

PeopleCore Training Model



Training Material Overview

System Drawings

System Modules

Process Control Drawings

Process Control Modules

Equipment Modules

Process Technology

Facility Overview

Duties

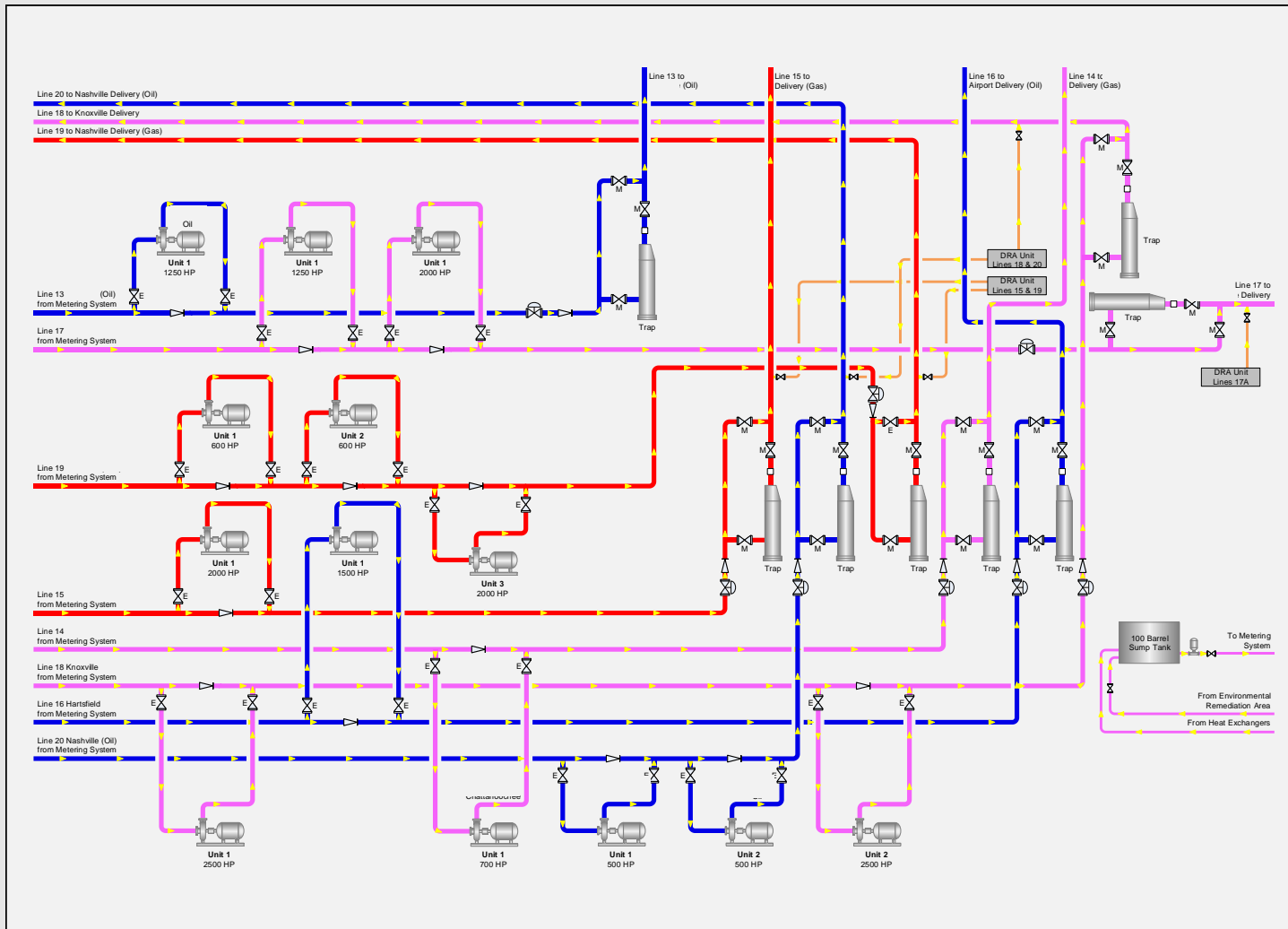
One-Pagers

Controller Training

Procedures

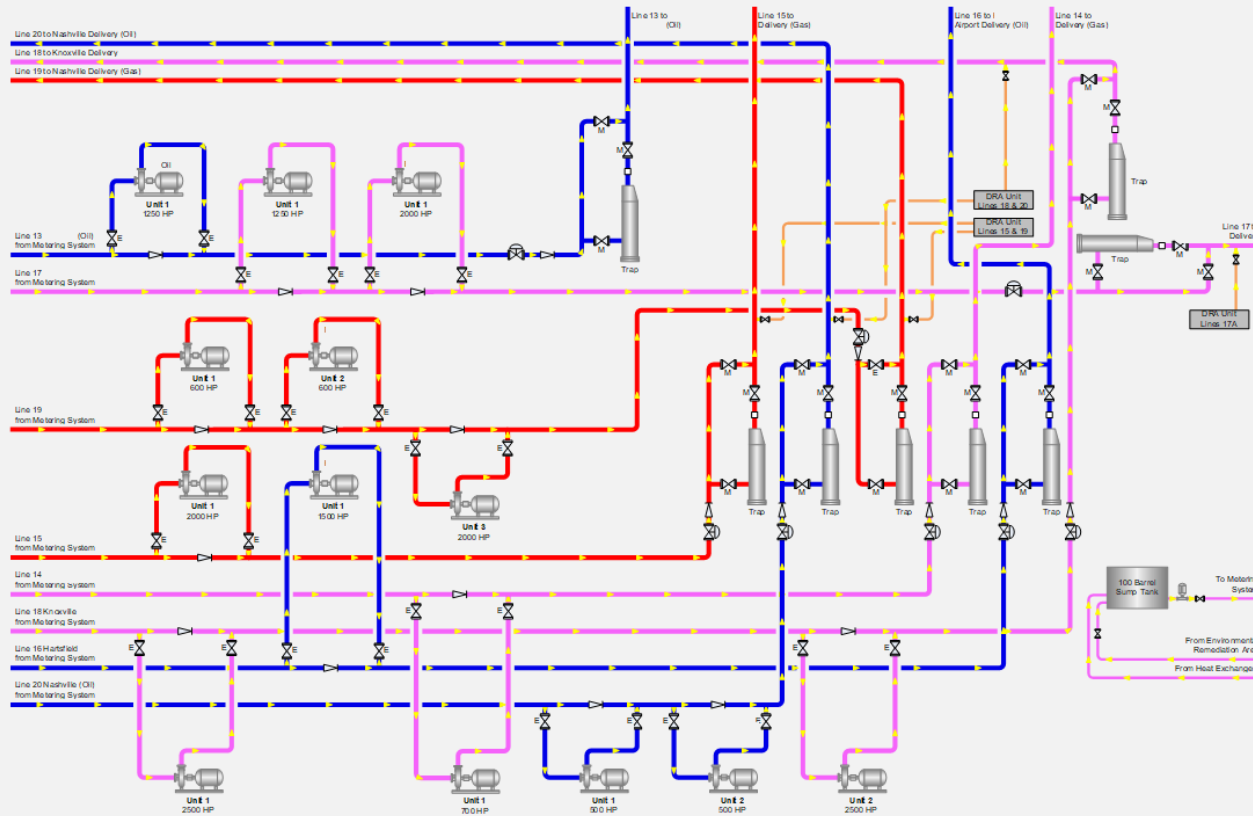


System Drawing



- Developed from Piping and Instrumentation Diagrams (P&IDs)
- Focuses on main process flow
- Major and minor lines
- Directional flow arrows
- Line colors to differentiate material
- Equipment (with name and tag numbers)

System Module



Stub Line System

Overview:

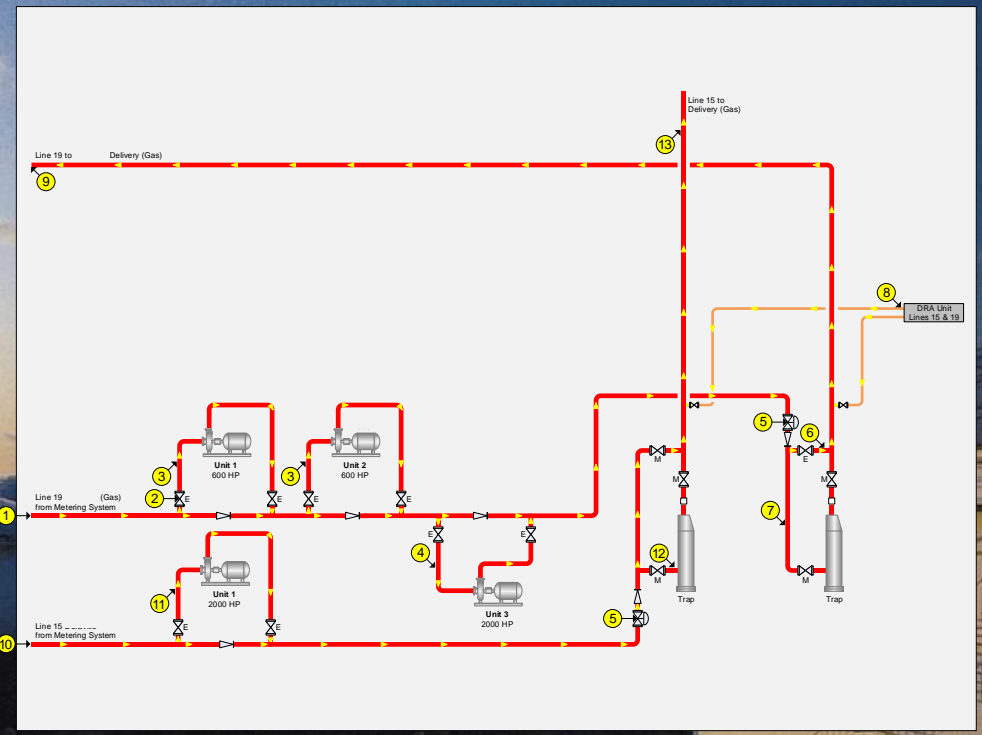
A Stub Line is a relatively short pipeline that supplies product from Atlanta Junction to the delivery location.

In the Stub Line System, there are three Stub Line Subsystems: Gas, Oil, and Mixed Stub Line. These subsystems contain product stub lines that run through the Atlanta Junction facility.

The Gas and Oil Stub Line Subsystems supply gas and oil product from the Product Tanks, respectively. The Mixed Stub Line Subsystem contains stub lines that can transport either gas or oil product from the tanks for delivery.

- Developed based on the System Drawing, which was redlined by the Client
- Provides detailed descriptions of the process flow
- Illustrates the interaction between the equipment in the system
- Explains why the system is important

Overview:
 The Gas Stub Line Subsystem contains the _____ and _____ Stub Lines. The Nashville Stub Line starts as a 12" diameter line and transports product from _____ to the _____ Delivery Facility _____ miles away. The _____ Stub Line starts as a 12" diameter line that supplies product _____ miles away to the _____ Delivery Facility. Both stub lines are one directional lines to _____ and _____ respectively. The maximum delivery rate from _____ to _____ is 5,800 bph. The maximum delivery rate from _____ to _____ is 5,100 bph.



Gas Stub Line Subsystem

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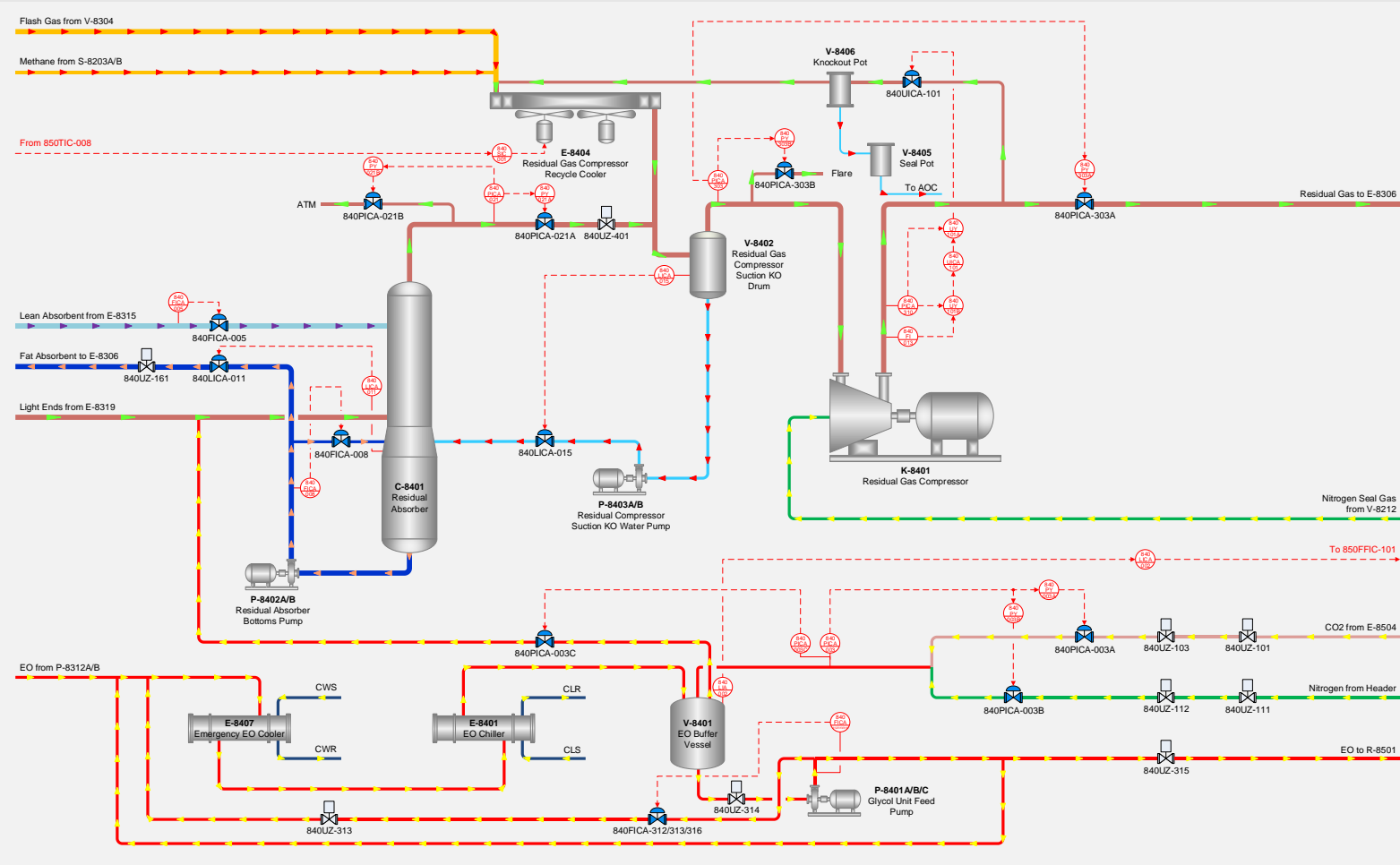
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System Module - Subsystems

- System Drawing broken into subsystems
- Subsystems provide an overview and purpose of a portion of the process flow
- Explains how each subsystem fits into the bigger system
- Uses nodes to identify important aspects in the subsystem and their purpose

Process Control Drawing

- Developed based on the P&IDs
- Used as a building block for the Process Control Modules
- Visual representation of the control loops in the system
- Represents how process flow and process control are related
- Include flow, level, temperature, and pressure controllers
- Illustrate Simple, Cascade, Split Range, and Complex Loops



Controller 840PICA-003 controls the pressure in the EO Buffer Vessel (V-8401). The pressure is controlled using three control valves in a split range configuration. The desired set point is entered into controller 840PICA-003. The pressure is measured by controller transmitter 840PTCA-003. In response to a difference between the measured pressure and the set point, 840PICA-003 manipulates control valves PICA-003A/B/C.

If the pressure in V-8401 is very low, controller 840PICA-003 opens control valve 840PICA-003B, allowing nitrogen into the vessel. This will increase the pressure in V-8401 in order to meet the set point.

If the pressure in V-8401 is low, controller 840PICA-003 opens control valve 840PICA-003A, allowing CO₂ to enter the vessel. This will increase the pressure in V-8401 in order to meet the set point.

If the pressure in V-8401 is above the set point, controller 840PICA-003 will open control valve 840PICA-003C. This will vent high pressure gas from the vessel to the Residual Absorber (C-8401) feed in order to meet the set point.

Purpose:
The objective of the pressure controller 840PICA-003 is to maintain the pressure in the EO Buffer Vessel.

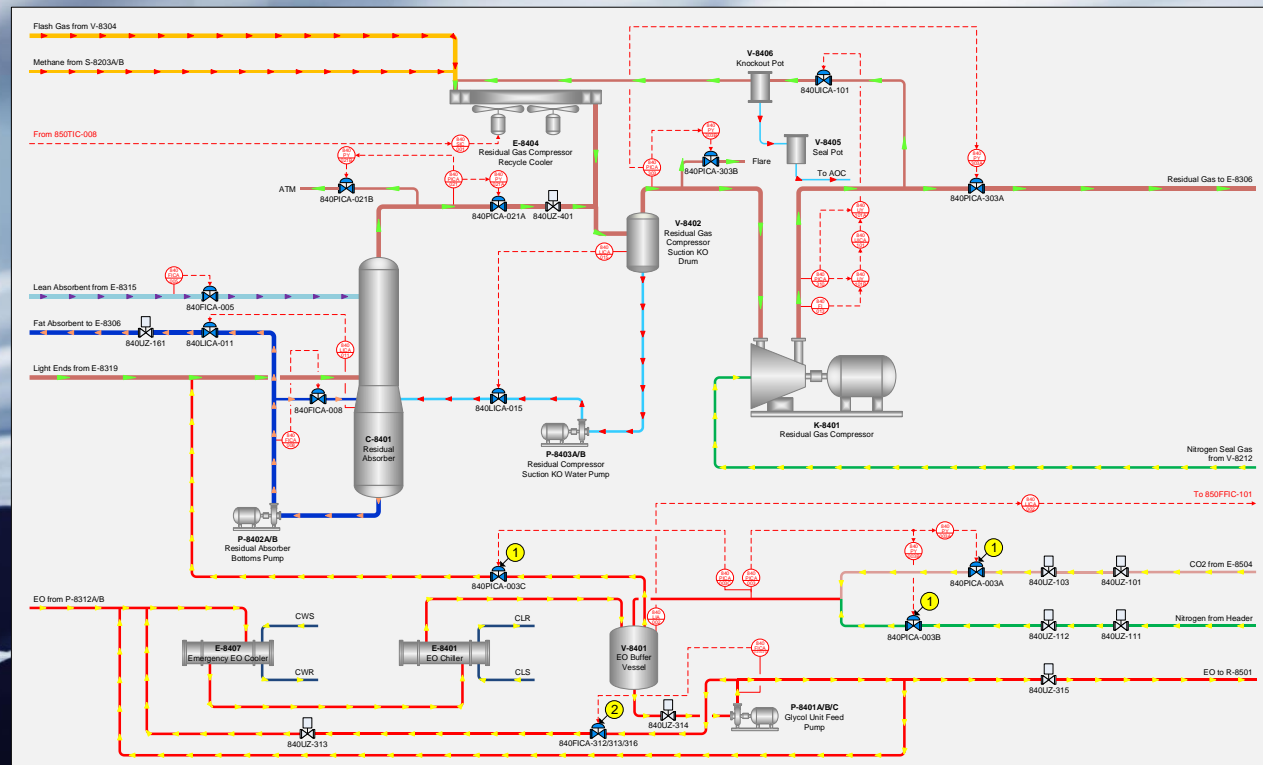
Controller 840FICA-312/313/316 controls the minimum flow rate through the Glycol Unit Feed Pump (P-8401A/B/C). The desired set point is entered into controller transmitters 840FICA-312/313/316, located on the discharge of P-8401A/B/C. In response to a difference between the measured flow rate and the set point, controllers 840FICA-312/313/316 manipulate control valves 840FICA-312/313/316. This adjusts the flow rate through the Glycol Unit Feed Pump in order to maintain the minimum flow requirement.

Purpose:
Minimum flow protection prevents the pumps from cavitating.

--- Instrument Signal
 --- Software Link
 --- Connection to Process

Overview:

The instruments in the Light End Removal System control the following: pressure and level in the EO Buffer Vessel, minimum flow rate through the Glycol Unit Feed Pumps, feed flow rate to the Residual Absorber, pressure and level in the Residual Gas Compressor Suction KO Drum, discharge pressure from the Residual Gas Compressor, and temperature of flash gas.



Light End Removal System

Process Control Module

- Explains the function and purpose of process controllers under normal operation
- Provides the operator with visual representation of how the process is controlled
- Provides detailed description of the components and logic behind each control loop in the system

Vertical Inline Centrifugal Pump

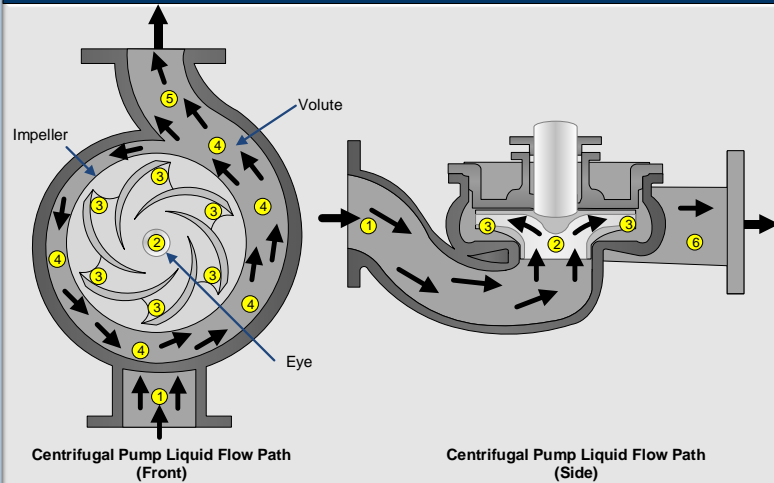


Various pumps are used in centrifugal, sump, and positive displacement. This image shows a vertically mounted, single stage, centrifugal pump. All centrifugal pumps operate using the principles discussed, regardless of shape, size, number of stages, or orientation.

How It Works


- 1 Liquid is forced into the suction of the centrifugal compressor.
 - 2 Upon entering the pump, the liquid is directed into the eye of the impeller.
- As the liquid enters the impeller, which is mounted on a shaft and driven by the motor, the rotation of the impeller accelerates the fluid outward. The fluid discharges from the periphery of the impeller at high velocity due to centrifugal force.
- 3
 - 4
- Upon exiting the top of the impeller, fluid flows toward the pump volute along the walls of the pump case. The volute increases in area for fluid flow, decreasing the speed of the liquid stream. The reduction of speed converts the kinetic energy of the fluid (obtained via the impeller) to potential energy (pressure).
- 5
 - 6
- The moving, higher pressure liquid approaches the discharge nozzle and is directed through the nozzle by the shape of the pump case.
- As the pressure energy builds within the pump casing, the pump begins to develop head (a liquid column). As the pump spins, the level of the liquid column constantly increases. Eventually, the top of the liquid column reaches the discharge piping outlet, and the liquid begins to flow.

Drawing



Monitoring

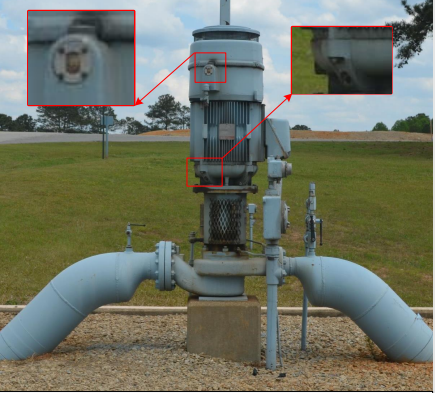
Bearing Oil Levels



Bearing Oil Level

Oil level is monitored through the oil sight glass that is affixed to the side of the bearing housing. Oil is necessary for any rotating equipment to operate. Lack of oil or contaminated oil will cause machine failure.

Refer to the System Operating Pressure Limits (SOPL) on the server to determine the pressure requirements for each line.



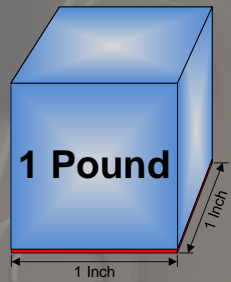
Bearing Oil Level

Equipment Module

- Developed based on detailed equipment drawings
- Illustrates the internal components of equipment
- Provides an overview and purpose of the equipment and its internal components
- Explains how it works
- Provides the monitoring points

Overview:

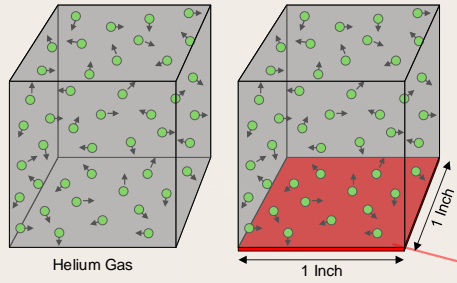
Compression is the process of increasing gas pressure by reducing the volume of the container in which the gas is held. In order to learn about Compression Technology, you must first understand pressure. Pressure is the amount of force acting on a certain area. The figures and text below will help you to understand the concept of pressure.



Pressure is the measurement of the force applied to a certain area. Another term for force is weight. This means that your weight divided by the area of your feet is the pressure that you exert on the ground as you stand still.

Similarly, a one pound bottomless box filled with water resting on a 1 square inch surface (red), exerts an average pressure of one pound per square inch, or 1 PSI.

Pressure



The water in the blue box is emptied and the box is filled with helium gas. Gas is made up of countless molecules (green circles) constantly traveling through the space inside of a container. As the gas molecules move inside of the container, they collide with the walls of the container and each other. These collisions exert a force on the inner surface of the container.

Instead of the weight of water exerting a force on the red area, the constant collision of countless helium molecules now exerts a force on the red area. If the total force of all of the gas molecule collisions on the red surface at any time is one pound, the pressure exerted on the bottom of the container is one pound per square inch.



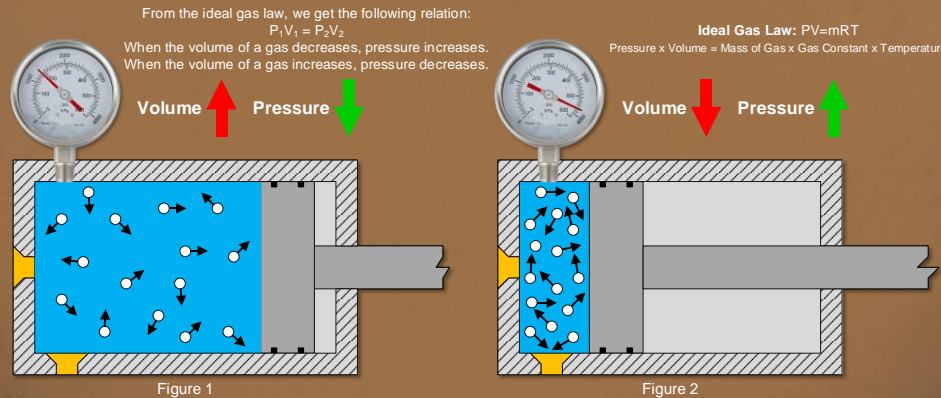
Gas Pressure Inside of a Container

As mentioned above, gas is made up of countless molecules traveling through the space inside of a container. In the Figure 1, the container happens to be a compressor cylinder that is sealed with a piston and valves.

The gas contained in the compressor is at a constant pressure and temperature. The space inside of the cylinder is the same as volume of the gas.

At these conditions, the gas molecules are constantly moving around inside of the cylinder. As the gas molecules move inside of the cylinder, they collide with the walls of the cylinder, the top of the piston, and each other. These collisions exert a force on the inner surface of the cylinder and on the top surface of the piston.

This force applied by the gas molecules over the entire inner surface of the cylinder is the gas pressure. Pressure is simply the force that is applied to a certain area. In most cases, it is in units of pounds per square inch.



When the pressure of gas must be increased, there are a few ways to do so. You can either add more gas to the container, heat the gas in the container, or the most common way is to reduce the volume of the container.

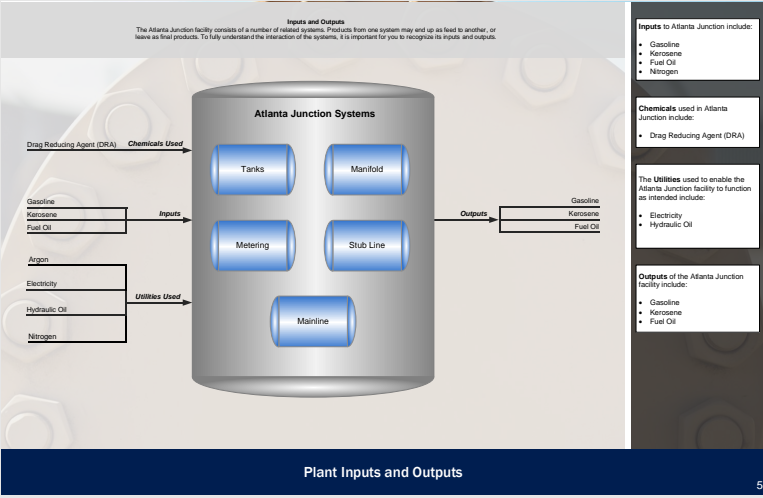
In the figure to the left, the volume inside of the cylinder is decreased by the piston moving forward. When this occurs, the pressure increases because there is the same amount of gas in a much smaller space.

Since the gas molecules don't have to travel as far to collide with the walls, there are many more collisions at any time. This means that there is more force applied to the inside surface of the cylinder. More force applied to any certain area results in a higher pressure.

Compression Technology

Process Technology

- Provides the operators with a basic understanding of chemistry and physics behind major technologies utilized in the facility or unit
- Allows the operator to build on the knowledge of how system processes work
- Discusses operational relationships
- Example technologies: compression, fractionation, absorption, adsorption, neutralization



Centrifugal Pump
Centrifugal pumps are used to move liquid streams throughout the facility. The spinning impeller on the pump gives the liquid velocity energy. Velocity is converted to pressure as the liquid leaves the pump. This increased pressure drives the liquid to flow to its lower pressure destination. Centrifugal pumps are useful for moving liquids at high flow rates with a low to moderate pressure increase.

Oil/Water Separator
Oil/Water Separators are vessels that rely on the differences in specific gravity to remove oils, scum, and solids from wastewater. Due to the different specific gravities, oil will naturally float on top of the water, while heavier solids will sink to the bottom.

Strainer
Strainers are filtering devices that remove particles and debris from the system flow path and protect downstream equipment. The strainers contain a fine mesh, removable basket sized to remove larger particles from the liquid stream.

Equipment

Facility/Unit Overview

- Provides a brief overview of the facility
- Discusses facility inputs and outputs
- Briefly discusses the types of equipment used in the facility
- Depicts a simplified flow through the facility
- Discusses material and physical hazards
- Discusses general safety and health considerations associated with the facility

Safety Data Sheets (SDSs)

Overview:

Purpose: Safety Data Sheets (SDSs) consist of pertinent information about the chemicals found in Exxon's facilities and the hazards associated with them.

Uses: Safety Data Sheets allow employees to be prepared for the hazards associated with chemicals before they come into contact with them out in the field. In the event of a spill or injury, the information in these documents will give employees and first responders the required knowledge of the chemicals and their properties in order to handle the situation appropriately.

Format: Unlike the former Material Safety Data Sheets (MSDSs), SDSs are displayed in a uniform format and include the following 16 sections. An (F) denotes a non-mandatory section of the SDS.

Section 1: Identification
Section 2: Hazard(s) Identification
Section 3: Composition/Information on Ingredients
Section 4: First-Aid Measures
Section 5: Fire-Fighting Measures
Section 6: Accidental Release Measures
Section 7: Handling and Storage
Section 8: Exposure Controls/Personal Protection

Section 9: Physical and Chemical Properties
Section 10: Stability and Reactivity
Section 11: Toxicological Information
Section 12: Ecological Information*
Section 13: Disposal Information*
Section 14: Transport Information*
Section 15: Regulatory Information*
Section 16: Other information

Location: Safety Data Sheets for all of Exxon's facilities are maintained online.

The NFPA diamond is broken into four colored sections, each representing a specific hazard: Health, Flammability, and Instability are rated numerically, and special hazards are identified with symbols or abbreviations.

Numbers in the three colored sections range from 0 to 4 with the following definitions:
0 = Minimal 1 = Slight 2 = Moderate
3 = Serious 4 = Severe

1. Highly toxic, may be fatal on contact with skin
2. Fatal or toxic on contact with skin
3. Irritating to skin
4. No hazard to skin

1. Flammable gases, liquids, or solids (F+)
2. Flammable liquids (F)
3. Combustible liquids (C)
4. Non-flammable, non-combustible (N)

1. Explosive
2. Highly reactive
3. Unstable (may undergo a violent chemical change)
4. No special hazard

1. Oxidizer
2. Corrosive
3. Toxic
4. Irritant

Material Hazards

Material	CAS Number(s)	NFPA Ratings	Major Hazards	Special PPE/Controls	Location
Fuel Oil	CAS: 64741-52-4	2, 2, 1	Combustible liquid. May cause cancer from prolonged and repeated skin contact. May damage fertility or the unborn child. May cause damage to liver, kidney and nervous system through prolonged or repeated exposure. Harmful if inhaled. Harmful to aquatic life. Skin and eye irritant. May contain and release toxic hydrogen sulfide (H ₂ S) gas.	Use adequate ventilation to keep gas and vapor concentrations below occupational exposure and flammability limits, particularly in confined spaces. Wear safety glasses if splashes are possible. Chemical protective clothing recommended based on degree of exposure. If hydrogen sulfide concentrations may exceed permissible exposure limit, a positive-pressure SCBA or Type C respirator with canister and access to fresh air is required. If necessary, protection. Permissible exposure limit is below permissible exposure limit a MOCDS, MOCDS-approved air-purifying respirator with acid gas cartridges may be acceptable for odor control, but continuous air flow monitoring for H ₂ S is recommended.	Multiple

Physical Hazards

Overview:
A Physical Hazard is defined as "A factor within the environment that can harm the body without necessarily touching it."
Physical hazards include, but aren't limited to, electricity, radiation, pressure, and heights amongst many others.
The Atlanta Junction contains multiple physical hazards. They can cause harm to yourself or your co-workers, if not controlled. The main physical hazards found are summarized in the table to the right. Through awareness and paying attention to your surroundings, you can apply the appropriate controls to keep everyone safe.

Physical Hazards

Hazard	Explanation	Major Hazard	Control
High Pressure	Pressure is present whenever there is a need to move a material, cause or lower a boiling point, or affect the state of a material (solid, liquid, gas).	Exposure to pressures over 400 psig could cause severe damage to the employee depending on the length of exposure. The results could be as simple as causing the loss of balance, or as severe as the amputation of a limb, or rupture of internal organs if the gas or air hits the bloodstream. Compression of a tire or vessel could cause a catastrophic failure of a system, release of hazardous material, fire, explosion, etc.	Be aware that material being released from piping could be under high pressure, and approach with caution. Ensure that all Pressure Relief Valves are in proper functioning, and that valves are closed when not in use. Do not open or face a blocked valve until it is safe to do so. Open all valves slowly to avoid a sudden release of pressure.
Elevated Platforms	Elevated platforms are in place to allow access to all parts of the facility. These platforms can present some unique hazards as weather conditions change.	Elevated platforms may cause personnel to slip as the surfaces become slick. Tripping may also cause injury due to the height of the platform.	Check the surface for debris, oil, water or other substances. Ensure that any ladder safety bar or chain is in place and that the railing is secure.
Rotating Equipment	Rotating equipment, such as centrifugal pumps and compressors, can be deadly because of their motion.	Rotating equipment or apparatus can trap clothing, hair or body parts.	Do not use a piece of equipment until you are instructed to do proper use. Do not remove guards or safety interlocks. Use the appropriate personal protective devices: glasses, gloves, goggles or face shield. Use approved tag, and try procedures before working on equipment.
Heat Stress	If air temperature is as warm as or warmer than the skin, blood brought to the body surface cannot lose its heat. Under these conditions, the heat continues to pump blood to the body surface. With much blood going to the external surface of the body, heavily branched outer blood vessels, the result, through dilation and fatigue occurs faster than a normal offset. Alertness and mental capacity may also be affected and lower an individual's comprehension and retention of information.	Due to an individual's loss of alertness and mental capacity, the frequency of accidents increases during prolonged periods of hot, humid weather. The health effects of prolonged exposure to hot environments range from dizziness to heat stroke, and possible death.	When feasible, the most stressful tasks should be performed during the cooler parts of the day (early morning or at night). Rest periods should be scheduled to alleviate the increase in the body heat load. Drink plenty of water, about 1 cup every 15 minutes. Avoid caffeinated drinks or heavy meals.

Physical Hazards

Overview:

The American Petroleum Institute (API) Gravity Test is performed at Pipeline in order to compare the density of an oil product sample to that of water. API Gravity is unitless but is often referred to as having units of temperature (°F). This test is performed in the Atlanta Junction Lab Building once a shift to compare against the API gravity value in the control room, during every batch change, and when tank products are switched.

Materials Required

- API Correction to 60°F Chart
- Hydrometer
- Stopwatch or clock
- Sample well

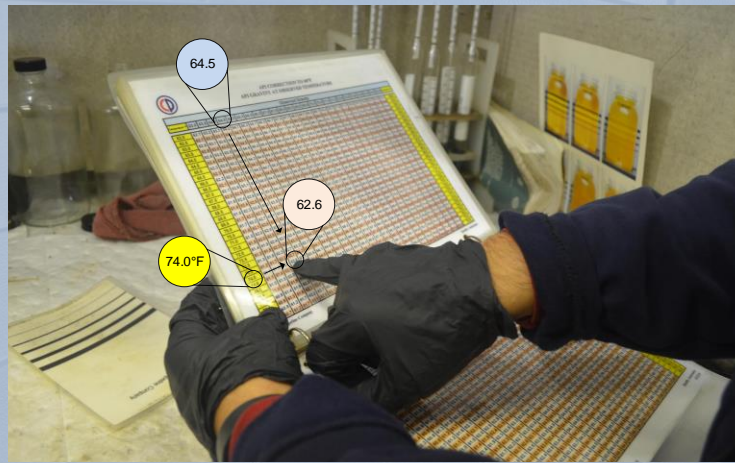
Preparing the Sample



- 1 In the hood, open the ball valve for the line being sampled. Allow the product to fill the sample well.
- 2 Choose a hydrometer that will measure gravity in the expected product range. Carefully slip the hydrometer into the sample well.
- 3 Flush the sample by allowing fresh product to flow through the sample well for 2-3 minutes. This will ensure a representative sample.
- 4 The hydrometer will bob up and down in the cylinder as the sample is flushed.
- 5 Shut off product flow through the cylinder. Allow the hydrometer to stabilize.

Reading and Correcting the Observed API Gravity

- 6 Once the hydrometer stops bobbing, read the gravity at the top of the liquid level, as well as the temperature.
- 7 Obtain the API Correction to 60°F Chart. Because API gravity is temperature dependent, the observed API gravity measurement must be corrected to a temperature of 60°F. Temperature is located on the left or right side of the chart (y axis), and observed gravity is located on the top of the chart (x axis).
- 8 Using the chart, find the temperature recorded in Step 6. Then, locate the recorded observed gravity value along the top of the chart. The cell at which the temperature row and observed gravity column meet will show the corrected API gravity.
- 9 Record the API gravity value. This value will later be compared to the API gravity value in the control room to ensure consistency of product.
- 10 Place the ball valve in the closed position. Drain the sample, and remove the hydrometer.



API Gravity Measurement

Duties

- Used as a job aid to provide step-by-step instructions on how to perform specific tasks
- Includes the materials needed to perform the task, instructions, and associated pictures to guide the operator

Brodie Relief Valves



The Brodie Relief Valves protect pipelines from being over pressured by a transit or other pressure anomaly. For pipeline and subline facilities, relief valves are installed on the suction side. At deliveries and end point facilities, they are installed upstream of the take-off valve.

When a Brodie Relief Valve opens, the pipeline operation enters "AOP-CC-J50, Operation of Any Safety Device." The relief systems include isolation valves that are normally open to provide a clear path to a relief tank or sump; these valves are closed to isolate the relief valve from the line or tank for maintenance. If it becomes necessary, some main line isolation valves can be closed remotely.

Thermal Relief Valves



High ambient air temperature and radiant heat from the sun can raise the pressure of the product in exposed pipe due to thermal expansion. Thermal Relief Valves are located on sections of piping that may become isolated from Brodie Relief Valves to provide over pressure protection and are set to open and vent to a relief tank or sump if a predetermined pressure is reached to prevent damage.

How It Works – Brodie Relief Valve

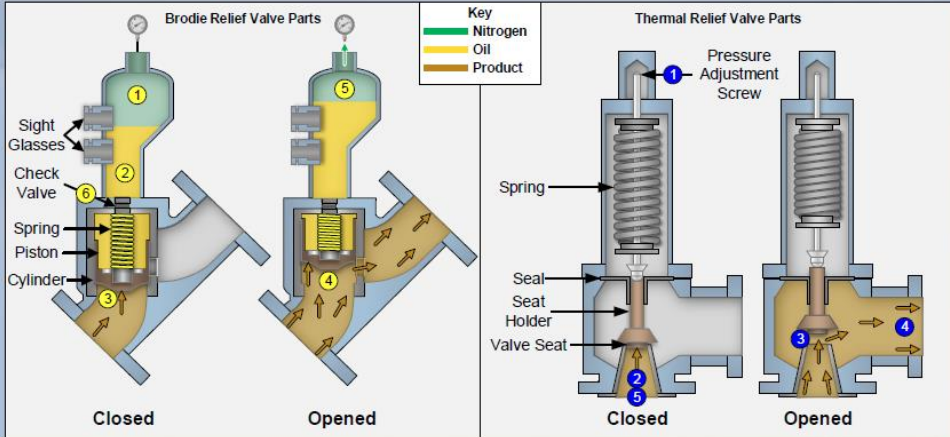
- 1 Nitrogen gas is used to pressurize the valve piston in order to keep the valve in the closed position. The pressure of the nitrogen gas in addition to the force of the valve spring is the valve set point.
- 2 Below the nitrogen is a level of oil that provides lubrication to the valve components, such as the spring and piston, to ensure the valve will open and close when required. The oil also provides a tight seal and acts as a barrier between the nitrogen gas and the valve's piston and cylinder.
- 3 When the fluid pressure in the pipeline is not enough to overcome the valve set point, the valve remains tightly closed.
- 4 As pipeline pressure increases to a level requiring surge relief, the spring and gas pressure are overcome, causing the spring to compress. The valve opens and product flows through ports in the cylinder, exiting to a relief tank.
- 5 When the valve opens, nitrogen gas exits from the top of the valve, expelling the gas pressure. Once the pipeline pressure decreases below the set point, the nitrogen pressure and spring cause the valve to close.
- 6 A check valve mounted to the internal surface of the cylinder head controls the opening and closing speed of the valve. The result is a fast-opening response.

How It Works – Thermal Relief Valve

- 1 The force that keeps the valve in the closed position is provided by a helical spring that is compressed by an adjusting screw.
- 2 When the fluid pressure in the pipeline is not enough to overcome the spring force, the valve remains in the closed position. The valve seat is pressed against the inlet nozzle, so fluid cannot pass through.
- 3 If the pipeline pressure increases to the point where the total upward force is greater than the spring force due to thermal expansion, the valve seat lifts from the inlet nozzle and the spring compresses.
- 4 Product flows through the valve to a relief tank or sump. By providing an alternate path for the pressurized fluid, pipeline pressure is relieved. A seal around the top of the valve seat holder prevents liquid from flowing into the upper portion of the valve.
- 5 Once the pipeline pressure decreases below the spring force, the valve returns to the closed position.

Monitoring Responsibilities – Brodie Relief Valve

Monitored Variable	Location	Notes
Nitrogen Pressure	Field	Low pressure causes the valve to open early High pressure causes valve to open late
Sight Glass for Oil Level	Field	To ensure proper lubrication in the valve
Stains Around Valve	Field	Indication that valve is leaking
Manual Isolation Valve Locked in Open Position	Field	



Relief Valves

One-Pagers

- A brief overview of a topic, equipment item, or task
- Include images and drawings,
- Explain the purpose and function (how it works) of the discussed topic,
- List main components and monitoring or inspection responsibilities