System Studies Incorporated

History of Cable Pressure System Designs

A look at the history of cable pressure system designs reveals how the systems evolved, how they differ, and what their relative strengths and weaknesses are. This brief overview explains the various design types and their characteristics. It also identifies the catalyst for all new designs, which is the need to correct problems with existing systems.

The Original Single Feed System

The first cable pressure system was known as Single Feed, where cables were fed pressurized air in the vault only. Pressures were monitored at the endpoints of the cables using pressure contactors—devices that indicated only if the cable pressures were above or below minimum standards.

While this simple design was an improvement over having cables with no pressure protection, there were some problems involved. If a leak occurred in a cable, air pressure would drop from the source to the leak. Beyond the leak the pressure in the cable would flatten out or drop further if there was another leak. A zero psi leak, for example, would leave the entire section of cable from the leak position to end unprotected. One leak could cause multiple electrical failures along the length of the cable.

Another disadvantage is that if the pressure in a cable did drop, the leak could be anywhere in the cable—a huge area of search.

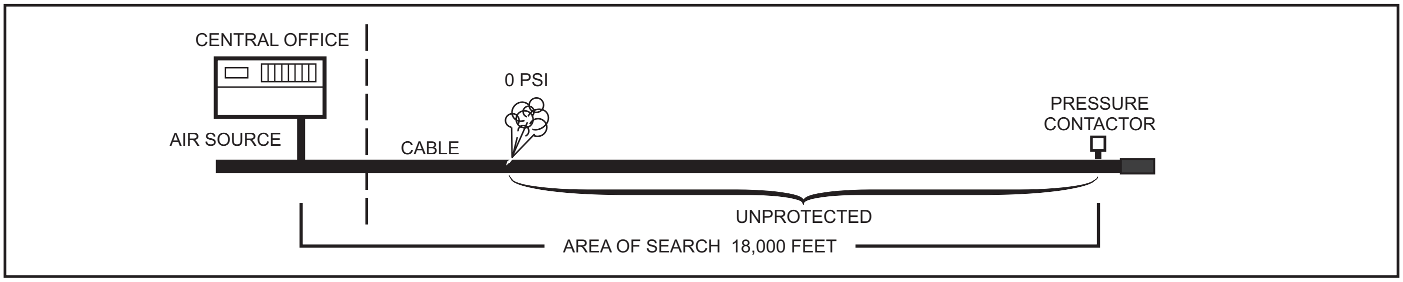

Figure 1: Single Feed Design

Development of the 6,000 Foot Manifold Spacing Design

The introduction of air pipe and the 6,000 Foot Manifold Spacing design was a result of problems associated with the original single feed design. Beginning is the early 1970s, air pipe and manifolds provided much-needed dual feed protection to the cables, which solved many of the problems associated with single feed systems. A leak between manifolds would be protected by air flow from both manifolds.

The only way to monitor for cable leaks in this original pipe system was through the use of pressure transducers installed at the midpoints between manifolds. Since there were no flow transducers available back then, the manifolds had to be placed far enough apart so that a cable leak would produce enough of a pressure drop to be detected by the pressure transducer. The engineers knew at this time that if a leak occurred close to an air source, such as near the central office, a flow increase would occur but very little pressure drop would take place.

Things changed with the introduction of the flow transducer in the late 1970s. The flow transducer remotely monitors the air flow used by a cable in Standard Cubic Feet per Hour(SCFH). Leaks close to an air source could now be monitored and identified.

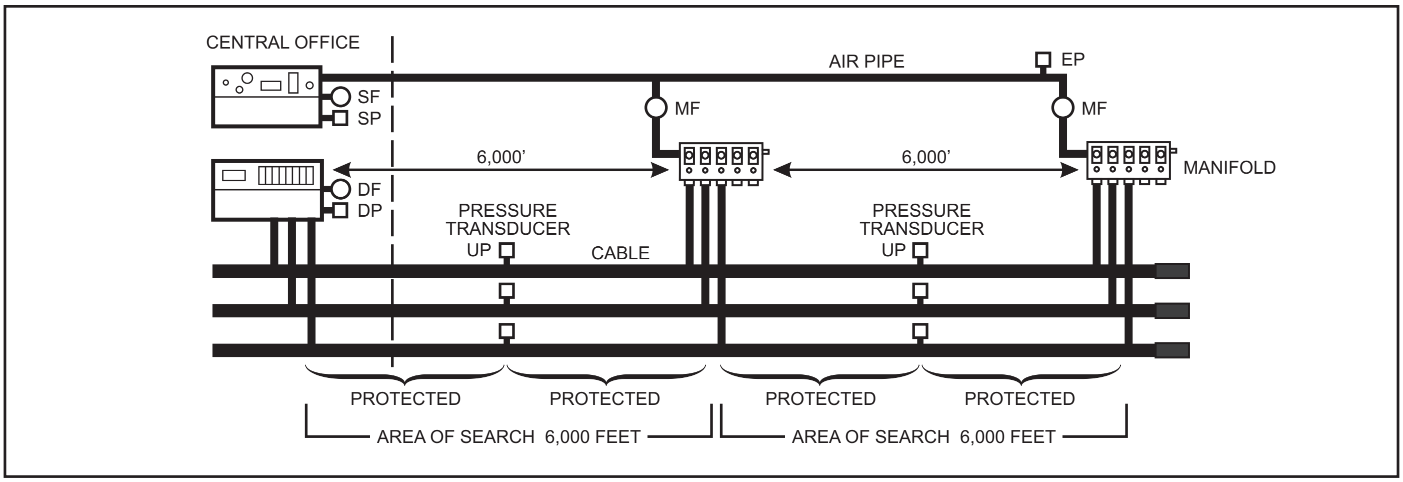

Figure 2: 6,000 Foot Manifold Spacing Design

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3,000 Foot Manifold Spacing Design

In the early 1980s when Wisconsin Bell was looking at ways to improve their cable pressure system, they identified several problems with the 6,000 foot cable pressure design:

1) Every cable in the system needed to have a pressure transducer installed between each manifold (UP Device Type). The result was many monitoring devices to maintain.
2) The air pressure in a cable had to drop (be put in jeopardy) before it could be identified.
3) When a leak was identified, the area of search was 6,000 feet (the distance between manifolds).
4) Identifying the biggest leak was impossible.

Something else was occurring in the telephone companies at that time. There was a change in maintenance philosophy; no longer was "service without regard to cost" the unspoken mode of operation. The belt was beginning to tighten.

Wisconsin Bell developed the first 3,000 Foot Manifold Spacing design. They decided to replace the midpoint pressure transducers in the 6,000 foot design with a manifold. Because flow transducers were now available, all manifolds would be monitored by a flow transducer (PressureWEB MF Device Type). And, to provide a better indication of air pipe delivery pressure to the manifolds, a pressure transducer was installed on the end of each air pipe (EP Device Type).

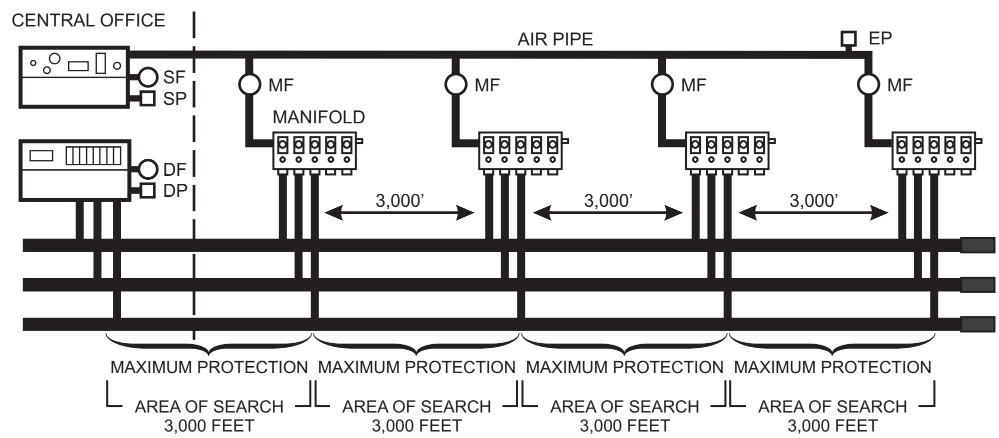

Figure 3: 3,000 Foot Manifold Spacing Design

The advantages of this design change were:

- Better cable protection (more air sources).
- Built-in buffering (closer air sources on opposite sides of a cable splice location).
- A leak was identified by a flow increase, not a pressure drop.
- Leaks did not have to be immediately dispatched upon because they were protected by the additional air sources.
- The area of search for a leak was reduced from 6,000 feet to 3,000 feet.
- Since air flow was being used for monitoring and leak locating, the biggest leak (highest flowing) could be identified.

There is a common misconception that when you replace the pressure transducers in a 6,000 foot system with a manifold, there is no way to remotely determine the pressures in the cables. In reality, this is accomplished just as effectively by the EP pressure transducer installed at the air pipe endpoint. If it reads below the minimum end of pipe pressure standard of 7.5 psi (5.5 psi or 6.0 psi, for example) cable protection in all of the cables is compromised. Using air flow information at a manifold (MF Device Type) to find and repair a high flowing leak is the quickest way to raise air pipe delivery pressure and overall cable pressure protection.

One Step Further, the BAPP Design

The 3,000 Foot Manifold Spacing Design has been used successfully for over 30 years. But there is a potential problem converting from a 6,000 foot manifold spacing design to 3,000 feet. With the additional manifolds used, the 3,000 foot design requires more air capacity. As a result, larger central office dryers may be needed, but potentially the most costly consideration is the installation of additional air pipe to feed the manifolds.

The BAPP, or Best Air Pressure Protection Design, makes some minor modifications to the 3,000 Foot Manifold Spacing Design to eliminate the installation of additional air pipe. The most important change is removing the source pressure monitoring (Device Type SP) from the pipe alarm panel to the first air pipe manifold location. Traditionally, the delivery pressure of an air pipe is adjusted to 10 psi at the pipe alarm panel in the central office. But this is not where cables are first fed. They are fed at the first manifold location. By adjusting the output pressure of the pipe panel, the actual delivery pressure at the first manifold can be increased to the desired 8 or 9 psi and overall air pipe delivery is improved. Additional air pipe is not required. What is required, however, is the installation of a flow transducer at the pipe panel that can read up to 190 SCFH.

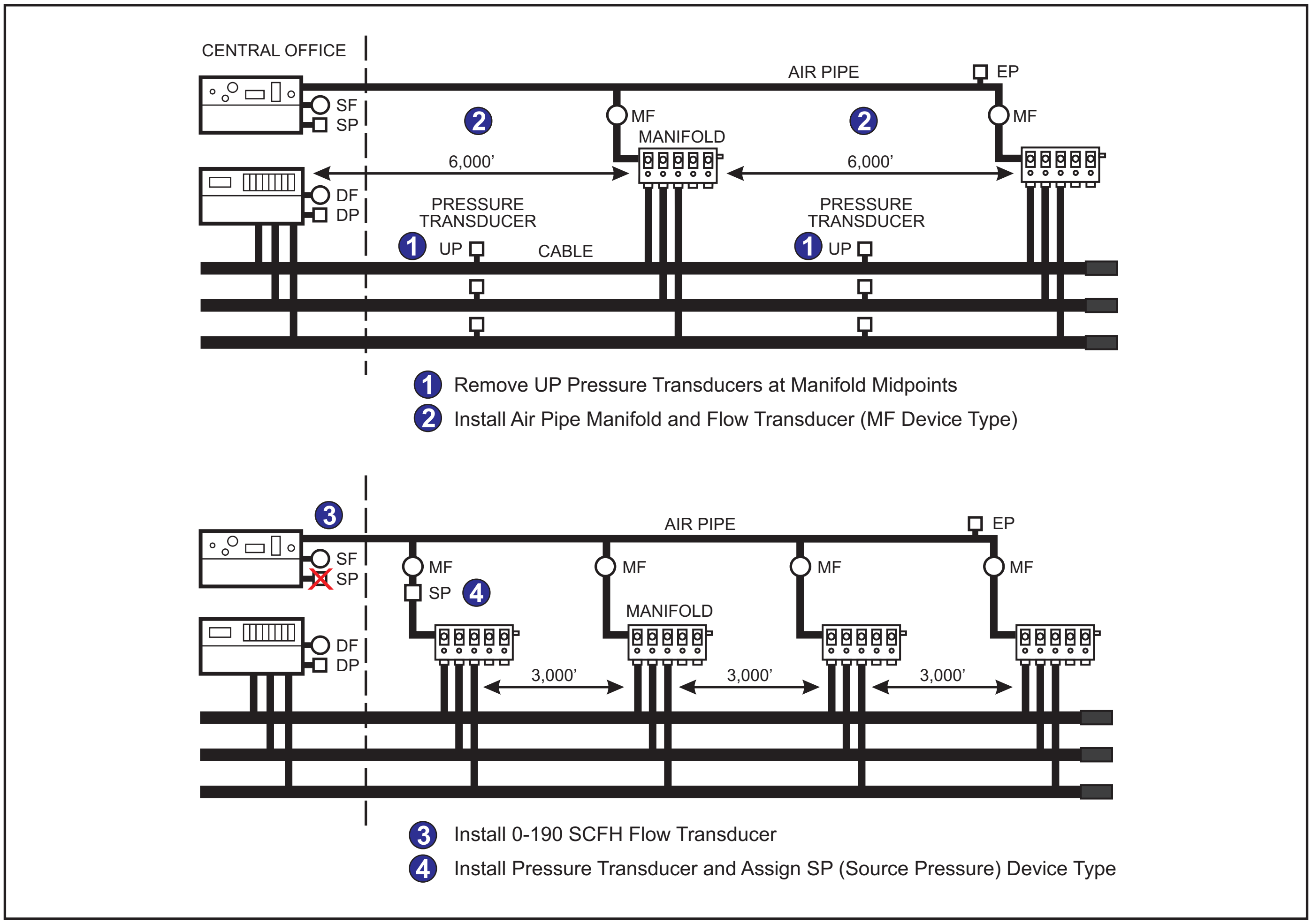

Figure 4: Converting 6000 Foot Manifold Spacing to BAPP Design

Why Not 6,000 Foot Spacing Today?

This original air pipe system was designed over forty years ago with the understanding that a large, dedicated air pressure crew would be required to maintain the system. Today, less than 20% of the manpower once required for cable maintenance is available for air pressure work. That's why the existing 6,000 Foot Manifold Spacing designs are failing.

- Is the BAPP better at protecting the cables? Yes, for the reasons stated on page 2.
- Is the BAPP system easier to maintain? Yes. You now have the ability to prioritize leak location. Pneumatic sections are smaller. There are fewer devices in the field (transducers) to maintain. Also, with the BAPP design, leak locating can be scheduled, rather than just in response to alarms.
- Is the BAPP design more tolerant of leaks? Yes, due primarily to its ability to provide more air to the cables.
- Is the BAPP a substitute for Leak locating? In some ways, yes. The design can support minor leaks, but the big ones still have to be repaired.

For additional information about the design characteristics described above or converting to the Best Air Pressure Protection Design, please call System Studies Incorporated at (800) 247-8255 from 6:00 a.m. to 4:00 p.m. Pacific Time, Monday through Friday.

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