



Bower Damberger Rolseth
Engineering Ltd.

DEER CREEK ENERGY LIMITED

Joslyn Phase 2, SAGD Facility
AFE # 002-0003-0002-0005-S1
Design Basis Memorandum
Rev. 3



DEER CREEK
Energy Limited

BDR Project: 33500
Date: March 18, 2005

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JOSLYN PHASE 2, SAGD FACILITY

Design Basis Memorandum

No	Revision	By	Date	Appr.	Date	Client	Date
0	DRAFT	STA	March 16, 2004	WJC	March 17, 2004		
1	Issued for Approval	DJW	March 31, 2004	STA	April 1, 2004		
2	Oct. 2004 Issue	DJW	Oct. 19, 2004	STA	Oct. 19, 2004		
3	March 2005 Issue	STA	March 18, 2005				

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1.0 INTRODUCTION

1.1 Abbreviations and Definitions

1.1.1 The abbreviations and definitions below have been listed in alphabetical order wherever possible.

°C	Degrees Celsius
°F	Degrees Fahrenheit
AEUB	Alberta Energy and Utilities Board
ANSI	American National Standards Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
BDR	Bower Damberger Rolseth Engineering Ltd.
BPD	Barrels per Day
BS&W	Basic Sediment & Water
CFM	Cubic feet per minute
Ckt	Circuit
cP	Centipoise
CSA	Canadian Standards Association
cSt	Centistoke
c/w	Complete with
CWE	Cold Water Equivalent
DAF	Dissolved Air Flotation
DBM	Design Basis Memorandum
DCEL	Deer Creek Energy Limited
EEMAC	Electrical Equipment Manufacturers Association
EPEA	Environmental Protection and Enhancement Act
ESD	Emergency Shutdown Valves
FVNR	Full Voltage Non-Reversing
HMI	Human Machine Interface
Hp	Horsepower
Hz	Hertz (frequency)
IFA	Issued for Approval
IFB	Issued for Bid
IFC	Issued for Construction
IGF	Induced Gas Flotation
IPCIT	Internal Pipeline Construction Inspection Tool
kA	Kilo-amps
kPa	Kilopascal
kVA	Kilo Volt-amps
kV	Kilo-volts
LBV	Line Block Valve
m ³ /day	Cubic meters per day
MAWP	Maximum Allowable Working Pressure
MCC	Motor Control Center
mm	Millimeter
MPa	Megapascal



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m/s	Meters/Second
MSAR	Multiphase Superfine Atomized Residue
MVA	Mega Volt-amps
NACE	National Association of Corrosion Engineers
NGR	Neutral Ground Resistor
PFD	Process Flow Diagram
ph	Phase
PLC	Programmable Logic Controller
psig	Pounds per square inch gauge pressure
Q.C.	Quality Control
RPO	Request for Purchase Order
RSView	Rockwell Software HMI Station
RTU	Remote Transmission Unit
SAGD	Steam Assisted Gravity Drainage
SCADA	Supervisory Control and Data Acquisition system
SCO	Synthetic Crude Oil
SLC	Allen Bradley PLC model
SSNRV	Soft Start Non-Reversing
SSPC	The Society for Protective Coatings
TOC	Total Organic Carbon
UPS	Un-interruptable Power Supply
Vac	Voltage – Alternating Current
Vdc	Voltage – Direct Current
VFD	Variable Frequency (speed) Drive

1.1.2 Where applicable, CSA standard abbreviations will be used for all instrumentation.

1.2 Project Description

Deer Creek Energy Limited (Deer Creek) intends to develop their Joslyn oil sands property as a commercial venture. The design and operation of the facility will be based on a steam assisted gravity drainage (SAGD) reservoir stimulation.

This portion of the project description covers the surface facilities, well pad connections, and surface pipelines for well effluent and steam supply.

The facility will be located adjacent to the reservoir approximately 70 km north of Fort McMurray, Alberta, at LSD: 14-28-95-12 W4M.

The project will be designed to produce 1908 m³/day of bitumen and recycle 95% of the produced water for steam re-injection. Deer Creek is designing to a 2.5:1 steam to oil ratio. The total dry steam production design is 4770 m³/day (CWE).

The main battery will consist of the oil treating train, water de-oiling process, water purification (evaporation) process, and main steam generation boilers.

Steam will be distributed to the well pads via a surface pipeline network. The same right-of-ways will be used for the well production fluid, fuel gas lines, and power distribution.

Well pads will consist of three (3) to five (5) new well pairs and the tie in of the well pair completed for Phase 1. Distribution headers for steam and manifolds, production and casing gas will be run to the wellheads. Measurement equipment for well testing will be provided at the well pads.

Provision will be made at the main facility and at the well pads to expand the production, gathering, and steam distribution system. The pipe racks will be designed to allow room for additional lines in the right-of-way spacing. Phase 1 equipment will be also utilized where possible and cost effective.

1.3 Project Objectives

To provide a well designed SAGD facility:

- to enable Deer Creek to recover and ship the bitumen from the Joslyn field;
- to ensure the water recovery process is efficient and durable;
- to meet or exceed all environmental objectives during construction and operation;
- to meet the schedule for Deer Creek;
- to meet or improve on the capital and operating cost objectives for Deer Creek.

1.4 Operations Criteria

The plant will operate on a continuous basis. Provision will be made for duplicate equipment on critical processes, or spare parts will be stocked for quick turnaround.

Oil production storage will be provided by two (2) 1590 m³ (10,000 bbl) oil storage tanks and one (1) 1590 m³ off-specification oil tank. All tanks will be manifolded to permit use of alternate tanks. The plant SCO (synthetic crude oil) storage will be in a single 1590 m³ tank. Tanks will provide approximately 3000 m³ of net storage capacity.

Evaporative water treating will use two (2) 60% trains. This will allow for clean-up of process internals while allowing the plant to operate at reduced capacity.

Produced water will be stored in several tanks in the facility. A 1590 m³ (10,000 bbl) surge tank will store water level controlled from the process, backwash water from the de-oiling train, and water collected from gas scrubbers in the facility.

A second 1272 m³ (8,000 bbl) skim tank will run at a fixed level to provide residence time to remove oil via gravity separation.

Water from the de-oiled water will be stored in a second 10,000 bbl tank, and boiler feed water will be stored in a third 10,000 bbl tank.

The steam system will have twin water tube boilers each sized at 50% capacity based on 4770 m³/day (CWE) total dry steam.

The produced fluids will be pipelined to site in an above-ground insulated gathering system. SCO injection at roughly 25% of bitumen production (80:20 bitumen:SCO ratio) will occur at the plant gate downstream of the group separator, and an additional 30% downstream of the free water knockout (65:35 bitumen:SCO). SCO will combine with the production flow through static mixers located upstream of the vessels.

Sales oil may initially be trucked; however, a pipeline is projected to be in place within one (1) year of start-up. The capability will be in place for the sales oil to be blended with SCO to meet the pipeline density and viscosity specifications. This will be done on site, downstream of the LACT feed pumps.

1.5 Oil Process

As noted above, all wellhead fluids will be pipelined to the main facility in an above-grade insulated gathering system. In addition, gas pressure build-up in the well annulus will be gathered at each well pad. The gas/oil ratio (G.O.R.) of the production is low; hence, annulus gas will be gathered and compressed. The gas will be metered at the pads and recombined with the group emulsion to the main facility.

Emulsion from each production well can be directed to a test header which flows to a two (2) phase test separator located in the well pad facility. The test separators enable gas and liquid production metering of individual wells.

The field emulsion will flow through an inlet group separator. The group separator reduces surging from the field production and removes the bulk of the produced gas. Downstream of the group separator, SCO diluent will be mixed with the group emulsion. The blend will flow to a pair of inlet free water knockouts (FWKOs). SCO will be added to improve the specific gravity of the oil to aid in separation from the water.

Bitumen and water will be separated in the free water knockout vessels. Emulsion will be level controlled to the treater and water will be cooled in heat exchangers and level controlled to the de-oiling system.

Gas from the FWKO will be gathered and cooled for use in the plant fuel supply. Any condensed oily water and condensate from the gas will be dumped to the water surge tank.

Emulsion from the FWKO vessel consisting of oil, some gas, and water will flow to the horizontal treater. Here additional SCO will be injected and mixed into the emulsion stream to cool the stream and improve the specific gravity ratio of the dil-bit and water. Vessel internals and residence time will remove the remaining water and impurities. Clean oil will be cooled in a heat exchanger and flow to the production tank and overflow to the sales tank.

If the oil is off specification, some or all of the main production can be diverted to the flash treater for final clean-up.

SCO purchased by Deer Creek will be blended with the sales oil to meet the pipeline specifications for density and viscosity. Sales oil will then be pumped via a LACT feed unit to an existing pipeline terminal. Note that the LACT unit is not included in this scope, but the feed pumps to the pipeline inlet will be provided with the main facility.

Gas overheads from the treater will be cooled, separated, and pressure controlled into the fuel system. A second pressure regulator will pressure control the treater gas to the flare header to prevent overpressuring the treater. All condensed liquids will be sent into the produced water system.

Off-specification or recycle treater oil can be diverted to a third storage tank. This oil will be transferred back through the treater train using recycle pumps. All tanks will be equipped with a bottom recycle system to constantly remove a small amount of fluid from each tank on a daily basis. This will prevent a buildup of BS&W in the bottom of the sales tanks. This high BS&W fluid will be processed in the recycle treating train.

Tank blanket gas will be provided from the fuel gas system. Excess tank vapours from the production will be boosted into the fuel gas header via a VRU compressor.

Slop oil from the production system will be recycled through a separate (recycle) treating train. This will be sized to handle the transfer rate from a dedicated transfer pump, allowing difficult emulsions to be processed without upsetting the main treating train.

1.6 Water De-oiling

Condensed steam from the reservoir will be separated out in the oil treating train as produced water.

The water will then be level controlled, after cooling, to a surge tank for de-oiling. Oil content in the water is anticipated to be below 2000 PPM from the oil process.

Process water will flow through a series of heat exchangers to be cooled to 85°C for the de-oiling process. The cooled water will flow to a 1590 m³ (10,000 bbl) surge tank.

Residence time and internals in the surge tank will allow some of the oil to rise to the surface. A skim system in the tank will allow the recovered oil to be transferred to the slop tank for processing in the secondary (recycle) treating train.

From the surge tank, water will be pumped to a dedicated skim tank. Capacity of the tank will be 1272 m³ (8000 bbl). The tank will be designed as a vortex tank, ensuring a five hour residence time in the tank to separate the bulk of the remaining oil from the water.

Tank static head pressure will be used to transfer the water through an induced gas flotation cell (IGF). The IGF will use a dissolved air flotation (DAF) pump to introduce a concentrated stream of gas bubbles into a column where the gas will help coalesce the emulsified oil to the surface.

Oil from the IGF will be skimmed from the vessel and pumped to the slop tank.

Water leaving the IGF will contain less than 20 ppm oil in water.

Final clean-up of the water to less than 5 ppm oil in water will be completed using dual walnut shell filters. Water will be pumped from the IGF through the filters. Dual filters will be used to provide 100% spare capacity, allowing one unit to be operational while the other is being backwashed or on stand-by.

De-oiled water from the walnut shell filters, ready for the purification train, will be held in a 1590 m³ (10,000 bbl) storage tank to provide surge capacity in the system.

1.7 Water Treatment

The water treatment train will remove hardness, silica, insoluble oil and grease, total organic carbon, and dissolved solids from the water. The system to be used by Deer Creek is a vapor compression evaporator. De-oiled wastewater will enter a feed tank where the pH is adjusted. The wastewater will be pumped through a heat exchanger to raise its temperature to the boiling point. It then will flow to a deaerator, which removes non-condensable gases such as carbon dioxide and oxygen. The hot deaerated feed then enters the evaporator sump, where it combines with a recirculating brine slurry. The slurry is pumped to the top of a bundle of two-inch heat transfer tubes, where it flows through liquid distributors to ensure a smooth, even flow of brine down each tube. As the brine flows down the tubes, a small portion evaporates and the rest falls into the sump to be recirculated.

The vapor travels down the tubes with the brine and is drawn up through mist eliminators on its way to the vapor compressor. Compressed vapor flows to the outside of the heat transfer tubes, where its latent heat is given up to the cooler brine slurry falling inside. As the vapor gives up heat, it condenses as distilled water. The distillate is pumped back through the heat exchanger, where it gives up sensible heat to the incoming wastewater. A small amount of the brine slurry is continuously released from the evaporator to control density.

Typically, 95 – 98% of the wastewater feed is converted to distillate (<10 ppm total non-volatile dissolved solids) for reuse in the SAGD process.

Distillate is stored in the 1590 m³ boiler feedwater tank.

1.8 Steam Generation

Clean boiler feed water will be boosted to an intermediate pressure and flow through an exchanger to recover process heat from the produced water prior to entering the steam boilers. After heat recovery, the BFW is pumped up to steam generation pressure. Pressure to the boilers will be provided by booster pumps feeding main boiler feedwater pumps. The boilers will then heat the water to the saturation temperature and finally boiled to steam. The design quality is 99% saturated steam.

The plant will use water tube boilers to generate the process steam. The boilers will produce steam at 4826 kPa (700 psig) for distribution to the well pads.

A small blowdown volume from the boilers will be returned to the de-oiled water tank. The liquid will be pressure regulated to a flash vessel. Steam vapour will be utilized in the plant utility steam system. The remaining liquid is level controlled through a heat exchanger to the de-oiled water tank and recycled. The condensate from the utility steam system is also returned to the de-oiled water tank.

The boiler feedwater system will consist of charge pumps and main boiler feed pumps. The charge pumps will transfer water from the storage tanks through the produced water heat exchangers. The pumps will provide sufficient pressure to maintain net positive suction to the main pumps at the elevated temperature.

The main pumps will supply water to the boilers at 5500 kPag (800 psig). Flow to the boilers is regulated by a control valve at the boiler. Excess volumes from the pumps will be recycled back to the boiler feedwater tank. To avoid temperature buildup in the feedwater tank, heat exchange will be necessary on the return flow.

The boilers will be twin 50% capacity units designed to produce 100,000 kg/hr of saturated steam each.

Boilers will have fuel systems designed to run on gas or liquid fuels. Metallurgy, fin spacing, and provision for soot handling will be incorporated into the boilers to enable the use of a liquid fuel system at a later date.

Boiler turndown capacity is roughly ten to one (10:1). With twin boilers, this provides a twenty to one (20:1) facility turndown, which provides plant capacity from a single well operation on up to full flow design.



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1.9 Water Disposal

The concentrated waste blowdown from the evaporators is collected in an agitated crystallizer feed tank and is transferred to the crystallizer recirculation line by the crystallizer feed pump. The concentrated brine feed is mixed with the recirculating brine slurry and is pumped through the shell and tube heater. The brine is heated a few degrees (sensible heating) as it passes through the heat exchanger and when it re-enters the vapor body, it flashes – effectively converting the sensible heat to latent heat in the form of vapor.

The vapors produced are collected in the sump of the main tower, pass through an entrainment separator, and enter the suction side of the vapor compressors. The vapor is pressurized and heated by the compressors and transferred to the shell side of the shell and tube heater where the vapor condenses, providing the thermal driving force for evaporation. The condensate is collected in the condensate tank and is returned to the de-oiled water tank.

In the crystallizer system, crystals are continuously formed within the brine slurry held up in the bottom of the main tower prior to entering the recirculation pump. Following the heating and flashing of the brine, water is removed. It becomes supersaturated and the salts precipitate from solution. These crystals are continuously removed by a centrifuge and the mother liquor is returned to the crystallizer recirculation pump suction. The solids are discharged from the system as a salt cake; these must be hauled away to a certified landfill location.



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2.0 DESIGN BASIS

2.1 Site Conditions

LSD	14-28-95-12 W4M
Max. Ambient Temp.	32°C
Min. Ambient Temp.	-40°C
Altitude	338 m.a.s.l.
Rainfall	1125 mm per year
Max. Wind Velocity	90 km/hr

2.2 Fluid Parameters

Inlet Bitumen	1908 m ³ /day
Inlet Water	4531 m ³ /day
Gas Oil Ratio	5 m ³ /m ³ oil
Inlet Oil API	8.3
Inlet Water S.G.	1.00
Inlet Gas S.G.	1.00
H ₂ S in Gas	3%
Inlet Sand	0.3% vol. oil
Design Operating Inlet Pressure	950 kPag (at main plant)
Design Operating Inlet Temperature	165°C
SCO Usage (Treating)	1028 m ³ /day
Source Water Usage	457 m ³ /day
Sales Oil Quality	<0.5% BS&W
Treater/FWKO Water Quality	<2000 ppm oil in water
Steam Oil Ratio	2.5
Steam Generator Discharge Quality	99%
Inject Steam Quality	>95%
Steam Generator Inlet Hardness	<0.2 ppm
Steam Generator Inlet TDS	<3.0 ppm
Steam Generator Inlet PH	8.5 to 9.5
Steam Generator Inlet Silica	<0.3 ppm
Steam Generator Non-Volatile TOC	<0.6 ppm
Steam Separator Operating Pressure	4826 kPag
Steam Injection Pressure at Wellhead	1379 kPag to 1900 kPag
Sour Fuel Gas Pressure	310 kPag
Sour Fuel Gas Temperature	60°C
Sweet Fuel Gas Pressure to Plant	9600 kPag
Sweet Fuel Gas Pressure to Boiler	340 kPag
Sweet Fuel Gas Temperature to Boiler	50°C



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2.3 Mechanical

2.3.1 Pipeline

	Pipeline Emulsion	Steam
MAWP	4378 kPa	7549 kPa
Design Temperature	204°C	316°C
Design Velocity	1 to 3 m/s minimum, 15 m/s maximum	
Material	A106B	A106B
Yield Strength	35,000 psi	35,000 psi
Coating	None	None
Insulation	TBA	TBA
Outer Coating	TBA	TBA
Wall Thickness	See Appendix IX	See Appendix IX
Stress Levels	See Appendix IX	See Appendix IX

2.3.2 Main Facility

	Bitumen	Water	Produced Gas	Steam	Glycol Utility
Design Pressure (kPa)	1379	1379	1379	7549	1379
Design Temperature (°C)	204	204	204	316	204
Material Pipe	A106B	A106B	A106B	A106B	A106B
Material Flanges	SA105	SA105	SA105	SA105	SA105
Material Fittings	A234 Gr. WPB	A234 Gr. WPB	A234 Gr. WPB	A234 Gr. WPB	A234 Gr. WPB
Studs & Nuts	B7M 2HM	B7M 2HM	B7M 2HM	B7M 2HM	B7M 2HM
Gaskets	Graphoil API 601	Graphoil API 601	Graphoil API 601	Graphoil API 601	Graphoil API 601

2.3.3 Wellsite Facilities

Wellhead Shut Off Valve	-	API Class 3,000
Fluid Meters	-	Differential Pressure, Vortex, & Coriolis
Steam & Gas Meters	-	Differential Pressure & Vortex
Chemical Pumps	-	Williams/Union/Milton Roy
Fluid Circulating Pump	-	TBA
	-	300 ANSI



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2.3.4 Valves and Piping (Facilities)

2.3.4.1 The types of valves to be used will be ball, check, globe, plug, butterfly, and gate valves. The valves will be suitable for Nace MR0175 sour service.

2.3.4.2 Piping will be designed to the maximum flange rating pressure at the specified temperature.

2.3.4.3 All stud bolts and nuts will be B7M and 2HM.

2.3.4.4 Refer to the Appendix for the piping and valve specifications.

2.3.5 Valves and Piping (Wellheads)

2.3.5.1 Types of valves will be ball, check, globe, and gate valves. Valves will be suitable for Nace MR0175 service.

2.3.5.2 Piping will be designed to CSA Z662 low temperature sour specifications. Wellhead facilities for produced emulsion and casing gas will be built to 300 ANSI class pressure design to achieve 4378 kPa working pressure at 204°C. The steam pipelines will be built to 600 ANSI class pressure design to achieve 7550 kPa working pressure at 316°C.

2.3.6 Painting and Internal Coating System

2.3.6.1 Internal coating is to be used in water service in storage tanks and downstream of storage tanks.

2.3.6.2 Internal coating to be Devoe, Enviroline, or equal. Coating will be completed to Deer Creek coating specifications.

2.3.6.3 External painting will be as per Deer Creek specifications.

2.3.7 Skid Design

2.3.7.1 All equipment, where possible, will be mounted on structural skids suitable for transport to site. Skids will be pre-wired where possible. Skid edge connections will be laid out to facilitate tie-ins to the area piping and electrical.

2.3.7.2 Larger equipment may require assembly at site, but will be pre-built to the extent allowed by trucking and weight limitations.

2.3.8 Rack Design

- 2.3.8.1 The interconnecting pipe rack will be built in modular sections mounted on a structural frame. Piping will be mounted at roughly three (3) meters above grade, with inter-connecting spools to the skids dropping down from the rack as required.
- 2.3.8.2 The rack will have a combination of insulated and utilidor enclosed piping. Critical lines will be heat traced to prevent freezing in cold weather.
- 2.3.8.3 Electrical cables will be supported on cable trays mounted with the rack piping.

2.4 Electrical

2.4.1 Voltages

- 2.4.1.1 All facilities will be designed utilizing equipment at the following voltage levels:
- 4160V, 3 phase, 60 Hz for on-site distribution from main switchgear (SWGR-100) to utilization MCCs in the main facility.
 - 4160V, 3 phase, 60 Hz for off-site distribution to well pads within a specified distance of the main facility.
 - 4160V, 3 phase, 60 Hz for motors sized 300 – 6000 hp.
 - 480V, 3 phase, 60 Hz for motors sized up to 300 hp.
 - 120/208V, 3 phase, 60 Hz for lighting and utilities
 - 120V, 1 phase, 60 Hz for motor control.
 - 125Vdc for 4160V switchgear control.
 - 24Vdc for process control and shutdown instrumentation.
 - 24/12Vdc for communications including uplinks and radio/Scada equipment.

2.4.2 Project Load

- 2.4.2.1 A detailed load list and load summary for the project is included as an appendix to this DBM. The estimated maximum operating load including well pads is 7,700 kW, not including load growth during detailed design. Assuming a load growth factor (LGF) of 1.10 – 1.25, the design operating load for the project is 8,700 kW.

2.4.3 Power Supply

2.4.3.1 The overall single line diagram for the project, drawing D-33500-E-04-301 Rev. 2, is attached as an appendix to this DBM.

2.4.3.2 ATCO Utilities will supply power to the main facility from a 25kV distribution system, to be fed from a new substation presently under construction. ATCO will supply a metering tank at the lease edge and an underground 25 kV feeder to ATCO owned main transformers T-100 and T-001. These transformers, rated 7.5/10 MVA ONAN/ONAF and 1500 kVA respectively, will step down the 25kV utility voltage for utilization by the project. All ATCO facilities and equipment will be owned, operated, and maintained by ATCO.

2.4.3.3 Power supply to well pads will be via ATCO supplied and installed overhead 25 kV, 3ph, power lines. Power lines will terminate at each site to a 750 or 1000 (as required by pad loading) kVA 25kV/480V step down transformer c/w metering supplied and installed by ATCO.

2.4.4 Emergency Generation

2.4.4.1 Standby diesel power generation will be installed at the main facility complete with auto start capability to allow for emergency operation during utility outages.

2.4.4.2 The emergency generation will be sized per minimum safe requirements to prevent equipment damage during an extended power outage. Emergency power will supply all critical and emergency loads including the plant control system, emergency lighting, instrument air systems, safety showers (including required pumps), freeze protection, and glycol heating circulation pumps.

2.4.4.3 The emergency generator(s) will not run synchronized with the utility. An auto transfer switch will be provided however, to allow a make before break transition back to utility power. When transferring back to utility power, the transfer switch will ensure the generators are paralleled with the utility for no more than 1 second.

2.4.5 Main Facility Distribution

2.4.5.1 Main transformer T-001 will feed 480Vac, facility MCC-1 which in turn will feed area 480Vac loads and both emergency MCC (E1, E2) lineups via an auto transfer switch.

2.4.5.2 Main transformer T-100 will feed a line up of 4160V switchgear (SWGR-100), which in turn will supply medium voltage boiler feedwater pump motors, evaporator recirc pumps, evaporator compressors, and 4160/480V utilization transformers for MCC-2 480V loads at the facility.

2.4.5.3 The 4160V power system will be high resistance grounded.

2.4.5.4 4160V main breaker CB-101 will contain an electronic feeder protection relay for metering of incoming power usage. Available information from the relay will be instantaneous and summarized values for:

- a) Line amps (per phase)
- b) Line volts (individual line-line combinations)
- c) Frequency (Hz)
- d) kW
- e) kVA
- f) kVARs
- g) Power factor

2.4.5.5 The feeder protection relay will also provide overcurrent, over/undervoltage, underfrequency, ground fault and other protection determined during the detailed design phase of the project. The 4160V main breaker will feed a common distribution bus, all housed in a line up of metal clad switchgear. This bus will supply 4160V boiler feed pump and evaporator compressor motor starters and individual feeder breakers for the following:

- a) 4160V/480V main facility utilization transformers

2.4.5.6 A summary of 4160V/480V utilization transformers for the project is shown below:

Tag	Description	Rating
T-002	MCC-2 Transformer	1500 kVA

2.4.5.7 The feeder breakers for the MCC-2 utilization transformer will be complete with electronic protection relay, metering, and all instrumentation required to protect the feeders and transformer. The transformer will be rated 4160V-480V, 3 ph, 60 Hz, and will feed a specific 480V motor control center (MCC-2) for its area. Transformers, switchgear, and MCCs will be sized to allow for a minimum of 25% expansion of the connected load.

2.4.6 480V Motor Control Centers (MCCs)

2.4.6.1 For the project the following MCC lineups will be provided:

Tag	Voltage	Location	Description
MCC-1	480V	MCC-1 Bldg	Main Facility – Water/Utilities Area
MCC-1E	480V	MCC-1 Bldg	Main Facility – Emergency Bus
MCC-2	480V	MCC-2 Bldg	Main Facility – Oil/Steam Area
MCC-2E	480V	MCC-2 Bldg	Main Facility – MCC-2 Emergency Bus
MCC-WP1	480V	Well Pad 1 MCC Bldg	Well Pad 1 – All Loads
MCC-WP2	480V	Well Pad 2 MCC Bldg	Well Pad 2 – All Loads
MCC-WP3	480V	Well Pad 3 MCC Bldg	Well Pad 3 – All Loads
MCC-WP4	480V	Well Pad 4 MCC Bldg	Well Pad 4 – All Loads

- 2.4.6.2 All MCCs will be housed in environmentally controlled buildings located strategically to optimize cost savings on both cable and tray. Locations will be selected to allow good access by operations personnel while addressing area classification, safety and maintenance concerns.
- 2.4.6.3 Main facility auxiliary MCCs will be fed from a 4160-480V, 3ph, 60 Hz step-down transformer mounted on the same skid as the MCC building. The neutral of the 480V transformer winding will be high resistance grounded through a 2A neutral grounding resistor.
- 2.4.6.4 Skid packages and buildings for the MCCs will be pre-fabricated, wired, and shipped to the field as a complete unit set up for field termination of the following:
- a) All load cabling.
 - b) All area control and communication cabling.
 - c) Emergency bus feeders (for main facility MCC buildings only).
- 2.4.6.5 Each 480V MCC will be complete with a fixed main breaker sized to protect the bus and supply feeder.
- 2.4.6.6 The main breaker or metering compartment of each 480V MCC will contain a digital meter to monitor volts, amps, watts, vars, power factor and total harmonic distortion.
- 2.4.6.7 MCC main breaker sections will include indication and alarm contacts for over/under voltage, ground fault and underfrequency, if required. Alarm contacts will be wired back to the main facility control system where logic will control any load shedding that may be required. Load shedding requirements, if any, will be determined during detailed design.
- 2.4.6.8 Ground fault indication will be provided for each 480V MCC. The ground fault relay will provide form C contacts for indication/alarm. Ground faults will alarm only and not trip.
- 2.4.6.9 Each MCC lineup will contain the following equipment:
- a) All required starters/VFDs for the areas motor loads.
 - b) Lighting panel(s) fed from a 480-120/208V 3ph 60 Hz transformer integral to the MCC lineup for sizes up to 45 kVA and remote to the lineup for greater than 45 kVA.

- c) A contactor panel for all outside/area lighting controlled by photocell. Photocell control for the facility will be via a single cell located at the main control room with contacts wired to the control system for control of individual area panels. Contactors for any utility loads (chemical pumps, etc.) will also be housed in this panel/MCC section.
- d) Lighting panel(s) and controls for area heat trace, fed from a 480-120/208V 3ph 60 Hz transformer integral to the MCC lineup.
- e) A dedicated section, with suitable barriers, containing the control system I/O equipment required for the MCC lineup.

2.4.6.10 The packaged MCC skid/enclosure will contain a number of utility outlets and alarm indication items (beacons/horns) as determined during the project Hazop.

2.4.7 Un-Interruptible Power Supply (UPS) Systems

2.4.7.1 A 125Vdc rectifier/charger system with dedicated batteries will be provided to supply control power to 4160V switchgear SWGR-100.

2.4.7.2 Control power for the main facility will be supplied from 24Vdc rectifier/charger systems located throughout the facility. The batteries for each 24Vdc system will be sized for a minimum of 24 hours backup for essential DC loads. The rectifier/ charger systems will have 208Vac, 3 phase input obtained from the emergency bus.

2.4.7.3 All 24Vdc systems will be negative grounded, i.e. non-floating.

2.4.7.4 Power for the main facility's computer, radio, and communication systems will be supplied from 120Vac UPSes Each 120Vac UPS will consist of a battery charger, dedicated batteries, and an inverter. The power supply for each 120Vac UPS will be from the emergency bus. Each inverter will supply power to the load through a static transfer switch, which will provide undetected transfer to the AC line should the inverter fail. The batteries supplied with each system will be sized to maintain essential 120Vac load for a minimum of 4 hours.

2.4.7.5 Backup times mentioned above are based on having the main facility's emergency generation available during utility power outages. The project Hazop will determine if different backup times are required, in which case charger and battery sizing will change.



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2.4.7.6 Following is a summary of the UPS systems that will be installed:

Location of Service	Size and Voltage	Service
MCC-1 Building	75 A, 125 Vdc	4160V SWGR-100
MCC-1 Building	200 A, 24 Vdc	Control System
MCC-1 Building	2 kVA, 120 Vac	Computer, Radio, Communications
MCC-2 Building	200 A, 24 Vdc	Control System
Office Building	5 kVA, 120 Vac	Computer, Radio, Communications
Each Well Pad	75A, 24 Vdc	Control & Communications

2.4.8 Lighting

2.4.8.1 Lighting for the facilities will be provided to allow for industry standard lighting levels around and in all work areas. The following lighting levels will be provided as a minimum:

Area	Lux	Area	Lux
Building Entrances	50	Stairs & Platforms	50
Process & Utility Working	60	Parking	20
Catwalk & General Walkways	20	General Yard	20
Truck Load/Unload	50	Warehouse/Garage	40
Office/Control Room	75		

2.4.8.2 Indoor Lighting

a) Indoor lighting will be provided as follows:

- i) Office/Living Quarters: Fluorescent Fixtures
- ii) Warehouse/Garage: High Pressure Sodium with fluorescent fixtures in office/desk areas.
- iii) MCC/Control Room/Generator areas: Fluorescent Fixtures
- iv) Process Areas: High Pressure Sodium
- v) Utilities Areas: High Pressure Sodium
- vi) Battery Backed lighting will be provided at all exits for all areas.

2.4.8.3 Outdoor Lighting

a) All exit doors, platforms, walkways, and ladders will be provided with high pressure sodium lighting to a level as specified in the chart above. Yard and outside area lighting will be provided through an interconnected series of floodlight pole systems. Each pole will consist of a hinged pole, winch, fixture spreader, and 400 watt high pressure sodium fixtures.

- b) All exterior lighting will be photocell controlled. This will consist of a master photocell wired into the facility control system. When in “Auto” mode the control system will switch exterior lighting contactors on at night and off during the day. In addition, an increased area and/or level of lighting will be provided when the lighting control is switched to “Maintenance” mode.

2.4.9 Electric Heat Tracing

- 2.4.9.1 Electric heat tracing will be installed for all piping systems, pumps, and equipment as defined on the P&IDs.
- 2.4.9.2 Self-limiting heat trace will be utilized for all systems with maximum operating or upset temperatures between 0°C and 150°C. For equipment or piping systems having an operating or upset temperature in excess of 150°C, MI (mineral insulated) heat trace will be used.
- 2.4.9.3 Power supply for the heat trace will be by area, supplied from the individual area MCC as required.
- 2.4.9.4 Controllers for the tracing will be located indoors wherever possible for areas with a high concentration of heat trace circuits.
- 2.4.9.5 Any heat trace installation that does not warrant an electronic controller will be fed from ground fault circuit interrupting breakers, with each heating cable terminating in a LED type indicating light.

2.4.10 Motors

2.4.10.1 Voltage and Rating:

- a) All motors less than 1 hp will be supplied at 120Vac 1 ph, 60 Hz
- b) All motors 1 hp to 300 hp will be supplied at 480Vac, 3 ph, 60 Hz
- c) All motors over 300 hp to 5000 hp will be supplied at 4160Vac, 3ph, 60Hz
- d) All motors greater than 5000 hp will be addressed on an individual basis for voltage, protection, etc.
- e) All motors will have a minimum service factor of 1.15. Service factors shall not be used to size motors to a load.

2.4.10.2 Protection:

- a) “Klixons” shall not be supplied or required for any motors installed in this facility.
- b) All VFD driven motors 100 hp and greater will have stator RTDs as a minimum. Bearing RTDs will be installed if recommended by the motor manufacturer.

- c) All 480V motors 100 hp and greater will be protected by an electronic motor protection relay.
- d) All 4160V motors will be protected by a Multilin 369 (or equal) motor protection relay.

2.4.10.3 Classification:

- a) All motors will be suitable for the area classification and use for which they are intended.
- b) All motors shall be WP rated as a minimum. TEFC motors shall be supplied in Zone 2 areas.

2.4.10.4 Control:

- a) Motor control circuits will be powered from the individual starter/VFD they control.
- b) Motor circuits will be wired with the N.O. ESD/SD contact(s) wired at the front of the control circuit in such a manner that the motor will stop upon tripping of the contact(s). Additionally, the control circuit will be de-energized if the starter/VFD main power disconnect is moved to the off position.
- c) RTDs from a motors stator and/or bearings will be wired back to an individual RTD monitor located on the motor starter/VFD cabinet, with shutdown directly into the motor control circuit. Additional contact(s) will be provided for alarm and shutdown indication to the main control system.

2.4.11 Cables

2.4.11.1 HL designated TECK cable will be utilized as the primary medium for electrical connection. Cables will be run through cable tray and underground trenches from feed point to end termination.

2.4.11.2 Cable connector types/ratings will be installed according to CEC and the construction specifications.

2.4.12 Installation

2.4.12.1 Area Classification

- a) All process areas handling flammable liquids, vapors, or gas, specifically but not limited to bitumen, produced gas, produced water, diluent, and fuels, will be classified as Class 1, Zone 2, Group IIA in accordance with:
 - i) American Petroleum Institute Recommended Practice RP-505: Recommended Practice for Classification for Electrical Installations at Petroleum Facilities Classified as Class 1 Zone 0, Zone 1, and Zone 2
 - ii) Canadian Electrical Code Part 1, Nineteenth Edition, C22.102

iii) Alberta Labour Code for Electrical Installations at Oil and Gas Facilities, Second Edition, 2002

- b) The fluids to be processed have sour (H₂S) attributes; therefore, all installations shall be done to standards required by a sour facility.
- c) Fugitive emission calculations will be done to determine the minimum ventilation requirements for all enclosed areas/packages containing hydrocarbons. The fugitive emissions study will confirm the zone classification and determine required ventilation rates. Hygiene for operating personnel will also be considered when determining ventilation rates.

2.4.12.2 Cable Tray & Conduit Systems

- a) Cable tray will be aluminum, ladder configuration, with a minimum of a D class rating for load bearing. All tray will be installed in accordance with manufacturer's specifications. Tray covers will be installed where required to avoid cable damage.
- b) Cable tray will provide the main artery for all cable routing from power and control distribution points to all end points. This will require tray to be installed from all MCC/Control buildings/packages throughout the facilities to device/equipment end points. Where required, cabling will be transitioned into conduit to reach its final termination point.
- c) All conduit systems installed will be comprised of aluminum components. Fittings, boxes, sleeves and miscellaneous components shall be installed using an approved anti-seize lubricant on all threaded surfaces.
- d) The support structure for the main cable tray runs will be from the main piperack. Additional piles and structural steel will be added as required to provide the minimum support points required for the system to channel to the required end locations.
- e) Strut/channel will be installed for support of tray and conduit components as required. All conduits will be secured to strut as per CEC and construction specifications utilizing approved straps.

2.4.12.3 Cable Installation

- a) Cable trenches will be provided as required for the installation of cabling to end points/equipment located remotely from the cable tray system. Trenches will be provided on firm undisturbed soil and be dug with a smooth and level bottom. A bed of sand as per the specifications will be provided above and below the cable to allow for proper drainage and cable movement due to minor settling, contraction, and expansion.

- b) Cable for the facility will be installed as per CEC and construction specifications. All cable will be provided with proper support and mechanical protection.

2.4.13 Spares

- 2.4.13.1 For this project a 25% spare level shall be utilized for cabling. Cable runs for control and utility shall be sized to incorporate a minimum of 25% spares. This extends to termination points such as junction boxes, control panels, and terminals.

2.5 Instrumentation and Control

2.5.1 Instrumentation/Operational Philosophy

- 2.5.1.1 Pressure and differential pressure instruments will be transmitters. Instruments will be connected to sensing points using 27mm threadolet connections as detailed in the piping specifications. All connections will have a three-valve manifold isolation valve to permit on-line isolation and calibration.
- 2.5.1.2 Temperature instruments will be RTD style probes mounted in 316 class stainless steel thermowells. Critical sensing points will have local temperature displays.
- 2.5.1.3 Level indication and control will be via transmitters. Each level transmitter will have a corresponding sight glass or sample taps. All level instruments will be mounted on bridles with 3" (89mm) block valves. The bridles will be capable of being isolated from the vessel to allow service. Instrument bridles will have low-pressure steam to them to allow backflushing to the vessel to minimize fouling. Bridles will be capable of blowing down to the slop header.
- 2.5.1.4 Control valves will be actuated with instrument air. The control signal will be via an I/P output from the control system. The control system signal will be derived from the appropriate process transmitter.
- 2.5.1.5 Control and ESD (emergency shutdown) valves will be equipped with position indicators. This will be relayed to the control system enabling a display of valve position. ESD type valves will show open or closed only, while flow and pressure valves will indicate a percent of travel.
- 2.5.1.6 Critical shut off valves will be solenoid actuated. The solenoids will be powered from the UPS system. This will ensure operation in the case of a power failure. ESD valves will be set to fail closed on loss of signal. Process valves for level and flow control will also fail closed on loss of signal. Blowdown and some bypass valves will fail open to protect equipment or for safety purposes.

2.5.2 Control System

- 2.5.2.1 The control system will be based on Rockwell Automation's Logix5000 platform for the main facility. The overall structure of this control system will consist of one (1) main control panel connected through a hardwired network to one (1) or more auxiliary (remote) control panels. All other local control panels supplied with specific equipment will also be connected to the network. All I/O devices will then be hardwired to these control panels.
- 2.5.2.2 In the main facility each of these remote I/O systems will be hardwired back to the main control system using suitable armored/shielded cabling. For the well pads the remote I/O will communicate back to the main control system via a SCADA system.
- 2.5.2.3 The control systems will be powered by a 24Vdc negative grounded power supply complete with battery back-up capable of supplying uninterrupted 24Vdc power to all of the control processors, control chassis, network systems, I/O modules, and end devices. This will allow for complete control system operation in the event of a utility power fail or a generated power fail.
- 2.5.2.4 For the main facility, all of the control and shutdown logic will reside in the main control logic processors located in the main control panel. This system will consist of two (2) redundant processors, each located in its own redundant controller chassis. Each of the two controller chassis containing the processors will also have redundant 24Vdc power supplies. This design will provide a control system with seamless and uninterrupted control in the unlikely event of hardware failure. Should any of this main control hardware fail, the operations personnel will be made aware of the failure through the HMI system, allowing the failed part to be replaced without any interruption in the facility control.
- 2.5.2.5 Remote control panels will contain either remote I/O chassis connected to the main control panel via the network, or remote chassis complete with a processor, also connected to the main control panel via the network. The hardware in the remote control panels will be Rockwell Automation ControlLogix.
- 2.5.2.6 The local control panels to be supplied by equipment vendors could possibly contain various types of control devices. Every effort will be made to have equipment vendors supply their control panels with Allen Bradley/Rockwell Automation control hardware. This could include ControlLogix, CompactLogix, or the SLC-500 PLC family. This will allow for seamless integration into the main control system.

- 2.5.2.7 The network utilized for this control system will be ControlNet, a state-of-the-art open network that will provide sufficient bandwidth for I/O, peer-to-peer messaging, and programming. ControlNet is a very efficient network in that it uses producer/consumer technology. This allows for all nodes on the network to simultaneously access the same data from a single source, thereby reducing response time. This ControlNet network will also be used for communication to HMI devices and will have redundant cables wherever possible. The local control panels supplied by equipment vendors may also be connected to the control system utilizing Rockwell Automation's DH+ network, depending on the hardware supplied.
- 2.5.2.8 The facility human machine interface (HMI) will be Rockwell Automation's RSView active display server. The hardware will consist of two (2) redundant server machines and either a tape, zip disk, or CD backup system. Both of these machines will be powered from the 120Vac un-interruptable power supply to allow the HMI system to continue to function in the event of a power failure. The server machines will be connected to the control system via the ControlNet network and will also utilize the redundant cabling.
- 2.5.2.9 Located in the main office/control room will be two (2) personal computers, each complete with two (2) 19" flat panel monitors and each connected to the 120Vac UPS system. These two machines will be networked to the RSView active display server machines using an ethernet/IP network, and will be running a Windows XP operating system and the RSView active display client software. This will provide the operations personnel with an interactive, dynamic, graphical display of the control system which will allow them to monitor and adjust specific operational parameters throughout the facility. It will also allow for data logging, trending, and report generation. In addition, PC-based HMIs could be located throughout the facility in any non-hazardous location.
- 2.5.2.10 Mounted in the front door of the main control panel, each of the auxiliary control panels, and perhaps throughout the facility, will be Rockwell Automation's Versa View panel-mounted HMI Color Touch screens. These screens may vary in size from 7" to 15", measured diagonally, depending on location, and will be powered from the 24Vdc UPS. These Versa View displays will have a Windows CE operating system and will also run the RSView active display client software. They will be connected to the RSView active display servers via a thin client Windows terminal services software. This HMI system will allow operations personnel to view the same display screens throughout the facility that they have access to in the main office/control room.
- 2.5.2.11 Utilizing the RSView active display server will allow for all HMI screen development and future modifications to be done on the server machines, and all of the clients will be updated immediately. This system will also allow for remote clients to connect to the server with either a read/write or read-only configuration, from almost anywhere in the world.

2.5.3 Metering and Meter Proving

2.5.3.1 Wellsites

- a) Gas, liquid, & steam meter runs will be differential pressure, vortex, or coriolis type.

2.5.3.2 Main Facility

- a) Gas meter run will be orifice plate, senior fitting type or vortex meter.
- b) Emulsion meter will be differential pressure, vortex meter, or mass meter.
- c) Bitumen meter run will be differential pressure, vortex meter, or mass meter.
- d) Steam meter will be a differential pressure or vortex meter.
- e) Boiler feed fuel gas meter will be a senior type orifice plate meter run.
- f) Water meter will be a vortex or magnetic meter.
- g) Chemical meters will be a magnetic meter or other.
- h) Flare meter will be a transit time ultrasonic meter.
- i) Prover taps will be provided on the downstream side of all liquid meters.

2.5.4 Instrument Air System

2.5.4.1 Wellsites

- a) All wellsite equipment will be pneumatically controlled and operated. The system will operate at 700 to 800 kPag.

2.5.4.2 Main Facility

- a) All main facility equipment will be pneumatically controlled.
- b) Pneumatic instruments will operate using instrument air. A full back-up compressor will be provided. System will operate at 700 to 800 kPag.

2.5.5 SCADA

- 2.5.5.1 All wellsite control systems will be capable of data transfer to and from the main facility control system. This will be done on a high speed unlicensed radio system. The system will be readily expandable and capable of a communication rate of 1 Mb/sec.

2.6 Safety

2.6.1 Fire Suppression

2.6.1.1 Portable fire extinguishers will be installed on all sites.

2.6.1.2 Wellsites

- a) As a minimum it is proposed to install one (1) 150# wheeled Purple K fire extinguisher for each wellsite, one (1) 30# handheld fire extinguisher for each skid, and one (1) 20# handheld CO₂ fire extinguisher for the MCC building. Final decision on type and quantity of extinguishers will be provided by Deer Creek safety personnel.

2.6.1.3 Main Facility

- a) As a minimum it is proposed to install four (4) 150# wheeled Purple K fire extinguishers for the facility, one (1) 30# handheld fire extinguisher for each skid, and one (1) 50# wheeled CO₂ fire extinguisher for the MCC building. Final decision on type and quantity of extinguishers will be provided Deer Creek safety personnel.

2.6.2 Miscellaneous Safety Equipment

2.6.2.1 Deer Creek safety personnel will be responsible for specifying and purchasing all miscellaneous safety equipment that will be required on site. This includes but is not limited to eyewash stations, chemical and fire burn kits, safety kits, SCBA apparatus, etc. Safety shower will be provided along with required safety equipment for hazardous chemicals.

2.7 Civil

2.7.1 Equipment Foundations

2.7.1.1 Most equipment will be mounted on structural steel skids provided by the equipment manufacturer. These skids will be placed on piled and grade beam foundations. The skids will be welded to the grade beams once they are positioned. Rotating equipment of significant size will have concrete in the equipment skid to add inertial mass. These skids will require shimming to the structural foundation prior to welding in place. Large equipment and tanks may be set on poured concrete foundations. The main steam generators and the evaporator towers will require poured concrete foundations.



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5.0 TECHNICAL GUIDELINES

5.1 Codes and Standards

This project will be built to codes and standards as an Alberta, Canada, project. Codes and standards listed are to be enforced as they apply to all equipment and installations for this project. Should local standards or regulations exceed or cause conflict, the issue shall be referred to the engineering company for clarification.

5.1.1 General

5.1.1.1 Occupational Health and Safety Association Regulations.

5.1.1.2 Worker's Compensation Regulations.

5.1.2 Mechanical

5.1.2.1 American National Standards Institute (ANSI) B31.3

5.1.2.2 American Society of Mechanical Engineers (ASME) Sect. VIII

5.1.2.3 American Society of Mechanical Engineers (ASME) B16.5

5.1.2.4 Canadian Standards Association (CSA) B51 – Boiler, Pressure Vessel and Pressure Piping Code.

5.1.2.5 Safety Codes Act, Boilers and Pressure Vessels Registration, Alberta, Canada

5.1.2.6 NACE MR 0175 sour service requirements.

5.1.2.7 Steel Structures Painting Council (SSPC) Specifications.

5.1.2.8 CSA Z662 Oil & Gas Pipeline Systems.

5.1.2.9 AEUB Guides 56 & 55.

5.1.2.10 API 650 for storage tanks.

5.1.2.11 API 610 for hydrocarbon pumps.

5.1.2.12 Deer Creek Energy Limited General Specifications.

5.1.3 Electrical

5.1.3.1 Canadian Electrical Code Part I, Eighteenth Edition C22.1-98 c/w all subsequent issued bulletins and amendments from the Alberta Safety Codes Council (STANDATA Electrical) April 1999 First Edition.



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- 5.1.3.2 Equipment will bear approval/certification of at least one of the accepted certification organizations listed in STANDATA Pub# LEG-ECR-2 (Rev 2).
- 5.1.3.3 Most recent Canadian Standards Association (CSA) codes and standards for electrical equipment, specifically pertaining to the Oil & Gas Industry.
- 5.1.3.4 Most recent Electrical Equipment Manufacturers Association (EEMAC) codes and standards for electrical equipment, specifically pertaining to the Oil & Gas Industry.
- 5.1.4 Civil
 - 5.1.4.1 National Building Code
 - 5.1.4.2 All equipment will be built to Alberta Standards for Earthquake Zone Zero.
- 5.1.5 Environmental
 - 5.1.5.1 Environmental Protection and Enhancement Act (EPEA).



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- XIII Main Facility Cost Estimate
- XIV Bitumen/Water Emulsion Viscosity Curves and Bitumen/SCO Blends
- XV Area Classification Plan
- XVI Overall Single Line Diagram
- XVII Project Load Summary
- XVIII Control Architecture
- XIX Project Schedule
- XX Material Balance (Oil Process)
- XXI Material Balance (Water)
- XXII Project Execution Plan



Bower Damberger Rolseth
Engineering Ltd.

DEER CREEK ENERGY LIMITED

Joslyn Phase 2, SAGD Facility
AFE # 002-0003-0002-0005-S1
Design Basis Memorandum
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DEER CREEK
Energy Limited

BDR Project: 33500
Date: March 18, 2005

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APPENDIX I

PROCESS FLOWSHEET (WELL PAD)

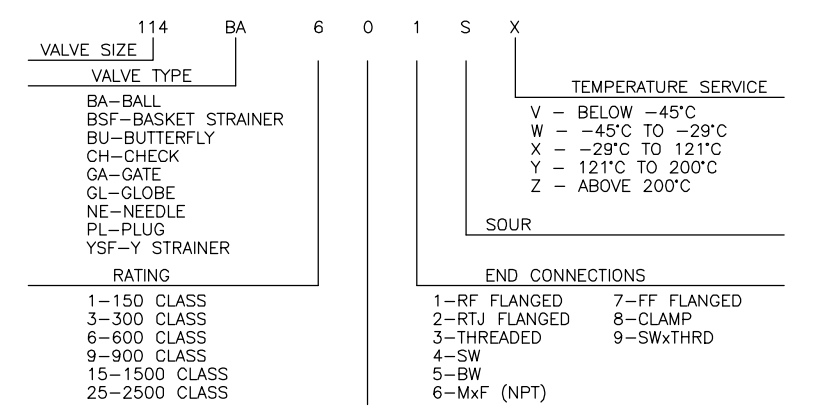
LEGEND

	GATE VALVE (GA)		INSULATION (H-HOT, C-COLD)
	BALL VALVE (BA)		INSULATION & HEAT TRACE
	PLUG VALVE (PL)		PROCESS PIPING
	NEEDLE VALVE (NE)		PNEUMATIC SIGNAL
	GLOBE VALVE (GL)		CAPILLARY TUBING
	CHECK VALVE (CH)		ELECTRICAL SIGNAL
	BUTTERFLY VALVE (BU)		HYDRAULIC SIGNAL
	SOCKET WELD VALVE		ELECTROMAGNETIC/SONIC SIGNAL
	SCREWED VALVE		SOFTWARE OR DATA LINK
	FLANGED VALVE	A.O.	AIR TO OPEN (FAIL CLOSED)
	CONTROL VALVE WITH DIAPHRAGM ACTUATOR	A.C.	AIR TO CLOSE (FAIL TO OPEN)
	CONTROL VALVE WITH PISTON ACTUATOR	C.S.O.(C)	CAR SEAL OPEN (CLOSED)
	PRESSURE REGULATOR	E.S.D.	EMERGENCY SHUTDOWN
	SOLENOID VALVE	F.P.	FULL PORT
	ANGLE CHOKE	R.P.	REGULAR PORT
	INLINE CHOKE	N.C.	NORMALLY CLOSED
	DIAPHRAGM	N.O.	NORMALLY OPEN
	Y-STRAINER	S.R.	SPRING RETURN
	PRESSURE SAFETY VALVE		SPEC BREAK
	ORIFICE METER RUN		SUPPLIED BY OTHERS
	TURBINE METER OR POSITIVE DISPLACEMENT METER		TIE IN NUMBER
	VORTEX METER		TIE IN LOCATIONS
	SPECTACLE BLIND, OPEN (CLOSED)		PNEUMATIC TO CURRENT
	CHANGE IN PIPE SIZE		CURRENT TO PNEUMATIC
	INLINE STRAINER		INSTRUMENT AIR
	RESTRICTING ORIFICE		STEAM TRAP

	LOCALLY MOUNTED INSTRUMENT
	MOUNTED ON MAIN CONTROL ROOM PANEL
	LOCAL PANEL MOUNTED INSTRUMENT
	PROGRAMMABLE LOGIC CONTROL SYSTEM
	PROGRAMMABLE LOGIC CONTROL SYSTEMS ACCESSIBLE TO OPERATOR
	AUX. PROGRAMMABLE LOGIC CONTROL SYSTEMS ACCESSIBLE TO OPERATOR
ACV	ANALYTIC CONTROL VALVE
AE	ANALYTIC ELEMENT
AIC	ANALYTIC INDICATING CONTROLLER
AT	ANALYTIC TRANSMITTER
AIT	ANALYTIC INDICATING TRANSMITTER
BDV	BLOWDOWN VALVE
BCS	BURNER CONTROL STATUS
BE	BURNER ELEMENT
BZ	BURNER IGNITOR
CV	CONTROL VALVE
dPI	DIFFERENTIAL PRESSURE INDICATOR
dPS	DIFFERENTIAL PRESSURE SWITCH
dPT	DIFFERENTIAL PRESSURE TRANSMITTER
ESDV	EMERGENCY SHUTDOWN VALVE
FA	FLOW ALARM (H-HIGH, L-LOW)
FC	FLOW CONTROLLER
FCV	FLOW CONTROL VALVE
FDSV	FIRE DETECTION SHUTDOWN
FSD	FLOW SHUTDOWN (H-HIGH, L-LOW)
FE	FLOW ELEMENT
FFSD	FLAME FAILURE SHUTDOWN
FI	FLOW INDICATOR
FIC	FLOW INDICATOR CONTROL
FIR	FLOW INDICATOR RECORDER
FR	FLOW RECORDER
FS	FLOW SWITCH (H-HIGH, L-LOW)
FQI	FLOW QUANTITY INDICATOR
FT	FLOW TRANSMITTER
FIT	FLOW INDICATOR TRANSMITTER
FY	FLOW TRANSDUCER
HIC	HAND INDICATING CONTROLLER
HR	HAND RECORDER
HS	HAND SWITCH
HY	HAND TRANSDUCER
H2S	H2S GAS DETECTION
H2ST	H2S GAS DETECTION TRANSMITTER
LA	LEVEL ALARM (H-HIGH, L-LOW)
LC	LEVEL CONTROLLER
LCV	LEVEL CONTROL VALVE
LEL	COMBUSTIBLE GAS DETECTION
LELT	COMBUSTIBLE GAS DETECTION TRANSMITTER
LG	LEVEL GAUGE
LI	LEVEL INDICATOR
LIC	LEVEL INDICATOR CONTROLLER
LR	LEVEL RECORDER
LIR	LEVEL INDICATOR RECORDER
LS	LEVEL SWITCH (H-HIGH, L-LOW)

LSD	LEVEL SHUTDOWN (H-HIGH, L-LOW)
LT	LEVEL TRANSMITTER
LIT	LEVEL INDICATOR TRANSMITTER
LY	LEVEL TRANSDUCER
ME	MOISTURE ELEMENT
MI	MOISTURE INDICATOR
PA	PRESSURE ALARM (H-HIGH, L-LOW)
PC	PRESSURE CONTROLLER
PCV	PRESSURE CONTROL VALVE
PDM	POSITIVE DISPLACEMENT METER
PI	PRESSURE INDICATOR
PIC	PRESSURE INDICATOR CONTROLLER
PIR	PRESSURE INDICATOR RECORDER
PIT	PRESSURE INDICATOR TRANSMITTER
PR	PRESSURE RECORDER
PRV	PRESSURE REGULATING VALVE
PS	PRESSURE SWITCH (H-HIGH, L-LOW)
PSD	PRESSURE SHUTDOWN (H-HIGH, L-LOW)
PSV	PRESSURE SAFETY VALVE
PT	PRESSURE TRANSMITTER
PVB	PRESSURE VACUUM BREATHER
PY	PRESSURE TRANSDUCER
RO	RESTRICTING ORIFICE
SAV	SOLENOID ACTUATED VALVE
SC	SURGE CONTROLLER
SCV	SURGE CONTROL VALVE
SDV	SHUTDOWN VALVE
IA	TEMPERATURE ALARM (H-HIGH, L-LOW)
TC	TEMPERATURE CONTROLLER
TCV	TEMPERATURE CONTROL VALVE
TE	TEMPERATURE ELEMENT
TI	TEMPERATURE INDICATOR
TIC	TEMPERATURE INDICATOR CONTROLLER
TR	TEMPERATURE RECORDER
TIR	TEMPERATURE INDICATOR RECORDER
TS	TEMPERATURE SWITCH (H-HIGH, L-LOW)
ISD	TEMPERATURE SHUTDOWN (H-HIGH, L-LOW)
TT	TEMPERATURE TRANSMITTER
TIT	TEMPERATURE INDICATOR TRANSMITTER
TW	THERMO WELL
TY	TEMPERATURE TRANSDUCER
VI	VIBRATION INDICATOR
VR	VIBRATION RECORDER
VS	VIBRATION SWITCH
VSD	VIBRATION SHUTDOWN
VSDH	VIBRATION SHUTDOWN HIGH
VT	VIBRATION TRANSMITTER
VIT	VIBRATION INDICATOR TRANSMITTER
XVPI	VALVE POSITION INDICATOR
XVPS	VALVE POSITION SWITCH
ZS	LIMIT SWITCH (O-OPEN;C-CLOSED)

VALVE DESIGNATIONS



	BODY STYLE MODIFIER					
	0	1	2	3	4	5
BALL	R.P. FLOATING	F.P. FLOATING	R.P. TRUNNION	F.P. TRUNNION		
BUTTERFLY	RUBBER LINED NON-LUGGED	RUBBER LINED LUGGED	TFE SEATED NON-LUGGED	TFE SEATED LUGGED	METAL SEATED NON-LUGGED	METAL SEATED LUGGED
CHECK	R.P. SWING	F.P. SWING	WAFER TYPE SWING	PISTON TYPE	PISTON TYPE WAFER	
GATE	R.P. WEDGE	FLEX WEDGE	F.P. SLAB	R.P. SLAB		
GLOBE	STD. BODY	ANGLE BODY	"Y" BODY			
NEEDLE	THREADED BONNET METAL SEAT	THREADED BONNET SOFT SEAT	OS&Y BONNET METAL SEAT	OS&Y BONNET SOFT SEAT	GAUGE VALVE THREADED METAL SEAT	GAUGE VALVE THREADED BONNET SOFT SEAT
PLUG	REGULAR PATTERN	SHORT PATTERN	JACKET			
BASKET STRAINER	ALTA					
"Y" STRAINER	ALTA					

LINE NUMBERING SYSTEM

114	-	600	C	PS	W	-	121
LINE SIZE (mm OD)		PRIMARY PRESSURE RATING	LINE MATERIAL CODE	PIPING SYSTEM CODE	TEMP. INDEX		LINE NUMBER

PRIMARY PRESSURE RATING

CLASS	RATING
150	ANSI 150#
300	ANSI 300#
600	ANSI 600#
900	ANSI 900#
1500	ANSI 1500#
2500	ANSI 2500#

LINE MATERIAL CODE

COATED PIPING	C
FIBRE GLASS	F
STAINLESS STEEL	S

PIPING SYSTEM CODE

SERVICE	SYMBOL
INSTRUMENT AIR	IA
PROCESS PIPING (ANIS B31.3 CODE)	
- SWEET PROCESS HYDROCARBONS, CAUSTIC, PROCESS DRAINS, AND VENT SYSTEMS	P
- SOUR PROCESS HYDROCARBONS, CAUSTIC, SOUR LIQUIDS, HYDROCARBONS, AND WATER, PROCESS DRAINS, AND VENT SYSTEMS	PS

TEMPERATURE INDEX

SERVICE	SYMBOL
BELOW -45°C	V
-45°C TO -29°C	W
-29°C TO 121°C	X
121°C TO 200°C	Y
ABOVE 200°C	Z

NO.	REVISION	PROJ. No.	BY	DATE	CHK.
6	GENERAL REVISIONS	43581	KN	05.11.09	CT 05.11.09
5	CASING GAS TAKE-OFF POINT ON PRODUCERS REVISED	43581	CT	05.09.20	
4	ISSUED FOR CONSTRUCTION	43581	CT	05.06.20	RDB 05.06.10
3	RE ISSUED FOR APPROVAL	43581	CT	05.04.15	
2	GENERAL REVISIONS	43581	CT	05.03.28	
1	ISSUED FOR APPROVAL	43581	CT	05.03.03	CT
0	PRELIMINARY ISSUE	43581	CT	04.10.26	

GENERAL NOTES:
1. "POST CONSTRUCTION DRAWINGS" ARE GENERATED FROM CONSTRUCTION CHANGE INFORMATION FORWARDED TO BOWER DAMBERGER ROLSETH ENGINEERING LTD. BY THE OWNER'S FIELD SUPERVISOR AND/OR SITES. CONTRACTORS ANY CHANGES NOT DOCUMENTED WILL NOT APPEAR ON THE DRAWING AND THEREFORE THE DRAWING MAY NOT BE AN ACCURATE REPRESENTATION OF THE CONSTRUCTED FACILITY.
2. PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION AND/OR EXCAVATION IT SHALL BE THE RESPONSIBILITY OF THE OWNERS REPRESENTATIVE TO VERIFY THE LOCATION AND STATUS OF ANY PIPING, ELECTRICAL, EQUIPMENT OR BUILDINGS.
3. ANY REVISIONS MADE TO EXISTING EQUIPMENT, PIPING OR ELECTRICAL ON A FACILITY NOT DESIGNED BY B.D.R. ENG. LTD. IS ONLY SHOWN AS A REPRESENTATION OF WHAT EXISTS AND MUST BE VERIFIED BY THE OWNER.

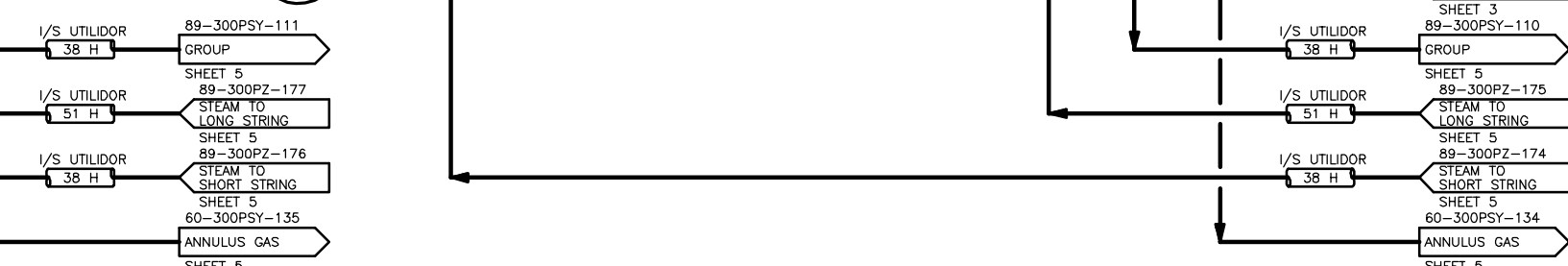
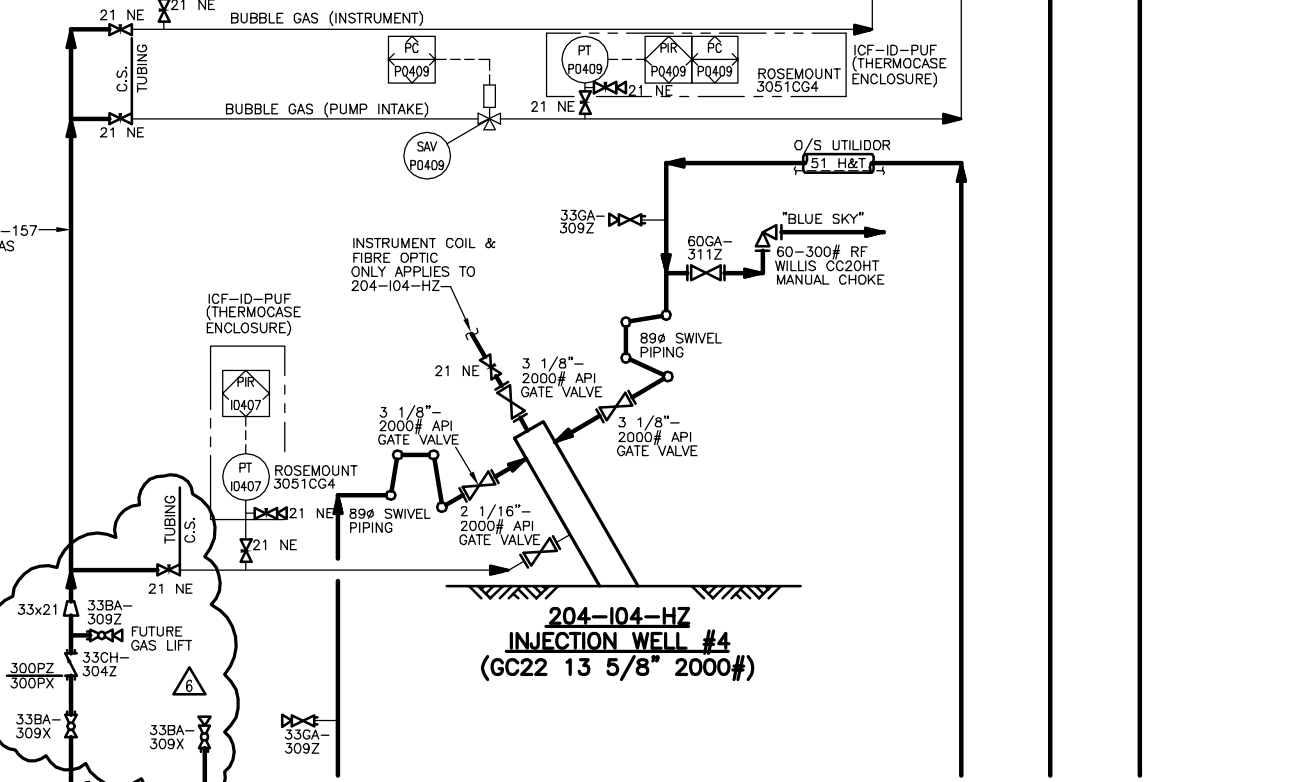
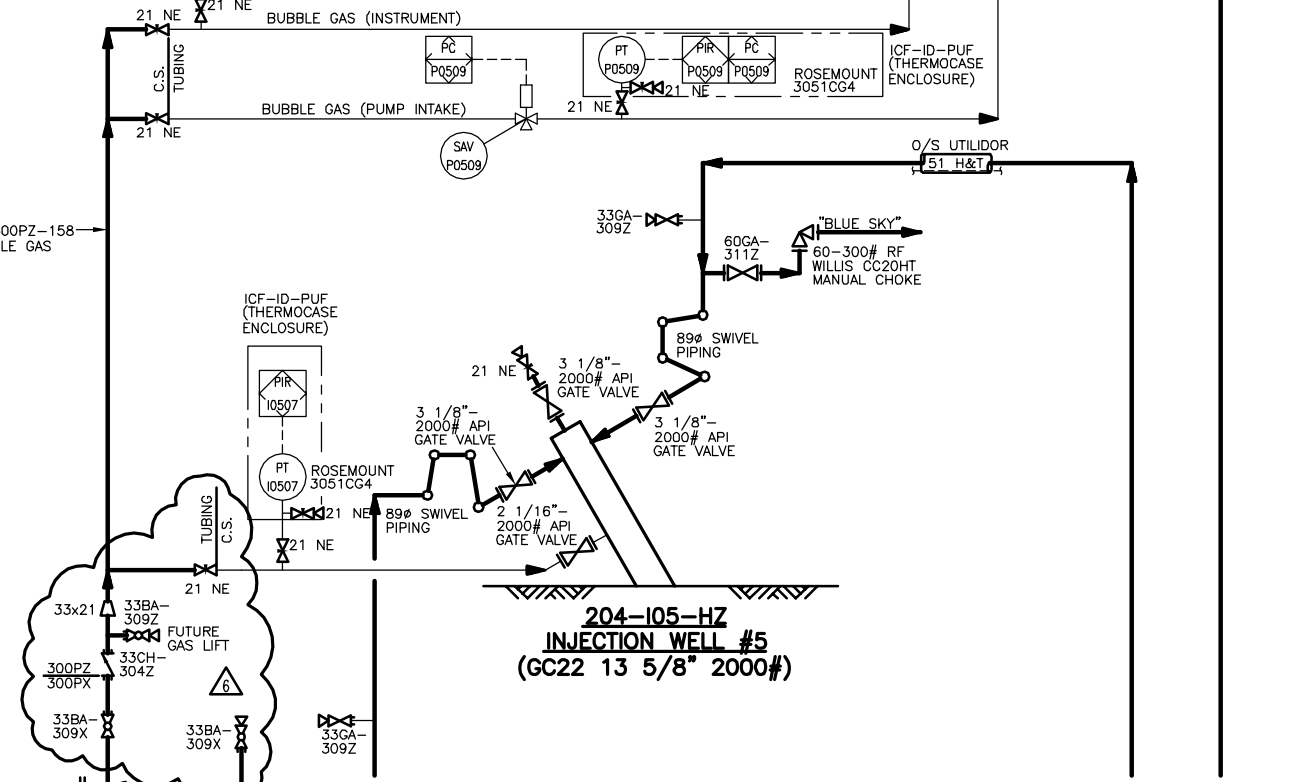
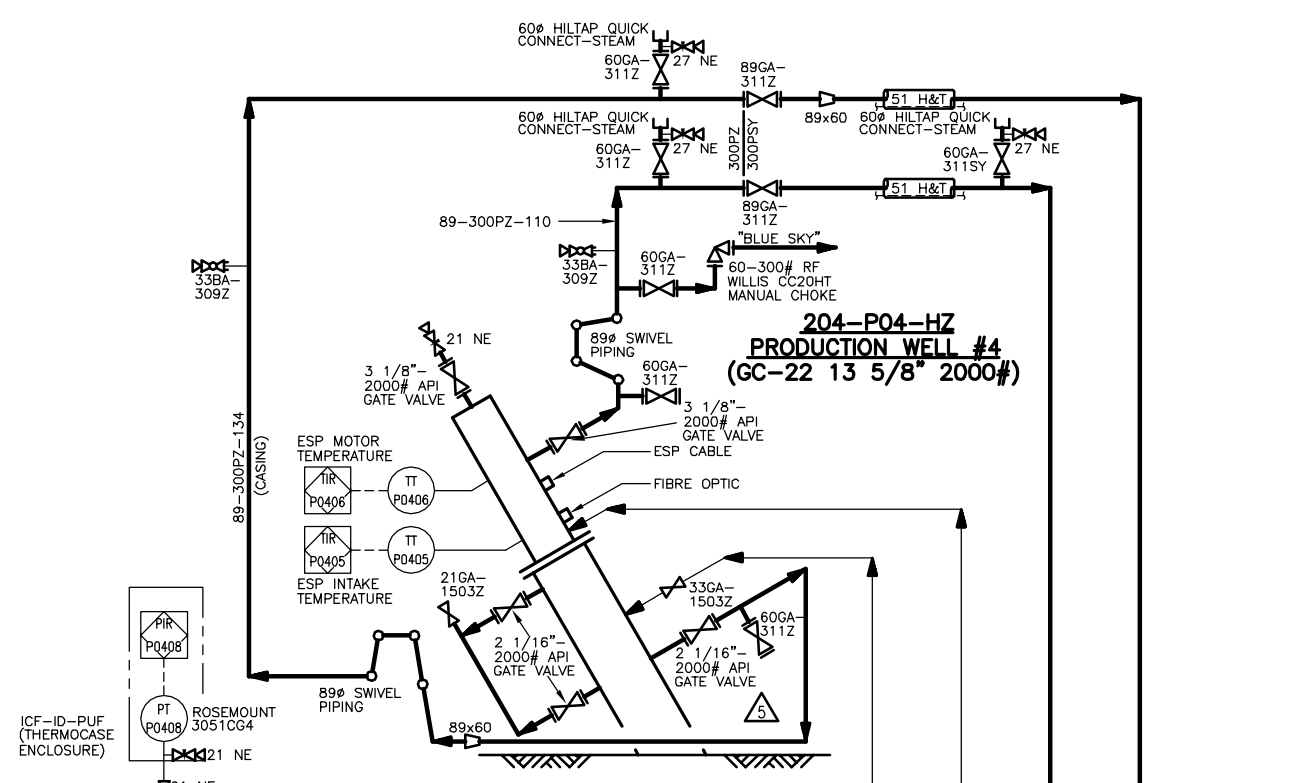
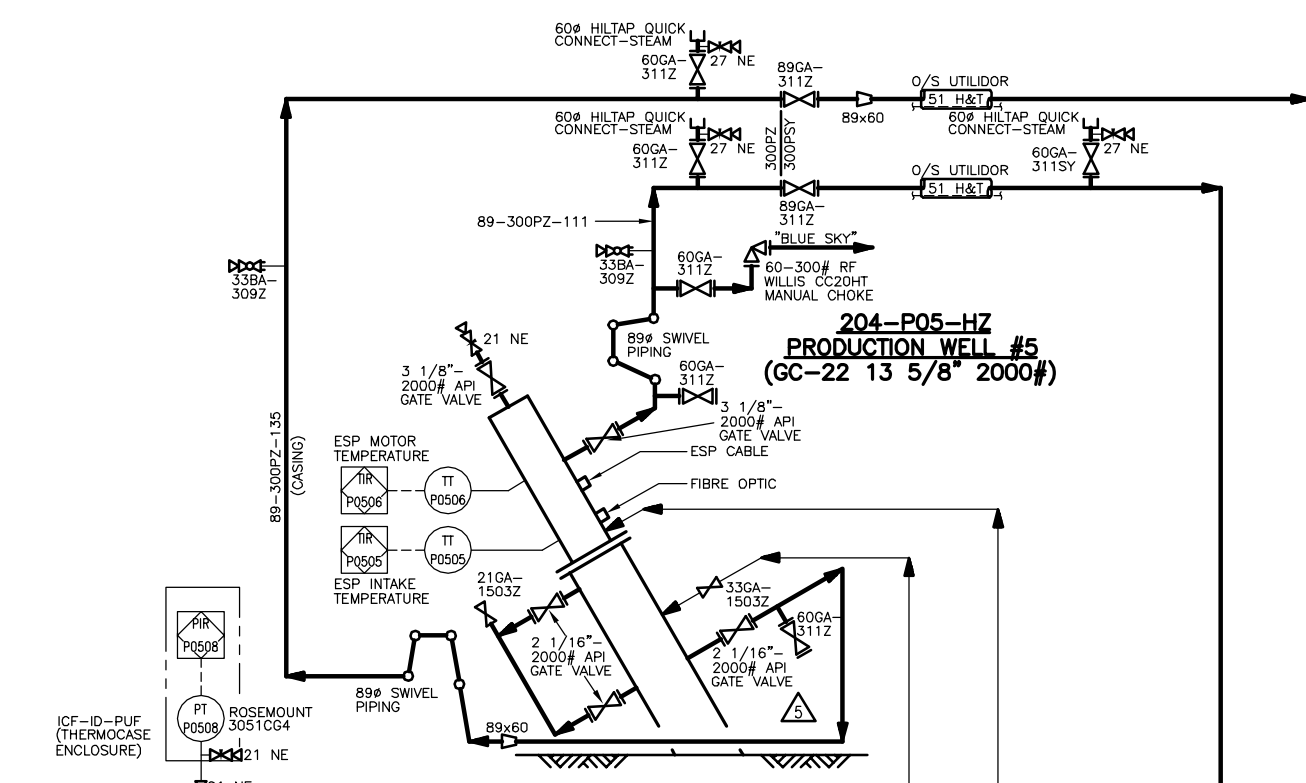
DRN.	BY	DATE
CT	CT	04.02.20
RDB	RDB	05.06.10
APP'D.		
L.S.D.	15-32-95-12	W4M



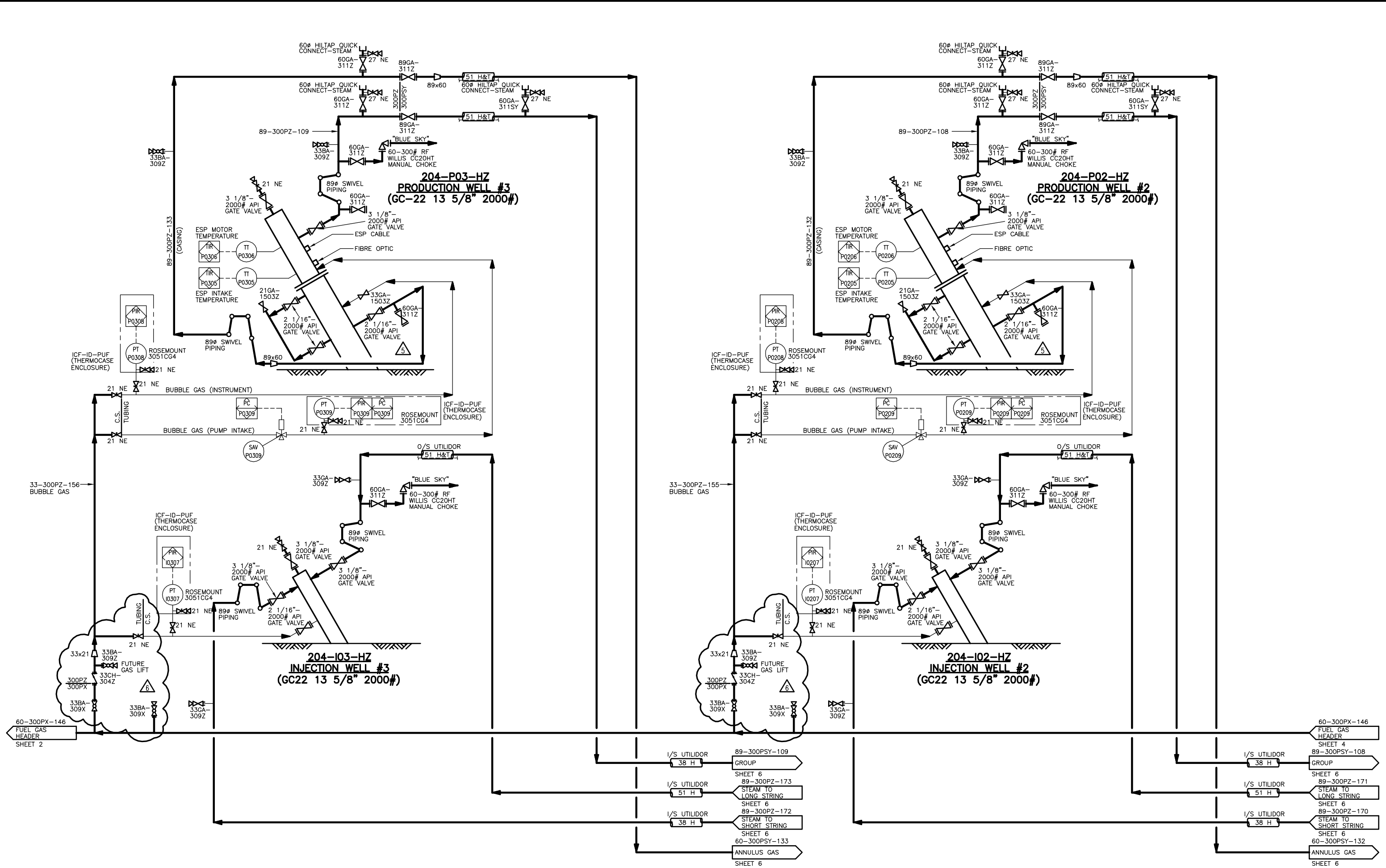
DEER CREEK Energy Limited

JOSLYN PHASE #2
WELLPAD #204 MECHANICAL FLOWSHEET

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1 OF 14	F-43581-F-00-01	6

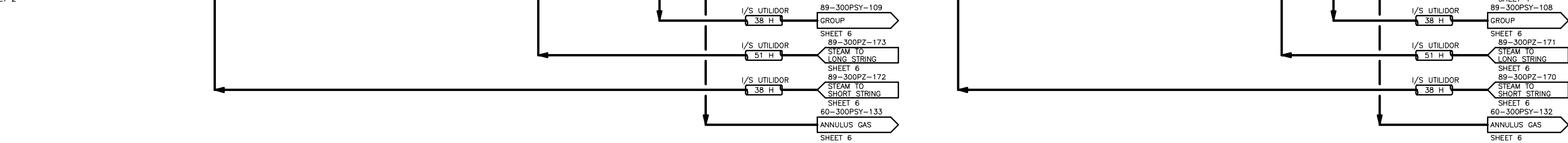


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2 OF 14	F-43581-F-00-01	6

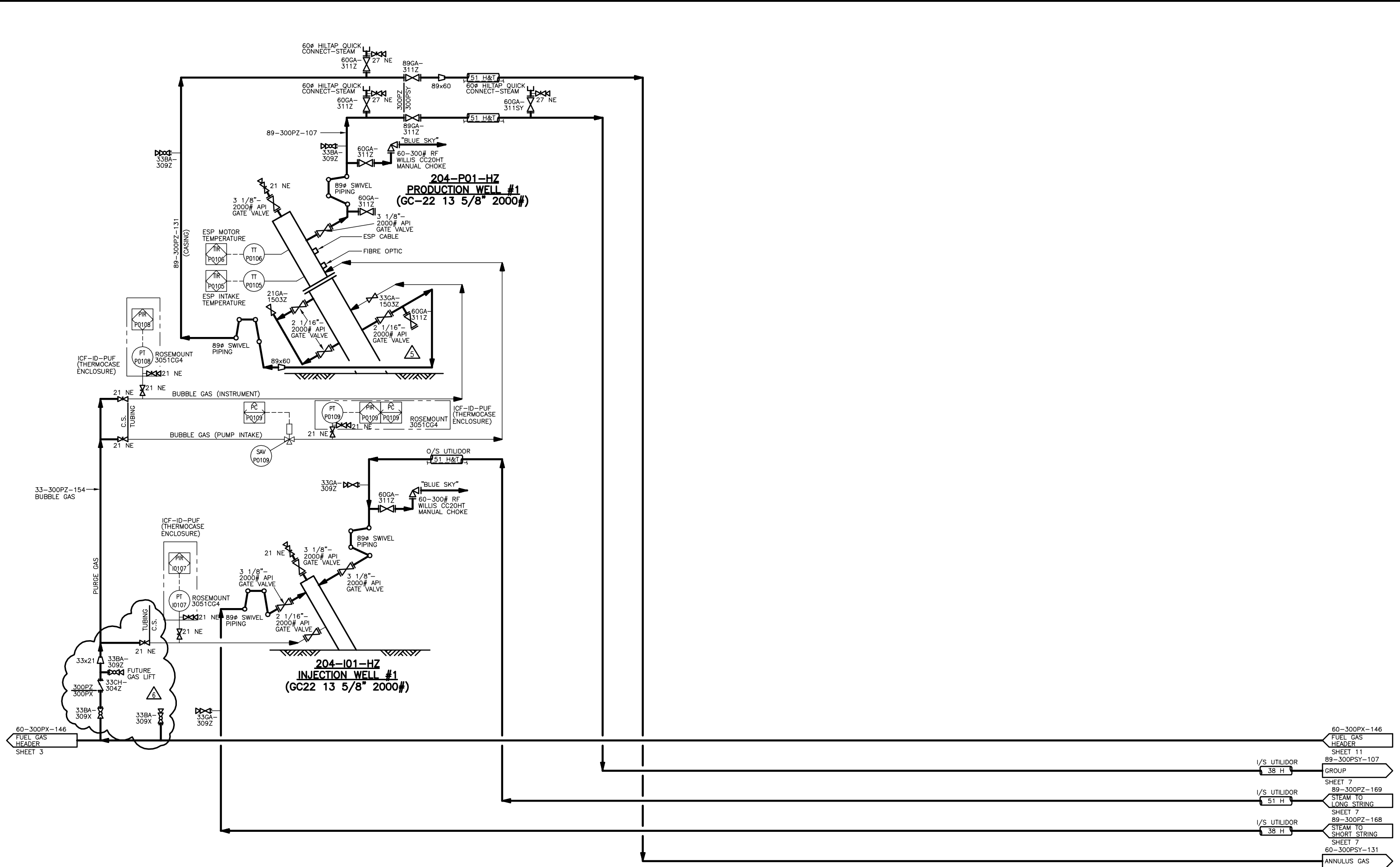


60-300PX-146
FUEL GAS
HEADER
SHEET 2

60-300PX-146
FUEL GAS
HEADER
SHEET 4



SHEET NUMBER	DRAWING NUMBER	REV
3 OF 14	F-43581-F-00-01	6



60-300PX-146
FUEL GAS
HEADER
SHEET 3

60-300PX-146
FUEL GAS
HEADER
SHEET 11

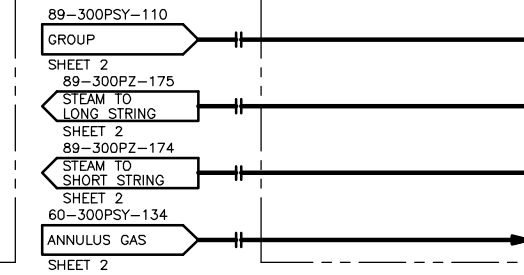
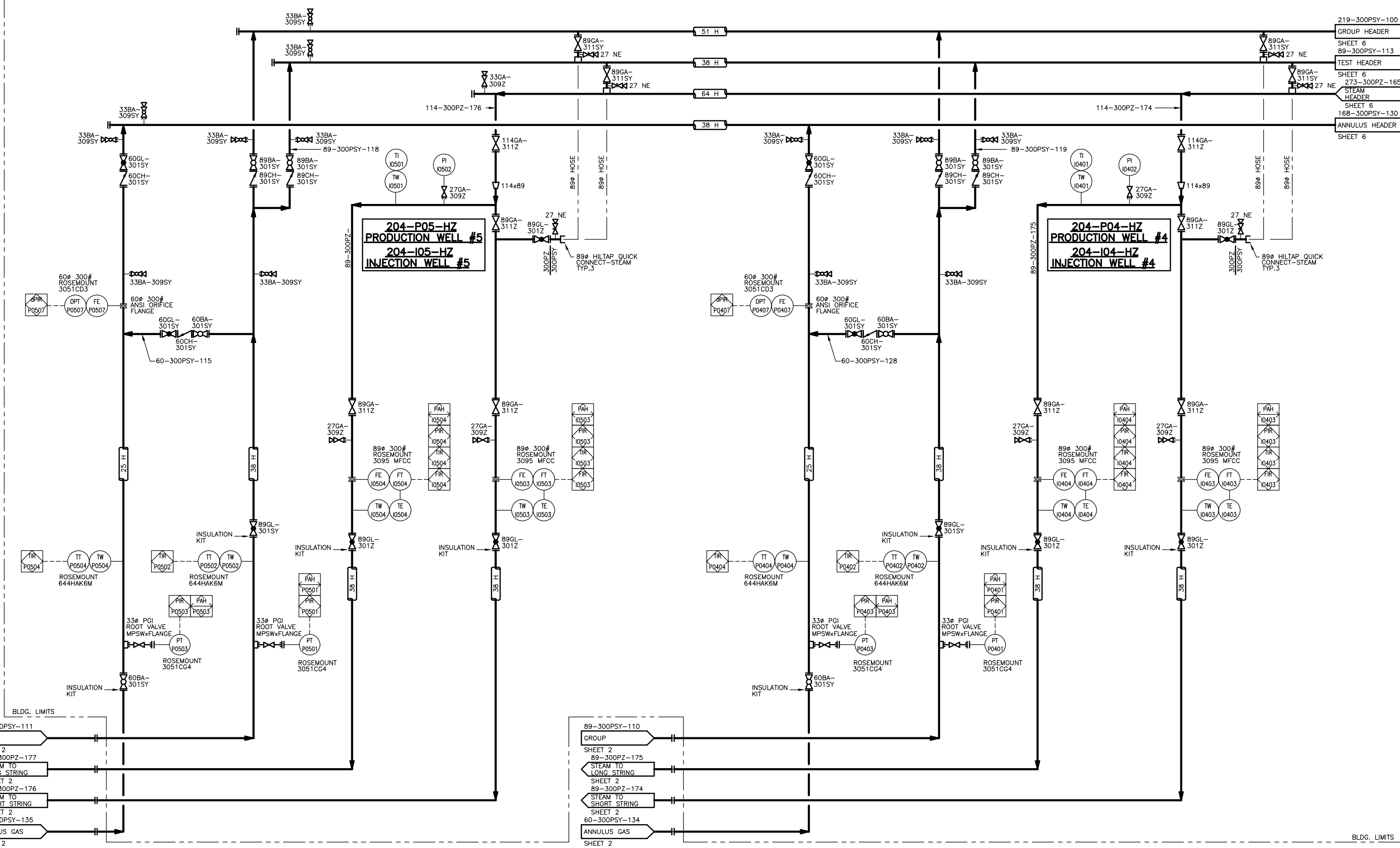
1/2" UTILIDOR
38 H
GROUP

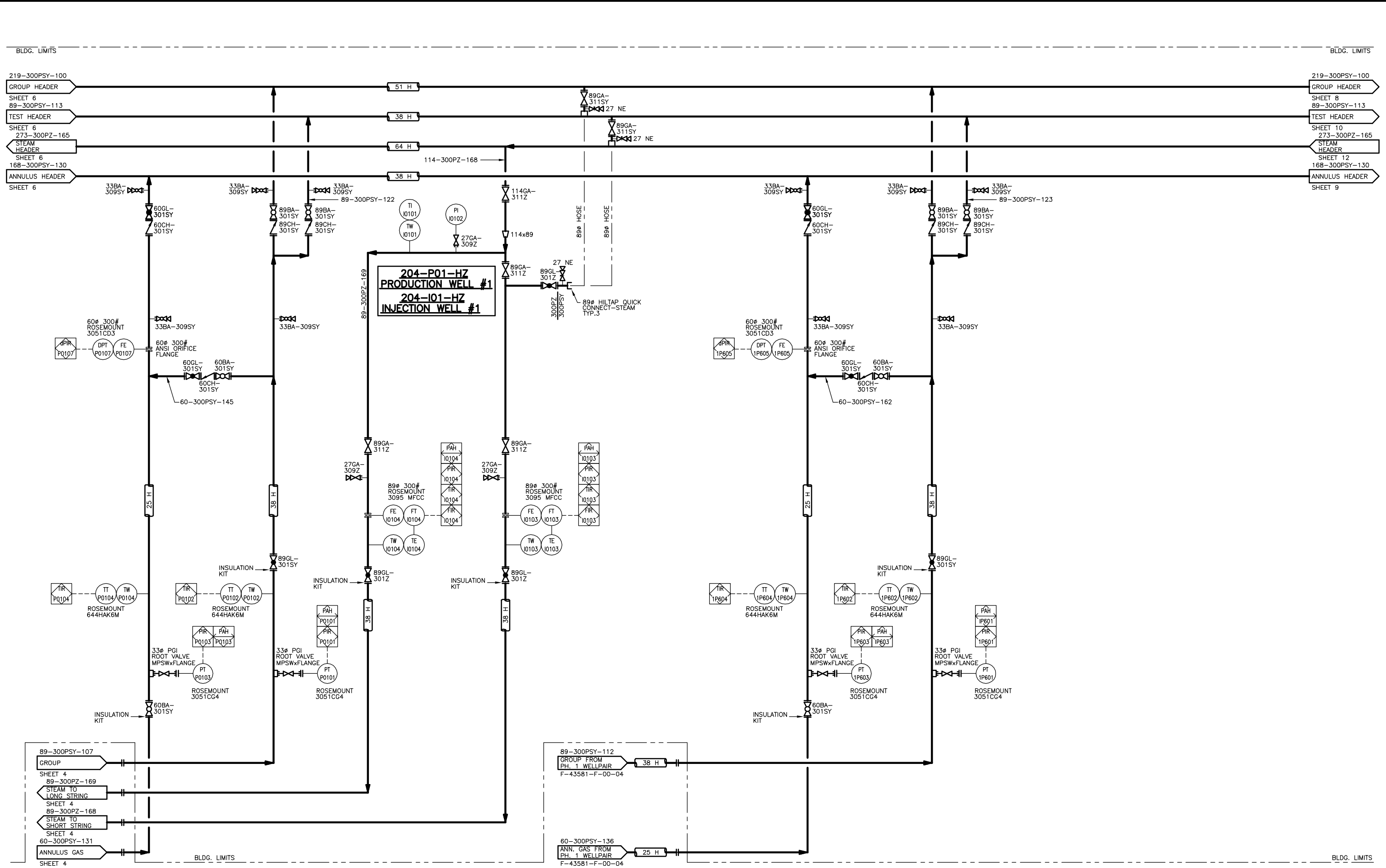
1/2" UTILIDOR
51 H
STEAM TO
LONG STRING

1/2" UTILIDOR
38 H
STEAM TO
SHORT STRING

60-300PSY-131
ANNULUS GAS
SHEET 7

SHEET NUMBER	DRAWING NUMBER	REV
4 OF 14	F-43581-F-00-01	6





BLDG. LIMITS

219-300PSY-100 GROUP HEADER
 SHEET 6
 89-300PSY-113 TEST HEADER
 SHEET 6
 273-300PZ-165 STEAM HEADER
 SHEET 6
 168-300PSY-130 ANNULUS HEADER
 SHEET 6

89-300PSY-107 GROUP
 SHEET 4
 89-300PZ-169 STEAM TO LONG STRING
 SHEET 4
 89-300PZ-168 STEAM TO SHORT STRING
 SHEET 4
 60-300PSY-131 ANNULUS GAS
 SHEET 4

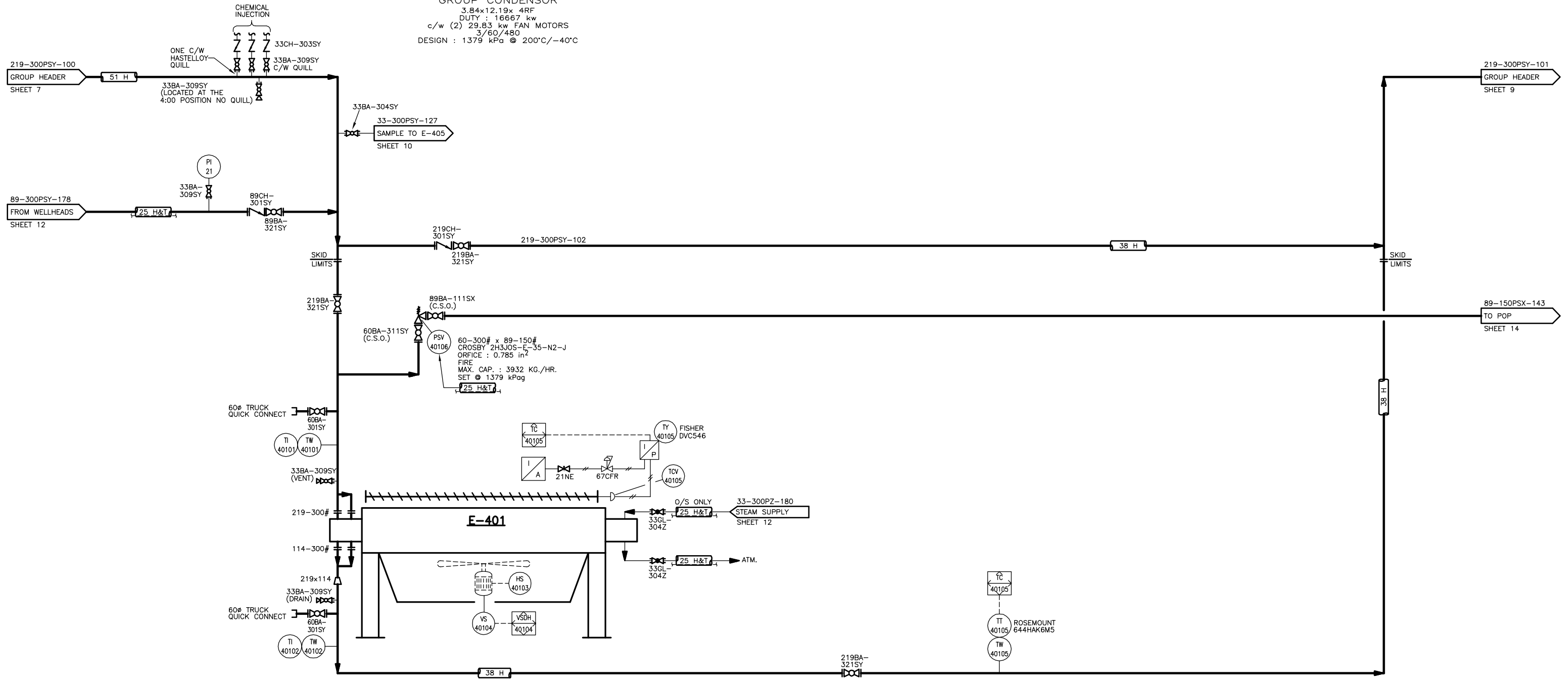
89-300PSY-112 GROUP FROM PH. 1 WELLPAIR
 F-43581-F-00-04
 60-300PSY-136 ANN. GAS FROM PH. 1 WELLPAIR
 F-43581-F-00-04

219-300PSY-100 GROUP HEADER
 SHEET 8
 89-300PSY-113 TEST HEADER
 SHEET 10
 273-300PZ-165 STEAM HEADER
 SHEET 12
 168-300PSY-130 ANNULUS HEADER
 SHEET 9

BLDG. LIMITS

SHEET NUMBER	DRAWING NUMBER	REV
7 OF 14	F-43581-F-00-01	6

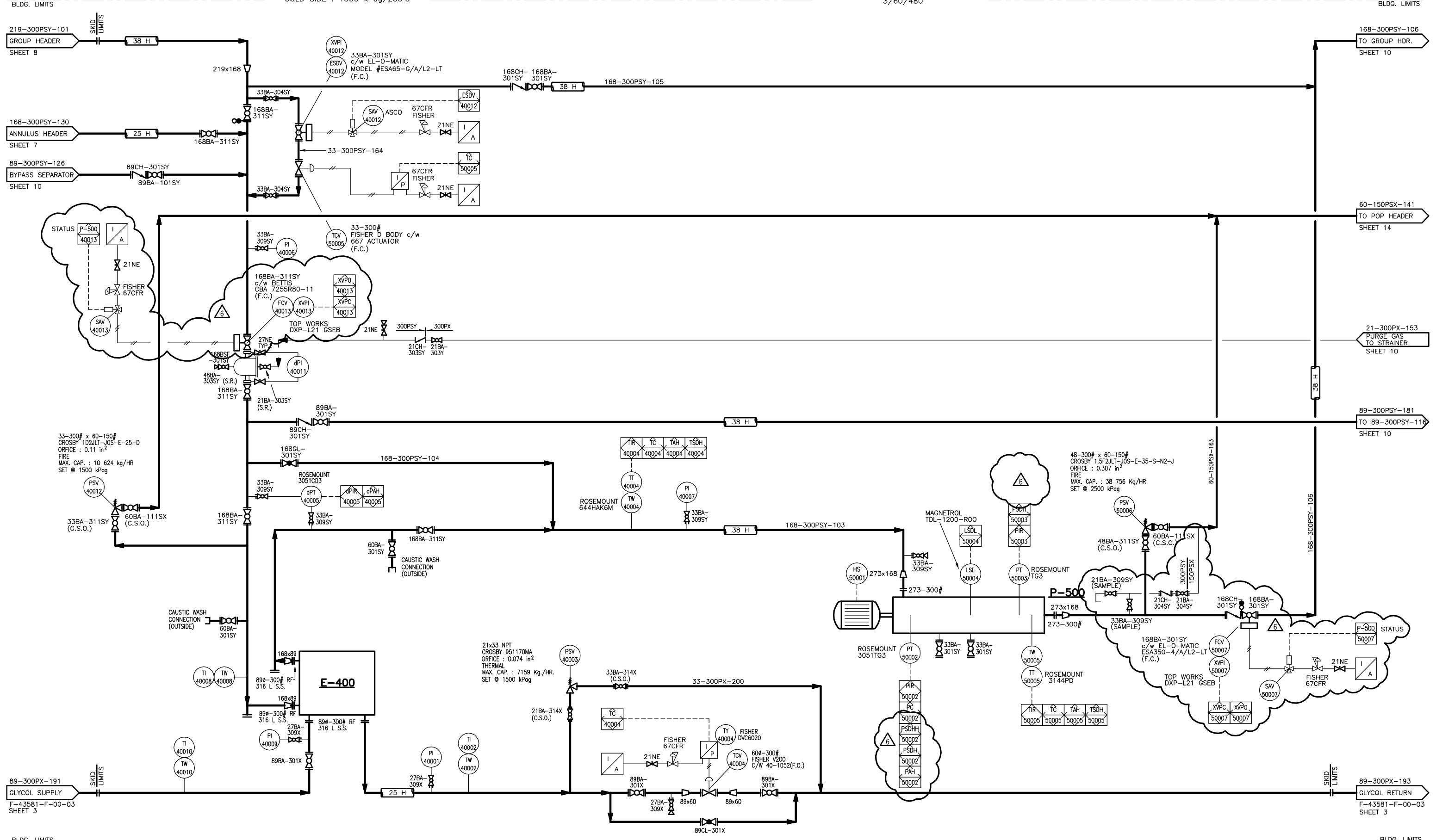
E-401
GROUP CONDENSOR
 3.84x12.19x 4RF
 DUTY : 16667 kW
 c/w (2) 29.83 kW FAN MOTORS
 3/60/480
 DESIGN : 1379 kPa @ 200°C/-40°C



SHEET NUMBER	DRAWING NUMBER	REV
8 OF 14	F-43581-F-00-01	6

E-400
GAS/GLYCOL EXCHANGER
 CPL 30-80
 DUTY : 409 kw
 HOT SIDE : 1500 kPag/200°C
 COLD SIDE : 1500 kPag/200°C

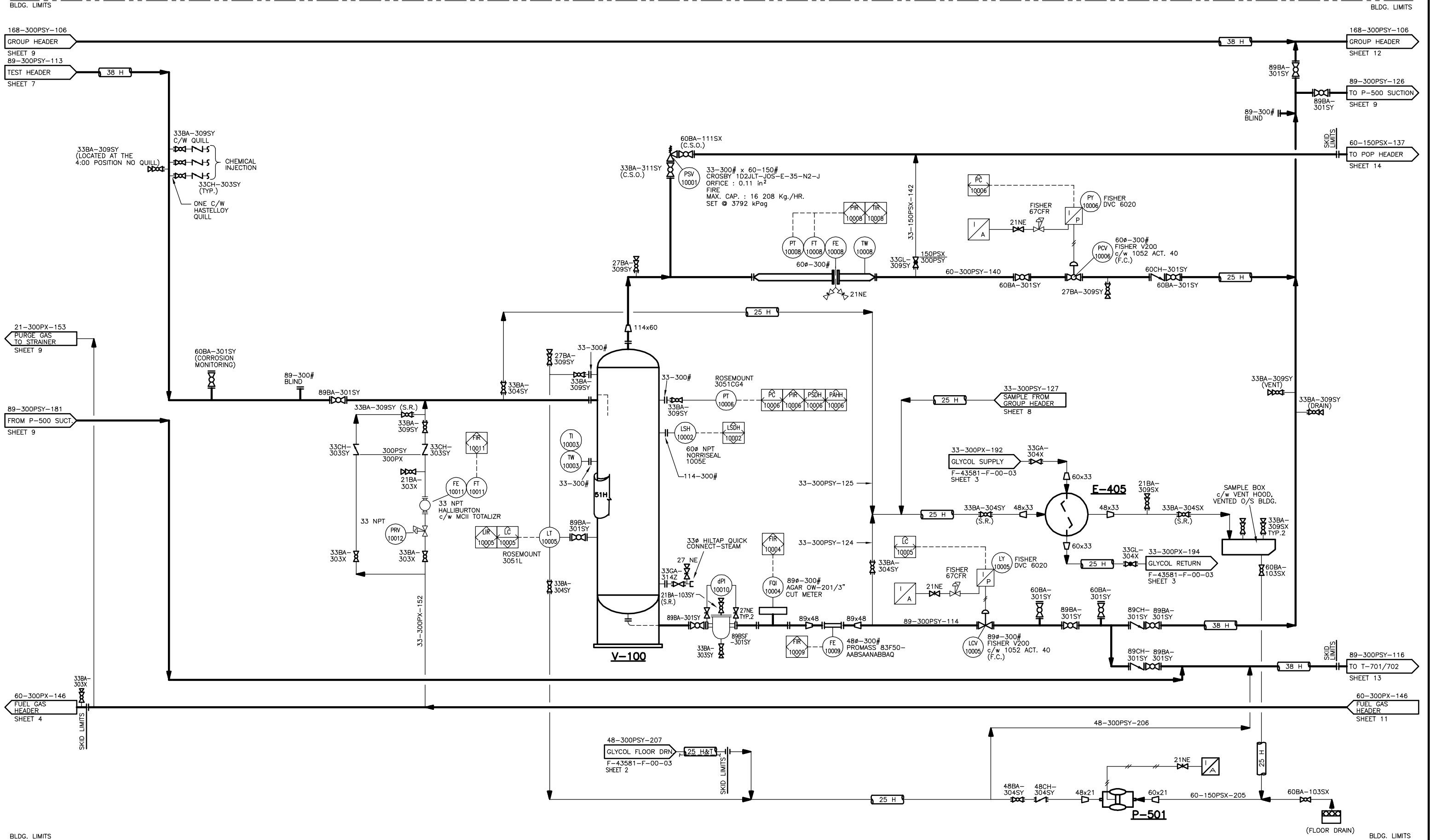
P-500
CASING PUMP MPP
 BORNEMANN TWIN SCREW MW 7T.3ZK-33
 120 m³/hr , 2000 kPag
 93.25 kw @ 1800 RPM VFD
 3/60/480



V-100
TEST SEPARATOR
762 O.D. x 2438 S/S
DESIGN: 3792 kPa @ 200°C
C.A. = 3.2mm

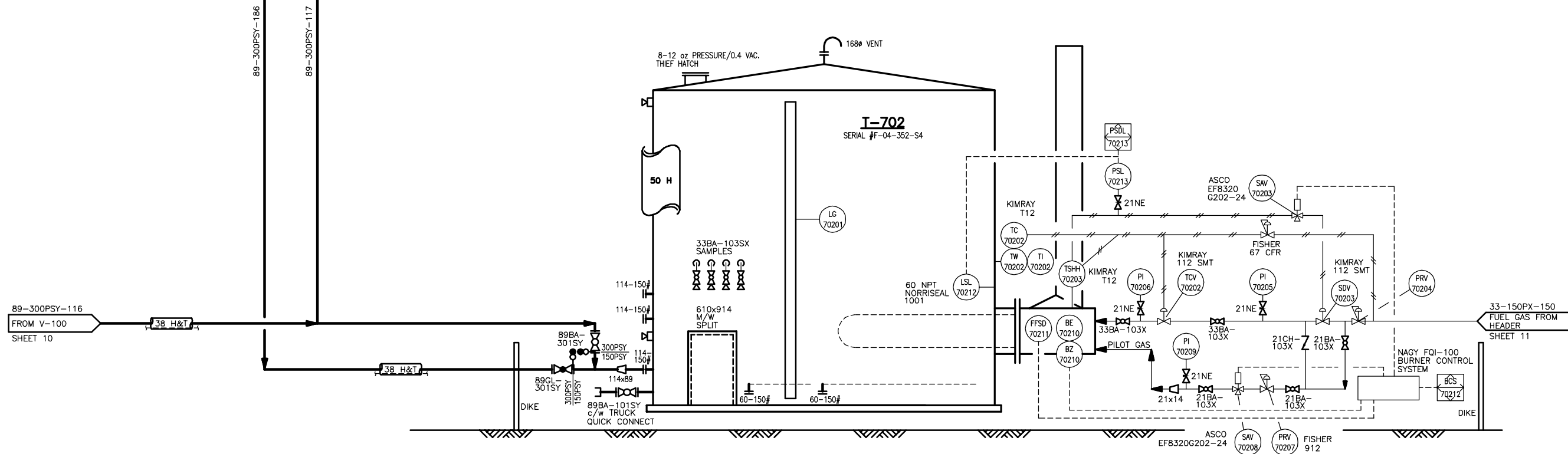
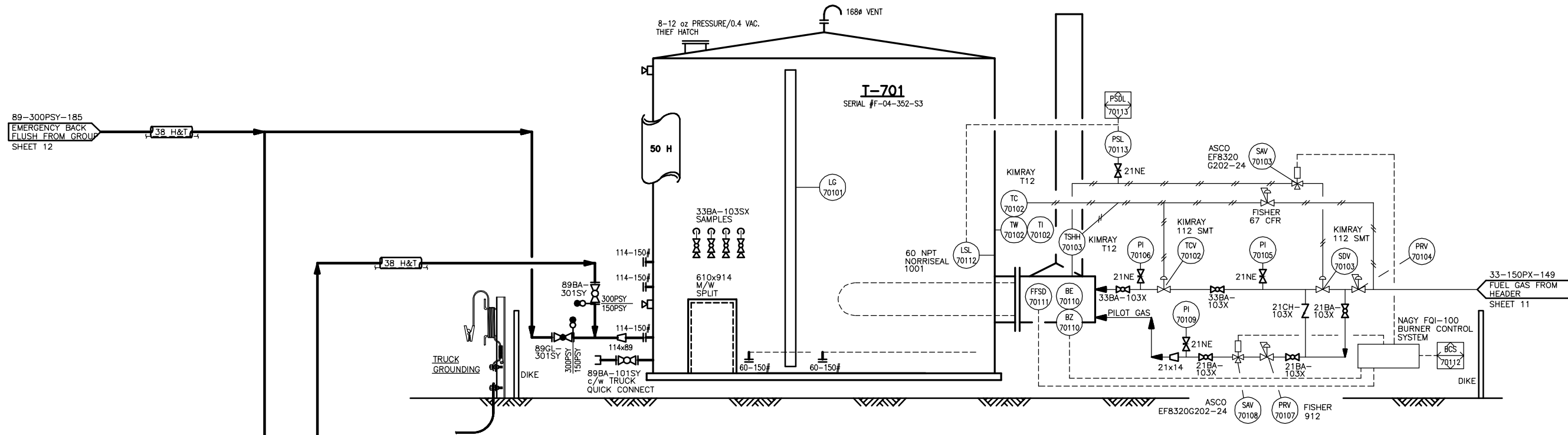
E-405
SAMPLE LINE COOLER
KETEMA LP
168ø x 1454 LONG
DESIGN SHELL/TUBE: 3482 kPag @ 225°C

P-501
SAMPLE BOX DRAIN PUMP



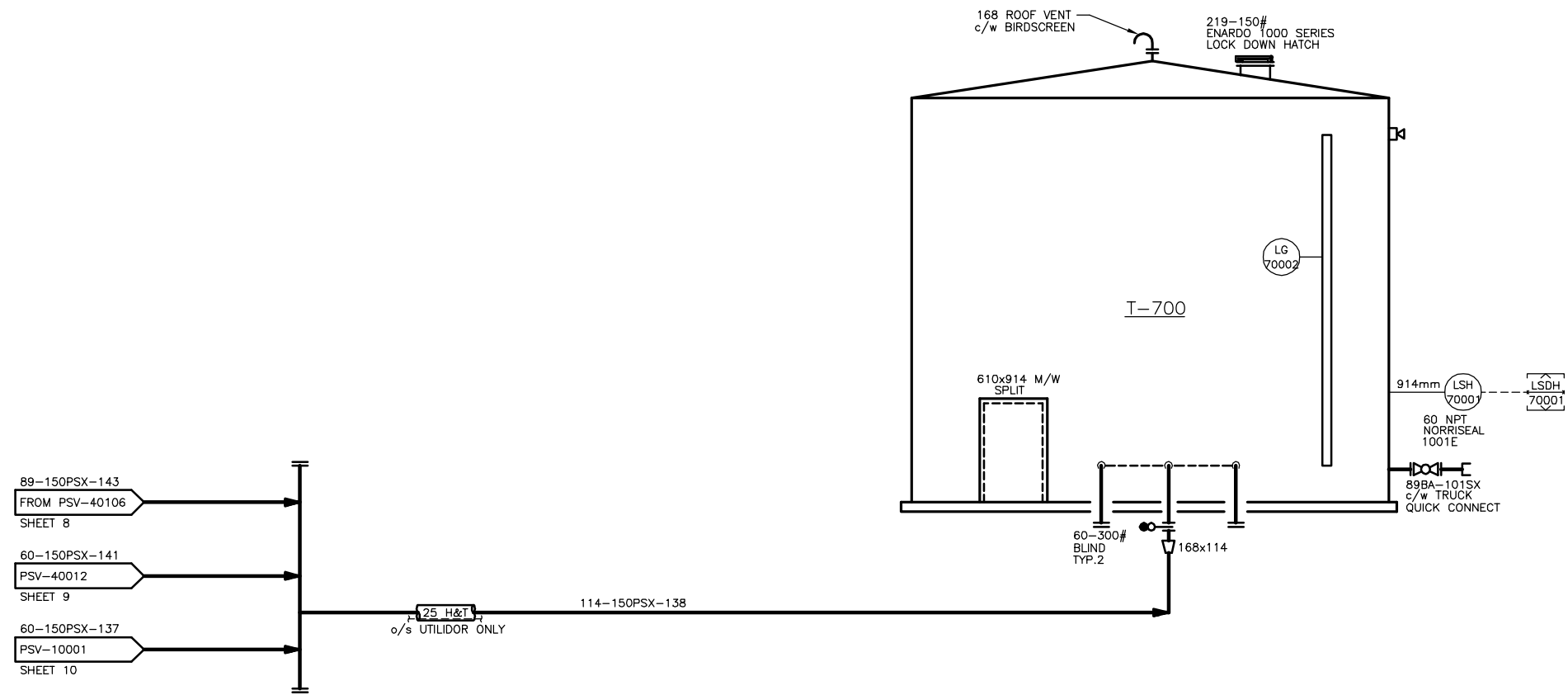
SHEET NUMBER	DRAWING NUMBER	REV
10 OF 14	F-43581-F-00-01	6

I-701/702
EMERGENCY BACK FLUSH TANKS
4648 O.D. x 7315 HIGH
119m³ (750bb)
c/w 500,000 BTU/HR BURNER
(RE-LOCATED FROM MSAR PROJECT)



SHEET NUMBER	DRAWING NUMBER	REV
13 OF 14	F-43581-F-00-01	6

T-700
 POP TANK
 4724 O.D. x 4877 HIGH
 80m³ (500BBL)



SHEET NUMBER	DRAWING NUMBER	REV
14 OF 14	F-43581-F-00-01	6



Bower Damberger Rolseth
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Rev. 3



DEER CREEK
Energy Limited

BDR Project: 33500
Date: March 18, 2005

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APPENDIX II

PROCESS FLOWSHEET (OIL TREATING)

LEGEND

	GATE VALVE (GA)		INSULATION (H-HOT, C-COLD)
	BALL VALVE (BA)		INSULATION & HEAT TRACE
	PLUG VALVE (PL)		PROCESS PIPING
	NEEDLE VALVE (NE)		PNEUMATIC SIGNAL
	GLOBE VALVE (GL)		CAPILLARY TUBING
	CHECK VALVE (CH)		ELECTRICAL SIGNAL
	BUTTERFLY VALVE (BU)		HYDRAULIC SIGNAL
	SOCKET WELD VALVE		ELECTROMAGNETIC/SONIC SIGNAL
	SCREWED VALVE		SOFTWARE OR DATA LINK
	FLANGED VALVE	A.O.	AIR TO OPEN (FAIL CLOSED)
	CONTROL VALVE WITH DIAPHRAGM ACTUATOR	A.C.	AIR TO CLOSE (FAIL TO OPEN)
	CONTROL VALVE WITH PISTON ACTUATOR	C.S.O.(C)	CAR SEAL OPEN (CLOSED)
	PRESSURE REGULATOR	E.S.D.	EMERGENCY SHUTDOWN
	SOLENOID VALVE	F.P.	FULL PORT
	ANGLE CHOKE	R.P.	REGULAR PORT
	INLINE CHOKE	N.C.	NORMALLY CLOSED
	Y-STRAINER	N.O.	NORMALLY OPEN
	PRESSURE SAFETY VALVE	S.R.	SPRING RETURN
	ORIFICE METER RUN		SPEC BREAK
	TURBINE METER OR POSITIVE DISPLACEMENT METER		SUPPLIED BY OTHERS
	SPECTACLE BLIND, OPEN (CLOSED)		TIE IN NUMBER
	CHANGE IN PIPE SIZE		TIE IN LOCATIONS
	INLINE STRAINER		PNEUMATIC TO CURRENT
			CURRENT TO PNEUMATIC

	LOCALLY MOUNTED INSTRUMENT
	MOUNTED ON MAIN CONTROL ROOM PANEL
	LOCAL PANEL MOUNTED INSTRUMENT
	DISTRIBUTED CONTROL SYSTEM ITEMS
	DISTRIBUTED CONTROL SYSTEM AUXILIARY OPERATOR'S INTERFACE
	DISTRIBUTED CONTROL SYSTEM ITEMS (COMPUTER FUNCTION)
	PROGRAMMABLE LOGIC CONTROL SYSTEM
	PROGRAMMABLE LOGIC CONTROL SYSTEMS ACCESSIBLE TO OPERATOR
	AUX. PROGRAMMABLE LOGIC CONTROL SYSTEMS ACCESSIBLE TO OPERATOR
	BLOWDOWN VALVE
	BURNER CONTROL STATUS
	BURNER ELEMENT
	BURNER IGNITOR
	CONTROL VALVE
	DIFFERENTIAL PRESSURE INDICATOR
	DIFFERENTIAL PRESSURE SWITCH
	EMERGENCY SHUTDOWN VALVE
	FLOW ALARM HIGH, L-LOW
	FLOW CONTROLLER
	FLOW CONTROL VALVE
	FIRE DETECTION SHUTDOWN
	FLOW SHUTDOWN HIGH, L-LOW
	FLOW ELEMENT
	FLAME FAILURE SHUTDOWN
	FLOW INDICATOR
	FLOW INDICATOR RECORDER
	FLOW RECORDER
	FLOW SWITCH (H-HIGH, L-LOW)
	FLOW TOTALIZER
	FLOW TOTALIZER


	FLOW TRANSDUCER		PRESSURE REGULATING VALVE
	HAND/OFF/AUTOMATIC		PRESSURE SWITCH (H-HIGH, L-LOW)
	H2S GAS DETECTION		PRESSURE SHUTDOWN HIGH, L-LOW
	H2S GAS DETECTION TRANSMITTER		PRESSURE SAFETY VALVE
	LEVEL ALARM HIGH, L-LOW		PRESSURE TRANSMITTER
	LEVEL CONTROLLER		PRESSURE VACUUM BREATHER
	LEVEL CONTROL VALVE		PRESSURE TRANSDUCER
	COMBUSTIBLE GAS DETECTION		RESTRICTING ORIFICE
	COMBUSTIBLE GAS DETECTION TRANSMITTER		SOLENOID ACTUATED VALVE
	LEVEL GAUGE		SURGE CONTROLLER
	LEVEL INDICATOR		SURGE CONTROL VALVE
	LEVEL INDICATOR CONTROLLER		SHUTDOWN VALVE
	LEVEL INDICATOR RECORDER		TEMPERATURE ALARM HIGH, L-LOW
	LEVEL RECORDER		TEMPERATURE CONTROLLER
	LEVEL SWITCH (H-HIGH, L-LOW)		TEMPERATURE CONTROL VALVE
	LEVEL SHUTDOWN HIGH, L-LOW		TEMPERATURE INDICATOR
	LEVEL TRANSMITTER		TEMPERATURE INDICATOR RECORDER
	LEVEL TRANSDUCER		TEMPERATURE SWITCH (H-HIGH, L-LOW)
	MOISTURE ELEMENT		TEMPERATURE SHUTDOWN HIGH, L-LOW
	MOISTURE INDICATOR		TEMPERATURE TRANSMITTER
	OVERSPEED SWITCH		THERMO WELL
	OVERSPEED SHUTDOWN		TEMPERATURE TRANSDUCER
	PRESSURE ALARM HIGH, L-LOW		VALVE ACTUATION INDICATOR
	PRESSURE CONTROLLER		VIBRATION SWITCH
	PRESSURE CONTROL VALVE		VIBRATION SHUTDOWN
	POSITIVE DISPLACEMENT METER		VIBRATION SHUTDOWN HIGH
	PRESSURE INDICATOR		VIBRATION TRANSMITTER
	PRESSURE INDICATOR CONTROLLER		VALVE POSITION INDICATOR
	PRESSURE INDICATOR RECORDER		VALVE POSITION SWITCH
	PRESSURE RECORDER		LIMIT SWITCH

11	UPDATED AS PER MECHANICAL FLOWSHEET	33500	CK	05.08.15	
10	REVISED FOR HAZOP REVIEW	33500	JG	04.12.08	
9	REVISED FOR DBM	33500	RG	04.08.30	
8	REVISED FOR DBM	33500	RG	04.03.31	
7	REVISED FOR CLIENT APPROVAL	33500	RG	04.03.10	
6	REVISED	33500	CT	04.02.10	
5	REVISED	33500	RG	04.02.03	
4	REVISED	33500	RG	04.01.08	
NO.	REVISION	PROJ. No.	BY	DATE	CHK.

GENERAL NOTES:	
1.	"BEST CONSTRUCTION PRACTICE" ARE OBSERVED FROM CONSTRUCTION CHANGE INFORMATION PROVIDED TO BOWER DAMBERGER ROLSETH ENGINEERING LTD. BY THE OPERATOR'S PROJECT SUPERVISOR AND CONTRACTOR. ANY CHANGES NOT DOCUMENTED WILL NOT APPEAR ON THE DRAWINGS AND THEREFORE THE DRAWING MUST BE AN ACCURATE REPRESENTATION OF THE CONSTRUCTED FACILITY.
2.	PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION AND/OR OPERATION IT SHALL BE THE RESPONSIBILITY OF THE OWNER REPRESENTATIVE TO VERIFY THE LOCATION AND SCOPE OF ANY PIPING, ELECTRICAL EQUIPMENT OR BUILDINGS.
3.	ANY REVISIONS MADE TO EXISTING EQUIPMENT, PIPING OR ELECTRICAL ON A FACILITY NOT DESIGNED BY BDR, INC. LTD. IS SOLELY SHOWN AS A REPRESENTATION OF WHAT EXISTS AND MUST BE VERIFIED BY THE OWNER.

DRN.	BY	DATE
CHK.	RG	03.08.29
APP'D.		
L.S.D.	14-28-95-12	W4M


Bower Damberger Rolseth
 Engineering Ltd.


JOSLYN PHASE 2 SAGD FACILITY
PROCESS FLOWSHEET (OIL TREATING)

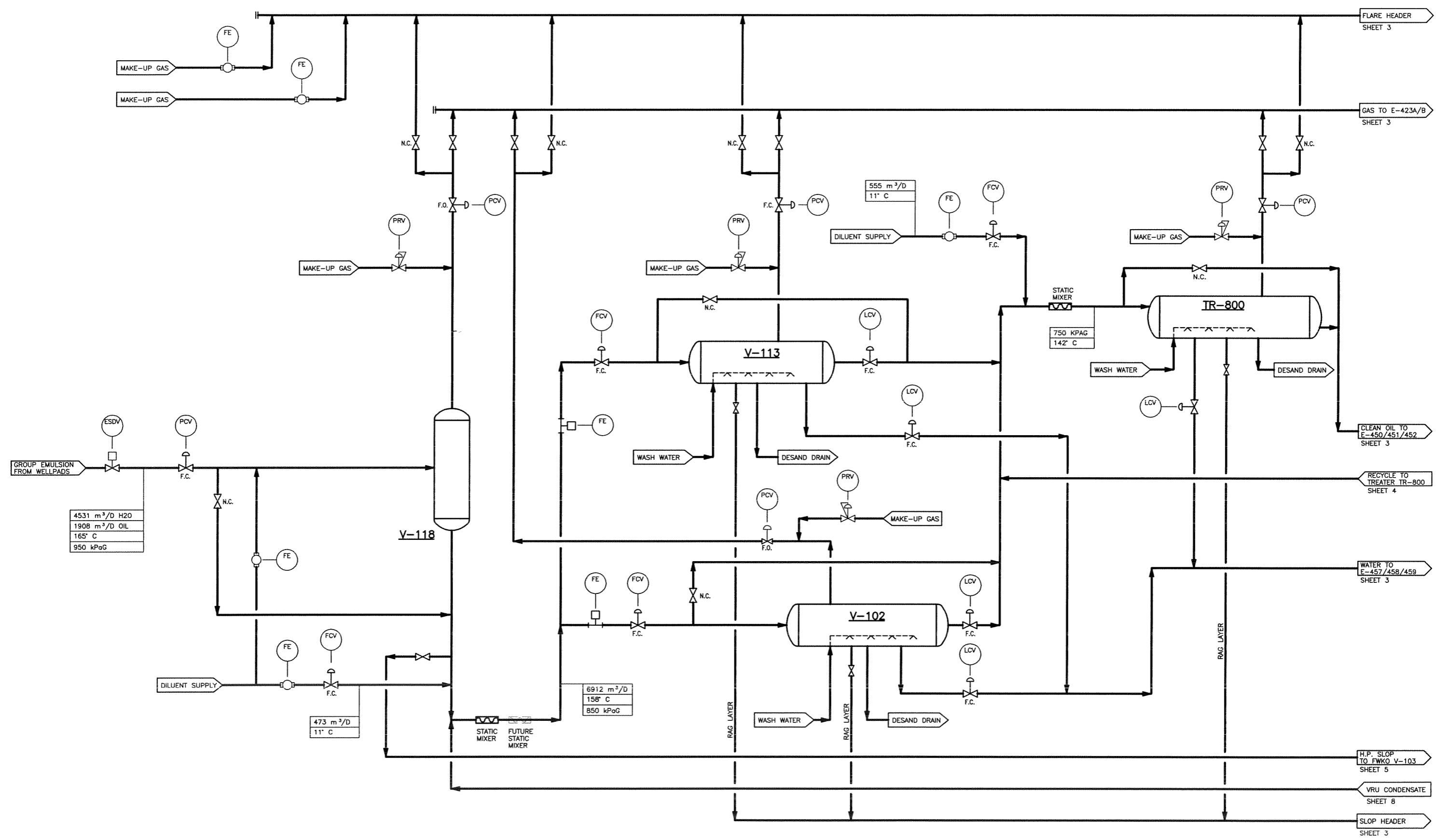
SHEET NUMBER	DRAWING NUMBER	REV
1 OF 8	F-33500-F-00-02	11

V-118
GROUP SEPARATOR

V-113
FREE WATER KNOCKOUT

V-102
FREE WATER KNOCKOUT

TR-800
TREATER



SHEET NUMBER	DRAWING NUMBER	REV
2 OF 8	F-33500-F-00-02	11

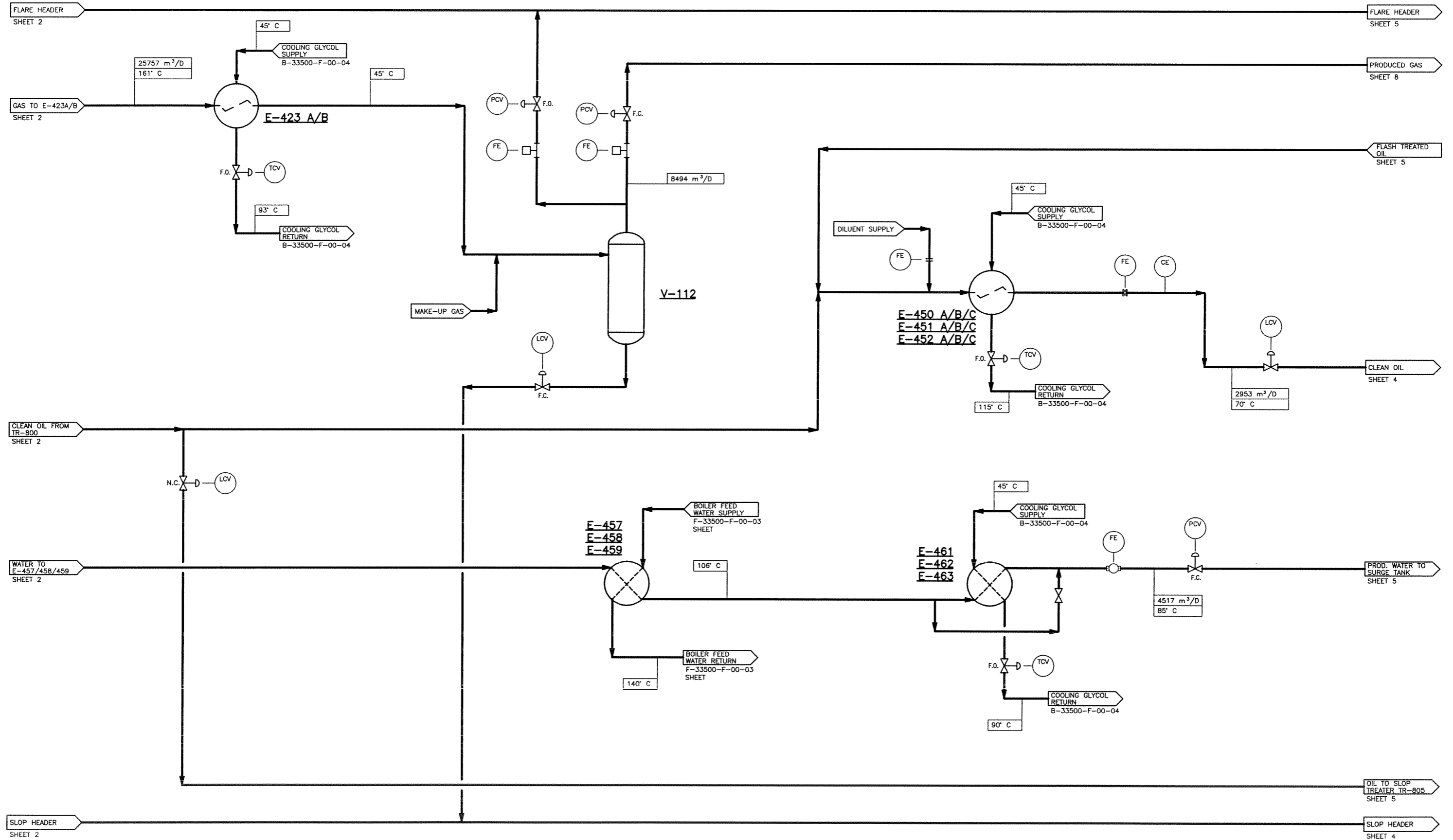
E-423 A/B
INLET VAPOUR COOLER

V-112
PROD. GAS SEPARATOR

E-457/458/459
PROD. WATER/BFW EXCH.

E-450/451/452 A/B/C (9 REQD.)
CLEAN OIL/GLYCOL EXCHANGERS

E-461/462/463
PROD. WATER/GLYCOL EXCH.



SHEET NUMBER	DRAWING NUMBER	REV
3 OF 8	F-33500-F-00-02	11

T-700
OIL PRODUCTION TANK

T-701
SALES OIL TANK

T-702
OFF SPEC. BITUMEN TANK

T-703
SLOP TANK

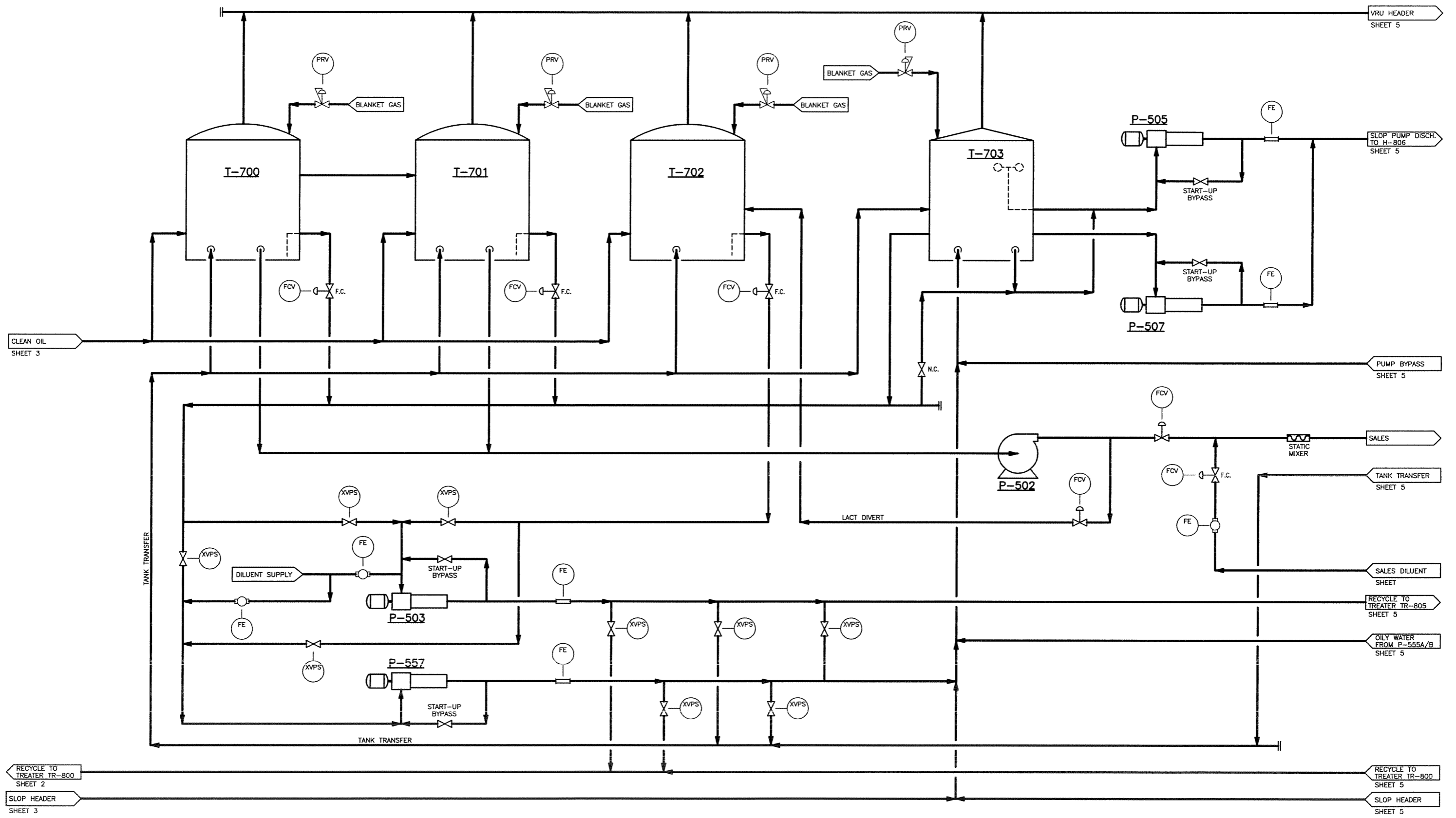
P-503
OFF SPEC. OIL RECYCLE PUMP

P-557
RECYCLE PUMP

P-502
LACT FEED PUMP

P-505
SLOP OIL PUMP

P-507
SLOP WATER PUMP



SHEET NUMBER	DRAWING NUMBER	REV
4 OF 8	F-33500-F-00-02	11

H-806
RECYCLE HEATER

V-103
RECYCLE FWKO

E-402 A/B
SLOP PROD. WATER/GLYCOL EXCH.

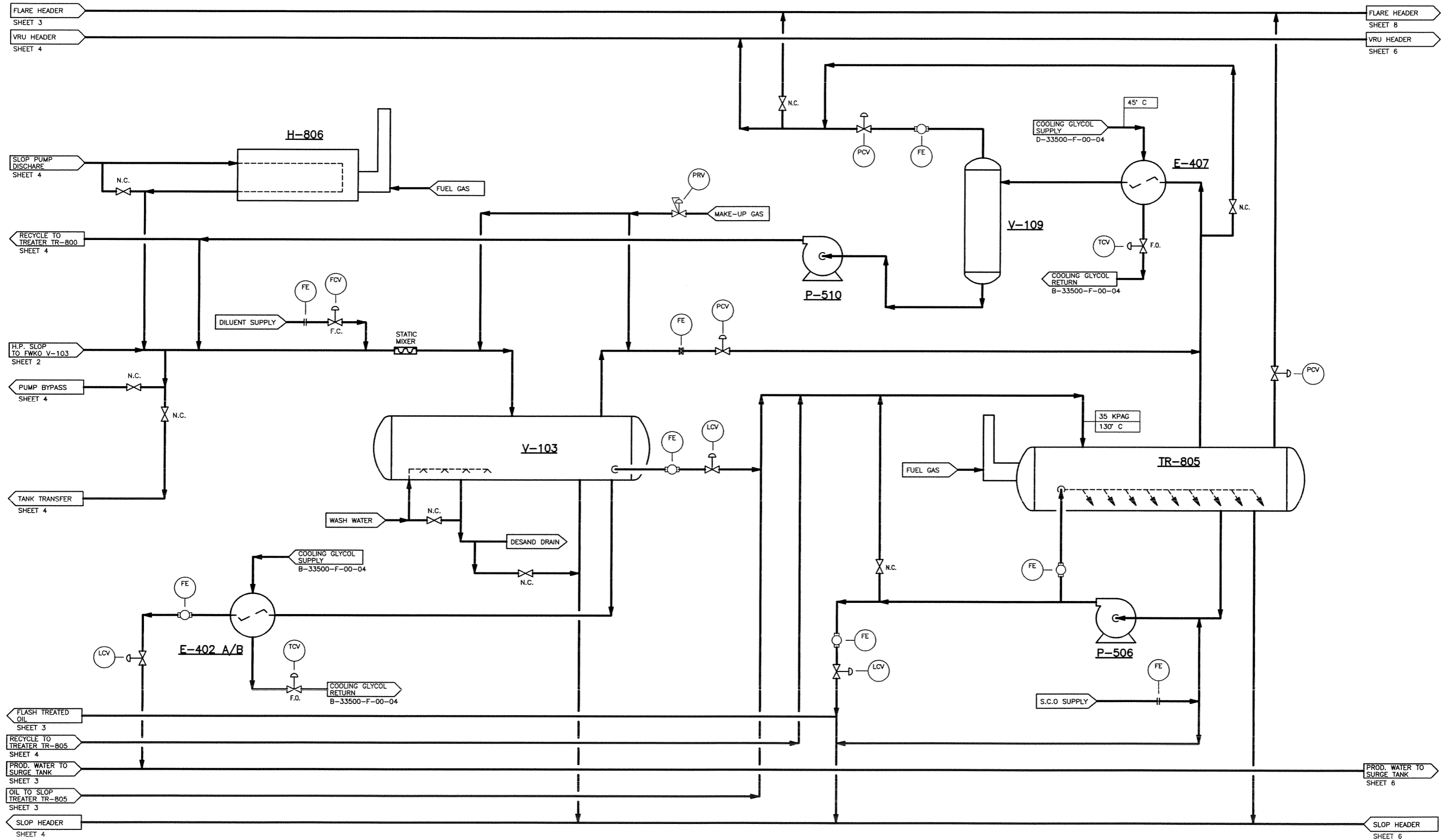
P-510
RECYCLE TREATER O.H.'S DRAIN PUMP

V-109
RECYCLE TREATER
OVERHEADS SEPARATOR

E-407
RECYCLE TREATER O.H.'S CONDENSER

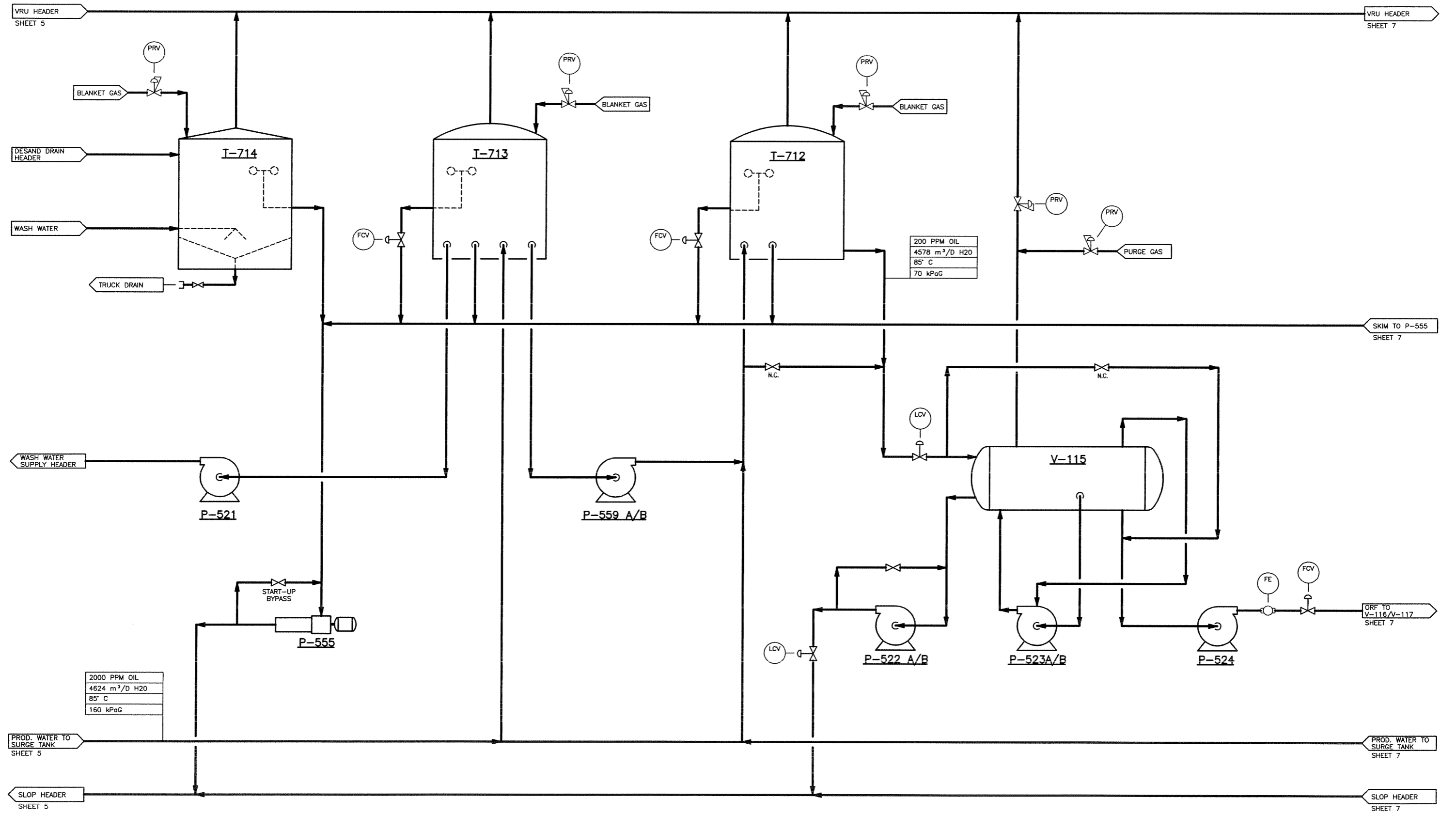
TR-805
RECYCLE TREATER

P-506
RECYCLE TREATER
RECIRC. PUMP



SHEET NUMBER	DRAWING NUMBER	REV
5 OF 8	F-33500-F-00-02	11

P-521 WASH WATER PUMP P-555 SKIM PUMP T-714 DESAND TANK T-713 SURGE TANK P-559 A/B SKIM FEED PUMPS T-712 SKIM TANK P-522 A/B IGF SKIM OVERFLOW OIL PUMPS P-523A/B IGF RECYCLE PUMPS V-115 INDUCED GAS FLOTATION UNIT P-524 ORF FEED PUMP



SHEET NUMBER	DRAWING NUMBER	REV
6 OF 8	F-33500-F-00-02	11

I-715
DE-OILED WATER TANK

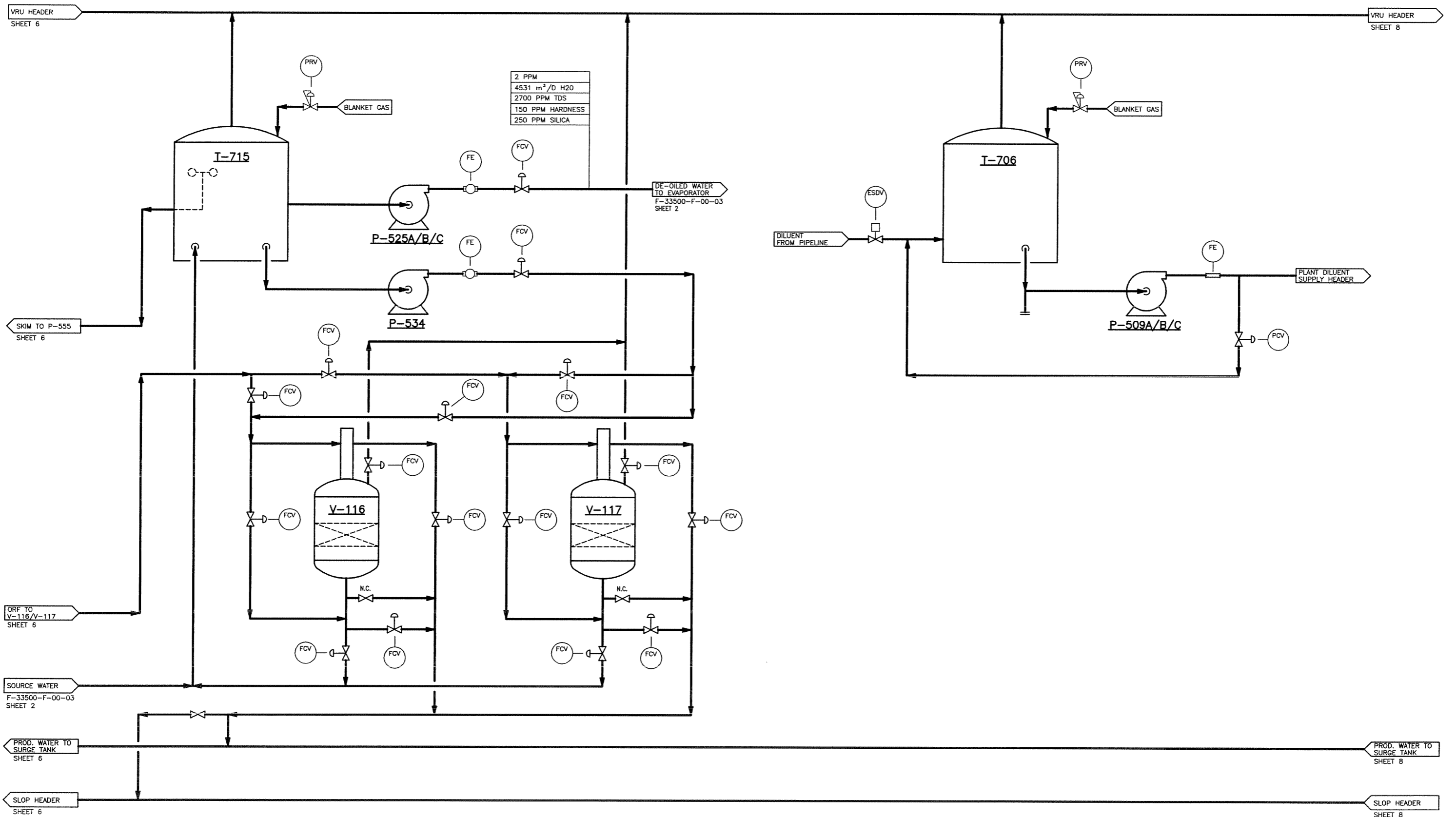
P-525 A/B/C
DE-OILED WATER PUMPS

P-534
OIL FILTER RECYCLE PUMP

V-116/V-117
OIL REMOVAL FILTER

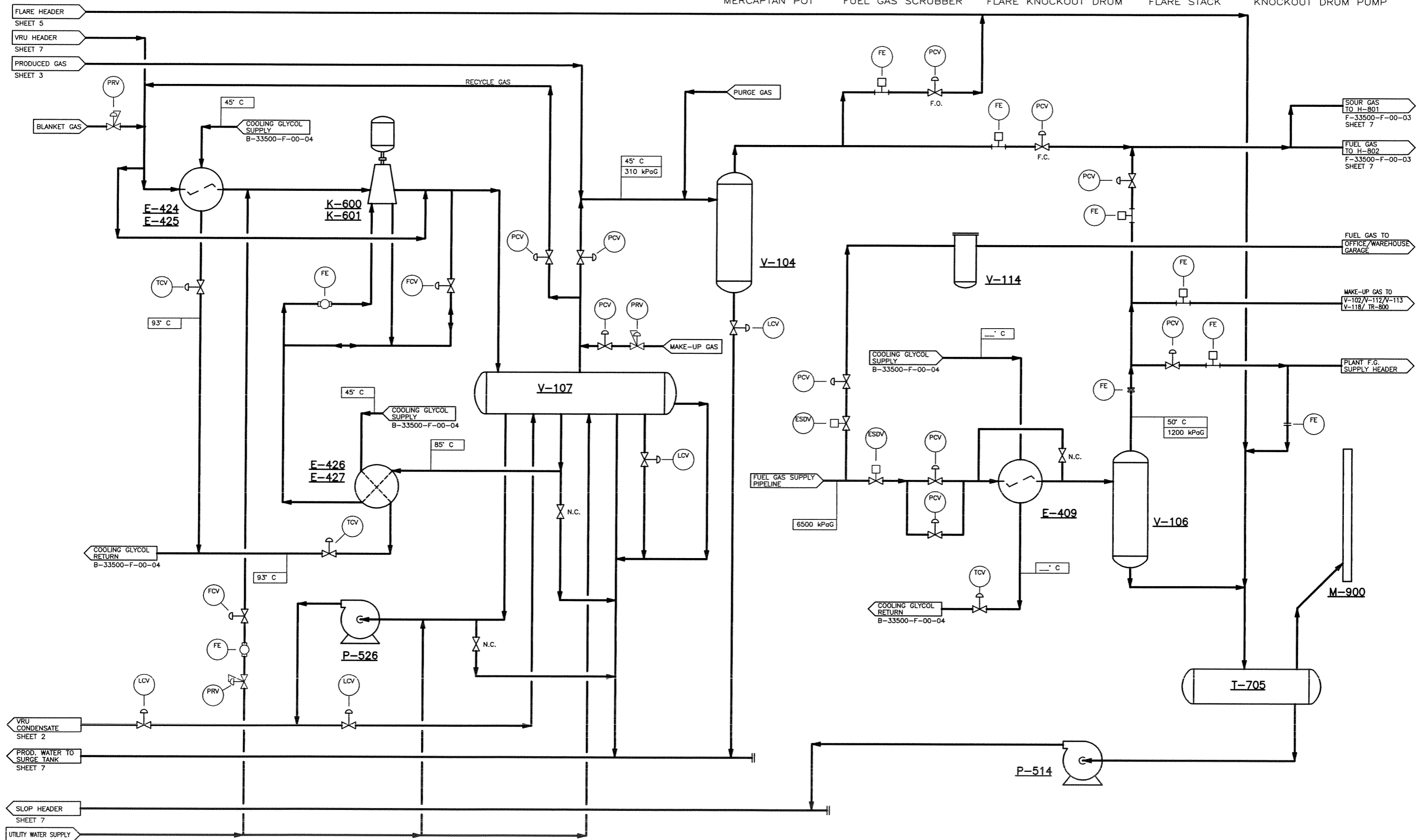
T-706
DILUENT TANK

P-509A/B/C
DILUENT PUMPS



SHEET NUMBER	DRAWING NUMBER	REV
7 OF 8	F-33500-F-00-0	11

E-424/425 VRU INLET COOLER K-600/601 VRU LIQUID RING COMPRESSOR V-107 VRU DISCHARGE SEPARATOR E-426/427 RING WATER/COOLING GLYCOL EXCHANGER P-526 VRU CONDENSATE PUMP V-104 SOUR FUEL GAS SEPARATOR E-409 FUEL GAS HEATER
 V-114 MERCAPTAN POT V-106 FUEL GAS SCRUBBER T-705 FLARE KNOCKOUT DRUM M-900 FLARE STACK P-514 KNOCKOUT DRUM PUMP



FLARE HEADER SHEET 5
 VRU HEADER SHEET 7
 PRODUCED GAS SHEET 3
 BLANKET GAS
 COOLING GLYCOL SUPPLY B-33500-F-00-04
 COOLING GLYCOL RETURN B-33500-F-00-04
 VRU CONDENSATE SHEET 2
 PROD. WATER TO SURGE TANK SHEET 7
 SLOP HEADER SHEET 7
 UTILITY WATER SUPPLY

PURGE GAS
 SOUR GAS TO H-801 F-33500-F-00-03 SHEET 7
 FUEL GAS TO H-802 F-33500-F-00-03 SHEET 7
 FUEL GAS TO OFFICE/WAREHOUSE GARAGE
 MAKE-UP GAS TO V-102/V-112/V-113 V-118/ TR-800
 PLANT F.G. SUPPLY HEADER



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










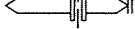























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Date: March 18, 2005

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APPENDIX III

PROCESS FLOWSHEET (WATER AND STEAM)

LEGEND

 GATE VALVE (GA)  BALL VALVE (BA)  PLUG VALVE (PL)  NEEDLE VALVE (NE)  GLOBE VALVE (GL)  CHECK VALVE (CH)  BUTTERFLY VALVE (BU)  SOCKET WELD VALVE  SCREWED VALVE  FLANGED VALVE  CONTROL VALVE WITH DIAPHRAGM ACTUATOR  CONTROL VALVE WITH PISTON ACTUATOR  PRESSURE REGULATOR  SOLENOID VALVE  ANGLE CHOKE  INLINE CHOKE  Y-STRAINER  PRESSURE SAFETY VALVE  ORIFICE METER RUN  TURBINE METER OR POSITIVE DISPLACEMENT METER  SPECTACLE BLIND, OPEN (CLOSED)  CHANGE IN PIPE SIZE  INLINE STRAINER	 INSULATION (H-HOT, C-COLD)  INSULATION & HEAT TRACE  PROCESS PIPING  PNEUMATIC SIGNAL  CAPILLARY TUBING  ELECTRICAL SIGNAL  HYDRAULIC SIGNAL  ELECTROMAGNETIC/SONIC SIGNAL  SOFTWARE OR DATA LINK <p>A.O. AIR TO OPEN (FAIL CLOSED) A.C. AIR TO CLOSE (FAIL TO OPEN) C.S.O.(C) CAR SEAL OPEN (CLOSED) E.S.D. EMERGENCY SHUTDOWN F.P. FULL PORT R.P. REGULAR PORT N.C. NORMALLY CLOSED N.O. NORMALLY OPEN S.R. SPRING RETURN</p>  SPEC BREAK  SUPPLIED BY OTHERS  TIE IN NUMBER  TIE IN LOCATIONS  PNEUMATIC TO CURRENT  CURRENT TO PNEUMATIC	 LOCALLY MOUNTED INSTRUMENT  MOUNTED ON MAIN CONTROL ROOM PANEL  LOCAL PANEL MOUNTED INSTRUMENT  DISTRIBUTED CONTROL SYSTEM ITEMS  DISTRIBUTED CONTROL SYSTEM AUXILIARY OPERATOR'S INTERFACE  DISTRIBUTED CONTROL SYSTEM ITEMS (COMPUTER FUNCTION)  PROGRAMMABLE LOGIC CONTROL SYSTEM  PROGRAMMABLE LOGIC CONTROL SYSTEMS ACCESSIBLE TO OPERATOR  AUX. PROGRAMMABLE LOGIC CONTROL SYSTEMS ACCESSIBLE TO OPERATOR <p>BDV BLOWDOWN VALVE BCS BURNER CONTROL STATUS BE BURNER ELEMENT BZ BURNER IGNITOR CV CONTROL VALVE DPI DIFFERENTIAL PRESSURE INDICATOR DPS DIFFERENTIAL PRESSURE SWITCH ESDV EMERGENCY SHUTDOWN VALVE FAH FLOW ALARM HIGH, L-LOW FC FLOW CONTROLLER FCV FLOW CONTROL VALVE FSDS FIRE DETECTION SHUTDOWN FSDH FLOW SHUTDOWN HIGH, L-LOW FE FLOW ELEMENT FFSD FLAME FAILURE SHUTDOWN FI FLOW INDICATOR FIR FLOW INDICATOR RECORDER FR FLOW RECORDER FS FLOW SWITCH (H-HIGH, L-LOW) FQI FLOW TOTALIZER FT FLOW TOTALIZER</p>	<p>FZ FLOW TRANSDUCER HOA HAND/OFF/AUTOMATIC H2S H2S GAS DETECTION H2ST H2S GAS DETECTION TRANSMITTER LAH LEVEL ALARM HIGH, L-LOW LC LEVEL CONTROLLER LCV LEVEL CONTROL VALVE LEL COMBUSTIBLE GAS DETECTION LELT COMBUSTIBLE GAS DETECTION TRANSMITTER LG LEVEL GAUGE LI LEVEL INDICATOR LIC LEVEL INDICATOR CONTROLLER LIR LEVEL INDICATOR RECORDER LR LEVEL RECORDER LS LEVEL SWITCH (H-HIGH, L-LOW) LSDH LEVEL SHUTDOWN HIGH, L-LOW LT LEVEL TRANSMITTER LZ LEVEL TRANSDUCER ME MOISTURE ELEMENT MI MOISTURE INDICATOR OSS OVERSPEED SWITCH OSSD OVERSPEED SHUTDOWN PAH PRESSURE ALARM HIGH, L-LOW PC PRESSURE CONTROLLER PCV PRESSURE CONTROL VALVE PDM POSITIVE DISPLACEMENT METER PI PRESSURE INDICATOR PIC PRESSURE INDICATOR CONTROLLER PIR PRESSURE INDICATOR RECORDER PR PRESSURE RECORDER</p> <p>PRV PRESSURE REGULATING VALVE PS PRESSURE SWITCH (H-HIGH, L-LOW) PSDH PRESSURE SHUTDOWN HIGH, L-LOW PSV PRESSURE SAFETY VALVE PT PRESSURE TRANSMITTER PVB PRESSURE VACUUM BREATHER PY PRESSURE TRANSDUCER RO RESTRICTING ORIFICE SAV SOLENOID ACTUATED VALVE SC SURGE CONTROLLER SCV SURGE CONTROL VALVE SDV SHUTDOWN VALVE TAH TEMPERATURE ALARM HIGH, L-LOW TC TEMPERATURE CONTROLLER TCV TEMPERATURE CONTROL VALVE TI TEMPERATURE INDICATOR TIR TEMPERATURE INDICATOR RECORDER TS TEMPERATURE SWITCH (H-HIGH, L-LOW) TSDH TEMPERATURE SHUTDOWN HIGH, L-LOW TT TEMPERATURE TRANSMITTER TW THERMO WELL TY TEMPERATURE TRANSDUCER VI VALVE ACTUATION INDICATOR VS VIBRATION SWITCH VSD VIBRATION SHUTDOWN VSDH VIBRATION SHUTDOWN HIGH VT VIBRATION TRANSMITTER XVPI VALVE POSITION INDICATOR XVPS VALVE POSITION SWITCH ZS LIMIT SWITCH</p>
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NO.	REVISION	PROJ. No.	BY	DATE	CHK.
12	UPDATED AS PER MECHANICAL FLOWSHEET	33500	CK	05.08.17	
11	REVISED	33500	LEV	05.02.23	
10	REVISED	33500	CT	04.10.20	
9	REVISED FOR DBM	33500	RG	07.08.31	
8	SWITCHED TO EVAPORATOR SYSTEM	33500	RG	04.07.28	
7	REVISED FOR DBM	33500	RG	04.04.01	
6	REVISED FOR CLIENT APPROVAL	33500	RG	04.03.15	
5	REVISED	33500	CT	04.02.12	
4	REVISED	33500	RG	04.01.30	


DRN.	BY	DATE
CHK.	RG	04.06.02
APP'D.		
L.S.D.	14-28-95-12	W4M

GENERAL NOTES:

- "BEST CONSTRUCTION PRACTICE" ARE ASSUMED FROM CONSTRUCTION CHANGE INFORMATION FORWARDED TO BOWER DAMBERGER ROLSETH ENGINEERING LTD. BY THE OWNER'S FIELD SUPERVISORS AND OR HIRER CONTRACTORS. ANY CHANGES NOT FORWARDED WILL NOT APPEAR ON THE DRAWINGS AND THEREFORE THE DRAWING MAY NOT BE AN ACCURATE REPRESENTATION OF THE CONSTRUCTED FACILITY.
- REFER TO THE COMMENTARY OF ANY CONSTRUCTION AND OR EXECUTION IT SHALL BE THE RESPONSIBILITY OF THE OWNER REPRESENTATIVE TO VERIFY THE LOCATION AND STATUS OF ANY PIPING, ELECTRICAL, EQUIPMENT OR SERVICES.
- ANY REVISIONS MADE TO EXISTING EQUIPMENT, PIPING OR ELECTRICAL ON A FACILITY NOT DESIGNED BY BDR, ENG. LTD. IS ONLY SHOWN AS A REPRESENTATION OF WHAT EXISTS AND MUST BE VERIFIED BY THE OWNER.



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Engineering Ltd.**



**JOSLYN PHASE 2 SAGD FACILITY
PROCESS FLOWSHEET (WATER & STEAM)**

SHEET NUMBER	DRAWING NUMBER	REV
1 OF 9	F-33500-F-00-03	12

M-903
SOURCE WATER FILTER

P-558A/B/C
SOURCE WATER PUMPS

T-740
SOURCE WATER TANK

E-416/E-417
SOURCE WATER/COOLING GLYCOL EXCHANGERS

M-901
SEAL WATER FILTER

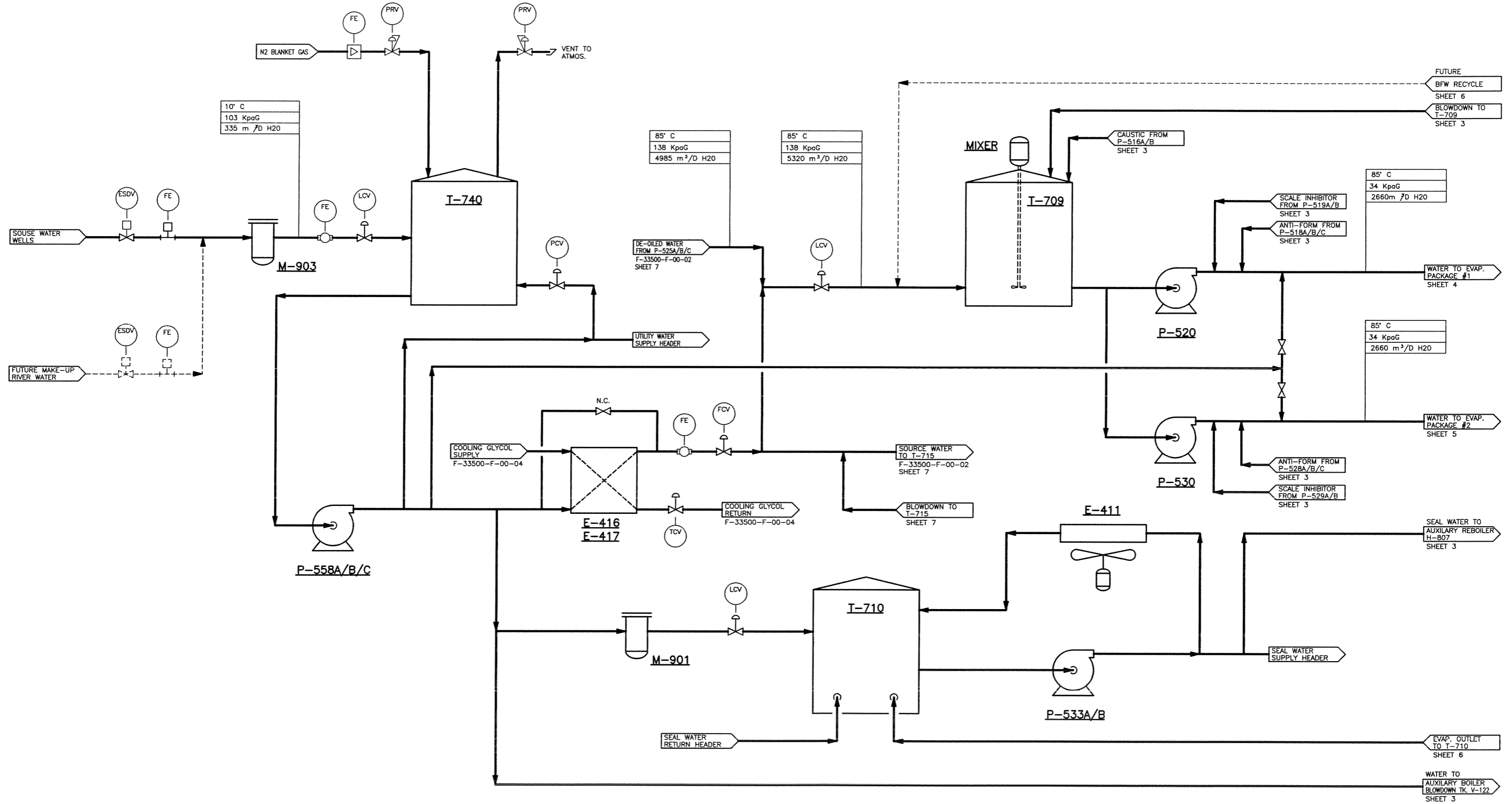
T-710
SEAL WATER TANK

T-709
EVAP. FEED TANK

P-520/P-530
EVAP. FEED PUMPS

P-533A/B
SEAL WATER PUMPS

E-411
SEAL WATER COOLER



V-133/V-134
BOILER CHEMICAL FEEDER POTS

H-807
AUX. BOILER

V-122
AUX. BOILER BLOWDOWN TANK

T-711
CAUSTIC TANK

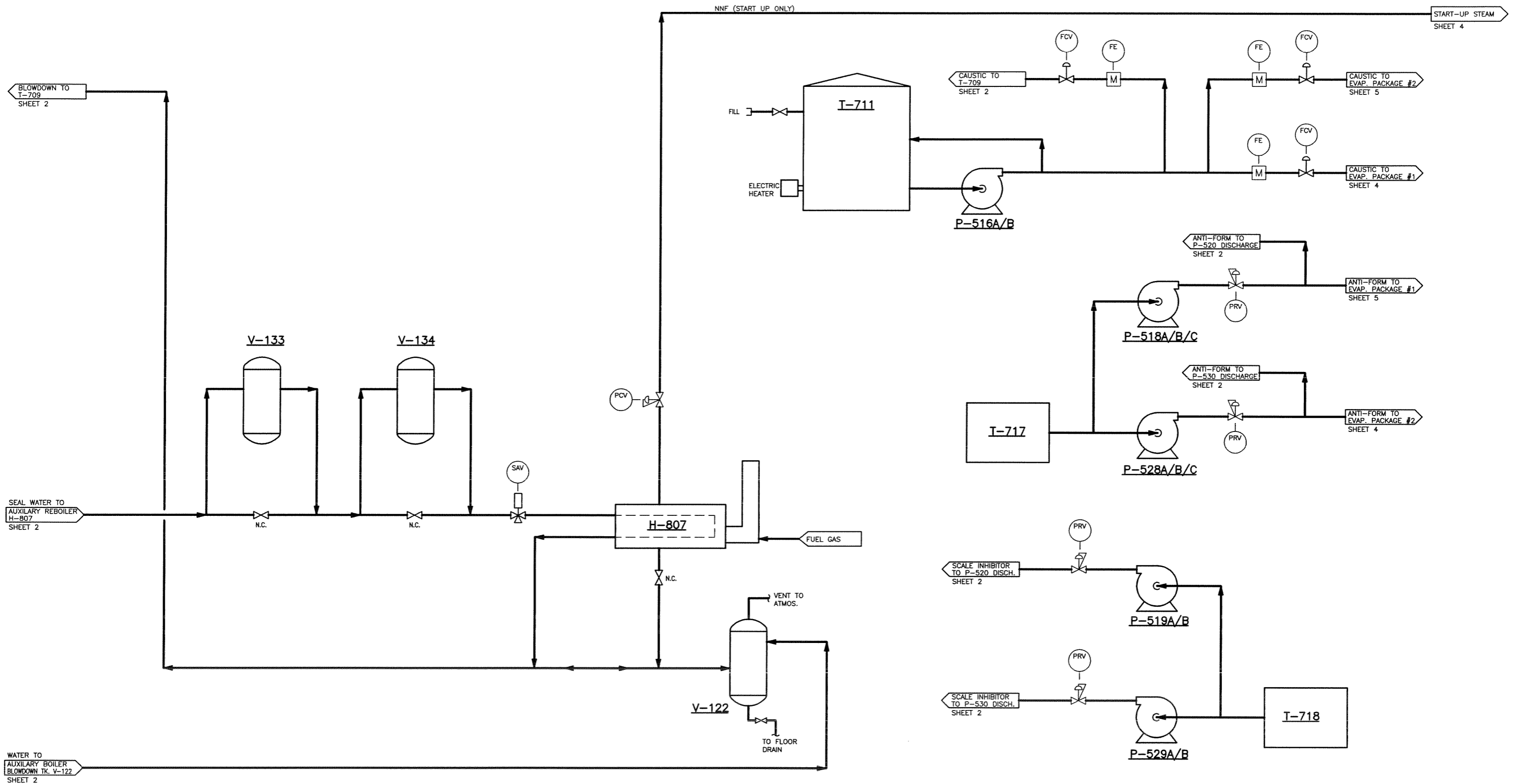
P-516A/B
CAUSTIC FEED PUMPS

T-717
ANTI-FOAM TANK

P-518A/B/C & P-529A/B/C
ANTI-FOAM PUMPS

T-718
SCALE INHIBITOR TANK

P-519A/B & P-529A/B
SCALE INHIBITOR PUMPS



SHEET NUMBER	DRAWING NUMBER	REV
3 OF 9	F-33500-F-00-03	12

E-412
FEED WATER/DISTILLATE EXCHANGER

V-120
DEAERATOR

P-580
SECONDARY FEED PUMP

P-581
DISTILLATE PUMP

K-606
VAPOR COMPRESSOR

V-121
DISTILLATE TANK

V-119
EVAPORATOR

P-582
EVAP. RECIRC. PUMP

START-UP STEAM
SHEET 3

NNF (START UP ONLY)

START-UP STEAM
SHEET 5

85° C
34 KpaG
2660 m³/D H2O

WATER TO EVAP.
PACKAGE #1
SHEET 2

90° C
103 kPaG
2544 m³/D H2O

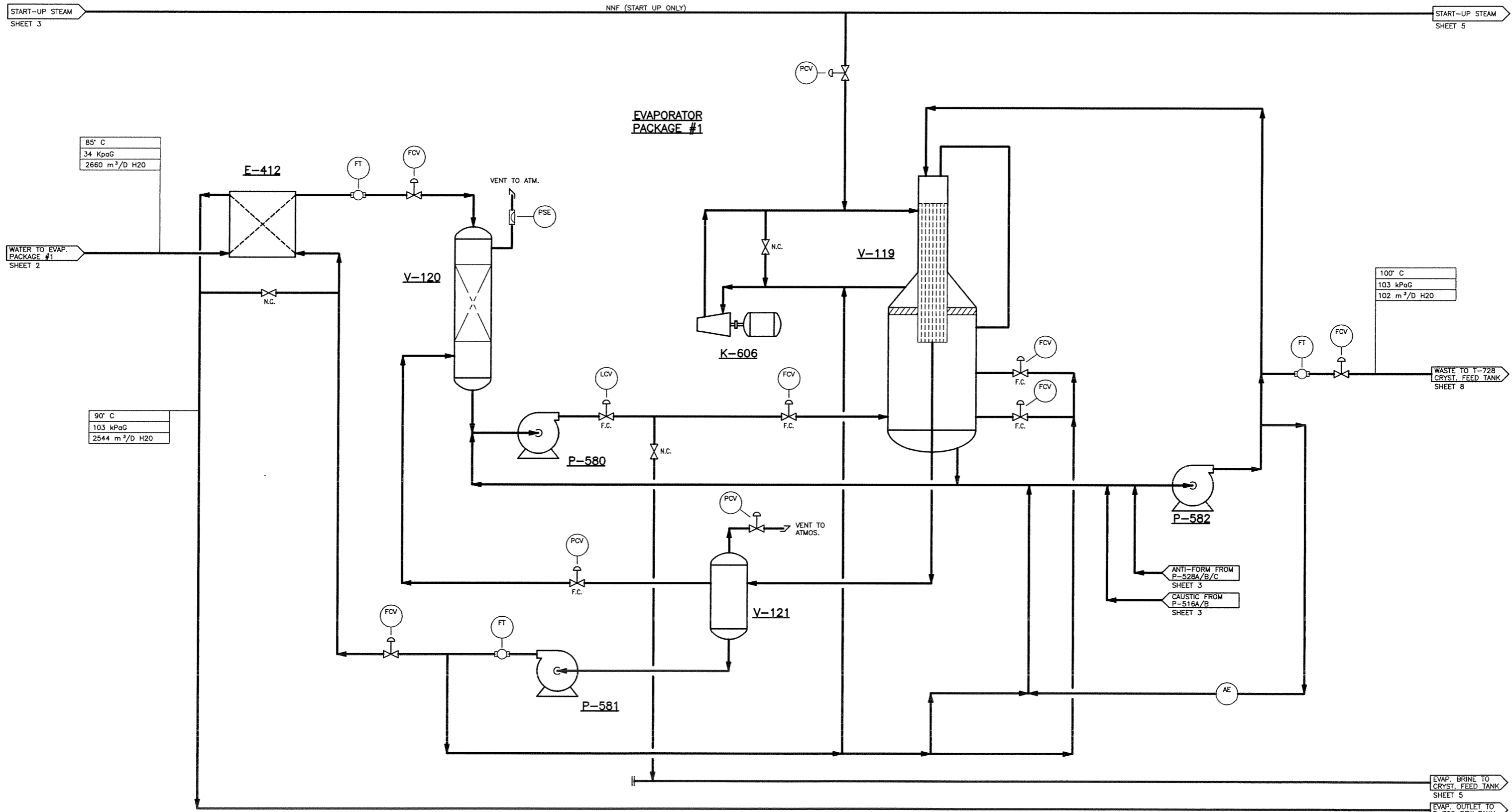
100° C
103 kPaG
102 m³/D H2O

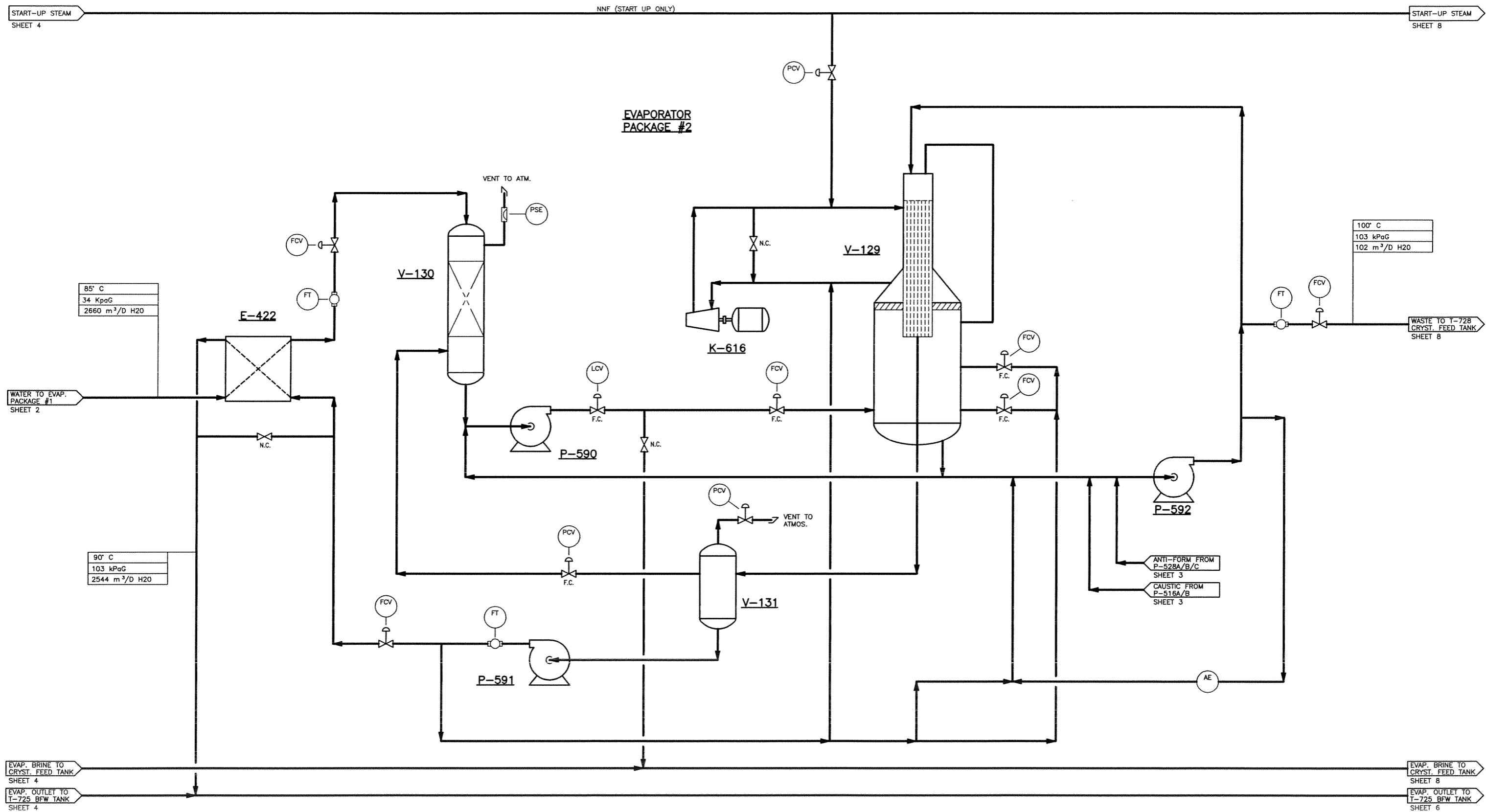
WASTE TO T-728
CRYST. FEED TANK
SHEET 8

ANTI-FORM FROM
P-528A/B/C
SHEET 3
CAUSTIC FROM
P-516A/B
SHEET 3

EVAP. BRINE TO
CRYST. FEED TANK
SHEET 5
EVAP. OUTLET TO
T-725 BFW TANK
SHEET 5

EVAPORATOR
PACKAGE #1





T-725
BOILER FEEDWATER TANK

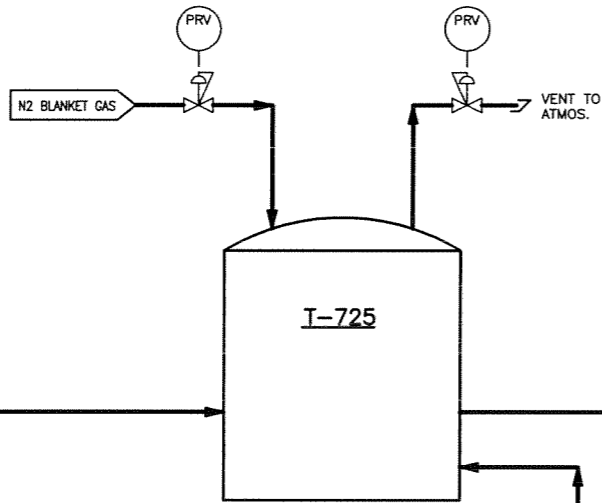
P-537A/B/C
L.P. BOILER FEEDWATER PUMPS

P-541A/B/C
H.P. BOILER FEEDWATER PUMPS

FUTURE
BFW RECYCLE
SHEET 2

BOILER FEEDWATER
TO H-801/H-802
SHEET 7

90° C
103 kPaG
5088 m ³ /D H2O



BOILER FEED WATER
FROM E-457/458/459
F-33500-F-00-02
SHEET 3

BOILER FEED WATER
TO E-457/458/459
F-33500-F-00-02
SHEET 3

140° C
5500 kPaG
5088 m ³ /D H2O

OXYGEN
SCAVENGER PUMPS

BOILER FEED WATER

P-537A/B/C

90° C
700 kPaG
5088 m ³ /D H2O

P-541A/B/C

PUMP RECYCLE TO
T-727
SHEET 7

EVAP. OUTLET
TO T-710
SHEET 2

EVAP. OUTLET TO
T-725 BFW TANK
SHEET 5

PUMP RECYCLE

SHEET NUMBER	DRAWING NUMBER	REV
6 OF 9	F-33500-F-00-03	12

E-414/E-415
GLYCOL/COMBUSTION AIR PREHEAT

K-604/K-605
COMBUSTION AIR BLOWER

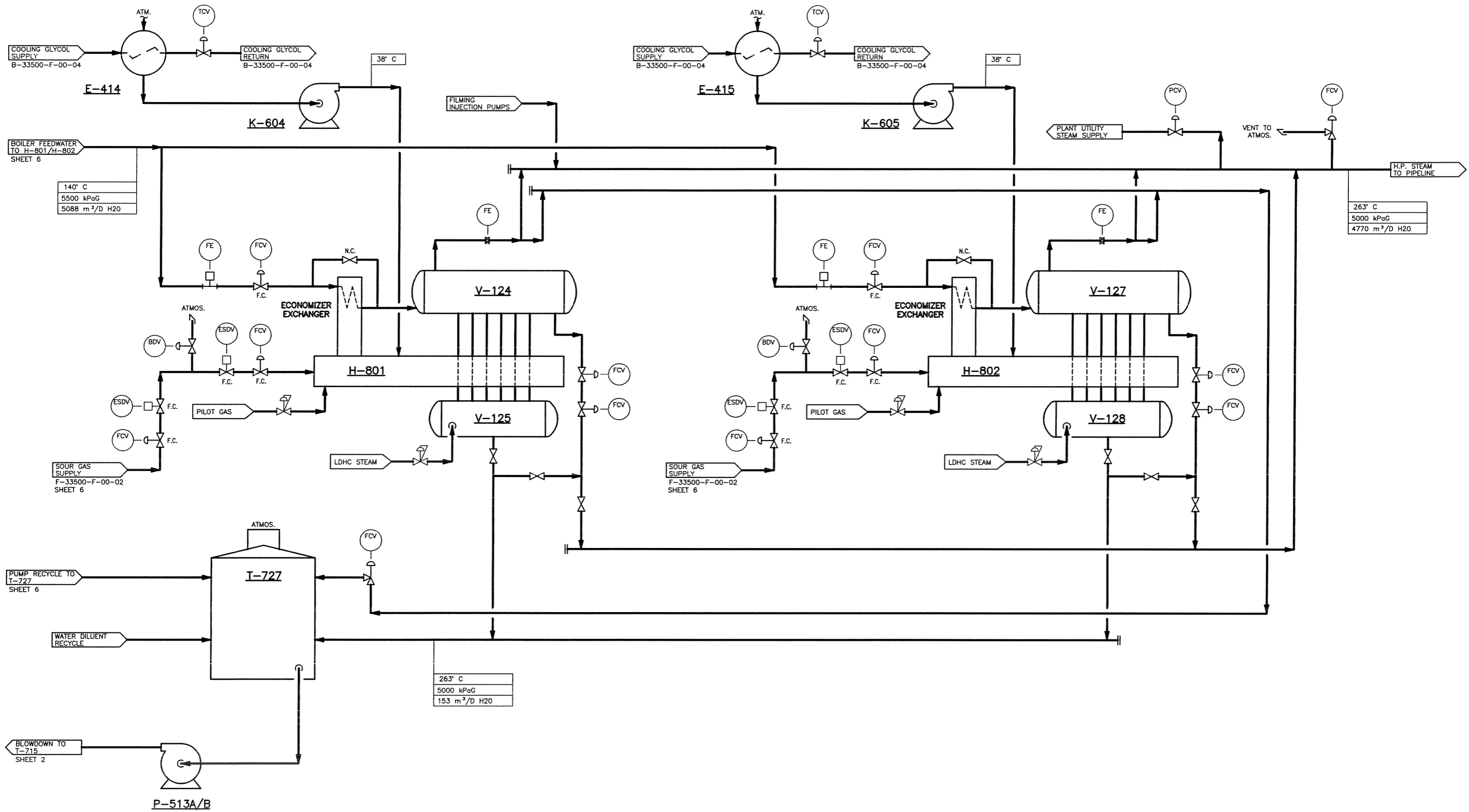
H-801/H-802
H.P. STEAM BOILER

V-124/127
STEAM DRUM

V-125/128
WATER DRUM

T-727
BLOWDOWN TANK

P-513A/B
BLOWDOWN RECYCLE PUMP



140° C
5500 kPaG
5088 m³/D H2O

263° C
5000 kPaG
4770 m³/D H2O

263° C
5000 kPaG
153 m³/D H2O

SHEET NUMBER	DRAWING NUMBER	REV
7 OF 9	F-33500-F-00-03	12

M-916
CRYSTALLIZER CATRIDGE FILTER

E-438
SEAL WATER COOLER

T-728
CRYSTALLIZER FEED TANK

P-543
CRYSTALLIZER FEED PUMP

V-136
CRYSTALLIZER VAPOR BODY

P-545
CRYSTALLIZER RECIRCULATION PUMP

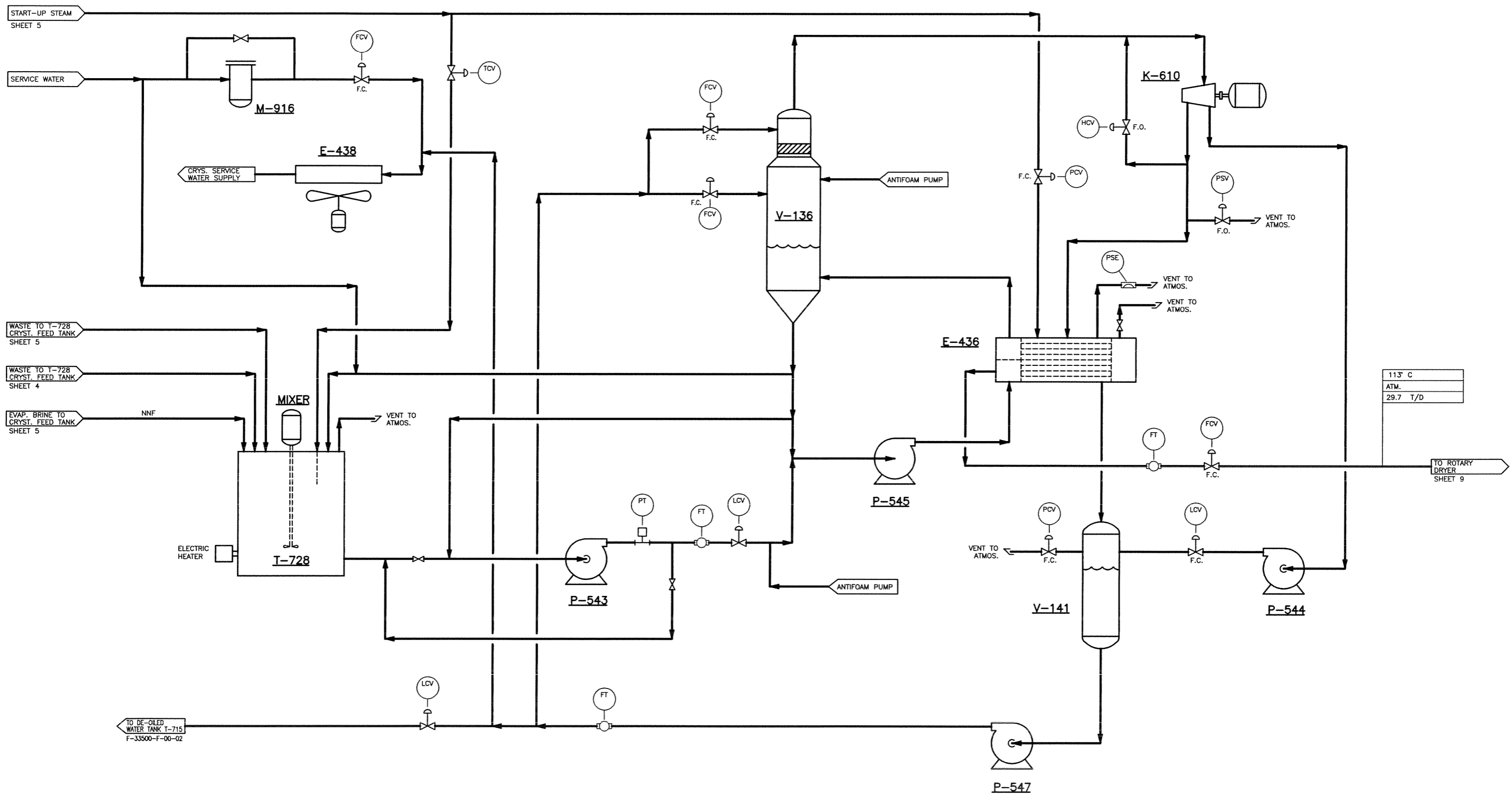
P-547
CONDENSATE PUMP

E-436
CRYSTALLIZER HEATER

V-141
CONDENSATE TANK

K-610
CRYSTALLIZER VAPOR COMPRESSOR

P-544
SILENCER DRAIN PUMP



113° C
ATM.
29.7 T/D

K-612
COMBUSTION AIR BLOWER

H-811
ROTARY DRYER

M-917
PUG MILL

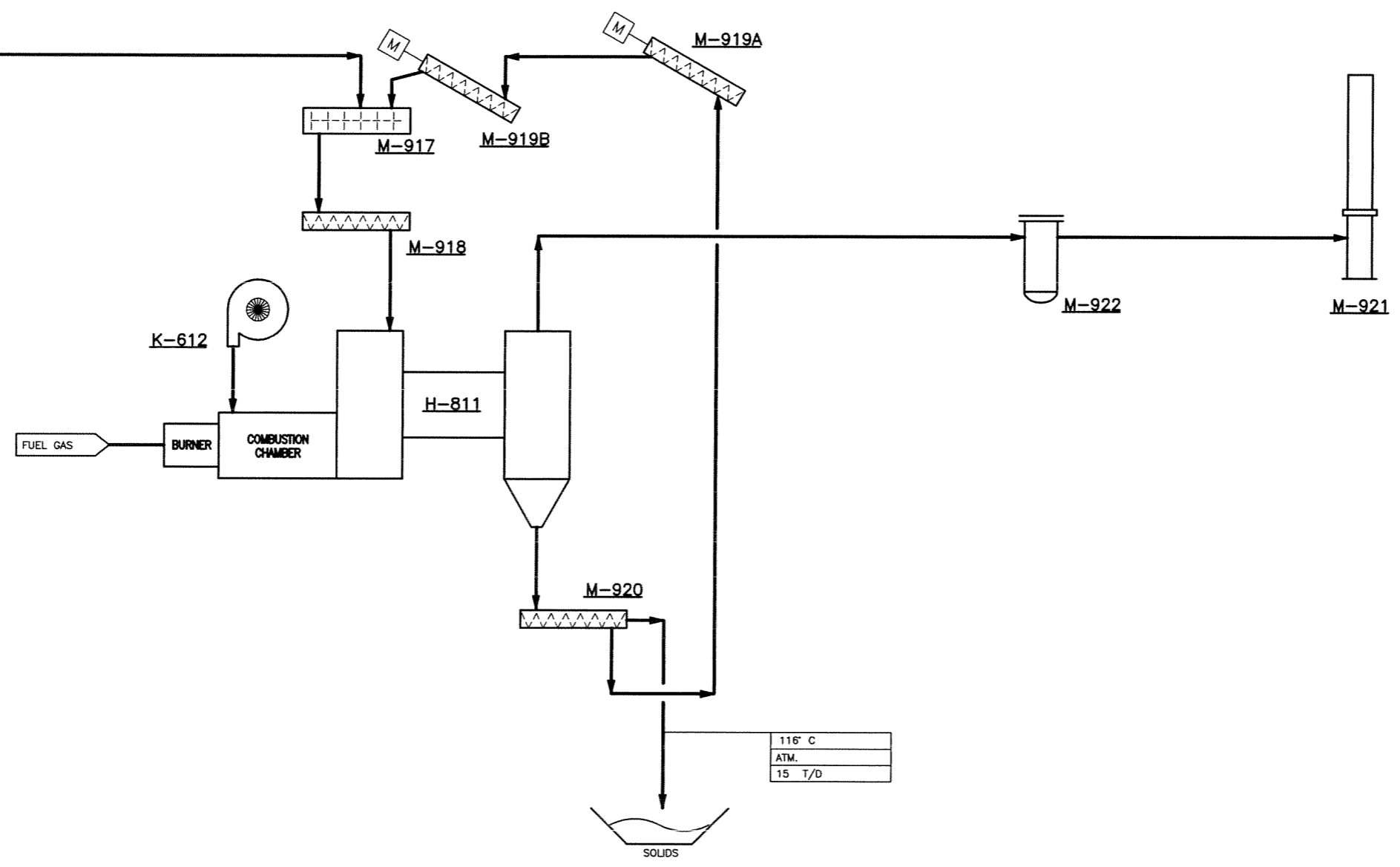
M-918
FEED SCREW

M-919A/B
RECYCLE CONVEYERS

M-920
PRODUCT SCREW

M-921
VENT STACK

M-922
BAGHOUSE FILTER



TO ROTARY
DRYER
SHEET 8



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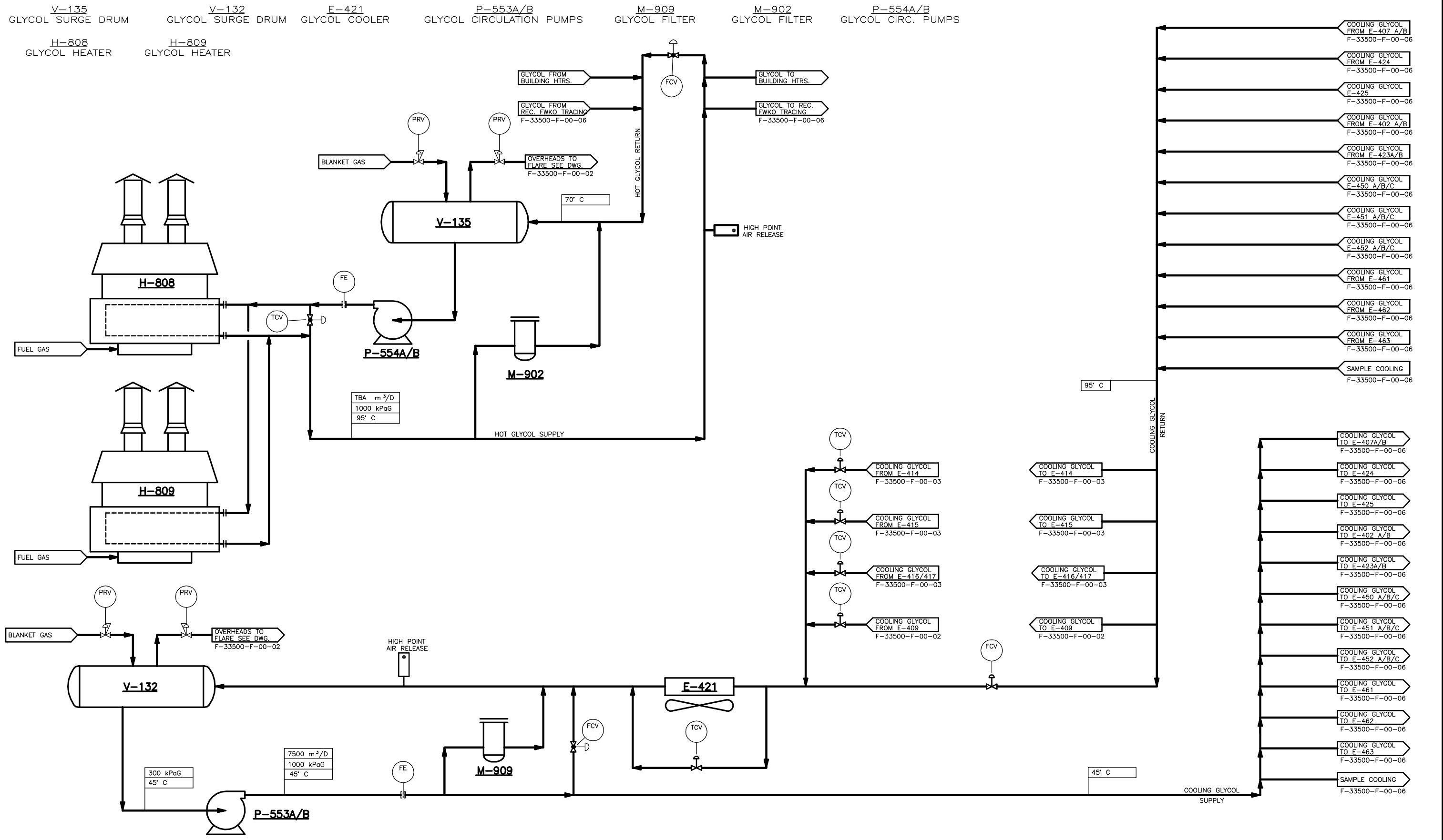
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BDR Project: 33500
Date: March 18, 2005

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APPENDIX IV

PROCESS FLOWSHEET (GLYCOL)



NO.	REVISION	PROJ. No.	BY	DATE	CHK.	DATE
10	ISSUED FOR APPROVAL	33500	CT	04.11.25		
9	REVISED FOR DBM	33500	RG	04.10.19		
8	REVISED	33500	CT	04.09.27		
7	REVISED FOR DBM	33500	RG	04.08.30		
6	REVISED	33500	CT	04.07.26		
5	REVISED	33500	RG	04.03.26		
4	REVISED	33500	RG	04.02.03		
3	REVISED	33500	RG	03.12.04		
2	REVISED	33500	RG	03.11.10		

PERMIT STAMP:	

DRN.	BY	DATE
	RG	03.09.04
CHK.		
APP'D.		
L.S.D.	14-28-95-12	W4M

GENERAL NOTES:

- "POST CONSTRUCTION DRAWINGS" ARE GENERATED FROM CONSTRUCTION CHANGE INFORMATION FORWARDED TO BOWER DAMBERGER ROLSETH ENGINEERING LTD. BY THE OWNER'S FIELD SUPERVISOR AND/OR HSEI CONTRACTORS. ANY CHANGES NOT DOCUMENTED WILL NOT APPEAR ON THE DRAWINGS AND THEREFORE THE DRAWING MAY NOT BE AN ACCURATE REPRESENTATION OF THE CONSTRUCTED FACILITY.
- PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION AND/OR OPERATION IT SHALL BE THE RESPONSIBILITY OF THE OWNER REPRESENTATIVE TO VERIFY THE LOCATION AND STATUS OF ANY PIPING, ELECTRICAL EQUIPMENT OR BUILDINGS.
- ANY RESPONSIBILITY TO EXISTING EQUIPMENT, PIPING OR ELECTRICAL ON A FACILITY NOT DESIGNED BY BDR, ENG. LTD. IS ONLY SHOWN AS A REPRESENTATION OF WHAT EXISTS AND MUST BE VERIFIED BY THE OWNER.



DEER CREEK Energy Limited		
JOSLYN PHASE #2 SAGD FACILITY PROCESS FLOWSHEET (GLYCOL)		
SCALE	DRAWING NUMBER	REV
N/A	B-33500-F-00-04	10



Bower Damberger Rolseth
Engineering Ltd.

DEER CREEK ENERGY LIMITED

Joslyn Phase 2, SAGD Facility
AFE # 002-0003-0002-0005-S1
Design Basis Memorandum
Rev. 3



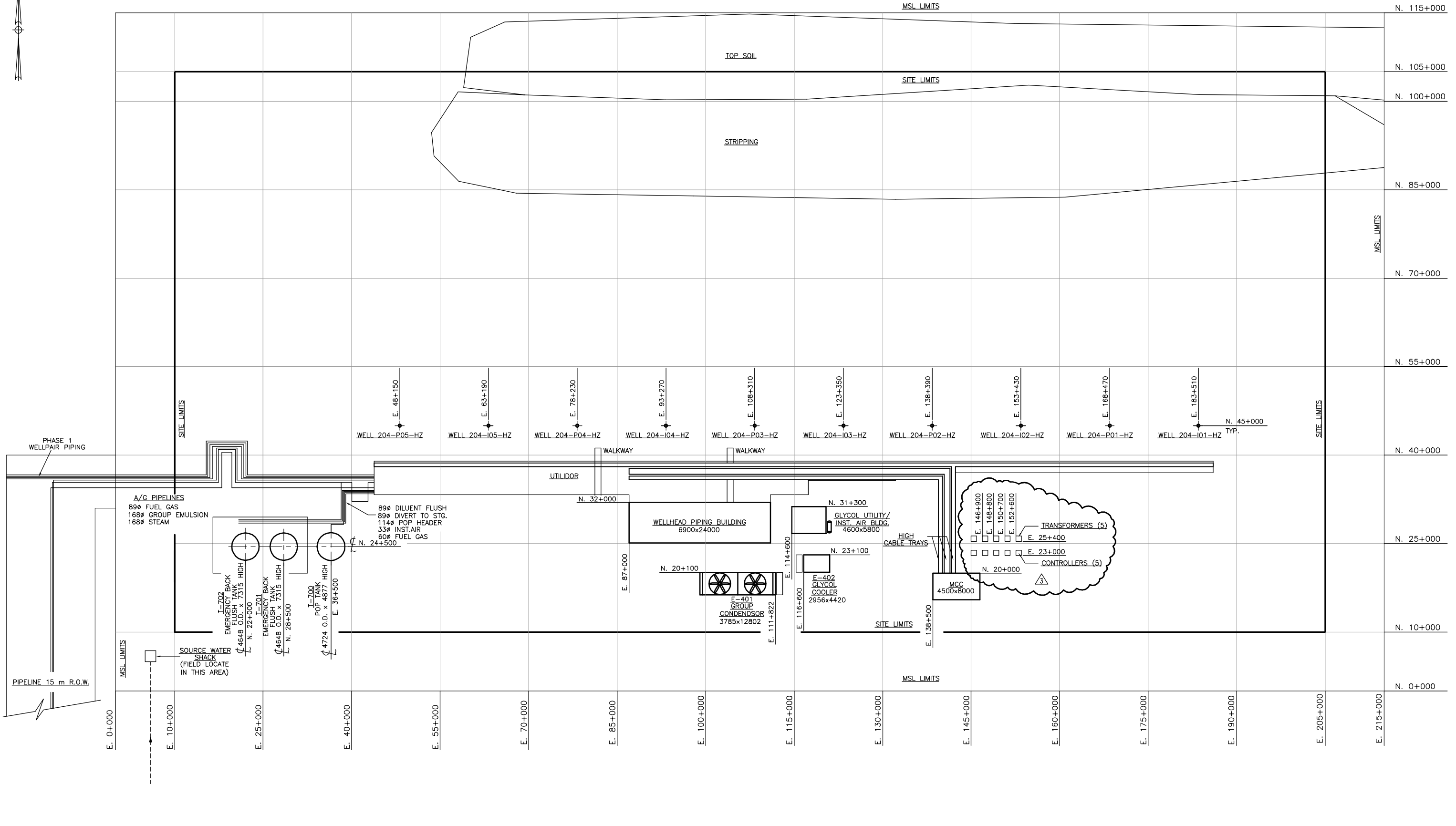
DEER CREEK
Energy Limited

BDR Project: 33500
Date: March 18, 2005

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APPENDIX V

**WELL PAD CONCEPTUAL
PLOT PLAN**



NO.	REVISION	PROJ. No.	BY	DATE	CHK.	DATE
4	LSD REVISED	43581	CT	05.10.06		
3	TRANSFORMERS/CONTROLLERS ADDED NEAR MCC	54088	CT	05.09.20	JR	05.09.21
2	ISSUED FOR CONSTRUCTION	43581	CT	05.06.17	RDB	05.06.13
1	ISSUED FOR APPROVAL	43581	CT	05.05.02		
0	PRELIMINARY ISSUE	43581	CT			

PERMIT STAMP:	

GENERAL NOTES:

- "POST CONSTRUCTION DRAWINGS" ARE GENERATED FROM CONSTRUCTION CHANGE INFORMATION FORWARDED TO BOWER DAMBERGER ROSETH ENGINEERING LTD. BY THE OWNER'S FIELD SUPERVISORS AND/OR THEIR CONTRACTORS. ANY CHANGES AND DISCREPANCIES WILL NOT APPEAR ON THESE DRAWINGS AND THEREFORE THE DRAWING MAY NOT BE AN ACCURATE REPRESENTATION OF THE CONSTRUCTED FACILITY.
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BY	DATE
DRN. CT	05.02.07
CHK. RDB	05.06.13
APP'D.	
L.S.D.	15-33-95-12 W4M

bdr
Bower Damberger Rolseth
Engineering Ltd.

DEER CREEK Energy Limited

JOSLYN PHASE #2
WELLPAD #204 PLOT PLAN

SCALE	DRAWING NUMBER	REV
1:300	D-43581-A-00-01	4



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Engineering Ltd.

DEER CREEK ENERGY LIMITED

Joslyn Phase 2, SAGD Facility
AFE # 002-0003-0002-0005-S1
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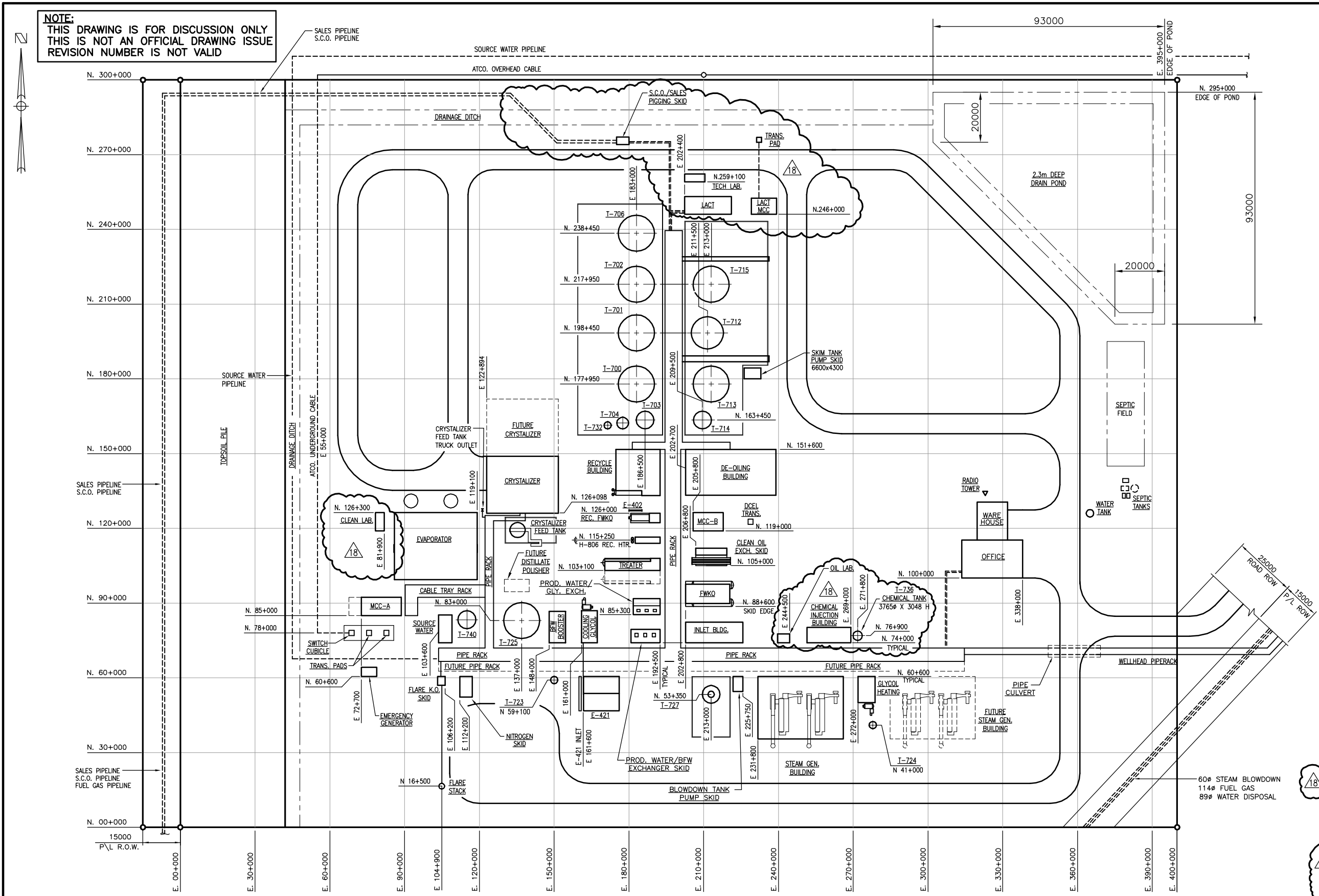
DEER CREEK
Energy Limited

BDR Project: 33500
Date: March 18, 2005

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APPENDIX VI
SITE PLOT PLAN

NOTE:
THIS DRAWING IS FOR DISCUSSION ONLY
THIS IS NOT AN OFFICIAL DRAWING ISSUE
REVISION NUMBER IS NOT VALID



BUILDING LEGEND			
EQUIPMENT DESCRIPTION	WIDTH	LENGTH	HEIGHT
INLET BUILDING	8600	23000	----
RECYCLE FWKO BUILDING	3760	4300	---
STEAM GENERATOR BUILDING	25200	34200	----
COOLING GLYCOL/INST. AIR BUILDING	6300	12900	---
GLYCOL HEATER BUILDING	6800	9500	---
GLYCOL COOLER (E-421)	6959	14751	----
FWKO SKID	10160	19165	----
TREATER SKID	4877	22207	----
DE-OILING BUILDING	18300	36300	----
RECYCLE BUILDING	18500	17700	----
BFW BOOSTER PUMP BUILDING	6600	12700	----
EVAPORATOR BUILDING	26900	33200	----
CRYSTALLIZER BUILDING	27000	22800	----
SOURCE WATER BUILDING	5400	11200	----
T-700 OIL PROD. TANK	14478ø	N/A	----
T-701 SALES OIL TANK	14478ø	N/A	----
T-702 OFF SPEC. BITUMEN TANK	14478ø	N/A	----
T-703 SLOP TANK	7163ø	N/A	----
T-704 POP TANK	4724ø	N/A	----
FLARE K.O. (T-705) SKID	3000	3600	----
T-706 S.C.O. TANK	14478ø	N/A	----
T-712 SKIM TANK	12954ø	N/A	----
T-713 SURGE TANK	14478ø	N/A	----
T-714 DESAND TANK	7163ø	N/A	----
T-715 DE-OILED WATER TANK	14478ø	N/A	----
T-725 BFW TANK	14478ø	N/A	----
T-727 STEAM GEN. BLOWDOWN TANK	7163ø	N/A	----
T-732 FLOOR DRAIN TANK	2896ø	N/A	----
T-740 SOURCE WATER TANK	7163ø	N/A	----
FLARE STACK	219ø	-----	39100
RECYCLE HEATER	1828ø	7925 S/S	----
OFFICE	27432	15240	----
WAREHOUSE	12192	15240	----
MCC-A BUILDING	7315	16000	----
MCC-B BUILDING	7315	12000	----
CLEAN OIL EXCHANGER SKID	7035	12500	----
PROD. WATER/GLYCOL EXCHANGER SKID	6500	11000	----
PROD. WATER/BFW EXCHANGER SKID	5500	11700	----
SKIM TANK PUMP BUILDING	4300	6600	----
T-723 COOLING GLYCOL POP TANK	2896ø	N/A	----
T-724 HEATING GLYCOL POP TANK	2896ø	N/A	----
FLARE KNOCKOUT BUILDING	3048	3658	----
CLEAN LAB	6000	4000	----
LACT	7100	18800	----
NITROGEN SKID	4900	8300	----
BLOWDOWN TANK PUMP SKID	4000	6100	----
CHEMICAL INJ. BUILDING	6200	15500	----
T-736 REG. EMULSION BREAKER DMO TANK	3658ø	N/A	----
LACT MCC	6500	10000	----
TECH. LAB.	3048	8100	----
CLEAN LAB.	3658	7315	----
OIL LAB.	3658	4877	----

NO.	REVISION	PROJ. No.	BY	DATE	CHK.	DATE
18	REVISED	33500	RG	05.11.03		
17	REVISED	33500	RG	05.10.08		
16	REVISED FOR EAST/WEST RACK CONSTRUCTION	33500	RG	05.07.11		
15	ADDED NITROGEN, BLOWDOWN PUMP AND DISTILLATE POLISHER BLDG.'S	33500	RG	05.05.26		
14	ISSUED FOR OIL RACK CONSTRUCTION	33500	RG	05.05.16		
13	REVISED RUN OFF POND	33500	RG	05.04.21		
12	REVISED	33500	RG	05.04.14		
11	ADDED LOCATION FOR T-725	33500	RG	05.02.15	RDB	05.02.16
10	ISSUED FOR OIL TANK FARM PAD LOCATIONS	33500	RG	05.01.12	CT	05.01.12

PERMIT STAMP:

GENERAL NOTES:
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DRN.	BY	DATE
CHK.	RG	04.02.25
APP'D.		
L.S.D.	14-28-95-12	W4M

bdr
Bower Damberger Rolseth
Engineering Ltd.

DEER CREEK
Energy Limited

JOSLYN PHASE 2 SAGD FACILITY
PLOT PLAN

SCALE	DRAWING NUMBER	REV
1:750	D-33500-A-00-01	18



Bower Damberger Rolseth
Engineering Ltd.

DEER CREEK ENERGY LIMITED

Joslyn Phase 2, SAGD Facility
AFE # 002-0003-0002-0005-S1
Design Basis Memorandum
Rev. 3



DEER CREEK
Energy Limited

BDR Project: 33500
Date: March 18, 2005

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APPENDIX VII

**BITUMEN, PRODUCED WATER,
GAS, SCO, AND SOURCE WATER
ANALYSES**



LABORATORY TEST RESULTS

JOB NUMBER: 52137-2004-0980

CUSTOMER: Deer Creek Energy Ltd.

CLIENT I.D: **Merv Jones**

LABORATORY I.D.: 52137-04-0980-1

DATE SAMPLED: **October 27, 2003**

DATE RECEIVED: 04-02-05

SAMPLE POINT: **Petro-Canada Heavy Oil**

TIME RECEIVED:

WORK DESCRIPTION:

REMARKS:

TEST DESCRIPTION	FINAL RESULT	DETECTION LIMIT	UNIT OF MEASURE	TEST METHOD	DATE	TECH
*Measured Density @ 35°C	998.7		kg/m ³	ASTM D-5002	04/02/10	JE
Measured Density @ 80 °C	970.5		kg/m ³	ASTM D-5002	04/02/10	JE
Calculated Density @ 15 °C	1010.9		kg/m ³	volume correction tables		
API Gravity @ 15.6 °C	8.4					
Kinematic Viscosity @ 60 °C	3016		cSt.	ASTM D-445	04/02/10	JE

* The sample was too heavy and viscous for an accurate density measurement at 15.0 °C

CORE LABORATORIES
2810 - 12th Street N.E.
CALGARY, ALBERTA T2E 7P7



LABORATORY TEST RESULTS

JOB NUMBER: 52137-2004-0980

CUSTOMER: Deer Creek Energy Ltd.

CLIENT I.D.: Merv Jones

LABORATORY I.D.: 52137-04-0980-1

DATE SAMPLED: October 27, 2003

DATE RECEIVED: 04-02-05

SAMPLE POINT: Petro-Canada Heavy Oil

TIME RECEIVED:

WORK DESCRIPTION:

REMARKS:

TEST DESCRIPTION	FINAL RESULT	DETECTION LIMIT	UNIT OF MEASURE	TEST METHOD	DATE	TECH
Simulated Distillation			°C	ASTM D-5307	04/02/12	BH
I.B.P.	218.6					
5% Off	301.7					
10% Off	346.0					
15% Off	382.1					
20% Off	416.4					
25% Off	447.5					
30% Off	479.1					
35% Off	511.6					
38% Off	535.9					
Percent Residue	61.81					

CORE LABORATORIES
 2810 - 12th Street N.E.
 CALGARY, ALBERTA T2E 7P7



LABORATORY TEST RESULTS

JOB NUMBER: 52137-2004-0980

CUSTOMER: Deer Creek Energy Ltd.

CLIENT I.D.: Merv Jones

LABORATORY I.D.: 52137-04-0980-1

DATE SAMPLED: October 27, 2003

DATE RECEIVED: 04-02-05

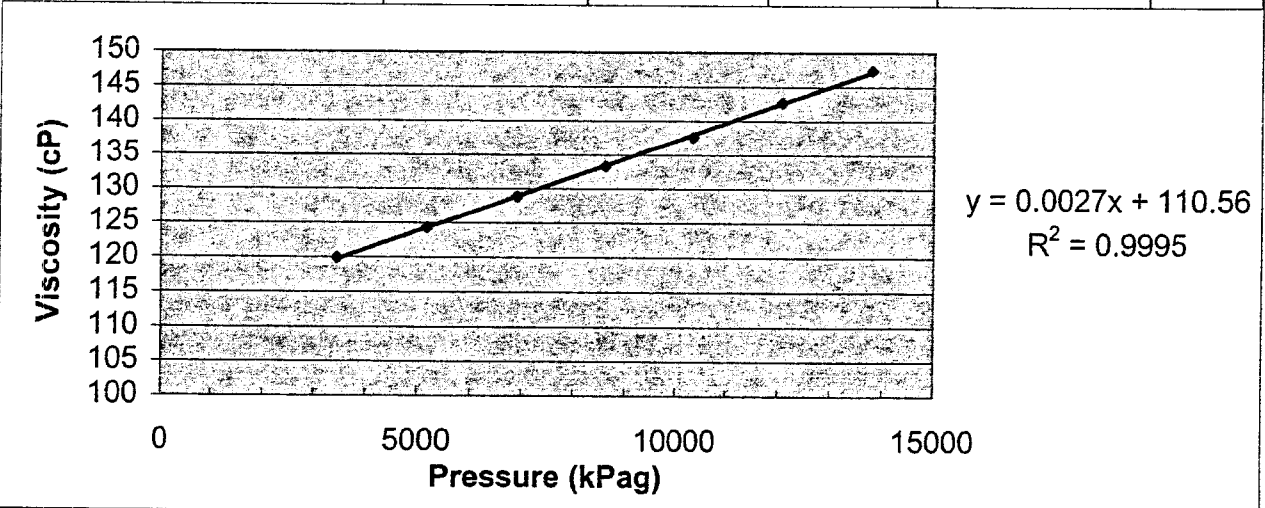
SAMPLE POINT: Petro-Canada Heavy Oil

TIME RECEIVED:

WORK DESCRIPTION:

REMARKS:

TEST DESCRIPTION	FINAL RESULT	DETECTION LIMIT	UNIT OF MEASURE	TEST METHOD	DATE	TECH
Pressurized Viscosity @ 120 °C			cP	Cambridge	04/02/23	DMc
13 790 kPa (g)	147.4					
12 065 kPa (g)	142.7					
10 342 kPa (g)	137.6					
8 618 kPa (g)	133.3					
6 895 kPa (g)	128.8					
5 171 kPa (g)	124.3					
3 447 kPa (g)	119.9					



CORE LABORATORIES
 2810 - 12th Street N.E.
 CALGARY, ALBERTA T2E 7P7

Phase B Produced Water Analysis

			Group	Group	Group	Group	Group
			Chemex	Chemex	Chemex	Chemex	Chemex
			93/4/06	93/5/20	93/5/21	93/9/24	93/11/01
Sodium	Na	mg/L	392	123	45	507	553
Potassium	K	mg/L	10.2	11.7	10	17.4	19.2
Calcium	Ca	mg/L	7.2	6.0	43.2	4.1	4.0
Magnesium	Mg	mg/L	2.6	1.7	3.0	1.2	1.1
Barium	Ba	mg/L	0.04	<0.1	<0.1	0.2	<0.1
	Sr	mg/L	0.2	0.1	0.1	0.2	0.2
Iron	Fe	mg/L	0.1	<0.1	<0.1	<0.1	0.1
Boron	B						
Chloride	Cl	mg/L	369	159	112	705	815
	Br	mg/L					
Iodine	I	mg/L					
Bicarbonate	HCO ₃	mg/L	202	114	81	226	192
Sulfate	SO ₄	mg/L	136	1	14	65	1
Carbonate	CO ₃	mg/L	0	<1	<1	<1	<1
Hydroxide	OH	mg/L	0	<1	<1	<1	<1
Hydrogen Sulphide	H ₂ S	mg/L		nil	nil	nil	nil
Silicon	Si		79	72.3	71.6		
Total Iron		mg/L	0.3	0.14	0.06	0.1	0.2
Total Silica		mg/L		115	118	232	206
Manganese		mg/L	0.02	0.01	0.01	<0.1	<0.1
Oil & Grease		mg/L	13.3	14	16	40	118
Lithium		mg/L	0.31	0.169	0.113	0.39	0.64
TDS			1,440				
Total Solids							
	evaporated	mg/L					
	ignition	mg/L		360	310	1900	1580
	calculated	mg/L		359	267	1411	1488
Relative Density				1.0000	1.0000	1.0010	0.9910
pH			7.71	8.00	7.20	7.40	7.60
Resistivity	Ohm-m			13.800	18.600	3.8200	3.4800
Total Hardness		mg/L	28.4	22	120	15	15
Total Alkalinity		mg/L	166	93	66	185	157

DEER CREEK ENERGY A425160:671143
Sample Point I.D. Client I.D. Meter Number Laboratory Number
 Operator Name: JOSLYN PROJECT PHASE 1 LSD: N/A Well ID: DEER CREEK
 Well Name: WELLHEAD (CASING) Company: DEER CREEK
 Field or Area: WELLHEAD (CASING) Sample Point: 11635, 11696 Container Identity: Percent Full

Test Recovery
 Interval 1: From: _____ To: _____ Interval 2: _____ Interval 3: _____
 Test Type: No. Mudstone Recovery Elevations (m) Sample Gathering Point Solution Gas
KB GRD Well Fluid Status Well Status Mode
Production Rates Well Status Type Well Type
Water m3/d Oil m3/d Gas 1000m3/d Gauge Pressures (kPa) Temperature (°C) Gas or Condensate Project License No.
200 300 100 21.6
Source As Received Source As Received

2004/10/14 2004/10/20 2004/10/25 2004/10/25 MW
Date Sampled Start Date Sampled End Date Received Date Reported Date Revision Reported Analyst

COMPONENT	COMPOSITION		LIQUID VOLUME m ³ /m ³ AIR FREE AS REC'D
	MOLE FRACTION AIR FREE AS REC'D	MOLE FRACTION AIR FREE ACID GAS FREE	
H2	0.0102	0.0328	
He	0.0000	0.0000	
N2	0.0632	0.2030	
CO2	0.6886		
H2S	0.0000		
C1	0.2096	0.6730	
C2	0.0009	0.0029	3.21
C3	0.0010	0.0032	3.68
IC4	0.0010	0.0032	4.36
NC4	0.0030	0.0096	12.62
IC5	0.0037	0.0119	18.06
NC5	0.0042	0.0135	20.29
C6	0.0052	0.0167	28.51
C7+	0.0094	0.0302	64.19
TOTAL	1.0000	1.0000	154.93

PROPERTIES

Calculated Mole Weight 37.9
Moisture Free as Sampled
Total

Calculated Relative Densities
1.307 0.837
Moisture Free as Sampled Moisture & Acid Gas Free

Calculated Pseudo Critical Properties
As Sampled Acid Gas Free
6359.1 271.7 4114.6 199.8
p_{Pc} (kPa) p_{Pc} (kPa/m) p_{Pc} (kPa) p_{Pc} (kPa/m)

Calculated Gross Heating Value (MJ/m³)
@ 101.325 kPa & 15°C
13.02 41.77
AP.MC (AGA #5) AP.MC (AGA #5) Acid Gas Free C7+ as Received

Gas Compressibility
@ 101.325 kPa & 15°C
0.9967

Hydrogen Sulphide
 On Site Gasac (moles ppm) Tuwer (moles%) In Lab <1
Gasac (moles ppm) Tuwer (moles%) Gasac (moles ppm) Tuwer (moles%)

Onsite analysis is required for accurate source H2S content.
 H2S degrades variably in all sample containers and is also matrix dependant.

* Information not supplied by client - data derived from LSD information Results relate only to items tested

Remarks:

**DEER CREEK ENERGY LIMITED
JOSLYN PHASE 2 SAGD FACILITY**

GAS ANALYSIS

An estimated final gas composition was used and is as follows

<u>COMPONENT</u>	<u>mol %</u>
Hydrogen Sulphide	3.00
Carbon Dioxide	48.50
Methane	48.50

SUNCOR BLEND ASSAY

Suncor Blend Name **OSA**
 Date issued **4/23/2002**

This assay is an estimate, developed from blend component samples at source. There may be variations in properties of the blend from time to time.

CUT	Whole Crude	Light Naphtha	Heavy Naphtha	Jet	Light Diesel	Heavy Diesel	Swing	Gas Oil	Heavy Gas Oil	Vacuum Gas Oil
TBP TEMPERATURE AT START OF CUT, F	-44	-44	200	340	470	550	650	700	800	900
TBP TEMPERATURE AT END OF CUT, F	1000	200	340	470	550	650	700	800	900	1000
YIELD OF CUT (LV% OF CRUDE)	100	10.6	12.6	11.5	8.9	16.5	9.6	17.9	10.1	2.2
YIELD OF CUT (wt% OF CRUDE)	100	8.0	11.1	11.2	9.1	17.4	10.3	19.5	11.1	2.5
API GRAVITY 15°C	33.7	88.1	56.4	37.9	30.5	26.0	23.0	20.6	18.8	17.1
SPECIFIC GRAVITY 15/15°C	0.857	0.644	0.753	0.835	0.873	0.898	0.916	0.930	0.942	0.952
ACID NUMBER (TAN), mg KOH/g	0.05	0.01	0.02	0.03	0.04	0.05	0.07	0.07	0.09	0.16
ANILINE POINT, °F			127	119	128	130	132	145	172	201
ASH, wt%	0.2									
ASPHALTENES, wt%	< 0.1						0.07	0.08	0.12	0.36
BS&W, vol%	< 0.1									
BROMINE NUMBER	1.7	0.2	0.4	0.8	1.1	1.6	2.3	3.0	3.5	3.6
CARBON RESIDUE (MCRT), wt%	0.02						< 0.01	< 0.01	0.02	0.75
CETANE INDEX				38.2	41.9	44.0	43.6			
CETANE NUMBER				35.9	36.9	39.4	39.4			
CHARACTERIZATION FACTOR (K-FACTOR)	11.6	12.5	11.9	11.4	11.3	11.4	11.4	11.5	11.6	11.9
CHLORIDES, Organic, ppm	< 1									
CHLORIDES, Total, ppm	< 1									
CLOUD POINT, °F		< -76	< -76	< -76	-55	-27	-7			
Cu STRIP CORROSION	1a									
FLASH POINT (Chevron), °F				149	234	295	355			
FLASH POINT (API), °F			51	147	215	254	284	302	322	334
FREEZE POINT, °F		< -76	< -76	-65	-41					
HYDROGEN SULPHIDE (DISSOLVED), ppm	8									
INSOLUBLES, TOLUENE, wt%	< 0.005									
MERCAPTAN SULPHUR, ppm	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
METALS										
Arsenic, ppm	< 0.3						< 0.3	< 0.3	< 0.3	< 0.3
Iron, ppm	< 0.15						< 0.15	< 0.15	< 0.15	< 0.15
Nickel, ppm	< 0.15						< 0.15	< 0.15	< 0.15	< 0.15
Silicon, ppm	< 1									
Sodium, ppm	< 1.5						1.7	1.7	< 1.5	< 1.5
Vanadium, ppm	< 0.05						0.1	0.1	0.1	0.0
NAPHTHALENES, LV%				0.20	3.25	4.42	4.05	2.75	2.61	3.43
NITROGEN - TOTAL, ppm	426	< 0.3	< 0.3	11	47	163	421	779	1,167	1,476
NITROGEN - BASIC, ppm	109	< 0.3	< 0.3	9	44	92	135	178	258	336
OCTANE NUMBER CLEAR, MON		69.4	45.3							
OCTANE NUMBER CLEAR, RON		70.2	43.5							
PONA ANALYSIS, LV%										
Paraffins		89.1	50.7	19.9						
Olefins		0.0	0.1	0.2						
Naphthenes		10.8	34.4	48.5						
Aromatics		0.1	14.9	31.4						
POUR POINT, °F		< -76	< -76	< -76	-59	-30	-9	20	38	50
PNA SUMMARY, wt%										
Saturates					62.8	53.6	46.3	43.9	43.8	43.3
Aromatics					37.1	45.9	52.8	54.8	53.6	51.7
Polars					0.1	0.5	0.9	1.3	2.6	5.0
REID VAPOR PRESSURE, psia	2.8	16.9	0.9	0.1						
REFRACTIVE INDEX @ 67°C					1.461	1.479	1.495	1.502	1.505	1.505
SALT CONTENT, mg/L	< 3									
SMOKE POINT, mm			30	17						
SULPHUR, wt%	0.19	< 0.01	< 0.01	0.03	0.07	0.15	0.26	0.36	0.47	0.55
VISCOSITY, cSt @ 60 F (15.5 C)		0.4	0.9	2.4	5.1	14.5	54.2			
VISCOSITY, cSt @ 104 F (40 C)	4.5	0.4	0.7	1.5	2.8	6.3	15.9	48.3		
VISCOSITY, cSt @ 212 F (100 C)						1.9	3.0	5.3	10.7	27.3
VISCOSITY, cSt @ 275 F (135C)									5.5	9.6

SUNCOR BLEND ASSAY

Suncor Blend Name OSA
 Date Issued 4/23/2002

This assay is an estimate, developed from blend component samples at source. There may be variations in properties of the blend from time to time.

CUT	Whole Crude	Light Naphtha	Heavy Naphtha	Jet	Light Diesel	Heavy Diesel	Swing	Gas Oil	Heavy Gas Oil	Vacuum Gas Oil
TBP TEMPERATURE AT START OF CUT, F	-44	-44	200	340	470	550	650	700	800	900
TBP TEMPERATURE AT END OF CUT, F	1000	200	340	470	550	650	700	800	900	1000
YIELD OF CUT (LV% OF CRUDE)	100	10.6	12.6	11.5	8.9	16.5	9.6	17.9	10.1	2.2
YIELD OF CUT (wt% OF CRUDE)	100	8.0	11.1	11.2	9.1	17.4	10.3	19.5	11.1	2.5
WAX, wt%	0.20								0.3	0.5
PNA COMPONENTS, wt%										
SATURATES					62.8	53.6	46.3	43.9	43.8	43.3
TOTAL AROMATICS					37.1	45.9	52.8	54.8	53.6	51.7
Monaromatics					32.1	32.9	30.8	29.3	28.9	29.9
Diaromatics					4.9	11.1	16.3	14.9	13.1	12.8
Polyaromatics					0.2	1.9	5.7	10.6	11.6	9.1
POLARS					0.1	0.5	0.9	1.3	2.6	5.0
GC COMPONENTS, VOL%										
ETHANE	0.0									
PROPANE	0.1									
ISO-BUTANE	0.5									
NORMAL BUTANE	1.8									
ISO-PENTANE	0.9									
NORMAL-PENTANE	2.2									
CYCLO PENTANE	0.3									
ISO-HEXANE	0.0									
NORMAL HEXANE	2.0									
BENZENE	0.1									
TBP Distillation										
IBP	-44	-44	200	340	470	550	650	700	800	900
5% OFF	122	35	208	347	475	556	653	705	803	902
10% OFF	192	51	216	354	479	562	655	710	807	905
30% OFF	421	96	246	381	497	584	665	729	821	917
50% OFF	593	127	274	408	513	604	675	748	838	931
70% OFF	701	157	301	434	529	623	685	768	857	947
90% OFF	816	186	326	458	543	641	695	789	882	976
95% OFF	860	193	333	464	547	646	698	794	891	988
FBP	1,000	200	340	470	550	650	700	800	900	1,000

TABLE 1

**DEER CREEK ENERGY LIMITED
JOSLYN CREEK PHASE 2 SAGD PROJECT**

SOURCE WATER CHEMISTRY PROVIDED BY MEMS
WELLS 3-4, 5-4, 9-5 and 3-5
Sampled and analyzed in September 2003

<u>PARAMETERS</u>	<u>UNIT</u> as Ion	<u>WELLS</u>				<u>Average</u>
		<u>3-4</u>	<u>5-4</u>	<u>9-5</u>	<u>2-5</u>	
Calcium	mg/L	45.3	39.7	44.8	46.7	44.1
Magnesium	mg/L	8.8	7.9	7	7.4	7.8
Sodium	mg/L	4	5	7	5	5.3
Potassium	mg/L	0.9	1	1.3	1	1.1
Sulphate	mg/L	3.9	3.3	2.5	2.5	3.1
Carbonate	mg/L	<5	<5	<5	<5	<5
Bicarbonate	mg/L	188	169	183	182	180.5
Hydroxide	mg/L	<5	<5	<5	<5	<6
pH	pH unit	8	7.9	7.9	7.9	
TDS calculated	mg/L	156	140	153	152	150.3
Total Hardness as CaCO ₃	mg/L	149.3	131.6	140.7	147.1	142.2
Dissolved Iron	mg/L	3.44	5.63	10.6	11.3	7.7
Reactive Silica	mg/L	12.4	12.8	12.2	12.5	12.5
Total Organic Carbon	mg/L	6	7	10	18	10.3

NOTE:

Units are in mg/L as ion unless otherwise indicated. Hardness is as CaCO₃. pH is in pH units.



Bower Damberger Rolseth
Engineering Ltd.

DEER CREEK ENERGY LIMITED

Joslyn Phase 2, SAGD Facility
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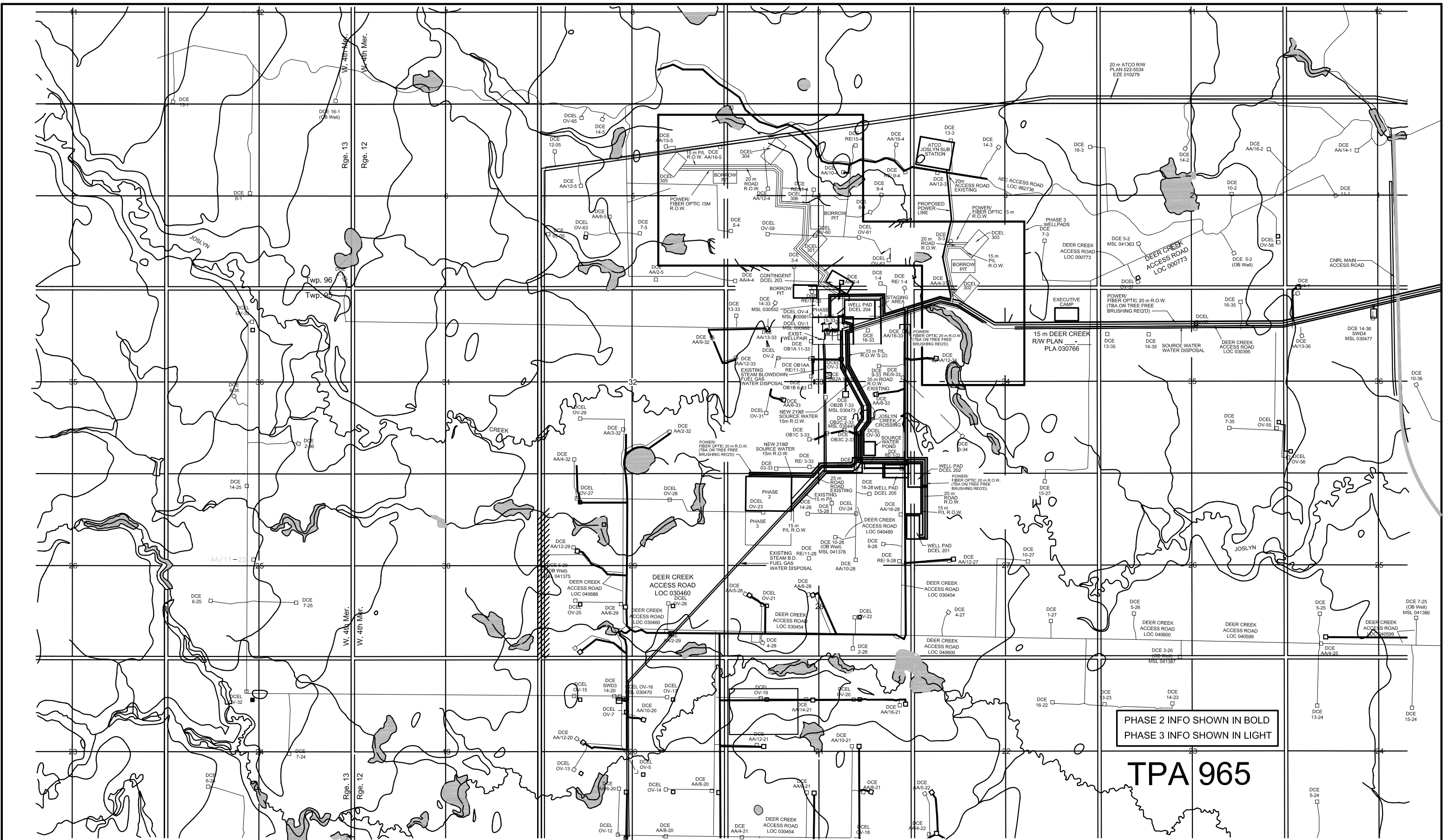
DEER CREEK
Energy Limited

BDR Project: 33500
Date: March 18, 2005

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APPENDIX VIII

AREA DEVELOPMENT PLAN



PHASE 2 INFO SHOWN IN BOLD
PHASE 3 INFO SHOWN IN LIGHT

TPA 965

NO.	REVISION	PROJ. No.	BY	DATE	CHK.	DATE
9	SOURCE WATER ROW REVISED, SECOND P/L ROW ADDED	43785	CT	05.01.21		

PERMIT STAMP:

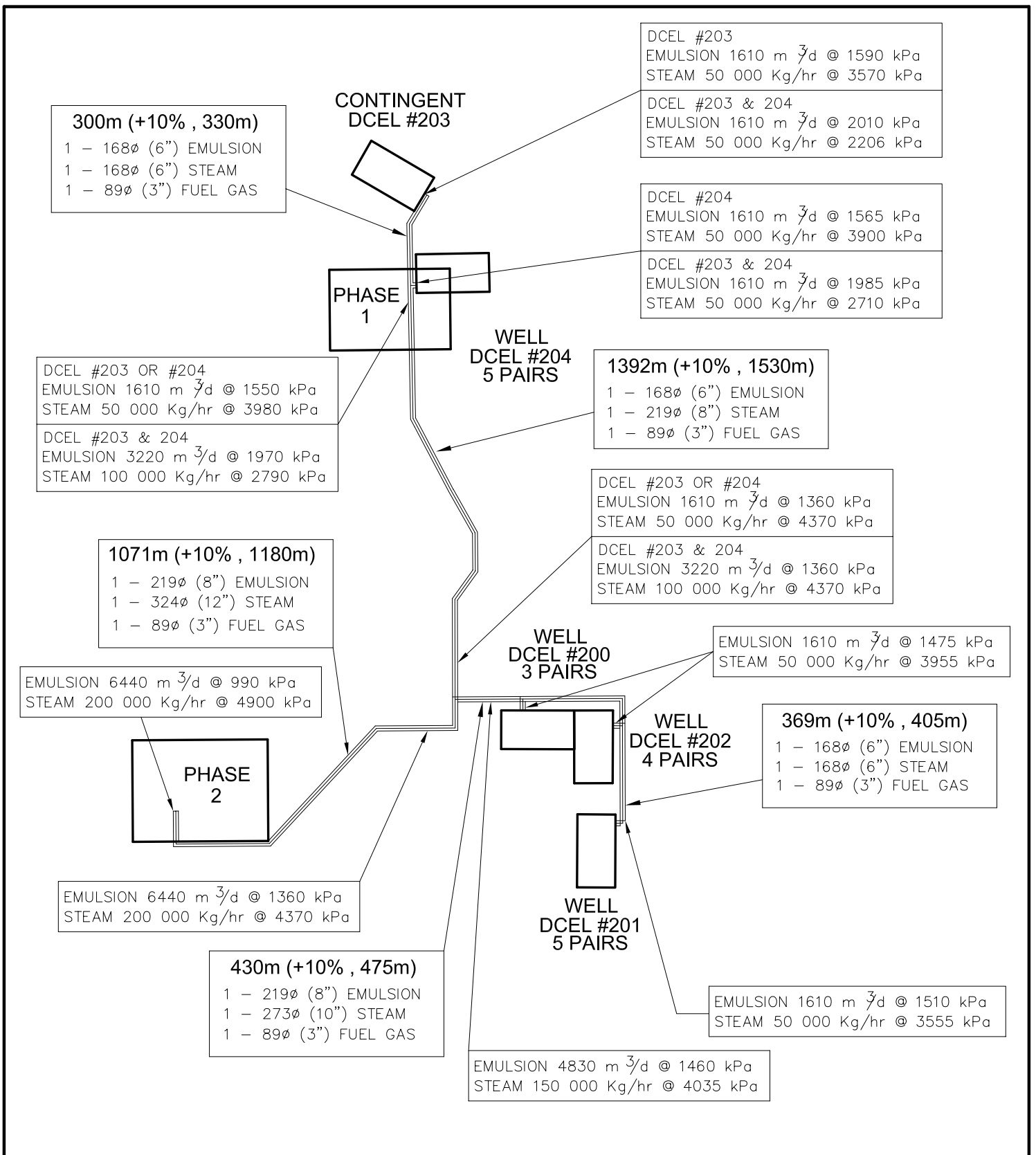
GENERAL NOTES:

- "POST CONSTRUCTION DRAWINGS" ARE GENERATED FROM CONSTRUCTION CHANGE INFORMATION FORWARDED TO BOWER DAMBERGER ROLETSH ENGINEERING LTD. BY THE OWNER'S FIELD SUPERVISORS AND/OR Hired CONTRACTORS. ANY CHANGES NOT DOCUMENTED WILL NOT APPEAR ON THE DRAWINGS AND THEREFORE THE DRAWING MAY NOT BE AN ACCURATE REPRESENTATION OF THE CONSTRUCTED FACILITY.
- PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION AND OR EXCAVATION IT SHALL BE THE RESPONSIBILITY OF THE OWNER'S REPRESENTATIVE TO VERIFY THE LOCATION AND STATUS OF ANY PIPING, ELECTRICAL, EQUIPMENT OR BUILDINGS.
- ANY REMEDIATION MADE TO EXISTING EQUIPMENT, PIPING OR ELECTRICAL ON A FACILITY NOT DESIGNED BY BOWER DAMBERGER ROLETSH ENGINEERING LTD. IS ONLY SHOWN AS A REPRESENTATION OF WHAT EXISTS AND MUST BE VERIFIED BY THE OWNER.

BY	DATE
DRN. RG	04.01.29
CHK.	
APP'D.	
L.S.D.	



DEER CREEK Energy Limited		
JOSLYN PHASE 2 SAGD FACILITY AREA DEVELOPMENT PLAN		
SCALE	DRAWING NUMBER	REV
1:15 000	D-33500-PL-00-01	9



1	REVISED WELL PADS	MHD	05.02.28
0	ISSUED FOR INFORMATION	CT	04.10.08
No.	REVISION	BY	DATE



	BY	DATE
DRAWN	CT	04.10.08
CHECK	.	.
APPROVED	.	.

bdr
 Bower Damberger Rolseth
 Engineering Ltd.

JOSLYN PHASE 2 SAGD FACILITY
 PIPELINE GATHERING SYSTEM
 PIPELINE LENGTHS

SCALE	DRAWING NUMBER	REV
1:15000	A-43785-PL-00-01	1



Bower Damberger Rolseth
Engineering Ltd.

DEER CREEK ENERGY LIMITED

Joslyn Phase 2, SAGD Facility
AFE # 002-0003-0002-0005-S1
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APPENDIX IX

**PIPING MATERIALS &
VALVE SPECIFICATIONS**

**DEER CREEK ENERGY LIMITED
JOSLYN PHASE 2, SAGD FACILITY**

GUIDE TO PIPING MATERIALS

SPEC. DESIGNATION		150 PX		
LINE CONTENT	Sweet hydrocarbon liquid & vapour, process air, caustic, process drains, glycol, water, and vent systems in temperature service between -29°C and 121°C			
DESIGN CODE	ANSI B-31.3 (latest)	RATING	150 # ANSI	
PRESSURE (DESIGN)	Refer to Line List	TEMP. (DESIGN)	Refer to Line List	
CORROSION ALLOWANCE	1.6mm (1/16")	STRESS RELIEVE	No	
X-RAY	10%	TEST PRESSURE	1.5 x Design Pressure	
SIZE RANGE	(½" to 1½") 21mm to 48mm	(2" to 8") 60 to 219mm	(10" & over) 273mm & over	NOTES
WALL SCHEDULE	80	40	40	
PIPE	C.S. Pipe Smls ASTM A-106 GR B	C.S. Pipe Smls ASTM A-106 GR B	C.S. Pipe Smls ASTM A-106 GR B	
FITTINGS - B.W. EX. REDUCERS		ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	
FITTINGS - B.W. REDUCERS ONLY		ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	
FITTINGS SCREWED/S.W.	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	
COUPLINGS	ASTM A-105 6000# FS to ANSI B16.11	ASTM A-105 6000# FS to ANSI B16.11	ASTM A-105 6000# FS to ANSI B16.11	
THREDOLETS/ SOCKOLETS	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	
SWAGES	ASTM A-106 GR B Sch 80 FS			
NIPPLES	ASTM A-106 GR B Sch 80 FS			
FLANGES	ASTM A-105 150# RF to ANSI B16.5	ASTM A-105 150# RF to ANSI B16.5	ASTM A-105 150# RF to ANSI B16.5	1,2
GASKETS	3.2mm Flexitallic 304SS	3.2mm Flexitallic 304SS	3.2mm Flexitallic 304SS	
BOLTS	ASTM A-193 B7 Bolts	ASTM A-193 B7 Bolts	ASTM A-193 B7 Bolts	
NUTS	ASTM A-194 2H Hex Nuts	ASTM A-194 2H Hex Nuts	ASTM A-194 2H Hex Nuts	
NOTES:	1. 21MM to 48MM FLANGES 150# SCRD. OR SOCKET WELD RF. 2. 273MM AND LARGER - STD. 150# SLIP ON FLANGES ALLOWED ON BDR APPROVAL.			
				BOWER DAMBERGER ROLSETH ENGINEERING LTD.
				Rev.: 0 February 2005

**DEER CREEK ENERGY LIMITED
JOSLYN PHASE 2, SAGD FACILITY**

GUIDE TO PIPING MATERIALS

SPEC. DESIGNATION	150 PSX			
LINE CONTENT	Sour hydrocarbon liquid & vapour, process air, caustic, process drains, and vent systems in temperature service between -29°C and 121°C			
DESIGN CODE	ANSI B-31.3 (latest)	RATING	150 # ANSI	
PRESSURE (DESIGN)	See Table I	TEMP. (DESIGN)	See Table I	
CORROSION ALLOWANCE	3.2mm (1/8")	STRESS RELIEVE	Yes in Gas only; No in Multi-Phase or Liquid	
X-RAY	10%, 100% Gas Only	TEST PRESSURE	1.5 x Design Pressure	
SIZE RANGE	(3/4" to 1 1/2") 27mm to 48mm	(2") 60mm	(3" & over) 89mm & over	NOTES
WALL SCHEDULE	160	80	40	3
PIPE	C.S. Pipe Smls ASTM A-106 GR B	C.S. Pipe Smls ASTM A-106 GR B	C.S. Pipe Smls ASTM A-106 GR B	
FITTINGS - B.W. EX. REDUCERS		ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	
FITTINGS - B.W. REDUCERS ONLY		ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	
FITTINGS SCREWED/S.W.	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	1
COUPLINGS	ASTM A-105 6000# FS to ANSI B16.11	ASTM A-105 6000# FS to ANSI B16.11	ASTM A-105 6000# FS to ANSI B16.11	1
THREADOLETS/ SOCKOLETS	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	1
SWAGES	ASTM A-106 GR B Sch 160 FS			1
NIPPLES	ASTM A-106 GR B Sch 160 FS			1
FLANGES	ASTM A-105 150# RF to ANSI B16.5	ASTM A-105 150# RF to ANSI B16.5	ASTM A-105 150# RF to ANSI B16.5	1,2
GASKETS	3.2mm Flexitallic 316SS	3.2mm Flexitallic 316SS	3.2mm Flexitallic 316SS	
BOLTS	ASTM A-193 B7M Bolts	ASTM A-193 B7M Bolts	ASTM A-193 B7M Bolts	
NUTS	ASTM A-194 2HM Hex Nuts	ASTM A-194 2HM Hex Nuts	ASTM A-194 2HM Hex Nuts	
NOTES:	1. SCREWED CONNECTIONS TO BE USED ONLY ON SECONDARY LINES AFTER FLANGED BLOCK VALVES. 2. 273MM AND LARGER - STD. 150# SLIP ON FLANGES ALLOWED ON BDR APPROVAL. 3. ALL 21MM THREADED PIPING TO BE XXS.			BOWER DAMBERGER ROLSETH ENGINEERING LTD.
				Rev.: 1 March 2005

**DEER CREEK ENERGY LIMITED
JOSLYN PHASE 2, SAGD FACILITY**

GUIDE TO PIPING MATERIALS

SPEC. DESIGNATION	150 SPSX			
LINE CONTENT	Stainless steel piping containing sour hydrocarbon liquid & vapour, process air, caustic, process drains, and vent systems in temperature service between -29°C and 121°C			
DESIGN CODE	ANSI B-31.3 (latest)	RATING	150 # ANSI	
PRESSURE (DESIGN)	See Table I	TEMP. (DESIGN)	See Table I	
CORROSION ALLOWANCE	Nil	STRESS RELIEVE	No	
X-RAY	Partial (min.)	TEST PRESSURE	1.5 x Design Pressure	
SIZE RANGE	(½" to 1½") 21mm to 48mm	(2" to 8") 60 to 219mm	(10" & over) 273mm & over	NOTES
WALL SCHEDULE	80	10S	Calculate	
PIPE	S.S. Pipe Smls ASTM A-312-TP316L	S.S. Pipe Smls ASTM A-312-TP316L	S.S. Pipe Smls ASTM A-312-TP316L	
FITTINGS - B.W. EX. REDUCERS		ASTM A-403-WP316L to pipe wall thickness	ASTM A-403-WP316L to pipe wall thickness	
FITTINGS - B.W. REDUCERS ONLY		ASTM A-403-WP316L to pipe wall thickness	ASTM A-403-WP316L to pipe wall thickness	
FITTINGS SCREWED	ASTM A-182-F316L 3000# FS	ASTM A-182-F316L 3000# FS	ASTM A-182-F316L 3000# FS	
COUPLINGS	ASTM A-182-F316L 3000# FS	ASTM A-182-F316L 3000# FS	ASTM A-182-F316L 3000# FS	
THREADOLETS	ASTM A-182-F316L 3000# FS	ASTM A-182-F316L 3000# FS	ASTM A-182-F316L 3000# FS	
SWAGES	ASTM A-312-TP316L Sch 80 FS			
NIPPLES	ASTM A-312-TP316L Sch 80 FS			
FLANGES	ASTM A-182-F316L 150# RF	ASTM A-182-F316L 150# RF	ASTM A-182-F316L 150# RF	1,2
GASKETS	3.2mm Flexitallic 316SS	3.2mm Flexitallic 316SS	3.2mm Flexitallic 316SS	
BOLTS	ASTM A-193 B8M Bolts	ASTM A-193 B8M Bolts	ASTM A-193 B8M Bolts	
NUTS	ASTM A-194 8M Hex Nuts	ASTM A-194 8M Hex Nuts	ASTM A-194 8M Hex Nuts	
NOTES:				
1. 21MM to 48MM FLANGES 150# SCRD. OR SOCKET WELD RF.				
2. 273MM AND LARGER - STD. 150# SLIP ON FLANGES ALLOWED ON BDR APPROVAL.				
			BOWER DAMBERGER ROLSETH ENGINEERING LTD.	
			Rev.: 0 February 2005	

**DEER CREEK ENERGY LIMITED
JOSLYN PHASE 2, SAGD FACILITY**

GUIDE TO PIPING MATERIALS

SPEC. DESIGNATION	150 SIAX			
LINE CONTENT	Stainless steel piping containing dry instrument air in temperature service between -29°C and 121°C			
DESIGN CODE	ANSI B-31.3 (latest)	RATING	150 # ANSI	
PRESSURE (DESIGN)	Refer to Line List	TEMP. (DESIGN)	Refer to Line List	
CORROSION ALLOWANCE	Nil	STRESS RELIEVE	No	
X-RAY	Partial (min.)	TEST PRESSURE	1.5 x Design Pressure	
SIZE RANGE	(½" to 1½") 21mm to 48mm	(2" to 8") 60 to 219mm	(10" & over) 273mm & over	NOTES
WALL SCHEDULE	80	10S	Calculate	
PIPE	S.S. Pipe Smls ASTM A-312-TP304L	S.S. Pipe Smls ASTM A-312-TP304L	S.S. Pipe Smls ASTM A-312-TP304L	
FITTINGS - B.W. EX. REDUCERS		ASTM A-403-WP304L to pipe wall thickness	ASTM A-403-WP304L to pipe wall thickness	
FITTINGS - B.W. REDUCERS ONLY		ASTM A-403-WP304L to pipe wall thickness	ASTM A-403-WP304L to pipe wall thickness	
FITTINGS SCREWED	ASTM A-182-F304L 3000# FS	ASTM A-182-F304L 3000# FS	ASTM A-182-F304L 3000# FS	
COUPLINGS	ASTM A-182-F304L 3000# FS	ASTM A-182-F304L 3000# FS	ASTM A-182-F304L 3000# FS	
THREADOLETS	ASTM A-182-F304L 3000# FS	ASTM A-182-F304L 3000# FS	ASTM A-182-F304L 3000# FS	
SWAGES	ASTM A-312-TP304L Sch 80 FS			
NIPPLES	ASTM A-312-TP304L Sch 80 FS			
FLANGES		ASTM A-182-F304L 150# RF	ASTM A-182-F304L 150# RF	1,2
GASKETS		3.2mm Flexitallic 304SS	3.2mm Flexitallic 304SS	
BOLTS		ASTM A-193 B8 Bolts	ASTM A-193 B8 Bolts	
NUTS		ASTM A-194 8 Hex Nuts	ASTM A-194 8 Hex Nuts	
NOTES:	1. 21MM to 48MM FLANGES 150# SCRD. OR SOCKET WELD RF. 2. 273MM AND LARGER - STD. 150# SLIP ON FLANGES ALLOWED ON BDR APPROVAL.			
			BOWER DAMBERGER ROLSETH ENGINEERING LTD.	
				Rev.: 0 February 2005

**DEER CREEK ENERGY LIMITED
JOSLYN PHASE 2, SAGD FACILITY**

GUIDE TO PIPING MATERIALS

SPEC. DESIGNATION	150 CPX			
LINE CONTENT	Internally coated piping containing sweet hydrocarbon liquid & vapour, water, process air, caustic, process drains, and vent systems in temperature service between -29°C and 121°C			
DESIGN CODE	ANSI B-31.3 (latest)	RATING	150 # ANSI	
PRESSURE (DESIGN)	See Table I	TEMP. (DESIGN)	See Table I	
CORROSION ALLOWANCE	Nil [Welded] 1.6mm (1/16") [Screwed]	STRESS RELIEVE	No	
X-RAY	100%	TEST PRESSURE	1.5 x Design Pressure	
SIZE RANGE	(½" to 1½") 21mm to 48mm	(2" to 8") 60 to 219mm	(10" & over) 273mm & over	NOTES
WALL SCHEDULE	80	40 (internally coated)	40 (internally coated)	
PIPE	C.S. Pipe Smls ASTM A-106 GR B	C.S. Pipe Smls ASTM A-106 GR B	C.S. Pipe Smls ASTM A-106 GR B	
FITTINGS - B.W. EX. REDUCERS		ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	
FITTINGS - B.W. REDUCERS ONLY		ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	
FITTINGS SCREWED/S.W.	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	
COUPLINGS	ASTM A-105 6000# FS to ANSI B16.11	ASTM A-105 6000# FS to ANSI B16.11	ASTM A-105 6000# FS to ANSI B16.11	
THREADOLETS/ SOCKOLETS	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	
SWAGES	ASTM A-106 GR B Sch 80 FS			
NIPPLES	ASTM A-106 GR B Sch 80 FS			
FLANGES		ASTM A-105 150# RF to ANSI B16.5	ASTM A-105 150# RF to ANSI B16.5	1,2
GASKETS		3.2mm Flexitallic 304SS	3.2mm Flexitallic 304SS	
BOLTS		ASTM A-193 B7 Bolts	ASTM A-193 B7 Bolts	
NUTS		ASTM A-194 2H Hex Nuts	ASTM A-194 2H Hex Nuts	
NOTES:	1. 21MM to 48MM FLANGES 150# SCRD. OR SOCKET WELD RF. 2. 273MM AND LARGER - STD. 150# SLIP ON FLANGES ALLOWED ON BDR APPROVAL.			BOWER DAMBERGER ROLSETH ENGINEERING LTD. Rev.: 0 February 2005

**DEER CREEK ENERGY LIMITED
JOSLYN PHASE 2, SAGD FACILITY**

GUIDE TO PIPING MATERIALS

SPEC. DESIGNATION	150 CPSX			
LINE CONTENT	Internally coated piping containing sour hydrocarbon liquid & vapour, process air, caustic, process drains, and vent systems in temperature service between -29°C and 121°C			
DESIGN CODE	ANSI B-31.3 (latest)	RATING	150 # ANSI	
PRESSURE (DESIGN)	See Table I	TEMP. (DESIGN)	See Table I	
CORROSION ALLOWANCE	Nil [Welded] 3.2mm (1/8") [Screwed]	STRESS RELIEVE	Yes in Gas only; No in Multi-Phase or Liquid	
X-RAY	Full (100%)	TEST PRESSURE	1.5 x Design Pressure	
SIZE RANGE	(3/4" to 1 1/2") 27mm to 48mm	(2" to 8") 60 to 219mm	(10" & over) 273mm & over	NOTES
WALL SCHEDULE	160	40 (internally coated)	40 (internally coated)	3
PIPE	C.S. Pipe Smls ASTM A-106 GR B	C.S. Pipe Smls ASTM A-106 GR B	C.S. Pipe Smls ASTM A-106 GR B	
FITTINGS - B.W. EX. REDUCERS		ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	
FITTINGS - B.W. REDUCERS ONLY		ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	
FITTINGS SCREWED/S.W.	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	1
COUPLINGS	ASTM A-105 6000# FS to ANSI B16.11	ASTM A-105 6000# FS to ANSI B16.11	ASTM A-105 6000# FS to ANSI B16.11	1
THREADOLETS/ SOCKOLETS	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	1
SWAGES	ASTM A-106 GR B Sch 160 FS			1
NIPPLES	ASTM A-106 GR B Sch 160 FS			1
FLANGES		ASTM A-105 150# RF to ANSI B16.5	ASTM A-105 150# RF to ANSI B16.5	1,2
GASKETS		3.2mm Flexitallic 316SS	3.2mm Flexitallic 316SS	
BOLTS		ASTM A-193 B7M Bolts	ASTM A-193 B7M Bolts	
NUTS		ASTM A-194 2HM Hex Nuts	ASTM A-194 2HM Hex Nuts	
NOTES:	1. SCREWED CONNECTIONS TO BE USED ONLY ON SECONDARY LINES AFTER FLANGED BLOCK VALVES. 2. 273MM AND LARGER - STD. 150# SLIP ON FLANGES ALLOWED ON BDR APPROVAL. 3. ALL 21MM THREADED PIPING TO BE XXS.			BOWER DAMBERGER ROLSETH ENGINEERING LTD. Rev.: 1 March 2005

**DEER CREEK ENERGY LIMITED
JOSLYN PHASE 2, SAGD FACILITY**

GUIDE TO PIPING MATERIALS

SPEC. DESIGNATION	150 PY			
LINE CONTENT	Sweet hydrocarbon liquid & vapour, process air, caustic, process drains, glycol, water, and vent systems in temperature service between 121°C and 200°C			
DESIGN CODE	ANSI B-31.3 (latest)	RATING	150 # ANSI	
PRESSURE (DESIGN)	Refer to Line List	TEMP. (DESIGN)	Refer to Line List	
CORROSION ALLOWANCE	1.6mm (1/16")	STRESS RELIEVE	No	
X-RAY	10%	TEST PRESSURE	1.5 x Design Pressure	
SIZE RANGE	(½" to 1½") 21mm to 48mm	(2" to 8") 60 to 219mm	(10" & over) 273mm & over	NOTES
WALL SCHEDULE	80	40	40	
PIPE	C.S. Pipe Smls ASTM A-106 GR B	C.S. Pipe Smls ASTM A-106 GR B	C.S. Pipe Smls ASTM A-106 GR B	
FITTINGS - B.W. EX. REDUCERS		ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	
FITTINGS - B.W. REDUCERS ONLY		ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	
FITTINGS SCREWED/S.W.	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	
COUPLINGS	ASTM A-105 6000# FS to ANSI B16.11	ASTM A-105 6000# FS to ANSI B16.11	ASTM A-105 6000# FS to ANSI B16.11	
THREDOLETS/ SOCKOLETS	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	
SWAGES	ASTM A-106 GR B Sch 80 FS			
NIPPLES	ASTM A-106 GR B Sch 80 FS			
FLANGES	ASTM A-105 150# RF to ANSI B16.5	ASTM A-105 150# RF to ANSI B16.5	ASTM A-105 150# RF to ANSI B16.5	1,2
GASKETS	Grafoil	Grafoil	Grafoil	
BOLTS	ASTM A-193 B7 Bolts	ASTM A-193 B7 Bolts	ASTM A-193 B7 Bolts	
NUTS	ASTM A-194 2H Hex Nuts	ASTM A-194 2H Hex Nuts	ASTM A-194 2H Hex Nuts	
NOTES:	1. 21MM to 48MM FLANGES 150# SCRD. OR SOCKET WELD RF. 2. 273MM AND LARGER - STD. 150# SLIP ON FLANGES ALLOWED ON BDR APPROVAL.			BOWER DAMBERGER ROLSETH ENGINEERING LTD. Rev.: 0 February 2005

**DEER CREEK ENERGY LIMITED
JOSLYN PHASE 2, SAGD FACILITY**

GUIDE TO PIPING MATERIALS

SPEC. DESIGNATION		150 PSY		
LINE CONTENT		Sour hydrocarbon liquid & vapour, process air, caustic, process drains, and vent systems in temperature service between 121°C and 200°C		
DESIGN CODE		ANSI B-31.3 (latest)	RATING	150 # ANSI
PRESSURE (DESIGN)		See Table I	TEMP. (DESIGN)	See Table I
CORROSION ALLOWANCE		3.2mm (1/8")	STRESS RELIEVE	Yes in Gas only; No in Multi-Phase or Liquid
X-RAY		10%, 100% Gas Only	TEST PRESSURE	1.5 x Design Pressure
SIZE RANGE	(3/4" to 1 1/2") 27mm to 48mm	(2") 60mm	(3" & over) 89mm & over	NOTES
WALL SCHEDULE	160	80	40	3
PIPE	C.S. Pipe Smls ASTM A-106 GR B	C.S. Pipe Smls ASTM A-106 GR B	C.S. Pipe Smls ASTM A-106 GR B	
FITTINGS - B.W. EX. REDUCERS		ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	
FITTINGS - B.W. REDUCERS ONLY		ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	
FITTINGS SCREWED/S.W.	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	1
COUPLINGS	ASTM A-105 6000# FS to ANSI B16.11	ASTM A-105 6000# FS to ANSI B16.11	ASTM A-105 6000# FS to ANSI B16.11	1
THREADOLETS/ SOCKOLETS	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	1
SWAGES	ASTM A-106 GR B Sch 160 FS			1
NIPPLES	ASTM A-106 GR B Sch 160 FS			1
FLANGES	ASTM A-105 150# RF to ANSI B16.5	ASTM A-105 150# RF to ANSI B16.5	ASTM A-105 150# RF to ANSI B16.5	1,2
GASKETS	Grafoil	Grafoil	Grafoil	
BOLTS	ASTM A-193 B7M Bolts	ASTM A-193 B7M Bolts	ASTM A-193 B7M Bolts	
NUTS	ASTM A-194 2HM Hex Nuts	ASTM A-194 2HM Hex Nuts	ASTM A-194 2HM Hex Nuts	
NOTES:	1. SCREWED CONNECTIONS TO BE USED ONLY ON SECONDARY LINES AFTER FLANGED BLOCK VALVES. 2. 273MM AND LARGER - STD. 300# SLIP ON FLANGES ALLOWED ON BDR APPROVAL. 3. ALL 21MM THREADED PIPING TO BE XXS.			
				BOWER DAMBERGER ROLSETH ENGINEERING LTD.
				Rev.: 1 March 2005

**DEER CREEK ENERGY LIMITED
JOSLYN PHASE 2, SAGD FACILITY**

GUIDE TO PIPING MATERIALS

SPEC. DESIGNATION	300 PX			
LINE CONTENT	Sweet hydrocarbon liquid & vapour, process air, caustic, process drains, water, glycol, and vent systems in temperature service between -29°C and 121°C			
DESIGN CODE	ANSI B-31.3 (latest)	RATING	300 # ANSI	
PRESSURE (DESIGN)	Refer to Line List	TEMP. (DESIGN)	Refer to Line List	
CORROSION ALLOWANCE	1.6mm (1/16")	STRESS RELIEVE	No	
X-RAY	10%	TEST PRESSURE	1.5 x Design Pressure	
SIZE RANGE	(½" to 1½") 21mm to 48mm	(2" to 8") 60 to 219mm	(10" & over) 273mm & over	NOTES
WALL SCHEDULE	160	40	Calculate	3
PIPE	C.S. Pipe Smls ASTM A-106 GR B	C.S. Pipe Smls ASTM A-106 GR B	C.S. Pipe Smls ASTM A-106 GR B	
FITTINGS - B.W. EX. REDUCERS		ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	
FITTINGS - B.W. REDUCERS ONLY		ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	
FITTINGS SCREWED/S.W.	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	
COUPLINGS	ASTM A-105 6000# FS to ANSI B16.11	ASTM A-105 6000# FS to ANSI B16.11	ASTM A-105 6000# FS to ANSI B16.11	
THREDOLETS/ SOCKOLETS	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	
SWAGES	ASTM A-106 GR B Sch 160 FS			
NIPPLES	ASTM A-106 GR B Sch 160 FS			
FLANGES	ASTM A-105 300# RF to ANSI B16.5	ASTM A-105 300# RF to ANSI B16.5	ASTM A-105 300# RF to ANSI B16.5	1,2
GASKETS	3.2mm Flexitallic 304SS	3.2mm Flexitallic 304SS	3.2mm Flexitallic 304SS	
BOLTS	ASTM A-193 B7 Bolts	ASTM A-193 B7 Bolts	ASTM A-193 B7 Bolts	
NUTS	ASTM A-194 2H Hex Nuts	ASTM A-194 2H Hex Nuts	ASTM A-194 2H Hex Nuts	
NOTES:	1. 21MM TO 48MM FLANGES 300# SCR.D. OR SOCKET WELD RF. 2. 273MM AND LARGER - STD. 300# SLIP ON FLANGES ALLOWED ON BDR APPROVAL. 3. ALL 48MM THREADED PIPING TO BE SCH 80 (XS).			BOWER DAMBERGER ROLSETH ENGINEERING LTD.
				Rev.: 0 February 2005

**DEER CREEK ENERGY LIMITED
JOSLYN PHASE 2, SAGD FACILITY**

GUIDE TO PIPING MATERIALS

SPEC. DESIGNATION	300 PSX			
LINE CONTENT	Sour hydrocarbon liquid & vapour, process air, caustic, process drains, and vent systems in temperature service between -29°C and 121°C			
DESIGN CODE	ANSI B-31.3 (latest)	RATING	300 # ANSI	
PRESSURE (DESIGN)	See Table I	TEMP. (DESIGN)	See Table I	
CORROSION ALLOWANCE	3.2mm (1/8")	STRESS RELIEVE	Yes	
X-RAY	Full (100%)	TEST PRESSURE	1.5 x Design Pressure	
SIZE RANGE	(1/2" to 1") 21mm to 33mm	(2") 60mm	(2 1/2" & over) 73mm & over	NOTES
WALL SCHEDULE	XXS	80	Calculate	3
PIPE	C.S. Pipe Smls ASTM A-106 GR B	C.S. Pipe Smls ASTM A-106 GR B	C.S. Pipe Smls ASTM A-106 GR B	
FITTINGS - B.W. EX. REDUCERS		ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	
FITTINGS - B.W. REDUCERS ONLY		ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	
FITTINGS SCREWED/S.W.	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	1
COUPLINGS	ASTM A-105 6000# FS to ANSI B16.11	ASTM A-105 6000# FS to ANSI B16.11	ASTM A-105 6000# FS to ANSI B16.11	1
THREADOLETS/ SOCKOLETS	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	1
SWAGES	ASTM A-106 GR B Sch XXS FS			1
NIPPLES	ASTM A-106 GR B Sch XXS FS			1
FLANGES	ASTM A-105 300# RF to ANSI B16.5	ASTM A-105 300# RF to ANSI B16.5	ASTM A-105 300# RF to ANSI B16.5	1,2
GASKETS	3.2mm Flexitallic 316SS	3.2mm Flexitallic 316SS	3.2mm Flexitallic 316SS	
BOLTS	ASTM A-193 B7M Bolts	ASTM A-193 B7M Bolts	ASTM A-193 B7M Bolts	
NUTS	ASTM A-194 2HM Hex Nuts	ASTM A-194 2HM Hex Nuts	ASTM A-194 2HM Hex Nuts	
NOTES:				
1. SCREWED CONNECTIONS TO BE USED ONLY ON SECONDARY LINES AFTER FLANGED BLOCK VALVES.				
2. 273MM AND LARGER - STD. 300# SLIP ON FLANGES ALLOWED ON BDR APPROVAL.				
3. ALL 48MM THREADED PIPING TO BE SCH 160.				
			BOWER DAMBERGER ROLSETH ENGINEERING LTD.	
			Rev.: 0 February 2005	

**DEER CREEK ENERGY LIMITED
JOSLYN PHASE 2, SAGD FACILITY**

GUIDE TO PIPING MATERIALS

SPEC. DESIGNATION	300 PSY			
LINE CONTENT	Sour hydrocarbon liquid & vapour, process air, caustic, process drains, and vent systems in temperature service between 121°C and 200°C			
DESIGN CODE	ANSI B-31.3 (latest)	RATING	300 # ANSI	
PRESSURE (DESIGN)	See Table I	TEMP. (DESIGN)	See Table I	
CORROSION ALLOWANCE	3.2mm (1/8")	STRESS RELIEVE	Yes	
X-RAY	Full (100%)	TEST PRESSURE	1.5 x Design Pressure	
SIZE RANGE	(½" to 1") 21mm to 33mm	(2") 60mm	(3" & over) 89mm & over	NOTES
WALL SCHEDULE	XXS	80	Calculate	3
PIPE	C.S. Pipe Smls ASTM A-106 GR B	C.S. Pipe Smls ASTM A-106 GR B	C.S. Pipe Smls ASTM A-106 GR B	
FITTINGS - B.W. EX. REDUCERS		ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	
FITTINGS - B.W. REDUCERS ONLY		ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	
FITTINGS SCREWED/S.W.	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	1
COUPLINGS	ASTM A-105 6000# FS to ANSI B16.11	ASTM A-105 6000# FS to ANSI B16.11	ASTM A-105 6000# FS to ANSI B16.11	1
THREDOLETS/ SOCKOLETS	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	1
SWAGES	ASTM A-106 GR B Sch XXS FS			1
NIPPLES	ASTM A-106 GR B Sch XXS FS			1
FLANGES	ASTM A-105 300# RF to ANSI B16.5	ASTM A-105 300# RF to ANSI B16.5	ASTM A-105 300# RF to ANSI B16.5	1,2
GASKETS	Grafoil	Grafoil	Grafoil	
BOLTS	ASTM A-193 B7M Bolts	ASTM A-193 B7M Bolts	ASTM A-193 B7M Bolts	
NUTS	ASTM A-194 2HM Hex Nuts	ASTM A-194 2HM Hex Nuts	ASTM A-194 2HM Hex Nuts	
NOTES:	1. SCREWED CONNECTIONS TO BE USED ONLY ON SECONDARY LINES AFTER FLANGED BLOCK VALVES. 2. 273MM AND LARGER - STD. 300# SLIP ON FLANGES ALLOWED ON BDR APPROVAL. 3. ALL 48MM THREADED PIPING TO BE SCH 160.			BOWER DAMBERGER ROLSETH ENGINEERING LTD. Rev.: 0 February 2005

**DEER CREEK ENERGY LIMITED
JOSLYN PHASE 2, SAGD FACILITY**

GUIDE TO PIPING MATERIALS

SPEC. DESIGNATION	300 CPSX			
LINE CONTENT	Internally coated piping containing sour hydrocarbon liquid & vapour, process air, caustic, process drains, and vent systems in temperature service between -29°C and 121°C			
DESIGN CODE	ANSI B-31.3 (latest)	RATING	300 # ANSI	
PRESSURE (DESIGN)	See Table I	TEMP. (DESIGN)	See Table I	
CORROSION ALLOWANCE	Nil [Welded] 3.2mm (1/8") [Screwed]	STRESS RELIEVE	Yes	
X-RAY	Full (100%)	TEST PRESSURE	1.5 x Design Pressure	
SIZE RANGE	(1/2" to 1") 21mm to 33mm	(2" to 8") 60 to 219mm	(10" & over) 273mm & over	NOTES
WALL SCHEDULE	XXS	40 (internally coated)	40 (internally coated)	3
PIPE	C.S. Pipe Smls ASTM A-106 GR B	C.S. Pipe Smls ASTM A-106 GR B	C.S. Pipe Smls ASTM A-106 GR B	
FITTINGS - B.W. EX. REDUCERS		ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	
FITTINGS - B.W. REDUCERS ONLY		ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	
FITTINGS SCREWED	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	1
COUPLINGS	ASTM A-105 6000# FS to ANSI B16.11	ASTM A-105 6000# FS to ANSI B16.11	ASTM A-105 6000# FS to ANSI B16.11	1
THREADOLETS	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	1
SWAGES	ASTM A-106 GR B Sch XXS FS			1
NIPPLES	ASTM A-106 GR B Sch XXS FS			1
FLANGES		ASTM A-105 300# RF to ANSI B16.5	ASTM A-105 300# RF to ANSI B16.5	1,2
GASKETS		3.2mm Flexitallic 316SS	3.2mm Flexitallic 316SS	
BOLTS		ASTM A-193 B7M Bolts	ASTM A-193 B7M Bolts	
NUTS		ASTM A-194 2HM Hex Nuts	ASTM A-194 2HM Hex Nuts	
NOTES:	1. SCREWED CONNECTIONS TO BE USED ONLY ON SECONDARY LINES AFTER FLANGED BLOCK VALVES. 2. 273MM AND LARGER - STD. 300# SLIP ON FLANGES ALLOWED ON BDR APPROVAL. 3. ALL 48MM THREADED PIPING TO BE SCH 160.			BOWER DAMBERGER ROLSETH ENGINEERING LTD.
				Rev.: 0 February 2005

**DEER CREEK ENERGY LIMITED
JOSLYN PHASE 2, SAGD FACILITY**

GUIDE TO PIPING MATERIALS

SPEC. DESIGNATION	600 PX			
LINE CONTENT	Sweet hydrocarbon liquid & vapour, process air, caustic, process drains, water, and vent systems in temperature service between -29°C and 121°C			
DESIGN CODE	ANSI B-31.3 (latest)	RATING	600 # ANSI	
PRESSURE (DESIGN)	Refer to Line List	TEMP. (DESIGN)	Refer to Line List	
CORROSION ALLOWANCE	1.6mm (1/16")	STRESS RELIEVE	No	
X-RAY	10%	TEST PRESSURE	1.5 x Design Pressure	
SIZE RANGE	(½" to 1½") 21mm to 48mm	(2½", 3") 73mm, 89mm	(2", 4" & over) 60mm, 114mm & over	NOTES
WALL SCHEDULE	160	40	Calculate	
PIPE	C.S. Pipe Smls ASTM A-106 GR B	C.S. Pipe Smls ASTM A-106 GR B	C.S. Pipe Smls ASTM A-106 GR B	
FITTINGS - B.W. EX. REDUCERS		ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	
FITTINGS - B.W. REDUCERS ONLY		ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	
FITTINGS SCREWED	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	
COUPLINGS	ASTM A-105 6000# FS to ANSI B16.11	ASTM A-105 6000# FS to ANSI B16.11	ASTM A-105 6000# FS to ANSI B16.11	
THREADOLETS	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	
SWAGES	ASTM A-106 GR B Sch 160 FS			
NIPPLES	ASTM A-106 GR B Sch 160 FS			
FLANGES	ASTM A-105 600# RF to ANSI B16.5	ASTM A-105 600# RF to ANSI B16.5	ASTM A-105 600# RF to ANSI B16.5	1
GASKETS	3.2mm Flexitallic 304SS	3.2mm Flexitallic 304SS	3.2mm Flexitallic 304SS	
BOLTS	ASTM A-193 B7 Bolts	ASTM A-193 B7 Bolts	ASTM A-193 B7 Bolts	
NUTS	ASTM A-194 2H Hex Nuts	ASTM A-194 2H Hex Nuts	ASTM A-194 2H Hex Nuts	
NOTES: 1. 21MM TO 48MM FLANGES 600# SCR.D. OR SOCKET WELD RF.				
			BOWER DAMBERGER ROLSETH ENGINEERING LTD.	
			Rev.: 0 February 2005	

**DEER CREEK ENERGY LIMITED
JOSLYN PHASE 2, SAGD FACILITY**

GUIDE TO PIPING MATERIALS

SPEC. DESIGNATION	600 PSX			
LINE CONTENT	Sour hydrocarbon liquid & vapour, process air, caustic, process drains, and vent systems in temperature service between -29°C and 121°C			
DESIGN CODE	ANSI B-31.3 (latest)	RATING	600 # ANSI	
PRESSURE (DESIGN)	See Table I	TEMP. (DESIGN)	See Table I	
CORROSION ALLOWANCE	3.2mm (1/8")	STRESS RELIEVE	Yes	
X-RAY	Full (100%)	TEST PRESSURE	1.5 x Design Pressure	
SIZE RANGE	(1/2" to 1 1/2") 21mm to 48mm	(2") 60mm	(2 1/2" & over) 73mm & over	NOTES
WALL SCHEDULE	XXS	160	Calculate	
PIPE	C.S. Pipe Smls ASTM A-106 GR B	C.S. Pipe Smls ASTM A-106 GR B	C.S. Pipe Smls ASTM A-106 GR B	
FITTINGS - B.W. EX. REDUCERS		ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	
FITTINGS - B.W. REDUCERS ONLY		ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	
FITTINGS SCREWED/S.W.	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	1
COUPLINGS	ASTM A-105 6000# FS to ANSI B16.11	ASTM A-105 6000# FS to ANSI B16.11	ASTM A-105 6000# FS to ANSI B16.11	1
THREDOLETS/ SOCKOLETS	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	1
SWAGES	ASTM A-106 GR B Sch XXS FS			1
NIPPLES	ASTM A-106 GR B Sch XXS FS			1
FLANGES	ASTM A-105 600# RF to ANSI B16.5	ASTM A-105 600# RF to ANSI B16.5	ASTM A-105 600# RF to ANSI B16.5	1
GASKETS	3.2mm Flexitallic 316SS	3.2mm Flexitallic 316SS	3.2mm Flexitallic 316SS	
BOLTS	ASTM A-193 B7M Bolts	ASTM A-193 B7M Bolts	ASTM A-193 B7M Bolts	
NUTS	ASTM A-194 2HM Hex Nuts	ASTM A-194 2HM Hex Nuts	ASTM A-194 2HM Hex Nuts	
NOTES:	1. SCREWED CONNECTIONS TO BE USED ONLY ON SECONDARY LINES AFTER FLANGED BLOCK VALVES.			
			BOWER DAMBERGER ROLSETH ENGINEERING LTD.	
			Rev.: 0 February 2005	

**DEER CREEK ENERGY LIMITED
JOSLYN PHASE 2, SAGD FACILITY**

GUIDE TO PIPING MATERIALS

SPEC. DESIGNATION	600 CPX			
LINE CONTENT	Internally coated piping containing sweet hydrocarbon liquid & vapour, process air, caustic, water, process drains, and vent systems in temperature service between -29°C and 121°C			
DESIGN CODE	ANSI B-31.3 (latest)	RATING	600 # ANSI	
PRESSURE (DESIGN)	See Table I	TEMP. (DESIGN)	See Table I	
CORROSION ALLOWANCE	Nil [Welded] 1.6mm (1/16") [Screwed]	STRESS RELIEVE	No	
X-RAY	Full (100%)	TEST PRESSURE	1.5 x Design Pressure	
SIZE RANGE	(1/2" to 1 1/2") 21mm to 48mm	(2" to 6") 60mm to 168mm	(8" & over) 219mm & over	NOTES
WALL SCHEDULE	160	40 (internally coated)	Calculate (internally coated)	
PIPE	C.S. Pipe Smls ASTM A-106 GR B	C.S. Pipe Smls ASTM A-106 GR B	C.S. Pipe Smls ASTM A-106 GR B	
FITTINGS - B.W. EX. REDUCERS		ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	
FITTINGS - B.W. REDUCERS ONLY		ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	
FITTINGS SCREWED	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	
COUPLINGS	ASTM A-105 6000# FS to ANSI B16.11	ASTM A-105 6000# FS to ANSI B16.11	ASTM A-105 6000# FS to ANSI B16.11	
THREADOLETS	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	
SWAGES	ASTM A-106 GR B Sch 160 FS			
NIPPLES	ASTM A-106 GR B Sch 160 FS			
FLANGES		ASTM A-105 600# RF to ANSI B16.5	ASTM A-105 600# RF to ANSI B16.5	1
GASKETS		3.2mm Flexitallic 304SS	3.2mm Flexitallic 304SS	
BOLTS		ASTM A-193 B7 Bolts	ASTM A-193 B7 Bolts	
NUTS		ASTM A-194 2H Hex Nuts	ASTM A-194 2H Hex Nuts	
NOTES: 1. 21MM TO 48MM FLANGES 600# SCRD. OR SOCKET WELD RF.				
			BOWER DAMBERGER ROLSETH ENGINEERING LTD.	
			Rev.: 0 February 2005	

**DEER CREEK ENERGY LIMITED
JOSLYN PHASE 2, SAGD FACILITY**

GUIDE TO PIPING MATERIALS

SPEC. DESIGNATION		600 PY		
LINE CONTENT		Sweet hydrocarbon liquid & vapor, process drains, water, vent, and utility steam in temperature service between 121°C and 200°C		
DESIGN CODE		ANSI B-31.3 (latest)	RATING	600 # ANSI
PRESSURE (DESIGN)		Refer to Line List	TEMP. (DESIGN)	Refer to Line List
CORROSION ALLOWANCE		1.6mm (1/16")	STRESS RELIEVE	No
X-RAY		10%	TEST PRESSURE	15307 kPag
SIZE RANGE	(½" to 1½") 21mm to 48mm	(2½", 3") 73mm, 89mm	(2", 4" & over) 60mm, 114mm & over	NOTES
WALL SCHEDULE	160	40	Calculate	
PIPE	C.S. Pipe Smls ASTM A-106 GR B	C.S. Pipe Smls ASTM A-106 GR B	C.S. Pipe Smls ASTM A-106 GR B	
FITTINGS - B.W. EX. REDUCERS		ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	
FITTINGS - B.W. REDUCERS ONLY		ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	
FITTINGS SCREWED/S.W.	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	
COUPLINGS	ASTM A-105 6000# FS to ANSI B16.11	ASTM A-105 6000# FS to ANSI B16.11	ASTM A-105 6000# FS to ANSI B16.11	
THREADOLETS/ SOCKOLETS	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	
SWAGES	ASTM A-106 GR B Sch 160 FS			
NIPPLES	ASTM A-106 GR B Sch 160 FS			
FLANGES	ASTM A-105 600# RF to ANSI B16.5	ASTM A-105 600# RF to ANSI B16.5	ASTM A-105 600# RF to ANSI B16.5	1
GASKETS	Grafoil	Grafoil	Grafoil	
BOLTS	ASTM A-193 B7 Bolts	ASTM A-193 B7 Bolts	ASTM A-193 B7 Bolts	
NUTS	ASTM A-194 2H Hex Nuts	ASTM A-194 2H Hex Nuts	ASTM A-194 2H Hex Nuts	
NOTES: 1. 21MM TO 48MM FLANGES 600# SCRD. OR SOCKET WELD RF.				
				BOWER DAMBERGER ROLSETH ENGINEERING LTD.
				Rev.: 0 May 2005

**DEER CREEK ENERGY LIMITED
JOSLYN PHASE 2, SAGD FACILITY**

GUIDE TO PIPING MATERIALS

SPEC. DESIGNATION		600 PZ		
LINE CONTENT		Process and utility steam in temperature service between 200°C and 315°C		
DESIGN CODE		ANSI B-31.3 (latest)	RATING	600 # ANSI
PRESSURE (DESIGN)		Refer to Line List	TEMP. (DESIGN)	Refer to Line List
CORROSION ALLOWANCE		1.6mm (1/16")	STRESS RELIEVE	No
X-RAY		10%	TEST PRESSURE	1.5 x Design Pressure
SIZE RANGE	(½" to 1½") 21mm to 48mm	(2½", 3") 73mm, 89mm	(2", 4" & over) 60mm, 114mm & over	NOTES
WALL SCHEDULE	160	40	Calculate	
PIPE	C.S. Pipe Smls ASTM A-106 GR B	C.S. Pipe Smls ASTM A-106 GR B	C.S. Pipe Smls ASTM A-106 GR B	
FITTINGS - B.W. EX. REDUCERS		ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	
FITTINGS - B.W. REDUCERS ONLY		ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	ASTM A-234 WPB to pipe wall thickness & ANSI B16.9	
FITTINGS SCREWED/S.W.	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	
COUPLINGS	ASTM A-105 6000# FS to ANSI B16.11	ASTM A-105 6000# FS to ANSI B16.11	ASTM A-105 6000# FS to ANSI B16.11	
THREADOLETS/ SOCKOLETS	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	ASTM A-105 3000# FS to ANSI B16.11	
SWAGES	ASTM A-106 GR B Sch 160 FS			
NIPPLES	ASTM A-106 GR B Sch 160 FS			
FLANGES	ASTM A-105 600# RF to ANSI B16.5	ASTM A-105 600# RF to ANSI B16.5	ASTM A-105 600# RF to ANSI B16.5	1
GASKETS	Grafoil	Grafoil	Grafoil	
BOLTS	ASTM A-193 B7 Bolts	ASTM A-193 B7 Bolts	ASTM A-193 B7 Bolts	
NUTS	ASTM A-194 2H Hex Nuts	ASTM A-194 2H Hex Nuts	ASTM A-194 2H Hex Nuts	
NOTES: 1. 21MM TO 48MM FLANGES 600# SCRD. OR SOCKET WELD RF.				
			BOWER DAMBERGER ROLSETH ENGINEERING LTD.	
			Rev.: 0 February 2005	

Valve Tag:	BA-101X (150# RP)	BA-111X (150# FP)
	BA-301X (300# RP)	BA-311X (300# FP)
	BA-601X (600# RP)	BA-611X (600# FP)

Service Condition:	Max 121 C Sweet Service
Pressure/Temperature Ratings:	150/300/600 ANSI R.F. Valves to be rated for full ANSI service at temp (240 psig for 150 ANSI) (665 psig for 300 ANSI, 1340 psig for 600 ANSI)
Size:	2" – 8" NPS 150# (Floating Ball Design) 2" – 6" NPS 300# (Floating Ball Design) 2" – 4" NPS 600# (Floating Ball Design)

Material Specification Chart:	
Body/Bonnet:	ASME B16.34 – API-6D – BS 5351 A216 WCB or A352 LCC (Split Body Design)
Bolting:	B7M / L7M
Ball:	4 RMS FINISH, CF8M/316SS
Seat:	RTFE / DEVLON
Stem:	316SS (Blow out proof)
Packing Box:	Extra deep, machined finish for low emissions
Packing:	Live-loaded die formed, high & low density graphite rings, with static sealed stem retainer, (HSN Seals)
Mounting Pad:	ISO 5211 design with locking provision
Operator:	Lever*
Certification Required:	API 607 "Fire Safe"
Recommended Manufacturer:	Kuka Figure # CCA15BGLN – Reduced port 150 ANSI CBA15BGLN – Full port 150 ANSI CCA30BGLN – Reduced port 300 ANSI CBA30BGLN – Full port 300 ANSI CCA60BVLN – Reduced port 600 ANSI CBA60BVLN – Full port 600 ANSI
Notes:	LN changes to GN for Gear Operated valves* BG or BV changes to LG or LV if low temp valves are used as a substitution

Deer Creek Phase II Valve Specifications

Ball Valves

Valve Tag:	BA-101SX (150# RP)	BA-111SX (150# FP)
	BA-301SX (300# RP)	BA-311SX (300# FP)
	BA-601SX (600# RP)	BA-611SX (600# FP)

Service Condition:	Max 121 C Sour Service (2.5 H2S in gas) in produced Oil & Water
Pressure/Temperature Ratings:	150/300/600 ANSI R.F. Valves to be rated for full ANSI service at temp (240 psig for 150 ANSI) (665 psig for 300 ANSI, 1340 psig for 600 ANSI)
Size:	2" – 8" NPS 150# (Floating Ball Design) 2" – 6" NPS 300# (Floating Ball Design) 2" – 4" NPS 600# (Floating Ball Design)

Material Specification Chart:	
Body/Bonnet:	ASME B16.34 – API-6D – BS 5351 A216 WCB or A352 LCC (Split Body Design)
Bolting:	B7M / L7M
Ball:	4 RMS FINISH, CF8M/316SS
Seat:	RTFE / DEVLON
Stem:	316SS (Blow out proof)
Packing Box:	Extra deep, machined finish for low emissions
Packing:	Live-loaded die formed, high & low density graphite rings, with static sealed stem retainer, (HSN seals)
Mounting Pad:	ISO 5211 design with locking provision
Operator:	Lever*
Certification Required:	API 607 "Fire Safe", NACE MR 0175, 2002
Recommended Manufacturer:	Kuka Figure #: CCA15BGLN – Reduced port 150 ANSI CBA15BGLN – Full port 150 ANSI CCA30BGLN – Reduced port 300 ANSI CBA30BGLN – Full port 300 ANSI CCA60BVLN – Reduced port 600 ANSI CBA60BVLN – Full port 600 ANSI
Notes:	LN Changes to GN for Gear operated valves* BG or BV changes to LG or LV if low temp valves are used as a substitution

Valve Tag:	BA-101SY (150# RP)	BA-111SY (150# FP)
	BA-301SY (300# RP)	BA-311SY (300# FP)
	BA-601SY (600# RP)	BA-611SY (600# FP)

Service Condition:	Max 200 C Sour Service (2.5 H2S in gas) in produced Oil & Water
Pressure/Temperature Ratings:	150/300/600 ANSI R.F. Valves to be rated for full ANSI service at temp (200 psig for 150 ANSI) (635 psig for 300 ANSI, 1270 psig for 600 ANSI)
Size:	2" – 8" NPS 150# (Floating Ball Design) 2" – 6" NPS 300# (Floating Ball Design) 2" – 4" NPS 600# (Floating Ball Design)

Material Specification Chart:	
Body/Bonnet:	ASME B16.34 – API-6D – BS 5351 A216 WCB or A352 LCC (Split Body Design)
Bolting:	B7M / L7M
Ball:	4 RMS FINISH, CF8M/316SS
Seat:	PEEK PFSD
Stem:	316SS (Blow out proof)
Packing Box:	Extra deep, machined finish for low emissions
Packing:	Live-loaded die formed, high & low density graphite rings, with static sealed stem seal retainer, (HSN Seals)
Mounting Pad:	ISO 5211 design with locking provision
Operator:	Lever*
Certification Required:	API 607 "Fire Safe", NACE MR 0175, 2002
Recommended Manufacturer:	Kuka Figure # CCA15BKLN – Reduced port 150 ANSI CBA15BKLN – Full port 150 ANSI CCA30BKLN – Reduced port 300 ANSI CBA30BKLN – Full port 300 ANSI CCA60BKLN – Reduced port 600 ANSI CBA60BKLN – Full port 600 ANSI
Notes:	LN changes to GN for Gear Operated valves* BK changes to LK if low temp valves are used as a substitution.

Valve Tag:	BA-121SX (150# RP)	BA-131SX (150# FP)
	BA-321SX (300# RP)	BA-331SX (300# FP)
	BA-621SX (600# RP)	BA-631SX (600# FP)

Service Condition:	Max 121 C Sour Service (2.5 H₂S in gas) in produced Oil & Water. Smaller isolation / critical applications
Pressure/Temperature Ratings:	150/300/600 ANSI R.F. Valves to be rated for full ANSI service at temp (250 psig for 150 ANSI) (665 psig for 300 ANSI, 1335 psig for 600 ANSI)
Size:	2" – 16" Bore (Trunnion Ball Design)

Material Specification Chart:	
Body/Bonnet:	ASME B16.34 – API-6D – BS 5351 A216 WCB or A352 LCC (Split Body Design)
Bolting:	B7M / L7M
Ball:	4 RMS FINISH, CF8M/316SS
Seat:	PTFE*, DEVLON*
Stem:	316SS (Blow out proof)
Packing Box:	Extra deep, machined finish for low emissions
Packing:	Stem Seal with self cleaning die formed, high & low density graphite rings, and static sealed O-rings (HSN seals).
Mounting Pad:	ISO 5211 design with locking provision
Operator:	Lever, or Worm Gear Operator for 6" and larger or wherever preferred.
Certification Required:	API 607 "Fire Safe", NACE MR 0175, 2002
Recommended Manufacturer:	Kuka Figure #: CGA15BGLS – Reduced port 150 ANSI CFA15BGLS – Full port 150 ANSI CGA30BGLS – Reduced port 300 ANSI CFA30BGLS – Full port 300 ANSI CGA60BVLS – Reduced port 600 ANSI CFA60BVLS – Full port 600 ANSI
Notes:	DEVLON is used in 600# & higher. LS Changes to GS for Gear operated valves. BG & BV change to LG & LV if low temp valves are used as a substitution. 4" FP & larger Trunnion mounted ball valves are furnished with emergency sealant & stem seal injection fittings.

Valve Tag:	BA-121SY (150# RP)	BA-131SY (150# FP)
	BA-321SY (300# RP)	BA-331SY (300# FP)
	BA-621SY (600# RP)	BA-631SY (600# FP)

Service Condition:	Max 200 C Sour Service (2.5 H ₂ S in gas) in produced Oil & Water. Smaller isolation / critical applications
Pressure/Temperature Ratings:	150/300/600 ANSI R.F. Valves to be rated for full ANSI service at temp (200 psig for 150 ANSI) (635 psig for 300 ANSI, 1270 psig for 600 ANSI)
Size:	2" – 16" Bore (Trunnion Ball Design)

Material Specification Chart:	
Body/Bonnet:	ASME B16.34 – API-6D – BS 5351 A216 WCB or A352 LCC (Split Body Design)
Bolting:	B7M / L7M
Ball:	4 RMS FINISH, CF8M/316SS
Seat:	PEEK PFSD
Stem:	316SS (Blow out proof)
Packing Box:	Extra deep, machined finish for low emissions
Packing:	Stem Seal with self cleaning die formed, high & low density graphite rings, and static sealed O-rings (HSN seals).
Mounting Pad:	ISO 5211 design with locking provision
Operator:	Lever, or Worm Gear Operator for 6" and larger or wherever preferred.
Certification Required:	API 607 "Fire Safe", NACE MR 0175, 2002
Recommended Manufacturer:	Kuka Figure #: CGA15BKLS – Reduced port 150 ANSI CFA15BKLS – Full port 150 ANSI CGA30BKLS – Reduced port 300 ANSI CFA30BKLS – Full port 300 ANSI CGA60BKLS – Reduced port 600 ANSI CFA60BKLS – Full port 600 ANSI
Notes:	LS Changes to GS for Gear operated valves. BK changes to LK if low temp valves are used as a substitution. 4" FP & larger Trunnion mounted ball valves are furnished with emergency sealant & stem seal injection fittings.

Valve Tag:	BA-103X (RP)	BA-113X (FP)
	BA-303X (RP)	BA-313X (FP)
	BA-603X (RP)	BA-613X (FP)

Service Condition:	Max 121 C Sweet Service
Pressure/Temperature Ratings:	3000# WOG C.S. Valves threaded or socket weld ends
Size:	½" – 1 ½" Bore (Floating Ball Design)

Material Specification Chart:

Body/Cap:	ASME B16.34 – API-6D – API-6A – CSAZ245.15 ASTM A105 / ASTM A675 Gr. 70 (3 piece Threaded Design)
Bolting:	Not applicable
Ball:	316SS
Seat:	Delrin AF
Stem:	17-4 PH SS
Seat/Body O-ring:	Viton / Viton
Gland Flange:	Carbon Steel Plated with locking provision
Packing:	Filled TFE with stainless steel packing follower
Thrust Washer:	Delrin
Operator:	Lever (ductile iron)

Recommended Manufacturer: **NUTRON**
Figure #
T3-R10S30B

Notes: **R10 indicates a 1" reduced port valve.**
F15 indicates a 1 ½" full port valve
05 -- ½"
07 -- ¾"
10 -- 1"
15 -- 1 ½"
20 -- 2"

Deer Creek Phase II Valve Specifications

Ball Valves

Valve Tag:	BA-103SX (RP)	BA-113SX (FP)
	BA-303SX (RP)	BA-313SX (FP)
	BA-603SX (RP)	BA-613SX (FP)

Service Condition:	Max 121 C Sour Service (2.5 H ₂ S in gas) in produced Oil & Water
Pressure/Temperature Ratings:	3000# WOG C.S. Valves threaded or socket weld ends
Size:	1/2" – 2" NPS (Floating Ball Design)

Material Specification Chart:

Body/Cap:	ASME B16.34 – API-6D – API-6A – CSAZ245.15 ASTM A105 / ASTM A675 Gr. 70 (3 piece Threaded Design)
Bolting:	Not applicable
Ball:	316SS
Seat:	Delrin AF
Stem:	17-4 PH SS
Seat/Body O-ring:	Viton / Viton
Gland Flange:	Carbon Steel Plated with locking provision
Packing:	Filled TFE with stainless steel packing follower
Thrust Washer:	Delrin
Operator:	Lever (ductile iron)
Certification Required:	NACE MR 0175, 2002
Recommended Manufacturer:	NUTRON Figure # T3-R10S30S
Notes:	R10 indicates a 1" reduced port valve. F15 indicates a 1 1/2" full port valve 05 – 1/2" 07 – 3/4" 10 – 1" 15 – 1 1/2" 20 – 2"

Valve Tag:	BA-103SY (RP)	BA-113SY (FP)
	BA-303SY (RP)	BA-313SY (FP)
	BA-603SY (RP)	BA-613SY (FP)

Service Condition:	Max 200 C Sour Service (2.5 H₂S in gas) in produced Oil & Water
Pressure/Temperature Ratings:	3000# WOG C.S. Valves threaded or socket weld ends
Size:	1/2" – 2" NPS (Floating Ball Design)

Material Specification Chart:

Body/Cap:	ASME B16.34 – API-6D – API-6A – CSAZ245.15 ASTM A105 / ASTM A675 Gr. 70 (3 piece Threaded Design)
Bolting:	Not applicable
Ball:	316SS
Seat:	PEEK
Stem:	17-4 PH SS
Seat/Body O-ring:	Viton / Viton
Gland Flange:	Carbon Steel Plated with locking provision
Packing:	Filled TFE with stainless steel packing follower
Thrust Washer:	Delrin
Operator:	Lever (ductile iron)
Certification Required:	NACE MR 0175, 2002
Recommended Manufacturer:	NUTRON Figure # T3-R10S30HP
Notes:	R10 indicates a 1" reduced port valve. F15 indicates a 1 ½" full port valve 05 – ½" 07 – ¾" 10 – 1" 15 – 1 ½" 20 – 2"

Valve Tag:	BA-103SZ (RP)	BA-113SZ (FP)
	BA-303SZ (RP)	BA-313SZ (FP)
	BA-603SZ (RP)	BA-613SZ (FP)

Service Condition:	Max 316 C HIGH TEMPERATURE SERVICE Sour Service (2.5 H2S in gas) in produced Oil & Water
Pressure/Temperature Ratings:	2000# WOG C.S. Valves threaded or socket weld ends
Size:	1/2" – 1 1/2" NPS (Floating Ball Design)

Material Specification Chart:	
Body/Cap:	ASME B16.34 – API-6D – API-6A – CSAZ245.15 ASTM A105 / ASTM A675 Gr. 70 (3 piece Threaded Design)
Bolting:	Not applicable
Ball:	316SS
Seat:	PEEK
Stem:	17-4 PH SS
Body seal:	Graphite
Gland Flange:	Carbon Steel Plated with locking provision
Packing:	Graphite with stainless steel packing follower
Thrust Washer:	Delrin
Operator:	Lever (ductile iron)
Certification Required:	NACE MR 0175, 2002
Recommended Manufacturer:	NUTRON Figure # T3-R10S20HP
Notes:	R10 indicates a 1" reduced port valve. F15 indicates a 1 1/2" full port valve 05 – 1/2" 07 – 3/4" 10 – 1" 15 – 1 1/2"

Deer Creek Phase II Valve Specifications

Swing Check Valve

Rev: 0

Valve Tag: CH-101X (150#)
CH-301X (300#)
CH-601X (600#)

Service Condition: MAX 121 C SWEET SERVICE

Pressure/Temperature Ratings: 150#/300#/600# / ANSI RF FLGD.
MAXIMUM PRESSURE TEMPERATURE RATING:
(240 PSIG@150 ANSI)
(665 PSIG@300 ANSI)
(1340 PSIG@600 ANSI)

Size : 2"-16" NPS.

Material Specification Chart:

Body/Bonnet: ASME B16.10, B16.5, B16.34, API 600.

A216-WCB

Bolting: B7

Clapper: A217 GR CA15

Seat: A105 / HF

Cover gasket: GRAPHITE SPIRAL WOUND (150/300/600#)

Certification Required: API 598

Recommended Manufacturer: TY FIGURE # 153RF008 (150#)

253RF008 (300#)

353RF008 (600#)

NAVCO FIG# CS-R--R01W8

CS-R--R03W8

CS-R--R06W8

Notes

Deer Creek Phase II Valve Specifications

Swing Check Valve

Rev: 0

Valve Tag: CH-101SX (150#)
CH-301SX (300#)
CH-601SX (600#)

Service Condition: MAX 121 C SOUR SERVICE

Pressure/Temperature Ratings: 150#/300#/600# / ANSI RF FLGD.
MAXIMUM PRESSURE TEMPERATURE RATING:
(240 PSIG@150 ANSI)
(665 PSIG@300 ANSI)
(1340 psig@600 ANSI)

Size :2"-16" NPS.

Material Specification Chart:

Body/Bonnet: ASME B16.10, B16.5, B16.34, API 600.

A216-WCB

Bolting: B7M

Clapper: 316SS

Seat: 316SS/ HF

Cover gasket: GRAPHITE SPIRAL WOUND (150/300/600#)

Certification Required: API 598. Nace MR-01-75-2002

Recommended Manufacturer: TY FIGURE # 153RF0012 (150#)

253RF0012 (300#)

353RF0012 (600#)

NAVCO FIG# CS-R--R01W12

CS-R--R03W12

CS-R--R06W12

Notes:

Rev: 0

Valve Tag: CH-101Z (150#)

Service Condition: MAX 316 C SWEET SERVICE

Pressure/Temperature Ratings: 150# ANSI RF FLGD.
MAXIMUM PRESSURE TEMPERATURE RATING:
(140 PSIG @ 150 ANSI)

Size : 2"-16" NPS.

Material Specification Chart:

Body/Bonnet: ASME B16.10, B16.5, B16.34, API 600.

A216-WCB

Bolting: B7

Clapper: A216 WCB/HF or A217 GR CA15 / HF

Seat: A105 / HF

Cover gasket: GRAPHITE SPIRAL WOUND (150#)

Certification Required: API 598

Recommended Manufacturer: TY FIGURE #153RF005 (150#)

NAVCO FIG# CS-R—F01W5

Notes

Rev: 0

Valve Tag: CH-301Z (300#)

Service Condition: MAX 316 C SWEET SERVICE

Pressure/Temperature Ratings: 300# ANSI RF FLGD.
MAXIMUM PRESSURE TEMPERATURE RATING:
(550 PSIG @ 300 ANSI)

Size : 2"-16" NPS.

Material Specification Chart:

Body/Bonnet: ASME B16.10, B16.5, B16.34, API 600.
A216-WCB

Bolting: B7

Clapper: A216 WCB/HF or A217 GR CA15 / HF

Seat: A105 / HF

Cover gasket: GRAPHITE SPIRAL WOUND (300#)

Certification Required: API 598

Recommended Manufacturer: TY FIGURE #253RF005 (300#)

NAVCO FIG# CS-R—F03W5

Notes

Rev: 0

Valve Tag: CH-601Z (600#)

Service Condition: MAX 316 C SWEET SERVICE

Pressure/Temperature Ratings: 600# ANSI RF FLGD.
MAXIMUM PRESSURE TEMPERATURE RATING:
(1095 PSIG @ 600 ANSI)

Size : 2"-16" NPS.

Material Specification Chart:

Body/Bonnet: ASME B16.10, B16.5, B16.34, API 600.

A216-WCB

Bolting: B7

Clapper: A216 WCB/HF or A217 GR CA15 / HF

Seat: A105 / HF

Cover gasket: GRAPHITE SPIRAL WOUND (600#)

Certification Required: API 598

Recommended Manufacturer: TY FIGURE #353RF005 (600#)

NAVCO FIG# CS-R—F06W5

Notes

Rev: 0

Valve Tag: CH-623Z (800#)

Service Condition: MAX 316 C HIGH TEMPERATURE SERVICE

Pressure/Temperature Ratings: 800 Class.

MAXIMUM PRESSURE TEMPERATURE RATING:
1460 PSIG@ 316 C

Size : 1/4"-1 1/2"

Material Specification Chart:

Body/Bonnet: ASME B16.5, B16.10, B16.11, B16.34, API 602.
Threaded, Bolted Cap A105N.

Bolting: B7M

Piston: A182-F6a/HF

Seat: A182-F6a/ HF

Bonnet gasket: GRAPHITE SPIRAL WOUND (800#)

Operator:

Certification Required: API 598. Nace MR-01-75-2002

Recommended Manufacturer: NAVCO FIG# CP-R05S08A5

OR EQUAL.

Notes:

Rev: 0

Valve Tag: CH-624Z (800#)

Service Condition: MAX 316 C HIGH TEMPERATURE SERVICE

Pressure/Temperature Ratings: 800 Class.

**MAXIMUM PRESSURE TEMPERATURE RATING:
1460 PSIG@ 316 C**

Size : 1/4"-1 1/2"

Material Specification Chart:

**Body/Bonnet: ASME B16.5, B16.10, B16.11, B16.34, API 602.
Socket Weld, Bolted Cap A105N.**

Bolting: B7M

Piston: A182-F6a/HF

Seat: A182-F6a/ HF

Bonnet gasket: GRAPHITE SPIRAL WOUND (800#)

Operator:

Certification Required: API 598. Nace MR-01-75-2002

Recommended Manufacturer: NAVCO FIG# CP-R05W08A5

OR EQUAL.

Notes:

Deer Creek Phase II Valve Specifications

Forged Steel Piston Check Valve

Rev: 0

Valve Tag: CH-629Z (800#)

Service Condition: MAX 316 C HIGH TEMPERATURE SERVICE

Pressure/Temperature Ratings: 800 Class.

**MAXIMUM PRESSURE TEMPERATURE RATING:
1460 PSIG@ 316 C**

Size : 1/4"-1 1/2"

Material Specification Chart:

**Body/Bonnet: ASME B16.5, B16.10, B16.11, B16.34, API 602.
Socket Weld x Threaded, Bolted Cap A105N.**

Bolting: B7M

Piston: A182-F6a/HF

Seat: A182-F6a/ HF

Bonnet gasket: GRAPHITE SPIRAL WOUND (800#)

Operator:

Certification Required: API 598. Nace MR-01-75-2002

Recommended Manufacturer: NAVCO FIG# CP-R05SW08A5

OR EQUAL.

Notes:

Rev: 0

Valve Tag: GL-101X (150#)
GL-301X (300#)
GL-601X (600#)

Service Condition: MAX 121 C SWEET SERVICE

Pressure/Temperature Ratings: 150#/300#/600# / ANSI RF FLGD.
MAXIMUM PRESSURE TEMPERATURE RATING:
(240 PSIG@150 ANSI)
(665 PSIG@300 ANSI)
(1340 PSIG@600 ANSI)

Size : 2"-12" NPS.

Material Specification Chart:

Body/Bonnet: ASME B16.10, B16.5, B16.34, API 600.

A216-WCB

Bolting: B7

Disc: A217 GR CA15

Seat: A105 / HF

Stem: A182 GR F6A

Stem packing: GRAPHITE

Bonnet gasket: GRAPHITE SPIRAL WOUND (150/300/600#)

Operator: HANDWHEEL OP

Certification Required: API 598

Recommended Manufacturer: TY FIGURE # 152RF008 (150#)

252RF008 (300#)

352RF008 (600#)

NAVCO FIG# GL-R--R01W8

GL-R--R03W8

GL-R--R06W8

Notes Gear operator on valves 10"-150# and larger
8"-300# and larger
6"-600# and larger

Rev: 0

Valve Tag: GL-101SX (150#)
GL-301SX (300#)
GL-601SX (600#)

Service Condition: MAX 121 C SOUR SERVICE

Pressure/Temperature Ratings: 150#/300#/600# / ANSI RF FLGD.
MAXIMUM PRESSURE TEMPERATURE RATING:
(240 PSIG@150 ANSI)
(665 PSIG@300 ANSI)
Size :2"-16" NPS. (1340 psig@600 ANSI)

Material Specification Chart:

Body/Bonnet: ASME B16.10, B16.5, B16.34, API 600.
A216-WCB
Bolting: B7M
Disc: 316 SS
Seat: 316SS/ HF
Stem: A182 F316
Stem packing: GRAPHITE
Bonnet gasket: GRAPHITE SPIRAL WOUND (150/300/600#)

Operator: HANDWHEEL OP

Certification Required: API 598. Nace MR-01-75-2002
Recommended Manufacturer: TY FIGURE # 152RF0012 (150#)
252RF0012 (300#)
352RF0012 (600#)

NAVCO FIG# GL-R--R01W12
GL-R--R03W12
GL-R--R06W12

Notes: Gear operator on valves 10"-150# and larger
8"-300# and larger
6"-600# and larger

Rev: 0

Valve Tag: GL-601Y (600#)

Service Condition: MAX 200 C SWEET SERVICE

Pressure/Temperature Ratings: 600# / ANSI RF FLGD.
MAXIMUM PRESSURE TEMPERATURE RATING:
(1270 PSIG @ 600 ANSI)

Size : 2"-6" NPS.

Material Specification Chart:

Body/Bonnet: ASME B16.10, B16.5, B16.34, API 600.
A216-WCB
Bolting: B7
Disc: A217 GR CA15 / HF
Seat: A105 / HF
Stem: A182 GR F6A
Stem packing: GRAPHITE
Bonnet gasket: GRAPHITE SPIRAL WOUND (600#)

Operator: HANDWHEEL OP

Certification Required: API 598

Recommended Manufacturer: TY FIGURE #352RF005 (600#)

NAVCO FIG# GL-R—R06W5

Notes Gear operator on valves 6"-600# and larger.

Rev: 0

Valve Tag: GL-101Z (150#)

Service Condition: MAX 316 C SWEET SERVICE

Pressure/Temperature Ratings: 150# ANSI RF FLGD.
MAXIMUM PRESSURE TEMPERATURE RATING:
(140 PSIG @ 150 ANSI)

Size : 2"-6" NPS.

Material Specification Chart:

Body/Bonnet: ASME B16.10, B16.5, B16.34, API 600.
A216-WCB
Bolting: B7
Disc: A217 GR CA15 / HF
Seat: A105 / HF
Stem: A182 GR F6A
Stem packing: GRAPHITE
Bonnet gasket: GRAPHITE SPIRAL WOUND (150#)

Operator: HANDWHEEL OP

Certification Required: API 598

Recommended Manufacturer: TY FIGURE #152RF005 (150#)

NAVCO FIG# GL-R—R01W5

Notes

Rev: 0

Valve Tag: GL-301Z (300#)

Service Condition: MAX 316 C SWEET SERVICE

Pressure/Temperature Ratings: 300# ANSI RF FLGD.
MAXIMUM PRESSURE TEMPERATURE RATING:
(550 PSIG @ 300 ANSI)

Size : 2"-6" NPS.

Material Specification Chart:

Body/Bonnet: ASME B16.10, B16.5, B16.34, API 600.
A216-WCB

Bolting: B7

Disc: A217 GR CA15 / HF

Seat: A105 / HF

Stem: A182 GR F6A

Stem packing: GRAPHITE

Bonnet gasket: GRAPHITE SPIRAL WOUND (300#)

Operator: HANDWHEEL OP

Certification Required: API 598

Recommended Manufacturer: TY FIGURE #252RF005 (300#)

NAVCO FIG# GL-R—R03W5

Notes

Rev: 0

Valve Tag: GL-601Z (600#)

Service Condition: MAX 316 C SWEET SERVICE

Pressure/Temperature Ratings: 600# ANSI RF FLGD.
MAXIMUM PRESSURE TEMPERATURE RATING:
(1095 PSIG @ 600 ANSI)

Size : 2"-6" NPS.

Material Specification Chart:

Body/Bonnet: ASME B16.10, B16.5, B16.34, API 600.

A216-WCB

Bolting: B7

Disc: A217 GR CA15 / HF

Seat: A105 / HF

Stem: A182 GR F6A

Stem packing: GRAPHITE

Bonnet gasket: GRAPHITE SPIRAL WOUND (600#)

Operator: HANDWHEEL OP

Certification Required: API 598

Recommended Manufacturer: TY FIGURE #352RF005 (600#)

NAVCO FIG# GL-R—R06W5

Notes Gear operator on valves 6"-600# and larger.

Rev: 0

Valve Tag: GL-603SX (800#)

Service Condition: MAX 121 C SOUR SERVICE

Pressure/Temperature Ratings: 800 Class.

**MAXIMUM PRESSURE TEMPERATURE RATING:
1775 PSIG@ 121 C**

Size : 1/4"-1 1/2"

Material Specification Chart:

**Body/Bonnet: ASME B16.5, B16.10, B16.11, B16.34, API 602.
Threaded, OS&Y, B.B., A105N.**

Bolting: B7M

Piston: 316SS

Seat: 316SS/ HF

Bonnet gasket: GRAPHITE SPIRAL WOUND (800#)

Operator:

Certification Required: API 598. Nace MR-01-75-2002

Recommended Manufacturer: NAVCO FIG# GL-R05S08A12

OR EQUAL.

Notes:

Deer Creek Phase II Valve Specifications

Forged Steel Globe Valve

Rev: 0

Valve Tag: GL-604SX (800#)

Service Condition: MAX 121 C SOUR SERVICE

Pressure/Temperature Ratings: 800 Class.

MAXIMUM PRESSURE TEMPERATURE RATING:
1775 PSIG@ 121 C

Size : 1/4"-1 1/2"

Material Specification Chart:

Body/Bonnet: ASME B16.5, B16.10, B16.11, B16.34, API 602.
Socket weld, OS&Y, B.B., A105N.

Bolting: B7M

Piston: 316SS

Seat: 316SS/ HF

Bonnet gasket: GRAPHITE SPIRAL WOUND (800#)

Operator:

Certification Required: API 598. Nace MR-01-75-2002

Recommended Manufacturer: NAVCO FIG# GL-R05W08A12

OR EQUAL.

Notes:

Rev: 0

Valve Tag: GL-603Z (800#)

Service Condition: MAX 316 C HIGH TEMPERATURE SERVICE

Pressure/Temperature Ratings: 800 Class.

MAXIMUM PRESSURE TEMPERATURE RATING:
1460 PSIG@ 316 C

Size : 1/4"-1 1/2"

Material Specification Chart:

Body/Bonnet: ASME B16.5, B16.10, B16.11, B16.34, API 602.
Threaded, OS&Y, B.B., A105N.

Bolting: B7M

Piston: A182-F6a/HF

Seat: A182-F6a/ HF

Bonnet gasket: GRAPHITE SPIRAL WOUND (800#)

Operator:

Certification Required: API 598. Nace MR-01-75-2002

Recommended Manufacturer: NAVCO FIG# GL-R05S08A5

OR EQUAL.

Notes:

Rev: 0

Valve Tag: GL-604Z (800#)

Service Condition: MAX 316 C HIGH TEMPERATURE SERVICE

Pressure/Temperature Ratings: 800 Class.

**MAXIMUM PRESSURE TEMPERATURE RATING:
1460 PSIG@ 316 C**

Size : 1/4"-1 1/2"

Material Specification Chart:

**Body/Bonnet: ASME B16.5, B16.10, B16.11, B16.34, API 602.
Socket Weld, OS&Y, B.B., A105N.**

Bolting: B7M

Piston: A182-F6a/HF

Seat: A182-F6a/ HF

Bonnet gasket: GRAPHITE SPIRAL WOUND (800#)

Operator:

Certification Required: API 598. Nace MR-01-75-2002

Recommended Manufacturer: NAVCO FIG# GL-R05W08A5

OR EQUAL.

Notes:

Deer Creek Phase II Valve Specifications

Forged Steel Globe Valve

Rev: 0

Valve Tag: GL-609Z (800#)

Service Condition: MAX 316 C HIGH TEMPERATURE SERVICE

Pressure/Temperature Ratings: 800 Class.

MAXIMUM PRESSURE TEMPERATURE RATING:
1460 PSIG@ 316 C

Size : 1/4"-1 1/2"

Material Specification Chart:

Body/Bonnet: ASME B16.5, B16.10, B16.11, B16.34, API 602.
Threaded x Socket weld, OS&Y, B.B., A105N.

Bolting: B7M

Piston: A182-F6a/HF

Seat: A182-F6a/ HF

Bonnet gasket: GRAPHITE SPIRAL WOUND (800#)

Operator:

Certification Required: API 598. Nace MR-01-75-2002

Recommended Manufacturer: NAVCO FIG# GL-R05SW08A5

OR EQUAL.

Notes:

Rev: 0	Valve Tag: GA-111X (150#) GA-311X (300#) GA-611X (600#)
--------	---

Service Condition: MAX 121 C SWEET SERVICE

Pressure/Temperature Ratings: 150#/300#/600# / ANSI RF FLGD.
MAXIMUM PRESSURE TEMPERATURE RATING:
(240 PSIG@150 ANSI)
(665 PSIG@300 ANSI)
(1340 psig@600 ANSI)

Size :2"-16" NPS.

Material Specification Chart:

Body/Bonnet: ASME B16.10, B16.5, B16.34, API 600.
A216-WCB

Bolting: B7

Wedge: A217 GR CA15

Seat: A105/ HF

Stem: A182 GR F6A

Stem packing: GRAPHITE

Bonnet gasket: GRAPHITE SPIRAL WOUND (300/600#)
GRAPHONIC (150 #)

Operator: HANDWHEEL OP

Certification Required: API 598

Recommended Manufacturer: TY FIGURE # 151RF008 (150#)
251RF008 (300#)
351RF008 (600#)

NAVCO FIG# GA-R--R01W8
GA-R--R03W8
GA-R--R06W8

Notes: Gear operator on valves 16"-150# and larger
12"-300# and larger
10"-600# and larger

Rev: 0	Valve Tag: GA-111SX (150#) GA-311SX (300#) GA-611SX (600#)
--------	--

Service Condition: MAX 121 C SOUR SERVICE

Pressure/Temperature Ratings: 150#/300#/600# / ANSI RF FLGD.
MAXIMUM PRESSURE TEMPERATURE RATING:
(240 PSIG@150 ANSI)
(665 PSIG@300 ANSI)
(1340 psig@600 ANSI)

Size :2"-16" NPS.

Material Specification Chart:

Body/Bonnet: ASME B16.10, B16.5, B16.34, API 600.
A216-WCB

Bolting: B7M

Wedge: 316SS

Seat: 316SS/ HF

Stem: A182 F316

Stem packing: GRAPHITE

Bonnet gasket: GRAPHITE SPIRAL WOUND (300/600#)
GRAPHONIC (150 #)

Operator: HANDWHEEL OP

Certification Required: API 598. Nace MR-01-75-2002

Recommended Manufacturer: TY FIGURE # 151RF0012 (150#)
251RF0012 (300#)
351RF0012 (600#)

NAVCO FIG# GA-R--R01W12
GA-R--R03W12
GA-R--R06W12

Notes: Gear operator on valves 16"-150# and larger
12"-300# and larger
10"-600# and larger

Rev: 0

Valve Tag: GA-611Y (600#)

Service Condition: MAX 200 C SWEET SERVICE

Pressure/Temperature Ratings: 600# / ANSI RF FLGD.
MAXIMUM PRESSURE TEMPERATURE RATING:
(1270 PSIG @ 600 ANSI)

Size : 2"-16" NPS.

Material Specification Chart:

Body/Bonnet: ASME B16.10, B16.5, B16.34, API 600.

A216-WCB

Bolting: B7

Wedge: A217 GR CA15 / HF

Seat: A105 / HF

Stem: A182 GR F6A

Stem packing: GRAPHITE

Bonnet gasket: GRAPHITE SPIRAL WOUND (600#)

Operator: HANDWHEEL OP

Certification Required: API 598

Recommended Manufacturer: TY FIGURE #351RF005 (600#)

NAVCO FIG# GA-R—R06W5

Notes Gear operator on valves 10"-600# and larger.

Rev: 0

Valve Tag: GA-111Z (150#)

Service Condition: MAX 316 C SWEET SERVICE

Pressure/Temperature Ratings: 150# ANSI RF
MAXIMUM PRESSURE TEMPERATURE RATING:
(140 PSIG @ 150 ANSI)

Size : 2"-12" NPS.

Material Specification Chart:

Body/Bonnet: ASME B16.10, B16.5, B16.34, API 600.
A216-WCB
Bolting: B7
Wedge: A217 GR CA15 / HF
Seat: A105 / HF
Stem: A182 GR F6A
Stem packing: GRAPHITE
Bonnet gasket: GRAPHITE SPIRAL WOUND (150#)

Operator: HANDWHEEL OP

Certification Required: API 598

Recommended Manufacturer: TY FIGURE #151RF005 (150#)

NAVCO FIG# GA-R—R01W5

Notes

Rev: 0

Valve Tag: GA-115Z (150#)

Service Condition: MAX 316 C SWEET SERVICE

Pressure/Temperature Ratings: 150# ANSI B/W.

**MAXIMUM PRESSURE TEMPERATURE RATING:
(140 PSIG @ 150 ANSI)**

Size : 2"-12" NPS.

Material Specification Chart:

Body/Bonnet: ASME B16.10, B16.5, B16.34, API 600.

A216-WCB

Bolting: B7

Wedge: A217 GR CA15 / HF

Seat: A105 / HF

Stem: A182 GR F6A

Stem packing: GRAPHITE

Bonnet gasket: GRAPHITE SPIRAL WOUND (150#)

Operator: HANDWHEEL OP

Certification Required: API 598

Recommended Manufacturer: TY FIGURE #151BW005 (150#)

NAVCO FIG# GA-R—B01W5

Notes

Rev: 0

Valve Tag: GA-311Z (300#)

Service Condition: MAX 316 C SWEET SERVICE

Pressure/Temperature Ratings: 300# ANSI RF
MAXIMUM PRESSURE TEMPERATURE RATING:
(550 PSIG @ 300 ANSI)

Size : 2"-12" NPS.

Material Specification Chart:

Body/Bonnet: ASME B16.10, B16.5, B16.34, API 600.
A216-WCB
Bolting: B7
Wedge: A217 GR CA15 / HF
Seat: A105 / HF
Stem: A182 GR F6A
Stem packing: GRAPHITE
Bonnet gasket: GRAPHITE SPIRAL WOUND (300#)

Operator: HANDWHEEL OP

Certification Required: API 598

Recommended Manufacturer: TY FIGURE #251RF005 (300#)

NAVCO FIG# GA-R—R03W5

Notes

Rev: 0

Valve Tag: GA-315Z (300#)

Service Condition: MAX 316 C SWEET SERVICE

Pressure/Temperature Ratings: 300# ANSI B/W.

**MAXIMUM PRESSURE TEMPERATURE RATING:
(550 PSIG @ 300 ANSI)**

Size : 2"-12" NPS.

Material Specification Chart:

Body/Bonnet: ASME B16.10, B16.5, B16.34, API 600.

A216-WCB

Bolting: B7

Wedge: A217 GR CA15 / HF

Seat: A105 / HF

Stem: A182 GR F6A

Stem packing: GRAPHITE

Bonnet gasket: GRAPHITE SPIRAL WOUND (300#)

Operator: HANDWHEEL OP

Certification Required: API 598

Recommended Manufacturer: TY FIGURE #251BW005 (300#)

NAVCO FIG# GA-R—B03W5

Notes

Rev: 0

Valve Tag: GA-611Z (600#)

Service Condition: MAX 316 C SWEET SERVICE

Pressure/Temperature Ratings: 600# ANSI RF
MAXIMUM PRESSURE TEMPERATURE RATING:
(1095 PSIG @ 600 ANSI)

Size : 2"-12" NPS.

Material Specification Chart:

Body/Bonnet: ASME B16.10, B16.5, B16.34, API 600.
A216-WCB
Bolting: B7
Wedge: A217 GR CA15 / HF
Seat: A105 / HF
Stem: A182 GR F6A
Stem packing: GRAPHITE
Bonnet gasket: GRAPHITE SPIRAL WOUND (600#)

Operator: HANDWHEEL OP

Certification Required: API 598

Recommended Manufacturer: TY FIGURE #351RF005 (600#)

NAVCO FIG# GA-R—R06W5

Notes Gear operator on valves 6"-600# and larger.

Rev: 0

Valve Tag: GA-615Z (600#)

Service Condition: MAX 316 C SWEET SERVICE

Pressure/Temperature Ratings: 600# ANSI B/W.

MAXIMUM PRESSURE TEMPERATURE RATING:
(1095 PSIG @ 600 ANSI)

Size : 2"-12" NPS.

Material Specification Chart:

Body/Bonnet: ASME B16.10, B16.5, B16.34, API 600.

A216-WCB

Bolting: B7

Wedge: A217 GR CA15 / HF

Seat: A105 / HF

Stem: A182 GR F6A

Stem packing: GRAPHITE

Bonnet gasket: GRAPHITE SPIRAL WOUND (600#)

Operator: HANDWHEEL OP

Certification Required: API 598

Recommended Manufacturer: TY FIGURE #351BW005 (600#)

NAVCO FIG# GA-R—B06W5

Notes Gear operator on valves 6"-600# and larger.

Deer Creek Phase II Valve Specifications

Forged Steel Gate Valve

Rev: 0

Valve Tag: GA-603SX (800#)

Service Condition: MAX 121 C SOUR SERVICE

Pressure/Temperature Ratings: 800 Class.

MAXIMUM PRESSURE TEMPERATURE RATING:

1775 PSIG@ 121 C

Size : 1/4"-1 1/2"

Material Specification Chart:

Body/Bonnet: ASME B16.5, B16.10, B16.11, B16.34, API 602.
Screwed, OS&Y B.B. A105N.

Bolting: B7M

Wedge: 316SS

Seat: 316SS/ HF

Stem: A182 F316

Stem packing: GRAPHITE

Bonnet gasket: GRAPHITE SPIRAL WOUND (800#)

Operator: HANDWHEEL OP

Certification Required: API 598. Nace MR-01-75-2002

Recommended Manufacturer: NAVCO FIG# GA-R05S08A12

OR EQUAL.

Notes:

Rev: 0

Valve Tag: GA-604SX (800#)

Service Condition: MAX 121 C SOUR SERVICE

Pressure/Temperature Ratings: 800 Class.

**MAXIMUM PRESSURE TEMPERATURE RATING:
1775 PSIG@ 121 C**

Size : 1/4"-1 1/2"

Material Specification Chart:

**Body/Bonnet: ASME B16.5, B16.10, B16.11, B16.34, API 602.
Socket weld, OS&Y B.B. A105N.**

Bolting: B7M

Wedge: 316SS

Seat: 316SS/ HF

Stem: A182 F316

Stem packing: GRAPHITE

Bonnet gasket: GRAPHITE SPIRAL WOUND (800#)

Operator: HANDWHEEL OP

Certification Required: API 598. Nace MR-01-75-2002

Recommended Manufacturer: NAVCO FIG# GA-R05W08A12

OR EQUAL.

Notes:

Deer Creek Phase II Valve Specifications

Forged Steel Gate Valve

/Rev: 0

Valve Tag:GA-603Z (800#)

Service Condition: MAX 316 C HIGH TEMPERATURE SERVICE

Pressure/Temperature Ratings: 800 Class.

**MAXIMUM PRESSURE TEMPERATURE RATING:
1460 PSIG@ 316 C**

Size : 1/4"-1 1/2"

Material Specification Chart:

**Body/Bonnet: ASME B16.5, B16.10, B16.11, B16.34, API 602.
Threaded, OS&Y B.B. A105N.**

Bolting: B7M

Wedge: A182-F6a/HF

Seat: A182-F6a/ HF

Stem: A182-F6a

Stem packing: GRAPHITE

Bonnet gasket: GRAPHITE SPIRAL WOUND (800#)

Operator: HANDWHEEL OP

Certification Required: API 598. Nace MR-01-75-2002

Recommended Manufacturer: NAVCO FIG# GA-R05S08A5

OR EQUAL.

Notes:

Rev: 0

Valve Tag: GA-604Z (800#)

Service Condition: MAX 316 C HIGH TEMPERATURE SERVICE

Pressure/Temperature Ratings: 800 Class.

**MAXIMUM PRESSURE TEMPERATURE RATING:
1460 PSIG@ 316 C**

Size : 1/4"-1 1/2"

Material Specification Chart:

**Body/Bonnet: ASME B16.5, B16.10, B16.11, B16.34, API 602.
Socket Weld, OS&Y B.B. A105N.**

Bolting: B7M

Wedge: A182-F6a/HF

Seat: A182-F6a/ HF

Stem: A182-F6a

Stem packing: GRAPHITE

Bonnet gasket: GRAPHITE SPIRAL WOUND (800#)

Operator: HANDWHEEL OP

Certification Required: API 598. Nace MR-01-75-2002

Recommended Manufacturer: NAVCO FIG# GA-R05W08A5

OR EQUAL.

Notes:

Deer Creek Phase II Valve Specifications

Forged Steel Gate Valve

Rev: 0

Valve Tag: GA-609Z (800#)

Service Condition: MAX 316 C HIGH TEMPERATURE SERVICE

Pressure/Temperature Ratings: 800 Class.

**MAXIMUM PRESSURE TEMPERATURE RATING:
1460 PSIG@ 316 C**

Size : 1/4"-1 1/2"

Material Specification Chart:

**Body/Bonnet: ASME B16.5, B16.10, B16.11, B16.34, API 602.
Socket Weld x Threaded, OS&Y B.B. A105N.**

Bolting: B7M

Wedge: A182-F6a/HF

Seat: A182-F6a/ HF

Stem: A182-F6a

Stem packing: GRAPHITE

Bonnet gasket: GRAPHITE SPIRAL WOUND (800#)

Operator: HANDWHEEL OP

Certification Required: API 598. Nace MR-01-75-2002

Recommended Manufacturer: NAVCO FIG# GA-R05SW08A5

OR EQUAL.

Notes:

Valve Tag: NE

Service Condition: Max 200 C
Sour Service (2.5 H2S in gas) in produced Oil & Water

Pressure/Temperature Ratings: 10,000# W.P. threaded end S.S.

Size: 1/4" - 3/4" NPS

Material Specification Chart:

Body/Bonnet: ASTM A182 F 316SS

Stem: ASM-5A-479 Type 316SS (Non-rotating)

Gland Packing: PTFE

Seat: Hard seated

Certification Required: NACE MR 0175, 2002

Recommended Manufacturer: Western Gauge
Figure #
WN13 ##

Notes: ## is replaced by;
33 - 1/4" M*F
34 - 1/2" M*F
37 - 3/4" * 1/2" M*F
56 - 1/2" F*F



Bower Damberger Rolseth
Engineering Ltd.

DEER CREEK ENERGY LIMITED

Joslyn Phase 2, SAGD Facility
AFE # 002-0003-0002-0005-S1
Design Basis Memorandum
Rev. 3



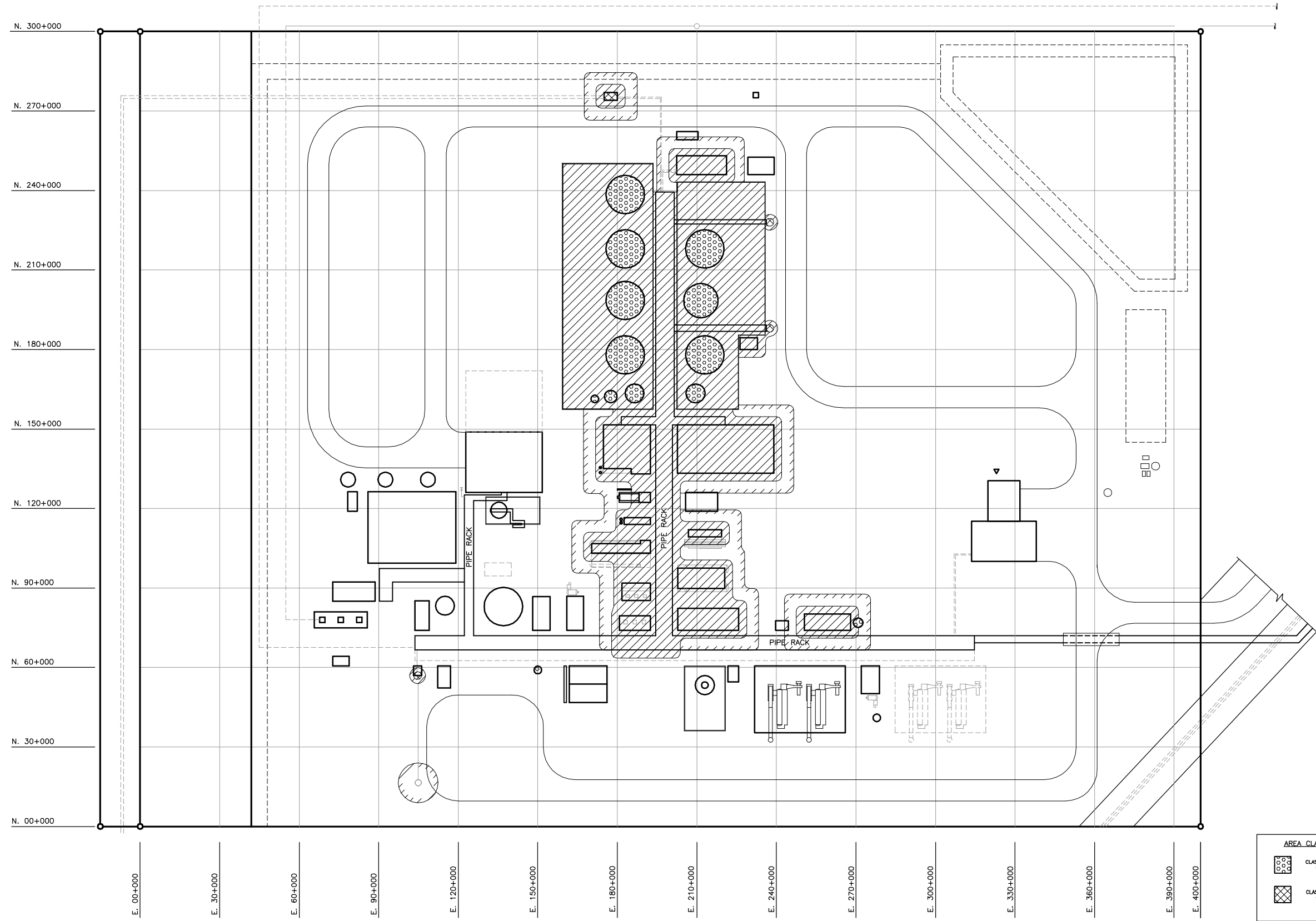
DEER CREEK
Energy Limited

BDR Project: 33500
Date: March 18, 2005

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APPENDIX XV

AREA CLASSIFICATION PLAN



AREA CLASSIFICATION/PERMIT ENTENT LEGEND			
	CLASS I, ZONE 0 GROUP D		CLASS I, ZONE 2 GROUP D
	CLASS I, ZONE 1 GROUP D		CLASS I, ZONE 2 GROUP D (WHEN HEAVIER THAN AIR VAPOUR IS PRESENT)

NO.	REVISION	PROJECT	DSN	DRN	CHK'D	APP'D	DATE
8	RE-ISSUED FOR FIELD CONSTRUCTION	33500	RLB	PC	WJC		05.09.28
7	GENERAL REVISIONS	33500	RLB	PC			05.07.26
6	GENERAL REVISIONS	33500	RLB	PC			05.06.28
5	UPDATE REVISION	33500	RLB	PC			05.01.24
4	UPDATE ISSUE	33500	RLB	PC			04.12.20
3	UPDATE ISSUE	33500	RLB	PC			04.12.01
2	UPDATE ISSUE	33500	WJC	PC			04.10.20
1	ISSUED FOR DBM INFORMATION	33500	WJC	PC			04.09.13
0	ISSUED FOR DBM	33500	WJC	PC			04.04.01

PERMIT STAMP:

GENERAL NOTES:

1. THIS CONSTRUCTION DRAWING WAS GENERATED FROM CONSTRUCTION CHANGE INFORMATION FORWARDED TO BOWER DAMBERGER ROISETH ENGINEERING LTD. BY THE OWNER'S FIELD SUPERVISORS AND/OR HIS/HER CONTRACTORS. ANY CHANGES NOT DOCUMENTED WILL NOT APPEAR ON THE DRAWINGS AND THEREFORE THE DRAWING MAY NOT BE AN ACCURATE REPRESENTATION OF THE CONSTRUCTED FACILITY.

2. PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION AND/OR EXCAVATION IT SHALL BE THE RESPONSIBILITY OF THE OWNER REPRESENTATIVE TO VERIFY THE LOCATION AND STATUS OF ANY PIPING, ELECTRICAL EQUIPMENT OR BALANCE.

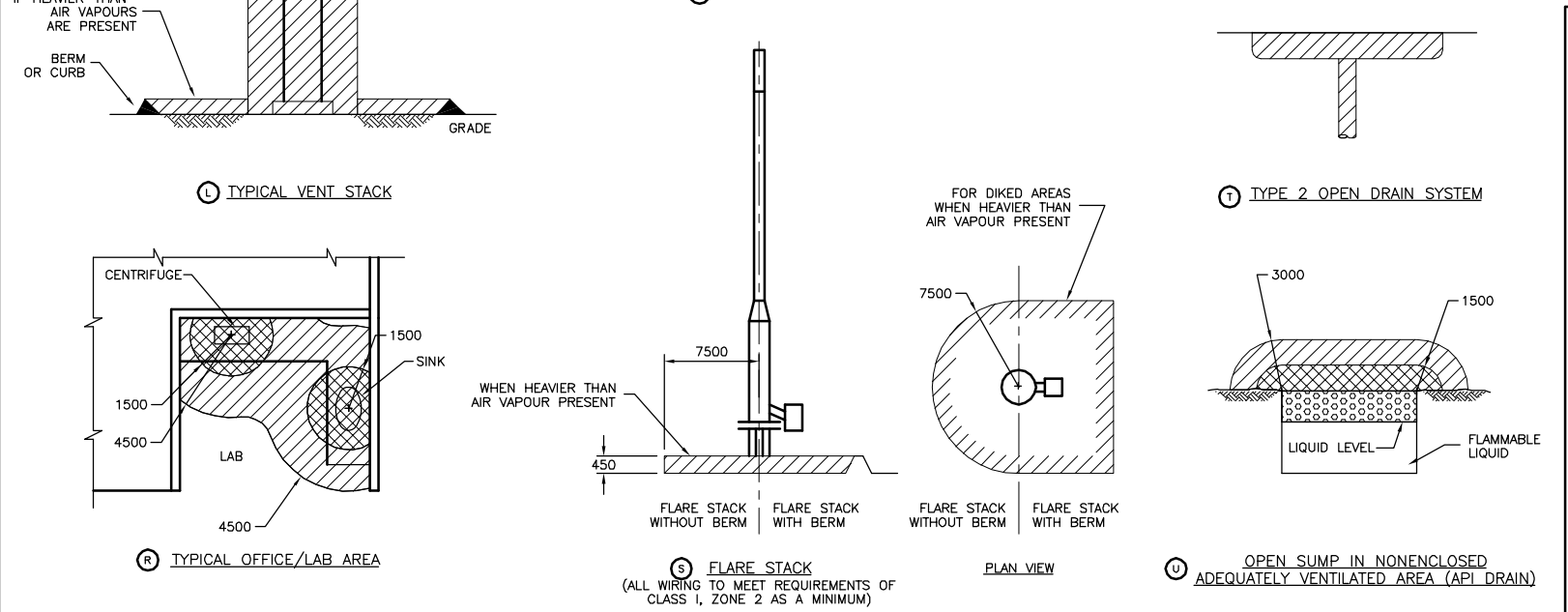
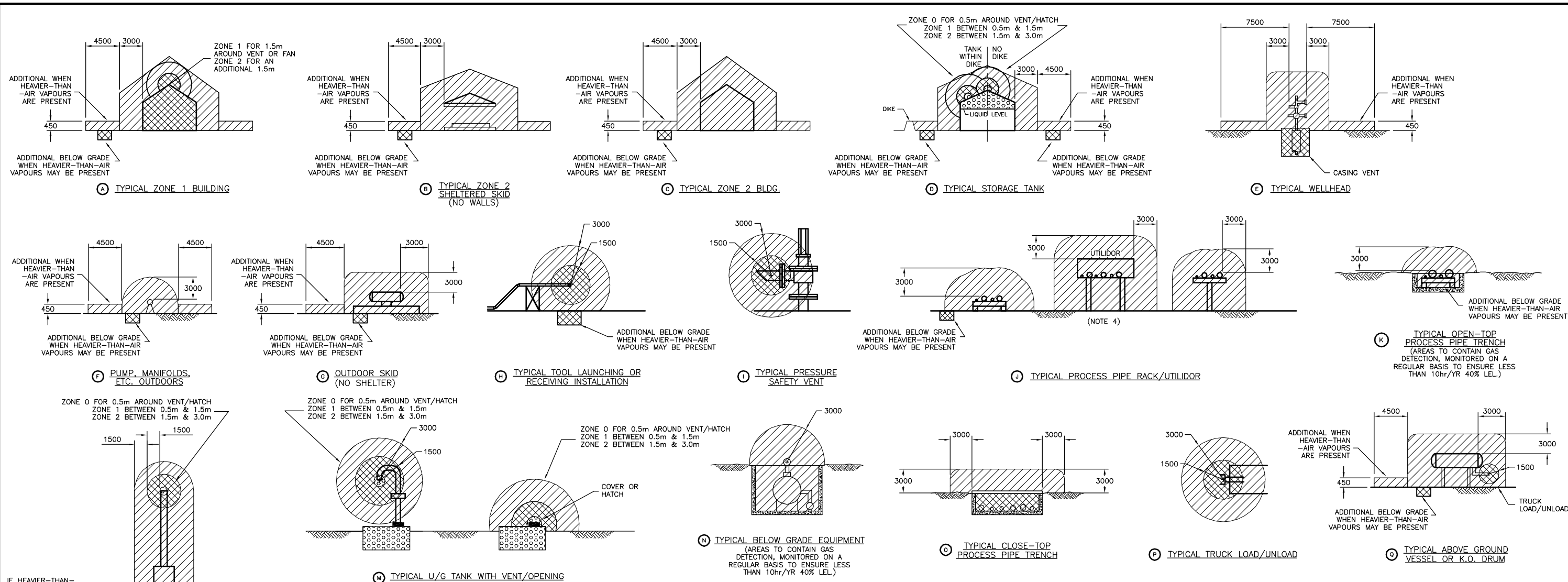
3. ANY REVISIONS MADE TO EXISTING EQUIPMENT, PIPING OR ELECTRICAL ON A FACILITY NOT DESIGNED BY B.D.R. ENG. LTD. IS ONLY SHOWN AS A REPRESENTATION OF WHAT EXISTS AND MUST BE VERIFIED BY THE OWNER.

	BY	DATE
DESIGN	WJC	04.09.13
DRAWN	PC	04.09.13
CHK'D		
APP'D		
L.S.D.		

DEER CREEK Energy Limited

JOSLYN PHASE #2 SAGD FACILITY
ELECTRICAL
AREA CLASSIFICATION

SCALE	DRAWING NUMBER	REV
1 : 750	D-33500-E-01-100	8



NOTES - GENERAL

- ALL AREA CLASSIFICATIONS DETERMINED USING
 - CEC 2002 EDITION C22.1
 - AB LEGISLATION #AR 151-71,
 - EUB GUIDE 56
 - NFPA 497
 - API 505
 - STANDATA : LATEST ISSUE
 - ALBERTA SAFETY CODES FOR ELECTRICAL INSTALLATIONS AT OIL & GAS FACILITIES 2ND EDITION 2002.
 - ENGINEERING REVIEWED GAS/FLUID ANALYSIS
- TYPICAL DETAILS SHOWN ASSUME EQUIPMENT/AREAS HANDLE OIL AND/OR GAS OR THEIR RELATED PROCESSES.
- REFER TO SITE SPECIFIC NOTES (BELOW) FOR DETAILS ON AREA/CABLE SEALING.
- UTILIDORS ARE ASSUMED TO HAVE SUFFICIENT LEAKAGE AND NATURAL VENTILATION TO BE ADEQUATELY VENTILATED.

AREA CLASSIFICATION LEGEND

	CLASS I, ZONE 0 GROUP D		CLASS I, ZONE 2 GROUP D
	CLASS I, ZONE 1 GROUP D		CLASS I, ZONE 2 GROUP D 450mm ABOVE GRADE (WHEN HEAVIER THAN AIR VAPOUR IS PRESENT)
	MINIMUM EXTENT OF VEHICLE ENTRY, PERMIT REQUIRED		

NOTES - SITE SPECIFIC

- NO FUGITIVE EMISSIONS CALCULATIONS WERE PERFORMED FOR THIS SITE.
- SKIDS ARE ENCLOSED, GAS PROCESS WITH NO DIKES. USE DETAIL A & C ABOVE.
- W.P. STYLE TECK CONNECTORS ONLY REQUIRED AS PER STANDATA CEC-18 (REV 2) RULE 18-150.
- ALL PROCESS END DEVICES NOT MARKED AS 'FACTORY SEALED' REQUIRE DEVICE SEALS.

SITE PROCESS DETAIL:

- MEDIUM : OIL ENTRAINED WITH WATER & GAS.
- GAS/VAPOUR DETAIL : LIGHT/SOUR

NO.	REVISION	PROJECT	DSN	DRN	CHK'D	APP'D	DATE
2	UPDATE ISSUE	33500	WJS	PC	WJS		04.12.06
1	ISSUED FOR DBM INFORMATION	33500	WJC	PC	WJC		04.09.13
0	ISSUED FOR DBM	33500	WJC	PC	WJC		04.04.01

PERMIT STAMP:

GENERAL NOTES:

1. MOST CONSTRUCTION DRAWINGS ARE GENERATED FROM CONSTRUCTION CHANGE INFORMATION FORWARDED TO SOUTH CREEK ENERGY SERVICES LTD. BY THE OWNER'S FIELD SUPERVISORS AND/OR OTHER CONTRACTORS. ANY CHANGES NOT DOCUMENTED WILL NOT APPEAR ON THE DRAWINGS AND THEREFORE THE DRAWING MAY NOT BE AN ACCURATE REPRESENTATION OF THE CONSTRUCTED FACILITY.
2. PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION AND/OR OPERATION IT SHALL BE THE RESPONSIBILITY OF THE OWNER REPRESENTATIVE TO VERIFY THE LOCATION AND STATUS OF ANY PIPING, ELECTRICAL EQUIPMENT OR BUILDINGS.
3. ANY REVISIONS MADE TO EXISTING EQUIPMENT, PIPING OR ELECTRICAL ON A FACILITY NOT OWNED BY B.D.R. ENG. LTD. IS ONLY SHOWN AS A REPRESENTATION OF WHAT EXISTS AND MUST BE VERIFIED BY THE OWNER.

DESIGN	BY	DATE
DRAWN	PC	04.02.25
CHK'D		
APP'D		
L.S.D.	14-28-95-12 W4M	

bdr
 Bower Damberger Rolseth
 Engineering Ltd.

DEER CREEK Energy Limited
 JOSLYN PHASE #2 SAGD FACILITY
 AREA CLASSIFICATION
 DETAILS

SCALE	DRAWING NUMBER	REV
N/A	D-33500-E-01-101	2



Bower Damberger Rolseth
Engineering Ltd.

DEER CREEK ENERGY LIMITED

Joslyn Phase 2, SAGD Facility
AFE # 002-0003-0002-0005-S1
Design Basis Memorandum
Rev. 3



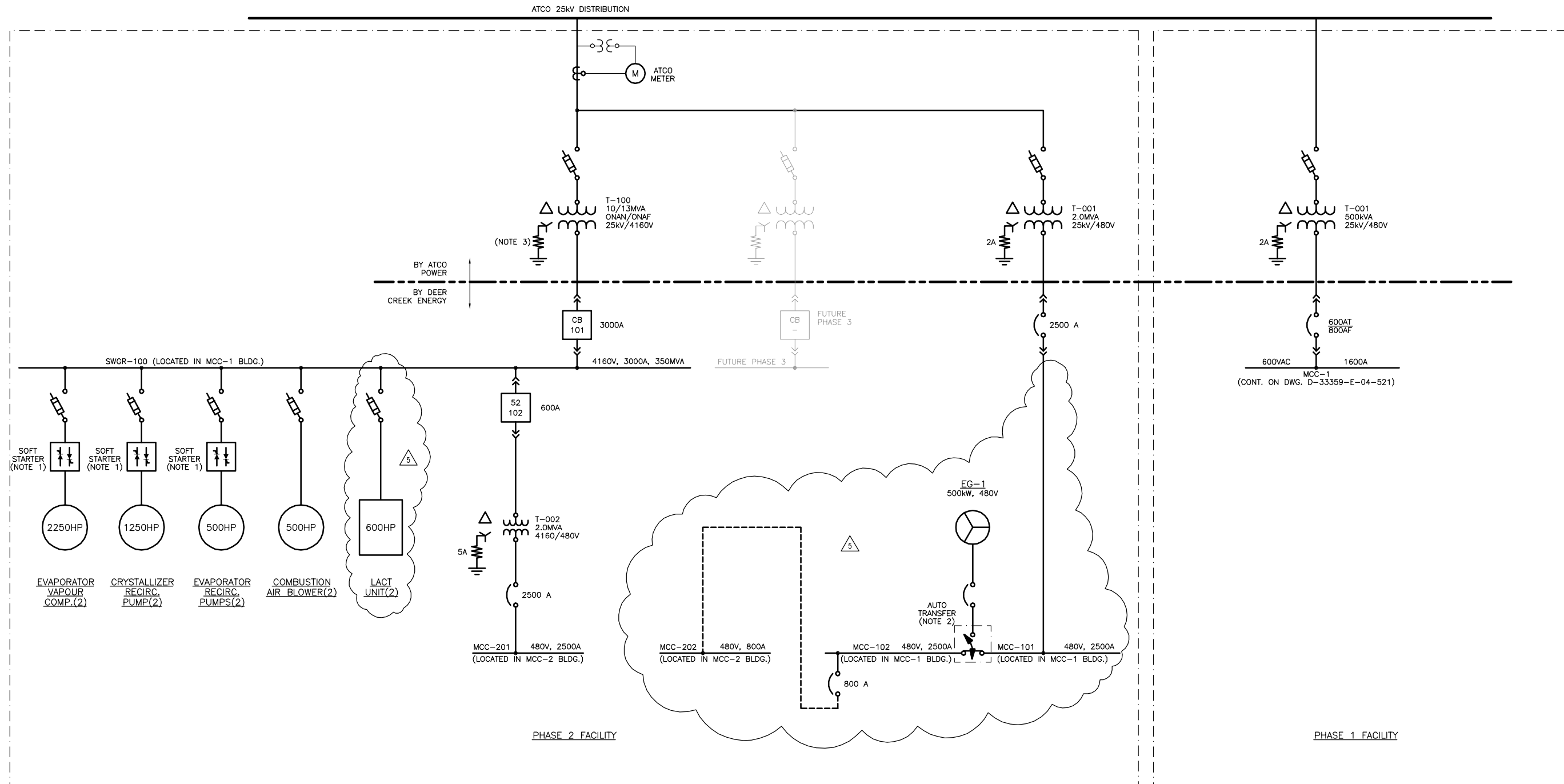
DEER CREEK
Energy Limited

BDR Project: 33500
Date: March 18, 2005

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APPENDIX XVI

**OVERALL
SINGLE LINE DIAGRAM**



NOTES:

- SOFT STARTERS ARE REQUIRED FOR PROCESS/MECHANICAL REASONS AND NOT NECESSARILY FOR VOLTAGE DROP ON MOTOR START.
- THE EMERGENCY GENERATOR WILL NOT RUN SYNCHRONIZED TO THE UTILITY. THE AUTO TRANSFER SWITCH WILL, HOWEVER, ALLOW A MAKE BEFORE BREAK TRANSITION BACK TO UTILITY POWER. THE TIME THE GENERATOR IS PARALLELED WITH THE UTILITY WILL NOT EXCEED 1 SECOND.
- 4160V SYSTEM TO BE HIGH RESISTANCE GROUNDING. NEUTRAL GROUNDING RESISTOR SIZE TO BE DETERMINED DURING DETAILED DESIGN.
- ALL 480V MCCS WILL BE RATED 2500A, WHERE POSSIBLE, FOR INTERCHANGEABILITY.

NO.	REVISION	PROJECT	DSN	DRN	CHK'D	APP'D	DATE
5	GENERAL REVISIONS	33500	RLB	PC			05.02.15
4	GENERAL REVISIONS	33500	RLB	PC			05.02.03
3	T-101/MCC-1 REVISIONS	33500	RLB	PC			04.12.08
2	T-001/MCC-1 REVISIONS	33500	WDS	PC			04.10.08
1	ISSUED FOR DBM INFORMATION	33500	WDS	PC			04.09.13
0	ISSUED FOR APPROVAL	33500	WDS	PC			04.03.23

PERMIT STAMP:

GENERAL NOTES:

- NOT CONSTRUCTION DRAWINGS ARE GENERATED FROM CONSTRUCTION CHANGE INFORMATION FORWARDED TO SOUTH CAROLINA HEALTH ENGINEERING LTD. BY THE OWNER'S FIELD SUPERVISORS AND OR THEIR CONTRACTORS. ANY CHANGES NOT DOCUMENTED WILL NOT APPEAR ON THE DRAWINGS AND THEREFORE THE DRAWING MAY NOT BE AN ACCURATE REPRESENTATION OF THE CONSTRUCTED FACILITY.
- BEFORE THE COMMENCEMENT OF ANY CONSTRUCTION AND OR ERECTION IT SHALL BE THE RESPONSIBILITY OF THE OWNER REPRESENTATIVE TO VERIFY THE LOCATION AND STATUS OF ANY PIPING, ELECTRICAL EQUIPMENT OR BUILDINGS.
- ANY REVISIONS MADE TO EXISTING EQUIPMENT, PIPING OR ELECTRICAL ON A FACILITY NOT OWNED BY BDR, ENG. LTD. IS ONLY SHOWN AS A REPRESENTATION OF WHAT EXISTS AND MUST BE VERIFIED BY THE OWNER.

	BY	DATE
DESIGN	WDS	04.03.23
DRAWN	PC	04.03.23
CHK'D		
APP'D		
L.S.D.	14-28-95-12	W4M

bdr
Bower Damberger Rolseth
Engineering Ltd.



JOSLYN PHASE #2 SAGD FACILITY
OVERALL
SINGLE LINE DIAGRAM

SCALE	DRAWING NUMBER	REV
N/A	D-33500-E-04-101	5



Bower Damberger Rolseth
Engineering Ltd.

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APPENDIX XVII

PROJECT LOAD SUMMARY



**LOAD SUMMARY
INCLUDING FUTURE LOAD (ESTIMATED BY RCF)**

Project : Joslyn Phase 2 SAGD Facility
No. : 33500

Rev : 5.0
Date : 2005-02-25

Bus	Building	Description	Volts	Ph	LGF	RCF	Max Operating Load (Includes LGF and RCF)				Nameplate			
							kW	kVA	Amps	PF	kVAR	kW	kVA	
SWGR-100	MCC-1	4160V Loads	4160	3	1.1	1.25	8,804	9,782	1,358	0.90	4,264	9,331	10,368	
MCC-1	MCC-1	Water/Evap Area 480V MCC	480	3	1.1	1.25	1,185	1,309	1,574	0.91	556	1,442	1,595	
MCC-2	MCC-2	Oil Process Area 480V MCC	480	3	1.1	1.25	1,460	1,610	1,937	0.91	679	1,922	2,122	
MCC-WP1	Wellpad 1 MCC	Wellpad 1 480V MCC	480	3	1.25	1.25	591	655	787	0.90	282	490	545	
MCC-WP2	Wellpad 2 MCC	Wellpad 2 480V MCC	480	3	1.25	1.25	513	568	683	0.90	245	490	545	
MCC-WP3	Wellpad 3 MCC	Wellpad 3 480V MCC	480	3	1.25	1.25	435	482	580	0.90	207	490	545	
MCC-WP4	Wellpad 4 MCC	Wellpad 4 480V MCC	480	3	1.25	1.25	591	655	787	0.90	282	490	545	
Total							13,578	15,060	348	0.90	6,515	14,657	16,265	
Total 4160V Load on SWGR-100 (Includes LGF and RCF)							10,264	11,392	1,581	0.90	4,943			
= 4160V Loads + MCC-2														
Total Emergency Bus Load							480	3	306	KVA				

Legend:

- Type** : M=Motor T=Transformer R=Resistance P=Panel or packaged equipment V=VFD (variable frequency drive) S=Soft Starter B=Circuit Breaker C=Contactor
- Nameplate** : Nameplate rating of load.
- Units** : Corresponding to **Nameplate**, must be one of : HP, kW, kVA.
- Actual** : Maximum running load in same units as **Nameplate**.
- PF** : Running power factor (0 to 1). Negative power factor indicates leading.
- LF** : Load factor (0 to 1) representing percentage of time unit is running at **Actual** load.
- LGF** : Load Growth Factor, estimated factor by which load will grow during detailed design.
- RCF** : Reserve Capacity Factor, estimated factor for future load growth, used for transformer sizing.
- E/N** : Emergency/normal.
- Div** : Area classification Division (Zone) 1 or 2.

SWGR-100

4160V Loads

Building : MCC-1

Date : 2005-02-25

Rev : 5.0

Tag No.	Vendor / Packager	RPO's	Building	Description	Type	Name Plate	Units	Actual	PF	LF	Volts	#	NP Amps	Max Operating Load			
														KW	KVA	KVAR	
K-606	Ionics	33500-6	Evaporator	VAPOR COMPRESSOR	M	2250	HP	2025	0.90	1	4160	3	287.6	1573.6	1748.4	242.7	762.1
P-582	Ionics	33500-26	Evaporator	EVAP RECIRC PUMP	M	500	HP	400	0.90	1	4160	3	63.9	310.8	345.4	47.9	150.5
K-616	Ionics	33500-6	Evaporator	VAPOR COMPRESSOR	M	2250	HP	2025	0.90	1	4160	3	287.6	1573.6	1748.4	242.7	762.1
P-592	Ionics	33500-26	Evaporator	EVAP RECIRC PUMP	M	500	HP	400	0.90	1	4160	3	63.9	310.8	345.4	47.9	150.5
K-604	Nebr. Boiler		Steam Gen	COMBUSTION AIR BLOWER	M	500	HP	400	0.90	1	4160	3	63.9	310.8	345.4	47.9	150.5
K-605	Nebr. Boiler		Steam Gen	COMBUSTION AIR BLOWER	M	500	HP	400	0.90	1	4160	3	63.9	310.8	345.4	47.9	150.5
K-6??	Ionics		Crystallizer	VAPOR COMPRESSOR	M	1500	HP	1200	0.90	1	4160	3	191.7	932.5	1036.1	143.8	451.6
T-MCC2			LACT	LACT Feeder	B	1500	kVA	1500	0.90	0.8	4160	3	208.2	1080.0	1200.0	166.5	523.1
T-MCC2			MCC-2	MCC-2 4160-480 Xfmr Feed	T	1500	kVA	1500	0.90	0	4160	3	208.2	0.0	0.0	0.0	0.0
Total										0.90	4160	3		6403.0	7114.5	987.4	3101.1

MCC-1	Tag No.	Vendor / Packager	RPO's	Building	Description	Name Plate	Type	Building : MCC-1			Rev : 5.0	Date : 2005-02-25			Nameplate kW	kVA			
								Units	Actual	PF		LF	E/N Emerg	Load			Volts	#####	NP
E-403		Ionics			LUBE OIL COOLER	5	M	HP	4	0.90	1	480	3	3.3	3.7	4.4	1.6	4.1	4.6
E-411		Ionics	33500-42		SEAL WATER COOLER	5	M	HP	4	0.90	1	480	3	3.3	3.7	4.4	1.6	4.1	4.6
E-413		Ionics			LUBE OIL COOLER	5	M	HP	4	0.90	1	480	3	3.3	3.7	4.4	1.6	4.1	4.6
E-421A		Exch. Industries	33500-54		COOLER FAN MOTOR#1	50	V	HP	40	0.90	1	480	3	33.2	36.8	44.3	16.1	41.4	46.0
E-421B		Exch. Industries	33500-54		COOLER FAN MOTOR#2	50	V	HP	40	0.90	1	480	3	33.2	36.8	44.3	16.1	41.4	46.0
E-421C		Exch. Industries	33500-54		COOLER FAN MOTOR#3	50	V	HP	40	0.90	1	480	3	33.2	36.8	44.3	16.1	41.4	46.0
E-421D		Exch. Industries	33500-54		COOLER FAN MOTOR#4	50	M	HP	40	0.90	1	480	3	33.2	36.8	44.3	16.1	41.4	46.0
E-421E		Exch. Industries	33500-54		COOLER FAN MOTOR#5	50	M	HP	40	0.90	1	480	3	33.2	36.8	44.3	16.1	41.4	46.0
E-421F		Exch. Industries	33500-54		COOLER FAN MOTOR#6	50	M	HP	40	0.90	1	480	3	33.2	36.8	44.3	16.1	41.4	46.0
H-807		Ionics			AUXILIARY BOILER POWER	6	B	KW	4.8	0.90	1	480	3	4.8	5.3	6.4	2.3	6.0	6.7
HT-60637		Ionics			OIL SUMP HEATER	3	C	KW	2.4	0.90	0.5	480	3	1.2	1.3	1.6	0.6	3.0	3.3
HT-61637		Ionics			OIL SUMP HEATER	3	C	KW	2.4	0.90	0.5	480	3	1.2	1.3	1.6	0.6	3.0	3.3
K-602					FLARE STACK BLOWER	5	M	HP	4	0.90	1	480	3	3.3	3.7	4.4	1.6	4.1	4.6
K-608				Cooling Glycol	INST AIR COMPRESSOR	50	M	HP	40	0.90	1	480	3	33.2	36.8	44.3	16.1	41.4	46.0
K-609				Cooling Glycol	INST AIR COMPRESSOR	50	M	HP	40	0.90	0.25	480	3	8.3	9.2	11.1	4.0	41.4	46.0
MX-709		Ionics			FEED TANK MIXER	1	M	HP	0.8	0.90	1	480	3	0.7	0.7	0.9	0.3	0.8	0.9
P-577		Ionics/Crystalizer			Recirc Pump	250	S	HP	200	0.90	1	480	3	165.8	184.2	221.6	80.3	207.2	230.2
P-577		Ionics/Crystalizer			Feed Tank Mixer	10	M	HP	8	0.90	1	480	3	11.1	6.6	7.4	8.9	3.2	8.3
P-577		Ionics/Crystalizer			Brine Tank Mixer	1.5	M	HP	1.2	0.90	1	480	3	1.7	1.0	1.1	1.3	0.5	1.2
P-577		Ionics/Crystalizer			Condensate Pump	7.5	M	HP	6	0.90	1	480	3	5.0	5.5	6.6	2.4	6.2	6.9
P-577		Ionics/Crystalizer			Silencer Drain Pump	1.5	M	HP	1.2	0.90	1	480	3	1.7	1.0	1.1	1.3	0.5	1.2
P-514		Nat. Oilwell	33500-23	Flare Area	FLARE KO PUMP	1	M	HP	0.8	0.90	1	480	3	0.7	0.7	0.9	0.3	0.8	0.9
P-516A		Ionics	33500-26		CAUSTIC PUMP	5	M	HP	4	0.90	1	480	3	3.3	3.7	4.4	1.6	4.1	4.6
P-516B		Ionics	33500-26		CAUSTIC PUMP	5	M	HP	4	0.90	1	480	3	3.3	3.7	4.4	1.6	4.1	4.6
P-520		Ionics	33500-26		PRIMARY FEED PUMP	40	M	HP	32	0.90	1	480	3	26.5	29.5	35.4	12.8	33.2	36.8
P-530		Ionics	33500-26		EVAP FEED PUMP	40	M	HP	32	0.90	1	480	3	26.5	29.5	35.4	12.8	33.2	36.8
P-533A		Ionics	33500-26		SEAL WATER PUMP	10	M	HP	8	0.90	1	480	3	6.6	7.4	8.9	3.2	8.3	9.2
P-533B		Ionics	33500-26		SEAL WATER PUMP	10	M	HP	8	0.90	1	480	3	6.6	7.4	8.9	3.2	8.3	9.2
P-536				Water Pump	BFW RECIRC PUMP	100	M	HP	80	0.90	0	480	3	110.8	0.0	0.0	0.0	8.3	9.2
P-537A		Westpower	33500-21	Water Pump	LP BOILER FEEDWATER PUMP	50	M	HP	40	0.90	1	480	3	33.2	36.8	44.3	16.1	41.4	46.0
P-537B		Westpower	33500-21	Water Pump	LP BOILER FEEDWATER PUMP	50	M	HP	40	0.90	1	480	3	33.2	36.8	44.3	16.1	41.4	46.0
P-537C		Westpower	33500-21	Water Pump	LP BOILER FEEDWATER PUMP	50	M	HP	40	0.90	1	480	3	33.2	36.8	44.3	16.1	41.4	46.0
P-542		Evap (Ionics)		Water Pump	K-606 AUX OIL PUMP	2	M	HP	1.6	0.90	1	480	3	1.3	1.5	1.8	0.6	1.7	1.8
P-552		Evap (Ionics)			DAF PUMP	10	M	HP	8	0.90	1	480	3	6.6	7.4	8.9	3.2	8.3	9.2
P-552A		Westpower	33500-35		K-607 AUX OIL PUMP	2	M	HP	1.6	0.90	1	480	3	1.3	1.5	1.8	0.6	1.7	1.8
P-553A		Westpower	33500-35		GLYCOL CIRC PUMP	125	M	HP	100	0.90	1	480	3	82.9	92.1	110.8	40.1	103.6	115.1
P-553B		Westpower	33500-35		GLYCOL CIRC PUMP	125	M	HP	100	0.90	0	480	3	0.0	0.0	0.0	0.0	103.6	115.1
P-558A		Westpower	33500-74	Water Pump	SOURCE WATER PUMPS	20	M	HP	16	0.90	1	480	3	13.3	14.7	17.7	6.4	16.6	18.4
P-558B		Westpower	33500-74	Water Pump	SOURCE WATER PUMPS	20	M	HP	16	0.90	0	480	3	0.0	0.0	0.0	0.0	16.6	18.4
P-558C		Westpower	33500-74	Water Pump	SOURCE WATER PUMPS	20	M	HP	16	0.90	0	480	3	0.0	0.0	0.0	0.0	16.6	18.4
P-560				Water Pump	FLOOR DRAIN TANK PUMP	3	M	HP	2.4	0.90	1	480	3	2.2	2.2	2.7	1.0	2.5	2.8
P-580		Ionics	33500-26		SECONDARY FEED PUMP	15	M	HP	12	0.90	1	480	3	9.9	11.1	13.3	4.8	12.4	13.8
P-581		Ionics	33500-26		DISTILLATE PUMP	40	M	HP	32	0.90	1	480	3	26.5	29.5	35.4	12.8	33.2	36.8
P-590		Ionics	33500-26		SECONDARY FEED PUMP	15	M	HP	12	0.90	1	480	3	9.9	11.1	13.3	4.8	12.4	13.8
P-591		Ionics	33500-26		DISTILLATE PUMP	40	M	HP	32	0.90	1	480	3	26.5	29.5	35.4	12.8	33.2	36.8
					Area Utilities Xfmr Emerg Bus	45	T	KVA	36	0.95	0.75	480	3	25.7	27.0	32.5	8.4	42.8	45.0
					Area Utilities Xfmr Normal Bus	45	T	KVA	36	0.95	0.75	480	3	25.7	27.0	32.5	8.4	42.8	45.0
					Area Heat Trace Xfmr	45	T	KVA	36	0.95	0.75	480	3	25.7	27.0	32.5	8.4	42.8	45.0
					Area Heat Trace Xfmr	45	T	KVA	36	0.95	0.75	480	3	25.7	27.0	32.5	8.4	42.8	45.0
					Area Exterior Ltg Xfmr	30	T	KVA	24	0.95	0.5	480	3	11.4	12.0	14.4	3.7	28.5	30.0
Totals								0.91	188	480	3	1914.1	861.9	951.9	1145.0	404.1	1442.0	1594.7	

MCC-2		Oil Process Area 480V MCC										Building : MCC-2			Rev : 5.0			Date : 2005-02-25																			
Tag No	Vendor / Package	RPO's	Building	Description	Type	Plate	Name	Units	Actual	PF	LF	E/N	Emerg	Load	Volts	#	NP	Amperes	kVA	kW	kVAR	Nameplate kW	Nameplate kVA														
K-600	HC Process Syst	33500-19		OIL VRU / LIQUID RING COMP	M	125	HP	100	100	0.90	1		0	480	3	138.5	82.9	92.1	110.8	40.1	103.6	115.1	103.6	115.1													
K-601	HC Process Syst	33500-19	Recycle	OIL VRU / LIQUID RING COMP	M	125	HP	100	100	0.90	0.5	0	0	480	3	138.5	41.4	46.0	55.4	20.1	103.6	115.1	103.6	115.1													
K-603			Recycle	RECYCLE BURNER BLOWER	M	20	HP	16	16	0.90	1	0	0	480	3	22.2	13.3	14.7	17.7	6.4	16.6	18.4	16.6	18.4													
P-502			Recycle	LACT FEED PUMP	M	40	HP	32	32	0.90	1	0	0	480	3	44.3	26.5	29.5	35.4	12.8	33.2	36.8	33.2	36.8													
P-503	Nat. Oilwell	33500-23	Recycle	OFF SPEC OIL PUMP	V	20	HP	16	16	0.90	1	0	0	480	3	22.2	13.3	14.7	17.7	6.4	16.6	18.4	16.6	18.4													
P-505	Nat. Oilwell	33500-23	Recycle	SLOP OIL PUMP	V	20	HP	16	16	0.90	1	0	0	480	3	22.2	13.3	14.7	17.7	6.4	16.6	18.4	16.6	18.4													
P-506	Universal	33500-09	Recycle	REC TRTR RECIRC PUMP	M	20	HP	16	16	0.90	0.5	0	0	480	3	22.2	6.6	7.4	8.9	3.2	16.6	18.4	16.6	18.4													
P-507	Nat. Oilwell	33500-23	Recycle	SLOP WATER PUMP	V	20	HP	16	16	0.90	1	0	0	480	3	22.2	13.3	14.7	17.7	6.4	16.6	18.4	16.6	18.4													
P-509A	Brown/Union	33500-28	De-Oiling	SCO PUMP	M	30	HP	24	24	0.90	1	0	0	480	3	33.2	19.9	22.1	26.6	9.6	24.9	27.6	24.9	27.6													
P-509B	Brown/Union	33500-28	De-Oiling	SCO PUMP	M	30	HP	24	24	0.90	1	0	0	480	3	33.2	19.9	22.1	26.6	9.6	24.9	27.6	24.9	27.6													
P-509C	Brown/Union	33500-28	De-Oiling	SCO PUMP	M	30	HP	24	24	0.90	0	0	0	480	3	33.2	0.0	0.0	0.0	0.0	24.9	27.6	24.9	27.6													
P-510	Nat. Oilwell	33500-23	Recycle	REC TRTR OH DRAIN PUMP	V	5	HP	4	4	0.90	1	0	0	480	3	5.5	3.3	3.7	4.4	1.6	4.1	4.6	4.1	4.6													
P-511			De-Oiling	SCO LACT PUMP	M	15	HP	12	12	0.90	1	0	0	480	3	16.6	9.9	11.1	13.3	4.8	12.4	13.8	12.4	13.8													
P-512A			Steam Gen	PHOSPHATE PUMP	M	20	HP	16	16	0.90	1	0	0	480	3	22.2	13.3	14.7	17.7	6.4	16.6	18.4	16.6	18.4													
P-512B			Steam Gen	PHOSPHATE PUMP	M	20	HP	16	16	0.90	1	0	0	480	3	22.2	13.3	14.7	17.7	6.4	16.6	18.4	16.6	18.4													
P-513A			Steam Gen	BLOWDOWN TANK PUMPS	M	10	HP	8	8	0.90	1	0	0	480	3	11.1	6.6	7.4	8.9	3.2	8.3	9.2	8.3	9.2													
P-513B			Steam Gen	BLOWDOWN TANK PUMPS	M	10	HP	8	8	0.90	0	0	0	480	3	11.1	0.0	0.0	0.0	0.0	8.3	9.2	8.3	9.2													
P-521	Brown/Union	33500-27	De-Oiling	DESAND WASH WATER PUMP	M	30	HP	24	24	0.90	1	0	0	480	3	33.2	19.9	22.1	26.6	9.6	24.9	27.6	24.9	27.6													
P-522A	Kvaerner	33500-10		IGF OVERFLOW PUMP	M	5	HP	4	4	0.90	1	0	0	480	3	5.5	3.3	3.7	4.4	1.6	4.1	4.6	4.1	4.6													
P-522B	Kvaerner	33500-10		IGF OVERFLOW PUMP	M	5	HP	4	4	0.90	0	0	0	480	3	5.5	0.0	0.0	0.0	0.0	4.1	4.6	4.1	4.6													
P-523A	Kvaerner	33500-10		IGF DISCH WATER RECYCLE PL	M	30	HP	24	24	0.90	1	0	0	480	3	33.2	19.9	22.1	26.6	9.6	24.9	27.6	24.9	27.6													
P-523B	Kvaerner	33500-10		IGF DISCH WATER RECYCLE PL	M	30	HP	24	24	0.90	0	0	0	480	3	33.2	0.0	0.0	0.0	0.0	24.9	27.6	24.9	27.6													
P-524	Westpower	33500-21	De-Oiling	ORF FEED PUMP	M	75	HP	60	60	0.90	1	0	0	480	3	83.1	49.7	55.3	66.5	24.1	62.2	69.1	62.2	69.1													
P-525A	Westpower	33500-68	De-Oiling	DE-OILED WATER PUMPS	M	50	HP	40	40	0.90	1	0	0	480	3	55.4	33.2	36.8	44.3	16.1	41.4	46.0	41.4	46.0													
P-525B	Westpower	33500-68	De-Oiling	DE-OILED WATER PUMPS	M	50	HP	40	40	0.90	0	0	0	480	3	55.4	0.0	0.0	0.0	0.0	41.4	46.0	41.4	46.0													
P-525C	Westpower	33500-68	De-Oiling	DE-OILED WATER PUMPS	M	50	HP	40	40	0.90	0	0	0	480	3	55.4	0.0	0.0	0.0	0.0	41.4	46.0	41.4	46.0													
P-526	HC Process Syst	33500-19		VRU CONDENSATE PUMP	M	2	HP	1.6	1.6	0.90	1	0	0	480	3	2.2	1.3	1.5	1.8	0.6	1.7	1.8	1.7	1.8													
P-534	Westpower	33500-21	De-Oiling	ORF RECYCLE PUMP	M	75	HP	60	60	0.90	1	0	0	480	3	83.1	49.7	55.3	66.5	24.1	62.2	69.1	62.2	69.1													
P-541A	KSB Pumps	33500-20	Steam Gen	HP BOILER FEEDWATER PUMP	S	300	HP	240	240	0.90	1	0	0	480	3	332.3	198.9	221.0	265.9	96.3	248.7	276.3	248.7	276.3													
P-541B	KSB Pumps	33500-20	Steam Gen	HP BOILER FEEDWATER PUMP	S	300	HP	240	240	0.90	1	0	0	480	3	332.3	198.9	221.0	265.9	96.3	248.7	276.3	248.7	276.3													
P-541C	KSB Pumps	33500-20	Steam Gen	HP BOILER FEEDWATER PUMP	S	300	HP	240	240	0.90	0	0	0	480	3	332.3	0.0	0.0	0.0	0.0	248.7	276.3	248.7	276.3													
P-554A	Westpower	33500-43	Glycol Heater	GLYCOL CIRC PUMP	M	20	HP	16	16	0.90	1	E	16	480	3	22.2	13.3	14.7	17.7	6.4	16.6	18.4	16.6	18.4													
P-554B	Westpower	33500-43	Glycol Heater	GLYCOL CIRC PUMP	M	20	HP	16	16	0.90	0	E	0	480	3	22.2	0.0	0.0	0.0	0.0	16.6	18.4	16.6	18.4													
P-555	Nat. Oilwell	33500-23	De-Oiling	WATER SKIM PUMP	V	5	HP	4	4	0.90	1	0	0	480	3	5.5	3.3	3.7	4.4	1.6	4.1	4.6	4.1	4.6													
P-557	Nat. Oilwell	33500-23	Recycle	RECYCLE PUMP	V	20	HP	16	16	0.90	1	0	0	480	3	22.2	13.3	14.7	17.7	6.4	16.6	18.4	16.6	18.4													
P-559A	Brown/Union	33500-29		SKIM FEED PUMP	M	40	HP	32	32	0.90	0	0	0	480	3	44.3	26.5	29.5	35.4	12.8	33.2	36.8	33.2	36.8													
TA-116	Brown/Union	33500-29		SKIM FEED PUMP	M	40	HP	32	32	0.90	0	0	0	480	3	44.3	0.0	0.0	0.0	0.0	33.2	36.8	33.2	36.8													
TA-117	Brown/Union	33500-29		ORF AGITATOR	M	10	HP	8	8	0.90	1	0	0	480	3	11.1	6.6	7.4	8.9	3.2	8.3	9.2	8.3	9.2													
				ORF AGITATOR	M	10	HP	8	8	0.90	1	0	0	480	3	11.1	6.6	7.4	8.9	3.2	8.3	9.2	8.3	9.2													
				Area Utilities Xfmr Emerg Bus	T	45	kVA	36	36	0.95	0.75	E	27	480	3	54.1	25.7	27.0	32.5	8.4	42.8	45.0	42.8	45.0													
				Area Utilities Xfmr Normal Bus	T	45	kVA	36	36	0.95	0.75	E	0	480	3	54.1	25.7	27.0	32.5	8.4	42.8	45.0	42.8	45.0													
				Area Heat Trace Xfmr	T	45	kVA	36	36	0.95	0.75	E	27	480	3	54.1	25.7	27.0	32.5	8.4	42.8	45.0	42.8	45.0													
				Area Heat Trace Xfmr	T	45	kVA	36	36	0.95	0.75	E	27	480	3	54.1	25.7	27.0	32.5	8.4	42.8	45.0	42.8	45.0													
				Area Exterior Ltg Xfmr	T	30	kVA	24	24	0.95	0.5	E	0	480	3	36.1	11.4	12.0	14.4	3.7	28.5	30.0	28.5	30.0													
				Office Area 480 V Feeder	B	30	kVA	24	24	0.95	0.5	E	12	480	3	36.1	11.4	12.0	14.4	3.7	28.5	30.0	28.5	30.0													
				Office Area 120 V UPS Feed	B	15	kVA	12	12	0.95	0.75	E	9	480	3	18.0	8.6	9.0	10.8	2.8	14.3	15.0	14.3	15.0													
														Totals			118			1062.0			1171.0			1408.5			493.5			1922.4			2121.8		

MCC-WP1 Wellpad 1 480V MCC

Building : Wellpad 1 MCC Rev : 5.0

Date : 2005-02-25

Tag No.	Description	Type	Name Plate	Units	Actual	PF	LF	Volts	Ph	NP Amps	Max Operating Load			Nameplate		
											kW	kVA	Amps	kVAR	kW	kVA
K-607	VRU Compressor	V	150	HP	120	0.90	1	480	3	166.2	99.5	110.5	132.9	48.2	124.3	138.1
K-601A	Air Compressor	M	5	HP	4	0.75	1	480	3	6.6	3.3	4.4	5.3	2.9	4.1	5.5
K-601B	Air Compressor	M	5	HP	4	0.75	0	480	3	6.6	0.0	0.0	0.0	0.0	4.1	5.5
P-501	Flare KO Drum Pump	M	5	HP	4	0.75	0.25	480	3	6.6	0.8	1.1	1.3	0.7	4.1	5.5
WP5-1	Wellhead Pump	M	75	HP	60	0.90	1	480	3	83.1	49.7	55.3	66.5	24.1	62.2	69.1
WP5-2	Wellhead Pump	M	75	HP	60	0.90	1	480	3	83.1	49.7	55.3	66.5	24.1	62.2	69.1
WP5-3	Wellhead Pump	M	75	HP	60	0.90	1	480	3	83.1	49.7	55.3	66.5	24.1	62.2	69.1
WP5-4	Wellhead Pump	M	75	HP	60	0.90	1	480	3	83.1	49.7	55.3	66.5	24.1	62.2	69.1
WP5-5	Wellhead Pump	M	75	HP	60	0.90	1	480	3	83.1	49.7	55.3	66.5	24.1	62.2	69.1
	Site Utilities/Heat Trace	T	45	kVA	36	0.95	0.75	480	3	54.1	25.7	27.0	32.5	8.4	42.8	45.0
Total											377.9	418.9	503.9	180.7	490.4	545.1

MCC-WP2 Wellpad 2 480V MCC

Building : Wellpad 2 MCC Rev : 5.0

Date : 2005-02-25

Tag No.	Description	Type	Name		Units	Actual	PF	LF	Volts	Ph	NP	Max Operating Load			Nameplate		
			Plate	150								kW	kVA	Amps	kVAR	kW	kVA
K-607	VRU Compressor	V		150	HP	120	0.90	1	480	3	166.2	99.5	110.5	132.9	48.2	124.3	138.1
K-601A	Air Compressor	M		5	HP	4	0.75	1	480	3	6.6	3.3	4.4	5.3	2.9	4.1	5.5
K-601B	Air Compressor	M		5	HP	4	0.75	0	480	3	6.6	0.0	0.0	0.0	0.0	4.1	5.5
P-501	Flare KO Drum Pump	M		5	HP	4	0.75	0.25	480	3	6.6	0.8	1.1	1.3	0.7	4.1	5.5
WP5-1	Wellhead Pump	M		75	HP	60	0.90	1	480	3	83.1	49.7	55.3	66.5	24.1	62.2	69.1
WP5-2	Wellhead Pump	M		75	HP	60	0.90	1	480	3	83.1	49.7	55.3	66.5	24.1	62.2	69.1
WP5-3	Wellhead Pump	M		75	HP	60	0.90	1	480	3	83.1	49.7	55.3	66.5	24.1	62.2	69.1
WP5-4	Wellhead Pump	M		75	HP	60	0.90	1	480	3	83.1	49.7	55.3	66.5	24.1	62.2	69.1
WP5-5	Future Wellhead Pump	M		75	HP	60	0.90	0	480	3	83.1	0.0	0.0	0.0	0.0	62.2	69.1
	Site Utilities/Heat Trace	T		45	kVA	36	0.95	0.75	480	3	54.1	25.7	27.0	32.5	8.4	42.8	45.0
Total												328.2	363.6	437.4	156.6	490.4	545.1

MCC-WP3		Wellpad 3 480V MCC		Building : Wellpad 3 MCC		Rev : 5.0		Date : 2005-02-25								
Tag No.	Description	Type	Name	Units	Actual	PF	LF	Volts	Ph	NP	Max Operating Load		Nameplate			
			Plate	HP						Amps	kW	kVA	kW	kVA		
K-607	VRU Compressor	V	150	HP	120	0.90	1	480	3	166.2	99.5	110.5	132.9	48.2	124.3	138.1
K-601A	Air Compressor	M	5	HP	4	0.75	1	480	3	6.6	3.3	4.4	5.3	2.9	4.1	5.5
K-601B	Air Compressor	M	5	HP	4	0.75	0	480	3	6.6	0.0	0.0	0.0	0.0	4.1	5.5
P-501	Flare KO Drum Pump	M	5	HP	4	0.75	0.25	480	3	6.6	0.8	1.1	1.3	0.7	4.1	5.5
WP5-1	Wellhead Pump	M	75	HP	60	0.90	1	480	3	83.1	49.7	55.3	66.5	24.1	62.2	69.1
WP5-2	Wellhead Pump	M	75	HP	60	0.90	1	480	3	83.1	49.7	55.3	66.5	24.1	62.2	69.1
WP5-3	Wellhead Pump	M	75	HP	60	0.90	1	480	3	83.1	49.7	55.3	66.5	24.1	62.2	69.1
WP5-4	Future Wellhead Pump	M	75	HP	60	0.90	0	480	3	83.1	0.0	0.0	0.0	0.0	62.2	69.1
WP5-5	Future Wellhead Pump	M	75	HP	60	0.90	0	480	3	83.1	0.0	0.0	0.0	0.0	62.2	69.1
	Site Utilities/Heat Trace	T	45	KVA	36	0.95	0.75	480	3	54.1	25.7	27.0	32.5	8.4	42.8	45.0
Total						0.90		480	3		278.5	308.4	370.9	132.5	490.4	545.1

MCC-WP4 Wellpad 4 480V MCC

Building : Wellpad 4 MCC

Rev : 5.0

Date : 2005-02-25

Tag No.	Description	Type	Name Plate	Units	Actual	PF	LF	Volts	Ph	NP Amps	Max Operating Load			Nameplate		
											kW	kVA	Amps	kVAR	kW	kVA
K-607	VRU Compressor	V	150	HP	120	0.90	1	480	3	166.2	99.5	110.5	132.9	48.2	124.3	138.1
K-601A	Air Compressor	M	5	HP	4	0.75	1	480	3	6.6	3.3	4.4	5.3	2.9	4.1	5.5
K-601B	Air Compressor	M	5	HP	4	0.75	0	480	3	6.6	0.0	0.0	0.0	0.0	4.1	5.5
P-501	Flare KO Drum Pump	M	5	HP	4	0.75	0.25	480	3	6.6	0.8	1.1	1.3	0.7	4.1	5.5
WP5-1	Wellhead Pump	M	75	HP	60	0.90	1	480	3	83.1	49.7	55.3	66.5	24.1	62.2	69.1
WP5-2	Wellhead Pump	M	75	HP	60	0.90	1	480	3	83.1	49.7	55.3	66.5	24.1	62.2	69.1
WP5-3	Wellhead Pump	M	75	HP	60	0.90	1	480	3	83.1	49.7	55.3	66.5	24.1	62.2	69.1
WP5-4	Wellhead Pump	M	75	HP	60	0.90	1	480	3	83.1	49.7	55.3	66.5	24.1	62.2	69.1
WP5-5	Wellhead Pump	M	75	HP	60	0.90	1	480	3	83.1	49.7	55.3	66.5	24.1	62.2	69.1
	Site Utilities/Heat Trace	T	45	kVA	36	0.95	0.75	480	3	54.1	25.7	27.0	32.5	8.4	42.8	45.0
Total											377.9	418.9	503.9	180.7	490.4	545.1



Bower Damberger Rolseth
Engineering Ltd.

DEER CREEK ENERGY LIMITED

Joslyn Phase 2, SAGD Facility
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DEER CREEK
Energy Limited

BDR Project: 33500
Date: March 18, 2005

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APPENDIX XX

MATERIAL BALANCE (OIL PROCESS)

Deer Creek Energy Limited - Joslyn Creek Phase 2
 Production Mass Balance - 12000 BPD (Nominal) Production Case

Stream Description		Inlet to Group Separator	Vapour from Group Separator	Emulsion from Group Separator	Recycle Slop to FWKO	Diluent to FWKO	Inlet to FWKO	Produced Gas from FWKO	Produced Water from FWKO	Diluent to Treater	Inlet to Treater	Produced Gas from Treater	Dil-Bit from Treater	Produced Water from Treater	Produced Gas from Production Tank	Produced Gas from Prod. Gas Separator	Condensed Water from Prod. Gas Separator	Produced Gas from Prod. Water Tank	Clean Oil to LACT	Diluent to LACT
Vapour Fraction		0.0035	1.0000	0.0000	0.0000	0.0000	0.0008	1.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	1.0000	1.0000	0.0000	1.0000	0.0000	0.0000
Temperature	°C	165	165	165	85	11	159	159	159	11	143	143	143	143	69	45	45	85	69	11
Pressure	kPaG	950	950	950	1497	950	850	850	850	850	750	750	750	750	3	715	715	3	350	1100
Total Mass Flow	kg/h	269535	788	268747	757	16912	286416	254	163829	19761	142094	0	117852	24242	410	469	572	79	117442	31374
Hydrocarbon Liquid Phase																				
Mass Flow	kg/h	80647	0	80647	375	16912	97853	0	323	19761	117284	0	117238	47	0	0	27	0	116734	31374
Standard Volume Flow	m3/d	1914	-	1914	9	475	2408	-	8	555	2968	-	2967	1	-	-	1	-	2954	881
Density	kg/m3	918	-	918	946	859	869	-	869	859	843	-	843	843	-	-	758	-	903	859
Viscosity	cP	21.7	-	21.7	76.1	7.6	10.3	-	10.3	7.6	7.8	-	7.8	7.8	-	-	0.8	-	53.1	7.6
Standard Density	kg/m3	1011.2	-	1011.2	987.2	854.6	975.3	-	975.3	854.6	948.3	-	948.3	948.3	-	-	784.6	-	948.3	854.6
API		8.3	-	8.3	11.7	33.9	13.4	-	13.4	33.9	17.6	-	17.6	17.6	-	-	48.7	-	17.6	33.9
Aqueous Phase																				
Mass Flow	kg/h	188100	0	188100	382	0	188310	0	163506	0	24809	0	614	24195	0	0	545	0	708	0
Density	kg/m3	903	-	903	969	-	908	-	908	-	924	-	924	924	-	-	990	-	978	-
Standard Volume Flow	Sm3/d	4519	-	4519	9	-	4524	-	3928	-	596	-	15	581	-	-	13	-	17	-
Actual Volume Flow	Am3/d	5000	-	5000	9	-	4977	-	4321	-	645	-	16	629	-	-	13	-	17	-
Vapour Phase (wet basis)																				
Mass Flow	kg/h	788	788	-	-	-	254	254	-	-	-	0	-	-	410	469	-	79	-	-
Density	kg/m3	6.34	6.34	-	-	-	8.35	8.35	-	-	-	9.34	-	-	1.63	9.93	-	1.12	-	-
Molecular Weight		21.26	21.26	-	-	-	30.32	30.32	-	-	-	36.33	-	-	45.98	31.34	-	32.98	-	-
Standard Gas Flow	Sm3/d	21065	21065	-	-	-	4755	4755	-	-	-	0	-	-	5075	8516	-	1357	-	-
Actual Gas Flow	Am3/d	2981	2981	-	-	-	729	729	-	-	-	0	-	-	6029	1134	-	1693	-	-
mole fraction water		-	0.6731	-	-	-	-	0.6463	-	-	-	0.5327	-	-	0.3027	0.0124	-	0.5799	-	-



Bower Damberger Rolseth
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Energy Limited

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APPENDIX XXI

**MATERIAL BALANCE
(WATER)**

**DEER CREEK ENERGY
JOSLYN CREEK
SAGD Project
Design Parameters**

Steam System

d	Steam Oil Ratio	2.5	
a	-100% steam to field	30000 bpd	= 4770.2 t/d
b	-Steam Quality	97 %	
c	-LP Steam Sep. Recov.	0 %	
e	-HLS Steam Required	0 % of Inflow	

Inlet Emulsion

g	-Oil in	12000 bpd	= 1908 t/d
h	-Water retained in Reservoir	1500 bpd	= 239 t/d
l	-Produced Water in	28500 bpd	= 4531.7 t/d

P.W. to Deoiling

j	-Sales Oil BS&W	0.5 %
k	-Solids Content	100 mg/l
l	-Oil Content	2000.0 mg/l
m	-Temperature	85 deg.C
n	-Specific Gravity - Water	0.968
f	-Specific Gravity - Oil	0.93

Oil Removal

o	-Skim Tank Outlet	82.5 % Removal	= 376.7 mg/l
p	-Skim Oil Water Content	60 %	
q	-IGF Outlet	94.5 % Removal	= 21.3 mg/l
r	-IGF Overflow - Normal	2.5 % of IGF Inflow	
s	- Maximum	10 % of IGF Inflow	
ee	-Oil Removal Filter Outlet	97 % Removal	= 1.0 mg/l

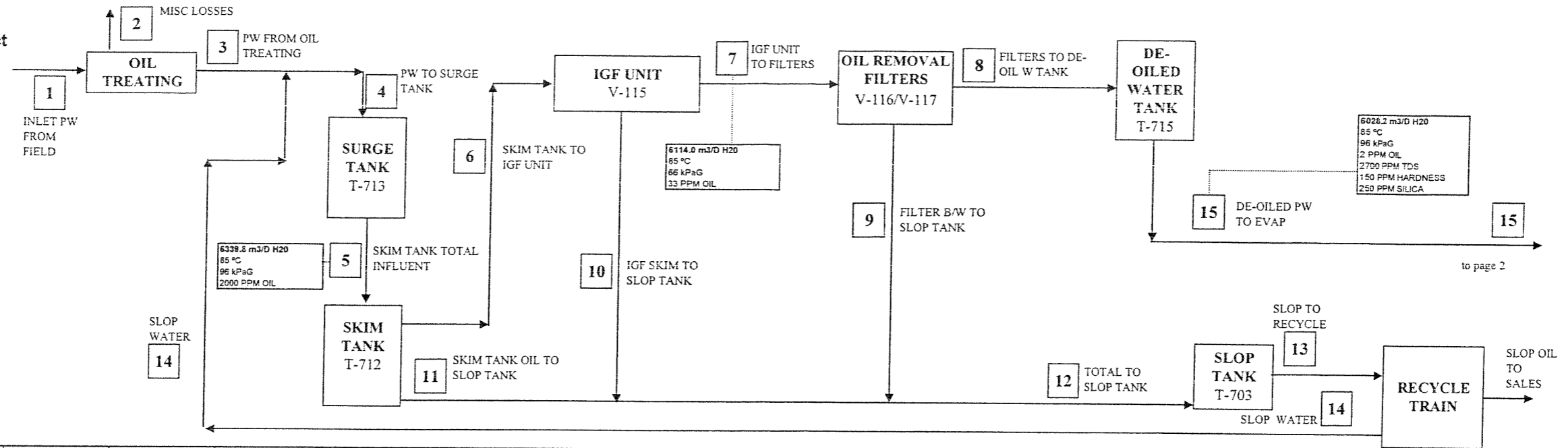
Solids Removal

u	-Skim Tank Outlet	35 % Removal	= 65.5 mg/l
v	-Solids accum. in Tanks	61 t/y	
w	-IGF Outlet	90 % Removal	= 1.0 mg/l
aa	-Oil Removal Filter Outlet	90 % Removal	= 1.0 mg/l
dd	-Oil Removal Filter Backwash	1.4 % of Filter Inflow	

SourceWater

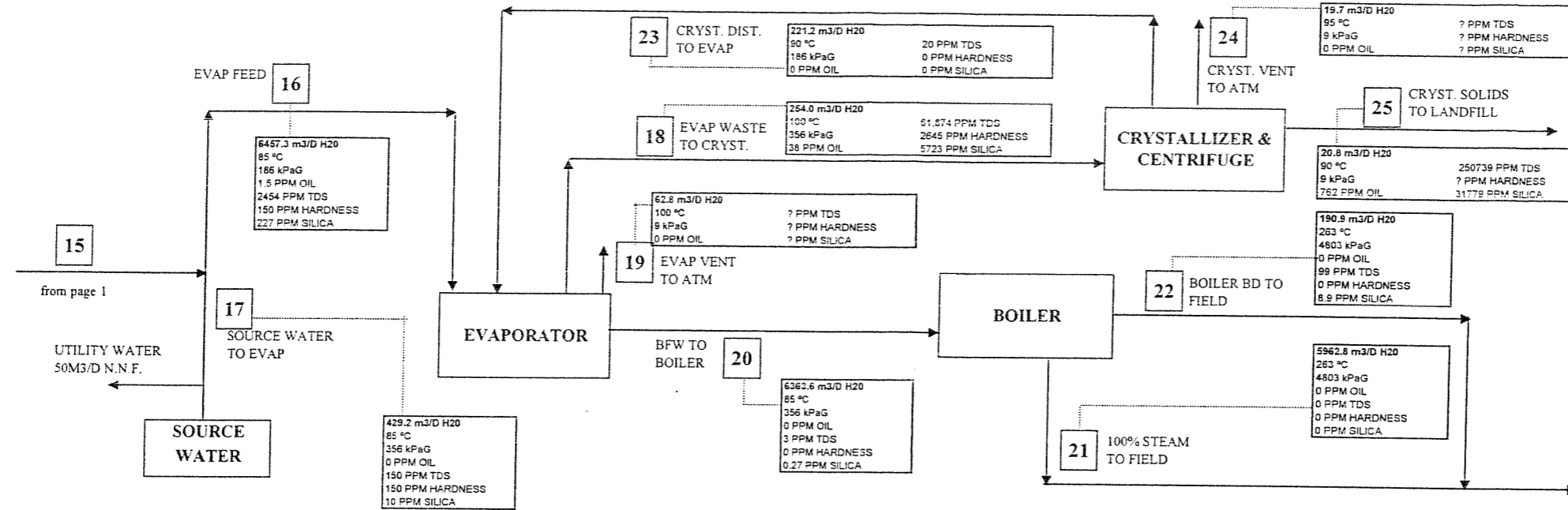
bb	-Total Req'd	495 t/d
cc	-Temperature	5 deg.C
mm	-Total Utility Water	25 t/d
nn	-Utility Water Recycle	50 % of Total

DEER CREEK ENERGY
 PHASE 2 JOSLYN CREEK
 COMMERCIAL SAGD Project
 Water Systems
 Material Balance



Stream:		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Stream Description		Inlet Prod. Water from Field	Misc Losses To Process	Prod. Water from Oil Treating	Prod. Water to Surge Tank	Skim Tank Total Influent	Skim Tank to IGF Unit	IGF Unit to Filters	Oil Filters to Deoil W Tank	Filter B/W to Slop Tank	IGF Skimmings to Slop Tank	Skim Tank Oil to Slop Tank	Total to Slop Tank	Slop to Recycle	Slop PW return from Recycle Train
	Total Flow	t/day	5847.9	13.8	5847.9	6136.9	6136.9	6072.2	5918.4	5835.3	83.1	152.1	64.5	301.4	301.4
Water	t/day	5849.1	13.8	5835.3	6123.6	6123.6	6069.9	5918.1	5835.3	82.9	151.7	53.8	288.4	288.4	288.4
Bitumen	mg/L	2000	2000	2000	2000	2000	323	33	2	2248	11628	206612	45291	45291	2000
	t/day	0.00	0.03	12.06	12.65	12.65	1.90	0.19	0.009	0.18	1.71	10.75	12.64	12.64	0.60
Solids	mg/L	100	100	100	100	100	66	7	1	431	2355	2	1308	1308	100
	t/day	0.58	0.00	0.58	0.61	0.61	0.40	0.04	0.00	0.04	0.36	0.0001	0.39	0.39	0.03
Temperature	deg C	85	85	85	85	85	85	85	85	85	85	85	85	85	85
Pressure	kPa(a)	260	260	260	260	190	190	160	450	450	190	160	190	190	190
Density	kg/m ³	968	968	968	968	968	968	968	968	968	968	968	968	968	968
Viscosity	cp	0.31	0.31	0.31	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32
Max. Flow	t/h	243.7	0.6	243.7	255.7	255.7	253.0	246.6	243.1	3.5	6.3	2.7	12.6	12.6	12.0
	Am ³ /h	251.7	0.6	251.7	264.2	264.2	261.4	254.8	251.2	3.6	6.5	2.8	13.0	13.0	12.4
	m ³ /d	6041.2	14.3	6041.2	6339.8	6339.8	6272.9	6114.0	6028.2	85.8	157.1	66.7	311.4	311.4	298.6
Notes			Sales BS&W, Produced Gas												

DEER CREEK ENERGY
 PHASE 2 JOSLYN CREEK
 COMMERCIAL SAGD Project
 Water Systems
 Material Balance



Stream:		15	16	17	18	19	20	21	22	23	24	25
Stream Description		Deoiled PW to Evap	Evap Feed	Source Water to Evap	Evap Waste to Crystallizer	Evap Vent to Atm	BFW to Boiler	100% Steam to Field	Boiler BD to Field	Crystallizer Distillate to Evap Feed	Crystallizer Vent to Atm	Crystallizer Solids to Landfill
Total Flow	t/day	5835.3	6250.7	415.4	256.5	60.8	6147.2	5962.8	184.4	213.5	19.0	23.9
Water	t/day	5835.3	6250.7	415.4	256.2	60.8	6147.2	5962.8	184.4	213.5	19.0	2.4
Bitumen	mg/L	2	1.5	0	38	0	0	0	0	0	0	762
	t/day	0.009	0.009	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.24
Solids	mg/L	1	0	0	0	0	0	0	0	50	0	900000
	t/day	0.00	0.004	0.00	0.10	0.00	0.00	0.00	0.00	0.01	0.00	21.25
Temperature	deg C	85	85	85	100	100	85	263	263	90	95	90
Pressure	kPa(a)	190	280	450	450	103	450	4897	4897	280	103	103
Density	kg/m ³	968	968	968	1010	968	966	966	966	965	965	1150
Viscosity	cp	0.32	0.32	0.32	2.83	2.71	0.31		0.31	0.31	0.31	
Max. Flow	t/h	243.1	260.4	17.3	10.7	2.5	256.1	248.4	7.7	8.9	0.8	1.0
	Am ³ /h	251.2	269.1	17.9	10.6	2.6	265.1	n/a	8.0	9.2	0.8	0.9
	m ³ /d	6028.2	6457.3	429.2	254.0	62.8	6363.6	5962.8	190.9	221.2	19.7	20.8
Notes					Water content includes 8.3% TDS which precipitates out as a suspended solid in stream 25		Fixed density from 956 to 966 for volumetric purposes only	Fixed to 966 for volumetric purposes only. CWE of 1000 is correct	Fixed density from 956 to 966 for volumetric purposes only			Suspended solids come from precipitating TDS in the water of stream 18