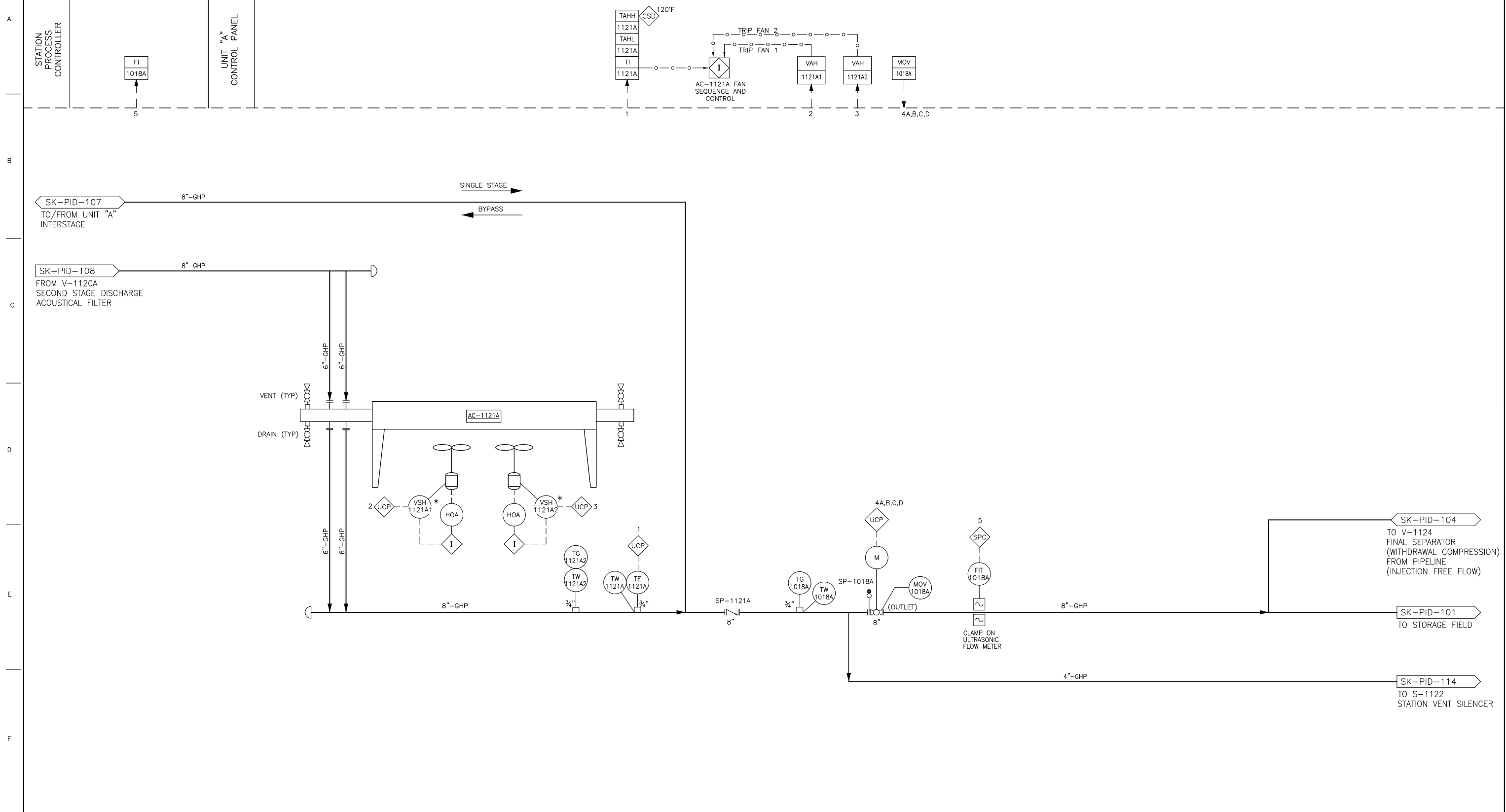
ALTON NATURAL GAS STORAGE

DWG NO. SK-PID-108

REV
C

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AC-1121A
GAS AFTERCOOLERR
12.5 MMBTU/HR
2815 PSIG D.P.
25_HP



2101 WEBSTER STREET SUITE 1800
OAKLAND, CA 94612-3060

PROJECT NO.
60310138

REFERENCE DRAWINGS

NOTES

NO.	DATE	REVISION	DES	DWN	CHK	APPR
C	12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP
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A	11/04/13	ISSUED FOR PRELIMINARY REVIEW	MD	MD		

PROFESSIONAL SEAL

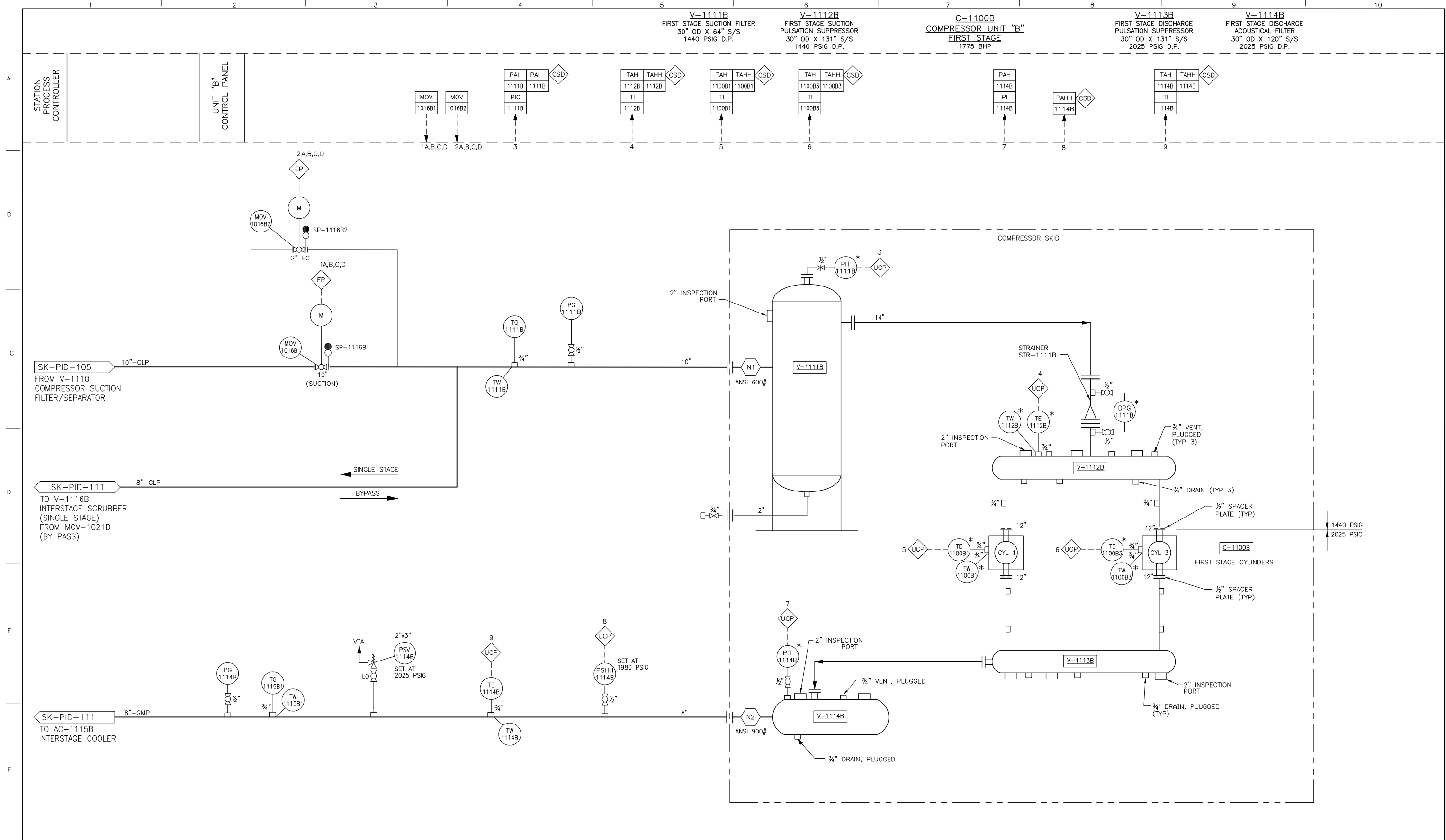
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DRAWN BY M DAVIS	10/24/13
CHECKED BY R SEIBERT	12/06/13
APPROVED BY S PETTO	12/06/13
APPROVED BY	

PIPING & INSTRUMENTATION DIAGRAM
MAIN GAS
COMPRESSOR UNIT "A" GAS AFTERCOOLER

ALTON NATURAL GAS STORAGE

DWG NO. SK-PID-109 REV C

P:\60310138-Alton Gas Storage\900-CAD-GIS\905 PIDs\SK-PID-110.dwg - Dec 04, 2013 12:11pm



AECOM
 2101 WEBSTER STREET SUITE 1800
 OAKLAND, CA 94612-3080
PROJECT NO.
60310138

REFERENCE DRAWINGS

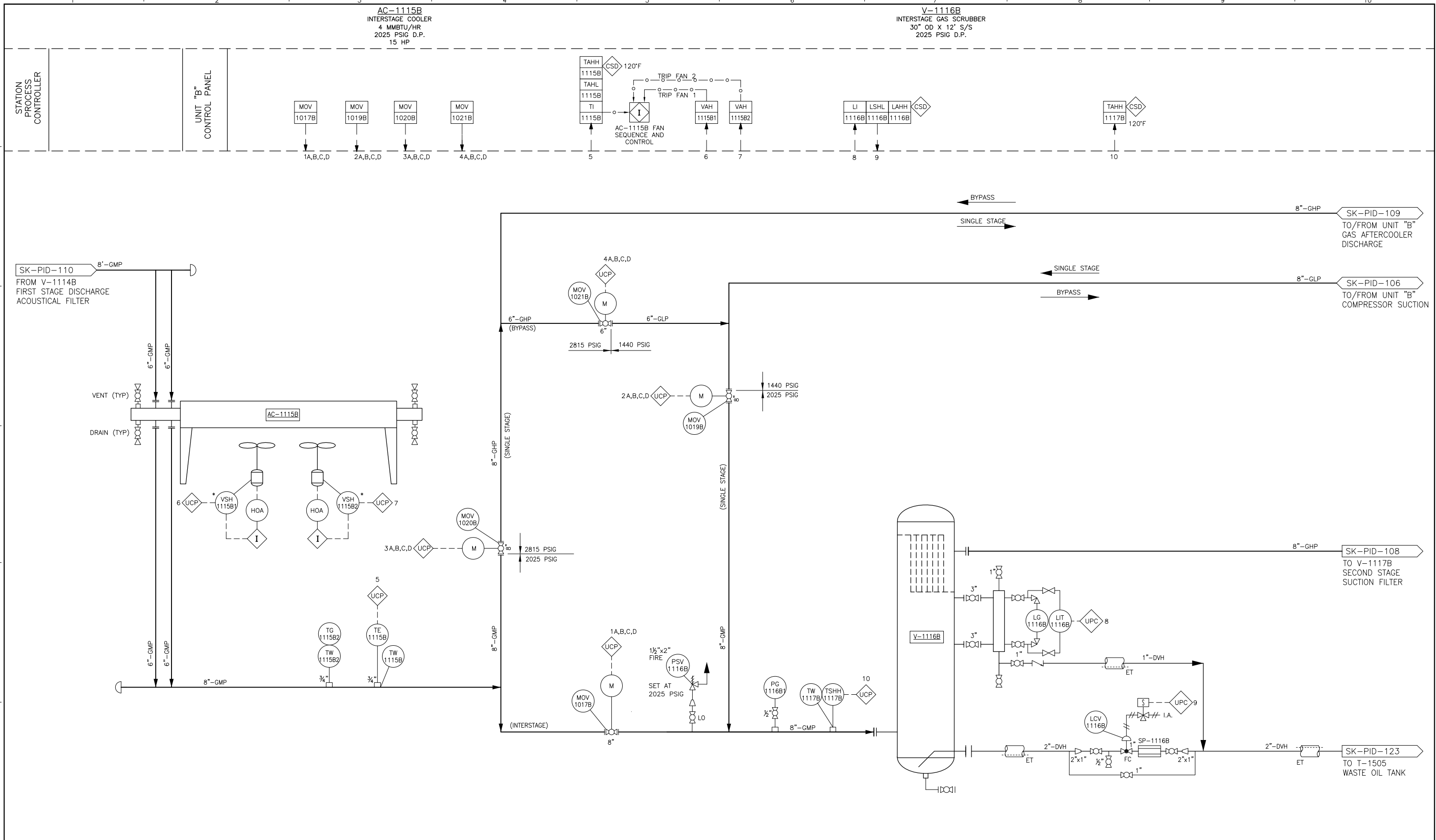
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NO.	DATE	REVISION	DES	DWN	CHK	APPR
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A	11/04/13	ISSUED FOR PRELIMINARY REVIEW	MD	MD		

PROFESSIONAL SEAL	SCALE: NONE	DATE
	DESIGNED BY: M DAVIS	10/24/13
	DRAWN BY: M DAVIS	10/24/13
	CHECKED BY: R SEIBERT	12/06/13
	APPROVED BY: S PETTO	12/06/13
	APPROVED BY:	

PIPING & INSTRUMENTATION DIAGRAM
 MAIN GAS
 COMPRESSOR UNIT "B" FIRST STAGE
 ALTON NATURAL GAS STORAGE
 DWG NO. SK-PID-110
 REV C

P:\60310138-Alton Gas Storage\900-CAD-GIS\905 PIDs\SK-PID-111.dwg - Dec 04, 2013 12:11pm



AECOM
 2101 WEBSTER STREET SUITE 1800
 OAKLAND, CA 94612-3000

PROJECT NO.
 60310138

NO.	DATE	REVISION	DES	DWN	CHK	APPR
C	12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP
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NO.	DATE	REVISION	DES	DWN	CHK	APPR

NO.	DATE	REVISION	DES	DWN	CHK	APPR

PROFESSIONAL SEAL

SCALE:	DATE
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DESIGNED BY: M DAVIS	10/24/13
DRAWN BY: M DAVIS	10/24/13
CHECKED BY: R SEIBERT	12/06/13
APPROVED BY: S PETTO	12/06/13
APPROVED BY:	

SK-PID-111

PIPING & INSTRUMENTATION DIAGRAM
MAIN GAS
COMPRESSOR UNIT "B" INTERSTAGE

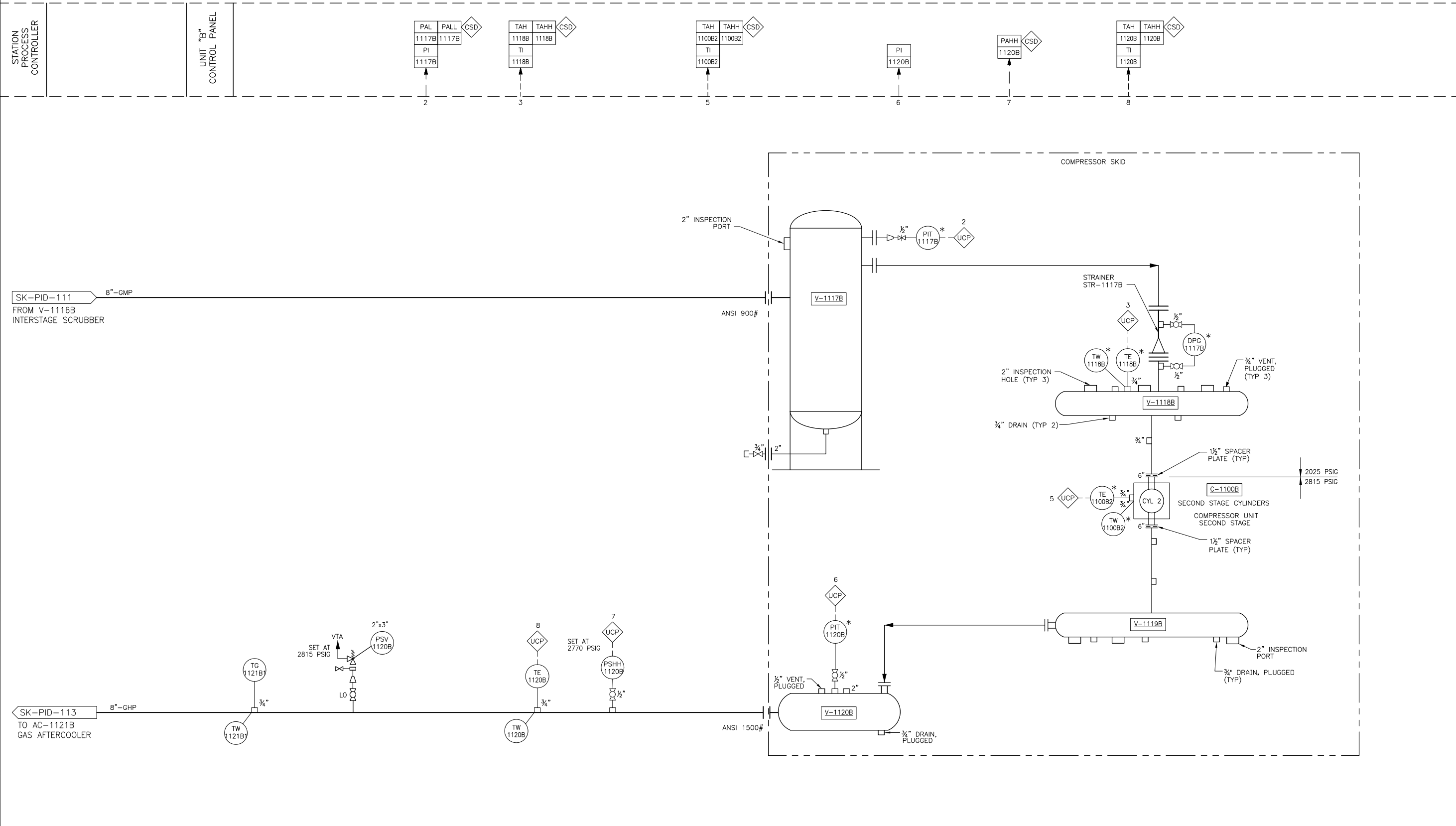
ALTON NATURAL GAS STORAGE

DWG NO. SK-PID-111

REV C

P:\60310138-Alton Gas Storage\900-CAD-GIS\905 PIDs\SK-PID-112.dwg - Dec 04, 2013 12:11pm

V-1117B SECOND STAGE SUCTION FILTER 24" OD X 60" S/S 2025 PSIG D.P.
 V-1118B SECOND STAGE SUCTION PULSATION SUPPRESSOR 24" OD X 133" S/S 2025 PSIG D.P.
 C-1100B COMPRESSOR UNIT "B" SECOND STAGE 1775 BHP
 V-1119B SECOND STAGE DISCHARGE PULSATION SUPPRESSOR 24" OD X 133" S/S 2815 PSIG D.P.
 V-1120B SECOND STAGE DISCHARGE ACOUSTICAL FILTER 24" OD X 90" S/S 2815 PSIG D.P.

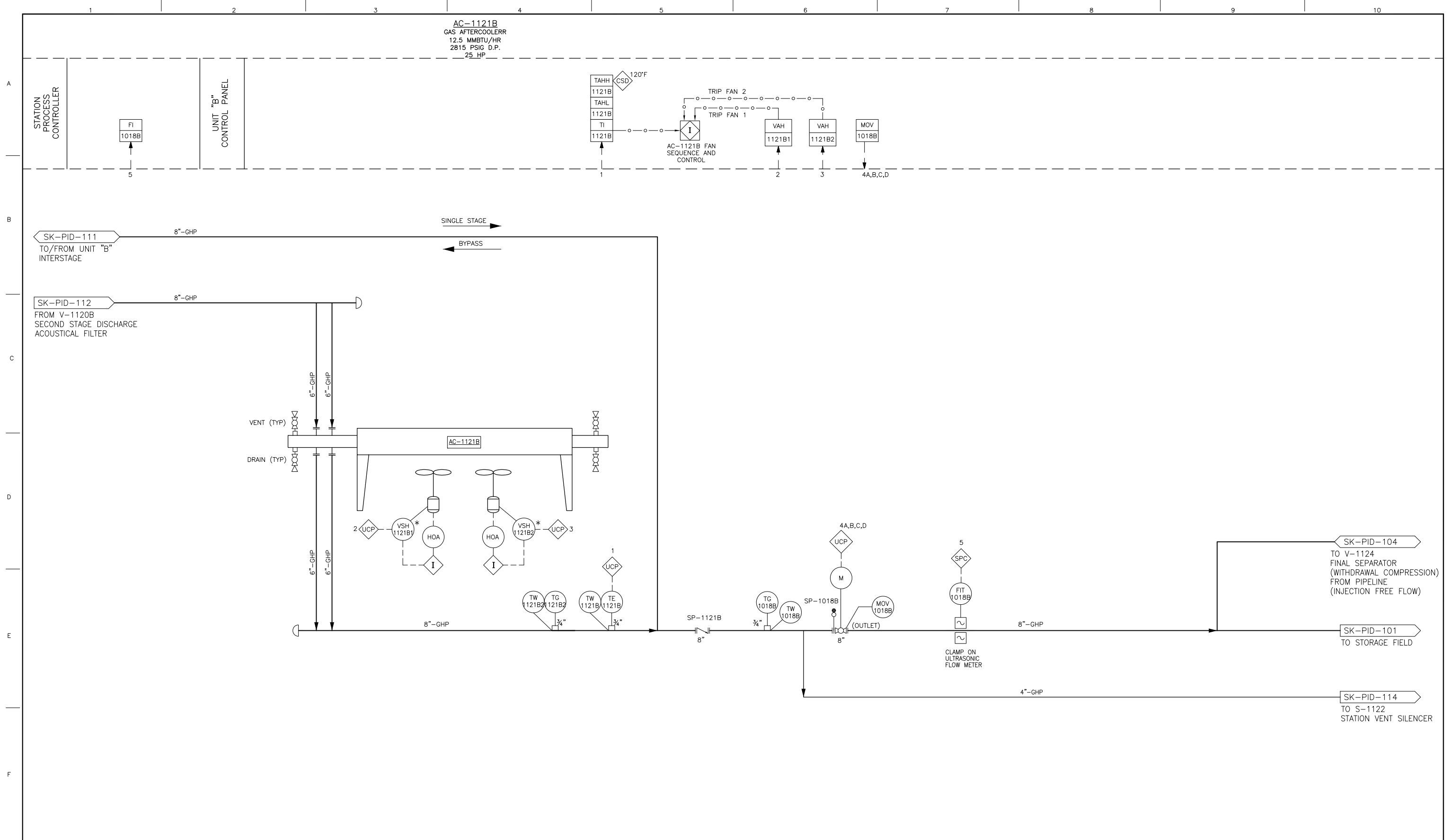


AECOM
 2101 WEBSTER STREET SUITE 1800
 OAKLAND, CA 94612-3060
PROJECT NO.
 60310138

SCALE:	NONE	DATE:	
DESIGNED BY:	M DAVIS		10/24/13
DRAWN BY:	M DAVIS		10/24/13
CHECKED BY:	R SEIBERT		12/06/13
APPROVED BY:	S PETTO		12/06/13

PIPING & INSTRUMENTATION DIAGRAM
 MAIN GAS
 COMPRESSOR UNIT "B" SECOND STAGE
 ALTON NATURAL GAS STORAGE
 DWG NO. SK-PID-112 REV C

AC-1121B
GAS AFTERCOOLER
12.5 MMBTU/HR
2815 PSIG D.P.
25_HP



2101 WEBSTER STREET SUITE 1800
OAKLAND, CA 94612-3060

PROJECT NO.
60310138

REFERENCE DRAWINGS

NOTES

NO.	DATE	REVISION	DES	DWN	CHK	APPR
C	12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP
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PROFESSIONAL SEAL

SCALE:	DATE
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DESIGNED BY: M DAVIS	10/24/13
DRAWN BY: M DAVIS	10/24/13
CHECKED BY: R SEIBERT	12/06/13
APPROVED BY: S PETTO	12/06/13

PIPING & INSTRUMENTATION DIAGRAM
MAIN GAS
COMPRESSOR UNIT "B" GAS AFTERCOOLER

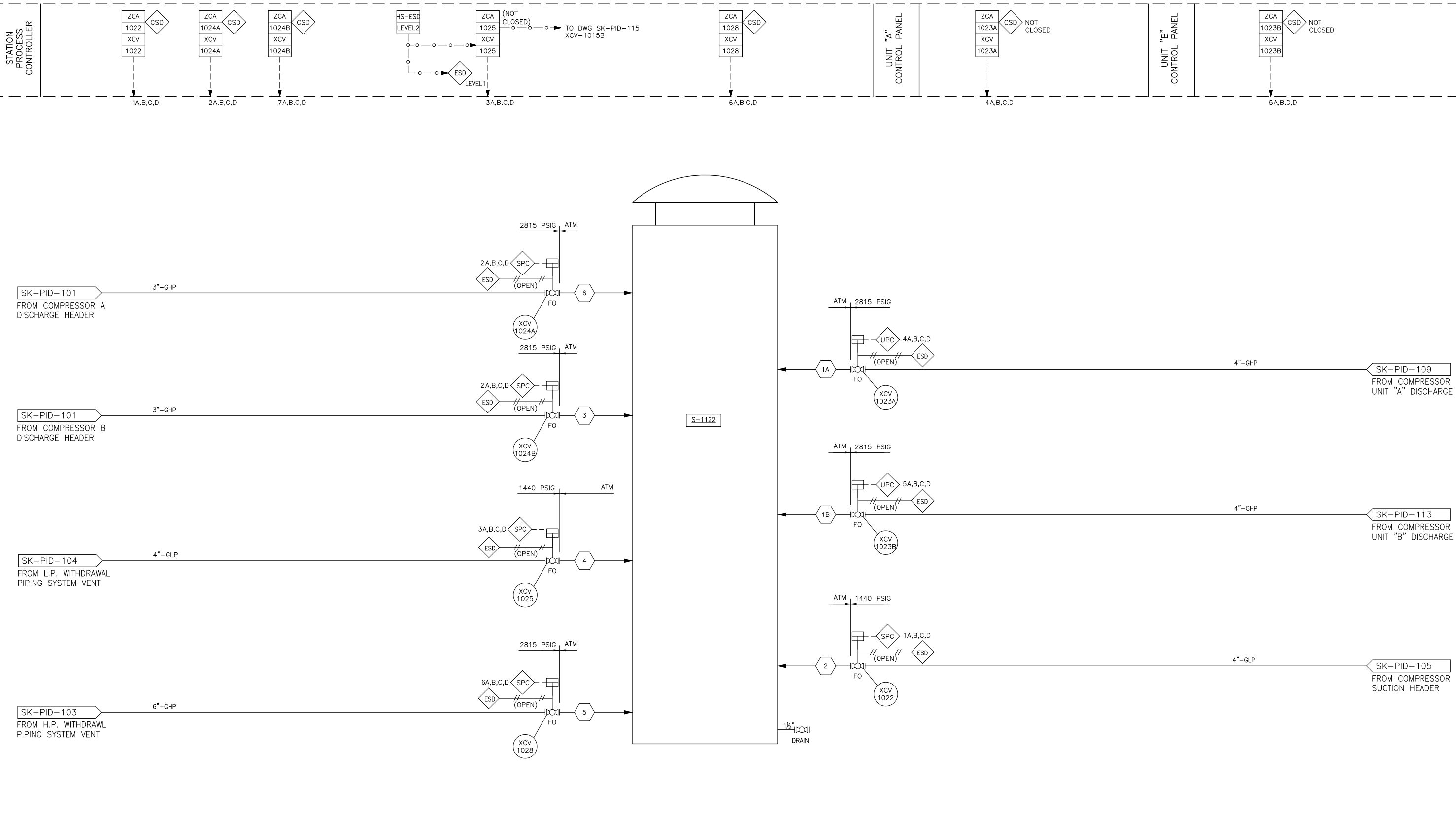
ALTON NATURAL GAS STORAGE

DWG NO. SK-PID-113

REV
C

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S-1122
STATION VENT SILENCER
12'-0" OD X 36'-7" H



P:\60310138-Alton Gas Storage\900-CAD-GIS\905 PIDs\SK-PID-114.dwg - Dec 04, 2013 12:11pm

AECOM
2101 WEBSTER STREET SUITE 1800
OAKLAND, CA 94612-3090
PROJECT NO.
60310138

REFERENCE DRAWINGS

NOTES

NO.	DATE	REVISION	DES	DWN	CHK	APPR
C	12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP
B	11/14/13	REISSUED FOR REVIEW	MD	MD		
A	11/04/13	ISSUED FOR PRELIMINARY REVIEW	MD	MD		

PROFESSIONAL SEAL

SCALE:	DATE:
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DESIGNED BY: M DAVIS	10/24/13
DRAWN BY: M DAVIS	10/24/13
CHECKED BY: R SEIBERT	12/06/13
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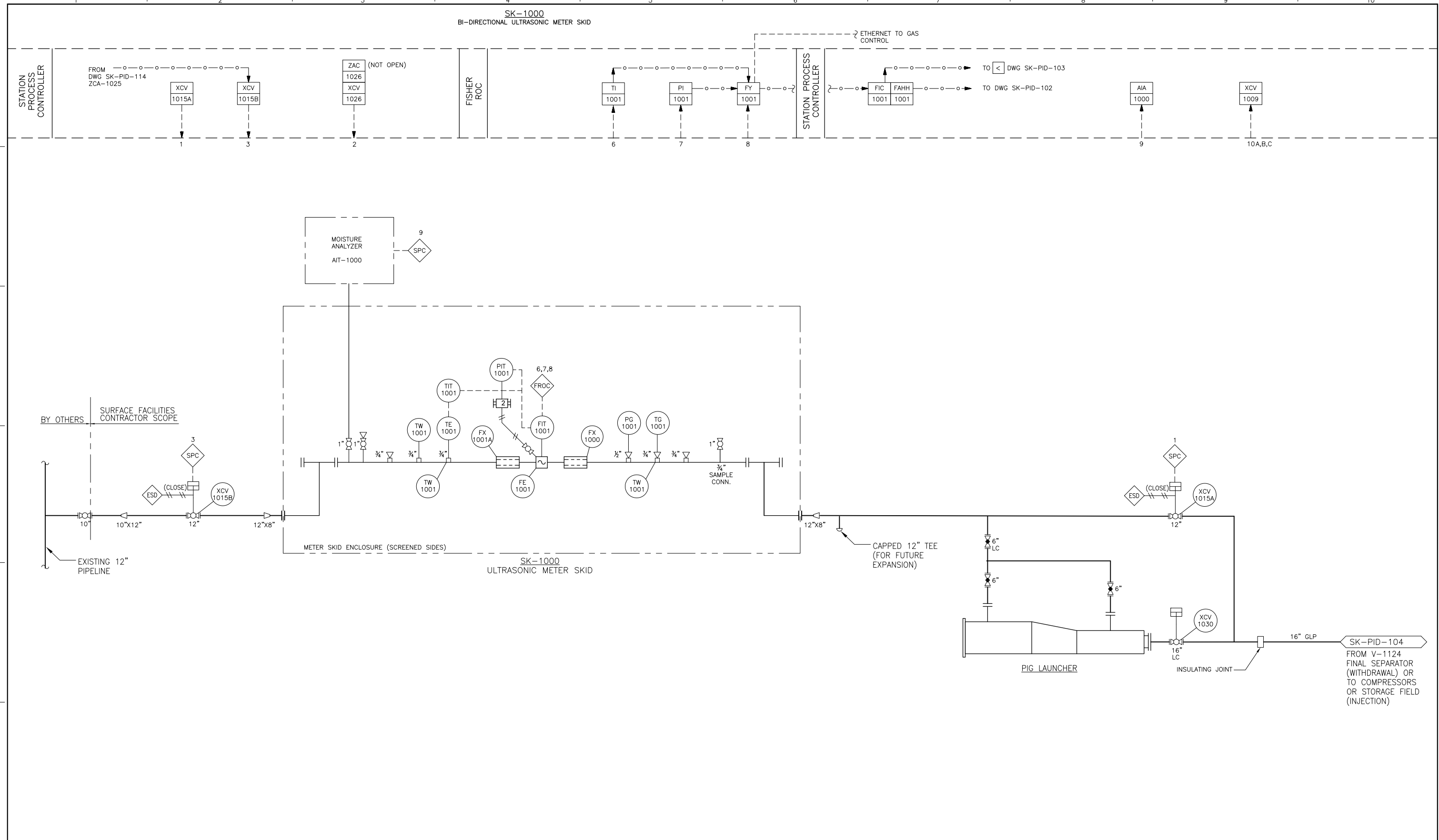
PIPING & INSTRUMENTATION DIAGRAM
MAIN GAS
STATION VENT SILENCER

ALTON NATURAL GAS STORAGE

DWG NO. SK-PID-114

REV
C

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AECOM
 2101 WEBSTER STREET SUITE 1800
 OAKLAND, CA 94612-3060

PROJECT NO.
 60310138

NO.	DATE	REVISION	DES	DWN	CHK	APPR
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A	11/04/13	ISSUED FOR PRELIMINARY REVIEW	MD	MD		

NO.	DATE	REVISION	DES	DWN	CHK	APPR

NO.	DATE	REVISION	DES	DWN	CHK	APPR

SCALE:	DATE
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DESIGNED BY	
M DAVIS	10/24/13
DRAWN BY	
M DAVIS	10/24/13
CHECKED BY	
R SEIBERT	12/06/13
APPROVED BY	
S PETTO	12/06/13

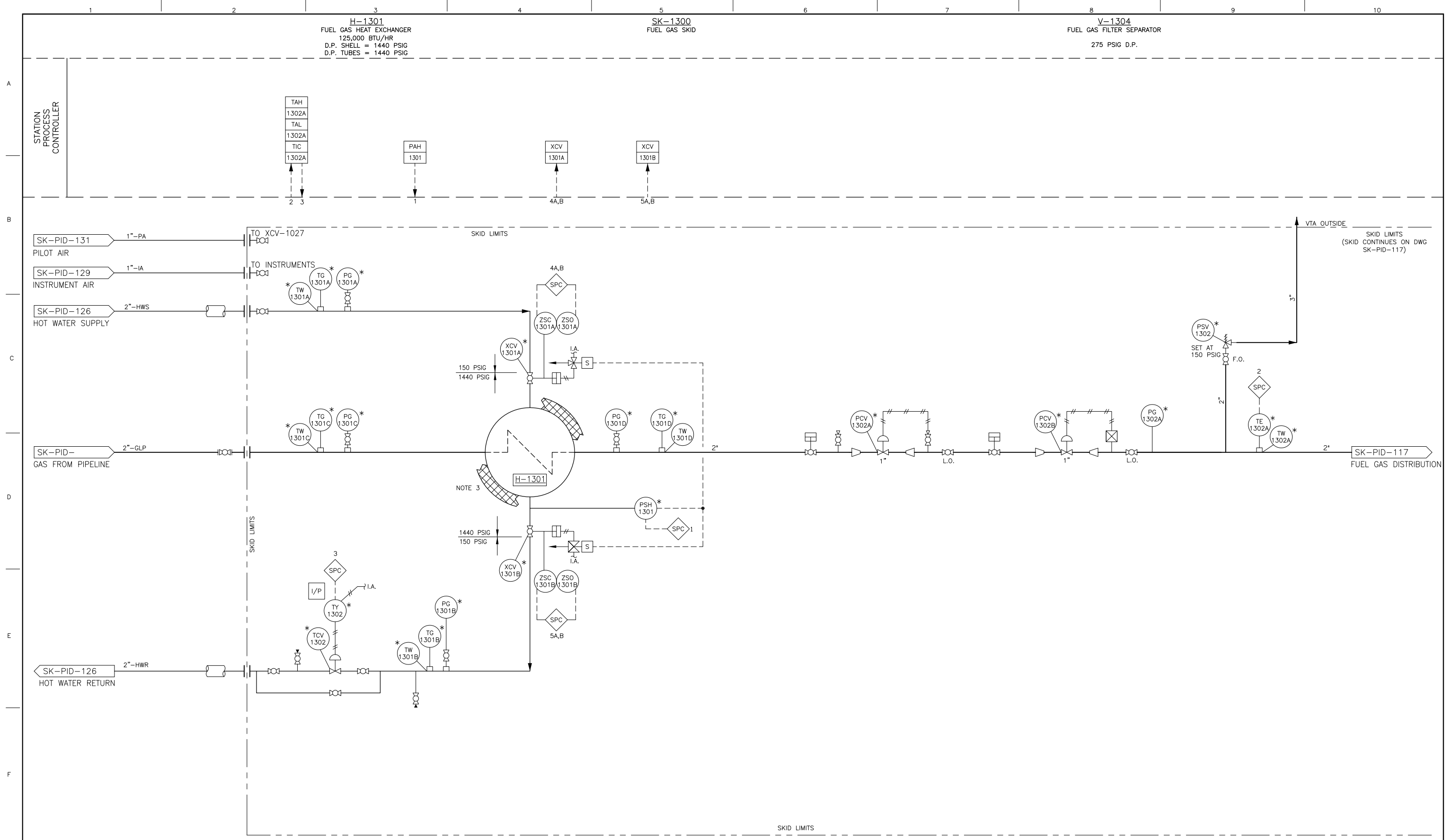
PIPING & INSTRUMENTATION DIAGRAM
MAIN GAS
METER SKID

ALTON NATURAL GAS STORAGE

DWG NO. SK-PID-115

REV C

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AECOM
 2101 WEBSTER STREET SUITE 1800
 OAKLAND, CA 94612-3060
PROJECT NO.
60310138

C 12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP
B 11/15/13	REVISED AND REISSUED FOR REVIEW	MD	MD		
A 11/08/13	ISSUED FOR PRELIMINARY REVIEW	MD	MD		
NO.	DATE				

PROFESSIONAL SEAL

SCALE:	NONE	DATE
DESIGNED BY:	M DAVIS	11/04/13
DRAWN BY:	M DAVIS	11/04/13
CHECKED BY:	R SEIBERT	12/06/13
APPROVED BY:	S PETTO	12/06/13

PIPING & INSTRUMENTATION DIAGRAM
FUEL GAS SKID

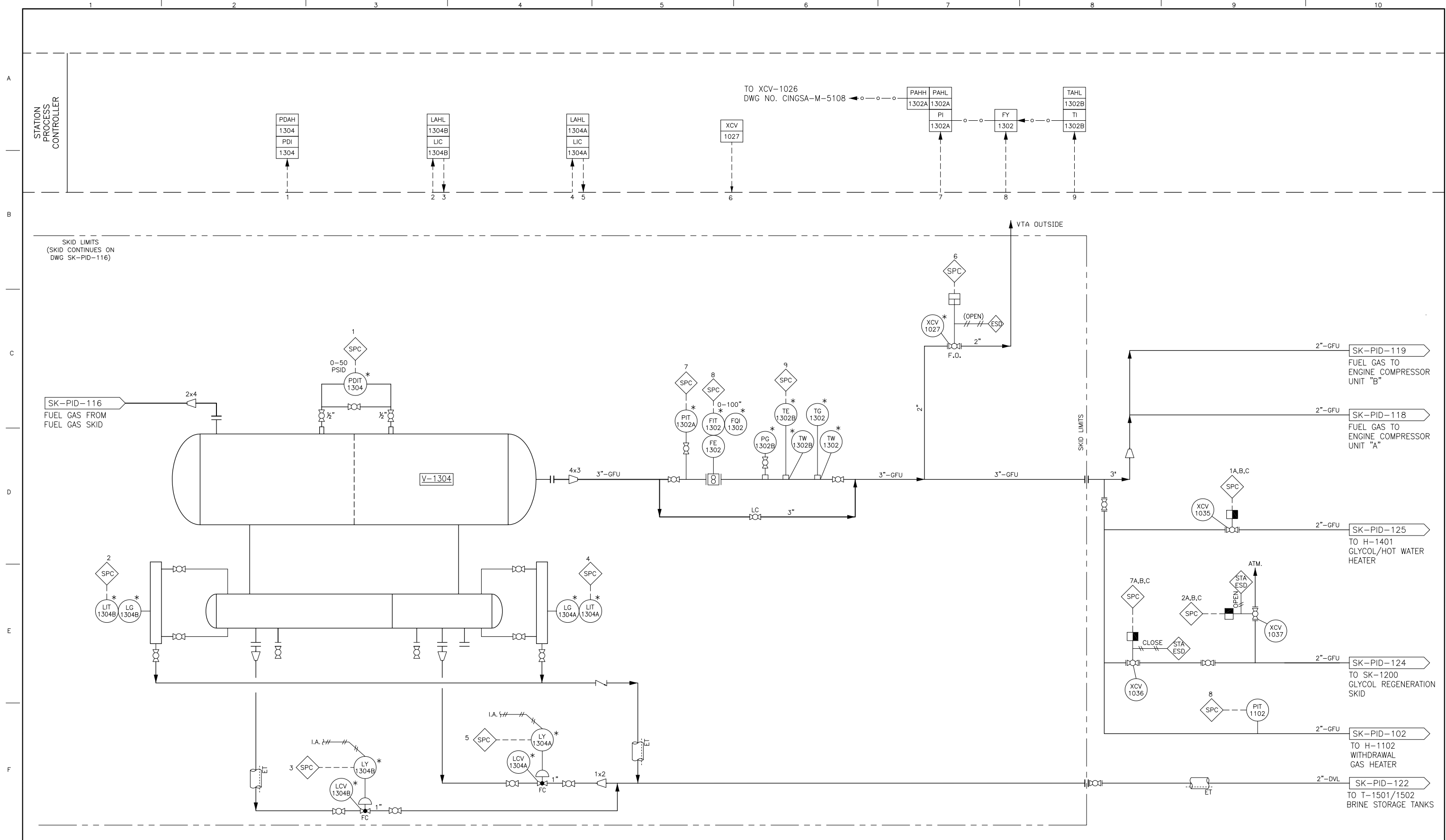
ALTON NATURAL GAS STORAGE

DWG NO. SK-PID-116 REV
C

REFERENCE DRAWINGS

NOTES

P:\60310138-Alton Gas Storage\900-CAD-GIS\905 PIDs\SK-PID-117.dwg - Dec 04, 2013 12:12pm



AECOM
 2101 WEBSTER STREET SUITE 1800
 OAKLAND, CA 94612-3060

PROJECT NO.
 60310138

NO.	DATE	REVISION	DES	DWN	CHK	APPR
C	12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP
B	11/15/13	REVISED AND REISSUED FOR REVIEW	MD	MD		
A	11/08/13	ISSUED FOR PRELIMINARY REVIEW	MD	MD		

NO.	DATE	REVISION	DES	DWN	CHK	APPR

NO.	DATE	REVISION	DES	DWN	CHK	APPR

PROFESSIONAL SEAL

SCALE:	DATE
NONE	
DESIGNED BY: M DAVIS	11/04/13
DRAWN BY: M DAVIS	11/04/13
CHECKED BY: R SEIBERT	12/06/13
APPROVED BY: S PETTO	12/06/13
APPROVED BY:	

TO XCV-1026
 DWG NO. CINGSA-M-5108

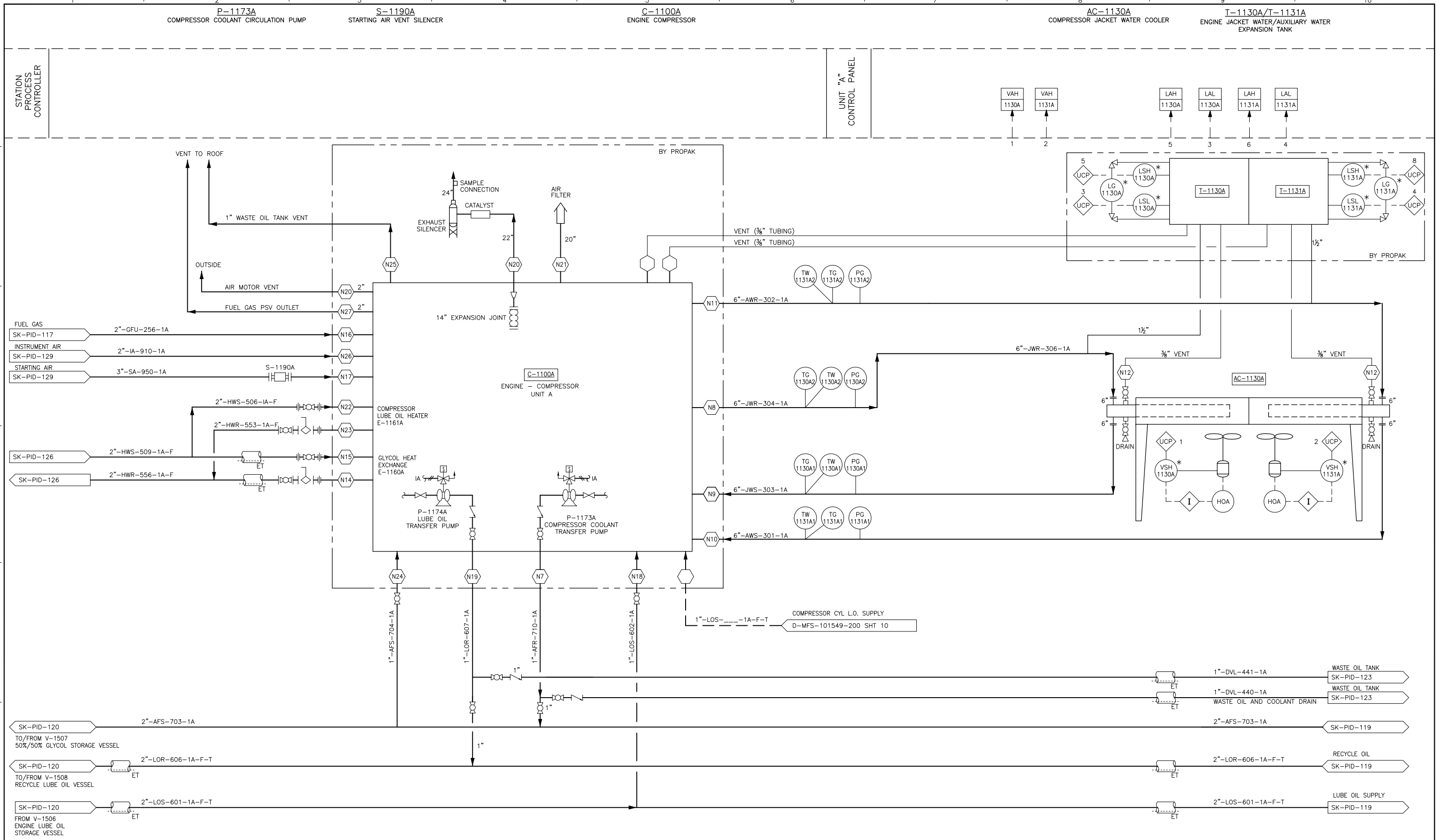
PIPING & INSTRUMENTATION DIAGRAM
FUEL GAS DISTRIBUTION

ALTON NATURAL GAS STORAGE

DWG NO. SK-PID-117

REV C

P:\60310138-Alton Gas Storage\900-CAD-GIS\905 PIDs\SK-PID-118.dwg - Dec 04, 2013 12:12pm



AECOM

2101 WEBSTER STREET SUITE 1800
OAKLAND, CA 94612-3060

PROJECT NO.
60310138

REFERENCE DRAWINGS

1. LETTERS IN HEXAGONS REPRESENT SKID CONNECTION POINTS. SEE VENDOR DRAWING FOR IDENTIFICATION.

NOTES

NO.	DATE	REVISION	DES	DWN	CHK	APPR
C	12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP
B	11/15/13	REVISED AND REISSUED FOR REVIEW	MD	MD		
A	11/08/13	ISSUED FOR PRELIMINARY REVIEW	MD	MD		

SCALE:	DATE
NONE	
DESIGNED BY: M DAVIS	11/04/13
DRAWN BY: M DAVIS	11/04/13
CHECKED BY: R SEIBERT	12/06/13
APPROVED BY: S PETTO	12/06/13
APPROVED BY:	

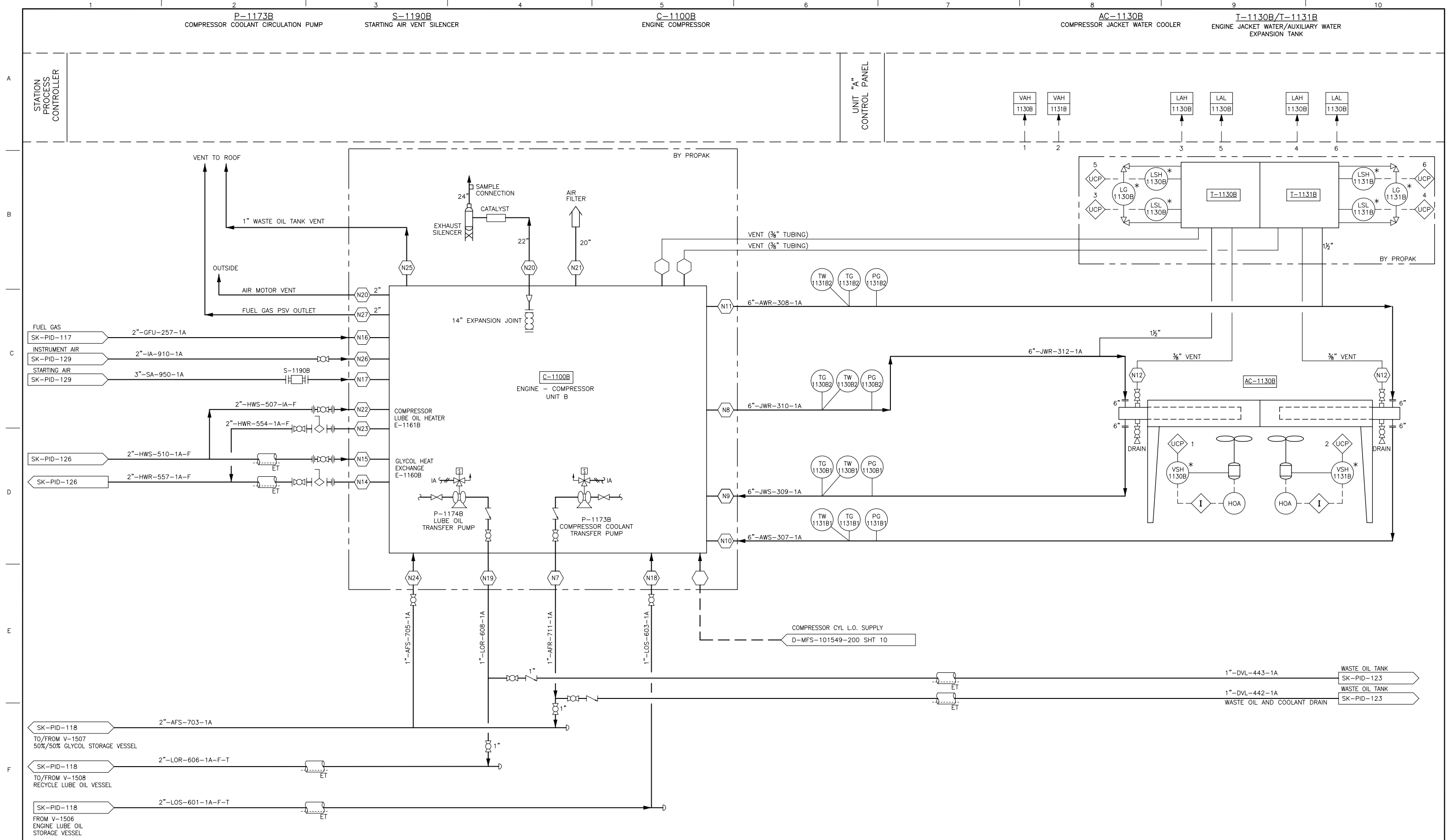
PIPING & INSTRUMENTATION DIAGRAM
ENGINE COMPRESSOR UNIT A AUXILIARIES

ALTON NATURAL GAS STORAGE

DWG NO. SK-PID-118

REV C

P:\60310138-Alton Gas Storage\900-CAD-GIS\905 PIDs\SK-PID-119.dwg - Dec 04, 2013 12:12pm



AECOM
 2101 WEBSTER STREET SUITE 1800
 OAKLAND, CA 94612-3060

PROJECT NO.
60310138

REFERENCE DRAWINGS

1. LETTERS IN HEXAGONS REPRESENT SKID CONNECTION POINTS. SEE VENDOR DRAWING FOR IDENTIFICATION.

NO.	DATE	REVISION	DES	DWN	CHK	APPR
C	12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP
B	11/15/13	REVISED AND REISSUED FOR REVIEW	MD	MD		
A	11/08/13	ISSUED FOR PRELIMINARY REVIEW	MD	MD		

PROFESSIONAL SEAL

SCALE:	NONE	DATE:	
DESIGNED BY:	M DAVIS	DATE:	11/04/13
DRAWN BY:	M DAVIS	DATE:	11/04/13
CHECKED BY:	R SEIBERT	DATE:	12/06/13
APPROVED BY:	S PETTO	DATE:	12/06/13

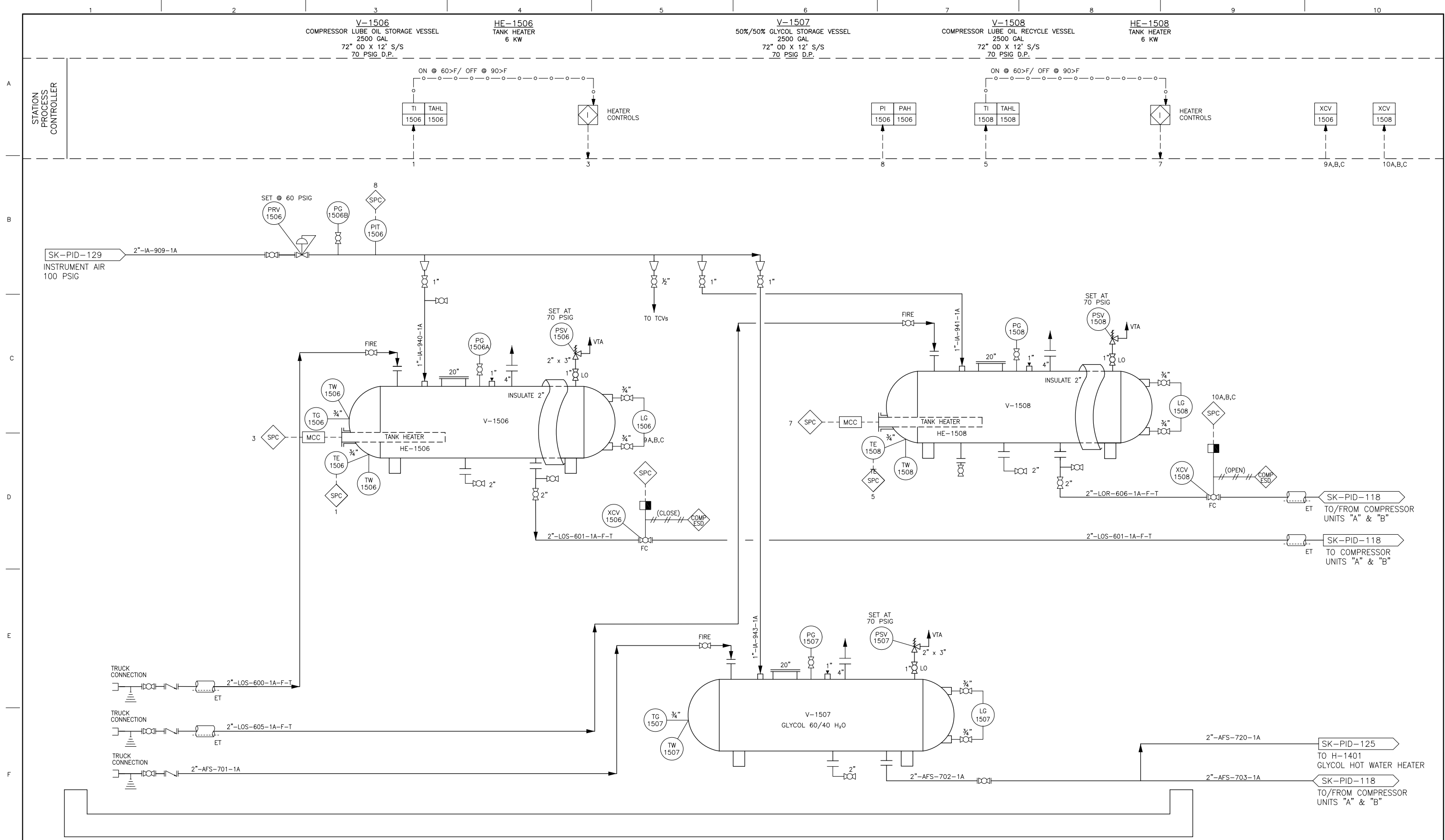
PIPING & INSTRUMENTATION DIAGRAM
ENGINE COMPRESSOR UNIT B AUXILIARIES

ALTON NATURAL GAS STORAGE

DWG NO. SK-PID-119

REV C

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AECOM
2101 WEBSTER STREET SUITE 1800
OAKLAND, CA 94612-3000
PROJECT NO.
60310138

1. HEAT TRACE AND INSULATE ALL LUBE OIL LINES.

REFERENCE DRAWINGS

NOTES

NO.	DATE	REVISION	DES	DWN	CHK	APPR
C	12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP
B	11/15/13	REVISED AND REISSUED FOR REVIEW	MD	MD		
A	11/08/13	ISSUED FOR PRELIMINARY REVIEW	MD	MD		

PROFESSIONAL SEAL

SCALE:	DATE
NONE	
DESIGNED BY: M DAVIS	11/04/13
DRAWN BY: M DAVIS	11/04/13
CHECKED BY: R SEIBERT	12/06/13
APPROVED BY: S PETTO	12/06/13

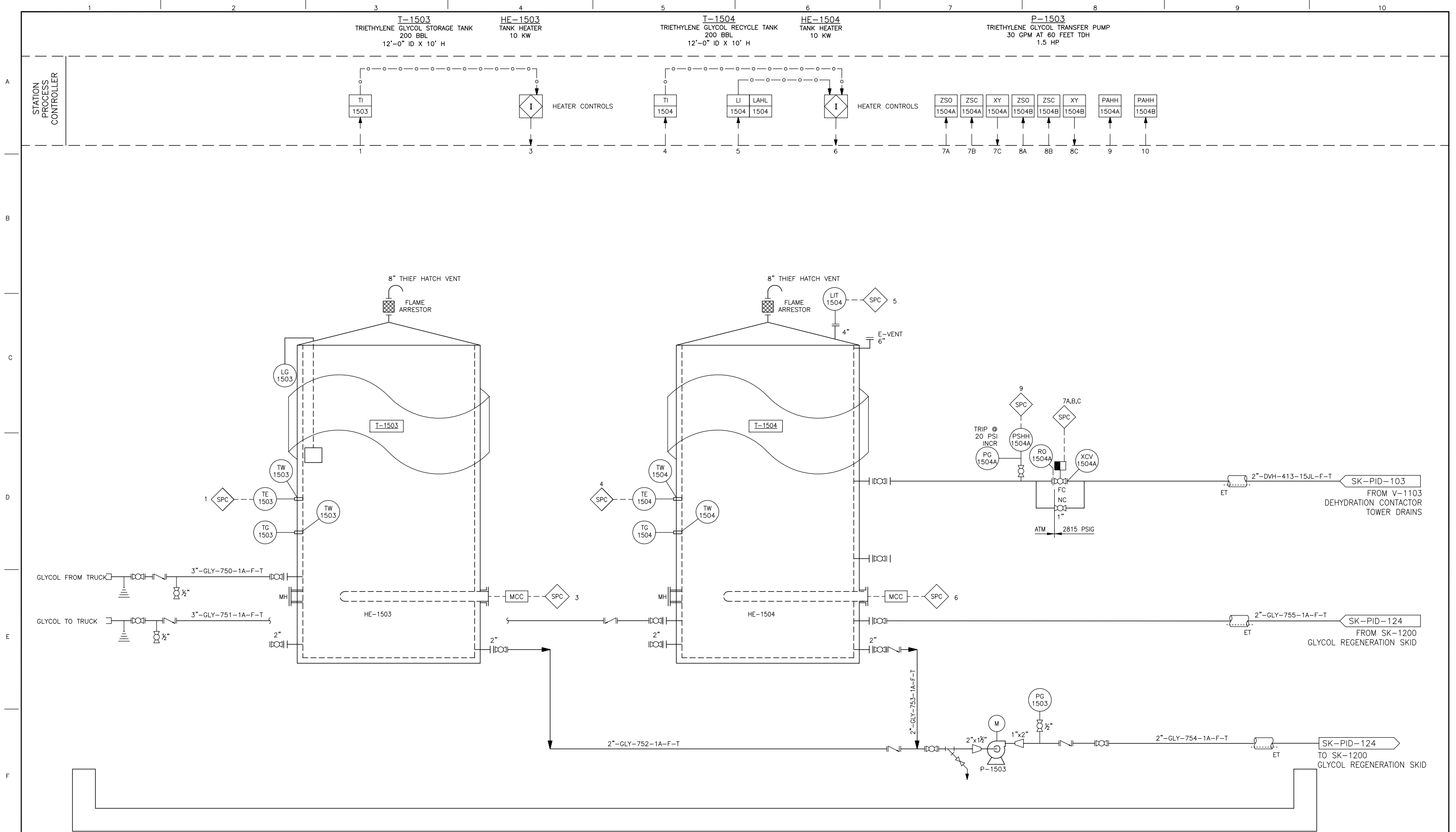
PIPING & INSTRUMENTATION DIAGRAM
LUBE OIL & COOLANT STORAGE

ALTON NATURAL GAS STORAGE

DWG NO. SK-PID-120

REV
C

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AECOM

2101 WEBSTER STREET SUITE 1800
OAKLAND, CA 94612-3080

**PROJECT NO.
60310138**

REFERENCE DRAWINGS

1. HEAT TRACE AND INSULATE ALL GLYCOL LINES.

NOTES

NO.	DATE	REVISION	DES	DWN	CHK	APPR
C	12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP
B	11/15/13	REVISED AND REISSUED FOR REVIEW	MD	MD		
A	11/08/13	ISSUED FOR PRELIMINARY REVIEW	MD	MD		

PROFESSIONAL SEAL

SCALE:	DATE
NONE	
DESIGNED BY M DAVIS	11/04/13
DRAWN BY M DAVIS	11/04/13
CHECKED BY R SEIBERT	12/06/13
APPROVED BY S PETTO	12/06/13
APPROVED BY	

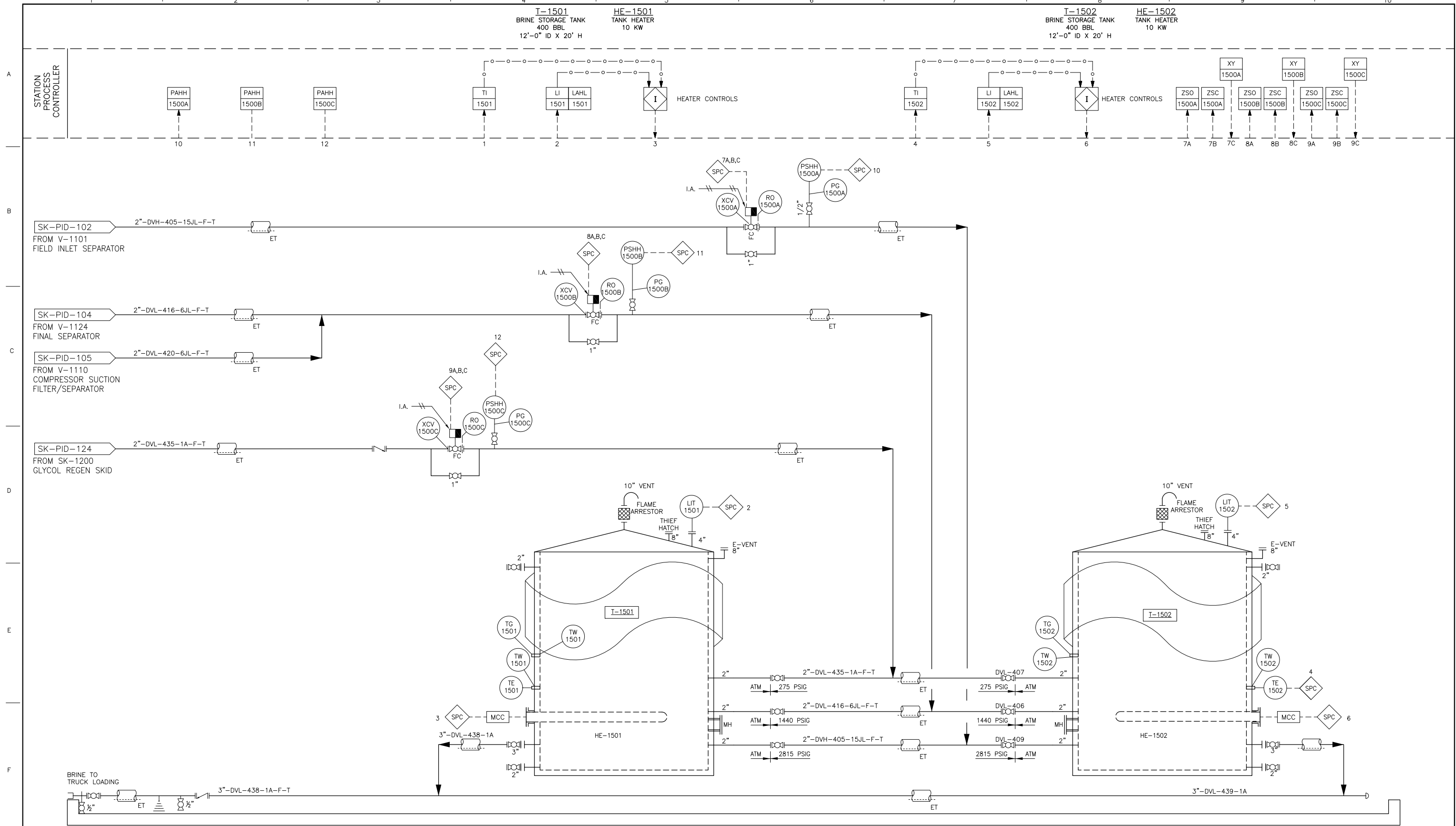
PIPING & INSTRUMENTATION DIAGRAM
GLYCOL STORAGE TANKS

ALTON NATURAL GAS STORAGE

DWG NO. SK-PID-121

REV
C

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AECOM
 2101 WEBSTER STREET SUITE 1800
 OAKLAND, CA 94612-3060

PROJECT NO.
 60310138

REFERENCE DRAWINGS

1. HEAT TRACE AND INSULATE ALL LIQUID DRAIN LINES.

NOTES

NO.	DATE	REVISION	DES	DWN	CHK	APPR
C	12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP
B	11/15/13	REVISED AND REISSUED FOR REVIEW	MD	MD		
A	11/08/13	ISSUED FOR PRELIMINARY REVIEW	MD	MD		

PROFESSIONAL SEAL

SCALE:	DATE
NONE	
DESIGNED BY: M DAVIS	11/04/13
DRAWN BY: M DAVIS	11/04/13
CHECKED BY: R SEIBERT	12/06/13
APPROVED BY: S PETTO	12/06/13
APPROVED BY:	

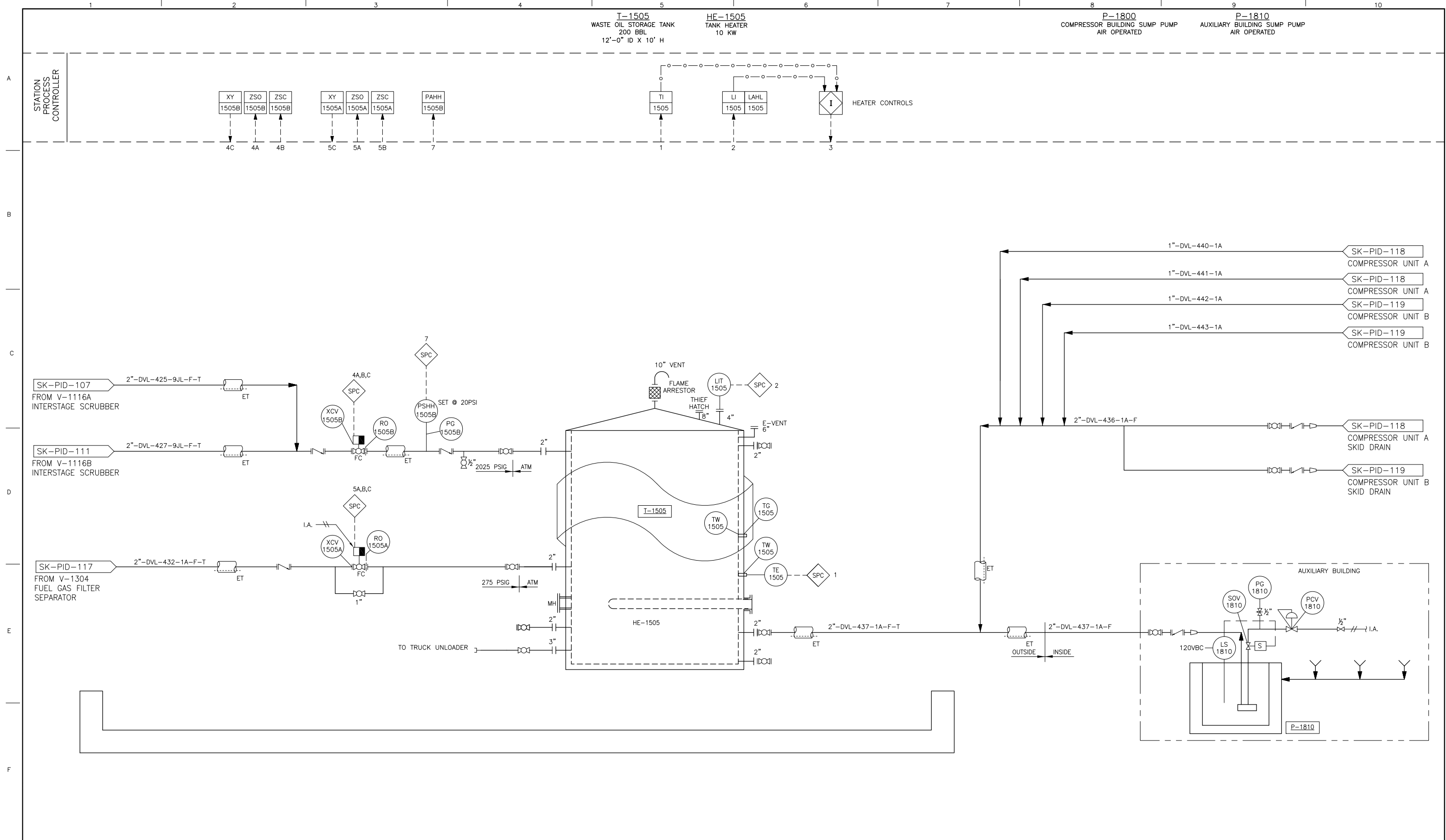
PIPING & INSTRUMENTATION DIAGRAM
 BRINE STORAGE TANKS

ALTON NATURAL GAS STORAGE

DWG NO. SK-PID-122

REV
 C

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AECOM
 2101 WEBSTER STREET SUITE 1800
 OAKLAND, CA 94612-3000
PROJECT NO.
60310138

REFERENCE DRAWINGS

1. HEAT TRACE AND INSULATE ALL LIQUID DRAIN LINES OUTSIDE BUILDINGS.

NO.	DATE	REVISION	DES	DWN	CHK	APPR
C	12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP
B	11/15/13	REVISED AND REISSUED FOR REVIEW	MD	MD		
A	11/08/13	ISSUED FOR PRELIMINARY REVIEW	MD	MD		

PROFESSIONAL SEAL

SCALE:	DATE
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DESIGNED BY M DAVIS	11/04/13
DRAWN BY M DAVIS	11/04/13
CHECKED BY R SEIBERT	12/06/13
APPROVED BY S PETTO	12/06/13
APPROVED BY	

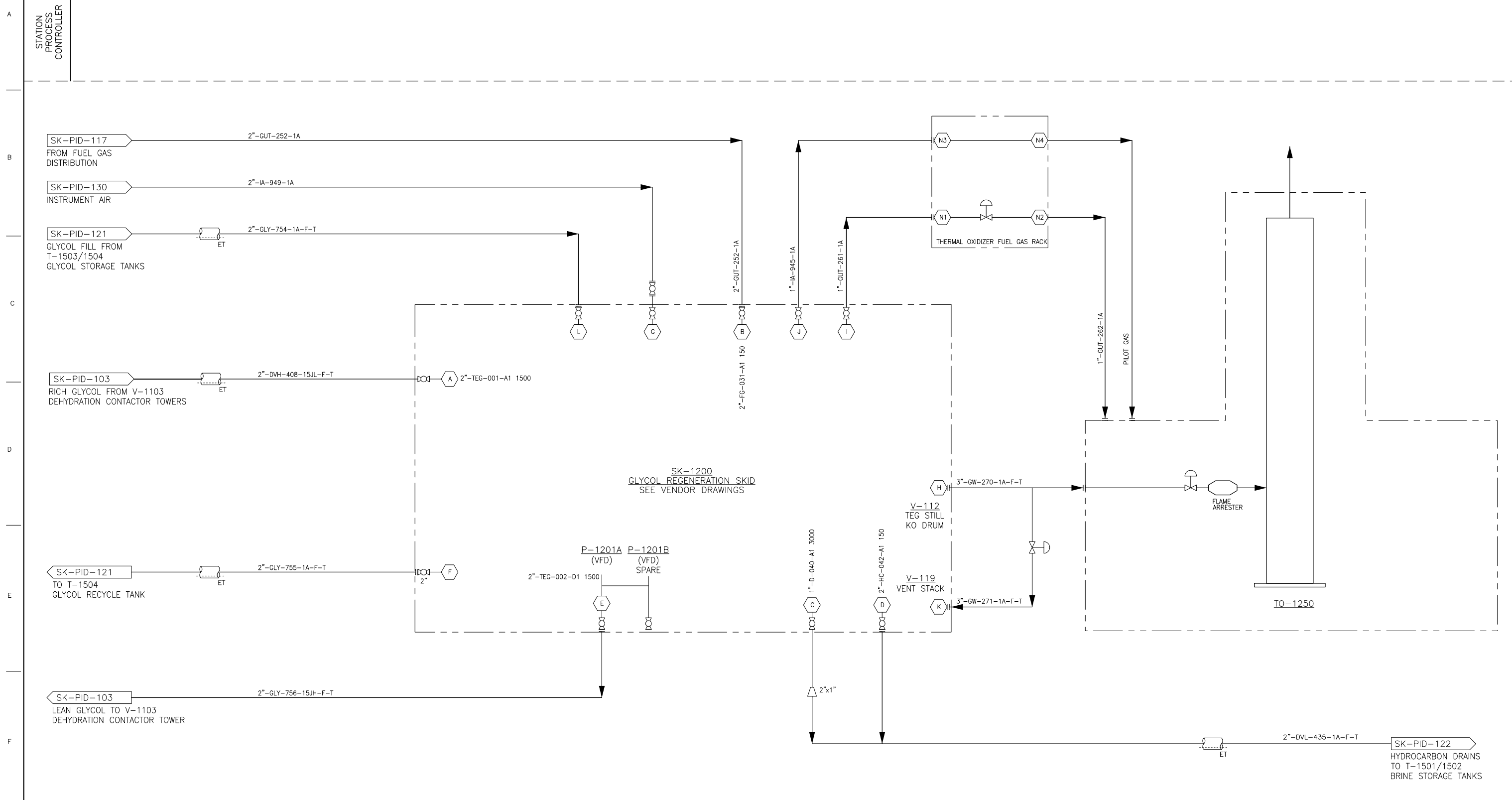
ALTON NATURAL GAS STORAGE

PIPING & INSTRUMENTATION DIAGRAM
WASTE OIL STORAGE TANK
 DWG NO. SK-PID-123

REV C

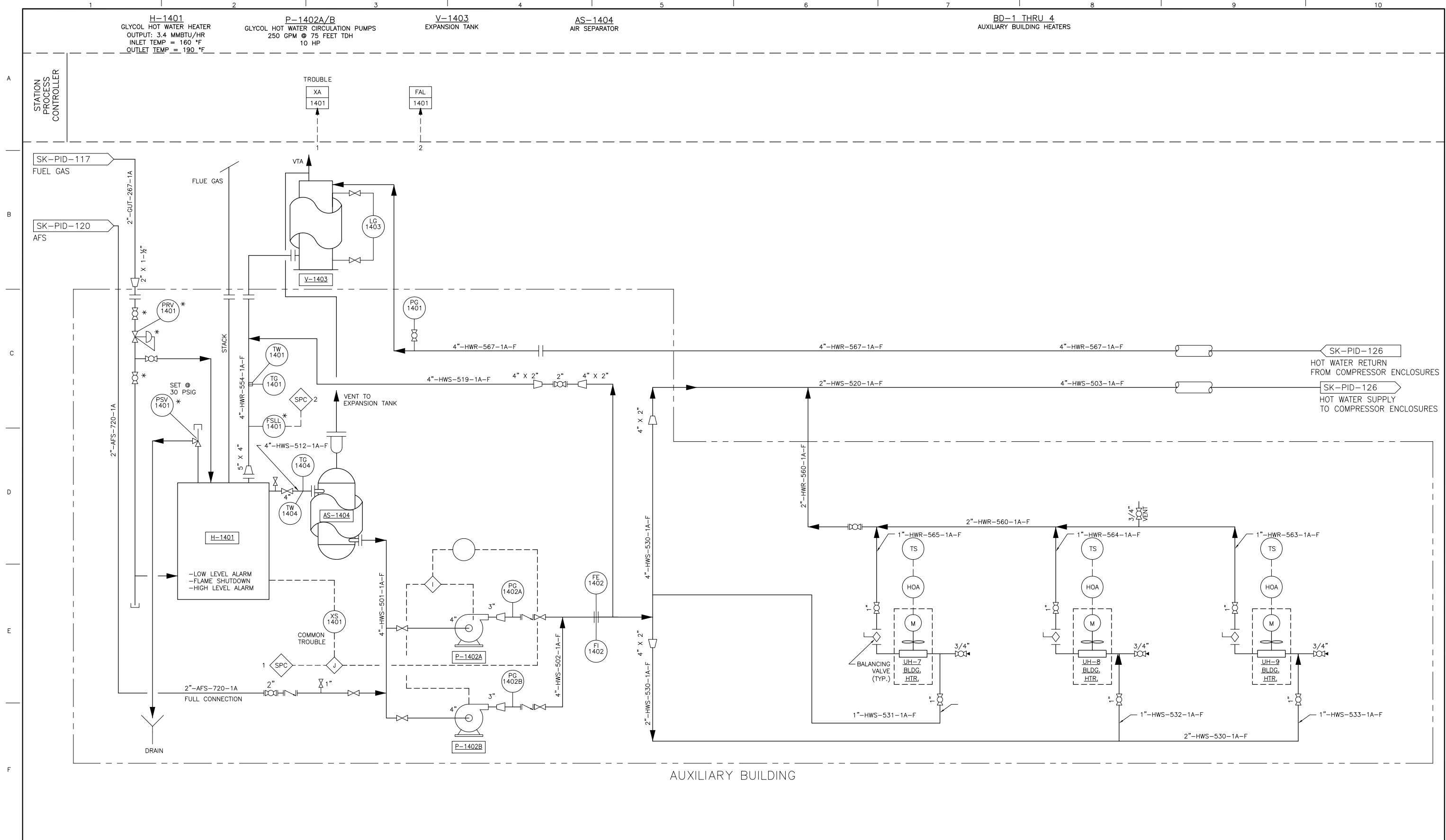
P:\60310138-Alton Gas Storage\900-CAD-GIS\905 PIDs\SK-PID-124.dwg - Dec 04, 2013 12:12pm

SK-1200 GLYCOL REGENERATION SKID
 P-1201A 30 HP (VFD)
 P-1201B 30 HP (VFD)
 TO-1205 THERMAL OXIDIZER



 2101 WEBSTER STREET SUITE 1800 OAKLAND, CA 94612-3060 PROJECT NO. 60310138	REFERENCE DRAWINGS	NOTES C 12/09/13 ISSUED FOR COST ESTIMATE MD MD RS SP B 11/15/13 REVISED AND REISSUED FOR REVIEW MD MD A 11/08/13 ISSUED FOR PRELIMINARY REVIEW MD MD NO. DATE REVISION DES DWN CHK APPR	PROFESSIONAL SEAL	SCALE: NONE DESIGNED BY: M DAVIS 11/04/13 DRAWN BY: M DAVIS 11/04/13 CHECKED BY: R SEIBERT 12/06/13 APPROVED BY: S PETTO 12/06/13	PIPING & INSTRUMENTATION DIAGRAM GLYCOL REGENERATION SKID ALTON NATURAL GAS STORAGE	
	DWG NO. SK-PID-124		REV C			

P:\60310138-Alton Gas Storage\900-CAD-GIS\905 PIDs\SK-PID-125.dwg - Dec 04, 2013 12:12pm



AUXILIARY BUILDING



2101 WEBSTER STREET SUITE 1800
DANFORTH, ONTARIO, CA 94612-3060

PROJECT NO.
60310138

REFERENCE DRAWINGS

1. INSULATE ALL HOT WATER LINES.

NOTES

NO.	DATE	REVISION	DES	DWN	CHK	APPR
C	12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP
B	11/15/13	REVISED AND REISSUED FOR REVIEW	MD	MD		
A	11/08/13	ISSUED FOR PRELIMINARY REVIEW	MD	MD		

PROFESSIONAL SEAL

SCALE:	DATE
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DESIGNED BY: M DAVIS	11/04/13
DRAWN BY: M DAVIS	11/04/13
CHECKED BY: R SEIBERT	12/06/13
APPROVED BY: S PETTO	12/06/13

PIPING & INSTRUMENTATION DIAGRAM
GLYCOL HOT WATER HEATER

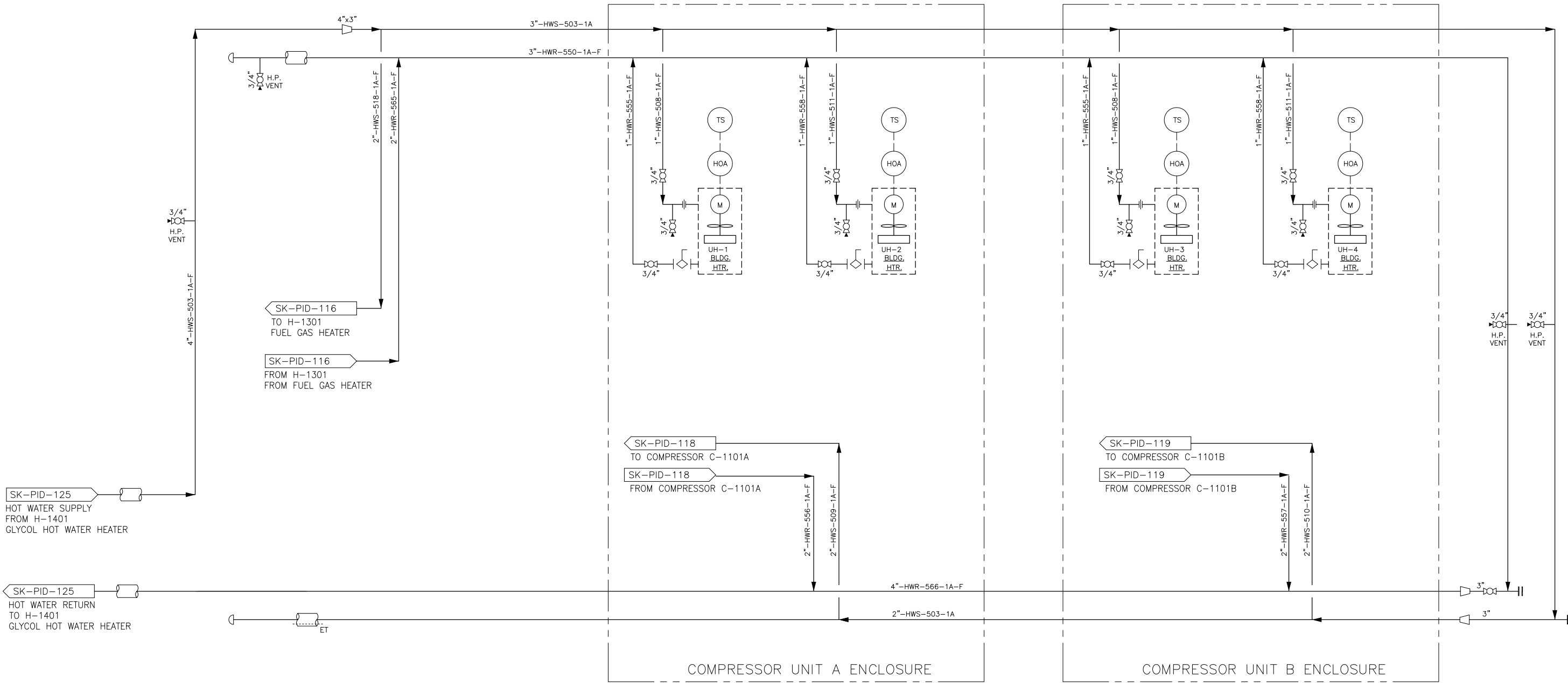
ALTON NATURAL GAS STORAGE

DWG NO. SK-PID-125

REV
C

UH-1 THRU 4
 COMPRESSOR ENCLOSURE HEATERS
 FAN CAP = 1340 CFM, 1/5 HP
 HEATER OUTPUT = 60,200 BTU/HR

STATION
 PROCESS
 CONTROLLER



P:\60310138-Alton Gas Storage\900-CAD-GIS\905 PIDs\SK-PID-126.dwg - Dec 04, 2013 12:12pm

AECOM

2101 WEBSTER STREET SUITE 1800
 OAKLAND, CA 94612-3060

PROJECT NO.
 60310138

REFERENCE DRAWINGS

1. INSULATE ALL HOT WATER LINES.

NOTES

NO.	DATE	REVISION	DES	DWN	CHK	APPR
C	12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP
B	11/15/13	REVISED AND REISSUED FOR REVIEW	MD	MD		
A	11/08/13	ISSUED FOR PRELIMINARY REVIEW	MD	MD		

PROFESSIONAL SEAL

SCALE:	DATE
DESIGNED BY: M DAVIS	11/04/13
DRAWN BY: M DAVIS	11/04/13
CHECKED BY: R SEIBERT	12/06/13
APPROVED BY: S PETTO	12/06/13
APPROVED BY:	

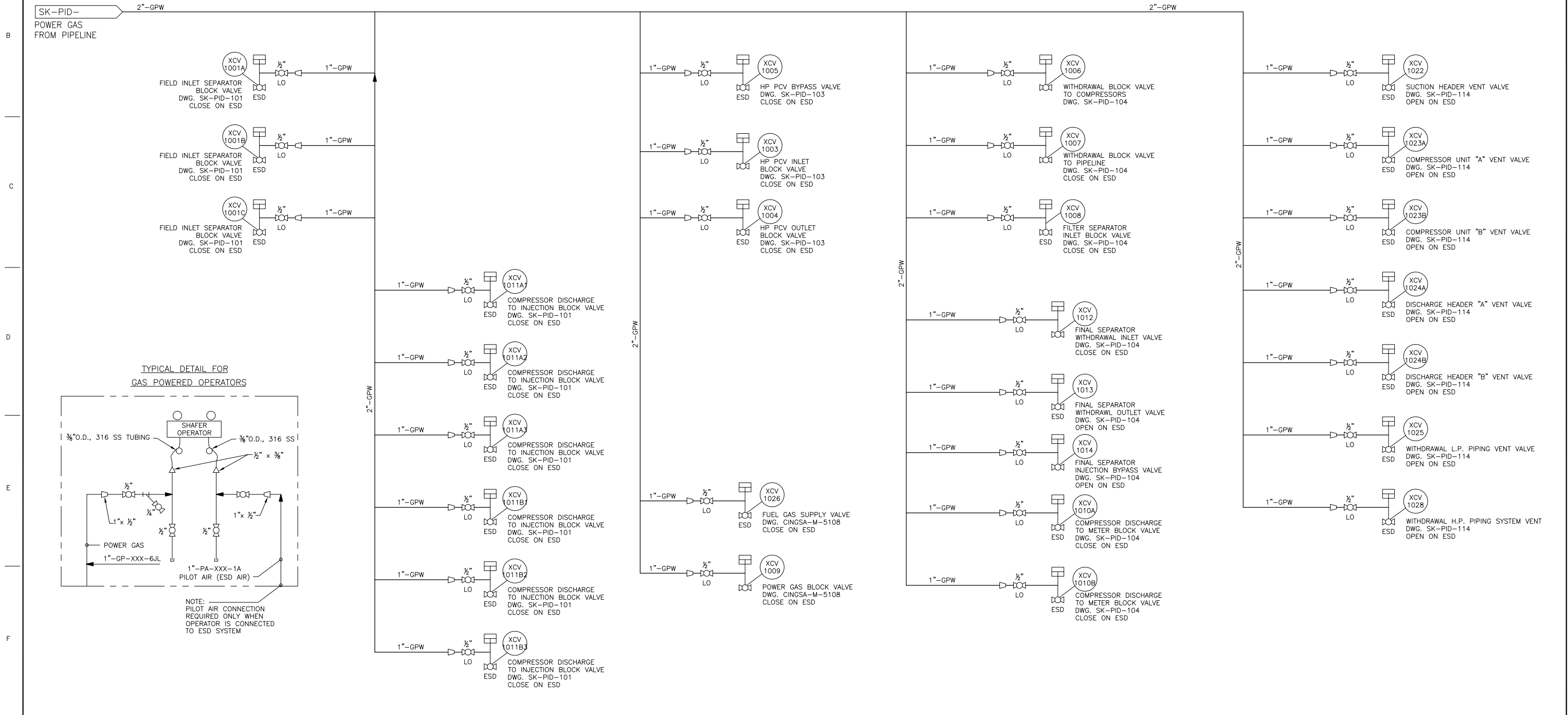
PIPING & INSTRUMENTATION DIAGRAM
 HOT WATER DISTRIBUTION

ALTON NATURAL GAS STORAGE

DWG NO. SK-PID-126

REV
 C

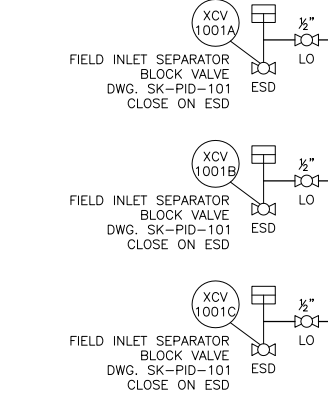
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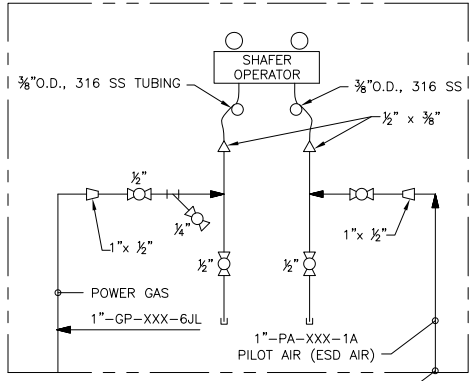
SK-PID-
POWER GAS
FROM PIPELINE

2"-GPW

2"-GPW



TYPICAL DETAIL FOR
GAS POWERED OPERATORS



NOTE:
PILOT AIR CONNECTION
REQUIRED ONLY WHEN
OPERATOR IS CONNECTED
TO ESD SYSTEM

2"-GPW

2"-GPW

2"-GPW

2"-GPW



2101 WEBSTER STREET SUITE 1800
OAKLAND, CA 94612-3060

PROJECT NO.
60310138

REFERENCE DRAWINGS

NOTES

NO.	DATE	REVISION	DES	DWN	CHK	APPR
C	12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP
B	11/15/13	REVISED AND REISSUED FOR REVIEW	MD	MD		
A	11/08/13	ISSUED FOR PRELIMINARY REVIEW	MD	MD		

PROFESSIONAL SEAL

SCALE:	DATE
NONE	
DESIGNED BY	M DAVIS 11/04/13
DRAWN BY	M DAVIS 11/04/13
CHECKED BY	R SEIBERT 12/06/13
APPROVED BY	S PETTO 12/06/13
APPROVED BY	

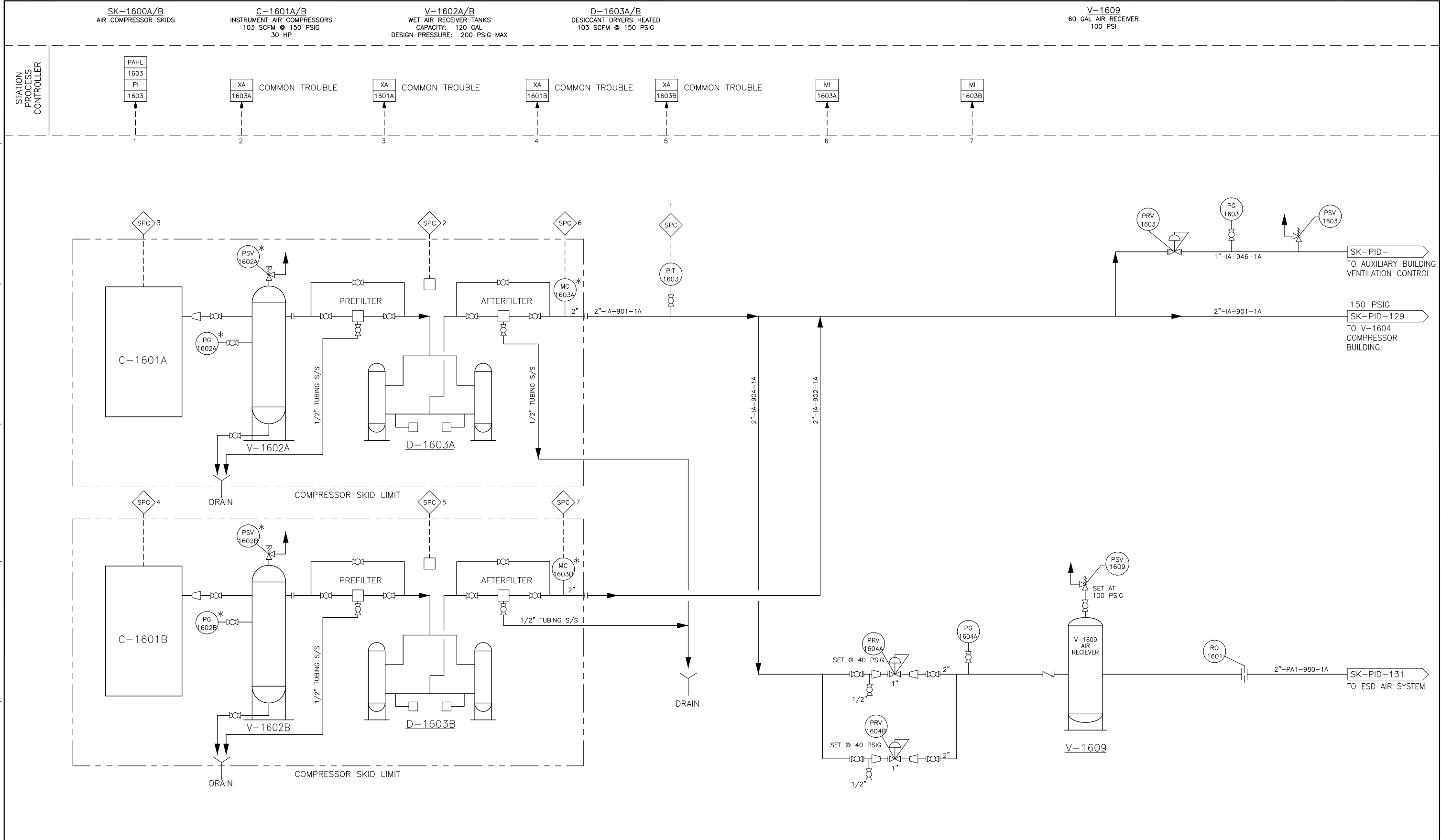
PIPING & INSTRUMENTATION DIAGRAM
POWER GAS

ALTON NATURAL GAS STORAGE

DWG NO. SK-PID-127

REV
C

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AECOM
 2101 WEBSTER STREET SUITE 1800
 OAKLAND, CA 94612-3060

PROJECT NO.
 60310138

NO.	DATE	REVISION	DES	DWN	CHK	APPR
C	12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP
B	11/15/13	REVISED AND REISSUED FOR REVIEW	MD	MD		
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NO.	DATE	REVISION	DES	DWN	CHK	APPR
C	12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP
B	11/15/13	REVISED AND REISSUED FOR REVIEW	MD	MD		
A	11/08/13	ISSUED FOR PRELIMINARY REVIEW	MD	MD		

NO.	DATE	REVISION	DES	DWN	CHK	APPR
C	12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP
B	11/15/13	REVISED AND REISSUED FOR REVIEW	MD	MD		
A	11/08/13	ISSUED FOR PRELIMINARY REVIEW	MD	MD		

SCALE:	DATE:
NONE	11/04/13
DESIGNED BY: M DAVIS	11/04/13
DRAWN BY: M DAVIS	12/06/13
CHECKED BY: R SEIBERT	12/06/13
APPROVED BY: S PETTO	12/06/13

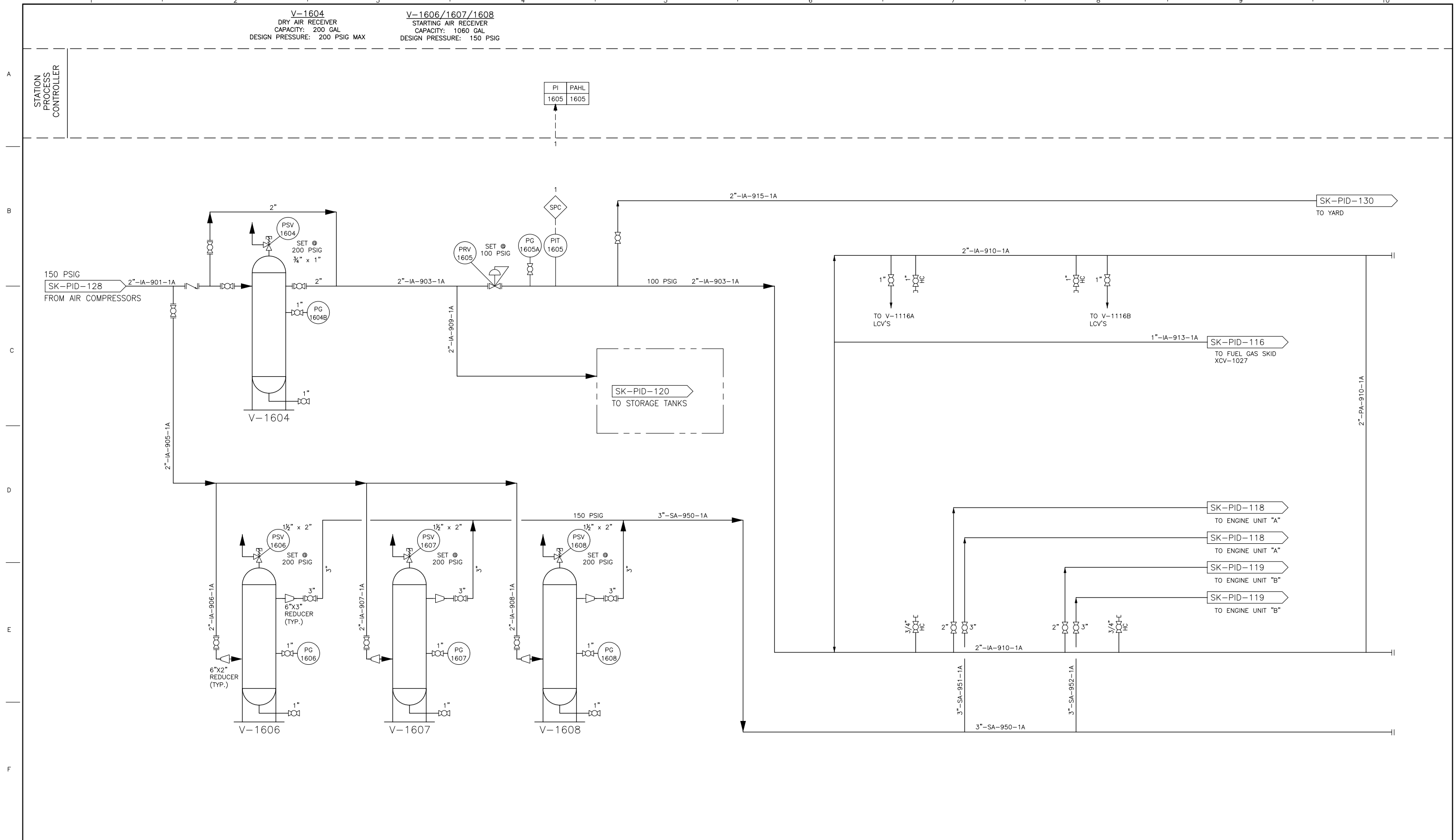
PIPING & INSTRUMENTATION DIAGRAM
INSTRUMENT AIR
AIR COMPRESSORS

ALTON NATURAL GAS STORAGE

DWG NO. SK-PID-128

REV C

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2101 WEBSTER STREET SUITE 1800
OAKLAND, CA 94612-3060

PROJECT NO.
60310138

NO.	DATE	REVISION	DES	DWN	CHK	APPR
C	12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP
B	11/15/13	REVISED AND REISSUED FOR REVIEW	MD	MD		
A	11/08/13	ISSUED FOR PRELIMINARY REVIEW	MD	MD		

NO.	DATE	REVISION	DES	DWN	CHK	APPR

NO.	DATE	REVISION	DES	DWN	CHK	APPR

PROFESSIONAL SEAL

SCALE:	DATE
NONE	
DESIGNED BY: M DAVIS	11/04/13
DRAWN BY: M DAVIS	11/04/13
CHECKED BY: R SEIBERT	12/06/13
APPROVED BY: S PETTO	12/06/13
APPROVED BY:	

PIPING & INSTRUMENTATION DIAGRAM
INSTRUMENT AIR
COMPRESSOR BUILDING

ALTON NATURAL GAS STORAGE

DWG NO. SK-PID-129

REV
C

V-1605
DRY AIR RECEIVER
CAPACITY: 200 GAL
DESIGN PRESSURE: 200 PSIG MAX

STATION
PROCESS
CONTROLLER

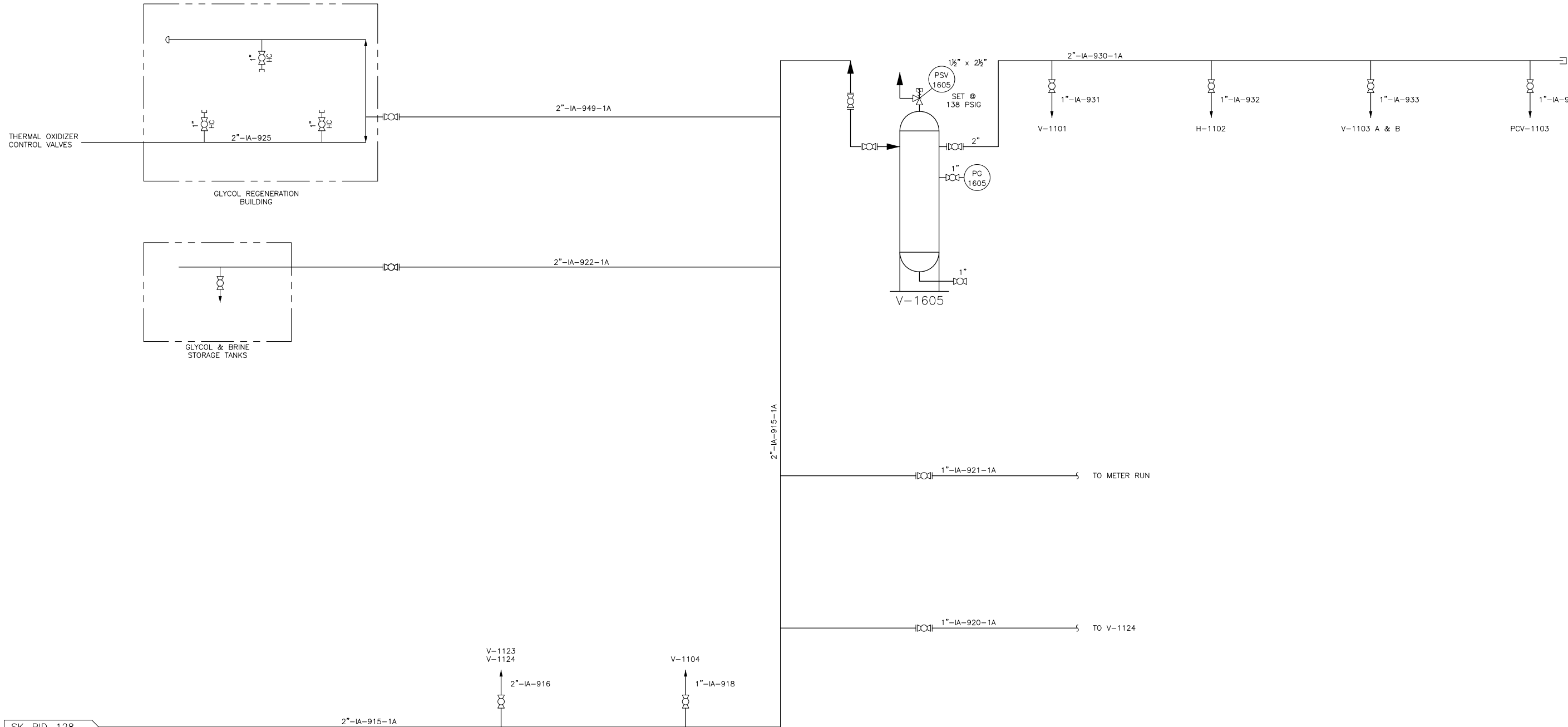
B

C

D

E

F



2101 WEBSTER STREET SUITE 1800
OAKLAND, CA 94612-3060

PROJECT NO.
60310138

REFERENCE DRAWINGS

NOTES

NO.	DATE	REVISION	DES	DWN	CHK	APPR
C	12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP
B	11/15/13	REVISED AND REISSUED FOR REVIEW	MD	MD		
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PROFESSIONAL SEAL

SCALE:	DATE
NONE	
DESIGNED BY: M DAVIS	11/04/13
DRAWN BY: M DAVIS	11/04/13
CHECKED BY: R SEIBERT	12/06/13
APPROVED BY: S PETTO	12/06/13

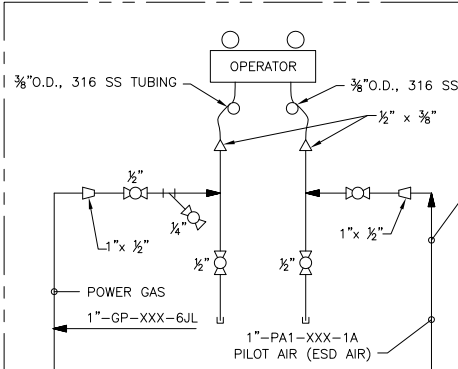
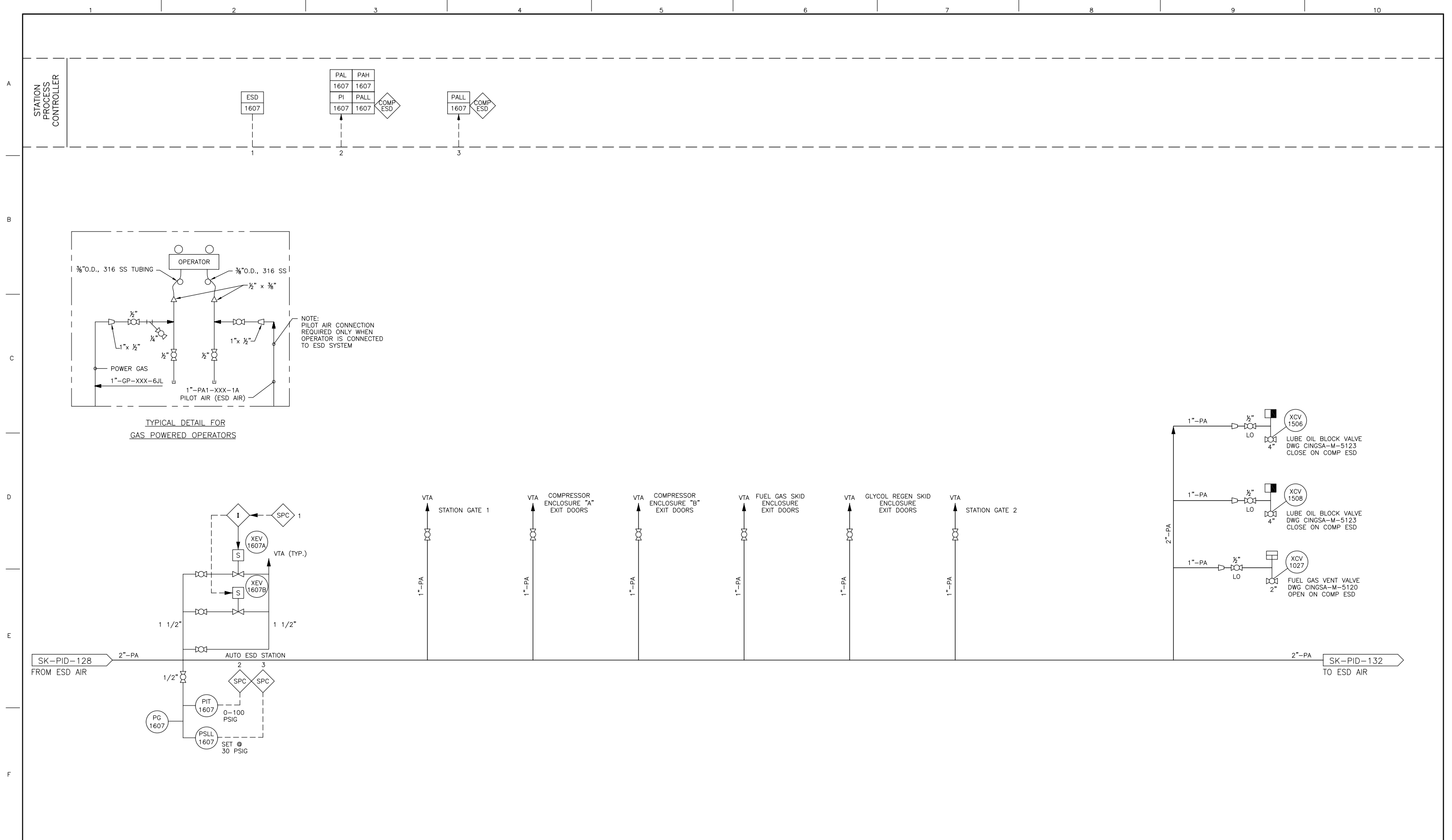
PIPING & INSTRUMENTATION DIAGRAM
INSTRUMENT AIR
YARD

ALTON NATURAL GAS STORAGE

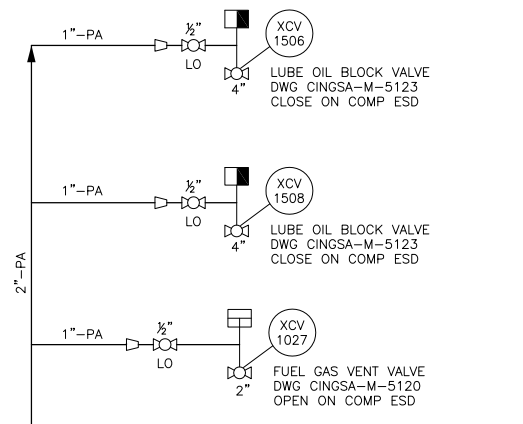
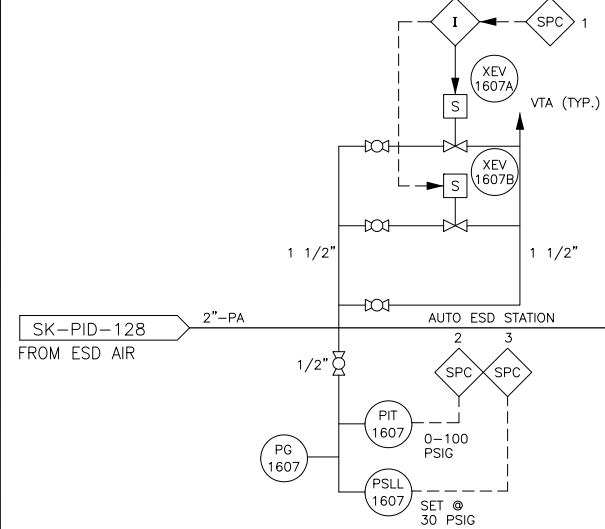
DWG NO. SK-PID-130

REV
C

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TYPICAL DETAIL FOR GAS POWERED OPERATORS



AECOM
2101 WEBSTER STREET SUITE 1800
OAKLAND, CA 94612-3060

PROJECT NO.
60310138

NO.	DATE	REVISION	DES	DWN	CHK	APPR
C	12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP
B	11/15/13	REVISED AND REISSUED FOR REVIEW	MD	MD		
A	11/08/13	ISSUED FOR PRELIMINARY REVIEW	MD	MD		

NO.	DATE	REVISION	DES	DWN	CHK	APPR

NO.	DATE	REVISION	DES	DWN	CHK	APPR

SCALE:	DATE
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DESIGNED BY	11/04/13
DRAWN BY	11/04/13
CHECKED BY	12/06/13
APPROVED BY	12/06/13

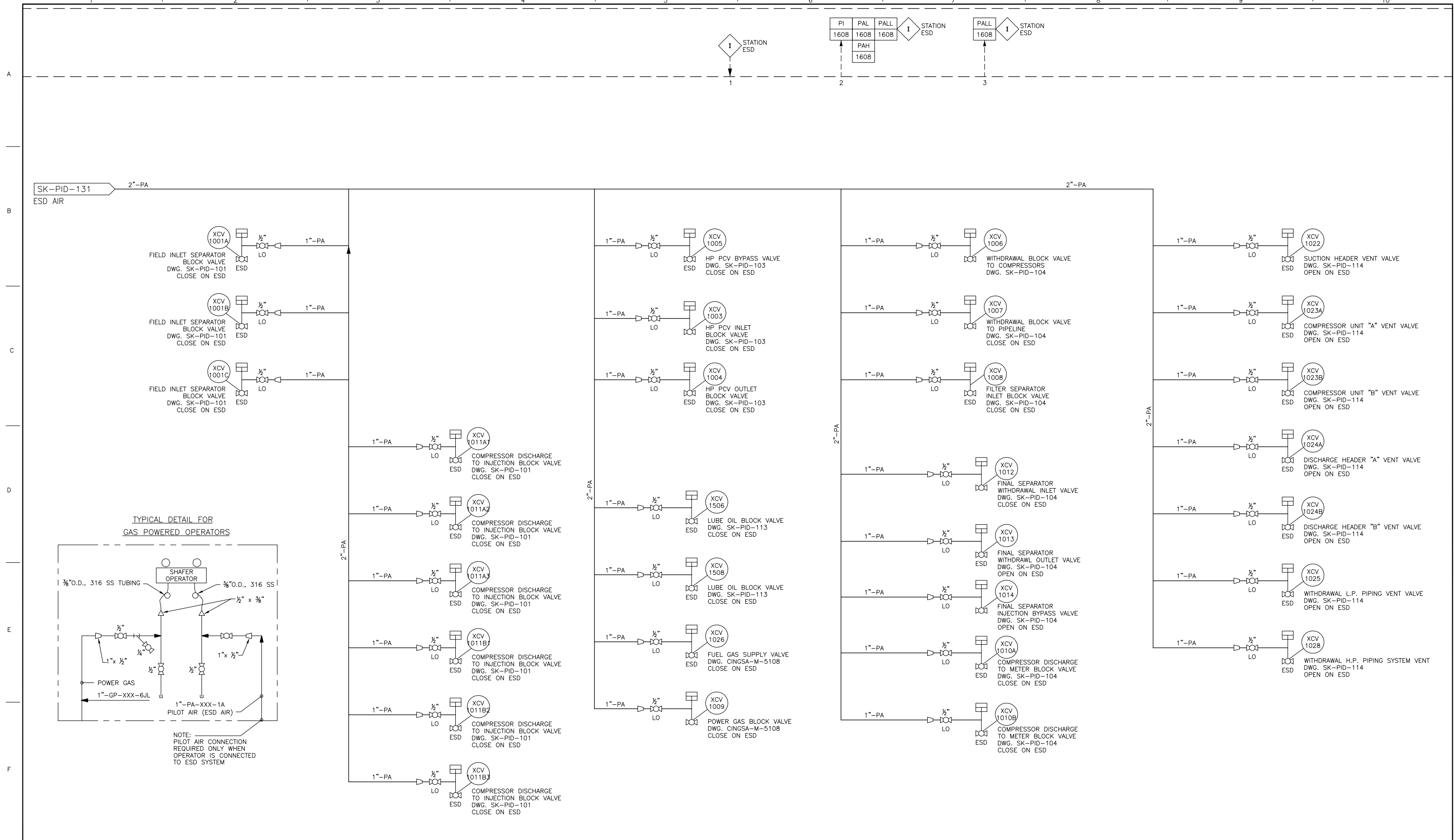
PIPING & INSTRUMENTATION DIAGRAM
ESD/PILOT AIR SYSTEM

ALTON NATURAL GAS STORAGE

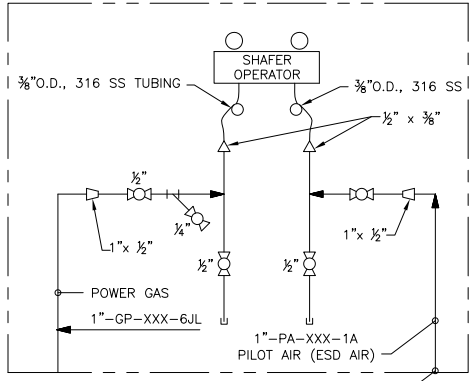
DWG NO. SK-PID-131

REV C

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TYPICAL DETAIL FOR GAS POWERED OPERATORS



NOTE:
PILOT AIR CONNECTION
REQUIRED ONLY WHEN
OPERATOR IS CONNECTED
TO ESD SYSTEM



2101 WEBSTER STREET SUITE 1800
OAKLAND, CA 94612-3000

PROJECT NO.
60310138

REFERENCE DRAWINGS

NOTES

NO.	DATE	REVISION	DES	DWN	CHK	APPR
C	12/09/13	ISSUED FOR COST ESTIMATE	MD	MD	RS	SP
B	11/15/13	REVISED AND REISSUED FOR REVIEW	MD	MD		
A	11/08/13	ISSUED FOR PRELIMINARY REVIEW	MD	MD		

PROFESSIONAL SEAL

SCALE:	DATE
NONE	
DESIGNED BY: M DAVIS	11/04/13
DRAWN BY: M DAVIS	11/04/13
CHECKED BY: R SEIBERT	12/06/13
APPROVED BY: S PETTO	12/06/13
APPROVED BY:	

PIPING & INSTRUMENTATION DIAGRAM
ESD/PILOT AIR SYSTEM

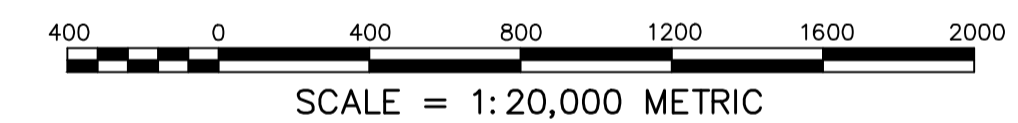
ALTON NATURAL GAS STORAGE

DWG NO. SK-PID-132

REV
C

CAVERN SITE CIVIL WORK

ALTON, COLCHESTER COUNTY, NOVA SCOTIA

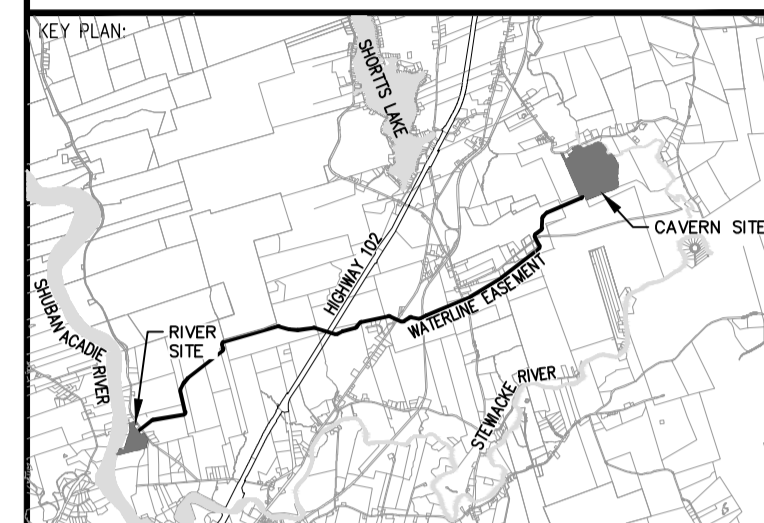


ISSUED FOR NSURB APPLICATION - 06-MAR-2015



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SEAL:



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NO.	DATE	DESCRIPTION
5		
4	2014/05/21	ISSUED FOR CONSTRUCTION
3	2014/03/13	ISSUED FOR REVIEW
2	2014/03/06	ISSUED FOR APPROVAL
1	2014/02/21	ISSUED FOR APPROVAL
0	2013/11/22	ISSUED FOR DISCUSSION

PROJECT NO: 111-26678	DATE: (YYYY/MM/DD) 2013/11/22
ORIGINAL SCALE: HORIZONTAL: 1:20,000 VERTICAL: DESIGNED BY:	IF THIS BAR IS NOT 25mm LONG, ADJUST YOUR PLOTTING SCALE.
DRAWN BY:	
CHECKED BY:	

CLIENT:
ALTON NATURAL GAS STORAGE LIMITED

CLIENT REF. #:
PROJECT:
ALTON NATURAL GAS STORAGE PROJECT
ALTON, NOVA SCOTIA

TITLE:
COVER SHEET

C-200-000

ISSUE:
ISSUED FOR NSURB APPLICATION
DATE OF: 2015/03/06

REV #
4

XREFS: K:\DARTMOUTH\2011\111-26678_ALTA_GAS\DWG\ENCL\REFERENCES\NEW_BASEMAP.DWG

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