

Common Language Standard

PSIG 001/2000

Objective: To develop a dictionary of terms commonly used in the pipeline simulation industry.

Standard for Common Language

Preface

The following is a dictionary of common terms used within the Pipeline Industry when modeling. Each software package and even different companies have their own language that goes with modeling. This is an attempt to correlate and define the terms. This is a work in progress and does not represent a complete list of terms used during modeling. If you know of terms that are missing or have an additional definition, please contact: standards@psig.org.

Glossary

Online Format

If you are viewing this glossary in an online or PDF format (rather than a printed format), simply click on the appropriate letter below in order to go to that area. Also, clicking on highlighted words in this document will take you to the definition of the highlighted word.

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Print Format

If you are viewing this glossary in a print format, underlined words within the Definitions column are defined alphabetically in their appropriate section.

TERMS	DEFINITION(S)
A	
absolute pressure	pressure measured with respect to zero pressure; the sum of atmospheric pressure and gauge pressure
absolute temperature	temperature measured with respect to absolute zero, in degrees Rankine or degrees Kelvin
absolute viscosity	dynamic relationship between a force and the fluid motion
absolute zero temperature	temperature at which there is no molecular motion
acceleration	rate at which an object changes velocity
active data	continually updated data, based on pipeline operation
actuators	part of a control system, which regulates speed, power, valve position, etc. to match a set point
adiabatic	without loss or gain of heat

TERMS	DEFINITION(S)
adiabatic efficiency	ratio of the theoretical temperature increase of a compressor to the actual temperature increase; a measure of the work done by a compressor that is not lost as heat
Affinity Laws	equations that correlate the relationship of head, speed, impeller diameter, flow, and efficiency for turbomachinery
ambient temperature	temperature of the surroundings (e.g. ground, air)
American Standard Code for Information Interchange (ASCII)	each number, letter, symbol and punctuation mark is represented by a different byte
API (American Petroleum Institute) Gravity	arbitrary measurement of density adopted in 1921 by the American Petroleum Institute and the Bureau of Standards $\text{API} = 141.5 / \text{gravity} - 131.5$
apparent power	combination of real and reactive power
apparent viscosity	Slope of the shear stress versus velocity gradient for a fluid. For Newtonian fluids, the apparent viscosity equals the absolute viscosity.
B	
balance	1) steady state of pipeline flow which has three critical characteristics: a) a single flow rate from the injection point to delivery point; (b) an even pack throughout the pipeline; and (c) approximately equal volumes entering and leaving the pipeline 2) processes of obtaining a steady state solution using a computer program
ball valve	ball-shaped valve with conduit port and 90 degree rotation; normally full port with minor pressure loss
bar scale	1) a symbol on a map used to graphically indicate the map's scale; 2) indication of scale on a bar chart
barrel	unit for volume of oil, the standard barrel contains 42 gallons
base load	minimum load
batch	continuous volume of liquid product in a pipeline; a batch has a constant density and viscosity and is distinguished from other batches with different densities and viscosities
batch cycle	set pattern of batches of similar commodity type that takes into account the interface contamination of batches, as well as the injection and delivery patterns of batches

TERMS	DEFINITION(S)
batch interface	region where two batches meet in a pipeline and where some mixing of the two batches occurs
batch sequence	list of batches placed in the order in which they will be transported in the pipeline system
batch-split volume	volume already injected for partially complete injection operations and the volume remaining in the line for partially completed delivery operations
batchtracking	process that pipeline companies use to determine the location of batch interfaces in the pipeline system
Bernoulli's equation	relates to the total energy at two points in an incompressible liquid flowing at a steady rate
Bernoulli's Principle	liquid pressure is inversely proportional to the square of liquid velocity
Best Efficiency Point (BEP)	point on the speed-efficiency curve where the pump/compressor is operating at its highest efficiency
block valve	valve which is either opened or closed; used to isolated equipment or pipe line sections
booster pumps	mechanical devices used to raise the head of liquid to meet minimum head requirements of the main line pumps downstream
brake horsepower (BHP)	effective (useful) horsepower developed by an engine
brake mean effective pressure	theoretical constant pressure that would need to be applied during each power stroke to produce the brake horsepower of an engine
branch	See lateral
BTU	British Thermal Unit; the amount of heat required to raise the temperature of one pound of water one degree Fahrenheit. Equivalent to 252 calories or 778.2 footpounds
buffer	a small batch that is placed between two dissimilar batches to minimize contamination and degradation
butterfly valve	relatively flat, rotating disc mounted on a bearing that allows it to rotate its axis
bypass valve	ON/OFF valve that allows fluid to bypass a station when open, and forces fluid to enter a station when closed; operates together with the station inlet valve
C	
can-type vertical pumps	pump where liquid enters through the inlet valve and flows to the bottom of the can increasing the suction head of the pump

TERMS	DEFINITION(S)
capacity	amount of fluid measured as a volume per unit time that the pump/compressor can move
capacity control	use of varying operating speeds to control the volume of fluid moved under certain given conditions
capacity expansion	process of safely increasing a pipeline's throughput by the addition of loops, stations, and/or drag reducing agents (DRAs) for liquid pipelines
capital costs	the cost of equipment and construction in building a pipeline system
carrier	company that transports petroleum/hydrocarbon commodities
cascade shutdown	gradual shutdown of the units in a station where the units are shutdown one by one in specified intervals
Case Remote Warning (CRW)	high case pressure warning alarm level
cathodic protection	type of protection that prevents external corrosion; it consists of setting up a current around the pipeline to reverse the flow of electrons and thus inhibit corrosion
cavitation	operating condition when the pressure in the pipeline drops below the vapour pressure of the liquid being transported, resulting in the rapid formation and collapse of vapour bubbles in a flowing liquid
cavitation index (K c)	ratio of pressure drop across the valve divided by the difference between the inlet pressure and the vapor pressure of the liquid. It is used to select a valve that will operate above the cavitation point
centrifugal compressor	rotating machine that uses a rotating impeller to increase the pressure and velocity of a gas
centrifugal pump	rotating machine device that uses centrifugal force to convert mechanical energy into pressure or head
centrifugal/gear pump	pump used to draw the crude oil at a constant pressure and flow rate
centripetal force	pulls or pushes an object towards the center of a circular path
changing custody	process where by the company that owns the fluid turns it over to another company for transport and that company becomes responsible for what happens to the fluid
check valve	a valve that allows flow in one direction only

TERMS	DEFINITION(S)
choked flow	1) operating condition that occurs when pressure at the vena contracta drops below the liquid vapor pressure and the liquid starts to vaporize and form bubbles; 2) operating condition that occurs when the fluid velocity reaches its sonic velocity in the equipment and no additional flow can be handled
clearance	percentage of the swept volume of gas through a reciprocating compressor which remains within the cylinder (see also: sweep)
coating	material applied to the pipe to help prevent corrosion
coefficient of thermal expansion	incremental increase in the volume of a unit of fluid for a rise in temperature of 10°C
column separation	condition that occurs in areas of low pressure, where a large number of bubbles coalesce and rise to the top of the pipe where they form a vapor cavity; Note: low pressure can be caused by the hydraulic gradeline intersecting the elevation, or from a low pressure surge (e.g. pump failure)
commodity	fluid that the pipeline transports, including crude oil, refined products, natural gas liquids, etc.
common carrier	pipeline company that provides fair and equal access for all customers
comm-out	communication outage; loss of communications from one or more stations requiring operation of those stations without analytical data
compressibility	measure of the change in volume and density of a fluid with respect to changes in pressure and temperature
compression ratio	ratio of absolute discharge and absolute suction pressures on a compressor (P_{da}/P_{sa})
continuity equation	mass can neither be created or destroyed in a closed system
control	imposition of operational limits to the pipeline
control system	system where something is measured and compared against a set point and an action is taken to achieve the set point
control valve	valve that has a control system which determines position based on a set point
controlling point	location that dictates the rate at which the pipeline will flow
cooling	process by which the temperature of the fluid is lowered
critical flow	fluid flow which is unstable, alternating between laminar and turbulent flow ; Critical flow occurs at Reynolds numbers between 2000 and 4000.

TERMS	DEFINITION(S)
critical point	location on a pipeline that determines the rate at which the fluid in the pipeline can flow
critical pressure differential	difference between the pressure at the valve inlet and at the vena contracta which would cause cavitation
critical velocity	speed at which laminar flow does not occur and turbulent flow is maintained
critical zone	see: critical flow
custody transfer	transfer of ownership or responsibility of a fluid. Measurement is corrected to standard pressure and temperature
customer	party that is affected by pipeline schedules, such as shippers, refineries, connecting pipelines, LDCs, power plants, or feeder pipelines
cut point	specific position in the batch interface to start or end an operation
cyclic surging	small surges of pressure that oscillate within the pipeline; cyclic surges are associated with pipeline equipment, such as reciprocating pumps/compressors and pressure reducing valves
D	
daily load profile	load profile developed in order to determine at what time during a typical day the maximum gas demand occurs
Darcy equation (the Darcy law)	mathematical relationship that is used to determine a simple system curve; Variables such as the length of the pipe, inside diameter of pipe, and acceleration due to gravity do not change within a single system. The only variable that changes in the Darcy law is v , the velocity of fluid flow in the pipe in feet per second.
dead band	how far a device can move within its mechanical linkage before it triggers a reaction
degradation	batch is delivered with an adjacent batch of lower quality, resulting in volume loss of the higher quality batch
degree day	measure of the extent to which the mean daily temperature varies from an assumed base, usually 65°F; one degree day is counted for each degree of variation
degree of tolerance	value assigned by an operator for the amount of change on pipeline conditions (magnitude) over a given time (interval) for the present state of the pipeline (steady state or transition)
dehydration	process of removing water vapor from gas
dehydrator	vessel used to remove water vapor from gas

TERMS	DEFINITION(S)
delivery	1) location where fluid is removed from the pipeline to the customer; 2) location where a pipeline receives flow
delivery-based scheduling	method of scheduling in which the delivery requirements are specified and the supply requirements are calculated as a result
demand	required flow
demand-based scheduling	another term for common-stock scheduling
densitometer	instrument that draws fluid from the pipeline and measures its density
density	measurement of the amount of mass of a substance per unit of volume
design capacity	maximum average capacity of the pipeline which is calculated assuming ideal operating conditions
design pressure	maximum pressure rating for a pipe based on its specified minimum yield strength (SMYS), diameter and wall thickness, operation zone, and weld joint type
determined viscosity	actual measurement of viscosity taken with a viscometer
differential head	increase in head between the suction and discharge nozzles of pumps/compressors (see also: head)
discharge control	control based on the limits of the station discharge pressure.
discharge nozzle	port through which fluid leaves the pump/compressor
discharge pressure	fluid pressure as it leaves a pump, compressor, or valve
discharge pressure allowable	pressure allowable that specifies the pressure that triggers the simultaneous shutdown of all the units
discharge set point	the set limit for discharge pressure allowed to exit the station
discharge valve	ON/OFF valve, such as a gate valve or a ball valve, that allows or disallows fluid from leaving a pump/compressor
displacement (compressor)	volume displaced by each stroke of a piston in a reciprocating compressor cylinder
displacement (pipe)	physical volume of a pipe section, usually in cubic feet
displacement meter	a type of meter that measures flow based on the physical displacement of fluid
distribution line	pipeline used for distribution of gas to other smaller systems
downsurge	pipeline pressure surge, which is negative because its magnitude is below the normal operating pressure of the pipeline

TERMS	DEFINITION(S)
drafting	process of delivering more gas than is presently entering the system.
drag	another term for frictional loss, often associated with the AGA flow equation
Drag Reducing Agents (DRAs)	long-chain organic molecules in a hydrocarbon or water base that are injected into pipelines to reduce frictional losses
draining	decrease in volume of oil in the pipeline due to lack of pressure
drooping characteristic curve	head developed at shut-off is lower than that on another part of the curve for pumps
dynamic fluid flow	see transient flow
dynamic head	kinetic energy of a fluid due to its velocity
E	
effective horsepower	power reading based on the pump/compressor usage
effectiveness	measured in terms of pipeline balance: stable flow rate, volume in equals volume out, and an even pipeline pack throughout
efficiency	1) ratio of the friction for a fluid moving through an ideal pipe to the friction for a fluid moving through an actual pipe 2) measure of how well a pump/compressor converts shaft horsepower into pressure and flow. More specifically, efficiency is the ratio of the hydraulic horsepower delivered at the discharge to the actual horsepower supplied to the shaft.
elevation head	potential energy per unit weight of a fluid because of its elevation above a reference level
elevation pressure	pressure due to the height of the liquid
elevation profile	graphical representation of a pipeline's elevation above a reference line (usually sea level) plotted against the distance along that pipeline
energy	ability to do work
energy consumption	quantity of energy consumed and measured in hours, such as horsepower -hours (Hp-h) and kilowatt-hours (kWh)
equal percentage valve	valve where the percentage change in fraction corresponds to the increased flow percentage, used normally as control valves Best results are obtained in the 30-70% open range.
equalize	static (no flow) condition that occurs when pressures become constant
error signal	a signal generated by the controller and is the difference between the set point and the information provided by the sensor

TERMS	DEFINITION(S)
Euler's equation	determines theoretical pump head available from a pump
expected capacity	volume the pipeline is expected to flow during a time period after shutdowns and other rate losses are taken into account
F	
feedback control system	type of control system, also called a closed loop, where the information collected is transmitted back to (or used in) the control system; also referred to as bumpless control
feeder pipeline	pipeline system that collects commodity from a number of different production facilities and provides the carrier system with commodity
final control element	part of a control system that actually affects what is happening in the control system
flash point or flashpoint	temperature at which a liquid will release sufficient vapour to form a mixture with air that can be ignited by a flame
flashing	when a pressure drop causes the fluid to become gas-liquid mixture that continues to flow within a pipeline
flat characteristic curve	head developed at shut-off is only slightly greater than that at the design capacity
flow	volume of fluid with respect to time moving through the pipeline devices
flow characteristic	describes how the valve operates when opened to different percentages
flow chart	1) diagram that shows logic, choices, and results of each step of a program with symbols and standard English 2) chart showing flow delivery into or out of a pipeline
flow control	operational limit based on the pipeline flow rate through a station
flow straightener	pipeline straightener that lessens any whorls or eddies in the flow that might decrease the accuracy of the meter measurement
friction	sliding of particles over one another which generates heat
friction factor (f)	determined experimentally or empirically by correlating the Reynolds number and the pipe relative roughness to the fluid friction in a flowing pipe; used by some flow equations to calculate pipe pressure loss
friction head loss (hf)	resulting loss of head pressure due to friction in a fluid flowing in a pipe; the head is converted to thermal energy
fundamental flow equation	gas flow equation using a calculated friction factor

TERMS	DEFINITION(S)
G	
gas	state of matter that has no definite shape or volume
gas horsepower	total horsepower available to a compressor before adiabatic and mechanical efficiencies are considered
gate valve	valve that closes by lowering a flat plate or gate to block the flow through the pipeline
gauge pressure	pressure measured above atmospheric pressure, expressed as psig
globe valve	valve that opens or closes when a plug, attached to a stem, moves linearly in a spherical or "globe"-shaped cavity
glycol	liquid that absorbs water; glycol is used to dehydrate gas; When combined with water, it is used as the heat transfer liquid in pipeline heaters.
graph	visual method of showing the relationship between two or more characteristics
graphical user interface (GUI)	Computer program user interface using graphics to control the software
gravitational energy	potential energy caused by changes in elevation
gravitometer	device which measures the specific gravity of a fluid
H	
head	potential energy exerted by a column of liquid that has the ability to do work; It is expressed as a "height" of the column
head pressure	pressure exerted on a unit area by a column of liquid
head-capacity (H-Q) curve	graphical representation of the relationship between the head and the flow rate for a centrifugal pump/compressor
header	1) collection of valves and/or short pipes connecting all the flow line in a given area; 2) modeling term for a short pipe which is treated as a steady state device in transient programs
heat exchanger	vessel which permits heat to be exchanged between hot and cold fluids
heater	device which increases the temperature of the fluid flowing through the heater
heater-treater	vessels which use heat and/or electricity to separate water from emulsion

TERMS	DEFINITION(S)
high recovery pressure control valve	valve which recovers a significant percentage of the pressure differential from inlet to the vena contracta
high signal converter	relay that compares two error signals and selects the highest one and sends this to the final control element
High Vapor Pressure (HVP)	liquid hydrocarbons with vapor pressure above 50 psi (340 kPa) absolute at 100°F (38°C)
horsepower	unit of work that represents the amount of work required to raise a one-pound weight 33,000 feet in one minute
hot synchronization	process of transferring the motor power supply from the VFD to the 60 Hz bypass bus
hunting	constant movement of a control system around the set point
hydrocarbon	chemical compound composed solely of carbon and hydrogen
hydrates	solids (ice) which form when water vapor in gas cools; can be a high temperature based on the amount of CO ₂ and H ₂ S
hydraulic gradient (gradeline)	graphical representation of the change in pressure or head with respect to distance along the pipeline
hydraulic horsepower	actual energy imparted to fluid flowing through a pump/compressor
hydraulic profile	hydraulic gradient
hydraulics	set of laws governing the behavior of fluids in the states of both rest and motion
hydrocarbon	Chemical compound composed solely of carbon and hydrogen
I	
I.D.	inside diameter of a pipe which is the difference between the nominal (outside) pipe diameter and twice the wall thickness (w.t.)
impeller	rotating part of a centrifugal compressor/pump that imparts kinetic energy to a fluid
incompressible fluids	fluids which have very little change in volume as pressure is increased or decreased significantly
indirect heater	vessel that heats a fluid without using a direct flame
induction motor	motor that uses current induced into the rotor by electromagnetic fields in the stator
inertia	force which keeps a stationary body from moving and a moving body from changing speed or direction
injection	process of accepting commodity into the pipeline system

TERMS	DEFINITION(S)
injection/delivery	pipeline operation where one liquid is pumped into the main line at the same time another liquid is pumped to a terminal
instantaneous measurement	value of the measurement at a specific instant in time
instrument	device that reads and records specific information about pipeline condition and operation, including pressure or temperature sensors, meters or detection devices
intake nozzle	suction nozzle
interface mix zone	location where two batches mix along the interface
interlocks	software or hardware that allows or prevents motors from starting, or valves from opening or closing
interstate pipeline	pipeline that crosses state lines
intrastate pipeline	pipeline system contained completely within a single state
J – K	
jeep	holiday detector
Kelvin (degrees temperature)	metric absolute temperature unit – Celsius + 273.16
kinematic viscometer	a device that measures efflux times in determining kinematic viscosity
kinematic viscosity	the ratio of a fluid's absolute(dynamic) viscosity to its density
kinetic energy	energy an object has as a result of its motion
L	
laminar flow	condition of fluid flow where fluid layers at the center of the pipeline move faster than the layers next to the pipe wall
Law of Conservation of Energy	energy cannot be created or destroyed; it can only be changed from one form to another
leak detection	examining and reporting any anomalies in the pipeline hydraulics
Leg	pipe – modeling term
line fill	sequence of commodities in the line
line looping	see: loop and looping
line pack or linepack	1) volume of fluid in the pipe at flowing pressure and temperature; 2) increased volume of a fluid within a given pipe due to increased pressure
line section	segment of pipeline between two terminals

TERMS	DEFINITION(S)
linear valve flow characteristic	proportional increased flow by equal opening increments of the valve
linebreak detector	automatic valve operator that activates if the rate of pressure drop exceeds a pre-set amount, thereby limiting fluid loss to the section in which the linebreak occurs
liquid	one of the three states of matter; has a definite volume, but no definite shape
Liquified Petroleum Gas (LPG)	fluid consisting mainly of ethane, propane and butane that exists as a gas at atmospheric pressure, but which is transported as a liquid by maintaining it under high pressure
load	flow to customers out of the pipe line system – modeling term
load factor	ratio of the average demand to the peak demand
load profile	manner that the fluid flow varies over a given period of time
load shifting	moving an entire load from a peak time to an off-peak time
look-ahead model	projects flow transients into the future, based on current operating conditions and any specified schedule of events; If any constraint violations are detected, alarms are issued so that preventative actions can be taken.
loop	sections of pipe that parallel the existing pipeline and are used to increase the capacity and efficiency of a pipeline
loop swing	putting a pipeline loop into or out of service
loop-fill	volume of commodity that fills the out-of-service loop section
looping	installation of sections of pipe that run parallel to the existing pipeline and that affect the capacity of the pipeline
Low Vapor Pressure (LVP)	hydrocarbons with vapor pressure lower than 50 psi (340 kPa) absolute at 100°F (38°C)
M	
mainline piping	all equipment including pipes, valves, flanges and fittings up to and including the first valve isolating the main line from a station, terminal, tank farm or delivery point. It includes scraper traps, crossovers, station by-passes, and instrument lines that are connected to the main piping.
Man Machine Interface (MMI)	interface between an operator and a computer
manifold	complex array of pipes and valves that allows station operators to direct incoming fluids from any receiving point to pieces of equipment or exit points
MAOP	Maximum Allowable Operating Pressure

TERMS	DEFINITION(S)
mass	amount of matter that an object contains
Maximum Operating Pressure (MOP)	<p>maximum pressure permitted for normal pipeline operation; MOP is related to pipe strength and the pipe's ability to withstand internal pressure.</p> <p>MOP is based on the lowest of four factors: design pressure, hydrostatic test pressure, flange rating, or historical operating pressure.</p>
mean pressure	average pressure in a flowing pipeline
mean temperature	average temperature in a flowing pipeline
mechanical efficiency	efficiency of the mechanical linkage between an engine and the pump/compressor it is driving
mechanical energy	ability to apply a force to an object causing it to move
mechanical losses	friction losses in bearings and stuffing boxes and other rotational contact points
mechanical vapor plug	used to provide a gas vapor seal when required during pipe replacement and repair
mechanical work	force acting on an object through a distance
meter	device that measures the amount of fluid entering and leaving a pipeline system
meter banks	single meters arranged in parallel configurations
meter factor	used to adjust meter readings to show the actual volume measured by the meter
meter multiplier	used where actual voltages and currents are too large to be registered by a meter
meter prover	device designed to test, or "prove", a meter's accuracy and determine the meter factor
meter run	one leg of a meter bank, consisting of a strainer, a meter, and the associated valves
meter stack	device equipped with a set-stop counter that shuts down the unit once the maximum allowable volume has been reached
metering	process used to measure the volume of fluid as it moves past a particular point on the pipeline
metering manifold	array of pipes and valves that allows a station operator to direct the shipment of fluid to a choice of several meters
momentum	attribute of an object's velocity multiplied by its mass

TERMS	DEFINITION(S)
monthly schedule	schedule that shows all batch injections and deliveries for a monthly time period (or tender period if less than a month)
Moody diagram	graph that shows relative roughness , and Reynolds number as a way to determine the friction factor (f) used in the Darcy equation
motor	converts electrical energy to mechanical energy in the form of a rotating shaft
multi-stage pump	pump that has two or more impellers mounted on the same shaft, and an equal number of liquid pressurization stages
N	
Natural Gas Liquids (NGL)	petroleum fluid primarily composed of ethane, propane, and butane. NGL is a gas at atmospheric pressure and it is transported as a liquid by maintaining it under high pressure
Net Positive Suction Head (NPSH)	head above the vapor pressure of the liquid existing at the pump suction nozzle
Net Positive Suction Head Available (NPSHA)	actual NPSH available at the pump suction for the particular operating conditions; NPSHA is the difference between NPSHR and NPSH
Net Positive Suction Head Required (NPSHR)	minimum NPSH required by the pump to prevent cavitation
net pumping requirement	total volume of commodity that the pipeline must pump every day of the month through each section of pipe in order to meet the Notice of Shipment
net standard volume	volume of a fluid at standard pressure and temperature after the deduction of S&W
network	system of pipes and equipment that is being modeled
node	connection point between different devices in a pipe line model
non-recoverable energy	head between the total energy head line and the total head line; energy that is no longer useful for moving oil down the pipeline because it has been converted to heat and absorbed by the ground surrounding the pipeline
NPSHR-capacity curve	shows the relationship between NPSHR and capacity
O	
observed volume	actual measured volume of a batch
O.D.	outside diameter of a pipe
off-line model	may be steady-state or transient , but does not have access to SCADA data; Inputs are typically entered manually.

TERMS	DEFINITION(S)
online model	uses real-time telemetry (SCADA) to retrieve current operating data
operating capacity	average sustainable flow rate over specified periods of time taking into account routine and unexpected maintenance and operating problems
operating limits	Set of limits for a section of operating pipeline that have been established to prevent over-pressuring and to allow the pipeline to be operated at high flow rates
operating point	point of intersection between a pump head-capacity curve and a system curve . This value is the maximum flow rate that a given pump can maintain in the pipeline.
optimization	selection of the most desirable combination of factors to meet a specified objective
optimizer	software that uses mathematical techniques to meet objective functions
P	
packing	increase in volume of fluid in the pipeline caused by an increase in pressure
Panhandle Formula	empirical equation used for calculating flow in gas pipe lines; two versions are Panhandle "A" (partially turbulent) and "B", sometimes called Modified, (fully turbulent)
parallel operation	configuration where pump/compressor capacities are additive while the head remains constant
partial pressure	pressure that a fluid would exert if it alone were present in the container
Pascal's laws	pressure acts uniformly in all directions on a small volume of liquid; In a liquid confined by solid boundaries, pressure acts perpendicular to the boundary
peak shaving	1) technique used to shift a portion of an electrical load at a peak time of day to a non-peak time; 2) technique used to meet peak demands using alternate gas supplies such as storage, LNG or propane air
piezometric pressure	pipe pressure plus elevation pressure
pig (pigged)	device, which may contain instruments, that is propelled by fluid down the pipeline to clean pipe walls, gather information about the pipe, or separate different batches of fluid
pig time	time required for a "pig" to traverse a section of pipeline
pipeline	continuous run of pipe and related equipment

TERMS	DEFINITION(S)
pipeline elevation profile	elevation of the pipeline above sea level
pipeline frictional loss	difference between the upstream discharge pressure and downstream suction pressure due to friction; The amount of energy lost between stations depends on flow rate, pipe size, and fluid characteristics.
pipeline hydraulics	set of laws governing the behaviour of fluids in motion or at rest, and the practical application of these laws in a pipeline system
pipe prover	common device used in the proving of a meter
Piping and Instrumentation Diagram (P&ID)	diagram showing the sequence of piping and instruments on a section of the pipeline but not drawn to scale
PLC	Programmable Logic Controller
plug valve	wedge shaped, reduced part valve with 90-degree rotation; causes high pressure drop
pocket (unloader)	reduces the flow through a reciprocating compressor by increasing the volumetric capacity of the compressor cylinder
potential energy	energy of position (usually the energy input to the system such as at pumps
potential or head energy	energy that can be converted to velocity or flow; This pressure is created through changes in elevation or by pump units that are equivalent to positive changes in elevation.
pour point	lowest temperature at which a liquid will pour, or flow
power (p)	rate at which work is done
power factor	ratio of real power (measured in Hp (kW)) and apparent power (measured in kVAr)
predictive model	permits "what if" analyses to be performed by calculating the effects of transients introduced by scheduled or unscheduled pipeline events, such as pump/compressor outages, valve closures, or supply variations. The operator typically enters these events into a "scenario".
pressure	amount of force (F) exerted on a unit area (A) of a surface
pressure base	assumed atmospheric pressure used in calculations requiring "absolute" pressure
pressure control	operational limit based on either the pipeline suction pressure or the discharge pressure at a station
pressure control valve	valve that regulates pressures at stations, restricting flow by use of a ball or plug positioned by an actuator
pressure loss	rate of decrease in pressure along the flowing pipeline (P f) due to friction of the fluid against the pipe wall

TERMS	DEFINITION(S)
pressure relief valve	a valve that opens automatically to relieve the line pressure that is above the safe operating limit
pressure transients	pressure waves, which travel through the pipes at the wave speed of the fluid; caused by changes in the operation of the system
pressure transmitters	instruments which measure and report pressure
pressurized surge tank	also called an accumulator; prevents the transfer of pressure waves to other parts of the pipeline system
primary location instruments	location where the instruments normally used to monitor the pipeline are located
process disturbances	things that change the steady state of a control system
profile	1) horizontal line that indicates changes in ground elevation along the pipeline route; 2) modeling term used to define changes with respect to time
Proportional Integral Derivative (PID)	controller which uses all terms in determining the movement to meet the set point
pump capacity	flow rate of a pump at a particular head as read off the head-capacity pump curve
pump characteristics	relations between flow, head, brake horsepower, and efficiency
pump curve	graph that shows the relationship between flow, head, horsepower, efficiency, and NPSHR of a pump
pump differential	total pressure output of a pump minus its suction pressure
pump differential head	difference in total head between the suction and discharge of the pump
pump head	amount of the increase in total head across the pump. It is sometimes referred to as pump differential head
pump head-capacity curve	graphical representation of pressure produced by the pump vs. flow rate
pump horsepower capacity curve	graphical representation of required power versus flow
pump runout	flow at which little to no head is produced
pump station	one of the installations built at intervals along a liquid pipeline to route and increase the flow; contains pumps and other equipment
pump unit lockout	removal from service of a shutdown pump unit
pump unit shutdown	temporary loss of a pump unit, indicating that one or more of the pump's operating parameters has been exceeded

TERMS	DEFINITION(S)
purge	procedure that removes all air from a pipeline to prevent fire or corrosion. The length of time required to purge a line is dependent on the size and length of the line, size of the blowoff valve, and the purging method selected.
push-stock	extra volume of commodity (batches) that shippers supply for injection into the pipeline to push the current contents of the line out; also known as working stock
PVR (Plant Volume Reduction)	the volume of gas removed from a pipeline at a hydrocarbon processing plant
Q	
quick opening valve flow characteristic	produces a very rapid increase in flow between the closed position and the partially open position
R	
ramping	1) gradual startup or shutdown of a pump unit; 2) modeling term meaning to change variables with time
Rankine (degrees temperature)	English measurement of absolute temperature; Fahrenheit + 459.69
rate of rise	surge control in which a pressure sensor initiates a device control that is proportional to the rate of pressure increase caused by the surge
real-time model	uses SCADA data to run in lock step with the actual pipeline. The goal is for calculated flows and pressures to track telemetered points, with consistent and reasonable accuracy, so that confidence can be gained in the model's ability to predict future operating conditions, as well as estimate conditions at non-telemetered locations.
receipts	1) flow into a system 2) flow out of a system
reciprocating compressor	1) a piston-type positive displacement compressor which increases the pressure of a definite volume of gas by reducing the cylinder volume, resulting in a pulsating delivery of gas; 2) any compressor which employs a piston working inside a cylinder to compress a gas; usually has "pockets" that allow for limited pressure and flow control
recirculation	the partial reversal of fluid flow at the impeller
recirculation valve	surge protection device that is used to create a compensating pressure wave to cancel the initial pressure surge
recoverable energy	head below the total head line; energy which is still useful for moving oil down the pipeline

TERMS	DEFINITION(S)
recycle line	gas line that allows re-circulation of discharge gas into the suction side of a centrifugal compressor; This permits a centrifugal compressor to be placed on- or off-line in parallel with other units without creating a surge condition.
reference level	zero elevation/head on a total energy diagram ; for pipeline applications, the reference level is usually sea level
regulator	control valve used to regulate pressure or flow
Reid Vapour Pressure (RVP)	measures the vapour pressure of liquids in a closed container under two specific conditions: liquid temperature and the ratio of liquid volume sample to the air volume sample
relative roughness (ϵ/D)	ratio of the absolute roughness of the inside pipe wall to the internal diameter of the pipe; Absolute roughness is the average height of imperfections in the pipe wall surface.
relief valve	valve specifically designed to protect a pipeline from exceeding MAOP by relieving to atmosphere or a tank
remote control	pipeline control achieved at a remote control center through the use of a SCADA system
Remote Terminal Unit (RTU)	computer located at a remote location that gathers the information provided by all the PLCs at the location, and transmits that information back to the host computer
report by exception	RTU sends information to the Host when data has changed by a specified amount
Reynolds number (Re)	mathematical relationship that describes the interdependence between the pipe diameter, fluid viscosity, and flow velocity; a dimensionless number used to describe the type of flow exhibited by a fluid flowing through a pipe
riser	vertical pipe intended to move fluid to either a higher or lower elevation, such as from the ocean floor to a platform
rising characteristic curve	preferred curve shape for pump H-Q curves; This curve has a steady increase of H with decreasing Q.
rotary motion valve	valve whose closure member rotates to open or close
rotating equipment	centrifugal pumps and compressors
roughness	measure of the surface condition of the internal wall of pipe; Roughness can change with the age of the pipe and the type of service it has provided.
RTU	remote transmission(terminal) unit used in telemetry (SCADA) systems to transmit operating information to a master terminal unit (MTU) usually located in a control center

TERMS	DEFINITION(S)
rupture disc	device that relieves pressure when an absolute pressure value is high enough to rupture the disc material, thus allowing fluid to flow into some type of a vessel
S	
SCADA	Supervisory Control and Data Acquisition System
schedule	A detailed and timed plan for any procedure or program involving the transportation of commodity through the pipeline system.
scheduled volume	size of a batch specified by the pipeline schedule.
scraper	pigging device used for cleaning paraffin or other substances from the inside surface of a pipeline ; see also: pig
scraper pig	pig equipped with brushes or urethane blades used to clean pipelines; see also: pig
sediment and water (S&W)	dissolved impurities such as salt, water, asphalt and other substances in crude oil, which come out of suspension and sink to the bottom of a container as the oil cools and settles.
sensor	instrument used to “sense” pipeline information such as pressure, flow or temperature.
separator	horizontal, vertical, or spherical vessel used to remove liquid from gas, and gas from liquid.
series configuration	a pump/compressor configuration in which pumps/compressors are linked together so that the discharge of one pump/compressor enters the inlet of another;. heads are additive at the same flow
series/parallel operation	flow is divided between the series pumps/compressors and the parallel pumps/compressors according to the capacity of each of the units
set point	preset value that is the desired value of a variable, such as suction or discharge pressure
shut-off head	head delivered by the pump at zero flow
side stream delivery	delivery of a partial flow from the main line to a midline location
side stream injection	injection of a partial flow at a midline location into the batch moving in the main line
single-stage pump	one impeller and one stage of pressurization
slack pipeline	maintaining column separation at a location with an extreme drop in elevation so that the pressure does not exceed the maximum operating pressure (MOP)
SMYS (Specified Minimum Yield Strength)	the design value of the strength of the steel from which pipe is made

TERMS	DEFINITION(S)
soft shutdown	using the VFD to slow the motor before stopping
soft start	with the VFD, AC power is increased gradually until the motor has reached full speed
solubility	capacity of a substance to be dissolved
sonic flow meter	device for measuring fluid flow by timing sound waves across a cross-section of pipe
sonic wave speed	speed at which a transient wave travels through a pipeline. It depends on fluid properties, and the elastic modulus of the pipe
sour	crude oil containing more than 0.5% sulphur
source	flow into a system
specific gravity	1) measure which compares the density of any liquid with the density of water at the reference temperature; 2) weight of a given volume of gas compared under standard conditions to an equal volume of dry air
specific heat	heat required to raise a unit mass of a substance one degree.
specific heat ratio	Ratio of specific heats at constant pressure and constant volume.
specific speed	design index that gives a general indication of the overall performance and geometry of the pump and impeller
specific weight	weight of a substance divided by its volume
Spitzglas formula	equation used for calculating flow in small diameter, low pressure distribution lines
square law	relationship between velocity and the pressure drop in the pipe, where for over a limited range of flows, pressure drop is proportional to the square of the velocity for flow rate (also called capacity)
standard temperature	temperature which is used to correct volumes to a standard volume
static	usually refers to a pipe segment with no flow
static gradient	representation of the height of liquid column or static head above the elevation at any point on the pipeline
static head	elevation of a column of liquid above a given reference point
static head pressure	pressure exerted upon a unit area by a column of liquid
static hydraulics	refers to the properties of liquids when liquids are at rest and examines how pressure and changes in elevation affect fluid behaviour in the pipeline
static pressure	pressure when the line is shutdown

TERMS	DEFINITION(S)
static resistance	sum of the elevation head and static head that must overcome before any liquid begins to flow
station bypass	diverting a full or reduced flow in the pipeline around a shut down station
station differential	pressure difference between the station suction pressure and the station discharge pressure
station suction valve	ON/OFF valve that allows fluid to enter a station when open, and forces fluid to bypass a station when closed. Operates together with the bypass valve.
steady state	For steady state to occur the flow into a pipe must equal the flow through the pipe which must equal the flow out of the pipe. Steady state also has no change in flow or pressure with respect to time.
steady state analysis	method of flow analysis of a pipeline system that assumes constant flowing conditions.
steady state energy equation	modification of Bernoulli's equation which accounts for friction and work added by pumps. It compares the energy in a fluid at two different points and accounts for the addition or removal of energy between the same two points.
steady-state model	performs offline simulation that does not allow for changing pipeline conditions over time. Stead-state model historically has been used for facilities planning and quick evaluation of operational situations. It remains an essential step in the transient modeling process.
steep characteristic curve	rising pump H-Q curve, with a large increase in head between the head developed at design capacity and at shut-off
storage field	reservoir, often a depleted gas field or salt dome, into which gas can be pumped during periods of low demand for later retrieval when needed
suction control	control based on the limits of the station suction pressure
suction pressure	pressure at the suction flange of a pump/compressor
suction set point	required suction pressure necessary for the station
suction valve	ON/OFF valve, such as a gate valve or a ball valve. If the valve is open, fluid can flow into the pump/compressor. If the valve is closed, no fluid can flow into the pump/compressor
Supervisory Control and Data Acquisition (SCADA)	complex system of computer hardware, software, communications media, devices and instruments that gathers and analyzes operating data and sends reports back to the control center, In addition, the SCADA system carries out commands issued by the operator at the control center
supply	flow into a system

TERMS	DEFINITION(S)
surge	1) pressure change produced by conditions such as pump/compressor startup or shutdown, valve openings or closures, and line leaks 2) pulsating flow in centrifugal compressors caused by operating under low flow conditions
surge pressure	rapid change in pipeline pressure
sustainable capacity	average sustainable flow rate over long periods of time taking into account routine maintenance and operating problems
sweep	a procedure that accelerates gas velocity, or increases gas turbulence, through a specific section of pipeline, for the purpose of removing accumulated liquids
system curve	line graph that shows how variables like viscosity, density, and flow rate combine with fixed conditions such as length of pipe, inside diameter of pipe, internal roughness of pipe, and changes in elevation influence throughput.
system map	map showing an overview of the entire pipeline system, including locations of terminals, stations and pipelines, and tables of tank capacity and line length
T	
terminal	location on the pipeline where facilities exist to inject commodity into or remove commodity from the pipeline; terminals may also include tanks and pumping equipment
terminal station	entry point for all the crude oil and refined products that are transported by a pipeline system
thermal energy	ability to do work due to temperature (heat)
thermal expansion	property of fluids which states that as the temperature increases, the volume of a fluid increases, and the specific gravity decreases
throughput	actual flow rate or forecast quantity of fluid to flow through the pipe
tight pipeline	preventing column separation at a location with an extreme drop in elevation by maintaining sufficient pressure upstream and downstream of the drop in elevation
time step	each calculation out in time for a transient model
torque	type of force that produces rotation of an object around a point
total energy diagram	graphical representation that shows the elevation profile of a pipeline, with the total head for each batch drawn as a horizontal line above the elevation profile
total energy head	total head at the beginning of a pipeline segment

TERMS	DEFINITION(S)
total energy head line	horizontal line on the total energy diagram which indicates the amount of total head which is in the liquid at the start of a pipeline segment
total head	the sum of static head, elevation head and dynamic head. Total head is the total useful energy the liquid has at any point
total line pressure	gravitational pressure plus pump pressure
total static head gradient	sum of the static head and the elevation at any given point in the pipeline
transducer	see sensor
transfer line	pipeline – modeling term
transient	unsteady (changing) flow or pressure condition that changes with time. A transient can also refer to a transition between two steady state conditions
transient flow	unsteady (changing) flow or pressure condition that changes with time; a transient can also refer to a transition between two steady state conditions.
transient analysis	method of flow analysis of a pipeline system that takes into consideration changing flowing or pressure conditions over time. Usually using a computer program
transient model	on- or off-line simulation that considers dynamic fluid flow characteristics over a specified time span; sometimes called Unsteady State model
transit time	time it takes the carrier to transport a batch from the supply point to the delivery point
transition region	area where the fluid flow is still turbulent, but the turbulence has not yet become fully developed
transmission line	long pipeline, usually with one or more stations
T&E	transportation and exchange of thermally equivalent volumes of gas between pipeline companies
tuning	the manipulation of physical pipeline characteristics (typically pipe roughness factors) until predicted flow and pressure values match actual data
turbine meter	a meter in which the measuring element is a multi-bladed rotor and to which the metered stream imparts a rotational velocity that is proportional to the mean velocity of the stream; volume is derived by counting rotor revolutions
turbulent flow	occurs when fluid particles in the pipeline flow in random directions and forward at the same velocity

TERMS	DEFINITION(S)
U – V	
unloader	See: pocket unloader
upsurge	pipeline pressure surge which is positive because its magnitude is above the normal operating pressure of the pipeline
valve	device used to control the rate of flow in a line, to open or shut off a line completely, or to serve as an automatic or semiautomatic safety device; common valves include the gate valve, plug valve, globe valve, needle valve, check valve, and pressure relief valve
valve flow coefficient (Cv)	specifies the capacity of a valve
vaporization	process whereby the cohesive forces in a liquid are no longer strong enough to hold the molecules together, resulting in a change of state of matter from liquid to gas
vapour pressure	pressure above which a liquid will not further vaporize. It is the pressure that maintains a liquid and its vapour in equilibrium at a given temperature
Variable Frequency Drive (VFD)	device that adjusts the speed of an electric motor by adjusting the frequency of AC power used by the motor
variable speed drive	With a variable frequency drive, although the system curve remains the same, the changed speed of the motor creates a new pump curve, and therefore a new operating point
velocity	speed in a given direction
velocity transients	also known as pressure transients, they are pressure waves that occur when there is a change in flow rate driven by a change in energy of the fluid in the pipeline
vena contracta	point of lowest pressure is just downstream of the actual orifice at a distance of about half the diameter of the orifice downstream
vertical centrifugal pump	pump's rotating unit is mounted in a vertical position
vertical inline pumps	single-stage vertical pumps with top-mounted motors, and suction and discharge nozzles arranged so that the pump cases can be conveniently connected into and supported by the piping
vibration	back and forth motion a machine exhibits from its rest position
viscometer	instrument that measures the amount of time required (the efflux or "flowing out" time) for a given quantity of fluid to pass through a capillary in a glass tube
viscosity	measure of a fluid's tendency to resist flow
volatility	measure of how easily a liquid will vaporize
volume	amount of space occupied by an object

TERMS	DEFINITION(S)
W, X, Y, Z	
w.t.	abbreviation for pipe wall thickness
wafer check valve	variety of check valve that has a two piece disk, hinged down the diameter of the pipe. Flow pushes the valve into the open position. When there is no flow, a spring pushes the disk shut to prevent back flow.
water hammer	pressure oscillation created by the rapid closing of a valve on a flowing pipeline
weight	measure of gravitational force on an object
wet gas	gas containing water vapor
Weymouth formula	equation used to calculate flow in gas pipelines
work	application of a force through a distance
working stock	also called push-stock; the extra volume of commodity that shippers supply when they commence shipping commodity on a pipeline system
yielding	when the MOP of a pipeline is exceeded, the steel walls of the pipe may stretch to such an extent that they will not recover when the pressure is reduced
Z factor	compressibility factor used to compensate for change in density of gas with temperature and pressure