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Five Reasons Why Aluminum Piping Makes Sense for Compressed Air Systems

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Introduction

Traditionally, engineers have specified a variety of piping materials for compressed air systems, including black iron, galvanized steel, copper, stainless steel and even plastic. More recently, aluminum piping has become an option considered by many contractors, architects and engineering firms. Aluminum piping makes sense for compressed air systems in many different applications.

Black iron and galvanized steel pipe are two common types of pipe used for compressed air systems. More than 60 to 70 percent of all compressed air systems installed today use black iron or galvanized pipe, due to a variety of factors:

- Contractors are familiar with these materials.
- Material costs are low.
- The pipe and compressed air system fittings are readily available.
- Steel pipe is rated for high pressure.

There are, however, five key reasons why aluminum piping is a superior material to use for most compressed air installations today, each of which addresses a key disadvantage to traditional pipe systems.

1. Lowering Installation Costs

More time is needed to install a compressed air system when using steel pipe compared to installing a system using other materials.

One factor behind this is that steel pipe must be threaded in order to join pipes and install the proper fittings. To properly thread steel pipe, you need special threading equipment and skilled workers to operate it. These workers cost more than unskilled workers, and that also drives up installation costs.

Also remember that threading pipes is dirty work. You need cutting fluids to get a good thread, and that must be cleaned from the pipe before you



can start using the system. Threading also creates a lot of debris.

Modifying and maintaining a compressed air system made with steel pipe is more difficult than modifying and maintaining systems built from other materials. One reason for this is that steel pipe is much heavier than other materials. Because steel pipe is so heavy, it requires more labor (read as higher labor costs) to handle the piping while making modifications than it would to make modifications to a system made with other piping materials.

2. Minimizing System Leaks

Another issue with threaded connections is that they will inevitably leak. It's been estimated that eight to 10 percent of the compressed air in a system will leak through threaded connections. This causes compressors to run harder and longer, driving up utility costs.

3. Aluminum Piping Doesn't Corrode

A common problem with using steel pipe is that moisture inside the system will cause pipes to rust from the inside out. Even if your compressed air system has a moisture trap, there will be some



moisture in the system and corrosion will occur. Even galvanized steel pipe will corrode, as not all pipes are galvanized both inside and out.

Corrosion causes several problems, beginning with air flow restricted by a rough inner surface caked with deposits caused by corrosion build up. Additionally, loose scale deposits collect over time and create pressure drops. This makes the air compressor work harder to maintain the pressure of the system. In extreme cases, loose scale can completely clog a line or damage equipment connected to a line. Of course, corrosion and loose scale affects air quality and makes it unsuitable for applications that require clean air.

4. Aluminum Outperforms the Copper Alternative

Copper piping is another solution for compressed air systems and is attractive because it doesn't corrode as much as steel pipe. While it can corrode, it doesn't have pipe scaling like steel pipe. This means that a copper system will have fewer air flow problems and air cleanliness problems than steel pipe, but it can still experience flow restriction over time.

A copper solution comes with its own set of disadvantages, however; perhaps the biggest is the cost of copper material itself. In October 2011, the price of copper increased by 20 percent, and subsequently, so did the price of copper pipe. Even though prices have dropped since then, the fact remains that copper pipe continues to be considerably more expensive than steel pipe.

Another disadvantage is that fittings must be soldered, and this causes its own set of problems. Soldering of course requires an open flame, making this a safety issue in some environments. And, soldering requires some skill to accomplish, an increasing problem in an era when skilled labor is becoming harder to find. If a joint is not soldered properly, it will leak, and leaks increase energy costs.

Finally, not all types of copper piping are suitable for use with high air pressures. So, if you're planning to use copper, you have to make sure that you choose a pipe that can handle the pressure.

5. PVC and Stainless Steel Present Obstacles in Cost and Durability

While steel pipe and copper pipe are the two most widely used materials for compressed air systems, you will also sometimes find systems that use PVC pipe and stainless steel pipe. In fact, it is against OSHA standards and highly dangerous to use PVC pipe for compressed air systems. PVC becomes brittle over time and may explode when transporting air under high pressure.

Stainless steel is another option, especially when the compressed air system is to be installed in a corrosive environment. In some cases, stainless steel is considered an option depending on the fluctuating cost of copper pipe.

As with other steel pipe systems, though, stainless steel systems can be costly to install. Threaded stainless steel pipe can be difficult to seal, often requiring the use of lubricants to thread correctly. Welding stainless steel drives up installation costs and safety concerns through the need of a skilled welder, and the added risk of smoke inhalation, damage to eye sight, and fire.

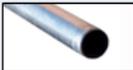
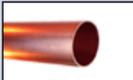
Material	Advantages	Disadvantages	Connection Methods
 Black Pipe	Low cost components Readily available Rated to high pressure Established (old) technology	Labor intensive Corrosion problems Prone to leaks Costly to repair Not easily modified Safety concerns	Threaded Welded Grooved Crimped
 Galvanized Steel	Low cost components Readily available Rated to high pressure Established (old) technology	Labor 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 (old) technology	Labor 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	Labor intensive Prone to leaks Costly to repair (labor) Incompatibility issues Safety concerns	Glued Fused Quick Connect
 Extruded Aluminum	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	Labor intensive Material costs Costly to repair (labor) Safety concerns	Threaded Welded Grooved Crimped Quick Connect

Table 1: Compressed Air Pipe Material Selection
 – Advantages and Disadvantages Comparison
 (for further comparison information go to Opus.mcerf.org)



Aluminum Piping is the Ideal Alternative

In recent years, aluminum piping has become a solid alternative to other piping materials for compressed air systems. Compared to the materials described above, installing a compressed air system using aluminum piping offers many advantages:

- Aluminum pipe systems are much easier to install and to modify than steel or copper pipe systems. Labor savings of 50 percent can be achieved, since aluminum pipe is supplied ready for use. No particular preparations beyond cutting, deburring, and chamfering are required, nor are special tools needed. Aluminum 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.
- Aluminum pipe is much lighter than steel pipe or copper pipe. This also reduces installation and modification costs.
- Another factor that makes aluminum pipe systems easier to install and modify is that it doesn't require threading or soldering.
- The compressed air provided by a system built with aluminum piping is much cleaner than air delivered by a steel pipe system. Aluminum pipe systems can help meet the requirements of [ISO 8573-1: 2010](#) air quality standards, should the application require it. Cleaner air also means lower maintenance costs.
- Aluminum pipe's corrosion-resistant properties mean optimal air flow, reduced energy costs, and better air quality.
- The fittings used with aluminum pipe systems fit securely and leak far less 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 aluminum pipe systems compared to steel pipe systems.

When compared to copper pipe systems, however, material costs for aluminum are about the same or even lower. And, the working pressure for aluminum is 232 PSI at 115 degrees. Overall, though, for many applications, aluminum piping is a solid alternative for compressed air systems.

Comparing True Costs

Table 2 shows the savings that are possible with an aluminum pipe compressed air system, in this case a Transair® system, compared to a steel pipe and copper pipe system. The material list for this project includes 500-ft. [150 meters] of pipe, 16 elbows, 7 tees, and 10 couplings. The labor hours were estimated using rates from the Mechanical Contractors Association of America (MCAA) manual, factored by 0.7, which is typical when estimating projects.

The results are quite dramatic. Comparing initial installation costs, an aluminum pipe system will save 38 percent when compared to the steel pipe system and 60 percent when compared to the copper pipe system.

	Transair	Threaded Carbon Steel	Copper
Pipe Schedule	Painted Alum	Sch 40	Type L
Material			
Pipe	\$ 2,073.75	\$ 1,935.60	\$ 2,880.00
Fittings	\$ 1,207.15	\$ 113.38	\$ 250.30
Material Total	\$ 3,280.90	\$ 2,048.98	\$ 3,130.30
Labor Hours	22.35	82.21	60.42
Labor Cost at \$65/man hour	1,459.90	5,343.65	3,927.30
Total Cost	\$ 4,740.80	\$ 7,392.63	\$ 7,057.60
Transair Savings			
Manhours Savings		73%	63%
Total Installed Cost Savings		36%	33%
<small>MATERIAL LIST: 500 feet of pipe, 16 elbows, 7 tees, and 10 couplings (unions). Comparison is Transair 40mm versus 2" pipe. Labor rates from MCAA manual are factored by 0.70, which is typical for estimating field jobs.</small>			

Table 2: Cost and Man-hour Savings Comparison



Transair Presents the Lowest Total Cost of Ownership

There are several aluminum piping systems on the market, but Transair carries a variety of advantages in both engineering and installation.

- The materials and modular design of a Transair air pipe system makes it easier and less expensive to install than traditional systems.
- Because of its modularity and the fact that its components are reusable, it's easy to extend, disassemble and even relocate the system.
- Can be deducted as a capital expense because of the reusability of components.
- Aluminum piping is easier to lift and handle than standard steel piping.
- Quick connect fittings provide an instant secure connection that is ready to be pressurized.
- The fittings eliminate the need for special tools and/or in-depth pipe preparation.
- The use of Transair also eliminates the time needed for certain installation processes (i.e., drying time for glue, threading, crimping, welding, soldering, etc.) depending on the materials used. (See Connection Method in Table 1.)
- Transair utilizes smooth interior surfaces and specially designed "full bore" fittings to propagate efficient laminar airflow. This eliminates the friction caused by rough surfaces in other systems, which leads to more turbulent airflow and pressure drop.
- Transair is guaranteed leak free due to its unique sealing characteristics. This leak-free characteristic combined with its full bore design is a real energy saver.
- Installing a Transair system will not only reduce energy bills, but also significantly cut carbon emissions. Transair installations qualify for [LEED certification points](#).

Transair's quick connection technology reduces energy consumption, improves operational efficiencies and minimizes installation and maintenance costs all resulting in the lowest overall cost of ownership. That makes Transair the best choice for new, renovation or expansion compressed air pipe systems projects.