VALVES ON LABORATORY EXPERIMENTS

Proper use of valves is of major importance in performing lab experiments. There are many different types present. Knowing when to open, close, or how much to adjust a valve is essential to fill or drain reactors and tanks and to properly use pumps and utilities such as air, water, and steam. Experiments cannot be performed well if lines aren't traced to check for the proper direction of flow of reactants, coolants, etc. The entire lab course can be looked at as simply intelligent adjustment of valves.

One incorrectly opened or closed valve can ruin an entire day's work. Occasionally, two valves may be open and enable flow in two directions instead of in the desired single direction. Essential to checking the line of flow is the consideration of the direction whenever you come to a T or Y intersection. It is also important to always TURN A VALVE BACK AGAINST IT'S STOP. This means: if a valve is to be opened fully, after it is completely opened, turn it one-half a revolution back. One can then immediately tell if the valve is open, as it will turn then stop after only half a turn. One cannot always tell if a valve is opened or closed if it is turned fully open, and can break it trying to force a fully open valve to open more! Sometimes, dirt or wear, or a rising-stem will readily indicate the state of the valve.

GATE: a wedge shaped gate is inside the valve. This is opened in the normal counter-clockwise direction when you are directly facing the handle. The gate and handle both rise. These valves are normally opened completely, typically taking three or more complete revolutions, minus the half turn back, to enable full flow. They are used on supply lines; i.e., steam, water, or air lines.

Often there will be a stamped or embossed size in inches to designate the pipe size the valve accommodates. Also, there is often a WOG number which indicates the pressure in PSI that the valve can safely withstand under the service of water, oil, or gas. Many of the larger or more expensive gate valves will have a threaded center stem that literally rises as the handle is turned to open the gate. This greatly facilitates the visual inspection of the extent to which the valve is opened. The pressure drop over a gate valve is very low. The older valves that have a center tag on the handle saying " FIG. 370" are gate valves.

GLOBE: These are unidirectional and often have an embossed arrow on the side to indicate the proper direction for installation and use. Fluid comes in one side and must rise up past a disc or gasket assembly that presses down on a ground flat center ring before it can exit on the other side. The disc or gasket rises gradually on opening the handle. These valves are therefore preferred for control of flow rate. Often they are used in conjunction with a flow measuring device, such as a rotameter. They also open in a counter-clockwise direction when looking directly at the handle. They are opened to any extent desired from just slightly to nearly completely open. The pressure drop is quite large over globe valves due to the convoluted path the fluid takes. The center tag on the handle may say "Regrinding Disc" or simply "Globe".

NEEDLE: also known as "metering" valves are similar in concept to globe valves but are usually smaller and may have a needle or very small V-shaped plunger that rises and falls with adjustment. They may have a small metal or plastic knob-like handle to turn. They are often used for very fine adjustment of flows commonly less than 1 to 2 mL per minute.

BALL: These are convenient quick open/close valves used for supply lines or drains. They contain a solid ball with a hole through the middle that is of the same internal diameter as the pipe it is specified for. The lever-type handle is turned slowly 90 degrees to prevent a water hammer effect due to rapid pressure changes. Thus, these are never used with delicate equipment. When the handle is parallel to the pipeline, there is full flow and very little pressure drop over the valve. When the handle is perpendicular to the pipeline, the valve is closed. These valves are never used in a partially open mode, due to wear considerations and the inaccuracy of adjustment.

PNEUMATIC: Expensive, automatic, air-activated valves, comprised of a V-type seat with a plunger that rises and falls between a set range from 0 - 100% open. They are normally used in conjunction with sensors, a microprocessor, and an automatically controlled air supply that is used to drive the valve stem up and down. By their nature, they are used for special control of flow that can be monitored with time and automatically adjusted as needed to compensate for changing conditions.

CHECK: These are unidirectional in line devices with a flap angled from the top normally at 45 degrees away from the direction of flow. This enables flow to go in one direction but not back through the flap. They can be marked to indicate the flow direction. They are used in systems where frequent stopping of flow might cause undesired back-mixing. Another type of check valve incorporates a ball that rests on a seat. Used in vertical rising lines, the ball is lifted by flow, but when flow stops the ball falls back on its seat and prevents fluid falling back down the line. These are often used in conjunction with pumps to prevent the need to prime the pump after it is shut off.

THREE-WAY: These are configured in either a Y or a T. They take an input and send the flow to one of two possible output lines. The concept is similar to having a Tee with two separate valves for selecting the output direction. Three-way valves can be a convenience, at a cost, or a necessity in close spaces. They often have a mark or arrow to indicate direction, and sometimes the handle is self indicating itself. There are also four-way, five-way, and six-way valves available.

STEAM TRAP: These behave like a selection valve that lets condensate out while keeping the steam in the system. The pressure of the steam drives the condensate out and then usually warms up the system to the extent that the "valve" part of the trap closes. The buildup of condensate is to be avoided because it prevents steam with its much higher heating capability from heating the materials it was intended to do. There are many types of steam traps. Their selection depends on the capacity needed and the type of equipment used. The economy of a process is dependent on the proper trapping of steam and reuse of condensate.

REGULATORS: These are used in conjunction with the valves on high pressure systems. They control steam pressure and also control the output pressure from compressed gas cylinders. They are comprised of a diaphragm that is opened by turning a handle or screw inward in a clockwise manner to increase the output pressure. To open gas cylinders: the regulator must first be closed (turned counter-clockwise fully till it is loose). The cylinder valve is then opened. Finally, the regulator is opened by turning the handle inward by clockwise motion. To close the regulator: first shut the cylinder valve. Bleed out the remaining gas and then close the regulator.