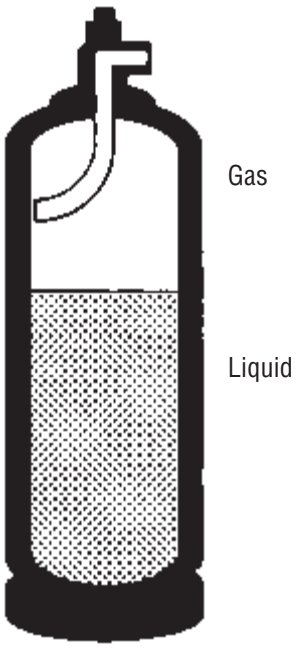
Liquid-Phase Withdrawal

Just as in vapor removal, the first step in liquid removal is orienting the package to gain access to the liquid phase. The liquid is pushed from the cylinder by the vapor pressure of the product. As the liquid is removed, the volume of the gas phase of the cylinder increases. Some liquid will vaporize to fill the additional space, but usually not enough to subcool the cylinder. Sometimes the vapor pressure of the product is not high enough to push the liquid out at the required rate. When this is the case, a method called padding is sometimes used to pressure the liquid. This enhances the rate at which the liquid can be pushed from the cylinder. Padding is the process by which an inert gas is added to the vapor space in the cylinder. **When adding the inert gas to the cylinder, the maximum allowable working pressure (MAWP) of the cylinder should never be exceeded.** This pressure rating is part of the DOT stamping on the cylinder. If you are not sure, contact our Technical Information Center at **1-877-ASG-4-GAS** for assistance.

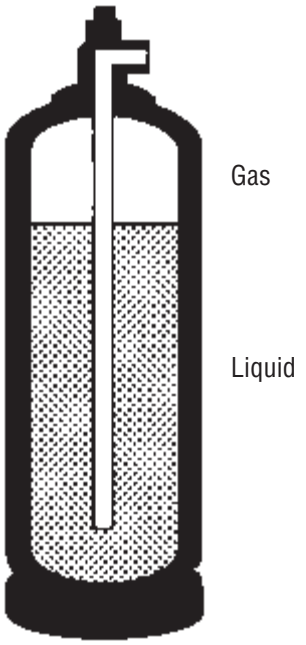
How the inert gas pressure is added depends on the cylinder. If the cylinder has dual valves, the inert gas can be added through the gas-phase valve. Be sure the source is regulated not to exceed the MAWP of the cylinder and is protected from back flow minimally by a check valve. If the cylinder has one valve, the nitrogen can be added while the cylinder is oriented to the vapor phase. Then the source must be disconnected before orienting to the liquid phase. Again, care must be taken not to exceed the MAWP of the cylinder.

Extreme care must be taken when handling the liquid phase of any liquefied compressed gas. Unlike gas, the liquid does not compress. Therefore, the liquid must always have a space to grow. In the cylinder this is the vapor space or head space. Earlier the DOT filling limits for liquefied compressed gases were discussed. These limits were set to prevent the cylinder from becoming liquid full at normal temperatures. If a vessel were to be liquid full, any increase in temperature would cause the liquid to expand and having no space to grow and very little, if any, compressibility would result in the rapid building of hydrostatic pressure. These pressures can build very rapidly and quickly cause overpressurization of the equipment. Systems using the liquid phase of these products should be adequately protected by pressure relief devices, especially where there is a chance to trap liquid between valves.

Liquid Withdrawal through Eductor Tubes



Gooseneck Eductor Tube



Full-Length Eductor Tube

Eductor tubes permit the withdrawal of liquefied compressed gases in the liquid phase with the cylinder in the normal upright position, without having to invert the cylinder. Airgas offers two types of eductor tubes: gooseneck tubes and full-length tubes.

- **Gooseneck Eductor Tubes**
  Gooseneck tubes allow the withdrawal of either gas or liquid. When the cylinder is in the normal upright position, gas is withdrawn. In a horizontal position, with the valve outlet facing up, liquid is withdrawn.
- **Full-Length Eductor Tubes**
  Full-length tubes are used for liquid withdrawal only.
- **Dual Valves**
  Some liquefied gas cylinders are equipped with dual valves. One valve is connected to a full-length eductor tube for liquid withdrawal. The other valve is for either gaseous withdrawal or for applying a head pressure to the liquid.