

Compressed Air Often Wasted

By R. Scot Foss, Plant Air Technology

A properly configured system will use the least amount of horsepower to satisfy demand.

Are you managing your compressed air system or reacting to it? Do you have problems such as excessive waste at consuming points, more energy than necessary, or persistent high compressor maintenance expense? If you are a typical facilities management professional, you may not know that these problems exist in your system. In most cases, undefined acceptability is the norm or standard for performance of the system. If production doesn't complain, then everything is considered O.K. It's unlikely that production would complain that you were supplying too much pressure or volume. It's doubtful that they would be concerned that you might be using too much energy to achieve their desired end results. In fact, in most plants, production considers air free and not its responsibility.

Some of the Problems:

Most facilities operate their compressed air systems on "good intentions". There is verbal or assumed minimum pressure that everyone would like to maintain, and everyone's opinion is different. In most cases, it is higher than what is necessary to do the job . . . sort of a margin of safety. In most cases the pressure will drop below that pressure form time to time. Despite this all-too-frequent dilemma, production continues to install air-operated equipment that requires pressure higher than the actual minimum pressure in the plant.

It is also normal that production will put in equipment with flow requirements that will exceed the capacity of the compressors in the system. No one will know it until the rest of the plant is in trouble. When you consider that the operating cost of compressed air on a hand tool can run into thousands of dollars of cost, one would think that the consumption and pressure would be an integral part of the buying decision. It's not!!!

In an effort to support the consumer, maintenance men and plant engineers try to operate the compressors at pressures that range from a few pounds higher than the implied minimum to 20 to 30 pounds higher. In most cases the reasoning behind this decision is not only costly, but also entirely incorrect. It does not help the problem, but compounds it.

A typical rationalization for increasing operating pressure is to overcome the resistance to flow in supposedly undersized piping. Another way of looking at the problem is to look at it as excess volume for the size of the pipe. Increasing the pressure in a line that has no demand controls will increase the volume of demand and make the problem worse.

Another rationalization for elevating the pressure is insufficient compressor capacity for the system. The truth is that when proper corrective action is taken in an unbalanced system, you can either elevate the point-of-use pressure with no added input horsepower or maintain the same pressure at the point of use and unload horsepower typically 25% to 35%.

An example of the above would be a system with three 50-hp compressors, clean up e2quipment, a 400 gallon receiver tank and no intent to control the maximum pressure of the demand to a lower point than the lowest load pressure of the compressors. The intention is to hold 90 psig at the point of use. Over the last few months the minimum pressure has been more and more toward 85 psig. The compressors are set to operate at 115 psig, but can't always hold that pressure.

At first, one would think that you needed more compressor capacity. Actually, the problem is that the consumption at the point of use without demand controls exceeds the capacity of the compressors. As the demand in an unbalanced system is a function of the supply pressure, whatever the demand was supposed to be at 90 has increased dramatically, since over a period of time operating pressure has been elevated to 115 psig.

If you could regulate and maintain all points of use (including hoses, blow-offs, etc.) to 90 psig, pressure at the point of use would remain at 90 psig and you would unload 30.5 bhp from the compressors. On a 3-shift basis at .08 per kvhr, that would amount to a saving of \$23,749 per year in electricity alone, plus a burden factor of times 1.35 or higher. It would not be necessary to add a compressor (and the attendant equipment). If you felt that it would be impossible to monitor point-of-use regulators, you could put in intermediate or sector controls that would also control to maximum pressure that demand and leaks could be fed at. Without demand controls your system would store nothing. With storage the compressors would never see any of the peaks or valleys, which would reduce added horsepower. It would also reduce surging through clean up equipment. Most of the time the problem is control of consumption, not supply capacity.

In most cases adding compressors or increasing pressure will make the problem worse. Temporary relief may come because of large fudge factors common to compressed air, but they will be followed shortly by the same old problems. If a large enough compressor or compressors are added, you might be able to overcome the uncontrolled "Black Hole" called consumption. This is, however, a very expensive way to get production off your back. When you consider that it will cost twice as much to run a compressor in the first year than what it cost to buy, this temporary fix-up is hard for any conscientious manager to swallow.

Regulation Inconsistencies:

Most plants have at least some regulators. They are usually used when manufacturers recommend them for pressure requirements and often come with the equipment. The fact that they are there does not imply that they will be used properly, provided that operators understand what "properly" means. Properly would imply a standard for this utility. It is very unlikely that there is any standard other than just getting by. Over a period of time operators will normally adjust the units to their maximum setting rather than to lubricate or maintain their equipment.

There are also typically unregulated points of use such as tools, blow off hoses, pulse type bag filters, part and scrap blow-offs, ejectors, and leaks. Although the application may not need regulation, the system does. The unimportant, non-regulated points of use become the kings of the system, while the regulated points of use become the second-class citizens. I doubt that you have heard a complaint regarding insufficient pressure at blow-off hoses or leaks.

Oddly enough, even when management recognizes wasted energy, unnecessary compressors, high maintenance costs and endless complaints, they may not get around to doing anything about it until a configuration audit is done so that costs can be properly applied to the system and return on investments can be applied to the decision-making process. A good rule of thumb in air systems is that there are always several explanations of the problem and at least as many alternatives to solve it. If you only look at the problem, you may miss the cause. If you know of only one solution, you probably have not investigated adequately.

In addition to intermediate or sector controls, whichever is most appropriate, you should install locking regulation at all points of use, whether they seem necessary or not. If this is poorly received, you can get regulators that have a predetermined stop on the lead stem of the unit to control a maximum pressure. In addition to controlling demand, storage, and leaks, these controls will control the way that the compressors load and unload. All this notwithstanding, perhaps the most important effect of a balanced system is the consistent pressures to production applications. When compressed air contributes to the quality and consistency of production as an assigned cause (instead of unassigned) other variables can be identified and limited. A cubic

foot of compressed air varies in weight at various pressures and temperatures. The objective of balancing the system is to supply the same number of pounds of compressed air at the supply end as is being consumed at a lower controlled pressure at the demand end.

Example: 100 cfm @ 80 psig = 83 cfm @ 100 psig at constant temperature.

Proper Balance; the Goal:

The primary fallacy is that the compressors run the system. It is also believed that by setting the compressors, you can control the pressure at the point of use. Following either premise will result in unreasonably high operating costs and very poor production results. In a properly balanced system, demand is controlled, storage is controlled, and compressor controls are used only to refine the response to the demands of consumption interpreted through storage. A properly configured system will always use the minimum amount of horsepower to satisfy the weight flow of demand regardless of changes in production or climate.

R. Scot Foss is president of Plant Air Technology, Charlotte, N.C., a company specializing in system auditing and designing. This series of articles is based on his book, "Compressed Air System Solution Series". A portion of the proceeds from sales of the book is donated to children's charities. The book can be ordered through Southern Corporation.