5Blue

Process Equipment Inc.

An ISO 9001:2015 Quality System Company

CORPORATE OVERVIEW

5Blue Process Equipment Inc. provides the oil and gas processing industry with high quality, custom engineered products worldwide. Focused on client performance, our team thrives on adding value by designing innovative solutions to meet technical and operational challenges. With a combined 200+ years of experience, our team of experts provides solutions for a diverse group of clients ranging from start-ups to the largest oil and gas corporations globally.

5Blue is committed to providing high quality products and services that are custom built to meet clients' specifications in a practical and functional lifecycle application, considering stringent environmental regulations and targeting zero-loss incidents. 5Blue offers comprehensive packages: from initial concept, design, engineering, manufacturing, transportation, installation and commissioning, to start-up and operator training. From the initial concept to the operational product, our in-house design and engineering group strives to produce a system that is reliable, safe, efficient, and easily maintained and provides an appropriate solution to our client's specific control and processing needs.

Located 5 kilometers from the Edmonton International Airport, 5Blue has direct access to road, rail and air transportation. We have well established working relationships with a number of logistics companies capable of delivering our product anywhere in the world. Ocean transportation is available through the ports of Vancouver, Montreal and Houston.

We constantly strive for excellence in our services and products.

FABRICATION CAPABILITIES

5Blue Process Equipment Inc. has extensive experience in the fabrication, assembly and testing of products and components covering the whole oil and gas process equipment range. 5Blue's fabrication and module assembly facility, designed and constructed to maximise efficiency, is located in Nisku, Alberta along the province's "High Load Transportation Corridor." Backed by a highly qualified and experienced team, the facility enables 5Blue to meet the needs of almost any project's scope.

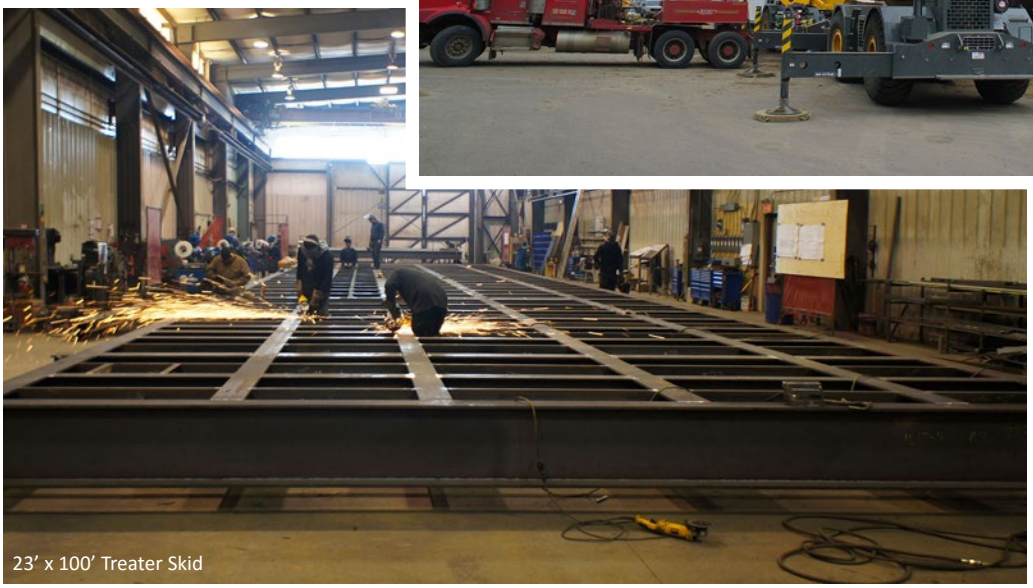
5Blue's primary fabrication facility includes: assembly, preparation, pipe spooling and component fabrication areas. The finishing facility includes painting, building, instrumentation and function testing.

In anticipation of ever changing requirements and challenges and to complement 5Blue's innovative custom design philosophy, as well as continuously looking to improve efficiency, 5Blue invests heavily into the latest technological advances in equipment, ensuring a quality product, every time.

Packaged processing systems and components can be fabricated to custom sizes and lengths. The primary assembly bay can accommodate single process modules up to 7.5m wide x 30m long x 6.5m high. It can also accommodate pressure vessels up to 4.3m in diameter and 30m in length, with weights up to 100 tons.

144" x 80' Free Water Knock Out (x2)

144" x 70' Treater Vessel



23' x 100' Treater Skid

QUALITY & SAFETY

QUALITY

5Blue is committed to quality assurance and control from initial design through final delivery and start-up including drawing review, material controls, and regular inspections at each stage of the project.

Quality is a collective team effort and a guiding principle for every employee. A professional team of quality personnel provide oversight to the organization's strong commitment to maintaining high levels of quality. The Quality Team works closely with all departments including Sales, Engineering, Drafting, Purchasing and Fabrication to ensure standards and specifications are met on every project.

All our products must meet the standards set out through participation in programs such as ASME, ANSI, ISO and many others. Our systems can be made from both ferrous and non-ferrous materials and are suitable for use in standard low temperature, high temperature, sour, corrosive and cyclic applications. Current welding procedures are qualified up to 8 inches thick.

Certifications, Codes & Standards:

- ASME Section VIII, Div.1 - Boiler & Pressure Vessel Code
- U - Stamp Certificate Number: 40,338
- ABSA – Quality Control Program Registration No. AQP-1507(S)
- ASME B31.1 and B31.3 - Pressure Piping Code
- CWB Certification – W59: Welded Steel Construction
- CSA Standards W47.1 Certification of Companies For Fusion Welding of Steel
- National Board of Boiler & Pressure Vessel Inspectors
- APEGA Permit to Practice
- API, NACE, AWS, ISP, CSA
- TEMA Heat Exchangers

SAFETY

5Blue is committed to sustaining a healthy and safe work environment for its employees, clients, contractors and the public.

Employees at every level, including management, supervisors and staff are equally responsible and accountable for the company's overall safety initiatives. Complete and active participation by everyone, every day, in every job is necessary to achieve the level of safety excellence 5Blue expects. We are committed to continuous improvement, by utilizing our employees' ideas and recommendations, in accordance with industry standards and best practices, to meet or exceed legislative requirements.

Ongoing safety analysis, education, training and stringent compliance are essential in order to achieve our goal of a zero injury workplace.

Our Safety Program is comprised of the following elements:

- Certificate of Recognition (COR)
- Full time, on-site health and safety representative
- Injury & Accident Prevention
- Job Hazard Analysis
- Safe Work Practices and Procedures
- Industry specific training
- Worksite inspections
- Equipment Maintenance Program
- Personal Protective Equipment and hands on training for use, selection and care
- Emergency Response plan

ENGINEERING & DESIGN CAPABILITIES

5Blue Process Equipment has extensive experience and capabilities in all aspects of process engineering for upstream oil and gas projects worldwide. 5Blue provides multi-discipline engineering services and can take a project from concept to installation.

Our teams are equipped with the latest tools and technologies including; 3D plant design systems, 3D component design and analysis software:

Engineering Services

- Conceptual and front-end engineering design
- Process engineering and design (including reverse engineering)
- Preliminary and detailed design
- Equipment Feasibility studies
- Quick turnaround projects—EPF
- AFE preparation
- Modularization
- Scheduling
- Cost estimating
- Specifications and operating procedures
- Procurement & expediting
- Project engineering management
- Quality & Regulatory Compliance

Engineering Tools and Software

- Compress - Pressure Vessel Design
- S-Frame - Structural Analysis and Design
- Caesar II - Pipe Stress Analysis
- VMG Sim - Process Simulation
- Aspen HYSYS - Process Simulation
- Aspen EDR - Heat Exchanger Design & Rating
- Autodesk AutoCAD - 2D/3D software
- CADWorx Plant Professional - Plant Design and Modeling
- Autodesk Inventor - Mechanical Design & 3D CAD
- Autodesk Navisworks - Project Review & Rendering Software

Amine Sweetening

5Blue Process Equipment Inc. designed amine sweetening systems are based on proven gas sweetening technology.

Gas/Liquid Amine sweetening uses the various types of amines (MEA, DGA, DEA, MDEA) to selectively remove hydrogen sulfide and carbon dioxide from natural gas. When the amine is contacted with the gas at low temperature and high pressure, it absorbs hydrogen sulfide and carbon dioxide. The liquid amine is regenerated by heating it at low pressure, which releases the acid gases. The amine can then be cooled and pressurized for reuse in absorbing more acid gas.

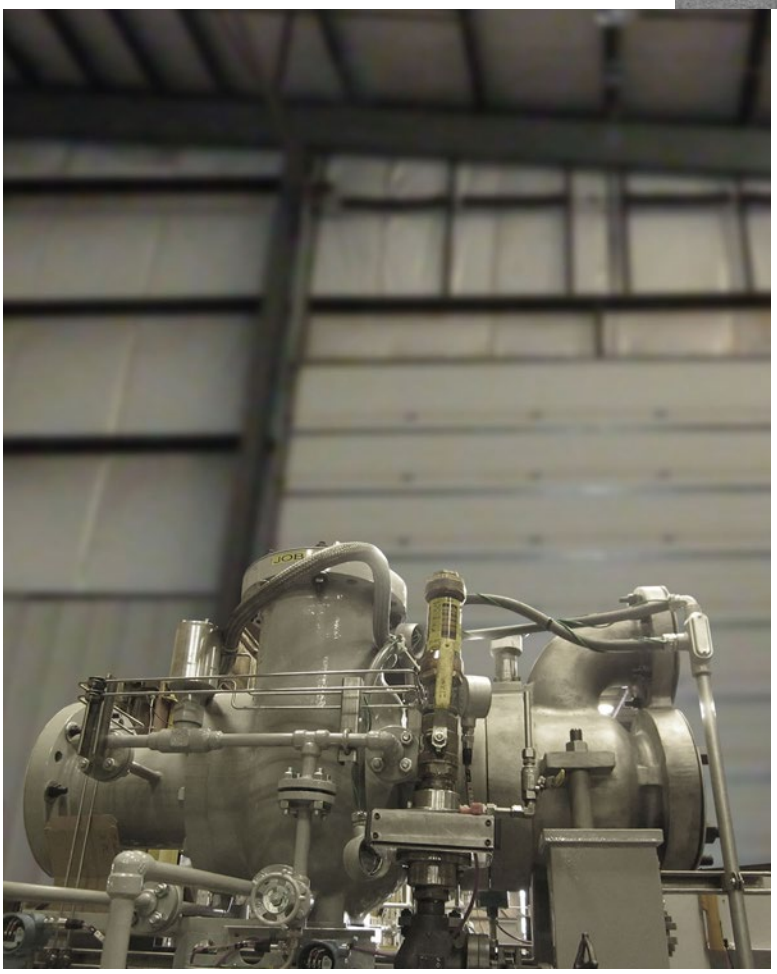
Liquid/liquid Amine sweetening uses the same amines as gas/liquid sweetening, but the product being sweetened is now a liquid hydrocarbon. The two liquids are contacted with each other in a liquid filled tower with random or structured packing. A coalescing vessel is needed to remove any entrained amine from the product stream. The regeneration of the amine is identical to the regeneration of a gas/liquid system.

Mechanical Refrigeration

Mechanical refrigeration for natural gas processing can be used in attaining a variety of outlet gas and liquid conditions. Commonly, it is used for controlling hydrocarbon dew point or recovery of heavier hydrocarbon components such as C3, C4 & C5+ from the inlet natural gas stream.

The raw natural gas is pre-cooled in a gas/gas exchanger and is then further cooled in a propane chiller to condense the heavier components. After the condensables are collected they are distilled to produce typically pentane plus or propane plus liquid.

Optional dehydration process can be used with an ethylene glycol/water mixture to suppress hydrate formation and achieve an outlet water content specification.



Turbo Expander

A turbo-expander is a centrifugal or axial flow turbine through which a high pressure gas is expanded to produce work that is often used to drive a compressor. As the work is extracted from the expanding high pressure gas, the expansion occurs in an isentropic process i.e., a constant entropy process and the low pressure exhaust gas from the turbine is at a very low temperature such as −150 °C and often known as cryogenic temperature.

Turbo-expanders are very widely used as sources of extreme refrigeration in industrial / cryogenic processes such as natural gas liquids (NGLs)/ LPG recovery from natural gas.

Produced Water Treatment

5Blue provides a full range of treatment solutions for removing oil and suspended solids from produced water with primary, secondary and tertiary treatment. We help the customer to recover oil and reduce disposal costs whether shipping it offsite or reinjecting on facility location.

Deoiling and desanding water product is based on a hydro-cyclone system. Depending on project requirement or customer choice we select internals (deoiling & desanding liners and holding plates).

As a primary treatment process we use CPI (Corrugated Plate Interceptor) Separator to remove free oil and solids and for secondary and tertiary we use Induced Gas Floatation Unit (IGF) & Walnut Shell Filters (WSF) respectively.

The oily water is transferred by positive displacement pumps to the inlet of the CPI Oil/Water Separator, where free oils are removed. The CPI Oil Separator comprises, first, a solids settlement chamber to allow solids to settle. These solids are removed by sand washing equipment. Secondly, the oil separator has the coalescence plates chamber with special internals installed where free oils are removed.

With special horizontal wave plate pack separators, the oily water always goes through the corrugated plates colliding with each wave section of the corrugated plates. The separation efficiencies are maintained even with increased back pressure due to algae and bacteria growth.

Due to the fact that corrugated plates are stacked on top of each other and the resulting shape (tapered at the corrugation ridges and extended at the corrugation peaks and valleys) the oil-containing water moves along the corrugated plates at varying speed.

This results in additional particle collisions which enable larger (slower) and smaller (faster) oil droplets to coalesce. As droplets become bigger, due to these particle collisions, they accelerate their upward movement, hence they are subsequently trapped by the corrugated plates

Water with residual dispersed oil content flows onwards under pressure to the Induced Gas Floatation (IGF) Unit. Here micro-fine gas bubbles are used for coalescing fine oil droplets and reducing the emulsified oils. The suspended solids are also reduced with the IGF unit. The processed water from the IGF unit is transferred by centrifugal pumps for final “POLISHING” to the Walnut Shell Filters (WSF). WSF or AC filters are used for final polishing, they are fed by the automatically operated feed pumps. A redundant standby filter can be activated during times, when other filters are undergoing maintenance or are being back-flushed.

TEG Dehydration

Water vapour present in natural gas streams has many adverse effects including liquid slug formation, ice and/or hydrate formation and eventually corrosion in downstream equipment and pipelines. Tri-Ethylene Glycol Dehydration (TEG) units are the most common system employed to remove water from the gas stream.

The wet gas is brought into contact with lean glycol in an absorber. Water vapour is absorbed in the glycol and subsequently reduces the gas dew point. The rich glycol then flows from the absorber to a regeneration system in which the entrained water is removed in a reboiler. The heating boils off the absorbed water vapour and the lean glycol is cooled and pumped back to the absorber tower.

Our designs can incorporate BTEX emissions reduction, low dew point requirements, and simultaneous hydrocarbon dew point control with the addition of Selexol™.

Common practice is to use TEG dehydration units at the wellhead downstream of an amine plant, storage, compression and/or gas processing facilities. Our TEG dehydration units are designed skid-mounted for simple installation and future mobility.

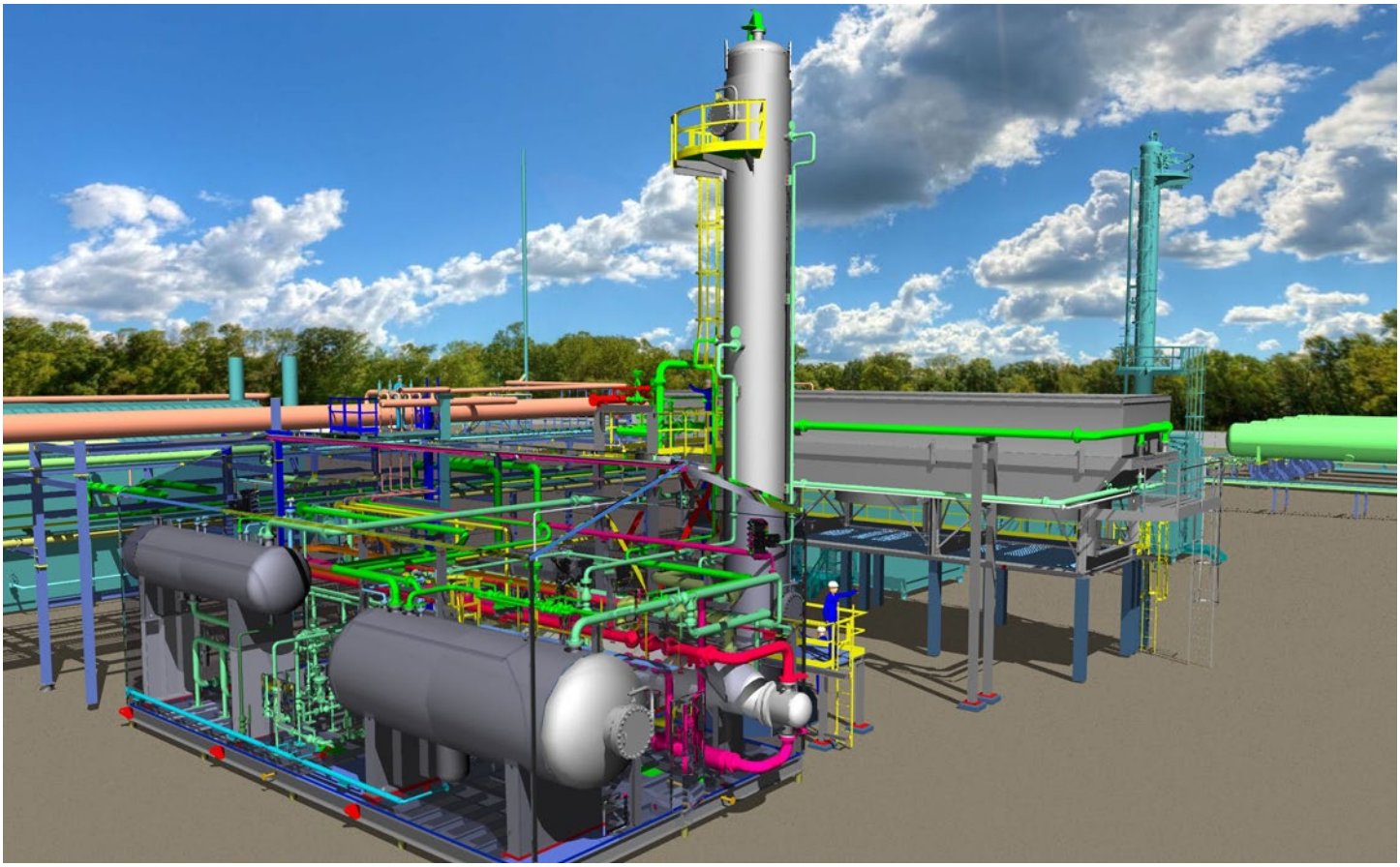
Mole Sieve

Mole sieve dehydration units provide an effective means to remove water vapour from a natural gas stream. Achieving cryogenic temperatures (-50°F and less) in natural gas processing requires the inlet gas to be free of water vapour. High water vapour can freeze at low temperature forming hydrates, and these hydrates will be problematic in a cryogenic process. Use of a mole sieve is an effective method to combat this issue.

5Blue Process Equipment Inc. has designed & supplied many Mole Sieve Units using various types of mole sieve media. The sieve media consists of a silicate compound containing very small pores of precise uniform size. The space between the silicate molecules act as a "trap" for the water vapour or others as it passes through the silicate. Basic design consists of two or more identical mole sieve towers. In a simple two-tower design, one tower operates in adsorption mode while the other in regeneration mode. Switching from adsorption to regeneration is done by use of automatic switching valves. As the active tower becomes saturated, it is automatically switched to regeneration mode while the regenerated unit now becomes active in adsorption mode.

Our mole sieve units are also skid-mounted for simple installation and future mobility.

DEBUTANIZER PACKAGE



TREATER PACKAGE FOR INLET FACILITIES

PUMP PACKAGE

5Blue Process Equipment Inc. has designed and supplied various types of pump packages. The photograph refers to pump packages completed in 2016 supplied to a client in the Sinai Gas Fields of Egypt.

These pumps have a flow capacity of 77.0 Cubic meter per hour with a discharge design pressure of 21 barg.

Other pump packages range in size from less than 1 gpm to greater than 2000 gpm. The services include cryogenic, reflux, lean amine, hydrocarbon, glycol and produced water injection systems.

CONDENSATE STABILIZATION

5Blue Process Equipment Inc. has also supplied ten (10) Condensate Stabilizer Packages during the course of the last three years. They range in size from 2,500 to 20,000 BPD capacity. We will now be supplying these units to clients in the Middle East.

Stabilization of Natural Gas Liquids (NGLs) refers to the flashing off of volatile hydrocarbon vapours from the liquid mixture under controlled conditions i.e. pressure 35 to 100 psig and temperature 100°F to 400°F.

The liquid condensate enters the stabilization unit after upstream separation. The incoming liquid is first preheated in the inlet heat exchanger and then flows into the upper section of the stabilizer tower. Inside the tower, the lighter components- typically methane, and ethane rise and exit through the overhead vapour outlet. The heavier liquid components descend and pass through the indirect heater to enable additional vapour to flash off, rise and exit the tower. Stabilized liquids are collected at the bottom of the tower and finally they are routed to the inlet heat exchanger to cool before they flow to storage tanks.

TEAM EXPERIENCE

Natural Gas Dehydration

Bangladesh Bibiyana Project - TEG Dehydration ..... (4) x 150 MMSCFD (each)
Bangladesh MB Project - TEG Dehydration ..... 110 MMSCFD
Bangladesh - TEG Dehydration ..... 150 MMSCFD
Liard Dehydration Station ..... 75 MMSCFD
Cabin Lake Gas Plant ..... 200 MMSCFD
Carmon Creek - Dehydration Unit (Acid Gas) ..... 2.8 MMSCFD
Weyburn CO2 Capture-Molecular Sieve ..... 2 - 4' x 30' Towers
Old Man Gas Plant Molecular Sieve Package ..... 3 – 5' x 24' Tower

Metering Units

Sales Gas/Condensate Metering Package ..... 80 MMSCFD CL 1500
Sales Gas Meter Package ..... 100 MMSCFD CL 600
Kiwigana-Sales Metering Package ..... 30 MMSCFD CL 2500
Blair Creek Gas Plant, Sales Gas Metering Package ..... 50 MMSCFD CL 600

Natural Gas And Liquid H2S And CO2 Removal

Oman - Amine Sweetening ..... 150 gpm, 100 MMSCFD
Northern Alberta - Amine Sweetening ..... 110 gpm, 80 MSCFD
US - Amine Sweetening ..... 600 gpm, 90 MMSCFD
Pakistan - Amine Sweetening Package Block 22 ..... 45 gpm, 20 MMSCFD
Birch Compressor Station - Amine Sweetening ..... 5.5 gpm, 2.2 MMSCFD
Cabin Lake Gas Plant - Amine Sweetening ..... 2200 gpm, 200 MMSCFD
Northern Alberta - Liquid C3+ Amine Sweetening ..... 535 gpm
Northern Alberta - Liquid C3+ Amine Sweetening ..... 60 gpm

Fractionation, Stabilization, Dew Point Control & NGL Recovery

Northern B.C. - De-Butanizer Package ..... 7,000 BPD
LPG Recovery Project, Indonesia - Turbo Expander ..... 66 MMSCFD, 650 BPD Cond ..... 230 MT/D LPG
Abu Tubul - Refrigeration Plant and Stabilization ..... 90 MMSCFD and 8000 BPD
Pakistan - TEG Dehydration, HCDP & Condensate Stab ..... 150 MMSCFD, 3000 BPD Cond
Indonesia-Mechanical Refrigeration, LPG Recovery ..... 60 MMSCFD, 350 BPD Cond ..... 1200 BPD LPG
Pakistan - Mechanical Refrigeration ..... 150 MMSCFD, 3000 BPD Cond
Egypt - Turbo Expander, LPG Recovery ..... 160 MMSCFD, 5000 BPD Cond ..... 3000 BPD LPG
Ecuador - Tarapoa Facility, HCDP and Frac Train ..... 80,000 BPD (Feed)
Pakistan - Zamzama EWT HCDP Unit and Dehy ..... 70.0 MMSCFD
Lator Gas Plant- De-Ethanizer & Stabilizer Exp ..... 4500 BPD Cond 2500 BPD
Kaybob Gas Plant Phase 2 - Condensate Stabilizers ..... 5000 BPD, (two trains)
Kaybob Gas Plant Phase 1 - Condensate Stabilizers ..... 5000 BPD
Simonette Gas Plant - Condensate Stabilizers ..... 5000 BPD

Separation Systems

Saskatchewan - FWKO Package ..... 144" ID x 80'-0" S/S, (four trains)
Saskatchewan - Treater Package ..... 144" ID x 70-0" S/S
Ferrier Gas Plant - Oil Treater &FWKO ..... 5500 BPD
Saskatchewan - FWKO Package ..... 120" OD x 50'-0" S/S
Saskatchewan - FWKO Package ..... 120" ID x 40'-0" S/S

5BLUE PRODUCT RANGE (PACKAGES & PRODUCTS)

SEPARATION SYSTEMS

- ⇒ Slug Catchers
- ⇒ Two/Three Phase Separators (Vertical/Horizontal)
- ⇒ Test and Group Separators
- ⇒ Multi-Cyclone Separators
- ⇒ Gas Coalescing Filtration

NATURAL GAS AND HYDROCARBON LIQUID H2S AND CO2 REMOVAL

- ⇒ Amine Sweetening
- ⇒ Molecular Sieve Sweetening for ultra-low H2S or CO2 removal
- ⇒ H2S Scavenger

FRACTIONATION AND STABILIZATION

- ⇒ De-Methanizers
- ⇒ De-Ethanizers
- ⇒ De-Propanizers
- ⇒ De-Butanizers
- ⇒ Condensate Stabilization
- ⇒ LPG/Propane Recovery Systems c/w Fractionation Trains

PROCESS AND THERMAL FLUID HEATERS

- ⇒ Line Heaters
- ⇒ Heat Medium Heaters
- ⇒ Salt Bath Heaters

METERING UNITS

- ⇒ Custody Transfer Metering Units- Orifice/Ultrasonic/Turbine Metering Systems

OIL TREATING AND UPGRADING

- ⇒ Heater Treaters
- ⇒ Electrostatic Treaters
- ⇒ Desalter Systems
- ⇒ Free Water Knockouts
- ⇒ Crude Stabilization and Vacuum Distillation

NATURAL GAS DEHYDRATION

- ⇒ Tri-Ethylene Glycol (TEG) Dehydration
- ⇒ Molecular Sieve Dehydration

HYDROCARBON DEW POINT CONTROL/ NGL RECOVERY SYSTEMS

- ⇒ Mechanical Refrigeration
- ⇒ Joule-Thompson (JT) Valves and Low Temp Separation (LTS)
- ⇒ MEG Injection & Regeneration Systems
- ⇒ Cryogenic Gas Processing c/w Turbo-Expander/ Compressors

PUMP UNITS/PACKAGES

- ⇒ Water Injection
- ⇒ Disposal Well Injection
- ⇒ Plant Fire Water Pump Packages
- ⇒ Chemical Injection Pump Packages

FLARE SYSTEMS

- ⇒ Flare Knock-out Drums
- ⇒ Flare Study and System Design

WATER TREATMENT PACKAGES

- ⇒ Well Site Produced Water Treatment Systems

LMF COMPRESSION PRODUCTS

- ⇒ Authorized distributor and packager

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Engineering, Design & Fabrication of Oil and Gas Processing Facilities

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