

TECHNICAL BRIEF

Technical Brief on Distribution Piping Network

Copper is the second most common piping material. It is a readily available metal that is resistant to corrosion, which means less contaminants and better air quality when the air reaches its point of use. However, the need to solder or braze it often requires a fire watch during installation. The material itself is expensive compared to steel. It is lighter, and installation is generally faster than with threaded steel pipe. Well brazed/soldered copper joints are very leak resistant, and copper can be easily modified.

Plastic is sometimes chosen for its easy installation by the end user. It is also inexpensive, resistant to corrosion, and lightweight. Be aware that the pressure rating is often stated at 80°F, and this rating decreases as temperature increases. PVC is the most common plastic piping, and it may become brittle and shatter, causing a workplace hazard. Because of this, PVC is prohibited by OSHA in many uses. This limits this type of piping in many compressor applications. Synthetic lubricants used in some compressors can act as a solvent for the pipe materials and/or adhesives used in the joining. Hence, it is also extremely prone to leaks, and therefore requires continuous labor for maintenance.

Aluminum piping systems can be all metal (tubing and fittings) or a combination of aluminum tubing with polymer fittings.

Aluminum with polymer fittings is a relatively new choice that is growing due to advantages like being corrosion-resistant, lightweight, easy to install, having smooth bore (low pressure drop), and a lower overall cost of ownership than many other materials. Its main benefit is being faster to install with potentially lower costs. It is also easily adapted to changes in the plant. Many specialized manufacturers offer a wide variety of fittings and accessories that minimize or potentially eliminate leak risk, allow for ease in system repair or modifications, and maximum flexibility. Downsides of modular aluminum systems are higher material costs (mainly due to the fittings) and pressure ratings limited to plant air applications. Maximum pressure is usually 200 psig.

Aluminum systems with metal fittings offer many of the same advantages as Aluminum Piping with polymer fittings but offer additional features and benefits. They can experience reduced expansion and contraction compared to plastic (polymer) fittings that can potentially lose structural strength of the fitting engagement or leak over time in some environments. Even though metal fittings have an initial higher cost, they are able to maintain pressure better and maintain no leak seals.

Stainless Steel advantages include being resistant to corrosion and its high-pressure rating, but it is generally the most expensive option. Some food, beverage, textile, pharmaceutical, electronics industry, and other plants using oil-free compressors install stainless steel piping to avoid or minimize potential corrosion and other contaminants down-stream. Like black iron and galvanized, installation can be labor intensive, and its threaded joints can be prone to leaks.

When designing and installing a new piping system, size it to minimize pressure drop. This is mostly a function of flow vs. pipe diameter, although pipe material, layout, and pressure also play roles. Size the piping for growth to avoid downtime when your production expands and needs more air.

The total pressure drop in a system from the point of use back to the air compressors will determine the required compressor discharge pressure. A rule of thumb for a typical 100 psi system is that every 2 psi increase in compressor discharge for a positive displacement compressor operating at full capacity increases the energy requirement by 1%. Minimizing system pressure drop is crucial and operating a system at lowest possible pressure is prudent.

Remember that operating at higher pressures leads to more waste through pipe leaks. Leaks are a major cause of pressure drop. The increased flow due to leaks causes a drop in system pressure, which can make all the air operated equipment function less efficiently and could negatively affect production and productivity rates. An on-going leak detection and maintenance program is always recommended, and your compressed air system provider can assist you in this area.

Restrictions in airflow also reduce system efficiency. Piping with rough interior surfaces (steel pipes) has higher pressure drop due to friction. Corrosion in black iron can increase restrictions over time, especially when liquid water is present in the system. Always review the compressed air dryer selection to assure that it is the correct technology and sized properly for the application and local plant operating conditions. Are there going to be any piping runs outside or between buildings that could be affected by temperature changes and swings? Will the piping system be exposed to temperature extremes and fluctuations? Have condensate drains been installed in the proper and most advantageous positions? All these factors could affect corrosion rates for black iron systems. Copper and aluminum piping have smooth surfaces that corrode less than steel piping in the presence of water. The smooth surface of copper and aluminum piping does result in lower pressure losses at high rates of flow.

Normal piping schematics show horizontal and vertical runs entering another pipe or header at right angles. Pressure losses can result from having too many bends in the piping, too small of a pipe, too many sharp right angles, and/or an un-serviced filter. Keep these factors in mind to minimize pressure drop. Long radius elbows are available and are designed to help in minimizing pressure losses.

Because of all these factors, it is always best and recommended to consult with a compressed air expert. A consultation will provide you with useful insights to the best material selection, best piping layout, the type and size of headers to use, as well as properly sizing and locating the piping drops. In the end you can be assured that the piping system will be efficiently working in concert with the other various elements of the compressed air system, delivering the required pressure and flow of compressed air to your equipment with optimum efficiency.