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Mitigating electrostatic pinholes in natural gas PE distribution pipe for DIMP IM requirements

What creates pinholes in PE gas pipe?

Pinholes are caused by the buildup of static electricity inside PE pipe. PE's physical characteristics naturally resist electrical charges. This property is called its "Dielectric Constant". Think of it as PE's ability to act as an electrical insulator. Medium Density PE has a dielectric constant of approximately 510 volts per thousandth of an inch thickness of PE. Therefore, for example, if a medium density PE pipe wall is 5 thousandths of an inch thick, then the pipe wall can withstand 5×510 or 2550 volts of electricity before the PE pipe wall material is physically broken down by an electrical charge.

When the voltage of the static inside the buried pipe exceeds the dielectric constant of the wall thickness of the pipe, the interior static arcs through the pipe wall to the earth's ground. The heat of that arcing static melts the pipe wall creating a pinhole leak.

Why are pinholes created in certain areas?

While the physics of how static is created is well known, it is not known what causes static to build up to levels inside PE pipe that can regularly arc through pipe walls in specific areas of PE fuel gas systems. However, you can identify those areas which regularly build up these high levels of interior static if your company repeatedly has to replace PE pipe in certain areas due to pinhole leaks. Our field experience is that in areas of your system you have identified having pinhole leaks will continue to have pinhole leaks.

How can I tell if the pinhole leak is caused by static and not a manufacturing or material defect in the pipe?

First, if the pipe had a hole created during manufacturing, upon installation the pipe would have failed to hold pressure during the installation pressure testing. Therefore, the defect had to have occurred after installation. PE pipe is nearly indestructible and for it to suddenly develop a defective hole after installation with no outside force is virtually statistically impossible.

Second, the type of defective hole is different if the hole is created in manufacturing pipe instead of by static electricity in the field. Defects during manufacturing are generally larger, smoother holes while pinholes are generally invisible to the naked eye.

Finally, the only way to definitively determine if the pinhole was created by static is to send the pipe with the pinhole leak to a testing lab. Under a microscope they can see the burn marks caused by electrostatic discharge and conclusively state the cause of the pinhole leak. To date our experience is we have yet to have a lab report state a pinhole leak was due to a manufacturing or material defect.

What are the characteristics of systems with pinhole leaks?

As far as we can ascertain, Ionix Gas Technologies has done more research and field remediation of pinhole leaks in PE fuel gas systems than any company or research organization. Based upon our field observations we have found:

1. Pinhole leaks are not caused by operational procedures, material defects or design parameters.
2. Pinhole leaks cluster in groups of pipes.
3. Pinhole leaks cluster in geographical areas.
4. Pinhole leaks cluster in service lines.
5. Most pinhole leaks occur in 1" or smaller plastic lines.
6. There seems no pattern for the number of pinhole leaks in pipe. We've seen 2, 3, 4 or more pinholes in the same pipe.
7. Pinhole leaks have only been observed in PE pipe material.
8. Pinhole leaks are not particular to a brand of pipe. We've seen pinholes in 3 different brands of pipe in the same service line.
9. Service areas experiencing pinhole leaks will continue to have pinholes unless static is eliminated inside the affected areas. A pinhole problem in your system will not just go away naturally.

How are pinholes eliminated?

Since pinhole leaks are created by internal static electricity, to control pinhole leak generation you must eliminate the interior pipe static in the affected service areas. That is accomplished by installing Ionix Static Suppression Cartridges or dosing Ionix MA at the gate stations or regulators which supply gas to the affected area. When gas is treated by Ionix, interior pipe static is eliminated from treatment point to burner tip. Pinholes cannot occur since there now is no interior pipe static to arc through the pipe wall and create pinholes.

How can I document the reduction in pinholes?

If you have identified pinholes in your system, these pinholes have accumulated over time. Also, since these are small leaks, there are probably many undetected leaks.

When you initially install Ionix to mitigate pinhole leak creation, for approximately 6 months you will probably not notice a change in the number of pinhole leak reports in the treated area. However, after 6 months of Ionix deployment, the pinholes leaks you do detect will be legacy pinhole leaks - leaks prior to deployment of Ionix. 6 months after deployment of Ionix you should begin to see a continual decline in pinhole leak reports in the affected area as you discover and repair the least detectable pinhole leaks.

Once the pinholes are repaired, can I discontinue using Ionix?

The mechanism which creates interior static in your affected system area is not fixed with the deployment of Ionix Static Suppression system because it is not known what that mechanism is. Ionix can only eliminate the interior pipe static inside your affected system generated by that unknown mechanism which in turn creates pinhole leaks. If you discontinue Ionix, static and its resulting pinholes will return. Ionix is a control of symptoms – not a cure.

How do I deploy Ionix?

Since every system is different, every Ionix deployment is different. Contact Ionix for a short outline of how to deploy an Ionix Static Suppression program for your systems needs.