Benefits of aluminium piping

Guillermo Hiyane, Parker Hannifin, Otsego, MI, USA

Compressed air is used in virtually all industrial facilities and power plants are no exception. Instrumentation and control systems in many plants are fully dependent upon a clean, reliable supply of compressed air. In addition, compressed air is used for non-instrument services such as cleaning pipes, boilers and condensers.

Traditionally, engineers have specified a variety of piping materials for compressed air systems, including black iron, galvanised steel, copper, stainless steel and plastic. More recently, however, aluminium piping, such as that offered by Parker Hannifin under the trade name Transair, has emerged as an attractive option.

Among the advantages are the following:

- Transair aluminium pipe systems are much easier to install and to modify than steel or copper pipe systems. Labour savings of 50% can be achieved, since Transair aluminium pipe is supplied ready for use. No particular preparations beyond cutting, deburring, and chamfering are required, nor are special tools needed. Transair aluminium pipe is calibrated, meaning that its diameter is strictly controlled. This means that associated quick-connect components will fit securely, and each connection is automatically secured. Aluminium pipe is much lighter than steel pipe or copper pipe. This also reduces installation and modification costs. Another factor that makes aluminium pipe sytems easier to install and modify is that they don't require threading or soldering.
- The compressed air provided by a system built with aluminium piping is much cleaner than air delivered by a steel pipe system.
- Aluminium pipe's corrosion-resistance and low-friction properties mean optimal air flow, reduced energy costs, and better air quality.
- The fittings used with aluminium pipe systems fit securely and provide a leak-free system, performing better than the fittings used with threaded systems. This translates directly into energy savings and improved plant productivity.

Naturally, there are some disadvantages. For example, material costs are higher for aluminium pipe systems compared to steel pipe systems – although when compared with copper pipe systems, material costs for aluminium are lower.

Also, the working pressure for aluminium is typically 232 psi at 115°F, compared with a typical rating for copper and steel piping of 250 psi at 400°F.

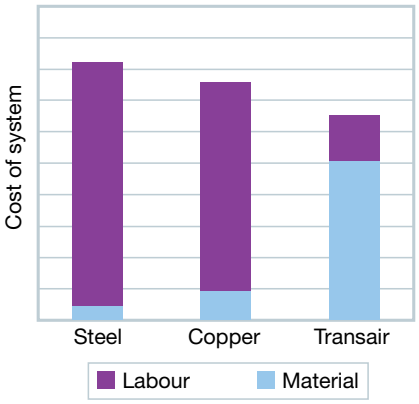
Overall, though, for many applications, aluminium piping is a good alternative for compressed air systems.

A summary of the advantages and disadvantages of various compressed air piping system materials is shown in Table 1.

Attractive payback

Installation costs dominate the total installed cost for all piping materials except for aluminium.

Figure 1. Labour and material costs for steel, copper, and aluminium (Transair) compressed air pipework



As shown in Figure 1, labour costs associated with installing steel pipe are 80% of the total installed cost and for copper piping the labour costs range from 50% to as high as 70%.

Similar high labour costs are associated with installations using glued connections for plastic pipe and fittings. This is not the case for aluminium piping, as Figure 1 confirms.

As noted above, with Transair aluminium piping there is strict control of the pipe diameter, allowing the use of quick-connect components that fit securely, as shown in Figure 2.

Unlike steel piping systems, Transair aluminium piping does not corrode and this can translate to significantly reduced pressure losses as shown in Figure 3. Pressure drop forces compressors to work

Table 1. Compressed air piping materials compared

Material	Advantages	Disadvantages	Connection methods
Black pipe	Low cost components, readily available, rated to high pressure, established technology	Labour intensive, corrosion problems, prone to leaks, costly to repair, not easily modified, safety concerns	Threaded, welded, grooved, crimped
Galvanised steel	Low cost components, readily available, rated to high pressure, established technology	Labour intensive, corrosion problems, prone to leaks, costly to repair, safety concerns, not easily modified	Threaded, welded, grooved, crimped
Copper	Low cost components, readily available, resistant to corrosion, established technology	Labour intensive, prone to leaks, costly to repair, not easily modified, safety concerns	Soldered, quick connect, crimped
Plastic	Low cost components, readily available, resistant to corrosion, lightweight	Labour intensive, prone to leaks, costly to repair (labour), incompatibility issues, safety concerns	Glued, fused, quick connect
Extruded aluminium	Corrosion resistant, low pressure drop, lightweight, dimensional integrity, resistant to mechanical shocks, easy to install and modify	Material cost, thermal expansion/ contraction, lower pressure rating	Welded, grooved, quick connect
Stainless steel	Corrosion resistant, low pressure drop, chemical compatibility, rated to high pressure	Labour intensive, material costs, costly to repair (labour), safety concerns	Threaded, welded, grooved, crimped, quick connect

Figure 2. Transair aluminium piping uses Quick-Connect connections

Figure 3. Pressure drop (at 100 ft, 40 mm dia pipe, 100 psi) *vs* air flow for steel piping (black or galvanised) and Transair (Al)

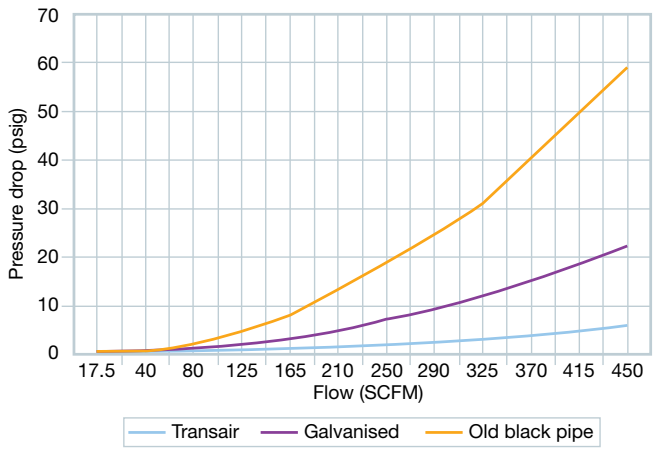
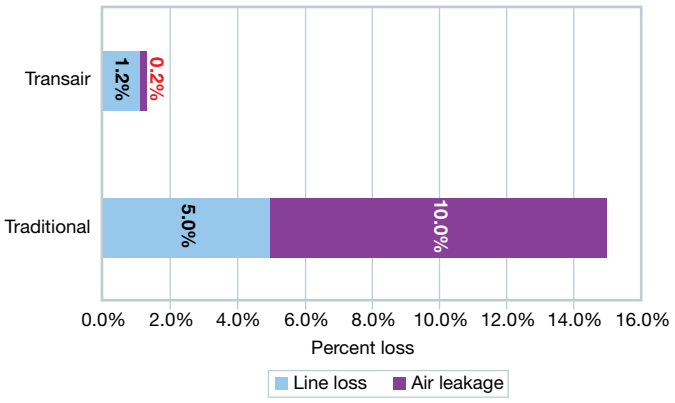


Figure 4. Comparison of wasted compressor utilisation for Transair and traditional compressed air pipework due to line losses and leakage



harder to supply the required air flow and pressure.

A major source of excessive pressure drop is pipe scale and corrosion which also can contaminate the air causing costly production downtime and equipment replacement.

Often, improvement in compressed air systems represents immediate opportunities for cost savings, with payback times of less than 36 months.

Typically, reduction in compressed air leakage provides the best opportunity for achieving savings (followed by compressor improvements).

Compared with aluminium piping systems, traditional compressed air piping contributes substantially to wasted compressor utilisation, from both line losses and air leaks. Air leakage from conventional systems may be as much as 50x greater than that from aluminium piping, and line losses are also are notably higher, as shown in Figure 4.

An energy analysis using a Parker Hannifin efficiency calculator has been developed to illustrate comparative 10-year running costs for an existing black iron compressed air system compared with a new Transair system for a 100 psi, 500 SCFM flow, 1650 ft length piping ring (Figure 5).

This indicates a payback time of about 29 months, principally arising from reduced system pressure drop and leakage volume.

Remote access via the internet of things

Parker Hannifin's SensoNODE sensor and SCOUT cloud technology, routed via the IIoT (Industrial Internet of Things), can provide users with 24-hour remote access to a compressed air system, using wireless remote monitoring to maintain optimum levels of compressed air flow, temperature, pressure, power and ambient humidity.

Figure 5. Example of output from Transair energy efficiency calculaor