

## **COMPRESSOR TERMS**

*This section provides definitions of major and general terms broadly applied to piston and diaphragm compressors.*

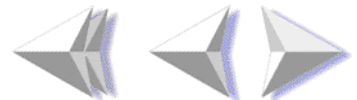
**ACTUAL CAPACITY** - is the quantity of gas actually compressed and delivered to the discharge system by the compressor at rated speed and under rated suction (inlet) and discharge conditions. Actual capacity is expressed in cubic feet per minute or cubic meters per hour and is referred to the first stage inlet flange temperature and pressure.

**CLEARANCE VOLUME** or **DEAD VOLUME** - is the volume present in one compressor cylinder or one compressor in excess of the net volume displaced by the piston or diaphragm during one cycle. It is often expressed as a percent of displacement. When applied to a double acting piston compressor, the volumes are referred to both the head end (HE) and the cylinder end (CE).

**COMPENSATING PUMP** - is a two stage pump designed to inject a measured quantity of hydraulic fluid into the hydraulic piping of a diaphragm compressor at a predetermined time during the compression cycle. The injection point is usually during the inlet portion of the compression cycle.

**COMPRESSIBILITY** - is the property of a substance capable of being reduced in volume by the application of pressure. See also [THERMODYNAMIC TERMS](#)

**COMPRESSION EFFICIENCY** - is the ratio of the theoretical work requirement to the actual work required to be done on the gas during compression and delivery. Expressed as a percentage, compression efficiency accounts for leakage, frictional losses, and thermodynamic variations from the theoretical process.



**COMPRESSION RATIO** - is the ratio of absolute discharge pressure to the absolute suction pressure corrected by the compressibility factor of the gas at both the suction and discharge pressures and temperatures. The term compression ratio can be applied to a single stage of compression and multi-stage compression. When applied to a single compressor or a single stage of compression, it is defined as the stage or unit compression ratio; when applied to a multi-stage compressor it is defined as the overall compression ratio.

**CORROSIVE GAS** - is a gas which attacks normal materials of construction. Water vapor when mixed with most gases does not make them corrosive within scope of this definition. In other cases, the presence of water initiates a corrosive action. Examples are carbon dioxide, hydrogen sulfide, chlorine, and fluorine.

**DESIGN PRESSURE** - is the pressure used to determine the stress levels in components which will either contain a fluid or gas under pressure at a corresponding temperature. The Design Pressure is always greater than the maximum allowable working pressure. See Maximum Allowable Working Pressure.

**DESIGN SPEED** - is the same as maximum allowable speed.

**DIAPHRAGM (MEMBRANE)** - is a thin metal disc isolating a gas from a hydraulic media in a diaphragm compressor while moving between two precision contours. The linear displacement of the diaphragm varies with each contour into which it is displaced, but in all cases it flexes between the gas plate and the hydraulic plate.

**DISCHARGE PRESSURE** - is the total pressure at the discharge flange of the compressor and is the summation of the static head plus the velocity head. Discharge pressure may be expressed as a gauge pressure or an absolute pressure (gauge pressure + atmospheric pressure = absolute pressure).



**DISCHARGE TEMPERATURE** - is the temperature of the gas exiting at the discharge flange of the compressor.

**DISPLACEMENT** - is the net volume displaced by the piston at the rated machine speed, generally expressed in cubic feet per minute or cubic meters per hour. For a single stage, single acting compressor, it is the displacement of the compressing end only; For a single stage, double acting compressor, it is twice the displacement of the compressing end less the volume of the piston rod. For multi-stage compressors, the displacement of the first stage is commonly stated as that of the entire compressor.

**DRY or WET GAS** - See the definitions under [THERMODYNAMIC TERMS](#).

**GAS PLATE** - is the component in a diaphragm compressor that comes into contact with the process gas or air. The plate is machined with a contour that is a mirror image of the hydraulic plate contour. In addition to the contour, a series of radial grooves are machined from the edge of the contour to the center of the plate to allow for unrestricted passage of gas from the periphery of the contour to the discharge check valve port.

**HEAD CAVITY** - See [PLATE CONTOUR](#).

**HYDRAULIC PLATE** - is the hydraulic distribution component in the diaphragm compressor. Its design allows for even distribution of hydraulic fluid against the diaphragm(s). The plate is machined with a contour that is a mirror image of the gas plate contour.

**INERT GAS** - is a gas which does not combine chemically with itself or any other element. The four gases of this type are helium, argon, neon, and krypton. In compressor terminology it usually means a gas which does not supply or support any of the needs of combustion, such as nitrogen.



**INLET (SUCTION) PRESSURE** - is the total gas pressure at the inlet connection flange of the compressor and is the summation of the static and velocity heads. For positive displacement compressors, the velocity pressure is usually so small to be considered at any point.

**INLET (SUCTION) TEMPERATURE** - is the temperature of the gas entering at the inlet flange of the compressor.

**LIMITER** - is a device with a dual function in the diaphragm compressor hydraulic system. The primary function is to assure volumetric efficiency by remaining closed until the gas pressure reaches the system discharge pressure. The secondary function is to limit the compressor pressure by opening at the set point, thereby reducing probability of over-pressurizing the compressor or system.

**LOWER HEAD** - See [HYDRAULIC PLATE](#)

**MAXIMUM ALLOWABLE SPEED** - is the highest speed at which the compressor design will permit continuous operation and is expressed in revolutions per minute (rpm).

**MAXIMUM ALLOWABLE WORKING PRESSURE** - is the maximum continuous operating pressure for which a compressor has been designed when handling the specified gas at the specified temperature. It is not the design pressure of the compressor or compressor auxiliaries.

**MECHANICAL EFFICIENCY** - is the ratio expressed as a percentage of the actual thermodynamic work done by a compressor to the actual shaft horsepower required by the compressor.

**NON-CORROSIVE GAS** - is one which does not attack normal materials of construction. However, the words non-corrosive and corrosive are relative terms.



OIL INJECTION PUMP - See [COMPENSATING PUMP](#)

PERFECT INTERCOOLING - is when a gas is cooled to the first stage inlet temperature following each stage of compression.

PISTON SPEED - is the distance traveled by the piston in a unit of time, either feet per or meters per second.

PLATE CONTOUR - is the profile machined in a flat plate ([Gas Plate](#) or [Hydraulic Plate](#)). The contour is either a single radius type or a two radius type and the diaphragm(s) flex between the contour in the Gas Plate and the contour in the Hydraulic Plate.

RATED DISCHARGE PRESSURE - is the highest continuous operating pressure to which a compressor component is subjected to meet the condition specified by the user for the intended service. The rated discharge pressure is always less than the Design Pressure and is frequently equal to the Maximum Allowable Working Pressure even though the definitions are not equal.

RATED HORSEPOWER - is the continuous input required too drive a compressor at the rated speed and the actual capacity under rated pressure and temperature conditions. For all compressors, it is the power required at the compressor shaft. It does not include losses in the driver or in the transmission equipment between the compressor and the driver.

RATED SPEED - is the highest speed necessary to meet the specified service conditions. Rated speed and maximum allowable speed may be the same, but rated speed can never exceed the maximum allowable speed.

SAFETY VALVE SETTING - is the setting of a relief device that is equal to or less than the Maximum Allowable Working Pressure. The Safety Valve Setting is not to be confused with or is to be used interchangeably with the Limiter setting. The safety valve is installed in the process gas piping system.



TRIPPING SPEED - is that speed at which the over speed device is set to function. It is normally 110% of the rated speed.

VACUUM - is a pressure below atmospheric pressure.

VALVE LIFT AREA - is the minimum net flow area between the valve and the seat when the valve is fully open. Usually, this is also the least area in a valve through which gas must flow and is used to determine the peak gas velocity and pressure drop.

VOLUMETRIC EFFICIENCY - is the ratio of volume of the gas admitted, at a specified temperature and pressure, to the volume of the full piston or diaphragm displacement.

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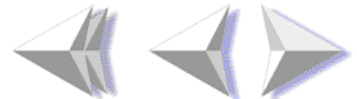
## **THERMODYNAMIC TERMS**

*Some of the definitions given are not as all inclusive as general thermodynamics may require. However, they define what is necessary for reciprocating compressor applications.*

COMPRESSIBILITY - is a volume ratio which indicates the deviation of the actual volume from that which has been determined by the Ideal Gas Laws. The compressibility factor is a multiplier.

CRITICAL PRESSURE - is the saturation pressure at the Critical Temperature. It is the highest vapor pressure the liquid can exert. Critical conditions must be determined experimentally for each pure gas. When calculated for a mixture, they are called Pseudo Critical Conditions.

CRITICAL TEMPERATURE - is the highest temperature at which a gas can be liquefied.



**DENSITY** - is the weight of a given volume of gas usually expressed as pounds per cubic foot or grams per cubic centimeter at standard pressure and temperature conditions for the system of measure.

**DEW POINT** - is the temperature at which the vapor will start to condense. Dew point of a gas mixture is the temperature at which the highest boiling point constituent will start to condense.

**DRY GAS** - is any gas or gas mixture which contains no water vapor, and where all of the constituents are substantially above their respective saturated vapor pressure at the existing conditions.

**ENERGY** - of a substance is its capacity either latent or apparent to exert a force through a distance.

**ENTHALPY** - is the sum of the internal and external energies.

**ENTROPY** - is a measure of the unavailable energy in a substance.

**EXTERNAL ENERGY** - is that energy represented by the product of pressure and volume. It may be regarded as the energy a substance possesses by virtue of the space it occupies.

**GAS SATURATED WITH ANOTHER VAPOR** - actually a gas is never saturated with a vapor. However, the space directly occupied by the gas and vapor may be saturated. This occurs when the vapor is at its dew point, the saturation temperature corresponding to its partial pressure.

**HEAT** - is the energy transferred because of a temperature difference. There is no transfer of mass.



**INTERNAL ENERGY** - is that energy which a substance possesses because of the motion and configuration of its atoms, molecules and sub-atomic particles.

**ISENTROPIC PROCESS (ADIABATIC)** - is one during which there is no heat added to or removed from the system.

**ISOTHERMAL PROCESS** - is one during which there is no change in temperature.

**KINETIC ENERGY** - is the energy a substance possesses by virtue of its motion or velocity. It is considered in driver calculations for the purpose of determining driver power.

**PARTIAL PRESSURE** - of a constituent in a mixture is the absolute pressure exerted by that portion of the mixture.

**POLYTROPIC PROCESS** - is one in which the changes in gas characteristics and properties are allowed throughout the process.

**POTENTIAL ENERGY** - is the energy a substance possesses because of its elevation above the earth or above some chosen datum plane.

**RATIO OF SPECIFIC HEAT** - is the ratio of the  $C_p$  and  $C_v$ , and is expressed as  $k$ . It may vary considerably with temperature.

**REDUCED PRESSURE** - is the ratio in absolute units of the actual gas pressure to the critical pressure of the gas.

**REDUCED TEMPERATURE** - is the ratio in absolute units of the actual gas temperature to the critical temperature of the gas.



**SATURATED VAPOR PRESSURE** - is the pressure existing at a given temperature in a closed volume containing a liquid and a vapor from that liquid after equilibrium conditions have been reached. It is dependent only on temperature and must be determined experimentally.

**SATURATION TEMPERATURE** - is the temperature corresponding to a given saturated vapor pressure or a given vapor.

**SPECIFIC GRAVITY** - is the ratio of the density of a given gas to the density of dry air, both measured at the same specific conditions of pressure and temperature. These conditions are usually 14.696 psiA and 60°F, or 1 barA and 0°C.

**SPECIFIC HEAT** or **HEAT CAPACITY** - is the rate of change in enthalpy with temperature. It may be measured at constant pressure or at constant volume. The values are different and are known as  $C_p$  and  $C_v$ , respectively.

**SPECIFIC VOLUME** - is the volume of a given weight of gas usually expressed as cubic feet per pound, or cubic meters per kilogram (cubic centimeters per gram).

**STP** - means the Standard Temperature and Pressure used for the system of measure. In the USA it is defined as 60°F and 14.696 psiA, while in the metric system it is defined as 0°C and 1 barA.

**TEMPERATURE** - is the property of a substance which gauges the potential or driving force for the flow of heat.

**WET GAS** - is any gas or gas mixture in which one or more of the constituents is at its saturated vapor pressure. The constituent at saturation pressure may or may not be water vapor.

**WORK** - is the energy transition and defined as force time distance. Work cannot be done unless there is motion.

